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2.4 Ecology

This section addresses resources for the two ecological environments: terrestrial (Subsection 2.4.1) and aquatic (Subsection 2.4.2).

2.4.1 Terrestrial Ecology

2.4.1.1 Regional Landscape

VCS is located within the coastal prairie ecosystem of east Texas, the southernmost tip of the tallgrass prairie system prevalent in the Midwest (USGS 2000). This area is typified by low elevation with native, open prairie grasses interspersed with post oak savannahs or live oak mottes (groves). Most uplands support Bluestem Grasslands, comprised of bushy bluestem (*Andropogon glomeratus*), slender bluestem (*Dichanthium tenue*), little bluestem (*Schizachyrium scoparium*), silver bluestem (*Bothriochloa saccharoides*), three-awn (*Aristida* spp.), buffalograss (*Buchloe dactyloides*), Bermudagrass (*Cynodon dactylon*), brownseed paspalum (*Paspalum plicatulum*), single-spike paspalum (*Paspalum monostachyum*), smutgrass (*Sporobolus poiretti*), sacahuista (*Nolina microcarpa*), windmillgrass (*Chloris cucullata*), southern dewberry (*Rubus trivialis*), live oak (*Quercus virginiana*), mesquite (*Prosopis* spp.), huisache (*Acacia farnesiana*), baccharis (*Baccharis* spp.), and MacCartney rose (*Rosa bracteata*) (McMahan et al. 1984). Much of the original coastal prairie in Victoria County has been converted to croplands or rangeland (TSHA 2001).

Inland freshwater marshes in this region typically support Maidencane-Alligator Weed Marsh vegetation. Commonly associated plants include water hyacinth (*Eichhornia crassipes*), cattail (*Typha* spp.), water-pennywort (*Hydrocotyle ranunculoides*), pickerelweed (*Pontederia cordata*), arrowhead (*Sagittaria* spp.), white waterlily (*Nymphaea odorata*), cabomba (*Cabomba furcata*), coontail (*Ceratophyllum demersum*), and duckweed (Family Lemnaceae) (McMahan et al. 1984).

The larger drainages often have bottomland forests. Bottomlands in the Guadalupe River basin commonly support Pecan-Elm Forest, including pecan (*Carya illinoesis*), American elm (*Ulmus americana*), cedar elm (*Ulmus crassifolia*), cottonwood (*Populus deltoides*), sycamore (*Platanus americanus*), black willow (*Salix nigra*), live oak, Carolina ash (*Fraxinus caroliniana*), bald cypress (*Taxodium distichum*), water oak (*Quercus nigra*), hackberry (*Celtis occidentalis*), virgin's bower (*Clematis* spp.), yaupon (*Ilex vomitoria*), greenbrier (*Smilax* spp.), mustang grape (*Vitis mustangensis*), poison oak (*Toxicodendron pubescens*), Johnson-grass (*Sorghum halipense*), Virginia wildrye (*Elymus submuticus*), Canada wildrye (*Elymus canadensis*), rescuegrass (*Bromus catharticus*), frostweed (*Helianthemum* spp.), and western ragweed (*Ambrosia* spp.) (McMahan et al. 1984).

2.4.1.2 General Site Description

The VCS construction landscape, as described in Subsection 2.2, consists of a proposed cooling basin (5785 acres disturbed) and approximately 1350 additional acres for the power block, ancillary facilities, parking, and laydown areas. Associated offsite areas include a cooling basin blowdown line to the Guadalupe River parallel to the transportation corridor, a rail spur, and an approximately 8.5 to 11-mile-long raw water makeup (RWMU) system pipeline between the RWMU pumphouse in Refugio County and VCS (Figures 2.2-4 and 2.2-5). New transmission corridors would be established to connect VCS with the existing power grid, but the exact route of these corridors has yet to be determined (Subsection 2.2.2.1). See also Subsection 2.4.1.7.

The main facility site consists primarily of rangeland (generally Bluestem Grasslands) with scattered oak mottes and encroaching thickets of invasive/nuisance shrubs, predominantly huisache (Figure 2.4-1). This rangeland receives varying levels of use by livestock, as approximately 1100 cattle and 150 horses are rotated among fenced parcels for grazing. Three management strategies are employed on the site to produce good forage for cattle and control the spread of invasive shrubs. Parcels of the property are burned on a 2.5-to-4.0 year rotation. Grazing by livestock is also used to maintain ground cover in an earlier stage of succession. Some portions of this rangeland have not been grazed in 3 to 4 years, and, thus, they can appear as tall “old field vegetation.” Finally, in some areas, encroaching shrubs are removed by mechanical and/or chemical (herbicidal) methods. The presence of livestock, the management of the property for these animals, and the general lack of upper level predators (see below) result in the classification of this landscape as a rangeland/grazing ecosystem. Such systems are dominated by plants and herbivores, and their productivity tends to be driven by climatic factors, primarily annual rainfall.

This rangeland is interspersed with ephemeral/intermittent streams and low-lying depressional wet areas (Figure 2.4-1). The largest ephemeral stream is Dry Kuy Creek, which originates in the northwest corner of the site and exits the south-central site boundary. According to U.S. Geological Survey 7.5-minute topographic maps, Kuy Creek is a perennial stream from north of the VCS site to its confluence with the Guadalupe River; however, based on field observations from October 2007 to July 2008, the portion of Kuy Creek located on the VCS site appears to flow intermittently. Consequently, Kuy Creek is characterized as an "intermittent stream.” Several other un-named ephemeral/intermittent streams occur on the site as tributaries of Dry Kuy Creek, Linn Lake, Black Bayou, and Kuy Creek. The ephemeral/intermittent streams have irregular flows, typically flowing after heavy rainfall events, but maintaining puddles through a portion of the year in low-lying areas near culverts, etc. It should be noted that sustained dry conditions existed in the region during these surveys. Flowing waters were observed in Dry Kuy Creek during only one (March) of five seasonal wildlife surveys. Bands of vegetation, primarily senna bean (*Sesbania drummondii*), border these stream channels. Flowing waters were observed in Kuy Creek during only two of five surveys, with

only widely dispersed isolated pools present during the May and July wildlife surveys. Depressional wetlands, as classified primarily by soil type, occur throughout the site and their presence in some locations may be related to roadbeds and other landscape features impeding flows through the natural site topography (Figure 2.4-1). The hydroperiod of these wetlands can be affected by drainage area, vegetative community, their frequency of use by cattle, and rainfall amounts and patterns. Most ephemeral/intermittent streams and/or depressions are typically bordered by senna bean, and a few of the drier depressions have senna bean or grassland vegetation throughout. Many of these wetland areas (classified as such primarily by soil indicators) were indistinguishable from adjacent grassland/brush habitats during field surveys for wildlife. Herbaceous vegetation in both moist soil habitats (ephemeral streams and more hydrologically persistent depressional wetlands) is typified by sedges, switchgrass, delta arrowhead (*Sagittaria platyphylla*), squarestem spikerush (*Eleochairis quadrangulata*), smartweed (*Polygonum spp*.), and brushy bluestem.

The primary open water habitat associated with VCS is Linn Lake, on the eastern boundary of the site (Figure 2.4-1). Linn Lake is a natural oxbow lake fed by Black Bayou and the Guadalupe River and is relatively shallow with highly variable water levels. The only persistent open water habitats on the site are stock watering ponds. There are approximately 24 of these small rectangular ponds scattered across the site. Some ponds are associated with windmill pumps as water sources, whereas others are excavated in natural depressions. Many of these ponds have 4- to 6-foot-tall berms adjacent to them. The berms are typically planted with fast-growing trees like salt cedar (*Tamarix* spp.) and function as windbreaks for livestock.

Potential wetland habitats on the VCS site were examined in 2008 and 2009 employing the routine wetland delineation methods described in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (USACE 2008) to assess for occurrence of hydrophytic vegetation, hydric soils, and wetland hydrology, as indicative that wetlands were present (where differences are noted between the two documents in field approach, the Regional Supplement took precedence over the 1987 manual). Potential wetland habitats examined included wetland areas identified on USFWS National Wetland Inventory (NWI) maps, unmapped potential wetland habitats observed during field efforts, and intermittent/ephemeral stream beds and associated potential wetlands. Site surveys indicated the presence of 1,843 acres of wetlands on the 11,532-acre VCS site. The field evaluation of wetlands occurred during unusually dry conditions, which led to a reliance on soil indicators for wetlands delineation. Because Exelon has not submitted a revised jurisdictional determination request or a permit application to USACE, the USACE has not concurred on the wetlands delineation or determined the extent of federally jurisdictional waters at the site.

The site topography is generally flat, with the terrain becoming more rolling near the eastern boundary before sloping sharply downward to the Guadalupe River basin, specifically the slope in the eastern part of the site. The forest vegetation is dominated by live oak with a dense understory of saw palmetto (*Serenoa repens*). Many of the live oaks are large, greater than 2 feet in diameter at breast height. The forest edge is not abrupt. Scattered live oak trees occur amid the grassland vegetation close to the forest. Little or no grassland vegetation occurs within the closed-canopy forest areas.

At the base of the slope, the upland forest vegetation transitions to bottomland forest (Figure 2.4-1) with a dense tree canopy dominated by black willow and green ash. Occasional bald cypress trees are present. Saw palmetto is largely absent except near the base of the slope. The bottomland forest vegetation extends several hundred feet eastward from the slope to Black Bayou but is present as a narrow band generally less than 500 feet wide along the shore of Linn Lake. A few widely scattered bald cypress trees grow in shallower parts of Linn Lake.

2.4.1.3 Offsite Areas

2.4.1.3.1 Raw Water Makeup System

Raw water would be piped to the VCS cooling basin from the pumping station adjacent to the Guadalupe River in Refugio County. Three possible routes (A, B, and C) for the makeup water pipeline have been surveyed. The pumping station is approximately 0.6 mile southwest of the GBRA Saltwater Barrier on the Guadalupe River (Figure 2.2-5).

Route A extends southwest from the pumping station for approximately 1.4 miles before turning northwest for 8.7 miles (10.1 total miles). This route would cross the San Antonio River, Elm Bayou, Cushman Bayou, Kuy Creek and a tributary of Dry Kuy Creek. Land uses along this route include cropland and pasture (approximately 65 percent), shrub and brush rangeland (17 percent), mixed forestland (13 percent) and deciduous forests (5 percent).

Route B follows Route A from the pumping station for 1.4 miles then extends another 1.2 miles to the southwest. It then extends to the northwest for 3.5 miles and converges with Route A for the remaining 5.2 miles. The total length of Route B is 11.3 miles. This route would cross the San Antonio River and one of its tributaries, Cross Bayou, Cushman Bayou, Kuy Creek, and a tributary of Dry Kuy Creek. Land uses along this route include shrub and brush rangeland (37 percent), cropland and pasture (44 percent), mixed forestland (14 percent) and evergreen forests (5 percent).

Route C extends northwest from the pumping station for 8.5 miles to the VCS. It crosses the San Antonio River, Elm Bayou, Kuy Creek, a tributary of Kuy Creek, and Dry Kuy Creek. Also, this route crosses a Natural Resources Conservation Service Wetlands Reserve Program area between Elm Bayou and Kuy Creek. Land uses along this route include cropland and pasture (41 percent),

forested wetlands (35 percent), shrub and brush rangeland (10 percent), and mixed forestland (14 percent).

The primary land covers include cropland and pasture, shrub and brush rangeland, and mixed forests. Vegetation within these land cover types is similar to that described for these land covers on the VCS site. All wetland acreages along the selected route would be subject to field verification. Assessment of impacts to jurisdictional wetlands/waters has yet to be determined (pending delineation and USACE confirmation at the COL stage).

2.4.1.3.2 VCND Transportation Corridor and Cooling Basin Blowdown Line

Independent of the VCS project, the Victoria County Navigation District (VCND) plans to build a transportation corridor to connect the VCND barge facility to the highway system (U.S. Highway 77) adjacent to the VCS, and this corridor would be used to transport the heavy components to the construction site. A heavy haul road (HHR) would be built on VCS property to connect the transportation corridor to the construction site. A 48-inch discharge blowdown line would be installed (buried) within the rights-of-way of the HHR and transportation corridor. Exelon determined that co-locating the transportation corridor and blowdown line would produce fewer impacts than if the corridors were separate (Figure 2.2-4).

The transportation corridor from U.S. Highway 77 to the barge facility would be approximately 6.8 miles long, extending east from the VCS, down gradient to the Guadalupe River floodplain for approximately 3.7 miles. The corridor would cross the Black Bayou, Sand Bayou, an unnamed water course and gullies, and the Guadalupe River. The construction rights-of-way for the combined transportation corridor and blowdown line would be approximately 270 feet wide between the VCS and the Guadalupe River, and approximately 300–310 feet wide from the Guadalupe River to the barge facility. The drivable surface of the road would vary from 80–100 feet in width.

The transportation and blowdown line corridor traverse habitats similar to those described for the bottomland portions of the VCS site, including an overstory of ash and other hardwoods and an understory of saw palmetto in the less disturbed areas. Assessment of impacts to jurisdictional waters has yet to be determined (pending delineation and USACE confirmation at COL stage).

2.4.1.4 Terrestrial Wildlife

2.4.1.4.1 Avifauna

Surveys were conducted seasonally starting from late October 2007 through early October 2008 to document avifauna use of the VCS site, covering late fall, late winter, late spring, late summer, and early fall. The avian monitoring consisted of 2 days (minimum 18 hours) per season of vehicular and pedestrian surveys of the various habitats of the proposed VCS site (see habitats in Figure 2.4-1) to

determine seasonal species composition and estimate relative abundance of avian species. One hundred and six avian species were observed on the VCS site during the various surveys (Table 2.4-1). Avian species such as bobwhite quail (*Colinus virginianus*), scissor-tailed flycatcher (*Tyrannus forficatus*), northern cardinal (*Cardinalis cardinalis*), and mockingbird (*Mimus polyglottos*) were considered abundant spring/summer species and likely to nest on the site. Species such as sandhill cranes (*Grus canadensis*) and cliff swallows (*Petrochelidon pyrrhonata*) were abundant in specific seasons and likely responding to favorable environmental conditions. Abundance categories were intuitively based on species encounters within the project area.

Regional data concerning occurrence of birds during the breeding season are derived during the annual North American breeding bird survey, conducted in June of each year. These surveys are 24.5 miles long with 3-minute stops every 0.5 mile to document avian species presence within 0.25 miles (Sauer et al. Jul 2007). The two closest breeding bird surveys to the VCS site are the Schroeder (No. 83014) and Indianola (No. 83013) routes. The Schroeder route lies west-northwest of Victoria, Texas and the Guadalupe River, approximately 20 miles northwest of the VCS site, and contains the following primary habitat types: grassland (35 percent), shrubland (28 percent), deciduous forests (17 percent), and pasture (14 percent) (Sauer et al. Jul 2007). Eighty-one avian species were observed along this route during the latest breeding bird survey. The Indianola route lies east of Green Lake and extends to the marshes below Port Lavaca. The route starts approximately 7.5 miles east-southeast of the VCS site. It contains the following primary habitat types: row crops (53 percent), emergent wetlands (16 percent), pasture (13 percent), and grassland (7 percent) (Sauer et al. Jul 2007). One hundred and nine species were observed during the latest (2007) breeding bird survey along this route. The higher number of species observed compared with the Schroeder route was likely a result of the presence of aquatic habitats and row crops along the Indianola route, which are more conducive to waterbird and waterfowl use. The numbers and types of birds documented for the VCS site in late May 2008 were more similar to the breeding bird survey results for the Schroeder route. This is expected, given the greater similarity in habitat types between the VCS site and the Schroeder breeding bird survey route.

The east coast of Texas, including the VCS site, is located at the terminus of the Central Flyway migration route, resulting in the occurrence of many different species of avifauna during the fall, winter, and spring months (Shackelford et al. Nov 2005). Thousands of migrating birds from the cooler regions of the continent visit or winter in the coastal zone of Texas annually. Other migrants traveling to or from Central and South America use this region of Texas as a stopover point before continuing their travels. Christmas Bird Counts (CBCs) are one measure of avian diversity during the winter period. During these counts, attempts are made to identify and count all birds within a 15-mile-diameter circle on one day during the winter season. The two CBCs nearest to the VCS site are the Guadalupe River Delta/McFaddin Family Ranches (TXGF) and the Victoria (TXVI) counts. TXGF is centered on the northwest corner of nearby Green Lake and the circle boundary extends to the

railroad tracks on the southeastern boundary of the VCS site. The circle includes a wide variety of habitats, including Guadalupe River riparian forest, rangeland, marshes, state Wildlife Management Areas, two chemical plants, and portions of Hynes and Guadalupe Bays. The number of avian species observed during the TXGF CBC from 2004 through 2006 ranged from 212 to 225 species (NAS 2007). The number of avian species observed during the TXVI CBC from 2004 through 2006 ranged from 126 to 152 species (NAS 2008).

Another measure of diversity associated with migration is the Great Texas Birding Classic. It is held annually in mid-April during spring migration along the Texas Gulf Coast. VCS, and Victoria County, are in the “central coast” region of this Classic, along with 18 other counties south to, and including, the Corpus Christi area. In 2007, 218 avian species were observed in the central coast region (GCBO 2008).

Avian surveys of the VCS site suggest a reduced avian diversity when compared to the long-term avian studies of this region. However, this is likely because of differences in size and complexity of areas surveyed, with most of the long-term studies covering larger areas with more diverse habitats, and having greater surveying efforts (numbers of observers documenting birds). The findings of the VCS surveys were thus a subset of the other, larger studies.

2.4.1.4.1.1 Mammals

Mammals either observed or indicated by tracks and other signs on the site during seasonal avian surveys include armadillo (*Dasypus novemcinctus*), white-tail deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), wild hog (*Sus scrofa*), bobcat (*Lynx rufus*), opossum (*Didelphiis virginiana*), eastern cottontail (*Silvilagus floridanus*), swamp rabbit (*S. aquaticus*), Attwater’s pocket gopher (*Geomys attwateri*), fox squirrel (*Sciurus niger*), gray squirrel (*S. carolinensis*), and coyote/dog (*Canis spp.*). Specific surveys for mammals were conducted in April/May of 2008. These were one-time surveys during the peak of activity of these species to document species presence and relative abundance. Abundance categories were intuitively based on species encounters within the project area and regional knowledge. Surveys included 800 total trap-nights (Sherman live traps) in the various habitats of the VCS site (for small mammals), with trapping effort apportioned based on habitat abundance (grassland habitats were trapped for 400 trap nights and the remaining four habitat types were trapped for 100 trap nights each) (Figure 2.4-2). Additionally, five remote game cameras were established at scent stations on site to document larger animals. Two of these were set for 25 days each in the grassland habitat, and one each were set in the bottomland, oak forest, and oak motte habitats (cameras could not be set in the wetland habitat type). A single nighttime spotlight survey occurred along the existing site roads, and two mist nets were deployed one night in the bottomland habitats for bats. Sixteen total mammal species were observed on the VCS site during all surveys combined (Table 2.4-2). The greatest diversity of small mammals (N=5 species), based on the Sherman live trap survey, was found in the bluestem grasslands, followed by depressional wetlands

(two species) and one species each for the oak forest and oak motte habitats. No small mammals were recorded in the bottomland hardwood areas with the Sherman traps; however, five larger mammal species were documented in bottomland habitat by a game camera. These bottomland hardwood areas are inundated for extended periods after heavy rains and small mammals are likely displaced by these events. Although not documented during the various survey methods, pocket gopher mounds are abundant on the upland portions of the site. These were confirmed to be Attwater's pocket gophers (*Geomys attwaterii*). Mammals considered abundant within the available habitats included Attwater's pocket gopher, white-tailed deer (*Odocoileus virginiana*), raccoon (*Procyon lotor*), fox squirrel (*Sciurus niger*), and cotton rat (*Sigmodon hispidus*). No bats were captured with the mist nets and none were observed during evening hours around aquatic habitats during other surveys.

2.4.1.4.1.2 Herpetofauna

The eastern garter snake (*Thamnophis sirtalis sirtalis*), broad-banded watersnake (*Nerodia fasciata confluens*), western diamondback rattlesnake (*Crotalus horridus*) and alligator (*Alligator mississippiensis*) were the only reptiles observed on site during the seasonal avian surveys. Specific surveys for reptiles and amphibians were conducted in May 2008. These were one-time surveys during the peak of activity of these species to document species presence and relative abundance. Abundance categories were intuitively based on species encounters within the project area and regional knowledge. Herpetological surveys included timed searches of the various habitat types (28 total hours) with searching effort apportioned based on habitat abundance (grassland habitats were searched for 12 hours and the remaining four habitat types were searched for 3 to 5 hours each) (Figure 2.4-2). Other surveying techniques included audible call counts during all surveying efforts, six funnel traps deployed for three nights each in aquatic habitats and a nocturnal road cruise on site roads. A total of 22 herpetological species were observed on the VCS site during all surveys combined, including eight snake, seven frog, three turtle, two lizard and one salamander species, as well as the alligator (Table 2.4-3). The greatest diversity (based on the timed searches) was found in the depressional wetland habitat type. No herpetological species were found within the bluestem grasslands during these timed searches, although a few species were observed in this habitat during the other surveys. Species considered abundant within the available habitats during these surveys included southern leopard frog (*Rana sphenocephala*) and diamondback water snake (*Nerodia rhombifer rhombifer*), with both species found primarily in the site's depressional wetlands.

2.4.1.5 Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) is responsible for designating lands as "critical habitat" for federally listed endangered and threatened species. Such lands are protected to aid the recovery of the species and may require special management activities. No area designated by the USFWS as critical habitat is found within or adjacent to the VCS site. The nearest critical habitat is the primary

wintering area for federally endangered whooping cranes (*Grus americana*), located approximately 18 miles south of the VCS site in Aransas and Calhoun Counties (CWS & USFWS Mar 2007) (Figure 2.4-3). Wintering habitat for the threatened piping plover (*Charadrius melodus*) is located along the shoreline of Matagorda Island (66 FR 36038-36086), approximately 25 miles south of the VCS site. Portions of the VCS site were included in a Safe Harbor Agreement for Attwater's prairie chicken (*Tympanuchus cupido attwateri*), a federally endangered species that was formerly known in Victoria County, with the landowner agreeing to manage vegetation on this property for this species until 2009 or until the property is sold. Because of this Safe Harbor Agreement and resulting site management activities, as well as the site's proximity to historical (currently unoccupied) breeding grounds, the VCS site lies within a priority management zone for this species (USFWS Sept 2007). However, based on discussions with the USFWS, this species does not reside on the proposed VCS site, and no experimental birds have been released there (the closest release was greater than 7 miles to the west in Goliad County).

