2.4 Ecology

This section describes the terrestrial and aquatic ecology of the site and vicinity that might be affected by the building, operation, and maintenance of proposed Units 3 and 4 at STP. Sections 2.4.1 and 2.4.2 provide general descriptions of terrestrial and aquatic environments on and in the vicinity of the STP site and in areas that would be subject to activities required for the proposed power transmission system upgrades. These areas include the 20 mi of existing transmission line corridor where upgrades would be required, the addition of a new 345-kV switchyard on the STP site, and the changes necessary to redirect five existing transmission lines into the new switchyard on the STP site (STPNOC 2010a). The 345-kV transmission lines to be upgraded originate at the STP site in Matagorda County and travel a 400-ft wide corridor for approximately 20 mi, terminating at the Hillje Substation. The Hillje Substation is located in the southwestern corner of Wharton County, just across the border from Matagorda County.

Detailed descriptions are provided where needed to support the analysis of potential environmental impacts from building, operating, and maintaining new nuclear power generating facilities and along transmission corridors where upgrades and tower replacement would be conducted to support the power transmission requirements for Units 3 and 4. These descriptions also support the evaluation of mitigation activities identified during the assessment to avoid, reduce, minimize, rectify, or compensate for potential impacts. Also included are descriptions of monitoring programs for terrestrial and aquatic environments.

2.4.1 Terrestrial Ecology

The STP site occupies approximately 12,220 ac immediately west of the Colorado River, approximately 10 mi from the river's confluence with Matagorda Bay, within the Coastal Prairies sub-province of the Gulf Coastal Plains physiographic province of Texas (STPNOC 2010a; TBEG 1996). This section identifies terrestrial ecological resources and describes species composition and other structural and functional attributes of biotic assemblages that could be affected by the building, operation, and maintenance of Units 3 and 4 and associated transmission lines.

2.4.1.1 Terrestrial Communities of the Site and Vicinity

The terrestrial communities found in this region are typical of the Coastal Prairies that begin near the Gulf of Mexico shoreline (adjoining the Gulf Coast Marshes) and occupy young deltaic sands, silts, and clays that form nearly flat grasslands (TBEG 1996). This area is typified by low elevation, generally less than 60 ft above MSL, with open prairie habitat interspersed with creek and river drainages flowing toward the Gulf Coast marshes. Trees are usually not found except locally along streams and in oak groves. Remnants of Coastal Prairies in Texas are dominated by little bluestem (*Schizachyrium scoparium*), brown-seed paspalum (*Paspalum plicatulum*), and Indiangrass (*Sorghastrum nutans*) (Diamond and Smeins 1984). Bottomland hardwood forests occur along the major river systems that drain the Coastal Prairies. The Gulf Coast Prairies are well suited to agriculture and farming, cattle ranching, and urban and industrial development (FWS and USGS 1999). These land uses have transformed the region and much of Matagorda County has been converted to croplands or pasture (STPNOC 2010a). Little of the original coastal prairie vegetation remains in the region.

The dominant land cover in the vicinity of the STP site consists primarily of habitats associated with agriculture and grazing, and grazing continues on portions of the STP site. Past agricultural land uses at the site have influenced the current vegetation at STP. The existing plant associations on the STP site consist primarily of successional vegetation occurring on old abandoned agricultural fields and pastures. Although the topography of the region is relatively flat and low, the landscape at the site can be characterized as either forested and bottomland habitats in low lying areas that consist of pastures or patchy forested lands near the Colorado River, low-lying wetland habitats, and upland areas where scrub-shrublands and grasslands have established on previously cultivated, grazed, or disturbed lands (STPNOC 2010a). Recent ecological surveys of the site provided information identifying and describing different habitats and mapped the vegetation cover and land use on the STP site (Figure 2-19) (ENSR 2008a; STPNOC 2008b). Two open water areas—the approximately 7000-ac MCR and the 46-ac ECP—represent the majority of the mapped habitat found onsite (Table 2-6, Figure 2-19). Areas immediately adjacent to existing facilities consist of parking areas, gravel lots, and landscaped areas. Two other types of land use are identified on the vegetation cover/land-use map: a dredge materials disposal area and the spoils area used for the building of existing STP Units 1 and 2. The vegetation cover types are briefly described in the following text.

Forested Communities

The bottomland forests occur along the site boundary with the Colorado River and represent the most diverse habitat found on the STP site. Much of the bottomland area was historically modified through land-use practices (clearing and herbicide applications) to promote livestock forage production. These bottomlands now consist of a mosaic of forested and pasture lands. Dominant tree species include pecan (*Carya illinoinensis*), sugarberry (*Celtis laevigata*), live oak (*Quercus virginiana*) and American elm (*Ulmus americana*). Shrubs and herbaceous plants include yaupon (*Ilex vomitoria*), American beautyberry (*Callicarpa americana*), dewberry (*Rubus* spp.), sedges (*Carex* spp.), and poison ivy (*Toxicodendron radicans*) (STPNOC 2010a). Depressions and sloughs within these bottomlands receive drainage from the upland portions of the site and provide shallow wetland habitats. Several STP facilities occur within the bottomland forest areas, including the RMPF, the dredge materials disposal area, and the MCR spillway/blowdown area (ENSR 2008a).

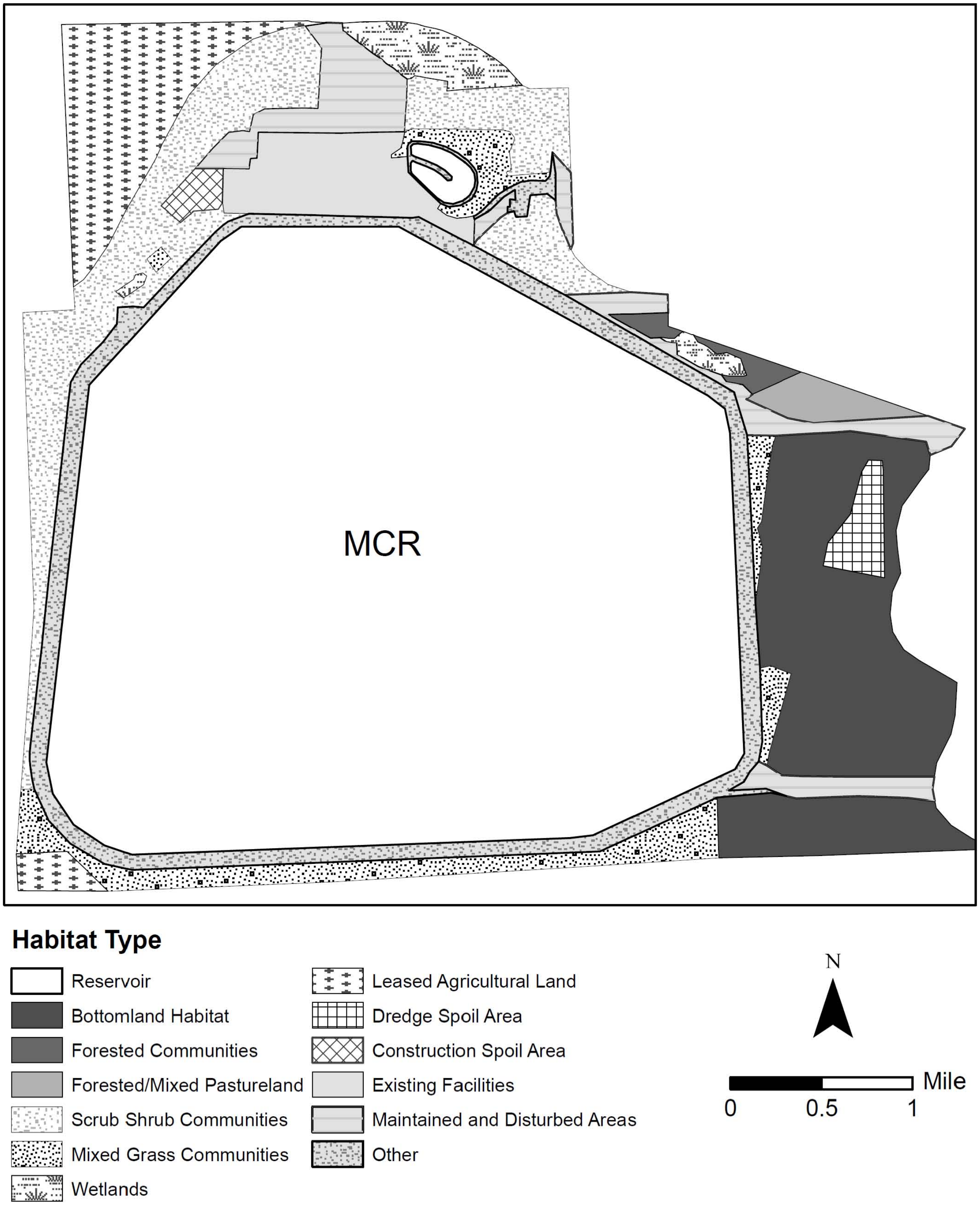

Figure 2-19. Vegetation Cover and Land-Use Cover Types at the STP Site

Table 2-6. Approximate Acreages of Habitats and Land Use Found on the STP Site

Habitat	Acreage	Habitat	Acreage
Bottomland Forest	1176	Dredge Materials Disposal Area	133
Upland Forest	53	Construction Spoil Area for Units 1 and 2	41
Mixed Forest/Grassland	91	Maintained Areas (Mowed Grasses and Forbs)	468
Pasture/Agriculture	536	Existing Facilities	300
Scrub Shrub	970	Existing roadways and levees	759
Mixed Grassland	485	Wetlands including Kelly Lake	162
Main Cooling Reservoir	7000	Essential Cooling Pond	46

Sources: ENSR 2008a, STPNOC 2008g

Upland forested habitat (53 ac) is found adjacent to Kelly Lake (ENSR 2008a) consisting of live oak, sugarberry, and yaupon. Immediately east of this community, a 91-ac mixed forest/ grassland habitat is leased for cattle. It contains sugarberry and a few live oaks with an herbaceous layer consisting of broadleaf carpetgrass (*Axonopus compressus*), Bermuda grass (*Cynodon dactylon*), and *Paspalum* species. Additional forested communities are located on the east side of the property north of the existing heavy haul road and on the southeast section of the property between the MCR spillway and the Colorado River.

Wetland Communities

Three types of wetlands are found on the STP site. The largest is a managed 110-ac shallow wetland area (part of the Texas Prairie Wetlands Project) that was developed in 1996 in the northern portion of the site adjacent to road FM 521 (STPNOC 2010a). To enhance the property for waterbirds (STPNOC 2010a), impoundments were built to create foraging habitat for wintering waterfowl, wading birds, and shorebirds. This managed wetland area is included as part of the Great Texas Coastal Birding Trail that spans the entire Texas Gulf (STPNOC 2010a; TPWD 2009g).

The second significant wetland habitat is associated with the 34-ac Kelly Lake in the eastern portion of the site (STPNOC 2010a; ENSR 2008a). It consists of open water areas surrounded by emergent vegetation including a band of cattail (*Typha* spp.) and arrowhead (*Sagittaria* spp.).

The third wetland component observed on the STP site includes 29 smaller wetlands totaling about 18 ac (Corps 2009b). Nineteen of these are less than 0.50 ac in size while the remaining eight range from 0.5 to 5.2 ac in size. The dominant vegetation within these sites includes cattail, spikerush (*Eleocharis* spp.), disk water hyssop (*Bacopa rotundifolia*), bluestem (*Andropogon* spp.), sea myrtle (*Baccharis halimifolia*), and rattlebox (*Sesbania drummondii*). Wetland vegetation is also associated with streams modified for surface and stormwater drainage common throughout the site (ENSR 2007a), including Little Robbins Slough, a stream that was relocated when building the MCR for existing Units 1 and 2.

Upland Communities

Upland areas on the STP site consist of a patchy mosaic of shrub-dominated and herbaceous vegetation typical of successional areas recovering from prior disturbance. Scrub-shrub habitat dominates the northern and western portions of the site (ENSR 2008a). This land was agricultural land before Units 1 and 2 were built (NRC 1975). The habitat is dominated by sea myrtle, dewberry, and patchy grasses—all plants common to disturbed or abandoned agricultural land in this region (STPNOC 2010a). Sea myrtle appears to be the most common shrub in the plant associations near the proposed plant site (STPNOC 2010a).

Mixed grasslands occur along the southern site boundary, north and east of the ECP, and between the MCR and bottomland habitats. The dominant grass species include angleton bluestem (*Dichanthium aristatum*), King Ranch bluestem (*Bothriochloa ischaemum*), bristle grass (*Setaria* spp.), brownseed paspalum, and Bermuda grass. Maintained and disturbed habitats on the STP site consist of areas that are routinely mowed, such as the outside slopes of levees (ENSR 2008a) and mowed fields adjacent to existing reactor facilities. Common plants in these areas include dallisgrass (*P. dilatatum*), brownseed paspalum, angleton bluestem, sedge (*Carex* spp.), Bermuda grass, clover (*Trifolium* spp.), and carpetgrass (STPNOC 2010a).

Wildlife Species on the STP Site

Wildlife species found within the STP site are typical of those found in the east Texas coastal prairie lands. Common mammals may include white-tailed deer *(Odocoileus virginianus),* bobcat *(Lynx rufus),* gray fox (*Urocyon cinereoargenteus*), eastern cottontail rabbit *(Sylvilagus floridanus),* raccoon *(Procyon lotor),* nine-banded armadillo *(Dasypus novemcinctus mexicanus),* Virginia opossum *(Didelphis virginiana)*, hispid cotton rat *(Sigmodon hispidus),* and feral pig *(Sus scrofa).* Mammals that were observed on the STP site during recent ecological surveys include white-tailed deer, feral pigs, eastern cottontail, swamp rabbit (*Sylvilagus aquaticus*), fox squirrels (*Sciurus niger*), gray squirrels (*S. carolinensis*), and hispid cotton rat. Of these, white-tailed deer were most often observed (ENSR 2008a).

Seven bat species occur in Matagorda County, and could potentially be associated with STP. These are the eastern pipistrelle or tri-colored bat (*Perimyotis subflavus*), the eastern red bat (*Lasiurus borealis*), the hoary bat (*L. cinereus*), the northern yellow bat (*L. intermedius*), the Seminole bat (*L. seminolus*), the evening bat (*Nycticeius humeralis*), and the Brazilian or Mexican free-tailed bat (*Tadarida brasiliensis*).

Common reptile species may include the alligator (*Alligator mississippiensis*), the copperhead snake (*Agkistrodon contortrix contortrix*), the cottonmouth snake (*A. piscivorus*), the eastern hog-nosed snake (*Heterodon platirhinos*), eastern racer (*Coluber constrictor*), corn snake (*Elaphe guttata*), eastern rat snake (*E. obsoleta*), the diamondback watersnake (*Nerodia rhombifer rhombifer*), eastern box turtle (*Terrapene carolina*), ornate box turtle (*T. ornata*), *snapping turtle* (*Chelydra serpentina*), *red-eared pond slider* (*Trachemys scripta elegans*), green anole (*Anolis carolinensis*), and five-lined skink (*Eumeces fasciatus*). Other reptiles potentially associated with STP include the western diamondback rattlesnake (*Crotalus atrox*), diamondback terrapin (*Malaclemys terrapin*), and the fence lizard (*Sceloporus undulatus*) (ENSR 2007b; STPNOC 2010a).

Amphibians likely to occur in wetland areas of the STP site include the southern leopard frog (*Rana sphenocephala*), the green tree frog (*R. clamitans*), and the bullfrog (*R. catesveiana*) (ENSR 2007b). Table 2-7 is a list of amphibians known to occur in Matagorda County.

Table 2-7. Amphibians Found in Matagorda County, Texas

Common Name	Scientific Name
Smallmouth Salamander	*Ambystoma texanum*
Eastern Newt	*Notophthalmus viridescens*
Eastern Lesser Siren	*Siren intermedia*
Gulf Coast Toad	*Incilius valliceps*
Woodhouse’s Toad	*Bufo woodhousii*
Northern Cricket Frog	*Acris crepitans*
Cope’s Gray Treefrog	*Hyla chrysoscelis*
Green Treefrog	*Hyla cinerea*
Squirrel Treefrog	*Hyla squirella*
Gray Treefrog	*Hyla versicolor*
Spotted Chorus Frog	*Pseudacris clarkii*
Bullfrog	*Rana catesbeiana*
Southern Leopard Frog	*Rana sphenocephala*

Source: AmphibiaWeb 2009

The site and the surrounding region host a large number of resident and migratory birds throughout the year. The STP site lies near the terminus of the Central Flyway migration route and the managed prairie wetlands are a stop along the Great Texas Coastal Birding Trail (TPWD 2009g). The STP site lies within a major migratory corridor for neotropical migrants, and radar studies indicate that floodplain forests and other forested wetlands are important stopover habitats (STPNOC 2010a).

Resident birds commonly seen and observed during recent surveys at the STP site include turkey vultures (*Cathartes aura*), black vultures (*Coragyps atratus*), crows (*Corvus* spp.), grackles (*Quiscalus* spp.), northern cardinal (*Cardinalis cardinalis*), red-winged blackbirds (*Agelaius phoeniceus*), bobwhite quail (*Colinus virginianus*), and mourning doves (*Zenaida macroura*). Many different species of wading birds were observed at the STP site when building Units 1 and 2 including wood storks (*Mycteria americana*), roseate spoonbills (*Platalea ajaja*), great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), white-faced ibis (*Plegadis chihi*), white ibis (*Eudocimus albus*), and little blue herons (*Egretta caerulea*) (NRC 1975). All of these birds except wood storks have been observed on the site more recently during the Mad Island Christmas Bird Count (CBC) surveys conducted each year (ENSR 2008a; STPNOC 2008b). Other waterbirds noted onsite included white pelicans (*Pelecanus erythrorhynchos*), laughing gulls (*Leucophaeus atricilla*), cormorants (*Phalacrocorax* spp.), anhingas (*Anhinga anhinga*), and belted kingfishers (*Megaceryle alcyon*). Waterfowl species that use STP wetlands include American coots (*Fulica americana*), teal (*Anas* spp.), and northern shovellers (*Anas clypeata*) (NRC 1975). Waterfowl observed on the MCR in 1987 included 16 duck species and 3 species of geese (STPNOC 2010a). Winter CBC surveys found 23 species of ducks and 5 species of geese (ENSR 2008a).

Avian species observed during more recent biological surveys on the site (2006 and 2007) are indicated in Table 2-8. Within the STP site, 215 total avian species have been documented during annual CBCs from 1993 through 2007 (ENSR 2008a). During this 15-year period, an average of 122 bird species was observed onsite per year, with a range of 60 to 142 species per year. Bird/habitat associations for STP included woodland (101 bird species observed), shoreline (48 species), open-water (40 species), grassland (24 species), and scrub-shrub (2 species). These species were classified by their habitat of occurrence (where they were observed); however, these birds may frequent multiple habitats found on the STP site (ENSR 2008a; STPNOC 2010a).

Waterbirds nest on terminal ends of the “Y” dike used to direct water flow in the MCR. Nesting on the MCR dikes was first observed in 1986 and has been monitored annually since 2000 as part of the Texas Colonial Waterbird Surveys (FWS 2009b). The STP colony has been dominated by nesting laughing gulls (53 percent) and gull-billed terns (*Gelochelidon nilotica*) (31 percent) of the approximately 1200 to 1600 nests per year counted from 2000 to 2005 (STPNOC 2010a). Seven additional bird species nest on the dikes with typically fewer than 100 nests each.

Table 2-8. Birds Observed On or Around the STP Project Area for Units 3 and 4

Common Name	Scientific Name	Habitat Observed	Trans-Gulf Migrant[(a)]
Red-winged blackbird	*Agaelaius phoeniceus*	Grassland/Scrub-shrub	
Anhinga	*Anhinga anhinga*	MCR	
Great blue heron	*Ardea herodias*	Wetland/MCR	
Cattle egret	*Bubulcus ibis*	Grassland/Wetlands	
Red-tailed hawk	*Buteo jamaicensis*	Grassland/Scrub-shrub	
Red-shouldered hawk	*Buteo lineatus*	Grassland/Scrub-shrub	
Crested caracara	*Caracara cheriway*	Grassland	
Turkey vulture	*Cathartes aura*	Grassland/Scrub-shrub/Developed	
Belted kingfisher	*Megaceryle alcyon*	Wetlands	X
Killdeer	*Charadrius vociferus*	Grassland/Developed	
Northern harrier	*Circus cyaneus*	Grassland/Scrub-shrub	
Northern bobwhite	*Colinus virginianus*	Grassland/Scrub-shrub	
Black vulture	*Coragyps atratus*	Grassland/Scrub-shrub/Developed	
American crow	*Corvus brachyrhynchos*	Grassland/Scrub-shrub	
Bluejay	*Cyanocitta cristata*	Scrub-shrub	
Fulvous whistling-duck	*Dendrocygna bicolor*	Wetland	
Little blue heron	*Egretta caerulea*	Wetlands	
Snowy egret	*Egretta thula*	Wetland/MCR	
Tri-colored heron	*Egretta tricolor*	Wetland/MCR	
White ibis	*Eudocimus albus*	Grassland/Wetlands	
American coot	*Fulica americana*	Wetlands	
Common yellowthroat	*Geothlypis trichas*	Scrub-shrub	X
Bald eagle	*Haliaeetus leucocephalus*	River shoreline	
Barn swallow	*Hirundo rustica*	Grassland/Developed	X
Laughing gull	*Leucophaeus atricilla*	MCR/Developed	
Northern mockingbird	*Mimus polyglottos*	Grassland/Scrub-shrub/Developed	
Brown-headed cowbird	*Molothrus ater*	Grassland/Scrub-shrub	
Black-crowned night-heron	*Nycticorax nycticorax*	Wetland	
Osprey	*Pandion haliaetus*	MCR	
American white pelican	*Pelecanus erythrorhynchos*	MCR	

Table 2-8. (contd)

Common Name	Scientific Name	Habitat Observed	Trans-Gulf Migrant[a]
Brown pelican	*Pelecanus occidentalis*	MCR	
Cliff swallow	*Petrochelidon pyrrhonota*	MCR	X
Roseate spoonbill	*Platalea ajaja*	MCR	
Purple martin	*Progne subis*	Grassland/Scrub-shrub/Developed	X
Boat-tailed grackle	*Quiscalus major*	Grassland/Scrub-shrub/Developed	
Gull-billed tern	*Gelochelidon nilotica*	MCR	
Eastern meadowlark	*Sturnella magna*	Grassland/Scrub-shrub	
American robin	*Turdus migratorius*	Grassland	
Scissor-tailed flycatcher	*Tyrannus forficatus*	Grassland/Scrub-shrub	X
Mourning dove	*Zenaida macroura*	Grassland/Developed	

Sources: STPNOC 2010a; ENSR 2008a
(a) Birds that cross the Gulf of Mexico from the Yucatan Peninsula to the Gulf Coast (TPWD 2009f).

2.4.1.2 Terrestrial Resources – Transmission Lines

Transmission corridors that originate at the STP site pass through forested, agricultural, and grass lands typical of Texas coastal prairie. The transmission lines and associated corridors are managed by four transmission service providers as described in Section 2.2. Only a 20-mi section of the Hillje transmission line would be disturbed by activities related to building the proposed Units 3 and 4. These activities would require replacing towers and upgrading the existing transmission lines along this section. Current transmission line corridor management involves mechanical, manual, and chemical methods to limit vegetation encroachment on transmission corridors.

The existing transmission lines generally pass through typical habitats associated with the coastal prairie region of east Texas—agricultural fields, pasture/rangeland, and some forests. However, the westward transmission lines reach into the Edwards Plateau with different habitats such as Edwards Aquifer springs and karst areas (STPNOC 2010a). The 20-mi STP-to-Hillje corridor passes primarily through agricultural lands—the majority of the land in the corridor (>95 percent) is currently used for agriculture and rangelands (STPNOC 2010a). Wildlife using agricultural and rangeland habitats in the STP-to-Hillje corridor areas are expected to be similar to those using the disturbed and maintained habitats found on the STP site, such as white-tailed deer, eastern cottontail, and raccoon. Depending on the condition of the fields (flooded or dry) and the types of crops grown, a wide variety of the birds common to the interior of the coastal plain of Texas could use the corridor habitats.

2.4.1.3 Important Terrestrial Species and Habitats

This section describes Federally and State-listed proposed, threatened, and endangered terrestrial species, any designated and proposed critical habitat, and ecologically important species or habitats, and commercially and recreationally valuable species that may occur in the vicinity of the STP site or within the vicinity of the 345-kV powerline that would be upgraded between the STP site and Hillje Substation. A list of Federally and State-listed species occurring in counties (Matagorda and Wharton) that contain the site and the 345-kV transmission line to be upgraded was obtained from the U.S. Fish and Wildlife Service (FWS) county listings for the State of Texas, and the TPWD (2008a). Location information was obtained from the TPWD, Wildlife Division, Diversity and Habitat Assessment Programs (Texas Natural Diversity Database 2009).

Important Terrestrial Species Site and Vicinity

Matagorda County has 24 terrestrial species that are either Federally or State-listed as endangered or threatened (TPWD 2008a; FWS 2009a). Areas on the STP site that would be affected by building Units 3 and 4 were investigated by contract biologists working for the applicant to determine the presence or absence of state or Federally listed fauna and flora, evaluate whether suitable habitat exists for these species and assess potential nesting areas and flyways.

Federally Listed Species

The Federally listed wildlife species with recorded occurrences in Matagorda and Wharton Counties are shown in Table 2-9. Only the American alligator (*Alligator mississippiensis*), listed as threatened under the Federal Endangered Species Act (ESA), has been observed on the STP site. There are no Federally listed plant species known to occur in Matagorda County.

Table 2-9. Federally Listed Terrestrial Species Identified by FWS as Occurring in the Vicinity of the STP Site and the STP-to-Hillje Transmission Corridor

	Scientific Name	Federal Status	State Status	Matagorda County	Wharton County
Birds					
Piping plover	*Charadrius melodus*	LT	T	Y	
Whooping crane	*Grus americana*	LE	E	Y	Y
Northern Aplomado falcon	*Falco femoralis septentrionalis*	LE	E	Y	
Reptiles					
American alligator	*Alligator mississippiensis*	DM, SAT	-	Y	

Source: FWS 2009a
LT = Federally listed as threatened; LE = Federally listed as endangered; DM = Delisted, monitor; SAT = Federally listed as threatened due to similarity of appearance; T = State-listed as threatened; E = State-listed as endangered; Y = occurs in the county.

The recently Federally delisted bald eagle (*Haliaeetus leucocephalus*) is also known to occur on site and active nesting sites have been located within and relatively close to the STP site boundaries. The bald eagle will remain Federally protected under the Bald and Golden Eagle Protection Act (16 USC 668-668d) and the Migratory Bird Treaty Act (16 USC 703, *et seq.*). It is also currently listed as a threatened species by the State of Texas and its occurrence and habitat use on the STP site is discussed with other State-listed species. The recently Federally delisted brown pelican (*Pelecanus occidentalis*) was also observed near the MCR. On November 17, 2009, (74 FR 59443) the FWS removed the brown pelican from the Federal List of Endangered and Threatened Wildlife due to recovery. Brown pelicans are listed as an endangered species by the State of Texas, and their occurrence and habitat use on the STP site is discussed with other State-listed species.

American Alligator — In 1967, the American alligator was classified by FWS as Federally endangered throughout its range, including Texas. By 1987, following several reclassification actions in other states, the American alligator was pronounced fully recovered, and was reclassified to "threatened based on similarity of appearance" to the American crocodile (*Crocodylus acutus*) in the remainder of its range (52 FR 21059). American alligators can be found throughout the Southeast from the Carolinas to the Texas and north to Arkansas (FWS 2008). Alligators generally live in wetlands and alligators commonly occur in the wetlands and near open ditches and waterways on the STP site. Operation of STP Units 1 and 2 has not been shown to adversely affect the American alligators found on the site.

Piping Plover — The Northern Great Plains population of piping plover (*Charadrius melodus*) was listed as threatened (50 FR 50726) due to excessive hunting during the 19th century and remains threatened as a result of flood control and water regulation that destroys or degrades the vegetated sandbars and river islands used for nesting. This population of plovers winters primarily along the Gulf Coast in Texas, Louisiana, Alabama, and Florida and critical habitat has been designated in these states for wintering habitat. In winter, these birds inhabit beaches, mudflats, and sandflats along the Gulf of Mexico as well as barrier island beaches and spoil islands on the Gulf Intercoastal Waterway. Piping plovers overwinter along Matagorda Bay and Matagorda Peninsula, approximately 7-8 mi south of the STP site (66 FR 36038).

Whooping Crane — The whooping crane (*Grus americana*) was listed as threatened with extinction in 1967 and listed as endangered in 1970. The Aransas-Wood Buffalo National Park Population (AWBP) of cranes nests in Wood Buffalo National Park in Canada and winters in coastal marshes at the Aransas National Wildlife Refuge in Texas approximately 35 mi south of the STP site (Figure 2-20). These birds arrive on the Texas coast between late October and mid-December and spend approximately 6 months on the wintering grounds at Aransas National Wildlife Refuge. Whooping cranes forage primarily in brackish bays, marshes, and salt flats, feeding on blue crabs (*Callinectes sapidus*), clams, and fruits of wolfberry (*Lycium* spp.). Although birds move to uplands in the refuge to feed on acorns, snails, crayfish and insects, they return to the salt marshes in the evening to roost. Use of uplands or croplands adjacent to

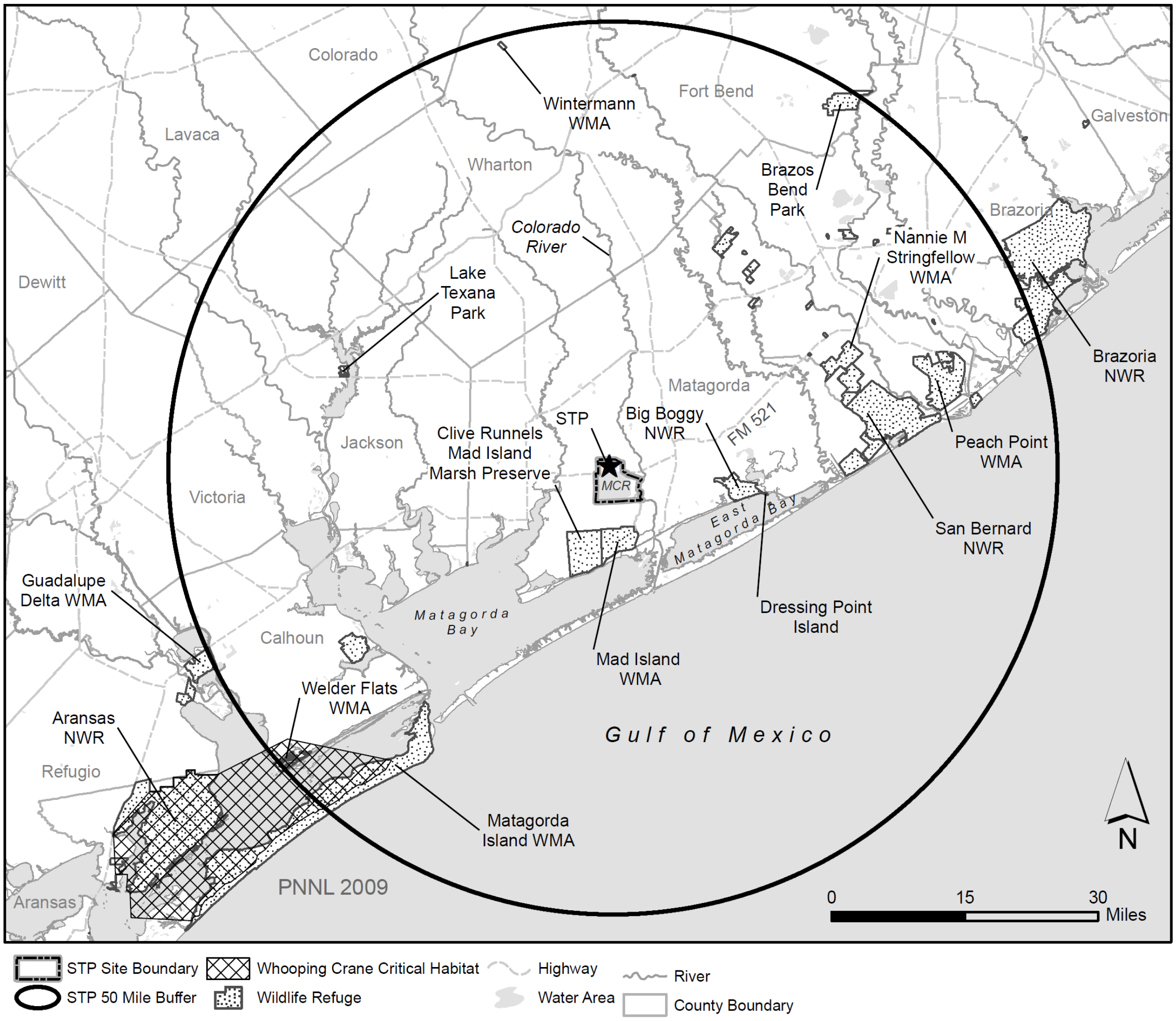

Figure 2-20. Locations of Wildlife Refuges and Critical Habitat Within 50 mi of the STP Site

the refuge is rare (TPWD 2003). The whooping crane has not been observed on the STP site and is not likely to use the inland habitats found onsite. These birds may migrate through the Central Flyway (as described below) and fly over the STP site, but are unlikely to reside at the STP site or to use agricultural lands found in the STP-Hillje transmission corridor.

Northern Aplomodo Falcon — The northern Aplomado falcon has been observed within 10 mi of the STP site, but has not been found on the STP site. A recovering population of the Federally endangered northern Aplomado falcon is located on Matagorda Island, which is part of the Aransas National Wildlife Refuge Complex, but no known nest sites are located within the vicinity of STP. Several Aplomado falcons have been observed during CBC bird surveys on the Mad Island Marsh during the past several years (NAS 2009).

State-Listed Species

The TPWD is responsible for maintaining lists of rare species in Texas. Species listed as threatened and endangered by TPWD with the potential to occur in Matagorda and Wharton County are documented in Table 2-10.

TPWD identified protected species potentially occuring in Matagorda County and Wharton County, and several have been subject to loss of their specific habitats as humans settled the area and altered the natural landscape. The decline of the red wolf (*Canis rufus*) has been linked to changes in land use and the predominance of agricultural use in east Texas, which has reduced forested habitats and enhanced habitats for the coyote (*C. latrans*). Habitat loss and degradation resulted in a population overlap for these two species, and interbreeding between the two canine species has effectively resulted in the extirpation of the red wolf from Texas (Davis and Schmidly 1994). Likewise, habitat has declined for the ocelot (*Leopardus pardalis*), and ocelots are now limited to a few isolated areas in southern Texas (TPWD 2003), with none occurring near the STP site. The Louisiana black bear (*Ursus americanus luteolus*), one of 16 subspecies of American black bear, was once common in the forests of eastern Texas. However, this subspecies was presumed to be extirpated from this area by the 1940s, and a resident breeding population does not currently exist in eastern Texas (TPWD 2003). The Eskimo curlew (*Numenius borealis*), which used to commonly migrate through the Texas coastal plains in March and April, has also been a victim of overhunting and the conversion of open and coastal prairie habitats to agriculture. This species was once an abundant spring migrant across the Texas coastal prairie but may now be extinct (TPWD 2003). As a result of population declines and possible extirpation and extinction, the red wolf, ocelot, Louisiana black bear, and Eskimo curlew would not be expected to occur in the vicinity of the STP site or associated transmission lines.

The bald eagle, brown pelican, wood stork, white-faced ibis, reddish egret (*Egretta rufescens*), sooty tern (*Sterna fuscata*), peregrine falcon (*Falco peregrinus*), and white-tailed hawk (*Buteo albicaudatus)* are listed by the State of Texas and are known to occur in the region. With the exception of the sooty tern and the wood stork, these species have all been observed on the STP site during recent winter CBC efforts or during site surveys. Bald eagles are present year-round throughout Texas as spring and fall migrants, breeders, or winter residents. Breeding populations occur primarily in the eastern half of the State and along coastal counties from Rockport to Houston (TPWD 2003). The bald eagle occurs on the STP site, and an active bald eagle nest is located near its eastern boundary in remote woodlands near the Colorado River. This nest site was first reported in 2004 (STPNOC 2010a, 2008b). A second bald eagle nest is located within 6 mi of the STP site (Texas Natural Diversity Database 2009).

Table 2-10. State-Listed Species Occurring or Potentially Occurring in the Region of the STP Site and the STP-to-Hillje Transmission Corridor

Common Name	Scientific Name	State Status	Matagorda County	Wharton County
Birds				
Bald eagle	*Haliaeetus leucocephalus*	T	Y	Y
Brown pelican	*Pelecanus occidentalis*	E	Y	
Eskimo curlew	*Numenius borealis*	E	Y	Y
Peregrine falcon	*Falco peregrinus*	T	Y	Y
Reddish egret	*Egretta rufescens*	T	Y	
Sooty tern	*Sterna fuscata*	T	Y	
White-faced ibis	*Plegadis chihi*	T	Y	Y
White-tailed hawk	*Buteo albicaudatus*	T	Y	Y
Wood stork	*Mycteria americana*	T	Y	Y
Interior least tern	(*Sternula antillarum athalassos*)	E		Y
Attwater's prairie chicken	*(Tympanuchus cupido attwateri)*			Y
Mammals				
Louisiana black bear	*Ursus americanus luteolus*	T	Y	
Ocelot	*Leopardus pardalis*	E	Y	
Red wolf	*Canis rufus*	E	Y	
Reptiles				
Smooth green snake	*Liochlorophis vernalis*	T	Y	
Texas horned lizard	*Phrynosoma cornutum*	T	Y	Y
Texas scarlet snake	*Cemophora coccinea lineri*	T	Y	
Texas tortoise	*Gopherus berlandieri*	T	Y	
Timber/canebrake rattlesnake	*Crotalus horridus*	T	Y	Y
Plants[(a)]				
Coastal gay-feather	*Liatris bracteata*			
Threeflower broomweed	*Thurovia triflora*			

Source: TPWD 2008a
(a) The plant species included in this table are species of concern in the state of Texas that were identified as being of interest by the TPWD (STPNOC 2008f).
DL= delisted, E= endangered, T = threatened, Y= yes or present.

Brown pelicans, also called American brown pelican or common pelican, are listed as an endangered species by the State of Texas. This species inhabits the Atlantic, Pacific, and Gulf Coasts of North and South America and is found on the Gulf Coast of Florida, Alabama, Louisiana, Texas, Mississippi, and Mexico. Since the 1960s, the brown pelican has made a gradual comeback in Texas from fewer than 10 breeding pairs to an estimated 4097 breeding pairs in 2005 in 12 colonies (73 FR 9408). Most of the breeding pairs in Texas occur on Pelican Island in Corpus Christi Bay, Nueces County, and Sundown Island near Port O'Connor in Matagorda County. Smaller colonies occasionally nest on Bird Island in Matagorda Bay, on Dressing Point Island in East Matagorda Bay, and on islands in Aransas Bay (TPWD 2003). A breeding colony also exists on Little Pelican Island in Galveston Bay (Glass and Roach 1997).

Brown pelicans inhabit warm coastal marine and estuarine environments of the Gulf of Mexico (Cornell 2009b) and are rarely found residing in inland habitats. Brown pelicans typically forage in shallow waters within 12 mi of nesting sites during breeding, and rarely venture more than 45 mi offshore. Brown pelicans nest on small, isolated coastal islands in Texas where they are safe from predators. Their diet consists almost entirely of fish and is primarily menhaden (*Brevoortia tyrannus*) and mullets (TPWD 2003). The brown pelican has been observed at the MCR and the Lower Colorado River, and may use water bodies on the site for resting, foraging, and drinking. Brown pelicans nest within Matagorda Bay and the GIWW, which is relatively close to the site (within 10 mi).

Wood storks historically were observed in the emergent wetlands and bottomland forest wetlands on STP (NRC 1975) but would not be likely to use the scrub-shrub and grassland habitats that exist within the disturbance footprint. Nesting of wood storks has been restricted to Florida, Georgia, and South Carolina; however, they may have formerly bred in most of the southeastern United States and Texas. A second distinct, non-endangered population of wood storks breeds from Mexico to northern Argentina. Storks from both populations move northward after breeding, with birds from the Mexico region moving up into Texas and Louisiana and as far north as Arkansas and Tennessee along the Mississippi River Valley (FWS 2009c).

The white-faced ibis and the reddish egret are both wading birds that frequent marshes and ponds and are likely to use the managed prairie wetland habitat found on the STP site. The white-faced ibis seems to prefer freshwater marshes, where it can find insects, newts, leeches, earthworms, snails, and especially crayfish, frogs, and fish (TPWD 2009d). Reddish egrets use their long, spear-like bills to stab their prey, which most often consists of small fish, frogs, tadpoles, and crustaceans in salt and brackish water wetlands (TPWD 2009e). The white-tailed hawk could potentially use a variety of the habitats found on the STP site for hunting and resting. No known nesting sites were found during recent ecological surveys of the proposed plant site and facilities.

