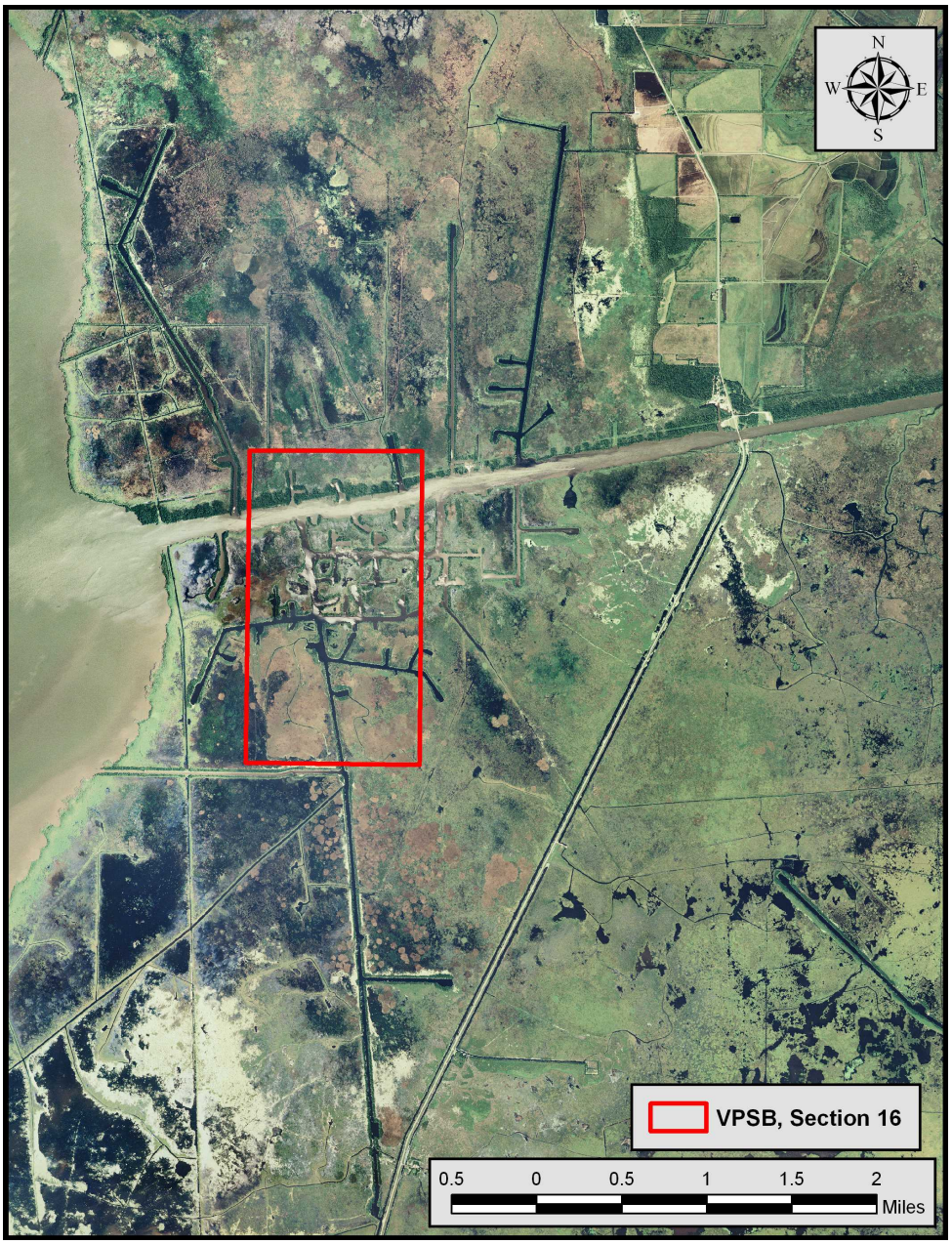
Processes Affecting Wetland Development at the Vermilion Parish School Board Property, Section 16 (T15S, R1E), Vermilion Parish, Louisiana



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Introduction

Analysis of wetland changes associated with oil and gas operations on the Vermilion Parish School Board (VPSB) property east of White Lake, LA (Figure 1) was completed using existing marsh habitat maps, registered aerial photography, soil survey data, and a variety of information regarding navigation and water control structures from the U.S. Army Corps of Engineers. The area of concern referenced in litigation filed by the Vermilion Parish School Board (*State of Louisiana, et al. v. The Louisiana Land and Exploration Company, et al.*) is Section 16 (T15S, R1E). Access to the property is by boat via the Schooner Bayou Canal, formerly a section of the original Intracoastal Waterway. The property is about 2 miles west of the Highway 82 bridge that crosses Schooner Bayou Canal. The property encompasses about 1,200 acres of marsh in the East White Lake oil and gas field.

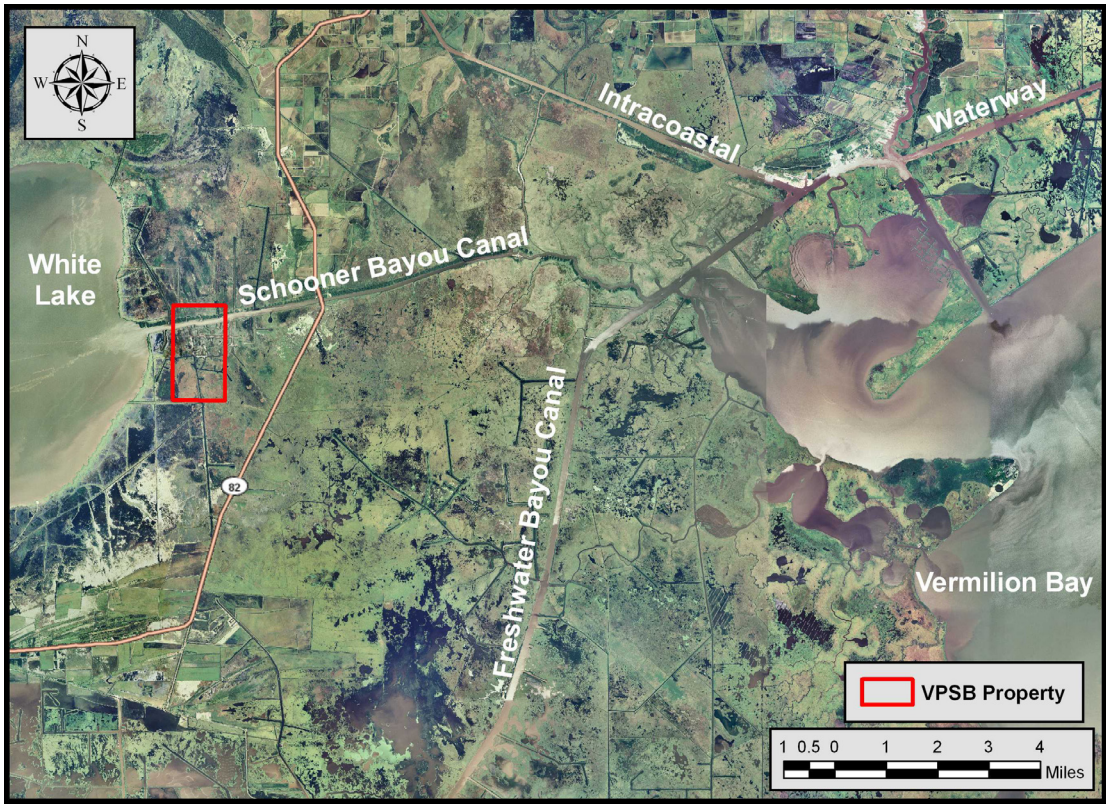

Figure 1. Location of Vermilion Parish School Board property within the general project area.

The study area is located within the Mermentau Basin in an area known as the South White Lake Marsh (Gammill, 2002). Specifically, the area is surrounded by fresh and intermediate marsh that is intersected by Schooner Bayou Canal near its northern boundary; White Lake is to the west and Vermilion Bay is to the east (Figure 2). Primary exchange of water between the Gulf of Mexico and Vermilion Bay is through Southwest Pass because the bay is separated from the Gulf by Marsh Island. Sediment and freshwater from the Wax Lake Outlet and the Atchafalaya River (east of the Wax Lake Outlet) enter the basin through the Intracoastal Waterway; however, the Schooner Bayou Control Structure and the Leland Bowman Lock regulate water and sediment exchange from the east.

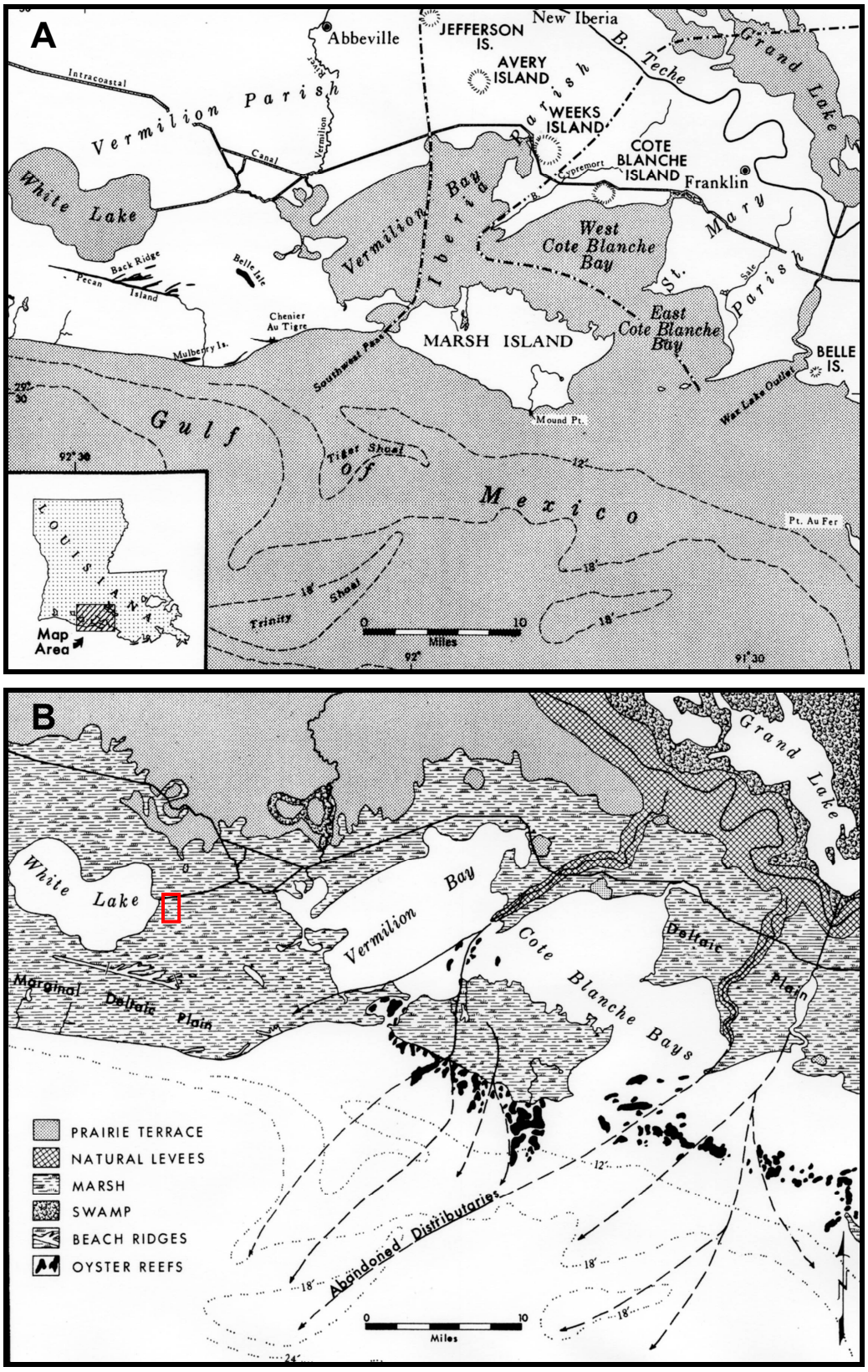

Figure 2. A. General physiography of the Teche-Vermilion Basin. B. General location of study area is outlined in red (from Coleman, 1966).

As illustrated in Figures 1 and 2, the Gulf Intracoastal Waterway follows a general east-west orientation north and east of the VPSB property. Exchange of water and sediment to and from the Intracoastal Waterway and within the marshes surrounding the VPSB Property is regulated by the Leland Bowman Lock and the Schooner Bayou Control Structure (Figure 3). Primary hydrologic patterns in this area are controlled by freshwater inflow from the north and rainfall. Overall, marshes in the study area are fresh to intermediate. Marshes are vigorous, and land loss trends illustrate minimal non-direct changes since the 1930s (Figure 4; Britsch and Dunbar, 2006).

