CHAPTER 2

DESCRIPTIVE OVERVIEW

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This chapter provides a general description of the Trinity River Watershed, the city of Dallas, Texas, and the primary study area under current conditions. The pertinent information includes climatology, physiography, geology, sociological, environmental, cultural and recreation data.

TRINITY RIVER WATERSHED

The Trinity River Basin lies in the eastern portion of the State of Texas, and is bounded on the north by the Red River Basin, on the east by the Neches and Sabine River Basins, on the west by the Brazos River Basin and on the south by the San Jacinto River Basin. The basin, with an overall length of about 360 miles and a maximum width in the headwaters of about 100 miles, extends along a northwest-southeast axis from Archer County to the northwest to Chambers County and continues in a southeasterly direction until it empties into the Gulf of Mexico at Trinity Bay near Galveston. The total drainage area of the basin encompasses more than 17,900 square miles.

The Trinity River, in the vicinity of the study area, is composed of four branches, the Clear, West, Elm and East Forks. The headwaters of each are located north and west of Dallas and Fort Worth and converge within the Metroplex. Specifically, the main stem of the Trinity River is formed in Dallas by the confluence of the West Fork and Elm Fork. The West Fork extends approximately 209 miles from Archer County and flows in a southeasterly direction to the city of Fort Worth where it is joined by the Clear Fork. The river continues in an easterly direction another 53 miles to its junction with the Elm Fork in Dallas. The Elm Fork rises in Montague County and flows in a southeasterly direction to join the West Fork and form the Trinity River at Dallas. The East Fork, although not specifically within the study area, rises in Grayson County from the northeast and flows southward to join the Trinity River 20 miles southeast of Dallas.

Within the area described above, the Trinity River Basin is influenced by more than 2,500 minor flow retarding structures and twelve major reservoirs. The Corps of Engineers constructed six of these reservoirs, including Benbrook, Joe Pool, Ray Roberts, Lewisville, Lavon and Grapevine. Other major Corps of Engineers flood control projects include the Dallas and Fort Worth Floodways. Non-Federal lakes influencing the basin include Amon Carter, Bridgeport, Eagle Mountain, Weatherford, Artington, Mountain Creek, White Rock, and Ray Hubbard. These flood control, recreation, hydropower and water conservation projects are shown in figure 2-1.

The Trinity is considered an urban river in all respects. It is significantly influenced by the amount of water it receives from watershed runoff, overflows from surrounding man-made reservoirs, and the controlled discharge of effluent from the sewage treatment plants.

The area hydrologically modeled in this study consisted of the entire drainage area upstream of the point where Five Mile Creek flows into the Trinity River near the intersection of the Trinity River and Interstate Highway 20 (about 10 miles southeast of downtown Dallas). This drainage area is shown in figure 2-2. The total drainage area at that point is approximately 6,275 square miles and lies within the Dallas/Fort Worth Metropolitan area. The total drainage areas of the Trinity River at the Elm Fork-West Fork confluence and at the Dallas Gage are 6,061 and 6,106 square miles, respectively. The terrain elevation varies from 1,200 feet National Geodetic Vertical Datum (NGVD) at the headwaters of the West Fork of the Trinity River approximately 35 miles south-southwest of Wichita Falls, Texas, to 380 feet NGVD at the confluence of Five Mile Creek and the Trinity River.

The Trinity River in the study reach is characterized as a main channel with an average depth of about 30 feet, a top width of about 200 feet and an average discharge of about 2,000 cubic feet per second (cfs) over the period of record from 1955 to 1992. The overbanks are generally very wide relative to the broad channel. The river channel has an average bottom slope of about 2.6 feet per mile and has proven to be very stable.

THE CITY OF DALLAS

The city of Dallas is located in Dallas County in north central Texas and serves as the county seat. The city is 35 miles east of Fort Worth and 245 miles north-northwest of Houston. Dallas has expanded to a highly diversified city since its incorporation in 1846, and is now the second largest city in the state of Texas. Dallas is a city of commerce, transportation, banking, retail and wholesale trade, conventions and trade shows. With its centralized location, Dallas is a favorite destination for tourists and has become one of the nation's busiest transportation hubs, being served by one of the world's busiest airports, Dallas Fort Worth International.

Dallas' diversified economy began as an agricultural trade center in the 1840's and has progressed into the wholesale and retail market center of the southwest. This economic strength fueled growth in banking, insurance, data processing, and electronic components which account for a major portion of the Dallas economy. In addition, Dallas is home to more than thirty-two Fortune 500 corporate headquarters, the World Trade Center, the Dallas Convention Center, Dallas International Market Hall, the Infomart and Reunion Arena. The county has 22 colleges and universities, 34 hospitals, 22 libraries and 68 banks.

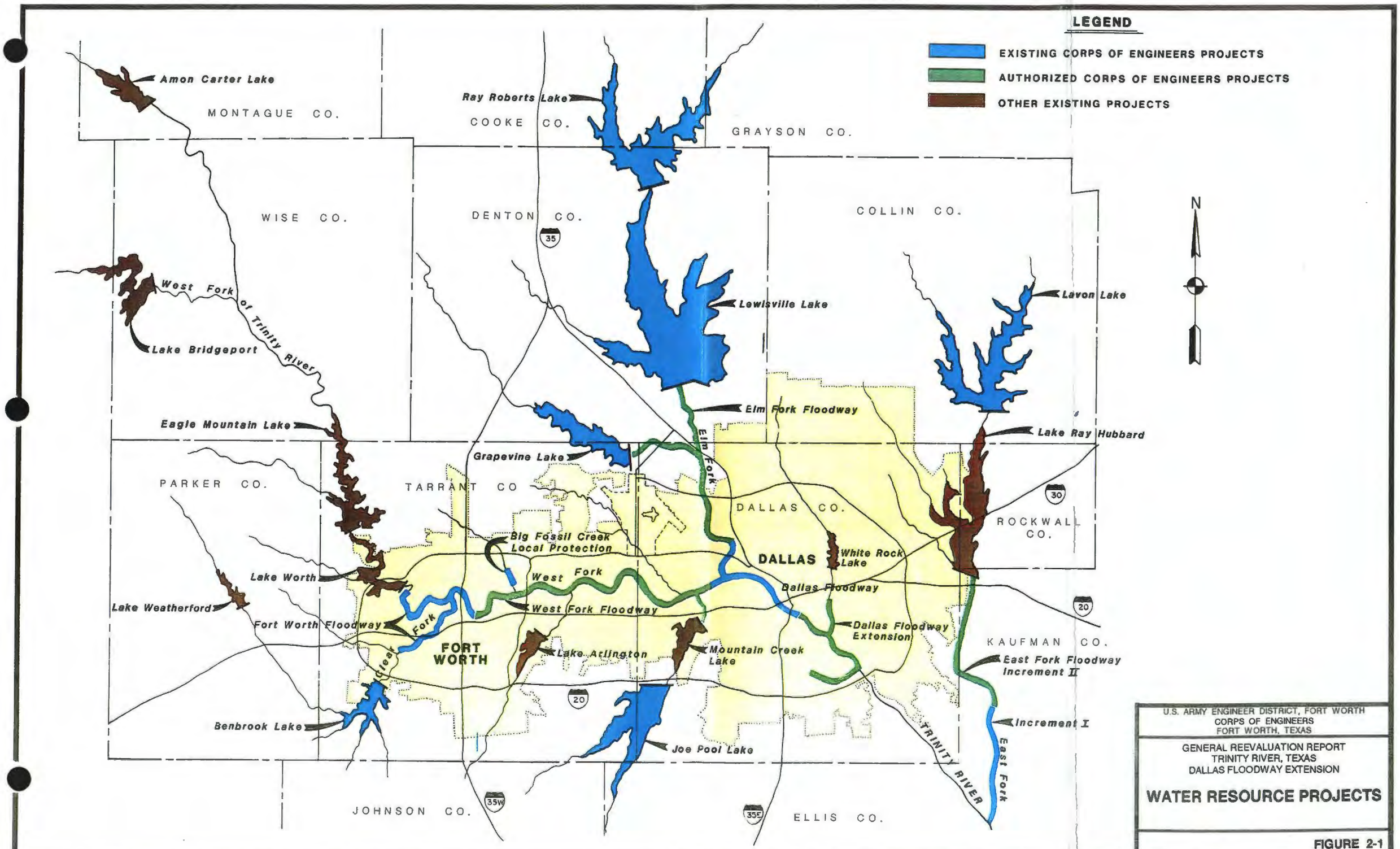
The Trinity River's original name, La Santisma Trinidad (the Most Holy Trinity), is derived from the convergence of three branches which come together in Dallas. The river flows easterly through a significant portion of the city of Dallas and influences land use in both the northern and southern sectors.

