

US EPA ARCHIVE DOCUMENT

**Cultural Resource Review of the PDH Project
Ascend Performance Materials
Chocolate Bayou Plant**

**C3 Petrochemicals LLC
PDH Project Brazoria County, Texas**

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Prepared for:



Prepared by:



TRC Environmental Corporation

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Acronyms

AOF	Active Operational Facility
APE	Area of Potential Effect
Ascend	Ascend Performance Materials Texas, Inc.
Atlas	Texas Archeological Sites Atlas
BA	Biological Assessment
CAA	Clean Air Act
C3 Petrochemicals	C3 Petrochemicals, LLC
FM	Farm to Market Road
GHG	Greenhouse Gas
LRRT	Outer Coastal Plain Land Resource Region
NRCS	Natural Resource Conservation Service
PDH	Propane dehydrogenation
PM	Particulate Matter
PSA	Pressure Swing Adsorption
PSD	Prevention of Significant Deterioration
SIL	Significant Impact Level
THC	Texas Historical Commission
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Section 1

Introduction

Pursuant to the federal Clean Air Act (CAA), C3 Petrochemicals, LLC is seeking a permit under the United States Environmental Protection Agency's (USEPA) Greenhouse Gas (GHG) Prevention of Significant Deterioration (PSD) Program to authorize construction of a Propane Dehydrogenation manufacturing (PDH) unit at the existing Chocolate Bayou chemical manufacturing complex in Brazoria County, Texas, Figure 1 (Appendix B).

The purpose of this archeological resource report is to determine whether any known cultural resources are likely to be impacted by the United States Environmental Protection Agency's (USEPA) issuance of the federal Green House Gas (GHG) permit. This research examined direct impacts from the PDH unit within the existing Chocolate Bayou chemical manufacturing complex and possible indirect impacts within 1 mile around the Active Operation Facility (AOF). The area of potential effect (APE) and Ascend Facility property line is illustrated in Figure 2 (Appendix B).

1.1 Defining the Area of Potential Effect

C3 Petrochemicals, LLC is proposing to add a propane dehydrogenation (PDH) unit at the existing Chocolate Bayou facility. The new unit will be constructed within the already developed portion of the AOF (Figure 2). The footprint of this unit will encompass a 300 feet by 750 feet area. This footprint is no longer in a natural state having been previously disturbed by previous construction activities (Figure 2). This footprint is the specific area of potential effect (APE) that is the area where construction or earth disturbing activities will occur and thus the possibility for direct impact to cultural resources is very low. The Texas Historical Commission (THC) considers sites like this to be previously disturbed and does not require shovel testing. This archeological resource report evaluates the likelihood of adverse effects to cultural resources resulting within that footprint from USEPA's issuance of the federal GHG permit. The cultural resource site file search takes into consideration a 1.6 km (one mile) radius around the property boundary (Figure 4). This search area is larger than the APE radius and was done to be conservative for the file search. After the drafting of this report an additional APE (laydown area) was analyzed and the results are discussed in the report found in Appendix D of this report. The APE was expanded again to include linear features (pipelines and power line) under separate cover.

Air emissions modeling demonstrates that all concentrations of air pollutants, with the exception of PM_{2.5} are below the USEPA SILs at the Ascend Facility property line. The SIL is the concentration of a pollutant, below which USEPA has determined the impact to be de minimis or insignificant. The SIL for PM_{2.5} was modeled to be a 479 meter radius around the centroid of construction. Accordingly, this report evaluates the likelihood of adverse effects cultural resources resulting from USEPA's issuance of the federal GHG permit within a 479 meter radius from the centroid of construction. Detailed information regarding air pollutants are found in the Biological Assessment (BA) under separate cover.

1.2 Project Purpose and Location

C3 Petrochemicals is planning to build a new propane dehydrogenation manufacturing (PDH) unit for the manufacturing of propylene. The introduction provides detailed location information in reference to the closest populous area of Alvin, Texas. The PDH plant will be located within the United States Geological Survey (USGS) 7.5' Quadrangle Maps of Hoskins Mound and Mustang Bayou. The Centroid of Construction is at latitude of 29.257192 N and longitude of -95.215707 W. The proposed PDH unit is located approximately three miles north of the F.M. 2004 bridge that crosses Lost Bay upstream of Chocolate Bay and West Galveston Bay.

1.3 Construction Information

Construction of the proposed expansion, associated infrastructure, and auxiliary equipment will take place within the AOF in an area which was formerly the site of an Olefins Facility most recently owned and operated by Equistar Chemical Company (equipment dismantled to ground, foundations left in place). The construction area is approximately 300 feet by 750 feet on which the existing foundation will be demolished and new foundations will be constructed Figure 2 (Appendix B). The existing foundations will be demolished and the area backfilled with approved select material and graded to allow installation of new concrete mat and pier foundations for the expansion. The proposed construction activities include the installation within the 300 foot by 750 foot construction area of approximately 150 reinforced concrete mat, pier, and spread footing foundations comprised of approximately 16,000 cubic yards of concrete. Additionally, an approximately 400 foot by 800 foot area outside of the construction area will be disturbed and used as a temporary equipment laydown and contractor parking facility. The laydown and parking area will require clearing a portion of the Ascend Facility property currently used for cattle grazing and historically used for agriculture. The temporary laydown and parking area will be grubbed to remove vegetation, back filled with stabilized

select material, graded, and covered with gravel. The results of the archeological investigation on the laydown area can be seen in Appendix D.

Section 2

Background Information

2.1 History of the Chocolate Bayou Facility

The C3 Petrochemicals site will be leased from Ascend and most recently was occupied by Equistar Chemical Company. The real property was acquired by Ascend from Solutia Inc. in 2009. Solutia Inc. was an affiliate of Monsanto Chemicals Division created in 1997. Monsanto constructed the original chemical plant at the present location in the 1950's; additions to the manufacturing complex have been continuously erected and dismantled, as needed, since its inception.

2.2 Regional Environmental Background

The facility is located within the Texas Gulf Coastal Plain, which is situated within the Outer Coastal Plain Land Resource Region (LRRT). This area is composed of grasslands and riparian bayous with topography gently sloping to the coast. Historic elevations within the APE range from five to approximately 20 feet above sea level. Development has increased the elevation of portions of the APE to as much as 33 feet. The area within the APE was historically agricultural. Chocolate Bayou is outside the APE and to the west of the AOF. Presently the land use varies from areas of continued agricultural and grazing use, to residential and industrial use. The chemical complex comprising the AOF has been in operation for over 50 years.

The watershed of Brazoria County is composed of the Brazos River and the San Bernard River along with numerous smaller creeks and bayous, such as Chocolate Bayou, that either drain into the aforementioned rivers or go directly into coastal bays. Brazoria County encompasses a portion of West Galveston Bay and all of Christmas and Drum Bays. All of these are part of the larger Galveston Bay complex.

Brazoria County is located on the Upper Texas Coast. It is bounded to the north by Harris (County Seat Houston), Fort Bend (County Seat Richmond) and Wharton (County Seat Wharton) Counties. To the east and west the county is bounded by Galveston (County Seat Galveston) and Matagorda (County Seat Bay City) Counties, respectively. The southern boundary of the county is the Gulf of Mexico.

2.2.1 Land Use

Brazoria County was traditionally a rural agricultural county, with large portions of land being used for rice, cattle, and hay production. In recent years urban sprawl from the Houston metroplex has seen Brazoria County cities such as Pearland and Alvin grow significantly in size. Large areas of former agricultural lands have been developed for residential or commercial purposes. Brazoria County experienced a 29.53% increase in population between the 2000 and 2010 census counts and this is one of the fastest growing counties in the state (Texas State Historical Association, 2012).

The land proposed to be used for the Project is currently used for industrial purposes and has been for the past 50 years. The land surrounding the PDH unit is a mix of other industrial/chemical facilities, agriculture, open water, and coastal marsh. Peterson Landing is an unincorporated community situated across Chocolate Bayou, and west, of the Ascend Facility is outside the APE.

2.2.2 Climate

Brazoria County averages 57 inches of precipitation per year (USDA, 1981). This is composed almost exclusively of rain as snow fall is rare. Summers are long and hot with average highs being 91 degrees Fahrenheit (°F); however highs above 100°F are not uncommon. Winters are mild with an average high temperature of 43°F. Colder temperatures as low as 20°F or even in the teens do occur, however their duration is typically short. Southerly winds dominate with southeast being the predominate direction. North winds are almost exclusively correlated with frontal passage.

As of January, 2013, Brazoria County is under a D1- moderate drought (USDA, 2012). This is a substantial improvement over 2011 when the general area was under a D4-exceptional drought (the most severe level) (USDA, 2012). Texas has been in a drought five of the last seven years. Droughts coupled with salt water intrusion from the 2008 land fall of Hurricane Ike have severely damaged many coastal marshes and estuary ecosystems along the Upper Texas coast.

2.2.3 Topography

Topography in Brazoria County ranges from sea level on the coast to 146 feet above sea level at the Damon Mound in the west central part of the county. Historic elevations within the APE range from ten feet to approximately twenty feet above sea level. Development has increased the elevation of portions of the APE to as much as 33 feet. The APE has been altered due to past agricultural use, including rice cultivation, and the construction of the industrial facilities

including the Ascend Facility. The Federal Emergency Management Administration floodplain maps show that the entire facility is within the 100-year floodplain of Chocolate Bayou.

2.2.4 Geology

The existing Chocolate Bayou Plant lies on the Beaumont Formation along the Gulf of Mexico. The Beaumont Formation is broadly described as a barrier island and beach deposits. The surface is almost featureless, characterized by relict river channels shown by meander patterns and pimple mounds on a meander belt ridge, separated by areas of low, relatively smooth, featureless back swamp deposits without pimple mounds. The Beaumont Formation consists mostly of clayey sand and silt of moderate permeability and drainage, low to moderate compressibility and shrink swell potential, level relief with local mounds and ridges, and high shear strength. This includes mainly stream channel, point bar, natural levee, back swamp, and to a lesser extent, coastal marsh and mud flats deposits (Barnes 1982). Concretions of calcium carbonate, iron oxide, and iron manganese oxides are present in zones of weathering. The thickness of the Beaumont deposits is roughly 100 feet.

2.2.5 Soils

According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), soils in the county are mostly alluvial loams and clays. They are highly productive. Approximately 70 percent of the county was considered prime farm land (Kleiner, 2012). There are 6 soil types mapped within the APE. These are represented in Table 1 (NRCS, 1981) and Figure 3 (Appendix B).

Table 1
Soils Found Within the APE

NRCS Map Unit Symbol	NRCS Map Unit Name	NRCS Map Unit Characteristics	USDA Classification				NRCS Hydric Soil
			Depth to Restrictive Feature	Drainage	Permeability	Landform	
13	Edna Fine Sandy Loam	0-1% slopes, not flooded	> 80 inches	Somewhat Poorly Drained	Moderate	Flats on Coastal Plains	Yes
15	Edna-Aris Complex	0-1% slopes, not flooded	> 80 inches	Somewhat Poorly Drained	Moderate	Flats on Coastal Plains	Yes
21	Ijam Clay	0-1% slopes, rarely	> 80 inches	Poorly Drained	Moderate	Flats on Coastal	Yes

NRCS Map Unit Symbol	NRCS Map Unit Name	NRCS Map Unit Characteristics	USDA Classification				NRCS Hydric Soil
			Depth to Restrictive Feature	Drainage	Permeability	Landform	
		flooded				Plains / Lagoons	
22	Ijam-Urban Land Complex	0-1% slopes, rarely flooded	> 80 inches	Poorly Drained	Moderate	Flats on Lagoons	Yes
24	Lake Charles Clay	0-1% slopes, not flooded	> 80 inches	Moderately Well Drained	Low	Flats on Coastal Plains	Yes
28	Leton-Aris Complex	0-1% slopes, occasionally flooded	> 80 inches	Poorly Drained	Moderate	Flats on Coastal Plains	Yes

2.2.6 Water Resources

The southern boundary of the county is the Gulf of Mexico. The Brazos River splits the county into east and west halves. The San Bernard River flows through the western part of the county. These two rivers make up the majority of the watershed in the county. Other minor drainages such as Halls Bayou, Oyster Bayou, Persimmon Bayou, Chocolate Bayou, and Jones Creek flow directly into the bay.

The Project is located within the existing developed portion of the Ascend property, which is situated on the left descending bank of Chocolate Bayou. Chocolate Bayou empties into Lost Bay, which empties into Chocolate Bay, and is part of the Galveston Bay system. The Brazos River is approximately 21 miles to the west of the Project. The San Bernard is even farther away at 30 miles west of the Project. In Brazoria County there are numerous stock tanks, irrigation canals, farm ponds, and emergent wetlands.

Section 3

Archeological Site File Search

An archeological site file search was performed by TRC archeologists on January 3, 2013, using the Texas Archeological Sites Atlas (Atlas) maintained by the THC. The file search found no cultural resources (archeological sites, cemeteries, historical landmarks, National Register of Historic Places, structures, historic districts) previously documented within the 2 kilometer search area.

A 2 kilometer radius from the APE was also assessed to determine the location of previous cultural resource projects and presence of previously documented cultural resources. Two archeological surveys have been performed within the search radius. In 1977, a cultural resources survey was done 0.44 miles west from the current facility; however, no additional information was available. About 0.51 mile north of the facility, another cultural resource survey was completed in 1978, and again no information is available for that survey.

The THC Atlas does show two prehistoric sites recorded in the 1970's within two kilometer radius of the proposed APE. Briefly, the sites include:

41BO41- A prehistoric shell midden lies 0.46 miles northwest with no recommendations or additional information presented at the time of recording.

41BO43- A prehistoric "very small" site in perfect condition at the time of identification was found 0.95 miles northwest from the C3 Petrochemicals location. Test pits yielded three "flint flakes" and one sherd. No additional information was available and no recommendations were presented at the time of filing.

A formal eligibility status of a cultural resource site is up to the determination of the Texas Historical Commission, however TRC recommends that these sites are not eligible for listing.

The atlas search found no documented National Register properties, cemeteries or historic landmarks documented within two kilometers of the APE.

In addition to the Atlas search, historic maps (Nationwide Environmental Title Research, LLC, 2009) including topographic maps from 1959 (<http://www.historicaerials.com/> accessed on January 3, 2013) depicting the APE were consulted to determine if historic structures or features were present. None were present within the APE on these historic maps.

3.1 Native American Tribes

Prior to European settlement, Brazoria County was inhabited by the Karankawa Indians (Carol A. Lipscomb, "KARANKAWA INDIANS," *Handbook of Texas Online* (<http://www.tshaonline.org/handbook/online/articles/bmk05>), accessed January 3, 2013; Published by the Texas State Historical Association). The Karankawa Indians inhabited a narrow strip of coastal Texas that extended from the southwest side of Galveston Bay south and west to Corpus Christi Bay and inland approximately 70 miles. Several accounts of the Karankawa Indians were recorded by Spanish and French explorers who visited this region. According to these accounts, the Karankawa Indians were a semi-nomadic people that lived in bands consisting of several family groups. Typically, these bands migrated seasonally between inland foraging grounds, which were inhabited during the warm season, and coastal encampments, which were utilized during the cool season. Encampments moved frequently to take advantage of food resources. The Karankawa Indians have been considered extinct since 1858. The C3 Petrochemicals facility is situated within the territory that the Karankawas were known to inhabit, however there is no evidence that Karankawas actually utilized the area of the Project. As this Native American tribe is considered to be extinct, consultation with this tribe is not possible nor warranted based on the location of the APE being inside an existing facility that has undergone previous land disturbance. There are no other known Native American tribes that inhabited the area.

3.2 Brazoria County Historical Museum

Jamie Murray, Collections Manager for the Brazoria County Historical Museum, was contacted to identify known cultural or historical resources within the local area. In a telephone conversation, she was aware of no significant resources in the vicinity of the C3 Petrochemicals facility. She contacted Sandra Pollan, Chair of the Brazoria County Historical Commission. On January 2, 2013, Ms. Pollan replied via e-mail (Pollan, 2011) that she knew of no significant cultural or historical resources in the vicinity of the proposed project.

Mr. Neil McLain, a volunteer at the Brazoria County Historical Museum, also replied that to the best of his knowledge, there are no known significant cultural resources in the vicinity of the plant.

Copies of a telephone communication record with Ms. Murray and the e-mail communications from Ms. Pollan and Mr. McLain are included in Appendix E.

Section 4

Conclusion

The geoarcheological potential for this area, which reflects archeological sites with a high degree of preservation and integrity, is minimal for prehistoric sites located in the Beaumont Formation. A Texas Department of Transportation model concerning prehistoric sites, referred to as the Houston-PALM, rates this area as low potential for intact prehistoric sites (Abbott 2001).

The lack of buildings depicted on the 1966 topographic map indicates no building(s) of historical significance are present in the 0.5 mile viewshed of the C3 Petrochemicals Chocolate Bayou facility. The fact that the proposed new PDH unit will be constructed within the boundaries of an existing facility, and on a foot print that has existing development indicates that there is no potential for intact archeological deposits in this AOF and therefore no effect to intact cultural resource sites. Thus, no field surveys (i.e., with shovel testing and/or mechanical trenching) are recommended for the proposed PDH plant area. Therefore, no further cultural resource investigation or mitigation is warranted. Shovel testing was conducted on the laydown area. The results of those findings are reported under separate cover that can be found in Appendix D.

The two cultural resource sites outside the APE, 0.46 and 0.95 miles away, will not be adversely affected by the proposed new PDH. Therefore, their eligibility status is not important to the new PDH. A formal eligibility status of a cultural resource site is up to the determination of the Texas Historical Commission.

No impacts to cultural resources (archeological sites, cemeteries, historical landmarks, National Register of Historic Places, structures, historic districts) will occur from this Project.

Section 5 List of Preparers

- J. Michael Quigg, M.A.

Section 6

References

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Appendix A

Resume of Author

J. Michael Quigg, M.A.

EDUCATION

M.A. Archaeology, The University of Calgary: 1973.

B.A. Anthropology, University of Northern Colorado, 1971.

PROFESSIONAL REGISTRATION AND CERTIFICATIONS

- Permitted to perform cultural resource investigations by the Bureau of Land Management (BLM) in Texas, Oklahoma, Wyoming, Montana, and New Mexico.
- Member of Council of Texas Archeologists (CTA).
- Texas Department of Transportation pre-certification (No. 4265) for service 2.10.1, 2.11.1, 2.8.1 (archeological survey, historical and archival research, and mitigation).

EMPLOYMENT HISTORY

Cultural Resource Project Manager/Principal Investigator, TRC Environmental Corporation, 1990 to present,

Staff Archaeologist, Texas Archaeological Research Laboratory, Austin, 1989-1990.

Senior Staff Archaeologist, Co-Principal Investigator, Prewitt and Associates, Inc., Austin, 1987-1989.

Staff Archaeologist, U.S. Forest Service, Clearwater National Forest, Idaho, 1987

Supervisory Archaeologist, Co-Principal Investigator, Historical Research Associates, Missoula, Montana, 1985-1986.

Vice-President, Secretary, Project Manager/Senior Archaeologist, Ethos Consultants, Ltd., Medicine Hat, Alberta, 1980-1985.

Plains/Prairie Archaeologist, Archaeological Survey of Alberta, Alberta, 1975-1980.

Seasonal Instructor and Private Consultant, Alberta, 1974-1975.

Curator of Osteology Collection and Manager, University of Calgary, Alberta, 1973-1974.

Contractor, Project Director, National Museum of Canada, Alberta, 1972, 1973.

Field Director, World Heritage Site, Head-Smashed-In Buffalo Jump, Alberta, 1971.

Field Director, Waterton National Park Archaeological Project, Alberta, 1971.

Teaching Assistant, University of Calgary Field School, Indian Springs, 1970.

Crew Chief, Waterton National Park Archaeological Project, Alberta, 1970.

EXPERIENCE

Mr. Quigg has 36 years of archeological experience involved in all aspects of cultural resource management (CRM) including private consulting, managing a cultural resource firm, directing CRM program, and government regulation. Mr. Quigg has managed and conducted over 60 individual cultural resource projects for Government agencies, oil and gas firms, mining, highways, transmission lines, water pipelines, and reservoir construction projects in Alberta, Montana, Colorado, Texas, and New Mexico. As a project manager he completely understands the nature of the complex cultural resource, problem areas, and works directly with clients to meet their specific project needs in obtaining governmental approval to proceed. He understands research issues and provides management plans to gather necessary data, structures data analyses, and writes reports to explain and interpret the resource, to obtain necessary regulatory approval of the documentation in timely and cost efficient manner. He provides direction and innovative ideas to



mitigate and manage cultural resources to the clients benefit while meeting government regulations.