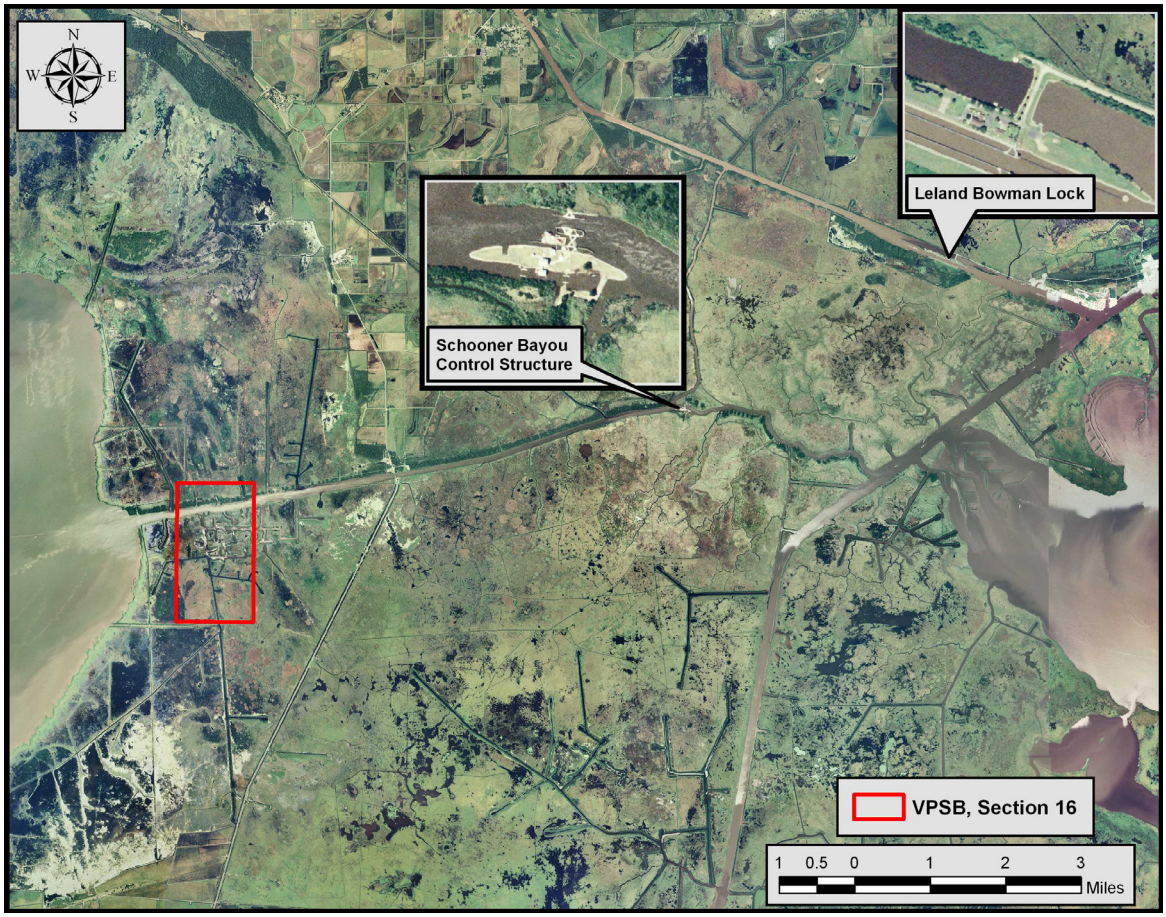

Figure 3. Location of the Leland Bowman Lock and the Schooner Bayou Control Structure relative to the VPSB property.

The purpose of this report is to evaluate the potential impact of oil and gas operations on marshes at the VPSB Property (Section 16, T15S, R1E). Aerial photography was used to document long-term surface changes since 1935, and existing study results and data sets were used to evaluate potential natural and human impacts on marsh sustainability during historical oil and gas operations.

Marsh Soil Associations

The primary soil association on the VPSB Property is the Allemands mucky peat (AE; Figure 5). The soil is classified as a very poorly drained organic soil common to freshwater marshes which are ponded most of the time and frequently flooded (NRCS,

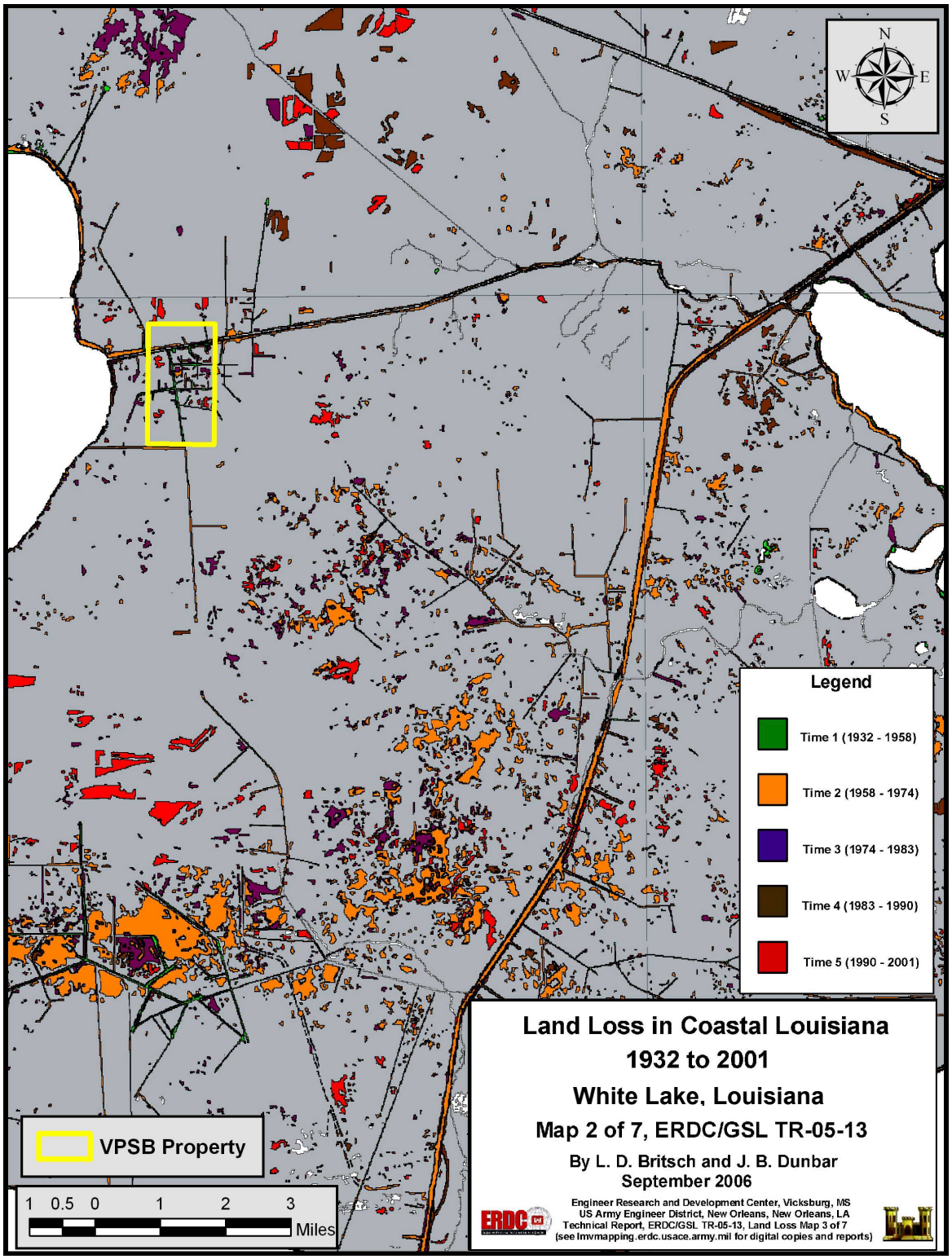

Figure 4. Land loss map for the South White Lake Marsh, 1932 to 2001, including the general area of the VPSB Property (within yellow box) (Britsch and Dunbar, 2006).

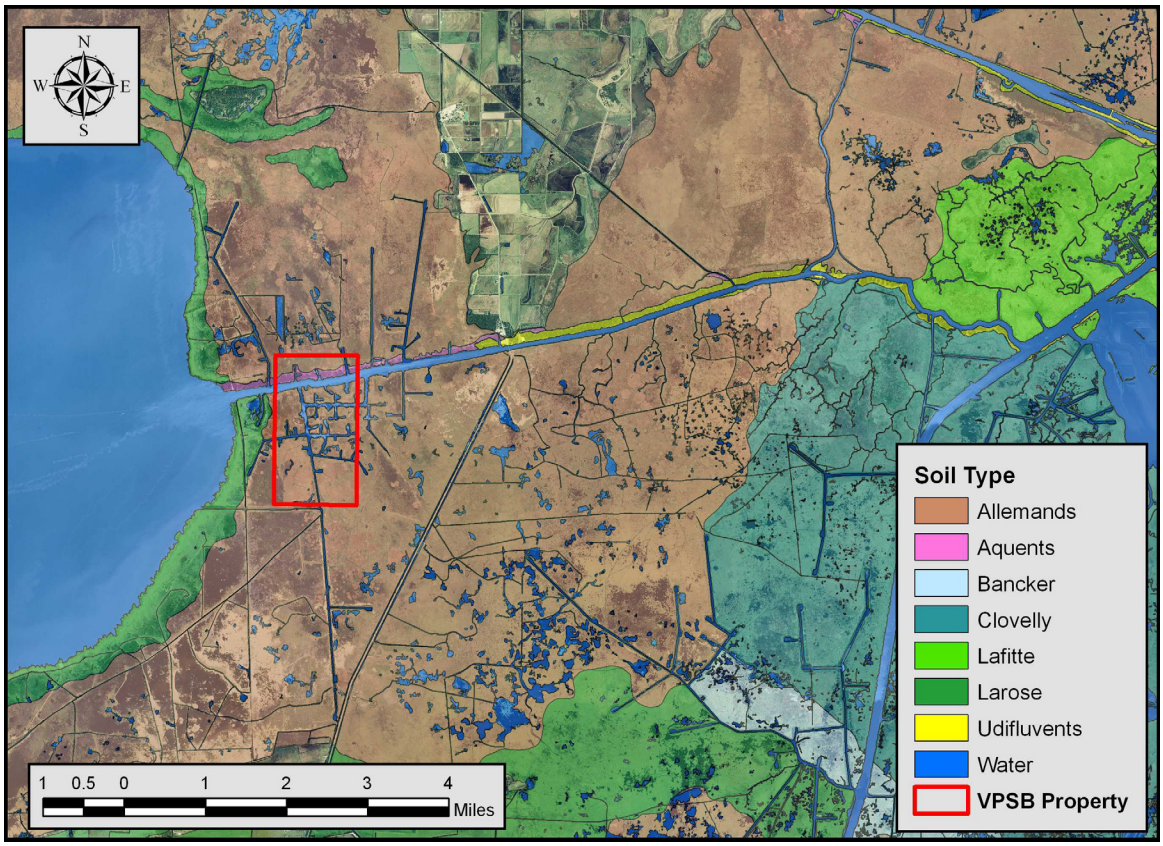

Figure 5. Distribution of soil types within the project area (Soil Data Mart, NRCS).

1996). Parent material of AE soils consists of decomposed organics overlying clayey backswamp deposits. A typical profile for this soil type is a mucky peat for the top 12 inches, followed by a muck for the next 3 feet, a mucky clay from 48 to 60 inches below the surface, and a clay between 60 and 80 inches. During periods when the soil is not flooded, the water table is about a foot above to 0.5 feet below the surface. The soil has a low load-supporting capacity. Permeability is moderately rapid or rapid in the organic material and very slow in the clayey underlying material. Salinity of AE soils ranges from nonsaline to very slightly saline (approximately 0-2.5 ppt), and total subsidence potential is high (NRCS, 1996). Natural vegetation in the area consists primarily of bulltongue and maidencane. Other common plants are cattail, water primrose, alligatorweed, and pickerelweed.

As illustrated in Figure 5, freshwater Larose mucky clays (LR) border the western margin of the property, whereas poorly drained, brackish mineral (Bancker) and organic (Clovelly) soils characterize marshes east of the Allemands muck near Vermilion Bay (NRCS, 1996). Larose mucky clay permeability is slow and the total subsidence is high. Salinity ranges from approximately 0 to 2.5 ppt. Natural vegetation of this soil type primarily includes bulltongue, cattail, and marshhay cordgrass. Other common vegetation includes alligatorweed, giant cutgrass, rattlebox, California bulrush, primrose, maidencane, and common buttonbush. This soil, when submerged, also supports aquatic and floating type plants including duckweed, milfoil, pennywort, water hyacinth, waterlilies, and coontail. Clovelly muck (CL) soils are poorly drained organic soils in brackish marshes that are frequently ponded and flooded. Maximum salinity is slightly saline (approximately 2.5-5 ppt). Natural vegetation found on Clovelly soils consists

mainly of marshhay cordgrass, as well as needlegrass rush, saltmarsh bulrush, Olney bulrush, and seashore saltgrass. Bancker muck (BA) is a poorly drained mineral soil in brackish marshes (NRCS, 1996). Salinity ranges from 0 to 2.5 ppt and vegetation includes mainly marshhay cordgrass, although needlegrass rush, seashore paspalum, saltmarsh bulrush, and smooth cordgrass are common.