STUDY AREA

The study area is located in the southern sector of Dallas, southeast of the downtown area. Specifically, the study area investigated can be defined as that portion of the Trinity River between the confluence of Five-Mile Creek, near the intersection of the Trinity River and Interstate Highway 20 (about 10 miles southeast of downtown Dallas) and the downstream end of the existing Dallas Floodway Levee System and bounded by the SPF limits. The study area also includes the White Rock Creek tributary between IH-30 from the northeast to its confluence with the Trinity River. The entire study area is located within the corporate city limits of Dallas, Texas. A map of the study area is shown in figure 2-3.

CLIMATOLOGY

The Trinity River watershed is located in a region of temperate mean climatological conditions, experiencing occasional extremes of temperature and rainfall of relatively short duration. According to the National Oceanic and Atmospheric Administration Station at Fort Worth, Texas, the 30-year mean rainfall amount is 33.7 inches per year with the most recent ten year (1987-1996) average being 37.88 inches. The extreme annual rainfall values since 1887 are a maximum of 53.54 inches occurring in 1991, and, a minimum of 17.91 inches occurring in 1921. The mean relative humidity is 65 percent with an average temperature of 65.8°Fahrenheit. The average first freeze date in the fall is November 13, while the average last freeze date in the spring is March 23.



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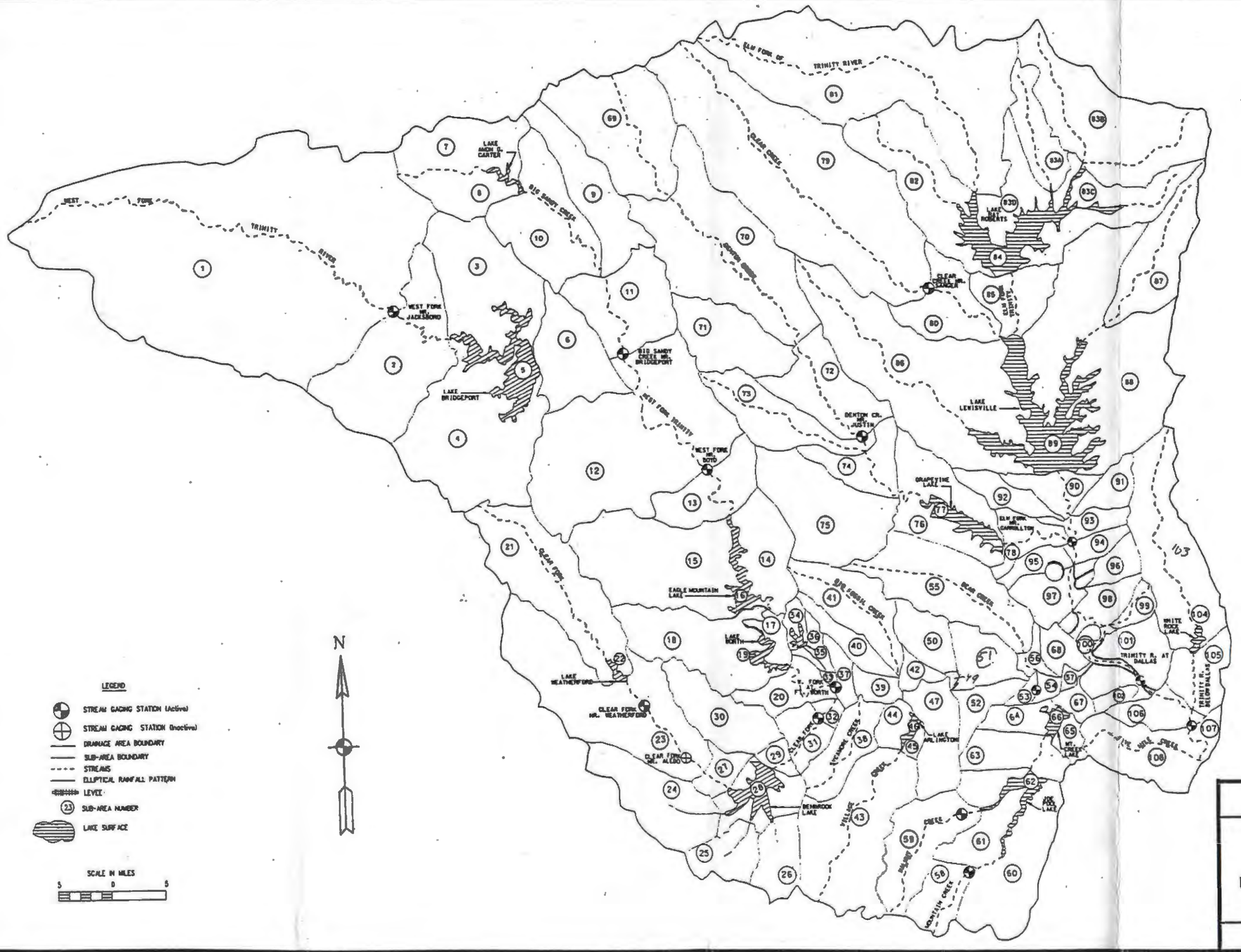
WATER RESOURCE PROJECTS