Eighteen animal species that are either federally or state-listed as endangered or threatened have been recorded or historically occurred in Victoria County (Table 2.4-4). No federal- or state-listed plants have been recorded for Victoria County. Table 2.4-4 reflects recorded or historical occurrences for federal and state-listed species for counties containing portions of the intake and transmission corridors, which include Calhoun, DeWitt, Goliad, Jackson, Matagorda, Refugio, Victoria, and Wharton. It should be noted that occurrences of federally-listed species on the state and federal Websites occasionally differ. The state Websites include all counties within the historical range of these species and the federal Websites include only counties with recent sightings. As a conservative approach, Exelon has included species in counties from both Websites. Exelon has initiated correspondence with the appropriate federal and state agencies (National Marine Fisheries Service, Texas Parks and Wildlife Department, and USFWS) regarding endangered and threatened species (Appendix A).

The only federally listed species observed on the VCS site during the avian surveys was a single bald eagle (*Haliaeetus leucocephalus*) soaring near Linn Lake in October 2007. Although de-listed under the Endangered Species Act, it remains protected under the Bald and Golden Eagle Protection Act (72 FR 37346-37372). Only two state-listed "threatened" species were observed on the VCS site during the various wildlife surveys. The white-tailed hawk (*Buteo albicaudata*) was observed in low numbers (fewer than five) during all surveys of the VCS site. They typically use shrubby rangeland habitats in eastern Texas, but nesting was not observed on site. The wood stork (*Mycteria americana*) is a large wading bird that is also listed as federally endangered in other portions of their range (southeastern United States). They have bred in Texas occasionally within the past few decades, but most current sightings are presumed to be post-breeding season birds dispersing from populations in Mexico. Wood storks feed in shallow open-water wetlands and the two sightings (one

bird each) in May and July on the VCS site were associated with the riverine bottomlands. In addition, a flock of 30 storks was observed flying over Linn Lake in October of 2008.

Whooping cranes (*Grus americana*) are listed as endangered by both federal and state agencies because of population declines first noted in the 1800s. These declines were thought to have been caused by human colonization of the northern Great Plains and subsequent conversion of native prairies and potholes to pasture and crop production (Campbell 2003). The population may have dropped below 30 cranes in the late 1930s, but multinational recovery efforts now estimate a population of over 400 birds. The majority of these cranes nest in the Wood Buffalo National Park in the Northwest Territories, Canada, and winter at the Aransas National Wildlife Refuge (NWR) on the coast of Texas, approximately 18 miles south of the VCS site. The Aransas area is listed as critical wintering habitat for the whooping crane (Figure 2.4-3; CWS & USFWS Mar 2007).

Whooping cranes migrate from their breeding grounds in the fall, generally arriving on the Texas coast between late October and mid December (Campbell 2003). They use an approximately 200-mile-wide migration path en route, then spend almost 6 months on the wintering grounds on and near the Aransas NWR. While on the wintering grounds, they typically forage in brackish bays, marshes, and salt flats, feeding on a variety of food sources including wolfberry fruit (*Lycium Carolinianum*), blue crabs (*Callinectes sapidus*), and other prey. The whooping cranes leave their Texas wintering grounds in late March and early April, returning to Canada. Survival of wintering cranes varies annually.

Despite the overall growth in whooping crane population since the 1940s, several potential threats to whooping cranes and their habitat have been identified. Potential threats include land development in the vicinity of the Aransas Wildlife Refuge, their wintering habitat, that limits expansion of nesting territory as the flock grows. Sea level rise, changes in fresh water inflows, the spread of black mangrove on the wintering grounds, wind energy development, and power lines have also been identified as threats. (WCEP Nov 2009) Several of these threats are discussed in the following paragraphs.

Changes in freshwater inflows into San Antonio Bay may impact blue crab populations (CWS & USFWS Mar 2007). Blue crabs are responsive to salinity levels. Changes in salinity levels potentially resulting from changes in freshwater inflows into the San Antonio Bay system and other factors such as precipitation could result in increased salinities and affect blue crab distribution and numbers. Thus an important food resource for the wintering cranes could be impacted. To further examine the diet, behavior, and habitat of whooping cranes in this region, a series of empirical studies (the SAGES project; Slack *et al.* 2009) were implemented to provide data for computer simulations. Impacts of one aspect investigated include the relationship of variation of freshwater inflows on whooping crane prey and crane use of the bay habitats. Among the many findings of these studies

were (1) the diet of cranes is varied and includes wolfberry fruit, blue crabs, clams, snails, insects, fiddler crabs, snakes, and fish; (2) that blue crabs were not always the primary prey item; (3) that wolfberry fruit production is strongly and negatively influenced by salinity levels during summer leaf production (i.e., high salinity = low production); (4) blue crab abundance was influenced by a combination of environmental factors including water levels, windspeeds, water temperature, and salinity; and (5) although salinity was statistically significant and positively correlated with crab abundance in the selected multivariate model, salinity level alone was not a determining factor in crab abundance. The results from these studies were incorporated into computer models. The following relationships were suggested based on computer simulations for the 11-year period from 1997 - 2007: (1) the food supply in the area does not seem limiting, even during lower freshwater inflow conditions within the 11-year period; (2) wolfberry abundance is lower when salinities are higher; (3) blue crab abundance was best explained by a suite of environmental factors that could not be simplified into single-factor predictive models; and (4) the relationship between salinity and whooping crane energetics and/or survival is still uncertain. Given that some of these findings were contrary to those from earlier studies (see comments in Slack *et al.*), additional studies have been proposed to more directly examine the relationship between freshwater inflows, blue crabs, and whooping crane energetics and survival.

The major cause of mortality of the current whooping crane population is collisions with transmission and distribution lines, especially lines within the migratory pathway (CWS & USFWS Mar 2007). Tower guy-wires are also a concern, although to a lesser degree. The USFWS required a transmission company to mark transmission lines with highly visible “aviation balls” within a Texas portion of the whooping crane migratory pathway (AEP 2007). “Spiral markers” are installed on some transmission lines to reduce avian collisions. Another threat to the wintering cranes includes impacts of disturbance (noise, human presence, etc.), a concern resulting from access to the wintering grounds (most areas are public domain) and the continued development along the Texas Coast.

High mortality rates for the Aransas-Wood Buffalo population of whooping cranes during 2008–2009 were documented by the Whooping Crane Eastern Partnership (WCEP), a group of government agencies and non-profit organizations that joined forces to reintroduce a migratory population of whooping cranes to eastern North America. According to WCEP, the majority of losses appear to have occurred during migration. Several possible factors for this mortality level have been identified such as extreme drought which affected food sources and fresh drinking water available in the wintering grounds and disease (e.g., infectious bursal disease (IBD)). Further, chick mortality at Wood Buffalo National Park in Canada was also high, potentially due to higher than average rainfall while the chicks were young. Data from specific analyses (e.g., necropsies, water quality and food source abundance data correlation) was not included in the WCEP assessment. (WCEP Nov 2009)

Due to the fact that only four crane carcasses were recovered, the reports of mortality during the 2008-2009 overwintering period were based primarily on the apparent absence of birds during USFWS aerial census events. These missing birds, which were documented as arriving at Aransas National Wildlife Refuge (ANWR) during earlier aerial censuses, accounted for up to 19 of the 23 suspected mortalities (USFWS 2009a and USFWS 2009b).

During the 2008-2009 overwintering season at ANWR, above-normal upland and water hole use was noted, scattering the cranes over a geographical area beyond their typical territory. As described in the January 2009 USFWS aerial census report, "This makes it very difficult to determine the identity of pairs and family groups and leads to much uncertainty during the census count" (USFWS 2009a). Limited visibility due to weather conditions and smoke from prescribed burns, as well as flight time limitations, were noted on multiple census flights, adding to the difficulty in spotting the widely dispersed cranes (USFWS 2009a). Considering these and other factors, it is possible that the extent of whooping crane mortality during the 2008–2009 overwintering period could be lower than reported.

Given the few carcasses recovered, questions also remain regarding the causes of the reported whooping crane deaths. USFWS reports from the first half of 2009 postulated that the birds absent during the later aerial census counts succumbed to injury, predation, and/or disease resulting primarily from food-related stress (particularly related to small amounts of wolfberries and blue crabs) believed to be brought on by the regional drought conditions (USFWS 2009b). Additionally, the need for the cranes to fly to upland areas to find fresh water to drink was cited as an energy burden that could have further weakened the birds (USFWS 2009b). However, as discussed previously, empirical research indicates that the crane diet is rich and varied, and even when blue crab and wolfberry numbers are low, cranes can meet their daily energy and protein requirements by efficiently foraging on foods such as insects, snails, and razor clams (Slack et al. Aug 2009). As an example, cranes were noted eating fiddler crabs immediately prior to their early departure from ANWR in spring 2009 (USFWS 2009b). Furthermore, the flock departed ANWR relatively early in 2009 (USFWS 2009b). Previous research has indicated that birds will generally migrate earlier than usual when food availability allows for rapid fattening and good physical condition (Studds and Marra 2007).

Additionally, other factors could have contributed to crane mortality. As noted in the USFWS report Whooping Crane Recovery Activities, October 2008–October 2009, the National Wildlife Health Center in Madison, Wisconsin was able to isolate a virus very similar to IBD in a recovered juvenile carcass. One of the symptoms of IBD is emaciation, even when a bird is receiving adequate food. If it turns out the virus is a form of IBD, this would be the first case ever documented in a crane from the Central Flyway (USFWS 2009b). Taking into account the available information, there is uncertainty regarding the specific cause or causes of death for the whooping crane mortalities reported over the 2008-2009 overwintering period at ANWR.

The brown pelican (*Pelecanus occidentalis*) is a large gray-brown bird with a characteristic long bill and pouch, known to forage on fish in coastal areas (Campbell 2003). Historically present in large numbers along the Atlantic and Gulf Coasts, the brown pelican population dropped dramatically by the mid-1970s primarily owing to insecticide (DDT) impacts on egg quality, and it was classified as federally-endangered throughout its range. Around 1900, an estimated 5000 brown pelicans nested on the Texas Coast, but the population declined to less than 10 breeding pairs by 1970, partially as the result of disturbance at their nesting areas by fishermen. Control of insecticide use and other recovery activities (e.g., nesting site protection) have resulted in recovery of segments of the population. In 1985, pelicans along the Atlantic and Florida Coasts had recovered sufficiently to be de-listed, whereas brown pelicans in Louisiana, Texas, and California remain classified as endangered. Currently, the Texas population is at or near historical levels (USFWS 2007a). Primary threats to Texas pelicans are loss of their nesting habitat, typically dredge spoil islands, which are subject to loss during hurricanes, and pollution from either off-shore oil wells or shipping. The closest nesting locations to the VCS site are in Aransas, Calhoun, and Matagorda Counties (USFWS 2007b).

Piping plovers (*Charadrius melodus*) are small stocky shorebirds that nest on shoreline beaches in the northern Great Plains, Great Lakes, and Atlantic Coast areas. All populations are listed as either federally-threatened or endangered. Piping plovers are a migratory species, wintering along the Gulf Coast and other southern locations. Critical wintering habitat for the piping plover is designated along the Texas Gulf Coast, with the closest area to the VCS site located in Matagorda Island bayside habitats in Calhoun County, approximately 25 miles south of the VCS site (Figure 2.4-3).

Five species of sea turtles are federally listed for Calhoun County (Table 2.4-4) including: loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*), and the Kemp's Ridley sea turtle (*Lepidochelys kempii*). Three species are known to nest on Texas barrier island beaches (TSTNR 2007), and all five could possibly occur in San Antonio Bay.

Sightings and strandings of endangered West Indian manatees (*Trichechus manatus*) have been recorded over the last 100 years across the entire Texas Coast (Schmidly 2004). A live stranding of a manatee occurred near Galveston, Texas, as recently as 2007 (TMMSN 2007). However, there is no evidence that a breeding population ever existed along the Texas Coast; individuals sighted/stranded in Texas probably represent migrants from Mexico (Schmidly 2004), possibly as the result of cool northern Gulf waters.

Several endangered or threatened species in Table 2.4-4 have become extirpated in the counties associated with the VCS site resulting from the loss of their specific habitats as humans settled the area and altered the natural landscape to a more open and managed agricultural landscape. Once

found throughout eastern Texas, the red wolf's (*Canis rufus*) decline was linked to these land use changes, which reduced their more forested habitats and enhanced that of the coyote (*Canis latrans*), resulting in a population overlap. Subsequent interbreeding between the two canine species has effectively resulted in the extirpation of the red wolf from Texas (Schmidly 2004). The ocelot (*Leopardus pardalis*) and jaguarundi (*Felis yagouaroundi cacomitli*) are neotropical cats that typically inhabit large, dense thickets of thorny shrubs. With the loss of vast areas of this habitat by conversion to agricultural lands, both species are now limited to a few isolated areas in more southern portions of Texas (Campbell 2003). The Louisiana black bear (*Ursus americanus luteolus*), one of 16 subspecies of American black bear, was once common in forested areas of eastern Texas. As the result of hunting and habitat loss, this subspecies was presumed to be extirpated from this area by the 1940s, and any recent sightings are thought to be dispersing juveniles from Louisiana (Campbell 2003). Attwater's prairie chickens are medium-sized grouse that historically inhabited Texas coastal tallgrass prairies. With the loss of much of this habitat type to agriculture, pastures, and overgrazing, fewer than 100 of this species are thought to exist in populations in Galveston and Colorado Counties. The Eskimo curlew (*Numenius borealis*), another species affected by the conversion of open and coastal prairie habitats to agriculture and over-hunting, was once an abundant migrant of the Texas prairie that may now be extinct. The last verified sighting of an Eskimo curlew occurred on the "coast of Texas" in 1987 (Campbell 2003).

2.4.1.6 Other Important Species and Habitats

"Important species" are defined in Table 2.4.1-1 of NUREG-1555, the *Standard Review Plan for Environmental Reviews for Nuclear Plants* (U.S. NRC Oct 1999), as those that are federally or state-listed as threatened or endangered, proposed for listing as threatened or endangered, commercially or recreationally valuable, essential to the maintenance or survival of species that are rare or commercially or recreationally valuable, critical to the structure and function of the local terrestrial ecosystem, or that serve as biological indicators. Listed/protected species observed on or near the VCS site include bald eagles, white-tailed hawks, and wood storks. Whooping cranes have not been observed on site, but the main facility and associated corridors lie within their migratory pathway (CWS & USFWS Mar 2007). Game species fall within the "commercially or recreationally valuable" species category. The primary game species observed on the VCS site include white-tail deer, feral pigs, rabbits, northern bobwhites, various species of doves, and waterfowl.

There are an estimated 1000 deer onsite (based on spotlight counts and hunter encounters), and 60 to 90 are harvested annually. One northern bobwhite is estimated to occur per 2 to 3 acres onsite, based on call counts and hunter encounters. No major "travel corridors" for game species are known to cross the VCS site. However, wintering waterfowl use nearby Linn Lake and Black Bayou and may traverse between there and any onsite depressional wetlands that contain water. The only land management activities for wildlife on this property are the burning, grazing, and shrub control

practices described above. Nuisance plants observed on the VCS site include huisache, and invasive salt cedar has been planted as windbreaks on some berms on the property. No nuisance animals other than feral hogs have been observed on the site. Although the proposed VCS site hosts such potential disease vectors as ticks and mosquitoes, Exelon is unaware of any vector-borne diseases resulting from them.

Important habitats, as defined under NUREG-1555, include wildlife refuges, sanctuaries, or preserves, habitats identified by federal or state agencies as rare or to be protected, wetlands, floodplains, other resources specifically protected by federal or state regulation, or land areas identified as critical habitat for threatened or endangered species. Ephemeral/intermittent streams and depressional wetlands exist within the boundaries of the VCS site, whereas more persistent waters (Linn Lake and Black Bayou) exist adjacent to the site. The proposed RWMU pipeline corridor and transportation corridor would cross bottomland habitats which may contain jurisdictional wetlands (Figures 2.2-4 and 2.2-5).

The Guadalupe River Delta Wildlife Management Area (WMA) is managed by the Texas Parks and Wildlife Department (TPWD) and is located approximately 11 miles southeast of the proposed site near the junction of Calhoun, Refugio, and Victoria Counties (Figure 2.4-3). The WMA consists of approximately 6200 acres of fresh and brackish water marshes, impoundments, bottomland areas, and bayous, largely fed by freshwater flows from the Guadalupe River. These lands have been used by various state and federal threatened and endangered avian species, migratory waterfowl and neotropical songbirds, and the estuary portions provide valuable spawning and nursery habitat for marine fish, shrimp, and blue crab (TPWD 2007a).

The Aransas NWR is composed of approximately 115,000 acres in five units in Aransas, Calhoun, and Refugio Counties, approximately 18 miles south of the VCS site (USFWS 2008b). A mixture of mainland, bay, and barrier island habitats, much of this refuge is classified as critical wintering habitat for endangered whooping cranes. The refuge hosts a multitude of wildlife species in addition to whooping cranes.

The Welder Flats Coastal Preserve consists of approximately 1500 acres of largely submerged land near the junction of the Victoria Barge Canal and the Gulf Intracoastal Waterway, approximately 26 miles southeast of the proposed site. The preserve is owned by the Texas General Land Office and is managed by the TPWD. The entire preserve is classified as critical wintering habitat for endangered whooping cranes. It contains beds of submerged aquatic vegetation, is used by waterfowl, wading birds and shorebirds, and is a valuable nursery ground for red drum and sea trout. The TPWD uses the shoreline as a stocking location for red drum and sea trout because of its high nursery value (TPWD 2007b).

2.4.1.7 Transmission Line Corridor Habitats and Communities

As described in Subsection 2.2.2, three new transmission corridors would be constructed from VCS to link to the existing transmission system (Figure 2.2-3). One corridor would traverse approximately 20 miles to the northwest and link in with the Coleto Creek substation. This corridor would cross habitat similar to that of the VCS site, largely rangeland and some forested lands, as well as some agricultural fields. A second corridor would connect the VCS site with a proposed Cholla substation approximately 20 miles to the northwest in DeWitt County. The new corridor would co-locate with existing transmission corridors, where practical, but would require additional corridor width. The third corridor would traverse approximately 60 miles between the VCS site and both the Hillje substation in Wharton County and the Blessing substation in Matagorda County. This corridor would also contain an approximately 10-mile connection between VCS and the existing STP-Whitepoint line. The habitat types to be traversed by this corridor would likely be similar to those of the VCS site, with the possible inclusion of agricultural fields and riverine bottomlands.

The routes of the new transmission lines have not been finalized; thus, a macro-corridor approach (3-mile-wide corridor within which the transmission corridors will likely fit) was employed to examine for sensitive habitats (Subsection 2.2.2). This methodology attempts to reduce impacts on human populations and ecological resources by avoiding sensitive areas such as wetlands and towns and using existing corridors (transmission and others) to the extent possible. Several inland water bodies/drainages within the macro-corridor are artificial (irrigation ponds/ditches/canals, aquaculture impoundments, etc.), but some natural drainages are present in the corridor toward Hillje and Blessing, including the Guadalupe, Lavaca, and Navidad Rivers. Land use within the macro-corridor is listed in Table 2.2-3 and is dominated by rangeland, pasture, and forestland. Thus, most land incorporated in the proposed expansions is already human altered and unlikely to be affected significantly by this activity. No areas designated by the USFWS as critical habitat for endangered or threatened species are crossed by these proposed corridors, nor do they cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas. These corridor expansions likely occur within the migratory pathway of waterfowl and whooping cranes. Potential wetlands within these corridors will be assessed upon finalization of the routes.

Endangered and threatened species known to occur in the counties within the macro-corridors are listed in Table 2.4-4. A species of concern within these counties as the result of the addition/expansion of transmission corridors is the migratory whooping crane. Cranes and other protected species (for Victoria County) are described in detail in Subsection 2.4.1.5. The list is based on classifications by the USFWS (2008a) and Texas Parks and Wildlife Department (2008). Exelon acknowledges that these lists are based on either recorded occurrences or historical ranges of species.

The transmission line corridors would be constructed and maintained in accordance with the established procedures of the company responsible for these tasks, AEP Texas Central Company.

2.4.2 Aquatic Ecology

The surface water bodies of interest, those that could potentially be affected by construction and operation of new units at VCS are:

- Onsite and near-site streams, wetlands, and ponds (including Linn Lake)
- Guadalupe River
- Guadalupe-Blanco River Authority (GBRA) Calhoun Canal System (an alternate freshwater intake location evaluated in Section 9.4)

Exelon implemented a pre-application monitoring program in January 2008 to characterize the aquatic communities of these water bodies. This monitoring program was the primary source for the descriptions of aquatic communities in Subsection 2.4.2 of the ER and was the basis for the assessment of potential impacts from construction and operation of the proposed facility.

Exelon's pre-application monitoring program encompassed fish and benthic macroinvertebrate surveys of onsite and "near-site" water bodies including several wetlands, a stock pond, permanent and intermittent streams draining the site, and two natural lakes; juvenile and adult fish sampling along approximately 18 miles of the Guadalupe River; ichthyoplankton sampling at the point where water is diverted from the Guadalupe River to the GBRA canal system; juvenile and adult fish sampling at Goff Bayou, which flows into the GBRA canal system; juvenile and adult fish sampling at a station in the GBRA Main Canal; and ichthyoplankton sampling at a station in the GBRA Main Canal. Subsection 2.4.2.1 summarizes the results of these surveys.

Survey results are summarized in the subsections that follow. They form the basis for the discussion of distribution and abundance of important aquatic species and assemblages on which the construction and operation of VCS could have an impact. Consistent with NRC guidance, a full year (January–December 2008) of data was collected, ensuring that seasonal differences in aquatic populations would be reflected.

2.4.2.1 Aquatic Communities

2.4.2.1.1 Onsite and Near-Site Streams, Wetlands, and Ponds

The approximately 11,500-acre VCS site is located on a "bench" or terrace west of the Guadalupe River in southern Victoria County, Texas. The terrain is relatively flat on the western side of the site, sloping gently down toward the eastern side of the site. The northeastern site boundary slopes

sharply downward to the Guadalupe River floodplain, more specifically Black Bayou (shown on some maps as McDonald Bayou) and Linn Lake—an oxbow lake into which Black Bayou flows (Figure 2.4-1).

The site is drained by three streams: Black Bayou and its tributaries drain the northern and eastern portion of the site; Dry Kuy Creek and its tributaries drain the central and southeastern portions of the site; and Kuy Creek and its tributaries drain the southwestern portion of the site (Figure 2.4-1). Black Bayou is a perennial stream, while Kuy Creek and Dry Kuy Creek are intermittent/ephemeral streams.

In addition to these drainages, the site contains stock ponds and ephemeral depressional wetlands of varying hydroperiods. Some of the wetland depressions appear to have been created when site roads were constructed many years ago and natural drainages were blocked or dammed. The centers of some of these wetlands have been deepened to provide additional water storage for livestock, creating open water habitats (ponds). Several additional livestock ponds have been created on the site, with most augmented by windmill-driven wells.

Linn Lake, which lies to the east of the site, is an approximately 905-acre oxbow lake. The lake is generally shallow with a muddy bottom. Although access to Linn Lake is limited, some fishermen seek panfish, bass, and catfish in its waters. The Linn Lake fishery is influenced by cycles of drought and flood in the Guadalupe River, with fish populations in the lake periodically replenished when flood waters transport fish into the basin.