Although of minor aerial extent, Aquents (AN) and Udifluvents (UD) are located adjacent to channels that were hydraulically excavated during the construction and maintenance of navigable waterways. Aquents are relatively low lying and composed of loam and clay, and Udifluvents are sandy to clayey soils typical of spoil banks that can be up to 15 feet higher than surrounding soils (NRCS, 1996). These soils are most common along Schooner Bayou Canal.

Historical Changes in Marsh Habitat

Habitat changes associated with the South White Lake Marsh are the result of natural processes and human modifications. Natural processes include relative sea level rise and saltwater encroachment. Human modifications are primarily related to hydrologic alterations and may include saltwater intrusion and increased water level fluctuations. Marsh vegetation has been mapped as intermediate to fresh in the VPSB project area since the 1940s (Figure 6). O'Neil (1949) identified vegetation types at and adjacent to the VPSB Property as fresh to intermediate marsh, classified as sawgrass marsh. Other species which appeared in this marsh were cattail, bulrush, roseau cane, bull-tongue, hogcane, and spike rush with yellow cutgrass near the ridges. Water levels ranged from 4 inches to plus 15 inches, resulting in the area being considered "deep marsh" (O'Neil, 1949).

By 1978, wetland vegetation had become more indicative of fresh marsh for the VPSB Property. Typical vegetation in this type of marsh was maidencane, water hyacinth, pickerelweed, alligatorweed, and Bulltongue (Chabreck and Linscombe, 1978). Freshening of the marsh can be correlated with the construction of water control structures and locks in the early 1950s. Based on 2001 vegetative mapping, marshes in the VPSB property remained classified as fresh (Figure 6C). Typical vegetation identified during this marsh survey included maidencane, pennywort, water hyacinth, pickerelweed, alligatorweed, and bulltongue (Linscombe and Chabreck, 2001). Although the area remained dominated by freshwater vegetation, the zone of intermediate marsh was positioned west of the 1978 boundary, possibly reflecting the influence of saltwater infiltration from the east (Figure 6).

Development of Schooner Bayou Canal

Schooner Bayou Canal, originally part of the Intracoastal Waterway, has had a primary influence on the development and natural evolution of South White Lake marshes. Prior to 1911, Schooner Bayou was a closed-end, non-navigable waterway exchanging water and sediment with Vermilion Bay; a connection with White Lake did not exist (see Appendix A for a detailed history of the Schooner Bayou Canal). The River and Harbor Act of March 2, 1907 provided for an inland waterway from Franklin to Mermentau, LA, which included the section up Schooner Bayou and by a dredged canal to White Lake, with dimensions of 5 feet deep and 40 feet bottom width (ARCE, 1907; H. Doc. 640, 1907). In February 1911, the canal between Schooner Bayou and White Lake was completed to authorized dimensions (ARCE, 1911). A tidal lock was built 4.5 miles west

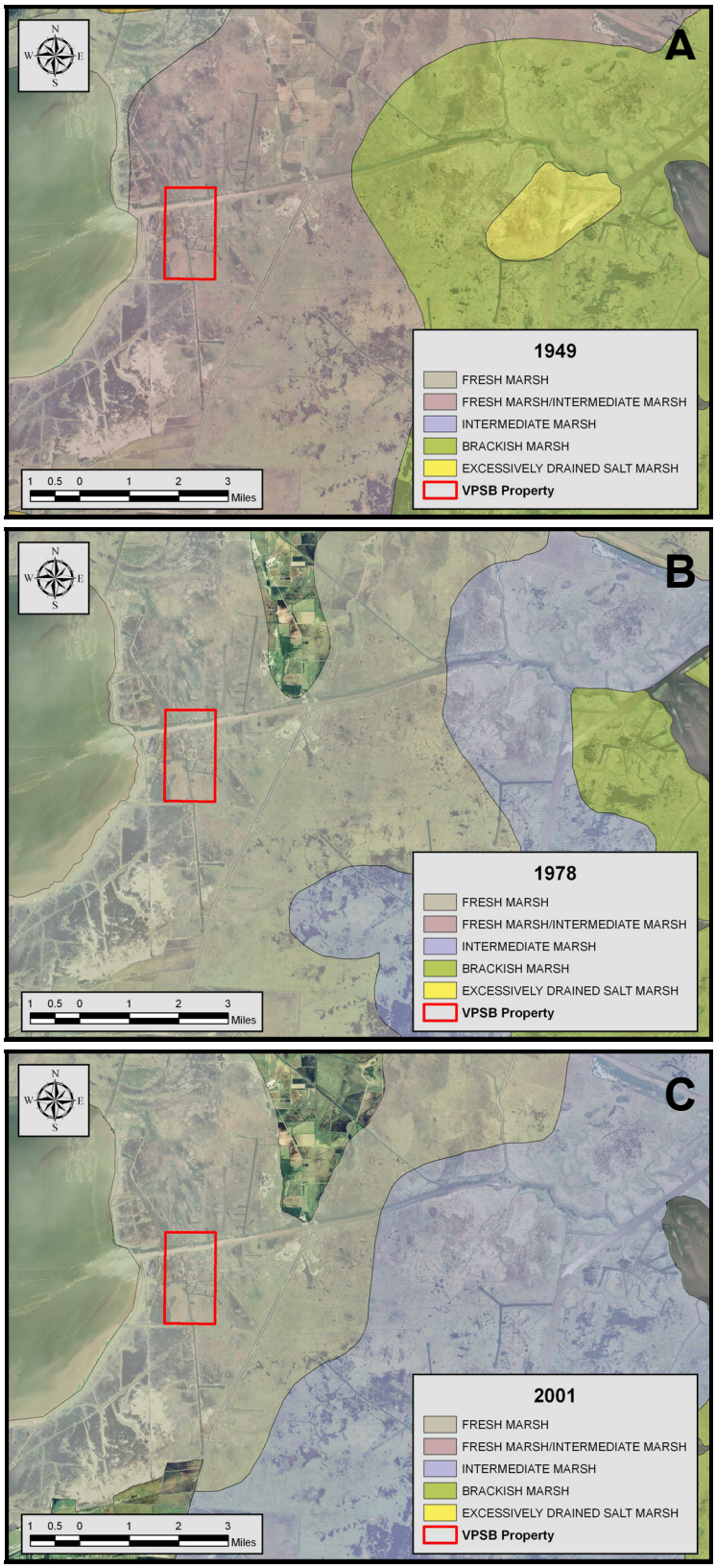

Figure 6. Distribution of marsh vegetation within the study area: A) **1949** (O'Neil, 1949), B) **1978** (Chabreck and Linscombe, 1978), C) **2001** (Linscombe and Chabreck, 2001).

of the mouth of Schooner Bayou from March 7 to October 12, 1912 to be operated only when the current in the bayou was reversed in order to prevent salt water from flowing into White Lake, thereby preventing potential damage to the rice industry in that area. The lock was placed in finished status March 1, 1913 (ARCE, 1913). From July 16 to October 29, 1914, a spillway dam was constructed around Schooner Bayou Lock to give additional relief to drainage and to reduce the current through the locks. The dam gates were kept closed whenever the Gulf water was higher than that of the canal (ARCE, 1914, 1915).

On March 2, 1919, the River and Harbor Act authorized a short cut canal between Vermilion River and Schooner Bayou, about 4 miles long, 5 feet deep, and 40 feet wide. This cut-off would bypass Vermilion Bay and enter Schooner Bayou 3.75 miles east of Schooner Bayou Lock (ARCE, 1919; H. Doc. 1336, 1913). The cut-off canal was dredged from February 1, 1922 to April 27, 1923 to project dimensions (ARCE, 1922, 1923). The River and Harbor Act of March 3, 1925 provided for a new route for the Louisiana and Texas Intracoastal Waterway with new dimensions of 9 feet MLW by 100 feet wide, which until then included Schooner Bayou Canal between the lock and White Lake (ARCE, 1925; H. Doc. 238, 1924). The new route, completed in fiscal year 1932, followed Vermilion River 1.3 miles, a part of the Schooner Bayou Cut-off canal, and a land cut running in a general northwesterly direction to the Mermentau River (ARCE, 1932). In fiscal year 1932, the North Fork Canal, extending from the Intracoastal Waterway south to a point west of Schooner Bayou Lock, was completed (ARCE, 1933). The Inland Waterway from Franklin to the Mermentau River, LA was now partially separate from the Intracoastal Waterway; its path following the Intracoastal Waterway to its intersection with the Schooner Bayou Cut-off, along this cut-off to Schooner Bayou and then through Schooner Bayou and a land cut to White Lake (ARCE, 1939).

The River and Harbor Act of July 24, 1946 provided for channel enlargement and realignment of the Inland Waterway from Vermilion Bay to White Lake, a total of 12.04 miles, to a minimum cross-sectional area of 3,000 square feet below mean low Gulf (MLG); for the enlargement of North Prong of Schooner Bayou and Schooner Bayou Cut-off to 6 ft deep by 60 feet wide MLG; for the construction of a gated control structure in the new channel near Schooner Bayou Lock for discharge of flood flows and control of tidal flows and salt water intrusion; and for incorporation of the existing project “Inland Waterway from Franklin, LA to the Mermentau River,” west of Vermilion Bay, in the modified project “Mermentau River, LA.” (ARCE, 1946; S. Doc. 231, 1946). Channel dimensions were not specified in the River and Harbor Act, but Senate Document 94 proposed the same cross section for Vermillion Bay to White Lake, giving dimensions of 15 feet deep and 170 feet bottom width MLG. Between April 19, 1950 and May 31, 1951, this section of the Inland Waterway was dredged (ARCE, 1950, 1951; S. Doc 94, 1941). The new Schooner Bayou Control Structure was completed on May 22, 1951 (ARCE, 1951). From September 4 to 22, 1951, a permanent dike closure was constructed across the east approach channel at the Old Schooner Bayou Lock and traffic was then routed through the new control structure (ARCE, 1952). In March 1952, the controlling depth from Schooner Bayou Control Structure to White Lake was 12 feet MLG, and in October 1955, it was 14 feet (ARCE, 1952, 1956).

Natural Storm Impacts to South White Lake Marshes

Roth (1998) documented storm characteristics and impacts within the South White Lake marshes for the period 1886 to 1997. Based on historical records, Roth determined that

on average, 1 tropical storm passes the area every 1.6 years, 1 hurricane can be expected to impact the area every 3.3 years, and a major hurricane traverses the region every 14 years. Of the tropical cyclones examined, 38 originated in the Gulf of Mexico, 16 in the Caribbean Sea, and 15 in the Atlantic (Roth, 1998). It was reported that the most common direction for a storm to approach was from the southeast.

Fourteen hurricanes have had direct impact on the VPSB property since 1915. The hurricane of August 15-19, 1915, also known as the "Saltwater Storm", made landfall just west of Galveston, Texas. Gales blew through Cameron and Vermilion Parishes, producing storm tides of 11 feet at Cameron, 10 feet at Grand Chenier, and 9.5 feet at Marsh Island. As such, saltwater flooded the entire Chenier Plain, including the marshes of southern Vermilion Parish where VSPB is located. The hurricane of August 6-10, 1940 produced severe flooding in southwest Louisiana. Over the 5 day period, the slow moving hurricane resulted in Abbeville receiving 31.66 inches of rain.

Hurricane Audrey struck southwest Louisiana on June 27, 1957. Audrey formed in the southwest Gulf of Mexico and moved ashore near the Texas/Louisiana border resulting in a disastrous storm surge. Storm surge and headwater flooding along the rivers of southwest Louisiana flooded over 1.6 million acres of land. In Vermilion Parish, the storm surge pushed inland to just south of Abbeville, putting Pecan Island under feet of saltwater (Roth, 2009). Being a very large category four hurricane with a 40 mile wide eye, Hurricane Audrey produced a storm surge 7 to 10 feet across Vermilion, Iberia, and St. Mary Parishes (Morgan et al., 1958).