FIGURE 2-1



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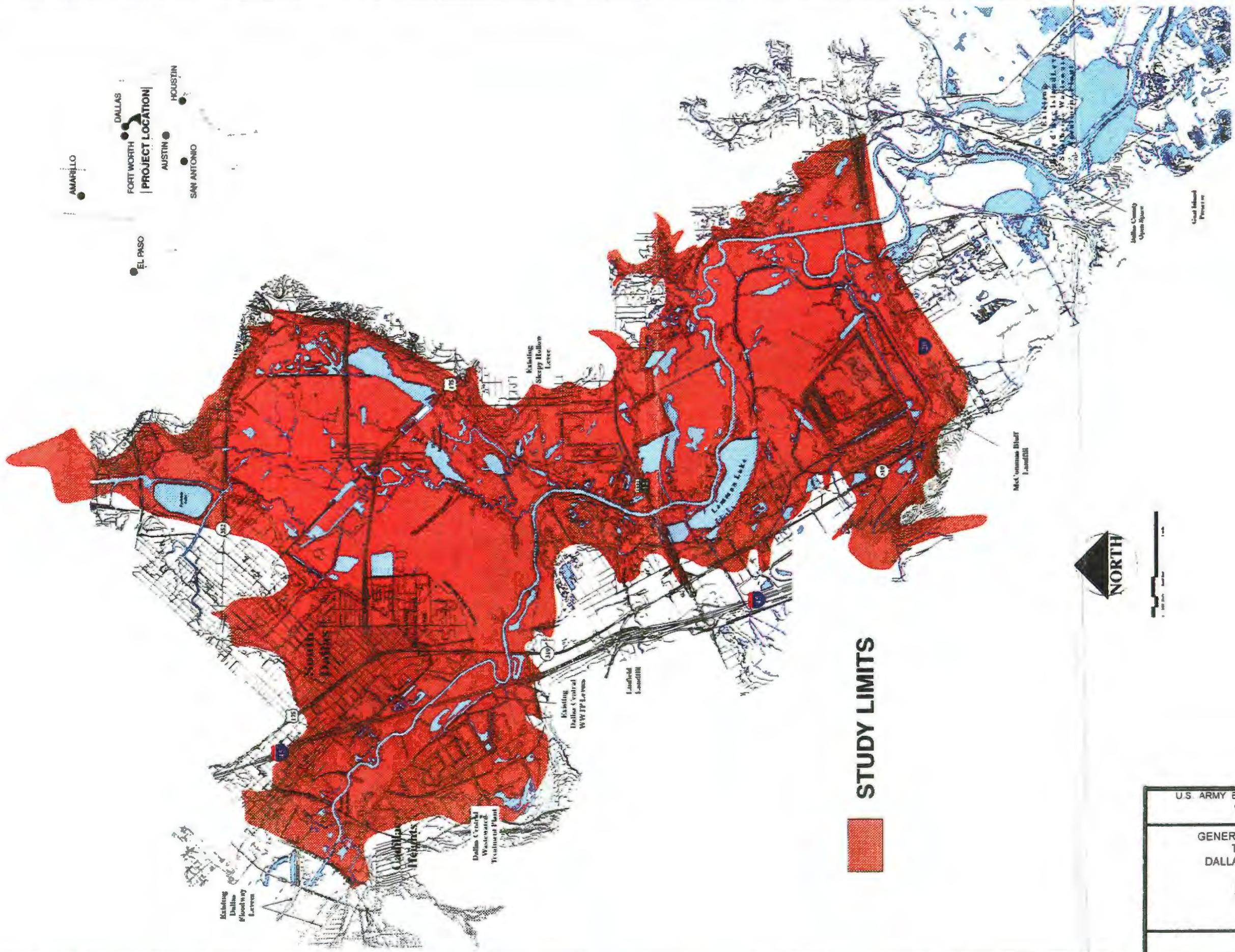
UPPER TRINITY RIVER BASIN

FIGURE 2-2



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STUDY AREA

FIGURE 2-3

Generally, the major storms experienced in the study area are produced by heavy rainfall from frontal-type storms which occur in the spring and summer months, but major flooding can also be produced by intense rainfall associated with localized thunderstorms. These thunderstorms may occur at any time during the year, but are more prevalent in spring and summer months. Table 2-1 presents a summary of climatological statistics for the city of Dallas.

Table 2-1
Climatological Statistics for Dallas, Texas
(Based on 109 years of Record)

RAINFALL	
Average Annual (1987-1996)	37.88 inches
Maximum Annual (1991)	53.54 inches
Minimum Annual (1921)	17.91 inches
Maximum 24-Hour (September 1932)	9.57 inches
TEMPERATURE	
Average Daily	65.8 °F
Daily Maximum (June 1980)	115 °F
Daily Minimum (December 1989)	-1 °F
RELATIVE HUMIDITY	
Average Daily	65 percent

The prevailing winds for this area are from the south or southeast, except during portions of the winter months. During this time, occasional high pressure polar air masses from the northwest result in north winds over most of the area.

BASIN PHYSIOGRAPHY AND GEOLOGY

The Trinity River Basin, situated in east central Texas, encompasses more than 17,900 square miles, and includes all or portions of 38 counties. Altitudes range from 1,500 feet above mean sea level in upper extreme reaches of the basin to sea level at the mouth in Trinity Bay. The gradient of the river decreases from almost 4.0 feet per mile to about 0.8 feet per mile toward the mouth. The basin is situated within two physiographic provinces, the Central Lowland province in the headwaters, with rock outcrops indicative of the Pennsylvanian and Permian age, and the Coastal Plain province, which includes varying outcrops throughout the basin. In the extreme upper basin, moderately rugged eastward-facing escarpments and stream valleys with narrow and steep-sided floodplains are indicative of a newly forming erosional cycle. The topography changes to primarily flat to gently rolling in the mid-basin prairies and Cross Timbers regions, becomes gently rolling to hilly through the East Texas timber belt, and then gradually levels out to very flat treeless areas (in uplands) in the Coastal Prairie.

STUDY AREA PHYSIOGRAPHY AND GEOLOGY

The Dallas Floodway Extension study area is located within the northernmost section of the Gulf Coastal Plains, which is characterized by essentially flat lying to gently dipping unconsolidated terrace and flood plain deposits. All physiographic features within this area were formed during the Cenozoic Era. Fluvial terrace deposits and alluvial deposits of the Quaternary Age occupy the floodplain area of the Trinity River. These deposits consist of gravel, sand, silt, and clay deposits.

The underlying bedrock consists of the lower and middle members of the Austin Chalk Formation, a chalky limestone with thin bentonitic beds scattered in the lower part. Within the study area, the Austin Formation has an estimated thickness of 300 feet to 700 feet and gently dips to the southeast.

Geologic structural features within the project area do not pose a significant threat to the integrity of the project. However, Paleozoic formations of the Ouachita series of Oklahoma extend south into this region and, at great depth, underlie the Cretaceous rocks exposed at the surface. The Ouachita series is characterized by intense folding and faulting. Normal and reverse faults north and east of Dallas, as well as the famous Balcones fault zone to the south, have been correlated with this regional structural feature. Regardless of these features, any seismic risk within the project area is considered to be minimal. Additionally, this project is located within zone "zero" on the seismic risk map of the United States, indicating no damage is expected as a result of earthquake activity. It is anticipated that all excavations can be accomplished with conventional earth moving equipment.