The VCS site is currently used primarily for raising livestock (mostly cattle, with a few horses). No crops are cultivated. Thus, there is no regular use of agricultural chemicals. Cattle are typically restricted to small parcels of the property at any given time, while remaining areas are left ungrazed. Many of the dryer portions of the site appear to be in a 2- to 5-year-old successional stage, containing "old field/disturbed area" plants. All portions of the site show signs of livestock use.

Exelon conducted quarterly surveys of the aquatic resources of the VCS site in 2008. Onsite and near-site streams, wetlands, and stock ponds were surveyed in spring (April), summer (July), fall (October), and winter (December) 2008. Twelve sampling stations were established based on a field reconnaissance in 2007 and an examination of topographic maps and aerial photographs. Each of these sampling stations is described in detail in the section that follows.

Station Locations and Descriptions

Station MC-1

Station MC-1 is located on a small, unnamed tributary of Black Bayou that drains a small area in the northern part of the site (Figure 2.4-4). Just downstream of this sampling station, on the adjacent property, this stream has been impounded to form a small fishing pond. Station MC-1 is located in the extreme upper end of this impoundment, at the point at which the stream begins to resemble a pond. This pond was almost entirely covered in floating primrose willow (*Ludwigia peploides*) during all four quarterly surveys. Substrate consists of firm clay with some organic deposition.

Station MC-2

Station MC-2, a small, unnamed, deeply incised intermittent stream that drains the northeastern portion of the site, flows into the Black Bayou/Linn Lake floodplain. In spring 2008 it consisted of several small isolated pools. Substrate in these pools consisted mainly of sand, with small amounts of organic matter. No aquatic vegetation was found in the pools; however, floating primrose willow, swamp smartweed (*Polygonum hydropiperoides*), and a species of millet were found in the streambed between the pools. This station was completely dry in July, October, and December.

Station MC-3

Station MC-3 is a small (0.1-acre) man-made pond in the approximate center of the site that is used to provide water for livestock. Water in the pond is relatively clear. In April, two species of submerged aquatic plants were present—muskgrass (*Chara spp.*) and bushy pondweed (*Najas guadalupensis*). The margins of the pond were dominated by squarestem spikerush (*Eleocharis quadrangulata*), intermixed with sedges (*Cyperus spp.*), floating primrose willow, and cattails (*Typha spp.*). By July, the pond had receded to a shallow puddle covered with floating primrose willow. In October and December, this pond was dry and the station could not be sampled.

Station MC-4

Station MC-4 is a small (0.5-acre) stock pond located directly south of MC-3 in the middle of a wetland depression. In April, the pond was approximately 115 feet by 225 feet with an average depth of 1.5 feet. Livestock activity was very evident around the margins of the pond. As a result, water clarity is low and no submerged aquatic vegetation is present. Floating primrose willow grows around the edges of the pond. By July, the water level had dropped substantially, and the average depth was less than one foot. In October, the pond was reduced to a small mud puddle. In December, the pond was completely dry.

Station MC-5 (Kuy Creek)

Station MC-5 is on Kuy Creek in a riparian woodland near the southern entrance to the site. The channel of the creek is deeply cut, with a soft to moderately firm bottom. Flows and water levels in Kuy Creek vary dramatically depending on the time of year and patterns of precipitation. No submerged aquatic vegetation is present in this section of the creek. During sustained dry periods, as in the summer and fall of 2008, this portion of the creek is reduced to a series of stagnant puddles. Kuy Creek drains the southwestern portion of the VCS site and flows southeast, ultimately meeting the Guadalupe River approximately 10 miles down river of the VCS site (Figure 2.4-4).

Station MC-6 (Dry Kuy Creek)

Station MC-6 is along Dry Kuy Creek, an intermittent/ephemeral tributary of Kuy Creek that flows southeast and drains the middle of the VCS site (Figure 2.4-4). Dry Kuy Creek holds water after sustained or heavy rainfall, but during extended periods of low rainfall it becomes a series of small stagnant pools in channel depressions or is completely dry. Water in these pools is typically turbid due to livestock walking through them. The substrate consists of soft silt and sand, and no aquatic vegetation is present.

Station MC-7 (Black Bayou)

Station MC-7 is on Black Bayou at a pipeline crossing a short distance above its confluence with Linn Lake. Although flows are significantly reduced during dry periods, Black Bayou is considered to be a perennial stream. Water level in Black Bayou was significantly lower in December than April, but the bayou always held water. Water in the bayou is generally turbid. The substrate is composed of moderately firm clay with a layer of organic material and soft silt. Although some filamentous algae may be found along the banks of the bayou, no submerged aquatic vegetation is present. Woody debris in the form of logs and fallen branches lies along the edges of the bayou.

Station MC-8 (Linn Lake)

Station MC-8 is in the upper basin of Linn Lake, a large oxbow lake, near the inflow of Black Bayou. Black Bayou empties into a broad flat of Linn Lake that is extremely shallow during most of the year and may be completely exposed during dry seasons. The substrate is composed of moderately firm clay and soft silt with an abundance of organic deposition. No submerged vegetation is present. This station held less than a foot of water in April and was completely dry in July, October, and December.

Station MC-9 (Linn Lake)

Station MC-9 is in the lower basin of Linn Lake, southeast of and across a large peninsula from MC-8. Linn Lake is shallow in this area with an average depth of <0.5 meters (1.5 feet). This depth is

relatively consistent for several hundred meters into the lake. The substrate consists of soft silt and clay; no submerged vegetation is present. This station was a mudflat in July and was completely dry in October and December.

Station MC-10 (Upper Cypress Lake)

Station MC-10 is in the headwaters of Cypress Lake, just upstream of the railroad trestle that marks the site boundary. It includes an expanse of shallow water (swamp) and a creek channel with a maximum depth of approximately 1 meter (3.3 feet). The substrate is moderately firm sand with some silt in quiescent areas. Vegetation along shorelines and islands includes bald cypress, black willow, and box elder. Large bald cypress trees were also present in the swamp and stream channel. No submerged aquatic vegetation is present. This station was completely dry in July, October, and December and could not be sampled.

Station MC-11

Station MC-11 is a stock pond in the approximate center of the VCS site. The surface area of the pond was approximately 0.5 acre in April. Substrate in the pond consisted of loose, silty clays and sand. Water in the pond was very turbid, and there was no evidence of submerged aquatic vegetation. Because the pond is heavily used by livestock, no aquatic vegetation grows along its banks. The water level at this station dropped steadily over the summer and fall, but it was sampled in all four quarters.

Station MC-12

Station MC-12 is a large, ephemeral wetland with the appearance of a freshwater marsh during rainy seasons and a pasture during dry seasons. During the April 2008 sampling effort, one small open area occurred in the middle of the wetland that was approximately 25 meters (84 feet) by 37 meters (120 feet). Water was clear, and substrate was composed of moderately soft soil with abundant organic deposition. The isolated emergent wetland is dominated by squarestem spikerush and rattlebush. Other associated vegetation consisted of American lotus (*Nelumbo lutea*), longbarb arrowhead (*Sagittaria longiloba*), grassy arrowhead (*S. graminea*), spider lily (*Hymenocallis occidentalis*), and swollen bladderwort (*Utricularia vulgaris*). By July 2008, soils at the site were completely dry, and all wetland vegetation had died. It remained dry in October and December.

Fish Sampling

As discussed previously, onsite and nearsite water bodies were sampled quarterly in 2008. Due to the variation in habitats observed at the 12 sites, a variety of sampling methods was employed to

efficiently capture resident fishes. Active sampling techniques included backpack electrofishing and seining. Passive sampling techniques included minnow traps, sunfish traps, and gill nets.

Fish were identified to species, measured, weighed, and released, unless it was necessary to retain a voucher specimen. In addition to fish data, detailed notes were taken on the conditions observed at each site. These notes included dominant substrate, aquatic and riparian vegetation, water level/ depth, weather conditions, water clarity, and presence of other wildlife.

Onsite fish sampling resulted in the capture of 4215 fish representing 16 families and 36 species (Table 2.4-5). Western mosquitofish (*Gambusia affinis*) was the most abundant species overall, representing 23.5 percent of all fish captured. This species is native to the south-central U.S., north to Indiana and Illinois, west to Texas, south to southern Mexico, and east to the Mobile River system (Vives and Hammerson 2009). Western mosquitofish thrive in hot, shallow waters with dense aquatic vegetation, such as stagnant ponds, ditches, and drainage canals. They are able to withstand dissolved oxygen concentrations less than 1.0 mg/L (Vives and Hammerson 2009), which means they are often the last fish to survive in degraded or disturbed waterbodies. Because of the species' reproductive behavior (e.g., livebearer, parental care, multiple broods) and its ability to tolerate high temperatures, low dissolved oxygen levels, and poor water quality, mosquitofish have a competitive advantage in environments unsuitable for more sensitive species (Etnier and Starnes 1993). This species' prevalence in onsite waterbodies was not surprising, given that several of the stock ponds and wetlands surveyed were small, stagnant pools that provided only marginal fish habitat. Other relatively abundant species were black bullhead (*Ameiurus melas*; 12.6 percent of total), white crappie (*Pomoxis annularis*; 12 percent of total), warmouth (*Lepomis gulosus*; 10.8 percent of total), bluegill (*Lepomis macrochirus*; 9.5 percent of total), and sailfin molly (*Poecilia latipinna*; 8.1 percent of total). These six species dominated collections, making up 76.6 percent of all fish collected from the 12 onsite and near-site waterbodies. With the exception of the sailfin molly, these species are widely distributed across the central U.S. and Gulf Coastal Plain (Lee et al. 1980). The sailfin molly is found in fresh, brackish, and saltwaters along the south Atlantic and Gulf Coasts and has been introduced elsewhere, including Arizona, Nevada, and California (Lee et al. 1980).

At the family level, the sunfishes (*Centrarchidae*) were most abundant, comprising 42.4 percent of all fish captured. The Centrarchids were also the most diverse group, with ten species collected, including seven Lepomis ("bream") species, two Pomoxis (crappie) species, and a single species of black bass, the largemouth bass (*Micropterus salmoides*). The livebearers (family Poecilidae), represented by two species, Western mosquitofish and sailfin molly, were the next most abundant group, making up 31.6 percent of all fish collected.

In addition to being the most abundant species, Western mosquitofish was the most widely distributed, occurring in 11 of the 12 waterbodies surveyed. As discussed previously, the

mosquitofish is a hardy species that is able to survive in stagnant pools and ditches that are subject to high temperatures and low levels of dissolved oxygen. Three centrarchids—warmouth, bluegill, and white crappie—were also widely distributed, occurring in 8 of 12 waterbodies surveyed. All three species are habitat generalists able to avail themselves of a range of habitats, from swamps to bayous to big rivers to reservoirs. By contrast, nine species were found in only one of 12 sampling locations: alligator gar (at MC-08), golden shiner (at MC-03), pugnose minnow (at MC-10), flathead catfish (at MC-10), suckermouth armored catfish (at MC-07), striped mullet (at MC-07), sheepshead minnow (at MC-07), black crappie (at MC-07), Rio Grande cichlid (at MC-08). These species are presumed to have more restrictive habitat or water quality requirements that limit their distribution. For example, white crappies were much more common (506 collected) than black crappies (3 collected) in onsite samples, reflecting the fact that white crappies "…tolerate turbid water and soft bottoms better than most other sunfishes, including black crappies" (Marcy et al. 2005).

Golden shiners (*Notemigonus crysoleucas*) were documented in large numbers at MC-03 in April, but were not captured elsewhere. This species' native range included parts of east Texas, but probably did not include the Guadalupe River drainage (Hassan-Williams and Bonner 2009). Golden shiners are often sold by local bait dealers and this species' presence at MC-03 may represent a "bait-bucket introduction." Other introduced or exotic species captured included Rio Grande cichlid (*Cichlasoma cyanoguttatum*), Mexican tetra (*Astyanax mexicanus*), common carp (*Cyprinus carpio*), and suckermouth armored catfish (*Pterygoplichthys anisitsi*). Golden shiners and common carp were the most abundant introduced species.

Species richness was highest at MC-07 (Black Bayou) where 24 species were collected, and MC-10, where 19 species were collected. Species richness was lowest at MC-12 (an ephemeral wetland) where Western mosquitofish was the only species captured. Black Bayou was the only perennial stream surveyed and one of only three stations that held water in all four seasons. Species assemblages in two stock ponds (MC-03 and MC-04) and the single fish pond (MC-01) were indicative of some level of "management" (stocking by fishermen or ranch hands) in the past, as they contained species such as bluegill and white crappie that are often stocked for fishing. The two stations with the highest measures of species richness were both on the east side of the site in the Guadalupe River floodplain, suggesting that these areas are periodically replenished (re-colonized) when the river floods. Stations with lowest measures of species richness were isolated wetlands, stock ponds, and creeks that dried up in the spring and remained dry throughout the summer and fall. These stations tended to be isolated from perennial water sources, thus they were less likely to be colonized (or re-colonized) by fish from the Guadalupe River or one of its tributaries.

No state or federally listed threatened or endangered species was collected during the aquatic survey. Although not listed as threatened or endangered by TPWD or the USFWS, the American eel (*Anguilla rostrata*) is documented as rare within the state. This species spawns in the Atlantic Ocean,

and adult females migrate up rivers along the Atlantic and Gulf Coasts to live out the majority of their lives before returning to the sea to spawn. Although none were captured, presence of American eels cannot be ruled out in the larger water bodies which are occasionally connected to the Guadalupe River (i.e, Black Bayou, Linn Lake, Cypress Lake, Kuy Creek).

Not surprisingly, common rough fish were the largest contributors to biomass. Common carp, captured at five stations, ranked first in overall biomass (Table 2.4-6). Other large contributors to overall biomass included spotted gar (*Lepisosteus oculatus*), smallmouth buffalo (Ictiobus bubalus), white crappie, alligator gar (*Atractosteus spatula*), and blue catfish (*Ictalurus furcatus*). Common carp, spotted gar and smallmouth buffalo, which are found in most sluggish Gulf Coast rivers, grow quickly, attain adult sizes in a relatively short time, and may weigh as much as 30 to 40 pounds.

Stations MC-11 and MC-07 exhibited the highest overall biomass, primarily because they were sampled during all four seasons. MC-08 and MC-03 also exhibited high biomass, despite a limited number of collections from these locations. In general, stations with high biomass exhibited high abundance of the large-bodied species described above. Although fish were captured from each station, several stations did not yield individuals large enough to register on the digital scale (sensitivity of 10 g), and thus no weight data is available for these stations. For example, 154 Western mosquitofish were collected at MC-12, but none was heavy enough to register on the scale. Therefore, the total biomass reported for this station was "0."

An extended period of low rainfall in the Victoria County area lowered water levels (or eliminated water altogether) at all onsite sampling locations, and severely hampered the summer (July) sampling effort. Six of the 12 onsite sampling stations (MC-2, MC-6, MC-8, MC-9, MC-10, and MC-12) were completely dry in July. At the other six stations, water levels had dropped dramatically since the April sampling, rendering all but one gear type (beach seine) unusable. Relatively small numbers of fish were collected at these six locations. Two new species—striped mullet (*Mugil cephalus*) and sheepshead minnow (*Cyprinodon variegatus*)—were collected at MC-7 (Black Bayou) in July. Black Bayou was the only onsite or near-site stream that was not reduced by the dry conditions to isolated puddles of water.

Benthic Macroinvertebrate Sampling

Benthic data were collected from all 12 onsite and near-site stations in spring (April) 2008 as part of an initial comprehensive inventory. After the spring sampling, the number of stations was reduced to six (MC-5, MC-6, MC-7, MC-8, MC-9, and MC-10) focusing on down-gradient areas most likely to be affected by site construction. During summer (July), only three of these stations (MC-5, MC-7, and MC-9) had water. In fall (October), only MC-7 had water. In winter (December), only MC-5 and MC-7 had water.

Benthis macroinvertebrates were collected with an Ekman dredge. Three grabs were taken at each sampling location, filtered through a sieve bucket to remove excess silt, and composited into one sample. In the laboratory, samples were sorted and identified to the lowest practical taxon with the aid of a digital zoom stereomicroscope.

Methods for determining Aquatic Life Use (ALU) based on macroinvertebrate samples collected from depositional habitats have not been developed by the Texas Commission on Environmental Quality (TCEQ Jun 2007). However, metrics and scoring criteria for rapid bioassessment protocols associated with Surber samples are available (TCEQ Jun 2007). Therefore, in an attempt to provide some means of comparison between sites, Ekman dredge data were analyzed using this protocol to determine ALU designations. Caution should be taken in interpreting these designations due to inherent differences in sampling technique.

The number of each taxon (group) collected, as well as its percent relative abundance at each sampling location is presented in Table 2.4-7. A total of 441 specimens representing at least 27 families and 45 genera were collected. The number of specimens identified from each station ranged from none at MC-6 to 108 at MC-7. The absence of benthic organisms at MC-6 is not surprising. This station was reduced to a pair of muddy puddles in April and was dry in July, October, and December. Flies and midges (Order Diptera) dominated collections at 11 of 12 sampling stations, and accounted for approximately 79 percent of all specimens collected. Two families of Dipteran midge larvae (Chaoboridae and Chironomidae) were particularly abundant. Midge larvae are considered indicators of poor water quality and are tolerant of pollution (EPA 2007). Other than dipterans, the most abundant taxa were molluscs (Physids and Sphaeriids were most common), freshwater shrimp (family Palaemonidae), and mayflies (Caenidae and Baetidae families).

The aquatic life use classifications calculated for each station are presented below (INT: intermediate, LIM: limited). Most sites were rated for "intermediate" aquatic life use (see below). Only two of the sites, MC-3 and MC-5, were scored as "high" aquatic life use. Both of these stations are characterized by large amounts of organic material either in the waterbody’s basin or on its margins, important for benthic organisms. Station MC-3, a shallow pond, has extensive aquatic vegetation and woody debris around its edges. Station MC-5, Dry Kuy Creek, has vegetation growing on its banks and rocks and woody debris in its channel, providing attachment sites and microhabitats for benthic organisms. Sites scored as "limited" (MC-2, MC-6, MC-9, and MC-11) contained little or no aquatic vegetation, and thus had little available organic matter in littoral areas.

Aquatic life use designations based on benthic invertebrates from 12 locations at the Exelon Victoria County Site are presented below:

	MC-1	MC-2	MC-3	MC-4	MC-5	MC-6	MC-7	MC-8	MC-9	MC-10	MC-11	MC-12
Source	25	19	32	29	33	0	27	23	19	27	19	23
ALU	INT	LIM	HIGH	INT	HIGH	LIM	INT	INT	LIM	INT	LIM	INT

The relative scarcity of benthic macroinvertebrates and prevalence of pollution-tolerant forms appears to be substrate-related rather than water quality-related. Rankings appeared to be independent of dissolved oxygen levels, for example. One of the sampling stations ranked as "limited" had the highest dissolved oxygen concentration measured in April. Substrates at stations ranked "limited" tended to be clay or sand and largely devoid of organic material. The aquatic vegetation, leaf litter, and woody material that would allow a more diverse benthic community to develop were almost never present. Only one station, MC-3, contained more than a few pollution-intolerant species, and as noted previously, this station contained a lush growth of aquatic vegetation as well as substantial amounts of woody debris.

As noted previously, in the description of fish sampling, low water levels hampered sampling of aquatic biota in July, October, and December. Six of 12 sampling locations could not be sampled in July. Water bodies that were sampled for benthic macroinvertebrates tended to be stagnant with low dissolved oxygen levels. Benthos sampling results reflected these poor water quality conditions. As discussed previously, only four stations could be sampled for benthic organisms in October, and only three in December.

2.4.2.1.2 Guadalupe River

The Guadalupe River rises in western Kerr County in south-central Texas. It flows southeast for approximately 250 miles before it empties into Guadalupe Bay (the northernmost arm of San Antonio Bay) near Seadrift, Texas (TPWD Sep 1974). The upper Guadalupe River, which flows across the Edwards Plateau, offers steep limestone bluffs, rapids, and stream banks lined with large cypress, oak, and elm trees. It crosses the Balcones Fault Line near New Braunfels (TSHA 2008), at which point it becomes a twisting, turning, slow-moving, coastal river with none of the limestone bluffs and rapids that characterize the upper river (TPWD Sep 1974). TPWD has designated the portion of the Guadalupe River from Farm-to-Market Road 447 in northwest Victoria County to its mouth on Guadalupe Bay as "ecologically significant" because it supports extensive freshwater and estuarine wetlands including the Guadalupe Delta Wildlife Management Area, one of the largest wetland reserves in the United States (TPWD 2008b).

The Guadalupe River's two most important tributaries are the Comal and San Marcos Rivers. Its drainage area is approximately 6070 square miles (TSHA 2008). One major reservoir, 8300-acre

Canyon Reservoir, and many smaller reservoirs have been built on its mainstem. Coleto Creek Reservoir (3100 acres) lies approximately 11 straight-line miles northwest of the VCS site and approximately 20 miles upstream of the proposed VCS discharge on the Guadalupe River. Coleto Creek Power Plant, a 632 MW coal-fired unit, was built on Coleto Creek, a tributary of the Guadalupe River, and went into service in 1980. The power plant uses Coleto Creek Reservoir as its cooling water source. The San Antonio River, another major tributary, merges with the Guadalupe River approximately 11 miles downstream of the Union Pacific railroad trestle, which is a short distance (0.25 miles) from the eastern boundary of the VCS site.

The Guadalupe River, in the vicinity of the VCS site, is characterized by a deeply incised channel and a broad (2- to 4-mile wide) floodplain. Substrates are typically mud and silt and contain a large amount of woody debris. Channel widths range from 32 to 54 meters, and mid-channel depths range from 2.2 to 6.0 meters. Logjams, created when dead and uprooted trees are carried downstream during floods and deposited when flood waters recede, are common. The GBRA periodically removes these logjams, which interfere with normal river flows and impede boat traffic.

Sampling Locations and Descriptions

Exelon conducted an assessment of the aquatic resources of the Guadalupe River over a 12-month period in 2008. Surveys of fish and benthic macroinvertebrates were conducted monthly at five sampling stations, designated GR-01 through GR-05, along an 18-mile reach of river (Figure 2.4-5). The upstream-most station, GR-01, is in the general area of the proposed discharge structure, and is approximately 1 mile southwest of the Invista Victoria Plant. This section of the river also receives effluent from the Invista Victoria Plant. Station GR-02 is immediately downstream of the point at which Linn Bayou empties into the Guadalupe River. Station GR-03 represents a "typical" river reach with no shoreline development and no industrial activity, and is in the approximate center of the 18-mile-long study area. Station GR-04 lies just downstream of the Kuy Creek-Guadalupe River confluence and approximately 0.5 mile upstream of the confluence of the San Antonio River and the Guadalupe River. Station GR-05 is adjacent to the diversion structure/gates of the GBRA Diversion Canal, the point at which water is diverted from the Guadalupe River into the GBRA's Calhoun Canal System. Station GR-05 is also a short distance upstream of the GBRA's Saltwater Barrier, which is used to prevent saltwater intrusion from Guadalupe Bay/San Antonio Bay during periods of drought and low flow in the Guadalupe River. The proposed Raw Water Makeup System pumphouse intake would withdraw makeup water from this reach of the river via a 0.6 mile-long intake canal.