Peregrine falcons have a wide and diverse distribution and the Texas Gulf coast is the spring staging area for peregrine falcon migration in the Western hemisphere. The peregrine falcon may also use a variety of habitats found on the STP site for hunting and perching. Fifteen peregrine falcons were noted in the total Mad Island Marsh CBC, but no known nesting sites were found during recent ecological surveys of the STP site (STPNOC 2010a) or recorded in TPWD databases (Texas Natural Diversity Database 2009). The coastline plays an important role in the survival of migrating peregrines. Birds take advantage of abundant prey along the open coastline and tidal flats to accumulate stores of fat (TPWD 2003). In Texas, the American peregrine is found primarily in the Trans-Pecos Region; the Arctic peregrine nests in Alaska, Canada, and Greenland, and migrates through Texas to South America for winter (TPWD 2003).

The sooty tern is a pelagic species that is found across tropical oceans. In eastern North America, this species nests on islands on islands in the Gulf of Mexico from Texas to Louisiana (NatureServe Explorer 2009a). This species is not likely to use or occur in the habitats found on the STP site. The sooty tern has not been observed during CBC surveys or any ecological surveys of the STP site and vicinity.

Of the State-listed reptiles that could occur on the STP site, the most likely to be found in the available habitats would be the smooth green snake (*Liochlorophis vernalis*), the Texas scarlet snake (*Cemophora coccinea lineri*), and the Texas tortoise (*Gopherus berlandieri*). The smooth green snake prefers coastal short-grass prairie habitats. The Texas scarlet snake prefers sandy soils and occurs in scrub-shrub and mixed hardwoods (ENSR 2007b). The Texas tortoise prefers scrub and grassland habitats. None of these species were encountered in surveys of the proposed project areas, and the TPWD database has no known locations for these species within the vicinity of the site (Texas Natural Diversity Database 2009).

The Texas horned lizard (*Phrynosoma cornutum*) prefers open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush, or scrubby trees. The timber rattlesnake (*Crotalus horridus*) could potentially use a variety of habitats on the site including flood plains, deciduous woodlands, and swamps where dense ground cover occurs. Neither of these species was encountered in any biological surveys of the proposed project areas, and the TPWD database has no known locations for these species within the vicinity of the site (Texas Natural Diversity Database 2009).

Two plant species of concern were identified by the TPWD with the potential to occur on or near the STP site: coastal gay-feather (*Liatris bracteata*) and threeflower snakeweed (*Thurovia triflora*), which are both endemic species to the coastal prairies in south Texas. These two species occur on the nearby Clive Runnells Family Mad Island Marsh Preserve (TPWD 2007). These plant species occur within coast prairie grasslands, in sparsely vegetated spots with clayey to silty soils (NatureServe Explorer 2009b). Neither of these plant species was found during biological surveys of the proposed project area. Coastal gay-feather does occur within 6 mi of the STP site (Texas Natural Diversity Database 2009).

Ecologically Important Species and Habitats

Ecologically important species and habitats in the vicinity of the STP site include several important refuges and preserves listed below and those wetlands on the STP site that provide significant habitat for flora and fauna. Wetlands that would be expected to provide important habitat onsite include the Texas Prairie Wetland Project, the emergent wetlands associated with Kelly Lake, and the wetlands found adjacent to the dredge spoils disposal area. Other smaller wetland areas on the site also provide limited habitat for a variety of wildlife.

The Texas Prairie Wetland Project in the northeast portion of the STP site is approximately 200 yards from the new switchyard site. Here, water impoundments are managed to create foraging habitat for wintering waterfowl, wading birds, and shorebirds. These impoundments are included as a viewing stop on the Great Texas Coastal Birding Trail that spans the entire Texas Gulf (TPWD 2009b).

The STP site lies within the Central Flyway migration route—a major migratory corridor for neotropical migrants and other birds. Thousands of migrating birds, especially waterfowl, fly south from cooler regions of the North American continent and visit or winter in this coastal area (STPNOC 2009a). This region of Texas is also an important stopover point for other migratory species traveling to or from Central and South America as part of the trans-Gulf migration. Crossing the Gulf of Mexico is a dangerous and energetically expensive phase of the migration process, requiring a long, non-stop flight (Simons et al. 2004) and making it a limiting factor for some bird populations. Resting and foraging areas near the Gulf Coast are critical to ensure that trans-Gulf migratory birds can continue their migration after recovering.

In addition to lying within the Central Flyway migration route, the region around STP contains three important wildlife areas. The Mad Island WMA (managed by TPWD) is approximately 3 mi due south of the STP site and was established to preserve coastal wetland habitat for wintering waterfowl. This 7200-ac management area consists of fresh to brackish marshes with sparse brush and flat coastal prairie (STPNOC 2010a). The area provides beneficial habitat for many wildlife species including sandhill cranes (*Grus canadensis*), bobcats, gray fox, raccoon, river otter (*Lontra canadensis*), mink (*Neovison vison*), armadillo, rabbits, and numerous other species. Hunting is allowed for feral hogs, alligators, and waterfowl through special permits (TPWD 2008b).

The 7063-ac Clive Runnells Family Mad Island Marsh Preserve is approximately 4 mi southwest of the STP site and contains both upland prairie and a variety of coastal wetlands (STPNOC 2010a). The preserve, owned and operated by The Nature Conservancy, is actively managed to enhance rice fields and wetlands for resident and migratory waterbirds. Nearly 250 species of birds—including migrating and resident songbirds, shorebirds, colonial nesting birds, and wading birds—use the area for feeding, resting and roosting.

The Big Boggy National Wildlife Refuge borders Matagorda Bay approximately 9 mi southeast of the STP site. It consists of more than 4500 ac of rice fields, managed impoundments, and salt marsh habitat, and was established to preserve habitat for neotropical migrating birds in the fall and spring, wintering waterfowl, and other bird life (STPNOC 2010a; FWS 2009d). Within the refuge, Dressing Point Island is an important bird rookery for many species of waterbirds, including the State-listed brown pelican.

Commercially and Recreationally Valuable Species

Commercially and recreationally valuable terrestrial species found at STP include game species, such as white-tailed deer, feral pigs, rabbits, gray squirrel, northern bobwhite quail, mourning dove, and numerous species of waterfowl (ENSR 2008a). Of these, deer, waterfowl, and mourning doves are considered common on the STP site (ENSR 2008a). Mourning doves likely use a variety of habitats at STP including croplands and pastures, grasslands, and open hardwood forests. The birds feed on cereal grains, and grass and forb seeds on the ground (Cornell 2009a). White-tailed deer are also likely to use a variety of habitats at the STP site including grasslands, shrublands, and open forest, but require shrubs and woody vegetation for browse (TPWD 2008c). No hunting or trapping is allowed on the STP site, and no travel corridors for game species cross the STP site, with the exception that migratory waterfowl use the MCR and other site impoundments and wetlands during migration. The Texas Gulf Coast is one of the most important wintering and migration habitats in North America for continental populations of waterfowl, shorebirds, and other wetland-dependent migratory birds. Although no hunting is allowed on the STP site, contractors are sometimes hired by the applicant to remove feral pigs from the STP site and reduce the population to avoid damage to the soils on the reservoir embankment and destruction of habitats by the pigs (STPNOC 2010a).

Invasive Species and Pests

Although the STP site hosts such potential disease vectors as ticks and mosquitoes, no vector-borne diseases have been reported to STPNOC (STPNOC 2010a). Invasive plant species are found on the STP property—for example yaupon and McCartney rose (*Rosa multiflora*) commonly occur. Feral pigs can become a pest species on the STP site when their foraging and rooting activities damage soils and plants.

Important Terrestrial Species and Habitats— Transmission Lines

The proposed upgrade of the transmission system includes replacing some of the towers and replacing conductors along the 20-mi corridor that runs between the STP site and the Hillje Substation, located in the southwestern corner of Wharton County, just across the border from Matagorda County. The corridor is 400 ft wide and 20 mi long and terminates at the Hillje Substation. The majority of the land in the corridor (more than 95 percent) is currently used for agriculture and rangelands.

Federally and State-listed Species

No Federally listed species (Table 2-9) except the American alligator are known to occur within 2 mi of the 20-mi transmission corridor. Two important species, the coastal gay-feather (State species of concern) and the bald eagle (State threatened species) are known to occur within 2 mi of the corridor (Texas Natural Diversity Database 2009).

The interior least tern (*Sterna antillarum athalassos*) is listed by TPWD as occurring or potentially occurring in Wharton County, although the FWS does not include the interior least tern in their county listing for Wharton. The subspecies is Federally listed only when inland (more than 50 mi from a coastline) where it may nest along sand and gravel bars within braided streams (TPWD 2003). This species has not been observed on the STP site or during CBC surveys of the surrounding areas. Its occurrence is unknown in the vicinity of the transmission corridor.

The Attwater's prairie chicken (*Tympanuchus cupido attwateri*) is also listed by TPWD as occurring or potentially occurring in Wharton County, although the FWS does not include this species in their county listing for Wharton. Habitat loss and alteration are the primary reasons for population decline of the Attwater's prairie chicken in eastern Texas—in 2003, fewer than 60 birds remained in two fragments of habitat located in Galveston and Colorado Counties. This species has not been observed on the STP site or during CBC surveys of the surrounding areas. Disturbed habitats and agricultural or managed rangeland habitats found with the 20-mi corridor are not suitable habitat for this species, which requires tall prairie grasslands (TPWD 2003).

Ecologically Important Species and Habitats—Transmission Lines

The STP-to-Hillje transmission corridor lies within the Central Flyway migration route-- a major migratory corridor for neotropical migrants and other birds. Because the transmission corridor leaves the site and travels to the north, the southern end is less than 10 mi from the Mad Island WMA and the Clive Runnels Mad Island Marsh Preserve. The corridor does contain a small amount of wetland habitat (~9 ac) as identified by the National Wetland Inventory data for the corridor (FWS 2010). No areas designated by the FWS as a critical habitat for endangered or threatened species are crossed by any of the corridors leaving STP nor do they cross any State or Federal parks, wildlife refuges or preserves, or WMAs (STPNOC 2008a).

Commercially and Recreationally Important Species

Game species common to the region that are likely to use the lands traversed by the transmission line corridor include those species commonly found in agricultural lands like deer, rabbits, squirrels, mourning dove, and possibly bobwhite quail. Vegetation management activities employed to maintain the corridor are unlikely to disturb these animals for periods much longer than the duration of the activity and vegetation management could actually benefit game species by providing more open habitats (STPNOC 2010a).

2.4.1.4 Terrestrial Ecology Monitoring

STPNOC does not conduct any routine monitoring of the terrestrial resources on the site. Regulatory agencies have not required ecological monitoring of the STP site or its associated transmission corridors since the period of reservoir filling (mid 1980s) and there is no ongoing monitoring of terrestrial resources on the site. The proposed location of Units 3 and 4 consists primarily of previously developed lands (warehouses, parking lots, laydown yards, etc.), a mowed field, and a relatively open shrubland area dominated by sea myrtle and bluestem grasses (STPNOC 2010a). Several biological surveys were recently conducted by the applicant's contractor on the proposed plant area to identify the habitats and species present. Additional work has been done to map and delineate important wetlands and associated habitat on the site (Corps 2009b; ENSR 2008a; STPNOC 2008c). Pedestrian surveys of the proposed project areas found no threatened and endangered species or other important species occupying the area (STPNOC 2010a).

Transmission line corridors that originate at the STP site pass through forests, agricultural areas, and grasslands typical of the Texas coastal prairie. As described in Section 2.2.2, the transmission lines and three associated corridors are managed by four transmission service providers (STPNOC 2010a). Only a 20-mi section of the Hillje transmission line corridor would be disturbed by building activities related to replacing towers and upgrading the existing transmission lines. The transmission system associated with existing Units 1 and 2 is maintained by the American Electric Power (AEP) Texas Central Company (TCC), which maintains the corridor from STP to the Hillje Substation. Current transmission line corridor management involves mechanical, manual, and chemical methods to limit vegetation encroachment on transmission corridors. These vegetation management activities are intended to reduce safety hazards from tall vegetation and minimize any potential disruptions to power transmission. AEP has procedures in place to document transmission line mortalities of large birds, should they occur, and to deal with bird nests found in hazardous locations along the corridors (STPNOC 2010a, 2009g).

2.4.2 Aquatic Ecology

This section describes the aquatic environment and biota in the vicinity of the STP site and other areas likely to be affected by building, operating, or maintaining the proposed Units 3 and 4. The section describes the spatial and temporal distribution, abundance, and other structural and functional attributes of biotic assemblages on which the proposed action could have an impact and also identifies "important" or irreplaceable aquatic natural resources and the locations that might be affected by the proposed action.

2.4.2.1 Aquatic Resources of the Site and Vicinity

Approximately 57.5 percent of the 12,220 ac STP site is covered in water (STPNOC 2010a). The onsite aquatic communities occur in several sloughs, drainage areas, wetlands, Kelly Lake, the ECP for existing Units 1 and 2, and the MCR. Within the vicinity, the major aquatic communities occur in the Colorado River and Matagorda Bay.

Sloughs, Drainage Areas, Wetlands, and Kelly Lake

Little Robbins Slough is a stream that flows across the site, from the northwest corner, along the western edge of the MCR embankment, and then out the southwest corner. This water flow is critical to the function and structure of the marshes below the site (Mad Island WMA and Clive Runnells Family Mad Island Marsh Preserve) flowing into GIWW. The slough is the major source of freshwater to the marshes, and the marshes are a nursery for juvenile fish and shellfish. During the building of the MCR, the slough was altered extensively (up to 65 percent of the drainage area for the slough in the southern boundary of the site was removed) and channelized into its current configuration (NRC 1975). The aquatic community in Little Robbins Slough from below the southern boundary of the site to Matagorda Bay was evaluated from 1973-74, to establish a baseline for the evaluation of the system after it was built. The results of this study and the evaluation of potential impacts from building the MCR indicated that there would be as much as 24 percent reduction of the annual freshwater runoff into the marshes, leading to potentially significant displacement of freshwater species and reduction of the nursery for estuarine-dependent organisms (NRC 1975). However, as a result of seepage flow from the MCR into the slough, subsequent studies after the MCR was built and prior to operation estimated the total long-term average annual reduction of freshwater input into the marshes to be 6 percent. The reduction in flow of freshwater from the slough into the marshes and any subsequent changes in salinity or nutrient input were not expected to alter the structure and function of the upper marsh aquatic community (NRC 1986).

The site has numerous drainage areas, including constructed drainage ditches, which vary in water flow and volume that are tied to rain events. The Final Environmental Statements (FESs) for the construction and operation phases of Units 1 and 2 (NRC 1975, 1986) included a description of the aquatic community at a number of these areas around the site. The most common species listed include: grass shrimp (*Palaemonetes kadiakensis*; also known as Mississippi grass shrimp), crayfish (possibly of several genera), blue crab, red shiner (*Cyprinella lutrensis*), mosquitofish (*Gambusia affinis*), silverband shiner (*Notropis shumardi*), sailfin molly (*Poecilia latipinna*), green sunfish (*Lepomis cyanellus*), warmouth (*L. gulosus*), bluegill (*L. macrochirus*), white crappie (*Pomoxis annularis*), tidewater silverside (*Menidia peninsulae*), striped mullet (*Mugil cephalus*), and several species of killifish (Family Cyprinodontidae, likely *Lucania* spp. and *Fundulus* spp.). Aquatic invertebrates reported were primarily the early life stages of midges, beetles, mayflies, biting midges, dragonflies, and damselflies. The fish and invertebrates are common species along the Texas coastline, and most of them tend to be tolerant of salinity and water temperature fluctuations (NRC 1975, 1986; Thomas et al. 2007; Hassan-Williams and Bonner 2009; STPNOC 2010a).

In May 2007, ENSR conducted a rapid bioassessment of the MDC. At the time, the channel ran from the North Accession Road west across the proposed power block area for proposed Units 3 and 4, and then turned southwest, eventually joining Little Robbins Slough (Figure 2-12). The MDC flowed through mostly mowed and some undisturbed fields. Its banks were uniformly sloped, lined with riparian vegetation, but the vegetation did not form a canopy cover across the ditch. The water surface width, water depth, top bank width, and substrate type (silt/clay and silt/clay/gravel) varied along the length of the MDC. Water temperature was 29.7°C, and dissolved oxygen was 8.0 to 8.4 mg/L (aerobic conditions). There was no continual flow of water in the MDC; however, water depth increased during rain events, and water drained into Little Robbins Slough during high flows. Eleven fish taxa and three non-fish taxa were identified during the rapid bioassessment. The dominant fish species changed throughout the length of the MDC, with various sunfish species (largemouth bass [*Micropterus salmoides*], redear sunfish [*Lepomis microlophus*], pumpkinseed [*L. gibbosus*], and bluegill) being dominant closest to the North Accession Road, followed by sailfin mollies and sheepshead minnows (*Cyprinodon variegatus*). The mid section of the MDC was dominated by mosquitofish. Red eared slider (*Trachemys scripta elegans*), crayfish (several genera occur in the area, e.g., *Procambarus* spp.), and grass shrimp (also known as Mississippi grass shrimp) were also collected. All collections were conducted with seines, and no aquatic insect larvae were reported (ENSR 2007c; STPNOC 2010a).

The rapid bioassessment showed that the types of aquatic organisms found in the MDC are good indicators of long-term effects, broad habitat characteristics, and integrated ecosystem conditions. The types of aquatic organisms are ubiquitous in Texas coastal wetlands along the Gulf in Texas. Largemouth bass are top predators, which are known to inhabit a wide range of habitats and pioneer areas that have recently been desiccated (Barbour et al. 1999; ENSR 2007c). The other sunfish species are all insectivores and intermediately tolerant species (Barbour et al. 1999; ENSR 2007c). Mosquitofish feed on insects, zooplankton, and detritus, are often found in shallow coastal waters, and can tolerate a range of temperatures, salinities, and oxygen conditions (Ross 2001; ENSR 2007c). Sheepshead minnows are hardy species and capable of living in harsh environments (Barbour et al. 1999; ENSR 2007c). Sailfin mollies are omnivores and can survive in a range of salinities and low oxygen conditions (Barbour et al. 1999; ENSR 2007c). These fish likely move throughout the drainage systems onsite when flow conditions accommodate their movement.

Kelly Lake is located in the northeast edge of the MCR embankment, approximately 7300 yds from the location for Unit 3 (Figure 2-14) (STPNOC 2010a). The lake covers approximately 34 ac and is primarily fed by drainage areas but may also receive groundwater discharge (STPNOC 2010a). There have been no aquatic ecology surveys in this lake during the licensing of existing STP Units 1 and 2 or during the recent efforts to characterize the site (NRC 1975, 1986; STPNOC 2010a).

Essential Cooling Pond

The ECP is a small cooling pond (46 ac) and serves as the ultimate heat sink for existing Units 1 and 2. In 2002, a survey of the ECP found only two fish species in the waters: sailfin molly and sheepshead minnow. Both of these species have been found in Little Robbins Slough, the MDC, and Colorado River, but only the sheepshead minnow has been found in the MCR (ENSR 2007c, 2008b, c; STPNOC 2010a).

Main Cooling Reservoir

The MCR is a 7000-ac, man-made impoundment that is the normal heat sink for waste heat generated during operations of existing STP Units 1 and 2 (Figure 2-21). The reservoir is unlined, and the normal maximum operating level elevation is 49 ft above MSL (currently, the operating level for Units 1 and 2 is 47 ft) (STPNOC 2010a). The water level and quality (e.g., total dissolved solids) in the MCR is maintained by pumping water from the Colorado River through the RMPF. The RMPF is located on the west bank of the Lower Colorado River, and consists of a traveling screen intake structure, siltation basin, sharp-crested weir, and a 1200 cfs capacity pump station. Water from the river is pulled through a coarse trash rack and log guides and into traveling water screens (STPNOC 2010a). A handling and bypass system on the traveling screens can collect fish caught on the screens and return them via a sluice downstream to the river (STPNOC 2010a). Water that passes through the traveling screens goes into a siltation basin, across a sharp-crested weir and into the pumping station. The water is then pumped into the northeast corner of the MCR through two buried 108-in. diameter pipelines (STPNOC 2010a). From the southeast corner of the MCR, water can be discharged through a pipeline and a seven-port diffuser back into the Colorado River downstream of the RMPF (STPNOC 2010a). A diverse aquatic community does exist in the MCR, but the organisms are not available for harvest. There is no public access or use of the MCR. The Corps has determined that the MCR is not waters of the United States (Corps 2009a), and the Corps and TCEQ have stated that the MCR is not waters of the State (TCEQ 2007; STPNOC 2010a).

In the FES for construction of STP Units 1 and 2 (NRC 1975), the NRC staff predicted that the MCR would become populated with an aquatic community as fish and other aquatic organisms were entrained by pumping water from the Colorado River. The NRC staff stated that initially, the community would resemble that in a river and then evolve into a community more typical of other freshwater impoundments in Texas (NRC 1975). The first survey of the aquatic community in the MCR was a catch-and-release fishing tournament for employees only in 1994. The most commonly caught species were red drum (*Sciaenops ocellatus*) and catfish (undetermined species, most likely blue catfish [*Ictalurus furcatus*]). Other species that were landed included black drum (*Pogonias cromis*), common carp (*Cyprinus carpio carpio*), largemouth bass, longnose gar (*Lepisosteus osseus*), Atlantic croaker (*Micropogonias undulatus*), and southern flounder (*Paralichthys lethostigma*) (STPNOC 2010a).

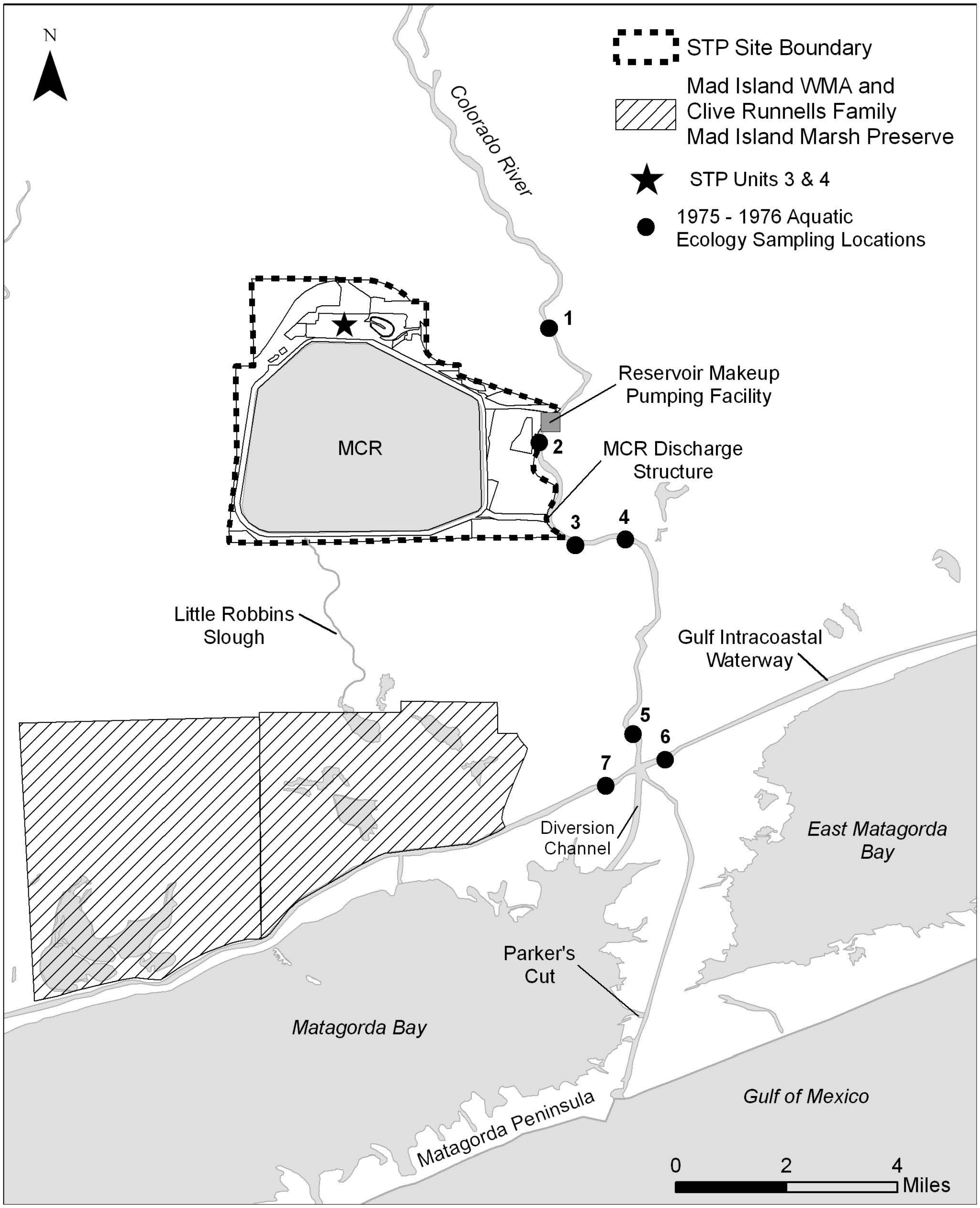

Figure 2-21. Location of STP with Respect to Important Aquatic Resources and the 1975-1976 Aquatic Ecology Sampling Locations

From May 2007 to April 2008, ENSR collected biological samples throughout the MCR and at the circulating water intake structure (CWIS) for existing Units 1 and 2 located within the MCR. The objective of the study was "to characterize the aquatic species within the MCR, and to evaluate impingement and entrainment impacts to establish, to the extent possible, relationships between the presence of aquatic organisms and the current (STP Units 1 and 2) intake design and operating parameters" (ENSR 2008b). To characterize the different aquatic zones and life stages of organisms found in the MCR, multiple types of sampling gear were used, including gill nets, trawls, beach seines, and plankton nets. Four sampling events took place over the year at five fixed locations within the MCR (ENSR 2008b) (Figure 2-21). Water temperature, salinity, and dissolved oxygen were recorded when samples were taken. At the CWIS, small mesh nets were used to sample impingement, and plankton nets were used to sample entrainment. Samples were collected over a 24-hour period, twice per month from May through September during the peak hot months of the summer, and once per month from October through April. The same water quality measurements were recorded during the CWIS sampling events (ENSR 2008b).

The results of the MCR sampling in 2007-2008 demonstrate that the prediction in the FES for construction (NRC 1986) for a diverse community of fish developing with time in the reservoir was mostly correct. A total of 11,605 finfish and invertebrates were collected over the duration of the sampling program for the MCR (Table 2-11). The most common fish species collected were with seines, and included threadfin shad (*Dorosoma petenense*, 62 percent), inland silverside (*Menidia beryllina*, 18 percent), rough silverside (*Membras martinica*, 12 percent), and blue catfish (3 percent). The macroinvertebrates were characterized using plankton tows, and a total of 5362 organisms were collected in the MCR. The most common species (84 percent of all samples) collected were Harris mud crab larvae (*Rhithropanopeus harrisii*), and more than 99 percent of all sampled organisms were crustaceans (ENSR 2008b). Thus, the robust aquatic community that has developed in the MCR resembles more the estuarine portion of the Colorado River rather than a freshwater impoundment.

During the sampling at the CWIS, very few fish species were impinged (<50 percent) or entrained (<1 percent). A total of 3982 organisms representing 25 fish species, 7 invertebrate species, and 1 reptile were collected during impingement sampling (Table 2-12). Impingement rates were highest during the winter and early spring months. The dominant species collected in the impingement samples were threadfin shad (42 percent), Harris mud crab (24 percent), blue crab (24 percent), Atlantic croaker (5 percent), and white shrimp (*Litopenaeus setiferus*, formerly known as *Penaeus setiferus*, 3 percent). A total of 207,696 organisms representing 9 different fish families and 12 different invertebrate classes were collected during entrainment sampling (Table 2-13). Entrainment rates were highest during the spring months. The dominant taxa collected in the entrainment samples were Harris mud crab (68 percent), unidentified decapods (15 percent), and harpacticoid copepods (6 percent). Less than 1 percent of the total composition of entrained organisms was fish eggs (ichthyoplankton) (ENSR 2008b).

Table 2-11. Fish and Shellfish Collected in the MCR by Gear Type, 2007-2008

Common Name	Scientific Name	Gill Net	Bag Seine	Trawl	Total
Finfish					
Atlantic croaker	*Micropogonias undulatus*	17		86	103
black drum	*Pogonias cromis*	26			26
blue catfish	*Ictalurus furcatus*	308	35	50	393
bluegill	*Lepomis macrochirus*		31		31
channel catfish	*Ictalurus punctatus*	3	21	6	30
common carp	*Cyprinus carpio carpio*	97		9	106
freshwater drum	*Aplodinotus grunniens*	7	3	39	49
gizzard shad	*Dorosoma cepedianum*		45	28	73
Gulf menhaden	*Brevoortia patronus*	4		1	5
inland silverside	*Menidia beryllina*		2068		2068
ladyfish	*Elops saurus*	36	1		37
gray (mangrove) snapper	*Lutjanus griseus*	2			2
naked goby	*Gobiosoma bosc*		3		3
needlefish	*Strongylura exilis*		1		1
pinfish	*Lagodon rhomboides*		3	1	4
red drum	*Sciaenops ocellatus*	1			1
rough silverside	*Membras martinica*		1362		1362
sheepshead minnow	*Cyprinodon variegatus*		4		4
smallmouth buffalo	*Ictiobus bubalus*	2			2
spotted gar	*Lepisosteus oculatus*		1	2	3
striped mullet	*Mugil cephalus*	1	41		42
threadfin shad	*Dorosoma petenense*		6463	768	7231
white mullet	*Mugil curema*		7		7
Invertebrates					
blue crab	*Callinectes sapidus*	11	2	6	19
rangia clam	*Rangia cuneata*			3	3
	Total	**515**	**10091**	**999**	**11605**

Source: ENSR 2008b

Table 2-12. Aquatic Species Collected during Impingement Sampling in the MCR's CWIS for Units 1 and 2, 2007-2008

Common Name	Scientific Name	Total Number
Finfish		
American eel	*Anguilla rostrata*	1
Atlantic croaker	*Micropogonias undulatus*	182
bay anchovy	*Anchoa mitchilli*	3
bay whiff	*Citharichthys spilopterus*	2
black drum	*Pogonias cromis*	2
blue catfish	*Ictalurus furcatus*	6
bluegill	*Lepomis macrochirus*	9
channel catfish	*Ictalurus punctatus*	4
common carp	*Cyprinus carpio carpio*	2
freshwater drum	*Aplodinotus grunniens*	5
freshwater goby	*Ctenogobius shufeldti*	2
gizzard shad	*Dorosoma cepedianum*	2
goby	*Gobiidae* spp.	8
Gulf menhaden	*Brevoortia patronus*	2
inland silverside	*Menidia beryllina*	5
ladyfish	*Elops saurus*	1
naked goby	*Gobiosoma bosc*	13
needlefish	*Strongylura exilis*	2
rough silverside	*Membras martinica*	2
sand seatrout	*Cynoscion arenarius*	3
sharptail goby	*Oligolepis acutipennis*	2
sheepshead	*Archosargus probatocephalus*	1
speckled worm eel	*Myrophis punctatus*	1
spot croaker	*Leiostomus xanthurus*	1
threadfin shad	*Dorosoma petenense*	1668
Invertebrates		
blue crab	*Callinectes sapidus*	944
brown shrimp	*Farfantepenaeus aztecus*	10
grass shrimp	*Paleemonetes pugio*	33
lesser blue crab	*Callinectes similis*	3
Harris mud crab	*Rhithropanopeus harrisii*	953
river shrimp	*Macrobrachium ohione*	3
white shrimp	*Litopenaeus setiferus*	106
Other		
flat-headed snake	*Tantilla gracilis*	1
	Total	**3982**

Source: ENSR 2008b

Table 2-13. Aquatic Species Collected During Entrainment Sampling in the MCR's CWIS for Units 1 and 2, 2007-2008

Common Name	Taxon	Total Number
Finfish		
anchovy	*Anchoa* spp.	30
clupeid	Clupeidae	544
fish egg		418
goby	Gobiidae	61
perch-like fish	Perciformes	6
naked goby	*Gobiosoma bosc*	5
needlefish	Belonidae	3
silversides	Atherinidae	201
wrasse	Labridae	3
Invertebrates		
amphipod	Amphipoda	145
bivalve	Mollusca	1
brachyuran decapod (zoea)	Brachyura	353
copepod	Copepoda	6588
decapod (mud crabs)	Panopeidae	10798
decapod (zoea)	Decapoda	31919
fish lice	Copepoda	399
harpacticoid copepod	Copepoda	12212
Harris mud crab	*Rhithropanopeus harrisii*	140192
insect	Insecta	24
midge	Diptera	110
mite or ticks	Acari	12
mysid shrimp	Mysida	2660
polychaete	Annelida	4
seed shrimp	Ostracoda	78
shrimp	Caridea	1
tongue biters	Isopoda	16
water flea	Cladocera	800
unidentified		113
	Total	**207,696**

Source: ENSR 2008b

Water quality sampling in the MCR showed that there were seasonal and spatial changes within the reservoir. Water temperature was the highest at the cooling water discharge area and gradually decreased by approximately 10°F as the water traveled through the internal levee system to the CWIS. The temperature through the water column did not vary much: 65.3°F to 96.1°F for surface measurements, and 65.1°F to 95°F for bottom measurements. Through the year, the temperature did vary, as temperature data from trawl samples increased from an average 86.4°F in May to 93.4°F in August and then decreased in October to 76.8°F and then to 70.5°F in February. Salinity remained constant throughout the reservoir and the water column, ranging from 1.6 to 1.7 ppt. Dissolved oxygen concentrations indicated that the MCR remained rather well oxygenated throughout the reservoir, in the water column, and throughout the year. Measurements for dissolved oxygen ranged from 4.6 mg/L to 13.9 mg/L and averaged 8.3 mg/L over the study period. The highest dissolved oxygen concentrations were during the month of May, and the lowest were during the month of August (ENSR 2008b).

Colorado River

The Colorado River is one of the largest river systems in Texas. The river is approximately 862 mi, extending from the high plains to the coastal marshes in Matagorda County (Figure 2-8). The segment of the river around STP, between Bay City and GIWW is a diverse, fluvial system that meanders through the coastal plain providing freshwater, sediments, and nutrients to Matagorda Bay (ENSR 2008c). Today, there is no direct connection between the Gulf of Mexico and the Colorado River. Aquatic resources associated with the Gulf of Mexico can move into and out of the Colorado River through the navigation channel (that connects the Gulf to the GIWW), the GIWW and a diversion channel to Matagorda Bay. The major shipping channels connect to the GIWW in the northeast through the Freeport Harbor Channel (Corps 2008) and in the southwest through the Matagorda Ship Channel (Corps 2007).

The flow of the Colorado River and the Gulf of Mexico has changed with development of the area since the 1920s. The course of the river prior to the 1920s flowed directly into Matagorda Bay. In the 1930s, a delta began to form in the mouth of the river and a channel was constructed through Matagorda Peninsula, shunting the river flows away from the bay directly into the Gulf of Mexico. Then in the 1950s, the Tiger Island Channel was constructed through the west side of the delta, re-establishing flow between the river and the bay. The Corps constructed a deeper river diversion channel northwest of the Tiger Island Channel in 1990. In 1991, two dams were constructed to divert the river flow, including one across the Tiger Island Channel (called the Tiger Island Cut dam, recently renamed to Parker's Cut) and a diversion dam across the river channel on Matagorda Peninsula. By July 1992, all of the Colorado River flow was diverted into Matagorda Bay, through the GIWW and the newly constructed diversion channel. The changes in freshwater inflow to Matagorda Bay over time, and the changes to flow from the Gulf of Mexico into the Colorado River have likely influenced the aquatic communities historically in the river and bay (Wilber and Bass 1998).

The Lower Colorado River has been evaluated on a limited basis with specific studies conducted in 1973-1974, 1975-1976, 1983-1984 associated with the licensing of existing STP Units 1 and 2 (NRC 1975, 1986). Baseline sampling in 1973-1974 for the construction FES was conducted during unusually heavy rainfall that changed the freshwater/saltwater makeup in the river around the proposed RMPF. Additional studies were performed in 1975-1976, prior to makeup water pumping, and in 1983-1984, during filling of the MCR. Below is a discussion of the findings of the surveys performed as part of the construction FES for phytoplankton (e.g., algae), zooplankton (e.g., copepods), macrozooplankton (e.g., larval stages of crustaceans), ichthyoplankton (e.g., fish eggs) and nekton (e.g., fish or other organisms living in the open water column) (STPNOC 2010a). Most of the sampling locations for the 1975-1976 are shown in Figure 2-21. The sampling locations in 1983-1984 were limited to the vicinity of the RMPF (NRC 1986).

Phytoplankton: In the summer of 1973, the Lower Colorado River and an adjacent stretch of GIWW were surveyed for phytoplankton. The phytoplankton community was dominated by diatoms and cyanobacteria (blue-green algae). A total of 524 taxa representing six major divisions were collected (NRC 1975). Diatoms were more numerous at the bottom-water samples, and cyanobacteria and dinoflagellates were predominant in the water column. The reviewers of the study noted that the phytoplankton results indicated a "relatively stable environment which allows development of a moderately diverse plankton flora" (STPNOC 2010a).

Zooplankton: Zooplankton was also surveyed during the 1973-1974 studies of the Lower Colorado River and GIWW. A total of 144 zooplankton species were collected, comprising of protozoans (65 species), rotifers (52 species), copepods (11 species), and cladocerans (6 species). The survey showed that the zooplankton community structure changed based on salinity, such that during periods of low river flow and strong incoming tides, species diversity increased at upstream stations. The study noted that estuarine species were likely carried further upstream than normal with the tidal pulse and were able to survive because of higher salinities (STPNOC 2010a).

Macrozooplankton: The area of the Lower Colorado River and GIWW was surveyed in 1975-1976 and 1983-1984 at stations 1 through 5 (Figure 2-21). Overall the results indicated that the abundance and occurrence of species in the macrozooplankton community were influenced by seasonal changes in the environment and with the movement of the saltwater up and down the river (salt wedge). Station 5, in the river near the GIWW, had the highest macroplankton densities, and the number of organisms decreased as samples were taken further up the river. In the 1975-1976 samples, both freshwater and estuarine-marine decapod larvae predominated the macrozooplankton community from May to September, and estuarine-marine decapods larvae dominated the community from October to December. The abundance and diversity of decapod larvae were lowest from January-April, where the copepod *Acartia tonsa* was most prevalent. In 1983, the most abundant zooplankton invertebrates were cladocerans, Malacostraca species, and copepods. But in 1984, the most abundant macrozooplankton invertebrates were immature stages of the Harris mud crab, ghost shrimp (*Callianassa* spp.), and jellyfish (Cnidaria) (NRC 1986).

The macrozooplankton community also included several species of commercial importance to the area, including early life stages of blue crab, white shrimp, and brown shrimp

(*Farfantepenaeus aztecus*, formerly known as *Penaeus aztecus*). Early life stages of pink shrimp (*Farfantepenaeus duorarum*, formerly known as *Penaeus duorarum*) were not reported and may have been included in the count of brown shrimp. The megalops stage of the blue crab was found at all stations but the density of the species decreased with the samples from further up the river. Postlarval white shrimp were found in all the samples but rarely occurred at stations 1-3, within the vicinity of STP intake and discharge structures. Postlarval brown shrimp were always found at station 5, near the GIWW, but the frequency of occurrence decreased in the samples from stations 1 and 2. The highest density of the early life stages of blue crab, white and brown shrimp was in the salt wedge at any sampling location. There was also a trend of higher density of early life stages of these crustaceans along the river banks as compared to the deeper river channel. In 1985-1986 survey study, the postlarval brown shrimp, all life stages of white shrimp, and megalops and juvenile stages of the blue crab were collected only sporadically and never in very high densities (NRC 1986).

In 1983-1984, the sediment basin in the RMPF was sampled. The predominant species in the sedimentation basin were postlarval stage of white shrimp, river shrimp, and Harris mud crab (NRC 1986).

Ichthyoplankton: Plankton tows were used to collect fish eggs at the five sampling stations on the Lower Colorado River from the GIWW to upstream of the RMPF. In 1975-1976, estuarine-marine species dominated throughout the sampling area, indicating that the results were influenced by an extended period of saltwater in the stations closest to the GIWW and a predominant salt wedge up the river. Densities of ichthyoplankton were highest from May-October 1975 and March-April 1976, and there was a positive trend between higher densities and increasing salinity. The sampling region in the river is considered an estuarine nursery ground for a number of commercially important species that were found during the survey: Gulf menhaden (*Brevoortia patronus*), Atlantic croaker, sand seatrout (*Cynoscion arenarius*), spotted seatrout (*C. nebulosus*), spot croaker (*Leiostomus xanthurus*, also called spot), sheepshead (*Archosargus probatocephalus*), pigfish (*Orthopristis chrysopterus*), black drum, red drum, and southern flounder. The most abundant ichthyoplankton species were Gulf menhaden, bay anchovy (*Anchoa mitchelli*), Atlantic croaker, and naked goby (*Gobiosoma bosc*). In early May and August, freshwater conditions were dominant, and the abundance of ichthyoplankton shifted to freshwater drum (*Aplodinotus grunniens*) and cyprinid species (NRC 1986).