Cultural resource investigation are carried out under a variety of Federal and state laws, regulations, and guidelines, such as the National Historic preservation Act (NHPA), the National Environmental Policy Act (NEPA), Native American Graves Protection and Repatriation Act (NAGPRA), Native American Free Exercise of Religion Act (NAFERA), Traditional Cultural Properties (TCP), Army Regulation 200-4 Cultural Resource Management, Army Regulation 420-40 Historic Preservation, Department of Defense Protection of Archeological Resources (32 CFR 229),. Mr. Quigg has worked directly with these legal requirements and Native Americans on particular sensitive projects. He has routinely completed archeological projects ranging from small surveys to large multidisciplinary field investigations, including development of management plans, popular brochures, and consultation.

TRC Environmental Corp. - 1990 to present

Principal/Co-Principal Investigator and project manager for the; BLM data recovery at Landis Property in Potter County in 2008; data recovery at Long View site in Roberts County for TxDOT in 2006; TxDOT 2007 data recovery at Gages Creek in Young County, BLM remedial testing in 2007 at four sites in West Amarillo Creek in Potter County, TxDOT 2006 data recovery project in Austin at 41TV2161; 2006 site assessments at Gages Creek in Young County; the 2005 assessment of 41RB112 in Roberts County; 1999-2000 Otero Mesa data recovery for Fort Bliss; the 1990 and 1996 Palo Duro Reservoir data recovery project (Sanders Site); Sulphur Springs Draw and Red Lake Reservoir survey and assessment projects; Mitchell Reservoir data recovery, Leon River Medicine Wheel ethnographic and archeological investigations; TxDOT data recovery at the Lino site (41WB437) in 1998, the 2000-2001 TxDOT data recovery at the Boiler site (41WB557); the 2002-2003 TxDOT Varga site (41ED28) mitigation; and data recovery at 41ZP364; and the Rush Site data recovery programs. He served as Project manager for large area survey of Area F at Jewett Mine, reservoir surveys, many small linear surveys, and principal author for the reporting of the early Archaic site excavations (41TG307 & 309) on the Concho River. Duties included the development and implementation of research designs, development of cost proposals, managing project budgets, hiring and directing field crews and on site investigations, analyses of faunal remains from 41HF128, 41TG346, and Palo Duro and Stacy Reservoir sites, ceramic and lithic data sets, integrating and interacting with sub-consultants on their technical assistance to various programs, report writing and compilation of all aspects of programs, and overall project management from beginning to end including client liaison, accounting oversight, curation of documents and artifacts.

Implemented interdisciplinary data analyses by technical experts including: geomorphology, stable carbon and nitrogen isotope analyses of bison bones, burned rocks, and ceramic sherds, macrobotanical analyses, phytolith studies, radiocarbon dating of burned rocks and ceramic sherds, lipid residue analyses on burned rocks and ceramic sherds, demagnetization analysis of burned rocks, diatom analysis, use wear studies on stone tools, *Rabdotus* shell A/I ratios and dating to assess site and feature context issues.

Archeological Data Recovery Projects

Mr. Quigg has managed and directed numerous data recovery/mitigation projects stemming from the Section 106 of the NHPA, Section 404 of the Clean Water Act, and Section 110 and the Antiquity Code of Texas (ACT). Mitigation projects have included a variety of site types such as stone circles, deep stratified campsites, single component camps, bison kills and processing centers, burned rock middens, and small burned rock features. Examples of major data recovery project are as follows:

- **Data Recovery at Three Prehistoric Sites at the Landis Property, Texas Panhandle, 2007 - 2010, for the Bureau of Land Management.** Mr. Quigg served as Project Manager, Principal Investigator, Field Director for this intensive (451 m²) testing, excavation, analysis and reporting. The three open sites were of different ages, with different stratigraphy, and provided diverse cultural assemblages for hunter-gatherers. Multiple outreach programs were conducted on-site for local individuals and groups as well as development of the Texas Beyond History webpage for the site. The technical report was two volumes (ca. 1200 pages) that integrated interdisciplinary approaches that included 16 technical analyses. Mr. Quigg is an author or co-author on 3 peer-reviewed journal articles that have been published from the data gathered from the project.
- **Data Recovery at 41YN452 in 2007 for Texas Department of Transportation, in North Central Texas.** Mr. Quigg served as Principle Investigator, Project Manager, and part time Field Director, on this 50.3-m³-multiple block excavation in 60 to 110 cm deep deposits that targeted a Late Archaic component in the right-of-way of FM 3109 for TxDOT. A two volume technical report (740 pages) integrated multiple technical analyses that provided great insight to human behaviors.
- **Data Recovery at 41RB112, 2006, for Texas Department of Transportation, Texas Panhandle.** Mr. Quigg served as Principle Investigator, Project Manager, and part time Field Director, on this 103-m³-multiple block excavation of .50+ cm deep deposit with two well-defined Plains Village period components (with pithouses) in the right-of-way of SH 70 for TxDOT. He directed this multidisciplinary data analyses and reporting phase. A two volume technical report (1200 pages) has been submitted to TxDOT.
- **Data Recovery at 41TV2161, 2006, for Texas Department of Transportation, Central Texas.** Mr. Quigg served as Principle Investigator, Project Manager, and part time Field Director, on this 40-m³-block excavation of 2.0+ m deep cultural deposits in the right-of-way of SH 130 for TxDOT. The project is on going with data analysis and reporting to continue.
- **Data Recovery at the Varga Site (41ED28), 2002-2003, for Texas Department of Transportation, Southwest Texas.** Mr. Quigg served as Principle Investigator, Project Manager, and report author on this 104-m³-block excavation of a 1.2 m deep four-component campsite in the right-of-way development. He oversaw a field crew of nine archeologists in the hand-excavations of two major blocks, and directed this multidisciplinary data analyses and reporting phase. He managed the contract and

budget, and coordinated with the client and other technical scientists. Included the text development for an outreach exhibit for Texas Beyond History web page, and brochure on site investigations.

- **Data Recovery at the Boiler Site (41WB557), 2000, for Texas Department of Transportation, South Texas.** Mr. Quigg served as Principle Investigator, Project Manager, Field Director, and primary report author on this 142-m³-block excavation of 1.5 m deep cultural deposits in the right-of-way for the planned Texas Department of Transportation improvement. He directed a field crew of 12 archeologists in the hand-excavations of two major blocks, directed the multidisciplinary data analyses, wrote a 550 page technical report, managed the contract and budget, and coordinated with the client.
- **Data Recovery at 41ZP364, 2000, for the Bureau of Land Management and International Boundary and Water Commission in South Texas.** Mr. Quigg served as the Principal Investigator, Project Manager, and Field Director on this geoarcheological and archaeological investigation. The investigations included 21 backhoe trenches that guided the hand excavations of 48 m² and two small block areas of 20 and 16 m². He directed the subsequent laboratory work, analysis, and wrote most of the 350 page technical report that included multidisciplinary investigations.
- **Prehistoric Site Testing and Data Recovery in the New Target Complex, Otero Mesa, in West Texas 1999, for U.S. Army, Fort Bliss.** Mr. Quigg served as Principle Investigator and primary author for the testing of four sites potentially eligible for the NRHP and the data recovery for seven sites to mitigate the direct impact the proposed U.S. Air Force development as required under Section 106. This project included detailed excavation and field-documentation on some 63 burned rock features, coupled with an interdisciplinary laboratory approach that brought new insights to the understanding of small burned rock features. He was the primary author for the 650 page technical report for the Directorate of Environment, Conservation Division at Fort Bliss, Texas.
- **Data Recovery at the Lino Site (41WB437): A Stratified Late Archaic Campsite in South Texas, 1998, for Texas Department of Transportation.** Mr. Quigg served as the Project Manager, Field Director, and primary author on this 235-m² mitigation required under Section 106. He directed the laboratory processing, supervised the data analysis, facilitated the interdisciplinary technical analyses, wrote most of the 450 page technical report, directed the report production, managed and controlled the project budget, and coordinated with regulators and the client.
- **Data Recovery at the Sanders Site (41HF128): A Single Event Late Archaic Camp/Bison Processing Site, Palo Duro River Authority, 1997, Northwest Texas.** Mr. Quigg served as the Project Manager and Field Director of the 115-m² data recovery program under Section 404 of the Clean Water Act and NEPA. He coordinated all laboratory analyses and interacted with professional from multiple disciplines to support the cultural interpretations. Mr. Quigg also conducted the detailed analyses of the faunal

and tool analyses. He wrote the 220 page technical report incorporating all recovered data and addressed six major research issues.

- **Data Recovery at the Rush Site, Colorado River Municipal Water District, 1993, Western Texas.** Mr. Quigg was the Project Manager and Field Director for the emergency mitigation of 45 m² necessary to comply with Section 404 of the Clear Waters Act for the client. He coordinated with the client, managed the budget, and conducted the stone tool, faunal and ceramic analyses, and interacted with numerous specialists to facilitate the integration of a multidisciplinary approach to the analysis and interpretations. He wrote the majority of the 200 page technical report and completed the project on time and in budget.
- **Data Recovery and Geomorphologic Investigations, Palo Duro Reservoir, Palo Duro River Authority, 1991, Northwestern Texas.** Mr. Quigg directed and field supervised the data recovery from two prehistoric campsites, a rock shelter, and a historic dugout during a three-month span with three separate crews that involved 20 personnel. He was responsible for client and government resource manager communications during the field and subsequent data analysis. He directed data analysis, conducted the faunal, ceramic, and stone tool analyses, coordinated with six technical subconsultants, integrated data sets, and wrote most of the 600 page technical report.
- **Mitigation Excavation at Two Prehistoric Sites, Texas Department of Transportation, 1990, Central Texas.** Mr. Quigg served as the Field Supervisor at Barton (41HY202) and Mustang Branch Sites (41HY209) under a Section 106 investigation clearing the right-of-way for new construction. He directly supervised 20 archeologists for six months in the excavation of two stratified camps, a lithic workshop, and a burned rock midden. The intensive excavations encompassed 330 m² and involved a vast array of cultural materials. He oversaw and guided the faunal analysis.
- **Mitigation of Large Multicomponent Tipi Ring Site (24TT83) and Buried Campsite (24CA194), U.S. Department of Energy, Western Area Power Administration, 1986, North-central Montana.** Mr. Quigg served as co-Principal Investigator and Field Director for the intense data recovery program along a transmission corridor. He directed an archeological crew of 12 people over a two-month period that involved 380-m² of excavation. Subsequently he coordinated the technical analyses, analyzed the lithic debitage, burned rocks, stone tools, faunal remains, and ceramic materials from the various components, and wrote the final comprehensive technical report.
- **Crown Site (FhNa-86) Mitigation, Ethos Consultants Ltd., 1984, Saskatchewan Research Council, Central Saskatchewan.** Mr. Quigg was the Field Director for this Middle Archaic to Late Prehistoric stratified site with nine separate components in three cultural units. He directly supervised the analyses of the various data sets including the stone and bone tool assemblages, the lithic debitage, and ceramic analyses, and wrote the technical report that was submitted to the client.

- **Lloyd Site (FhNa-35) Mitigation, Ethos Consultants Ltd., 1982, Saskatchewan Research Council, Central Saskatchewan.** Mr. Quigg was the Field Director for this site excavation of a Late Prehistoric, single component, buried campsite. He directed the laboratory processing of various data sets that included 18,000 artifacts and conducted the faunal identification, supervised the stone tool analysis, and the lithic identification, and wrote the technical report for the client.
- **Mitigation of EcPp-24 and EfPg-5, Ethos Consultants Ltd. 1982, Southwestern Alberta.** Mr. Quigg served as Principal Investigator, Project Manager, and Field Supervisor for these two buried campsites in planned highway construction zones. He oversaw the laboratory processing, coordinated and communicated with the client, conducted the lithic and stone tool analysis and authored the final technical report.
- **Mitigation of Ross Glen Stone Circle Site, Ethos Consultants Ltd., 1981, Southeastern Alberta.** Mr. Quigg was the Principal Investigator, Project Manager, and Field Director of a large scale, 508 m², and hand-excavation of a stone circle site. He directed the laboratory processing and stone tool and lithic debitage analysis, burned rock and feature analysis, and wrote the 200-page technical report with conclusions, interpretations, and management recommendations.
- **Highway Salvage in the Crowsnest Pass, Lifeways of Canada Ltd., 1975, Southwestern Alberta.** Mr. Quigg served as Field Director for this multiple site data recovery program along the planned expansion of highways in Crowsnest Pass. He directed a crew of 10 archaeologists, conducted the stone tool and lithic debitage analysis, completed the feature descriptions, and was primary author in the final technical report.

Archeological Site Assessment Projects

Mr. Quigg has managed and conducted numerous site testing and evaluation projects in Texas, Alberta, and Montana. These projects ranged from evaluating single surface sites, deeply buried campsites, bison kill sites, burned rock middens, medicine wheels, stone cairns, to multiple component buried campsites. Information recovered was analyzed, interpreted, and used in the development of site-specific and project related recommendations and determination of sites eligibility for inclusion to the National Register of Historic Places under the Section 106. This included the development of data recovery plans, project specific budgets, hiring staff, and scheduling. A sample of projects Mr. Quigg has managed is listed below.

- **West Amarillo Creek Remedial Testing at 41PT185, 41PT186, and 41PT245 for the BLM in Northwestern Texas in 2007.** As Project Manager and Principal Investigator Mr. Quigg directed the basin wide geomorphic investigations (48 trenches), followed by the hand excavation of 48.0 m³ at selected locations at these prehistoric sites. A status report, draft and final interim reports were authored by Mr. Quigg with subsequent analysis and reporting.
- **Gages Creek Eligibility Assessment of 41YN450 and 41YN452, Texas Department of Transportation, 2006, North-central Texas.** As Project Manager and Principle

Investigator Mr. Quigg directed the National Register field assessment of these two prehistoric sites buried in the TxDOT right-of-way in Young County. Field assessment included hand excavations (6.5 m³) and mechanical trenching (n=7) in terrace deposits that documented buried cultural remains. He directed the preliminary data analysis and coauthored the interim report submitted to TxDOT. Site results and recommendations were presented to the client and government review agencies, who concurred with the recommendations.

- **Survey and Eligibility Assessment of Two Prehistoric Sites at Boot Ranch, 2005, Central Texas.** Mr. Quigg served as Principle Investigator and project manager. He oversaw the survey of 377 ac including 67 shovel tests, documentation of nine sites, the assessment of two sites including 15 units, 53 m in eight trenches, mapping of sites, and profiling. He coauthored the report that presented the data findings, recommendations. The report and recommendations were accepted by the Army Corps of Engineers.
- **Eligibility Assessment of 41RB112, Texas Department of Transportation, 2005, Texas Panhandle.** Mr. Quigg served as Principle Investigator and field director. He directed a 10 person crew in the hand excavations and profiling of this two part site. He authored the interim report that presented the data findings, recommendations, and a data recovery plan that included research questions and field approach to follow. The report and recommendations were accepted by the Texas Historical Commission.
- **Eligibility Assessment of 41BL278, Texas Department of Transportation, 2004, Central Texas.** Mr. Quigg served as Principle Investigator, project manager, and field director. He directed the hand-excavations on 10 units (4.1-m³), backhoe trenching, site mapping, exposure profiling, and oversaw the geoarcheological investigations. He coauthored the interim report that presented the data findings, recommendations. The report and recommendations were accepted by the Texas Historical Commission.
- **Eligibility Assessment of 41MS69, Texas Department of Transportation, 2004, Central Texas.** Mr. Quigg served as Principle Investigator, project manager, and field director. He directed the hand-excavations (8.9-m³), site mapping, and exposure profiling. He coauthored the interim report that presented the data findings, recommendations. The report and recommendations were accepted by the Texas Historical Commission.
- **Eligibility Assessment of Three Prehistoric Sites along FM 580W Over Lynch Creek, Texas Department of Transportation, 2004, Central Texas.** Mr. Quigg served as Principle Investigator and field director. He directed the hand-excavations of 21 units (17.4-m³), trenching of deposits (n=5), mapping of sites, profiling, and oversaw the geoarcheological assessment. He coauthored the interim report that presented the data findings, recommendations, and a data recovery plan that included research questions and field approach to follow. The report and recommendations were accepted by the Texas Historical Commission.

- **Eligibility Assessment of 41EP4439, Texas Department of Transportation, 2002, West Texas.** Mr. Quigg served as Principle Investigator and oversaw the project that included 20 backhoe trenches, 20 manual units, and geoarcheological investigations. The final report that presented the data findings, recommendations. The report and recommendations were accepted by the Texas Historical Commission.
- **Noodle Creek Eligibility Assessment, Texas Department of Transportation, 2002, North Texas.** Mr. Quigg was Project Manager and directed the National Register field assessment of site 41JS102 in the highway right-of-way next to the Noodle Creek Bridge crossing in Jones County. Field assessment included hand excavations and mechanical trenching in terrace deposits that documented buried cultural remains. Subsequently, he directed the data analysis and report writing. Site results and recommendations were presented to the client and government review agencies, who concurred with the recommendations.
- **USA #3 Assessment, TransTexas Oil And Gas Corp, 1997, South Texas.** Mr. Quigg was Project Manager and Field Director of the assessment of two prehistoric sites (41ZP39 and 41ZP176) in a well pad and pipeline ROW development zone at Falcon Reservoir. The site file search was followed by shovel testing and unit excavations that documented the buried nature of two sites. Site results and recommendations were presented to the client and government review agencies. The investigations resulted from the Archeological Resource Protection Act.
- **Pershing Field Assessment, Fort Sam Houston, 1997, Southern Texas.** Mr. Quigg served as Project Manager and Filed Director of the archeological and geomorphologic assessment of 50 acres of undeveloped land on Fort Sam Houston. The natural terrace deposits were assessed through the excavation of 19 backhoe trenches to evaluate the potential for intact buried archeological remains. One prehistoric surface site was evaluated with shovel tests. The recovered data was assessed and recommendations were presented in a report coauthored by Mr. Quigg. The investigations were part of an Environmental Assessment document.
- **Assessment of Leon River Medicine Wheel, U.S. Army at Fort Hood, 1993-1994, Central Texas.** Mr. Quigg served as project manager and field director of seven archeologists in assessing the NRHP eligibility of this native religious site. He integrated geomorphology, geoarcheology, two geotechnical studies, and oral interviews of native religious leaders with hand excavation data and detailed feature recording techniques to thoroughly document the size, extent, age, and nature of the stone features and associated artifacts within shallow sediments. Mr. Quigg conducted a literature search into the history and background of northern plains medicine wheel investigations and ethno-history, preformed specific data analyses, incorporated interdisciplinary technical analyses and results, and interpretations, and made recommendations for site protection and significance. He interacted with native religious leaders, archeologists, and government personnel in overall coordination of investigations and subsequent medicine

wheel renewal ceremonies. Mr. Quigg also participated directly in the sacred reconstruction ceremonies and yearly renewals.