EXISTING DALLAS FLOODWAY LEVEES

The existing Dallas Floodway Levee System is a federally sponsored project currently maintained by the city of Dallas. The Dallas Floodway Extension study initially had a primary focus to evaluate current conditions and proposed improvements for those areas downstream of the Dallas Floodway that are susceptible to flood damages up to and including the SPF event. However, due to changes in the floodplain and the backwater effects on the downstream end of the Dallas Floodway Levees, the risk of overtopping of these levees has become a major consideration. Therefore, the Dallas Floodway Levee System is included in this investigation. The design of the Dallas Floodway Levees was based on construction of the levee crest to the SPF flood water surface elevation plus four feet of freeboard. The SPF flood elevations used to establish the original design grade of the levees were computed using hand backwater calculations. Subsequent studies, using an LRD-1 hydraulic model, confirmed the original SPF flood elevations. The HEC-2 hydraulic model compiled for this study, updated for current conditions, computes higher water surfaces downstream of the Dallas Floodway than those computed with the earlier model.

The downstream end of the Dallas Floodway levees is located near the abandoned Atchison, Topeka, and Santa Fe (AT&SF) Railroad bridge. The East Levee has a terminal section extending perpendicular to the river along the AT&SF Railroad tracks and directly beneath the newly constructed DART Rail Line bridge to high ground. A portion of this extension of the East Levee is earth embankment with a design crest elevation of 425.2, while the remainder is a concrete floodwall up to 7 feet in height extending to the high ground limit. The concrete floodwall portion of the levee has a design crest elevation of 423.0 and includes two integral stoplog closure sections. One of these stoplog structures provides passage for a dual track Southern Pacific Railroad line. The other stoplog structure formerly served the same purpose, but the tracks have been removed as part of the construction of the DART Rail line bridge. For the purpose of this study, the stoplog structures have been assumed to be in place prior to the occurrence of a major flood event and reliable up to the floodwall design crest elevation of 423.0.

A topographic survey compiled from aerial photographs taken in February of 1991 indicated that a length of about 600 feet of the East Levee embankment near the AT&SF Railroad bridge had degraded to an elevation of about 422.0. The West Levee, at the same location along the river, has not degraded significantly below the design grade elevation of 425.2. The survey also indicated that other portions of both the East and West Levee crests have degraded below the design grade, but this location on the East Levee was the most critical. The city has restored the East Levee design grade at the AT&SF Railroad with work

completed during 1996. The city initiated additional work within the Dallas Floodway in late 1998 to address other levee crest deficiencies upstream. In light of the city's progress and continued efforts to restore levee design grade, the overtopping elevation chosen to be used in this analysis for the Dallas Floodway East Levee was based on the crest elevation of the concrete floodwall of 423.0. The current hydraulic study computed a baseline conditions SPF water surface elevation at the AT&SF Railroad bridge of 426.0, and a 500-year water surface elevation of 422.4. This analysis indicates that under current conditions, the occurrence of an approximate 500-year flood event would overtop the concrete floodwall portion of the East Levee.

EXISTING ROCHESTER PARK LEVEE

The Rochester Park Levee was constructed during the time this study was performed and has been hydraulically modelled in the baseline conditions hydraulic model. The design of the levee was based on the SPF water surface from previous hydraulic analysis plus four feet of freeboard which yielded a design elevation of 417.0. This elevation was computed by the earlier LRD-1 hydraulic model discussed above and was used for the entire levee crest without allowance for the slope of the hydraulic grade line from the portion of the levee farthest downstream to the upstream end of the levee. The upstream end of the Rochester Park Levee terminates at a natural ground elevation of 415.5. Based on the earlier hydraulic study, this elevation provided about two feet of freeboard above the SPF water surface at that location. As originally designed, flood discharges exceeding the design capacity of the levee system would initially enter the protected area at the upstream end of the levee, across broad natural ground areas at an elevation lower than the levee crest, thus preventing a catastrophic failure of the levee. However, as more detailed topographic mapping became available, it was determined that farther upstream from the end of the levee, at Hatcher Street and South Central Expressway, the underpass would allow flood waters to enter the areas protected by the Rochester Park Levee at an elevation lower than at the area near the upstream end of the levee. The elevation at the underpass above which flood waters would begin to inundate those areas protected by the Rochester Park Levee north of the C.F. Hawn Freeway is estimated to be 413.0 and the elevation above which flood waters would begin to inundate those areas south of the C.F. Hawn Freeway is estimated to be 414.5. The current hydraulic study computed a 100-year water surface elevation at Hatcher Street, under baseline conditions of 412.0, and a 500-year water surface elevation of 418.1. Based on this analysis, the current level of protection provided by the Rochester Park Levee is approximately the 110 -year flood event. This approximate evaluation of level of protection is used primarily to show the difference between the results of this study and the previous hydraulic analysis that was used for the design of the levee system. The location of this levee is shown on figure 2-4.

EXISTING CENTRAL WASTEWATER TREATMENT PLANT LEVEE

The Central Wastewater Treatment Plant (CWWTP) is located on the right overbank of the Trinity River between the Missouri-Kansas-Texas Railroad bridge and the Interstate Highway 45 bridge. It is protected from flooding by a ring levee system that surrounds the main structures of the treatment plant. The levee survived the flood of 1990 without overtopping, but required emergency repairs during the flood. The city of Dallas has since implemented a plan, designed by the engineering firm of Albert H. Halff & Associates, Inc. of Dallas, to upgrade the CWWTP Levee and other plant facilities to comply with Texas Water Commission requirements to provide 100-year flood protection plus three feet of freeboard. The results of the hydraulic analysis used to establish the design levee crest elevation of 415.0 compares very closely with the water surface profiles presented in this report. This elevation was used to estimate the CWWTP levee level of protection at approximately the 140-year flood event. This levee is shown in figure 2-4.

EXISTING SLEEPY HOLLOW COUNTRY CLUB LEVEE

The Sleepy Hollow Country Club Golf Course is located between the Linfield Landfill and the Loop 12 bridge on the right bank of Trinity River. A small levee approximately 10 feet in height is located along the right bank of the river channel and provides about a 10-year level of protection for the golf course based on observance of recent flood events and analysis of recent topographic data. For flows less than a 10-year frequency event, the levee encroaches upon the main bridge opening of the Loop 12 bridge for about 50 percent of its length. The Loop 12 highway crossing of the floodplain consists of two additional relief bridges that are not affected by the golf course levee.