The 1983-1984 survey found that the most abundant ichthyoplankton species were bay anchovy, darter goby (*Ctenogobius boleosoma*), and naked goby. These were the only species collected from station 2, next to the RMPF. The temporal and spatial tends of the dominant ichthyoplankton species of the post-pumping sampling were similar to the trends found during the 1975-1976 (NRC 1986).

Nekton: Seines and trawls were used for nekton sampling at all locations along the Lower Colorado River in 1975-1976, and only at station 2 in 1983-1984. The most abundant species in the earlier study were white shrimp, Gulf menhaden, bay anchovy, croaker, and mullet. All of these species except for menhaden decreased in abundance as the sampling progressed up the river. Many of the commercially important estuarine species (e.g., red drum and southern flounder) were only collected at station 5. The density of menhaden changed based on location and sampling gear, with highest densities at station 1 from trawl samples and at station 1 seine samples. Bay anchovy, an estuarine resident, was the second most abundant species at station 5. The invertebrate species were found at all locations during 1975-1976 sampling. At station 1, the most abundant invertebrate species changed based on gear type: brown shrimp were the most abundant in trawl samples, and blue crabs were the most abundant in seine samples. In 1983-1984, the number of invertebrates at station 2 decreased: five shrimp (river and white shrimp), two blue crabs, and a crayfish (NRC 1986). Brown, pink, and white shrimp are of commercial importance in the vicinity of the STP site (TPWD 2002; Corps 2007), and while various life stages of brown and white shrimp were collected in the 1975-1976 and 1983-1984 studies, pink shrimp were only reported once during those studies in the 1984 impingement samples in the Colorado River (NRC 1986).

A comprehensive aquatic survey of the Colorado River in the vicinity of the STP site was conducted by ENSR from June 2007 through May 2008 as part of the application process for the proposed Units 3 and 4 at STP (STPNOC 2010a). The goals of this study were to:

- Determine current species richness and relative abundances for fish and macroinvertebrates in the Lower Colorado River study area;
- Determine the current distribution of species associated with RMPF and the discharge facility;
- Compare current data to historical data to determine if the composition of aquatic organisms has changed considerably since the initial existing STP Units 1 and 2 licensing; and
- Document current salinity patterns in the Lower Colorado River (ENSR 2008c).

Figure 2-22 and Figure 2-23 show the study area associated with the 2007-2008 aquatic assessment consisted of an approximately 9-mi stretch of the Lower Colorado River extending from the GIWW north to the FM 521 bridge, which is approximately 1.5 mi east of the MCR (ENSR 2008c). The river stretch was divided into three reaches, each 3 mi in length, using the navigation mile markers (NMM) currently in place along the river. The reaches were identified as Segment A (from the GIWW to NMM 3), Segment B (from NMM 3 to NMM 6), and Segment C (from NMM 6 to NMM 9). Segment C included both the RMPF, located just upstream of NMM 8, and the MCR's discharge structure located just upstream of NMM 6. Sampling was conducted using gill nets, hoop nets, trawls, and bag seines to collect fish and invertebrate species within the different reaches of the river (ENSR 2008c).

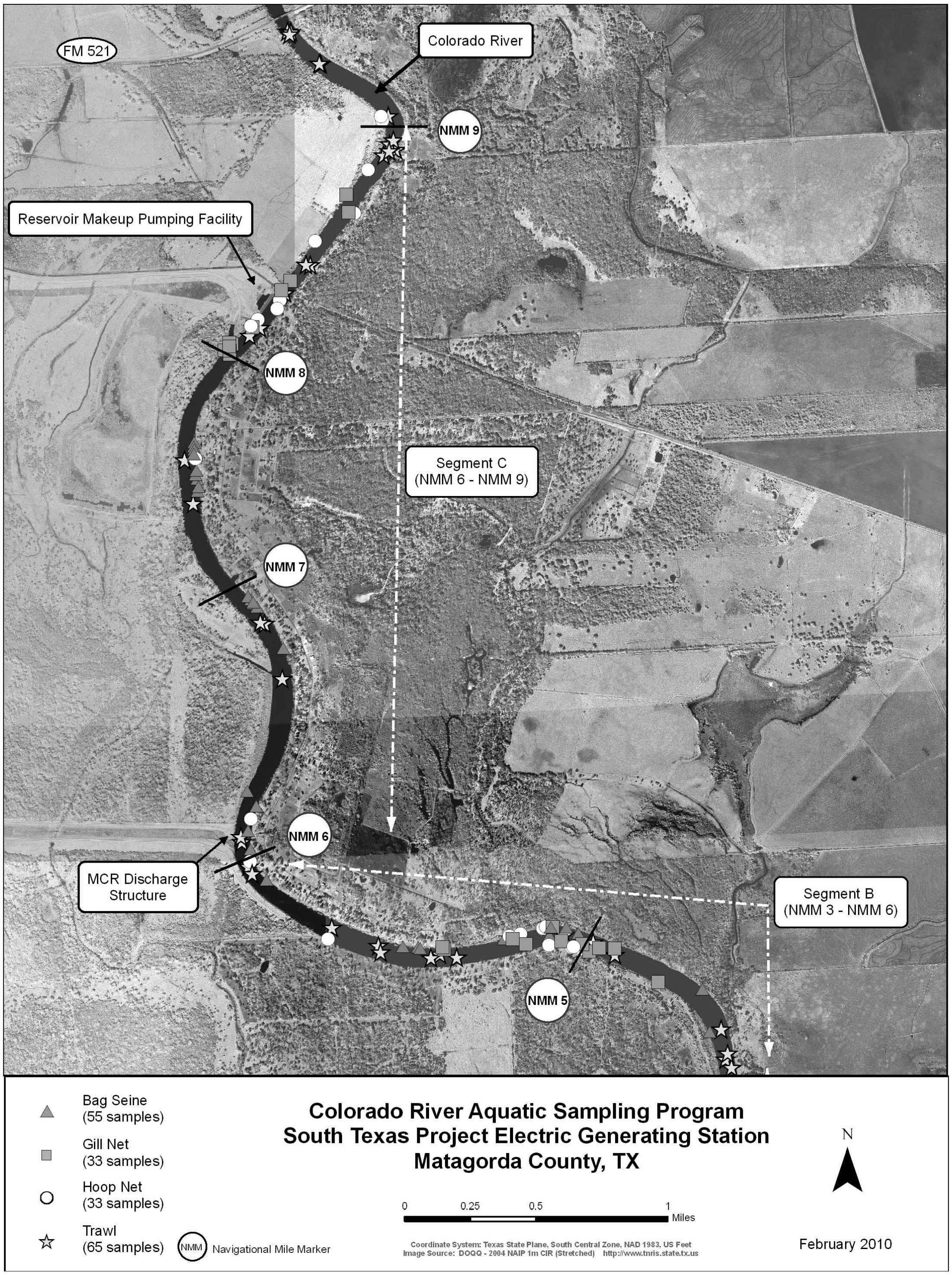

Figure 2-22. Aquatic Ecology Sampling Locations for 2007-2008, from NMM 5 to 9

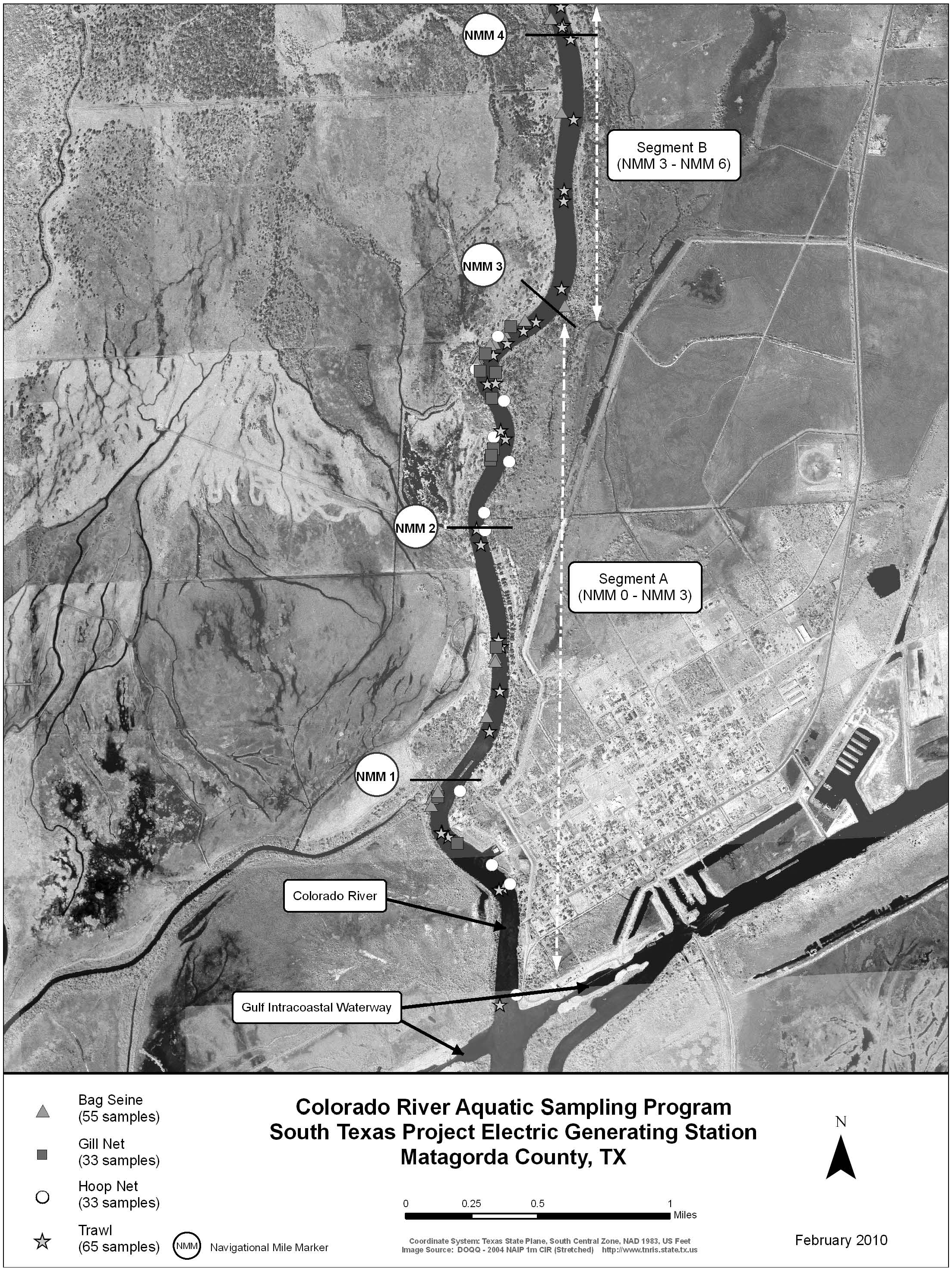

Figure 2-23. Aquatic Ecology Sampling Locations for 2007-2008, from GIWW to NMM 4

Hydrological data including salinity, dissolved oxygen, and temperature were collected during each sampling event in 2007-2008. In addition, hydrological data were collected at NMMs located at one-mi intervals on the river to help define where and how these attributes affect the species community within the river (ENSR 2008c).

Biological and environmental data were used to characterize spatial and temporal patterns of species richness and diversity, relative abundance, and fish and macroinvertebrate size relationships. Species richness, diversity, and relative abundance were estimated by gear type for the entire study area as well as within each river reach. Simpson's Index, Shannon-Wiener diversity indices, evenness, and the Jaccard coefficient of community similarity were analyses used to evaluate and characterize the aquatic community (ENSR 2008c).

A total of 186 samples were collected over the year-long assessment using four sampling gears (65 trawls, 55 seines, 33 gill nets, and 33 hoop nets) within the approximate 9-mi study area of the Lower Colorado River (Table 2-14). Catch rates for each of the gears were variable from month to month and some trends were evident based on the season. Percent composition of organisms collected by each gear during the study indicated that all gears were represented by more than 8 species (each comprising greater than 1 percent of the total catch), and species composition captured by each of the gears varied considerably among seasons. Species richness, diversity, and evenness by river segment and gear indicated that species collected with trawls and seines had greater species richness (44 total species versus 18-20 species collected in gill nets and hoop nets); however other diversity metrics were not considerably different among the sampling gears. Segment A (closest to the GIWW) had the highest value of species richness for all gears except hoop nets. Species diversity in trawl catches varied moderately among the three river segments, with both the Simpson's and Shannon-Wiener Index values indicate that Segment B had slightly higher diversity than Segments A and C (ENSR 2008c).

Hydrological data showed seasonal trends. Surface water temperatures ranged from 11.6°C in January to 31.0°C in August, and bottom water temperatures ranged from 11.1°C in January to 30.8°C in August. The difference in temperature from the surface to the bottom of the river was an average of 0.4°C throughout the study period, reflecting the general shallow depths in the system. Salinity changed by season, with lower salinities during winter and higher salinities during spring. Salinity readings at the surface were fairly stable ranging from 0.0 ppt to about 7 ppt, with the highest salinities occurring downstream, in Segment A, below NMM 2, and the lowest in Segment C, above NMM 8 (Figure 2-22 and Figure 2-23). Salinities at mid-water depths were the most variable of all three depths recorded. Throughout the year, the bottom salinities were generally highest, ranging from 0.0 ppt to a high of 25 ppt, with the lowest salinities reaching further upstream. Comparison of flow rates and catch rates for all four gears indicates an inverse relationship between flow rate and catch rate. Dissolved oxygen ranged from 5-12 mg/L, with the highest measurements at the surface compared to the bottom of the river. There were no strong relationships between catch rate and dissolved oxygen or salinity; however, bag seine catch rates had a slight positive trend with increasing salinity (ENSR 2008c).

Table 2-14. Fish and Shellfish Collected in the Colorado River by Gear Type, 2007-2008

Common Name	Scientific Name	Bag Seine	Gill Net	Hoop Net	Trawl	Total
alligator gar	*Atractosteus spatula*	2	2	13		17
Atlantic brief squid	*Lolliguncula brevis*	1			30	31
Atlantic croaker	*Micropogonias undulatus*	562	1		482	1045
Atlantic cutlassfish	*Trichiurus lepturus*				6	6
Atlantic seabob	*Xiphopenaeus kroyeri*				127	127
Atlantic spadefish	*Chaetodipterus faber*			3		3
Atlantic threadfin	*Polydactylus octonemus*				6	6
bay anchovy	*Anchoa mitchilli*	24			264	288
bay whiff	*Citharichthys spilopterus*	15			2	17
bayou killifish	*Fundulus pulvereus*	3				3
black drum	*Pogonias cromis*	1	1	1	1360	1363
blackcheek tonguefish	*Symphurus plagiusa*				3	3
blue catfish	*Ictalurus furcatus*	51	22	3	677	753
blue crab	*Callinectes sapidus*	190	2	3	77	272
bluegill	*Lepomis macrochirus*	3				3
brown shrimp	*Farfantepenaeus aztecus*	264			192	456
bull shark	*Carcharhinus leucas*		6			6
channel catfish	*Ictalurus punctatus*	22		2	6	30
cichlid	*Cichlasoma* spp.				16	16
crayfish	*Procambarus* sp.				1	1
crevalle jack	*Caranx hippos*	2				2
cyprinids	Cyprinidae	1				1
diamond killifish	*Adinia xenica*	11				11
flathead catfish	*Pylodictis olivaris*			2		2
freshwater goby	*Ctenogobius shufeldti*	9				9
gafftopsail catfish	*Bagre marinus*		9		183	192
gizzard shad	*Dorosoma cepedianum*	8		2	52	62
grass carp	*Ctenopharyngodon idella*		2	1		3
grass shrimp	*Palaemonetes pugio*	1762				1762
gray (mangrove) snapper	*Lutjanus griseus*				1	1

Table 2-14. (contd)

Common Name	Scientific Name	Bag Seine	Gill Net	Hoop Net	Trawl	Total
Gulf killifish	*Fundulus grandis*	15				15
Gulf menhaden	*Brevoortia patronus*	2960	5	2	1076	4043
hardhead catfish	*Ariopsis felis*		1	1	252	254
Harris mud crab	*Rhithropanopeus harrisii*				1	1
inland silverside	*Menidia beryllina*	6				6
killifish sp.	*Fundulus* sp.	5				5
ladyfish	*Elops saurus*		2		1	3
lesser blue crab	*Callinectes similis*	1			5	6
lined sole	*Achirus lineatus*				3	3
longnose gar	*Lepisosteus osseus*			1		1
mosquitofish	*Gambusia affinis*	1				1
naked goby	*Gobiosoma bosc*	3				3
pigfish	*Orthopristis chrysoptera*				1	1
pinfish	*Lagodon rhomboides*				11	11
rainwater killifish	*Lucania parva*	2				2
red drum	*Sciaenops ocellatus*	8	8	38	25	79
red eared slider	*Trachemys scripta elegans*			1		1
river shrimp	*Macrobrachium ohione*	10			5	15
rough silverside	*Membras martinica*	17				17
sailfin molly	*Poecilia latipinna*	150				150
sand seatrout	*Cynoscion arenarius*	22	5		294	321
sharptail goby	*Oligolepis acutipennis*	39				39
sheepshead	*Archosargus probatocephalus*	14	1	6	48	69
sheepshead minnow	*Cyprinodon variegatus*	79			7	86
shiner	*Notropsis* spp.	2				2
silver jenny	*Eucinostomus gula*				2	2
silver perch	*Bairdiella chrysoura*				350	350
smallmouth buffalo	*Ictiobus bubalus*		32	5		37
southern flounder	*Paralichthys lethostigma*	2	2	3	12	19
southern stingray	*Dasyatis americana*				1	1
spot croaker	*Leiostomus xanthurus*	88		1	156	245
spotfin mojarra	*Eucinostomus argenteus*	3			5	8
spotted gar	*Lepisosteus oculatus*	1	1	10	1	13

Table 2-14. (contd)

Common Name	Scientific Name	Bag Seine	Gill Net	Hoop Net	Trawl	Total
spotted seatrout	*Cynoscion nebulosus*		4		53	57
star drum	*Stellifer lanceolatus*				86	86
striped mullet	*Mugil cephalus*	1676		1	1	1678
threadfin shad	*Dorosoma petenense*	4			7	11
violet goby	*Gobioides broussonnetii*	2				2
white mullet	*Mugil curema*	181			2	183
white shrimp	*Litopenaeus setiferus*	584			2870	3454
	Total	**8806**	**106**	**99**	**8760**	**17771**

Source: ENSR 2008c

Changes in the aquatic community over time in the Colorado River were evaluated using the results of the 1974, 1983, 1984, and 2007-2008 studies. The sampling locations and gear types did vary with each study, making some comparisons more difficult. Trawl samples collected from the GIWW to the STP site in 1974 showed that there was a moderately diverse species community for the lower river based on measures for species richness, diversity, and evenness. All three measures were slightly lower than those in similar segments of the river compared to the 2007-2008 study, suggesting that the diversity of aquatic species is greater now than in the past. Data collected during 1974 examining specific segments also indicated a diverse community for all three segments. The 1983-1984 trawl and seine data indicated overall lower species richness, diversity, and evenness relative to the present data (ENSR 2008c). Rerouting of the Lower Colorado River (completed in 1992) has likely contributed to these changes in diversity of aquatic species.

The Jaccard coefficients of community similarity was used to determine similarities between the samples collected in similar reaches of the Lower Colorado River based on the presence or absence of taxa. For this measure, as the coefficient approaches 1.0, the more taxa in the two samples are the same; and for the converse, as the coefficient approaches 0, the samples have fewer taxa in common. In comparing applicable months and gears from the 2007-2008 data with samples collected during 1974, the Jaccard coefficient value was 0.44, indicating that the less than half of the aquatic species sampled in 1974 were the same as those found in 2007-2008. Comparison of applicable months from the 2007-2008 data to the 1983-1984 samples resulted in a coefficient value of 0.19, indicating that there was low similarity for these aquatic communities (ENSR 2008c). Comparison of data from river Segment C in 2008 with 1974 and 1983-1984 trawl data for a similar river segment resulted in values of 0.36 and 0.37, respectively, suggesting a moderate level of similarity between historical and present communities. Comparison of data for bag seine samples from applicable months during

2007-2008 with 1983-1984 seine data resulted in coefficient values of only 0.07 and 0.11, suggesting low similarity between historic and present day communities in shallow waters accessible to seines. When 2007-2008 bag seine data for Segment C was compared to 1983 to 1984 data from the same segment, Jaccard coefficient values increased to 0.31 and 0.33, suggesting moderate community similarity. Overall, present data indicate a more diverse faunal community than that represented by historic data in the Lower Colorado River (ENSR 2008c).

The number and assortment of organisms collected during this study indicate that this portion of the Lower Colorado River supports a diverse assemblage of fauna. The regular occurrence of both freshwater and saltwater species, the range of macroinvertebrate and finfish fauna, and the sheer number of species captured among various sampling gears and river reaches provide evidence of a dynamic ecosystem. There was low to moderate level of similarity between the current 2007-2008 faunal communities and the historic communities (1974 and 1983-84) (ENSR 2008c).

Matagorda Bay

Matagorda Bay is 300 mi^2 formed by a 45-mi-long barrier island-peninsula complex that is parallel to the Gulf of Mexico coast southeast of the STP site. The bay is connected to the waters on the site through the discharges of Little Robbins Slough into the marshes next to the GIWW, which then flows into the bay. As mentioned above, the Colorado River flows by STP then across the GIWW into a diversion channel into the bay. The bay is described as the Matagorda Bay system, and it is the third largest estuary on the Texas coast. The bay system includes Lavaca, East Matagorda, Keller, Carancahua, and Tres Palacios bays (Corps 2007).

The aquatic community of Matagorda Bay system includes organisms in the open water areas as well as organisms over hard substrates (including oyster reefs and offshore sands). In the open water areas of the bay, phytoplankton (e.g., algae) are the major primary producers that are the main food source for zooplankton (e.g., small crustaceans), fish and benthic organisms (e.g., mollusks). As discussed in a recent Corps EIS (2007), a study of Lavaca Bay by the FWS found that phytoplankton species composition changes based on the season, with maximum abundance occurring in the winter and minimum in the summer, and the most dominant organisms were diatoms. Zooplankton composition also changed seasonally, with the greatest abundance during the spring and smallest in the fall. The dominant species are the copepod, *Acartia tonsa* and the barnacle nauplii (swimming juvenile life-stage of barnacles). The same composition of phytoplankton and zooplankton are thought to be found throughout the Matagorda Bay estuary (Corps 2007).

The Matagorda Bay system supports a diverse population of aquatic organisms that are found in the open water column (nekton), including fish, shrimp, and crabs. The nekton assemblages consist mainly of secondary consumers feeding on zooplankton or juvenile and smaller organisms in the water column. Some of these species are resident species, spending their entire life in the bay, whereas other species may spend only a portion of their life cycle in the bay. According to a summary of studies on the nekton species in the Matagorda Bay estuary, the dominant nekton species inhabiting the Matagorda Bay estuary include the bay anchovy, Atlantic croaker, brown shrimp, pink shrimp, white shrimp, hardhead catfish (*Ariopsis felis*), sand seatrout, blue crab, and Gulf menhaden. All of these species are ubiquitous along the Texas coast and they are unaffected by seasonal or other short-term changes (e.g., salinity). The abundance of these species naturally changes with the season, with biomass and number usually being the smallest in the fall after Gulf-ward migrations. In the winter and early spring, newly spawned fish and shellfish begin migrating into the bay, with the maximum biomass observed during the summer months (Corps 2007). Many of these species have been collected in the Colorado River and some in the MCR at the STP site (NRC 1975, 1986; ENSR 2008b, c; STPNOC 2010a).

Areas of the Matagorda Bay estuary that are not considered open water include oyster reefs and offshore sands. The oyster reefs of Matagorda Bay are formed in areas where the substrate is hard and the current is strong enough to provide phytoplankton and nutrients to the oysters and carry sediment away from the organisms. The reefs are subtidal or intertidal and found near passes and cuts, and along the edges of marshes. The oyster reefs provide an ecological important function to the bay system by providing habitat to other benthic organisms and influencing water clarity and quality (oysters can filter water 1500 times the volume of their body per hour). While oysters can survive in salinities ranging from 5 to 40+ ppt, they thrive within a range of 10 to 25 ppt. The current distributions of oyster reefs in Matagorda Bay are not mapped, but the prominent locations (including commercial harvests) are in the vicinity of Lavaca Bay (Corps 2007). One of the goals of the diversion of the Colorado River into the bay is to increase mixture of freshwater in the estuary, and enhance locations of the bay for further reef development (Wilbur and Bass 1998).

The offshore sands of the Matagorda Bay system include areas of open sandy substrate as well as regions where seagrass or attached algae grow. Much of the diverse fauna in these areas is buried in the sand and the organisms rely on the phytoplankton for food. Sand dollars (*Mellita quinquiesperforata*) and several species of brittle stars (*Hemipholis elongata*, *Ophiolepis elegans*, and *Ophiothrix angulata*) are some of the most common species found in the shallow offshore sands. The bivalves in offshore sands include the blood ark (*Anadara ovalis*), incongruous ark (*A. brasiliana*), southern quahog (*Mercenaria campechiensis*), giant cockle (*Dinocardium robustum*), disk dosinia (*Dosinia discus*), pen shells (*Atrina serrata*), common egg cockle (*Laevicardium laevigatum*), crossbarred venus (*Chione cancellata*), tellins (*Tellina* spp.), and the tusk shell (*Dentalium texasianum*). The most common gastropods are moon snail (*Polinices duplicatus*), ear snail (*Sinum perspectivum*), Texas olive (*Oliva sayana*), Atlantic auger (*Terebra dislocata*), Sallé's auger (*Terebra salleana*, now known as *Hastula salleana*), scotch bonnet (*Phalium granulatum*), distorted triton (*Distorsio clathrata*), wentletraps (*Epitonium* sp.), and whelks (*Busycon* spp.). Crustaceans also inhabit the open sand areas, including white and brown shrimp, rock shrimp (*Sicyonia brevirostris*), blue crabs, mole crabs (*Albunea* spp.), speckled crab (*Arenaeus cribrarius*), box crab (*Calappa sulcata*), calico crab (*Hepatus epheliticus*), and pea crab (*Pinnotheres maculatus*). With respect to the number of individuals found in the open sands, the most abundant infaunal organisms are the polychaetes (Capitellidae, Orbiniidae, Magelonidae, and Paraonidae) (Corps 2007).

2.4.2.2 Aquatic Resources – Transmission Lines

Power generated from proposed Units 3 and 4 would be transmitted using existing transmission line corridors. Only a 20-mi section of the Hillje transmission line would be disturbed by building activities related to replacing towers and upgrading the existing transmission lines. The transmission corridors pass through forested, agricultural, and grass-lands typical of the Texas coastal prairie (STPNOC 2010a). The water bodies crossed by the transmission corridors include small rivers, small streams, agricultural ponds, drainage areas, and wetlands (NRC 1975). No aquatic surveys are known to have been conducted along these corridors. The staff's review of the terrain along the Hillje transmission line during a pre-application site visit did not indicate any notable aquatic features within that region of the corridor (NRC 2008a). Observed water bodies included wetlands and small ponds. Aquatic species in the water bodies along the transmission corridors are likely similar to those communities typically found along the coastal plain and are likely tolerant to temporary changes in water quality (STPNOC 2010a).

2.4.2.3 Important Aquatic Species and Habitats

This section discusses important aquatic species and habitats that could be affected by building, operating, and maintaining the proposed Units 3 and 4 and associated transmission lines. Although there are no designated critical habitats for aquatic species in the vicinity of the STP site and associated transmission lines, this section will discuss other important habitats for aquatic species.

Important Species

This section describes important species in the vicinity of the STP site and associated transmission lines that could be affected by the proposed actions (Table 2-15). Such species include commercially and recreationally important species, species with designated essential fish habitat (EFH), Federally and State-listed species, and ecologically important species that are essential to the maintenance or survival of the other species or critical to the structure and function of the riverine, estuarine, and marine ecosystems.

Table 2-15. Important Aquatic Species that May Occur in the Vicinity of STP Site

Common Name	Scientific Name	Type	Category
American eel	*Anguilla rostrata*	Fish	State-Rare
Atlantic croaker	*Micropogonias undulatus*	Fish	Commercial; Ecological
bay anchovy	*Anchoa mitchilli*	Fish	Commercial; Ecological
black drum	*Pogonias cromis*	Fish	Commercial; Recreational
blue catfish	*Ictalurus furcatus*	Fish	Commercial; Recreational
blue sucker	*Cycleptus elongates*	Fish	State-Threatened
bluegill	*Lepomis macrochirus*	Fish	Recreational; Ecological
channel catfish	*Ictalurus punctatus*	Fish	Commercial; Recreational
flathead catfish	*Pylodictis olivaris*	Fish	Recreational
gafftopsail catfish	*Bagre marinus*	Fish	Recreational
gray (mangrove) snapper	*Lutjanus griseus*	Fish	EFH
Gulf menhaden	*Brevoortia patronus*	Fish	Commercial; Ecological
hardhead catfish	*Ariopsis felis*	Fish	Recreational
inland silverside	*Menidia beryllina*	Fish	Ecological
king mackerel	*Scomberomorus cavalla*	Fish	Recreational; EFH
largemouth bass	*Micropterus salmoides*	Fish	Ecological
mosquitofish	*Gambusia affinis*	Fish	Ecological
red drum	*Sciaenops ocellatus*	Fish	Commercial; Recreational; EFH
rough silverside	*Membras martinica*	Fish	Ecological
sheepshead	*Archosargus probatocephalus*	Fish	Commercial; Recreational
smallmouth buffalo	*Ictiobus bubalus*	Fish	Recreational
smalltooth sawfish	*Pristis pectinata*	Fish	Federally & State-Endangered
Southern flounder	*Paralichthys lethostigma*	Fish	Commercial; Recreational
Spanish mackerel	*Scomberomorus maculatus*	Fish	Recreational; EFH
spotted seatrout	*Cynoscion nebulosus*	Fish	Commercial; Recreational
striped mullet	*Mugil cephalus*	Fish	Commercial; Ecological
threadfin shad	*Dorosoma petenense*	Fish	Ecological
blue crab	*Callinectes sapidus*	Invertebrate	Commercial; Ecological
brown shrimp	*Farfantepenaeus aztecus*	Invertebrate	Commercial; Ecological; EFH
Eastern oyster	*Crassostrea virginica*	Invertebrate	Commercial; Ecological
grass shrimp	*Paleamonetes pugio*	Invertebrate	Ecological
Gulf Coast clubtail	*Gomphus modestus*	Invertebrate	State-Rare
pink shrimp	*Farfantepenaeus duorarum*	Invertebrate	Commercial; EFH; Ecological
smooth pimpleback	*Quadrula houstonensis*	Invertebrate	State-Proposed Threatened
Texas fawnsfoot	*Truncilla macrodon*	Invertebrate	State-Proposed Threatened
Western Gulf stone crab	*Menippe adina*	Invertebrate	EFH
white shrimp	*Litopenaeus setiferus*	Invertebrate	Commercial; EFH

Table 2-15. (contd)

Common Name	Scientific Name	Type	Category
blue whale	*Balaenoptera musculus*	Mammal	Federally Endangered
finback whale	*Balaenoptera physalus*	Mammal	Federally Endangered
humpback whale	*Megaptera novaeangliae*	Mammal	Federally Endangered
sei whale	*Balaenoptera borealis*	Mammal	Federally Endangered
sperm whale	*Physeter macrocephalus*	Mammal	Federally Endangered
West Indian manatee	*Trichechus manatus*	Mammal	Federally & State-Endangered
hawksbill sea turtle	*Eretmochelys imbricata*	Reptile	Federally & State-Endangered
green sea turtle	*Chelonia mydas*	Reptile	Federally & State-Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Reptile	Federally & State-Endangered
leatherback sea turtle	*Dermochelys coriacea*	Reptile	Federally & State-Endangered
loggerhead sea turtle	*Caretta caretta*	Reptile	Federally & State-Endangered

Sources: NRC 1975; GMFMC 2004; LCRA 2006; Corps 2007; TPWD 2009a, b, h; NMFS 2009a; FWS 2009a

Commercial and Recreational Species

The important commercial fisheries in Matagorda Bay target shrimp (grass, brown, and white), Eastern oysters (*Crassostrea virginica*), blue crabs, and finfish. All of these species have been found in the Colorado River in the vicinity of the site and in the MCR, except for oysters. The marine and estuarine finfish include Gulf menhaden, striped mullet, bay anchovy, spotted seatrout, southern flounder, and Atlantic croaker, sheepshead, and red and black drum. Important freshwater species included blue catfish, channel catfish (*Ictalurus punctatus*), smallmouth buffalo (*Ictiobus bubalus*), and bluegill (NRC 1975; LCRA 2006; Corps 2007; ENSR 2008b, c; STPNOC 2010a).

The contribution of commercial catch from Matagorda Bay compared to all the harvest in the Texas bay systems varies based on the fishery. Matagorda Bay has one of the lowest percentages of the total finfish harvest of all Texas bay systems, which was less than 5 percent of the coast-wide landings from 1997 to 2001. Over the same time period, Matagorda Bay contributed more of the commercial catch of shellfish from the Texas bay systems: 24 percent of brown shrimp; 29 percent of white shrimp; and 13 percent of blue crabs. The contribution of eastern oysters commercially harvested in Texas is only about 5 percent from Matagorda Bay (Corps 2007).

TPWD's guide to fishing indicates that the following species are of recreational interest in the vicinity of STP site: catfish (blue, channel, flathead [*Pylodictis olivaris*], gafftopsail [*Bagre marinus*], hardhead), black and red drum, southern flounder, king mackerel (*Scomberomorus cavalla*), and Spanish mackerel (*S. maculatus*), spotted seatrout, and sheepshead (TPWD 2008a). All of these species have been found in the Colorado River in the vicinity of the site, except for the mackerel (NRC 1975; STPNOC 2010a; ENSR 2008b, c).

The following is a description of the life cycles of important recreational and commercial aquatic species (Table 2-15), included to facilitate understanding of how and when these species utilize estuarine habitat in the project area. The species that have designated EFH in the area are discussed further below, as well as in the EFH assessment in Appendix F.

Commercially and Recreationally Important Fish

Atlantic croaker. The Atlantic croaker is an inshore demersal fish found from the Gulf of Maine to Florida and throughout the Gulf of Mexico. During their life they move throughout the area: eggs are laid in the water column in the marine environment; as larvae, the croakers move into estuarine areas and become demersal; juveniles are demersal and move into tidal rivers and creeks, where they spend 6 to 8 months; adult croakers are demersal and move between estuarine and oceanic waters, and then they spawn in the nearshore of the Gulf in September to May. In the vicinity of Matagorda Bay, Atlantic croakers are considered highly abundant as juveniles, and abundant as adults, but other life stages are not found. The youngest croakers feed on zooplankton, but juveniles and adults are bottom feeders, consuming benthic worms, mollusks, and crustaceans. Adults may occasionally eat other fish. Striped bass (*Morone saxatillis*), southern flounder, blue catfish, red drum, sheepshead and spotted seatrout prey on Atlantic croakers (Patillo et al. 1997; Corps 2007; TPWD 2009m).

Texas has a valuable commercial fishery for Atlantic croakers, but not in the Matagorda Bay area (Corps 2007). They are commonly caught recreationally in the area, although croakers are not considered a popular game fish (Patillo et al. 1997). There are no limits for harvesting croakers in Texas (TPWD 2009o). Since these fish use marine, estuarine, and tidal rivers, they have often been collected during surveys of waters in and around the STP site. Atlantic croakers have been collected in Matagorda Bay (Corps 2007) and in the Colorado River during the 1975-1976 (NRC 1986) and 2007-2008 surveys (ENSR 2008c). This species was also collected in the MCR during the 1994 employee tournament (STPNOC 2010a) and in the 2007-2008 survey (ENSR 2008c).

Bay anchovy. Bay anchoy are rather small (4 in. maximum in length) schooling fish that may represent the greatest biomass of any fish in the estuarine waters along the Gulf Coast. They are a common foraging fish for other aquatic and terrestrial predators. Bay anchovy are pelagic, and occur throughout the water column over their life stages in estuarine and tidal river habitats. They are tolerant of poor water quality, and can be found in relatively anoxic conditions in pollution-stressed areas. Thus, shifts in population, where bay anchovy become the dominant species, can be an indicator of detoriating water quality. Eggs are most abundant at the surface of the water, while larvae, juveniles and adults are nektonic, freely swimming in the water. In Matagorda Bay, the adults and spawning adults are highly abundant, juveniles and larvae are abundant, and eggs are common. Spawning occurs in bays, estuaries, and tidal rivers in waters less than 20 ft deep during the spring and early summer along the Texas coast. Juveniles and adults feed primarily on zooplankton, small crustaceans, mollusks and other fish as well as detritus (Patillo et al. 1997; Hassan-Williams and Bonner 2009).

Bay anchovy are indirectly important to commercial and recreational fishing as a major food source for the game fish in the region (Corps 2007). This species was collected in the Colorado River during the 1975-1976 nekton samples (NRC 1986), the 1983-1984 ichthyoplankton samples (NRC 1986), and in the 2007-2008 bag seine and trawl samples (ENSR 2008c). In addition, bay anchovy have been found in the MCR and were collected during impingement studies of the MCR's CWIS (ENSR 2008b). They have also been collected in nekton samples in Matagorda Bay (Corps 2007).

Black drum. Black drum are common demersal fish species found from the Chesapeake Bay to Florida, and throughout the Gulf of Mexico. The species is estuarine-dependent and found throughout Matagorda Bay and in the tidal rivers. Eggs are pelagic and buoyant, and the larvae stay in the water column and are pushed by the tides into estuaries and tidal rivers. Juveniles prefer shallow, nutrient rich, turbid waters such as in the tidal rivers of the region. Adults often move in large schools, searching for food in estuaries and bays. Spawning occurs primarily in nearshore water and estuaries. All life stages are common in Matagorda Bay. Black drum feed on benthic organisms, and adults particularly feed on oysters (Patillo et al. 1997).

Black drum are harvested commercially in Matagorda Bay, and are also an important seasonal recreational species in the region (Patillo et al. 1997). There are no bag or possession limits for the commercial harvest of black drum; however, they must be from 14 to 30 in. long (TPWD 2009o). The recreational bag limit for black drum is five fish per day between 14 and 30 in. long. However, one fish over 52 in. may be retained per day as part of the bag limit (TPWD 2009p). Black drum have been collected in the Colorado River during the 1975-1976 ichthyoplankton samples (NRC 1986) and mostly in the 2007-2008 trawl samples (ENSR 2008c). This species was also collected in the MCR during the 1994 employee tournament (STPNOC 2010a), during 2007-2008 gill sampling around the MCR as well as in impingement samples of the MCR's CWIS (ENSR 2008b).

Bluegill. The bluegill is a native fish throughout Texas and across the eastern United States, and it is commonly introduced to areas for recreational purposes. In Texas, they are found in lakes and ponds, and while they prefer slow-moving water (e.g., streams and rivers). Younger fish generally utilize areas where there is cover (e.g., woody debris) while adults seek more open waters. Bluegill are nest builders, and spawning occurs from April through September. Bluegill feed primarily on insects, crustaceans, and fish but may also consume some plant material (Hassan-Williams and Bonner 2009; TPWD 2009m).

Bluegills are a recreationally important species, but there are no limits for their collection (TPWD 2009l). The species has been collected onsite in the MDC (ENSR 2007c;

STPNOC 2010a), as well as in the MCR survey and during impingement studies of the MCR's CWIS (ENSR 2008b). Bluegill were also collected in the Colorado River during the 2007-2008 sampling (ENSR 2008c).

Catfish. There are five catfish species that have been collected on and around the STP site: blue, channel, flathead, gafftopsail and hardhead catfish. Blue and channel catfish are commercially and recreationally important fish in the Colorado River, flathead and hardhead catfish are recreationally important, and gafftopsail catfish are commercially important species in Texas. There are commercial bag and possession limits for blue and channel catfish, and while there are no such limits for gafftopsail catfish, the three catfish species must be greater than 14 in. for commercial harvest. There are recreational bag and minimum length limits for blue, channel and flathead catfish, but there are no posted limits for hardhead catfish (TPWD 2009l, o). All of these species are top predators in the food chain; however, they differ in their tolerance of salinity. Blue, flathead, and hardhead catfish are found in freshwater, estuarine and marine waters; channel catfish prefer freshwater; and gafftopsail catfish prefer estuarine and marine waters. Hardhead catfish are the smallest of the five species with a maximum length of 19 in.; gafftopsail, blue, channel, and flathead catfish can grow to 34, 47, 50, and 55 in., respectively. The males of these species build nests, and spawning occurs in spring and summer as the water warms. All of the species are bottom dwellers, feeding on benthic crustaceans, mollusks, and other invertebrates, as well as small fish. As adults, the gafftopsail catfish differ in that they only consume other fish (Corps 2007; Hassan-Williams and Bonner 2009; TPWD 2009m).