Between 1957 and 2005, seven hurricanes impacted the VPSB property with flooding or physical damage to the marsh. When Hurricane Carla crossed the Texas coast north of Corpus Christi as a Category 3 storm (September 11, 1961), southwest Louisiana storm surge values ranged from 7-8 feet. Hurricane Hilda was a Category 2 storm when it came onshore near the Atchafalaya River (October 3, 1964), resulting in storm surges from 3-5 feet across Iberia and Vermilion Parishes (Roth, 2009). On September 16, 1971, Hurricane Edith made landfall just east of the VPSB property as a Category 2 storm with 100 mph winds, creating storm surges were 8+ feet in Cameron and Vermilion Parishes (Roth, 2009). Three years later, Hurricane Carmen made landfall east of Vermilion Bay as a Category 3 storm (September 8, 1974). Vermilion Parish was affected by category one conditions. On August 15, 1985, Hurricane Danny made landfall just west of the project area as a Category 1, producing storm surge in Vermilion Parish from 5 to 8 feet. During the same year, Hurricane Juan made landfall just east of the project area as a Category 1 event (October 28, 1985). Storm surge in Vermilion, Iberia, and St. Mary Parishes fluctuated between 3 and 6 feet (Roth, 2009). After a seven-year absence of major storms, Hurricane Lili crossed the project area on October 3, 2002 as a Category 1 storm with winds of 90 mph. This event was a precursor to two major storms that would leave an indelible mark on the natural habitat and inhabitants of southwestern Louisiana.

On September 23, 2005, Hurricane Rita made landfall between Johnson's Bayou and Sabine Pass as a Category 3 storm (120 mph winds). Storm surge inundated all of southwestern Louisiana with up to 18 feet of marine water from the Gulf. It was the worst storm surge flooding recorded during the last 150+ years. Cameron Parish was flooded with 12 to 18 feet of Gulf water, and Vermilion Parish sustained 10- to 12-ft surges levels. This hurricane caused substantial infrastructure damage throughout southwestern Louisiana and widespread saltwater flooding in the project area (Byrnes

and McBride, 2009). Three years later, Hurricane Ike produced storm winds and water levels in the project area similar to those of Hurricane Rita. On September 13, 2008, Hurricane Ike crossed the Texas coast near Galveston as a Category 2 storm (110 mph winds) resulting in storm surge values ranging from 8 to 12 feet across eastern Cameron, Vermilion, Iberia, and St. Mary Parishes (Figure 7; Byrnes and McBride, 2009). Again, widespread saltwater inundation from the Gulf flooded fresh marshes of the project area.

The purpose of this summary is to provide perspective as to the potential magnitude and impact of natural processes on coastal ecosystems throughout southwestern Louisiana, but more specifically at and adjacent to the VPSB property. As stated earlier, major hurricanes like Ike and Rita have impacted southwestern Louisiana about every 14 years, but smaller hurricanes and tropical storms impact the area every 1 to 3 years. Coastal marshes are elevated just slightly above still water level, so these ecosystems are used to being inundated periodically by storm surge from the Gulf. Short-term damages due to physical reworking of marshes by wave and current processes and salt water inundation from storm surge are not uncommon. Storms leave their mark on coastal ecosystems (Figure 8), but marshes are resilient over the long term, even though widespread vegetation dieback and sediment export from marshes are short-term consequences of these natural events.

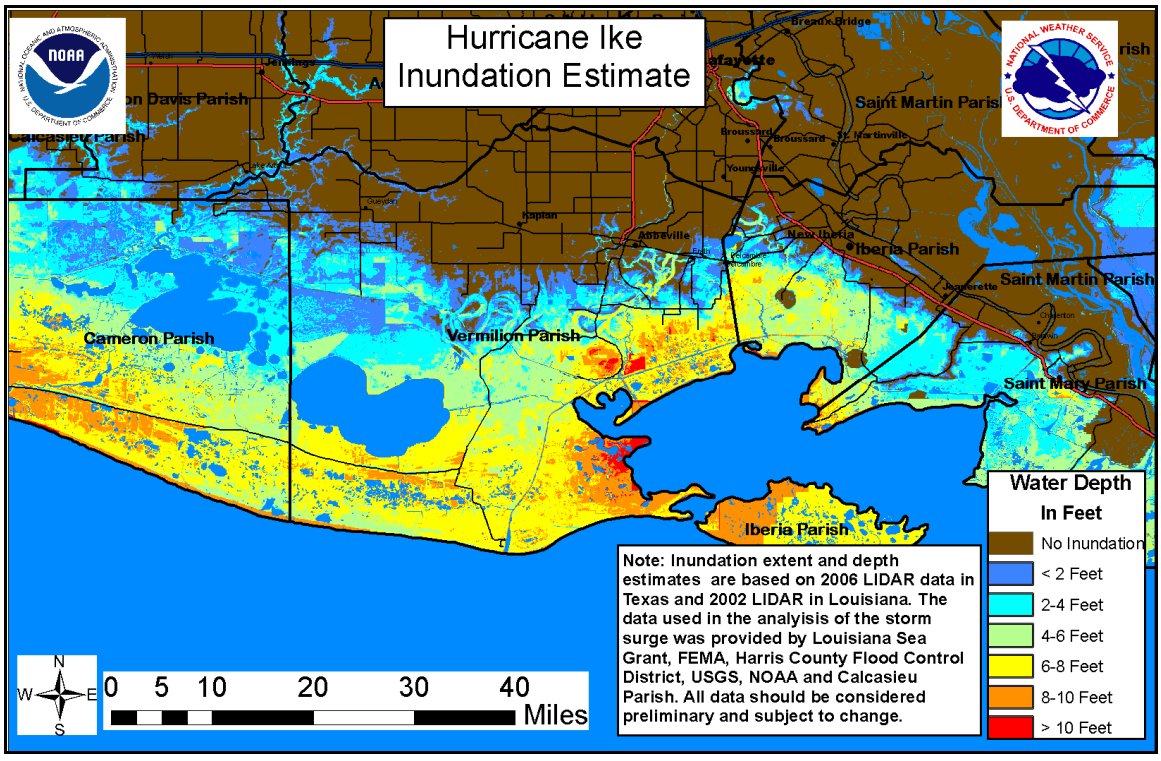

Figure 7. Hurricane Ike storm surge inundation for Vermilion Parish; VPSB property was under 6 to 8 ft of Gulf water (http://www.srh.noaa.gov/images/lch/ike/Vermilion_Parish_Inundation.png).

Figure 8. Dying vegetation along the coast due to salt water intrusion from Hurricane Ike. The brown marshes along the coast indicate dying vegetation due to salt water burn. Brown water in the Gulf is suspended sediment exported from marshes when surge waters receded (http://www.srh.noaa.gov/images/lch/ike/SaltWaterBurn.png).

Salinity Variations in Schooner Bayou Canal

The U.S. Army Corps of Engineers, New Orleans District, established a series of salinity monitoring stations in the Mermentau Basin to document changes in water salinity for commercial fisherman and farming industry, and any other interested observers. Three regions have been monitored (http://www.mvn.usace.army.mil/ops/sms/index.asp) since 2000 for water salinity and temperature, the most important of which to the project area is the Schooner Bayou sampling sites. Figure 9 illustrates the location of monitoring stations along Schooner Bayou Canal; S9 is located about 0.6 miles east of the VPSB Property in Schooner Bayou Canal, and S11 is about 0.6 miles west of the property. Salinity plots for both stations are illustrated in Figure 10.

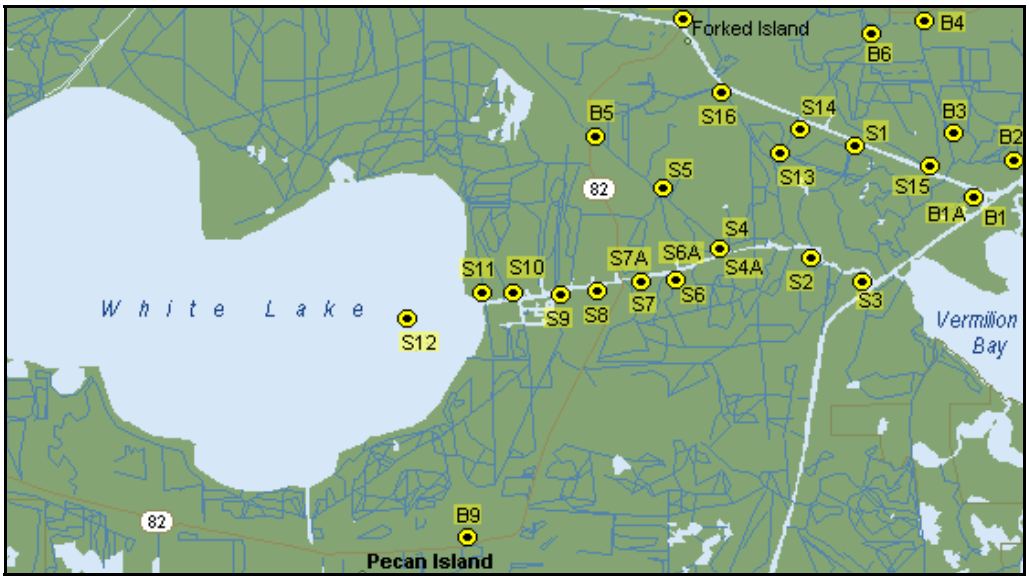

Figure 9. USACE salinity stations along Schooner Bayou Canal (http://www.mvn.usace.army.mil/ops/sms/verm.asp).

Salinity variations at each station are quite consistent for the period of record. As such, it is expected that salinity trends in Schooner Bayou and other access canals on the VPSB Property would be similar to those recorded at each station. Although average salinity for each station is about 2 parts per thousand (ppt), significantly greater salinities were encountered at each station during periods of drought and following Hurricanes Rita and Ike. Greatest salinity readings (>8 ppt) were associated with severe drought, but duration of salinity readings exceeding the median were tied to the passage of major hurricanes (Rita: >1 year; Ike: ~1 year). Storm surge allows large volumes of salt water to infiltrate low-lying marsh in the project area in a short period of time; however, very low surface elevation gradients retain salt water in the marshes and waterways for long periods of time, thereby causing short-term dieback of fresh and intermediate marshes (see Figures 8 and 10). In time, coastal systems equilibrate to normal conditions and marshes regain long-term characteristics of their natural environment. If oil and gas operations on the VPSB Property were not environmentally sustainable, marsh habitat and aquatic ecosystems would reflect potential toxic impacts. Marsh habitat appears as healthy today as it did when drilling operations began in the early 1940s.

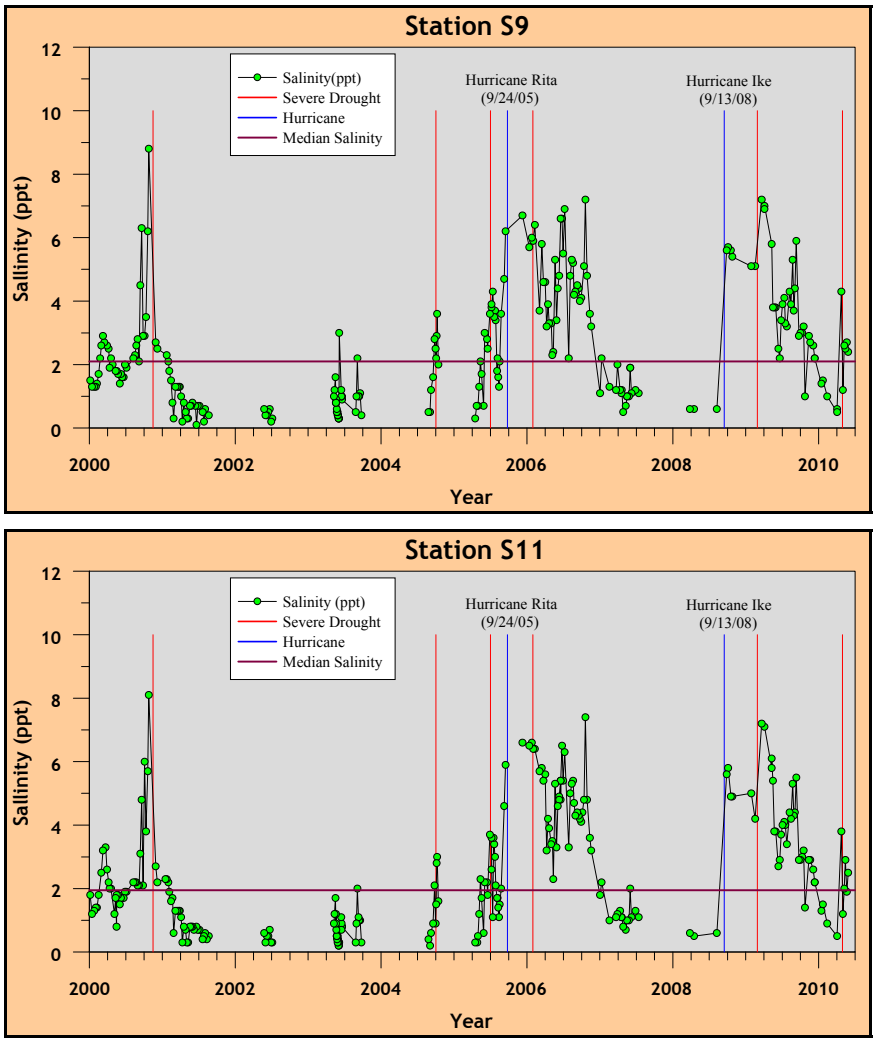

Figure 10. Time series of salinity for Stations S9 and S11 in Schooner Bayou Canal, 2000 to 2010. Red and blue vertical lines mark the time of major hurricanes and droughts that appear to correlate well with peaks in salinity.