ENVIRONMENTAL SETTING

GENERAL

Of major concern, environmentally, to this study are the floodplain areas adjacent to the river. The study area is located within a fully developed metropolitan area, and the environmental setting varies significantly. Located immediately upstream of the study area is the Dallas Floodway Project, which was constructed with Federal funds in 1957 and consists of a channel and levee system that extends from Mountain Creek to the Atchison, Topeka, and Santa Fe (AT&SF) Railroad bridge. Since the construction of this project, the environmental characteristics of the area have been significantly modified, although some riparian vegetation and wildlife habitat have reestablished naturally. From the AT&SF Railroad bridge downstream to the Interstate Highway 20 Trinity River crossing, the topography consists mainly of bottomland hardwoods, scattered wetlands, open water areas, gravel pits, and open fields which are used for grazing livestock. The project area is within an area known as the "Great Trinity Forest", which roughly encompasses the Trinity River mainstem floodplain between the existing Dallas Floodway and the IH-20 crossing, and the White Rock Creek floodplain from the confluence with the Trinity River upstream to IH-30. A summary of the environmental setting is provided below. The complete analysis is provided in Appendix F.

AIR QUALITY

The project study area is located within the Environmental Protection Agency's Air Quality Region (AQCR) 215 for Texas, which consists of 19 counties, including Dallas, Denton and Tarrant. AQCR 215 is classified as a serious non-attainment area for ozone and attainment/unclassifiable for other National Ambient Air Quality Standards including lead, sulfur dioxide, nitrogen dioxide, carbon monoxide, and particulate matter of aerodynamic shape less than or equal to 10 micrometers in diameter.

In 1995 and 1996, the Texas Natural Resource and Conservation Commission (TNRCC), Office of Air Quality, reported that the average annual criteria pollutant concentrations for the city of Dallas were as follows: lead - 0.03 micrograms per cubic meter ($\mu g/m^3$); PM10 - 29 $\mu g/m^3$; carbon monoxide - 0.75 parts per million (ppm); sulfur dioxide - 0.003 ppm; ozone - 0.0023 ppm; and, nitrogen dioxide - 0.017 ppm.

Trees influence air quality. Direct effects are generally more local in nature, while indirect effects may be more generalized. Trees lower local air temperatures by shading and transpiration. Trees may also alter air flows which, depending on the location of the trees and adjacent buildings, may either reduce energy use or increase it. A dense forest or row of trees upwind of a building may cause a heat island to form around the building during the summer time by blocking off air flow. A windbreak upwind of a building during the winter, however, may result in reduced heating requirements. Energy use, in turn, affects air quality on a regional basis by influencing the extent of fossil fuel use. Living trees can either directly remove or contribute to atmospheric pollution. Generally, the benefits of trees outweigh their detrimental impacts. Quantification of their effects on removal of air pollutants has been measured, and models developed, which have application to the project area. Estimates of the annual pollution removal rates of trees within the study area were developed using the United States Department of Agriculture's Urban Forest Effects (UFORE)

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ROCHESTER PARK AND CWWTP LEVEES

FIGURE 2-4

program. It is assumed that herbaceous vegetation also has some pollutant uptake capabilities since they are functionally similar to trees. However, due to a lack of published materials describing these pollutant removal coefficients, herbaceous vegetation was not included in this analysis. Table 2-2 provides a summary of the total current pollution removal rates of trees within the Great Trinity Forest, the city of Dallas, and the detailed project area (under existing conditions and future without-project conditions).

Table 2-2
Air Pollution Removal Rates By Trees
(Tons / Year)

Area	Carbon Monoxide	Sulfur Dioxide	Nitrogen Dioxide	Particulate Matter (10 µm)	Ozone
Existing Great Trinity Forest	13.30	11.74	32.93	77.16	145.19
Existing City of Dallas	137.72	128.92	355.96	955.24	1,491.82
Detailed Project Area - Existing Conditions	1.41	1.24	3.48	8.17	15.37
Detailed Project Area - Future Without-Project	2.02	1.78	4.99	11.70	22.02

WATER QUALITY

The portion of the Trinity River in which the proposed project lies is designated by the TNRCC as segment 805. While the water quality of the Trinity River continues to improve, four areas of concern remain in this segment. According to tests conducted every two years by the TNRCC, nitrite+nitrate, orthophosphorus, total phosphorus and fecal coliform concentrations were outside criteria or screening levels 92.5%, 97.67%, 94.59%, and 38% of the time, respectively. Dissolved oxygen levels have historically been considered a serious problem but have shown great improvement and are now rarely lower than the standards criteria of 5.0 milligrams per liter. Low flow rates and high temperatures, typical in the dry summer months, create conditions under which water quality problems such as high algal growth and low dissolved oxygen levels may exist.

The Texas Department of Health issued an aquatic life closure for a stretch of the Trinity River in January 1990 due to elevated levels of chlordane in fish tissue. This 66-mile stretch of the Trinity River, denoted as Segment 806, extends from Fort Worth to IH-20 in southern Dallas County, which includes the DFE project area. Fishing can be conducted, but no taking of fish is currently allowed. In addition, the TNRCC does not support contact recreation within the waters of Segment 806 due to continued water quality violations discussed in the above paragraphs.

Effluent from several wastewater treatment plants discharge into the Trinity and tributaries throughout the Dallas / Fort Worth Metroplex. The Central Wastewater Treatment Plant (CWWTP) in Dallas meets and often exceeds stringent requirements as stated in the discharge permits issued by the state. In the last three years, 15 chronic toxicity tests have been conducted for the organism *Ceriodaphnia dubia* in 100% effluent. All tests results have been negative, indicating that the effluent may be used to provide fish and wildlife habitat.

VEGETATIVE COVER

General

The proposed project is located in the Blackland Prairies vegetative ecoregion, and the predominant soil is classified as frequently flooded Trinity Clay. Tree species common to this area include- elms, sugarberry, pecan, oak, black willow, cottonwood, and osage orange.

The "Great Trinity Forest", as defined above, encompasses approximately 5,956 acres, of which 5,456 acres are woodland and include bottomland hardwoods, mixed Deciduous, and wetlands/bottomland hardwoods. The remaining 500 acres are composed of water, grassland, scrub/shrub, and urban areas. Table 2-3 shows the vegetative/land cover types, by number of acres and percent of total cover, within the Great Trinity Forest. A vegetative cover map is shown in figure 2-5.

Table 2-3
Types of Vegetative/Land Cover Within the Great Trinity Forest

Type of Cover	Acres	Percent of Total Cover
Bottomland Hardwoods	4,198	70.5
Wetlands/Bottomland Hardwoods	1,045	17.5
Water	233	3.9
Mixed Deciduous	213	3.6
Pasture/Unmanaged Grasslands	121	2.0
Scrub/Shrub	63	1.1
Agriculture	37	0.6
Urban/Roads/Bare Ground	15	0.3
Low Density Urban & Residential	13	0.2
Managed Grassland	12	0.2
Unclassified/Bare Ground	3	0.1
Bare Ground	3	0.1
TOTAL	**5,956**	**100**

U.S. Army Corps of Engineers - Ft. Worth District
Environmental Division - Evaluation Branch
GIS Unit, July, 1997

Dallas Floodway Extension

Landuse Vegetative Cover

- Water
- Wetland
- Oak/Pecan forest (high quality)
- Cottonwood/Ash Elm/Willow forest (medium quality)
- Mixed Grass and Forbs
- Landfill/ Disturbed
- Urban

N

State Plane Zone 5351

Scale 1:24,000

0 1/4 1/2 3/4 1

Miles

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VEGETATIVE COVER MAP

FIGURE 2-5

Bottomland Vegetation

Bottomlands occur in the transition zone between aquatic and upland ecosystems, and bottomland hardwoods are considered to be Texas' most diverse ecosystem. Within the Dallas Floodway, the dominant species is black willow and cottonwood. Downstream from the AT&SF Railroad bridge to the Dallas County line, the dominant tree species are mature black willow, cedar elm, sugarberry, green ash, pecan, American elm, box elder, cottonwood, red mulberry, and osage orange. The dominant understory shrubs, woody vegetation and vine species consist of immature tree species of the same type mentioned above, along with western soapberry, swamp privet, common greenbrier, honeysuckle, and poison ivy. In areas of dense canopy cover, the dominant herbaceous groundcover species include poison ivy, wild onion, violets, Virginia creeper, and Canadian wild rye. In areas where the canopy cover is more open, the tree species are the same, but the percent cover of herbaceous vegetation increases, with the dominant species being marsh elder, ragweed and sedges.