Blue catfish were collected in the Colorado River during the 2007-2008 sampling, predominantly in the trawl samples (ENSR 2008c), and they were also collected in the MCR during the 1994 employee tournament (STPNOC 2010a), in the 2007-2008 samples throughout the MCR as well as in impingement samples at the MCR's CWIS (ENSR 2008b). Channel catfish were less common than blue catfish, but they were collected in the Colorado River during the 2007-2008 survey (ENSR 2008c) and in the MCR during the 2007-2008 samples throughout the MCR as well as in impingement samples at the MCR's CWIS (ENSR 2008b). Only two flathead catfish were collected in the Colorado River during 2007-2008 (ENSR 2008c). Gafftopsail were collected in the Colorado River during 2007-2008 (ENSR 2008c) and in open- water sampling of Matagorda Bay (Corps 2007). Hardhead catfish were collected in the Colorado River during 2007-2008 (ENSR 2008c) and in nekton samples in Matagorda Bay (Corps 2007).

Gulf menhaden. Gulf menhaden are only found in the Gulf of Mexico, typically in the estuarine and nearshore marine waters but the juveniles will often move up tidal rivers. They are an important link in the food chain between primary producers, phytoplankton and detritus, and top predators. Like bay anchovy, they are an important foraging fish for other aquatic and terrestrial predators. The species is migratory, moving in and out of estuaries over their lifetime. In Matagorda Bay, Gulf menhaden are highly abundant as adults and juveniles, but their other life stages are not present. Spawning has not been observed, but the species is thought to spawn offshore in marine waters from October through April. Larvae feed primarily on zooplankton. The fish lose their teeth as they metamorphose into juveniles, and they become omnivorous filter feeders consuming phytoplankton, zooplankton and detritus (Patillo et al. 1997; Hassan-Williams and Bonner 2009).

Gulf menhaden are commercially important fish in the Gulf of Mexico (Patillo et al. 1997), but they are not harvested in Matagorda Bay (Corps 2007). The species was collected in the Colorado River during the 1975-1976 ichthyoplankton and nekton samples (NRC 1986) and during the 2007-2008 survey, particularly in the bag seines (ENSR 2008c). Gulf menhaden were also collected during the 2007-2008 MCR survey as well as during impingement studies of the MCR's CWIS (ENSR 2008b). They were also one of the dominant species in nekton samples from Matagorda Bay (Corps 2007).

Sheepshead. Sheepshead spawn offshore during March and April. The species is a broadcast spawner, releasing eggs and sperm into the water column for fertilization in the coastal waters. Larvae are pelagic as they move into the seagrass beds of the estuary, where they remain as plankton for 30 to 40 days, then metamorphose into juveniles. As they mature into juveniles they become substrate-oriented, remaining in the seagrass beds. Adults are demersal in the nearshore waters. In Matagorda Bay, sheepshead are abundant as adults and juveniles, but their other life stages are not present. Larvae are carnivorous, and juveniles and adults are omnivorous (Patillo et al. 1997; Corps 2007).

Sheepshead are commercially harvested in Matagorda Bay (Corps 2007), and there are no bag or possession limits for harvesting, only that the fish must exceed 15 in. in length. Recreational catches are limited to five fish per day, and they must exceed 15 in. in length (TPWD 2009l, o). Sheepshead were collected in the Colorado River during the 1975-1976 ichthyoplankton samples (NRC 1986) and 2007-2008 survey (ENSR 2008c). They were also collected during impingement studies of the MCR's CWIS (ENSR 2008b). Sheepshead was also one of the dominant species in nekton samples from Matagorda Bay (Corps 2007).

Smallmouth buffalo. Smallmouth buffalo are primarily freshwater fish (Hassan-Williams and Bonner 2009), but they were collected in all segments of the Colorado River to the GIWW during the 2007-2008 survey (ENSR 2008c). They are found in streams along the U.S. east coast up to Pennsylvania, west to Montana, and south to Mexico. In Texas, they are found throughout the state with the exception of the Panhandle region. They are common in reservoirs and large streams with modest currents. Smallmouth buffalo are broad cast spawners over submerged aquatic vegetation (SAV), and they spawn from March through September. The species feeds primarily on the bottom, consuming insects, mollusks, zooplankton, periphyton and detritus (Hassan-Williams and Bonner 2009). Smallmouth buffalo are primarily recreationally important fish, although they are harvested for pet and livestock feed

(Hassan-Williams and Bonner 2009). The species was collected during the 2007-2008 surveys of the MCR and the Colorado River (ENSR 2008b, c).

Southern flounder. Southern flounder are in coastal habitats from North Carolina, through Florida and along the Gulf coast to northern Mexico. Spawning occurs offshore during the late fall and early winter. Eggs and sperm are randomly released into the water column for fertilization. After spawning, adults return to the estuaries and rivers. Larval flounder remain offshore in the plankton for 4 to 8 weeks. As they metamorphose into juveniles, currents carry the larvae into estuaries. Juvenile southern flounders begin migrating to up tidal rivers, where, according to some researchers, juvenile and young adults remain for the first 2 years (Patillo et al. 1997; Corps 2007; Hassan-Williams and Bonner 2009).

Southern flounder are commercially harvested in Matagorda Bay (Corps 2007) and are also recreationally important in the region. There are commercial bag and possession limits, recreational bag limits, and harvested fish must exceed 14 in. in length (TPWD 2009f, i). Southern flounder were collected in the Colorado River during the 1975-1976 ichthyoplankton and nekton samples (NRC 1986) as well as during the 2007-2008 survey (ENSR 2008c). The species was also collected in the MCR during the 1994 employee tournament (STPNOC 2010a) but was not collected in the 2007-2008 survey (ENSR 2008b).

Spotted seatrout. The spotted seatrout is an inshore demersal fish found from Massachusetts down to Florida and throughout the Gulf of Mexico to the Bay of Campeche, Mexico. They are most abundant from Florida to Texas. Eggs are either pelagic or demersal, depending on salinity. Larvae start out pelagic and become demersal after 4 to 7 days. Juveniles and adults remain demersal as they complete their life cycle, forming small schools, foraging in inshore waters. In Matagorda Bay, all of the life stages of spotted seatrout are common. The species is an opportunistic, visual carnivore that feeds in the upper portion of the water column and near the surface (Patillo et al. 1997).

Spotted seatrout have been a commercially important species in Texas, but declining populations resulted in a closure of the fishery. Currently there is no commercial harvesting of them in Matagorda Bay (Patillo et al. 1997; Corps 2007). The species is part of the recreational fishery within the vicinity of STP, and the regulations state that only 10 fish are allowed per day, each between 15 and 25 in. in length (TPWD 2009l). Spotted seatrout were collected in the Colorado River during the 1975-1976 ichthyoplankton samples (NRC 1986) and 2007-2008 survey of the river (ENSR 2008c). Spotted seatrout have also been collected in Matagorda Bay (Corps 2007).

Striped mullet. Striped mullet are found worldwide in warm, tropical, sub-tropical, and temperate waters. They are an important forage fish for other aquatic and terrestrial predators. The species is a broadcast spawner, releasing eggs and sperm into the water column for fertilization in the coastal waters. The eggs and larvae remain offshore where they develop into prejuveniles, and then enter the bays and estuaries to mature. In Matagorda Bay, all life stages of the striped mullet are abundant. Larvae are carnivorous, consuming planktonic material. Their diet changes from omnivores to herbivores as they develop as juveniles, and adults remain predominantly herbivores (Patillo et al. 1997; Corps 2007).

Striped mullet are harvested commercially in Matagorda Bay, and are also recreationally important in the vicinity of STP (Corps 2007). There are no commercial or recreational limits for catching striped mullet however, from October through January fish may only be collected if they are less than 12 in. in length (TPWD 2009l, o). Stripped mullet have been collected in onsite drainages (NRC 1975; STPNOC 2010a) as well as in the MCR (ENSR 2008b). The species was also collected in the Colorado River during the 1975-1976 nekton samples (NRC 1986) and in the 2007-2008 survey (ENSR 2008c).

<u>Commercially and Recreationally Important Shellfish</u>

Blue crab. Blue crabs are crustaceans (decapods) and are abundant throughout the Gulf of Mexico. During their life stages, they are found in various regions of the coastal waters. After female blue crabs mate, they migrate to higher salinity areas of the estuary (near tidal inlets or just offshore) where they lay their eggs. The female carries the eggs attached to the underside of her abdomen for about 2 weeks. Just prior to the eggs hatching, females move seaward and the eggs hatch offshore. Blue crab larvae pass through several larval stages in the marine plankton before moving back into the estuary with the surface plankton. Female blue crabs occur in the bays year round, but their population peaks in June and July. Male blue crabs remain in the lower salinity portions of the bays throughout their life. In Matagorda Bay, adults, spawning adults, and juvenile crabs are common, and the larvae are highly abundant. Larval crabs likely feed on plankton and zooplankton, whereas juveniles and adults are omnivores, scavengers, detritivores, predators, and cannibals that feed on a variety of plant and animal matter (Patillo et al. 1997; Corps 2007).

Blue crabs are commercially important shellfish in Matagorda Bay, and while there are no bag or possession limits there are regulations on the size, number of traps that can be placed, and time of year for harvesting the crabs. The species is also important recreationally, and the regulations are similar to commercial harvesting (TPWD 2009f, i). Blue crabs were collected onsite in drainages (NRC 1975; STPNOC 2010a) and were one of the most common species collected in the 2007-2008 survey of the MCR (ENSR 2008b) and during the impingement sampling at the MCR's CWIS (ENSR 2008b). They were collected in the Colorado River during the 1975-1976 nekton samples (NRC 1986) and during the 2007-2008 survey (ENSR 2008c). Blue crabs have also been collected in nekton samples in Matagorda Bay (Corps 2007).

Eastern oyster. Eastern oysters are mollusk (bivalves) that are found throughout the estuarine coastal areas of the Gulf of Mexico. As adults, the oysters are sessile and can form reefs over time. In the spring, rising temperatures and chemical cues stimulate the release of sperm into the water column by male oysters. Females then release their eggs into the water. The eggs are planktonic. Larval oysters remain as plankton in the water column for 2 or 3 weeks before settling onto a hard substrate and eventually transforming into adults. In Matagorda Bay, all life stages are common. While larvae consume plankton, juvenile (spat) and adults are suspension filter feeders, consuming plankton and zooplankton as they filter large quantities of brackish water (Patillo et al. 1997; Corps 2007).

Eastern oysters are harvested commercially in Matagorda Bay. Open season for oysters is from sunrise to sunset during November through April, but there are no season limits for private leases with permits from TPWD. Commercial regulations are associated with the size, culling, collection method, and quantity. The species may also be collected recreationally in Texas from November through April, and there are limits associated with the size, collection tools, and quantity (TPWD 2009l, o). There are no reports of oysters in the Colorado River above the GIWW, but there are efforts to improve oyster reefs in Matagorda Bay (LCRA 2006; Corps 2007).

Species with Designated Essential Fish Habitat

EFH has been designated by the Gulf of Mexico Fishery Management Council in the Lower Colorado River, GIWW, and Matagorda Bay. Below is a discussion of the four fish and three shellfish species that are protected as part of this designation. Further information can be found in the EFH Assessment included in Appendix F in support of a NRC/Corps joint consultation with the National Marine Fisheries Service (NMFS) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act.

EFH is designated by life stage for each species as follows. Coastal migratory pelagic fish include juvenile king mackerel (*Scomberomorus cavalla*) and all life stages (eggs, larvae, juveniles, adults) of the Spanish mackerel (*S. maculatus*). The grey (mangrove) snapper (*Lutjanus griseus*) is the only species of reef fish in the vicinity, and the listing is for all life stages of the gray snapper. All life stages of red drum are listed in the vicinity. The shrimp species include all life stages for the brown shrimp, pink shrimp, and white shrimp. Finally, EFH for the vicinity includes all life stages of the Western Gulf stone crab (*Menippe adina*). *Menippe adina* has been recognized as a new species, distinct from *M. mercenaria*, and is the species most common in the Gulf along the Texas coastline (Guillory et al. 1995).

King mackerel are highly migratory and are aggressive predators that specialize in feeding on other fishes. Common prey includes herrings, including menhaden and sardines. King mackerel can live to at least 14 years, although most die earlier. Females grow larger than males and spawn in their third or fourth year of life, with spawning occurring in the summer months (TSFGW 2005). Adults are primarily found offshore, but juveniles occasionally frequent estuarine waters for foraging (GMFMC 2004). Although no king mackerel have been observed during sampling studies, juvenile king mackerel are likely to occur in Matagorda Bay, GIWW, and the Colorado River.

Adult Spanish mackerel forage in estuarine and marine nearshore pelagic waters, and eggs and juveniles also occur nearshore marine surface (eggs) and pelagic (juveniles) waters (GMFMC 2004). Spawning takes place from late spring to late summer at depths of less than 50 m along the Texas inner continental shelf (De Vries et al. 1989). Although no Spanish mackerel have been observed during sampling studies, adults may occur in the Colorado River, the GIWW, and Matagorda Bay whereas eggs, larvae, and juveniles are most likely to occur in the GIWW and Matagorda Bay.

For estuarine habitats associated with the Colorado River, GIWW, and Matagorda Bay, larval, juvenile, and adult life stages of gray snapper, or mangrove snapper, are likely present because this species occupies primarily inshore habitats (GMFMC 2004). Eggs are found primarily in marine waters as part of the plankton community. Juveniles and adults are found in inshore marine and estuarine habitats with SAV or near mangroves, where they forage on small fish and crustaceans (Croker 1962). Gray snapper were collected within the first 3 mi of the Colorado River and the GIWW during the 2007-2008 sampling events (ENSR 2008c). Adults and juveniles occur in potential foraging habitat within the Colorado River, GIWW, and Matagorda Bay.

Red drum larvae and juveniles spend most of their time in estuarine soft bottom, sand/shell, and SAV habitats actively feeding on mysids, crustaceans, and fish. Adults spend some time near inshore SAV, sandy or hard-bottom foraging habitats, but are predominantly found offshore where spawning activities occur (GMFMC 2004). Red drum move to deep offshore waters to spawn in the fall and then return to nearshore coastal and estuarine habitats where they spend most of their life cycle (FFWCC 2007). Tidal currents move larvae to nearshore habitats, where they grow rapidly as juveniles during the first 2 years, and associate with seagrass habitats with little wave action (Buckley 1984). Red drum were collected in the Colorado River in 2007-2008 (ENSR 2008b, c) and are known to be in Matagorda Bay and the GIWW. Red drum was collected with all types of sampling gear, indicating that the species was well distributed in the river. With the exception of spawning adults, all life stages of red drum may occur in the Colorado River, GIWW, and Matagorda Bay.

In the vicinity of STP, EFH is designated for three shrimp species: pink, white, and brown shrimp. All of these species migrate from offshore pelagic environment as larvae to inhabit grassy, estuarine habitats as juveniles (GMFMC 2004). Adult shrimp spawn in offshore waters between spring and early summer for brown shrimp, and from spring to fall for white shrimp (FWS 1983), and throughout the year for pink shrimp (TPWD 2002). White shrimp larvae may also be found in the nearshore marine water column, but prefer estuarine habitats, and migrate further upstream in estuarine waters than brown shrimp (GMFMC 2004). White and brown shrimp prefer soft bottom, shallow estuarine areas (FWS 1983). Post-larval and juvenile pink shrimp are closely associated with seagrass beds in estuarine waters (TPWD 2002). Juvenile and adult shrimp of all three species are omnivorous with diets that vary depending on available food sources within the occupied habitat which is preferably soft bottom, shallow estuarine areas (FWS 1983). Both white and brown shrimp were collected in sampling studies all along the Colorado River in 1975-1976, 1983-1984 and 2007-2008 (ENSR 2008b, c). Larval and juvenile white and brown shrimp are likely to occur in the Colorado River, GIWW, and Matagorda Bay. Pink shrimp are often difficult to distinguish from brown shrimp, and pink and brown shrimp are usually reported together in information about the shrimping fishery in Texas coastal waters (Patillo et al. 1997); this is likely the reason pink shrimp are not reported in the Colorado River studies. The three shrimp species combined represent the greatest commercial harvest for Matagorda Bay, exceeding the catches for finfish and other shellfish (TPWD 2002; Corps 2007).

The Gulf stone crab occupies estuarine and marine SAV, sand/shell, and hard-bottom habitats as eggs, larvae, and juveniles (GMFMC 2004). Adults prefer a diet of oysters, are typically found near oyster reefs or other hard-bottom substrate, and are both intertidal and subtidal (Wilber 1989). The stone crab fishery is managed by a Gulf of Mexico Fishery Management Plan to regulate this renewable fishery with harvest only of claws greater than 2.75 in. long. Florida stone crabs require high salinities for juvenile growth, but the Western Gulf stone crab tolerates estuarine waters (GMFMC 2004). All life stages of Western Gulf stone crab may occur in the GIWW and Matagorda Bay, but none of the surveys conducted in the vicinity of STP since the 1970s has identified this species.

Ecologically Important Species

Several ecologically important species or taxa occur in the onsite water bodies and the Colorado River near the STP site. Ecologically important species are those that are important to the structure or function of the aquatic system (e.g., forage fish for many other species), or they provide critical links in the food web for Gulf of Mexico estuarine and marine ecosystems. These species may also be indicators of habitat quality in the system. As discussed in Section 2.4.2.1, there have been few surveys of on-site water bodies and the Colorado River that have included characterization of the primary producers and species representative of the lower parts of the food chain (e.g., surveys of algae and macroinvertebrates). However, the surveys of aquatic communities indicate that there is an abundant and diverse aquatic community in onsite water bodies and the river that could only exist if the primary producers and species representative of the lower parts of the food chain were also abundant and diverse.

In addition to primary producers, forage fish and invertebrates play ecologically important roles in the food web. Some of these include commercially important species and species with designated EFH. Bay anchovy is a commercially important species (discussed above) that is also an important forage fish. Anchovies are consumed by other fish found in the Colorado River such as Atlantic croaker, blue catfish, ladyfish, red drum, sand seatrout, spotted seatrout, and southern flounder (Patillo et al. 1997). Other examples of fish (particularly early life stages) and invertebrates that are important prey for other fish and are also commercially important include Altantic croaker, striped mullet, and blue crab (Patillo et al. 1997). Brown, pink, and white shrimp are species with designated EFH (discussed above) that are also important food sources for a number of other fish, including ladyfish, hardhead catfish, red drum, black drum, sand seatrout, spotted seatrout, and southern flounder (Patillo et al. 1997).

Other commercially important species are used as indicators of habitat quality. Because bay anchovy can adapt quickly to pollution stress, shifts in their population may be an indicator of poor deteriorating water quality. Atlantic croaker, Gulf menhaden, and Eastern oyster are indicator species for environmental stress, often used in toxicity studies with heavy metals and organic compounds, and are target species for NOAA's National Status and Trends Program (Patillo et al. 1997). Gulf menhaden are frequently involved in fish kills and have been monitored as an indicator of hypoxia (low dissolved oxygen) in the Gulf. Because the distribution and abundance of oysters is particularly influenced by salinity, this species is one of the key organisms being monitored as part of the recovery of Matagorda Bay and in understanding freshwater inflow into the bay since the completion of the Colorado River diversion project (Patillo et al. 1997; LCRA 2006).

Grass shrimp are ecologically important as prey for a number of aquatic and terrestrial species as well as for their role in breaking down detritus in estuarine and tidal rivers (Patillo et al. 1997). The species was one of the most frequently collected invertebrates in the 2007-2008 Colorado River survey and in the MCR (ENSR 2008b, c), and all life stages are considered highly abundant in Matagorda Bay (Patillo et al. 1997). These shrimp are not commercially important but are likely collected as bait for recreational fishing. Grass shrimp are most often found in shallow waters, often in vegetated areas. Juveniles and adults can tolerate salinities from 0 to 55 ppt, but it is unclear how salinity affects early life stages and growth. The spawning season is from February to October. Grass shrimp are opportunistic, omnivorous feeders, including consumption of large detrital particles, and provide food sources for organisms in a variety of trophic levels (Patillo et al. 1997).

Ecologically important species for the onsite water bodies (e.g., the MDC and MCR) include foraging fish and invertebrates. Largemouth bass, bluegill, and mosquitofish were the most common species collected in the MDC (ENSR 2007c). These fish are tolerant of environmental changes, and common in inshore waters in Texas. All of these species are carnivores, feeding primarily on macroinvertebrates, and as adults may also feed on other smaller fish (Hassan-Williams and Bonner 2009). The most common fish in the MCR were the threadfin shad, inland silverside, and rough silverside (ENSR 2008b). These fish are probably the main prey for such top carnivore species found in the MCR as the blue and channel catfish (Patillo et al. 1997). Threadfin shad are planktivore filter feeders while inland silverside are carnivores, feeding primarily on macroinvertebrates (Patillo et al. 1997; Hassan-Williams and Bonner 2009).

Federally and State-Listed Species

All the Federally listed aquatic species in Matagorda County are those listed by NMFS and include the endangered smalltooth sawfish (*Pristis pectinata*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), and Kemp's ridley sea turtle (*Lepidochelys kempii*). The threatened species include the loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*). In addition, NMFS lists several endangered whale species that could be found off the Texas coastline in deeper offshore waters, including blue whale (*Balaenoptera musculus*), finback whale (*B. physalus*), sei whale (*B. borealis*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*). Because the whale species are not found in Matagorda Bay, the GIWW, or the Colorado River, they are not included in the Biological Assessment (BA) (in Appendix F).

The only State-listed endangered species in Matagorda County is the West Indian manatee (*Trichechus manatus*). While the West Indian manatee is Federally listed as endangered and occurring in Texas, it is not listed as occurring in Matagorda County. The State-listed threatened species in Matagorda County include a fish, the blue sucker (*Cycleptus elongates*), and two freshwater mussels, the smooth pimpleback (*Quadrula houstonensis*) and the Texas fawnsfoot (*Truncilla macrodon*). TPWD has identified rare and protected species in the county, including American eel (*Anguilla rostrata*), Gulf Coast clubtail (dragonfly) (*Gomphus modestus*), and the freshwater mussels, creeper (squawfoot) (*Strophitus undulatus*) and pistolgrip (*Tritogonia verrucosa*) (TPWD 2009i).

In correspondence with the TPWD, none of these aquatic species were found within 6 mi of the STP site (STPNOC 2010a; TPWD 2009a, j). The Federally listed sea turtle species may be found in Matagorda Bay and the navigational shipping channels at Port Freeport. The other Federally listed species are not likely to be found within the bay or shipping channels. No identified threatened and endangered aquatic species are located along the Hillje transmission line corridor (STPNOC 2010a; TPWD 2009j).

<u>Federally Listed Species</u>

Smalltooth sawfish was listed by NMFS as endangered on April 1, 2003 (68 FR 15674), and they were once prevalent throughout Florida and were commonly encountered from Texas to North Carolina. The current range of this species is now restricted to peninsular Florida, therefore, the smalltooth sawfish is not included in the BA (in Appendix F). NMFS states that the primary reason for the decline of the species is bycatch (especially in gill nets) in various commercial and recreational fisheries. Loss of habitat is cited as another reason for the decline of the species, especially the mangrove forests that are important nursery areas for juvenile sawfish. Sawfish inhabit shallow waters close to shore with muddy or sandy bottoms, often in mangroves. They also occur in sheltered bays, on shallow banks, and in estuaries or river mouths, occasionally traveling inland in large river systems (NMFS 2009b; Corps 2008). There have only been three records of sawfish reported in the Matagorda Bay region in the last 20 years: Carancahua Bay (Matagorda Bay) in 1979; in the Gulf of Mexico off Aransas Bay in 1984; and an unverified report in Lower Laguna Madre (Baffin Bay) in 2003. There are no current or short-term recovery efforts identified for the species in the region or within Texas (TPWD 2009n).

Loggerhead sea turtles are distributed widely in tropical and subtropical seas, in the Atlantic Ocean from Nova Scotia to Argentina, Gulf of Mexico, Mediterranean Sea, and Indian and Pacific oceans (although they are rare in the eastern and central Pacific). They nest all along the Atlantic coast from Florida to as far north as New Jersey, but they nest sporadically along the Gulf coast, including Texas. The population of loggerheads in Texas has been declining as has the world-wide population. Loggerheads are the most abundant sea turtle in Texas marine waters, preferring shallow inner continental shelf waters and occurring very infrequently in the bays. They are often seen around offshore oil rig platforms, reefs, and jetties. Loggerheads are probably present year-round but they are most often noticed in the spring when the Portuguese man-of-war (*Physalia physalis*) (one of their preferred food choices) is abundant. Loggerheads constitute a major portion of the dead or moribund turtles that are washed ashore (stranded) each year on the Texas coast. A large proportion of these deaths are the result of drowning from accidental capture by shrimp trawlers. Nests have been confirmed along the Texas coastline, mostly to the south in the vicinity of Padre Island (NMFS and FWS 2007a, 2008; TPWD 2009k; Corps 2007, 2008). This species does occur in the study area. To the northwest, eight loggerheads were caught in Freeport Harbor from 1995 to 2000, one loggerhead was captured by a relocation trawler in 2002, and one was killed during dredging operations of the entrance/jetty channel to Freeport Harbor in 2006 (Corps 2008). To the southeast, a loggerhead turtle was killed in 1996 during dredging operations in the entrance channel of the Matagorda Ship Channel, and two loggerheads were taken in the entrance channel of the ship channel during dredging operations in 2006 (Corps 2007). The loggerhead sea turtle is further discussed in the BA in Appendix F.

The green sea turtle is a circumglobal species found throughout tropical and subtropical waters. Their distribution in U.S. Atlantic waters is around the U.S. Virgin Islands, Puerto Rico, and continental United States from Massachusetts to Texas. The green turtle in Texas inhabits shallow bays and estuaries where it can graze on various marine grasses, but juveniles are often found in bays without seagrasses. The greatest cause for the decline of the species worldwide is commercial harvest for eggs and food, but the turtles are also threatened by incidental catch during commercial shrimp trawling (TPWD 2009i). Major nesting activity for these turtles occurs outside of U.S. waters, on Ascension Island, Aves Island (Venezuela), Costa Rica, and in Surinam. Nesting within the U.S. is primarily in Florida, with some nesting areas in Georgia, North Carolina, and Texas (NMFS and FWS 1991; Hirth 1997). Green turtle nests are rare in Texas and have primarily been located south at Padre Island National Seashore. No green turtle nests have been recorded around Matagorda Bay. Juvenile and adult green turtles are in the study area (NMFS and FWS 1991, 2007b; TPWD 2009i; Corps 2007, 2008). A study by Texas A&M University at Galveston (TAMUG) in 1996-1997 (Williams and Renaud 1998) found that four of the green turtles fitted with radio transmitters spent time in Lavaca Bay, western Matagorda Bay, and Powderhorn Bayou. A green turtle was recorded swimming in the Matagorda Ship Channel and one was taken during dredging operations at the same location in 2004 (Williams and Renaud 1998; Corps 2007). In 2006, two green turtles were killed during maintenance dredging of the entrance and jetty channels of the Freeport Harbor Project (Corps 2008). The Atlantic green sea turtle is further discussed in the BA in Appendix F.

The leatherback sea turtle is found in the Atlantic, Pacific, and Indian oceans; as far north as British Columbia, Newfoundland, Great Britain and Norway; and as far south as Australia, Cape of Good Hope, and Argentina. This species is mainly pelagic, occupying the open ocean, and seldom approaches land except for nesting. Foraging turtles have been observed in bays and estuaries following large concentrations of jellyfish (TPWD 2009i). Leatherbacks nest primarily in tropical regions. The largest nesting assemblages in the Atlantic and Caribbean occur in the U.S. Virgin Islands, Puerto Rico, and Florida. There have been no recorded nests in Texas since the 1930s on Padre Island. There have been occasional reports of leatherbacks feeding on jellyfish off Port Aransas and Brownsville. No leatherback sea turtles have been taken by dredging activities in Texas. One leatherback was caught in 2003 by a relocation trawler in a shipping channel approximately 1.5 mi north of Aransas Pass (NMFS and FWS 1992a, 2007c; TPWD 2009k; Corps 2007, 2008). This species is unlikely to occur in the vicinity of the STP site. The leatherback sea turtle is further discussed in the BA in Appendix F.

The hawksbill sea turtle is probably the most tropical of all the sea turtles, found throughout the tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans and rarely in temperate regions. Hawksbill sea turtles are widely distributed in the Caribbean and western Atlantic, and all life stages have been found regularly off southern Florida and in the northern Gulf (especially Texas). The first and only hawksbill nest recorded in Texas was in 1998 at Padre Island National Seashore. Outside of Florida, Texas is the only state where hawksbills are encountered with any regularity. Most of these sightings are around stone jetties and have been post-hatchling and juvenile turtles. These small turtles have probably traveled north from nesting beaches in Mexico (NMFS and FWS 1993, 2007d; TPWD 2009k; Corps 2007, 2008). This species potentially occurs in the study area. The hawksbill sea turtle is further discussed in the BA in Appendix F.

The Kemp’s ridley sea turtles distribution is primarily in the Gulf of Mexico and the Atlantic seaboard. It is the smallest marine sea turtle in the world. The turtles inhabit shallow coastal and estuarine waters, usually over sand or mud bottoms. Kemp’s ridleys are found in small numbers in Texas and are probably in transit between crustacean-rich feeding areas in the northern Gulf and breeding grounds in Mexico. The nesting area for Kemp’s ridleys is almost entirely on an 11-mi stretch of coastline near Rancho Nuevo, Tamaulipas, Mexico, approximately 190 mi south of the Rio Grande. The species has nested sporadically in Texas in the last 50 years, with reports increasing over the last 12 years from 4 nests in 1995 to 102 nests in 2006, with a majority of the nests at Padre Island National Seashore. There was one nest recorded on Matagorda Peninsula in 2002, and four on Matagorda Island in 2004. The increase in nests is related to the success of breeding programs in Texas. A study by TAMUG in 1996 found that seven of the Kemp's ridley turtles fitted with radio transmitters spent most of their time within 4 mi of the western shoreline of Matagorda Bay, but also swam to Lavaca Bay, Carancahua Bay, Tres Palacios Bay, and Powderhorn Bayou (Williams and Renaud 1998). Two Kemp's ridleys were taken at the entrance of the Matagorda Ship Channel in 2006 during dredging operations (NMFS and FWS 1992b, 2007e; TPWD 2009k; Corps 2007, 2008; Williams and Renaud 1998). Of all the turtles, Kemp's ridleys are likely to be the most common in the study area. The Kemp's ridley sea turtle is further discussed in the BA in Appendix F.

The blue whale is listed as endangered by NMFS under the ESA. This species inhabits and feeds in both coastal and pelagic environments, and its distribution is thought to be associated with its food requirements. Populations of blue whales move toward the North and South Poles in the spring to feed in waters with high zooplankton production during summer months. In the fall, the whales move toward the subtropics, presumably to reduce energy expenditure while fasting and reproducing. The blue whale is considered only an occasional visitor in the U.S. Atlantic waters. While the actual southern limit of the range of the blue whale is unknown, the western North Atlantic is thought to be still within its feeding range. Some records have suggested an occurrence of this species in waters near Florida and in the Gulf of Mexico. However, the blue whale is not expected to occur in the study area and, therefore, is not included in the BA (Corps 2007, 2008).

The finback or fin whale is listed as endangered by NMFS under the ESA. This species is found offshore and the whales tend to be nomadic. Finback whales follow the same migration for feeding and reproduction as the blue whales. The finback whale is not expected to occur in the study area and, therefore, is not included in the BA (Corps 2007, 2008).

The sei whale is listed as endangered by NMFS under the ESA. This species inhabits, breeds, and feeds in open oceans, and is usually restricted to more temperate waters. Sei whales migrate several thousand miles to the equator in the fall. Their feeding ranges and reproduction are similar to those of the blue whales. They are also known to occur near Cuba, the Virgin Islands and infrequently in U.S. waters. In the vicinity of U.S. waters, sei whales are grouped into four stocks: East North Pacific, Hawaii, Nova Scotia, and Western North Atlantic stocks. There are not enough data to determine trends in the recovery of the species. However, sei whales continue to be taken through unauthorized hunting and incidental ship strikes and gillnetting bycatch. Sei whales are not expected to occur in the study area and, therefore, are not included in the BA (Corps 2007, 2008).

The humpback whale is listed as endangered throughout its range and is considered "depleted" under the Marine Mammal Protection Act. The humpback whale is found worldwide in all ocean basins, but this species is less common in Arctic waters. Humpback whales are generally considered to inhabit waters over continental shelves, along their edges and around some oceanic islands. These whales are seasonal migrants and are found in temperate and tropical waters of both hemispheres during the winter breeding season. During the summer feeding season, most humpbacks occur in higher latitude waters with high biological productivity. In the vicinity of U.S. waters, there are currently four recognized stocks (based on geographically distinct winter ranges) of humpback whales: Gulf of Maine, the eastern North Pacific, the central North Pacific, and the western North Pacific stocks. The worldwide population of humpback whales is thought to have been greater than 125,000 individuals prior to commercial whaling activities. The U.S. population of humpbacks is currently estimated to be less than 7000 whales. Recovery plans for the species are focused on maintaining and enchancing habitats, identifying and reducing direct human impact, monitoring and updating of data on the species, and enhancing coordination and cooperation between recovery program units across the globe. The only known occurrence of humpbacks in Texas waters was in 1992 along the Bolivar Jetty near Galveston. The humpback whale is not expected to occur in the study area and, therefore, is not included in the BA (Corps 2007, 2008).

The sperm whale is listed as endangered by NMFS under the ESA. Overexploitation from commercial whaling during the past two centuries is thought to be the reason for the decline of the species. Sperm whales are found throughout the world's oceans in deep waters. They tend to inhabit areas with water depths exceeding 1900 ft, and are uncommon in waters less than 985 ft deep. Sperm whale migrations are not as predictable or well understood as the humpback whales. Their distribution appears to be dependent on their food source and suitable conditions for breeding and varies with the sex and age composition of the group. Those whales in the oceans in mid-latitudes tend to migrate north and south depending on the seasons (whales move poleward in the summer), while the whales in tropical and temperate areas do not have an obvious seasonal migration. The sperm whale is not expected to occur in the study area and, therefore, is not included in the BA (Corps 2007, 2008).

<u>State-listed Species</u>

The West Indian manatee is listed by TPWD as an endangered species in Matagorda County. FWS lists the species in all the counties up the coast of Texas to Calhoun County, just south of Matagorda County. This aquatic mammal inhabits brackish bays, large rivers, and saltwater systems. Its diet consists of available submergent, emergent, and floating vegetation. The manatee is more commonly found in the warmer waters off of coastal Mexico, the West Indies, and Caribbean to northern South America. In the U.S., manatees are primarily found in Florida. Sitings of manatees in Texas are extremely rare and are likely to be individuals that are migrating or wandering up from Mexican waters. Historically, manatees were found in Cow

Bayou, Sabine Lake, Capano Bay, the Bolivar Peninsula, and the mouth of the Rio Grande. In May 2005, a live manatee was photographed in the Laguna Madre near Port Mansfield, south of Corpus Christi. The Corps determined that manatees were unlikely to be found in the vicinity of the Matagorda Ship Channel and Port Freeport (Corps 2007, 2008), and therefore, they are unlikely to be found within the vicinity of STP.

The blue sucker, State listed as threatened, is described as a sucker that is dark olive or blue-black on its back and sides and white on the underside. The species is thought to reach up to a length of 40 in., with a small head, small mouth and overhung snout typical of sucker species (Thomas et al. 2007). The species is reported to be in the major rivers of Texas, usually in the channels and free-flowing pools with moderate currents and exposed bedrock, hard clay, sand or gravel substrates. Its spawning areas are typically upstream in riffles (TPWD 2009h). There are no reports of the blue sucker in the Colorado River in the vicinity of STP, although the habitat for the fish exists in the region.

TWPD categorized the American eel as rare and protected in Matagorda County. American eel is found in rivers and streams along in all the states in the Gulf Coast and along the Atlantic. It is a catadromous species, meaning that eels spend most of their lives in freshwater and travel to the western Atlantic Ocean (Sargasso Sea) to spawn. The larvae are ribbon-shaped and are carried by currents back to rivers. Larvae then metamorphose into "glass eels" and move back upstream into rivers to mature into adults. The adults can grow up to 4.3 ft. in length, and have a slightly compressed, snake-like body (Thomas et al. 2007). The number of eels reported in Texas has been diminishing since the 1970s. LCRA has reported finding an American eel as far up the Colorado River as Altair, Texas, where the eel had to traverse over dams. However, in studies over the last 30 years, TPWD has only collected seven eels in the bays sampled from Matagorda down to Corpus Christi (STPNOC 2010a). ENSR (2008b) reported collecting one adult eel (2.6 ft in length) during the impingement sampling in the MCR's CWIS for Units 1 and 2.

Gulf Coast clubtail is a dragonfly that is reported in Matagorda County and categorized as rare and protected by TPWD. The early life stages of the clubtail are aquatic and are spent in medium-sized rivers with moderate gradients and streams with silty sand or rocky substrate. The adult clubtails are found to forage in trees along stream riparian areas (TPWD 2009h). There are no reports of clubtails in the surveys of water bodies around STP, although the habitat for these dragonflies exists in the region.

Four freshwater mussels have been identified by TPWD as being found in Matagorda County (TPWD 2009h). While not much is known specifically about the life histories and distribution of these species, they are all known as uniod mussels and have a larval stage called a glochidium. For glochidia to mature to juvenile mussels, they must live as a parasite in the gill tissues of a host fish. An important component to the distribution of freshwater mussels in various water bodies is associated with the relationship between the mussels and the host fish (Howells et al.

1996). While the habitat exists around STP and in the drainages along the Hillje transmission corridor to support these freshwater mussel species, none of these organisms have been reported during surveys of the onsite water bodies at STP or in the reach of the Colorado River in the vicinity of the site (ENSR 2008a, b, c; STPNOC 2010a). Below is a discussion on what is known about the four species reported by TPWD in Matagorda County.

Texas Parks and Wildlife Commission acted on November 5, 2009, to place 15 of the 50 freshwater mussel species that have been identified in the state on the State threatened species list (TPWD 2009h; 35 Texas Register 249). The list includes the smooth pimpleback and Texas fawnsfoot that are reported for Matagorda County. Smooth pimpleback is reported in the Colorado and Brazos River drainage basin. It prefers substrates that are mud, sand and fine gravel in very slow to moderate flow rates. It is unclear if the mussels have glochidia and the host species for the glochidia is unknown (Howells et al. 1996; TPWD 2009i). Surveys from 1980 to 2006 for the smooth pimpleback have noted steep declines in the number of extant populations in both river drainages (TPWD 2009h). Texas fawnsfoot is reported in the Colorado, Trinity and Brazos River drainages. However, there is no information about its preferred habitat, glochidia production or fish host species (Howells et al. 1996; TPWD 2009i).

Additionally, TPWD categorized two other freshwater mussels, creeper and pistolgrip, as rare and protected in Matagorda County. Creeper or squawfoot occurs in drainages from the Guadalupe River to the north and east, including the Colorado River drainage. The creeper has been found in a variety of habitats, including substrates varying from silt to gravel, shallow to fairly deep water, and flow rates from still to rather rapid. The species does appear to be sensitive to drought conditions. While the creeper is known to produce glochidia and several fish hosts have been identified (e.g., largemouth bass, creek chub (*Semotilus astromaculatus*), plains killifish (*Fundulus zebrinus*) and green sunfish), there is evidence that the species might be able to complete its life cycle without a host species (Howells et al. 1996). Pistolgrip occurs in drainages from the San Antonio River to the north and east, including the Colorado River drainage. Like the creeper, the pistolgrip has been reported in a variety of habitats. The species is known to produce glochidia but the fish host species is unknown. Historically, the pistolgrip has been important economically for the shell-button industry as well as a producer of high quality, freshwater pearl industry (Howells et al. 1996).

Important Habitats

As discussed in Section 2.4.1.3, the Mad Island WMA and Clive Runnells Family Mad Island Marsh Preserve are to the southwest of the STP site and are important habitats for aquatic organisms associated with Matagorda Bay and the Gulf of Mexico (Figure 2-21). The area consists of freshwater wetlands, estuarine intertidal marshes and intertidal flats, and supports early life stages of red drum, blue crab, shrimp, oysters, southern flounder and speckled seatrout (*Cynoscion nebulosus*) (TPWD 2007; TNC 2009). The flow of water from Little Robbins Slough in the vicinity of STP provides freshwater into these wetlands, and the mixture of freshwater and estuarine waters is essential to the productivity of the aquatic community (NRC 1975, 1986; TPWD 2007; TNC 2009). Additionally, there is designated EFH in the vicinity of STP. The Colorado River extending up to the bridge at FM 521, GIWW and Matagorda Bay are within Ecoregion 5 of the designated EFH by the Gulf of Mexico Fishery Management Council's FMP (GMFMC 2004). Ecoregion 5 extends from Freeport, Texas to the Mexican border. FMPs applying to waters identified for the Colorado River, GIWW and Matagorda Bay within the vicinity of STP include coastal migratory pelagic, reef fish, red drum, shrimp, and stone crab (GMFMC 2004). There are no habitat areas of particular concern for the Colorado River (GMFMC 2004). Further discussion can be found in the EFH Assessment in Appendix F.