In addition to collecting fish and benthic samples, biologists gathered information on physical characteristics of the river and river bed and took field measurements of water quality in order to characterize habitat quality. Habitats at the five Guadalupe River sites are similar, and are all characterized by a deeply incised channel, a mud and silt substrate, and large amounts of woody

debris (sticks, branches, logs), both floating and submerged. The river is normally very turbid, preventing the establishment of submerged aquatic vegetation. Floating aquatic plants, such as water lettuce and water hyacinth, are present but are relatively uncommon in the river.

Fish Sampling

Biologists used boat-mounted electrofishing gear to collect baseline data on Guadalupe River fish at five sampling sites, (each associated with an approximately 650-meter long transect). Electrofishing was employed because it is the least selective sampling method available and efficiently collects fish from most riverine habitats (i.e., runs, shallows, shoals, undercut banks, and backwaters). Barbour et al. (1999) noted that all fish sampling gear is selective to some degree, but "electrofishing has proven to be the most comprehensive and effective single method for collecting stream fishes."

In total, 10,310 fish representing 42 species were collected from the five Guadalupe River sites (Table 2.4-8). Overall, red shiner (*Cyprinella lutrensis*, 48.5 percent of total), gizzard shad (*Dorosoma cepedianum*, 7.3 percent), threadfin shad (*Dorosoma petenense*, 5.8 percent), spotted gar (*Lepisosteus oculatus*, 5.5 percent), and striped mullet (*Mugil cephalus*, 5.4 percent) were the most abundant species, comprising more than 72 percent of all fish collected. No other species made up more than 5 percent of the total.

As indicated in Table 2.4-8, 22 fish species were collected at all five Guadalupe River sampling sites, suggesting widespread distribution in the lower river, although some of these species, like the common carp (*Cyprinus carpio*), the channel catfish (*Ictalurus punctatus*) and the freshwater drum (*Aplodinotus grunniens*), were collected in fairly low numbers. Other species had a more limited distribution. For example, the ribbon shiner (*Lythrurus fumeus*), burrhead chub (*Macrhybopsis marconis*), golden topminnow (*Fundulus chrysotus*), skip jack herring (*Alosa Chrysochloris*), sheepshead minnow (*Cyprinodon variegatus*), redear sunfish (*Lepomis microlophus*) and Southern flounder (*Paralichthys lethostigma*) were all collected at only one station, and only one specimen of each species was captured. Alligator gar (*Atractosteus spatula*) were collected only at station GR-04, and in very small numbers (3 individuals over the 12-month sampling period). Three species were collected only at station GR-05, the downstream-most sampling location: grass carp (*Ctenopharyngodon idella*), golden topminnow (*Fundulus chrysotus*), and sheepshead minnow (*Cyprinodon variegatus*). An American eel (*Anguilla nostrata*) was observed, but not collected at station GR-05.

In summary, 42 species of fish representing 18 families were collected from the Guadalupe River study area over the 12-month sampling period. The family Centrarchidae contributed the most species (11), followed by Cyprinidae (7), Ictaluridae (3), and Lepisosteidae (3). As noted previously, the species most commonly collected were red shiner, gizzard shad, threadfin shad, spotted gar, and striped mullet. These species, which are all well adapted to life in turbid, low-gradient, coastal plain

streams like the Guadalupe River, are common residents of streams and bayous along the Texas Coast (Lee et al. 1980, Mettee et al. 1996, Chilton 1997, Hassan-Williams and Bonner 2009, TPWD 2008a).

Although red shiners, gizzard shad, threadfin shad, and striped mullet were numerically dominant in Guadalupe River samples, they constituted a comparatively small proportion of the fish biomass. Four species generally regarded as "rough fish" accounted for 62 percent, by weight, of the fish collected: spotted gar (24.1 percent), smallmouth buffalo (21.9 percent), common carp (8 percent), and longnose gar (8 percent) (Table 2.4-9). By contrast, five popular gamefish (largemouth bass, spotted bass, white crappie, black crappie, and bluegill) collectively made up only 1.7 percent of fish collected, by weight.

Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate samples were collected monthly at the five Guadalupe River stations from April 2008 through December 2008. Sampling was conducted with a standard, manually operated Petite Ponar Dredge. Three sediment grabs were taken at each site, one along each bank and one in mid-river, and then composited into one sample. In the laboratory, samples were sorted and identified to the lowest practical taxon with the aid of a digital zoom stereomicroscope.

Methods for determining aquatic life use based on Ponar dredge samples have not been developed by the TCEQ (TCEQ Jun 2007). However, metrics and scoring criteria for rapid bioassessment protocols associated with Surber samples do exist (TCEQ Jun 2007) and were used as surrogates. Therefore, in an attempt to provide some means of comparison between sites, Ponar dredge data were analyzed with this protocol to determine ALU designations. Caution should be taken in interpreting these designations due to inherent differences in sampling technique.

The number of taxa collected, as well as their percent relative abundance at each site is presented in Table 2.4-10. The most abundant invertebrate taxon overall was a gastropod mollusc (*Hydrobiidae*), which was collected in extremely high numbers at several sites. Burrowing mayflies (genus *Hexayonia*) and the invasive bivalve mollusc *Corbicula* were also relatively common at all five sites. Flies, midges (*Chironomidae*), and riffle beetles (*Elmidae*), were less common but widely distributed across the various sites. When applying the benthic metrics and scoring criteria described above, all five river sites received "intermediate" aquatic life use designations.

Two insect species are shown on TPWD's Rare, Threatened, and Endangered Species of Texas database as potentially occurring in the project area: the Texas asaphomyian tabanid fly (*Asaphomyia texensis*) and "a mayfly" (*Tortopus circumfluus*) (TPWD 2009). The Texas tabanid fly, shown on the TPWD database as potentially occurring in Goliad and Victoria Counties, was not collected during the surveys. *Tortopus circumfluus* is only known to occur in Victoria County. *Tortopus*

mayfly larvae were collected during the surveys, at stations GR-01 and GR-02. However, there was no way to determine if these larvae were *T. circumfluus* because only adults of the genus Tortopus can be keyed to the species level. Neither of these species has legal protection in Texas but both are rare and considered species of concern in the broadest sense, meaning that TPWD biologists are concerned about their conservation and these concerns are factored into the agency's reviews of proposed projects.

2.4.2.1.3 GBRA Calhoun Canal System

The GBRA operates and maintains a water delivery system in the lower Guadalupe River drainage that conveys fresh water to municipal, industrial, and agricultural customers in the region. The GBRA Calhoun Canal System includes the Lower Guadalupe Diversion Dam and Saltwater Barrier, two smaller saltwater barriers on Hog and Goff Bayous, a pump station operated jointly by Dow Chemical and the GBRA, a separate GBRA-operated pump station for area refineries, and approximately 80 miles of delivery canals and 8 miles of water supply pipeline. The Canal System provides water to rice, pasture and row crop producers, aquaculture ventures, BP Chemicals Company, Seadrift Coke, Dow Chemical, the GBRA Port Lavaca Water Treatment Plant, and Calhoun County Rural Water Supply System, as well as the Aransas National Wildlife Refuge's Whitmire Unit. The Guadalupe River immediately upstream of the GBRA Saltwater Barrier is the source of the fresh water that is distributed to GBRA's agricultural, industrial, and municipal users via the canal system. This system is analyzed as an alternative cooling water supply in Section 9.4.

Goff Bayou

Goff Bayou fish were sampled by electrofishing at a transect immediately upstream of the GBRA's Inverted Siphon (Figure 2.4-5). The Goff Bayou site is considerably shallower than the Guadalupe River sites with a maximum depth of approximately 9.2 feet (2.8 meters). The invasive water hyacinth (*Eichhornia crassipes*) is abundant at the Goff Bayou site. As indicated in Table 2.4-8, electrofishing collections at this site over the 12-month sampling period were numerically dominated by striped mullet (17.5 percent of total), gizzard shad (16.9 percent), Gulf menhadon (9.0 percent), and spotted gar (8.9 percent). These four species accounted for 52 percent of all fish collected at this site. Threadfin shad (7.0 percent), bay anchovy (5.5 percent), smallmouth buffalo (5.3 percent), and western mosquitofish (4.5 percent) were also relatively common. A total of 1298 fish representing 33 species were collected over the 12-month sampling period. The total weight of fish captured at this site over the 12-month sampling period was 355 kilograms, the highest of the sites surveyed (Table 2.4-9). This was approximately 1.6 times the average weight captured at the five Guadalupe River sites (223.4 kilograms) and 15 times the weight of fish collected from the GBRA Main Canal (24 kilograms). The comparatively high biomass of fish collected at Goff Bayou reflects the presence of substantial numbers of large-bodied "rough" fish (e.g., smallmouth buffalo, spotted gar, and common carp), and the high density of striped mullet. The amount of fish biomass at this site is presumed to

be related to a habitat factor or factors, such as the lush growth of aquatic weeds that promote growth and survival of the heavier-bodied species and striped mullet. Goff Bayou offers an abundance of forage (small prey species) for the spotted gar and other top-of-the-food-chain predators, dense aquatic vegetation that provides cover and food for a variety of fish species, and a rich, organic bottom substrate with decaying vegetation and invertebrates that provides food for the bottom-feeding species (e.g., smallmouth buffalo, common carp, and striped mullet).

Bluefin killifish (*Lucania goodei*) were captured in both Goff Bayou and the GBRA Main Canal. The presence of this species in the Guadalupe River was first reported in an article published in the February 2008 issue of the Texas Journal of Science (Gallaway et al. Feb 2008). Gallaway et al. (2008) suggest that the species was introduced with wetland vegetation imported from a nursery in Florida to an artificial wetland built on the Invista Victoria Plant. Bluefin killifish were first noted from this wetland in 1998, and have since spread to the Guadalupe River. The presence of bluefin killifish at sampling locations at least 20 miles downstream of the Invista Plant suggests that this species is dispersing throughout the lower river.

GBRA Main Canal

The GBRA Main Canal was sampled by electrofishing at a single transect near the Relift No. 1 Pump Station (Figure 2.4-5). The GBRA Main Canal has a maximum depth of 5.6 feet (1.7 meters) and much less woody debris than the Guadalupe River and Goff Bayou sampling locations. Cover in the canal is limited to vegetation along the edges, consisting mainly of water hyacinth. Collections from the Main Canal were dominated by sunfish (*Centrarchids*) and small-bodied schooling species. Longear sunfish (*Lepomis megalotis*) and warmouth (*Lepomis gulosus*) were the most abundant sunfish, making up 23.5 percent and 8.2 percent, respectively, of all fish collected from this site (Table 2.4-8). Western mosquitofish (*Gambusia affinis*) were also very common, comprising 14.2 percent of fish collection at this site. Minnows (*Cyprinidae*) and minnow-like species, such as the inland silverside (*Menidia beryllina*), were also common at this site. There were noticeably fewer large-bodied species such as gar and catfish at this location. The total weight of fish captured at this site over the 12-month period was only 24 kilograms, as opposed to 355 kilograms at the Goff Bayou site and 223.4 kilograms (on average) at the five Guadalupe River sampling stations (Table 2.4-9).

Although the Guadalupe River and GBRA Calhoun Canal sites were similar in terms of species richness and densities (if not biomass) of fish present, there were obvious differences in the types of fish present. The Guadalupe River fish assemblage was dominated by freshwater species commonly found in freshwater streams across south Texas. Several marine-estuarine species were present, but, with the exception of the striped mullet, they tended to be uncommon in collections. The two GBRA Calhoun Canal sites had relatively more marine-estuarine species and had four marine-estuarine species not collected from the Guadalupe River sites: ladyfish, Gulf menhaden, pinfish, and

Gulf pipefish. The two Calhoun Canal sites typically had higher conductivities during the sampling period than the Guadalupe River sites (station GR-05 was the exception), reflecting their proximity to the high-conductivity (brackish) waters of Guadalupe Bay and San Antonio Bay, and offered water quality conditions slightly more conducive to marine and estuarine fish species. Salinities at all the study sites were low, however, on the order of 0.3 parts per thousand (Stations GR-01, -02, -03, and -04) to 0.7 parts per thousand (station GR-05, Goff Bayou, GBRA Main Canal).

2.4.2.2 Important Aquatic Resources

2.4.2.2.1 Important Aquatic Species

"Important species," including rare species and commercially or recreationally valuable species, have also been considered. Rare species include species listed by the USFWS or National Marine Fisheries Service (NMFS) as threatened or endangered, species proposed for listing by these agencies, species that are candidates for listing by these agencies, and species that are listed as threatened or endangered by the state in which the proposed facilities are located. Although diadromous (migratory) fish are not one of the groups designated as "important," migratory fish have also been considered in the impact assessment.

Rare/Sensitive Species

Construction and operation of proposed new units at the VCS site could potentially impact aquatic populations, including sensitive species, located in onsite and near-site streams, wetlands, and ponds (Victoria County), and the lower Guadalupe River (Calhoun, Refugio, and Victoria Counties). Consequently, TPWD county lists were reviewed to identify sensitive aquatic species in these three counties. Sensitive species in this context are (1) state- or federal-listed species, (2) species that are candidates for federal listing, and (3) species proposed for listing by the USFWS.

Two protected aquatic species, the opossum pipefish (*Microphis brachyurus*) and the smalltooth sawfish (*Pristis pectinata*), are known to occur in these three counties. The opossum pipefish, listed as "threatened" by the state of Texas and designated a "species of concern" by the NMFS, occurs in coastal portions of Calhoun and Refugio Counties, but has not been recorded in Victoria County (TPWD 2005; TPWD 2009). Breeding adult opossum pipefish are found in low-salinity portions of estuaries along the Atlantic Coast of Florida and from the Gulf Coast of Florida to Mexico (NMFS Jan 2009a). Larvae are carried by coastal rivers into higher-salinity (brackish) estuarine waters, where they develop into late-stage larvae and juveniles. Juveniles are normally found in coastal marine and oceanic environments. There, they continue to develop and then migrate as adults back to freshwater tributary streams, generally within 30 miles of the coast (NMFS Jan 2009a). This species is dependent on freshwater streams and marshes along the Gulf Coast habitats that have been replaced by development and degraded by water quality changes and alterations of historic flow

regimes. The smalltooth sawfish, the only member of the elasmobranch (sharks, skates, and rays) group that has been afforded protection under the Endangered Species Act, was listed as endangered on April 1, 2003 (68 FR 15674). Once common in shallow waters of the Gulf of Mexico and along the south Atlantic Coast, the U.S. population is now restricted to peninsular Florida with substantial numbers only in the Everglades area (NMFS 2009). Slow to mature and producing only 15-20 young per litter (embryos develop internally, rather than externally, and young are born with adult appearance), the species is extremely vulnerable to overfishing. The sawfish's tendency to become entangled in nets, especially gill nets, is believed to be the main reason for the species' decline. As late as the 1960s, this species was relatively common in the northern and western Gulf of Mexico. Since 1971, however, there have been only three (in 1978, 1979, and 1984) published or museum reports of smalltooth sawfish collected from this region, all from Texas (NMFS Jan 2009b). TPWD has placed the smalltooth sawfish on its lists of rare species for most coastal counties, including Calhoun, Jackson, Matagorda, and Refugio Counties. These listings are clearly based on historical records rather than up-to-date information on the species' range. The American eel (*Anguilla rostrata*), although not listed as threatened or endangered by TPWD or the USFWS, is documented as rare within the state. This species occurs in most coastal counties in Texas, including Calhoun, Refugio, and Victoria Counties.

TPWD county lists have also been reviewed to identify sensitive aquatic species in counties that would be crossed by the proposed RWMU system intake pipeline and transmission line corridors. Seven counties would be affected: Calhoun, Dewitt, Goliad, Jackson, Matagorda, Victoria, and Wharton. Two protected aquatic species, the opossum pipefish and the smallmouth sawfish, are known to occur in these counties. The opossum pipefish has been recorded in coastal portions of Calhoun County (TPWD 2009). As described in the previous paragraph, this species spawns in fresh and low-salinity estuarine waters along the coast of Texas and could be present in lower reaches of rivers and streams flowing into Matagorda and San Antonio Bays (TPWD 2005). The smalltooth sawfish has been recorded in three of the seven counties: Calhoun, Jackson, and Matagorda (TPWD 2009). None of these records is recent, however.

The American eel is believed to occur in six of the seven counties that would be crossed by proposed transmission corridors, with DeWitt the only exception. As noted in the previous subsection, the possibility exists that other unrecorded or recently discovered rare species might occur in the aforementioned counties. Exelon has written the TPWD, the USFWS, and the NMFS seeking information on any state- or federal-listed species that might be affected by construction and operation of VCS.

As described previously, Exelon commissioned baseline aquatic surveys of: (1) the VCS site, (2) an 18-mile-reach of the Guadalupe River, and (3) selected portions of the GBRA's Calhoun Canal system. The goal of the surveys was to establish baseline conditions in these water bodies for

purposes of impact assessment and to identify any special status aquatic species that might be present. To date, no state-listed or federally listed species has been collected. A single American eel was observed, but not captured, by biologists electrofishing at Guadalupe River station GR-05 in April. American eels have been documented in the upper Guadalupe River drainage and, therefore, this species' presence in the study area was not unexpected.

Two possible range extensions have been documented as a result of fish community sampling. Bantam sunfish (*Lepomis symmetricus*) have been collected from the Guadalupe River and the GBRA Main Canal, but have not been collected from Goff Bayou. The southwestern boundary of this species' range was previously reported as being the Colorado River in Texas (Hubbs et al. 1991, Thomas et al. 2007). Also, one ribbon shiner (*Lythrurus fumeus*) was collected at GR-01 in January 2008. The southwestern boundary of this species' range was thought to be the Lavaca River drainage. However, given that only one specimen has been collected, this may simply represent a migrant from populations in the nearby Lavaca River and does not necessarily indicate a persistent (breeding) population.

Commercially or Recreationally Important Species

Based on anecdotal reports and casual interviews of local residents, no commercial fishermen are currently working the Guadalupe River in the vicinity of the VCS site. The lower Guadalupe River offers typical Texas coastal plain recreational fishing opportunities, with a variety of centrarchid (e.g., bluegill, warmouth, largemouth bass, spotted bass) and ictalurid (e.g., blue catfish, channel catfish, flathead catfish) species present in good numbers. Other common species, including the smallmouth buffalo and freshwater drum, are regarded as "rough fish" by most sport fishermen, but are prized as food fish by some. Species such as spotted gar and longnose gar, collected frequently during the study from the project area, are occasionally sought by bow fishermen. The TPWD has not conducted creel surveys in the project area to quantify angler effort, harvest, or success. Anecdotal information suggests that blue, flathead, and channel catfish are the most sought-after species, followed by centrarchids such as largemouth bass and panfish (Lepomids, including bluegill, warmouth, and longear sunfish). Limited public access and logjams in this reach of the Guadalupe appear to reduce fishing pressure. The GBRA Diversion Canal and associated creeks and bayous are also used by local fishermen who launch boats at a public boat ramp on Hog Bayou and fish for catfish, bass, and panfish.

In the lowest reaches of the river, especially the Guadalupe Delta area, trotlining for blue, channel, and flathead catfish is a popular activity. Commercial fishing and crabbing are also important in the Guadalupe Delta region. There is also some commercial crabbing in the Guadalupe River from its mouth (point at which it empties into Guadalupe Bay) north to State Highway 35, the state-designated

freshwater-saltwater boundary and the legal boundary for commercial crabbing. A portion of Goff Bayou lies north of State Highway 35 and is used by at least one commercial crabber.

Diadromous Species

Based on a literature review and the ongoing surveys, no anadromous fish species ascend the Guadalupe River to spawn upstream or downstream of the VCS site. There are relatively few true anadromous species (e.g., Gulf sturgeon [*Acipenser oxyrinchus desotoi*], Alabama shad [*Alosa alabamae*], and striped bass [*Morone saxatilis*]) in the Gulf of Mexico, and these species spawn in rivers flowing into the Gulf of Mexico further east, in Louisiana, Mississippi, Alabama, and Florida (USFWS undated). One migratory fish species, the American eel, does ascend Gulf Coast streams in Texas, including the Guadalupe River.

The American eel occurs in rivers and streams along the east coast of the United States from Maine to Florida, and along the Gulf Coast from Florida to Texas (Facey and Van Den Avyle 1987). The American eel is catadromous, growing to sexual maturity in fresh water and migrating hundreds of miles into the Atlantic Ocean (the Sargasso Sea) to spawn. Eggs spawned in the Sargasso Sea drift westward and northward with ocean currents and develop into larvae, then nektonic glass eels. The eels swim west across the Continental Shelf and enter Atlantic Coast and Gulf Coast estuaries, where they mature into adults. Small numbers of eel larvae are carried by winds and currents from the Atlantic Ocean into the Gulf of Mexico, almost certainly via the Yucatan Strait. From the Gulf of Mexico, young eels "wander" into Gulf Coast and Central American estuaries and rivers (Nedeau 2005). American eels are uncommon in Texas. In 30 years of sampling coastal waters, the Coastal Fisheries Division of the TPWD encountered only seven eels, in Matagorda Bay, San Antonio Bay, and Corpus Christi Bay (three in 1984, one in 1986, one in 1988, and two in 2001). The Inland Fisheries Division of the TPWD encountered only 15 eels in 20 years of sampling in freshwater reservoirs and streams, two in the 1980s, ten in 1990, and three in 2003 to 2004, (NatureServe 2008).

In response to a petition received in November 2004, the USFWS announced (on July 6, 2005) in a 90-day finding that it was initiating a status review to determine if listing the American eel was warranted (70 FR 38849). The discussion of population status indicated that population declines have been most dramatic in Canada and New England, and that populations may be stable in the southeastern United States. On February 2, 2007, the USFWS published its findings on a Petition to List the American eel (72 FR 4967), summarized as follows: "After a thorough review of all available scientific information, we find that listing the American eel as either threatened or endangered is not warranted at this time."

As noted previously in this section, a single American eel was observed by Exelon’s biologists at station GR-05 on the Guadalupe River in April 2008, but they were not able to capture it or

photograph it. This species has no official status or legal protection in Texas; however, it is rare and considered a species of concern in the broadest sense, meaning that TPWD biologists are concerned about its conservation and these concerns are factored into the agency's reviews of proposed projects.