- **Burned Rock Mound Chronometric Assessment, U.S. Army, Fort Hood, 1993, Central Texas.** Mr. Quigg served as Field Director for the field evaluation of nine burned rock mounds (domed and annular middens) to assess their archeological potential and establish an absolute chronometric framework for this site type. After reviewing some 100 prehistoric sites with burned rock features, Mr. Quigg selected nine promising sites and led the recovery of datable materials through backhoe trenching and limited hand excavations, which subsequently yielded 53 radiocarbon assays. This allowed for the creation of a chronological framework of burned rock mounds at Fort Hood and helped evaluate Fort Hood mound features with respect to their NRHP eligibility.
- **Mitchell Reservoir Testing, Colorado River Municipal Water District, 1992, Northern Texas.** Mr. Quigg served as Principal Investigator and directed the day-to-day operation of the 32-m² block excavations at 41MH49. He directed the laboratory operations and data analysis that included the integration of a number of technical analyses to support the interpretation. He wrote most of the final report and prepared the recommendations.
- **Site Assessment at ANR Pipeline Crossing of Palo Duro Creek, 1992, North Texas.** Mr. Quigg served as Project Manager and Field Director of an archeological and geomorphologic assessment of a river crossing in north Texas. Following a site file search, a foot traverse of the ROW was completed, and then six backhoe trenches were excavated and documented. The crossing was assessed, results evaluated, interpretations presented, and recommendations were made to the client.
- **Site Evaluation, U.S. Army, Fort Hood, 1991-1992, Central Texas.** Mr. Quigg served as Field Director and implemented the field evaluation program to assess individual prehistoric sites across the base. In conjunction with a project Geomorphologist, he evaluated over 500 prehistoric sites using numerous criteria, completed detailed evaluation forms, and made site specific recommendations.
- **Evaluation of Stone Circle Site EaPg-3, Archeological Survey of Alberta, 1984, Southern Alberta.** Mr. Quigg served as Principal Investigator and Field Supervisor of the site assessment through detailed documentation of eight stone circles. The investigations included feature mapping, the weighing and recording the depths of rocks, excavation of 81 augur tests and screened matrix, the hand excavation of 10 test pits. Data was subsequently analyzed and a comprehensive technical 35-page report was completed. Recommendations for future investigations were presented to the government.
- **Buried Prehistoric Campsite Evaluation, Alberta Transportation, 1981-1982, Alberta Foothills.** Mr. Quigg formulated field strategies and analysis goals to evaluate two buried prehistoric campsites through the excavation of 120 m². He integrated metric

and descriptive analyses of over 1500 lithic artifacts, interpreted knapping technologies through refits studies, analyzed burned rocks, features, and conducted detailed faunal analysis, to place these events in time and space. He evaluated internal horizontal and vertical patterning to interpret human use of space, assess site integrity, and made recommendations for further work. He compiled and wrote the final 150 page technical report.

- **Excavation and Analysis Strategies to Evaluate Buried Prehistoric Sites, Alberta Transportation, 1980-1981, Southern Alberta.** Mr. Quigg devised excavation and analysis strategies to assess six shallowly buried prehistoric sites along multiple highway corridors. He served as Principal investigator and field director investigations that involved hand excavations by a six-person crew, managed the logistics and deployment of the crew, conducted data analysis, interpreted results, and reported the findings in a 200-page technical document. Mr. Quigg managed the overall project, and formulated the recommendations.
- **Archeological, Ethnographic, and Historical Literature Review of Site Specific Data, State Historical Society of North Dakota, 1983-984, Montana, North Dakota, and Wyoming, United States and Alberta and Saskatchewan, Canada.** Mr. Quigg served as Co-Principal Investigator and coordinator of a site-specific data review of stone circle site excavations from across the Northwestern Plains. This program included a review and synthesis of excavation methods, recording procedures, data analyses, data results, site and feature documentation strategies on stone circles and provided a detailed management plan and future direction concerning this specific site type.

Archeological Inventory/Survey Projects

Mr. Quigg has completed roughly 60 cultural resource inventories throughout the Plains states. These inventories ranged from small well pad and gravel pits to very large block areas of 6,000 acres to 100 mile long linear ROWs requiring multiple crews. Inventories were completed for government agencies, private industry, and individuals. Projects involved foot surveys of development areas, shovel testing, inventories of historic and prehistoric sites, completion of site forms, site and building sketch maps, analyzing cultural materials, writing reports, and making site and project eligibility recommendations and providing direction for future investigations. Listed below are a number of representative inventory projects.

- **Brushy Creek Reservoir Survey, City of Marlin, 2005, Texas.** Mr. Quigg served as Principal Investigator and director a crew of six in surveying 1140 ac with 523 shovel tests for the City of Marlin's proposed reservoir. Fifteen new sites and He co-authored the technical report, managed the budget, and coordinated with the client.
- **Right-of-way Survey in four counties in central Texas, Texas Department of Transportation, 2006, North Central Texas.** Mr. Quigg served as field director on two

of the surveys. He co-authored the technical report, managed the budget, and coordinated with the client.

- **Archeological Surveys in Central Texas, Texas Department of Transportation, 2006.** Mr. Quigg served as Principal Investigator and field director on two surveys. He conducted the foot traverses, shovel tests, and monitored the backhoe trenching, co-authored the technical report, managed the budget, and coordinated with the client.
- **Reconnaissance for FPL Energy's Horse Hollow Wind Power Project, 2006.** Mr. Quigg served as Principal Investigator and field director on this reconnaissance and chert sourcing project. He conducted the road and tower inspections, assessed impacts to area, collected natural chert samples for instrumental neutron activation analyses, authored the technical report, managed the budget, and coordinated with the client.
- **Backhoe trenching to discovery buried cultural resources along FM 2214 for Texas Department of Transportation, 2005, North Central Texas.** Mr. Quigg served as Principal Investigator and field director to investigate the alluvial deposits for cultural remains through 11 backhoe trenches (76 m) and profiling. He authored the technical report that included the findings and recommendations. He managed the budget, and coordinated with the client. The Texas Historical Commission and the Army Corps of Engineers accepted the report.
- **Sand Hill Energy Center, Travis County, Central Texas, 2002.** Mr. Quigg served as Principal Investigator and Field Director on two projects related to the expansion of facilities at the City of Austin power plant. He also co-authored the technical reports and managed the budget, and coordinated with the client.
- **Red Lake, Martin County, Southern Llano Estacado, 1993.** Mr. Quigg served as Principal Investigator and Field Director during the inventory and site assessment for proposed 47 ha. Reservoir for the Colorado River Municipal Water District. He also co-authored the technical report and managed the budget, and coordinated with the client.
- **Sulphur Springs Draw Reservoir: Geoarchaeological and Archaeological Investigations, Southern Llano Estacado, 1994.** Mr. Quigg served as Principal Investigator and Field Director during the inventory and site assessment for proposed 435 ha. Sulphur Draw Reservoir for the Colorado River Municipal Water District. He also co-authored the technical report and managed the budget, and coordinated with the client.
- **Texcor Property Assessment, Prewitt and Associates, Inc., 1988, West Texas.** Mr. Quigg served as Field Archeologist for the reconnaissance of a proposed hazard waste site in Kinney County. He authored a letter report (No. 356) with recommendations to the client.
- **Brooke Army Medical Center Assessment, Prewitt and Associates, Inc., 1988, South Texas.** Mr. Quigg served as the Field Archeologist for the reconnaissance of

development impact along Salado Creek in Fort San Houston. He wrote the report with the recommendations to the client.

- **City of Robinson Water Plant, Prewitt and Associates, Inc., 1988, Central Texas.** Mr. Quigg served as the Archeologist for the reconnaissance of a 153 m long pipeline corridor and 7.4 acres parcel around the intake structure. He authored an appendix that included methods, results, and provided recommendations to the client.
- **Hidalgo County Drainage Ditch Realignment, Prewitt and Associates, Inc., 1988, South Texas.** Mr. Quigg served as the Field Archeologist for the reconnaissance of proposed development of water drainage ditches. He coauthored the final report.
- **Cultural Resource Inventory, Bureau of Indian Affairs, Northern Cheyenne Indian Reservation, 1986, Eastern Montana.** Mr. Quigg Field Directed the inventory of 6,300 non-continuous acres, 200 miles of road corridors, and 85 springs. He helped document 139 sites, created site typologies, analyzed site distribution by environmental attributes, projected settlement pattern distributions, and wrote the final report for the BIA.
- **Class II Cultural Resource Inventory, Bureau of Land Management, Milk River Region, 1985, Northern Montana.** Mr. Quigg field directed the inventory of 6,720 acres in the valley breaks of the Milk River Valley. He helped record over 200 sites encompassing 1,100 features including rock cairns, stone circles, lithic scatters, bison kills, and historic sites. He completed the data and site distribution analyses, coauthored the written documentation of the findings and interpretations for the BLM.
- **An Historical Impact Assessment, Deadfish Water Diversion, Ethos Consultants Ltd. 1984, Southern Alberta.** Mr. Quigg served as Project Manager and field director for the inventory and assessment of a 14.5 km ROW, documented in detail 12 prehistoric and one historic site through hand excavation of 102 m² individual features, site mapping, and recorded weight and depth of feature rocks. He also wrote and produced a 167 page technical report with site specific and general project recommendations to the government regulators.

Preparation of Cultural Resource Operational Management Plan and Management Plans

- **Palo Duro Reservoir, Operational Management Plan, Palo Duro River Authority, 1994, Hansford County, Texas.** Mr. Quigg helped develop the first OMP to be accepted for a reservoir in Texas. He was the primary author and compiled necessary data to write the contents of a plan that allows for the management of the cultural resources in the vicinity of the reservoir under the Texas Antiquities Code.
- **Archeological, Ethnographic, and Historical Literature Review of Site Specific Data, State Historical Society of North Dakota, 1983-984, Montana, North Dakota, and Wyoming, United States and Alberta and Saskatchewan, Canada.** Mr. Quigg served as Co-Principal Investigator and coordinator of a site-specific data review of

stone circle site excavations from across the Northwestern Plains. This program included a review and synthesis of excavation methods, recording procedures, data analyses, data results, site and feature documentation strategies on stone circles and provided a detailed management plan and future direction concerning this specific site type.

Preparation of Testing, Data Recovery Plans, and Research Designs

- **Treatment Plan for Three Archeological Sites on the Landis Property near Amarillo, Texas.** Mr. Quigg developed an in-depth plan for the Bureau of Land Management. The plan presented a research design including research issues and questions, detailed field work plan for three sites, presented various technical analyses, and reporting to address six stated research issues. The client and regulators approved the plan.
- **Research Design for Sites 41WB556 and 41WB557, Texas Department of Transportation, 2000, South Texas.** Mr. Quigg developed and wrote a data recovery plan for two buried, prehistoric sites to be impacted by highway development. The plan covered the field investigations, data analysis, reporting to address six stated research issues. The client and regulators approved the plan.
- **Data Recovery Plan for 41ZP364, TransTexas Gas Corporation, 1997, South Texas.** Mr. Quigg developed the data recovery plan was used to guide the field and laboratory investigations. It was prepared to comply with the 1997 MOA for Well Pad #1 signed by the Council, BLM, SHPO, and the client. The client and regulators approved the plan.
- **Testing Plan for 41ZP39 and 41ZP176, TransTexas Gas Corporation, 1997, South Texas.** Mr. Quigg developed the testing plan used to assess these sites in the direct impact areas for inclusion into the NRHP. It was intended that the results was have a finding of no effect for the limited impacts by the pipeline route. The client and regulators approved the plan.
- **Testing of 41MT14 Sulphur Draw Reservoir, 1992, Colorado River Municipal Water District, Northwest Texas.** Mr. Quigg developed the testing plan for a buried campsite in the dam axis of the proposed reservoir. The regulators approved the plan.
- **Testing of 41MT21 Sulphur Draw Reservoir, 1992, Colorado River Municipal Water District, Northwest Texas.** Mr. Quigg developed the testing plan for a buried campsite in the dam axis of the proposed reservoir. The regulators approved the plan.

Historical Investigations

Mr. Quigg has managed, directed, and participated in historic site inventories, archival documentation, and record searches for various projects across the Plains, often as components of larger projects. These investigations have centered on documenting standing structures and mine sites. He has directed the hand excavation of a historic dugout and house foundation in Palo Duro Reservoir. He has documented various mining structures in the Clearwater National Forest in Idaho and at Rock Lake Marias Pass, Cabinet Mountain Wilderness, and Helmville East in Montana, and directed the records search for the Mitchell Reservoir Project and Area F at Jewett Mine.

- **Palo Duro Reservoir Historic Sites, Palo Duro River Authority, 1991, Northwestern Texas.** Mr. Quigg directed and field supervised the data recovery from a historic dugout (41HF113) and historic rock foundation (41HF8). He directed data analysis and communicated with historic archeologist for a chapter of the final report.
- **Zan's Cabin, U.S. Forest Service, 1987, Northern Idaho.** Mr. Quigg served as Archeologist and conducted the reconnaissance and documentation of the historic structure and pioneer mine prior to structure removal.
- **Footrot Cabin Assessment, U.S. Forest Service, 1987, Northern Idaho.** Mr. Quigg served as Archeologist and conducted the reconnaissance, documentation, and assessment of the historic structure.

Native American Consultation

Mr. Quigg has participated in a number of consultation processes with Native American groups in Texas and Canada. He has served as Project Archeologist and interacted with a number of Plains Tribes.

- **The Leon Medicine Wheel, U.S. Army Fort Hood, 1996, Fort Hood, Texas.** Mr. Quigg conducted interviews with the elders Mr. William Tallbull, Haman Wise, Floyd Youngman and Lee Lonebear of the Medicine Wheel Alliance, coordinated activities with the American Indian Resource, and Education Coalition of Texas, participated in spiritual cleansing ceremonies, was a participant in the actual reconstruction and rededication ceremony for the sacred wheel. Was Project Manager and primary author in the archeological and documentation of the medicine wheel and associated ceremonial events.
- **Northern Cheyenne Reservation, Bureau of Indian Affairs, 1986, Eastern Montana.** As Field Director of a large inventory across native lands and sites he interviewed a number of tribal members and leaders, in the location, markings, and dealings with sacred sites and how to protect these religious and sensitive sites. He was coauthor in the final report.

Technical Data Analyses

Mr. Quigg has personally conducted numerous site specific and in-depth analyses on various cultural materials and data sets including lithic debitage, ceramics, stone tools, bone tools, burned rocks, and faunal assemblages. He has developed expertise in these data sets and has formulated specific analysis to address specific research questions or issues relating to specific topics. The structured analyses have permitted concentration of often-limited resources on the most important data sets to address important questions.

- **Ceramic Analyses:** Mr. Quigg has performed metric and non-metric descriptions, analyzed data, and presented results in chapters of reports. He has formulated research designs and incorporated instrumental neutron activation, organic residue, stable carbon isotope, and petrographic analysis with the more descriptive analyses. Examples of ceramic analysis from excavated sites include the Long View (41RB112), Rush site (41TG346) in western Texas, the Manyfingers site (DhPj-31) in southern Alberta, the Cory Ranch site in (24TT83) in central Montana, and the Otero Mesa sites in Fort Bliss in southern New Mexico and western Texas. He has conducted chemical analyses such as stable carbon and nitrogen isotope and lipid residue analysis on sherds to explore for foods being cooked in vessels. He has used sherds to obtain direct radiocarbon AMS dates.
- **Faunal Analyses:** Mr. Quigg has conducted element and animal identifications, isolated animal ages through tooth eruption and fusion rates, identified sex based on bone metric data, and conducted in-depth butchering analyses on assemblages from bison kills, processing centers, and campsites sites and bison processing areas in western and northern Texas, and southern Alberta and central Saskatchewan. Examples of faunal analyses include Long View (41RB112), Rush site (41TG346) in western Texas, three sites (41RN169, 41CC131, 41CN95) in O.H. Ivie Reservoir in central Texas, Clear creek Golf Course 41CV413 in central Texas, the Sanders site (41HF128) and other Palo Duro Reservoir sites in northwestern Texas, the Lloyd site (FhNa-35) and Crown site (FhNA-86) in central Saskatchewan, the Manyfingers site in southern Alberta, and S.S. Burmis in southwestern Alberta. These assemblages included hundreds of elements and generally a variety of species. Other smaller assemblages have been analyzed and reported upon such as those from Justiceburg Reservoir. Mr. Quigg maintains his own faunal comparative collected. He has conducted chemical analysis on animal bones such as stable carbon and nitrogen isotope to investigate the types of foods specific animals were eating and what changes in the diet have occurred over time.
- **Lithic Analyses:** Mr. Quigg has conducted raw material identifications and metric and non-metric descriptive analyses on lithic artifacts and debitage. These and other analyses have been conducted on specific sites from across broad regions of hunter and gathers including the Schmidt Quarry (24BW559) and the Lost Terrace Site (24CH68) in Montana, lithic tool and debitage analysis of sites in the Palo Duro Reservoir and Fort Hood, the stone tool and debitage analyses for three sites near Falcon Reservoir in southern Texas and the Lloyd (FhNa-35) and Crown site (FhNA-86) in central Saskatchewan, the stone tool analysis from the Rush site (41TG346), the Sanders site stone tool assemblages (41HF128) both in Texas, and many other lithic assemblages

from across southern Alberta. Mr. Quigg maintains his own lithic reference collection from across two Canadian provinces, and four Plains states.

- **Burned Rock Analyses:** Mr. Quigg has been conducting burned rock analysis for many years at a variety of sites and has instigated a multiple disciplinary approach to help understand these poorly known waste products. He has employed the use of stable carbon and nitrogen isotope data, lipid residues, and starch grain analysis to help address the types of food resources that have been processed by the rocks. He has integrated rock size, weight data, and diatom data with specific context of features to address feature functions. He has also employed AMS radiocarbon dating of organic residues from burned rocks to determine the age of features. Examples of these analyses include the Varga (41ED28), Lino site (41WB437), the Boiler site (41WB557) and 41ZP364 in southern Texas, and the Otero Mesa burned rock features in Fort Bliss.

Collection Management

Mr. Quigg has managed, organized and sorted archeological collections, documents, and photographs from Baniff, Japer, and Waterton National Parks in Canada stored at the University of Calgary. He collected, processed and curated new faunal specimens for the osteological comparative laboratory at the Department of Archaeological, University of Calgary. Mr. Quigg also maintained, organized, and labeled a large collection of animal, fish, and bird skeletons for continuous use by staff and students and for instructional purposes. He performed osteological identifications for numerous individuals and groups while at the University of Calgary. Mr. maintains his own personal non-human osteological and lithic source comparative collections from the plains region.

SPECIALIZED TRAINING AND WORKSHOPS

- National Historic Preservation Act Section 106 Workshops
- Identification and Management of Traditional Cultural Places by T. F. King
- Managing Multiple Projects, Objectives, and Deadlines
- Time Management Training
- American Red Cross first aid and CPR Training
- U.S. Department of Labor and Mine Safety and Health Administration Training

Teaching History

- **Instructor, Continuing Education, University of Calgary, 1974, 1974-1975 Calgary, Alberta.** Mr. Quigg planned the curriculum and taught two night undergraduate courses in southern Alberta/Plains archaeology.
- **Instructor, Department of Archaeology, University of Calgary, 1974, Crowsnest Pass, Southwestern Alberta.** Mr. Quigg planned the curriculum, directed field and laboratory efforts, and taught three undergraduate archaeological field courses to 20 students.

- **Teaching Assistant/Field Director, Department of Archeological, University of Calgary, 1970, Waterton National Park, Southwestern Alberta.** Mr. Quigg directed 27 students in field excavation techniques and taught techniques and data recovery methods at a complex stratified campsite during a 6-week archaeological field school at Indian Springs under the direction of Dr. Leslie B. Davis.
- **Student Leader, Department of Anthropology, University of Northern Colorado, 1970, Sanora Mexico.** Mr. Quigg assisted eight students in a 2-week long archaeological reconnaissance and site documentation in northern Sanora under the direction of Dr. George Fay. He recorded open-air camps, shell middens, and rock art sites.

Organizations and Memberships

Council of Texas Archeologist
 Texas Archeological Society
 Plains Anthropological Society
 Travis County Archeological Society

Elected or Appointed Positions, and Honors

Received Aware for Excellence in Archaeology by the Texas Historical Commission, 2001.
 Chair, Governmental Affairs Committee, Council of Texas Archeologists, 1994-1995
 Member of the Board of Directors, Montana Archaeological Society, 1986
 Member of the Board of Directors of the Association of Consulting Archaeologists, Alberta, 1981, 1982, and 1985.
 Present, Association of Consulting Archaeologists, Alberta, 1983
 Member of the Board of Directors of Southeastern Alberta Archaeological Society, Alberta, 1981-1984
 Vice President/Secretary, Ethos Consultants Ltd. 1981-1985
 Board of Directors, Big Brothers, Medicine Hat, Alberta. 1981-1985
 Honorary Research Associate, Department of Archaeology, University of Calgary, Nov. 1973-Mar. 1975.