2.4.2.4 Aquatic Monitoring

STPNOC does not conduct any routine monitoring of the aquatic resources on the site. Regulatory agencies have not required ecological monitoring of the STP site, the operation of the RMPF on the Colorado River, or the associated transmission corridors since the period of reservoir filling (mid-1980s), and there is no ongoing monitoring of aquatic resources on the site. There have been studies in the past associated with licensing of the existing STP Units 1 and 2, and impingement and entrainment impacts at the RMPF at both high- and low-river flow conditions were estimated (NRC 1975, 1986). Several studies were conducted in preparation for the combined license (COL) application for proposed Units 3 and 4.

The recent studies have included a rapid bioassessment of onsite drainages ditch system (ENSR 2007c) and aquatic assessments of the MCR and the CWIS for existing Units 1 and 2 (ENSR 2008b) and the Colorado River (ENSR 2008c). The onsite drainage ditch system was characterized using a modified version of EPA's standardized Rapid Bioassessment Protocols, including fish surveys and water quality sampling (physiochemical analyses). Results were used to evaluate potential aquatic ecology impacts of building activities that would eliminate some existing ditches, change the flow of water, especially during rain events, into the remaining and expanded drainage ditch system (ENSR 2007c).

From May 2007 through April 2008, the aquatic ecology of the MCR was characterized, and an evaluation of impingement and entrainment at the CWIS for existing Units 1 and 2 on the MCR was conducted. This was the first effort to characterize the fish and shellfish community in the MCR since it was constructed (other than a catch-and release fishing tournament for employees in 1994) (STPNOC 2010a). Four sampling events were conducted across four sampling regions in the MCR to collect fish and shellfish using a variety of sampling gears. The impingement and entrainment studies at the CWIS were conducted over a 24-hr period, twice per month from May through September and once per month from October through April. Results of these studies were used to characterize the aquatic resources in the MCR and to "establish relationships between the presence of aquatic organisms and the intake design and operation parameters" of existing STP Units 1 and 2 for evaluating potential impacts with the proposed new units (ENSR 2008b).

From June 2007 through May 2008, the aquatic ecology of the Colorado River was characterized for an approximately 9-mi stretch extending from the GIWW north to the FM521 bridge. The Lower Colorado River in the vicinity of the site has not been characterized except for studies associated with the STP site. These studies, associated with licensing of existing STP Units 1 and 2, were conducted in 1974, 1976, 1983 and 1984. This study was the first one to be conducted since the Corps completed the diversion channel of the Colorado River in 1993, diverting the flow of the river into Matagorda Bay rather than flowing directly into the Gulf. Results of the study were used to compare the aquatic communities, current flow, and salinity patterns to those prior to the 1992 diversion channel construction (ENSR 2008c).

There are no known aquatic surveys of the transmission corridors for existing STP Units 1 and 2. Only a 20-mi section of the Hillje transmission line would be disturbed by construction activities for proposed Units 3 and 4. Maintenance and operation practices for the transmission lines are consistent with state regulations for protection of aquatic life (STPNOC 2010a).

2.5 Socioeconomics

This section describes the socioeconomic baseline of the proposed site. It describes the characteristics of the 50-mi region surrounding the STP site, including population demographics, density, and use that form the basis for assessing the potential social and economic impacts from building and operating the proposed two new nuclear units. These impacts are for the region[a] surrounding the proposed site. This discussion emphasizes the socioeconomic characteristics of Matagorda, Brazoria, Calhoun, and Jackson Counties, although it considers the entire region within a 50-mi radius of the proposed site. STPNOC assumed that the residential distribution of the proposed Units 3 and 4 construction and operational workforces would resemble the residential distribution of STPNOC's current workforce. As of January 2007, approximately 83 percent of the STP employees reside within two counties—Matagorda (60.7 percent) and Brazoria (22.4 percent). The remaining 17 percent are distributed across at least 18 other counties, with less than 5 percent of the employees per county (Table 2-16). STPNOC also assumed that most of the socioeconomic impacts would occur within Matagorda and Brazoria Counties. The review team has also examined the possibility that significant numbers of workers (numbering in the hundreds during the peak building period) may choose to live in Wharton, Fort Bend, Calhoun, Jackson, and Victoria Counties. (Lavaca County and Colorado County are within 50 mi, but currently have almost no STP workers and are at a somewhat greater distance than the other counties mentioned.) In Wharton, Fort Bend, and

(a) For the purposes of this EIS, the relevant region is limited to that area necessary to include social and economic base data for (1) the county in which the proposed plant would be located and (2) those specific portions of surrounding counties and urbanized areas (generally up to 50 mi from the station site) from which the construction/operations work force would be principally drawn, or that would receive stresses to community services by a change in the residence of construction/operations workers.

Victoria Counties, the existing populations are relatively large and the STP plant-related population is small and not as noticeable, so significant socioeconomic impacts are unlikely. Calhoun and Jackson Counties are both close to the STP site and lightly populated. Impacts are more likely there. Most of the data and analysis in this section will be concerned with a socioeconomic impact area containing four counties: Matagorda, Brazoria, Calhoun, and Jackson. The scope of the review of community characteristics is guided by the magnitude and nature of the expected impacts of building, maintaining, and operating the proposed project and by those site-specific community characteristics that can be expected to be affected by these impacts.

Table 2-16. Distribution of STP Employees, January 2007

County	Percent of Total Number of Employees	Cumulative Percent	County Population, 2000
Matagorda	60.7%	60.7%	37,957
Brazoria	22.4%	83.2%	241,767
Wharton	4.5%	87.6%	41,188
Fort Bend	4.1%	91.7%	354,452
OTHER	2.3%	94.0%	N/A
Calhoun	1.6%	95.6%	20,647
Jackson	1.3%	96.9%	14,391
Victoria	1.2%	98.1%	84,088
Harris	0.8%	98.9%	3,400,578
Aransas	less than 0.1%	99.0%	22,497
Austin	less than 0.1%	99.2%	23,590
Fayette	less than 0.1%	99.3%	21,804
Galveston	less than 0.1%	99.5%	250,158
Cass	less than 0.1%	99.6%	30,438
Colorado	less than 0.1%	99.6%	20,390
DeWitt	less than 0.1%	99.7%	20,013
Goliad	less than 0.1%	99.8%	6928
Hood	less than 0.1%	99.9%	41,100
Lavaca	less than 0.1%	99.9%	19,210
Williamson	less than 0.1%	100.0%	249,967
Total	100%	–	–

Source: STPNOC 2010a

The population data for the 50-mi area are based on the 2000 U.S. Census data and were estimated by the applicant with SECPOP 2000, a computer program that calculates population by emergency planning zone sectors (Sandia 2003).[a] In addition, the review team analyzed the economic, employment, and population trends for the region using additional U.S. Census data sets and population projections from the Texas State Data Center and Office of the State Demographer.

The analytical area is a 50-mi circle centered on the proposed power block and includes all or a portion of nine counties in Texas. Table 2-17 identifies the counties and provides population information for each county within 50 mi of the STP site and Figure 2-24 shows the 50-mi analytical area.

Table 2-17. Counties within 50 mi of the STP Site

County	Resident Population (Year 2000)	Resident Population Estimate (January 1, 2007)
Matagorda County	37,957	36,930
Brazoria County	241,767	291,729
Calhoun County	20,647	20,958
Colorado County	20,390	21,925
Fort Bend County	354,452	503,315
Jackson County	14,391	14,598
Lavaca County	19,210	19,382
Victoria County	84,088	86,756
Wharton County	41,188	42,262

Source: Texas State Data Center 2007

2.5.1 Demographics

For a historical perspective, the 1940 population of Matagorda County was 20,066 people and over the next 60 years the population almost doubled to 37,957 in 2000. Brazoria County population in 1930 was only 23,114 people but continually rose in urban areas after 1940. Between 1970 and 1980 the population grew 57 percent. Calhoun County, the smallest of the four counties during the 1940s had a 1940 population of 5911 and despite being hit hard by a couple of hurricanes it grew to a population of 20,647 in 2000 with the help of new industry. Also increasing since the 1940s is the Hispanic population of the counties. Unlike the previous counties Jackson County's population has remained fairly constant since World War II. The 1950 population was 12,916 and fifty years later, the 2000 census reported a population of 14,391.

(a) Table G-1 in Appendix G provides population summary statistics for all counties within a 50-mi radius of the STP site that were used to assist in narrowing the scope to assess socioeconomic impacts.

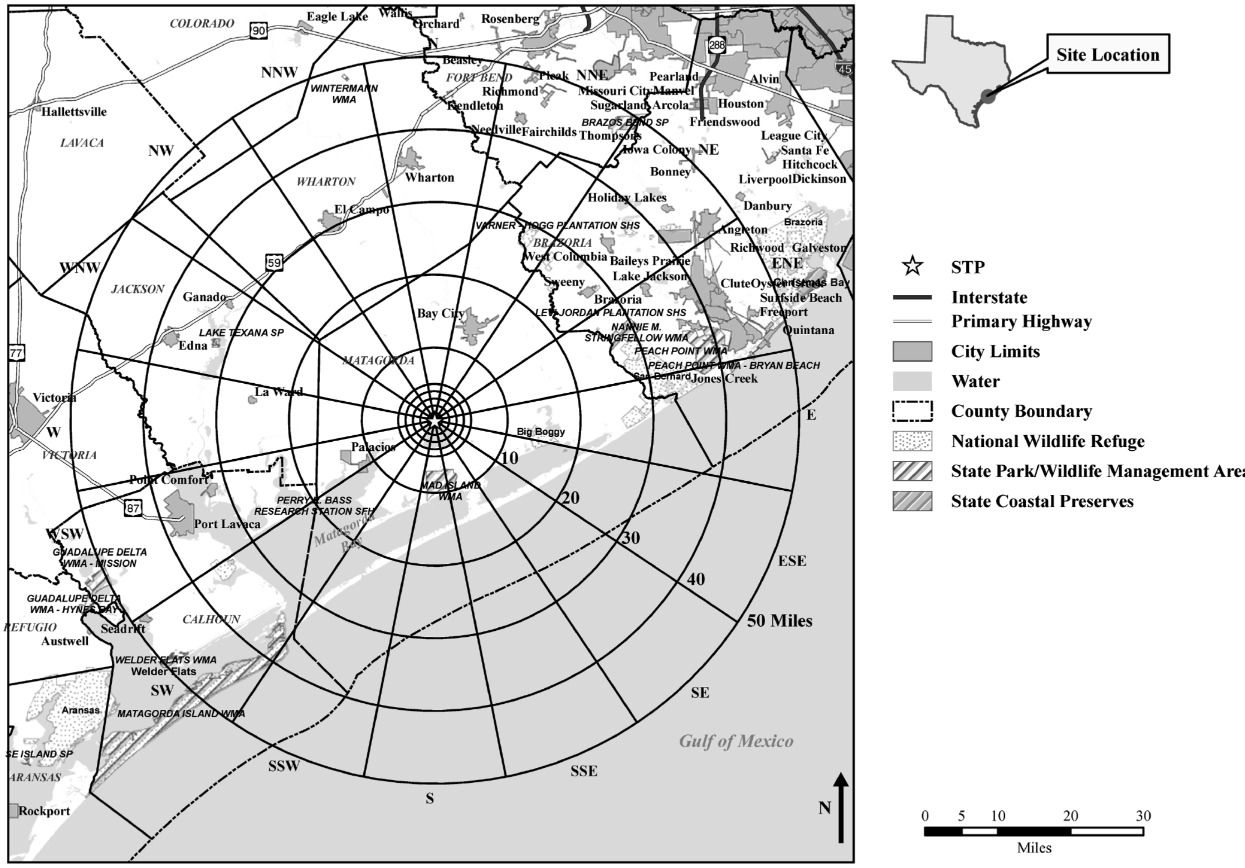

Figure 2-24. Map of Central Texas Gulf Coast, Showing Counties Potentially Affected by the Proposed Units 3 and 4 (STPNOC 2010a)

For the purposes of this analysis, the review team divided the total population within the analytical area into three major groups: residents who live permanently in the area; transients who may temporarily live in the area but have a permanent residence elsewhere; and migrant workers who travel into the area to work and then leave after their job is done. Transients and migrant workers are not fully characterized by the U.S. Census, which generally captures only resident populations.

2.5.1.1 Resident Population

Table G-1 in Appendix G shows the estimated population in 2000 within 50 mi of the center of the proposed STP site. In this table, the center of the circle is the same as on Figures 2.5-1 of the ER (STPNOC 2010a), midway between the power blocks for the existing Unit 2 and Unit 3 of the proposed site, with concentric circles in 10 mi increments up to 50 mi from the proposed location. Resident population data for the area surrounding the STP site indicate low population densities and a rural setting. The transient population for 0–10 mi was added to the 2000 resident population for use in the projections, and is reflected in Table G-1. The population projections for radii of more than 10 mi include only residents.

The population growth rates shown in Table 2-18 were calculated for each county based on county projections obtained from the Texas State Data Center. The Texas State Data Center presents population projections by county for the period 2000-2060 by 10-year increments, using standard population cohort-component methods, age-specific birth and death rates calculated from the 2000 Census, and four age/gender specific migration rates. Their migration rates are calculated as: a) zero, b) the rates prevailing between 1990 and 2000 (a period of high population growth), c) half the rates between the 1990 and 2000, and d) the rates estimated for the period between 2000 and 2004. Both the Texas State Data Center and STPNOC considered the One-Half 1990–2000 Migration Scenario as the most appropriate population scenario for most counties for use in long-term planning, because migration is expected, but the 1990–2000 rate is not expected to be maintained over the coming years. STPNOC believed that the 2000–2004 Migration Scenario was based on estimates and represented too few years upon which to base a meaningful long-term trend (STPNOC 2010a).

Table 2-18 shows the historical and projected populations for the nine counties closest to the STP site. The statewide Texas rate is provided for perspective. Table 2-18 shows that the estimated county populations for 2007 generally are less than the county populations projected by any of the methods that include migration. The exceptions are Brazoria and Fort Bend Counties, which continue to feel the strong growth of Houston at their eastern ends. For five of the nine counties (Matagorda, Calhoun, Jackson, Victoria, and Wharton) and for Texas as a whole, the estimated 2000-2007 growth rate for population was less than either Texas State Data Center 2000-2010 rate based on migration during the 1990s. For two counties (Lavaca and Colorado), it was between the two rates. Based on Table 2-18 the review team believes that for most counties in the area surrounding the STP site, a long-term population forecast based on half the 1990-2000 migration rate appears more reasonable than one that continues the rapid in-migration of the 1990s. Much of the more rapid population growth in Brazoria and Fort Bend counties also appears to be centered on their east ends, outside of the 50-mi region.

The nearest population concentration is the Matagorda-Sargent CCD, 8 mi south-southeast of the site with a 2000 population of 3335. The nearest municipality with more than 15,000 residents is Bay City, Texas, 13 mi north-northeast of the STP site, with a 2000 population of 18,667 (STPNOC 2010a). Other municipalities in the 50-mi region, their 2000 populations, and locations relative to STP, are presented in Table 2-19. Although Brazoria and Fort Bend Counties are included in the Houston-Baytown-Sugarland Metropolitan Statistical Area (MSA), the core Houston metropolitan area is slightly outside of the 50-mi region. The core of the Victoria Texas MSA (which includes Calhoun County) is also outside of the 50-mi region. The Houston-Baytown MSA had a 2000 population of 4,715,407 while the Victoria MSA had a 2000 population of 111,663 (STPNOC 2010a).

Table 2-18. Historical and Projected Populations for Counties in the STP Region

Year	Matagorda Population	Matagorda Annual Percent Growth	Brazoria Population	Brazoria Annual Percent Growth	Calhoun Population	Calhoun Annual Percent Growth	Colorado Population	Colorado Annual Percent Growth	Fort Bend Population	Fort Bend Annual Percent Growth	Jackson Population	Jackson Annual Percent Growth	Lavaca Population	Lavaca Annual Percent Growth	Victoria Population	Victoria Annual Percent Growth	Wharton Population	Wharton Annual Percent Growth	Texas Population	Texas Annual Percent Growth
1970	27,913	N/A	108,312	N/A	17,831	N/A	17,638	N/A	52,314	N/A	12,975	N/A	17,903	N/A	53,766	N/A	36,729	N/A	11,196,730	N/A
1980	37,828	3.10%	169,587	4.60%	19,574	0.90%	18,823	0.70%	130,846	9.60%	13,352	0.30%	19,004	0.60%	68,807	2.50%	40,242	0.90%	14,229,191	2.40%
1990	36,928	-0.20%	191,707	1.20%	19,053	-0.30%	18,383	-0.20%	225,421	5.60%	13,039	-0.20%	18,690	-0.20%	74,361	0.80%	39,955	-0.10%	16,986,510	1.80%
2000	37,957	0.30%	241,767	2.30%	20,647	0.80%	20,390	1.00%	354,452	4.60%	14,391	1.00%	19,210	0.30%	84,088	1.20%	41,188	0.30%	20,851,820	2.10%
2007 Estimated	36,930	-0.40%	291,729	2.70%	20,958	0.20%	21,925	1.00%	503,315	5.10%	14,598	0.20%	19,382	0.10%	86,756	0.40%	42,262	0.40%	23,834,206	1.90%
2010 Projected (1990-2000 Migration Rate)	41,924	1.00%	314,415	2.70%	23,171	1.20%	22,655	1.10%	532,988	4.20%	16,069	1.10%	19,593	0.20%	95,665	1.30%	44,844	0.90%	26,058,565	2.30%
2010 Projected (2000-2004 Migration Rate)	39,258	0.30%	308,517	2.50%	21,784	0.50%	22,854	1.10%	556,805	4.60%	14,799	0.30%	19,588	0.20%	89,928	0.70%	44,102	0.70%	25,105,646	1.90%
2010 Projected (Half 1990-2000 Migration Rate)	41,406	0.90%	287,643	1.80%	22,684	0.90%	21,693	0.60%	452,097	2.50%	15,571	0.80%	19,298	0.00%	94,193	1.10%	44,276	0.70%	24,330,612	1.60%
2020	44,715	0.80%	335,925	1.60%	24,427	0.70%	23,113	0.60%	563,873	2.20%	16,745	0.70%	19,665	0.20%	107,437	1.30%	47,381	0.70%	28,005,788	1.40%
2030	47,062	0.50%	383,598	1.30%	25,732	0.50%	24,064	0.40%	682,296	1.90%	17,432	0.40%	19,685	0.00%	117,096	0.90%	49,647	0.50%	31,830,589	1.30%
2040	48,664	0.30%	429,766	1.10%	26,571	0.30%	24,782	0.30%	789,864	1.50%	17,759	0.20%	19,316	-0.20%	125,040	0.70%	50,968	0.30%	35,761,201	1.20%

Sources: Texas State Data Center 2006, 2007; USCB 1973

Table 2-19. Municipalities in the 50-mi Region Surrounding the STP Site

Municipality	County	2000 Population	Distance from STP (mi)	Direction
Angleton	Brazoria	18,130	45	NE
Bay City	Matagorda	18,667	12	NNE
Edna	Jackson	5899	38	WNW
El Campo	Wharton	10,945	31	NNW
Freeport	Brazoria	12,708	43	ENE
Lake Jackson	Brazoria	26,386	40	NE
Matagorda-Sargent CCD	Matagorda	3335	8	SSE
Palacios City	Matagorda	5153	11	SW
Port Lavaca	Calhoun	12,035	37	SW
Wharton	Wharton	9237	36	N

Source: STPNOC 2010a

2.5.1.2 Transient Population

Transients include seasonal or daily workers or visitors to large workplaces, schools, hospitals and nursing homes, correctional facilities, hotels and motels, and at recreational areas or special events. NRC Regulatory Guide 4.7 (NRC 1998) defines transient population as people who work, reside part-time, or recreate in an area but do not permanently reside there. However, the U.S. Census Bureau (USCB) includes residents of facilities such as nursing homes, hospitals, college dormitories and military quarters as part of the residential population, effectively excluding part of what could otherwise be considered “transient.” Transient population estimates (following the Census definition) for the area up to 10 mi radius around the STP site are included in Table G-1, of Appendix G.

The major employment facilities in the area, in addition to STP, include OXEA Corporation and Equistar Chemicals LP, also known as Lyondell Corporation. OXEA Corporation is located approximately 3 mi north-northeast of STP’s plant and employs a total of 155 persons. Equistar, located about 4 mi east of the STP site, employs 194 workers (STPNOC 2010a). In addition, recreational attractions in the area attract thousands of visitors each year. Recreational opportunities in the area include Riverside Park, Bay-Cel Golf Club, Rio Colorado Golf Club, FM 521 River Park, Fisherman’s Motel and RV, Lighthouse RV Park, Matagorda Harbor, and the Mad Island WMA. Section 2.5.2.4 discusses recreational activities in the region more thoroughly and ER Table 2.5-24 shows the major sources of recreation in the region surrounding the STP site.

More broadly, Table 2-20 shows the number of hotel nights available, occupancy, and estimated hotel nights stayed in the four counties nearest the STP site for the year 2006. The available hotel space (about 5200 rooms) would allow 1.9 million room nights, of which about 1.1 million (57 percent) are claimed by guests on an annual basis, for an annual average of about 3000 occupied hotel rooms per night (Texas Tourism 2006).

Table 2-20. Hotels Nights Available and Sold in Four-County Socioeconomic Impact Area Surrounding the STP Site, 2006

County	Hotel Room-Nights Annual 2006 (Thousand)	Average Percent Occupancy	Estimated Nights Sold 2006 (Thousand)
Matagorda	240.3	49.1	118
Brazoria	650.4	58.7	382
Calhoun	185.2	46.6	86.3
Jackson	23	60.4	13.9
Total	**1099**	**53.7**	**600.2**

Source: Texas Tourism 2006

Accounting for major employers (other than STP), overnight accommodations, major recreation areas, and marinas within the 10 mi radius, a total of 1622 transients could be present within the 10 mi radius (STPNOC 2010a). No comparable estimate is available for the area outside of 10 mi but within 50 mi.

2.5.1.3 Migrant Labor

The USCB defines a migrant laborer as someone who is working seasonally or temporarily and moves one or more times from one place to another to perform seasonal or temporary employment. During STP scheduled refueling outages, there is an influx of migrant construction labor to the area who are hired by STP to carry out fuel reloading activities, equipment maintenance, and other projects associated with the outage. STP employs approximately 1500-2000 additional employees during every refueling outage, which occurs every 18 months for each unit (STPNOC 2010a).

The 2002 Census of Agriculture indicates the migrant farm labor population is within 50 mi of the proposed site. Farm operators were asked whether any hired or contract workers were migrant workers, defined as a farm worker whose employment required travel that prevented the worker from returning to his permanent place of residence the same day. Migrants tend to work short-duration, labor-intensive jobs harvesting fruits and vegetables. Out of 4135 hired farm workers recorded in the four counties closest to the STP site, the 2002 Census of Agriculture records, only a small percentage met the definition of migrant workers. While there is no direct count of migrant labor, 3026 of the farm laborers worked less than 150 days, and only 95 of the 1051 farms reporting the presence of these short-term laborers reported any workers meeting the definition of migrant worker (DOA 2002). According to the Matagorda County Agricultural Extension Agency and the Texas Workforce Commission, there are few, if any migrant workers within 10 mi of the plant due to the mechanized nature of the agricultural industry in this area (STPNOC 2010a).

2.5.2 Community Characteristics

For a historical perspective in the 1940s, Matagorda County's economy consisted of significant oil production and farms. Oil has dropped off because of lower oil prices and farms have declined due to consolidation and mechanization but agriculture still remains important. Growth has occurred because of new industries such as the Celanese plant and STP. In the 1940s, Brazoria County saw a large increase in manufacturing jobs, and the 1950s brought service companies such as Monsanto. Farm production also peaked in the 1950s. Later petroleum and mineral production and marketing along with extraction and manufacturing, the chemical industry, fishing and the recreation industry molded the county's economy and development. After World War II the Aloca plant, the Union Carbide and Carbon Chemicals Company and other companies provided job opportunities. During the 1950s, agriculture, manufacturing and mineral-related companies comprised a majority of the local economy. Today, Calhoun County still has an agricultural based economy with cotton, cattle, corn and grain sorghum the chief products but plastics, aluminum manufacturing and other manufacturing are just as important to the county's economy and development. Jackson County saw a significant decrease in farming during the 1930s, however, this was somewhat offset by the discovery of oil in 1934. Agriculture rebounded during World War II and by the 1990s Jackson County was a leading producer of rice and cattle with over 90 percent of the county used for farming and ranching (TSHA 2009a, b, c, d).

The transportation network in the four counties really started developing in the early 20th century through the 1940s with construction of extensive railways to open the area to national markets and encourage immigration. However, since the 1980s, much of the track has been abandoned. Several waterways were developed or improved such as the clearing of a massive log jam on the Lower Colorado River and the creation of the Gulf Intracoastal Canal. There was push to build roads in the 1920s and 1930s after which improvements were made such as replacing ferries with bridges.

The STP site sits near the Gulf Coast in a rural area with several small towns located within 15 mi of the plant. The populations of Calhoun and Matagorda counties are about 60 percent minority, which is just slightly over the state average. Brazoria and Jackson counties are about 45 percent minority, which is below the state average. Calhoun and Matagorda counties have a higher percentage of the population living below the poverty line than the Texas state average. The four-county socioeconomic impact area is described in terms of racial characteristics and income level in Table 2-21.

Further discussion of the demographic composition of the socioeconomic impact area can be found under "Environmental Justice" in Section 2.6. The remainder of this section addresses community characteristics including the regional economy, transportation networks and infrastructure, taxes aesthetics and recreation, housing, community infrastructure and public services, and education.

Table 2-21. Minority and Low-Income Populations (2000 U.S. Census)

County	Percentage Minority	Percentage Below Poverty
United States	30.9%	12.4%
Texas	58.6%	15.4%
Brazoria	43.4%	10.2%
Calhoun	60.6%	16.4%
Jackson	45.8%	14.7%
Matagorda	61.1%	18.5%
Source: USCB 2000a		

2.5.2.1 Economy

The principal economic centers in Matagorda, Brazoria, Jackson, and Calhoun Counties include: Bay City (Matagorda County); Angleton (Brazoria County); Brazosport CCD (Brazoria County), which contains the Lake Jackson-Clute-Freeport area; Port Lavaca (Calhoun County); and Edna (Jackson County). Matagorda County's economy is based primarily on ranching (cattle), farming agriculture (rice, cotton, sorghum, and corn), oil and natural gas production and refinement, petrochemical production, electricity generation, and commercial fishing and fisheries. Brazoria County's economy is largely based on petroleum and chemical production, mineral resource extraction (oil, gas, sulfur, salt, lime, sand, and gravel), tourism, cattle ranching, and agriculture (rice, beans, sorghum, nursery plants, corn, cotton, and timber). Houston has a large influence on the economy of northeast Brazoria County. In the four counties most significantly impacted by the development and operation of STP, the government and government enterprises industry employs the greatest number of workers. Other important sectors of employment include state and local government, construction, and retail trade (BEA 2008). Table 2-22 shows industry in the four counties. The U.S. Department of Labor collects data on construction workforce sizes by state and by selected MSAs. Employment in the U.S. Department of Labor category of Construction and Extraction Occupations, based on data gathered in 2002 through 2005, was 141,650 for the Houston-Baytown-Sugarland MSA (STPNOC 2010a).

The top employers in the four-county socioeconomic impact area are listed in Table 2-23. In addition to STPNOC, only two other large employers are within the 10-mi radius. The first employer is the OXEA Corporation, which is located 5 mi north-northeast of the STP site. The plant produces industrial chemicals and employs approximately 155 workers. The second employer is Lyondell Chemical, which produces polyethylene chemicals. It is located approximately 7 mi east of the STP site and employs approximately 194 workers (STPNOC 2008d).

Table 2-22. Employment by Industry, 2006

Industry	Matagorda	Brazoria	Calhoun	Jackson	Total
Total Employment	*16,188*	*121,526*	*12,912*	*7558*	*158,184*
Wage and Salary Employment	10,897	89,190	10,185	5247	115,519
Proprietors Employment	5291	32,336	2727	2311	42,665
Farm Proprietors Employment	983	2158	321	1016	4478
Nonfarm Proprietors Employment	4308	30,178	2406	1295	38,187
Farm Employment	1280	2429	394	1229	5332
Nonfarm Employment	14,908	119,097	12,518	6329	152,852
Private Employment	12,280	101,960	10,980	5196	130,416
Forestry, Fishing and Related Activities	833	538	336	176	1883
Mining	217	1147	268	(D)	1632
Utilities	(D)	261	(D)	(D)	261
Construction	827	17,190	2136	738	20,891
Manufacturing	489	12,515	3004	(D)	16,008
Wholesale trade	309	2829	(D)	258	3396
Retail trade	1746	13,867	1196	667	17,476
Transportation and Warehousing	(D)	3967	195	(D)	4162
Information	100	914	69	92	1175
Finance and Insurance	398	3687	452	230	4767
Real Estate and Rental and Leasing	728	5604	303	131	6766
Professional and Technical Services	473	6323	425	277	7498
Management of Companies and Enterprises	27	107	(D)	0	134
Administrative and Waste Services	808	6621	(D)	124	7553
Educational Services	(D)	1271	(D)	15	1286
Health Care and Social Assistance	(D)	7869	(D)	262	8131
Arts, Entertainment, and Recreation	141	1679	84	31	1935
Accommodation and Food Services	1084	7113	798	293	9288
Other Services, Except Public Administration	1358	8458	603	431	10,850
Government and Government Enterprises	2628	17,137	1538	1133	22,436
Federal, Civilian	95	515	45	36	691
Military	85	691	88	32	896
State and local	2448	15,931	1405	1065	20,849
State government	105	2864	67	46	3082
Local government	2343	13,067	1338	1019	17,767

Source: BEA 2008
Note (D): As reported by the United States Bureau of Economic Analysis, “not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.”

Table 2-23. Major Employers in Matagorda, Brazoria, Calhoun, and Jackson Counties

Employer	Private/Public	Type	Number
	Matagorda County[a]		
South Texas Project	Private	Electric Generation and Transmission	1365
Bay City Independent School District	Public	Education	700
Matagorda County Hospital District	Public	Hospital	475
Wal-Mart Associates, Inc.	Private	Retail	300
Palacios Independent School District	Public	Education	270
HEB Grocery	Private	Retail	260
Matagorda County	Public	Public Service	260
Lyondell Chemical Company (Equistar)	Private	Chemical	194
OXEA Corporation (formerly Celanese)	Private	Chemical	155
	Brazoria County[b]		
The Dow Chemical Company	Private	Chemical	4570
Texas Department of Criminal Justice	Public	Prison System	2440
Infinity Group	Private	Specialty Contractor	2413
Brazosport Independent School District	Public	Education	2015
Wal-Mart Associates Inc.	Private	Retail	1880
Pearland Independent School District	Public	Education	1810
Alvin Independent School District	Public	Education	1758
Brazoria County	Public	Public Service	1313
Industrial Specialists Inc.	Private	Specialty Contractor	1069
ConocoPhillips	Private	Refining	900
	Calhoun County[b]		
Inteplast Group	Private	Chemical	1700
Formosa Plastics	Private	Chemical	1500
Dow Chemical	Private	Chemical	660
Alcoa	Private	Chemical	630
Calhoun County ISD	Public	Education	613
King Fisher Marine Service	Private	Dredging	330
HEB Grocery	Private	Retail	275
INEOS Nitriles	Private	Chemical	N/A
Calhoun County	Public	Government	N/A
Harmony Industrial	Private	Contract Employees	N/A
International Bank of Commerce	Private	Business	N/A
SSI Management Group	Private	Contract Employees	N/A
Seadift Coke LP	Private	Chemical	N/A
	Jackson County		
The Inteplast Group Ltd.	Private	Plastic Film	1600

Sources: STPNOC 2010a, 2008d; CCEDC 2008; and Exelon 2008.
(a) Data were collected in 2007.
(b) Data undated.

The STP site currently employs approximately 1300 full-time employees, with an additional 1500-2000 workers during maintenance outages (STPNOC 2010a). STP is the largest employer in Matagorda County. Table 2-16 shows where the STP site's employees lived in January 2007. The review team simplified its analysis by concentrating on Matagorda, Brazoria, Calhoun, and Jackson Counties. Approximately 86 percent live in these four counties. Although an additional 8.6 percent live in Wharton and Fort Bend Counties, these are relatively large population counties and would not be expected to be significantly affected by the addition of a small number of construction or operations workers employed by the two proposed units. The review team used the distribution of the STP employees as the basis for several demographic assumptions in its economic impact assessment discussed in Chapters 4 and 5 of this EIS.

Table 2-24 shows the number of workers employed and the unemployment rates for Matagorda, Brazoria, Calhoun, and Jackson Counties and the State of Texas for 1995 and 2005. These data show the number of employed workers in Matagorda County and Calhoun County grew more slowly than the State's rate of 1.83 percent per year, adding 0.12 and 0.23 percent respectively per year to employment during the decade, while the much larger Brazoria County grew much faster than the state—2.97 percent per year. Jackson County saw a 2.24 percent decrease in the number of employed workers. Unemployment decreased significantly in all the counties except for Jackson County.

2.5.2.2 Taxes

Several types of taxes would be impacted by proposed Units 3 and 4. The following subsections describe major taxes, their structure and annual dollar yield. Taxes included in this discussion include personal income and corporate franchise taxes, sales and use tax, and property taxes.

Personal Income and Corporate Franchise Taxes

The State of Texas does not levy a personal income tax on individuals. Texas's primary business tax is the franchise tax, imposed on each taxable entity organized in Texas or doing business in Texas. In 2006, the State of Texas received $2.6 billion (3.6 percent of its total net revenue of $72.4 billion) from franchise taxes. The revised franchise tax base as of January 1, 2008, is the taxable entity's margin. Margin equals the lowest of three calculations: total revenue minus cost of goods sold, total revenue minus compensation, or total revenue times 70 percent. The tax rates are 0.5 percent of the margin for entities primarily engaged in wholesale or retail trade and 1.0 percent for all other taxable entities (STPNOC 2010a). STPNOC qualifies as an "other taxable entity" and, therefore, is subject to the 1.0 percent tax rate.

Table 2-24. Employment and Unemployment Statistics for Matagorda, Brazoria, Calhoun, and Jackson Counties

County	Year	Labor Force	Employment	Unemployment	Unemployment Rate
Matagorda	1995	17,430	14,921	2509	14.4%
	2005	16,430	15,097	1333	8.1%
	Avg. Annual Growth Rate	-0.59%	0.12%	-4.69%	
Brazoria	1995	105,654	97,672	7982	7.6%
	2005	134,404	126,697	7707	5.7%
	Avg. Annual Growth Rate	2.40%	2.97%	-3.51%	
Calhoun	1995	9548	8660	888	9.3%
	2005	9407	8863	544	5.8%
	Avg. Annual Growth Rate	-0.15%	0.23%	-3.87%	
Jackson	1995	8514	8170	344	4.0%
	2005	6668	6341	327	4.9%
	Avg. Annual Growth Rate	-2.43%	-2.24%	-0.49%	
Four-County Total	1995	141,146	129,423	11,723	8.3%
	2005	166,909	156,998	9911	5.9%
	Avg. Annual Growth Rate	1.67%	2.13%	-1.55%	
Texas	1995	9,572,436	8,985,635	586,801	6.1%
	2005	11,225,882	10,626,606	896,276	5.3%
	Avg. Annual Growth Rate	1.59%	1.83%	5.27%	

Sources: BLS 2008; STPNOC 2010a

Sales and Use Taxes

The State sales tax rate for Texas is 6.25 percent of the sale price of taxable goods and services. Local jurisdictions, including cities, counties, transit authorities, and some special purpose districts, may also impose a local sales tax after voter approval but may not exceed 2 percent altogether. The State of Texas received $18.3 billion (25 percent of its revenue) from sales tax collections in 2006 (STPNOC 2010a).

Neither Matagorda County nor the special purpose districts in the county levy sales tax. Cities in Texas may impose additional sales tax, up to the maximum of 2 percent, for the following purposes: sales tax for general fund purposes (1 percent); additional sales tax for property tax reduction (up to 0.5 percent); sales tax for street maintenance (0.25 percent); sales tax for industrial and economic development (up to 0.5 percent); and sales tax for sports and community venues (up to 0.5 percent). The cities of Bay City and Palacios in Matagorda County impose the maximum 2 percent tax rate, making the total sales tax 8.25 percent in these cities. Brazoria, Calhoun and Jackson counties all have a county tax of 0.5 percent and the larger economic centers in these counties generally have a 1.5 percent tax for a total sales tax of 8.25 percent (Texas Comptroller 2008).

The State of Texas currently imposes a 6 percent hotel occupancy tax on rooms in a hotel costing at least $15 per day; however, stays of at least 30 consecutive days are exempt from the tax. Texas received $308 million (0.4 percent of its revenue) from this tax in 2006. Cities and some counties are eligible to adopt a hotel occupancy tax on rooms costing at least $2 per day. To implement a local occupancy tax a majority vote by the governing body is required and the tax revenues must be used to directly promote tourism and the convention and hotel industry. The City of Bay City has imposed a 7 percent sales tax above the 6 percent state sales tax on eligible hotel rooms (STPNOC 2010a).

Property Taxes

Most private property owners pay property taxes to the county and a local school district; however, other local jurisdictions to whom property owners pay taxes may include the host city, hospital district, and junior college district. The sole local source of tax revenue for school districts is the property tax (STPNOC 2010a). Property values are set by the county appraisal district and the tax rate is set by the governing body of each local jurisdiction. Tax rates are expressed as an amount per $100 of assessed value. The tax levy is determined by multiplying the total taxable value by the total tax rate per $100 of value. Total tax rates can include a maintenance and operation (M&O) rate (day to day maintenance and operations), an interest and sinking fund (I&S) rate, or both (STPNOC 2010a).

Matagorda County is more likely to be impacted by property taxes related to new nuclear units at the STP site than Brazoria, Calhoun, and Jackson Counties, because the STP site is within the Matagorda County boundaries. The 2005 total county property tax rate for Matagorda County was $0.31 per $100 of assessed value, all part of the M&O rate. Matagorda County levied approximately $8.1 to $8.2 million annually in property taxes between 2001 and 2005; and the owners of the STP facility are their largest property taxpayers. For the first half of this decade, STP property tax payments to the county, excluding the hospital and special districts, represented nearly three-fourths of Matagorda County's total tax revenues. Table 2-25 presents the total property taxes collected by the county, the total property taxes the STP owners have paid to Matagorda County, and the percent of the total county property taxes that are paid by the owners (STPNOC 2010a).

The STP owner's agreement with Matagorda County allows it to pay a service fee in lieu of property taxes with an annual revenue cap of $6.1 million. The owners also have a similar agreement with the local hospital district, capped at $2.7 million per year. The STP site is within the boundaries of four additional special taxing districts: Navigation District #1, Drainage District #3, the Palacios Seawall District, and the Coastal Plains Groundwater District. The owners pay the standard millage rates assigned by these taxing districts each year. Table 2-26 shows the districts, tax rates, and owner payments to each taxing entity for 2001 through 2006 (STPNOC 2010a).

Table 2-25. Matagorda County Property Tax Information, 2000-2005 (in millions of dollars)

Year	Total Taxable Value	Total County Levy	STP Payments to County[(a)]	STP Payments as % of Total[(a)]
2001	$2788	$8.18	$5.97	72.9
2002	$2559	$8.23	$6.10	74.1
2003	$2580	$8.21	$6.10	74.3
2004	$2551	$8.12	$6.10	75.1
2005	$2655	$8.19	$6.10	74.5
2006	N/A	N/A	$6.10	N/A

Source: STPNOC 2010a
(a) Reflects payments only to Matagorda County; does not include payments to the Hospital District or other special districts.