2.4.2.2.2 Important Aquatic Habitats

Many marine and estuarine fishes that are managed by the Gulf of Mexico Fishery Management Council (GMFMC) rely on coastal bays and tidal rivers during part of their lives. The tidally influenced sections of the Guadalupe River and its tributaries, as well as Guadalupe and San Antonio Bays, have been designated essential fish habitat (EFH), which is defined as those waters and substrate necessary to fish or shellfish for spawning, breeding, feeding, or growth to maturity (GMFMC Oct 1998). Virtually every estuary in Texas has been similarly designated. Discussion of EFH is in §600.10 of the regulations implementing the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; P.L. 104-297). The GMFMC and NMFS are responsible for designating EFH for each life stage of federally managed marine fish species.

The generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC (GMFMC Oct 1998) prescribes EFH for federally managed species, including shrimp, red drum, reef fish, and coastal migratory pelagic species. Riverine systems, such as the Guadalupe River, are considered important to EFH because the quantity, quality and timing of the stream discharge into estuaries affects the supply of nutrients, maintains the salinity gradients, flushes pollutants, and provides other functional value. The boundaries of estuarine EFH follow those identified in the Cooperative Gulf of Mexico Estuarine Inventory conducted in each state. The landward boundary of estuarine EFH is the limit of permanent freshwater bottom; seaward limits are the coastal barrier islands. Thus, in the San Antonio Bay, EFH is all waters and substrates (mud, sand, shell, rock and associated biological communities) within the estuarine boundaries, up to the permanent freshwater bottom of the Guadalupe River (GMFMC Oct 1998). The GBRA’s Saltwater Barrier is therefore the landward boundary of EFH in the Guadalupe River–San Antonio Bay system.

Habitats in the lower Guadalupe River and San Antonio Bay near the VCS site include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Managed species that are considered important with respect to this ER include shrimp and red drum (GSMFC 2005). EFH has been designated for all life stages (egg, larvae, post-larvae, juvenile, and adult) of these species. The NOAA has prepared maps showing EFH for the various species and life stages (NOAA undated).

Categories of EFH in the lower Guadalupe River and San Antonio Bay that could be impacted by the project include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine

benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, and seagrasses. Detailed information on EFH is provided in the 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC. In addition to providing EFH for the federally managed species listed above, the San Antonio Bay estuary provides nursery and rearing habitat for other important estuarine species as well as for non-harvested forage species that support the harvested species.

2.4.2.3 Nuisance Species

The Asiatic clam, *Corbicula fluminea*, is a problematic invasive mollusk from southeastern Asia. It is a small bivalve that is typically found at high densities and has a relatively high growth rate (GSMFC 2005). Because of its tolerance of a wide variety of aquatic conditions and its high reproductive rate, it has developed into a pest that clogs ditches and interferes with pipes and heat exchangers of power plants. The first reported collection of *Corbicula* in Texas occurred in the Neches River in 1958 (Karatayev et al. Aug 2005). *Corbicula* were next discovered near El Paso in 1964, suggesting that the species was invading Texas from both east and west. From 1970 through 1979, Corbicula spread throughout much of Texas and during this period was first discovered in the Guadalupe and Blanco River systems (Karatayev et al. Aug 2005). By 2005, *Corbicula* had been reported from 162 lotic and 174 lentic waterbodies in Texas. Based on the surveys conducted to date (Subsection 2.4.2.1.2), *Corbicula* appear to be a major component of the benthos in the reach of the Guadalupe River that adjoins the VCS site. They are less evident in the GBRA canal system, perhaps because the canals are more steep sided than the river and lack the river's sandbars and sandbanks. Although present in low densities in the GBRA Calhoun Canal system, *Corbicula* have never created any operational problems, such as clogging pipes or damaging pumps, for the GBRA.

The water hyacinth (*Eichoria crassipes*), a free-floating perennial plant, was introduced into the United States (Florida) from South America in the 1880s and has since spread throughout the southeastern and southwestern United States and into parts of the mid-Atlantic and Pacific Northwest (FDEP undated, CAIP 2001). A serious problem for water system managers in the southern United States, water hyacinth grows rapidly and can take over a waterway in a matter of days when conditions are favorable for its growth. This plant is found throughout the GBRA canal and diversion system, including Goff Bayou. Clumps of water hyacinth are occasionally seen floating in the Guadalupe River.

Water lettuce (*Pistia stratiotes*), a species regarded as nonnative by some botanical authorities (who believe it was introduced from the Caribbean during the Colonial era) and indigenous to the United States by others (it was recorded by pioneer naturalists in Florida in the 18th century), is a floating perennial plant that under certain conditions forms "vast mats that disrupt submersed plant and animal communities and interfere with water movement and navigation" (Langeland and Burks 2006). This species is also found throughout the GBRA canal and diversion system, including Goff

Bayou, and is presumed to occur in backwaters of the Guadalupe River. It is generally less abundant than water hyacinth, and to date it has not presented any operational problems for the GBRA.

Hydrilla (*Hydrilla verticillata*), a nonnative plant from Asia, has been found in 100 water bodies in Texas (LCRA 2003). It is a fast-growing, nuisance species that quickly establishes itself and produces dense mats of vegetation that can clog pipes and ditches and otherwise restrict water flow. It was first recorded in Texas in 1969 and has since spread through much of the state, from north-central to eastern Texas and south to the Rio Grande (LCRA 2003; Jacono and Richerson Dec 2003). Although present in the upper and middle reaches of the Guadalupe River, and a problem in several GBRA reservoirs, it is present in limited backwater areas of the lower river and the GBRA canal system, if at all.

2.4.2.4 Preexisting Environmental Stresses

Environmental or man-induced stresses include thermal and chemical pollutants (discharges), which are regulated by the TCEQ under the Texas Pollutant Discharge Elimination System (TPDES) program. The TCEQ is required, under Section 303(d) of the Clean Water Act, to identify water bodies for which effluent limitations are not stringent enough to satisfy water quality standards. In every even-numbered year, the TCEQ publishes a "Texas Water Quality Inventory and 303(d) List" that identifies freshwater streams, impoundments, tidal streams, and coastal bays that are impaired for one or more pollutants and therefore do not meet one or more water quality standards (TCEQ 2008). Stream segments in the vicinity of the VCS site that could potentially be affected by construction or operation of the new units are listed in Table 2.3.3-4 of Subsection 2.3.3 and shown in Figure 2.3.3-2.

Segment 1803 of the Guadalupe River, which lies adjacent to the VCS site and would receive effluent from the proposed new units, did not appear on 2004, 2006, or 2008 TCEQ lists of impaired waters. Segment 1802, the short segment of the Guadalupe River between its confluence with the San Antonio River and the Saltwater Barrier, likewise did not appear on 2004, 2006, or 2008 lists. Segment 1801, the tidal portion of the Guadalupe River (from the GBRA Saltwater Barrier to Guadalupe Bay), appeared on the 2004 list as impaired for low dissolved oxygen but met state water quality standards in the last two assessments. (TCEQ 2004, 2006, 2008)

Bay Segment 2462, Guadalupe/Hynes/San Antonio Bay, was listed as impaired for bacteria (oyster waters) in 2004, 2006, and 2008 (TCEQ 2004, 2006, 2008). Fecal coliform is the indicator bacterium used by the TCEQ to determine if bay and gulf waters are suitable for shellfish harvesting. Assessment of oyster waters is coordinated with the Seafood Safety Division of the Texas Department of State Health Services, which is responsible for monitoring and classifying shellfish waters into four categories for harvesting: approved, conditionally approved, restricted, and prohibited. Bay segments are classified and mapped, with maps available for viewing on the Texas

Department of State Health Services Website. The map currently displayed on the Website, dated November 1, 2008, shows Guadalupe Bay as a Restricted Area, Hynes Bay as a Conditionally Approved Area, and San Antonio Bay as an Approved Area for shellfish harvesting (TDSHS Nov 2008).

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Table 2.4-1 (Sheet 1 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

Avian Group	Species	Abundance[c]				
		Oct 07	Mar 08	May 08	Jul 08	Oct 08
Wading Birds	Roseate spoonbill (*Ajaia ajaja*)	Uncom	Uncom	Uncom	Com	—
	Great egret (*Ardea alba*)	Com	Com	Uncom	Com	Uncom
	Great blue heron (*Ardea herodias*)	Com	Com	Uncom	Uncom	Uncom
	American bittern (*Botaurus lentiginosus*)[d]	—	—	—	—	—
	Cattle egret (*Bubulcus ibis*)	—	—	Com	Uncom	—
	Green heron (*Butorides virescens*)[d]	—	—	—	—	—
	Little blue heron (*Egretta caerulea*)	Uncom	Uncom	Uncom	Uncom	Uncom
	Snowy egret (*Egretta thula*)	Uncom	—	Uncom	—	—
	Tricolored heron (*Egretta tricolor*)	Uncom	—	Uncom	—	—
	White ibis (*Eudocimus albus*)	Com	Com	Com	Com	Uncom
	Least bittern (*Ixobrychus exilis*)[d]	—	—	—	—	—
	Wood stork (*Mycteria americana*)	—	—	—	Uncom	Com
	Yellow-crowned night-heron (*Nyctanassa violacea*)	—	Uncom	Uncom	—	—
	Black-crowned night-heron (*Nycticorax nyctocorax*)[d]	—	—	—	Uncom	—
	Whitefaced or glossy ibis (*Plegadis chihi or falcinellus*)	—	Com	—	Uncom	—
Shoredbirds	Spotted sandpiper (*Actits macularia*)[d]	—	—	—	—	—
	Western sandpiper (*Calidris mauri*)[d]	—	—	—	—	—
	Least sandpipier (*Calidris pusillus*)[d]	—	—	—	—	—
	Mountain plover (*Charafrius montanus*)	—	Uncom	—	—	—
	Killdeer (*Charadrius vocifeous*)	Com	Com	Uncom	—	Com
	Black-necked stilts (*Himantopus mexicanus*)[d]	—	—	—	—	—
	Short-billed dowitcher (*Limnodromus griseus*)[d]	—	—	—	—	—
	Long-billed dowitcher (*Limnodromus scolopaceus*)[d]	—	—	—	—	—
	Stilt sandpiper (*Micropalma himantopus*)[d]	—	—	—	—	—

Table 2.4-1 (Sheet 2 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

Avian Group	Species	Abundance[c]				
		Oct 07	Mar 08	May 08	Jul 08	Oct 08
Shoredbirds (cont.)	American avocet (*Recurviristra americana*)	Uncom	—	—	—	—
	Lesser yellowlegs (*Tringa flavipes*)[d]	—	—	—	—	—
	Greater yellowlegs (*Tringa melanocleuca*)	—	Uncom	—	—	Uncom
	Solitary sandpiper (*Tringa solitaria*)[d]	—	—	—	—	—
Other Waterbirds	Wood duck (*Aix sponsa*)[d]	—	—	—	—	—
	Northern shoveler (*Anas clypeata*)	—	Uncom	—	—	—
	Blue-winged teal (*Anas discors*)[d]	—	—	—	—	Uncom
	Mottled duck (*Anas fulvigula*)[d]	—	—	—	—	—
	Anhinga (*Anhinga anhinga*)	Com	Com	—	—	—
	Yellow rail (*Coturnicops novaboracensis*)[d]	—	—	—	—	—
	Black-bellied whistling duck (*Dendrocygna autumnalis*)	—	—	Uncom	Uncom	—
	Fulvous whistling duck (*Dendrocygna bicolor*)	Uncom	—	—	—	—
	White pelican (*Pelecanus erythrorhynchos*)	Com	Com	Uncom	—	—
	American coot (*Fulicia americana*)	—	Uncom	—	—	—
	Sora (*Porzana carolina*)[d]	—	—	—	—	—
	Cormorant spp. (*Phalacrocorax sp*)	Uncom	Uncom	—	—	—
Upland Game Birds	Northern bobwhite quail (*Colinus virginianus*)	Uncom	Uncom	Abun	Abun	Uncom
	Common ground dove (*Columbina passerina*)	—	—	Uncom	Uncom	Uncom
	Sandhill crane (*Grus canadensis*)	Com	Abun	—	—	—
	Wild turkey (*Meleagris gallapavo*)	Uncom	Uncom	Uncom	—	—
	Mourning dove (*Zenaida macroura*)	Com	Com	Abun	Com	Abun

Table 2.4-1 (Sheet 3 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

Avian Group	Species	Abundance[c]				
		Oct 07	Mar 08	May 08	Jul 08	Oct 08
Passerines & Other Birds	Red-winged blackbird (*Agelaius phoeniceus*)	—	Uncom	Com	Uncom	—
	Ruby-throated hummingbird (*Archilochus colubris*)	—	—	—	Uncom	—
	Tufted titmouse (*Baeolophus bicolor*)	—	Uncom	Uncom	Uncom	Uncom
	Great horned owl (*Bubo virginiana*)[d]	—	—	—	—	—
	Northern cardinal (*Cardinalis cardinalis*)	Com	Com	Abun	Abun	Com
	Chimney swift (*Chaetura pelagica*)[d]	—	—	—	—	—
	Lark sparrow (*Chondestes grammacus*)[d]	—	—	—	—	—
	Yellow-billed cuckoo (*Coccyzus americanus*)	—	—	Uncom	Uncom	—
	Northern flicker (*Colaptes auratus*)	—	Uncom	—	—	—
	Eastern wood pewee (*Contopus virens*)	—	—	—	—	Uncom
	American crow (*Corvus brachyrhynchos*)	—	Uncom	Uncom	Uncom	Com
	Yellow-rumped warbler (*Dendroica coronata*)	—	Uncom	—	—	—
	Yellow-throated warbler (*Dendroica dominica*)[d]	—	—	—	—	—
	Palm warbler (*Dendroica palmarum*)	—	—	—	—	Uncom
	Pileated woodpecker (*Dryocopus pileatus*)	—	—	—	Uncom	—
	Gray catbird (*Dumetella caroleninsis*)	—	—	—	—	Uncom
	Blue grosbeak (*Guiraca caerulea*)	—	—	—	Uncom	—
	Barn swallow (*Hirundo rustica*)	Com	—	—	—	Abun
	Loggerhead shrike (*Lanius ludovicianus*)	Com	Com	—	Uncom	Com
	Red-bellied woodpecker (*Melanerpes carolin*us)	—	Uncom	Uncom	Uncom	Uncom
	Song sparrow (*Melospiza melodia*)	—	Com	—	—	—
	Mockingbird (*Mimus polyglottos*)	Com	Com	Abun	Com	Com
	Black-and-white warbler (*Mniotitla varia*)	—	—	—	Uncom	—
	Brown-headed cowbird (*Molothrus ater)*	—	Uncom	Com	Uncom	—
	Great crested flycatcher (*Myiarchus crinitus*)	—	—	Uncom	—	—

Table 2.4-1 (Sheet 4 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

Avian Group	Species	Abundance[c]				
		Oct 07	Mar 08	May 08	Jul 08	Oct 08
Passerines & Other Birds (cont.)	Ladder-backed woodpecker (*Picoides scalaris*)	—	—	Uncom	—	Uncom
	Painted bunting (*Passerina ciris*)	—	—	Uncom	Uncom	—
	Indigo bunting (*Passerina cyanea*)[d]	—	—	—	—	—
	Savannah sparrow (*Passerculus sandwichensis*)	—	Com	—	—	Uncom
	Cliff swallow (*Petrochelidon pyrrhonata*)	—	—	Com	Abun	Com
	Vesper sparrow (*Pooecetes gramineus*)[d]	—	—	—	—	—
	Carolina chickadee (*Poecile carolinensis*)	—	Uncom	Uncom	Uncom	Uncom
	Blue-gray gnatcatcher (*Poliotila caerula*)	—	Uncom	—	—	Uncom
	Prothonotary warbler (*Prothonotaria citrea*)[d]	—	—	—	—	—
	Great-tailed grackle (*Quiscalus mexicanus*)	—	—	—	Uncom	—
	Common grackle (*Quiscalus quiscala*)	—	Uncom	—	—	—
	Eastern phoebe (*Sayornis phoebe*)	—	Com	—	—	—
	Eastern bluebird (*Siala sialis*)	—	Uncom	—	—	—
	Yellow-bellied sapsucker (*Sphyrapicus varius*)	—	—	—	—	Uncom
	Dickcissel (*Spiza americana*)	—	—	Uncom	—	—
	Field sparrow (*Spizella pusilla*)	—	Uncom	—	—	—
	Northern rough-winged swallow (*Stelgidopteryx serripannis*)	—	—	—	—	Uncom
	Barred owl (*Strix varia*)	—	Uncom	Uncom	Uncom	Uncom
	Eastern meadowlark (*Sturnella magna*)	Com	Com	Uncom	Abun	Uncom
	Tree swallow (*Tachycineta bicolor*)	Com	Uncom	—	—	—
	Bewick's wren (*Theyomanes bewickii*)	—	—	Uncom	—	—
	Scissor-tailed flycatcher (*Tyrannus forficatus*)	Uncom	—	Abun	Com	Com
	Eastern kingbird (*Tyrannus tyrannus*)[d]	—	—	—	—	—
	Orange-crowned warbler (*Vermivora celata*)	—	—	—	—	Uncom
	White-eyed vireo (*Vireo griseus*)	—	Com	Com	Com	—

Table 2.4-1 (Sheet 5 of 5)
Avian Species Observed During Wildlife Surveys[a] of the Proposed VCS Site[b] in Victoria County, Texas: 2007–2008

Avian Group	Species	Abundance[c]				
		Oct 07	Mar 08	May 08	Jul 08	Oct 08
Passerines & Other Birds (cont.)	Red-eyed vireo (*Vireo olivaceus*)[d]	—	—	—	—	—
Birds of Prey/Soaring Birds	White-tailed hawk *(Buteo albicaudatus*)	Uncom	Uncom	Uncom	Uncom	Uncom
	Red-tailed hawk (*Buteo jamaicensis*)	Com	Com	Uncom	Uncom	Uncom
	Red-shouldered hawk (*Buteo lineatus*)	—	Uncom	Uncom	Uncom	Uncom
	Crested caracara (*Caracara plancus*)	Uncom	Com	Uncom	Uncom	Uncom
	Turkey vulture (*Cathartes aura*)	Com	Com	Com	Abun	Abun
	Northern harrier *Circus cyaneus*)	—	Uncom	—	—	—
	Black vulture (*Coragyps atratus*)	Uncom	Uncom	Uncom	Uncom	Uncom
	Merlin (*Falco columbarius*)	Uncom	—	—	—	—
	Kestrel (*Falco sparverius*)	Com	Com	—	—	Com
	Bald eagle (*Haliaeetus leucocephalus*)	Uncom	—	—	—	Uncom

(a) Survey periods were October 22–24, 2007; March 11–13, 2008, May 28–29, 2008, July 15–16, 2008, and October 7–8, 2008.

(b) The site includes the VCS site, Black Bayou, and Linn Lake.

(c) Estimated abundances (within expected habitats) were classified as Abun = Abundant; Com = Common; and Uncom = Uncommon/Rare. "—" indicate birds were not observed during the specified survey and thus relative abundance was not determined. Abundance classifications were intuitively based on species encounters within the project area.

(d) These species were not observed during the five seasonal surveys but were observed during other site visits/surveys.

Table 2.4-2 (Sheet 1 of 2)
Mammals of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Northern pygmy mouse	*Baiomys taylori*	G	O
Ringtail	*Bassariscus astutus*	B, F, M	—
Coyote	*Canis latrans*	G, F	U
American beaver	*Castor canadensis*	I	—
Hispid pocket mouse	*Chaetodipus hispidus*	G	—
Least shrew	*Cryptotis parva*	G, F	—
Nine-banded armadillo	*Dasypus novemcinctus*	G, F	C
Virginia opossum	*Didelphis virginiana*	G, B, F, I	C
Big brown bat	*Eptesicus fuscus*	G, B, F, I	—
Attwater's pocket gopher	*Geomys attwateri*	G	A
Southern flying squirrel	*Glaucomys volans*	B, F, M	—
Silver-haired bat	*Lasionycteris noctivagans*	G, B, F, I	—
Red bat	*Lasiurus borealis*	G, B, F, I	—
Hoary bat	*Lasiurus cinereus*	G, B, F, I	—
Northern yellow bat	*Lasiurus intermedius*	G, B, F, I	—
Seminole bat	*Lasiurus seminolus*	G, B, F, I	—
Black-tailed jackrabbit	*Lepus californicus*	G	—
Northern river otter	*Lontra canadensis*	G, B, F	—
Bobcat	*Lynx rufus*	G, F, M	O
Striped skunk	*Mephitis mephitis*	G, F	—
Long-tailed weasel	*Mustela frenata*	G, B, F	—
Cave Myotis	*Myotis velifer*	G, B, F, I	—
White-nosed coati	*Nasua narica*	B, F, M	—
Eastern woodrat	*Neotoma floridana*	G, F	—
Crawford's gray shrew	*Notiosorex crawfordi*	G	—
Evening bat	*Nycticeius humeralis*	G, B, F, I	—
Big free-tailed bat	*Nyctinomops macrotis*	G, I	—
White-tailed deer	*Odocoileus virginiana*	G, B, F, M	A
Northern grasshopper mouse	*Onychomys leucogaster*	G	—
Marsh rice rat	*Oryzomys palustris*	I	O
Collared peccary	*Pecari tajacu*	G, F	—
White-footed mouse	*Peromyscus leucopus*	G, F	O
Deer mouse	*Peromyscus maniculatus*	G, B, F, M	—
Eastern Perimyotis	*Pipistrellus subflavus*	G, B, F, I	—
Northern raccoon	*Procyon lotor*	B, F, I	A

Table 2.4-2 (Sheet 2 of 2)
Mammals of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Cougar	*Puma concolor*	G, F	—
Fulvous harvest mouse	*Reithrodontomys fulvescens*	G	U
Plains harvest mouse	*Reithrodontomys montanus*	G	—
Eastern mole	*Scalopus aquaticus*	G, F	—
Eastern gray squirrel	*Sciurus carolinensis*	B, F, M	O
Eastern fox squirrel	*Sciurus niger*	B, F, M	A
Hispid cotton rat	*Sigmodon hispidus*	G, I	A
Mexican ground squirrel	*Spermophilus mexicanus*	G	—
Thirteen-lined jackrabbit	*Spermophilus tridecemlineatus*	G	—
Eastern spotted skunk	*Spilogale putorius*	G, B, F	—
Feral hog	*Sus scrofa*	G, B, F, M	C
Swamp rabbit	*Sylvilagus aquaticus*	I	—
Eastern cottontail	*Sylvilagus floridanus*	G, F	C
Brazilian free-tailed bat	*Tadarida brasiliensis*	G, I	—
American badger	*Taxidea taxus*	G	—
Common gray fox	*Urocyon cinereoargenteus*	G, F	—
Red fox	*Vulpes vulpes*	G, F	—

(a) According to Schmidly (2004).
(b) General habitats: G = bluestem grassland, B = bottomland hardwood forest, F = live oak forest, M = live oak motte, I = depressional wetland.
(c) Abundance categories were intuitively based on species encounters within the project area and regional knowledge: A = abundant, C = common, U = uncommon, O = occasional, R = rare, — = not observed.

