BOB Project 2017-02

MARINE ARCHAEOLOGY SURVEY
IN SUPPORT OF LAVACA BAY REEF PROJECT
CALHOUN COUNTY, TEXAS

Prepared for:

Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744-3291

Prepared by:

BOB Hydrographics, LLC
1315 Fall Creek Loop
Cedar Park, Texas 78613

Principal Investigator:
Robert Gearhart

August 2017

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Abstract

BOB Hydrographics, LLC (BOB) conducted a marine archaeological survey of a proposed oyster reef restoration site in Lavaca Bay, Texas. This project, sponsored by the Texas Parks and Wildlife Department, spans portions of State Mineral Lease Tracts 17A and 20A in Calhoun County. The area of potential effect (APE) proposed for reefing is 30 acres. A total of 50 acres was surveyed, including a 50-meter buffer around the APE. Water depth averages 5 feet. Reefing will require placement of a substrate, such as oyster shell, clam shell, limestone, river-rock or crushed concrete, on the seafloor to provide a hard surface for attachment of oysters. Field investigations included a marine geophysical survey, performed under Texas Antiquities Permit 8004, on May 31, 2017. An archaeological assessment was conducted of all data acquired by the survey. The purpose of BOB's survey was to locate potential archaeological sites that would be affected by reefing-related activities. No artifacts were collected during this survey. A review of cultural background determined that 5 marine archaeological investigations, one desktop study, and, at least, 18 wrecks have been reported within 3 miles of the APE. Analysis of geophysical survey results from this survey discovered one target potentially eligible for the State Antiquities Landmark or for the National Register of Historic Places. Anomaly 1 is recommended for avoidance. This study was completed in compliance with Section 106 of the National Historic Preservation Act (Public Law 89-665; 16 U.S.C. 470) and the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191). The minimum reporting and survey requirements for marine archaeological studies conducted under a Texas Antiquities Permit are mandated by The Texas Administrative Code, Title 13, Part 2, Chapters 26 and 28, respectively. Project records are curated at the Texas Parks and Wildlife Department in Austin.

I. Introduction

BOB Hydrographics, LLC (BOB) conducted a marine archaeological survey of a proposed oyster reef restoration site in Lavaca Bay, Texas (Figure 1). The Texas Parks and Wildlife Department (TPWD) sponsored this project and contracted with BOB to conduct an archaeological assessment. The area of potential effect (APE), where reefing is proposed, covers 30 acres. A total of 50 acres was surveyed, including a 50-meter (m) buffer around the APE. The survey spans portions of State Mineral Lease Tracts 17A and 20A in Calhoun County. Water depth averages 5 feet (ft). Cultural resources investigations were required by the Texas Historical Commission (THC) because reefing activities might affect historic cultural resources resting on or embedded in the seafloor.

The results reported in this document will support TPWD's application for a United States Army Corps of Engineers Permit. The APE is planned for ongoing oyster habitat restoration and enhancement projects by placement of a clean material, known as cultch, on the seafloor, providing a hard surface for attachment of oysters. Over the term of the Corps of Engineers Permit, numerous projects of various size will occur within the APE. Cultch will be spread in a uniform manner. Cultch thickness, normally, will not exceed 12 inches in mud substrates and 3 inches in shell hash substrates. A total of 34,000 cubic yards of cultch could be placed at the site. Cultch likely will be oyster shell, but clam shell, limestone, river-rock, crushed concrete, or other similar material, approved by TPWD, also might be used. A barge-based, mounding approach may be used in muddy substrates for larger restoration projects. Mounded cultch will not exceed a height of 2 ft above the bay bottom.

Geophysical survey was completed on May 31, 2017. The Principal Investigator conducted all fieldwork, with assistance from Dougie Williamson, and was solely responsible for archaeological data analysis and report preparation. The purpose of this study was to assess the archaeological potential of the APE; however, no artifacts were collected during this survey. An archaeological assessment was conducted of all geophysical data acquired by the survey, including areas located beyond the APE. Submerged archaeological sites, in this context, might be sunken or abandoned watercraft. Submerged historic remains may be eligible for nomination to the National Register of Historic Places (NRHP) or as State Antiquities Landmarks. A review of the cultural background determined that 5 marine archaeological investigations, one desktop study, and, at least, 18 wrecks have been reported within 3 miles of the APE. Analysis of geophysical survey results from this investigation discovered one target potentially eligible for the State Antiquities Landmark or for the NRHP. Anomaly 1 is recommended for avoidance.

This study was completed in compliance with Section 106 of the National Historic Preservation Act (Public Law 89-665; 16 U.S.C. 470), requiring that the lead agency consider the effects of projects, receiving either permits or funding from the federal government, upon historic resources. This study complies also with the Antiquities Code of Texas (Texas Natural Resource Code, Title 9, Chapter 191), which provides for the protection of cultural resources on state lands. The APE is publicly owned; therefore, Texas Antiquities Permit 8004 was obtained prior to beginning fieldwork. Title 13, Part 2, Chapters 26 and 28 of The Texas Administrative Code mandates the minimum reporting and survey

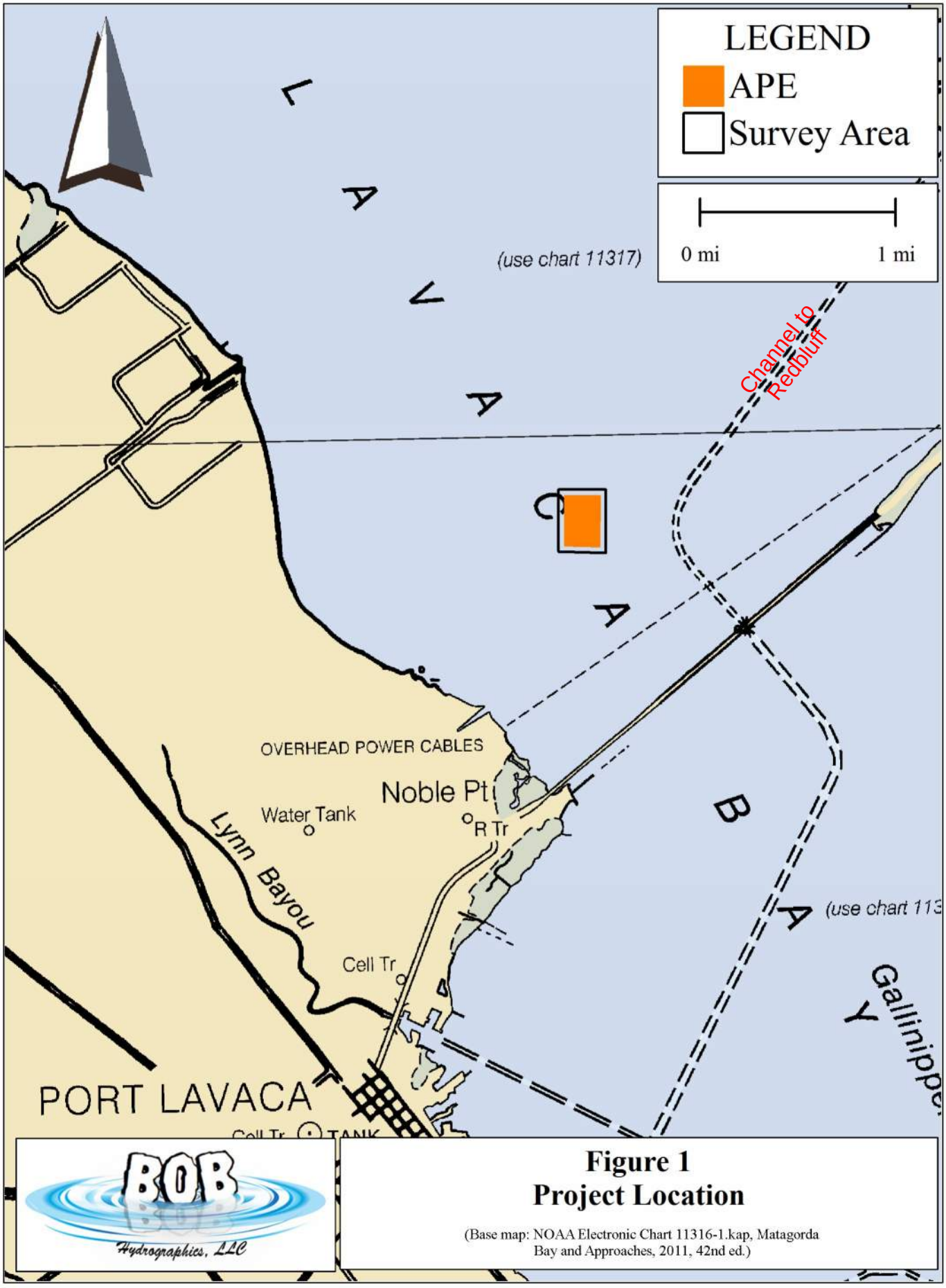

Figure 1
Project Location

(Base map: NOAA Electronic Chart 11316-1.kap, Matagorda Bay and Approaches, 2011, 42nd ed.)

requirements, respectively, for marine archaeological studies conducted under Texas Antiquities Permits. Project records are curated at the TPWD in Austin.

