TABLE 1-3

Electric and Magnetic Field Calculations
Single Circuit 69 kV w/24.9 kV Underbuild (U/B) Hickory Forest to New Berlin
Single Pole Delta Tangent Design with 25-Ft Clearance to U/B

DIST (feet)	B MAX (mG)	E MAX (V/m)	Isc (milliamps)	L (feet)
-200	0.870	0.010	0.01	503,545
-175	1.130	0.020	0.02	251,772
-150	1.530	0.020	0.02	251,772
-125	2.170	0.030	0.02	167,848
-100	3.320	0.040	0.03	125,886
-75	5.640	0.070	0.05	71,935
-50	11.360	0.100	0.08	50,354
-45	13.460	0.100	0.08	50,354
-40	16.140	0.100	0.08	50,354
-35	19.600	0.090	0.07	55,949
-30	24.050	0.090	0.07	55,949
-25	29.720	0.110	0.08	45,777
-20	36.670	0.150	0.11	33,570
-15	44.490	0.190	0.14	26,502
-10	51.990	0.210	0.16	23,978
-5	57.340	0.200	0.15	25,177
0	59.020	0.170	0.13	29,620
5	56.660	0.180	0.14	27,975
10	51.000	0.210	0.16	23,978
15	43.580	0.230	0.17	21,893
20	35.990	0.230	0.17	21,893
25	29.280	0.210	0.16	23,978
30	23.780	0.180	0.14	27,975
35	19.440	0.150	0.11	33,570
40	16.060	0.130	0.10	38,734
45	13.420	0.110	0.08	45,777
50	11.340	0.090	0.07	55,949
75	5.630	0.060	0.05	83,924
100	3.310	0.040	0.03	125,886
125	2.160	0.030	0.02	167,848
150	1.520	0.020	0.02	251,772
175	1.130	0.020	0.02	251,772
200	0.870	0.010	0.01	503,545

Calculations are based on 69kV loads @ 43 amps/phase & 24.9kV loads @ 330 amps/phase.
"DIST" is distance in feet from transmission line centerline.
"B MAX" is maximum magnetic field in milligauss.
"E MAX" is maximum electric field in kiloVolts per meter.
"Isc" is calculated short-circuit current (milliamps) on a large tractor-trailor (compare to 5 milliamps).
"L" is calculated length (feet) of ungrounded fence for a short-circuit current of 5 milliamps.

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TABLE 1-4

Electric and Magnetic Field Calculations
Double Circuit 69 kV w/24.9 kV Distribution Underbuild (U/B) Hickory Forest to New Berlin
Single Pole Vertical Tangent Design with 25-Ft Clearance to U/B

DIST (feet)	B MAX (mG)	E MAX (V/m)	Isc (milliamps)	L (feet)
-200	0.830	0.005	0.00	1,007,089
-175	1.080	0.007	0.01	719,349
-150	1.480	0.009	0.01	559,494
-125	2.120	0.012	0.01	419,620
-100	3.300	0.016	0.01	314,715
-75	5.710	0.020	0.02	251,772
-50	11.680	0.053	0.04	95,008
-45	13.840	0.071	0.05	70,922
-40	16.580	0.096	0.07	52,453
-35	20.070	0.126	0.10	39,964
-30	24.500	0.160	0.12	31,472
-25	30.060	0.196	0.15	25,691
-20	36.740	0.226	0.17	22,281
-15	44.080	0.237	0.18	21,247
-10	50.880	0.217	0.16	23,205
-5	55.400	0.159	0.12	31,669
0	56.280	0.083	0.06	60,668
5	53.270	0.030	0.02	167,848
10	47.230	0.034	0.03	148,101
15	39.680	0.033	0.02	152,589
20	32.200	0.026	0.02	193,671
25	25.740	0.032	0.02	157,358
30	20.570	0.035	0.03	143,870
35	16.580	0.034	0.03	148,101
40	13.540	0.029	0.02	173,636
45	11.210	0.022	0.02	228,884
50	9.410	0.016	0.01	314,715
75	4.620	0.014	0.01	359,675
100	2.730	0.014	0.01	359,675
125	1.800	0.011	0.01	457,768
150	1.280	0.008	0.01	629,431
175	0.950	0.006	0.00	839,241
200	0.740	0.005	0.00	1,007,089

Calculations based on loads of 31 & 43 amps/phase (69kV) & 330 amps/phase (24.9kV).
"DIST" is distance in feet from transmission line centerline.
"B MAX" is maximum magnetic field in milligauss.
"E MAX" is maximum electric field in kiloVolts per meter.
"Isc" is calculated short-circuit current (milliamps) on a large tractor-trailor (compare to 5 milliamps).
"L" is calculated length (feet) of ungrounded fence for a short-circuit current of 5 milliamps.

1.6 CONSTRUCTION CONSIDERATIONS

Projects of this type require surveying and clearing, foundation installation, structure assembly and erection, conductor and shield wire installation, and cleanup when the project is completed.

1.6.1 Clearing

Any required clearing of the ROW will be performed under the direction of GVEC (Owner). Methods of disposal available are controlled burning, burying, mulching, and salvaging. The option selected will be in accordance with the landowner's wishes and often requires that cleared brush and trees be stacked and left for wildlife use. Trees in the ROW are cleared to ensure safe operation of the line. The ROW will be utilized for access during construction operations, with only a few cases where ingress and egress through private property is necessary. In these cases, existing private roads will be used where possible, but only with the agreement of the property owner. Temporary culverts will be used to cross creeks and tributaries.

Clearing plans, methods, and practices are extremely important for success in any program designed to minimize the adverse effects of electric transmission lines on the natural environment. The following factors, thoughtfully implemented and applied to this project, will help meet this goal:

1. Clearing will be performed in a manner which will maximize the preservation of natural beauty and the conservation of natural resources, and minimize marring and scarring of the landscape, or silting of streams.

2. Where ROWs enter dense woodlands from a meadow or cross major highways and rivers, clearing may be done in such a way that a screen of natural vegetation is left in the ROW on each side of the road or river. If natural vegetation or the location of a support structure is such that a screen cannot be left, the planting of low growing trees, native shrubs, etc., will be considered to provide screening.

3. The time and method of clearing ROWs will take into account soil stability, the protection of natural vegetation, and the protection of adjacent resources, such as natural habitat for wildlife and the prevention of silt deposition in water courses.

4. The use of a "Seppie" (flail mower), instead of bulldozers with dirt blades, may be used in clearing operations where such use will preserve the cover crop of grass, low-growing brush, and similar vegetation.

5. Trees and brush will be cleared in a straight path unless otherwise requested by a landowner.

1.6.2 Construction

The following is a description of typical construction methods for transmission line projects.

Survey crews will stake or otherwise mark structure locations. If foundations are to be installed into areas without solid rock, crews will either direct-embed structures or pour foundations utilizing augered circular holes, rebar cages, and anchor bolts or stubs

Crews will transport and assemble structures and related hardware. After the foundations have cured sufficiently, crews will set the structures. The usual procedure is to assemble each structure on its side, then lift the structure and set it on its base. However, taller structures may need to have sections assembled in the air. Sections are either jacked together or connected using bolts, which will be torqued to the recommended value. Where direct-embedded structures are used, crews will install them by augering oversized holes, lifting and setting the structure, and backfilling with native soils, select fill, or concrete, depending on soil conditions at the site (based on soils testing).

Although vehicular traffic is a very large part of this operation, construction crews will take care to minimize damage to the ROW by minimizing the number of pathways traveled.

Guard structures (temporary wood pole structures) will be installed near crossings such as distribution power lines, overhead telephone lines, roadways, and any other areas where there may be a safety hazard during wire installation. The conductors and shield wires are installed via a tensioning system. A rope is first threaded through the stringing blocks or dollies for each conductor and shield wire. Conductor and shield wires are then pulled by the ropes and held tight by a tensioner which essentially keeps the wires from coming in contact with the ground and other objects which could be damaging to the wire. When the wire is tensioned to the required sag, the wire is taken out of the blocks and placed in the suspension and dead-end clamps for permanent attachment.

The best environmental planning can be reversed or defeated by uncontrolled construction activities. The entire force employed by the Owner's crews and/or contractors should be geared to the preservation and enhancement of natural beauty and the conservation of natural resources. The following criteria will help to attain this goal. (These criteria are subject to adjustment befitting the rules and judgments of any public agencies whose lands may be crossed by the proposed line.)

1. Clearing and grading of construction areas such as storage areas, setup sites, etc. will be minimal. These areas will be graded in a manner which will minimize erosion and conform to the natural topography.

2. Borrow areas, if any, will be located away from public view. These areas will be restored to such condition that erosion will be avoided and their appearance is

acceptable. Borrow pits can be tastefully blended into the natural landscape. The Owner will work with landowners on the location and restoration of these areas.

3. Soil which has been excavated during construction and not used will be evenly backfilled onto a cleared area or removed from the site. The backfilled soil will be sloped gradually to conform with the terrain and the adjacent land. If natural seeding will not provide ground cover in a reasonable length of time, appropriate vegetation may be planted.

4. Erosion control devices will be constructed where necessary to prevent soil erosion in the ROW.

5. Roads will be provided with side drainage ditches and culverts to prevent soil or road erosion as required.

6. Roads will not be constructed on unstable slopes. Where feasible, service and access roads will be constructed jointly.

7. Clearing and construction activities in the vicinity of stream beds will be performed in a manner to minimize damage to the natural condition of the area.

8. Every effort will be made to avoid oil spills and other types of pollution, particularly while performing work in the vicinity of streams, lakes and reservoirs.

9. Water used for construction purposes and taken from streams or other bodies of water will be limited to volumes which will not cause harm to the ecology or aesthetics of the area.

10. Every precaution will be taken to prevent the possibility of accidentally starting range or forest fires. Full compliance with fire laws and regulations is a necessity.

11. Tension stringing of conductors may be employed where possible to reduce the amount of vegetation clearing before final conductor locations are established. Helicopters may be considered for use in otherwise inaccessible areas, as well as in areas where clearing may be prohibited.

12. When possible, in areas of high wildlife use or in areas of known endangered or threatened species habitat, construction will be performed during seasons of low wildlife occurrence, such as between periods of peak waterfowl migrations (generally spring and fall) and during non-breeding season (species dependent).

13. Soil disturbance during construction will be kept to a minimum.

1.6.3 Cleanup

The cleanup operation involves the leveling of all disturbed areas, the removal of all debris and the restoration of any items damaged by the construction of the project. All unavoidable damages will be referred to the Owner's department responsible for landowner relations for mitigation.

The following criteria provide for the cleanup of construction debris and the restoration of the area's natural setting. Further requirements may be imposed by land management agencies and/or private property owners whose land the line crosses.

1. If cleared vegetation is mulched, it may be spread out over ROW, given to landowner or nursery as a product for beneficial use or picked up and taken to a landfill. In all cases, erosion control devices will be maintained and inspections conducted until site is 70% revegetated.

2. If temporary roads are removed, the original slopes will be restored and planted with natural ground cover.

3. Seeding of restored areas will be accomplished as required to encourage growth of grasses and other vegetation which is ecologically desirable.

4. Construction equipment, supplies, and personal property will be dismantled and removed from the ROW when construction is completed.

5. Burning is to be used as a means of disposal only where no practical alternative exists. Any material to be burned will be piled in a manner and in locations that will cause the least fire risk. Care will be taken to prevent fire or heat damage to desirable trees and shrubs within and adjacent to the ROW and substation. Burning will conform with local fire and air quality regulations.

6. Consideration will be given to the establishment of native vegetation of value as food and cover for wildlife.

7. If it is necessary to clear down to the mineral soil, the topsoil will be saved, replaced and stabilized without undue delay by the appropriate seeding of grasses, shrubs and other native vegetation compatible with the surrounding ground cover.

8. Construction waste, with the exception of cleared vegetation, will be removed prior to completion of the project.

9. Replacement of soil adjacent to water crossings for access roads will be at slopes less than the normal angle of repose for the soil type involved. Sodding or seeding will be accomplished without undue delay.

10. Where site factors make it unusually difficult to establish a protective vegetative cover, other restoration procedures may be advisable, such as the use of gravel, rocks, concrete, etc.