Historical Wetland Changes on the VPSB Property

Numerous historical aerial photographic data sets document marsh changes that have occurred at the VPSB Property since 1935. Most historical imagery was provided by Michael Pisani & Associates, Inc. or obtained online through various State and Federal agencies. The 1940 and 1951 images were provided by plaintiff's experts. The September 25, 1935 image reflects the character of the marsh prior to development of the East White Lake oil and gas field (Figure 11; Pisani, 2010). Schooner Bayou Canal had been in place since February 1911 but access canals were not dredged on the VPSB property until the late 1930s. The original canals were present on the May 11, 1940 image, taken a couple of months after Well W1 was spudded (Barnhill, 2010). Notice the notches in the canal levees that allowed water to flow freely between the marsh and canals (Figure 12A).

By January 1951, the field was quite active and many new access wells had been completed (Figure 12B). As can be seen in the lower right portion of the image, controlled burning of marsh grass was an active part of marsh management in the area. Besides direct removal of sediment during canal construction, a process that was permitted as part of the lease (Barrett, 2010; Barnhill, 2010), marsh in the area looks quite vigorous. Although most wells in the East White Lake field produced little to no water up to this time, a closed saltwater disposal system (injection well) was established in 1948 at LA Furs #A-4 to dispose of produced water (Barrett, 2010).

Unvegetated dredged material disposal was present along the northern margin of Schooner Bayou Canal in 1951, indicating that the canal has been recently excavated. According to historical records (see Appendix A), authorization was granted to the USACE by Congress to increase channel dimension to 15 ft deep and 170 ft bottom width as part of the 1946 River and Harbor Act. This work was started in April 1950 and completed in May 1951, reflecting canal changes illustrated on the 1951 imagery.

By 1955, only minor changes in access canal excavation had taken place and the marsh surface looked healthy (Figure 13). Although the month and day are not known for the 1965 aerial, the image appears to reflect higher than normal water level, possibly during the winter months (Figure 14). The image is of relatively poor quality, so the marsh surface is difficult to evaluate using this image. The April 1979 image is of much better quality than 1965, and the marsh surface adjacent to access canals appear healthy (Figure 15). Over the following 8 years, only minor changes in the marshes and canals were recognized (Figure 16). By March 1998, high-resolution color-infrared imagery illustrated a well-developed marsh adjacent to access canals throughout the VPSB property (Figure 17). Although the November 2005 image records the impact of Hurricane Rita on marsh development, the rapid dieback of marsh vegetation due to saltwater burning reveals a relatively intact marsh surface, except for the location of access canals, many of which were originally excavated in the 1940s (~60 years earlier; Figure 18). The 2008 image provides a true-color, high-resolution view of the VPSB property (Figure 19), illustrating the consistency in marsh vegetation cover relative to the 1955 image (compare with Figure 13). Marsh vegetation looks quite healthy in the presence of major oil and gas development (Barrett, 2010; Barnhill, 2010) on the property and the natural impacts of Hurricane Rita and other storms during the 70-year period of record.

Figure 11. Aerial image of the VSBP property on September 25, 1935, prior to field operations.

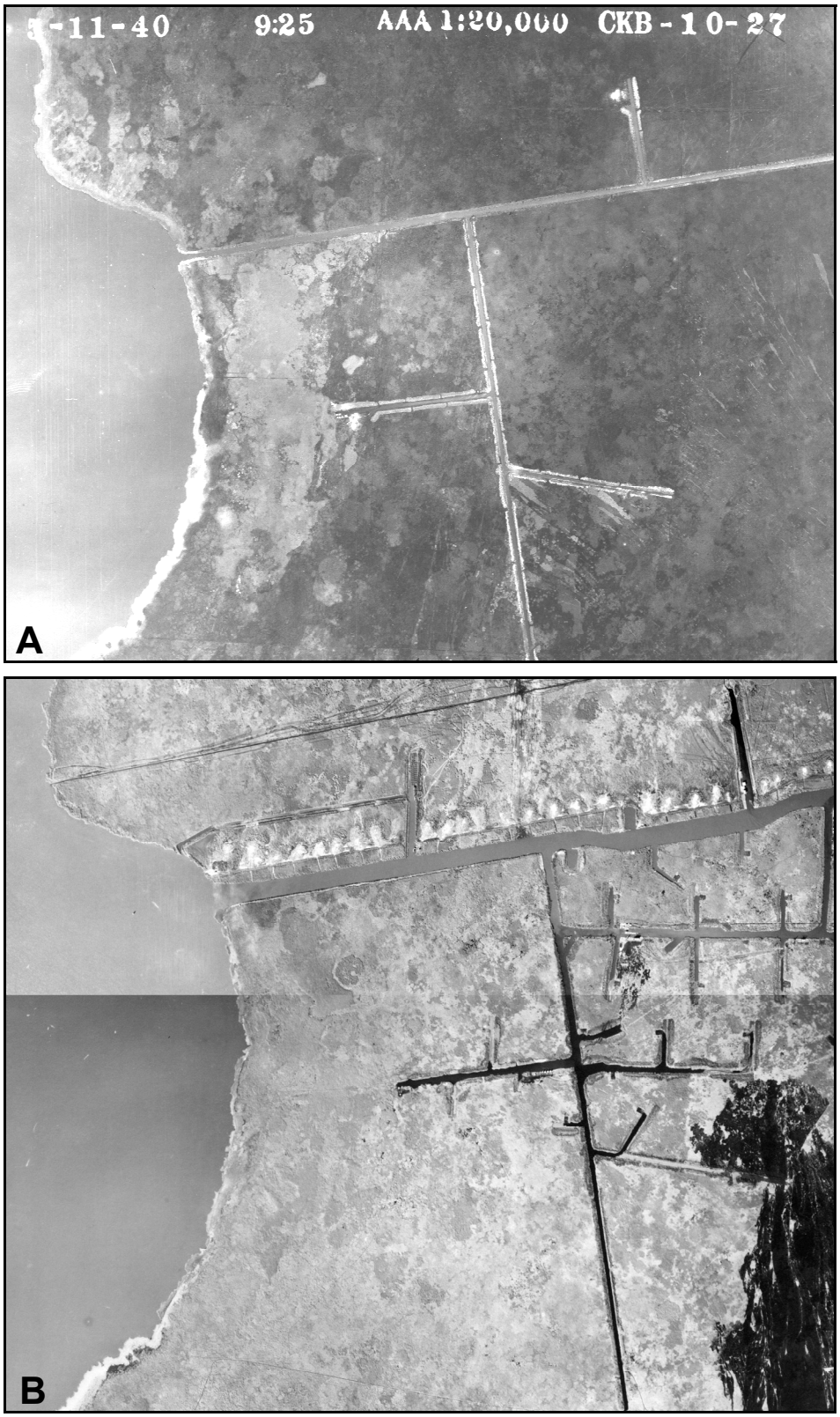

Figure 12. A. Aerial image of the VSBP property on May 11, 1940, approximately 2 months after Well W1 was spudded; B. Aerial image of the VSBP property on January 8, 1951, approximately 3 years after LA Furs #A-4 was turned into a saltwater injection well.

Figure 13. Aerial image of the VSBP property in 1955.

Figure 14. Aerial image of the VSBP property in 1965.

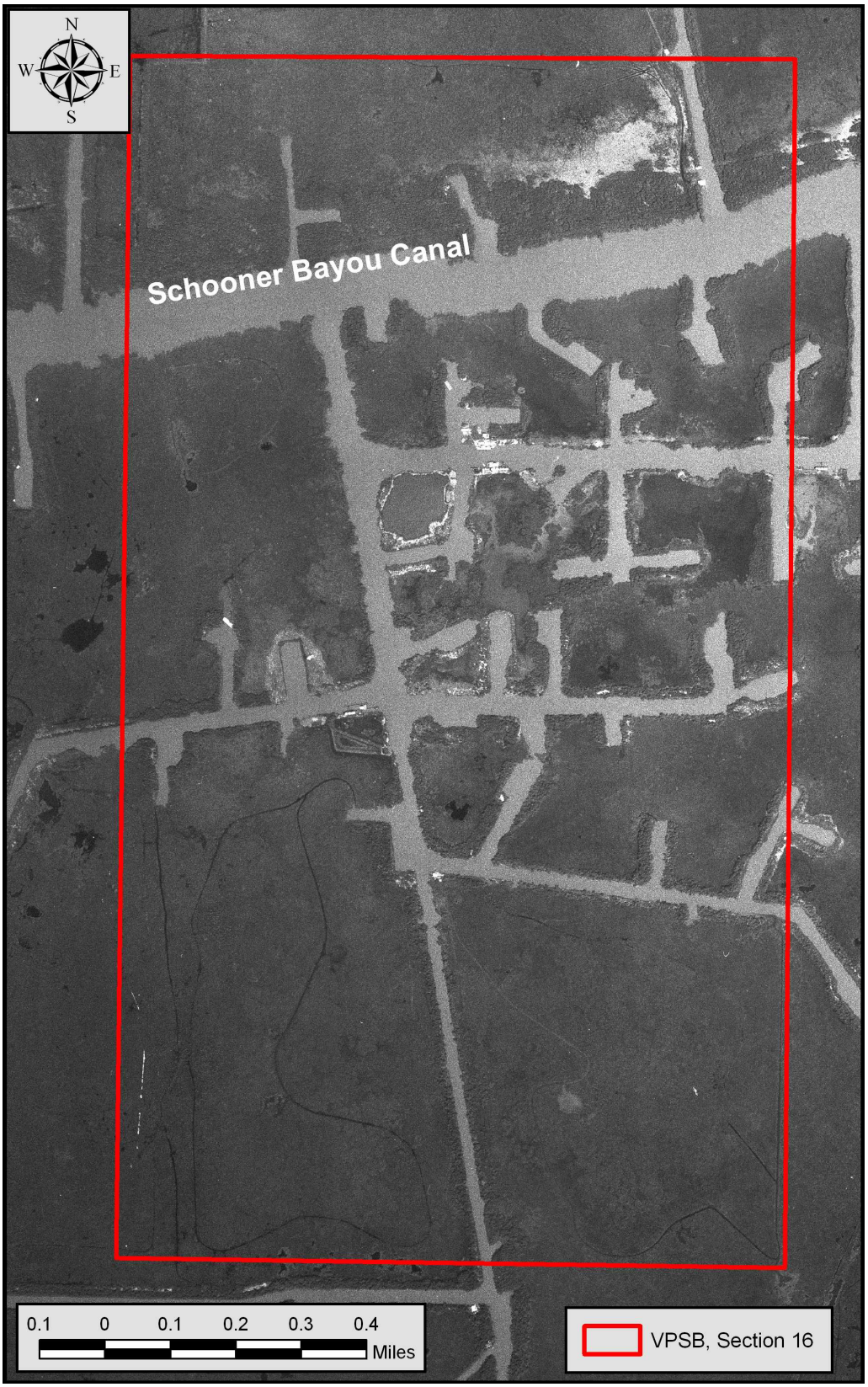

Figure 15. Aerial image of the VSBP property in April 1979.

Figure 16. Aerial image of the VSBP property in April 1987.