Wetland Vegetation

Wetlands are defined as those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, under normal circumstances, a prevalence of vegetation typically adapted to life in saturated soil conditions. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. The wetlands located in the study area are scattered throughout the flood plain in isolated depressions or very low gradient drainages, and contain marsh elder, ragweed, cottonwoods, green ash, and black willows, with occasional box elders. Rapid growth of invading cottonwood, green ash and willows has resulted in a rapid conversion of emergent wetlands to bottomland hardwood wetlands during the recent past.

Grasslands

Open grasslands developed from reclaimed mine areas and abandoned agriculture fields are commonly used as grazing lands for livestock, with vegetation characteristic of disturbed bottomland pastures. Common grass species include purple threeawn, King Ranch bluestem, sideoats grama, Japanese brome, tumble windmillgrass, bermuda grass, jungle rice, barnyard grass, plains lovegrass, perennial ryegrass, Texas wintergrass, Dallisgrass, annual bluegrass, and Johnson grass, while dominant herbaceous species include giant ragweek, annual sunflower and goldenrod. These open areas are expected to eventually succeed to bottomland hardwood forests, based on a comparison of historic and recent photographs.

FISH AND WILDLIFE RESOURCES

Similar to the plant species of the flood plain, fish and wildlife species vary considerably within the study area. Influence of man, his developments and residual wastes have brought about significant changes in the habitat, food supplies and, thus, resident populations of fish and wildlife resources. Predator control, indiscriminate hunting, use of pesticides, and various forms of air, water, and land pollution has been responsible for modified distribution of fish and wildlife populations throughout the area. The surviving fish and wildlife live in a modified natural habitat within the immediate influence of an encroaching urban complex.

Fish (Aquatic) Resources

In addition to the mainstem of the Trinity River, adjacent wetlands and open water areas support a variety of fish species. Within the mainstem of the river, concerns about the quality of the fishery habitat include turbidity and oxygen-demanding pollutants, which interact to produce lowered dissolved oxygen concentrations. Physical habitat for fisheries is scarce, particularly in the channelized reaches within the existing Dallas Floodway upstream of the project area. Several studies verify that stream fisheries have improved during the last twenty years, due primarily to improved water quality resulting from improved waste water treatment. Sportfish present in the study area include largemouth bass, channel catfish, crappie, and

white bass. Other species which tend to be more tolerant of moderate levels of nutrients and lower dissolved oxygen present in the area include common carp, river carpsucker, longnose gar, freshwater drum, several species of shiners, and bullhead catfish. Non-sport species found in the study area that are less tolerant to pollutants include gizzard shad, mosquitofish, and several sunfish species.

Wildlife Resources

The river channel, wetlands, open water areas, and forested areas support a variety of wildlife species for cover, food, and nesting areas. Bird species which have been reported or observed within the study area, include migratory warblers and sparrows, meadowlark, mourning dove, crow, red-tailed hawk, American kestrel, herons, egrets, mallard, wood duck, blue-winged teal, green-winged teal, lesser scaup, grackle, scissor-tailed flycatcher, kingbird, logger-head shrike, black birds and swallows. A major heron rookery exists within a heavily wooded area along Rector Road west of the Central Wastewater Treatment Plant. At least five species of birds have been observed nesting in the rookery. Amphibians, reptiles, and mammals which are common to the area include frogs and toads, snakes, turtles, cottontail rabbit, cotton rat, field mice, opossum, raccoon, bobcat, beaver, nutria and coyotes.

THREATENED AND ENDANGERED SPECIES

Table 2-4 provides a list of federally protected species that may occasionally migrate through the project area.

Table 2-4
Federally Listed Threatened and Endangered Species Whose Migratory Corridor Includes Dallas County, Texas

Species	Scientific Name	Status
American peregrine falcon	*Falco peregrinus anatum*	Endangered
Arctic peregrine falcon	*Falco peregrinus tundrius*	Threatened
Bald eagle	*Haliaeetus leucocephalus*	Threatened
Black-capped vireo	*Vireo atricapillus*	Endangered
Interior least tern	*Sterna antillarum*	Endangered
Piping plover	*Charadrius melodus*	Threatened
Whooping crane	*Grus americana*	Endangered

(Source: U.S. Fish and Wildlife Service, June 1997)

CULTURAL RESOURCES

The cultural resources under consideration in the project area may be identified as archaeological sites and architectural or structural elements in the landscape that are at least 50 years of age. The Dallas Floodway Extension (DFE) study area or area of potential effect (APE) has been defined as that terrain along the Trinity River between the Corinth Street Viaduct and U.S. Interstate 635 falling within the SPF floodplain. The proposed project footprint is that portion of the APE which is scheduled to be directly impacted by terrain modification and construction activity. Once archaeological deposits are extensively disturbed, reconstruction or rehabilitation of the evidence to explain past behavior is extremely limited to

absent. The material remains (artifactual data) of prehistoric and historic archaeological sites make up the record of the human past, and it is the analyses and interpretation of the contextual relationships between the artifactual remains which provides us with our window to the past. Evidence indicates that the inception of human activity in the project area likely dates to around 12,000 years ago. Prehistoric exploitation of the riverine system lasted until the early 1800s.

Historically, the Trinity River may have been visited by Luis de Moscoso de Alvorado between 1541 and 1545, as he led the survivors of the Hernando de Soto Expedition back to Mexico following de Soto's death on the Mississippi River in 1541. Later, the area came under the domain of Spain, which was competing with the French to the north for land entitlement. By 1823 the area was under the rule of the Republic of Mexico until Texas won independence in 1836. John Neely Bryan established a post at Dallas 1842, and some early settlers arrived in the project area by 1844, such as William Perry Overton and family. Dallas County was organized in 1846, and less than a year later in 1847, another settler in the area, William Brown Miller, started the first ferry service across the Trinity River at the large meander in the middle of the project area.