1.7 MAINTENANCE CONSIDERATIONS

Periodic inspection of the ROW, structures, and line will be performed by GVEC's Line Maintenance Department in order to provide a safe and reliable power line. The major maintenance item will be the trimming of trees that pose a potential danger to the conductors or structures. Preservation of both the environmental and natural resource conservation factors designed and built into transmission system siting require a thoughtful, comprehensive program for maintaining the facility. The following factors are incorporated into the Owner's program for this project.

1. Native vegetation, particularly that of value to fish and wildlife, which has been saved through the construction process and which does not pose a hazard to the safe operation and maintenance of the transmission line, will be allowed to grow in the ROW. Native grass cover and low-growing shrubs will be maintained if ecologically appropriate, in the areas immediately adjacent to transmission structures.

2. Once a cover of vegetation has been established, it will be properly maintained for the safe operation and maintenance of the ROW.

3. Access roads and service roads, where permitted, will be maintained with native grass cover. Where grading is necessary, roads will be graded to the proper slope in order to prevent soil erosion.

4. If used, EPA approved herbicides will be carefully selected to have a minimum effect on desirable indigenous plant life, and selective application will be used whenever appropriate. To preserve the natural environment, it is essential that herbicides be applied in a manner fully consistent with the protection of the entire environment, particularly the health of humans and wildlife.

5. Maintenance inspection intervals will be established and routine maintenance will be encouraged when access roads are firm or dry. Maintenance vegetative clearing in particularly critical areas shall be done on a short cycle to satisfy minimal requirements and avoid heavy, long-term cutbacks.

6. Aerial and ground maintenance inspection activities of the transmission line facility will include observation of soil erosion problems, fallen timber and conditions of the vegetation which require attention. Where necessary on the basis of erosion control, native shrubs or grasses may be planted.

7. Public acceptance of ROWs is generally broadened when compatible multiple use of the ROW is allowed. Transmission line ROWs can be made available for appropriate types of multiple use concepts, such as farming and cattle grazing, as long as the activity does not inhibit the safe operation and maintenance of the electrical system.

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2.0 ENVIRONMENTAL SETTING

2.0 ENVIRONMENTAL SETTING

PBS&J, with input and assistance from GVEC and the LCRA, delineated a study area for the proposed project, an area within which to study the existing environment and eventually locate alternative routes. The boundaries of this study area were dictated by the location of the Hickory Forest and New Berlin substations, other existing ROW (roads, transmission lines, etc.), and existing cultural and land use features. The study area needed to be large enough to contain several potential alternative routes. The study area, shown on Figure 2-1, is a roughly rectangular area approximately 6 miles (north to south) by 12 miles (east to west) and covering approximately 91,000 acres (ac) in Guadalupe County, Texas.

2.1 PHYSIOGRAPHY

As shown in Figure 2-2, Guadalupe County is located within a transitional zone between the Blackland Prairie and Interior Gulf Coastal Plain physiographic regions of Texas (Bureau of Economic Geology (BEG), 1977). The Blackland Prairie Region extends in a belt-like fashion along the inner margin of the Gulf Coastal Plains from near Uvalde, in south Texas, to the Oklahoma state line northeast of Dallas. The Blacklands cross the northwestern portion of Guadalupe County where the deep, fertile black clay soils have historically supported an intense agricultural industry. The Gulf Coastal Plain is the southern element of an elevated former sea bottom characterized by low topographic relief, marshy tracts, elevations below 500 ft, and sedimentary geologic formations. The Gulf Coastal Plain was formed during the Cenozoic Era when cycles of transgression and regression of the ancestral Gulf of Mexico deposited sands, shales, clays, and marls (Sellards, et al.,1932).

The study area lies to the east of the Balcones Escarpment, which is a line of dissected hills marking the main line of displaced bedrock across the Balcones Fault Zone. This escarpment, formed by the crustal sheering and uplifting of cretaceous limestone strata along the Balcones Fault Zone, marks the boundary between the hilly Edwards Plateau to the west, and the rolling prairies of the Gulf Coastal plain to the east (Swanson, 1995). Differences in almost all natural land attributes including climate, topography, vegetation, and precipitation are noticeable along this border. The terrain west of the escarpment consists of highly erosive, stoney soils with numerous rock outcroppings and an abundance of grasses that support a productive ranching industry. By contrast, a gently rolling terrain composed of deep fertile soils that support various agricultural activities characterizes the landscape east of the escarpment.

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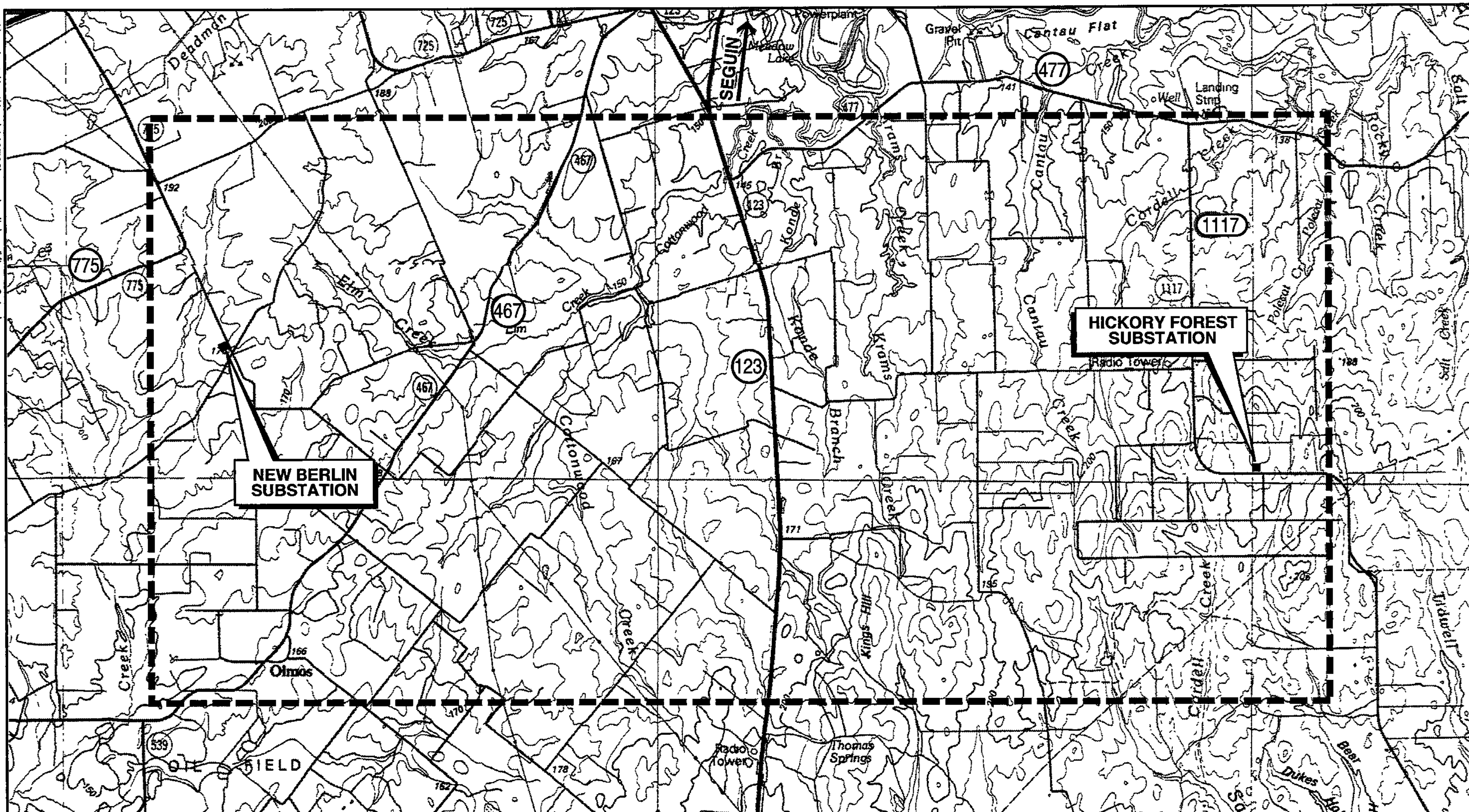

north

1 0 1 2 miles

Base Map: USGS 1:100,000 Quadrangles; Cuero, New Braunfels, San Antonio and Seguin, Texas

STUDY AREA BOUNDARY

PBSJ
• Engineering
• Environmental Consulting
• Surveying

Figure 2-1

STUDY AREA LOCATION

HICKORY FOREST - NEW BERLIN

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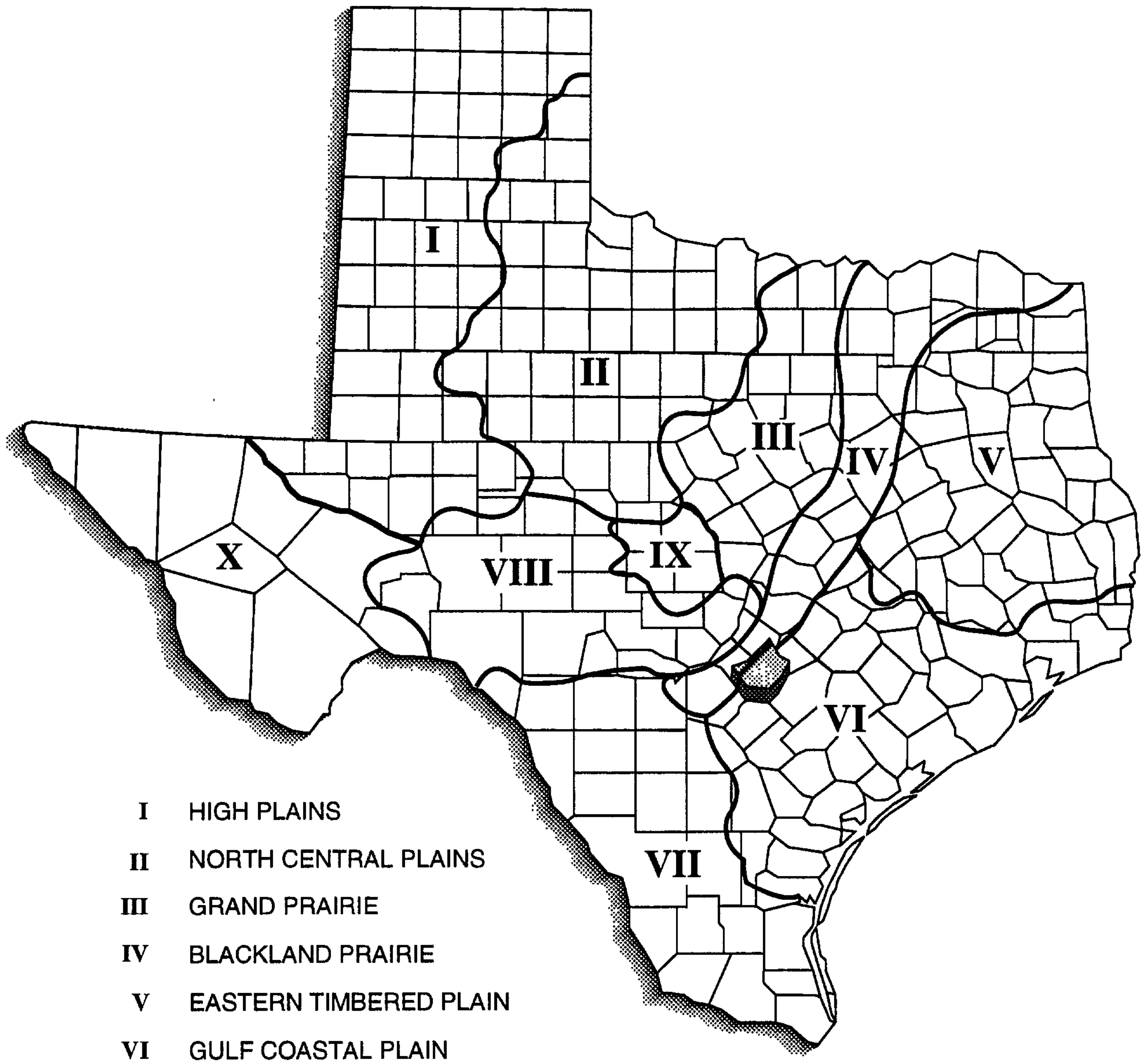


I HIGH PLAINS

II NORTH CENTRAL PLAINS

III GRAND PRAIRIE

IV BLACKLAND PRAIRIE

V EASTERN TIMBERED PLAIN

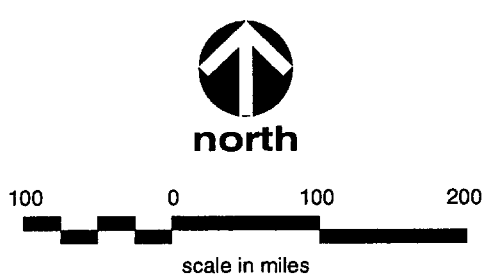
VI GULF COASTAL PLAIN

VII RIO GRANDE PLAIN

VIII EDWARDS PLATEAU

IX LLANO BASIN

X TRANSPECOS BASIN & RANGE



Source: BEG, 1970/1977

PBSJ
• Engineering
• Environmental Consulting
• Surveying

Figure 2-2

LOCATION OF GUADALUPE COUNTY
IN RELATION TO THE
PHYSIOGRAPHIC REGIONS OF TEXAS
HICKORY FOREST - NEW BERLIN

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U5

Regionally, the Blackland Prairie and Interior Gulf Coastal Plain form an upland terrain that slopes gently toward the coast, and which is dissected by a dendritic network of southeast-flowing rivers and streams. Within the study area, however, the land surface is hilly to nearly flat. Elevations of the land surface range from about 440 ft above mean sea level (msl) along tributaries near the Guadalupe River, to over 700 ft above msl in the higher elevations (hilly areas in the southeast). Prominent physiographic features in the study area are broad, flat, alluvial and fluviatile terrace plains.