Professional Presentations

- 1971 Archaeological Research in Waterton Lakes National Park. Paper presented at 29th Annual Plains Conference, Winnipeg.
- 1974 Prehistoric Settlement Patterns in the Southwestern Alberta Foothills. Paper presented at the 17th Annual Meeting of the Montana Archaeological Society, Bozeman, Montana.
- 1977 Summary of Tipi Ring Excavations in Southern Alberta. Paper presented at the 32nd Annual Plains Conference.
- 1977 Prehistoric Settlement Patterns in Southern Alberta. Paper presented to Edmonton chapter of Archeological Society of Alberta, Edmonton.
- 1978 Besant Tipi Ring Excavations. Paper presented at the 36th Annual Plains Conference, Denver, Colorado.
- 1978 Summary of Tipi Ring Excavations in Alberta to 1978. Paper presented at the 11th Annual Chacmool Archaeological Conference, "Megaliths to Medicine Wheels: Boulder Structures in Archaeology," Calgary, Alberta.
- 1980 Stone Alignments. Paper presented at the 1980 Alberta Archaeological Society meeting, Lethbridge.

- 1981 Social Structure at the Ross Glen Tipi Ring Site. Paper presented at the 39th Plains Conference, Bismarck, North Dakota.
- 1982 A 4700-Year Old Tool Assemblage from East Central Alberta. Paper presented at the 40th Annual Plains Conference and 15th Annual Chacmool Symposium, Calgary, Alberta.
- 1984 A Ceramic-Bearing Avonlea Component in Southwestern Alberta. Paper presented at the 42nd Plains Conference, Lincoln, Nebraska.
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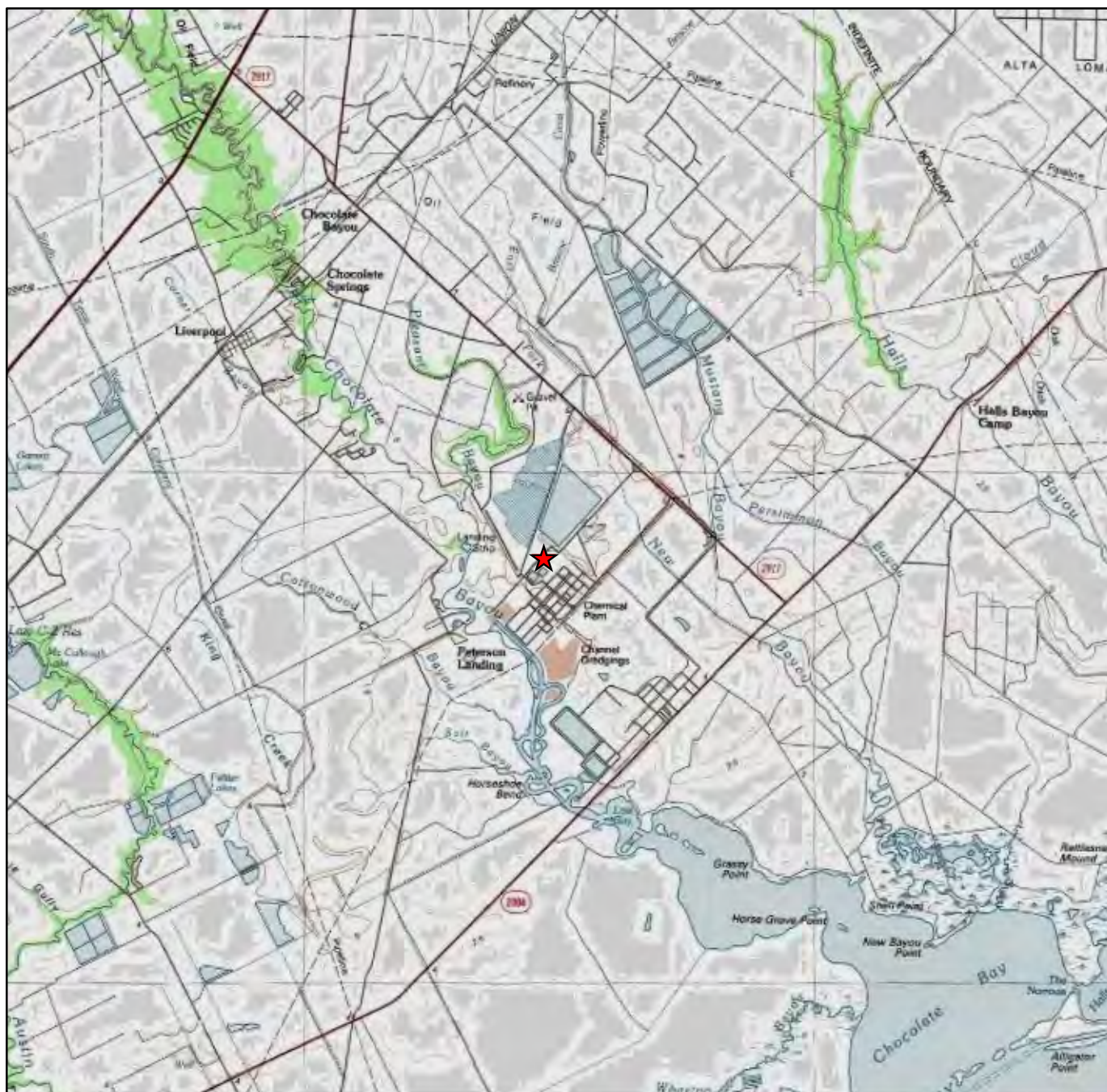
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Appendix B Figures

TRC - GIS



BASE MAP: USGS 100K TOPOGRAPHIC QUADRANGLE
SERIES: ANGLETON, TX. (1984)

★ C3 PETROCHEMICALS PDH PROJECT LOCATION



0 3 6 Kilometers



10011 Meadowglen Lane
Houston, TX 77042
Phone: 713.244.1000

C3 Petrochemicals, LLC PDH Project

PROJECT LOCATION
CULTURAL RESOURCE REPORT
ALVIN, BRAZORIA COUNTY, TEXAS

DRAWN BY:	RNCARR
APPROVED BY:	NSYLVESTER
PROJECT NO:	199212.0000.0000
FILE NO.	199212_1_Cultural.mxd
DATE:	MARCH 2013

FIGURE 1

TRC - GIS

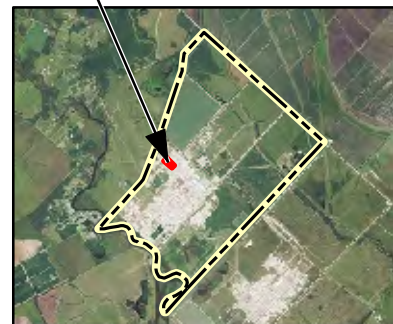


BASE MAP: NATIONAL AGRICULTURE
IMAGERY PROGRAM (2012)

- C3 PETROCHEMICALS PDH PROJECT CONSTRUCTION AREA: 300' X 750'
- ASCEND CHOCOLATE BAYOU FACILITY PROPERTY LINE



0 300 600
Feet



10011 Meadowglen Lane
Houston, TX 77042
Phone: 713.244.1000

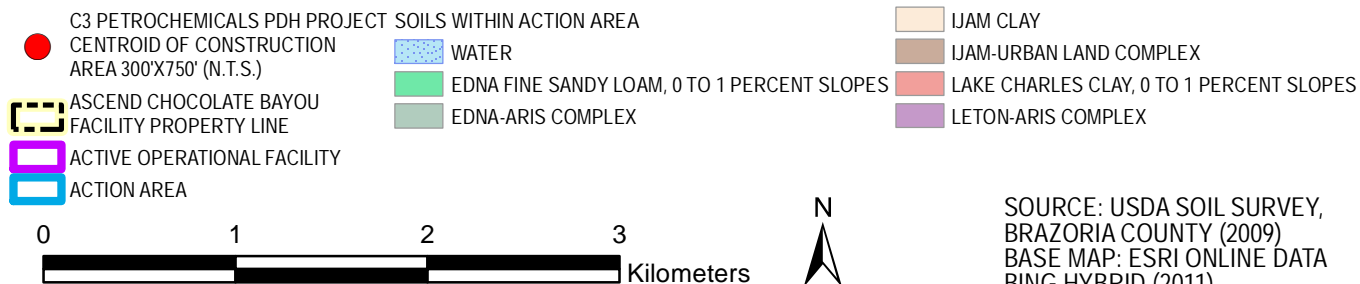
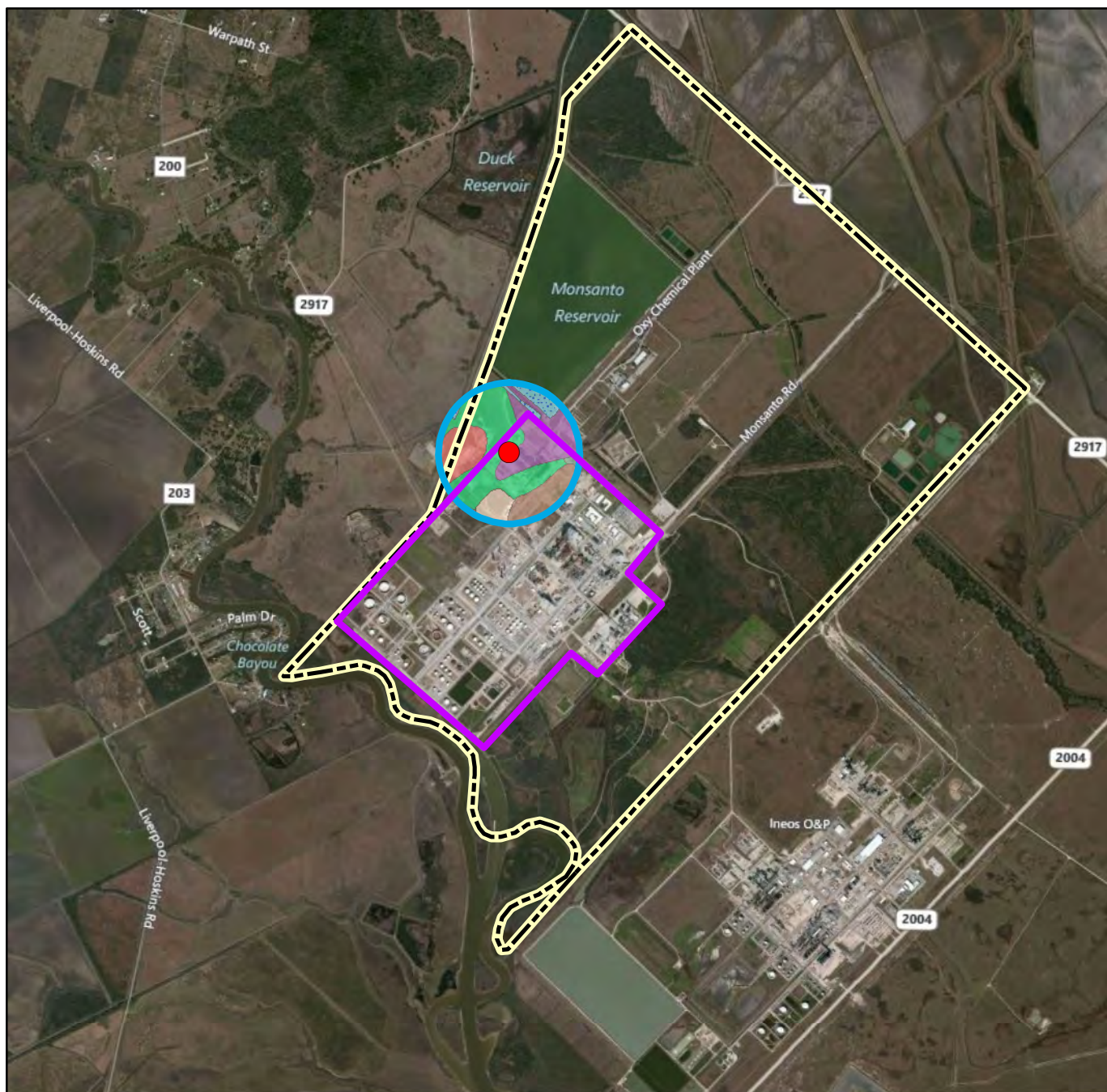
C3 Petrochemicals, LLC PDH Project

**CONSTRUCTION AREA - 2012 AERIAL PHOTOGRAPH
CULTURAL RESOURCE REPORT
ALVIN, BRAZORIA COUNTY, TEXAS**

DRAWN BY:	RNCARR
APPROVED BY:	NSYLVESTER
PROJECT NO:	199212.0000.0000
FILE NO.	199212_2_Cultural.mxd
DATE:	MARCH 2013

FIGURE 2

TRC - GIS



10011 Meadowglen Lane
Houston, TX 77042
Phone: 713.244.1000

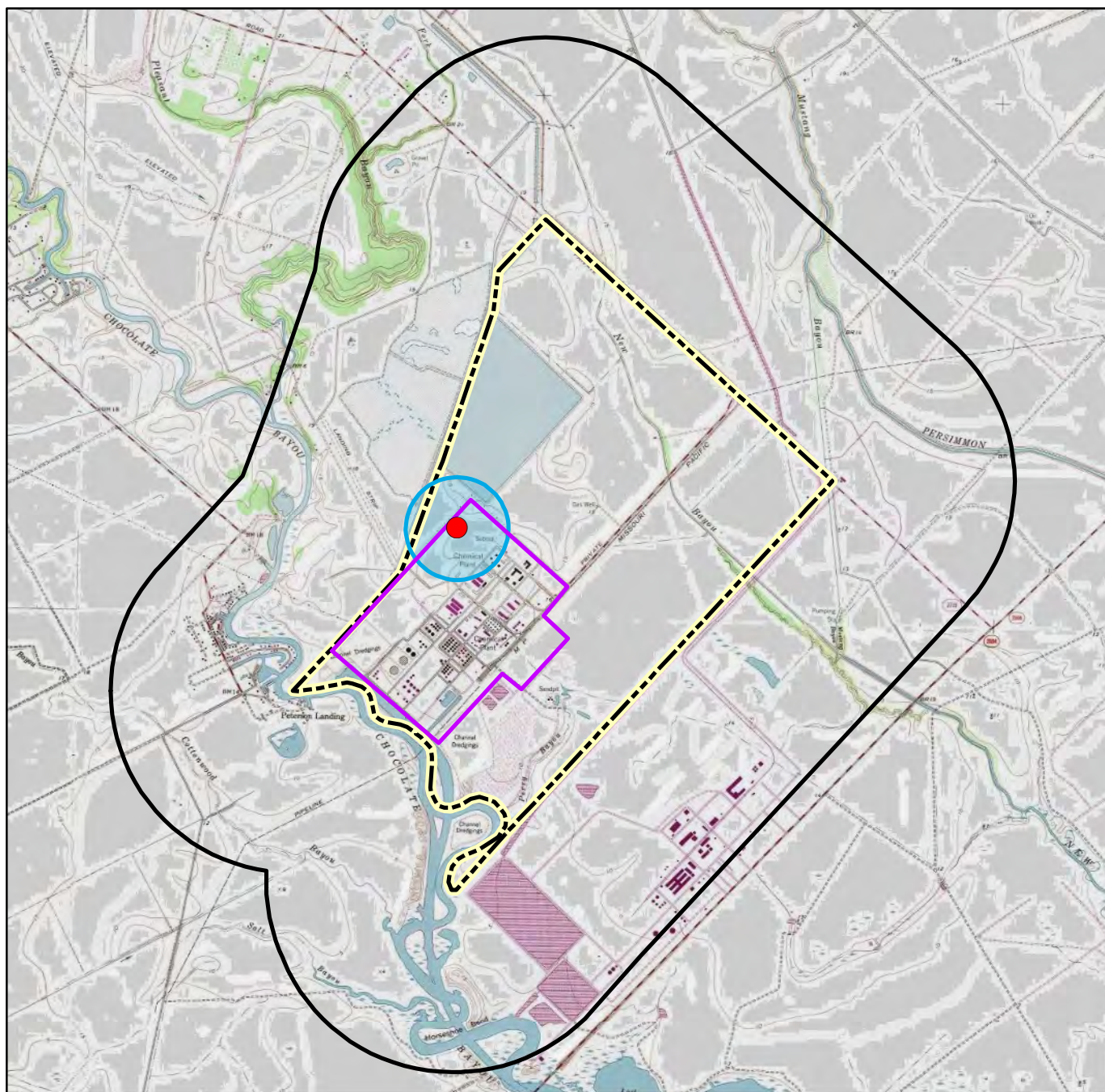
C3 Petrochemicals, LLC PDH Project

**SOIL SURVEY
CULTURAL RESOURCE REPORT
ALVIN, BRAZORIA COUNTY, TEXAS**

DRAWN BY:	RNCARR
APPROVED BY:	NSYLVESTER
PROJECT NO:	199212.0000.0000
FILE NO.	199212_3_Cultural_Soils.mxd
DATE:	OCTOBER 2013

FIGURE 3






TRC - GIS



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES:
HOSKINS MOUND AND MUSTANG BAYOU, TX



0 2 4 Kilometers

-  C3 PETROCHEMICALS PDH PROJECT
CENTROID OF CONSTRUCTION
AREA 300'X750' (N.T.S.)
-  ASCEND CHOCOLATE BAYOU
FACILITY PROPERTY LINE
-  ACTIVE OPERATIONAL FACILITY
-  ACTION AREA
-  1-MILE SEARCH RADIUS



10011 Meadowglen Lane
Houston, TX 77042
Phone: 713.244.1000



C3 Petrochemicals, LLC PDH Project



**1-MILE RADIUS SEARCH OF
TEXAS ARCHAEOLOGICAL SITES ATLAS
ALVIN, BRAZORIA COUNTY, TEXAS**

DRAWN BY:	RNCARR
APPROVED BY:	NSYLVESTER
PROJECT NO:	199212.0000.0000
FILE NO.	199212_4_Cultural.mxd
DATE:	OCTOBER 2013

FIGURE 4

Appendix C Photos

Project: C3 Petrochemicals PDH Project	
Client: C3 Petrochemicals	County, State: Brazoria County, TX
Feature: Construction Area	
Date: 01/21/2013	
Comments: Photo view from the east side of the Area of Potential Effect (construction area) facing west.	
Feature: Construction Area	
Date: 01/21/2013	
Comments: Photo view from the north side of the Area of Potential Effect (construction area) facing south.	

Project: C3 Petrochemicals PDH Project	
Client: C3 Petrochemicals	County, State: Brazoria County, TX
Feature: Construction Area	
Date: 01/21/2013	
Comments: Photo view from the west side of the Area of Potential Effect (construction area) facing east.	
Feature: Construction Area	
Date: 01/21/2013	
Comments: Photo view from the south side of the Area of Potential Effect (construction area) facing north.	

Appendix D

Cultural Resources Report for Laydown Area

**Intensive Cultural Resource Survey:
Construction Parking and Laydown Parcel
Ascend Performance Materials
Chocolate Bayou Plant**

**C3 Petrochemicals LLC
PDH Project Brazoria County, Texas**

By:

J. Michael Quigg

Prepared for:



ENVIRON International Corporation
Houston, Texas 77042

Prepared by:



TRC Environmental Corporation
Austin, Texas 78752

TRC Technical Report No. 199212

July 2013

**Intensive Cultural Resource Survey:
Construction Parking and Laydown Parcel
Ascend Performance Materials
Chocolate Bayou Plant**

**C3 Petrochemicals LLC
PDH Project Brazoria County, Texas**

By:

J. Michael Quigg

Prepared for:



**10333 Richmond Avenue, Suite 910,
Houston, Texas 77042**

Prepared by:



**TRC Environmental Corporation
505 East Huntland Drive, Suite 250
Austin, Texas 78752**

**J. Michael Quigg, Principal Investigator
TRC Technical Report No. 199212**

July 2013

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EXECUTIVE SUMMARY

TRC Environmental Corporation (TRC) was contracted by ENVIRON International Corporation of Houston, Texas to perform a cultural resource survey of the proposed construction parking and equipment laydown parcel at the existing Ascend Performance Materials (Ascend) Chocolate Bayou Plant in Brazoria County, Texas. The proposed parking/laydown parcel, or Area of Potential Effect (APE), is necessary to support construction activities associated with the new C3 Petrochemicals, LLC propane dehydrogenation (PDH) manufacturing unit at the Chocolate Bayou Plant. The proposed construction is scheduled to impact less than the top 30 centimeters (12 inches) of the 0.1 square kilometers (24.5 acres) parcel surface through grading and adding a gravel layer. The purpose of this archeological investigation was to determine whether any cultural resources are likely to be affected by the proposed construction in the APE, which activity is associated with the United States Environmental Protection Agency's issuance of a federal Greenhouse Gas (GHG) permit for the new PDH manufacturing unit.

