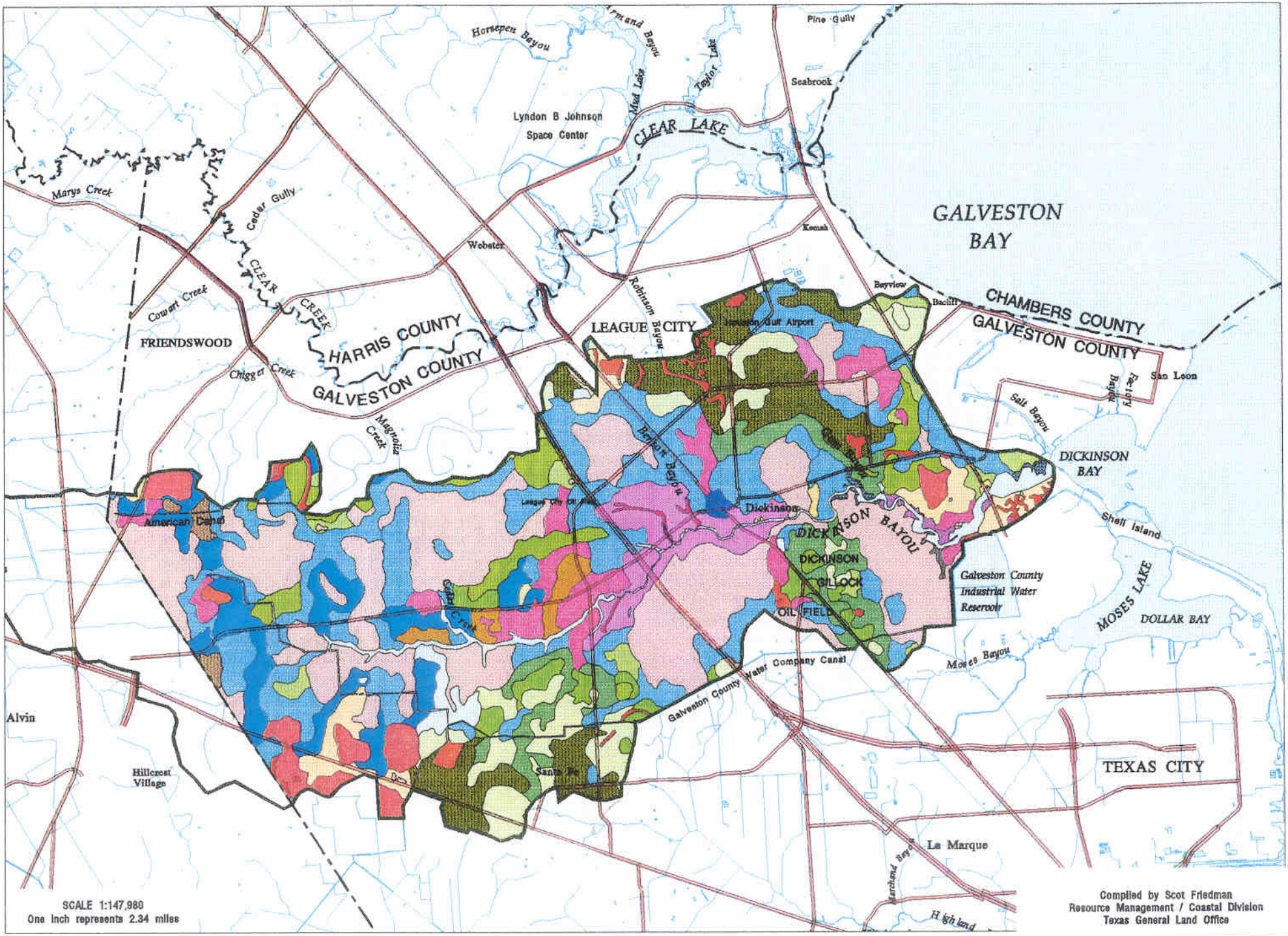
Figure 4. Soils of the Dickinson Bayou Watershed



tidal segments include contact recreation and high-quality aquatic life habitat (TWC, 1992). The TNRCC water quality data for the last four years for Dickinson Bayou tidal and above-tidal segments are included in tables 1 and 2.

Permitted facilities on the tidal segment include two domestic facilities (sewage treatment) with a total effluent discharge of 3.75 million gallons per day (MGD) and five industrial discharge outfalls totaling 0.08 MGD. The above-tidal segment has two permitted domestic outfalls totaling 0.75 MGD (TWC, 1992). In addition to permitted outfalls, Fay et al. (1991) conducted aerial and boat surveys of the Dickinson Bayou shoreline and found 24 unpermitted discharge outfalls, including 11 storm drains, one oil-related discharge, one lawn drainage, one sewage discharge, and 10 unknown and miscellaneous discharges.