Table 2.4-3 (Sheet 1 of 3)
Amphibians and Reptiles of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Frogs			
Blanchard's cricket frog	*Acris crepitans blanchardi*	B, F, M, I	C
Eastern green toad	*Bufo debilis*	G, I	—
Texas toad	*Bufo speciosus*	G, I	—
Gulf coast toad	*Bufo valliceps*	G, I	C
Woodhouse's toad	*Bufo woodhousii woodhousii*	G, I	—
Eastern narrowmouth toad	*Gastrophryne carolinensis*	B, F, M, I	O
Great plains narrowmouth toad	*Gastrophryne olivacea*	B, F, M, I	—
Cope's gray treefrog	*Hyla chrysoscelis*	B, F, M, I	—
Green treefrog	*Hyla cinerea*	B, F, M, I	C
Squirrel treefrog	*Hyla squirella*	B, F, M, I	O
Gray treefrog	*Hyla versicolor*	B, F, M, I	—
Spotted chorus frog	*Pseudacris clarkii*	B, F, M, I	—
Strecker's chorus frog	*Pseudacris streckeri*	B, F, M, I	—
Western chorus frog	*Pseudacris triseriata*	B, F, M, I	—
Bullfrog	*Rana catesbeiana*	I	C
Southern leopard frog	*Rana sphenocephala*	I	A
Hurter's spadefoot	*Scaphiopus hurterii*	G, I	—
Salamanders			
Smallmouth salamander	*Ambystoma texanum*	I	—
Eastern newt	*Notophthalmus viridescens*	I	—
Slimy salamander	*Plethodon glutinosus complex*	I	—
Southern redback salamander	*Plethodon serratus*	I	—
Western lesser siren	*Siren intermedia nettingi*	I	C
Crocodilians			
American alligator	*Alligator mississippiensis*	I	C
Lizards			
Green anole	*Anolis carolinensis*	B, F, M, I	—
Texas spotted whiptail	*Cnemidophorus gularis*	G	—
Marbled whiptail	*Cnemidophorus marmoratus*	G	—
Six-lined racerunner	*Cnemidophorus sexlineatus sexlineatus*	G	—
Five-lined skink	*Eumeces fasciatus*	B, F, M	C
Broadhead skink	*Eumeces laticeps*	B, F, M	—
Mediterranean gecko	*Hemidactlus turcicus turcicus*	B, F	—

Table 2.4-3 (Sheet 2 of 3)
Amphibians and Reptiles of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Keeled Earless lizard	*Holbrookia propinqua propinqua*	G	—
Western slender glass lizard	*Ophisaurus attenuatus*	G	—
Texas horned lizard	*Phrynosoma cornutum*	G	—
Texas spiny lizard	*Sceloporus olivaceus*	G, F	—
Southern prairie skink	*Sceloporus septentrionalis obtusirostris*	G, F	—
Northern fence/Prairie lizard	*Sceloporus undulatus hyacinthinus*	G, F	—
Ground skink	*Scincella lateralis*	B, F, M	C
Snakes			
Broad-banded copperhead	*Agkistrodon contortrix laticinctus*	B, F, M	—
Western cottonmouth	*Agkistrodon piscivorus leucostoma*	I	U
Texas glossy snake	*Arizona elegans arenicola*	G	—
Eastern yellow-bellied racer	*Coluber constrictor flaviventris*	G	—
Western diamondback rattlesnake	*Crotalus atrox*	G, F	—
Canebrake rattlesnake	*Crotalus horridus atricaudatus*	B, F, M	—
Great plains rat snake	*Elaphe emoryi*	G, F	—
Southwestern rat snake	*Elaphe guttata meahllmorum*	G, F	—
Texas rat snake	*Elaphe obsoleta lindheimeri*	G, F	C
Mud snake	*Farancia abacura*	I	—
Eastern hognose snake	*Heterodon platirhinos*	G	—
Texas night snake	*Hypsiglena torquata jani*	G	—
Prairie king snake	*Lampropeltis calligaster calligaster*	G	O
Speckled king snake	*Lampropeltis getula splendida*	G	O
Louisiana milk snake	*Lampropeltis triangulum amaura*	B, F, M	—
Texas blind snake	*Leptotyphlops dulcis*	B, F, M	—
Eastern coachwhip	*Masticophis flagellum flagellum*	G	C
Texas coral snake	*Micrurus fulvius tenere*	B, F, M	—
Blotched water snake	*Nerodia erythrogaster transversa*	I	—
Broad-banded water snake	*Nerodia fasciata confluens*	I	C
Diamondback water snake	*Nerodia rhombifer rhombifer*	I	A
Rough green snake	*Opheodrys aestivus*	B, F, M	—
Bull snake	*Pituophis catenifer sayi*	G	—
Graham's crayfish snake	*Regina grahamii*	I	—
Western massasauga	*Sistrurus catenatus tergeminus*	G, F	—
Western pygmy rattlesnake	*Sistrurus miliarius streckeri*	G, F	—

Table 2.4-3 (Sheet 3 of 3)
Amphibians and Reptiles of Potential Occurrence[a] at VCS and Abundance Estimates of Those Observed in the Spring Surveys of 2008

Common Name	Scientific Name	General Habitat[b]	Observed/ Abundance[c]
Marsh brown snake	*Storeria dekayi limnetes*	B, F, M, I	—
Flathead snake	*Tantilla gracilis*	B, F, M	—
Plains black-headed snake	*Tantilla nigriceps nigriceps*	B, F, M	—
Checkered garter snake	*Thamnophis marcianus marcianus*	G, I	—
Gulf coast ribbon snake	*Thamnophis proximus orarius*	G, I	—
Eastern garter snake	*Thamnophis sirtalis sirtalis*	G, I	—
Texas lined snake	*Tropidoclonion lineatum texanum*	G, I	—
Ground snake	*Virginia striatula*	B, F, M, I	U
Rough earth snake	*Virginia striatula*	B, F, M	—
Turtles			
Spiny softshell	*Apalone spinifera*	I	U
Common snapping turtle	*Chelydra serpentina*	I	U
Texas tortoise	*Gopherus berlandieri*	G	—
Cagle's map turtle	*Graptemys caglei*	I	—
Yellow mud turtle	*Kinosternon flavescens*	I	—
Mississippi mud turtle	*Kinosternon subrubrum hoppocrepis*	I	—
Texas river cooter	*Pseudemys texana*	I	—
Common mush turtle	*Sternotherus odoratus*	I	—
Eastern box turtle	*Terrapene carolina*	G, F	—
Ornate box turtle	*Terrapene ornata*	G	—
Red-eared slider	*Trachemys scripta*	I	C

(a) According to Tennant (1984, 1985, 2006), and Dixon (2000).
(b) General habitats: G = bluestem grassland, B = bottomland hardwood forest, F = live oak forest, M = live oak motte, I = depressional wetland.
(c) Abundance categories were intuitively based on species encounters within the project area and regional knowledge: A = abundant, C = common, U = uncommon, O = occasional, R = rare, — = not observed.

Table 2.4-4 (Sheet 1 of 2)
Protected Species In Counties Associated with the VCS Site

Common Name	Scientific Name	Federal Status[a]	State Status[a]	Counties[b]
Amphibians				
Sheep Frog	*Hypopachus variolosus*	—	T	Cal, Gol, Ref
Black-spotted newt	*Notopthalmus meridionalis*	—	T	Cal, Gol, Ref, Vic
Birds				
White-tailed hawk	*Buteo albicaudatus*	—	T	All
Piping plover	*Charadrius melodus*	LT	T	Cal, Mat, Ref
Reddish egret	*Egretta rufescens*	—	T	Cal, Jac, Mat, Ref, Vic
Northern Aplomado falcon	*Falco femoralis septentrionalis*	LE	E	Ref
Peregrine falcon	*Falco peregrinus anatum*	DL	T	All
Arctic peregrine falcon	*Falco peregrinus tundrius*	DL	T	All
Whooping crane	*Grus Americana*	LE	E	All
Bald eagle	*Haliaeetus leucocephalus*	DL	T	Cal, DeW, Gol, Jac, Mat, Ref, Vic, Wha
Wood stork	*Mycteria Americana*	—	T	All
Eskimo curlew	*Numenius borealis*	LE	E	Cal, Mat
Brown pelican	*Pelecanus occidentalis*	LE-PDL	E	Jac, Mat, Ref, Vic
White-faced ibis	*Plegadis chihi*	—	T	All
Interior least tern	*Sterna antillarum athalassos*	LE	E	Gol, Jac, Vic, Wha
Sooty tern	*Sterna fuscata*	—	T	Cal, Jac, Mat, Ref
Attwater's prairie chicken	*Tympanuchus cupido attwateri*	LE	E	Ref, Vic, Wha
Fishes				
Smalltooth sawfish	*Pristis pectinata*	LE	E	Cal, Jac, Mat, Ref
Oppossum pipefish	*Microphis brachyurus*	—	T	Cal
Mammals				
Red wolf	*Canis rufus*	LE	L	All
Jaguarundi	*Herpailurus yaguarondi*	LE	E	Cal
Ocelot	*Leopardus pardalis*	LE	E	Cal, Gol, Mat, Ref
White-nosed coati	*Nasua narica*	—	T	Ref, Vic
West Indian manatee	*Trichechus manatus*	LE	E	Cal, Mat, Ref
Black bear	*Ursus americana*	T/SA	T	Cal
Louisiana black bear	*Ursus americanus luteolus*	LT	T	Jac, Mat, Ref, Vic, Wha
Plants				
Black lace cactus	*Echinocereus reichenbachii var. albertii*	LE	E	Ref

Table 2.4-4 (Sheet 2 of 2)
Protected Species In Counties Associated with the VCS Site

Common Name	Scientific Name	Federal Status[a]	State Status[a]	Counties[b]
Reptiles				
Loggerhead sea turtle	*Caretta caretta*	LT	T	Cal, Jac, Mat, Ref
Texas scarlet snake	*Cemophora coccinea lineri*	—	T	Cal, Jac, Mat, Ref
Green sea turtle	*Chelonia mydas*	LT	T	Cal, Mat, Ref
Timber/canebrake rattlesnake	Crotalus horridus	—	T	Cal, DeW, Gol, Jac, Mat, Ref, Vic, Wha
Leatherback sea turtle	Dermochelys coriacea	LE	E	Cal, Mat, Ref
Indigo snake	Drymarchon corais	—	T	Gol, Ref
Atlantic hawksbill sea turtle	Eretmochelys imbricata	LE	E	Cal, Mat, Ref
Texas tortoise	Gopherus berlandieri	—	T	Cal, DeW, Jac, Gol, Mat, Ref, Vic
Cagle's map turtle	Graptemys caglei	—	T	DeW, Vic
Kemp's ridley sea turtle	Lepidochelys kempii	LE	E	Cal, Mat, Ref
Smooth green snake	Liochlorophis vernalis	—	T	Mat
Texas horned lizard	Phrynosoma cornutum	—	T	Cal, DeW, Gol, Jac, Mat, Ref

Sources: TPWD 2009, USFWS 2008a

(a) LE/E = Endangered; LT/T = Threatened; C = Candidate; **-** = Not listed; DL = delisted taxon, recovered, monitored for first five years post delisting; PDL = proposed for delisting; SA = listed due to similarity of appearance with a threatened species

(b) Counties containing the proposed Exelon facilities, intake corridor and transmission lines where protected species are listed [All = listed for all counties: Cal = Calhoun, DeW = DeWitt, Gol = Goliad, Jac = Jackson, Mat = Matagorda, Ref = Refugio, Vic = Victoria, & Wha = Wharton]. The main facility site is in Victoria County and the intake corridor originates in Refugio County. New and existing transmission corridors to be upgraded will occur in seven counties (excluding Refugio).

Table 2.4-5 (Sheet 1 of 2)
Number Collected (#) and Percent Relative Abundance (%) of Fish Captured at 12 Locations on the Exelon Victoria County Site in 2008

Family	Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lepisosteidae																												
	Alligator gar	*Atractosteus spatula*															5	**7.4**									5	**0.1**
	Spotted gar	*Lepisosteus oculatus*							2	**0.4**					20	**2.9**	1	**1.5**					11	**1.9**			34	**0.8**
Clupeidae																												
	Gizzard shad	*Dorosoma cepedianum*													14	**2.0**	3	**4.4**			2	**1.0**	20	**3.5**			39	**0.9**
	Threadfin shad	*Dorosoma petenense*													69	**10.1**			9	**69.2**	2	**1.0**					80	**1.9**
Cyprinidae																												
	Golden shiner	*Notemigonus crysoleucas*[(a)]					65	**14.2**																			65	**1.5**
	Red shiner	*Cyprinella lutrensis*																			6	**3.0**					6	**0.1**
	Common carp	*Cyprinus carpio*[(a)]					25	**5.5**	18	**3.6**	1	**0.6**			1	**0.1**			2	**15.4**			16	**2.8**			63	**1.5**
	Pugnose minnow	*Opsopoeodus emiliae*																			1	**0.5**					1	**0.0**
	Bullhead minnow	*Pimephales vigilax*													5	**0.7**	1	**1.5**			12	**5.9**					18	**0.4**
Catostomidae																												
	Smallmouth buffalo	*Ictiobus bubalus*									1	**0.6**			3	**0.4**	1	**1.5**					7	**1.2**			12	**0.3**
Characidae																												
	Mexican tetra	*Astyanax mexicanus*[(a)]									4	**2.2**			17	**2.5**					1	**0.5**					22	**0.5**
Ictaluridae																												
	Black bullhead	*Ameiurus melas*	515	**44.9**	3	**1.5**	1	**0.2**			1	**0.6**											11	**1.9**			5,31	**12.6**
	Yellow bullhead	*Ameiurus natalis*					19	**4.2**	15	**3.0**	10	**5.6**											4	**0.7**			48	**1.1**
	Blue catfish	*Ictalurus furcatus*													1	**0.1**	5	**7.4**	1	**7.7**	1	**0.5**					8	**0.2**
	Channel catfish	*Ictalurus punctatus*													1	**0.1**					18	**8.9**					19	**0.5**
	Flathead catfish	*Pylodictis olivaris*																			1	**0.5**					1	**0.0**
Loricariidae																												
	Suckermouth armored catfish	*Pterygoplichthys anisitsi*[(a)]													5	**0.7**											5	**0.1**
Mugilidae																												
	Striped mullet	*Mugil cephalus*													19	**2.8**											19	**0.5**
Atherinopsidae																												
	Inland silverside	*Menidia beryllina*													29	**4.2**	2	**2.9**			4	**2.0**					35	**0.8**
Fundulidae																												

Table 2.4-5 (Sheet 2 of 2)
Number Collected (#) and Percent Relative Abundance (%) of Fish Captured at 12 Locations on the Exelon Victoria County Site in 2008

Family	Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
	Golden topminnow	*Fundulus chrysotus*	42	**3.7**											1	**0.1**											43	**1.0**
Poeciliidae																												
	Western mosquitofish	*Gambusia affinis*	223	**19.4**	185	**90.7**	32	**7.0**	162	**32.7**	113	**63.5**	31	**68.9**	77	**11.3**	2	**2.9**			6	**3.0**	6	**1.1**	154	**100.0**	991	**23.5**
	Sailfin molly	*Poecilia latipinna*					30	**6.6**	205	**41.3**					77	**11.3**	22	**32.4**			9	**4.5**					343	**8.1**
Cyprinodontidae																												
	Sheepshead minnow	*Cyprinodon variegatus*													34	**5.0**											34	**0.8**
Moronidae																												
	White bass	*Morone chrysops*													3	**0.4**	1	**1.5**									4	**0.1**
Centrarchidae																												
	Green sunfish	*Lepomis cyanellus*			5	**2.5**	127	**27.8**	15	**3.0**	4	**2.2**															151	**3.6**
	Warmouth	*Lepomis gulosus*	137	**11.9**	11	**5.4**	146	**31.9**	49	**9.9**	37	**20.8**			44	**6.4**					21	**10.4**	12	**2.1**			457	**10.8**
	Orangespotted sunfish	*Lepomis humilis*																			2	**1.0**	108	**19.0**			110	**2.6**
	Bluegill	*Lepomis macrochirus*	39	**3.4**			3	**0.7**	16	**3.2**	7	**3.9**			200	**29.3**	23	**33.8**			67	**33.2**	46	**8.1**			401	**9.5**
	Longear sunfish	*Lepomis megalotis*													2	**0.3**					11	**5.4**					13	**0.3**
	Redear sunfish	*Lepomis microlophus*	4	**0.3**											14	**2.0**					2	**1.0**					20	**0.5**
	Bantam sunfish	*Lepomis symmetricus*	79	**6.9**					8	**1.6**					23	**3.4**					1	**0.5**					111	**2.6**
	Largemouth bass	*Micropterus salmoides*	8	**0.7**					1	**0.2**													5	**0.9**			14	**0.3**
	White crappie	*Pomoxis annularis*	100	**8.7**			9	**2.0**	5	**1.0**			14	**31.1**	21	**3.1**	1	**1.5**			35	**17.3**	321	**56.5**			506	**12.0**
	Black crappie	*Pomoxis nigromaculatus*													3	**0.4**											3	**0.1**
Sciaenidae																												
	Freshwater drum	*Aplodinotus grunniens*																	1	**7.7**			1	**0.2**			2	**0.0**
Cichlidae																												
	Rio Grande cichlid	*Cichlasoma cyanoguttatum*[(a)]															1	**1.5**									1	**0.0**
Total			1147		204		457		496		178		45		683		68		13		202		568		154		4215	

(a) Exotic or introduced species

Table 2.4-6 (Sheet 1 of 2)
Combined Weight (g) and Percent of Total Weight (%) for Each Species Based on Data Collected from 537 Individuals at 12 Locations on the Exelon Victoria County Site in 2008[a]

Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
		g	%	g)	%	g	%	gg	%	g	%	g	%	g	%	g	%	g	%	g	%	g	%	g	%	g	%
Alligator gar	*Atractosteus spatula*															7,470	**47.1**									7,470	**6.9**
Spotted gar	*Lepisosteus oculatus*							230	**3.6**					18,490	**66.4**							5,780	**14.5**			24,500	**22.6**
Gizzard shad	*Dorosoma cepedianum*													30	**0.1**					20	**0.9**	550	**1.4**			600	**0.6**
Golden Shiner	*Notemigonus crysoleucas*[b]					730	**5.1**																			730	**0.7**
Common carp	*Cyprinus carpio*[a]					7,560	**53.2**	2,450	**38.6**	160	**23.2**			770	**2.8**							16,000	**40.2**			26,940	**24.8**
Smallmouth buffalo	*Ictiobus bubalus*													630	**2.3**	2,500	**15.8**					9,080	**22.8**			12,210	**11.3**
Black bullhead Catfish	*Ameiurus melas*					1,030	**7.2**			20	**2.9**											330	**0.8**			1,380	**1.3**
Yellow bullhead catfish	*Ameiurus natalis*					1,040	**7.3**	420	**6.6**	50	**7.2**											440	**1.1**			1,950	**1.8**
Blue catfish	*Ictalurus furcatus*													670	**2.4**	4,890	**30.8**			1,130	**50.0**					6,690	**6.2**
Channel catfish	*Ictalurus punctatus*													900	**3.2**					20	**0.9**					920	**0.8**
Flathead catfish	*Pylodictis olivaris*																			20	**0.9**					20	**0.0**
Suckermouth armored catfish	*Pterygoplichthys anisitsi*[a]													730	**2.6**											730	**0.7**
Striped mullet	*Mugil cephalus*													2,437	**8.7**											2,437	**2.2**
Sailfin molly	*Poecilia latipinna*					40	**0.3**																			40	**0.0**
White bass	*Morone chrysops*															900	**5.7**									900	**0.8**

Table 2.4-6 (Sheet 2 of 2)
Combined Weight (g) and Percent of Total Weight (%) for Each Species Based on Data Collected from 537 Individuals at 12 Locations on the Exelon Victoria County Site in 2008[(a)]

Common Name	Scientific Name	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
		g	%	g)	%	g	%	gg	%	g	%	g	%	g	%	g	%	g	%	g	%	g	%	g	%	g	%
Green sunfish	*Lepomis cyanellus*					370	**2.6**	590	**9.3**	10	**1.4**															970	**0.9**
Warmouth	*Lepomis gulosus*					2,800	**19.7**	1,490	**23.5**	410	**59.4**			120	**0.4**					50	**2.2**					4,870	**4.5**
Bluegill	*Lepomis macrochirus*	15	**1.0**			70	**0.5**	430	**6.8**	40	**5.8**			280	**1.0**					20	**0.9**					855	**0.8**
Longear sunfish	*Lepomis megalotis*																			50	**2.2**					50	**0.0**
Redear sunfish	*Lepomis microlophus*	10	**0.7**											40	**0.1**											50	**0.0**
Largemouth bass	*Micropterus salmoides*	20	**1.4**					300	**4.7**													5,640	**14.2**			5,960	**5.5**
White crappie	*Pomoxis annularis*	1,406	**96.9**			570	**4.0**	430	**6.8**					2,530	**9.1**	110	**0.7**			950	**42.0**	1,850	**4.7**			7,846	**7.2**
Black crappie	*Pomoxis nigromaculatus*													230	**0.8**											230	**0.2**
Freshwater drum	*Aplodinotus grunniens*																					110	**0.3**			110	**0.1**
Total		1,451		0		14,210		6,340		690		0		27,857		15,870		0		2,260		39,780		0		108,458	

(a) Weight was not recorded for specimens less than 10 grams.
(b) Exotic or introduced species

Table 2.4-7 (Sheet 1 of 2)
Macroinvertebrates in Benthic Samples from 12 Locations on the Exelon Victoria County Site in 2008