2.2 GEOLOGY

Sedimentary strata deposited along the inner (landward) margin of the Gulf Coast geosyncline during the Early Tertiary Period characterize the geology of the study area. The lithologies of the sediments reflect different depositional environments including continental (alluvial plain), transitional (delta, lagoon, and beach), and marine (continental shelf). In profile, these strata occur as a series of truncated wedges that dip gently and thicken toward the coast. In plan view, the strata crop out in belts that roughly parallel the Texas coastline with successively younger strata exposed southeast of older strata. The strata are differentiated into formations that, from oldest to youngest, include the Eocene-age Wilcox and Carrizo sand groups of the Tertiary Period, the Late Pleistocene Fluviatile terrace deposits, and recent alluvium deposits of the Quaternary Period (BEG, 1974).

The Wilcox Group, which outcrops in roughly the western half of the study area, is mapped as an irregular band that varies in width from 1 to 4 miles. The Wilcox consists of about 1,250 ft of clay, silt, fine- to medium-grained sand, sandy shale, and thin beds of lignite. The sandstone units in the upper part are 5 to 30 ft thick; while in the lowermost part the sandstone units are a few inches to 10 ft thick. The individual beds are lenticular and are difficult to correlate, which results from the sediments having been deposited in channel and lagoon environments by meandering rivers.

The Carrizo Sand Group parallels the Wilcox Group to the south, and has a width of 2 miles to 4 miles in the eastern end of the study area. The Carrizo Sand is described as thick-bedded, poorly sorted, noncalcareous, medium- to very coarse-grained sandstone at a thickness of about 100 ft to 140 ft. Locally, it contains bands of iron-oxide.

Fluviatile terrace deposits outcrop in one relatively small area in the north-central portion of the study area along Cottonwood Creek near its confluence with the Guadalupe River. The deposits, occurring along stream terraces, may consist of three or more levels, which may correspond to coastal Pleistocene units. Units include gravel, sand, silt, and clay in various proportions, with gravel dominating the older, higher terraces. These terraces can be up to 50 ft thick in some areas.

2.3 SOILS

2.3.1 Soil Associations

The Soil Survey of Guadalupe County indicates four general soil associations within the study area (Soil Conservation Service (SCS) [now the Natural Resources Conservation Service (NRCS)], 1977). Dominating the study area, the Crockett-Demona-Windthorst Association includes deep, moderately well-drained, gently sloping loamy to sandy soils on uplands. The Sunev-Seguin Association is made up of deep, loamy soils over alluvial surfaces along the floodplain and low terraces of the Guadalupe River in the northern portion of the study area. The Patilo-Arenosa Association found within the southeastern portion of the study area, includes deep, well-drained, sloping, sandy soils on uplands. The Houston Black-Heiden Association, in the northwestern portion of the study area, consists of deep, moderately well drained to well drained, gently sloping to moderately steep, clayey soils on uplands.

2.3.2 Prime Farmland Soils

"Prime farmland" is defined by the Secretary of Agriculture in 7 CFR (Federal Register Vol. 43, No. 21) as land having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Prime farmlands are those having the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops, when properly managed, including water management (SCS, 1978). Prime farmland includes cropland, pastureland, rangeland, and forestland, but does not include land converted to urban, industrial, transportation, or water uses. Unique farmlands are those whose value is derived from their particular advantages for growing specialty crops. Statewide and locally important farmlands are defined by the appropriate state or local agency as important for the production of food, feed, fiber, forage, or oilseed crops. Other lands are generally not suited to crop production without applying extensive management.

Of the total land area of the county (approximately 457,024 ac), 175,724 ac (or 38%) are estimated to be prime farmland soils (SCS, 1979). Of the 26 soil-mapping units within the study area, 11 have been identified as prime by the SCS. These are areas with the proper soil conditions for farmlands, although some areas are not currently cultivated or have not recently been cultivated.

2.4 MINERAL AND ENERGY RESOURCES

Mineral resources in the study area are primarily limited to near-surface deposits of alluvial sand and gravel that is used for construction aggregate, ceramic clay, and caliche. Areas of sand and gravel extraction occur along the floodplain and terrace complexes of the Guadalupe River and its tributaries (BEG, 1979). One gravel pit is documented within the study area.

Also within the study area, petroleum is the chief exploitable energy resource produced (BEG, 1976). Several oil wells are located in the southwestern portion of the study area.

2.5 WATER RESOURCES

2.5.1 Surface Water

The study area lies primarily within the central portion of the Guadalupe River Basin. The Guadalupe River Basin extends from its headwaters in southwestern Kerr County and flows southeasterly to the San Antonio Bay system on the Gulf of Mexico. It is bounded on the north by the Colorado River Basin, on the east by both the Lavaca River Basin and the Lavaca-Guadalupe Coastal Basin, and on the south by the San Antonio River Basin. The total drainage area of the Guadalupe River Basin is 6,070 square miles (Texas Department of Water Resources (TDWR), 1984). The westernmost portion of the study area drained by Elm Creek falls within the San Antonio River Basin.

The Guadalupe River roughly parallels the northern study area boundary. Elm Creek, Cottonwood Creek, Konde Branch, Krams Creek, Cantau Creek, and Cordell Creek are the major tributaries of the Guadalupe River within the study area. These features and their associated intermittent tributaries drain the majority of the study area northward to the Guadalupe River. Several other small tributaries of the Guadalupe River drain the study area to the southeast. A second stream, also named Elm Creek (and its associated tributaries) drain the western portion of the study area southwest to the San Antonio River.

2.5.2 Floodplains

According to the Federal Emergency Management Agency's (FEMA) detailed flood hazard boundary maps for Guadalupe County (1995), several 100-year floodplains exist within the study area. They are located primarily along Cottonwood Creek, Elm Creek, Konde Branch, Krams Creek, and Cantau Creek. None of the mapped 100-year floodplains within the study area are wider than 3,000 ft.

2.5.3 Ground Water

The study area lies over an outcrop of the Carrizo-Wilcox Aquifer. The Wilcox Group and the overlying Carrizo Formation of the Claiborne Group form this hydrologically connected system. The Carrizo-Wilcox aquifer is composed of sand, locally interbedded with gravel, silt, clay, and lignite deposited during the Tertiary Period.

The Wilcox supplies small to large quantities of ground water at depths ranging from about 50 ft near the outcrop to about 2,800 ft near the southeast corner of Caldwell County. Ground water yields reported for wells located in the vicinity of the study area have typically ranged from more than 500 gallons/minute (gpm) to less than 50 gpm. Well yields of as much as 2,000 gpm have been reported for the Wilcox in areas further south and east of the study area, typically in areas where the Carrizo Sand overlies the Wilcox and the two units are considered a single hydrologic unit. Water quality in the Wilcox is generally fresh to moderately saline. Ground water below a depth of 200 ft is generally fresh, whereas water above that level ranges from fresh to moderately saline. Hardness and iron content are the major water quality problems in the use of water from the Wilcox. Most wells completed in the Wilcox yielded hard to very hard ground water with iron concentrations ranging from 0.3 milligrams/liter (mg/l) to 38 mg/l (Texas Water Development Board (TWDB), 1995).

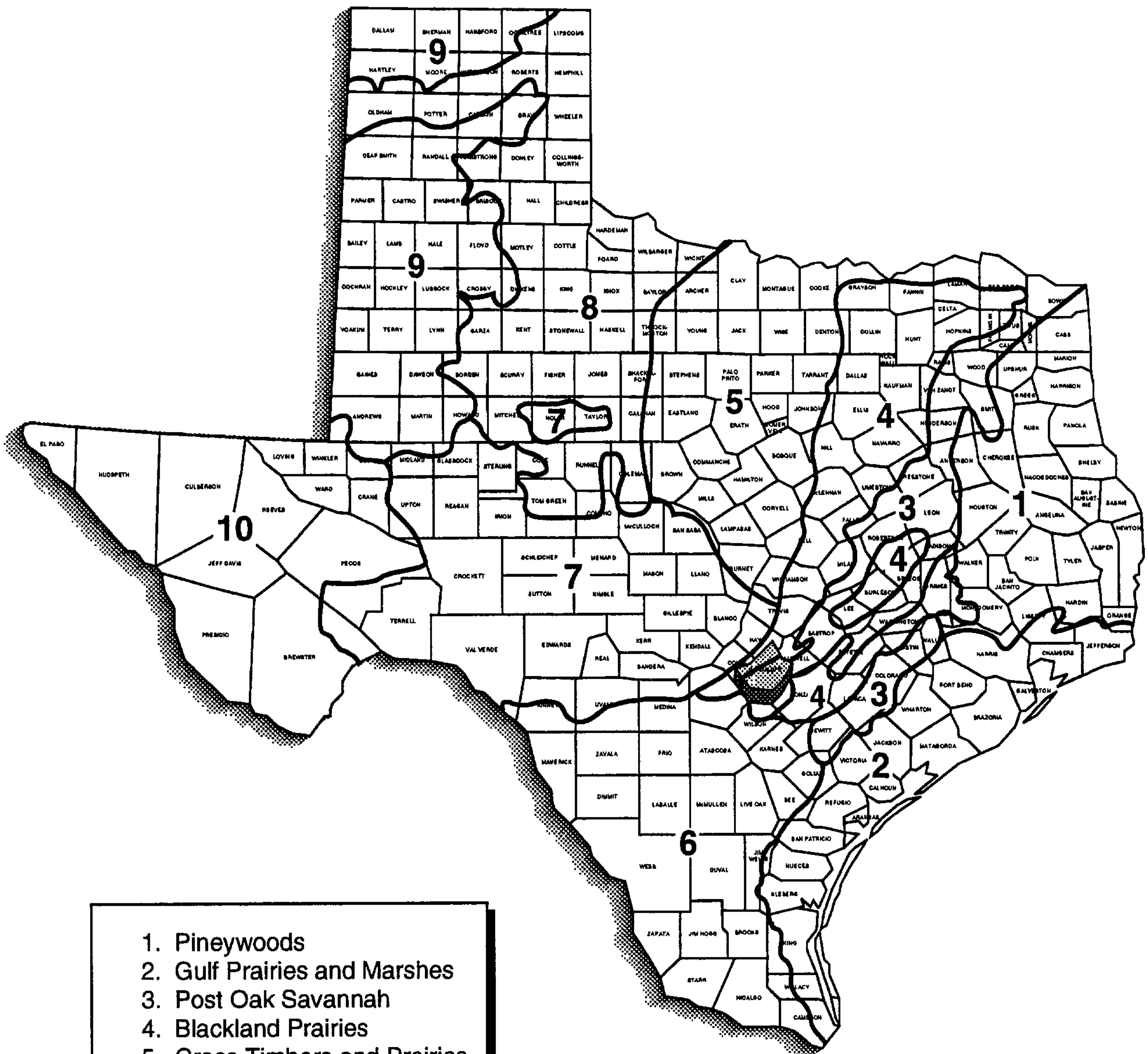
2.6 ECOLOGICAL RESOURCES

2.6.1 Vegetation Communities

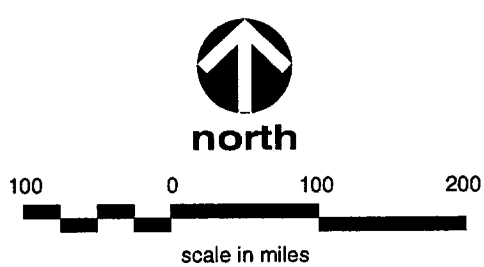
As illustrated on Figure 2-3, Guadalupe County is located within the Blackland Prairies and Post Oak Savannah vegetational regions of Texas, according to Hatch et al., (1990). The study area occurs within a transitional zone between these two regions but is predominantly within the Post Oak vegetational area. The boundary between the Blackland Prairies and the Post Oak Savannah vegetational areas is poorly defined as the vegetation composition is very similar along the boundary.