This report is organized into six sections that provide context for interpreting the survey results and includes maps of magnetic contours and side-scan sonar imagery. Section II relies upon a combination of published literature and data collected by this survey to summarize the physical environment of the APE. Section III summarizes the relevant cultural background within a 3-mile radius of the APE, including maritime history and shoreline developments, previous archaeological investigations, and the potential for intact archaeological sites. Section IV summarizes methods for conducting the geophysical survey and for processing and analyzing the geophysical data. Section V presents an archaeological assessment of the geophysical data and provides recommendations specific to archaeological findings within the APE. Bibliographic references cited in the text are included as Section VI.

II. Physical Environment

The APE is in the upper portion of Lavaca Bay. The seafloor in the present-day APE consists mostly of estuarine mud, having no discernable slope, except for isolated areas of shell reef. Figure 2 shows the landscape of 1888 (United States Coast and Geodetic Survey [USCGS] 1888). Historic water depth in the APE was charted as about 5.5 ft, Mean Low Water. National Oceanic and Atmospheric Administration's (NOAA) charts the depth as closer to 5 ft, Mean Lower Low Water, consistent with depths observed during this survey.

Geomorphology of the APE was influenced by sea level changes during and after the Late Wisconsin Glaciation. Continental glaciers held back significant amounts of water from the sea during the Late Wisconsin, resulting in a much lower sea level than exists today. Geologists have charted the timing and magnitude of sea level rise (e.g. Weise, et al. 1980: Figure 16). Sea level has risen more than 300 ft since the last glacial low stand, about 20,000 to 22,000 years ago.

Floodplains of the Lavaca River and Garcitas Creek were about 90 ft below the APE elevation during the Late Wisconsin Glaciation (Patch 2004:47; Bryne 1975). Archaeologists are interested in this former late Pleistocene/Holocene landscape because the timing of its most recent subaerial exposure overlaps the period of human habitation in North America. The fresh surface water and ecological diversity of an estuary would have attracted both prehistoric human and animal populations.

About 9,500 years before present, the APE was inundated by the sea, and the Lavaca River and Garcitas Creek valleys became a single tidal estuary. Roughly 90 ft of fluvial sediments, originating in the Lavaca River and Garcitas Creek basins, have covered the former Pleistocene land surface, beneath the APE, since that time. The modern burial depth of any prehistoric sites associated with that ancestral landscape will protect them from disturbance for the conceivable future.

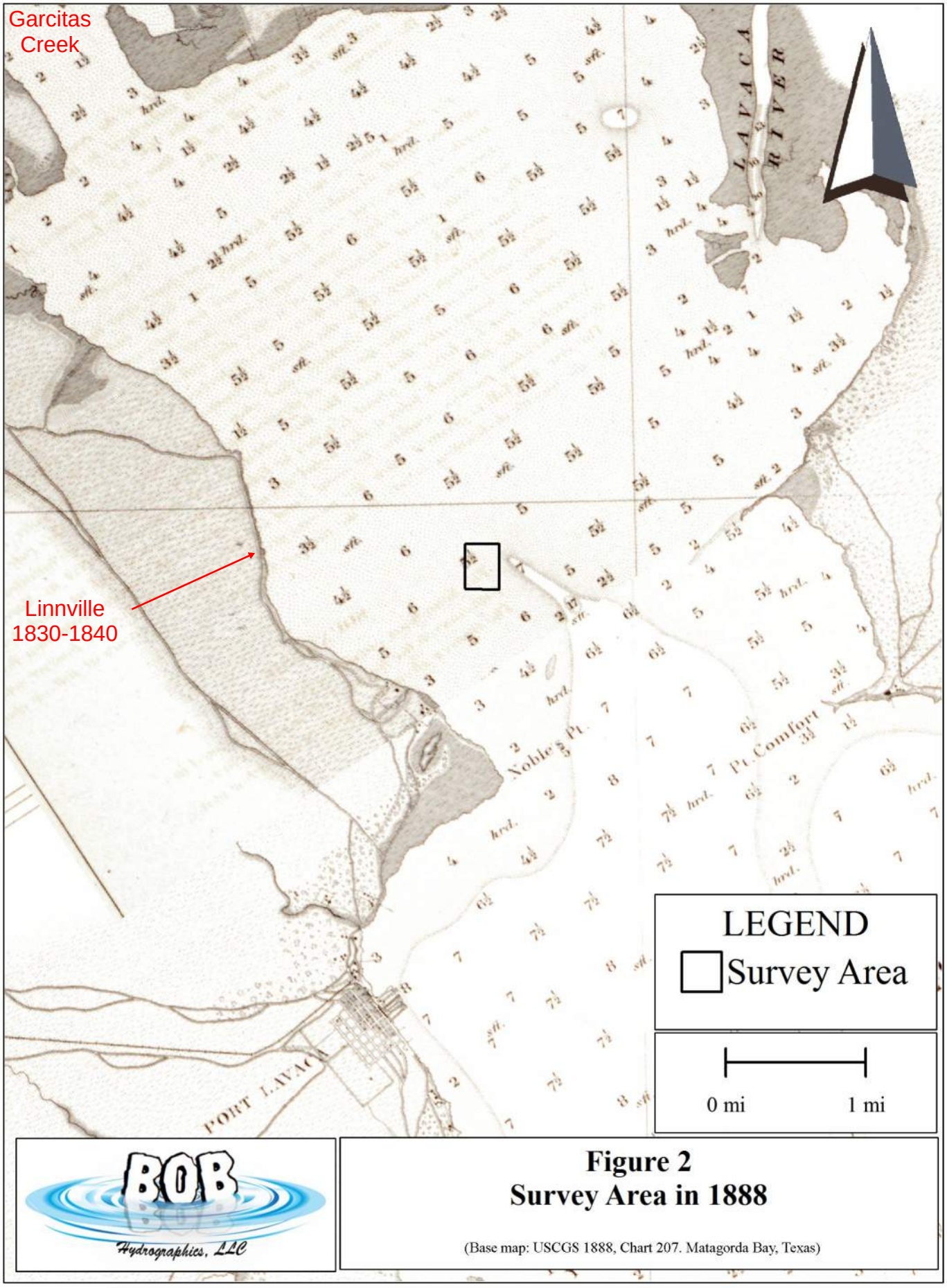

Figure 2
Survey Area in 1888

(Base map: USCGS 1888, Chart 207. Matagorda Bay, Texas)

III. Cultural Background

Maritime History

Exploration of the Texas Coast began in 1519, when a Spaniard named Alonso Alvarez de Piñeda led an expedition, on behalf of the governor of Jamaica, to map lands bordering the Gulf of Mexico. A Piñeda map shows major inlets along the Texas Coast, one of which might be Pass Cavallo, the entrance to Matagorda Bay, although there is no proof that he entered the bay or explored its shores (Weddle 1985). Piñeda demonstrated there is no shortcut to Asia through the Gulf of Mexico. His logs also helped to identify the fastest sailing route between Vera Cruz and Havana (Chipman 1992: 24-26). The Spanish silver fleet, sailing out of Vera Cruz, conducted steady trade with Havana for about 250 years, until 1790. Their ships typically followed either a northern route, paralleling the coast, or crossed the central Gulf of Mexico. Seasonal changes in wind and current patterns determined their choice of routes (Lugo-Fernandez et al. 2007). The northern route occasionally imperiled Spanish flotillas when storms pushed them toward the coast.

The first Europeans known to explore the Texas Coast were survivors from the shipwrecked Pánfilo de Narváez expedition of 1527. Cabeza de Vaca and 80 other Spaniards sailed on makeshift rafts to what many believe was Galveston Island. Those who survived the first winter were enslaved by Native Americans. Only four men returned to tell their stories of wandering from tribe to tribe through what is now Texas and northern Mexico to the Pacific Coast, eventually reaching Mexico City after eight years. Cabeza de Vaca published his story in 1542 upon returning to Spain (e.g., Cabeza de Vaca 2013).

In the same year of Cabeza de Vaca's publication, Europeans were exploring Matagorda Bay for the first time. Luis de Moscoso Alvarado led Hernando De Soto's expedition into the bay in 1542, having taken command upon De Soto's death (Chipman 1992:39-40; Weddle 1991:100). Shortly after Alvarado's visit, Guido de Lavazares is believed to have visited Matagorda Bay in 1558 (Chipman 1992:48-49 and Weddle 1991:100-103). There is no record of ships lost in the bay during this early period. While undocumented visits are possible during the ensuing years, Spain largely ignored the Texas Coast for the next two centuries, except when other countries encroached on their territory. Such was the case when René Robert Cavelier, Sieur de La Salle arrived in 1685 with 300 colonists.