The Texas Historical Commission Archeological electronic Sites Atlas, which contains previously documented cultural resource sites and details of previous archeological investigations, was consulted on July 10, 2013. No previously identified cultural resource sites or cultural resource surveys are documented within the APE or within a 1.6 kilometer (1 mile) radius of this proposed project area. On July 11, 2013, TRC Project Archeologist J. Michael Quigg conducted an intensive Phase I cultural resource survey that included a pedestrian survey and shovel tests in the proposed parking/laydown parcel.

No archeological sites or prehistoric artifacts were identified on or near the surface (top 30 centimeters or 12 inches) during the survey and shovel testing in the proposed APE. The presence of modern materials and recent historic artifacts (such as metal wire, round nails, chunks of cement, clay pipe fragments, and plastic) in the shovel tests, marine fossil shells near or on the surface, evidence of uneven surfaces, and some mixing of soil horizons all combined indicate the top and near surface of this APE has been previously disturbed. TRC's archeologist recommends no further archeological investigations at this proposed parking/laydown parcel.

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) was contracted by ENVIRON International Corporation of Houston, Texas to perform cultural resource survey of the proposed construction parking and equipment laydown parcel at the existing Ascend Performance Materials (Ascend) Chocolate Bayou Plant in Brazoria County, Texas. The proposed parking/laydown parcel, or Area of Potential Effect (APE), is necessary to support construction activities associated with the new C3 Petrochemicals, LLC propane dehydrogenation (PDH) manufacturing unit at the Chocolate Bayou Plant. The proposed construction is scheduled to impact less than the top 30 centimeters (12 inches) of the 0.1 square kilometers (24.5 acres) parcel surface through grading and adding a gravel layer. The APE is located within the Chocolate Bayou Plant but out the currently active operational areas of the manufacturing complex.

To resolve whether the proposed undertaking has the potential for damaging or destroying any cultural resources, C3 Petrochemicals, through ENVIRON, decided to be proactive and conduct an archeological survey to facilitate the federal permitting process. The Phase I cultural resource evaluation of the proposed impact area followed existing federal guidelines that include: Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966 (P.L. 89-665; 80 Stat. 915; 16 USC §470 et seq.); the National Environmental Policy Act (NEPA) of 1969 (P.L. 91-190; 83 Stat. 852; 42 USC §4221 et seq.); Executive Order No. 11593 of 1971, "Protection and Enhancement of the Cultural Environment"; the Archeological and Historic Preservation Act (AHPA) of 1974 (P.L. 93-291; 88 Stat. 174; 16 USC §469 et seq.); the American Indian Religious Freedom Act (AIRFA) of 1978 (P.L. 95-341; 92 Stat. 469; 42 USC §12996); and the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (P.L. 101-601; 104 Stat. 3048; 25 USC §3001 et seq.). Pursuant to the federal Clean Air Act, C3 Petrochemicals is seeking a permit under the United States Environmental Protection Agency's (EPA) Greenhouse Gas (GHG) Prevention of Significant Deterioration (PSD) program to authorize construction of a propane dehydrogenation (PDH) unit.

The Chocolate Bayou Plant was originally constructed by Monsanto Company (Chemicals Division) in 1962 on a site located southwest of Alvin, Texas in Brazoria County, which was selected for its proximity to intercoastal waterway and customers (Figure 1). The real property was later acquired by Ascend from Solutia Inc. in 2009. Solutia Inc. was formed as a divestiture of the Monsanto Company Chemical business. Ascend owns and operates a world-scale acrylonitrile facility at the Chocolate Bayou Plant, which currently occupies about 2.02 km² (500 ac.) on a 10.1 km² (2,500 ac.) site. Today, the plant continues to be an industry leader, manufacturing a wide range of intermediate or 'building-block' chemicals that are used to make other products such as man-made fibers and herbicides. The Ascend plant runs 24 hours a day, with a staff of about 600 employees.

C3 Petrochemicals, LLC is planning to build a new propane dehydrogenation (PDH) manufacturing unit inside the existing Chocolate Bayou Plant (Figure 1). The Chocolate Bayou Plant complex is located on Farm to Market (FM) road 2917, approximately 12.9 km (8 mi) south of the intersection of State Highway 35 and FM 2917 (Figure 1). The C3 Petrochemicals PDH unit will use propane as a raw material, which will be dehydrogenated to produce polymer-grade and chemical-grade propylene. This propylene product will be distributed to customers via pipeline.

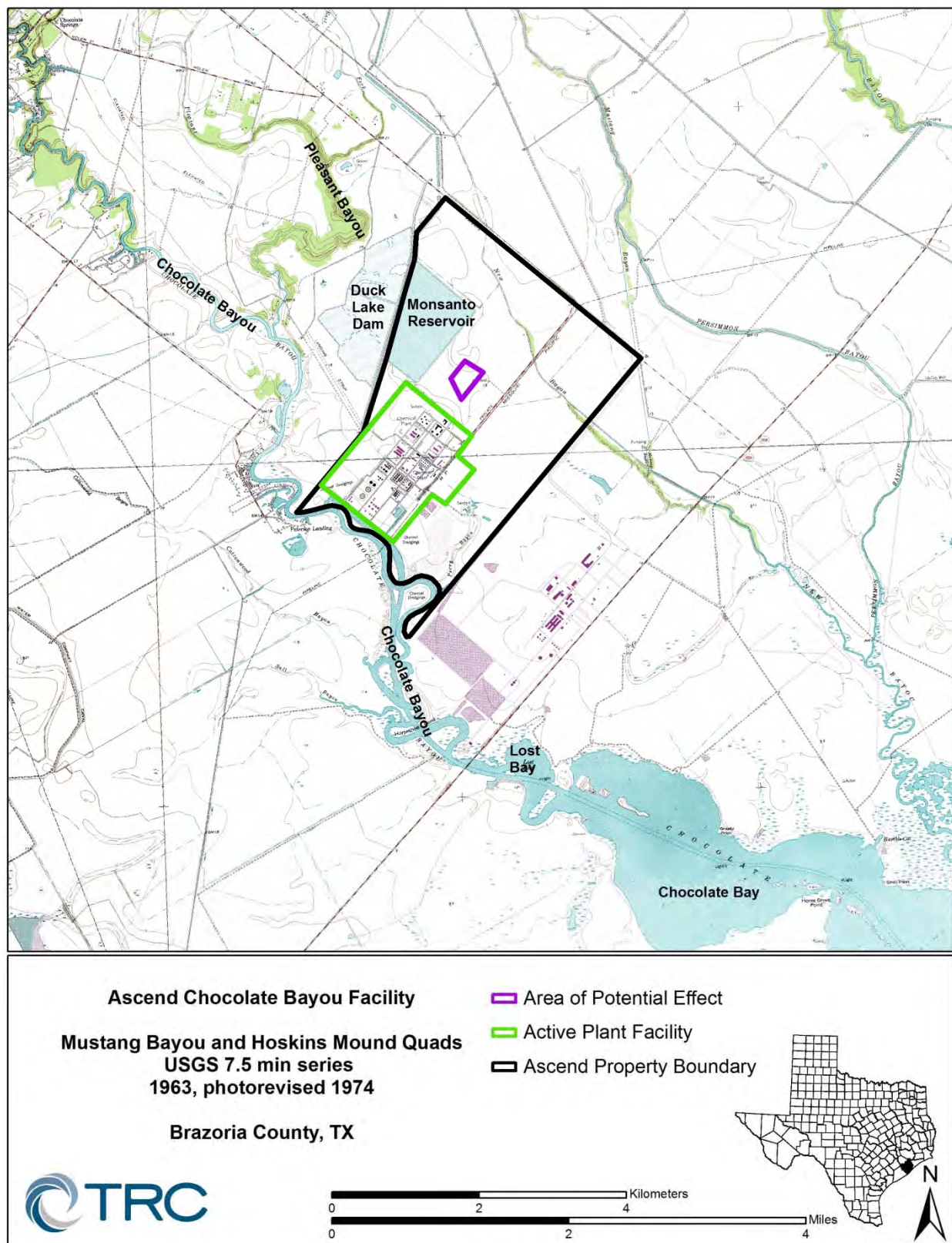


Figure 1. Location of Ascend property, with specific project APE, in Brazoria County, Texas

During the construction phase of this PDH unit, the contractor will require parking and laydown space for materials and equipment. This needed area, the APE, is currently used for grazing cattle and is adjacent to Ascend's active operational areas within the Chocolate Bayou Plant.

On July 11, 2013, J. Michael Quigg, Project Archeologist of the Planning, Permitting, and Licensing Practice of TRC's office in Austin, Texas, conducted an intensive Phase I cultural resource survey through pedestrian survey and excavation of shovel tests across the APE to locate any cultural resources that would potentially be impacted by this proposed project. The present ground surface in the APE appeared disturbed to varying degrees from the natural condition, and is currently used as a cattle pasture (Figure 2). Vegetation in this pasture consists of various grasses and sparse bunch grasses, nonnative wild rose bushes, and the occasional small bush (Figure 3).

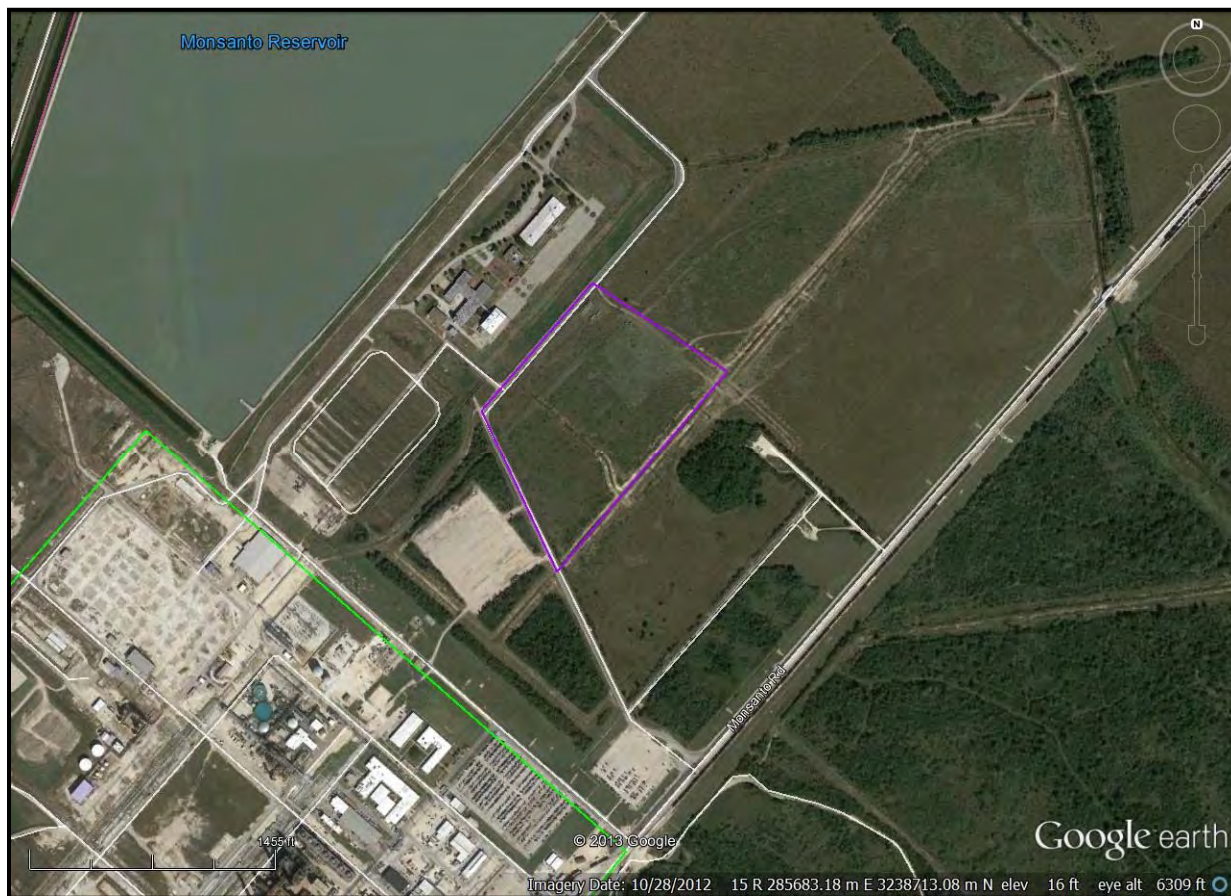


Figure 2. A 2012 aerial photograph of the APE, showing general location of proposed parking and equipment storage parcel, existing road and ditches that surround the parcel, plus the linear line of the existing pipeline across the property. Note: The existing Ascend plant and proposed C3 Petrochemicals plant site are located to the southwest, in the lower left hand corner.



Figure 3. View of typical ground surface with low grasses in the APE.

A buried pipeline for the existing plant facility crosses the northwestern portion of this parcel from the northeast and is visible on aerial photographs and on the ground (see Figure 2). An existing paved road borders the northwestern and southwestern sides (see Figure 2). A manmade drainage ditch nearly 3 m deep extends along the northeastern and southeastern boundaries of the parcel (Figure 4). Much of the ditch exhibits the natural soil profile along the APE. Within the APE, another manmade ditch crosses the parcel from northwest to southeast in the southern third of the parcel, and is about 1 m deep (Figure 5).



Figure 4. View of drainage ditch along southeastern boundary of APE (view from road to the northeast).



Figure 5. View southeast of shallow drainage ditch that crosses the southern third of APE.

Information provided by Ascend personnel was that the APE would be surface scraped and leveled, the top organic layer removed and set aside, and a 15 cm (6 in.) layer of gravel would be spread across the scraped area. This area would be used during construction as a parking lot and equipment storage area. It was anticipated the scraping would not exceed 30 cm (12 in.) deep.

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2.0 ENVIRONMENTAL SETTING

2.1 PHYSIOGRAPHY

C3 Petrochemicals LLC is planning to build a new propane dehydrogenation manufacturing unit inside the existing Ascend Chocolate Bayou Plant site southwest of Alvin, Texas in Brazoria County (see Figure 1). Brazoria County is situated on the Gulf Coastal Plain in southeastern Texas, approximately 13 km (8.1 mi) from the Gulf of Mexico shore. The Gulf of Mexico represents a structural basin formed by lithosphere deformation. The Texas Coastal Plain, which extends westward to the Balcones Escarpment and as far north as the Ouachita uplift in southern Oklahoma, consists of seaward-dipping bodies of sedimentary rock, most of terrigenous clastic origin, that reflect the gradual infilling of the basin from its margins (Abbott 2001). The coastal region is underlain by rocks and unconsolidated sediments that are quite young in a geological sense, ranging from modern to Miocene in age. These consist predominantly of a series of fluviodeltaic bodies arranged in an off lapped sequence, with interdigitated and capping eolian, littoral, and estuarine facies making up a relatively minor component of the lithology. Major bounding disconformities between these formations are usually interpreted to represent depositional hiatuses that occurred during periods of sea level low stand. The oldest rocks in this fill are of Late Cretaceous age. As a result of the geometry of basin filling, successively younger rock units outcrop in subparallel bands from the basin margin toward the modern coastline.

The project area is low in elevation and ranges from about 3.0 to 4.6 m (10 to 15 ft) above mean sea level. Prior to modern land developments, the area was a marshy region with oxbow channels and low rises above and adjacent the many bayous (Figure 6).

Chocolate Bayou is the principal bayou located generally west of the project area; although others such as New Bayou and Mustang Bayou are just to the east, Pleasant Bayou to the north, and Cottonwood Bayou to the southwest (see Figure 1). As do all waterways that eventually join the Gulf of Mexico, including the Brazos River to the south, Chocolate Bayou flows southeastward. This Bayou traverses most of eastern Brazoria County, ultimately flowing into the Gulf of Mexico at a point north of Freeport and south of Galveston, Texas.

2.2 GEOLOGY AND GEOMORPHOLOGY

The project area is underlain by the Beaumont Formation of the Pleistocene (Qb, Figure 7, Barnes 1982). This consists mostly of clay, silt, and sand and includes mainly stream channel, point-bar, natural levee, backswamp, and to a lesser extent coastal marsh and mud flat deposits. Concretions of calcium carbonate, iron oxide, and iron-manganese oxides are in the zones of weathering. The surface is almost featureless, characterized by relict river channels shown by meander patterns and pimple mounds on meander belt ridges and often separated by areas of low, relatively smooth, featureless back swamp deposits without pimple mounds. The thickness is ± 30.5 m (100 ft). The stippled overprint (Qb-stippled) shows areas that are dominantly clay and mud of low permeability, high water-holding capacity, high compressibility, high to very high shrink-swell potential, poor drainage, level to depressed relief, low shear strength, and high plasticity. Geologic units include interdistributary muds, abandoned channel fill muds, and overbank fluvial muds.



Figure 6. A 1943 and 1965 Texas General Land Office aerial mosaic photograph composite depicting marshy areas and oxbow channels across the APE.

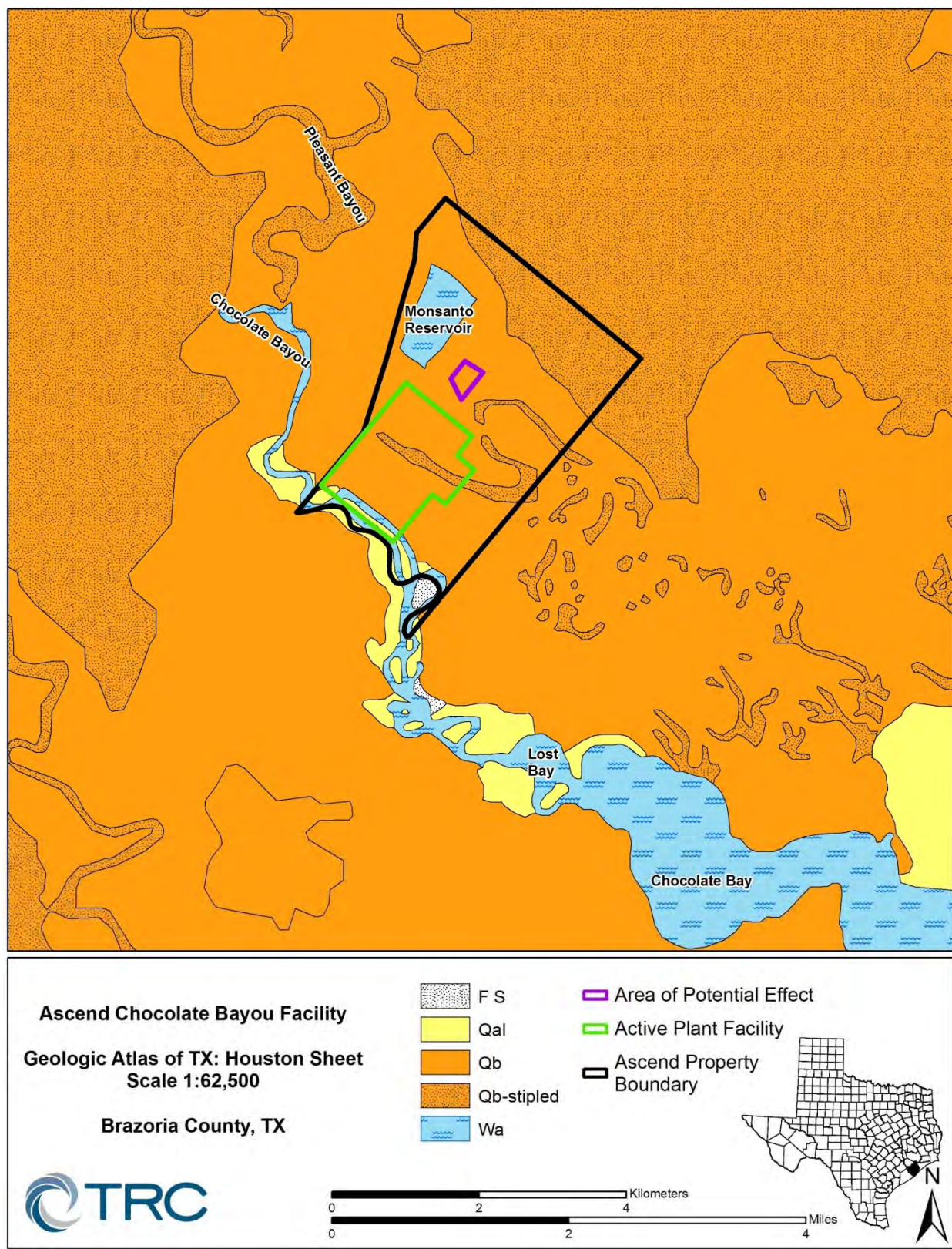


Figure 7. Project area depicted on Beaumont Formation deposits (Qb).