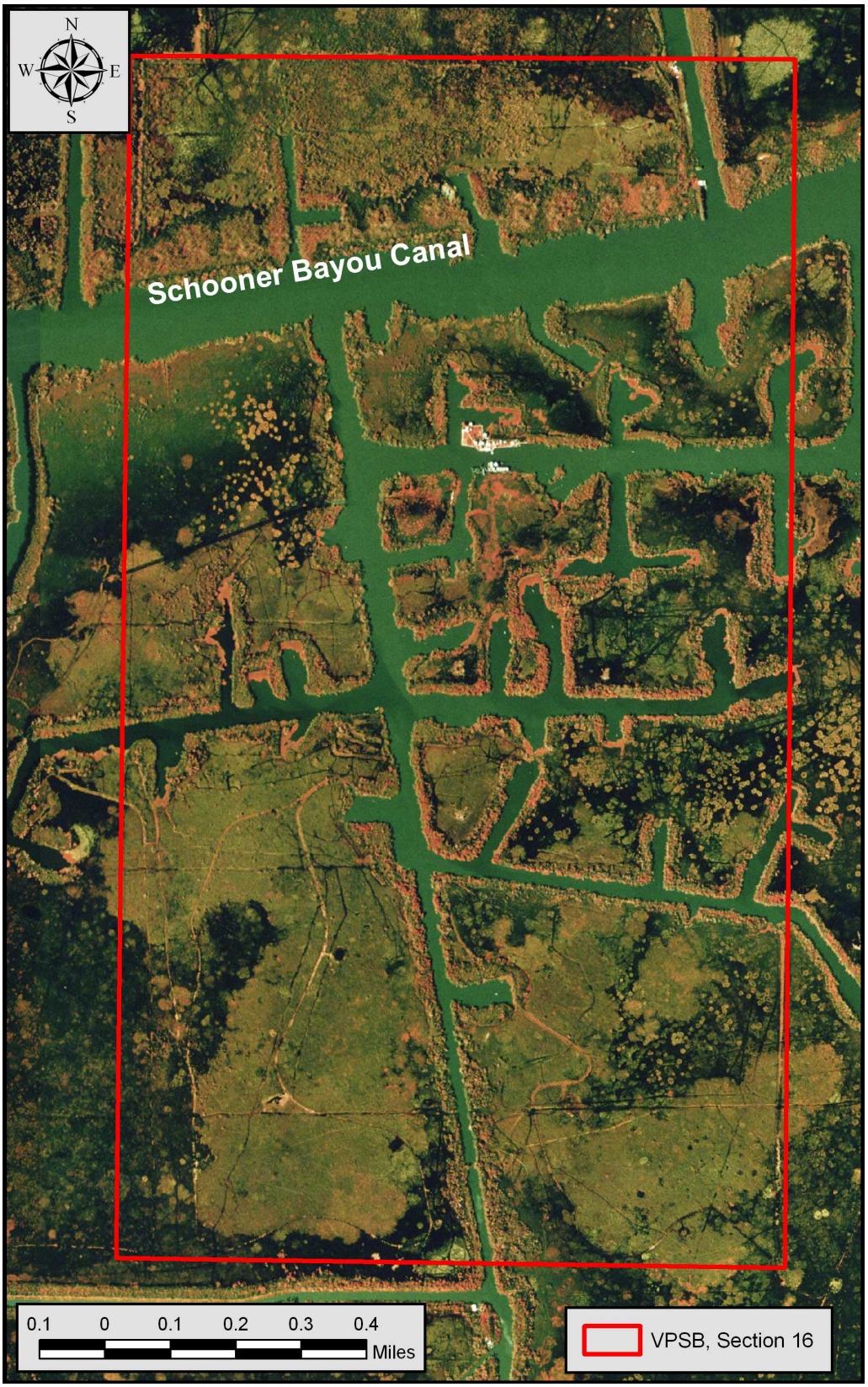

Figure 17. Aerial image of the VSBP property in March 1998.

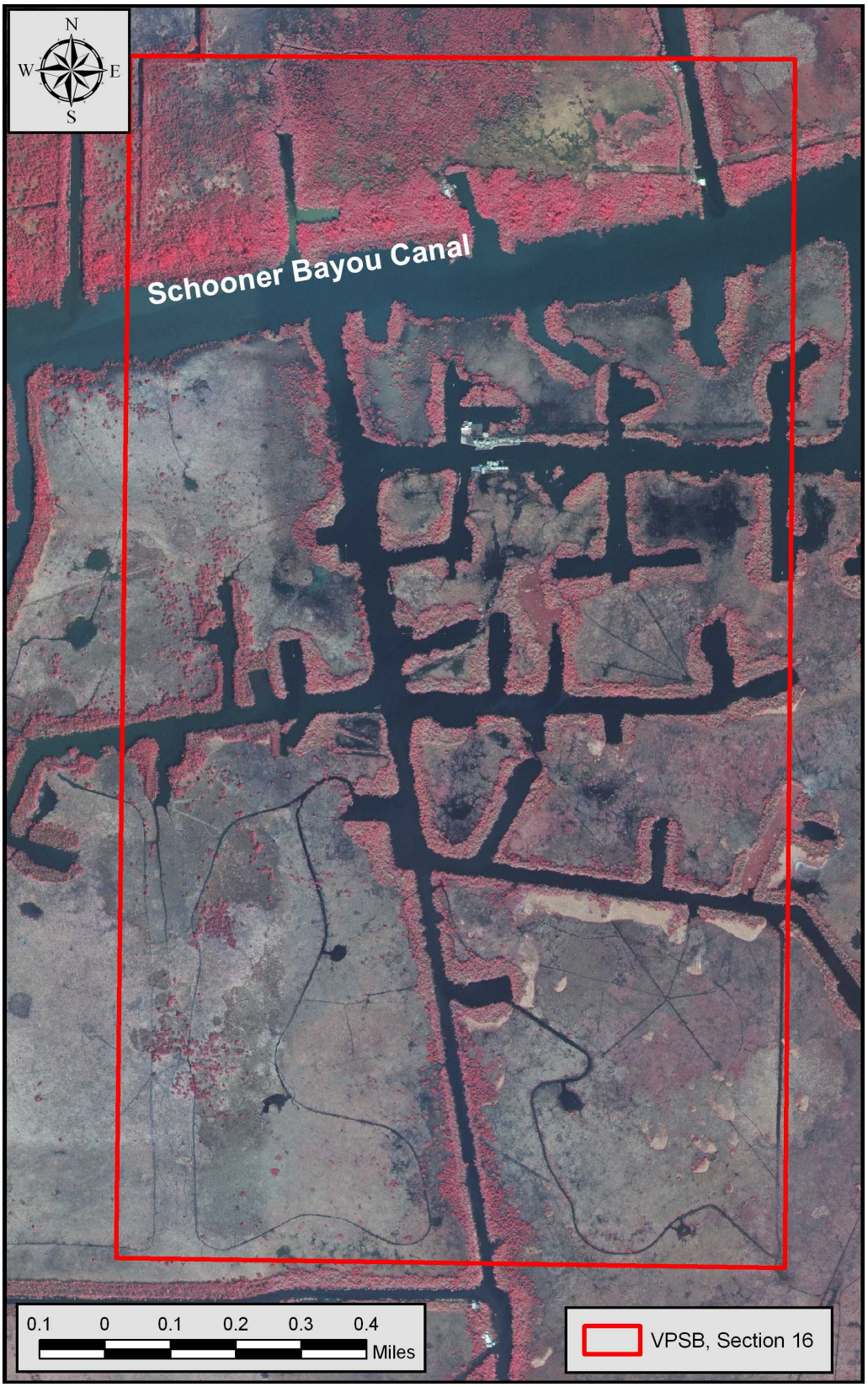

Figure 18. Post-Hurricane Rita aerial image of the VSBP property on November 18, 2005.

Figure 19. Aerial image of the VSBP property on October 26, 2008.

A site visit on May 25, 2010 confirmed the observations made using aerial photography. After traversing all major access canals on the VPSB property in a small vessel, observing adjacent marsh deposits and the production facility, and observing no oil sheens in the canals, marshes adjacent to canals and interior on the property appear in good physical shape.

Potential Impact of Oil and Gas Activities

Oil and gas activities have been in existence on the VPSB Property and surrounding marshes since the early 1940s. Most significant access canals were constructed to support these activities by the 1950s. Natural marsh hydrology at the 1,200 acre VPSB site was altered due to the construction of these canals, as well as the Schooner Bayou Canal civil works project that was part of the USACE Inland Waterway. Schooner Bayou Canal was the original waterway dredged through marshes in Section 16 that opened flow of water and sediment between Vermilion Bay and White Lake. Access canals associated with the East White Lake Field weren't initiated for approximately 30 years after Schooner Bayou Canal was completed as part of the original Intracoastal Waterway. Regardless of these localized changes in marsh hydrology, the primary question addressed in this report relates to potential negative impacts on marsh ecosystems resulting from oil and gas activities.

The VPSB Property is intersected by Schooner Bayou Canal near its northern boundary (Figure 19). Access to field operations originates from this primary canal. Field operations have continued since the early 1940s when initial access canals were established for field exploration and production. Most access canals at the site have been operational since 1955. Besides direct removal of marsh and sediment associated with access canal construction and maintenance, the 2008 marsh surface appears very similar to that present in the 1950s, despite the impact of numerous droughts and hurricanes and local alterations to marsh hydrology associated with oil field operations. The VPSB marsh appears very resilient to natural and human changes imposed on the system, resulting in vigorous wetlands that appear in good physical shape.

Based on all available physical evidence, there is no indication that oil and gas operations on the VPSB Property have adversely impacted the marsh in this area, even though access canals and field operations have been continuous since the early 1940s. Pisani (2010) indicated no adverse impacts to the soil or water in the area as well, consistent with our observations of no adverse impact to marsh ecosystem. Given the resilience of the VPSB marsh ecosystem, proposed dredging of canal bottoms to remediate potential contamination due to oil field operations (ICON, 2010) would not be warranted. If any impacts that warrant remediation can be demonstrated, the most effective means of isolating potentially contaminated areas would be to plug canals where contamination had been identified. The risk with dredging contaminated sediment is that contaminants will be remobilized during the dredging process, potentially causing more damage than isolating a dormant condition by closing off an area via canal plugging.

Comments Regarding CEI Expert Report

The expert report submitted by Coastal Environments, Incorporated (CEI) states that "CEI was specifically tasked with assessing and documenting any direct and indirect impacts to the environment caused by activities associated with exploration and

production of oil and gas reserves" on the VPSB property (CEI, 2010). Comments related to the CEI report will focus on processes related to physical changes in the marsh since the early 1940s. Construction of Schooner Bayou Canal and access canals within the field represent the most visible change to the landscape on the VPSB property. However, Barrett (2010) and Barnhill (2010) document that these activities were permitted properly and represented the only means for exploration and production of the oil and gas field as agreed upon in the mineral lease dated April 4, 1935 between VPSB and Louisiana Land & Exploration (LL&E). Union Oil was assigned 50% of the lease in 1940. Although CEI states "Access to this area traditionally required construction of trainasses, or pirogue ditches…", access to the VPSB property was facilitated about 30 years earlier by the construction of Schooner Bayou Canal as part of the Intracoastal Waterway. This civil works project provided primary access to the site in 1911, which facilitated oil and gas exploration and production on the VPSB property.

When discussing hydrology of the north and south White Lake area, CEI notes that "Salinity levels in the project area are generally fresh; however, some saltwater intrusion may occur in times of drought, when locking operations allow spikes of salt water into the sub-basin and insufficient head differential exists to flush the salt water out". As shown using salinity data obtained from Schooner Bayou Canal between 2000 and 2010, droughts have a strong influence on short-term spikes in salinity, but hurricanes have the greatest impact on elevated salinity levels for extended periods of time. Both are primary natural processes for modulating salinity fluctuations on the VPSB property. Oil and gas operations in the field have no impact on salinity fluctuations in the area.

Under their report section "Marsh Vegetation", a statement is made that "Many areas within the sub-basin have experienced marsh loss due to saltwater intrusion, which mainly impacts areas adjacent to man-made channels and dredged waterways because these areas create channels that allow for higher salinity waters to enter interior marshes". Although this process may occur at locations away from the project area, it is not a process that has influenced the VPSB property. This is well illustrated by comparing the sequence of aerial photography discussed earlier in the report.
As a general comment, reference to oil sheens encountered on the property were numerous. While attending a site visit on May 25, 2010, particular attention was paid to the presence or absence of oil sheens on the property waterways because it was emphasized frequently in the CEI report. No oil sheens were encountered in any of the major canals traversed on the property. CEI's observations of numerous oil sheens during their site visits appear inconsistent with our field observations. Finally, concluding statements in section 4.5 of the CEI report include "contaminants can be dispersed", "they can facilitate transportation of contaminants", "Osprey can potentially carry", "contamination can accumulate", and "contaminated areas could subject themselves to possible health issues". None of these phrases point to any specific and direct problems at the VPSB property. Specific examples of how specific contaminants have caused specific damage on the property are required to make scientifically-defensible cause and effect statements.

Observations and Conclusions

The Vermilion Parish School Board entered into a mineral lease with Louisiana Land & Exploration in April 1935 for the purpose of oil an gas exploration and production. According to Barrett (2010) and Barnhill (2010), expectations were that standard industry practices would be used in hopes of developing the field. Union Oil was assigned 50%

of the lease in 1940, with LL&E retaining the other 50%, and Union Oil proceeded to drill. The first produced water injection well was established in 1948 to dispose of brine waste into deep saltwater aquifers.

A visual comparison of aerial photography between 1935 and 2008 illustrates primary changes to the marsh surface associated with the dredging of permitted access canals. A direct comparison of the 1955 and 2008 photographs indicates very few changes to the marsh surface for this 50+ year period, attesting to the resiliency of the VPSB marshes to natural (hurricanes and droughts) and human-induced (oil field development) factors influencing long-term marsh changes. As stated earlier, based on all available physical evidence, there is no indication that oil and gas operations on the VPSB Property have adversely impacted marshes adjacent to canals in this area, even though access canals and field operations have been continuous since the early 1940s.