La Salle attempted to establish a permanent colony, Fort St. Louis, upstream from Lavaca Bay on Garcitas Creek. Through a series of unfortunate events, the French colony at Fort St. Louis was short lived. The expedition lost one of three ships upon their arrival, and a second ship returned to France with a group of colonists. Then, while La Salle was attempting to find the Mississippi River with an overland expedition, their last ship, *La Belle*, grounded during a storm and was lost in Matagorda Bay. With no way to return to Europe, those remaining at Fort St. Louis eventually perished (Weddle 1991).

La Salle's engineer, Minet, was among those who returned to France, taking with him the first map of Matagorda Bay. Although Fort St. Louis failed, its existence renewed Spanish interest in the Texas Coast. Spain mounted several expeditions to search for the French settlement. Alonso de León finally discovered the abandoned remains of Fort St. Louis in 1689. Spain established La Bahía del Espíritu

Santo on the former site of Fort St. Louis in 1721 but moved it inland to the Guadalupe River four years later (Weddle 1991).

General Luis Aury, former Mexican governor of Galveston Island by appointment of José Manuel Herrera, established a temporary settlement in Matagorda Bay after losing control of Galveston to Jean Lafitte (Davis 2005: 324, 337). Aury left Galveston Island for Matagorda in May 1817 when it became clear he could no longer hold power in Galveston. It has been speculated that Aury destroyed his fleet in Matagorda Bay after Xavier Mina was defeated at Soto de la Marina in June of that year (Taylor 1957:30–31). Borgens, et al. (2007: 27) suggests that Aury destroyed no more than five vessels there despite a claim by the Spanish governor of Texas, Antonio Martinez, that he had sailed into Matagorda Bay with 13 vessels. A letter written six months later to United States President James Monroe also refers to Aury's loss of vessels. "…Aury, having lost a number of his Vessels on the Mexican Coast, and unable to maintain his position, either at Galveston or Matagorda, sailed for this Place [Amelia Island, Florida]" (Bankhead and Henley 1818). The number of vessels destroyed and their locations remain a mystery.

Stephen F. Austin founded the town of Matagorda in 1822 at the mouth of the Colorado River on East Matagorda Bay. Austin lobbied the Mexican Government to settle Galveston to promote a cotton market with England, which likewise would benefit his colony at Matagorda. A Mexican port of customs was established in Galveston in 1825 (Cotham 1998:1; Francaviglia 1998:91, 95) followed quickly by a Matagorda custom house in 1831 (Guthrie 1988). Increased trade soon prompted formation of other communities along the shores of Matagorda Bay.

The town of Linnville formed in 1830 around John Linn's Landing near the entrance to upper Lavaca Bay. Linnville played a part in supplying the Texas Army during the Texas War for Independence (Guthrie 1988: 130, 148 and 155) and was designated the official port of entry for the Lavaca Customs District in 1839. Linnville was destroyed in 1840 by a Comanche raid, commemorated by a Texas Centennial Historical Marker. The marker reads: "Site of the Town of Linnville. An early Texas port named for John Joseph Linn, 1798-1885, pioneer merchant of Victoria who located his warehouse here in 1831. Around this a settlement grew up which was destroyed by Comanche Indians on August 8, 1840. Erected by the State of Texas, 1936." Linnville was soon replaced by the town of Lavaca, the busiest port on the bay during the Texas Republic Period (Maywald 2010).

The town of Indianola, located seaward of the APE on Matagorda Bay, had its beginnings in 1844 when Carl, Prince of Solms Braunfels, chose a site on Indian Point for landing German immigrants bound for the interior of Texas (Malsch 2010). By 1846 a deep-water port and a military depot were established to supply the army during the United States' war with Mexico. Indianola thrived for three decades, reaching a population of 5,000 people, and becoming the second busiest port in Texas, until severe hurricanes in 1875 and 1886 destroyed the town.

The destruction of Indianola removed Port Lavaca's main commercial rival. Port Lavaca became the county seat in 1886 and saw its rail link with Victoria reestablished in 1887. Imports and exports through Matagorda Bay declined as the railroads expanded during the 1880s. Port Lavaca shifted its commercial

emphasis from cattle to seafood and tourism. The seafood industry dominated Port Lavaca's maritime economy through the Great Depression and up until the growth of raw material industries. By 1940 the population of Port Lavaca had grown to just over 2,000 people (Maywald 2010).

Natural gas and oil were discovered upstream from Lavaca Bay during the 1930s, which led to the authorization of the Channel to Red Bluff in 1945. Commercial shipping to and from destinations outside of Matagorda Bay began to rebound with the growth of the petro-chemical and aluminum industries during the 1940s (Maywald 2010). Congress authorized the first deep-draft channel through Matagorda Bay in 1958 in response to the industrial growth. The Matagorda Ship Channel was dredged through Matagorda Peninsula in 1965 and was opened to traffic in 1966 (Alperin 1977).

Potential for Historic Shipwrecks

Europeans navigated the upper portion of Lavaca Bay since at least 1685 when LaSalle established Fort St. Louis on Garcitas Creek, upstream from the bay. He was followed, literally, in 1689 when Alonso de León led an expedition to search for LaSalle's settlement. Subsequent Spanish expeditions entered Lavaca Bay in search of a suitable location for their own settlement, and by 1721 they chose the former site of Fort St. Louis, rechristened La Bahía del Espíritu Santo. Water access to this community was through Lavaca Bay and Garcitas Creek until the town moved inland four years later (Weddle 1991). Commercial shipping traversed Upper Lavaca Bay by 1830 and throughout the struggle for Texas Independence to and from the small community of Linnville, formed around John Linn's Landing.

Shipwrecks reported within 3 miles of the APE are included in Table 1. Sources consulted for Table 1 include the THC Texas Archaeological Sites Atlas (THC Atlas); the NOAA Automated Wreck and Obstruction Information System (AWOIS) database; a shipwreck database compiled by PBS&J; and historic maps from the Texas Historical Overlay (Foster, et al. 2006). There also is potential for unreported wrecks in Lavaca Bay dating back to the time of early European navigation through the area.

The THC Atlas contains reports of shipwrecks from historic records. The AWOIS database is maintained by NOAA to support the charting of coastal areas. AWOIS tends to report recent shipwrecks; however, historic wrecks are included. Positions for wrecks in AWOIS are usually more accurate than those from historic records, although positions pre-dating the era of satellite position systems can vary considerably from actual locations. A group of archaeologists, including this author, assembled the PBS&J database, in part, based on information gathered from charts, historical reports, THC files, and AWOIS. The PBS&J database focuses primarily on well-documented commercial wrecks postdating 1850.

The THC Atlas was searched over a radius of 3 miles from the APE. The positions of most reported wrecks remain uncertain. Positions reported in historical accounts are often imprecise. Vessels reported as lost in Lavaca Bay may be included in Table 1 unless information exists to suggest a more precise position further than 3 miles from the APE.

At least 18 shipwrecks and 9 unidentified obstructions have been reported within a 3-mile radius of the APE (Table 1) by one or more of the sources listed above. Seven additional wrecks are reported from the Lavaca Bay area, some of which might be near the APE. Archaeologists have yet to record any of the wrecks listed in Table 1.

Table 1: Wrecks and Obstruction Reported Within Three Miles of APE

Name of Vessel	THC No.	PBS&J No.	AWOIS No.	Description	Date Lost	Locality
Ben Hur		1096		gas screw	1917	Port Lavaca, Matagorda Bay Area
Edgar		1590		wood schooner	c. 1886	Matagorda/Lavaca area
General Bustamente		1588		wood sloop	1830	Sand bar or beach in Lavaca or Matagorda Bay
Ilda	1725				9/11/1961	Lavaca Bay
Jan R.	314				9/11/1961	Lavaca Bay
Mary Ethel			5313	39-ft, wood fishing boat	1980	Lavaca Bay [NOAA Chart 11317 until c. 1993]
Nettie		1310		steel schooner	8/15/1916	Port Lavaca, Matagorda Bay Area
Obstruction			5295		Pre-1980	Lavaca Bay
Obstruction		1661	5300	platform		Lavaca Bay
Obstruction		1592	5301			Lavaca area
Obstruction		1593	5365			Lavaca area
Obstruction		1594	5279			Lavaca area
Obstruction		1595	5366			Lavaca area
Obstruction		1613	5302			Lavaca Bay
Obstruction		1614	5320			Lavaca Bay
Obstruction			5305		Pre-1980	NOAA surveyed in 1992: oyster bed extending offshore from foul area littered with wrecks
Swan		733		schooner	Dec. 1846	Port Lavaca
Thistle		1380		gas screw	6/19/1929	Port Lavaca, Matagorda Bay Area
U&I	1947	1591		lugger	1920s	Lavaca Bay
Unknown			5271	multiple barges	Pre-1975	Two groups of sunken derelict barges confirmed by NOAA survey in 1992
Unknown			5273	steel	Pre-1979	Confirmed by NOAA survey in 1992
Unknown			5304	steel barges	Pre-1980	NOAA confirmed mangled, submerged wreckage of numerous steel barges
Unknown			8271		Pre-1992	NOAA recommend charting wreck in 1993]
Unknown			8719		Pre-1992	NOAA recommend charting visible wreck in 1993]
Unknown			8720		Pre-1992	NOAA recommend charting visible wreck in 1993]
Unknown			8722		Pre-1992	Foul with wrecks; NOAA recommended charted in 1993
Unknown	1235				Pre-1976	Lavaca Bay ("Foul Wks"; 2013 NOAA Chart 11317)
Unknown	1238				Pre-1976	Lavaca Bay (possible duplicate with AWOIS 5273)
Unknown				unkown	Pre-2013	Lavaca Bay [Wreck Awash symbol; 2013 NOAA Chart 11317]
Unknown				unkown	Pre-2013	Lavaca Bay ["Wks" charted; 2013 NOAA Chart 11317]
Unknown				unkown	Pre-2013	Lavaca Bay [Wreck Awash symbol; 2013 NOAA Chart 11317]
Unknown				unkown	Pre-2013	Port Lavaca [Wreck Awash symbol; 2013 NOAA Chart 11317]
Volunteer		1397		wood, gas screw	4/14/1919	Port Lavaca, Matagorda Bay Area
William & Mary	1001			schooner	6/25/1851	Lavaca Bay