The project area is situated within a broad zone of Beaumont Formation that extends across the coastal region south of Houston (Abbott 2001; Barnes 1982). The Beaumont, or Prairie, terrace is the youngest continuous coastwise terrace fronting the modern Gulf (Abbott 2001). Sandy deposits associated with littoral facies are also frequently considered part of the Beaumont. Many investigators (cf. Fisk 1938, 1940; DuBar et al. 1991) have correlated the Beaumont terrace with the Sangamon Interglacial (ca. 130 to 75 thousand years ago), although age estimates range from Middle Wisconsinan (Alford and Holmes 1985) to 100 to 600 thousand years ago (Blum and Price 1994). While debate about the temporal affiliations of, and correlations among, the deposits that underlie the major coastline terraces remain active, they are of little direct geoarcheological relevance, because virtually all investigators agree that these deposits predate the earliest demonstrated dates of human occupation in North America.

2.3 SOILS

The soils across this parcel are listed as a combination of Leton-Aris complex (Figure 8; Grenwelge et al. 1981). This complex is across nearly level nonsaline soils. These are associated with old stream meanders that include circular to oblong depressions and circular mounds or knolls. The mounds are 38 to 101.6 cm (15 to 40 ft) in diameter and are about 61 cm (2 ft) higher than the surrounding intermound areas. This complex is about 40 percent Leton soils and 35 percent Aris soils. The Leton soils are in the depressions. The Aris soils are mostly on the low circular mounds.

The Leton soils have a surface layer of neutral loam about 53.3 cm (21 in) thick (Figure 9). The surface layer is gray (10YR 4/1) to light grayish brown (10YR 6/2) in the upper part, and gray in the lower part. The subsoil to a depth of 83.8 cm (33 in) is gray clay loam. The Leton soils are poorly drained and runoff is very slow. These soils are formed in ancient fluvial deposits.

Typical Aris soils have a surface layer of neutral dark gray (10YR 4/1) fine sandy loam about 15.2 cm (6 in) thick. The next layer to about 50.8 cm (20 in) is grayish brown (10YR 5/2), slightly acidic brown loam. These are also poorly drained with slow runoff and have high shrink-swell potential (Grenwelge et al. 1981). These soils are also formed in ancient fluvial deposits.

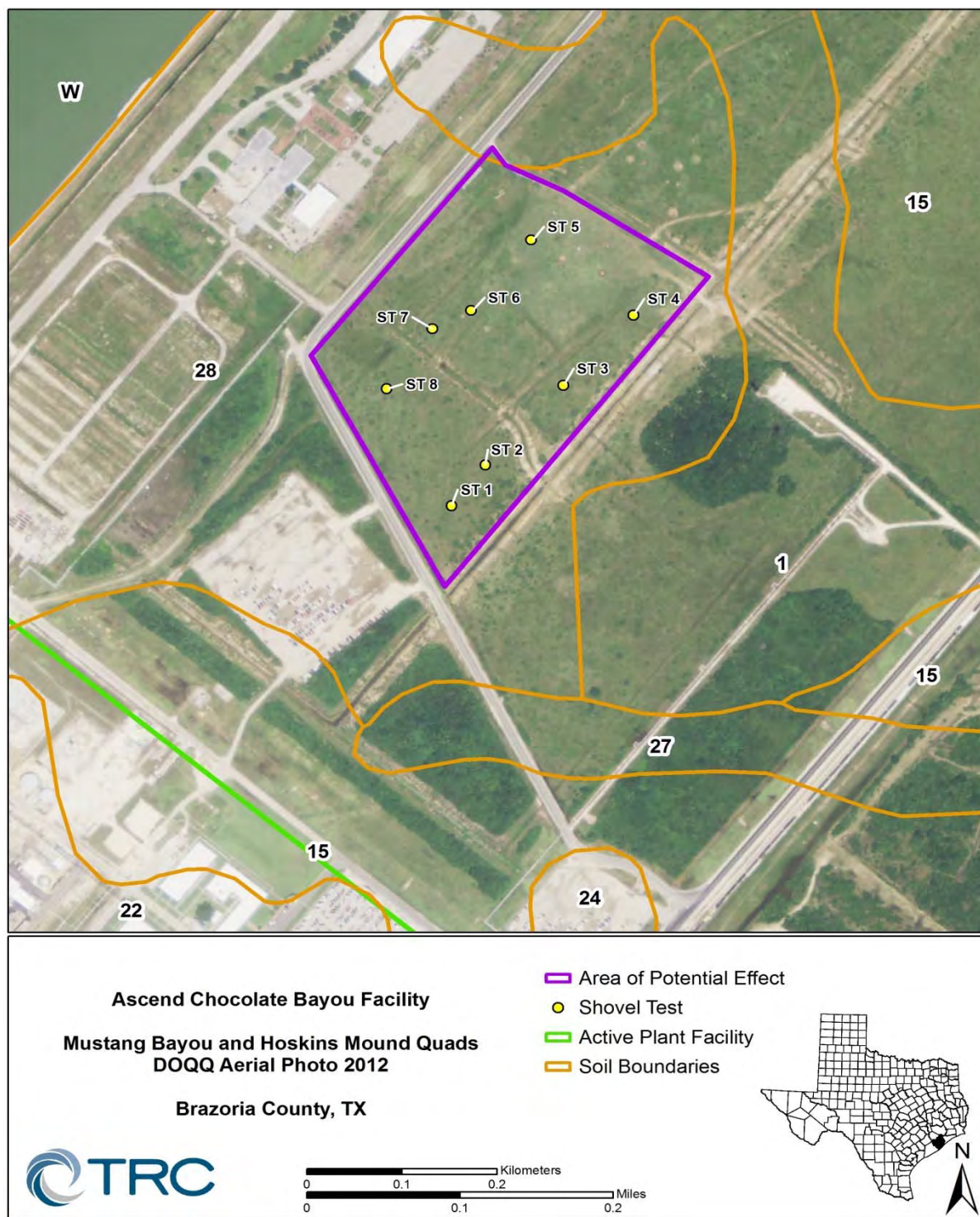


Figure 8. Soil types depicted in project area (after Grenwelle et al. 1981). Note: #28 across the APE is the combination of Leton-Aris Complex.



Figure 9. Typical soil profile along manmade ditch that shows A, B, and C horizons.

2.4 CLIMATE

Evidence for climatic change from the Pleistocene to the present is most often obtained through studies of pollen and faunal sequences (Bryant and Holloway 1985; Collins 1995, 2004). While the specific paleoclimatic history of the coastal region remains unclear, Bryant and Holloway (1985) present a generalized sequence of climatic change for nearby east-central Texas that includes three separate climatic periods—the Wisconsin Full Glacial period (22,500 to 14,000 before present [B.P.]), the Late Glacial period (14,000 to 10,000 B.P.), and the Post-Glacial period (10,000 B.P. to present). Evidence from the Wisconsin Full Glacial period indicates that the climate in east-central Texas was considerably cooler and more humid than at present. Pollen data indicate that the region was more heavily forested in deciduous woodlands than during later periods (Bryant and Holloway 1985). The Late Glacial period was characterized by slow climatic deterioration and a slow warming and/or drying trend (Collins 1995, 2004). In east-central Texas, the deciduous woodlands were gradually replaced by grasslands and post oak savannas (Bryant and Holloway 1985). During the Post-Glacial period, the east-central Texas environment appears to have been more stable. The deciduous forests had long since been replaced by prairies and post oak savannas. The drying and/or warming trend that began in the Late Glacial period continued into the mid-Holocene, at which point there appears to have been a brief amelioration to more mesic conditions lasting from roughly 6000 to 5000 B.P. Recent studies by Bryant and Holloway (1985) indicate that modern environmental conditions in east-central Texas were probably achieved by 1,500 years ago.

The modern climate of Brazoria County is classified as humid or hot and moist. However, the coastal area is frequently cooled by sea breezes. Winters are warm, but occasionally interrupted by incursions of cool air from the north. Rains occur throughout the year and precipitation is adequate for all crops. Hurricanes occur every few years (Grenwelge et al. 1981).

In winter, the average temperature is 12.8° Celsius (C), or 55° Fahrenheit (F). In summer, the average temperature is 27.2°C (81°F). Annual precipitation is 132.1 cm (52 in), with one period of peak rainfall. About 60 percent of the annual precipitation occurs from April through September, and thunderstorms occur about 70 days each year (Grenwelge et al. 1981). Snowfall is extremely rare.

Average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent (Grenwelge et al. 1981).

2.5 FLORA AND FAUNA

2.5.1 Flora

Brazoria County is situated near the southeastern edge of the Texas biotic province (Blair 1950), an intermediate zone between the forests of the Austroriparian and Carolinian provinces and the grasslands of the Kansas, Balconian, and Tamaulipan provinces. Some plant species reach the limits of their ecological range within the Texas province. McMahan et al. (1984) further define four broad communities that characterize the Gulf Coastal Plain portion of the Texas biotic province: (1) coastal marsh/barrier island, (2) coastal prairie, (3) coastal gallery forest, and (4) pine-hardwood forest (cf. Abbott 2001:24-26). The APE lies within the coastal prairie vegetation community and is described below.

The coastal prairie category consists primarily of grasses with minor amounts of forbs and woody plants in areas that are not saturated on a seasonal basis (Abbott 2001:24-26). This community is characteristic of upland areas and grades into the pine-hardwood forest to the north and east and into the coastal marsh/barrier island area to the south. Numerous grasses are found in the prairie environments, but the principal taxa include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), indiagrass (*Sorghastrum*), eastern grama (*Tripsacum dactyloides*), switchgrass (*Panicum virgatum*), brownseed paspalum (*Paspalum plicatulum*), sideoats grama (*Bouteloua curtipendula*), slender bluestem (*Schizachyrium tenerum*), buffalograss (*Bouteloua dactyloides*), threeawn (*Aristida purpurea*), and Texas wintergrass (*Nassella leucotricha*). Common forbs include Maximilian sunflower (*Helianthus maximiliani*), Engelmann daisy (*Engelmannia peristenia*), dotted gayfeather (*Liatris punctata*), yellow neptunia (*Neptunia lutea*), prairie clover (*Dalea purpurea*), wildbean (*Apios americana*), paintbrush (*Castilleja linariaefolia*), bluebonnet (*Lupinus subcarnosus*), ragweed (*Ambrosia artemisiifolia*), croton (*Croton*), milkweed (*Asclepias* sp.), verbena (Verbenaceae), and winecup (*Callirhoe involucrate*). Woody plants occurring in the coastal prairie include mesquite (*Proposis* spp.), honey locust (*Gleditsia triacanthos*), huisache (*Acacia farnesiana*), eastern baccharis (*Baccharis halimifolia*), rattlebox (*Sesbania punicea*), live oak (*Quercus virginiana*), elm (*Ulmus* spp.), hackberry (*Celtis* spp.), Chittamwood (*Bumelia lanuginosa*), and coralberry (*Symphoricarpos orbiculatus*). The frequency of trees increases dramatically as the coastal prairie grades into the pine-hardwood forest, forming an open woodland environment with common stands of hardwood trees and occasional pines.

According to Mowery et al. (1960), about 95 percent of the upland vegetation consisted of coarse bunchgrasses prior to European settlement. However, many of the original bunchgrasses have been eliminated by heavy grazing over the past 20 or 30 years, and the vegetation is now much lower quality. Introduced plants such as bermudagrass (*Cynodon dactylon*), dallisgrass (*Paspalum dilatatum*), and burclover (*Medicago polymorpha*) are now common in many pastures.

Many of the plants in the region, including mesquite, Texas ebony (*Pithecellobium flexicaule*), and blackbush acacia (*Acacia rigidula*), are legumes that produce a pod with an edible bean. Prehistoric populations may have consumed these edible beans. Uses, nutrition, history, and ethnographic accounts of utilization of mesquite pods, beans, and even the wood, is thoroughly discussed by Bell and Castetter (1937:1-55).

2.5.2 Fauna

The Texas biotic province is a broad ecotone or transitional zone (Blair 1950). At least 49 species of mammals have occurred in this Texan province, with most (41 species) co-occurring with the adjacent Austroriparian zone. Common species include: coyote (*Canis latrans*); white-tailed deer (*Odocoileus virginianus*); skunks (*disambiguation*); cottontail rabbit (*Sylvilagus floridanus*); jaguar (*Panthera onca*); northern pygmy mouse (*Baiomys taylori taylori*); nine-banded armadillo (*Dasypus novemcinctus*); turtles (*Terrapene ornate*); 16 species of lizards; 39 species of snakes; some 5 species of amphibians; and a variety of permanent and migratory birds. Bison (*Bison bison*) and pronghorn (*Antilocapra americana*) were also present at various times in the past, and were likely a major food source for Native populations.

3.0 CULTURAL BACKGROUND

3.1 PREHISTORIC OVERVIEW

The initial human occupations in the New World can now be confidently extended back before 12,000 years ago (Dincauze 1984; Haynes et al. 1984; Kelly and Todd 1988; Lynch 1990; Meltzer 1989). Evidence from Meadowcroft Rockshelter in Pennsylvania indicates that humans were present in eastern North America as early as 14,000 to 16,000 years ago (Adovasio et al. 1990), while more recent discoveries at Monte Verde in Chile provide unequivocal evidence for human occupation in South America by at least 12,500 years ago (Dillehay 1989, 1997; Meltzer et al. 1997). Most archeologists presently discount claims of much earlier human occupation during the Pleistocene glacial period (but see Butzer 1988).

The earliest generalized evidence for human activities in southeast Texas is represented by the Paleoindian period (12,000 to 7,000 years ago [Patterson 1995]). This stage coincided with ameliorating climatic conditions following the close of the Pleistocene epoch that witnessed the extinction of herds of mammoth, horse, camel, and bison. Cultures representing various periods within this stage are characterized by series of distinctive, relatively large, often fluted, lanceolate projectile points. These points are frequently associated with spurred end scrapers, graters, and bone foreshafts. Paleoindian groups are often inferred as organized into egalitarian bands consisting of a few dozen individuals that practiced a fully nomadic subsistence and settlement pattern. Due to poor preservation of floral materials, subsistence patterns in southeast Texas are known primarily through the study of faunal remains. Subsistence focused on the exploitation of plants, small animals, fish, and shellfish, even during the Paleoindian period. There is little evidence in this region for hunting of extinct megafauna, as has been documented elsewhere in North America. Rather, a broad-based subsistence pattern appears to have been practiced during all prehistoric time periods. In southeast Texas, the Paleoindian stage is divided into two periods based on recognizable differences in projectile point styles (Patterson 1995). These include the Early Paleoindian period (12,000 to 10,000 years ago), which is recognized based on large, fluted projectile points (i.e., Clovis, Folsom, Dalton, San Patrice, and Big Sandy), and the Late Paleoindian period (10,000 to 7,000 years ago), which is characterized by unfluted lanceolate points (i.e., Plainview, Scottsbluff, Meserve, and Angostura).

3.1.1 Archaic Period (7000 to 1900 Years Ago)

The onset of the Hypsithermal/Altithermal drying trend marks the beginning of the Archaic stage (7,000 to 1,900 years ago [Patterson 1995]). This climatic trend marked the beginning of a significant reorientation of lifestyle throughout most of North America, but this change was far less pronounced in southeast Texas. Elsewhere, the changing climatic conditions and corresponding decrease in the big game populations forced people to rely more heavily upon a diversified resource base composed of smaller game and wild plants. In southeast Texas, however, this hunting and gathering pattern is characteristic of most of prehistory. In general, the appearance of a more diversified tool kit, the development of an expanded ground stone assemblage, and a general decrease in the size of projectile points are hallmarks of this cultural stage. Material culture shows greater diversity during this broad cultural period, especially in the application of ground stone technology.

Traditionally, the Archaic period is subdivided into Early, Middle, and Late subperiods. In southeast Texas, the Early Archaic period (7,000 to 5,000 years ago) is marked by the presence of Bell, Carrollton, Morrill, Trinity, Wells, and miscellaneous Early Stemmed projectile points. The Bell point is the only type in this period that is closely associated with the southern Plains. Many of the latter point types continue into the Middle Archaic period (5,000 to 3,500 years ago) and several new types appear, including Bulverde, Lange, Pedernales, Williams, Travis, and probably the Gary-Kent series. The Late Archaic period (3,500 to 1,900 years ago) is characterized by Gary, Kent, Darl, Yarbrough, Ensor, Ellis, Fairland, Palmillas, and Marcos points.

In the western part of inland southeast Texas, a Late Archaic mortuary tradition developed in the lower Brazos and Colorado river valleys and in the intervening area (Hall 1981; Patterson 1995). Organized burial practices actually started during the Middle Archaic period, but reached full development in the Late Archaic with the use of exotic grave goods such as boatstones and bannerstones (probably used as atlatl weights), stone gorgets, corner-tang knives, stingray spines, shark teeth, and marine shell beads and pendants. Other burial practices included the systematic orientation of burial direction, body position, use of red ochre, and use of locally made grave goods, such as long bone implements and bone pins. Most burials are found in extended supine position, though some extended prone and bundle burials are also known. Burial direction is usually consistent within single sites, but varies from site to site. Patterson et al. (1993) report that at least 11 sites are associated with this mortuary tradition in Austin, Fort Bend, and Wharton counties.

3.1.2 Early Ceramic Period (1,900 to 1,350 Years Ago)

The use of pottery did not start uniformly throughout southeast Texas. Pottery manufacture appears to have diffused into this region from adjacent regions, primarily from the east along the coastal margin (Patterson 1995). Aten (1983:297) argues that pottery was being manufactured on the coastal margin of the Texas-Louisiana border by about 2,070 years ago, in the Galveston Bay area by about 1,900 years ago, in the western part of the coastal margin by about 1,600 years ago, and in the Conroe-Livingston inland area by about 1,500 years ago. Southeastern Texas ceramic chronologies are best known in the Galveston Bay area, where Aten (1983) established a detailed chronological sequence.

The earliest ceramic periods in the Galveston Bay and neighboring Sabine Lake areas appear to be approximately contemporaneous with the earliest ceramic periods of the lower Mississippi Valley (Aten 1984). Early assemblages contain substantial quantities of Tchefuncte ceramics. In the Sabine Lake region, grog-tempered varieties of Baytown Plain and Marksville Stamped are common, while grog-tempered ceramics do not occur in the Galveston Bay area 129 km (80 mi) to the west until several hundred years later. With the exception of a few Tchefuncte ceramic types, other southern Louisiana ceramics are not found on the Gulf coast west of the Sabine Lake area.

Goose Creek sandy-paste pottery was used throughout southeast Texas, and somewhat farther north, in the Early Ceramic, Late Prehistoric, and the early part of the Historic periods (Aten 1984; Patterson 1995; Pertulla et al. 1995). The Goose Creek series is the primary utility ware throughout the prehistoric sequence in Southeast Texas, though it temporarily gives way to Baytown Plain for about 200 years, during transition between Late Prehistoric and Historic periods, before once again becoming predominant into the Historic period (Aten 1984). A minor variety, Goose Creek Stamped, occurs only in the Early

Ceramic period (Aten 1983). Three other minor pottery types—Tchefuncte (Plain and Stamped), Mandeville, and O’Neal Plain variety Conway (Aten 1983)—were used only during the Early Ceramic period. The Mandeville and Tchefuncte types are characterized by contorted paste and poor coil wedging. Mandeville has sandy paste (like Goose Creek), while Tchefuncte paste has relatively little sand. Given their technological similarities, Mandeville and Tchefuncte may represent different clay sources rather than distinct pottery types (Patterson 1995). The bone tempered pottery that characterizes ceramic assemblages elsewhere in Texas is uncommon in Southeast Texas.