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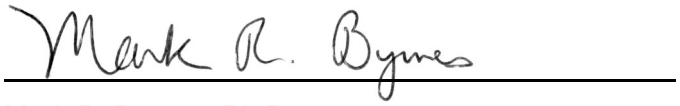
Signature

The above report reflects scientific fact and my opinions and conclusions derived from these facts. I reserve the right to amend this report as new data become available.

Applied Coastal Research and Engineering, Inc.



Mark R. Byrnes, Ph.D.

June 29, 2010

Appendix A

Historical Development of the Schooner Bayou Canal

Appendix A. History for Schooner Bayou Canal			
Date	**Authority**	**Description**	**Source**
1875		Survey for connecting the inland waters along the margin of the Gulf of Mexico, from Donaldsonville, in Louisiana, to the Rio Grande River, in Texas, by cuts and canals. "In selecting the route followed, it was proposed to utilize the navigable bayous, lakes, bays, and sounds or lagoons, near the coast, and make the cuts connecting them along the shortest lines available." Section II of the survey extended from the head of Vermillion Bay, LA to Galveston, TX. "The observed characteristics of this portion of the section leads to the belief that, at a period not geologically remote, Sabine, Calcasieu, Grand and White Lakes, and Vermillion Bay were all connected by passes, of which the bayous followed by the survey are all that remain, and that the connection has gradually been obliterated by the action of the Gulf tides." "In re-opening, because of the unstable character of the "prairie tremblante," the material excavated to make the cuts must be deposited at a considerable distance from their sides." About one half of Schooner Bayou, 6.5 miles, located between White Lake and Vermillion Bay, needed to be "cleaned out." The estimated amount to be removed for a canal 60 feet wide at bottom and 6 feet deep in Schooner Bayou was 127,740 cy of material. Referring to White Lake, "On the east side of the lake is to be found a narrow strip of willows, thence to Schooner Bayou, a distance of about five miles, all is swamp, with the exception of one ridge about 4,000 feet across and 6 feet high, which extends to the north, and has more or less timber (mostly hackberry) upon it."	ARCE, 1875, p. 876-890
Feb. 1, 1907		Report on examination of project for interior waterway from the Rio Grande to the Mississippi. The plan presented contemplated a channel for light-draft navigation with depth of 5 feet and bottom width of 40 feet. "Schooner Bayou runs westward from Vermillion Bay to within about 6 miles of White Lake. By making a cut through the intermediate marsh connection will be given with White Lake …"	H. Doc. 640, 59th Cong., 2nd Sess.
March 2, 1907	River & Harbor Act	The project for an inland waterway from Franklin to Mermentau, LA was adopted by Congress and provided for a channel 5 feet deep and 40 feet bottom width. The proposed channel was to connect with Bayou Teche near Franklin, LA; thence to Cote Blanche and Vermillion bays by a dredged canal and existing drainage canals or bayous; thence up Schooner Bayou; thence by a dredged canal to White Lake; across White Lake; thence by a dredged canal to Grand Lake and across this lake to Lake Misere, west of the Mermentau River.	ARCE, 1907, p. 415
July 1, 1908 to June 30, 1909		"The construction of a lock at a suitable point between Vermilion Bay and White Lake has been found necessary for the purpose of regulating the flow through the canal with a view to preventing damage to rice lands by reason of contamination of the waters of White Lake by salt water."	ARCE, 1909, p. 451
Oct. 6, 1908		A contract for the section of the canal between Vermilion and Mermentau Rivers with John Andersen, of Gulfport, MS, was approved by the Chief of Engineers. All excavated material was required to be deposited 15 feet from the south edge of the dredged canal, except in the bay and lakes, where it was specified to be deposited on the north side of, and at least 100 feet from, the edge of the channel.	ARCE, 1909, p. 1468; Professional Memoirs, Vol. VIII, Jan.-Feb. 1916, No. 37
Nov. 5 to Dec. 1, 1908 & March 25 to June 17, 1909		"The channel had been completed through Vermillion Bay, and the dredge was working westward from Schooner Bayou, when the plant was completely destroyed by fire on the night of June 17." At the end of the fiscal year, 33,340 feet of channel in and west of Vermilion Bay had been completed and 96,606.22 cy excavated.	ARCE, 1909, p. 1468; 1910, p. 1612
March 8, 1909		"As Cote Blanche and Vermilion Bays were shallow and difficult on navigation in rough weather, a route through the land north of these bodies of water was recommended by the special board constituted under Special Orders , No. 10, Chief of Engineers, March 8, 1909, having this portion of the intracoastal waterway under consideration. Based on this report authorization was given to procure the right of way for the modified route, but no actual acquisition or construction to be obtained until further authorized by Congress on account of the increased cost."	ARCE, 1914, p. 2250
1910		Vermillion Bay had an original average depth of about 7 feet MLW, White Lake of 4 to 5 feet, and the land through which it was necessary to dredge had a general elevation of 1 to 2 feet above sea level.	ARCE, 1910, p. 503
Dec. 3, 1909 to June 30, 1910		Dredging resumed with the removal of 337,896.53 cy of material being removed. "By June 30, 1910, the waterway had been nearly completed, about 3 miles of marsh and the portions within Grand Lake, White Lake, and three small lakes between them being all that remained to be done."	ARCE, 1910, p. 1612
July 1, 1910 to March 20, 1911 & June 17 to 30, 1911		Dredging was performed on the portion of the waterway between Vermilion Bay and Grand Lake, with the removal of 26,198.48 cy of material.	ARCE, 1911, p. 1753
Feb. 1911		The canal between Schooner Bayou and White Lake was completed.	ARCE, 1911, p. 1753
Feb. 27, 1911	River & Harbor Act	The Secretary of War was authorized, on the recommendation of the Chief of Engineers, to make such changes in the location of the channel between Franklin and Mermentau, LA as may be considered desirable.	ARCE, 1911, p. 541
July 1 to Sept. 30, 1911		Dredging was completed on the portion of the waterway between Vermilion Bay and Grand Lake, with the removal of 138,440.82 cy of material.	ARCE, 1912, p. 1971
Feb. 13, 1912		A contract was made with Messrs. Eskald & Alexander for constructing a tidal lock in a "cut-off" in Schooner Bayou. "The lock gates are of creosoted timber and the wing walls of concrete; the banks of the cut form the side walls. The gates are single leafs, turning on a horizontal hinge at the bottom and are designed to resist a head of water from either direction."	ARCE, 1912, p. 1971

Appendix A. History for Schooner Bayou Canal			
Date	**Authority**	**Description**	**Source**
March 7 to Oct. 12, 1912		A tidal lock was completed in Schooner Bayou 4.5 miles from the mouth and placed in finished status March 1, 1913. The lock was operated only when the ordinary current in the bayou was reversed and consisted of 2 wooden gates each 40 feet long turning on horizontal hinges at the bottom with concrete wall supported on pile foundations. The distance between the gated was 300 feet; clear width of gates, 36 feet. "The lock was built to prevent salt water from flowing into White Lake, to prevent damage to the rice industry in that section. "There is no standard lift (salt-water control)." The clear depth over the floor when the gates were down was 8 feet at mean Gulf datum.	ARCE, 1913, p. 724, 726, 2205; 1920, p. 989
Feb. 3, 1913		A report was submitted on improvement of Vermilion River, LA and channel to connect Vermilion River with the inland waterway between Franklin and Mermentau at Schooner Bayou. Currently, the waterway goes from Schooner Bayou, through Vermilion Bay, to Vermilion River. The proposed change of route would be to the north of the bay and would form an easterly extension of the cut now proposed to connect Schooner Bayou and Vermilion River. This cut-off section was desired because of the danger of the open waters and the shallowness of the water in West Vermilion Bay. The improvement contemplated was a canal similar in dimensions to the connecting inland waterway, from a point on Vermilion River about 1.75 miles above its mouth to Schooner Bayou. The land through which the canal would run was "low, uninhabited, unimportant marsh, about 1 to 2 feet above mean low water, and the work would consist of dredging..."	H. Doc. 1336, 62nd Cong., 3rd Sess.
Jan. 17, 1914		A report was submitted on the St. Georges Sound, FL, to the Rio Grande section of the proposed continuous inland waterway (Intracoastal Waterway) from Boston, MA to the Rio Grande, with a view towards a channel with a maximum depth of 9 feet, or such lesser depths along any sections as may be found sufficient for commercial, naval, or military purposes. The inland canal route between Bayou Teche and Mermentau River, originally selected on account of the small amount of excavation which would be required in the original construction, was proven impracticable through Cote Blanche and Vermilion Bays, and inadvisable in the large lakes, on account of the soft character of the bottom and the resulting tendency of any dredged channel to fill under wave action. The canal recommended would be 7 feet deep and have a bottom width of 75 feet. The portion between Bayou Vermilion and Mermentau would connect Vermillion River to Schooner Bayou about 1,500 feet above its mouth, thence following Schooner Bayou for 4.5 miles to where the present 5-foot canal leaves it, thence following that waterway by enlarging the canal for about 3 miles farther to a point south of Little Prairie Ridge, thence running above White Lake and Grand Lake to Mermentau River; a total length of 42.6 miles. "No dredging will be required in Bayou Vermilion and none in Schooner Bayou."	H. Doc. 610, 63rd Cong., 2nd Sess.
June 22, 1914		A contract was entered into with N. G. Scott, of New Orleans, LA, for a "movable dam in the old bend of original bayou near lock with a view to giving additional relief to drainage and reducing current through locks."	ARCE, 1914, p. 745, 746,
July 1, 1913 to June 30, 1914		Rights of way had been staked out for the short cut from Vermilion River to Schooner Bayou. The estimated amount to be removed was 250,000 cy of material.	ARCE, 1914, p. 745
July 16, 1914 to Oct. 29, 1914		The spillway dam around Schooner Bayou lock was constructed and completed. "The dam is of the platform grillage type, resting on piles which form the substructure for the spillway openings. The frame bracing, block hangers, and walkway form the superstructure. The flow of water is controlled by five wooden gates, 12 feet 8 inches wide and 9 feet 11 inches high, hinged at the top to the top framework of the dam. The elevation of the sill is 6 feet below mean sea level." The dam gates were kept closed whenever the Gulf water was higher than that of the canal.	ARCE, 1915, p. 840, 2605; 1916, p. 898; 1925, p. 861
July 1, 1914 to June 30, 1915		The U. S. dredge *Grossetete* operated in the section of the canal at the mouth of Schooner Bayou to maintain the project channel 5 feet deep and 40 feet bottom width with the removal 2,055 cy of material. The U.S. dredge *Delatour* removed 7,595 cy of material from the same section. "During the extreme low-water period it was found necessary for 20 days to operate the gates to prevent salt water from passing to White Lake."	ARCE, 1915, p. 2605, 2607
Jan. 25 to Feb. 2, 1916		The U.S. steamer *Hyacinth* with U.S. derrick barge *No. 2*, worked on a shoal in Schooner Bayou near the lock, removing 580 cy of material.	ARCE, 1916, p. 2456
Feb. 27 to June 21, 1918		The U.S. dredge *Grossetete* operated in the Vermilion-Mermentau section of the waterway, including in Vermilion Bay at the mouth of Schooner Bayou, removing a total amount of 76,785.23 cy of material and resulting in a ruling depth at mean low Gulf of 5 feet.	ARCE, 1918, p. 2605
March 2, 1919	River & Harbor Act	Provided for a short cut through the marsh between Vermilion River and Schooner Bayou, about 4 miles in length, having a depth of 5 feet below mean low Gulf level and a bottom width of 40 feet. This cut-off, when completed would bypass Vermilion Bay and enter Schooner Bayou 3.75 miles from Schooner Bayou Lock. In this area, under ordinary conditions, the mean range of tide was about 10 inches; the extreme range about 14 inches.	ARCE, 1919, p. 1017-1018
May 16 to June 3, 1919		The U.S. dredge *Delatour* removed 19,888 cy of material from shoals in Vermilion Bay at the mouth of Schooner Bayou.	ARCE, 1919, p. 2684
July 1, 1918 to June 30, 1919		The U.S. dredge *Grossetete* dredged a slip for launches at Schooner Bayou Lock, removing 80 cy of material. The U.S. dredge Delatour placed 8,630 cy of earth fill on the Schooner Bayou Lock reservation, raising the grade to an elevation of 4.5 feet above mean low Gulf level.	ARCE, 1919, p. 2689
July 1, 1920 to June 30, 1921		At the Schooner Bayou Lock, 300 feet of levee and 200 feet of sand walk were built.	ARCE, 1921, p. 997
Dec. 16, 1921		Authority was given to begin excavation of the canal from Vermilion River to Schooner Bayou.	ARCE, 1922, p. 1016
Jan. 1922		Borings were made along the centerline of the proposed short cut canal from Vermilion River to Schooner Bayou, which showed that the material to be removed consisted principally of peaty muck, mud, and soft clay.	ARCE, 1922, p. 1016