The Blackland Prairies vegetational area is characterized by gently rolling to nearly level topography with elevations ranging from 300 to 800 ft. The well-dissected terrain within the region allows for rapid surface drainage. This prairie region once supported a tallgrass prairie dominated by little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), sideoats grama (*Bouteloua curtipendula*), and tall dropseed (*Sporobolus asper* var. *asper*). The soils of the Blackland Prairies are extremely fertile and have largely been converted to cropland or tame pastures, although remnants of native vegetation communities are found and are often used as rangeland (Thomas, 1975; Hatch et al., 1990).

The Post Oak Savannah vegetational area covers approximately 8.5 million ac and consists of gently rolling to hilly terrain. The elevations are similar to the Blackland Prairies region and within the area loamy prairie soils occur on uplands. The two dominant tree species of the Post Oak Savannah are post oak (*Quercus stellata*) and blackjack oak (*Quercus marilandica*). The oaks maintain their present distribution due to the favorable moisture-holding characteristics of the sandy soils. Most of the Post Oak Savannah is in improved pasture or in native pastures intermingled with blocks of oak-hickory woodlands. The prairie climax grasses remaining include little bluestem, Indiangrass, switchgrass, purpletop (*Tridens flavus*), and species of Chasmanthium. Aside from post oak and blackjack oak, elms (*Ulmus* spp.), sugar hackberry (*Celtis laevigata*), hickories (*Carya* spp.), and eastern red cedar (*Juniperus virginiana*) are scattered among the relatively short oaks. This region has been



1. Pineywoods
2. Gulf Prairies and Marshes
3. Post Oak Savannah
4. Blackland Prairies
5. Cross Timbers and Prairies
6. South Texas Plains
7. Edwards Plateau
8. Rolling Plains
9. High Plains
10. Trans-Pecos



Source: Hatch et al., 1990

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Figure 2-3

LOCATION OF GUADALUPE COUNTY IN RELATION TO THE VEGETATIONAL AREAS OF TEXAS

HICKORY FOREST - NEW BERLIN

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extensively farmed developed into managed pastures (Thomas, 1975; Hatch et al., 1990), although some areas have returned to native grassland.

A major vegetation community within the study area is grassland habitat. This community consists of grasslands of variable species composition and management conditions, including: improved pasturelands under various management conditions; grasslands that may also be considered abandoned pastures (since native species have become reestablished) but may still remain under some management practices; and ROWs (along roadways and on utility easements). Most of the grassland acreage appears to be under minimal management and overgrazing is evident, as characterized by a dominance of Texas winter-grass (*Stipa leucotricha*), threeawn (*Aristida* sp.), and silver bluestem (*Bothriochloa saccharoides*) in many areas. Remnant native grassland communities are rare or non-existent within the study area due to the extent of agricultural development.

Croplands are scattered throughout the study area, but only to a small extent. Oats, wheat, corn, and sorghum are the most commonly planted crop species in the county. Hay production is also evident throughout the study area, combined with livestock grazing. Brushland communities occur where woody species have been allowed to regenerate in areas that had been previously converted to cropland or pastureland. The absence of land management practices has resulted in the colonization of native, woody species, as well as invasive plant species that tend to populate disturbed areas. Honey mesquite (*Prosopis glandulosa*), Texas persimmon (*Diospyros texana*), eastern red cedar, and Texas colubrina (*Colubrina texensis*) are dominant shrubs throughout the study area. Additional shrubby species that are common in the study area include elbowbush (*Forestiera pubescens*), little-leaf sumac (*Rhus microphylla*), and common hoptree (*Ptelea trifoliata*). Relatively large blocks of mature honey mesquite and eastern red cedar characterize a few areas. Most of these areas are subject to livestock grazing.

Upland woodland communities found within the study area are mainly dominated by post oak and blackjack oak, and typically include other tree species such as live oak (*Quercus virginiana*), cedar elm (*Ulmus crassifolia*), sugar hackberry, and eastern red cedar. Shrub species associated with upland woodlands include yaupon (*Ilex vomitoria*), American beautyberry (*Callicarpa americana*), and coralberry (*Symphoricarpus orbiculatus*). Upland woodlands are also subject to livestock grazing.

Bottomland/riparian and hydric habitats within the study area occur primarily along the banks and edges of streams and stock ponds. Riparian habitat, which consists of narrow bands of woody vegetation occurring immediately adjacent to streams or within the channel of a relatively narrow floodplain, is of minor extent within the study area, with most streamside woodlands being undifferentiated in character from upland woodlands. Due to agricultural development, urban development, or intensive grazing, the remaining riparian habitat consists of mature woody species, which were either left when areas were cleared for agriculture or were too woody or large in size to be affected by livestock grazing. Black willow (*Salix nigra*), American elm (*Ulmus americana*), cedar elm, pecan (*Carya illinoinensis*), live oak, osage orange (*Maclura pomifera*), and sugar hackberry are found along the streambanks.

Much of the remaining woodlands found within the study area consist of fencerow vegetation. Fencerow habitat typically includes sugar hackberry, eastern red cedar, live oak, honey mesquite, and shrub species, such as Texas persimmon, elbowbush, Texas colubrina, and an occasional Trecul yucca (*Yucca treculeana*).

Hydric habitat typically includes herbaceous wetland plant species associated with streams, impoundments, and topographic lows. Hydric habitats occur in the study area that are considered to be jurisdictional wetlands by the U.S. Army Corps of Engineers (USACE). If these areas meet the criteria of jurisdictional wetlands pursuant to Section 404 of the Clean Water Act, certain activities (e.g., placement of fill) within these habitats are subject to USACE regulation. Spikerush (*Eleocharis* spp.), sedges (*Carex* spp.), and cocklebur (*Xanthium* sp.) are typical species occurring within the floodplains of the creeks and along the edges of the ponds.

Aquatic habitat includes those areas which are predominantly water-covered (e.g., lakes, rivers, ponds, and major streams). The vegetation associated with these water bodies is very minor within the study area. As most ponds in the area are subject to livestock grazing, very few hydric or aquatic species remain. However, occasional species found within this habitat include pondweed (*Potamogeton* sp.) and cattail (*Typh*a sp.), along with black willow, spikerush, and sedge.

2.6.2 Wildlife

Guadalupe County lies at the junction of the Texan Biotic Province, the Balconian Biotic Province, and the Taumaulipan Biotic Province, as described by Blair (1950) and illustrated in Figure 2-4. This transitional region is recognized as a broad ecotone between the forests of the Austroriparian and Carolinian provinces of eastern Texas and Oklahoma and the grasslands of the western parts of these states. The vertebrate fauna of the study area is represented by a mixture of species from the Austroriparian, Tamaulipan, Chihuahuan, Kansan, Balconian, and Texan biotic provinces. Several major wildlife habitat types, which closely coincide with the vegetational communities described above, occur within the study area. These habitat types include pastureland, open savannah, upland woodlands, and riparian woodlands.

Pastureland habitats within the study area support many faunal species common to the region. Mammalian species characteristic of this habitat type include the eastern cottontail (*Sylvilagus*

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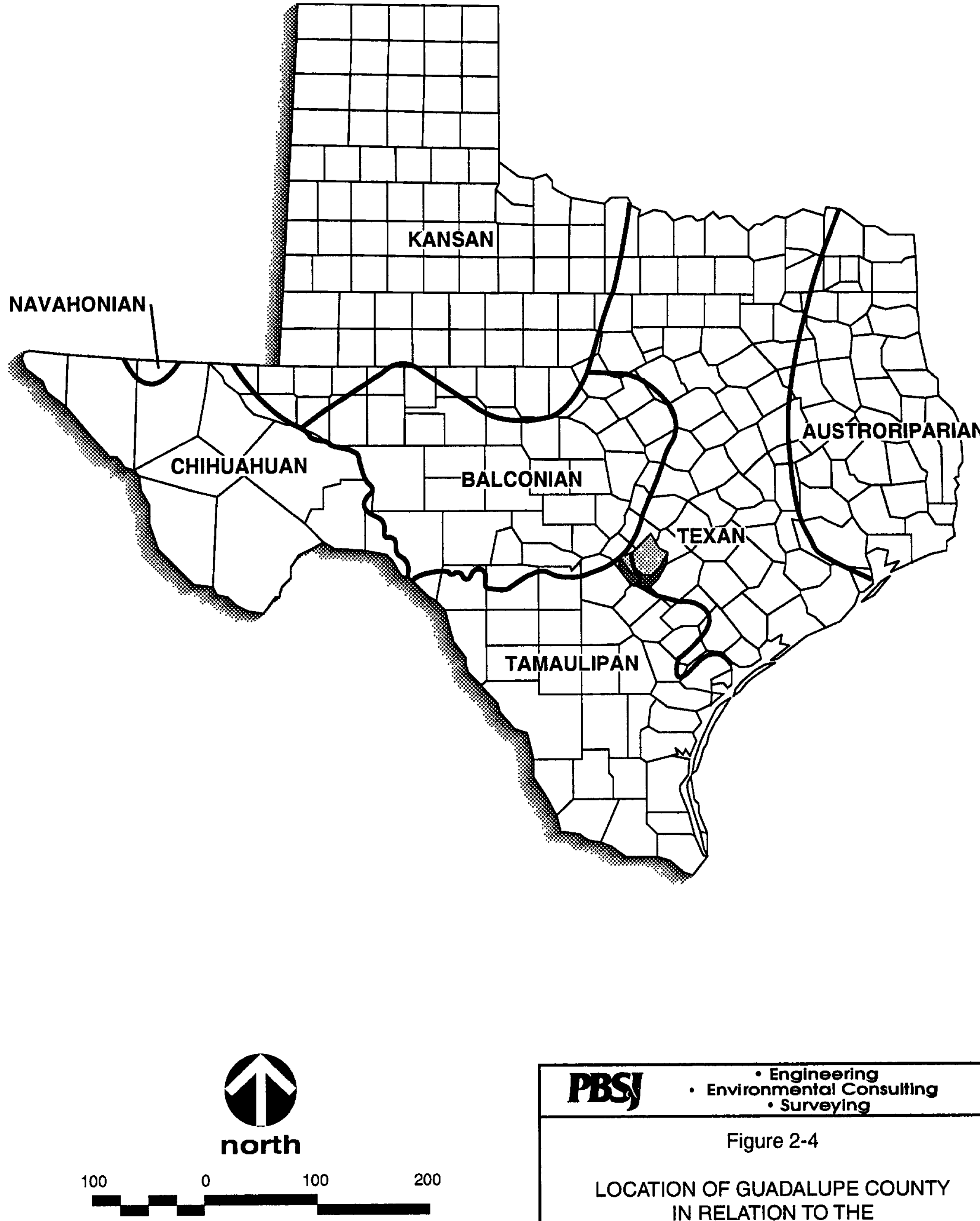

Source: Blair, 1950

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Figure 2-4

LOCATION OF GUADALUPE COUNTY
IN RELATION TO THE
BIOTIC PROVINCES OF TEXAS

HICKORY FOREST - NEW BERLIN

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floridanus), hispid cotton rat (*Sigmodon hispidus*), white-footed mouse (*Peromyscus leucopus*), and nine-banded armadillo (*Dasypus novemcinctus*). Common bird species include the northern bobwhite (*Colinus virginianus*), eastern meadowlark (*Sturnella magna*), mourning dove (*Zenaida macroura*), and killdeer (*Charadrius vociferus*). Reptile and amphibian species common to this habitat type include the six-lined racerunner (*Cnemidophorus sexlineatus sexlineatus*), Texas rat snake (*Elaphe obsoleta lindheimerii*), eastern hognose snake (*Heterodon platirhinos*), and Gulf Coast toad (*Bufo valliceps*).