Factors Affecting Vessel Loss

Factors contributing to the loss of watercraft vary depending on environmental conditions. Historic government statistics, summarized by Gearhart, et al. (1990: Volume IV, 59-61), categorized vessel casualties, including most accidents and incidents resulting in injury or loss of property, and reported the value of losses incurred. A total loss was reported if the hull could not be saved. These statistics do not reflect the degree to which cargo and vessels were salvaged. Types of casualties included foundering, stranding, collision and other (including fires, boiler explosions, injuries, and mechanical failures, etc.).

Foundering was the primary mechanism of vessel loss in navigable waters. The *Annual List of Merchant Vessels of the United States* (United States Department of the Treasury 1906-1946) defined foundering as leaking or capsizing of vessels. Foundering accounted for about 6 percent of historic vessel losses. Despite its low rate of occurrence, recovery from foundering was less likely than from any other type of casualty. Fifty-four percent of all foundered vessels were reported as totally lost.

Stranding was the primary mechanism of loss in shoal waters and was, by far, the most common type of shipwreck during the historic period. Stranding (or grounding) accounted for 64 percent of total losses reported by the U.S. Lifesaving Service for the period 1876 through 1914 (Gearhart, et al. 1990: Volume IV, 59-61). Stranding occurred where the water was too shallow for navigation, including shorelines, harbor bars and reefs. Forty-six percent of stranding events resulted in a total loss.

Severe weather accounted for 55 percent of total losses reported by the U.S. Lifesaving Service from 1876 through 1914. Almost half of all losses from foundering were caused by weather, compared with two thirds of losses from stranding. Mariners had short warning of approaching storms prior to modern weather forecasting. The central Texas Coast can experience hazardous weather conditions throughout much of the year. Hurricane season lasts from late June through October. Hurricane-force winds can devastate ships caught unprepared. During the winter, severe cold fronts affect the Texas Coast. These “Northers” may have winds exceeding 50 miles per hour, generating dangerous waves, and can last 24–36 hours (McGowen 1976:19–23, 94).

Factors Affecting Vessel Preservation

Preservation of sunken watercraft depends mainly upon their composition and the extent of their burial in the seafloor. Vessels may become partially buried soon after sinking due to the combined effects of storm-induced current scour, liquefaction of sediments, and their weight pressing down on a waterlogged substrate. Ships made of metal are equally susceptible to burial as wooden hulls, but metal hulls remain exposed much longer than wooden ones in saline waters along the Texas Coast. Exposed wooden components tend to disintegrate quickly where wood-boring organisms thrive. Biological organisms and water saturation weaken the wood, which is then more easily disarticulated and laid flat or removed by fishing trawlers and storm waves. Burial promotes long-term preservation of wood by creating an oxygen-deprived environment, which limits biological activity. Given a sufficient quantity of weakly-consolidated sediment, a significant portion of a hull might become preserved in this manner.

Iron corrodes five times faster in seawater than when buried on land. Iron artifacts tend to become concreted when calcium carbonate from the seawater cements adjacent materials, such as rock and sand, or even other artifacts, to the iron object. Prolonged oxidation can leach out most or all iron mineral, leaving only a carbonate mold of the original artifact (Hamilton 1998). Iron and steel hulls, nevertheless, can survive seawater exposure for well over a century.

Previous Investigations

Five marine archaeological surveys and one desktop study, none of which overlaps the APE, have been completed within 3 miles of the APE (Table 2). Abstracts of reports from most of these investigations are available on the THC Atlas.

The earliest archaeological survey in the area dates from 1991-1992 along the lower reaches of the Lavaca and Navidad Rivers in Jackson and Calhoun counties (Pearson and James 1991; Pearson et al. 1993). A magnetometer survey and diver investigations were completed, on behalf of the U.S. Army Corps of Engineers, under Texas Antiquities Permit 1027. Their study reported a steamboat (Site 41JK9), scuttled in 1864, and a wooden fishing trawler (Site 41JK188) in Jackson County, upstream of Lavaca Bay. Both sites are greater than 3 miles from the APE.

URS Corporation contracted with HRA Gray & Pape, LLC in 2005 to conduct a cultural background study of areas located within a half mile of the Matagorda Ship Channel. Hughey (2005) compiled a list of 19 historic markers, 36 archaeological sites, and 9 shipwrecks based on AWOIS and THC Atlas databases. This was a preliminary, desktop study in support of proposed modifications to the Matagorda Ship Channel.

A survey was conducted by NCS Subsea, Inc. in December 2005 on behalf of URS Corporation and their client, the Calhoun County Navigation District, supporting proposed modifications of the Matagorda Ship Channel. The survey included the turning basin at Point Comfort and three nearby dredge placement areas. Data from their survey was analyzed and reported by PBS&J (Borgens and Gearhart 2006) under Texas Antiquities Permit 4079. PBS&J found no evidence for potential shipwreck sites in the study area.

URS Corporation hired PBS&J, on behalf of the Calhoun County Navigation District, to perform extensive field investigations associated with proposed expansion of the ship channel, which would double its width and deepen the channel by 8 ft. Their 2006 remote-sensing survey acquired magnetometer, side-scan sonar, and bathymetric data along both sides of the Matagorda Ship Channel and in proposed dredged material placement areas. The survey, performed under Texas Antiquities Permit 4080, recommended avoidance of 39 potentially significant magnetic anomalies, and 4 sonar targets (Borgens et al. 2007).

In 2013 a study was conducted in support of a Liquid Natural Gas project proposed by Excelerate Energy in Lavaca Bay. The investigation included a remote sensing data analysis, performed under Texas Antiquities Permit Number 6335 (Tuttle 2013), but as of this writing, only an interim report has been submitted.

Surveying And Mapping, LLC conducted a marine archaeological survey of Harvest Pipeline Company's proposed West Ranch to Point Comfort Pipeline Project, located in the upper portion of Lavaca Bay. Their study, performed under contract with Blanton and Associates, Inc., is nearest the APE and is the most recent marine investigation reported with 3 miles. Gearhart (2016a) recommended avoidance of 22 magnetic anomalies and a charted area of periodically exposed wreckage.

Table 2: Previous Investigations Within Three Miles of the APE

Antiquities Permit	Principal Investigator	Report Title	Sponsor
7341	Robert Gearhart	Marine Archaeology Survey of Proposed West Ranch to Point Comfort Pipeline, Calhoun County, Texas	Blanton & Associates, Inc.
6335	Michael Tuttle	Lavaca Bay LNG Project, Texas Antiquities Permit Number 6335 Update on Remote Sensing Data Analysis and Recommendation for In-Water Investigation, and Request for Comments under Section 106 of NHPA	Excelerate Liquefaction and Lavaca Bay Pipeline
4080	Amy Borgens	Marine Geophysical Survey for Historic Properties, Matagorda Ship Channel and Potential Placement Areas, Matagorda Ship Channel Improvement Project, Matagorda and Lavaca Bays, Texas	URS Corporation
4079	Amy Borgens	Archaeological Investigations Related to Calhoun County Navigation District's Proposed Turning Basin and Marine Improvements and Associated Placement Areas, Lavaca Bay, Calhoun County, Texas	URS Corporation
None; desktop study	James Hughey	A Cultural Resources Assessment Study: The Potential Impact to Cultural Resources Within Property Proposed for Improvements to the Matagorda Ship Channel and Associated Dredge Locations in Matagorda and Calhoun Counties	URS Corporation
1027	Charles Pearson	Underwater Archaeology Along the Lower Navidad and Lavaca Rivers, Jackson County, Texas.	U.S. Army Corps of Engineers, Galveston District

IV. Research Design

Survey Methods

A 30-acre proposed reefing area in Lavaca Bay was surveyed for this project. A total of 50 acres was surveyed, including a 50-m buffer around the APE. The geophysical survey was designed to meet or exceed the following minimum standards of the THC for archaeological survey of state-owned submerged lands (Texas Administrative Code, Title 13, Part 2, Chapter 28, Rule 28.6): 1) the survey must be conducted under a Texas Antiquities Permit issued by the THC; 2) the survey line interval cannot

exceed 20 m (30 m when greater than 3 nautical miles offshore); 3) bottom-disturbing activities must be avoided within 50 m of potentially significant targets (150 m when more than 3 nautical miles offshore); 3) the survey area must extend beyond the limits of bottom-disturbing activities by the width of the avoidance margin; 4) survey instrumentation must include a marine magnetometer, a high-resolution side-scan sonar, and a recording fathometer all of which must record data digitally to electronic storage media; 5) survey instrumentation should be interfaced with a positioning system having accuracy comparable to or better than a differential global positioning system receiver; 6) the magnetometer must be towed within 6 m of the marine bed and should sample at least once per second; 7) the side-scan sonar should operate at a minimum frequency of 300 kiloHertz (kHz); and 8) the positioning system should sample at least once per second. No artifacts were collected during this survey.