Both stream segments on the bayou are water-quality-limited. Water quality problems identified in the tidal segment include eutrophic impacts, elevated fecal coliforms, elevated nitrogen, total phosphorus, and orthophosphorus (TWC, 1992). Also, the Texas State Soil and Water Conservation Board lists the above-tidal segment of Dickinson Bayou on the statewide list of waters affected by nonpoint-source pollution. Nutrients from agriculture are mentioned as the reason for listing the segment.

Ward and Armstrong (1992) summarized water and sediment data for the Galveston Bay system, including Dickinson Bay and the tidal segment of the bayou, and reported historical trends for some parameters. Statistical trends based on historical water-quality data from the bayou show probable or possible decreases in salinity (upper 1.5 m), total suspended solids, biological oxygen demand, ammonia nitrogen, and chlorophyll-a. Water-quality parameters showing possible or probable increasing trends include total fecal coliforms, dissolved oxygen deficit, and nitrate nitrogen. Other parameters, such as total phosphorus and total organic carbon, indicate no trend.

Knudson and Belaire (1975) recorded frequent fish kills during summer months in the six-kilometer portion of Dickinson Bayou directly upstream from two sewage treatment plants that are principal contributors of wastes to the bayou. All of the major fish kills occurred during the night or early morning and during significant algal blooms in conditions of low dissolved oxygen. Low dissolved oxygen in bottom waters during saltwater intrusion is a natural occurrence in narrow stratified estuaries. However, Knudson and Belaire (1975) concluded that this natural event alone would not be enough to cause the fish kills, as fish could normally avoid oxygen-depleted bottom waters. It appeared that algae-stimulating nutrients (primarily phosphorus) from the sewage treatment plants were the primary cause of the disturbed oxygen balance in the bayou from Highway 3 to FM 646.

Table 1. Water quality information for Dickinson Bayou tidal (From TWC, 1992).

PARAMETER	CRITERIA	NUMBER SAMPLES	MIN.	MAX.	MEAN	Number of Values Outside Criteria	Mean Values Outside Criteria
DISSOLVED OXYGEN (MG/L)	4.0	23	1.2	13.5	6.6	1	1.2
TEMPERATURE (F)	95.0	23	48.7	90.3	73.6	0	0
PH	6.5-9.0	22	7.3	8.5	7.8	0	0
CHLORIDE (MG/L)	N/A	21	23	10600	3852	0	0
SULFATE (MG/L)	N/A	20	7	1940	546	0	0
TOTAL DISSOLVED SOLIDS (MG/L)	N/A	23	129	16450	6310	0	0
FECAL COLIFORMS (#/100 ML)	200	19	10	70800	445	10	3141

Table 2. Water quality information for Dickinson Bayou above tidal (From TWC, 1992).

PARAMETER	CRITERIA	NUMBER SAMPLES	MIN.	MAX.	MEAN	Number of Values Outside Criteria	Mean Values Outside Criteria
DISSOLVED OXYGEN (MG/L)	4.0	16	1.4	10.2	6.1	2	2.7
TEMPERATURE (F)	90.0	16	45.6	84.2	68.3	0	0
PH	6.5-9.0	15	6.9	8.1	7.6	0	0
CHLORIDE (MG/L)	200	16	4	2900	264	1	2900
SULFATE (MG/L)	100	15	4	460	93	3	240
TOTAL DISSOLVED SOLIDS (MG/L)	600	16	50	550	363	0	0
FECAL COLIFORMS (#/100 ML)	200	14	10	54600	741	11	1497

Unpublished data from the Texas Parks and Wildlife Department (TPWD) reveal that 26 fish kills occurred in Dickinson Bayou between 1970 and 1988. Estimates of the numbers of dead fish from individual reports ranged from less than 1,000 to several million fish, primarily gulf menhaden (Brevoortia patronus). Water quality data included with the TPWD fish-kill reports usually indicated low dissolved oxygen levels in bottom waters and algal blooms.

Sediment data from surficial sediments in Dickinson Bayou generally showed elevated levels of arsenic, copper, and mercury (Ward and Armstrong, 1992). Ward and Armstrong (1992) also noted a trend for increasing levels of copper in bayou sediments. White et al. (1985) analyzed sediments for selected trace metals from two stations in Dickinson Bay and two in Dickinson Bayou. None of the trace metals, with the possible exception of zinc, appeared to be present in elevated quantities in the bayou.