The open savannahs occurring within the study area support, or periodically support, species of both woodland and grassland habitat types due to the diversity of forage and the edge effect between the two habitat types. Typical mammal species found in the savannah habitats are the black-tailed jackrabbit (*Lepus californicus*), eastern cottontail, white-tailed deer (*Odocoileus virginianus*), nine-banded armadillo, and striped skunk (*Mephitis mephitis*). Avian species common to the savannahs include the northern mockingbird (*Mimus polyglottos*), northern cardinal (*Cardinalis cardinalis*), lark sparrow (*Chondestes grammacus*), and northern bobwhite. Herpetofauna frequently occurring within this habitat type include the ground skink (*Scincella lateralis*), green anole (*Anolis carolinensis*), Texas rat snake, western coachwhip (*Masticophus flagellum testaceus*), and Gulf Coast toad.

The upland woodlands occurring within the study area are typically dense post oak-cedar elm woodlands. Characteristic woodland-inhabiting species likely to occur in the study area include the white-tailed deer, Virginia opossum (*Didelphis virginiana*), eastern cottontail, raccoon (*Procyon lotor*), striped skunk, and bird species such as the Carolina chickadee (*Poecile carolinensis*), northern cardinal, blue jay (*Cyanocitta cristata*), golden-fronted woodpecker (*Melanerpes aurifrons aurifrons*), and mourning dove. Common reptile species include the green anole, Texas spiny lizard (*Sceloporus olivaceus*), ground skink, rough green snake (*Opheodrys aestivus*), broad-banded copperhead (*Agkistrodon contortrix laticinctus*), and western diamondback rattlesnake (*Crotalus atrox*).

Bottomland/riparian woodlands within the study area occur along tributaries of the Guadalupe River and other major creeks and streams. Characteristic mammalian species of these mesic woodlands include the raccoon, Virginia opossum, white-tailed deer, hispid cotton rat, eastern cottontail, and fox squirrel (*Sciurus niger*). Bird species commonly occurring within these habitats include the belted kingfisher (*Ceryle alcyon*), northern cardinal, northern mockingbird, Carolina chickadee, blue jay, and ladder-backed woodpecker (*Picoides scalaris*). Common herpetofauna occurring within the riparian woodlands include the green treefrog (*Hyla cinerea*), Blanchard's cricket frog (*Acris crepitans blanchardi*), rough green snake, diamondback water snake (*Nerodia rhombifera rhombifera*), green anole, and Texas spiny lizard, among others.

Aquatic habitats within the study area include Elm, Cottonwood, Cordell, Cantau, Krams, Polecat, and Bear creeks, Konde Branch, and numerous additional unnamed tributary streams, and stock ponds. Streams of the study area are typically shallow intermittent drainages. Aquatic vegetation is limited by the ephemeral nature of these streams, scouring by stormwater flows, shading, and by the distribution of suitable substrates. Suitable substrates for aquatic macrophyte growth are often present in pool habitats, but steep banks and shading by riparian vegetation usually restrict substantial growth to the shallower upstream portions of these pools. Commonly occurring aquatic plants likely to be present within the streams and ponds of the study area include coontail (*Ceratophyllum* sp.), water milfoil (*Myriophyllum* sp.), bladderwort (*Utricularia* sp.), pondweed and cattails (*Typha* spp.) Faunal species occurring within the aquatic habitats of the study area include such fish species as the blackstripe topminnow (*Fundulus notatus*), mosquitofish (*Gambusia affinis*), sailfin molly (Poecilia latipinna), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis megalotis*), and channel catfish (*Ictalurus punctatus*), among others. Other faunal species which utilize or periodically utilize the aquatic habitats include the diamondback water snake, redstripe ribbon snake (*Thamnophis proximus rubrilineatus*), southern leopard frog (*Rana sphenocephala*), Blanchard's cricket frog, red-eared slider (*Trachemys scripta elegans*), raccoon, Virginia opossum, great blue heron (*Ardea herodias*), wood duck (*Aix sponsa*), and various species of migratory waterfowl and wading birds.

2.6.3 Endangered and Threatened Species

2.6.3.1 Plants

Currently, 28 plant species are listed by the U.S. Fish and Wildlife Service (FWS) as endangered or threatened in Texas (FWS, 2001). The state list of endangered and threatened plant species promulgated by the Texas Parks and Wildlife Department (TPWD) consists of the same species listed by the FWS (TPWD, 1999). None of these endangered or threatened species are known to occur in Guadalupe County. One endangered species, Texas wild-rice (*Zizania texana*), has been recorded in adjacent Hays County, and is found in the clear, constant-temperature, spring-fed waters of the San Marcos River. The study area offers no suitable habitat, and is beyond the limited current range of this species.

Three sensitive plant species; the big red sage (*Salvia penstemonoides*), sandhill woolywhite (*Hymenopappus carrizoanus*), and Park's jointweed (*Polygonella parksii*) are identified by the TPWD's Biological and Conservation Data System (TXBCD) as of possible occurrence within Guadalupe County. These species are not currently listed by the state or the FWS, but are included on the TPWD rare plant list (Poole et al., 2000). Big red sage currently exists in its natural state in Real County and historically occurred in Bandera, Bexar, Gillespie, Guadalupe, Kendall, Kerr, and Wilson counties (Poole et al., 2000). This species naturally occurs in moist to seasonally wet clay or silt soils in creekbeds and seepages associated with limestone canyons (Texas Organization for Endangered Species (TOES), 1993). Big red sage is cultivated as a landscape plant, but has diminished over much of its historic range, possibly because of habitat destruction and collection. This plant is considered a species of concern (SOC) by the FWS (1999a). SOC are species for which there is evidence for possible listing as threatened or endangered, but additional data is necessary before such a determination can be made. Although these species have not been recorded within the study area, the sandhill woolywhite has been recorded from a location near the southeast corner of the study area and Park's jointweed has been recorded from two locations near the southeast and southwest corners of the study area, respectively (TXBCD, 2001). The sandhill woolywhite occurs in disturbed or open areas within grasslands and post oak woodlands in deep sands of the Carrizo and similar Eocene formations. Park's jointweed occurs in early successional grasslands and openings in post oak woodlands, in deep loose sands of the Carrizo and similar Eocene formations (TOES, 1993).

2.6.3.2 Animals

Table 2-1 lists wildlife species considered to be rare, endangered, or threatened by the FWS and TPWD that could potentially occur within Guadalupe County. Sources reviewed to develop the list include FWS (1995, 1999a, 1999b, 2000, and 2001) TPWD (1999), and TXBCD (2001). It should be noted that inclusion on the list does not imply that a species is known to occur in the study area, but only acknowledges the potential for occurrence. Only those species listed as endangered or threatened by FWS are afforded complete federal protection.

Two taxa listed in Table 2-1 are considered by both the FWS and TPWD as endangered. These are the whooping crane (*Grus americana*) and interior least tern (*Sterna antillarum*). The piping plover (*Charadrius melodus*) is listed by both the FWS and TPWD as threatened. The bald eagle (*Haliaeetus leucocephalus*) is currently listed as threatened by both agencies, but has been proposed for delisting by the FWS. The mountain plover (*Charadrius montanus*) has been proposed for listing as threatened by the FWS and is currently not listed by the TPWD. None of these species are known to reside in the study area, but could pass through during migration or, in the case of the mountain plover, overwinter (Oberholser, 1974; Texas Ornithological Society (TOS), 1995).

The study area lies within the migration corridor of the whooping crane. Each fall, the entire population from Wood Buffalo National Park in northern Canada migrates primarily to the Aransas National Wildlife Refuge (NWR) and adjacent areas of the central Texas coast in Aransas, Calhoun, and Refugio counties to overwinter (FWS, 1995; Lewis, 1995). During migration, these birds may stop at small stock ponds or other water bodies occurring in pastureland and feed in cultivated fields such as sorghum or corn. The whooping crane is a potential migrant in the study area, although FWS (1999a) has no records of this species for Guadalupe County.

TABLE 2-1

ENDANGERED, THREATENED, AND RARE WILDLIFE
OF POTENTIAL OCCURRENCE IN GUADALUPE COUNTY[1]

Common Name[2]	Scientific Name[2]	Status[3]	
		FWS	TPWD
FISH			
Gudalupe bass	*Micropterus treculi*	SOC	NL
REPTILES			
Cagel's map turtle	*Graptemys caglei*	C	NL
Texas horned lizard	*Phrynosoma cornutum*	SOC	T
Texas tortoise	*Gopherus berlandieri*	NL	NL
Timber rattlesnake	*Crotalus horridus*	NL	T
BIRDS			
Whooping crane	*Grus americana*	E	E
Interior least tern	*Sterna antillarum*	E	E
Piping plover	*Charadrius melodus*	T	T
Bald eagle	*Haliaeetus leucocephalus*	T/PDL	T
Mountain plover	*Charadrius montanus*	PT	NL
White-faced ibis	*Plegadis chihi*	SOC	T
Loggerhead shrike	*Lanius ludovicianus*	SOC	NL
American peregrine falcon	*Falco peregrinus anatum*	NL	E
Arctic peregrine falcon	*Falco peregrinus tundrius*	NL	T
MAMMALS			
Cave myotis	*Myotis velifer*	SOC	NL
Plains spotted skunk	*Spilogale putorius interrupta*	SOC	NL

[1] According to FWS (1995, 1999a, 1999b, 2000, 2001), TPWD (1999), TXBCD (2001).

[2] Nomenclature follows Collins (1990), Hubbs et al. (1991), AOU (1998, 2000), and Manning and Jones (1998).

[3] FWS - U.S. Fish and Wildlife Service.

TPWD - Texas Parks and Wildlife Department.

E - Endangered.

T - Threatened.

PT - Proposed for listing as threatened

T/PDL - Currently listed as Threatened, but proposed for delisting.

C - Taxa for which the FWS has, on file, suficient information on biological vulnerability and threat(s) to support proposals to list as endangered or threatened. Development and publication of proposed rules are anticipated.

SOC - FWS Species of Concern; species for which there is some evidence of vulnerability, but not enough data to support listing at this time.

NL - Not listed.

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The interior least tern historically has nested on sandbars of the Colorado River, Red River, and Rio Grande within Texas. Small remnant breeding populations persist at isolated locations within the historic range. This species winters along the entirety of the Texas coast and may migrate across the study area (FWS, 1995; TOS, 1995; Thompson, et al., 1997).

The piping plover is a statewide migrant of potential occurrence in Guadalupe County. This species, however, has not been recorded in the county (Oberholser, 1974; FWS, 1995, 1999a; TXBCD, 2001).

The bald eagle is an uncommon to rare migrant and winter resident throughout the state (TOS), 1995). It is generally found in coastal areas and around large bodies of water such as reservoirs, lakes, and rivers. Nesting in Texas is largely restricted to the eastern one-third of the state and to the coastal prairies region. In Texas, wintering and migrating bald eagles frequently stop over along the shores of large water bodies, which provide the eagle with the bulk of its dietary requirements. No sightings of this bird are recorded for Guadalupe County (Oberholser, 1974; FWS, 1995).

The mountain plover is a migrant/winter resident in Texas and inhabits agricultural fields. It is a rare summer resident in the Trans-Pecos grasslands and may migrate as far east as the Colorado River basin. This species winters in south Texas and has been recorded from Guadalupe County (Oberholser, 1974 Kutac and Caran, 1994). They inhabit range, pastures, croplands, and fallow fields (Oberholser, 1974; Knopf, 1996), and may occur in the study area as a migrant or winter resident.