Appendix A. History for Schooner Bayou Canal			
Date	**Authority**	**Description**	**Source**
Feb. 1, 1922		The U.S. dredge *Grossetete* began the excavation of the canal between Vermillion River and Schooner Bayou, working from the Vermilion end.	ARCE, 1922, p. 1016
July 1, 1921 to June 30, 1922		At the Schooner Bayou Lock, 670 feet of small levee were constructed to keep out high water when the lock gates were closed.	ARCE, 1922, p. 1025
July 1 to Nov. 20, 1922 & April 1923		The U.S. dredges *Grossetete* and *Delatour* obtained full project dimensions in the canal between Vermilion River and Schooner Bayou, with the removal of 240,054 cy of material. The project was completed on April 27, 1923 and the total amount excavated was 415,408 cy of material.	ARCE, 1923, p. 890-891
April 12, 1924		A report was submitted on the Intracoastal Waterway from MS River at or near New Orleans, LA, to Corpus Christi, TX, which included the waterway from Vermilion River to Mermentau River. The present route followed the natural Schooner Bayou for 5 miles, then "White Lake Canal" (5 by 40 feet) for 7 miles (canal between White Lake and the natural Schooner Bayou). "Whatever route is chosen should leave Schooner Bayou somewhere east of the lock, the lock being still retained and operated as a barrier to salt water entering White Lake. In order to preserve this lake as a reservoir of fresh water for use in rice irrigation..." The channel recommended was 9 feet deep and 100 feet wide and would go from Vermilion River, then follow Schooner Bayou Cutoff for about 3.88 miles, intersecting Schooner Bayou at a point about 2,700 feet from its mouth; thence along Schooner Bayou to the vicinity of North Prong, about one-half mile east of Schooner Bayou Lock, for about 4 miles; thence northwesterly through the marsh about 34.4 miles to a point on the Mermentau River; a total distance of 43.58 miles. The total amount to be removed for this section of the inland waterway was estimated to be 9,800,000 cy of material.	H. Doc. 238, 68th Cong., 1st Sess.
March 3, 1925	River & Harbor Act	Provided for a waterway from the MS River at or near New Orleans to the Sabine River, LA and TX, via the northerly or Plaquemine Route, having a depth of 9 feet at MLW and a bottom width of 100 feet. Note: the Inland Waterway section from Schooner Bayou to White Lake is no longer included in the Intracoastal Waterway.	ARCE, 1925, p. 853
Jan. 21, 1927	River & Harbor Act	Provided for the maintenance of the previous project (5 by 40 feet) until the completion of the 9 by 100 foot channel.	ARCE, 1927, p. 920
July 1, 1930 to June 30, 1931		Dredging was performed in the Vermilion-Mermentau section of the Intracoastal Waterway.	ARCE, 1931, p. 1000
June 30, 1931		The controlling depth of the Schooner Bayou Lock was 8 feet at mean Gulf datum.	ARCE, 1931, p. 1010
July 1, 1931 to June 30, 1932		The Vermilion-Mermentau section of the Intracoastal Waterway was completed. In addition, "A canal 5 feet deep and 40 feet bottom width through North Fork to connect the 5 foot by 40 foot canal west of Schooner Bayou Lock and the intracoastal waterway west of Vermilion Lock is being dredged by contract."	ARCE, 1932, p. 897
July 1, 1932 to June 30, 1933		The canal through North Fork extending from the Intracoastal Waterway south to a point west of Schooner Bayou Lock was completed in 1932.	ARCE, 1933, p. 539
Oct. 13, 1933		Operation of the Vermilion Lock and spillway began. The controlling depth was 12 feet at mean low Gulf level,	ARCE, 1935, p. 736
June 26, 1934	Permanent Appropriations Repeal Act	Operating and care of the Schooner Bayou locks was now included in the project for the Inland Waterway from Franklin to the Mermentau River.	ARCE, 1936, p. 709
Sept. 11 to Nov. 21, 1936		Schooner Bayou lock and dam were improved and reconstructed. Work consisted of the building of three cofferdams, unwatering the lock and spillway, repairing the sheet-pile cut-off wall under the spillway dam, and renewing all reinforcing irons on the spillway structure and the lock gates.	ARCE, 1937, p. 753
March 23, 1939		Report submitted on reexamination of LA-TX Intracoastal Waterway from the MS River at or near New Orleans, LA, to Corpus Christi, TX. The recommended modification of the existing project was to provide a channel 12 feet deep and 100 feet wide, affording a depth of 9 feet over a width of 125 feet.	H. Doc. 230, 76th Cong., 1st Sess.
1939		There are two waterways in this area. The first is the Intracoastal Waterway, which goes from the Vermilion River, through part of the Schooner Bayou cut-off canal, and then through a land cut running NW to Mermentau River. Vermilion Lock was constructed 1.75 miles west of Vermilion River to prevent the ingress of salt water from Vermilion Bay. The second, and the one that will be focused on, is the Inland Waterway, which follows the Intracoastal Waterway to its intersection with the Schooner Bayou cut-off, along this cut-off to Schooner Bayou, thence through Schooner Bayou (and Schooner Bayou Lock) and a land cut to White Lake.	ARCE, 1939, p. 883, 888

Appendix A. History for Schooner Bayou Canal			
Date	**Authority**	**Description**	**Source**
July 28, 1941		Report submitted on reexamination of Mermentau River and tributaries, LA, and the LA and TX Intracoastal Waterway, with a view to improvement in the interests of navigation, national defense, flood control, and also determining whether the proposed improvement would result in any increase in salinity. A study was done on the rice crop water supply from 1933 to 1940 and concluded that the salinity of White Lake normally varied between 120 and 200 grains per gallon (1 part per thousand = 70 grains per gallon; 1.7-2.9 ppt). "The existing channel of the old 5-by-40-foot inland waterway from Grand Lake to White Lake and from White Lake to Vermilion Bay is proposed to be enlarged to a cross section having a 170-foot bottom width at a bottom elevation of -15 feet mean low Gulf providing a net cross section of 3,000 square feet below mean low Gulf datum." This would provide an alternate route for the outflow of the Mermentau Basin. Also proposed was a control spillway at Schooner Bayou. This structure would be kept open during all periods of run-off from the Mermentau Basin and would be kept closed during the rice season to prevent intrusion of salt water from Vermilion Bay, except when necessary to admit water from the bay to compensate for the withdrawal from the lakes by the irrigation pumps. A dam and lock at Southwest Pass was also proposed to help reduce the salinity of Vermilion Bay. These proposed improvements were not recommended. It was found that the proposed improvements of the Intracoastal waterway recommended in House Doc. 230 would not increase the salinity in the vicinity of the Mermentau River.	S. Doc. 94, 77th Cong., 1st Sess.
July 1, 1946		A report was submitted on the Mermentau River and tributaries, and the Gulf Intracoastal Waterway and connecting waters, LA in the interest of navigation, flood control, irrigation, and drainage, and for the prevention of stream pollution and salt-water intrusion. The recommended modifications for the Inland Waterway, Grand Lake through White Lake to Vermilion Bay, included: 1. Channel enlargement and realignment to provide a minimum section of 3,000 square feet for interflow between the lakes and discharge of Mermentau flood flows; and channel enlargement, North Prong of Schooner Bayou, inland waterway, to provide a channel 6 feet deep and 60 feet wide for inland waterway navigation; 2. a gated control structure, two bays at 12 by 75 feet at MSL, in the realigned channel from White Lake to Vermilion Bay near Schooner Bayou Lock.	S. Doc. 231, 79th Cong., 2nd Sess.
July 24, 1946	River & Harbor Act	Authorized the modification of the existing project to provide for the channel enlargement and realignment of the Inland Waterway from Vermilion Bay to White Lake (12.04 miles) and from White Lake to Grand Lake to a minimum section of 3,000 square feet below mean low Gulf level or interflow between lakes and discharge of flood flows; for channel enlargement of North Prong of Schooner Bayou; and for construction of a gated control structure in the new channel near Schooner Bayou Lock for discharge of flood flows and control of tidal flows and salt water intrusion, and the incorporation of the existing project "Inland Waterway from Franklin, La., to the Mermentau River," west of Vermilion Bay, in the modified project "Mermentau River, La."	ARCE, 1946, p. 965; 1949, p. 1034; 1956, p. 640
Jan. 1948		The controlling depth of the canal from Schooner Bayou Lock to White Lake was 7 feet mean low Gulf.	ARCE, 1948, p. 1050
Aug. 8, 1949		Construction of Schooner Bayou Control Structure was initiated.	ARCE, 1950, p. 1040
April 19 to June 3, 1950		New work dredging was performed in between White Lake and Vermilion Bay by the dredge *Duplex* with the removal of 1,564,063 cy of material.	ARCE, 1950, p. 1040
May 1950		The controlling depth of the canal from Schooner Bayou to White Lake was 7 feet mean low Gulf.	ARCE, 1950, p. 1041
June 26 to 30, 1950		New work dredging was performed in between White Lake and Vermilion Bay by the dredge *Port Arthur* with the removal of 59,712 cy of material.	ARCE, 1950, p. 1040
July 1 to Sept. 8, 1950		New work dredging was performed in between White Lake and Vermilion Bay by the dredge *Port Arthur* with the removal of 1,099,067 cy of material.	ARCE, 1951, p. 846
Jan. 19 to May 31, 1951		New work dredging was performed and completed in between White Lake and Vermilion Bay by the dredge *Duplex* with the removal of 2,983,993 cy of material.	ARCE, 1951, p. 846
May 7, 1951		The east and west gates of the old Schooner Bayou lock failed and an emergency closure of the approaches was performed.	ARCE, 1951, p. 848
May 22, 1951		Schooner Bayou Control Structure was completed.	ARCE, 1951, p. 847
Sept. 4 to 22, 1951		A permanent dike closure was constructed across the east approach channel at the old Schooner Bayou Lock and traffic was now routed through the new control structure.	ARCE, 1952, p. 798-799
Oct. 9, 1951		The old Schooner Bayou Lock was abandoned by authority of the Chief of Engineers.	ARCE, 1953, p. 743
July 1, 1952 to June 30, 1953		The Schooner Bayou Control Structure was operated as required to: "Conserve fresh water by maintenance of normal lake stages and prevent uncontrolled tidal inflow during the rice irrigation season; release promptly floodwaters during abnormal stages; and limit minimum stages in interest of navigation."	ARCE, 1953, p. 742
April 1953		The controlling depth from Schooner Bayou Cut-Off Canal west to the old Schooner Bayou lock was 12 feet and from here west to White Lake was 11 feet mean low Gulf. Note: controlling depths still under project for Inland waterway. No controlling depths were provided immediately following dredging between Vermilion Bay and White Lake.	ARCE, 1953, p. 687
Oct. 1955		The controlling depth from Schooner Bayou Cut-Off Canal to Schooner Bayou Control Structure was 13 feet and from here to White Lake was 14 feet mean low Gulf.	ARCE, 1956, p. 642

Appendix A. History for Schooner Bayou Canal			
Date	**Authority**	**Description**	**Source**
April 23, 1956		By authority of the Chief of Engineers, the project was reclassified as an "Operation and Maintenance, General" project under the category, "Navigation (Locks, Dams, Reservoirs, and Canals)."	ARCE, 1957, p. 609
June 27, 1957		Minor damage to Schooner Bayou control structure operating machinery was sustained as a result of high tides following hurricane "Audrey," making them inoperative for a short time.	ARCE, 1957, p. 610
Sept. 23 to 24, 1957		The dam at Schooner Bayou was raised to elevation 7.0 feet and the drainage gaps were closed which were cut for drainage of storm tides resulting from Hurricane Audrey at the north prong of Schooner Bayou during the period July 22 to Aug. 13, 1957.	ARCE, 1958, p. 559
April 1958		The controlling depth from White Lake to Schooner Bayou control structure was 10 feet mean low Gulf and through the control structure it was 12 feet. Note: controlling depths still under project for Inland waterway.	ARCE, 1959, p. 564
June 14 to 27, 1973 & April 29 to May 31, 1974		A new northeast guidewall on structure number two was constructed on Schooner Bayou control structure.	ARCE, 1973, p. 11-15; 1974, p. 11-16
May 21, 1973 & March 17 to May 20, 1975		Dewatering structures one and two were constructed on Schooner Bayou control structure.	ARCE, 1973, p. 11-15; 1975, p. 11-15
Oct. 1, 1978 to Sept. 30, 1979		Dredging was performed at Schooner Bayou Control Structure in the boat slip and old lock channel with the removal of 2,000 cy of material.	ARCE, 1979, p. 11-14