Common Name	Family	Genus	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Mayflies	**Caenidae**	*Caenis*					8	**27.6**	3	**30.0**					1	**0.9**			1	**1.3**							13	**2.9**
	Baetidae	*Fallceon*													1	**0.9**											1	**0.2**
Dragonflies/ Damselflies	**Libellulidae**	*Perithemis*					1	**3.4**																			1	**0.2**
	Gomphidae	*Aphylla*	2	**2.4**							2	**4.7**															4	**0.9**
Water boatmen	**Corixidae**	*Trichocorixa*													1	**0.9**							1	**14.3**	1	**6.3**	3	**0.7**
Caddisflies	**Hydroptilidae**	*Orthotrichia pupa*					1	**3.4**																			1	**0.2**
Beetles	**Hydrophilidae**	*Berosus*													1	**0.9**	1	**25.0**	2	**2.7**							4	**0.9**
	Elmidae	*Dubiraphia*																			1	**16.7**					1	**0.2**
	Scarabidae																		1	**1.3**							1	**0.2**
	Haliplidae	*Haliplus*					4	**13.8**																			4	**0.9**
		Peltodytes					1	**3.4**							1	**0.9**											2	**0.5**
	Curculionidae						1	**3.4**																			1	**0.2**
	Chrysomelidae										1	**2.3**															1	**0.2**
Flies and midges	**Suborder: Brachycerca**										3	**7.0**															3	**0.7**
	Ephydridae																		6	**8.0**							6	**1.4**
	Tabanidae	*Chrysops*					3	**10.3**																	1	**6.3**	4	**0.9**
	Ceratopogonidae	*Ceratopogon*	2	**2.4**					3	**30.0**	2	**4.7**			14	**13.0**	2	**50.0**	13	**17.3**	1	**16.7**					37	**8.4**
		Culicoides	1	**1.2**							1	**2.3**			2	**1.9**			9	**12.0**	2	**33.3**					15	**3.4**
		Probezzia	2	**2.4**											1	**0.9**											3	**0.7**
		Serromyia	1	**1.2**																							1	**0.2**
		Sphaeromias	1	**1.2**					1	**10.0**					2	**1.9**									2	**12.5**	6	**1.4**
	Chaoboridae	*Chaoborus*			42	**72.4**																					42	**9.5**
	Chironomidae	*Procladius*	25	**29.4**	10	**17.2**					3	**7.0**			20	**18.5**							1	**14.3**	2	**12.5**	61	**13.8**
		Clinotanypus	16	**18.8**							1	**2.3**															17	**3.9**
		Tanypus									1	**2.3**			15	**13.9**			30	**40.0**	1	**16.7**					47	**10.7**
		Rheotanytarsus	16	**18.8**					1	**10.0**							1	**25.0**	3	**4.0**							21	**4.8**
		Cryptochironomus	1	**1.2**											3	**2.8**							2	**28.6**			6	**1.4**
		Dicrotendipes									1	**2.3**							1	**1.3**							2	**0.5**
		Parachironomus	8	**9.4**					1	**10.0**																	9	**2.0**
		Polypedilum	4	**4.7**											1	**0.9**											5	**1.1**
		Chironomus									2	**4.7**			25	**23.1**							1	**14.3**	1	**6.3**	29	**6.6**

Table 2.4-7 (Sheet 2 of 2)
Macroinvertebrates in Benthic Samples from 12 Locations on the Exelon Victoria County Site in 2008

Common Name	Family	Genus	MC-1		MC-2		MC-3		MC-4		MC-5		MC-6		MC-7		MC-8		MC-9		MC-10		MC-11		MC-12		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Flies and midges (cont.)	**Chironomidae (cont.)**	*Tanytarsus*													1	**0.9**			1	**1.3**							2	**0.5**
		Coelotanypus													2	**1.9**			8	**10.7**							10	**2.3**
		Microchironomus													2	**1.9**											2	**0.5**
Mosquitoes	**Culicidae**	*Aedes*									19	**44.2**															19	**4.3**
Molluscs	**Physidae**		4	**4.7**	1	**1.7**	2	**6.9**	1	**10.0**															3	**18.8**	11	**2.5**
	Planorbidae						2	**6.9**																			2	**0.5**
	Ancylidae	*A*																							1	**6.3**	1	**0.2**
		B																							1	**6.3**	1	**0.2**
	Sphaeriidae	*A*	1	**1.2**			6	**20.7**			1	**2.3**			3	**2.8**					1	**16.7**					12	**2.7**
		B	1	**1.2**							3	**7.0**			3	**2.8**											7	**1.6**
	Unionidae														1	**0.9**											1	**0.2**
		Toxolasma texasiensis																					1	**14.3**			1	**0.2**
Crustaceans	**Palaemonidae**	*Palaemonetes*													8	**7.4**							1	**14.3**	4	**25.0**	13	**2.9**
	Cambaridae				5	**8.6**					3	**7.0**															8	**1.8**
Segmented Worms	**Phylum: Annelida**				P						P				P		P				P		P				P	
Totals			85		58		29		10		43		0		108		4		75		6		7		16		441	

P = present

Table 2.4-8 (Sheet 1 of 2)
Number Collected (#) and Percent Relative Abundance (%) of Fishes Collected from the Guadalupe River, Goff Bayou, and the GBRA Main Canal, January–December 2008

Family	Common Name	Scientific Name	GR-01		GR-02		GR-03		GR-04		GR-05		GR-All		Goff		Canal		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lepisosteidae	Alligator gar	*Atractosteus spatula*							3	**0.2**			3	**0.0**					3	**0.0**
	Spotted gar	*Lepisosteus oculatus*	147	**2.7**	71	**4.7**	61	**6.2**	195	**15.9**	91	**7.7**	565	**5.5**	116	**8.9**	15	**1.2**	696	**5.4**
	Longnose gar	*Lepisosteus osseus*	39	**0.7**	27	**1.8**	35	**3.6**	36	**2.9**	34	**2.9**	171	**1.7**	10	**0.8**			181	**1.4**
Elopidae	Ladyfish	*Elops saurus*													1	**0.1**			1	**0.0**
Anguillidae	American eel	*Anguilla rostrata*[a]									1	**0.1**	1	**0.0**					1	**0.0**
Clupeidae	Skipjack herring	*Alosa chrysochloris*			1	**0.1**							1	**0.0**					1	**0.0**
	Gulf menhaden	*Brevoortia patronus*													117	**9.0**	2	**0.2**	119	**0.9**
	Gizzard shad	*Dorosoma cepedianum*	273	**5.1**	168	**11.1**	47	**4.8**	130	**10.6**	137	**11.5**	755	**7.3**	219	**16.9**	21	**1.6**	995	**7.7**
	Threadfin shad	*Dorosoma petenense*	554	**10.3**	5	**0.3**	2	**0.2**	19	**1.5**	14	**1.2**	594	**5.8**	91	**7.0**	4	**0.3**	689	**5.3**
Engraulidae	Bay anchovy	*Anchoa mitchilli*							3	**0.2**	2	**0.2**	5	**0.0**	72	**5.5**	31	**2.4**	108	**0.8**
Cyprinidae	Grass carp	*Ctenopharyngodon idella*[b]									2	**0.2**	2	**0.0**					2	**0.0**
	Red shiner	*Cyprinella lutrensis*	3,419	**63.4**	760	**50.0**	444	**45.1**	195	**15.9**	178	**15.0**	4,996	**48.5**	18	**1.4**	43	**3.3**	5,057	**39.2**
	Common carp	*Cyprinus carpio*[b]	3	**0.1**	1	**0.1**	6	**0.6**	22	**1.8**	20	**1.7**	52	**0.5**	50	**3.9**	13	**1.0**	115	**0.9**
	Ribbon shiner	*Lythrurus fumeus*	1	**0.0**									1	**0.0**					1	**0.0**
	Burrhead chub	*Macrhybopsis marconis*	1	**0.0**									1	**0.0**					1	**0.0**
	Pugnose minnow	*Opsopoeodus emiliae*	7	**0.1**	9	**0.6**			49	**4.0**	18	**1.5**	83	**0.8**	7	**0.5**	83	**6.4**	173	**1.3**
	Bullhead minnow	*Pimephales vigilax*	117	**2.2**	76	**5.0**	60	**6.1**	25	**2.0**	42	**3.5**	320	**3.1**	14	**1.1**	57	**4.4**	391	**3.0**
Catostomidae	Smallmouth buffalo	*Ictiobus bubalus*	18	**0.3**	17	**1.1**	37	**3.8**	18	**1.5**	33	**2.8**	123	**1.2**	69	**5.3**	12	**0.9**	204	**1.6**
	Gray redhorse	*Moxostoma congestum*															1	**0.1**	1	**0.0**
Characidae	Mexican tetra	*Astyanax mexicanus*[b]	127	**2.4**	36	**2.4**	40	**4.1**	65	**5.3**	53	**4.5**	321	**3.1**	15	**1.2**	23	**1.8**	359	**2.8**
Ictaluridae	Yellow bullhead	*Ameiurus natalis*															1	**0.1**	1	**0.0**
	Blue catfish	*Ictalurus furcatus*	31	**0.6**	18	**1.2**	21	**2.1**	8	**0.7**	19	**1.6**	97	**0.9**	24	**1.8**			121	**0.9**
	Channel catfish	*Ictalurus punctatus*	1	**0.0**	9	**0.6**	25	**2.5**	11	**0.9**	16	**1.3**	62	**0.6**	3	**0.2**	1	**0.1**	66	**0.5**
	Tadpole madtom	*Noturus gyrinus*															6	**0.5**	6	**0.0**
	Flathead catfish	*Pylodictis olivaris*			6	**0.4**	19	**1.9**	5	**0.4**	3	**0.3**	33	**0.3**	6	**0.5**			39	**0.3**
Loricariidae	Suckermouth armored catfish	*Pterygoplichthys anisitsi*[b]					1	**0.1**	3	**0.2**	5	**0.4**	9	**0.1**	3	**0.2**	10	**0.8**	22	**0.2**
Mugilidae	Striped mullet	*Mugil cephalus*	191	**3.5**	7	**0.5**	14	**1.4**	77	**6.3**	265	**22.3**	554	**5.4**	227	**17.5**			781	**6.1**
Atherinopsidae	Inland silverside	*Menidia beryllina*	180	**3.3**	6	**0.4**	1	**0.1**	46	**3.7**	35	**2.9**	268	**2.6**	37	**2.9**	102	**7.9**	407	**3.2**
Fundulidae	Golden topminnow	*Fundulus chrysotus*									1	**0.1**	1	**0.0**					1	**0.0**
	Bluefin killifish	*Lucania goodei*[b]													3	**0.2**	2	**0.2**	5	**0.0**
Cyprinodontidae	Sheepshead minnow	*Cyprinodon variegatus*									1	**0.1**	1	**0.0**					1	**0.0**
Syngnathidae	Gulf pipefish	*Syngnathus scovelli*															2	**0.2**	2	**0.0**

Table 2.4-8 (Sheet 2 of 2)
Number Collected (#) and Percent Relative Abundance (%) of Fishes Collected from the Guadalupe River, Goff Bayou, and the GBRA Main Canal, January–December 2008

Family	Common Name	Scientific Name	GR-01		GR-02		GR-03		GR-04		GR-05		GR-All		Goff		Canal		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Poeciliidae	Western mosquitofish	*Gambusia affinis*	71	**1.3**	50	**3.3**	19	**1.9**	71	**5.8**	52	**4.4**	263	**2.6**	59	**4.5**	184	**14.2**	506	**3.9**
	Sailfin molly	*Poecilia latipinna*	15	**0.3**	6	**0.4**	2	**0.2**	39	**3.2**	23	**1.9**	85	**0.8**	9	**0.7**	62	**4.8**	156	**1.2**
Moronidae	White bass	*Morone chrysops*	1	**0.0**							3	**0.3**	4	**0.0**	2	**0.2**			6	**0.0**
Centrarchidae	Green sunfish	*Lepomis cyanellus*			1	**0.1**	2	**0.2**					3	**0.0**					3	**0.0**
	Warmouth	*Lepomis gulosus*	11	**0.2**	21	**1.4**	6	**0.6**	40	**3.3**	27	**2.3**	105	**1.0**	8	**0.6**	106	**8.2**	219	**1.7**
	Orangespotted sunfish	*Lepomis humilis*	14	**0.3**	1	**0.1**	2	**0.2**					17	**0.2**			1	**0.1**	18	**0.1**
	Bluegill	*Lepomis macrochirus*	42	**0.8**	61	**4.0**	34	**3.5**	72	**5.9**	42	**3.5**	251	**2.4**	56	**4.3**	90	**6.9**	397	**3.1**
	Longear sunfish	*Lepomis megalotis*	85	**1.6**	98	**6.5**	43	**4.4**	26	**2.1**	21	**1.8**	273	**2.6**	26	**2.0**	304	**23.5**	603	**4.7**
	Redear sunfish	*Lepomis microlophus*					1	**0.1**					1	**0.0**					1	**0.0**
	Bantam sunfish	*Lepomis symmetricus*							1	**0.1**	2	**0.2**	3	**0.0**			3	**0.2**	6	**0.0**
	Spotted bass	*Micropterus punctulatus*	9	**0.2**	19	**1.3**	26	**2.6**	28	**2.3**	7	**0.6**	89	**0.9**	2	**0.2**	2	**0.2**	93	**0.7**
	Largemouth bass	*Micropterus salmoides*	2	**0.0**					1	**0.1**	1	**0.1**	4	**0.0**	13	**1.0**	2	**0.2**	19	**0.1**
	White crappie	*Pomoxis annularis*	3	**0.1**	5	**0.3**			15	**1.2**	11	**0.9**	34	**0.3**	6	**0.5**	6	**0.5**	46	**0.4**
	Black crappie	*Pomoxis nigromaculatus*	5	**0.1**	5	**0.3**	1	**0.1**	15	**1.2**	17	**1.4**	43	**0.4**	9	**0.7**	1	**0.1**	53	**0.4**
Sparidae	Pinfish	*Lagodon rhomboides*															1	**0.1**	1	**0.0**
Sciaenidae	Freshwater drum	*Aplodinotus grunniens*	7	**0.1**	7	**0.5**	4	**0.4**	6	**0.5**	8	**0.7**	32	**0.3**	4	**0.3**			36	**0.3**
Cichlidae	Rio Grande cichlid	*Cichlasoma cyanoguttatum*[(b)]	15	**0.3**	28	**1.8**	32	**3.2**	5	**0.4**	3	**0.3**	83	**0.8**	1	**0.1**	104	**8.0**	188	**1.5**
Paralichthyidae	Southern flounder	*Paralichthys lethostigma*													1	**0.1**			1	**0.0**
Achiridae	Hogchoker	*Trinectes maculatus*							1	**0.1**			1	**0.0**					1	**0.0**
Total			5,389		1,519		985		1,230		1,187		10,310		1,298		1,295		12,903	

(a) Observed but not collected
(b) Exotic or introduced species

Table 2.4-9
Combined Weight (kg) and Percent of Total Weight (%) of Fish Data Collected (2,949 Individuals) from the Guadalupe River, Goff Bayou, and the GBRA Main Canal, January–December 2008[a]

Common Name	Scientific Name	GR-01		GR-02		GR-03		GR-04		GR-05		GR-All		Goff		Canal		Total	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Alligator gar	*Atractosteus spatula*							8	**3.2**			8	**0.7**					8	**0.6**
Spotted gar	*Lepisosteus oculatus*	73	**25.2**	26	**25.4**	30	**16.5**	99	**37.5**	41	**14.6**	269	**24.1**	46	**12.8**	7	**28.1**	321	**21.5**
Longnose gar	*Lepisosteus osseus*	26	**8.9**	9	**8.4**	28	**15.3**	10	**3.7**	17	**6.1**	89	**8.0**	9	**2.5**			98	**6.5**
Ladyfish	*Elops saurus*													<1	**0.0**			<1	**0.0**
Skipjack herring	*Alosa chrysochloris*			<1	**0.2**							<1	**0.0**					<1	**0.0**
Gulf menhaden	*Brevoortia patronus*													<1	**0.0**			<1	**0.0**
Gizzard shad	*Dorosoma cepedianum*	28	**9.4**	20	**20.0**	9	**4.7**	15	**5.9**	14	**5.0**	86	**7.7**	9	**2.5**	<1	**0.5**	95	**6.4**
Threadfin shad	*Dorosoma petenense*	<1	**0.0**	<1	**0.0**							<1	**0.0**					<1	**0.0**
Grass carp	*Ctenopharyngodon idella*[b]									28	**10.2**	28	**2.5**					28	**1.9**
Common carp	*Cyprinus carpio*[a]	2	**0.5**	<1	**0.4**	6	**3.3**	48	**18.2**	33	**11.9**	89	**8.0**	44	**12.4**	7	**29.6**	140	**9.4**
Smallmouth buffalo	*Ictiobus bubalus*	38	**13.0**	21	**21.0**	77	**42.4**	35	**13.2**	73	**26.1**	244	**21.9**	113	**31.7**	6	**25.1**	363	**24.2**
Gray redhorse	*Moxostoma congestum*															<1	**0.5**	<1	**0.0**
Mexican tetra	*Astyanax mexicanus*[a]			<1	**0.0**	<1	**0.0**			<1	**0.0**	<1	**0.0**					<1	**0.0**
Blue catfish	*Ictalurus furcatus*	58	**20.0**	13	**12.4**	15	**8.4**	6	**2.4**	10	**3.5**	102	**9.2**	14	**3.8**			116	**7.8**
Channel catfish	*Ictalurus punctatus*	<1	**0.2**	1	**1.1**	1	**0.3**	2	**0.7**	4	**1.3**	8	**0.7**	3	**0.8**			10	**0.7**
Flathead catfish	*Pylodictis olivaris*			3	**3.2**	4	**2.2**	5	**1.8**	2	**0.9**	14	**1.3**	17	**4.8**			32	**2.1**
Suckermouth armored catfish	*Pterygoplichthys anisitsi*[a]					<1	**0.0**	<1	**0.2**	1	**0.3**	1	**0.1**	1	**0.3**			2	**0.2**
Striped mullet	*Mugil cephalus*	56	**19.2**	2	**1.7**	7	**3.8**	25	**9.7**	46	**16.7**	137	**12.2**	90	**25.2**			226	**15.1**
White bass	*Morone chrysops*	<1	**0.1**							1	**0.4**	2	**0.1**	1	**0.2**			2	**0.1**
Warmouth	*Lepomis gulosus*	<1	**0.0**	<1	**0.1**	<1	**0.0**	1	**0.4**	<1	**0.2**	2	**0.2**	<1	**0.0**	1	**2.9**	3	**0.2**
Bluegill	*Lepomis macrochirus*	<1	**0.1**	1	**0.6**	<1	**0.1**	1	**0.2**	1	**0.4**	3	**0.2**	1	**0.2**	<1	**1.2**	4	**0.2**
Longear sunfish	*Lepomis megalotis*	<1	**0.1**	<1	**0.3**	<1	**0.1**	<1	**0.1**	<1	**0.0**	1	**0.1**	<1	**0.0**	<1	**1.2**	1	**0.1**
Spotted bass	*Micropterus punctulatus*	1	**0.3**	1	**1.3**	1	**0.6**	4	**1.5**	1	**0.3**	8	**0.7**	1	**0.2**	<1	**0.7**	9	**0.6**
Largemouth bass	*Micropterus salmoides*	1	**0.2**					<1	**0.1**	<1	**0.1**	1	**0.1**	6	**1.6**	1	**5.3**	8	**0.5**
White crappie	*Pomoxis annularis*	<1	**0.1**	<1	**0.2**			1	**0.4**	1	**0.2**	2	**0.2**	1	**0.2**	1	**2.8**	3	**0.2**
Black crappie	*Pomoxis nigromaculatus*	1	**0.3**	1	**0.9**	<1	**0.0**	1	**0.5**	2	**0.7**	5	**0.5**	1	**0.2**	<1	**0.4**	6	**0.4**
Freshwater drum	*Aplodinotus grunniens*	7	**2.3**	2	**2.4**	3	**1.8**	1	**0.5**	4	**1.3**	17	**1.6**	<1	**0.1**			18	**1.2**
Rio Grande Cichlid	*Cichlasoma cyanoguttatum*[a]	<1	**0.0**	<1	**0.3**	1	**0.5**					1	**0.1**			<1	**1.8**	2	**0.1**
Southern flounder	*Paralichthys lethostigma*													1	**0.3**			1	**0.1**
Total		292		102		182		263		278		1116		355		24		1495	

(a) Weight was not recorded for specimens less than 10 grams.
(b) Exotic or introduced species

Table 2.4-10 (Sheet 1 of 2)
Benthic Macroinvertebrates Collected at Five Stations on the Guadalupe River, April–December 2008

Common Name	Family	Genus	GR-01		GR-02		GR-03		GR-04		GR-05		Total	
			#	%	#	%	#	%	#	%	#	%	#	%
Mayflies	Ephemeridae	*Hexagenia*	94	**20.5**	99	**9.7**	19	**0.5**	26	**11.4**	24	**20.0**	262	**4.8**
	Polymitarcyidae	*Tortopus*	6	**1.3**	1	**0.1**							7	**0.1**
		Campsurus			3	**0.3**	1	**0.0**	1	**0.4**			5	**0.1**
	Caenidae	*Cercobrachys*	2	**0.4**			1	**0.0**					6	**0.1**
		Caenis	1	**0.2**			7	**0.2**			1	**0.8**	9	**0.2**
		Brachycercus	8	**1.7**	1	**0.1**							9	**0.2**
	Palingeniidae	*Pentagenia vittegera*	5	**1.1**					4	**1.7**	1	**0.8**	10	**0.2**
	Baetidae	*Apobaetis*	1	**0.2**									1	**0.0**
Stoneflies	Perlidae		1	**0.2**									1	**0.0**
Caddisflies	Leptoceridae	*Oecetis*	2	**0.4**	4	**0.4**	2	**0.1**	2	**0.9**			10	**0.2**
		Nectopsyche			2	**0.2**	1	**0.0**					3	**0.1**
	Polycentropodidae	*Neureclipsis*					1	**0.0**					1	**0.0**
		Cyrnellus			1	**0.1**	3	**0.1**					4	**0.1**
	Hydroptilidae	*Hydroptila*					1	**0.0**			1	**0.8**	2	**0.0**
		Neotrichia					3	**0.1**					1	**0.0**
Dragonflies/ Damselflies	Gomphidae	*Gomphus*	5	**1.1**	1	**0.1**	2	**0.1**			4	**3.3**	12	**0.2**
		Dromogomphus			1	**0.1**							1	**0.0**
		Stylurus			2	**0.2**			2	**0.9**	2	**1.7**	6	**0.1**
	Coenagrionidae				1	**0.1**							1	**0.0**
		Argia			1	**0.1**							1	**0.0**
	Macromiidae	*Macromia*					1	**0.0**	1	**0.4**			2	**0.0**
Beetles	Scarabaeidae								1	**0.4**			1	**0.0**
	Elmidae	*Stenelmis*	6	**1.3**	11	**1.1**	13	**0.4**	4	**1.7**	6	**5.0**	40	**0.7**
		Dubiraphia	2	**0.4**	1	**0.1**			1	**0.4**	2	**1.7**	1	**0.0**
		Heterelmis	2	**0.4**			5	**0.1**					7	**0.1**
		Hexacylloepus			1	**0.1**					1	**0.8**	2	**0.0**
	Chrysomelidae				1	**0.1**							1	**0.0**
	Dryopidae	*Helichus*	1	**0.2**									1	**0.0**
Flies and midges	Ceratopogonidae	*Probezzia*	4	**0.9**			2	**0.1**					6	**0.1**
		Sphaeromias	8	**1.7**	10	**1.0**	7	**0.2**	14	**6.1**	6	**5.0**	45	**0.8**
		Culicoides									2	**1.7**	2	**0.0**
	Chironomidae	*Procladius*					1	**0.0**					1	**0.0**
		Ablabesmyia	1	**0.2**			3	**0.1**					4	**0.1**
		Microspectra	7	**1.5**									7	**0.1**
		Cryptochironomus	12	**2.6**	4	**0.4**	21	**0.6**	12	**5.2**	17	**14.2**	66	**1.2**
		Cryptotendipes							7	**3.1**			7	**0.1**
		Dicrotendipes			4	**0.4**			2	**0.9**	7	**5.8**	13	**0.2**
		Fissimentum			1	**0.1**							1	**0.0**
		Stelenchomyia									1	**0.8**	1	**0.0**
		Paracladopelma	1	**0.2**			1	**0.0**					2	**0.0**
		Polypedilum			12	**1.2**	6	**0.2**	7	**3.1**	2	**1.7**	27	**0.5**
		Chironomus			24	**2.4**	5	**0.1**					29	**0.5**
		Microchironomus			2	**0.2**	1	**0.0**					3	**0.1**
		Axarus	2	**0.4**			1	**0.0**	1	**0.4**	2	**1.7**	6	**0.1**
		Eukiefferiella			1	**0.1**							1	**0.0**
		Endochironomus	1	**0.2**									1	**0.0**
		Stictochironomus	2	**0.4**	7	**0.7**	2	**0.1**	5	**2.2**	2	**1.7**	18	**0.3**