Cagle's map turtle (*Graptemys caglei*) has been designated by the FWS as a candidate for listing as endangered or threatened. This means that FWS has enough information to warrant proposing this species to the endangered and threatened species list, and development and publication of proposed rules are anticipated. Endemic to the Guadalupe River drainage, Cagle's map turtle inhabits free-flowing segments and shallow impoundments with unimproved banks (Linam et al., 1994). Highly aquatic, it seldom ventures on land except to lay eggs, but requires adequate basking sites, such as exposed rocks, logs, cypress knees, or gravel bars (Bartlett and Bartlett, 1999). Robust populations occur between Victoria and Seguin, with scattered populations further upstream (Linam et al., 1994). This species may occur within the study area, in perennial segments of tributaries of the Guadalupe River.

Six vertebrate species that are classified by the FWS as SOC have been identified as being of potential occurrence in the study area: the Guadalupe bass (*Micropterus treculi*), Texas horned lizard (*Phrynosoma cornutum*), white-faced ibis (*Plegadis chihi*), loggerhead shrike (*Lanius ludovicianus migrans*), cave myotis (*Myotis velifer*), and plains spotted skunk (*Spilogale putorius interrupta*). Of these, the Texas horned lizard and white-faced ibis are state-listed as threatened. The Guadalupe bass has been recorded from the Guadalupe River above Gonzales (Lee et al., 1980) and is expected to occur within the study area in tributaries of the Guadalupe when flowing waters are present. The Texas horned lizard was historically found throughout the state and prefers open, flat terrain with sparse scattered vegetation. It has been recorded from Guadalupe County (Dixon, 2000; TXBCD, 2001) and thus may occur within the study area. However, over the past 20 years, this species has almost vanished from the eastern half of the state. It has virtually disappeared east of a line from Fort Worth to Austin to Corpus Christi (Price, 1990). There is a remote possibility that the white-faced ibis could fly through the study area during migration. The loggerhead shrike occurs throughout the state, preferring open brushy habitat, and is likely to be a relatively common inhabitant of the study area (Oberholser, 1974). The cave myotis occurs in caves, old buildings, and under bridges in much of the western two-thirds of the state, and has been recorded from Guadalupe County (Davis and Schmidly, 1994). The plains spotted skunk, a subspecies of the eastern spotted skunk, is limited to east Texas. Its range includes Guadalupe County (Schmidly, 1983; Davis and Schmidly, 1994). Spotted skunks are inhabitants of grasslands, forest edges, woodlands, croplands, fencerows, and farmyards.

Several species that are not listed or considered SOC by the FWS are listed as endangered or threatened by the TPWD and recorded as possibly occurring in Guadalupe County by the TXBCD (2001). These are the Texas tortoise (*Gopherus berlandieri*), timber rattlesnake (*Crotalus horridus*), and peregrine falcon (*Falco peregrinus*). Adapted to a variety of habitats, the Texas tortoise has been recorded from Guadalupe County, where it is considered rare (Kutac and Caran, 1994) and at the northern edge of its range (Dixon, 2000). Its occurrence in the study area is possible but unlikely. Although the timber rattlesnake is not reported from Guadalupe County (Dixon, 2000), the study area is within the range of the species, and it may occur in dense thickets and abandoned pastures and farmland (Tennant, 1998). Two subspecies of the peregrine falcon occur in Texas. The American peregrine falcon (*Falco peregrinus anatum*) is a known resident in the Chisos and Guadalupe mountains (TOS, 1995). The Arctic subspecies (*Falco peregrinus tundrius*) winters along the entire Gulf coast and occurs statewide during migration (FWS, 1995). The peregrine falcon has been delisted by the FWS (64 FR 46542-48; August 25, 1999); however, the American peregrine falcon and arctic peregrine falcon are listed as endangered and threatened, respectively by the TPWD. Either of these taxa have the potential to occur in the study area during spring and fall migration.

2.7 SOCIOECONOMICS

This section presents a summary of economic and demographic characteristics for Guadalupe County and the State of Texas and describes the socioeconomic environment of the study area. Literature sources reviewed include publications by the U.S. Bureau of Census (USBOC), the Texas State Data Center (TSDC), the Texas Workforce Commission (TWC), and the Texas Water Development Board (TWDB).

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2.7.1 Population Trends

Guadalupe County is considered part of the San Antonio Metropolitan Statistical Area (MSA) and is a member of the Alamo Area Council of Governments (State Planning Region 18). The San Antonio MSA is the third largest such area in the state by population (28th nationally) with an estimated population of 1,592,383 for 2001 (AIS Market Data, 2001). The area was the ninth fastest-growing MSA in the state between 1990 and 1996, increasing by 12.5% over this period. Since 1990, the population of the San Antonio MSA, which includes Bexar, Comal, Guadalupe, and Wilson counties, has increased at an average rate of 1.8% every year.

As shown in Figure 2-5, the population of Guadalupe County grew at a rate exceeding that of the state over the last two decades, and future projections show that the county's population increase is expected to continue to outpace that of the state in the coming three decades. Between 1980 and 1990, Guadalupe County's population grew by 38.8% and the state increased by 19.3%. During the 1990s, Guadalupe County's population increased by 37.2% and the state increased by 22.7% (TSDC 2001, USBOC 2001).

During the next 30 years, Guadalupe County's population is expected to increase by 26.9% between 2000 and 2010, by 27.5% between 2010 and 2020, and by 24.3% between 2020 and 2030. During the same time period, the state is expected to increase its population by 17.7% between 2000 and 2010, by 17.3% between 2010 and 2020, and by 13.8% between 2020 and 2030 (TWDB, 2001).

2.7.2 Employment

As shown in Figure 2-6, the civilian labor force (CLF) in Guadalupe County was significantly higher than that of the state throughout the 1980s and remained higher until 1998. By July 2001, it had fallen far below the state's CLF. Between 1980 and 1990, the CLF for Guadalupe County increased by 54.0% from 20,905 to 32,208. The CLF continued to increase (by 29.5%) reaching 41,738 by 1998. Between 1998 and July 2001, the CLF for Guadalupe County reached 45,238 representing an increase of 8.3%. By comparison, the State of Texas' CLF increased from 6,737,000 to 8,615,000 (27%) between 1980 and 1990; and between 1990 and 1998 it increased further to 10,081,000 (17%). Between 1998 and May 2001, Texas' CLF had increased to 10,520,000 (4%) (TWC 2001).

During most of the years since 1980, unemployment rates in Guadalupe County have consistently remained at over 1% below that of the state. In 1980, Guadalupe County's unemployment rate was 4.4% and the state's was 5.2%. In the 1990s, the county's unemployment rate remained at 4.4% and the state's rate increased to 6.3%. By 1998, the county dropped to 2.5% and the state dropped to

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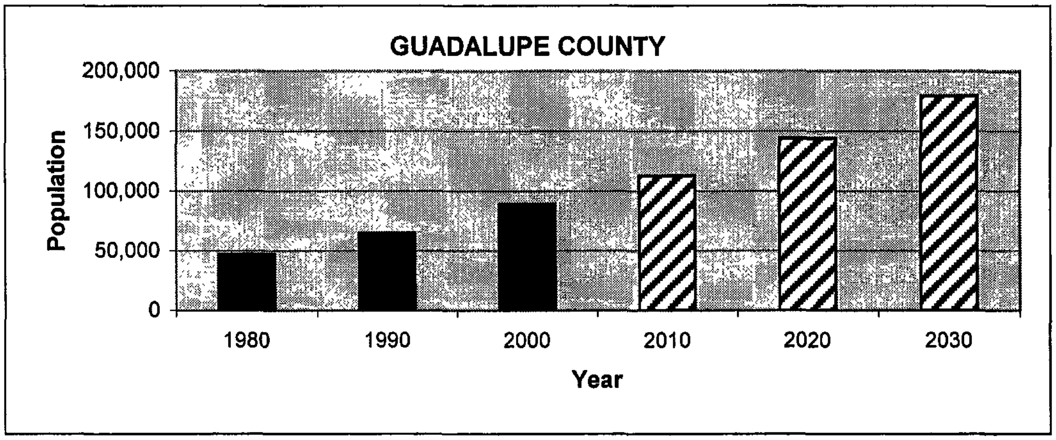
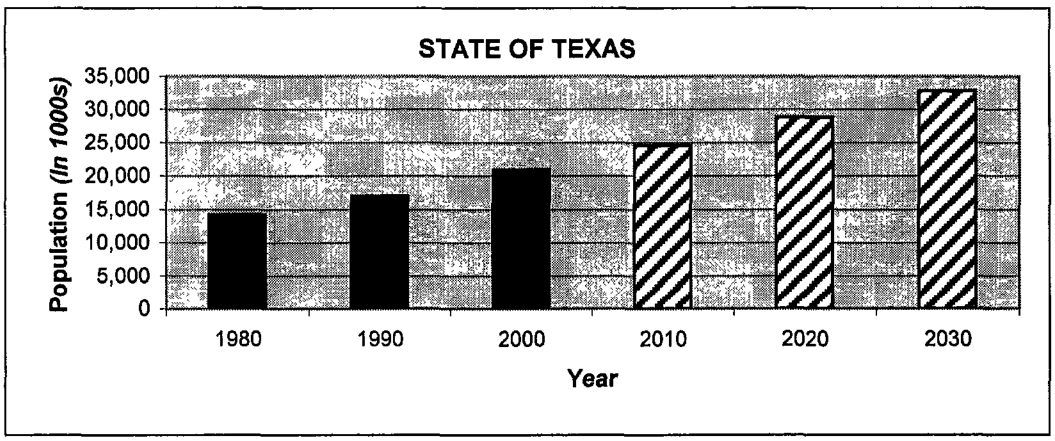
FIGURE 2-5

POPULATION TRENDS AND PROJECTIONS,
GUADALUPE COUNTY AND THE STATE OF TEXAS





Source: TSDC, 2001; TWDB, 2001; USBOC, 2001.

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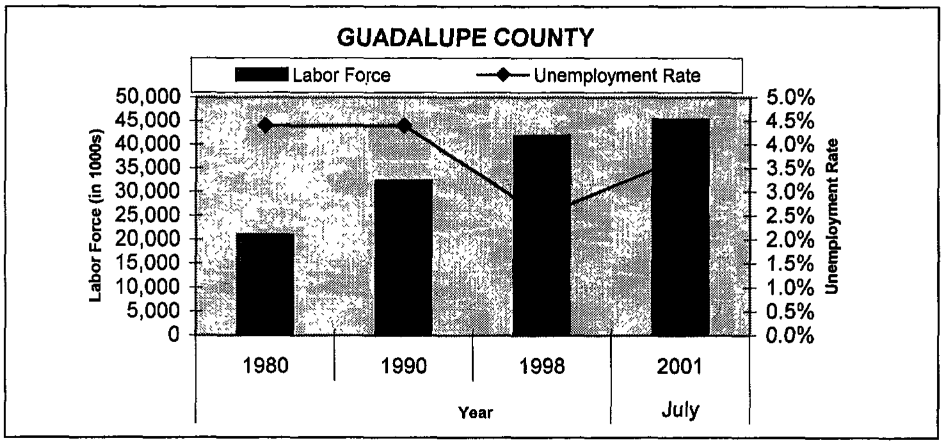
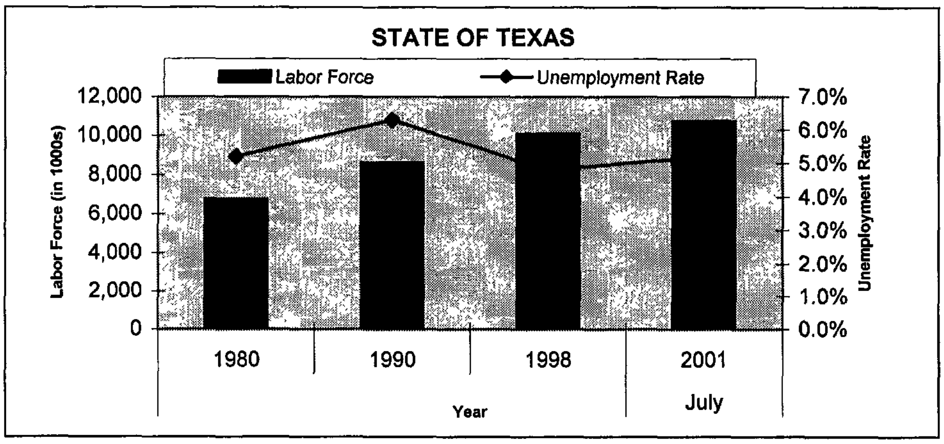
FIGURE 2-6

CIVILIAN LABOR FORCE AND UNEMPLOYMENT RATE
FOR GUADALUPE COUNTY AND THE STATE OF TEXAS





Source: TWC, 2001.