To date there are 41 archaeological sites known within or immediately adjacent to the DFE Study Area, which includes seven that are outside of the APE and seven that are only partially within the APE. Fourteen of the sites are reportedly within the project footprint, six of which have been destroyed by development. Of the remaining eight archaeological sites, seven are prehistoric, while the eighth is an old City of Dallas dump dating between ca. 1890 and 1940. Generally, prehistoric sites within the study area will represent riverine habitats exploitation. A typical site may consist of large occupational horizons composed of small activity-specific loci such as molluscan (Naiad) exploitation sites. These sites, many of which have not been extensively examined, may have been repeatedly revisited either seasonally or throughout a season by an undetermined population.

The Late Prehistoric period, which includes all ceramic-bearing culture groups, are most frequently identified at sites in the project area and footprint, although Late Archaic occupations are also recorded in modest numbers, while Early and Middle Archaic components are less frequently encountered. One explanation provided assumes that older sites are deeply buried. For example, at the Aubrey Site, a Paleoindian occupation located upstream on the Elm Fork of the Trinity River, intact and in situ cultural materials were recovered more than eight meters below the current flood plain surface. This condition indicates that early prehistoric sites in the mainstem portion of the Trinity River incorporating the project area may be at least as deep. Prehistoric sites positioned within floodplains may be subjected to massive erosional or depositional forces. In addition, during stable periods with little sediment movement, the surviving deposits will be subjected to extensive weathering through soil formation processes, which generally have greatest expression in floodplain settings.

Archaeological sites that are either located on old fill deposits (terraces) in the modern floodplain are positioned on benches or finger ridges along the lower edge of the Pleistocene valley wall, will likely present a more compressed soil stratigraphic sequence. These kinds of locations rely on overland flow deposition or sheetwash erosion as a means of covering or deflating archaeological deposits. However, they generally provide nearly flat surfaces where the context of cultural remains may remain relatively intact, even during times of local sediment gain or loss. These deposits are not as thick as those in active river bottoms. As in the floodplain, soil development during stable depositional periods is moderately well expressed on these bench and finger ridge features. However, bio-turbation due to such agents as roots, bugs and burrowing animals, becomes a more important factor in assessing artifactual distributions in the thinner deposits.

The edge of the 100-year flood stage is between the current channel and the valley wall. It may be considered roughly synonymous with the Late Holocene floodplain margin. Topographic settings, such as knolls and flood plain rises, in this portion of the upland bottom may likely contain buried prehistoric deposits. As noted above, these areas are stable and receive sediment from the valley wall. In addition, these areas are likely to have topographic features that formed old surfaces and were later buried. As the City of Dallas expanded rapidly during the second and third quarter of the 20th century, much of this area was impacted

by the development of light industry and manufacturing, as well as residential enclaves. In addition, sand and gravel quarrying, as well as waste disposal, have had a major impact on the area.

A total of 748 architectural resources or buildings and structures were identified in the APE, 49 of which are in the project footprint. However, 43 of the 49 structures are either destroyed, not historic or have poor integrity. A complete listing of the historic and prehistoric sites, as well as the architectural inventory, for the area of potential effect and project footprint area is provided in Appendix H.

HAZARDOUS, TOXIC AND RADIOLOGICAL WASTE (HTRW)

In 1993, a study titled "Initial Assessment for the Evaluation of Hazardous and Toxic Wastes" was conducted by Albert H. Halff Associates, Inc. The objective of the study was to research existing areas of HTRW contamination, and to identify suspect or previously unknown HTRW sites located within the Dallas Floodway Extension project area. In the report, nine areas of suspected HTRW contamination were identified, which represented the original areas of concern and thus formed the basis of subsequent Corps HTRW site investigations and project decisions.

Follow-up investigations were conducted by several different firms. Environmental Sciences and Engineering conducted a feasibility level site investigation at a number of these sites. Freese and Nichols investigated Linfield Landfill and one of the adjacent gravel pits. Geo-Marine conducted further feasibility level site investigations and developed cost estimates for this report. Tetra Tech NUS conducted an additional site investigation at Linfield Landfill. Results of these five studies, plus results of Corps of Engineers efforts in interviewing local residents and officials, searching regulatory agency files for studies conducted by others, and visually inspecting the project area increased the number of areas with suspected HTRW contamination to the 14 listed below, which are described in more detail in Appendix J of this report.

1. Praxair (formerly Linde Gas) - Acetylene gas manufacturing / packaging facility
2. Tri-Gas / Occidental Chemicals - Industrial gas facility and active silicate plant
3. Dallas Public Schools (formerly Proctor and Gamble)
4. Trinity Recycling (now Okon Metals) - Metals recycling facility
5. Various Gravel Pits - Near Trinity Recycling, near IH-45, ponded area near Dixie Metals, and ponded area near Linfield Landfill
6. Valley Steel & W.E. Grace Manufacturing Company - Industrial facilities
7. Dallas Demolition Company
8. Vacant Land Near Dal-Chrome
9. Energy Conversion Systems & Darling International
10. Vacant Land North of Central Wastewater Treatment Plan
11. Municipal Sludge Disposal Lagoon E
12. Union Pacific Railroad Landfill - Located northeast of Linfield Landfill
13. Linfield Landfill
14. Open Dump Near Linfield Landfill - Located due west of Linfield Landfill

SOCIO-ECONOMIC CONDITIONS

The Bureau of the Census reports the population for the city of Dallas as 904,100 persons in 1980 and 1,007,600 persons in 1990, while the North Central Texas Council of Governments shows the 1997 population at 1,052,300. These figures account for more than 80 percent of the population in Dallas County, and show an annual growth rate of over 10 percent.

Over this ten-year period, employment in the service industry has increased almost 50 percent, highlighting a significant shift from a manufacturing-based economy to a service related economy. Non-farm employment increased almost four percent between 1990 and 1994, while the construction industry led the job growth figures in 1994 with an increase of over 10 percent.

The D/FW area is one of the nation's leading distribution centers, generating a significant demand for warehouse space. The Metroplex is also an established transportation center for the nation. The Dallas Fort Worth International Airport covers 17,500 acres and was designed to meet the future needs of the entire North Texas area. The Metroplex exhibits positive growth trends that are anticipated to continue into the future. The location and climate are pleasant.

Due to the location of the Cadillac Heights residential neighborhood in relation to the downstream end of the existing Floodway and the potential impacts of any flood damage reduction project in this area, a comparison of socio-economic data for this neighborhood and the city of Dallas as a whole is presented in table 2-5. The majority of the data represents 1990 Census Bureau data. Unemployment figures for the city of Dallas, in 1994, were reported at 5.3 percent. In 1996, this rate decreased to 3.9 percent, and is currently reported at 3.6 percent. Local industries and employment are well diversified and unemployment rates are lower than the State average. Per capita income for 1995 was estimated at $18,180, with an average salary of about $30,000.