The survey was conducted from a 20-foot bay boat on May 31, 2017. The Principal Investigator performed the survey with assistance in the field from Dougie Williamson. The Principal Investigator was solely responsible for archaeological data analysis and report preparation. Geographic positions were acquired using a Hemisphere AtlasLink global navigation satellite system. All data, except sonar, was logged in Hypack navigation software. Horizontal position estimates for each sensor were recorded in real time. Positions are based on the Universal Transverse Mercator (UTM) Coordinate System (Zone 14 North, meters). Bathymetry data were acquired using a Teledyne-Odom CVM Echotrac fathometer equipped with a 200-kHz transducer. A Marine Magnetics SeaSPY magnetometer was towed on the surface 62.5 ft aft of the survey boat.

Side-scan sonar data was acquired using a 600-kHz Edgetech 4125 system towed from the survey vessel's port side. Sonar imagery was recorded using Edgetech's Discover acquisition software. Geographic positions were embedded into the digital sonar data as it was recorded. Sonar data was recorded along a 25-m-wide (82-ft) swath overlapping with data from adjacent vessel tracks. Chesapeake SonarWiz software was used to combine sonar data from each transect into a composite sonar mosaic.

The purpose of the survey was to map geophysical anomalies that might have historical significance. In the context of submerged lands, historical significance typically, although not necessarily, refers to association with historic shipwrecks. The primary instrument for locating potential shipwrecks in buried contexts is the magnetometer. Exposed shipwrecks are most easily recognized in side-scan sonar imagery; however, historic wrecks in Texas bays are more often buried. Vessels predating World War II tend to be constructed of wood, which quickly deteriorates when exposed to wood-loving organisms, common to warm saline environments. Nevertheless, buried wooden hulls can retain a high level of artifact preservation and historic integrity. Wrecks exposed above the mudline for more than a few years tend to be constructed of materials other than wood.

Low-frequency fluctuations in magnetic data caused, for example, by diurnal passage of the sun or by geologic gradients were removed prior to contouring using a filter algorithm. The algorithm treats short-term fluctuations, exceeding a 2-nanoTesla (nT) threshold amplitude, as anomalous values. The result is a dataset in which abnormally high and low magnetic amplitudes (anomalies) are centered around zero (representing the ambient level). All amplitude shifts, smaller than the threshold value, are reduced to

zero and are treated as ambient background. This process removes low frequency data, leaving potentially significant anomalies intact, and allows a visual representation of anomaly polarity.

Diurnally-corrected magnetometer data was contoured using Blue Marble's Global Mapper® software (Version 17.2) at a 5-nT contour interval. Magnetic amplitudes between +5 nT and −5 nT are considered insignificant. Contour maps omit the 0-nT contour level to prevent a cluttered appearance. Positive amplitude is indicated by red contours, and negative amplitude is drawn as blue contours.

Interpretation of Magnetometer Data

Most magnetic anomalies in marine environments are caused by relatively small pieces of ferromagnetic debris, which tends to concentrate near high-traffic areas, marine disposal areas, industrial developments, petroleum wells, and pipelines. The frequency of ferromagnetic debris far outnumbers shipwrecks, necessitating some means for distinguishing between the two when conducting archaeological assessments. The method used here is based primarily upon a study by Gearhart (2011) that compared shipwreck and debris anomalies. Gearhart has analyzed magnetic data from a large and diverse collection of anomaly sources, including 39 verified shipwrecks and many debris sources with the goal of characterizing differences between these two categories of magnetic sources. Shipwrecks in his dataset represent a broad spectrum of material compositions, construction styles, ages, and archaeological contexts. Their hulls include construction from wood, iron, steel, and concrete. Their propulsion systems range from sail to steam-driven paddlewheels and propellers, and from oil and diesel screws to towed or pushed barges. They range in age from the mid-16th to the mid-20th century. They have been found in diverse depositional environments including harbor entrances, surf zones, beaches, marsh, oyster reefs, open bay waters, and the Gulf of Mexico. And this assortment of watercraft found their way to the seafloor in various ways including stranding on beaches, foundering at sea, by fire, by explosions (both accidental and intentional), and by abandonment. Some were partially demolished or salvaged after wrecking. Others remain largely untouched since the day they sank. Yet despite their many differences, they share common characteristics, which form the basis for this interpretative method.

Complexity

Archaeologists frequently have characterized shipwreck anomalies as appearing "multicomponent" or "complex", because shipwreck anomalies are observed to exhibit multiple dipoles, as well as unpaired monopoles. Such observations, however, can be affected by sampling bias. In other words, a single anomaly might look quite different depending on how many points are sampled and where those points occur. Some early observations of complexity in wreck anomalies also might have been influenced by magnetometer technology of the times. Proton precession systems, for example, tended to produce false noise spikes in the presence of high magnetic gradients.

Garrison, et al. (1989: II, 223) summarized several common methods for prioritizing anomalies with a focus on complexity. Shipwreck anomalies were characterized as having: multiple peaks of differing magnitudes spread over an area greater than 10,000 square meters (2.5 acres); gentle gradients; and a linear association with anomalies on adjacent transects. A typical debris anomaly was characterized as

having a single peak covering an area of less than 10,000 square meters, a steep gradient, and no alignment of anomalies on adjacent lines.

Horizontal Dimensions

Anomaly width, or duration as preferred by some, is a common and valid measure used by archaeologists for discriminating potential shipwreck anomalies from those believed more likely caused by debris. For example, Linden and Pearson (2014) would consider an anomaly significant if it has amplitude of at least 50 nT and a duration equivalent to 65 ft or more. The horizontal dimensions of shipwreck and debris anomalies overlap considerably, especially when considering wrecks with wooden hulls, thus width alone is not particularly useful for discriminating between the two. There is a 15-fold difference in width between the smallest wood-hulled sailing ship and the largest steel tanker, so large wrecks tend to be obvious. Unfortunately, small, wooden-hulled watercraft, even many steamboats, tend to have anomalies no wider than many debris anomalies.

Small, wooden (and generally historic) shipwrecks are the most difficult sites to detect precisely because their anomalies overlap in size with many debris anomalies. Site 41CL92 (Figure 3) has the smallest verified wreck anomaly known to this author. Divers confirmed the site as an early 19th-century sailing vessel containing a large collection of concreted artifacts, iron bar stock, and pig iron ballast (Borgens 2004). The anomaly measures 155 x 176 ft (47.2 x 53.6 m) to the 5-nT contour, whereas, the site measures 23 x 52 ft (7 x 15.9 m). The archaeological site is 15-30 percent the width of the anomaly and covers about 4 percent of the anomaly's area.

The smallest wreck in Gearhart's anomaly dataset is a buried wooden hull measuring roughly 13 x 35 ft based on diver probes (Gearhart 2016b: Mag-13). The Mag-13 wreck, as it is referred to in Gearhart (2016b), measures 8-18 percent the width of its magnetic anomaly, 164 x 197 ft (50 x 60 m). The Mag-13 anomaly is about 10-percent wider than the 41CL92 anomaly, even though the Mag-13 site is more compact. Based on the models provided by these two anomalies, it seems reasonable that historic watercraft with wooden hulls as short as 24 ft long might have anomalies measuring as small as 80 ft across.

Small shipwreck anomalies cannot be distinguished from debris anomalies based on size alone. All of the wood-hulled sailing ships and all but one of the wood-hulled steamboat anomalies known to this author are smaller than 10,000 square meters, Garrison, et al.'s (1989: II, 223) minimum suggested size for typical shipwreck anomalies. Site 41CL92, for example, covers an area of only 1,580 square meters (0.4 acres) out to the 5-nT contour.