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4.8%. And by July 2001, Guadalupe County's unemployment increased to 3.7% and the state increased to 5.2% (TWC 2001).

Covered employment data tallies jobs that are located in the county and it includes workers covered by state unemployment insurance and most agricultural employees. The data includes all corporation officials, executives, supervisory personnel, clerical workers, wage earners, pieceworkers, and part-time workers. The data excludes employment covered by the Railroad Retirement Act, self-employed persons, and unpaid family workers. A study of the fourth quarter covered-employment data for 1998 and 2000 shows that covered employment in Guadalupe County increased from 21,187 to 22,041 (4.0%) while the State of Texas increased from 8,781,346 to 9,411,578 (0.78%) during this same period (TWC 2001).

2.7.3 Leading Economic Sectors

As shown in Figure 2-7, fourth quarter TWC employment figures for 2000 show that the leading economic sectors in Guadalupe County are manufacturing (25.0%), retail (23.0%), government (21.4%), and services (16.6%). By comparison, the leading economic sectors for Texas for the fourth quarter in 2000 are services (26.7%), trade (24.4%), government (16.6), and manufacturing (11.5%) (TWC, 2001).

2.7.4 Community Values

The term "community values" is included as a factor for the consideration of transmission line certification under Section 37.056(c)(4) of the Texas Utilities Code. This term has not been specifically defined for regulatory purposes by the PUCT. However, on the CCN application for transmission lines, the PUCT requests information concerning the following items under the general heading Community Values:

- Approvals or permits required from other governmental agencies;
- General description of the area traversed by the line;
- Residences, business, schools, churches, cemeteries, hospitals, nursing homes, or other habitable structures within 200 feet of the centerline of the proposed project;
- FAA-registered airstrips located in the area;
- Radio/TV towers, microwave relay stations and other electronic installations in the vicinity of the proposed route; and
- Irrigated pasture or croplands utilizing center-pivot or other traveling irrigation systems.

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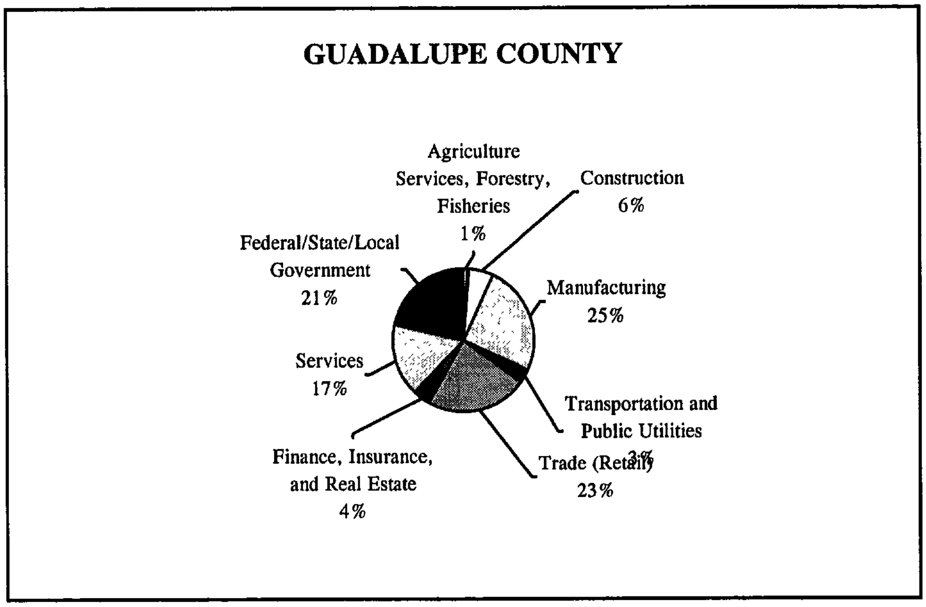
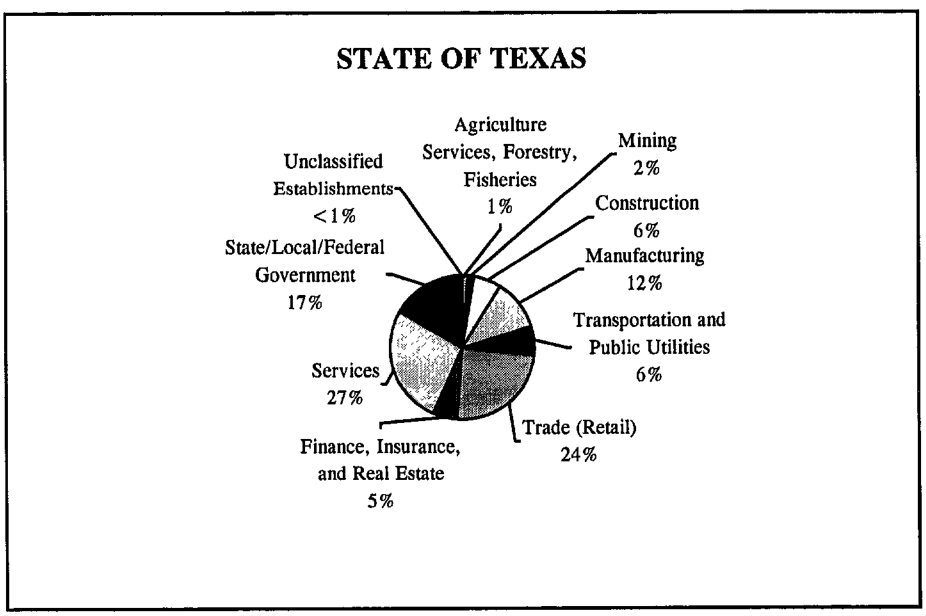
FIGURE 2-7

LEADING ECONOMIC SECTORS FOR
GUADALUPE COUNTY AND THE STATE OF TEXAS





Source: TWC, 2001.

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- Each of the above items, insofar as it affects community values, is discussed in the appropriate section of this document.

2.8 HUMAN DEVELOPMENT

2.8.1 Land Use

Land use in Guadalupe County is primarily agricultural. A review of the Natural Resources Conservation Service's (NRCS – formerly the SCS) Natural Resources Inventory land use estimates indicate that agricultural land uses (pastureland, rangeland, and cropland) account for 90% of the total land within the county. The county reported a slight increase in urban land use between 1982 (2%) and 1992 (5%) (SCS, 1987; NRCS, 1992).

The study area is located entirely within Guadalupe County. There are no incorporated cities within the study area, but the City of Seguin is located immediately to the north. Several small, unincorporated communities are located in the western half of the study area, including Dugger, Elm Creek, Sweet Home, and Olmos. The study area is located in State Planning Region No. 18, which is represented by the Alamo Area Council of Governments, with headquarters in San Antonio.

The study area exhibits a patchwork of agricultural and residential land uses, although the vast majority of lands are still used for agriculture, as in the county as a whole. Rural residential subdivisions located in the study area are undoubtedly associated with the relative nearness of the San Antonio metropolitan area approximately 15 miles west, and more locally, the Seguin area, just north of the study are boundary. The bulk of this residential development is located in the eastern half of the study area (east of SH 123), on the more wooded, non-agricultural tracts.

SH 123 also separates the study area into two roughly equal halves (east and west), which exhibit distinctly different land use/transportation patterns. East of the highway, the property boundaries, and thus roads, generally form a north/south–east/west grid, while west of the highway this grid is "tilted," with a northwest/southeast–northeast/southwest orientation.

2.8.2 Transportation Facilities

SH 123 splits the study area into roughly equal east and west halves. This highway runs from San Marcos in the north, to the Kenedy/Karnes City area in the south. The rest of the transportation system consists of a network of state-maintained farm-to-market roads, county roads, and subdivision streets (generally also maintained by the county, outside incorporated city limits).

2.8.3 Parks and Recreation

A review of the Texas Outdoor Recreation Inventory (TORI, 1990) and the Texas Outdoor Recreation Plan (TORP, 1984), as well as federal, state, and local maps, and field surveys did not identify park or recreation facilities within the study area.

2.8.4 Aviation Facilities

A review of the San Antonio Sectional Aeronautical Chart (Federal Aviation Administration (FAA), 2000), the Airport/Facility directory for the South Central U.S. (FAA, 2001), TxDOT's Texas Airport Directory (TxDOT, 2001), aerial photography, and USGS maps revealed no public or military airfields within the study area boundary.

The nearest such facility is the Seguin Auxiliary Airfield, located approximately 2.2 miles north of the study area. The primary mission of this military facility is to provide an auxiliary airfield for Randolph AFB (San Antonio) instructor pilots. The airfield serves mainly for touch-and-go landing practice of T-38 aircraft for the undergraduate pilot training program. The installation contains three runways on approximately 961 acres. Limited ground facilities include a fire station, an operations building, and a small control tower (U.S. Department of The Air Force (USAF), 2000).

In addition, there are two private landing strips in the study area. One is a grass strip located on the north side of Settler's Way Road, southwest of Elm Creek. The second is an improved runway in the middle of a "fly in–fly out" subdivision where the streets double as taxiways between individual hangars and the runway. This strip is located off of FM 467, northeast of Elm Creek.

2.8.5 Agriculture

Agriculture is one of the most important segments of the economy in Guadalupe County with agricultural land uses still dominating both the county and the study area. Agricultural land uses account for 90% of the total land in Guadalupe County with pastureland, cropland, and rangeland comprising 43%, 29%, and 18% of the land uses respectively (SCS, 1987; NRCS, 1992).

According to the 1997 Census of Agriculture, there were 1,841 farms covering an estimated 347,763 ac in Guadalupe County, with the total market value of agricultural products sold totaling an estimated $31,361,000 (USBOC, 1997). Guadalupe County falls within the Texas Agricultural Statistic Service (TASS) District 8N, with primary crops including wheat, grain sorghum, oats, and corn (TASS, 1998).

2.9 AESTHETICS

Aesthetics is included as a factor for consideration in the evaluation of transmission facilities in Section 37.056(c)(4) of the Texas Utilities Code. The term aesthetics refers to the subjective perception of natural beauty in landscape by attempting to define and measure an area's scenic qualities.

Consideration of the visual environment includes a determination of aesthetic values (where the location of a transmission line could potentially affect the scenic enjoyment of the area). Aesthetic values considered in this analysis, which combine to give an area its aesthetic identity, include:

- topographical variation (hills, valleys, etc)
- prominence of water in the landscape
- vegetation variety (forests, pasture, etc.)
- color
- diversity of scenic elements
- degree of human development or alteration
- overall uniqueness of the scenic environment compared to the larger region

The study area exhibits a medium level of aesthetic quality for the region, with a gently rolling topography. A great deal of the study area is still in agricultural production or undeveloped. As a result, the study area exhibits a rather typical landscape, significantly impacted by human activities.

Landscapes with water as a major element, such as rivers, lakes, and reservoirs, are often considered to represent areas of greater aesthetic value. There are no large bodies of water or rivers within the study area boundary, and only a few permanently flowing streams or creeks. Nonetheless, these features can add a scenic element to small-scale landscapes, especially in agricultural areas where much of the native vegetation has been cleared.

TxDOT, in partnership with the Texas Historical Commission (THC) and other state agencies, has mapped 10 separate "Travel Trails" throughout Texas to provide travel routes that highlight natural, cultural, and scenic attractions within different areas of the state. These routes are described in pamphlets distributed by TxDOT and THC offices and tourist information centers, and marked by special signs along designated highways. The "Texas Independence Trail" encompasses forty distinct sites throughout southeastern Texas that mark locations and events pivotal to the fight for Texas freedom. The western segment of this trail follows FM 466 from Seguin to Gonzales. Although FM 466 crosses the extreme northeast corner of the study area, no specific attractions are noted in this area. This route is also recommended for sight-seeing drives as wildflowers adorn the landscape in springtime months (THC and TxDOT, 2000).