Table 2.4-10 (Sheet 2 of 2)
Benthic Macroinvertebrates Collected at Five Stations on the Guadalupe River, April–December 2008

Common Name	Family	Genus	GR-01		GR-02		GR-03		GR-04		GR-05		Total	
			#	%	#	%	#	%	#	%	#	%	#	%
		Xestochironomus					3	**0.1**					3	**0.1**
		Epoicocladius			2	**0.2**							2	**0.0**
		Rheocricotopus					1	**0.0**					1	**0.0**
		Cardiocladius							1	**0.4**			1	**0.0**
		Larsia	3	**0.7**									3	**0.1**
		Ablabesmyia			3	**0.3**	1	**0.0**	1	**0.4**			5	**0.1**
		Tanypus			7	**0.7**			2	**0.9**	1	**0.8**	10	**0.2**
		Coelotanypus			5	**0.5**	1	**0.0**	9	**3.9**	2	**1.7**	17	**0.3**
		Paramerina	1	**0.2**	6	**0.6**	5	**0.1**	3	**1.3**	3	**2.5**	18	**0.3**
		Tanytarsus					1	**0.0**	1	**0.4**			2	**0.0**
		Cladotanytarsus							3	**1.3**			3	**0.1**
Molluscs	Corbiculidae		20	**4.4**	17	**1.7**	24	**0.7**	16	**7.0**	5	**4.2**	82	**1.5**
	Hydrobiidae		253	**55.1**	752	**73.9**	3412	**95.4**	96	**41.9**	23	**19.2**	4536	**84.0**
	Ancylidae				4	**0.4**							4	**0.1**
	Planorbidae	*Menetus*			1	**0.1**							1	**0.0**
	Unionidae		1	**0.2**	1	**0.1**	1	**0.0**					3	**0.1**
	Physidae		1	**0.2**	3	**0.3**	2	**0.1**	1	**0.4**			7	**0.1**
	Sphaeriidae		1	**0.2**	12	**1.2**	5	**0.1**	3	**1.3**			21	**0.4**
	Marine Gastropod								1	**0.4**			1	**0.0**
Leeches	*Subclass: Hirudinea*				2	**0.2**	4	**0.1**	1	**0.4**	1	**0.8**	8	**0.1**
Flatworms	Planariidae										1	**0.8**	1	**0.0**
Crustaceans	Palaemonidae	*Palaemonetes*	5	**1.1**	6	**0.6**			1	**0.4**			12	**0.2**
	Gammaridae	*Gammarus*					5	**0.1**			3	**2.5**	8	**0.1**
	Order: Podocopida				1	**0.1**	1	**0.0**					2	**0.0**
	Class: Branchiura						1	**0.0**					1	**0.0**
Segmented worms	*Phylum: Annelida*		P		P		P		P		P		P	
Totals			459		1018		3577		229		120		5403	

P = present

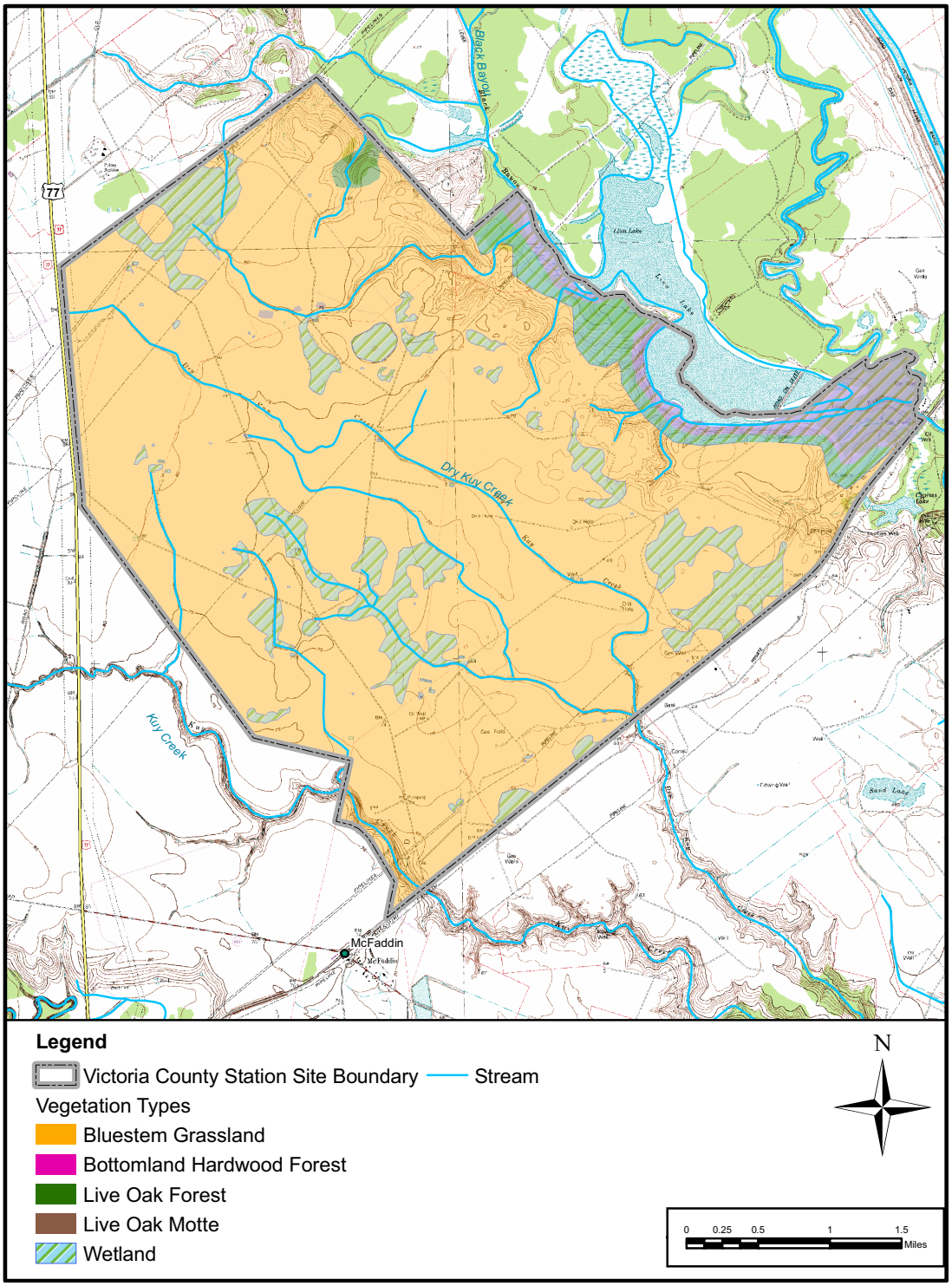

Figure 2.4-1 Habitat Types on the VCS Site

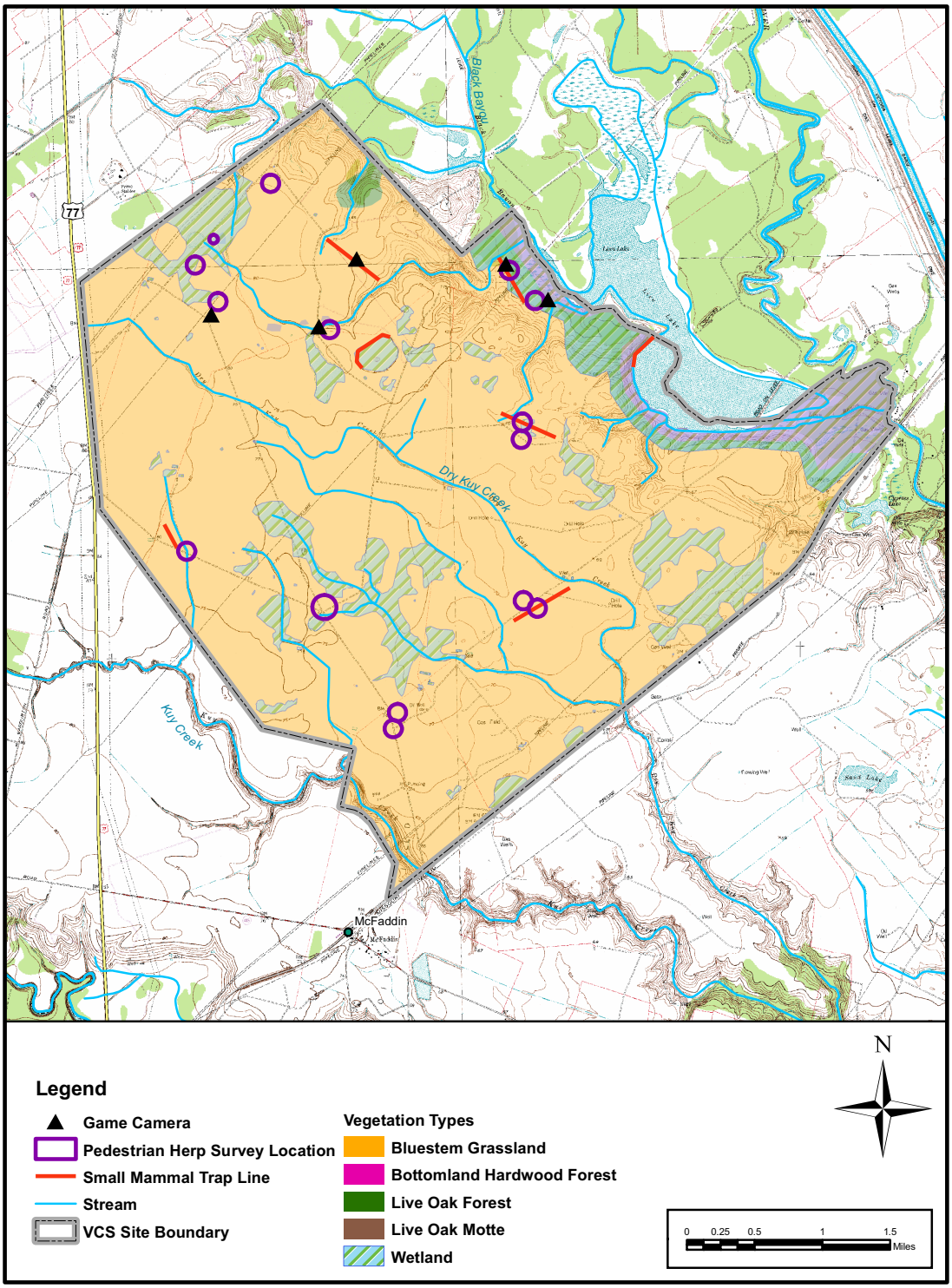

Figure 2.4-2 Locations of Herpetological and Mammal Surveys on the VCS Site

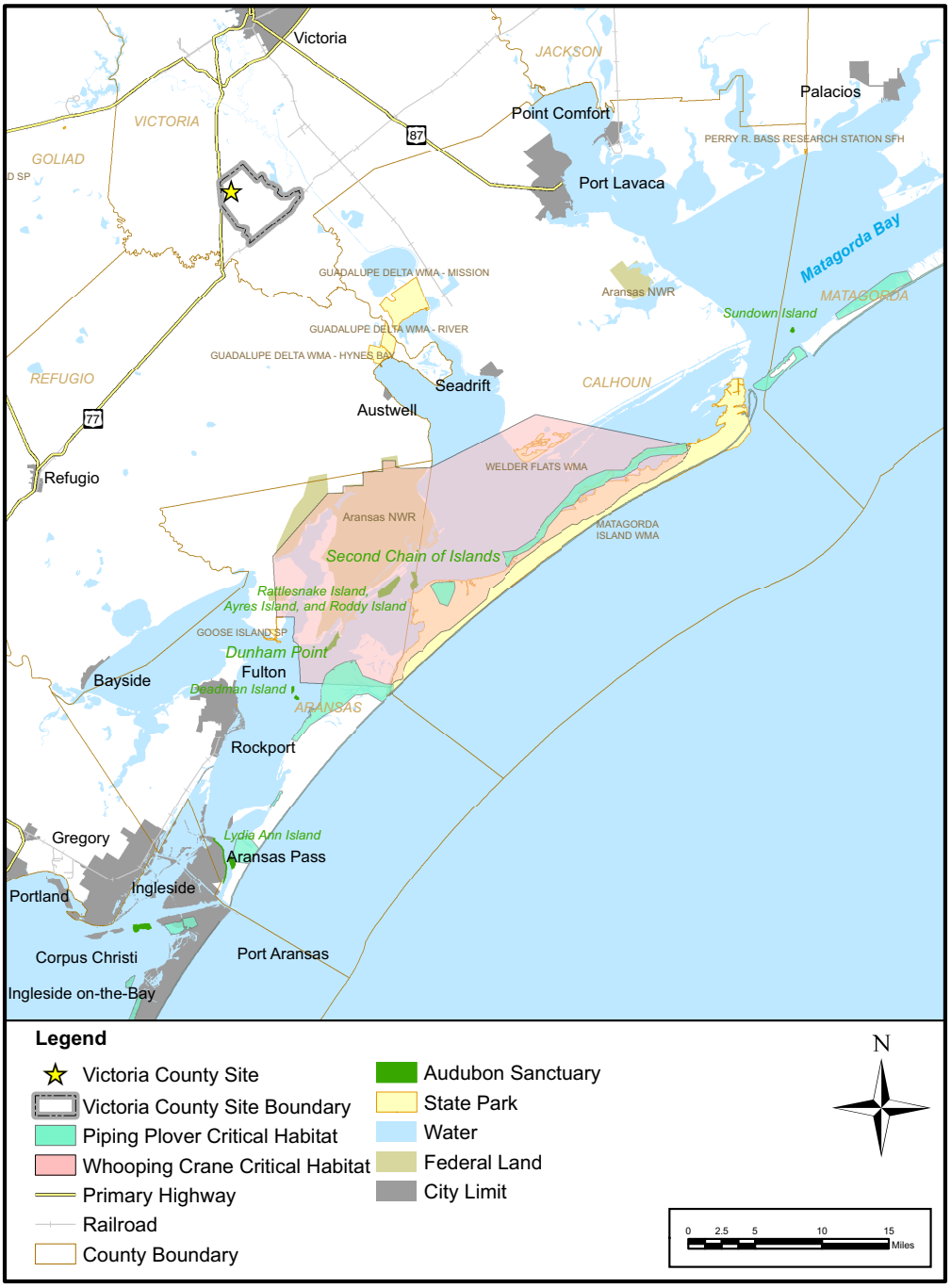

Figure 2.4-3 Critical Habitats, Parks, and Refuges Near the VCS Site

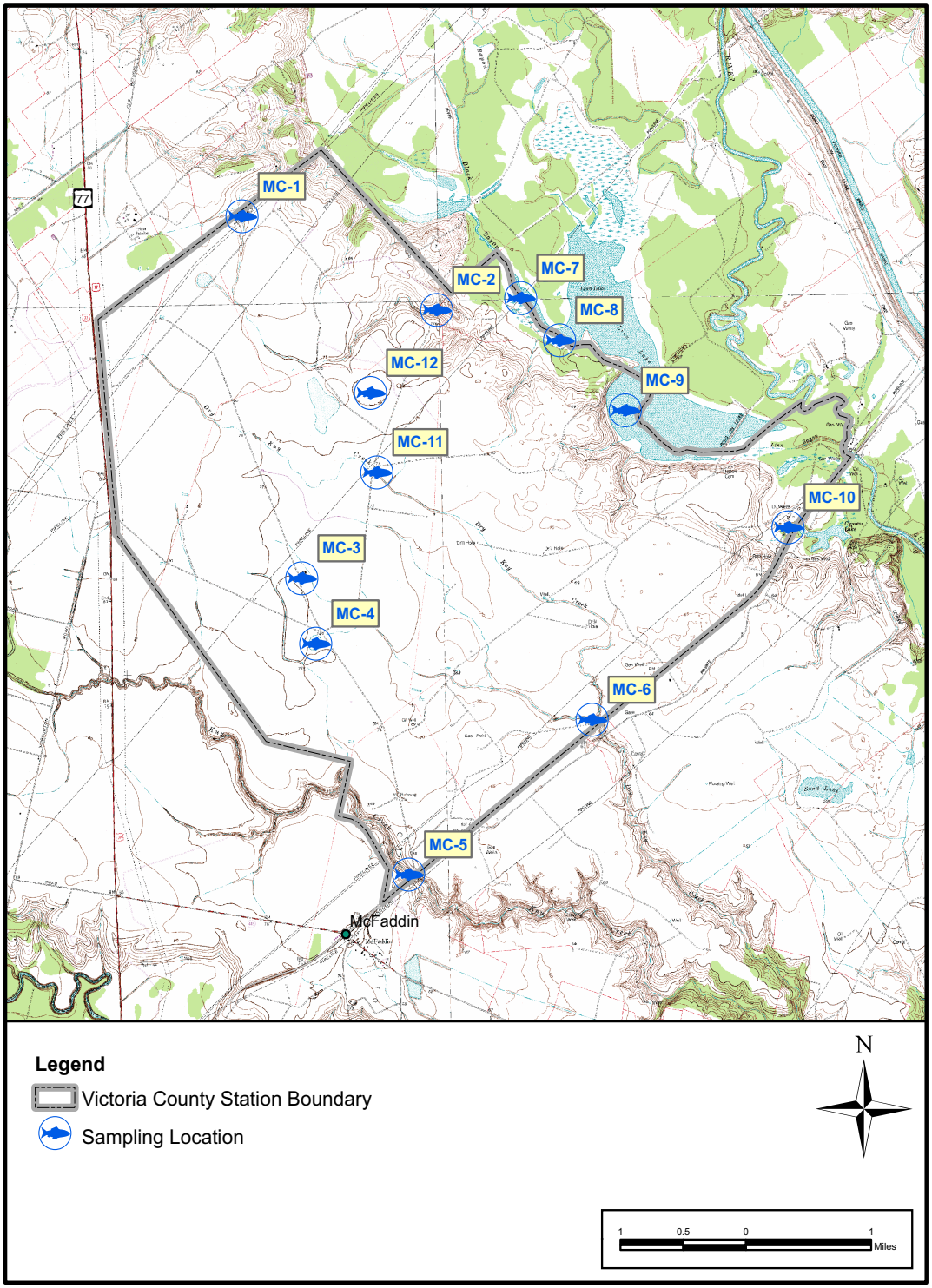

Figure 2.4-4 Onsite/Near-Site Fish Sampling Locations

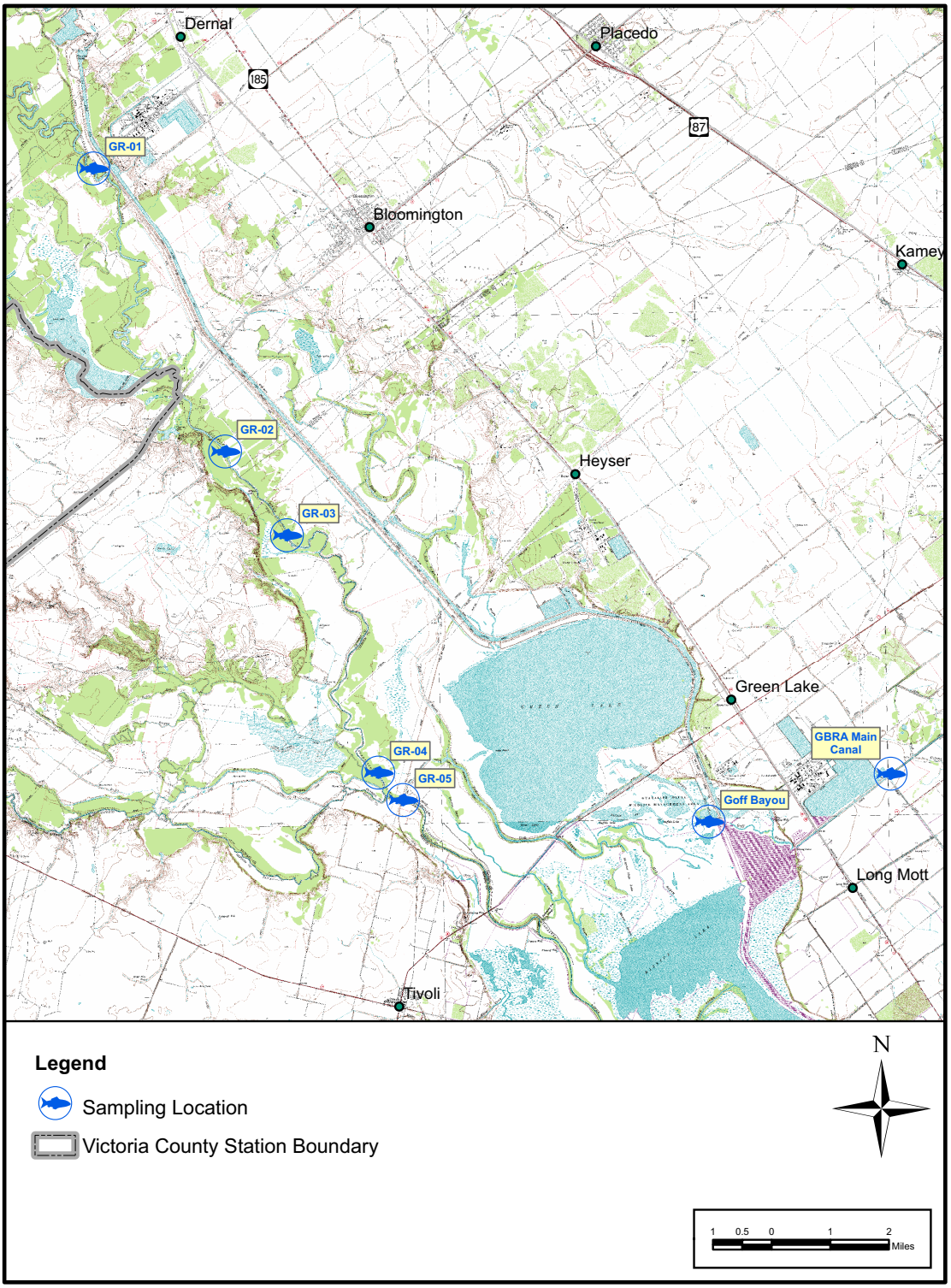

Figure 2.4-5 Guadalupe River and GBRA Canal System Sampling Locations