Table 2-26. Property Tax Statistics for Matagorda County and Special Districts 2001-2006 (in millions of dollars)

Year	Taxing District	Rate/$100 of Assessed Valuation	Levy	Other Fees	Total STP Payment
2001	Matagorda County	$0.29	$3.36	$2.61	$5.97
	Matagorda County Hospital	0.12524	$1.43	$1.12	$2.55
	Navigation District #1	0.03981	$0.46	$0.00	$0.46
	Drainage District #3	0.019	$0.22	$0.21	$0.42
	Palacios Seawall	0.03487	$0.40	$0.37	$0.77
	Total STP Owner Payments		**$5.86**	**$4.30**	**$10.17**
2002	Matagorda County	$0.32	$2.96	$3.14	$6.10
	Matagorda County Hospital	0.1507	$1.39	$1.00	$2.39
	Navigation District #1	0.03981	$0.37	$0.00	$0.37
	Drainage District #3	0.0246	$0.23	$0.00	$0.23
	Palacios Seawall	0.0422	$0.39	$0.00	$0.39
	Coastal Plains Groundwater [2]	0.005	$0.05	$0.00	$0.05
	Total STP Owner Payments		**$5.37**	**$4.14**	**$9.51**
2003	Matagorda County	$0.32	$2.88	$3.22	$6.10
	Matagorda County Hospital	0.1614	$1.46	$1.00	$2.46
	Navigation District #1	0.03981	$0.36	$0.00	$0.36
	Drainage District #3	0.0276	$0.25	$0.00	$0.25
	Palacios Seawall	0.0454	$0.41	$0.00	$0.41
	Coastal Plains Groundwater	0.005	$0.05	$0.00	$0.05
	Total STP Owner Payments		**$5.41**	**$4.22**	**$9.63**

Table 2-26. (contd)

Year	Taxing District	Rate/$100 of Assessed Valuation	Levy	Other Fees	Total STP Payment
2004	Matagorda County	$0.32	$2.32	$3.78	$6.10
	Matagorda County Hospital	0.20999	$1.53	$1.00	$2.53
	Navigation District #1	0.03981	$0.29	$0.07	$0.36
	Drainage District #3	0.0322	$0.23	$0.02	$0.25
	Palacios Seawall	0.0454	$0.33	$0.08	$0.41
	Coastal Plains Groundwater	0.005	$0.04	$0.01	$0.05
	Total STP Owner Payments		**$4.73**	**$4.96**	**$9.69**
2005	Matagorda County	$0.31	$1.95	$4.15	$6.10
	Matagorda County Hospital	0.2124	$1.34	$1.00	$2.34
	Navigation District #1	0.03981	$0.25	$0.00	$0.25
	Drainage District #3	0.0322	$0.20	$0.00	$0.20
	Palacios Seawall	0.0354	$0.22	$0.00	$0.22
	Coastal Plains Groundwater	0.005	$0.03	$0.00	$0.03
	Total STP Owner Payments		**$4.01**	**$5.15**	**$9.15**
2006	Matagorda County	$0.27	$2.44	$3.66	$6.10
	Matagorda County Hospital	0.17214	$1.57	$1.00	$2.57
	Navigation District #1	0.03758	$0.34	$0.00	$0.34
	Drainage District #3	0.022	$0.20	$0.00	$0.20
	Palacios Seawall	0.02528	$0.23	$0.00	$0.23
	Coastal Plains Groundwater	0.00433	$0.04	$0.00	$0.04
	Total STP Owner Payments		**$4.82**	**$4.66**	**$9.48**

Source: STPNOC 2010a

Schools are funded solely through local property taxes. Districts are designated either “property rich” (Texas Education Code, Chapter 41) or “property poor” (Texas Education Code, Chapter 42) based on a wealth benchmark, calculated as the district’s total assessed property valuation divided by the total number of students. Those districts with a total wealth per student above the State benchmark are considered Chapter 41 and those below the benchmark are Chapter 42. The Chapter 41 “property wealthy” districts are required to send a portion of their local property tax revenue in to the State for redistribution to Chapter 42 districts. As with property taxes paid to local jurisdictions, school property taxes consist of both M&O and I&S components and Chapter 41 districts are allowed to keep all I&S collections (STPNOC 2010a). Recent changes by the Texas legislature in 2006 to provide residential tax relief has placed an annual cap on Independent School District (ISD) property tax rates used to fund M&O. Under the new rules, if school boards set a property tax rate above the State cap, the rate would have to be approved in a “rollback” election. The M&O portion of the rollback tax rate is the tax rate that would be needed to raise eight percent more operating funds than the previous year. The exception to the rollback election would be if a district was responding to a natural disaster (STPNOC 2010e).

STP owners pay taxes to the Palacios ISD where STP is the largest property taxpayer, representing an average of 83 percent of Palacios ISD annual revenues between 2000 and 2005. Palacios ISD is considered a Chapter 41 or "property wealthy" district and therefore is required to send a portion of their tax collections to the State for redistribution. Table 2-27 shows Palacios ISD's total revenues, the portion sent to the State and the STP owners' contributions between 2000 and 2005 (STPNOC 2010a).

Table 2-27. Palacios Independent School District Property Tax Revenues and Disposition 2000-2005 (in millions of dollars)

Year	Total District Revenue	STP Owner Total Pmts to ISD	STP Owner Payments as a Portion of Revenues to State	Excess Percentage (goes to State)	Revenue Remaining in District	STP Owner Portion Remaining in District	STP Owner Payments as % of Revenues Remaining in District
2000	$14.90	$12.78	$5.38	42.1%	$8.63	$7.40	85.8
2001	$15.94	$15.78	$8.54	54.1%	$7.32	$7.24	99.0
2002	$15.29	$12.94	$5.78	44.7%	$8.46	$7.15	84.6
2003	$14.92	$12.40	$5.22	42.1%	$8.63	$7.18	83.1
2004	$13.87	$10.55	$3.76	35.6%	$8.93	$6.79	76.0
2005	$12.88	$9.19	$2.72	29.6%	$9.07	$6.48	71.4
Total	**$87.80**	**$73.63**	**$31.39**			**$42.24**	

Source: STPNOC 2010a

Revenues and Expenditures

Matagorda County's total general revenues for 2006 were $17.1 million. Ninety-one percent of its general revenues are from property taxes, of which the STP owners paid $6.1 million (35.6 percent). Expenditures, including general revenues and restricted funds, were $17.9 million. Since Brazoria County is part of the Houston metropolitan area, it is more urbanized than Matagorda County. In 2006, Brazoria County's General Fund revenues were $66.5 million, with property taxes contributing 84 percent and expenditures for 2006 were $66.5 million (STPNOC 2010a). Jackson County's general revenues for 2007 were $7.2 million, with taxes representing $5.2 million and expenditures were $5.5 million (Jackson County 2008). Calhoun County's general revenues for 2007 were an estimated $22.6 million and expenditures were approximately $9.97 million (Calhoun County 2008). STP is not a significant contributor to tax revenues in Brazoria, Calhoun, or Jackson Counties.

2.5.2.3 Transportation

The STP site's transportation network includes State highways, U.S. highways, FM roads, county roads, two railroad networks, nine regional airports and a waterway via the Lower Colorado River. Public transportation in Matagorda County is provided by RTransit. RTransit provides services by appointment to the rural general public, elderly, and persons with disabilities (STPNOC 2010a). In its current configuration and mission of serving special needs, RTransit would have no impact on, and would be unaffected by, the proposed Units 3 and 4 at STP.

Roads

No interstate highways are located within the 50-mi vicinity, but there are two U.S. highways. Highway 59 runs northeast-southwest connecting Fort Bend, Wharton, Jackson and Victoria Counties and Highway 87 runs northwest-southeast and connects Victoria and Calhoun Counties. Many of the roads in the socioeconomic impact area are county roads or FM roads, which are relatively light-duty rural roads. A number of FM and county roads intersect the major highways and connect to the towns within these counties, providing outlying areas access to the State and U.S. Highway system. For example, State Highway 60 runs north-south connecting Highway 59 to FM 521, providing access to the STP site (STPNOC 2010a). Figure 2-25 presents the major road networks in the 50-mi region around the STP site, and Figure 2-26 highlights the most likely employee commuter routes to and from the site on local roads. STPNOC believes that workers commuting from Matagorda County would take one of five routes that connect to FM 521 and access the site. Table 2-28 lists the Matagorda County roadways that STP workers would use to access the plant, the Texas Department of Transportation (TxDOT) road classifications for each road, the number of lanes, the 2005 Average Annual Daily Traffic (AADT) counts at key locations and threshold capacity. Workers commuting from the east side of Matagorda County and all of Brazoria County would likely take Highway 60 south, exiting onto FM 521 west to the STP site. From Calhoun County and Jackson Counties, workers would likely take State Highway 35 and State Highway 111, respectively before connecting to local roads near the site.

Crowding on roadways is often described by Transportation Research Board "Level of Service" (LOS) designations. LOS defines the flow of traffic on a designated highway. LOS designations can range from LOS A (traffic freely flowing) to LOS F (a point where traffic flow exceeds the design capacity of the highway resulting in severe congestion). There is no Transportation Research Board LOS determination for these Texas roads; however, TxDOT does maintain capacity data for these roads in the form of usage (AADT) and functional class system (STPNOC 2010a).

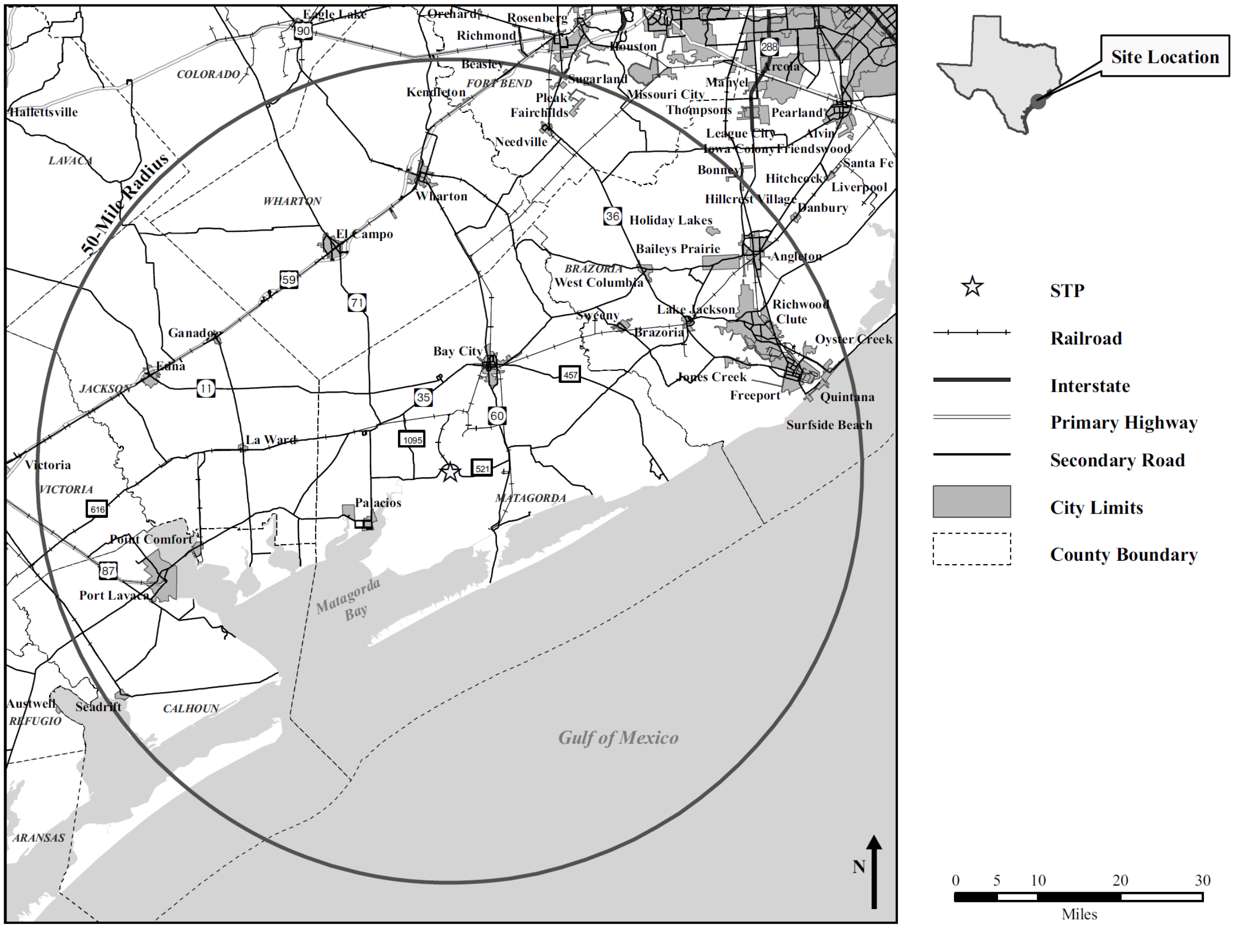

Figure 2-25. Road, Highway, and Rail Transportation System (STPNOC 2010a)

The 2000 Matagorda County population was 37,957 and is expected to increase by 9 percent by 2010 and 18 percent by 2020 (Table 2-18). An average outage work force of approximately 1500 to 2000 additional workers for existing STP Units 1 and 2 would use FM 521 for approximately one month during every refueling outage, scheduled for each reactor, and would add 700 to 800 vehicles per day temporarily to the traffic counts on FM 521 in Table 2-28. (STPNOC 2010a).

Rail

There is no passenger rail service in the four-county socioeconomic impact area, but there are two main freight rail lines near the STP site. The Burlington Northern Santa Fe line runs north-south, ending in Matagorda. The Union Pacific Railroad runs east-west from Brazoria County and continues westward into Jackson County, eventually turning southward along the Texas Gulf Coast and heading toward Mexico. Both lines have spurs leading to industrial facilities.

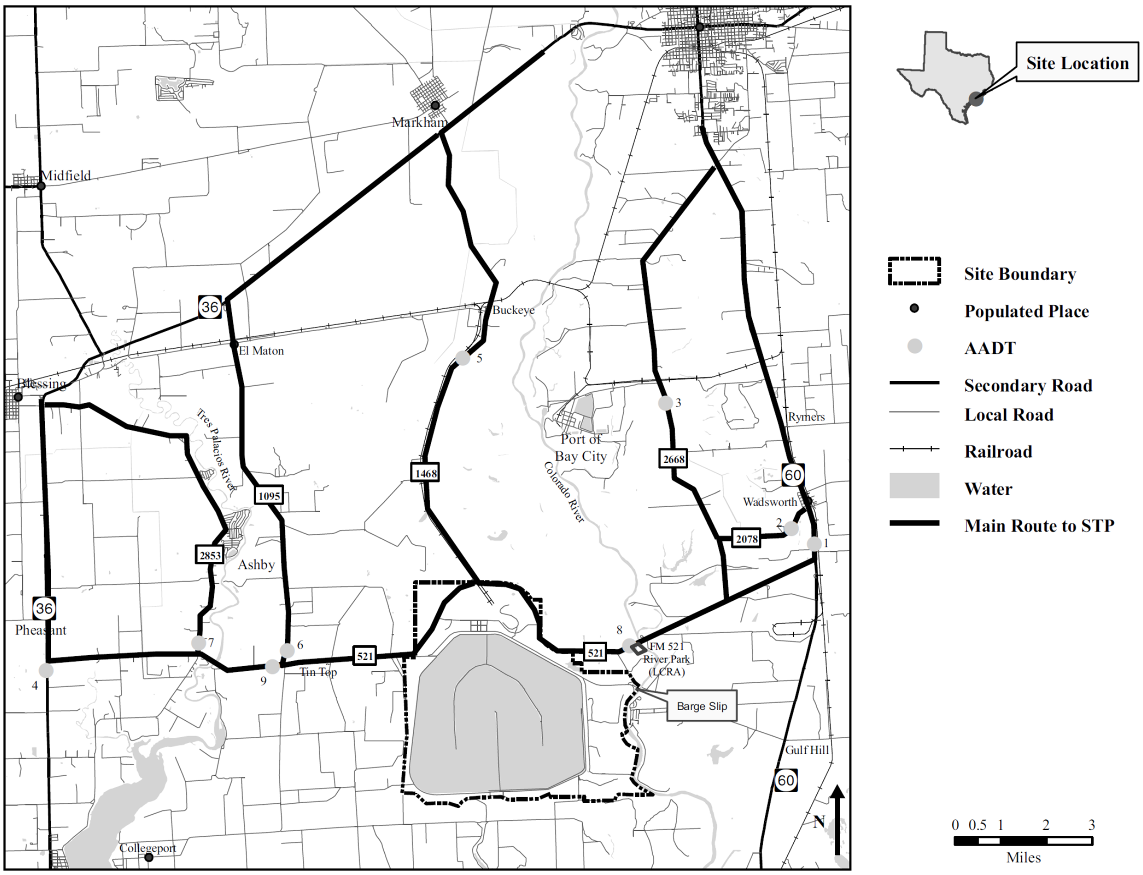

Figure 2-26. Main Routes to STP Site (STPNOC 2010a)

STPNOC reports that a 9-mi railroad spur that heads north from the site to the main east-west rail line is currently "out-of-service." This line formerly served the STP site and STPNOC anticipates that it would be repaired to support building Units 3 and 4. The only railcars with access to this railroad spur are consigned to the STP site (STPNOC 2010a). STPNOC states it would follow all environmental requirements and use protective measures while repairing the spur (STPNOC 2008e).

Waterways

The STP site is located 10 mi north of Matagorda Bay on the west side of the Lower Colorado River. The U.S. Coast Guard is the primary enforcer of regulations related to barges making STP deliveries while TPWD also patrols the river to enforce State regulations. Located on the east side of the STP site is a barge slip used for delivery of major equipment during construction of the first two units at STP. It is expected to be used for deliveries associated with proposed Units 3 and 4 (STPNOC 2010a). The STP barge slip is within tidal reaches of the Gulf of Mexico and is not impacted by seasonal low water issues (STPNOC 2008e).

Table 2-28. Roadway Use Statistics for Most Likely Routes to the STP Site

Roadway and Location[a]	Number of Lanes	Type	TXDOT Road Classification	Average Annual Daily Traffic (AADT) for 2005[b]	Threshold Capacity (passenger cars per hour)[c]
Highway 60 south to FM 521 west	2	Undivided	Rural Major Collector	3880	2300
FM 2078 west to FM 2668 south	2[d]	Undivided	Rural Minor Arterial	450	4200
FM 2668 south to FM 521 west	2	Undivided	Rural Major Collector	1100	2300
FM 521 west to Highway 35 west	2	Undivided	Rural Major Collector	1330	2300
FM 1468 south to FM 521 east	2[d]	Undivided	Rural Minor Arterial	600	4200
FM 1095 south to FM 521 east	2	Undivided	Rural Major Collector	480	2300
FM 2853 south to FM 521 east	2	Undivided	Rural Major Collector	580	2300
FM 521 west	2	Undivided	Rural Major Collector	2530	2300
FM 521 east	2	Undivided	Rural Major Collector	1543	2300

Source: STPNOC 2010a
(a) The traffic counts (AADTs) identified on Figure 2-26 correspond to those listed in this table.
(b) Traffic counts for a 24-hr time period.
(c) Capacity used in travel demand modeling by TxDOT, metropolitan planning organizations, and local governments. The capacity is typically based on level of service (LOS) C (stable flow) based on the Transportation Research Board Highway Capacity Manual. LOS A or B (free flow to reasonably free flow) may also be used as the threshold capacity level in less congested urban areas.
(d) Rural Minor Arterial value form Suburban Fringe Column.

Air

The closest major airport in the area is outside the 50-mi radius in Houston. There are two airports in Matagorda County and one in each of the other three counties within the economic impact region. Most of the regional airports primarily support agricultural aviation.

2.5.2.4 Aesthetics and Recreation

Table 2-29 lists the major recreation areas (state parks and WMAs) within 50 mi of the STP site. There are no major recreation facilities such as destination amusement parks or professional sports venues within 50 mi of STP. A variety of annual events are held in Bay City. These include the Matagorda County Fair and Rodeo, which takes place in March. Other annual events held in Bay City that attract outside visitors include the Bay City Chamber Annual Fishing Tournament in May, the Jazz Festival in July, the Shrimporee and Blessing of the Fleet in August, the Bull Blast in October, and the Fisherman's Festival in December (STPNOC 2010a).

Table 2-29. Wildlife Management Areas and Parks Within 50 mi of the STP Site

Name	Acreage	Location	Annual Visitors	Overnight Facilities
Wildlife Management Areas				
Matagorda Island	56,688	Calhoun County	1100	Primitive Camping
Mad Island	7200	9 mi east of Collegeport – Matagorda County	1200	None
Peach Point	11,938	West of Freeport near Jones Creek, Brazoria County	2700	None
D.R. Winterman	246	Egypt, Wharton County	Less than 10	None
Mad Island Marsh Preserve	7063	South east of Collegeport, Matagorda County	1700	None
Big Boggy National Wildlife Refuge	5000	Wadsworth, Brazoria County	250	None
San Bernard National Wildlife Refuge	45,311	Matagorda and Brazoria Counties	32,000	None
Brazoria National Wildlife Refuge	43,388	Angleton, Brazoria County	35,000	None
Nannie M. Stringfellow Wildlife Management Area	3664	8 mi from Brazoria, Brazoria County	300	None
Parks				
Brazos Bend State Park	5000	Needville, Fort Bend County	206,000	Campsites with water and electricity
LCRA Hollywood Bottom	36	Along the Colorado River south of Wharton, Wharton County	3700	Camping with limited facilities
LCRA Matagorda Bay Nature Park	1600	Mouth of the Colorado River on the Matagorda Peninsula -Matagorda County	25,000[(a)]	Tent camping on beach 70 site RV-park with full utility hook-ups
LCRA FM-521 River Park	13	4 mi west of Wadsworth on FM 521-Matagorda County	3000	None

Source: STPNOC 2010a
(a) This number reflects how many overnight RV stays that have occurred since the park opened.

The closest state park to the STP site is Brazos Bend in Needville (Fort Bend County), approximately 35 mi from the STP site. Birding is a major tourist attraction in the 50-mi STP region and Matagorda County has ranked first in the North American Audubon CBC for the past nine years. The Great Texas Coastal Birding Trail goes through many areas within 50 mi of STP and 14 State-recognized birding sites are located in Matagorda County. These sites include pull-outs along FM 2031 (as well as other local roads) and the Matagorda County

Birding Nature Center, with trails and observation platforms (TPWD 2009c). With its 110 ac of man-made seasonally flooded prairie wetlands that host many species of wintering ducks and roosting geese, the STP site is a stop along the Birding Trail. There is an observation area and tours are available through the Visitors Center. Migrant shorebirds and other water birds can be seen onsite in the spring (STPNOC 2010a).

The Matagorda Bay area recreation activities include camping, hiking, bicycling, surfing, swimming, beach combing, bird watching, nature study, fishing, passenger ferry, on-island shuttle and scheduled tours. With the exception of peak times, Matagorda Beach and Sargent Beach receive less than 100 visitors a day. There are two local outriggers providing guided tours of the Colorado River and an annual fishing tournament that occasionally uses the Colorado River (STPNOC 2008a).

Existing STP Units 1 and 2 do not have cooling towers. Instead, they have a 7000-ac MCR. The 13-mi embankment of the MCR is visible from the southeast along the Colorado River and other points surrounding the site. The tallest structures on the site are the 145-ft high reactor containment domes, which are visible from FM 521, the closest road to the site. They are also visible from secondary roads from points 6.5 to 7 mi to the southwest. The terrain surrounding the site is rather flat and treeless, so there is little to screen the site from area roadways. No STP site facilities can be seen from Matagorda Bay, the Intracoastal Waterway or from any of the recreation areas listed in Table 2-29 (STPNOC 2010a).

2.5.2.5 Housing

Approximately 86 percent of current STP 1 and 2 employees reside in Brazoria (22.4 percent), Calhoun (1.6 percent), Jackson (1.3 percent) and Matagorda (60.7 percent) counties. An additional 14 percent are distributed across at least 16 other counties (see Table 2-16). Within 50 mi of the proposed site, there are residential areas in and near cities and towns, smaller communities, and farms.

Rental property is scarce in the rural areas of the region, but is available in the larger municipalities such as Bay City, Palacios, Edna, Port Lavaca, Angleton, Pearland, Alvin, and the Brazosport CCD (Lake Jackson-Clute-Freeport) area. In the vicinity of the STP site, housing structures are generally isolated, single-family homes. Newer residential developments are primarily associated with the towns or cities in the socioeconomic impact area.

Table 2-30 provides the number of housing units and vacancies for the four-county socioeconomic impact area: Brazoria, Calhoun, Jackson, and Matagorda. While some more recent data are available for some larger counties in Texas, this was not true for all of the four counties of interest. Consequently, year 2000 data are presented in this analysis for consistency across counties. While the review team believes the data will differ between 2000 and when building begins, the review team also believes that most of the housing markets would be larger and more able to accept additional population and, therefore, use of more current population data would not change the conclusions of this report. In 2000, there were a total of 126,022 housing units in the socioeconomic impact area, with an average vacancy rate of 13.8 percent. The vacancy rates for Calhoun, Jackson, and Matagorda counties were higher than the average rate for the four-county socioeconomic impact area, while the vacancy rate for Brazoria County was lower than the average (USCB 2000a).

Table 2-30. Regional Housing Information by County for the Year 2000

County	Total Housing Unit	Occupied	Owner Occupied	Renter Occupied	Vacant Housing	Percent Vacancy
Brazoria	90,628	81,954	60,674	21,280	8674	9.6%
Calhoun	10,238	7442	5417	2025	2796	27.3%
Jackson	6545	5336	3936	1400	1209	18.5%
Matagorda	18,611	13,901	9282	4619	4710	25.3%
Total	**126,022**	**108,633**	**79,309**	**29,324**	**17,389**	**13.8%**

Source: USCB 2000a

Of 4710 vacant housing units in Matagorda County in 2000, 685 were for rent and 244 were for sale. Also, of the 4710 vacant units, 709 were mobile homes and 224 were in the category of RVs, boats, vans, etc. Of 8674 vacant housing units in Brazoria County, 3168 were for rent and 984 were for sale. Of the 8674 vacant units, 1535 were mobile homes and 176 were in the category of RVs, boats, vans, etc (STPNOC 2010a). Of 2796 vacant housing units in Calhoun County in 2000, 385 were for rent and 114 were for sale. Also, of the 1209 vacant units, 518 were mobile homes and 38 were in the category of RVs, boats, vans, etc. Of 1209 vacant housing units in Jackson County in 2000, 256 were for rent and 67 were for sale. Also, of the 2796 vacant units, 204 were mobile homes and 14 were in the category of RVs, boats, vans, etc. (USCB 2000b, c, d, e, f, g). A total of 5903 vacant housing units were available for sale or rent in the two counties.

Vacant housing units for seasonal, recreational, or occasional use were approximately 2407 in Matagorda County, 1496 in Brazoria County, 1751 in Calhoun County and 228 in Jackson County. Hotel/Motel data for the four-county socioeconomic impact area in 2006 is presented in Table 2-20 (STPNOC 2010a; USCB 2000b, c, d, e, f, g). There were approximately 1099 hotel rooms per night available with an average occupancy of about 54 percent.

2.5.2.6 Public Services

Water Supply and Waste Treatment

The STP site consumed 422 million gallons of water in 2005 from five onsite groundwater wells. Approximately five percent of this water was used for sanitary and drinking uses. From 2001 through 2006 STP used approximately 1.1 million gallons per day (MGD) on average for all purposes pertaining to existing STP Units 1 and 2. The STP site is permitted to withdraw an average of 2.7 MGD (STPNOC 2010a).

Water assessment and planning in Texas is performed on a regional basis rather than a county or city basis and all four counties in the socioeconomic impact area are in different planning regions. Each region is made up of several different counties and is represented by a Regional Water Planning Group, composed of representatives from a variety of interests that prepares a regional water plan for the region. Matagorda County is in Region K. Brazoria County is located in Region H, which also includes the City of Houston. Calhoun County is located in Region L (includes San Antonio) and Jackson County is located in Region P. Below is a brief overview of each region's water issues from 2010 to 2060. More information on surface water and groundwater issues can be found in Section 2.3.

Region K's population is projected to increase nearly 100 percent between 2010 and 2060 to 2.7 million people (representing 5 percent of the projected Texas population); however, water demands are not projected to increase as significantly. Water demand in 2060 for Region K is expected to be about 1.3 million ac-ft, up slightly from the 2010 level of about 1.1 million ac-ft. The Colorado River and its tributaries are the primary surface water supply sources and five primary aquifers provide groundwater supplies. Due to reservoir sedimentation and expired water supply contracts, Region K expects its total water supply to decrease from 1.18 million ac-ft in 2010 to 888,000 ac-ft in 2060. Water demand would be 400,000 ac-ft more than water supply. However, water management strategies for Region K are expected to provide 860,000 ac-ft of additional water supply by 2060. Water management strategies for Region K to meet 2060 demand include reuse, seawater desalination, conservation and the LCRA-SAWS Water Project. The LCRA-SAWS Water Project includes off-channel reservoirs, agricultural water conservation, additional groundwater development, and new and/or amended surface-water rights (STPNOC 2010a).

Region H population is expected to represent 23 percent of the State's population in 2010 (5.8 million people) and increase 89 percent to 10.9 million people in 2060. Total water demand is projected to be 2.3 million ac-ft in 2010 and 3.4 million ac-ft in 2060. Total water supply is projected to decrease due to reduced supplies in the Gulf Coast Aquifer because of district subsidence regulations from 2.71 million ac-ft in 2010 to 2.56 million ac-ft in 2060. Region H plans to meet the 2060 deficit of 800,000 ac-ft using several water management strategies including reuse, seawater desalination and conservation. These strategies are expected to provide 1.3 million ac-ft of water by 2060 (STPNOC 2010a).

Although Region L population is expected to increase approximately 75 percent between 2010 and 2060, water demand is expected to increase less dramatically. Water demand is projected to increase from 985,000 ac-ft in 2010 to 1.27 million ac-ft in 2060, while year 2060 water supplies are projected to be 1.02 million ac-ft. Region L water management plans to compensate for this deficit include coordinated use of surface water and groundwater, reuse, groundwater and seawater desalination, conservation and the LCRA-SAWS Water Project. These strategies are expected to provide 730,000 ac-ft of additional water by 2060 (TWDB 2006c).

Region P population is expected to remain relatively stable between 2010 and 2060 (less than 50,000). Water demand is expected to decrease slightly during that same period. Region P is projected to see a decrease in water demand from 226,000 ac-ft in 2010 to 207,000 ac-ft in 2060. The total water supply is estimated to remain constant at 209,000 ac-ft per year throughout the 2010 to 2060 time period. Region P is expected to meet their 2010 deficit by pumping additional groundwater during the irrigation season, then allowing water levels to recover. Water management plans for Region P include conservation for municipal users only, the continued use of good agricultural practices, and fees for groundwater export out of the region (TWDB 2006a).

Table 2-31 describes water suppliers in the four-county socioeconomic impact area, their current capacities, and their average daily production. Currently, there is excess production capacity in water supply facilities.

Local governments provide wastewater treatment and TCEQ regulates it. Plant capacity is based on an average usage over a period of time and therefore, short-term usage may exceed the overall capacity (STPNOC 2010a). Once a plant has exceeded 75 percent of permitted average daily or annual average flow for three consecutive months, the permitted plant must begin engineering and financial planning for expansion/upgrades of the facility. Once the facility reaches 90 percent of permitted average daily flow for three straight months, it must obtain TCEQ authorization to begin building. There are a few systems in the area which have occasionally exceeded permitted capacity, but none that have done so for 3 months in a row. Table 2-32 details public wastewater treatment facilities in the socioeconomic impact area, the average flow rates for their plant designs, and their average monthly processing. The rural areas of each county are on septic systems (STPNOC 2010a).

Table 2-31. Water Supply, Capacity, and Average Daily Consumption by Major Water Supply Systems in Brazoria, Calhoun, Jackson, and Matagorda Counties

System Name	Population Served[a,b]	Primary Water Source[b]	Total Production (MGD)[c]	Max Purchased Capacity (MGD)[c]	Average Daily Consumption (MGD)[c]
		Brazoria County			
City of Alvin	17,916	Groundwater	8.739	4.75	1.307
City of Angleton	19,167	Purchased Surface Water	5.112	2.016	1.91
City of Clute	13,836	Purchased Surface Water	2.08	0	0.361
City of Freeport	25,058	Purchased Surface Water	0	2	1.4
City of Lake Jackson	25,890	Purchased Surface Water	6.696	2	3.1
City of Pearland	56,877	Purchased Surface Water	13.54	0	3.14
County Subtotal	*158,744*		*36.167*		*11.218*
		Calhoun County			
Calhoun County Rural Water System	3705	Purchased Surface Water	2.26	0	0.205
City of Point Comfort	2751	Surface Water	1.152	0	0.128
City of Port Lavaca	13,269	Purchased Surface Water	0	2	1.14
City of Seadrift	2331	Groundwater	2.304	0	0.104
Port O'Connor MUD	3810	Purchased Groundwater	1.044	0	N/A
County Subtotal	*25,866*		*6.76*		*1.577*
		Jackson County			
City of Edna	5899	Groundwater	3.16	0	0.544
City of Ganado	1847	Groundwater	2.923	0	0.199
Jackson County WCID 1	741	Groundwater	0.346	0	0.047
Jackson County WCID 2	480	Groundwater	0.324	0	0.057
County Subtotal	*8967*		*6.753*		*0.847*
		Matagorda County			
City of Bay City	19,263	Groundwater	8.856	4.403	2.409
City of Palacios	5100	Groundwater	1.973	1.224	0.542
County Subtotal	*24,363*		*10.829*		*2.951*

Sources: STPNOC 2010a; EPA 2008; TCEQ 2008b

(a) Data selected based on major populations served per county. Year of data not provided. Data extracted from TCEQ database that is updated continuously.

(b) EPA 2008.

(c) TCEQ 2008b.

WCID = Water Control and Improvement District. MUD = Municipal Utilities Department.

Table 2-32. Designed Capacity and Maximum Water Treated in Wastewater Treatment Systems in Brazoria, Calhoun, Jackson, and Matagorda Counties

System Name	Plant Designed Average Flow (MGD)	Average Wastewater Processed (MGD)	Time Period
Brazoria County			
Oak Manor MUD	0.080	0.026	January 2006 – December 2006
City of Sweeny	0.975	0.396	January 2006 – December 2006
City of Alvin	5.000	2.396	January 2006 – December 2006
Commodore Cove Improvement District	0.060	0.024	January 2006 – December 2006
City of Brazoria	0.750	0.422	January 2006 – December 2006
City of Lake Jackson	4.000	2.868	January 2006 – December 2006
City of West Columbia	1.600	0.646	January 2006 – December 2006
Brazoria County FWSD No. 1	0.140	0.034	January 2006 – December 2006
City of Pearland (STP No. 2)	3.100	1.517	January 2006 – December 2006
City of Pearland (STP No. 3)	1.750	1.692	January 2006 – December 2006
City of Freeport	2.250	0.839	January 2006 – December 2006
City of Freeport	0.300	0.008	January 2006 – December 2006
City of Clute	4.000	2.713	January 2006 – December 2006
City of Hillcrest Village	0.150	0.082	January 2006 – December 2006
City of Angleton	3.600	1.465	January 2006 – December 2006
City of Angleton	0.250	0.093	January 2006 – December 2006
City of Danbury	0.504	0.157	February 2006 – November 2006
City of Oyster Creek	0.500	0.194	January 2006 – December 2006
City of Pearland	0.950	0.457	January 2006 – December 2006
Brazoria County MUD No. 3	2.400	1.064	January 2006 – December 2006
City of Pearland	2.000	1.394	January 2006 – December 2006
City of Pearland	0.250	0.341	January 2006 – December 2006
City of Manvel Outfall 001A and Outfall B	0.100	0.060	January 2006 – December 2006
Brazoria County MUD 21	0.250	0.125	January 2006 – December 2006

Table 2-32. (contd)

System Name	Plant Designed Average Flow (MGD)	Average Wastewater Processed (MGD)	Time Period
Calhoun County			
City of Point Comfort	0.2	0.057	September 2006 – August 2007
City of Port Lavaca	1.5	1.24	October 2006 – September 2007
City of Seadrift	0.3	0.15	September 2006 – August 2007
Port O'Connor MUD	0.6	0.11	September 2006 – August 2007
Guadalupe-Blanco River Authority	0.03	0.009	September 2006 – August 2007
South-Central Calhoun County W.	0.075	0.021	August 2006 – July 2007
Jackson County			
City of Edna	1.8	0.713	September 2006 – August 2007
City of Ganado	0.35	0.201	September 2006 – August 2007
City of La Ward	0.013	0.0017	September 2006 – August 2007
Jackson County WCID No. 1	0.062	0.042	August 2006 – July 2007
Jackson County WCID No. 2	0.045	0.045	October 2006 – September 2007
Matagorda County			
City of Palacios	0.800	0.512	January 2006 – December 2006
Matagorda County WCID No. 6	0.193	0.065	January 2006 – December 2006
City of Bay City	4.300	2.420	January 2006 – December 2006
Markham MUD	0.300	0.042	January 2006 – December 2006
Matagorda County WCID No. 5	0.075	0.046	January 2006 – December 2006
Beach Road MUD	0.050	0.027	January 2006 – December 2006
Lower Colorado River Authority	0.025	0.003	August 2006 – December 2006

Sources: STPNOC 2010a; Exelon 2008
WCID = Water Control and Improvement District.
MUD = Municipal Utilities Department.
N/A = Not Available.

Police, Fire and Medical

The Matagorda County Emergency Management Office is the lead agency responsible for emergency management planning in Matagorda County and coordinates with both the Governor's Division of Emergency Management and the STP Emergency Response Organization when responding to emergencies. Table 2-33 and Table 2-34 provide police and fire information for the four county socioeconomic impact area. Emergency management officials consider police and fire protection adequate at this time (STPNOC 2010a).

Table 2-33. Law Enforcement Personnel 2005

Political Jurisdiction	Total Law Enforcement Employees	Total Police Officers[a]	Total Civilians[b]
Brazoria County			
Brazoria County	279	164	115
Alvin	70	43	27
Angleton	47	36	11
Brazoria	10	6	4
Clute	31	22	9
Danbury	1	1	0
Freeport	36	27	9
Lake Jackson	58	43	15
Manvel	10	8	2
Oyster Creek	9	5	4
Pearland	121	91	30
West Columbia	15	8	7
Total	687	454	233
Calhoun County			
Calhoun County	56	22	34
Point Comfort	1	1	0
Port Lavaca	25	19	6
Seadrift	2	2	0
Total	84	44	40
Jackson County			
Jackson County	24	14	10
Edna	11	9	2
Ganado	4	3	1
Total	39	26	13
Matagorda County			
Matagorda County	70	40	30
Bay City	45	33	12
Palacios	20	15	5
Total	135	88	47
Total All Counties	**945**	**612**	**333**

Source: FBI 2006

(a) Individuals who ordinarily carry a badge and a firearm and have full arrest powers.

(b) Personnel such as clerks, radio dispatchers, stenographers, jailers, and mechanics.

Table 2-34. Fire Protection Personnel[(a)]

Fire Dept Name	Dept Type	Number of Stations	Active Firefighters (Career)	Active Firefighters (Volunteer)	Active Firefighters (Paid per Call)	Non Firefighting (Civilian)	Non Firefighting (Volunteer)
Brazoria County							
Alvin Volunteer Fire Department	Volunteer	2	0	65	0	2	0
Angleton Fire Department	Volunteer	3	0	34	0	0	0
Brazoria Fire Dept	Volunteer	1	0	26	0	0	0
Brookston Volunteer Fire Department	Volunteer	1	0	10	0	0	2
Clute Volunteer Fire Department	Volunteer	2	0	31	0	0	1
Columbia Lakes Volunteer Fire Department	Volunteer	1	0	16	0	0	0
County Road 143 Volunteer Fire Department	Volunteer	1	0	12	0	0	4
Damon Volunteer Fire Department	Volunteer	1	0	12	0	0	4
Demi-John Volunteer Fire Department	Volunteer	1	0	16	0	0	6
Freeport Fire Department	Mostly Volunteer	2	9	15	0	0	0
Iowa Colony Volunteer Fire Department	Volunteer	1	0	16	0	0	5
Jones Creek Volunteer Fire Department	Volunteer	1	0	20	0	0	0
Lake Jackson Volunteer Fire Department	Volunteer	2	0	52	0	0	5
Liverpool Volunteer Fire Department	Volunteer	1	0	12	0	0	6
Manvel Volunteer Fire Department	Volunteer	2	0	23	5	0	0
Old Ocean Volunteer Fire Department	Volunteer	2	0	14	0	0	0
Pearland Volunteer Fire Department	Volunteer	4	0	55	0	0	0
River's End Volunteer Fire Department	Volunteer	1	0	10	0	0	20
Rosharon Volunteer Fire Department	Volunteer	1	0	14	0	0	0
Surfside Volunteer Fire Department	Mostly Volunteer	1	1	8	0	0	5
Sweeny Fire and Rescue	Volunteer	1	0	30	0	0	10
The Danbury Volunteer Fire Department	Volunteer	1	0	14	0	1	0
Wild Peach Volunteer Fire Department	Volunteer	1	0	21	0	0	0

Table 2-34. (contd)

Fire Dept Name	Dept Type	Number of Stations	Active Firefighters (Career)	Active Firefighters (Volunteer)	Active Firefighters (Paid per Call)	Non Firefighting (Civilian)	Non Firefighting (Volunteer)
Calhoun County							
Magnolia Beach Volunteer Fire Department	Volunteer	1	0	11	0	0	2
Olivia-Port Alto Volunteer Fire Department	Volunteer	1	0	20	0	0	0
Port Lavaca Fire Department	Mostly Career	2	16	11	0	1	0
Port O'Connor Volunteer Fire Department	Volunteer	1	0	20	0	0	10
Seadrift Volunteer Fire Department	Volunteer	1	0	15	0	0	2
Thomaston Volunteer Fire Department	Volunteer	1	0	8	0	0	12
Jackson County							
Edna Fire Department	Mostly Volunteer	1	8	22	0	1	0
Ganado Volunteer Fire Department	Volunteer	1	0	0	26	0	0
La Ward Volunteer Fire Department	Volunteer	1	0	15	0	0	3
Matagorda County							
Bay City Volunteer Fire Department	Volunteer	1	0	46	0	0	0
Blessing Voluntary Fire Department	Volunteer	1	0	12	0	0	0
Carancahua Volunteer Fire Department	Volunteer	1	0	12	0	0	8
Markham Volunteer Fire Department	Volunteer	1	0	20	0	0	5
Matagorda Volunteer Fire Department	Volunteer	2	0	22	0	0	25
Midfield Volunteer Fire Department	Volunteer	1	0	17	0	0	25
Palacios Volunteer Fire Department	Volunteer	2	0	25	0	0	0
Van Vleck Volunteer Fire Department	Volunteer	1	0	8	0	0	0
Total All Counties		**54**	**34**	**810**	**31**	**5**	**160**

Source: USFA 2008

(a) Data is from the U.S. Fire Administration National Fire Department Census. Responses are voluntary and the USFA estimates that, as of 2008, approximately 85% of the nation's fire departments have responded.