2.10 CULTURAL RESOURCES

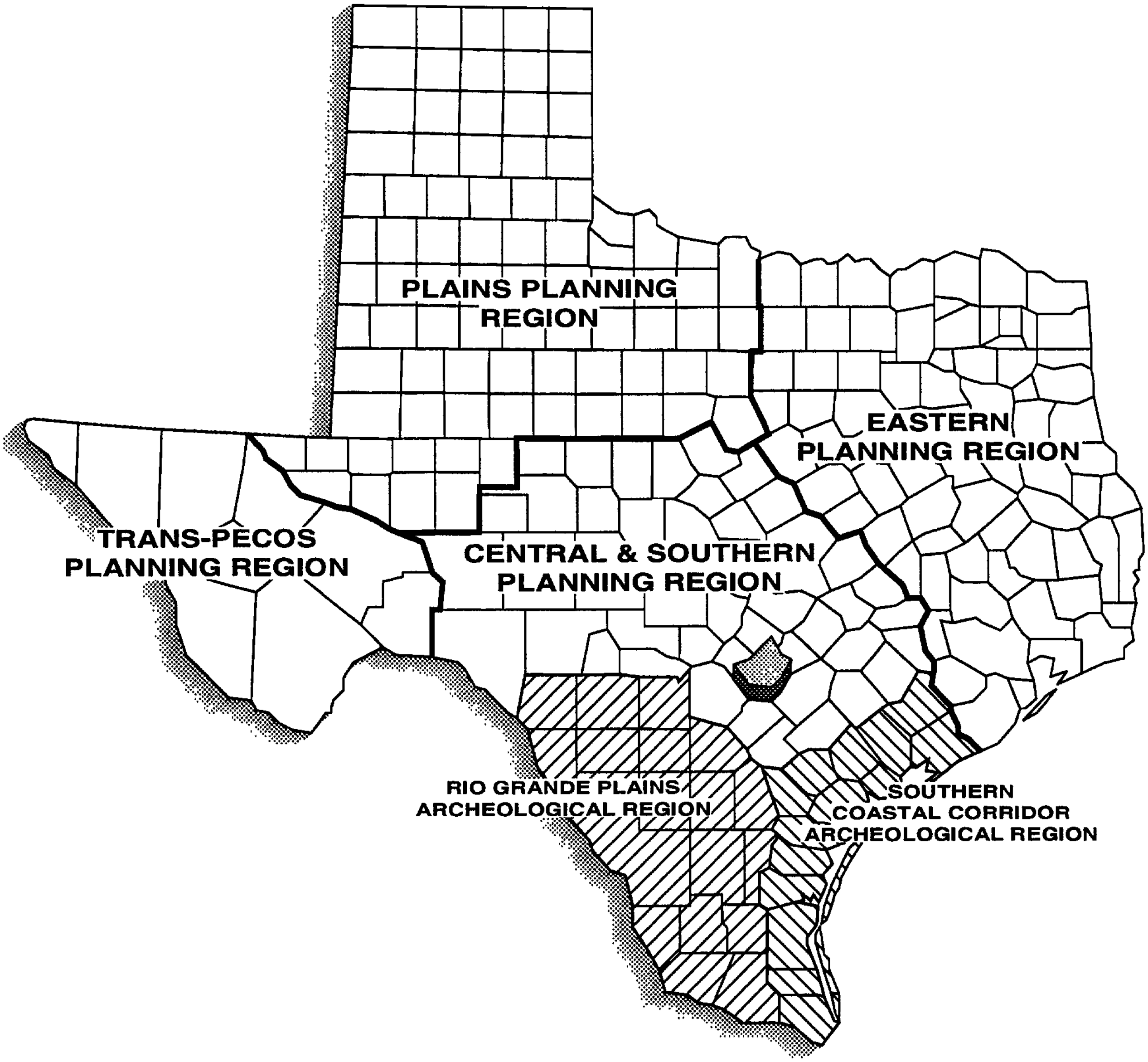
2.10.1 Cultural Overview

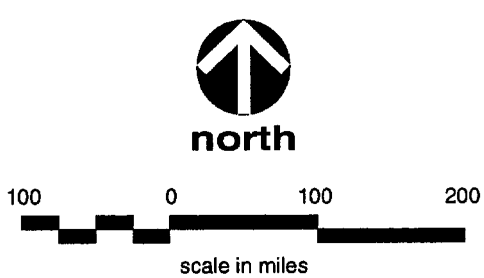
As shown on Figure 2-8, Guadalupe County is located in the Central and Southern Cultural Resources Planning Region (Mercado-Allinger et al., 1996). The cultural history of the project area, developed from archaeological and historical records as presented in previous research reports, can be assigned to four primary chronological and developmental stages: Paleoindian, Archaic, Late Prehistoric, and Historic. These divisions are believed to reflect changes in subsistence and cultural development. The three prehistoric periods have been defined based on ecological adaptation and specific diagnostic materials. The historic period reflects both the effect of European immigration on the native populations and the actual settlement of the region by Europeans and Americans.

It has been noted by previous researchers (Foster, that the cultural history of the current project area is "homogenous" in the sense that the Study Area and adjacent areas have together been occupied by a continuity of culture groups, each of which maintained in its own time a commonly shared pattern of beliefs, values, and lifeways. For these groups of people, whether they were Native Americans of prehistoric times, Hispanic Americans of the late eighteenth to early nineteenth century period, or Anglo Americans of the Texas Republic, the current geopolitical boundaries were nonexistent. Historic sites tend to reflect ranching/farming and activities related to ranching/farming, as this was the primary means of subsistence during the historic settlement of the region.

Paleoindian Period (pre-12,000 B.P. to ca. 8500 B.P.)

Beginning prior to 12,000 Before Present (B.P.) and continuing to about 8500 B.P., the Paleoindian Period is the earliest known prehistoric cultural sequence in the Central Texas archaeological area. Coinciding with the decline of the Wisconsin glaciation, the stage is characterized by a relatively cool, moist climate. This stage is alternately referred to as the "Big Game Hunting" tradition (Willey, 1966), due to a presumed heavy reliance upon now-extinct species of Pleistocene megafauna as a food source during the earlier portion of this stage. However, it should be stressed that rarely are megafaunal remains found in association with Paleoindian sites. Most archaeologists now believe that this correlation between Paleoindian groups and the hunting of megafauna has been exaggerated. Ethnographic analogies with modern low-energy societies have suggested that hunter/gatherer groups relied more heavily on gathered vegetal material than was previously thought. Temporally diagnostic tool kits consisted of a variety of finely chipped, sometimes fluted, lanceolate projectile points, such as the *Clovis, Folsom* and *Plainview* types (Willey, 1966).





Source: Texas Historical Commission, 1996

PBSJ
• Engineering
• Environmental Consulting
• Surveying

Figure 2-8

LOCATION OF GUADALUPE COUNTY IN RELATION TO THE CULTURAL RESOURCES PLANNING REGIONS OF TEXAS

HICKORY FOREST - NEW BERLIN

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The early Holocene in Central Texas was characterized by a climatic shift from cool and moist to warm and dry. This climatic change precipitated a vegetation change. By approximately 10,000 BP, vegetation along the southeastern edge of Central Texas began to shift from the Wisconsin deciduous forest to an oak savannah (Bryant and Holloway, 1985).

Social organization probably consisted of loosely structured, highly mobile social groups composed of several nuclear families referred to as bands. Few intact Paleoindian sites have been recorded in this region of Central Texas. Paleoindian sites in Central Texas occur more commonly as small, scant lithic scatters, usually located in upland areas along the divides of major and minor watersheds. These archaeological sites are thought to represent transient campsites, resource procurement loci, or retooling stations by band-size or smaller groups. Rarer are rock shelter/butchering localities such as the Montell Shelter in Uvalde County (Sellards, 1952) and the Levi Site in Travis County (Alexander, 1963). Stratified sites (41BX52 and 41WM235) have been excavated by the Texas State Department of Highways and Public Transportation (SDHPT) in Bexar and Williamson counties (Weir, 1985).

Archaic Period (8500 to 1250 BP)

At the end of the Paleoindian Period, the archaeological record exhibits evidence of a diversification in subsistence patterns which marks the beginning of the complex chronological period referred to as the Archaic Stage. Indications suggest that the prehistoric inhabitants began hunting a variety of small game animals, including deer and rabbit, as well as gathering edible roots, nuts and fruits. Many constructs have been used to classify the developmental sequences of the Central Texas Archaic, with Kelly's (1947) application of the Midwestern Taxonomic System (McKern, 1939) being most prevalent. However Kelly's division of the Edwards Plateau Aspect gradually lost favor among researchers in Central Texas following the publication of *An Introductory Handbook of Texas Archaeology* (Suhm et al., 1954).

In 1962, Johnson et al., provided a formal division of the Edwards Plateau Aspect into the Early, Middle, and Late periods, based on patterns of subsistence and settlement. Although these divisions are still commonly used in the archaeological literature, many researchers have abandoned this terminology in favor of a five-part division developed by Weir (1976). Weir proposed the term "Central Texas Archaic" to represent the Archaic manifestation in the area and recognized a continuum of five phases. Weir's phases are based upon projectile points and associated tools from 17 Central Texas sites, radiocarbon dates from southwest Texas, the application of the systems of positive and negative feedback, and three of Birdsell's (1968) equilibrium systems. The equilibrium systems are population density, group communication, and local group (Weir, 1976). Weir's phases are the San Geronimo phase (8000+ to 4500 B.P.), the Clear Fork phase (5000 to 4000 B.P.), the Round Rock phase (4200 to 2600

B.P.), the San Macros phase (2800 to 1800 B.P.), and the Twin Sisters phase (2000 to 700 B.P.) (Weir, 1976).

The next major contribution to the understanding of Archaic chronology was Prewitt's (1981) attempt to refine Weir's model. Prewitt named four phases, Circleville, San Geronimo, Jarrell, and Oakalla, which encompassed the late Paleoindian and the early part of the Archaic; four additional phases, Clear Fork, Marshall Ford, Round Rock, and San Macros, which are within the middle part of the Archaic; and three late Archaic phases, Uvalde, Twin Sisters, and Driftwood (Prewitt, 1981).

Both Weir (1976) and Prewitt (1981) recognize the presence of a cultural continuum which began approximately 8,500 years ago and evolved throughout the Archaic. Within the Early Archaic period (8500-4600 B.C.), the earliest culture, Prewitt's Circleville Phase, exhibits a continuation of Paleoindian technology and adaptation of Archaic subsistence patterns (Prewitt, 1981). Story (1985) suggests periods of drought during the Early Archaic may have caused a clustering of small family-sized social groups along the Balcones Escarpment where springs and associated plant and animal resources were common. Approximately 7,000 years ago, a dissemination of cultural groups becomes evident as projectile point morphology differs strongly from the earlier phase, and through the following approximately 2,000 years, a variety of stemmed projectile points and specialized stone implements developed. Projectile point types representative of the Early Archaic period include *Wells, Gower, Bandy, Martindale*, and *Tortugas*.

Burned rock middens first appeared during Prewitt's Oakalla phase, approximately 5,000 years ago. Some hypotheses which attempt to explain the development of these middens include the "Intersecting Hearth Hypothesis" (Kelly and Campbell, 1942), "the Community Dump Hypothesis" (Sorrow, 1968), and the "Rock Oven Hypothesis." Weir (1976) postulates that these features are byproducts of acorn processing. According to Creel (1977), the most overriding circumstance that characterizes burned rock midden locations is their proximity to water. The technology, which caused the development of these features, seems to reflect periods of increased specialization.

During the early part of the Middle Archaic period (4600-2300 B.P.), a coalescence of cultural traits appears to have occurred. The period is best exemplified in a refinement of the process that created burnt rock middens, as well as an amalgamation of projectile point types. Earlier middens often exhibit a mixture of soil, burned rocks, tools, and lithic debitage. However, beginning with the Clear Fork and culminating in the Marshall Ford and Round Rock phases (Prewitt 1981), the middens may contain burned rocks and little else. Sites representing these phases may contain *Bulverde* (Marshall Ford) or *Pedernales* (Round Rock) projectile points. Mesic conditions on the Edwards Plateau and the brief appearance of buffalo may have lured hunters from the eastern woodlands, as exemplified by the occurrence of varieties of *Calf Creek* dart points such as *Bell* and *Andice* (Johnson and Goode, 1994). Later in the period less mesic conditions appear to have prevailed and the dart point types *Nolan* and