3.1.3 Late Prehistoric Period (1,300 to 450 Years Ago)

On the upper Texas coast, the onset of the Late Prehistoric period (1,250 to 450 years ago [Ricklis 2004]) is defined by the appearance of the bow and arrow. Along the coastal margin of southeast Texas, use of the atlatl (i.e., spearthrower) and spear was generally discontinued during the Late Prehistoric period, though the inland subregions continued their use, along with the bow and arrow, through the Late Prehistoric period (Aten 1967; Keller and Weir 1979; Ensor and Carlson 1991; Patterson 1980, 1995; Wheat 1953). In fact, Patterson (1995:254) proposes that use of the bow and arrow started in southeast Texas as early as the end of the Middle Archaic period (ca. 6,000 years ago), using unifacial arrow points that consisted of marginally retouched flakes. However, this argument has not received general acceptance. The unifacial arrow point types (Alba, Catahoula, Perdiz, and Scallorn; see Turner et al. 2011) are characteristic of this period. These appear to be associated with a small prismatic blade technology.

A serial sequence for these point types is best defined at Mitchell Ridge (41GV66 [Ricklis 1994]) in Galveston Island. The initial subperiod around 1300 years ago is associated with the bow and arrow, represented by Scallorn arrow points. At Mitchell Ridge, wounds inflicted by two Scallorn points were apparently the cause of death for one adolescent female. This burial dates to around 750 years ago.

The subsequent subperiod is marked by the appearance of the Toyah phase/interval with Perdiz arrow points in inland areas, whereas the Rockport phase is present along the central Texas coast (Ricklis 2004). In the Toyah period (ca. 1,300/1,250 years ago), bison bones are prominent, along with a suite of chipped stone tools that include unifacial end scrapers, thin bifacial knives, expanded base drills/perforators and a blade-core technology. The Mitchell Ridge Toyah assemblage is well dated to a range of ca. 1,300/1,250 years ago.

In the Late Prehistoric period of the coastal regions, grog (crushed sherd) tempering of pottery vessels was introduced, presumably from the east, at about 1,050 years ago (Aten 1983; Ricklis 2004), and incorporated into the existing bone tempered technology. The grog tempered varieties include San Jacinto Plain and Baytown Plain variety Phoenix Lake. San Jacinto pottery contains relatively sparse, small-sized temper, while Baytown Plain has comparatively larger amounts of sherd grog fragments that are often visible on vessel surfaces. Sandy-paste Goose Creek pottery remained in use through the Late Prehistoric period. Rockport Plain and asphaltum coated pottery from the Central Texas Coast (Ricklis 1995) are found at a few sites in southeast Texas during the Late Prehistoric and Protohistoric periods. Decorations on simple bowls, jars, and constricted neck ollas became more elaborate. The decorations have close parallels between decorative motifs on the upper Texas coast at this time with various types in coastal Louisiana and the Lower Mississippi Valley (Ricklis 2004).

3.1.4 Protohistoric Period (450 to 250 Years Ago)

For the most part, Protohistoric and early historic Native American sites in southeast Texas have not been correlated with the ethnographic record (Story 1990:258). Similarly, reconciling the ethnographic record to prehistoric Native American groups in this region is problematic. Late Prehistoric and historic population movements further complicate this issue. Aten (1983) has reconstructed the territories of native groups present in this region in the early eighteenth century, including the Akokisa, Atakapa, Bidai, Coco (Karankawa), and Tonkawa. The presence of the Tonkawa in southeast Texas may be due to their rapid expansion from central Texas in the seventeenth and eighteenth centuries (Newcomb 1993:27). The Karankawa Indians are thought to have occupied the coastal margin of this region as far east as Galveston Island and the corresponding mainland (Aten 1983). Judging by the scarcity of Rockport pottery on sites east of the San Bernard River, the ethnic association of the Karankawa Indians with the Coco tribe may be in doubt.

If Aten (1983) is correct, and the Karankawa Indians did extend eastward as far as Galveston Island and the corresponding inland regions, then the Ascend Chocolate Bayou Plant lies within the homeland of the Karankawa Indians prior to the early historic European Colonial era (e.g., Newcomb 1983; Ricklis 1996). Although certain other tribes, such as the Tonkawa, Lipan Apache, and Comanche, are known to have operated on or near the Texas coastal plains in early historic times, these groups were all late arrivals into the Texas region, having moved southward from the Great Plains as horse-mounted hunter gatherers during the 17th and 18th centuries (see Newcomb 1961; Campbell 1983, 1988). The Karankawas, the sole known indigenous Native group that occupied the coastal shoreline zone between the Galveston Bay area and Baffin Bay, lived within a narrow strip of territory that extended from the Gulf of Mexico shoreline to approximately 40 km (24.9 mi) inland, to include the prairie margins adjoining the coastline. Thus, the Karankawa are the only Native American tribal group inferred to be represented by prehistoric archeological materials within the central Texas coast region.

The Karankawa were an ethnically and linguistically distinct, non-agricultural, hunter-gatherer-fisher people. They subsisted primarily through a combination of intensive fishing in the coastal bays and lagoons, and hunting of game, most importantly white-tailed deer and bison, that inhabited the terrestrial environment of the coastal prairies. They also gathered a wide range of plant foods that were available along the shorelines, the moist floodplains of streams, and the level prairies between stream valleys. The Late Prehistoric Rockport phase, dated to ca. 650 to 250 years ago, and identifiable on the basis of an artifact assemblage containing diagnostic lithic and ceramic artifact types, is recognized as the archeological expression of indigenous Karankawa culture (see Ricklis 1996). Sites of the Rockport phase are abundantly documented in the Corpus Christi area.

During the Colonial period of the 17th, 18th Century and the first two decades of the 19th Century, the Karankawa had a relationship alternating between peaceful to confrontational with the Spanish missions newly established on the coastal prairies of Texas (see Ricklis 1996). The Karankawa were initially interested in attending the mission of Espíritu Santo, established in 1722 on Garcitas Creek in Victoria County. However, relations between the Karankawa and the Spanish personnel took an abrupt turn for the worse in 1726, and the Karankawa abandoned the mission. A new mission, Nuestra Señora del Rosario, was established at Goliad in 1756 (Bolton 1915), and was frequented and included some Karankawa until closing in 1806. The mission of Nuestra Señora del Refugio was also established for the Karankawa in

1795, and many Karankawas lived and worked there until closing in 1830. During the first three decades of the 19th Century, the Karankawa underwent a significant degree of acculturation to Spanish Colonial lifeways, such as learning to herd cattle and weave cotton blankets. Additionally, many of the Karankawa converted to Christianity (Ricklis 1996). However, with the independence of Mexico and the demise of the Spanish empire in the New World after 1820, the Karankawa homeland was opened to more aggressive Mexican and Anglo-American settlement. During the decades between 1820 and 1850, and especially after 1836, when Texas became independent of Mexico, the incursion of American settlers and ranchers onto the Texas coastal prairies resulted in the extirpation of the Native lifeways. The Karankawa were either driven south of the Rio Grande into Mexico, or were absorbed into the emerging ranching economy. By the 1850s, the Karankawa tribe ceased to exist as a recognizable cultural and ethnic entity (Himmel 1999; Ricklis 1996).

A long sequence of pre-Karankawa human occupation has been documented for the central Texas coastal region (Ricklis 2004), but not in the upper Texas coast. Scattered surface finds of diagnostic chipped stone dart points indicate the presence of early peoples during Paleo-Indian times, approximately 13,000 to 9,000 years ago. Following the Paleo-Indian period, a long continuum of Archaic occupation has been documented and radiocarbon dated for the area of the lower Nueces River valley and estuaries of Nueces and Corpus Christi Bays (Ricklis 2004). Early Archaic occupation, dated to approximately 7,500 to 6,800 years ago, is marked by oyster-shell middens at sites in the Corpus Christi area, including 41NU266 (Ricklis et al. 1995). Middle Archaic sites are scattered along the lower Nueces River and the northern shoreline of Nueces Bay; these sites, dated to ca. 6,000 to 4,500 years ago, consist of shell middens that are dominated brackish-water clam (*Rangia flexuosa*) valves, and containing chipped stone dart points of the Bell, Tortugas and Early Triangular types (see Turner et al. 2011 for type definitions), scraping and cutting tools, perforated oyster shells (probable net weights), and otoliths of marine fishes such as black drum (*Pogonias cromis*), redfish (*Sciaenops ocellata*), speckled sea trout (*Cynoscion nebulosis*) and Atlantic croaker (*Micropogon undulatus*).

3.1.5 Contact Period

European contact in lower south Texas initially occurred between A. D. 1528 and 1537 by Spanish explorer Cabeza de Vaca, who crossed south Texas after being shipwrecked along the Texas coast near Galveston Bay. The Spanish attempted to conquer the native inhabitants and colonize the region. The contact with the Spanish and other outside groups caused significant changes in the material assemblages with the addition of metal, glass and other foreign goods that partially disrupted the prehistoric lifeways. Both metal and stone arrow points (i.e., Guerrero types) are characteristic of this period. The native groups, termed Coahuiltecan on the basis of common root language, were soon drastically reduced in number through the ravages of European diseases. Even the history of this Native American population is poorly understood (Newcomb 1990). For an in-depth understanding of native inhabitation at the time of contact see Salinas (1990) and Ruecking (1955). Additionally, proceedings from "An Exploration of a Common Legacy: A Conference on Border Architecture" (Hester 1978) delineated a broad range of topics concerning the history of the region.

3.1.6 Historic Period (250 Years Ago to Present)

The first half of the 18th Century was when the fur trade and mission system, as well as the wide spread effects of epidemic diseases, irreparably disrupted native cultures and social systems. This process is clearly discernible at the Mitchell Ridge site, where the burial data indicates severe population decline and group mergers (Ricklis 1994), coupled with increased participation on the part of the Native American population in the fur trade. By the time significant Anglo-American settlement of Texas began in the early 1800s, the indigenous Indian population was greatly diminished. The Alabama/Coushatta Indians, currently residing in southeast Texas, are recent immigrants displaced from further east in the late 18th to early 19th Centuries (Newcomb 1961).

The Anglo-American settlement of Brazoria County began in the early 1820s as part of the colonization of Texas under the auspices of the Spanish government (McMillan 1926; Puryear and Winfield 1976; Texas State Historical Association 2002; Wharton 1939; Yelderman 1979). Moses Austin was initially granted authorization and land grants to settle 300 families within the Brazos and Colorado river valleys, but his death in June 1821, and Mexican independence from Spain, delayed those plans. Stephen F. Austin assumed leadership responsibility from his father Moses, and received transfer of the original Spanish land grants from the newly established Mexican government in 1823. In November 1821, following arrangements with Austin, the first group of governmentally sanctioned colonists sailed on the schooner *Lively* from New Orleans to the Texas coast, anchoring near the mouth of the Brazos River, a few miles south of the project area. Karankawa Indians, living near the new colonial settlements, had a few skirmishes with these new settlers. The Karankawas began moving out of the area as the population in the colonies increased, and by the 1850s had migrated as far south as Mexico.

4.0 ARCHEOLOGICAL OBJECTIVES AND METHODS

4.1 INTRODUCTION

The archeological investigation described in this report was undertaken with three primary goals in mind:

1. To locate and record archeological resources within the APE.
2. To provide a preliminary assessment of the significance of any archeological resources encountered in regard to their potential for inclusion in the National Register of Historic Places (NRHP) and/or for designation as State Antiquities Landmarks (SALs).
3. To make recommendations for the treatment of any archeological resources identified based on their NRHP and/or SAL assessments.

The first of these goals was accomplished through a review of the Texas Historic Sites electronic Atlas that contains locations of the state's previously documented cultural resources, followed by a pedestrian survey and shovel testing in the 0.1 square km (24.5 ac.) parcel.

4.2 SITE FILE SEARCH

An electronic file search was performed by TRC archeologists on July 10, 2013 using the electronic Texas Archeological Sites Atlas (Atlas) maintained by the Texas Historical Commission (THC) to determine if any cultural resource properties or surveys had been previously documented in the APE or the surrounding 1.6 km (1 mi.) of the project area.

In addition to the Atlas search, historic USGS topographic maps (Nationwide Environmental Title Research, LLC, USGS Map Viewer) from 1943, 1959, and 1966 depicting the APE were consulted to determine if historic structures or features were present within the APE. Historic aerial maps, using Google earth, were also accessed to determine when the plant and pipelines were constructed.

4.3 ARCHEOLOGICAL FIELD INVESTIGATION METHODS AND CONDITIONS

On July 11, 2013, TRC archeologist J. Michael Quigg conducted an archeological field survey by walking the APE, including inspecting the profiles of the manmade ditches in and along the margins of the APE and the excavation of eight shovel tests in the APE (Figures 10). Survey conditions were ideal, with sunny hot weather, but limited surface visibility. The surface appeared previously disturbed and altered, with low grass cover over 90 percent of the parcel (see Figures 3, 4 and 5). The area is currently used as a cow pasture and hay storage. Two metal hay feeding stalls and a couple of old farm equipment pieces are present (Figure 11). A buried pipeline exists along the northwestern third of the parcel.

In general, shovel tests were roughly 30 cm in diameter, and dug to between 10 and 30 cm below ground surface (cmbs), the maximum depth of the proposed impacts in this area (Figure 12). Sediments could not be easily screened through a 6.4 mm mesh screen. The very hard, compacted clay was chopped into smaller lumps, beat with the shovel, and then picked through to inspect for cultural materials. Shovel test data, including the size and depth of the hole, soil conditions, if sediments were screened, and any materials observed, was recorded on TRC shovel test forms.

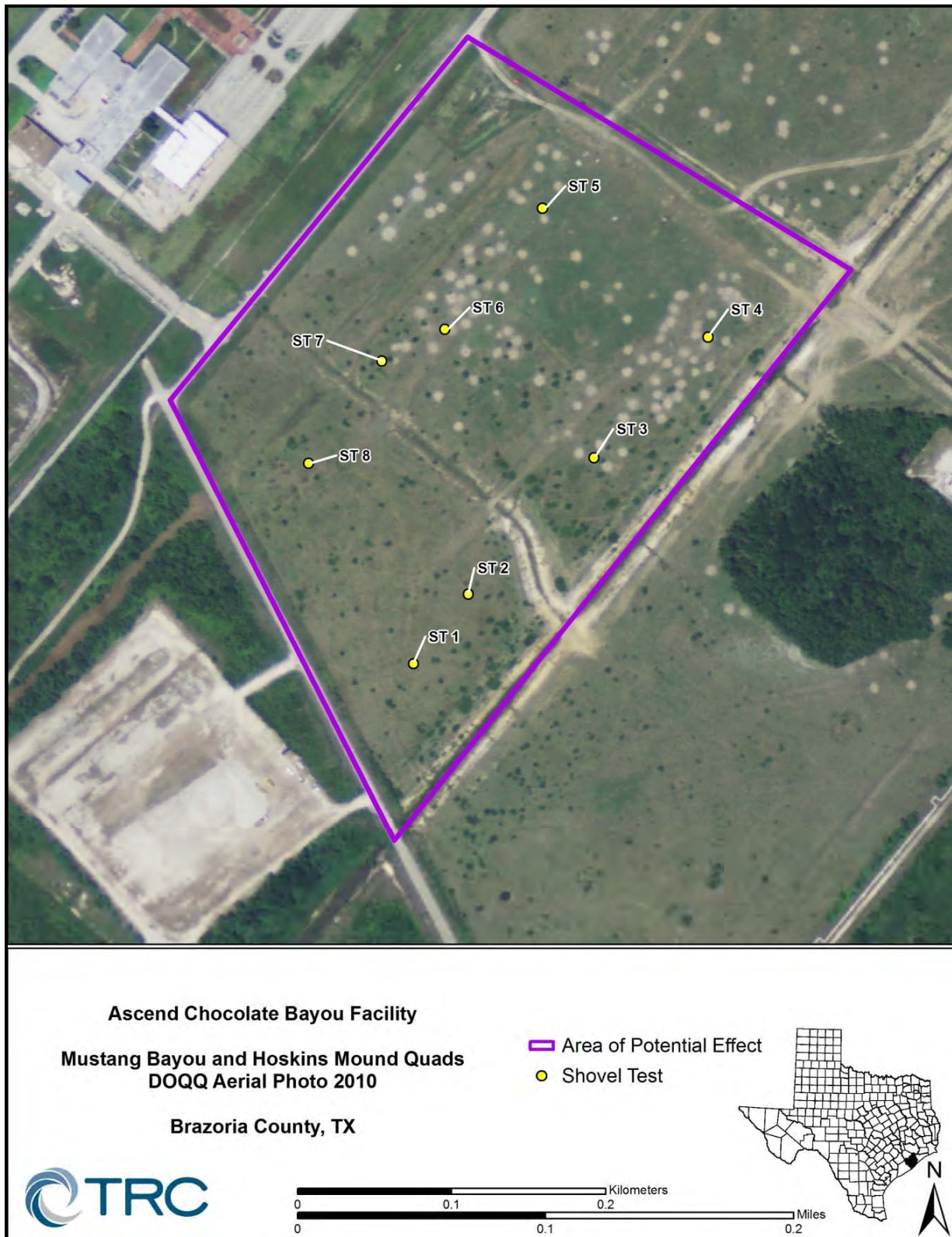


Figure 10. The APE depicting shovel test locations on 2010 aerial photograph.



Figure 11. View southeast with equipment at northern end of APE.



Figure 12. Shovel Test 1 in the APE.

Note metal wire at base of tape measure at 30 cmbs.

5.0 ARCHEOLOGICAL INVESTIGATION RESULTS

The electronic site file search of the Texas Historic Sites Atlas for the immediate area proposed for development as the parking/laydown parcel revealed no previously documented cultural resources (archeological sites, cemeteries, historic landmarks, State Antiquities Landmarks, NRHP structures, historic districts) in the proposed APE or inside the existing facility. The 1.6 km (1 mi) radius from the APE boundary assessment to determine the location of previous cultural resource projects and presence of previously documented cultural resources only revealed two previous archeological surveys and no previously documented cultural resources. In 1977, a cultural resource survey was conducted 0.7 km (0.44 mi.) northwest of the proposed APE, but no additional information is available. About 0.82 km (0.51 mi.) northwest of the proposed APE, another cultural resource survey was completed in 1978, and again no other information is available for that survey.

None of the historic topographic maps from (1929, 1932, 1943, 1959, and 1963) or early aerial photographs consulted showed the presence of historic structures in the APE (Figure 13). The searches did confirm the construction of the adjacent facilities by 1963.



Figure 13. A 1959 historic topographic of the APE that shows no historic structures in the proposed parcel.

The pedestrian survey across the project area was random, and inspected exposed areas in and along the margins (ditches) of the parcel. A couple of pieces of farm equipment (see Figure 11), cow feeding bins, chunks of cement, rebar, fragments of bricks, plastic, chunks of metal, fossil marine shells (Figure 14), and three areas of exposed sand (Figure 15), were all observed on the surface and in the exposed cuts. No historic standing structures or structure foundations were observed in the APE. The long, deep manmade ditches along the parcel boundaries and across parts of the parcel revealed no exposed prehistoric artifacts or features. The various exposures revealed the occasional small water worn pebble, pockets of fossil marine shells in differing states of preservation, and the occasional piece of modern trash.



Figure 14. Exposed fine sand at surface with cow bioturbation in the APE.



Figure 15. Chunk of fossil marine shell cemented in limestone along margin of manmade ditch at edge of APE.

The eight shovel tests dispersed across the parcel revealed no buried prehistoric artifacts or features, but did encounter a variety of historic artifacts (Table 1). The historic artifacts were in the form of a 7 cm long chunk of round metal wire at 30 cmbs (see Figure 12), two rusted round nails (10 to 30 cmbs), chunks of coal (4 to 28 cmbs), small chunks of concrete, a small chunk of clay sewer pipe fragment (Figure 16), and plastic at 13 cmbs (Figure 17). Many shovel tests encountered water worn fossil marine shells (oyster shells) generally from 5 to 30 cmbs. In Shovel Tests 2, 5, and 7, lots of fossil marine shells were encountered very near the surface (Figure 18).

Table 1. Shovel Test Data, Observations, and Results.