Table 2-35 presents hospital use and medical practitioner data by county. There are a total of eight hospitals in the four county socioeconomic impact areas. Four of those hospitals are in Brazoria County, with over 213 beds and 766 physicians. Calhoun and Jackson counties each have one hospital with 25 and 54 staffed beds and 20 and 4 doctors respectively. Matagorda County has two hospitals with 83 staffed beds and at least 41 doctors.

Table 2-35. Hospital Data for Brazoria, Calhoun, Jackson and Matagorda Counties

Facility Name	Staffed Beds	Admissions [(a)]	Census [(b)]	Outpatient Visits [(a)]	Personnel [(c)]	No. of Physicians
Brazoria County						
Alvin Diagnostic and Urgent Care Center	NA	NA	NA	NA	NA	NA
Angleton Danbury Medical Center	43	2385	21	46,745	257	NA
Brazosport Regional Health System	156	5812	61	107,883	491	NA
Sweeny Community Hospital	14	274	2	15,560	123	NA
Total	213	8471	84	170188	871	766
Calhoun County						
Memorial Medical Center	25	1385	13	29,674	349	NA
Total	25	1385	13	29674	349	20
Jackson County						
Jackson County Hospital District	54	403	32	NA	108	NA
Total	54	403	32	NA	108	4
Matagorda County						
Matagorda County General Hospital	66	2222	21	34,912	329	NA
Palacios Community Medical Center	17	391	2	5846	27	NA
Total	83	2613	23	40,758	356	41
Total All Counties	**375**	**12872**	**152**	**240,620**	**1684**	**831**

Sources: STPNOC 2010a and Exelon 2008
(a) Total during a recent 12-month period.
(b) Average daily census during a recent 12-month period.
(c) Hospital personnel list does not include doctors that serve patients in the hospital, but are not employed by the hospital.
NA – Not Available.

Low-income residents are able to access low-cost medical care through two organizations in Matagorda County: the Matagorda County Hospital District Public Health Clinic (Public Health Clinic) and the Matagorda Episcopal Health Outreach Program. The Public Health Clinic is a county organization that assists residents through three programs: the Indigent Care Program, the Low-Income Program, and Reduced Rates for the Uninsured Program. The Matagorda Episcopal Health Outreach Program is funded and operated by a faith-based non-governmental organization and provides mobile medical services to low-income and uninsured populations. Low-income residents in Brazoria, Calhoun, and Jackson counties are able to access low-cost care from the County Health Department (STPNOC 2010a).

Social services in the four-county socioeconomic impact area are provided by State and local governmental and non-governmental organizations. The United Way helps support many organizations in the four counties. STPNOC employees have been active in many of these same organizations. The primary State-level organization that provides social services is the Texas Health and Human Services Commission. The Commission oversees the Department of Aging and Disability Services, the Department of Assistive and Rehabilitative Services, the Department of Family and Protective Services, and the Department of State Health Services, which, collectively, provide the following services: Medicaid, Children's Health Insurance Program, Temporary Assistance for Needy Families, Food Stamps and Nutritional Programs, Family Violence Services, Refugee Services, and Disaster, Assistance (STPNOC 2010a). Table 2-36 shows the list of United Way agencies in Matagorda County, together with their client bases and their funding.

Education

A total of 17 school districts with 136 schools supported a 2005-2006 student enrollment of 69,709 (Table 2-37) (NCES 2008) in the socioeconomic impact area. In addition, there are 12 private schools with a 2005-2006 student enrollment of approximately 1496 students. There are two colleges approximately 50 mi from the STP site (STPNOC 2010a). The public school systems in the four-county socioeconomic impact area are organized into ISDs. Table 2-37 and Table 2-38 provide summary data on the public and private schools, respectively, in the four-county socioeconomic impact area.

Brazoria County has the largest number of school districts and the most expansion, because Houston is encroaching on it. Alvin ISD expects its population to double in the next 10 years. Local school officials at Angleton ISD stated they would have extra capacity with the new construction and renovation plans currently underway and Columbia-Brazoria ISD stated they already have extra capacity. Bay City ISD is likely to be impacted more than other districts due to the proximity of the STP site. Local officials at Bay City ISD stated that facilities currently are adequate and that they have a new high school, though they also note that, depending on the age and location of in-migrating children, portable buildings may be needed (Scott and Niemeyer 2008). Capacity data were not available on the private schools in the socioeconomic impact area, although student–teacher ratios were available. Private schools do not have the same obligation to serve as public schools, so their prospective enrollment levels and capacities are more optional. Brazosport College awards both Baccalaureate and Associate Degrees and is approximately 54 mi from STP in Lake Jackson, Texas. The college's 2007 enrollment in both credited and non credit courses was 34,484 (Brazosport College 2008). Wharton County Junior College awards Associate Degrees. The main campus, which had a 2006 enrollment of 6089, is located approximately 55 mi from STP in Wharton, Texas (STPNOC 2010a). A branch campus of Wharton County Junior College opened in Bay City in 2008. Due to the current aging workforce at nuclear power plants and the expansion of the STP plant, the branch campus offers a program in Nuclear Power Technology (WCJC 2008).

Table 2-36. United Way Agencies of Matagorda County

Matagorda County United Way Agencies	Number of Clients Last Fiscal Year	% Budget from United Way for 2001	$ Received From United Way & Grants Received Using United Way Funding as Matching Funds	% of Budget From United Way & Grants Matched by United Way Funds
Matagorda County United Way & HELPLINE	9000	100%	$30,000	100%
American Red Cross- Bay City Chapter	17,000	45%	$49,500	51%
Association for Retarded Citizens	69	48%	$31,000	48%
Bay City Day Care	400	7%	$32,500	10%
Bay City Community/ Salvation Army Food Pantry	9000	32%	$4500	32%
Boy Scouts	1132	1%	$10,000	1%
Boys & Girls Club-Palacios	369	19%	$46,000	95%
Caring & Sharing Food Pantry	10,332	26%	$12,000	53%
Court Appointed Special Advocates	746	16%	$93,900	99%
Council on Substance Abuse	1321	3%	$473,454	99%
DARE-BCISD	2000	3%	$1000	3%
DARE-TISD	600	3%	$1000	3%
Economic Actions Committee	2043 utilities/nutrition	8%	$45,617	12%
4-H Marine---Sea Masters	142	25%	$1000	25%
Friends of Elder Citizens	425 daily meals	9%	$423,000	76%
Girl Scouts	224	1%	$9500	1%
Kids in Distress	25	79%	$11,695	84%
Literacy Volunteers of America	62	30%	$34,500	100%
Matagorda Episcopal Hospital Outreach Program	2657	6%	$68,862	24%
Rainbow Land Day Care	70 daily	23%	$55,580	100%
Salvation Army - Bay City Service Unit	1228	10%	$29,757	25%
Teen Court	1685	19%	$85,000	100%
Women's Crisis Center	1600	6%	$510,793	91%
Total Dollars Received			$2,060,158	

Source: Matagorda County United Way, as reported in STPNOC 2008e

Table 2-37. Public School Statistics in the Four-County Socioeconomic Impact Area, 2005-2006

	Schools	Students	Student Teacher Ratio	Capacity	Available Capacity
Brazoria County					
Alvin ISD	20	13,266	15.7	(a)	(b)
Angleton ISD	13	6444	16.1	8700	2300
Brazosport ISD	21	13,260	15.9	13,043+	(b)
Columbia-Brazoria ISD	6	3056	15.2	3450 to 3600	400–500
Damon ISD	2	164	12.2	164	0
Danbury ISD	4	759	13.4	Not available	(c)
Pearland ISD	21	15,543	17	19,500	4000
Sweeny ISD	4	2086	15.2	2,300+	200+
Calhoun County					
Calhoun County ISD	9	4326	16	Not available	Not available
Jackson County					
Edna ISD	5	1472	13.5	Not available	(d)
Ganado ISD	2	658	11.8	Not available	Not available
Industrial ISD	4	989	11.5	Not available	Not available
Matagorda County					
Bay City ISD	8	4140	14	4600	500
Matagorda ISD	1	56	7	112	56
Palacios ISD	6	1638	13.9	Not available	(e)
Tidehaven ISD	5	889	11.9	1050	161
Van Vleck ISD	5	963	12	Not available	Not available
Total	**136**	**69,709**	-		

Sources: NCES 2008; STPNOC 2010a

(a) Student population expected to nearly double in the next 10 years. Extensive building development program is underway.
(b) Some excess capacity once ongoing building program completed.
(c) District is in the process of preparing a facilities study. New construction expected in the next 5 years.
(d) District just completed construction of a new elementary school.
(e) District is in the process of preparing a facilities study.

STPNOC has partnered with community leadership, ISD leaders, educators, colleges, business owners, and other industry in the development of a community- and regional-based education alliance called the Gulf Coast Industry Education Alliance. Their goal is to have a “Grow Your Own” community-based workforce. They are accomplishing this by working with the region’s middle schools and high schools to get students in the right classes for a career in nuclear energy. The Alliance also works with State and national funding agencies to identify available funds for expanding existing laboratories, developing student skills, and attracting and retaining teachers (STPNOC 2010a).

Table 2-38. Private School Statistics in the Four-County Socioeconomic Impact Area, 2005-2006

Private School	Location	Grade Levels	Enrollment	Student/ Teacher Ratio
Brazoria County				
Brazosport Christian School	Lake Jackson	pK-12	293	9.7
Carden-Jackson School	Pearland	pK-8	118	8.7
Columbia Christian School	West Columbia	pK-12	88	8.6
Hope Christian Learning Center	Pearland	8-12	7	7
Living Stones Christian School	Alvin	K-12	207	9.7
Montessori School of DT	Pearland	pK-1	63	12.7
Our Lady Queen of Peace Catholic School	Richwood	pK-8	311	9.5
Pearland Heritage Christian Academy	Monaville	K-7	26	6.5
St. Helen Catholic School	Pearland	K-8	249	17.2
Sweeny Christian School	Sweeny	pK-5	67	10.5
Calhoun County				
Our Lady of the Gulf Catholic School	Port Lavaca	K-8	67	NA[a]
Jackson County				
None				
Matagorda County				
Holy Cross School	Bay City	pK-6	133	12.4
Total			**1496**	

Source: STPNOC 2008a
(a) This information is not available.

2.6 Environmental Justice

Environmental justice refers to a Federal policy established under Executive Order 12898 that requires each Federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations (59 FR 7629).[a] The Council on Environmental Quality has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040).

(a) Minority categories are defined as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; or Hispanic ethnicity; “other” may be considered a separate minority category. Low income refers to individuals living in households meeting the official poverty measure. To see the US Census definition and values for 2000, visit the US Census website at: http://ask.census.gov/.

This section describes the existing demographic and geographic characteristics of the proposed site and its surrounding communities. It offers a general description of minority and low-income populations within the 50-mi region surrounding the site. The characterization in this section forms the analytical baseline from which the determination of potential environmental justice effects would be made. The characterization of populations of interest includes an assessment of "populations of particular interest or unusual circumstances," such as minority communities exceptionally dependent on subsistence resources or identifiable in compact locations, such as Native American settlements.

2.6.1 Methodology

The review team first examined the geographic distribution of minority and low-income populations within 50 mi of the STP site, employing a geographic information system and the 2000 Census to identify minority and low-income populations. The review team verified its analysis by field inquiries to numerous agencies and groups (Appendix B).

The first step in the review team's environmental justice methodology is to examine each census block group that is fully or partially included within the 50-mi region to determine for each block group whether the percentage of any minority or low-income population is great enough to identify that block group as a minority or low-income population of interest. If either of the two criteria discussed below is met for a census block group, that census block group is considered a minority or low-income population of interest warranting further investigation. The two criteria are whether:

- the population of interest exceeds 50 percent of the total population for the block group or
- the percentage of the population of interest is 20 percent (or more) greater than the same population's percentage in the census block group's State.

The identification of census block groups that meet the above two part criteria is not in and of itself sufficient for the review team to conclude that disproportionately high and adverse impacts exists. Likewise, the lack of census block groups meeting the above criteria cannot be construed as evidence of no disproportionately high and adverse impacts. Accordingly, the review team also conducts an active public outreach and on-the-ground investigation in the region of the plant to determine whether minority and low-income populations may exist in the region that are not identified in the census mapping exercise. To reach an environmental justice conclusion, starting with the identified populations of interest, the review team must investigate all populations in greater detail to determine if there are potentially significant environmental impacts that may have disproportionately high and adverse effects on minority or low-income communities. To determine whether disproportionately high and adverse effects may be present, the review team considers the following:

Health Considerations

1. Are the radiological or other health effects significant or above generally accepted norms?
2. Is the risk or rate of hazard significant and appreciably in excess of the general population?
3. Do the radiological or other health effects occur in groups affected by cumulative or multiple adverse exposures from environmental hazards?

Environmental Considerations

4. Is there an impact on the natural or physical environment that significantly and adversely affects a particular group?
5. Are there any significant adverse impacts on a group that appreciably exceed or [are] likely to appreciably exceed those on the general population?
6. Do the environment effects occur in groups affected by cumulative or multiple adverse exposure from environmental hazard? (NRC 2007a)

If this investigation in greater detail does not yield any potentially disproportionate and adverse impacts on populations of interest, the review team may conclude that there are no disproportionately high and adverse affects. If, however, the review team finds any potentially disproportionate and adverse effects, the review team would fully characterize the nature and extent of that impact and consider possible mitigation measures that may be used to lessen that impact. The remainder of this section discusses the results of the search for potentially affected populations of interest.

Minority Populations: Census data for Texas characterizes 11.5 percent of the population as Black, 0.6 percent as American Indian or Alaskan Native, 2.7 percent as Asian, 0.1 percent as Native Hawaiian or other Pacific Islander, 11.7 percent as some other race, 2.5 percent as multiracial, 29 percent aggregate of minority races and 32 percent as Hispanic ethnicity (STPNOC 2010a). Total minorities, consisting of all racial minorities plus Hispanic whites, make up 52.4 percent of the population.

Figure 2-27 through Figure 2-30 show the location of all census block groups that meet the criteria for any of the minority populations identified for environmental justice purposes, as calculated by the review team from the 2000 Census (USCB 2000h). Of the 230 block groups within the 50-mi radius of the STP site, the review team identified 19 census block groups that have significant Black or African American populations (Figure 2-28). One block group located in Matagorda County has a significant Asian population (revealed by STPNOC and review team scoping and outreach processes to be predominantly Vietnamese) (Figure 2-29).

Significant Hispanic populations exist in 30 census block groups in the region (Figure 2-30). Ten block groups have significant “some other race” population (all of these block groups are also Hispanic), and 71 block groups in the region have significant aggregate minority populations (Figure 2-27).

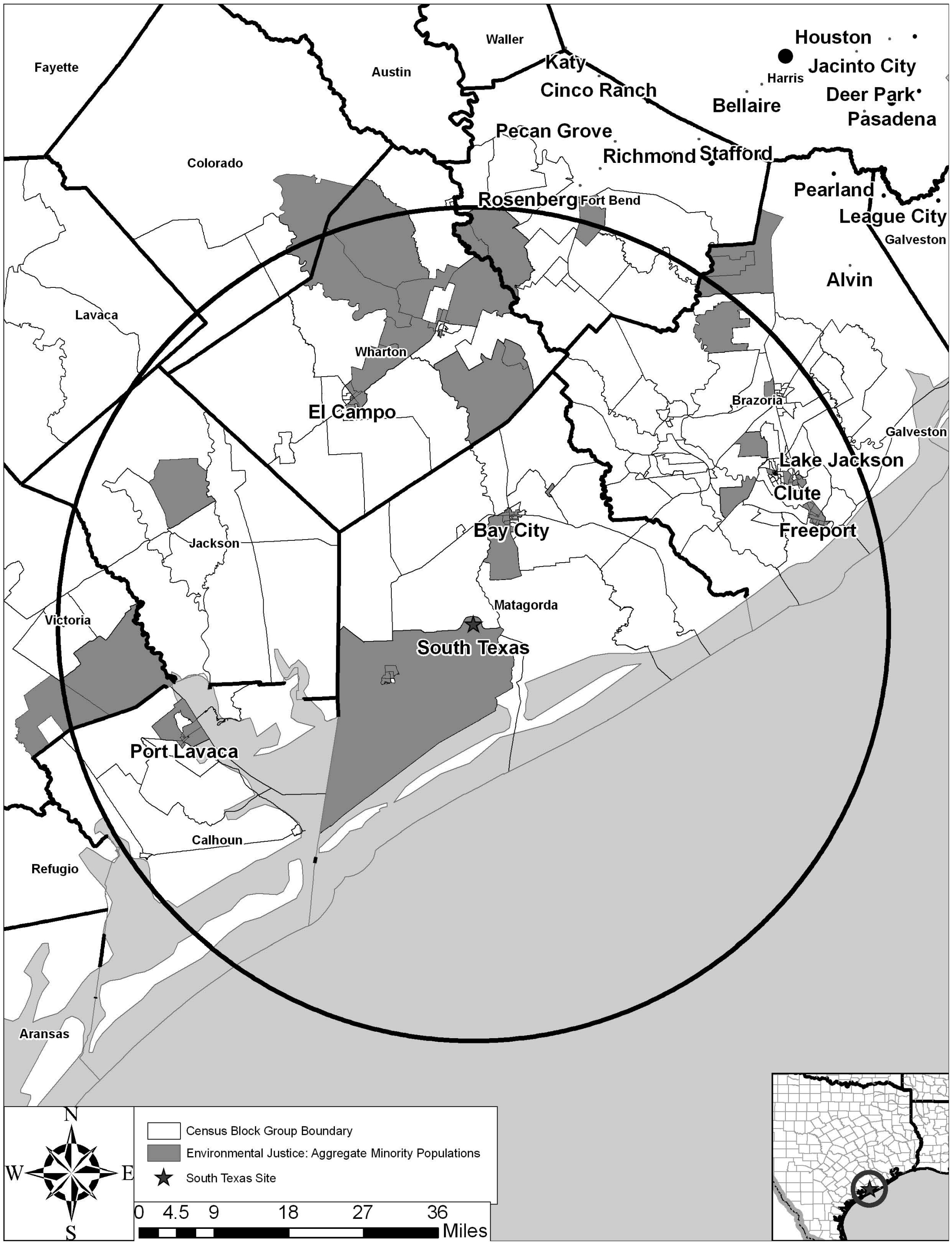

Figure 2-27. Aggregate Minority Populations in Block Groups Meeting Environmental Justice Selection Criteria (USCB 2000h)

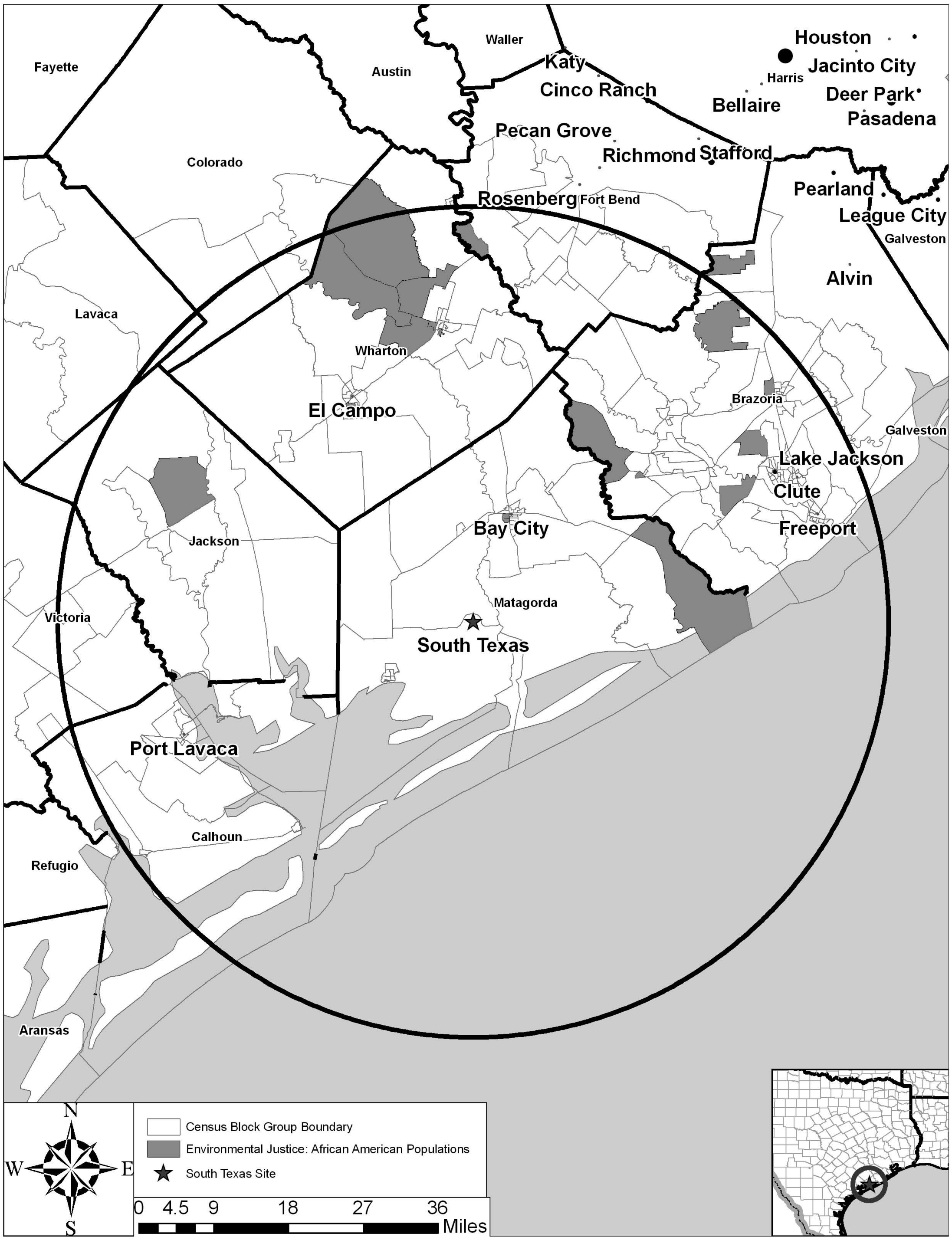

Figure 2-28. Black or African American Populations in Block Groups Meeting Environmental Justice Selection Criteria (USCB 2000h)

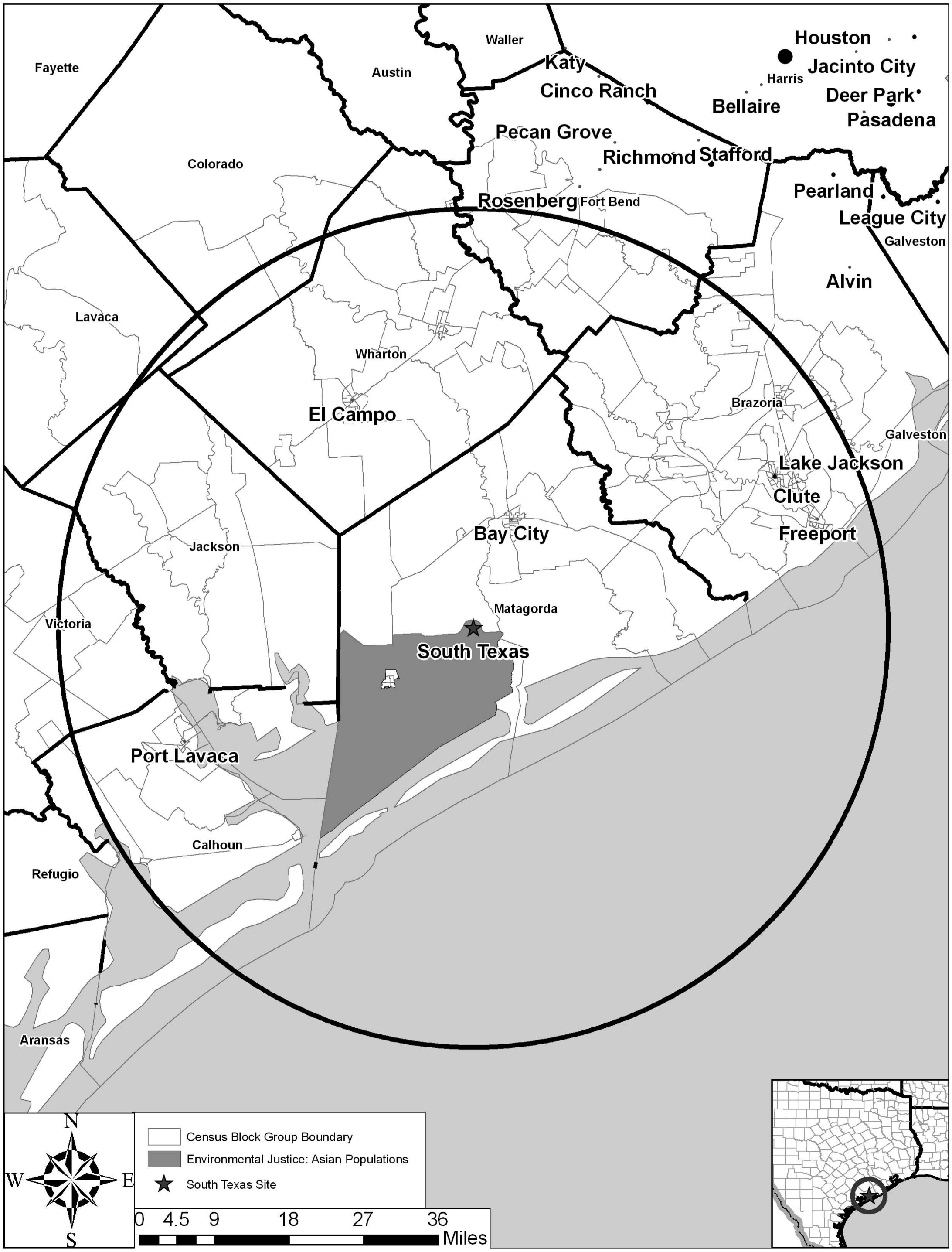

Figure 2-29. Asian or Pacific Islander Populations in Block Groups Meeting Environmental Justice Selection Criteria (USCB 2000h)

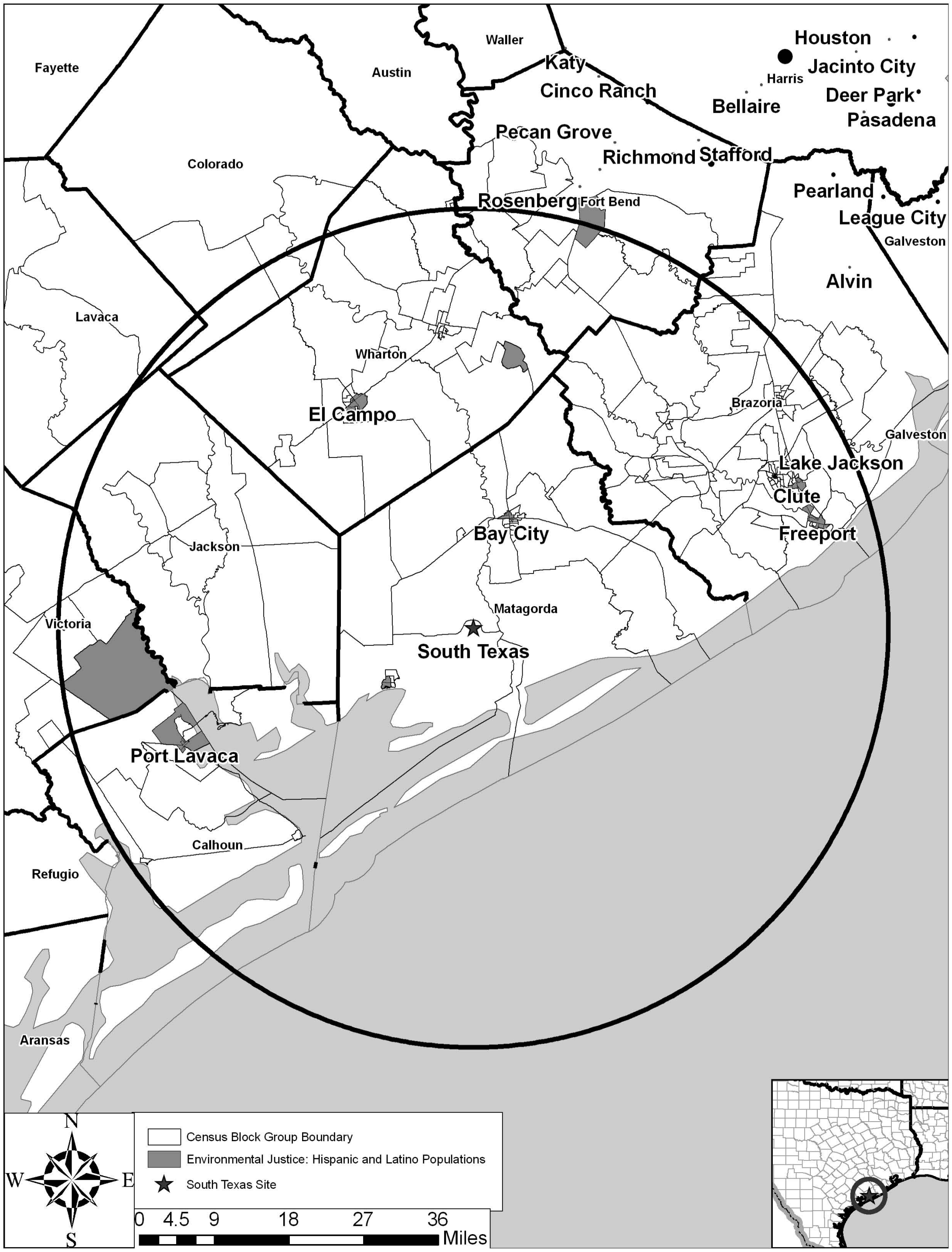

Figure 2-30. Hispanic Populations in Block Groups Meeting Environmental Justice Selection Criteria (USCB 2000h)

Low-Income Populations: The review team used census data to identify low-income households within the analytical area (USCB 2000i). The data indicates that 14 percent of Texas households are low income. There are six block groups in the STP region with significant low-income populations. Three of these block groups are located in Wharton County, two in Matagorda County, and one in Brazoria County. The geographic location of the low-income block groups is shown in Figure 2-31.

2.6.2 Scoping and Outreach

During the development of its ER, STPNOC interviewed community leaders of the minority populations within the analytical area (STPNOC 2010a). The review team built upon this base and performed additional interviews within the analytical area that had the potential for the greatest environmental and socioeconomic effects. The review team interviewed local, State, and county officials, business leaders, and key members of minority communities within the four county socioeconomic impact area to assess the potential for disproportionate environmental and socioeconomic effects that may be experienced by minority and low-income communities impacted by building and operating the proposed Units 3 and 4 (STPNOC 2010a; Scott and Niemeyer 2008). Advanced notice of public scoping meetings was provided by the review team in accordance with NRC guidance. These activities did not identify any additional groups of minority or low-income persons not already identified in the geographic information system analysis of Census data, except for an isolated community on the banks of the Lower Colorado River downstream from the plant that may include significant numbers of low-income individuals (although not identified on census maps as either low income or minority) who may be engaged in subsistence fishing.

2.6.3 Subsistence and Communities with Unique Characteristics

For each of the identified low-income and minority populations, it is necessary to determine if any of those populations appears to have a unique characteristic at the population level that would cause an impact to disproportionately affect them. Examples of unique characteristics might include lack of vehicles, sensitivity to noise, close proximity to the plant, subsistence activities, or lack of basic health care, but such unique characteristics need to be demonstrably present in the population and relevant to the potential environmental impacts of the plant. If the impacts from the proposed action would appear to affect an identified minority or low-income population more than the general population because of one of these or other unique characteristics, then a determination is made whether the impact is disproportionate when compared to the general population. Through its review of the applicant's ER, its own outreach and research, and through scoping comments, the review team identified two communities (a Vietnamese community at Palacios and a small, potentially low-income community downstream from the STP site on the Lower Colorado River) with potentially unique characteristics for further considerations within the vicinity of the STP site. The review team assesses the subsistence and special characteristics of these populations in Sections 4.5.5 and 5.5.4.

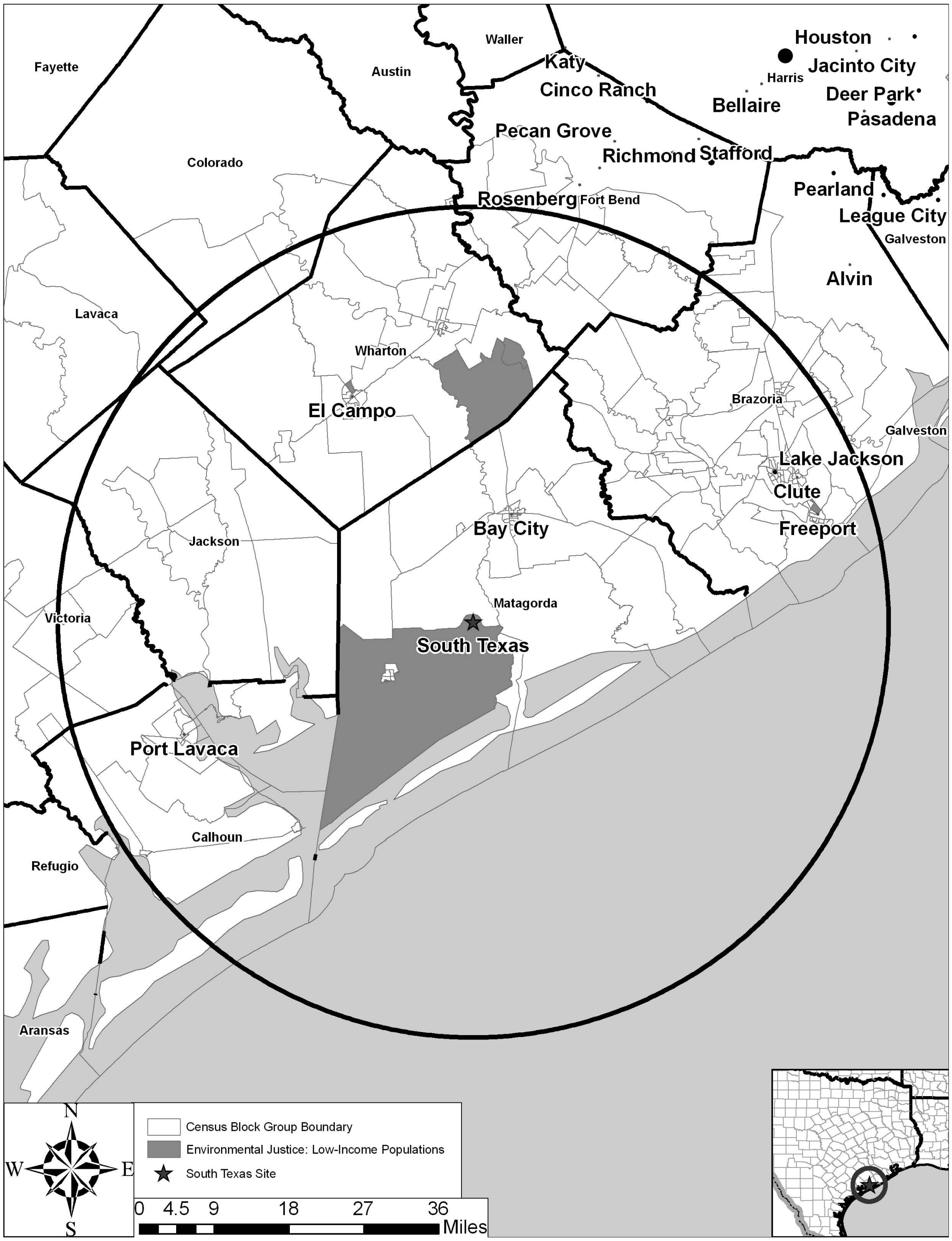

Figure 2-31. Aggregate Low-Income Populations in Block Groups Meeting Environmental Justice Selection Criteria

The review team considered STPNOC's documented outreach process on environmental justice issues (STPNOC 2010a, 2008a) and conducted its own interviews with local officials in Bay City and Palacios (Scott and Niemeyer 2008). The review team also considered public comments related to the proposed project. Finally, the review team performed literature reviews for academic studies and performed internet searches for documented subsistence activities by minority and low-income populations. The review team did not find any indications that any populations had unique characteristics or practices that could potentially lead to a disproportionately high and adverse impact in the Matagorda County area.

The review team's outreach and scoping activity did not identify any special socioeconomic circumstances or potential environmental pathways.

2.6.4 Migrant Populations

The USCB defines a migrant worker as an individual employed in the agricultural industry in a seasonal or temporary nature and who is required to be absent overnight from their permanent place of residence. From an environmental justice perspective, there is a potential for such groups in some circumstances to be disproportionately affected by emissions in the environment. However, in the four-county area surrounding the STP site the 2002 Census of Agriculture found only 95 out of 1051 farms employing 3026 short-term farm laborers reported individuals meeting the definition of migrant farm workers, and only 72 of those farms were found in Matagorda County, which would not add many low-income or minority individuals to those already present in the resident population, even if all of the migrant workers were minority or low-income individuals. Based on the average number of short-term workers per farm in the four-county area, the review team estimates that the total number of migrant workers is about 300 in the four-county area, most of who work in Matagorda County. No information was available concerning their actual location of employment within the county.

2.6.5 Environmental Justice Summary

The review team found low-income, Black, Hispanic, Asian, some other race, and aggregated minority populations that exceed the percentage criteria established for environmental justice analyses. Consequently, the review team performed additional analyses before making a final environmental justice determination. Based on the information in the STPNOC ER (STPNOC 2010a), public input, and its own outreach and analysis, the review team determined that because there are minority and low-income populations of interest in the region and particularly because some of these live in close proximity to the proposed site, impacts to these communities must be considered in greater detail, as discussed in Section 2.6.1. The result of the review team's analyses can be found in Section 4.5 for construction effects and Section 5.5 for operational effects.

2.7 Historic and Cultural Resources

In accordance with 36 CFR 800.8(c), the review team has elected to use the National Environmental Policy Act of 1969, as amended (NEPA) process to comply with the obligations imposed under Section 106 of the National Historic Preservation Act (NHPA). In addition to NUREG-1555 (NRC 2000), NRC Staff Memorandum (NRC 2010) provides guidance to staff on cultural and historic resource analysis in its environmental reviews.

The review team determined that the physical area of potential effect (APE) for the COL review is the area at the power plant site and the immediate environs that may be impacted by land-disturbing activities associated with building and operating two new nuclear generating units. The visual APE for the STP site is a 1-mi radius from the physical APE, determined by the maximum distance from which the tallest structures associated with proposed Units 3 and 4 can be seen from offsite locations.

This section discusses the historic and cultural background in the STP site region. It also details the efforts that have been taken to identify cultural resources in the physical and visual APEs and the resources that were identified. A description of the consultation efforts is also provided. The assessments of effects from building and operating the proposed new units are found in Sections 4.6 and 5.6, respectively.

2.7.1 Cultural Background

The area in and around the COL site has a rich cultural history and a substantial record of significant prehistoric and historic resources. The Colorado River system flows through the area and influenced settlement in the area. The archaeological record indicates that prehistoric occupation of the area was as follows (Hester 1995; Turner and Hester 1985):

- Paleoindian (pre-7800 B.C.) – The earliest inhabitants of Texas during the late Pleistocene are associated with the Clovis Complex based upon the presence of the Clovis fluted point that is commonly found throughout North America. Clovis is commonly associated with hunting of the extinct mammoth and other large Pleistocene fauna. The Clovis people either were replaced or transitioned to the Folsom Complex, which flourished between 8800 and 8200 B.C. The hallmark artifact of the Folsom period is the Folsom fluted point, which is often found in association with forms of bison that are presently extinct. After Folsom, evidence of sites dating to the later stages of the Paleoindian period are identified by a range of finely made Paleoindian projectile points.
- Early Archaic (7800 B.C. to 6000 B.C.) – The Archaic represents a time when people became more settled and broadened their use of flora and fauna. While the early phases of this period are not well understood, later phases are generally well documented by numerous distinctive triangular points and large barbed specimens found across Texas.

- Middle Archaic (6000 B.C. to 2500 B.C.) – An increase in the number of archaeological sites dating to this period suggests an increase in population. An increase in economic complexity is suggested by the greater diversity of stone tools. Regional differentiation begins to appear, with sites in South Texas often characterized as shell middens. Burial sites begin to appear and exotic items suggesting commercial trade are found.
- Late Archaic (2500 B.C. to 700 B.C.) – This period is characterized by distinct types of projectile points and stone tools, suggesting continued economic diversification and regionalization.
- Late Prehistoric (700 B.C. to 1500 A.D.) – The Late Prehistoric era is marked by the introduction of the bow and arrow and pottery. Although the hunting and gathering lifeways of the Archaic period continue, distinctive changes in material culture, hunting patterns, and other facets of Late Prehistoric settlement and subsistence do occur and reflect a change from previous periods.