Amplitude

Anomaly amplitude correlates poorly with horizontal dimensions of a magnetic source, because amplitude depends greatly upon the mass of the source and the distance between the magnetometer and the source. Small sources can produce large amplitude when measured at close range. Shipwreck anomalies from Gearhart (2011) have average peak-to-peak amplitudes of 270 nT for wood-hulled sailing vessels (n=6); 5,020 nT for wood-hulled machine-powered vessels (n=7); and 10,386 nT for iron-

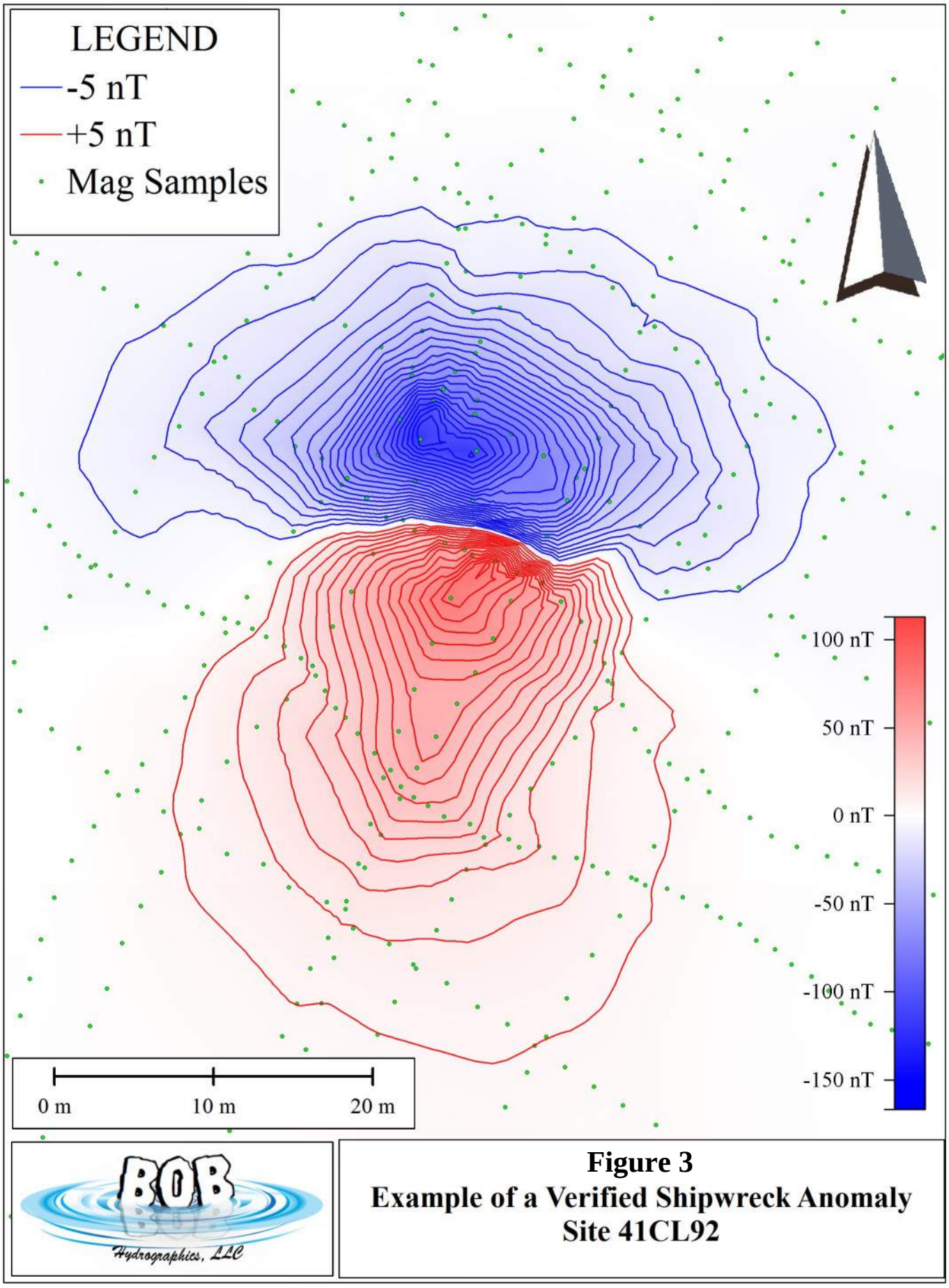

Figure 3
Example of a Verified Shipwreck Anomaly
Site 41CL92

and steel-hulled vessels (n=12). Magnetic debris can produce amplitudes virtually anywhere within that same range, thus amplitude is of little use for differentiating shipwrecks from debris.

Orientation

Shipwreck anomalies (e.g., Figure 3) consistently share a common orientation with respect to earth's magnetic field, despite the great diversity of wrecks described above. All wreck anomalies observed by this author, to date, are oriented with their primary negative pole north of their positive pole. This is expected to be the case for all wrecks (and all other complex anomaly sources) in mid-latitudes of the northern hemisphere. By contrast, debris anomalies may exhibit any orientation.

Shipwrecks, and other complex sources, have anomalies closely aligned to the direction of magnetic north. This phenomenon is believed due to the random orientations of hundreds or even thousands of individual magnetic components comprising many complex sources, including shipwrecks. The magnetic field of each component interacts with that of its neighbors. The overlapping portions of fields that oppose one another in direction tend to cancel, while lines of force that run in the same general direction reinforce each other. Since a small portion of each field is aligned with (induced by) earth's local field, the net result of all these interactions is that more reinforcement occurs in the direction of magnetic north than in any other direction, resulting in a north-aligned anomaly. A simple debris source, on the other hand, is a solitary object on the seabed having, by definition, no nearby sources affecting its magnetic field, thus the alignment of its anomaly is determined not by earth's magnetic field direction but by the object's orientation on the seabed. Hence debris anomalies can be oriented along any point of the compass.

Orientation can differentiate magnetic anomalies caused by most simple debris sources from anomalies caused by complex sources, including shipwrecks, and has potential to eliminate close to 80 percent of debris anomalies from further archaeological concern. Roughly 20 percent of simple debris sources have northerly orientations like those observed over complex sources. Absent a sonar target, there is no reliable method known, short of physically probing an anomaly, to differentiate that 20 percent of debris having northerly orientations from buried shipwrecks.

Anomalies can be eliminated from consideration as potential shipwrecks by demonstrating that their orientations differ substantially from the direction of magnetic north. It seems extremely unlikely that a shipwreck could have a magnetic anomaly that is not aligned closely with magnetic north, as this would require a large percentage of the wreck's many ferromagnetic components, by chance, to have the same magnetic moment. On the other hand, the anomaly of a simple debris source should align with earth's magnetic field only when its magnetic moment, as determined by its orientation on the seafloor, closely aligns with magnetic north.

The interpretation of magnetic anomalies, based on orientation, requires comparing unidentified magnetic anomalies, contoured at a 5-nT interval, to the anomaly of a small, verified wreck anomaly, such as 41CL92, shown in Figure 3. One must ensure that the reference anomaly is contoured, oriented, and scaled using the same parameters as the survey data to which it is compared. Anomalies having a polar orientation like 41CL92 should be considered possible shipwrecks unless contradicted by other

information, such as reliable evidence of an abandoned petroleum well nearby, since anomalies over steel well casings happen to closely resemble shipwreck anomalies.

V. Results

Results are illustrated below. Geophysical survey transects are illustrated in Figure 4 overlain on the pre-planned lines. Transects were spaced 20 m apart, as required by THC survey guidelines. One geophysical target, Anomaly 1, resembles examples of magnetic anomalies recorded over verified shipwrecks. Side-scan sonar data is illustrated as a mosaic in Figure 5 overlain by the APE. Small areas of shell reef are visible in the sonar data, but no significant side-scan sonar targets were observed.

Magnetometer data is illustrated as contours in Figure 6. One magnetic anomaly (Appendix A; not for public disclosure) has been interpreted as a potential historic shipwreck based on its resemblance to verified wreck anomalies (e.g., Figure 3), as described in Section IV. The possible association of Anomaly 1 with a historic shipwreck cannot be ruled out based on the geophysical data at hand. In the absence of further information, its source must be considered potentially eligible for inclusion on the NRHP.

Information regarding petroleum infrastructure was obtained from the Railroad Commission of Texas' Public GIS Viewer. No wells or pipelines are reported in the APE, and no magnetic anomalies were observed that would suggest the presence of petroleum infrastructure in the area. The nearest charted wells are two dry holes located about 900 ft southwest of the APE. A third dry hole is charted about 1,200 west-northwest of the APE.

Recommendations

One magnetic anomaly (Appendix A; not for public disclosure) is recommended for avoidance based on its resemblance to anomalies typically recorded over verified shipwrecks. If Anomaly 1 is associated with a historic wreck, it could meet criteria for State Antiquities Landmark or NRHP eligibility. BOB recommends cultural resource clearance for the remaining 29.2 acres of the APE, highlighted in Figure A-1 (Appendix A), but excluding the avoidance buffer around Anomaly 1.