Shellfish harvesting data from the Texas Department of Health for the Galveston Bay system for 1955 to 1991 was summarized by Jensen and Su (1993). Data show that Dickinson Bay and the tidal segment of the bayou were designated as either "insanitary areas" or "polluted areas" because of high levels of fecal coliforms and were closed to oystering during the 36-year period. Jensen and Su (1993) indicate that the overwhelming source of fecal coliforms in the Galveston Bay system is runoff from upland areas, with urbanized areas being a major contributor.

LIVING RESOURCES

Fish and Wildlife

Unpublished fish and shellfish data from the TPWD compare the abundance of 12 species caught in bag seines or by otter trawls in Dickinson Bay to other bays in the Galveston Bay system. Bag seine data were collected from 1978 through 1991 and otter trawl data from 1983 through 1991. Except for bag seine data for gulf menhaden, striped mullet (Mugil cephalus), and red drum (Sciaenops ocellata), the average catch per unit effort for most species caught in Dickinson Bay generally ranks in the bottom 50 percent in abundance when compared to other minor bays in the Galveston Bay system. Gulf menhaden and striped mullet are the only species that are relatively abundant in Dickinson Bay, as bag seine data indicate the bay ranks third among the 29 minor bays in the Galveston Bay system for gulf menhaden and fourth for striped mullet. In addition, fish and shellfish diversity is low to average in Dickinson Bay. The bay ranks nineteenth out of 29 bays for the average number of species caught in each bag seine and next to last among 13 bays for the average number of species caught by otter trawl. The Shannon Weaver diversity index for bag seine samples from Dickinson Bay is 0.54, or twelfth among

the 29 minor bays of the Galveston Bay system. The Shannon Weaver diversity index for trawl samples is 0.48, or last among the 13 minor bays.

Fish and shellfish data for Dickinson Bayou are limited to unpublished TPWD fish kill reports, some cursory seining during fieldwork for this study in March 1994, and field observations by Walsh Engineering, Inc. (1993). Fish kill data indicate that gulf menhaden 2.5-7.6 cm in length, striped mullet 15-20 cm in length, and hardhead catfish (Arius felis) 15 cm in length are abundant in the bayou during summer months. Juvenile gulf menhaden, crabs (Callinectes sapidus), and shrimp (Penaeus sp.) were netted at several shoreline areas of the tidal segment of the bayou in March 1994. Juvenile shrimp were most abundant along a high marsh on the south shoreline near Gum Bayou. Walsh Engineering, Inc. (1993) reported that striped mullet and blue crab were present in the bayou during field investigations.

Wildlife is diverse along the bayou and areas bordering Dickinson Bay because of the variety of coastal wetland and upland habitats. Walsh Engineering, Inc. (1993) conducted a field inspection of the bayou watershed to determine wildlife populations. Most of the sighted animal species were birds, including mourning dove (Zenaida macroura), double-crested cormorant (Phalacrocorax auritus), brown thrasher (Toxostoma rufum), chimney swift (Chaetura pelagica), white ibis (Eudocimus albus), boat-tailed grackle (Quiscalus mexicanus), rock dove (Columba livia), snowy egret (Egretta thula), crow (Corvus brachyrhynchos), belted kingfisher (Ceryle alcyon), blue jay (Cyanocitta cristata), cardinal (Cardinalis cardinalis), osprey (Pandion haliaetus), and swallow-tailed kite (Elanoides forficatus). Other wildlife observed were the diamondback water snake (Nerodia rhombifera rhombifera), cottontail rabbit (Sylvilagus floridanus), and fox squirrel (Sciurus niger).

Additional wildlife surveys were conducted by the U.S. Army Corps of Engineers (Jones, 1986a) for the Edgewater Development Tract, a proposed wetland mitigation bank on the southern shoreline of Dickinson Bayou before it enters Dickinson Bay. The 286-acre tract is bounded on the north by Dickinson Bayou, on the west by Highway 146, and on the south by the Texas City hurricane protection levee. Wildlife and vegetation on the tract are probably typical of species occurring in coastal prairies, brushlands, and wetlands just inland of the bay and bayou.

The COE (Jones, 1986a) listed birds using the Edgewater Development Tract. A total of 24 species of birds, all migratory, were observed flying and/or resting in the area during four field investigations. Three species--the water pipit (Anthus spinoletta), shortbilled marsh wren (Cistothorus platensis), and swamp sparrow (Melospiza georgiana)--were utilizing the wetlands. Other species used areas outside the