The historic period can be traced to the 1500s when the Spanish and French explored the Texas Coast (Hall and Ford 1973). At that time, the Native American groups living in the areas were collectively known by the Europeans as the Karankawa. The French attempted to settle the Matagorda Bay area in 1685 and again in 1718, but neither attempt was successful, largely due to conflict with the Karankawa Indians. Historic settlement of the area commenced when Stephen F. Austin obtained a grant from the Mexican government in 1821 to permit 300 American families to settle along the Colorado River. When an additional 3000 families were allowed to settle in the area in 1828, population increased rapidly. Matagorda County was created in 1837, shortly after Texas gained its independence from Mexico. Farming in the Matagorda region concentrated on sugar and cotton production and, following the Civil War, cattle ranching.

2.7.2 Historic and Cultural Resources at the Site

The following information was used to identify the historic and cultural resources at the STP site:

- Original Construction FES (NRC 1975),
- Original Environmental Report (NRC 1975), which included the Texas Archaeological Survey Report (Hall and Ford 1973),
- Original Operation EIS (NRC 1986),
- South Texas Project Units 3 and 4 Environmental Report, Rev 4 (STPNOC 2010a),
- Information obtained from the Texas Archaeological Site Files (STPNOC 2010a), and
- Information obtained from the Matagorda County Museum Archives and Collections Department.

STPNOC conducted a review of records maintained by the National Park Service and the Texas Historical Commission to identify important cultural and historic resources located within 10 mi of the project site (STPNOC 2010a). This review identified six Texas Historic Landmarks and two Historic Texas cemeteries, all of which were more than 6 mi from STP. One of these places, the Matagorda Cemetery, located 9 mi southeast of STP, is the only site listed in the National Register of Historic Places located within 10 mi of the project site. A search of the Texas Archaeological Research Laboratory at the University of Texas at Austin indicated that 35 archaeological properties have been identified within 10 mi of the plant, none of which have been evaluated for listing in the National Register. Four of these archaeological properties are historic sites and are recorded as State archeological landmarks, as maintained by the Texas Archaeological Research Laboratory at the University of Texas at Austin; one is a cistern, one is a farmstead, one is a refuse scatter, and one is a homestead ruin. The remaining thirty-one sites are prehistoric. Of these, three are described as only a projectile point find, five are lithic scatters, and twenty-three are shell middens. The majority of prehistoric sites are located in the Mad Island WMA more than 7 mi south of the STP site (STPNOC 2010a).

The number of archaeological sites recorded within 10 mi of the STP site is likely more a reflection of the small amount of area that has been archaeologically surveyed than it is a reflection of the number of archaeological sites that exist. Regional settlement patterns would suggest that prehistoric people lived along the Colorado River and that archaeological evidence of their habitation should exist. Few surveys, however, have been conducted along the Colorado River in the area adjacent to the plant to confirm this pattern.

The archaeological sites record search indicated that prehistoric sites, most characterized as shell middens, have been located adjacent to the STP site. When the Texas Archaeological Survey visited the heavily vegetated STP site in 1973, its investigations included a pedestrian surface survey with limited subsurface testing and an historic records search. Survey coverage at this time included sufficient acreage to construct two additional reactor units (Hall and Ford 1973). In December 2006, STPNOC contacted the Texas State Historic Preservation Officer (SHPO) and requested an additional review of the STP site under NHPA Section 106 (STPNOC 2010a). Concurrence was obtained from the State that there would be no impacts to historic properties in January 2007 (THC 2007). Therefore, no further cultural resource investigations were required by the State.

When construction of existing STP Units 1 and 2 was completed in the 1980s, much of the plant site was extensively disturbed by construction. As documented in aerial photographs, the new areas proposed for proposed Units 3 and 4 were disturbed by the existing STP Units 1 and 2 construction (STPNOC 2010a).

In 2007, NRG and its cultural resource contractor EarthTech, conducted a reconnaissance-level cultural resources assessment of the STP site. They reviewed existing information for the STP site and the area within a 10-mi diameter. Based on the literature review, EarthTech concluded that any sites that may have existed onsite would no longer retain their cultural integrity because the area was heavily disturbed (STPNOC 2010a).

During the site visit in February 2008, the NRC staff reviewed the documentation used by the applicant to prepare the cultural resource section of the ER. The staff also visited the Matagorda County Museum and Archives located in Bay City. According to the Matagorda County Museum and Archives, the remains of a circa 1900 farmstead are located on the STP site (Rodgers 2008). However, no activity related to building or operating the plant is planned for this area. Staff at the Matagorda County Museum and Archives also identified another home of historic significance that had previously been located adjacent to and northeast of the STP site. The 'Tadmor,' an octagon-shaped house constructed in the mid-1800s was a well-known local landmark. After years of neglect and inclement weather, the home is no longer standing.

2.7.3 Consultation

In January 2008, the NRC initiated consultation on the proposed action by writing the Texas SHPO and the Advisory Council on Historic Preservation (NRC 2008b). Also in January 2008, the NRC initiated consultations by writing to four Native American Tribes with historical ties to the Matagorda Bay coastal region (See Appendix F for complete listing). In the letters, NRC provided information about the proposed action, indicated that review under the NHPA would be integrated with the NEPA process in accordance with 36 CFR 800.8, invited participation in the identification and possible decisions concerning historic properties, and invited participation in the scoping process. Similarly, in March 2010, the NRC provided copies of the draft EIS to the Texas SHPO, Advisory Council on Historic Preservation, and the four previously contacted Tribes and invited comments on the review team's preliminary determination of no historic properties affected by the proposed action. In March 2010, the Texas SHPO concurred with the determination of no historic properties affected (THC 2010). In May 2010, the Alabama-Coushatta Tribe of Texas confirmed that the proposed action will cause no known impacts to religious, cultural, or historical resources of importance to the Tribe, but requested further consultation if an alternative site is selected or in the event of any inadvertent cultural discoveries (Celestine 2010).

On February 5, 2008, as part of its NEPA scoping process, the NRC elected to conduct a public scoping meeting in Bay City, Texas. No comments or concerns regarding historic and cultural resources were raised at this meeting or in the scoping process. Subsequent to the NRC initiating consultation with the Texas SHPO, the Advisory Council, and the Tribes, the Corps elected to participate as a cooperating agency with the NRC under the updated Memorandum of Understanding between the NRC and the Corps. Public meetings were also held in Bay City, Texas, in May 2010 to discuss the analysis and results in the draft EIS and no comments or concerns regarding historic and cultural resources were raised.

2.8 Geology

A detailed description of the geological, seismological, and geotechnical engineering conditions at the STP site is provided in Section 2.5 of the STPNOC FSAR (STPNOC 2010b) as part of the COL application. A summary of the long-term and short-term geologic impacts of the proposed STP project is addressed in ER Section 2.6 (STPNOC 2010a). A description of the hydrogeologic setting of the proposed site is addressed in the ER as well (STPNOC 2010a). The regional and site-specific geologic descriptions provided by the applicant as part of the safety analysis for this COL application (Section 2.5 of the FSAR) are based on the results of field and subsurface investigations conducted during pre-application activities for proposed Units 3 and 4 (STPNOC 2010a, b) and the most current published geologic data, in addition to the results of the site characterization studies conducted prior to and during construction of Units 1 and 2. The NRC staff's independent assessment of the site safety issues related to the proposed STP site will consider the applicant's detailed analysis and evaluation of geological, seismic, and geotechnical engineering data. The NRC staff's detailed evaluation of the applicant's geological characterization for the STP site will be addressed in the NRC staff's Safety Evaluation Report (in process).

The STP site is located within the Coastal Plain physiographic province which forms a broad band parallel to the Texas Gulf Coast (Ryder 1996) which is also described as the Gulf Coastal Plains physiographic province by the Bureau of Economic Geology research unit at the University of Texas at Austin (TBEG 1996). The STP site lies in the Coastal Prairies sub-province of this physiographic province and exhibits a relatively flat topography with land elevation ranging from sea level on the coast to 300 ft above sea level along the western boundary of the province (TBEG 1996). The land surface elevation in the immediate vicinity of the STP site is 30 ft above MSL. Figure 2-16 shows the stratigraphic column that represents the geology beneath the STP site.

For the purposes of considering the hydrogeological setting in the vicinity of the STP intake structure on the Colorado River, an apparent feature is the incision in the sediments by the river to an elevation of approximately 14 ft below MSL (STPNOC 2010a). At the nearby STP site, this would imply direct communication between the Colorado River and the Upper Shallow Aquifer (STPNOC 2010a).

Within the Coastal Prairies physiographic sub-province, the STP site is located within the Coastal Lowlands Aquifer System (TBEG 1996) which is comprised of a wedge of southeasterly dipping sedimentary deposits of Holocene age through Oligocene age. The thickness of the aquifer ranges from 0 ft at the up-dip limit of the aquifer system in the northwest to approximately 1000 to 2000 ft in Matagorda County at the down-dip limit of the system in the southeast. Sediments in the Coastal Lowlands Aquifer System varies from zero at the western boundary, where it is in contact with the Vicksburg-Jackson confining unit at the land surface, to as much as 6000 ft below sea level where the base of the aquifer is defined by groundwater with a dissolved-solids concentration of more than 10,000 milligrams per liter (Ryder 1996). Within Texas, the Coastal Lowlands Aquifer System in the vicinity of the STP site, part of the Gulf Coast Aquifer system, has not been declared a sole source aquifer by the Environmental Protection Agency (EPA 2009a, b, c).

Within Matagorda County, there are approximately 368 active oil and gas wells; 120 oil and 248 gas wells (TRC 2009a, b, c); active energy exploration is ongoing in the region. Of these wells, STPNOC noted that there are seven petroleum wells, nine oil/gas wells, and 26 gas wells in the site vicinity (STPNOC 2010a). In Texas, subsurface mineral rights may be separate from surface land ownership rights. Co-owners of STP own or control all of the mineral interests within and underlying the STP site, and have the ability to acquire any outstanding mineral interests in the subsurface that may be required for safe operation of the facility (STPNOC 2010a). In addition to oil and gas exploration, numerous byproducts of the refining process are also extracted and made commercially available by chemical producers in Matagorda County, (i.e., OXEA Corporation's Bay City Plant and Lyondell Chemical Company's Equistar facility). The USGS mineral industry survey for sand and gravel producers (USGS 2008) did not identify principal producers of construction sand and gravel in Matagorda County, Texas. The USGS did not identify principal producers of crushed stone in Matagorda County (USGS 2009d). The source or sources of sand and gravel for the backfill and concrete necessary to construct proposed Units 3 and 4 are not identified (STPNOC 2010b). However, the applicant states that the bulk of the structural fill will come from offsite sources. Structural fill for existing STP Units 1 and 2 was obtained from the Eagle Lake/Gifford Hill source which is approximately 55 mi north of the STP site (STPNOC 2010b).

2.9 Meteorology and Air Quality

The following sections describe the climate and air quality of the STP site. Section 2.9.1 describes the climate of the region and area in the immediate vicinity of the STP site, Section 2.9.2 describes the air quality of the region, Section 2.9.3 describes atmospheric dispersion at the site, and Section 2.9.4 describes the meteorological monitoring program at the site.

2.9.1 Climate

The STP site is located in Matagorda County, near the Gulf of Mexico in the southeastern portion of Texas. Its climate, which is classified as maritime subtropical, is marked by relatively short, mild winters, long, hot summers, and mild springs and falls. The Azores high-pressure system is the source of maritime tropical air masses much of the year. Occasional cold continental air masses displace the maritime air during the winter.

Affected Environment

The closest first-order National Weather Service station is Victoria, Texas, about 53 mi west of the site. This station represents the general climate at the STP site. The National Weather Service (NWS) station at Corpus Christi, Texas, about 100 mi southwest is also representative of the site, and is more indicative of the diurnal variation of weather at the site because of its proximity to the coast. Representative meteorological data have also been collected at the Palacios Municipal Airport about 13 mi west southwest of the site. In subsequent sections, the review team relies on the climatological and storm characteristics for these sites in estimating long-term characteristics for the STP site.

The following climatological statistics are derived from local climatological data for Palacios, Victoria, and Corpus Christi. Temperatures are more variable in the winter than in the summer because of the differences in air mass source regions. Daytime maximum temperatures range from about 65°F in January to about 94°F in July and August; nighttime minimum temperatures range from about 47°F in January to about 75°F in July and August. Monthly average wind speeds range from about 10 mph in September to about 14 mph in March and April. Precipitation ranges from about 2 in. per month in February peaking to about 4 to 5 in. per month in May and June and again in September and October. Snow occurs during more than 50% of the winters, but snowfall is generally limited to trace amounts. The STP site is flat with no topographic features that would cause the local climate to deviate significantly from the regional climate.

On a larger and longer-term scale, climate change is a subject of national and international interest. The GCRP (GCRP 2009) has provided valuable insights regarding the state of knowledge of climate change. The projected change in temperature from ‘present day’ (1993-2008) over the period encompassing the licensing action (i.e., to the period 2040 to 2059 in the GCRP report) in the vicinity of the STP site is an increase of between 0 to 3°F. While the GCRP has not incrementally forecasted the change in precipitation by decade to align with the licensing action, the projected change in precipitation from the ‘recent past’ (1961-1979) to the period 2080 to 2099 was presented; the GCRP report forecasts a decrease of between 10 to 15 percent (GCRP 2009).

Based on the assessments of the GCRP and the National Academy of Sciences’ National Research Council, the EPA determined that potential changes in climate caused by greenhouse gas (GHG) emissions endanger public health and welfare (74 FR 66496). The EPA indicated that, while ambient concentrations of GHGs do not cause direct adverse health effects (such as respiratory or toxic effects), public health risks and impacts can result indirectly from changes in climate. As a result of the determination by the EPA and the recognition that mitigative actions are necessary to reduce impacts, the review team concludes that the effect of GHG on climate and the environment is already noticeable, but not yet destabilizing. In CLI-09-21, the Commission provided guidance to the NRC staff to consider carbon dioxide and other GHG emissions in its NEPA reviews and directed that it should encompass emissions from constructing and operating a facility as well as from the fuel cycle (NRC 2009b). NRC Staff

Memorandum (NRC 2010) provides additional guidance to NRC staff on consideration of GHGs and carbon dioxide in its environmental reviews. The review team characterized the affected environment and the potential GHG impacts of the proposed action and alternatives in this EIS. Consideration of GHG emissions was treated as an element of the existing air quality assessment that is essential in a NEPA analysis. In addition, where it was important to do so, the review team considered the effects of the changing environment during the period of the proposed action on other resource assessments.

2.9.1.1 Wind

Wind at the STP site is consistent with the dominant influence of the Azores high and the coastal location of the site. The seasonal variation of the prevailing directions shows a predominance of southeasterly winds except in January, July, and August when south winds prevail, and November and December when northerly winds prevail (STPNOC 2009a). The coastal location of the site is expected to lead to typical onshore (southeast) winds during the day and offshore winds at night. Also, because the diurnal fluctuation of land temperatures is greater than the fluctuation of water temperatures and the land-water temperature difference is greater during the day than it is at night, the review team expects that the daytime onshore wind speeds would be greater than the nighttime offshore speeds. Wind direction persistence is generally limited to 4 hr or less; persistence of 8 hr or longer occurs less than 10 percent of the time, and persistence of 12 hr or longer occurs less than 4 percent of the time.

2.9.1.2 Temperature

Neither the ER (STPNOC 2009a) nor the FSAR (STPNOC 2009b) provide onsite temperature information for the STP site. Consequently, the review team determined that the average temperatures at the site are consistent with the temperature data from Palacios, Victoria and Corpus Christi. Based on data in Table 2.7-4 of the ER (STPNOC 2010a) for observations at 15 NWS and cooperative observing stations and the climatological record for the Corpus Christi NWS station, the temperature extremes at the site would be about 10°F and 108°F. These values are within the ranges of extremes observed (i.e., 4°F to 13°F and 102°F to 112°F for lows and highs, respectively).

2.9.1.3 Atmospheric Moisture

The STP meteorological system measures dewpoint temperature. However, neither the ER nor the FSAR presents onsite atmospheric moisture data. Consequently, the review team determined that the relative humidity data for Palacios and the Corpus Christi NWS station are representative of the STP site. Relative humidities for 0600 local standard time (LST) approximate the daily maximum values. Monthly average 0600 LST relative humidities range from about 86 percent in December to about 94 percent in August. Relative humidities for 1200 LST approximate the daily minimum relative humidity. Monthly average 1200 LST relative humidities range from a high of about 67 percent in January to low of about 56 percent in July. Climatological statistics for Corpus Christi and Victoria indicate that STP site could expect heavy fog 30 to 40 days per year. Palacios fog data included in the ER are consistent with this expectation. The likelihood of fog is greatest from November through March and least from June through August.

2.9.1.4 Severe Weather

The site can experience severe weather in the form of thunderstorms, tornadoes, and tropical storms. Thunderstorms are the most frequent severe weather events. They occur on an average of about 55 days per year at Victoria, and about 31 days per year at Corpus Christi. The majority of the thunderstorms occur from May through September. It is likely that the frequency of thunderstorms at the STP site is closer to that of Corpus Christi, because of the site's proximity to the coastline, than to Victoria. Tropical cyclones, including hurricanes and tropical storms, pass near the STP site an average of about once every other year and an average of about two to three hurricanes pass near the site every 10 years. Nine hurricanes have made landfall between Corpus Christi and Galveston since 1950; the most recent being hurricanes Humberto in 2007 and Ike in 2008. Tornadoes are the least frequent of these extreme weather events. Using tornado statistics from 1950 through 2003 and the methodology outlined in NUREG/CR-4461, *Tornado Climatography of the Contiguous United States* (Ramsdell and Rishel 2007), the NRC staff estimates that the probability of a tornado striking the nuclear island at the STP site is about 2×10^{-4} yr^{-1}.

2.9.1.5 Atmospheric Stability

Atmospheric stability is a derived meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined by the difference in temperature between two heights. A seven-category atmospheric stability classification scheme based on temperature differences is set forth in Regulatory Guide 1.23, Revision 1 (NRC 2007b). When the temperature decreases rapidly with height, the atmosphere is unstable and atmospheric dispersion is greater. Conversely, when temperature increases with height, the atmosphere is stable and dispersion is more limited. Typically, the atmospheric stability is classified as neutral to unstable during the day and neutral to stable at night. Cloudiness and high winds tend to decrease both stability and instability resulting in more nearly neutral conditions.

Measurements at the 10- and 60-m levels of the STP meteorological tower are used to determine atmospheric stability for the STP site. On an annual basis, the atmosphere at the STP site is stable about 46 percent of the time, neutral about 29 percent of the time, and unstable about 25 percent of the time. These percentages vary seasonally with more frequent stable and unstable conditions in the summer and early fall, and more frequent neutral conditions in the winter and early spring (STPNOC 2009a).

Large water bodies, notably the Gulf of Mexico and the STP MCR, have the potential to affect atmospheric stability. The STP meteorological tower is sufficiently far from both the Gulf and the MCR that the review team concludes that it is unlikely that either has an effect on determining atmospheric stability for the environmental review.

2.9.2 Air Quality

The discussion on air quality includes the six common "criteria pollutants" for which the EPA has set national ambient air quality standards (ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead). The air quality discussion also covers heat-trapping "greenhouse gases" (primarily carbon dioxide) which have been the principal factor causing climate change over the last 50 years (GCRP 2009).

The STP site is in central Matagorda County, Texas at the southern edge of the Metropolitan Houston-Galveston Intrastate Air Quality Control Region (40 CFR 81.38). The Corpus Christi-Victoria Intrastate Air Quality Control Region (40 CFR 81.136) lies immediately south and west of Matagorda County. All of the counties in these Air Quality Control Regions adjacent to the STP site are in compliance with the National Ambient Air Quality Standards (40 CFR 81.344) except Brazoria County to the north; Brazoria County is classified Non-Attainment/Severe relative to the 8-hr ozone standard and lead for which no designation has been made. There is no mandatory Class I Federal Area where visibility is an important value within 100 mi of the STP site.

Carbon dioxide concentration has been building up in the Earth's atmosphere since the beginning of the industrial era in the mid-1700s, primarily due to the burning of fossil fuels (coal, oil, and natural gas) and the clearing of forests. Human activities have also increased the emissions of other greenhouse gases such as methane, nitrous oxide, and halocarbons. These emissions are increasing the optical thickness of heat-trapping gases in the Earth's atmosphere, causing global surface temperatures to rise (GCRP 2009).

2.9.3 Atmospheric Dispersion

As described in Section 2.9.4, the NRC staff visited the meteorological measurement system at the site and reviewed the available information on the design of the meteorological measurement program, and evaluated data collected by the program. Based on this information, the NRC staff concludes that the program provides data that represent the affected environment onsite meteorological conditions as required by 10 CFR 100.20. The data also provide an acceptable basis for making estimates of atmospheric dispersion for the evaluation of the consequences of routine and accidental releases required by 10 CFR 50.34, 10 CFR Part 50, Appendix I and 10 CFR 52.79.

2.9.3.1 Short-Term Dispersion Estimates

STPNOC calculated short-term dispersion estimates using 3 years of onsite meteorological data (STPNOC 1997, 1999, and 2000). These estimates which were provided in ER Section 2.7.5.2 were based on distances to the Exclusion Area Boundary (EAB) and outer boundary of the Low Population Zone (LPZ) in ER Table 2.7-13 (STPNOC 2010a). The exclusion area and LPZ are defined in 10 CFR 50.2. STPNOC (2009c) revised these distances in response to an NRC request for additional information (NRC 2009a) and recalculated the dispersion estimates. Based on its review of the revised dispersion estimates, the NRC staff determined that the revised estimates did not appropriately reflect realistic dispersion conditions at the site. Consequently, using the revised EAB and LPZ distances, the NRC staff calculated site-specific short-term dispersion estimates for the EIS design basis accident review.

The NRC staff's short-term dispersion estimates for use in design basis accident calculations are listed in Table 2-39. They are based on the PAVAN computer code (Bander 1982) calculations of 1-hr and annual average atmospheric dispersion (χ/Q) values from a joint frequency distribution of wind speed, wind direction and atmospheric stability. These values were calculated for the shortest distances from a release boundary envelope that encloses the Unit 3 or Unit 4 release points to the EAB and to the LPZ. The EAB χ/Q value listed in Table 2-40 is the median 1-hr χ/Q, which is assumed to persist for 2 hr. The LPZ χ/Q values listed in Table 2-40 were determined by logarithmic interpolation between the median 1-hr χ/Q, which was assumed to persist for 2 hr, and the annual average χ/Q following the procedure described in Regulatory Guide 1.145 (NRC 1983).

Table 2-39. Atmospheric Dispersion Factors for Proposed Units 3 and 4 Design Basis Accident Calculations

Time period	Boundary	χ/Q (s/m^3)
0 to 2 hours	Exclusion Area Boundary	3.64×10^{-5}
0 to 8 hours[(a)]	Low Population Zone	2.53×10^{-6}
8 to 24 hours[(a)]	Low Population Zone	2.23×10^{-6}
1 to 4 days[(a)]	Low Population Zone	1.70×10^{-6}
4 to 30 days[(a)]	Low Population Zone	1.15×10^{-6}

(a) Times are relative to beginning of the release to the environment.

Table 2-40. Maximum Annual Average Atmospheric Dispersion and Deposition Factors for Evaluation of Normal Effluents for Receptors of Interest

Receptor	Downwind Sector	Distance (mi)	No Decay χ/Q (s/m^3)	2.26-Day Decay χ/Q (s/m^3)	8-Day Decay χ/Q (s/m^3)	D/Q (1/m^2)
EAB	NW	0.52	1.5×10^{-5}	1.5×10^{-5}	1.4×10^{-5}	1.0×10^{-7}
Site Boundary	NNW	0.69	8.1×10^{-6}	8.1×10^{-6}	7.3×10^{-6}	6.4×10^{-8}
Residence	WSW	2.18	6.3×10^{-7}	6.2×10^{-7}	5.1×10^{-7}	1.8×10^{-9}(a)
Meat Animal	WSW	2.18	6.3×10^{-7}	6.2×10^{-7}	5.1×10^{-7}	1.8×10^{-9}(a)
Veg. Garden	WSW	2.18	6.3×10^{-7}	6.2×10^{-7}	5.1×10^{-7}	1.8×10^{-9}(a)
Unit 4 Reactor	WNW	0.17	8.3×10^{-5}	8.3×10^{-5}	8.0×10^{-5}	3.4×10^{-7}

(a) 3.03 mi NNW

2.9.3.2 Long-Term Dispersion Estimates

Long-term dispersion estimates for use in evaluation of the radiological impacts of normal operations were calculated by STPNOC using the XOQDOQ computer code (Sagendorf et al. 1982). This code implements the guidance set forth in Regulatory Guide 1.111 (NRC 1977) for estimation of χ/Q values and deposition factors (D/Q) for use in evaluation of the consequences of normal reactor operations. In July 2009, STPNOC (STPNOC 2009c, e) revised the distances used for calculating χ/Q and D/Q estimates for specific receptors of interest including the closest point of the EAB, the closest residence, the closest meat animal, and the closest vegetable garden.

The results of the STPNOC calculations are presented in Table 2-40 for receptors of interest. Table 2-40 also includes χ/Q and D/Q estimates at the Unit 4 location for releases from Unit 3 for use in estimating Unit 4 construction worker doses after Unit 3 begins operation. Table 2.7-16 in the ER (STPNOC 2010a) presents annual average atmospheric dispersion and deposition factors for 22 distances between 0.25 and 50 mi from the release point for each of 16 direction sectors.

2.9.4 Meteorological Monitoring

There has been a meteorological monitoring program at the STP site since July 1973. The initial measurements were to provide the onsite meteorological information required for licensing of the existing STP Units 1 and 2. Measurements have continued in support of the existing STP Units 1 and 2 operations. The meteorological system was upgraded to enhance reliability in December 1994 and again in 2005 (STPNOC 2010a). The 1994 system provided the data used by STPNOC in preparation of the COL application.

The 1994 and 2005 instrument systems are described in Section 6.4 of the STPNOC ER (STPCNOC 2010a). The primary meteorological tower is situated about 1.3 mi east of the proposed location of proposed Units 3 and 4. The primary meteorological tower instruments include wind speed and direction and temperature sensors at 10 m and 60 m above ground, dew point temperature at 10 m above ground, and precipitation and solar radiation near ground level. A 10-m backup meteorological tower is located about 0.4 mi south of the primary tower. Instrumentation on the backup tower consists of wind speed and direction and temperature at 10 m. Table 6.4-4 of the ER (STPNOC 2010a) lists the instrumentation in the 1994 measurement system and compares instrument specifications with criteria set forth in NRC guidance and industry standards.

The NRC staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program. Based on this information, the NRC staff concludes that the program provides data that represent the affected environment onsite meteorological conditions as required by 10 CFR 100.20. The data also provide an acceptable basis for making estimates of atmospheric dispersion for the environmental review evaluation of the consequences of routine and accidental releases required by 10 CFR 50.34, 10 CFR Part 50, Appendix I and 10 CFR 52.79.

2.10 Nonradiological Health

This section describes aspects of the environment at the STP site and within the vicinity of the site associated with nonradiological human health impacts. The section provides the basis for evaluation of impacts to human health from building and operation of the proposed Units 3 and 4. Building activities have the potential to affect public and occupational health, create impacts from noise, and impact health of the public and workers from transportation of construction materials and personnel to the STP site. Operation of the proposed Units 3 and 4 has the potential to impact the public and workers at the STP site from operation of the cooling system, noise generated by operations, electromagnetic fields (EMF) generated by transmission systems, and transportation of operations and outage workers to and from the STP site.

2.10.1 Public and Occupational Health

This section describes public and occupational health at the STP site and vicinity associated with air quality, occupational injuries and etiological agents (i.e., disease causing microorganisms).

2.10.1.1 Air Quality

Public and occupational health can be impacted by changes in air quality from activities that contribute to fugitive dust, vehicle and equipment exhaust emissions, and automobile exhaust from commuter traffic (NRC 1996). Air quality for Matagorda County is discussed in Section 2.9.2. Fugitive dust and other particle material (including PM_{10} [particle matter less than

10 microns] and $PM_{2.5}$) can be released into the atmosphere during any site excavations and while grading is being conducted. Most of these activities that generate fugitive dust are short in duration, over a small area, and can be controlled using watering, application of soil adhesives, seeding, and other best management practices (STPNOC 2010a). Mitigation measures to minimize and control fugitive dust are required for compliance with all Federal, State, and local regulations that govern such activities (NRC 1996; STPNOC 2010a).

Exhaust emissions during normal plant operations associated with on-site vehicles and equipment as well as from commuter traffic can affect air quality and human health. Nonradiological supporting equipment (e.g., diesel generators, fire pump engines), and other nonradiological emission-generating sources (e.g., storage tanks) or activities are not expected to be a significant source of criteria pollutant emissions. Diesel generators and supporting equipment would be in place for emergency-use only but would be started regularly to test that the systems are operational. Emissions from nonradiological air pollution sources are permitted by TCEQ. The ER (STPNOC 2010a) states that the current permit for STP operations was renewed on January 25, 2006, and is valid until January 25, 2011. STPNOC also complies with TCEQ's permit for operation of portable and emergency engines and turbines (30 TAC Section 106.511). The authorization states that the maximum annual operating hours for the emergency diesel generators for Units 1 and 2 as well as any future systems shall not exceed 10 percent of the normal annual operating schedule for the primary equipment.

2.10.1.2 Occupational Injuries

In general, occupational health risks to workers and onsite personnel engaged in activities such as building, maintenance, testing, excavation and modifications are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) or occupational illnesses. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. The U.S. Bureau of Labor Statistics provides reports that account for occupational injuries and illnesses as total recordable cases, which includes those cases that result in death, loss of consciousness, days away from work, restricted work activity or job transfer, or medical treatment beyond first aid. The State of Texas also tracks the annual incidence rates of injuries and illnesses for electric power generation, transmission and distribution workers. These records of statistics are used to estimate the likely number of occupational injuries and illnesses for operation of Units 1 and 2 and predict the likely number of cases for the proposed new units.

Occupational injury and fatality risks are reduced by strict adherence to NRC and OSHA safety standards, practices, and procedures to minimize worker exposures. Appropriate State and local statutes also must be considered when assessing the occupational hazards and health risks associated with the STP site. Currently, STPNOC has programs and personnel to promote safe work practices and respond to occupational injuries and illnesses for Units 1 and 2. Procedures are in place with the objective to provide personnel who work at the STP site with an effective means of preventing accidents due to unsafe conditions and unsafe acts. They include safe work practices to address hearing protection, confined space entry, personal protective equipment, heat stress, electrical safety, ladders, chemical handling, storage, and use, as well as other industrial hazards. Personnel are provided training on STPNOC safety procedures. In addition, STPNOC requires contractors to develop and implement safety procedures with the intent of preventing injuries, occupational illnesses, and deaths (STPNOC 2010a).

2.10.1.3 Etiological Agents

Public and occupational health can be compromised by activities at the STP site that encourage the growth of disease causing microorganisms (etiological agents). Thermal discharges from Units 1 and 2 into the MCR and then into the Colorado River have the potential to increase the growth of thermophilic microorganisms. As mentioned in Section 2.3.3.1, the segment of the Colorado River adjacent to the STP site is listed by TCEQ as impaired by the presence of bacteria. The types of organisms of concern for public and occupational health include enteric pathogens (such as *Salmonella* spp. and *Pseudomonas aeruginosa*), thermophilic fungi, bacteria (such as *Legionella* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.). These microorganisms could result in potentially serious human health concerns, particularly at high exposure levels.

A review of the outbreaks of human water-borne diseases in Texas indicates that the incidence of most of these diseases is not common. Outbreaks of Legionellosis, Salmonellosis, or Shigellosis that occurred in Texas from 1996 to 2008 were within the range of national trends in terms of cases per 100,000 population or total cases per year, and the outbreaks were associated with pools, spas, or lakes (CDC 1997, 1998b, 1999, 2001, 2002b, 2003, 2004b, 2005, 2006b, 2007, 2008d, 2009, 2010). Texas does have higher incidences of infection by *Naegleria fowleri* compared to most other States in the country. Infection with *N. fowleri* causes the disease primary amebic meningoencephalitis (PAM), a brain infection that leads to the destruction of brain tissue and is fatal (CDC 2008c). From 1995 to 2007, there were three waterborne disease outbreaks in Texas (one each in 1998, 1999, and 2002). None of the outbreaks were from recreational exposure to untreated water (e.g., swimming or boating in a river) (CDC 1998a, 2000, 2002a, 2004a, 2006a, 2008a, b). From 1972 to 2007, there have been 36 occurrences of PAM in Texas, ranging from zero to five cases per year. All of these cases were fatal, exposures occurred during the months of June through September, and four exposures occurred in lakes and one occurred in a river. In a review of documentation of PAM cases in Texas dating back to 1972, none of the cases of PAM appear to be from exposure to waters in Matagorda County (CDC 1998a, 2000, 2002a, 2004a, 2006a, 2008a, b; LCRA 2007c; TDSHS 1995, 1997). The review team contacted the CDC in October 2009 and confirmed that there have been a few cases of PAM in the State of Texas since 2007; however, these cases were not in Matagorda County (CDC 2009).

2.10.2 Noise

Sources of noise at the STP site are those associated with operation of Units 1 and 2, including transformers and other electrical equipment, circulating water pumps, and the public address system. The STP site is located on 12,220 ac surrounded by farmland and the Colorado River. There are 10 residences within 5 mi of the STP site, with the closest residence about 1.5 mi west-southwest of the EAB (STPNOC 2010a). The rural surroundings and enclosure of noise-generating equipment in facilities help to mitigate onsite noise perceived by offsite receptors. There are no measurements of noise at the STP site (STPNOC 2010a).

Activities associated with building the new units at the STP site would have peak noise levels in the range of 100- to 110-decibels on the A-weighted scale (dBA). As illustrated in Table 2-41, noise strongly attenuates with distance. A decrease of 10-dBA in noise level is generally perceived as cutting the loudness in half. At a distance of 50 ft from the source these peak noise levels would generally decrease to the 80- to 95-dBA range and at distance of 400 ft, the peak noise levels would generally be in the 60- to 80-dBA range. For context, the sound intensity of a quiet office is 50 dBA, normal conversation is 60 dBA, busy traffic is 70 dBA, and a noisy office with machines or an average factory is 80 dBA (Tipler 1982).

Table 2-41. Construction Noise Sources and Attenuation with Distance

Source	Noise Level (dBa) (peak)	Noise Level (dBa) Distance from Source			
		50 ft	100 ft	200 ft	400 ft
Heavy trucks	95	84–89	78–83	72–77	66–71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80–89	74–82	68–77	60–71
Dozer	107	87–102	81–96	75–90	69–84
Generator	96	76	70	64	58
Crane	104	75–88	69–82	63–76	55–70
Loader	104	73–86	67–80	61–74	55–68
Grader	108	88–91	82–85	76–79	70–73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Forklift	100	95	89	83	77

Source: Golden et. al 1980

Regulations governing noise associated with the activities at the STP site are generally limited to worker health. Federal regulations governing construction noise are found in 29 CFR Part 1910, *Occupational Health and Safety Standards*, and 40 CFR Part 204, *Noise Emission Standards for Construction Equipment*. The regulations in 29 CFR Part 1910 deal with noise exposure in the construction environment, and the regulations in 40 CFR Part 204 generally govern the noise levels of compressors. Although several Texas municipalities have noise ordinances, the State of Texas does not have noise regulations covering rural areas that would be applicable to the STP site.

2.10.3 Transportation

The highway and rail transportation network surrounding the STP site is shown in Figure 2-2. According to the ER (STPNOC 2010a), all roadways in the area are composed of a treated bituminous surface. The sole access road to the STP site for operations workers at Units 1 and 2 is FM 521. FM 521 is fed from the east by US Highway 60, from the north by FM 1468, and from the west by US Highway 35 and FM 1095. Existing traffic for Units 1 and 2 will continue to enter the site via the east entrance to the plant. There are north and west entrances to the site that may be used in the future. There is a 9-mi railroad spur north of the site that could be used in the future to transport heavy components and oversized equipment to the STP site for building of the proposed new units. The rail line would be upgraded and the rail route to Buckeye would be reestablished (STPNOC 2010a). Some large equipment items could also be transported to the STP site by barge. Heavy components would be transported by barge to the existing STP barge slip on the Lower Colorado River (Figure 2-3). The components would be offloaded from the barge and transported to the construction site by truck. A 2.5-mi heavy haul route, entirely within the site, would be built from the barge slip to the construction site.

2.10.4 Electromagnetic Fields

Transmission lines generate both electric and magnetic fields, referred to collectively as EMF. Public and worker health can be compromised by acute and chronic exposure to EMF from power transmission systems, including switching stations (or substations) on-site and transmission lines connecting the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 Hz (60 cycles per second), which is considered to be extremely low frequency (ELF). In comparison, television transmitters have frequencies of 55 to 890 MHz and microwaves have frequencies of 1000 MHz and greater (NRC 1996).

Electric shock resulting from direct access to energized conductors or from induced charges in metallic structures is an example of an acute effect from EMF associated with transmission lines (NRC 1996). Objects near transmission lines can become electrically charged by close proximity to the electric field of the line. An induced current can be generated in such cases, where the current can flow from the line through the object into the ground. Capacitive charges can occur in objects that are in the electric field of a line, storing the electric charge, but isolated from the ground. A person standing on the ground can receive an electric shock from coming into contact with such an object because of the sudden discharge of the capacitive charge through the person's body to the ground. Such acute effects are controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria and adherence to the standards for transmission systems regulated by the Public Utility Commission of Texas (PUCT).

Long-term or chronic exposure to power transmission lines have been studied for a number of years. These health effects were evaluated in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996, 1999)[(a)] for nuclear power in the United States, and are discussed in the ER (STPNOC 2010a). The GEIS (NRC 1996) reviewed human health and EMF and concluded:

> The chronic effects of electromagnetic fields (EMFs) associated with nuclear plants and associated transmission lines are uncertain. Studies of 60-Hz EMFs have not uncovered consistent evidence linking harmful effects with field exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be forced and longer-term effects, if real, are subtle. Because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.

2.11 Radiological Environment

A radiological environmental monitoring program (REMP) has been conducted around the STP site since operations began in 1988. This program measures radiation and radioactive materials from all sources including the existing units at STP. The REMP includes the following exposure pathways: direct radiation, atmospheric, aquatic and terrestrial environments and groundwater and surface water. A pre-operational environmental monitoring program was conducted beginning in 1986 to establish a baseline to observe fluctuations of radioactivity in the environment after operations began. After routine operation of Unit 1 started in 1988 and Unit 2 started in 1989, the monitoring program continued to assess the radiological impacts on workers, the public and the environment. The results of this monitoring for the STP site are documented in annual reports entitled "Annual Radiological Environmental Operating Report" and "Annual Radioactive Effluent Release Report" (e.g., STPNOC 2010f, g). These reports show that exposures or concentrations in air, water, and vegetation are comparable to, if not statistically indiscernible from, pre-operational levels, with minor exceptions. The NRC's Liquid Radioactive Release Lessons Learned Task Force Report (NRC 2006) made recommendations regarding potential unmonitored groundwater contamination at U.S. nuclear plants. In response

(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999. Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

to that report, STPNOC summarized results of groundwater sampling performed by STPNOC around the STP site in its Annual Environmental Operating Report for 2007 (STPNOC 2008h).

As discussed in Section 2.3, drinking water in the area is obtained from deep aquifer wells, which are monitored quarterly. No tritium has been detected from monitoring of these wells. Tritium is released to the MCR. Monitoring shows that levels of tritium in the shallow aquifer around the MCR originating from the liquids discharged to the MCR are below the EPA drinking water standard (40 CFR Part 141) (see Section 5.9.6).

2.12 Related Federal Projects and Consultation

The review team reviewed the possibility that activities of other Federal agencies might impact the issuance of COLs to STPNOC. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating agency for preparation of the EIS. As discussed in Chapter 1, the Corps is a cooperating agency for preparation of this EIS.

Federal lands within a 50-mi radius of the STP site include the Big Boggy and San Bernard National Wildlife Refuges administered by the FWS. The 5000-ac Big Boggy National Wildlife Refuge borders Matagorda Bay and is approximately 9 mi southeast of the STP site (STPNOC 2010a). The 45,311-ac San Bernard National Wildlife Refuge contains coastal prairies and salt marshes in southern Matagorda and Brazoria counties. There are no wilderness areas or rivers included in the national wild and scenic rivers system within the 50-mi region. The closest Native American Tribal reservations are more than 50 mi from the STP site (STPNOC 2008f).

The NRC is required under Section 102(2)(C) of NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EIS. During the course of preparing this EIS, the NRC consulted with the FWS and NOAA Fisheries. A list of key consultation correspondence is identified in Appendix F.

2.13 References

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