Avoidance buffers are mandated by The Texas Administrative Code, Title 13, Part 2, Chapter 26. The buffer for inland waters is set at 50 m (164 ft) beyond significant target boundaries. Disturbance of the seafloor must be avoided within 50 m (164 ft) of Anomaly 1, as measured outward from its +/- 5-nT contours. Disturbance of the seafloor also must be avoided within a 50-m (164-ft) buffer surrounding the APE. Seafloor disturbances include, but are not limited to, dredging, anchoring, use of barge spuds, and compaction of the substrate by heavy overburden, such reefing materials. If shipwreck remains, or other potentially historic materials, are discovered anywhere in the APE during construction, work should be halted within 50 m (164 ft) of the find until the THC can provide direction concerning the discovery.

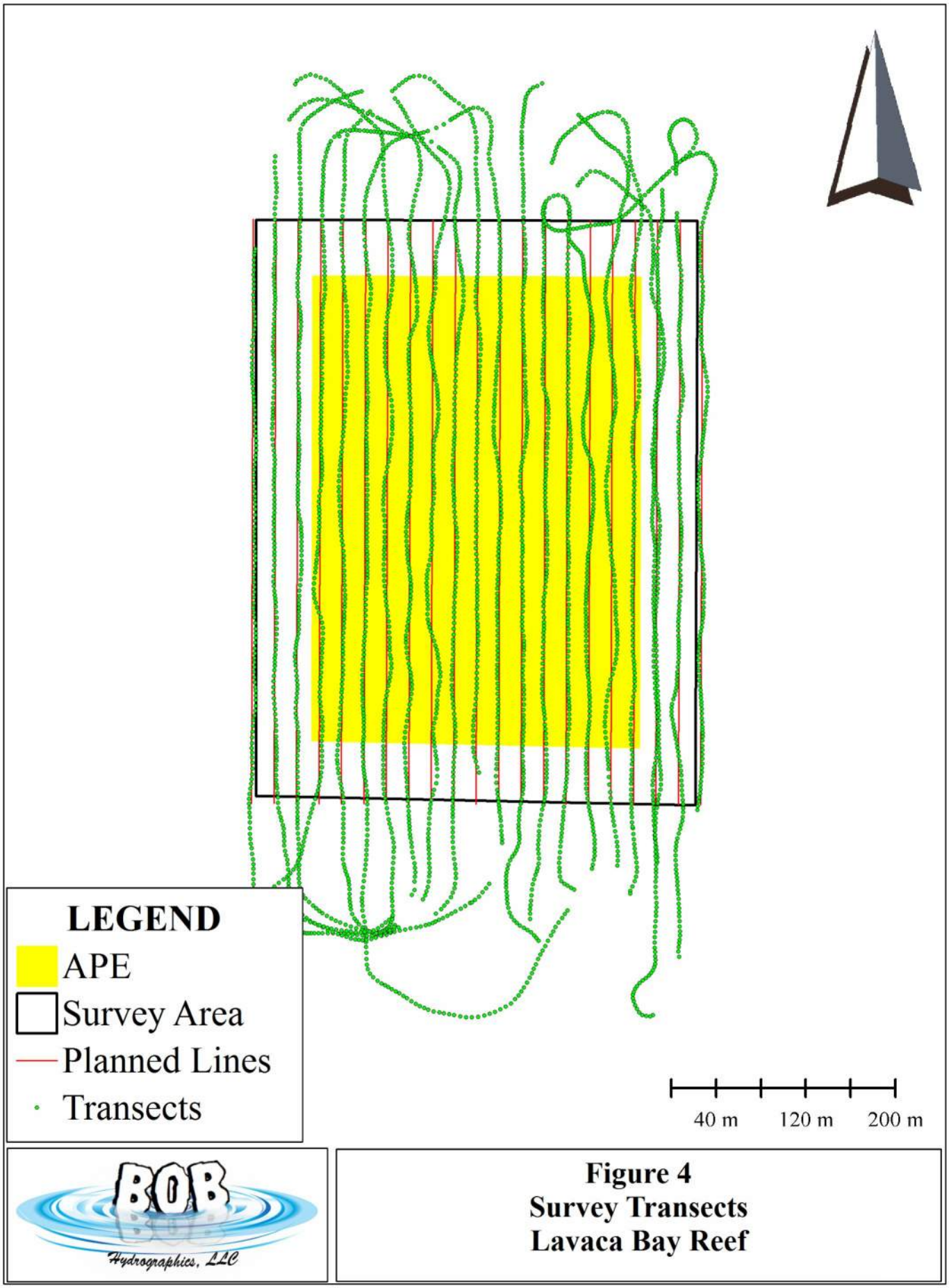

Figure 4
Survey Transects
Lavaca Bay Reef

BOB Hydrographics, LLC

Figure 5
Side-Scan Sonar
Lavaca Bay Reef

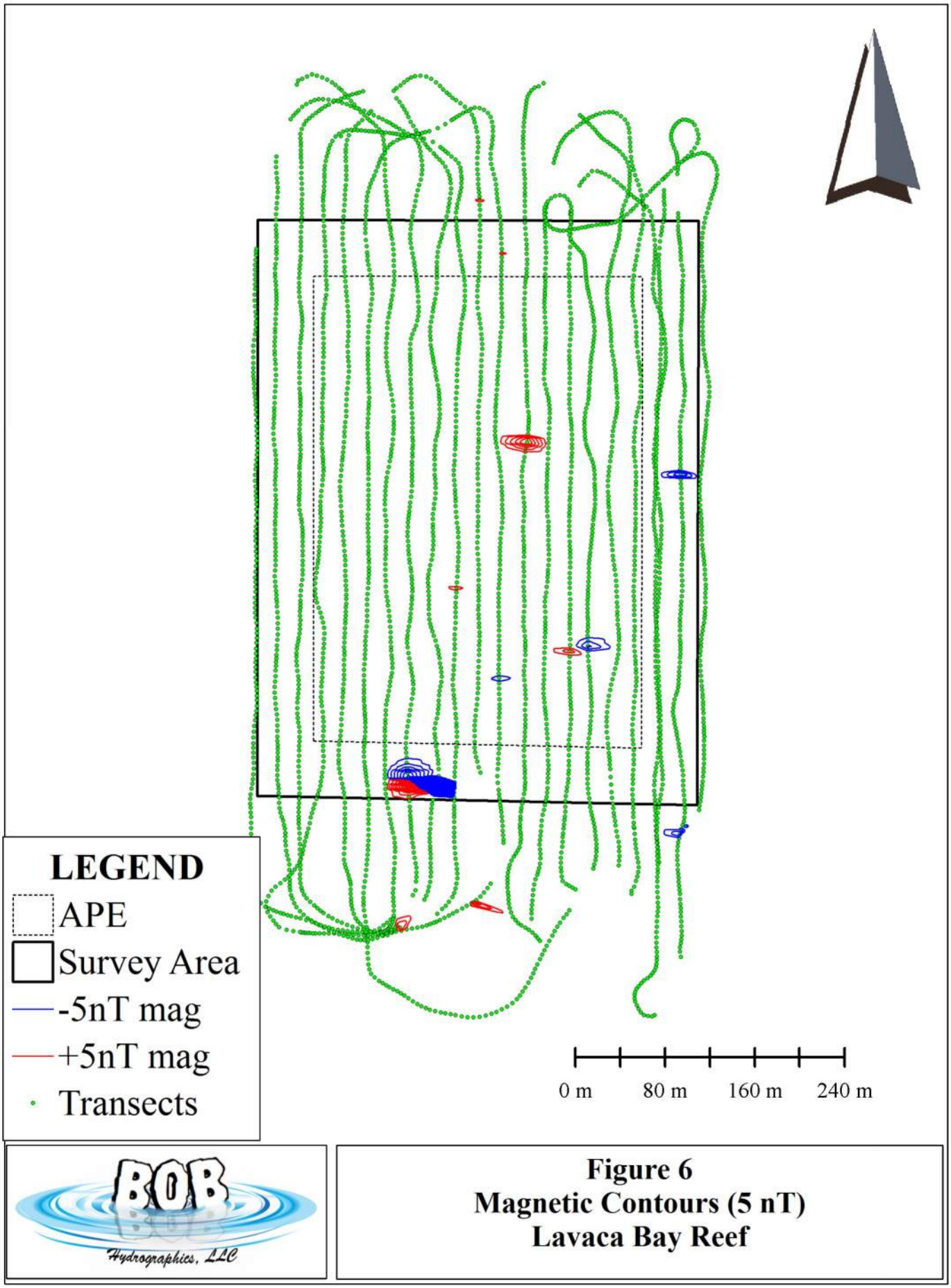

Figure 6
Magnetic Contours (5 nT)
Lavaca Bay Reef

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Appendix A: Geophysical Targets Recommended for Avoidance (Not for Public Disclosure)

Appendix B: Texas Antiquities Permit 8004 and THC Correspondence

April 25, 2017

Robert Gearhart
BOB Hydrographics, LLC
1315 Fall Creek Loop
Cedar Park, TX 78613-5820

Re: Project review under the Antiquities Code of Texas
Lavaca Bay Reef Project, Calhoun County, Texas
Texas Antiquities Permit Application **#8004**

Dear Colleague:

Thank you for your Antiquities Permit Application for the above referenced project. This letter presents the final copy of the permit from the Executive Director of the Texas Historical Commission (THC), the state agency responsible for administering the Antiquities Code of Texas.