Excavation Unit	Width by Depth (centimeters)	Description	Results
Shovel Test 1	30 x 30	Shallow A & B horizons, hard mixed clay	Small diameter wire at 30 cmbs, no prehistoric artifacts
Shovel Test 2	30 x 30	Hard mixed clay	Water worn fossil marine shell 15-20 cmbs, no prehistoric artifacts
Shovel Test 3	30 x 20	A horizon to 10 cm, B to 13, C below 13 cm	No prehistoric artifacts
Shovel Test 4	30 x 20	A horizon to 7, B to 11, C below	No prehistoric artifacts
Shovel Test 5	30 x 28	Very hard clay, mixed soils, no C horizon present	Chunks of coal throughout, lots of water rounded marine shells, no prehistoric artifacts
Shovel Test 6	30 x 27	Soft soils, A, B, & C horizons	Rusted round nail in yellow C horizon, no prehistoric artifacts
Shovel Test 7	30 x 21	Hard clay	Lots of fossil marine shells, cluster at 10 cmbs, no prehistoric artifacts
Shovel Test 8	30 x 19	Hard clay	Plastic at 13 cm in base of B horizon, rusted round nail at 10 cm, no prehistoric artifacts



Figure 16. Recent artifacts, top left to right, cement plaster, clay sewer pipe fragment, round nail, two chunks of cement. Scale in centimeters.



Figure 17. Shovel Test 8 with modern plastic in profile at 13 cmbs.



Figure 18. Shovel Test 7 with fossil marine shell cluster in profile at 10 cmbs.

The soil stratigraphy observed was quite variable and often appeared mixed in the shovel tests, but not in the adjacent drainage ditches. Some shovel tests revealed very shallow A horizons of a dark grayish brown (10YR 4/2), often less than 5 cm thick, with thin brownish gray (10YR 6/2) B horizons over a yellowish C horizon in the 20 to 30 cm deep holes. Other soil profiles appeared similar in color throughout.

The soil was extremely hard, dry, compact, and impossible to screen. Only the occasional small water rounded pebble was encountered.

No prehistoric sites, features, or artifacts were observed within the APE in any of the inspected surface exposures, nor within the subsurface shovel tests.

6.0 SUMMARY AND RECOMMENDATIONS

Archeologists were tasked to first determine if cultural resources were present inside the APE, and secondly to determine if these cultural resources constitute historic properties as defined by the National Historic Preservation Act of 1966, and the Antiquities Code of Texas.

If resources are found and constitute historic properties, the archeologist must attempt to assess their eligibility for nomination to the National Register of Historic Places (NRHP). According to the National Historic Preservation Act of 1966 (Section 106), a Federal agency must assess any potentially harmful action upon resources that are or could be listed on the NRHP. Federal Regulations (36 CFR 60.4) lists four criteria to be used when evaluating properties for nomination to the NRHP. Those eligible should include properties:

- a) That are associated with events that have made a significant contribution to the broad patterns of our history; or
- b) That are associated with the lives of persons significant in our past; or
- c) That embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- d) That have yielded, or may be likely to yield, information important in prehistory or history.

In summary, the entire area of the APE lies in an existing undeveloped cattle pasture in deposits that are assigned to the Beaumont Formation, which are pre-Holocene in age. Ascend has proposed this parcel, outside the active operational area of the existing plant facility, for a parking and laydown area as part of the C3 Petrochemicals, LLC plan to build a new propane dehydrogenation manufacturing unit inside the active operational area of the Ascend Chocolate Bayou Plant southwest of Alvin, Texas. The APE was subjected to a pedestrian survey and subsurface testing through eight shovel tests by a professional archeologist.

No prehistoric sites, features, or artifacts were observed either surface or subsurface in any of the inspected exposures or shovel tests. Insubstantial historic items were scattered across the surface and encountered in some of the shovel tests. The most frequent discovery was the fossil marine shells in the exposures along the drainage ditches and in most of the shallow shovel tests.

It was determined that no prehistoric cultural properties were present within the APE, based on the absence of significant findings in the effort to locate cultural remains on the ground surface, in numerous long ditch exposures, and through subsurface testing. Therefore, an eligibility appraisal using the criteria (a through d) described in the Federal Code concerning the National Historic Preservation Act of 1966 (36 CFR 60.4) was not necessary. TRC does not recommend any further archeological investigation within the proposed APE. However, should any human remains be encountered during the proposed undertaking, all work should cease immediately and C3 Petrochemicals and/or Ascend should notify

local law enforcement, who in turn will notify the local medical examiner's office. If the remains are not recent, the THC should be notified.

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Appendix E

Reference Pages

HOUSTON AREA GEOARCHEOLOGY



**A Framework
for Archeological
Investigation,
Interpretation,
and Cultural
Resource
Management in
the Houston
Highway District**

BY JAMES T. ABBOTT

Citation

Diana J. Kleiner, "BRAZORIA COUNTY," *Handbook of Texas*

Online(<http://www.tshaonline.org/handbook/online/articles/hcb12>), accessed May 03, 2013. Published by the Texas State Historical Association.

BRAZORIA COUNTY. Brazoria County, on the prairie of the Gulf Coast at the mouth of the Brazos River in Southeast Texas, is bordered by Matagorda, Fort Bend, Harris, and Galveston counties. It covers an area of 1,407 square miles. Its highest altitude, Damon Mound, is 146 feet above sea level. The center of the county lies at approximately 29°10' north latitude and 95°26' west longitude, near the county seat, Angleton. Other principal towns include Alvin, Amsterdam, Brazoria, Damon, Pearland, Rosharon, West Columbia, Holiday Lake, Old Ocean, Bailey's Prairie, Iowa Colony, Bonney, Hillcrest Village, Brookside Village, Danbury, Liverpool, Manvel, and Sweeny; the towns that constitute Brazosport include Clute, Freeport, Quintana, Oyster Creek, Jones Creek, Lake Jackson, Richwood, and Surfside Beach. Key county roads include State highways 6, 35, 36, and 288, and railroad service is provided by the Union Pacific and Burlington Northern Santa Fe railroads. The annual rainfall is fifty-two inches, and the mean annual temperature is 69° F. Hurricanes and floods are common in the region, among the most notable being the hurricanes of 1854, 1900, 1909, 1915, 1932, 1941, Hurricane Carla in 1961, and the floods of 1899, 1913, 1915, 1929, and 1940. Soils in the county are chiefly alluvial loams and clays, and are highly productive when well drained. The growing season averages 309 days a year. In 1982, between 61 and 70 percent of the land was considered prime farmland. The principal streams flowing through Brazoria County into the Gulf of Mexico include the Brazos and San Bernard rivers, Oyster Creek, Bastrop Bayou, and Chocolate Bayou. The Gulf Intracoastal Waterway crosses Brazoria County near the coast. The Brazos River divides the county into two sections; the western one-third is covered by hardwoods, and the rest is generally prairieland. Abundant groves of pin oak, cedar, live oak, mulberry, hackberry, ash, elm, cottonwood, and pecan trees grow in the river and creek bottoms, while cordgrasses, bunchgrasses, and sedges predominate in the coastal marshes. When settlers first arrived, wildlife was abundant, including deer, bear, turkey, and fish. Two major national wildlife refuges, the Brazoria and San Bernard, are close to the Gulf Coast in Brazoria County. In 1947 the county ranked fourth in state timber production. More recently, the petrochemical industry and mineral resources including oil, gas, sulfur, salt, lime, sand, and gravel, concentrated in the Damon Mound-West Columbia-Freeport area, have dominated the county economy. Magnesium is also extracted locally from seawater.

Before Anglo-American colonization, the region was occupied by Karankawa Indians. Archeological excavations have revealed some of the shell middens and campsite refuse of this nomadic people, who exploited maritime and mainland resources on a seasonal basis as early as a.d. 450. Skirmishes with colonists, including the battle of Jones Creek in 1824, resulted in expulsion of most of the Indian population to the area south of the Rio Grande by 1850. In 1528 Spanish explorer Álvar Núñez Cabeza de Vaca landed on the Isle of Mal Hado (Island of Evil Destiny), possibly San Luis Island. Scholars agree that his party probably crossed Oyster Creek, Old Caney Creek, and the Brazos and San Bernard rivers, roaming the area that became Brazoria County looking for provisions. Spanish soldiers under Alonso De León, governor of Coahuila, passed through the region in search of the La Salle expedition in 1689, and Joaquín de Orobio y Bastera came in 1727 searching for possible French intruders in the Trinity River area. In an effort to forestall French or English incursions, the Spanish began to occupy Texas in the eighteenth century, but entered the future Brazoria County chiefly to trade with Indians or search for stolen horses. Though expeditions on the Trinity probably traveled through for missionary purposes in the 1750s, the area was not settled by the Spanish. Similarly, early American military expeditions did not reach the future county, though a popular tradition suggests that pirate Jean Laffite used the mouth of the Brazos as a rendezvous and buried treasure along its banks.

Though the alluvial bottomlands of the county's rivers attracted settlement by Americans as early as 1820, the passengers of the schooner *Lively* who landed at the mouth of the Brazos in December 1821 passed on to Richmond. The area was first populated when Stephen F. Austin selected it for his proposed settlement, and eighty-nine of Austin's Old Three Hundred had grants in what is now Brazoria County by 1824. The earliest

Lipscomb, Carol A. 2011. Karankawa Indians. In *The Handbook of Texas Online* (<http://www.tshaonline.org/handbook/online/articles/bmk05>), accessed January 3, 2013.

KARANKAWA INDIANS. The now-extinct Karankawa Indians played an important role in the early history of Texas. The name Karankawa became the accepted designation for several groups or bands of coastal people who shared a common language and culture. Those bands, identified in early historic times, included the Capoques (Coaques, Cocos), Kohanis, Kopanes (Copanes), and Karankawa proper (Carancaquacas). They inhabited the Gulf Coast of Texas from Galveston Bay southwestward to Corpus Christi Bay. All spoke a little-known language called Karankawa, and only about 100 words of that language have been preserved. The significance of the name Karankawa has not been definitely established, although it is generally believed to mean "dog-lovers" or "dog-raisers." That translation seems plausible, since the Karankawas reportedly kept dogs that were described as a fox-like or coyote-like breed. The Karankawas were poorly equipped, nomadic people who migrated seasonally between the barrier islands and the mainland. Their movements were dictated primarily by the availability of food and secondarily by climate. They obtained food by a combination of hunting, fishing, and gathering. Fish, shellfish, and turtles were staples of the Karankawa diet, but a wide variety of animals and plants contributed to their sustenance.

Always on the move, the Karankawas rarely remained at a single campsite for more than a few weeks. Their principal means of transportation was the dugout canoe, a crude watercraft made by hollowing out the trunk of a large tree. Those primitive dugouts, unsuited for deep, open water, were used primarily in the relatively shallow waters between the islands and the mainland. Each canoe was spacious enough to carry an entire family along with their household goods. The Karankawas traveled overland by foot, and were often described as powerful runners, as well as expert swimmers. A portable wigwam, or ba-ak, provided shelter for the coastal people. The crude structure, large enough to accommodate seven or eight people, consisted of a willow pole frame that was covered with animal skins and rush mats. Karankawas crafted baskets and pottery, both of which were often lined with asphaltum, a natural tar substance found on Gulf Coast beaches. The chief weapon of the tribe, for both hunting and warfare, was the long bow and arrow. Bows were made of red cedar and reached from the eye or chin level to the foot of the bearer. Karankawas were known for their distinctive physical appearance. The men, described as tall and muscular, wore deerskin breechclouts or nothing at all. They painted and tattooed their bodies, and also pierced the nipples of each breast and the lower lip with small pieces of cane. They often smeared their bodies with a mixture of dirt and alligator or shark grease to ward off mosquitoes. Women also painted and tattooed their bodies and wore skirts of Spanish moss or animal skin that reached to the knees. The social and political organization of the Karankawas was determined by their nomadic lifestyle. They traveled in small bands of thirty to forty people headed by a chief. Those bands often subdivided into smaller groups, probably individual family units, to facilitate foraging. Communication was maintained by a well-developed system of smoke signals that enabled the scattered groups to come together for social events, warfare, or other purposes.

Karankawa ceremonialism centered around gatherings known as "mitotes," which were held for a variety of purposes, each involving different activities. The ceremonies often included dances and the consumption of an intoxicating beverage brewed from the parched leaves of the yaupon (*Ilex cassine* or *vomitorea*), a small shrublike tree native to south Texas. That "black drink" was consumed exclusively by the men of the tribe.

Brazoria County

<http://www.texasalmanac.com/topics/government/brazoria-county>

Filed Under:

[Counties](#)



Physical Features: Flat Coastal Plain, coastal soils, drained by Brazos and San Bernard rivers; Brazoria Reservoir, Eagle Nest Lake, Harris Reservoir, Mustang Lake East/West, San Bernard Reservoirs.

Economy: Petroleum and chemical industry, fishing, tourism, agribusiness. Part of Houston metropolitan area.



History: Karankawa area. Part of Austin's

"Old Three Hundred" colony of families arriving in early 1820s. County created 1836 from Municipality of Brazoria, organized in 1837; name derived from Brazos River.

Race/Ethnicity: (In percent) Anglo, 52.44; Black, 12.02; Hispanic, 28.34; Asian, 5.48; Other, 1.72.

Vital Statistics, annual: Births, 4,898; deaths, 1,188; marriages, 1,827; divorces, 1,062.

Recreation: Beaches, water sports; fishing, hunting; wildlife refuges, historic sites; state and county parks; replica of the first capitol of the Republic of Texas at West Columbia.

[Explanation of Sources](#)

and [Data List Guide](#)

Minerals: Oil, gas, sand, gravel.

Population	324,769
Change fm 2010	3.7
Area (sq.mi.)	1,608.6
Land area(sq.mi.)	1,357.7
Altitude (ft.)	sea level–146
Rainfall (in.)	57.24
Jan. mean. min.	43.7
July mean max.	91.8
Civilian labor	156,798
Unemployed	6.9
Wages	\$1,107,726,888
Per Capita Inc.	\$38,677
Prop. Value	\$25,680,313,868
Retail Sales	\$3,312,852,293

*United States Department of Agriculture
Soil Conservation Service
in cooperation with the
Brazoria County Commissioners Court and
Texas Agricultural Experiment Station*

*soil survey of
brazoria county, texas*



U.S. Drought Monitor

Texas

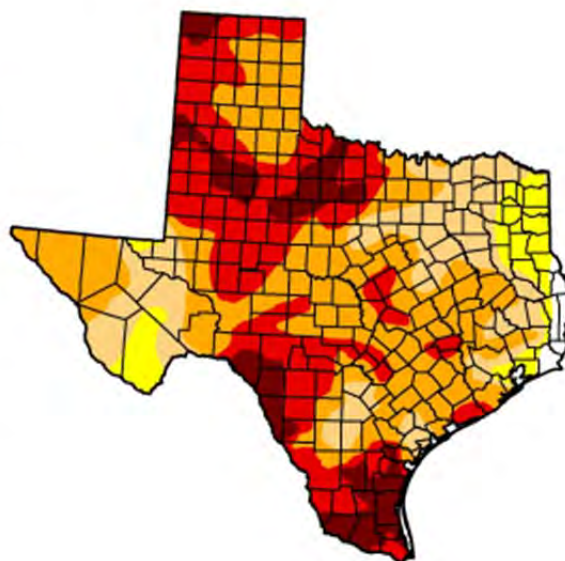
April 30, 2013

Valid 7 a.m. EST

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	1.45	98.55	91.99	73.73	36.42	10.09
Last Week (04/23/2013 map)	1.45	98.55	92.21	70.03	38.05	11.93
3 Months Ago (01/29/2013 map)	10.38	89.62	76.15	51.20	22.12	6.57
Start of Calendar Year (01/01/2013 map)	3.04	96.96	87.00	65.39	35.03	11.96
Start of Water Year (09/25/2012 map)	9.13	90.87	78.73	57.41	24.91	5.18
One Year Ago (04/24/2012 map)	18.60	81.40	62.79	46.64	25.42	9.31

Intensity:

 D0 Abnormally Dry	 D3 Drought - Extreme
 D1 Drought - Moderate	 D4 Drought - Exceptional
 D2 Drought - Severe	



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu>



Released Thursday, May 2, 2013
Eric Luebehusen, U.S. Department of Agriculture

From: Johnney Pollan <pollanone@sbcglobal.net>
Sent: Sunday, October 02, 2011 5:03 PM
To: Hanley, Robert
Subject: Site Location of INEOS USA, LLC Facility

Dear Sir,

I have reviewed your project map forwarded me by Jamie Murray of the Brazoria County Historical Museum and can find no evidence of either cultural or historical importance within the parameter of your project, specifically any that may not have already been impacted by existing development. I understand that Mrs Murray is researching the archival records for an such and will contact you separately should she find anything in the records that may affect your permit application.

Thank you for making contact. This process not only helps to protect our irreplaceable history, but keeps us current with the ongoing developments in the area. We appreciate your diligence

Sincerely,

Sandra D. Pollan, Chair
Brazoria County Historical Commission
Texas Archeological Stewards Network



TRC Environmental Corporation
30 Patewood Drive, Suite 100
Patewood Plaza One
Greenville, SC 29615

Main 864.281.0030
Fax 864.281.0288

Communication Record

Participant(s)	Company Name	Telephone No.
Jamie Murray	Brazoria County Historical Museum	979.864.1208

Project No: 185864.0000.0000 **Date/Time:** 29 September 2011
Project Name: Ineos USA LLC, NEPA Resources Review
Meeting/Conversation (explain): Telephone Call
Prepared by: Robert Hanley **Title:** Senior Environmental Scientist

Signature: _____
Subject/Purpose: Cultural/Historical Review

TRC contacted the Brazoria County Historical Museum to inquire about cultural or historical resources in the vicinity of the Chocolate Bayou facility. TRC e-mailed a location map of the facility.

Ms. Murray was not aware of any significant cultural or historical resources in the vicinity of the Chocolate Bayou facility. She said that she would pass the information on to representatives of the Brazoria County Historical Commission.

\\ntapa-pmeeting\phi1-voll\--\WPPH\PT2\192202\0000\R-002\Appendix B-1.docx

ENVIRONMENTAL • ENERGY • INFRASTRUCTURE



From: Neal McLain <nmclain@annsgarden.com>
Sent: Friday, September 30, 2011 9:00 PM
To: Hanley, Robert
Cc: Barbara Burkhardt; Dave Brandes; Ed Barrios; Fred Lewis; Cody Dingee; Jamie Murray; Jennifer Sanchez; Netta Shingler; Tom Schneider; Neal McLain
Subject: Re: Site Location of INEOS USA, LLC Facility

Mr. Hanley:

This is in reference to the Site Location of INEOS USA, LLC Facility.

Jamie Murray, of Brazoria County Historical Museum, forwarded your two messages to me. I am a volunteer at BCHM, with responsibility for cataloging maps. I also volunteer for the following organizations:

- Friends of Brazoria Wildlife Refuges (FOBWR)
<http://refugefriends.org>
- Texas Master Naturalist Cradle of Texas Chapter (TMN-COT)
<http://tmn-cot.org>
- U.S. Fish & Wildlife Service, Texas Mid-coast NWR Complex (USFWS)
<http://1.usa.gov/TMC-NWRC>

After studying the map you sent, I am not aware of any "known, significant cultural or historical sites and/or resources within a one-mile radius of the INEOS site" or within the INEOS property as shown by a blue line on your map.

I forwarded your request to representatives from USFWS, FOBWR, and TMN-COT to solicit their opinions. As of 5:00 pm September 30, 2011, I had not heard from anyone who disagrees with this opinion.

When studying the map you sent, I paid particular attention to two features:

- The Chocolate Bayou Wildlife Conservation Center, located on INEOS-owned land south of highway FM2004. Volunteers from TMC-COT conduct environmental education (EE) classes for local elementary school students at this facility. Inasmuch as INEOS sponsors this program, I assume they're aware of it. A Google map showing the location of this property is at:

<http://bit.ly/INEOS-map>.

This facility appears to be outside of the areas of interest shown on your map.

- Brazoria National Wildlife Refuge, located south of Chocolate Bayou.

A map of the refuge is posted at:

http://refugefriends.org/maps/BNWR_2009.pdf

The entire refuge appears to be outside of the areas of interest as shown on your map.

Please be aware that I am not a surveyor, a lawyer, or a professional engineer. The opinion I expressed above is based solely on my experience as a volunteer for organizations mentioned above.

Neal McLain
416 County Road 912A
Brazoria, TX 77422-7695
979-798-2284 home
979-824-3586 cell