Please keep this copy for your records. The Antiquities Permit investigations requires the production and submittal of one printed copy of the final report, a completed abstract form submitted via our online system, two copies of the tagged PDF final report on CD (one with site location information & one without), and verification that any artifacts recovered and records produced during the investigations are curated at the repository listed in the permit. The abstract form maybe submitted via the THC website (www.thc.state.tx.us) or use url: http://xapps.thc.state.tx.us/Abstract/login.aspx Additionally, you must send the THC shapefiles showing the boundaries of the project area *and* the areas actually surveyed via email to archeological_projects@thc.texas.gov.

If you have any questions concerning this permit or if we can be of further assistance, please contact Lillie Thompson at 512/463-1858. The reviewer for this project is Amy Borgens, 512/463-6096.

Sincerely,

for
Mark Wolfe
Executive Director

MW/lft

Enclosures

Cc: Anne Idsal, Tx GLO
Rebecca Hensley, TPWD

State of Texas

TEXAS ANTIQUITIES COMMITTEE

ARCHEOLOGY PERMIT # 8004

This permit is issued by the Texas Historical Commission, hereafter referred to as the Commission, represented herein by and through its duly authorized and empowered representatives. The Commission, under authority of the Texas Natural Resources Code, Title 9, Chapter 191, and subject to the conditions hereinafter set forth, grants this permit for:

Underwater Survey

To be performed on a potential or designated landmark or other public land known as:

Title: ***Lavaca Bay Reef Project***
County: ***Calhoun***
Location: ***Lavaca Bay, 1 mile north of bridge to Point Comfort***

Owned or Controlled by: (hereafter known as the Permittee):

Texas General Land Office
1700 North Congress Avenue, Ste. 935
Austin, TX 78701

Sponsored by (hereafter known as the Sponsor

Texas Parks and Wildlife Department
1501 FM 517 East
Dickinson, TX 77539

The Principal Investigator/Investigation Firm representing the Owner or Sponsor is:

Robert Gearhart
BOB Hydrographics, LLC
1315 Fall Creek Loop
Cedar Park, TX 78613-5820

This permit is to be in effect for a period of:

1 Years and 0 Months

and Will Expire on:

04/21/2018

During the preservation, analysis, and preparation of a final report or until further notice by the Commission, artifacts, field notes, and other data gathered during the investigation will be kept temporarily at:

BOB Hydrographics, LLC

Upon completion of the final permit report, the same artifacts, field notes, and other data will be placed in a permanent curatorial repository at:

Texas Parks & Wildlife Dept. Lab.

Scope of Work under this permit shall consist of:

Underwater survey (May include remote sensing survey and diver ground-truthing). For details, see scope of work submitted with permit application.

ARCHEOLOGY PERMIT # 8004

This permit is granted on the following terms and conditions:

1) This project must be carried out in such a manner that the maximum amount of historic, scientific, archeological, and educational information will be recovered and preserved and must include the scientific, techniques for recovery, recording, preservation and analysis commonly used in archeological investigations. All survey level investigations must follow the state survey standards and the THC survey requirements established with the projects sponsor(s).

2) The Principal Investigator/Investigation Firm, serving for the Owner/Permittee and/or the Project Sponsor, is responsible for insuring that specimens, samples, artifacts, materials and records that are collected as a result of this permit are appropriately cleaned, and cataloged for curation. These tasks will be accomplished at no charge to the Commission, and all specimens, artifacts, materials, samples, and original field notes, maps, drawings, and photographs resulting from the investigations remain the property of the State of Texas, or its political subdivision, and must be curated at a certified repository. Verification of curation by the repository is also required, and duplicate copies of any requested records shall be furnished to the Commission before any permit will be considered complete.

3) The Principal Investigator/Investigation Firm serving for the Owner/Permittee, and/or the Project Sponsor is responsible for the publication of results of the investigations in a thorough technical report containing relevant descriptions, maps, documents, drawings, and photographs. A draft copy of the report must be submitted to the Commission for review and approval. Any changes to the draft report requested by the Commission must be made or addressed in the report, or under separate written response to the Commission. Once a draft has been approved by the Commission, one (1) printed, unbound copy of the final report containing at least one map with the plotted location of any and all sites recorded and two copies of the report in tagged PDF format on an archival quality CD or DVD shall be furnished to the commission. One copy must include the plotted location of any and all sites recorded and the other should not include the site location data. A paper copy and an electronic copy of the completed Abstracts in Texas Contract Archeology Summary Form must also be submitted with the final report to the Commission. (Printed copies of forms are available from the Commission or also online at www.thc.state.tx.us.)

4) If the Owner/Permittee, Project Sponsor or Principal Investigator/Investigation Firm fails to comply with any of the Commission's Rules of Practice and Procedure or with any of the specific terms of this permit, or fails to properly conduct or complete this project within the allotted time, the permit will fall into default status. A notification of Default status shall be sent to the Principal Investigator/Investigation Firm, and the Principal Investigator will not be eligible to be issued any new permits until such time that the conditions of this permit are complete or, if applicable, extended.

5) The Owner/Permittee, Project Sponsor, and Principal Investigator/Investigation Firm, in the conduct of the activities hereby authorizes, must comply with all laws, ordinances and regulations of the State of Texas and of its political subdivisions including, but not limited to, the Antiquities Code of Texas; they must conduct the investigation in such a manner as to afford protection to the rights of any and all lessees or easement holders or other persons having an interest in the property and they must return the property to its original condition insofar as possible, to leave it in a state which will not create hazard to life nor contribute to the deterioration of the site or adjacent lands by natural forces.

6) Any duly authorized and empowered representative of the Commission may, at any time, visit the site to inspect the fieldwork as well as the field records, materials, and specimens being recovered.

7) For reasons of site security associated with historical resources, the Project Sponsor (if not the Owner/Permittee), Principal Investigator, Owner, and Investigation Firm shall not issue any press releases, or divulge to the news media, either directly or indirectly, information regarding the specific location of, or other information that might endanger those resources, or their associated artifacts without first consulting with the Commission, and the State agency or political subdivision of the State that owns or controls the land where the resource has been discovered.

8) This permit may not be assigned by the Principal Investigator/Investigation Firm, Owner/Permittee, or Project Sponsor in whole, or in part to any other individual, organization, or corporation not specifically mentioned in this permit without the written consent of the Commission.

9) Hold Harmless: The Owner/Permittee hereby expressly releases the State and agrees that Owner/Permittee will hold harmless, indemnify, and defend (including reasonable attorney's fees and cost of litigation) the State, its officers, agents, and employees in their official and/or individual capacities from every liability, loss, or claim for damages to persons or property, direct or indirect of whatsoever nature arising out of, or in any way connected with, any of the activities covered under this permit.The provisions of this paragraph are solely for the benefit of the State and the Texas Historical Commission and are not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

10) Addendum: The Owner/Permittee, Project Sponsor and Principal Investigator/Investigation Firm must abide by any addenda hereto attached.

Upon a finding that it is in the best interest of the State, this permit is issued on 04/21/2017.

Pat Mercado-Allinger

Pat Mercado-Allinger, for the Texas Historical Commission

TEXAS HISTORICAL COMMISSION

real places telling real stories

August 1, 2017

Michael Strutt
Texas Parks and Wildlife Department
4200 Smith School Rd.
Austin, Texas 78744-3291

Re: Project review under Section 106 of the National Historic Preservation Act of 1966 and the Antiquities Code of Texas
Draft Report Review: *Marine Archeology Survey in Support of Lavaca Bay Reef Project, Calhoun County*
Texas Antiquities Permit No. 8004, Tracking No. 201708539

Dear Mr. Strutt:

Thank you for your correspondence describing the above referenced project. This letter serves as comment on the proposed federal undertaking from the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission. As the state agency responsible for administering the Antiquities Code of Texas, these comments also provide recommendations on compliance with state antiquities laws and regulations.

The review staff, led by State Marine Archeologist Amy A. Borgens has completed its review of the draft report. In May 2017, BOB Hydrographics conducted a marine archeological remote-sensing survey of 50 acres for a proposed oyster reef restoration site in State Tracts 17A and 20A in Lavaca Bay, Calhoun County for Texas Parks and Wildlife Department (TPWD). One significant magnetic target (Anomaly 1) was recommended for avoidance and the THC concurs with this recommendation. The proposed project may proceed if Anomaly 1 can be avoided. Further investigation will be needed for anomalies which cannot be avoided.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this federal and state review process, and for your efforts to preserve the irreplaceable heritage of Texas. **If you have any questions concerning our review or if we can be of further assistance, please contact Amy Borgens at 512-463-9505 or amy.borgens@thc.texas.gov.**

Sincerely,

for
Mark Wolfe
State Historic Preservation Officer
MW/ab

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