Table 2-5
Comparative Socio-Economic Data -
Cadillac Heights vs. City of Dallas

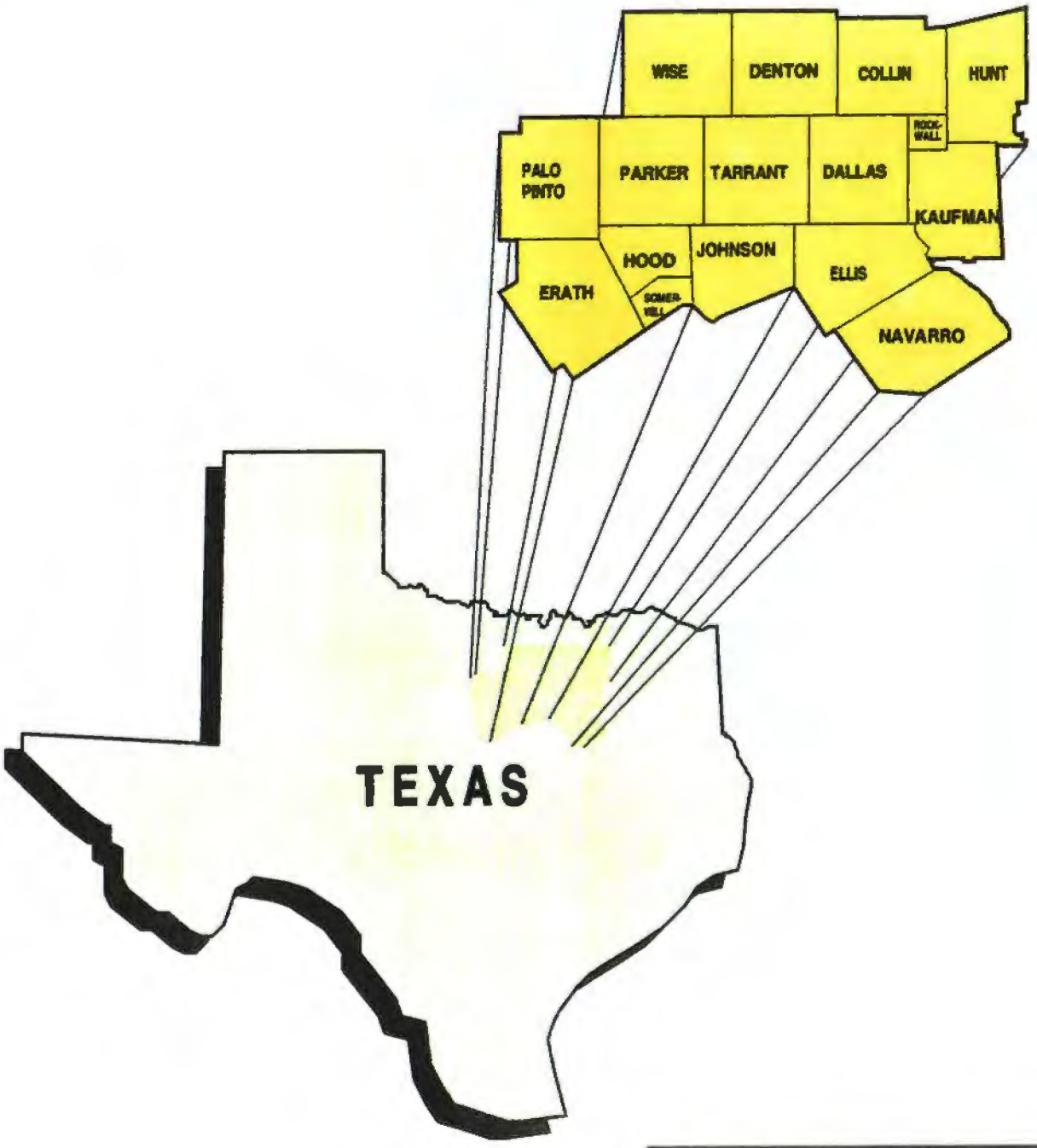
	Cadillac Heights	City of Dallas
Number of Homes	416	479,622
High / Low Price of Homes	$53,500 / $3,960	$11,949,900 / NA
Average Appraised Value	$17,500	$64,700
Percent Homeowners	51.5%	44.1%
Percent Single-Family Units	64.9%	47.5%
Percent Multi-Family Units	31.0%	50.4%
Number of Persons	1,168	1,052,300
Percent Persons Under 18	35.5%	25.0%
Percent Persons Over 65	6.8%	9.7%
Total Percent Hispanic	58.0%	20.3%
Total Percent Black	40.9%	29.5%
Total Percent White	1.0%	47.7%
Total Percent Without High School Degree	73.4%	26.5%
Total Percent Unemployed	9.1%	7.4%
Average Income	$15,089	$27,489
Percent Households on Public Assistance	35.4%	5.7%
Number of Persons Below Poverty Level	46.6%	17.8%

RECREATIONAL RESOURCES

REGIONAL RESOURCES

The 1990 Texas Outdoor Recreation Plan (TORP), prepared by the Texas Parks and Wildlife Department (TPWD), identifies existing recreational facilities, usage trends, and projected recreational needs for 23 regions within the state. The Dallas Floodway Extension is located within a 16-county area designated in the TORP as Region 4, shown in figure 2-6.

Region 4 has experienced several years of rapid population growth. With 336.6 people per square mile, the density of Region 4 is surpassed only by the Houston region. Many of the small towns and rural areas within Region 4 have become part of the rapidly expanding metropolitan area as people have moved



U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION

REGION 4 - TORP

FIGURE 2-6

from the heavily populated cities to the suburbs. People in these urbanizing areas are finding open space increasingly scarce. The region now ranks twenty-first out of twenty-three regions in recreation land per thousand populations.

Residents of Region 4 are generally worse off than the state as a whole in recreational facility supply. Of 19 commonly used facilities or designated resources, 13 have a below average supply. The supply of baseball fields, swimming pools, and campsites is among the lowest in the state. A complete listing of region four facilities is provided in Appendix I. State parks located within a one hour drive of the study area include Lewisville Lake State Park and Cedar Hill State Park at Joe Pool Lake. The Texas Legislature has authorized the acquisition of approximately 1,500 acres along the Trinity River within the study area for a future low density recreational area to be named Trinity River State Park. Funding sources for acquisition of all of these lands, however, have not been identified.

Residents in the Metroplex need not drive far to find recreational waters because many of the state's major reservoirs are located in the metropolitan area. A total of 232,581 surface acres gives the region more lake acres than all regions except Deep East Texas; however, the large numbers of people residing in the region make the suitable surface acres per thousand population still fall below the state average.

With so many reservoirs in the area, the value of the free-flowing sections of the region's rivers increases as they become more rare. Public agencies within Region 4 are taking a fresh look at the valuable natural resources along these long neglected streams. Many cities have identified linear corridor resources within their jurisdictions which are highly desirable for recreation. Sites within the Trinity River floodplain are among those most actively studied. Nine cities and three counties within the region are participating with North Central Texas Council of Governments in the development of a *Common Vision* to protect the resources within this corridor. Goals include the development of a regional construction permit system and cooperation in the creation of a linear greenbelt of parks and trails along and adjacent to the river and its tributaries.

LOCAL RESOURCES

More than 6,000 acres of existing parks, open spaces, natural areas, and cemeteries are available for present or future public use within an 80 square mile section of the county that includes the study area. These public and private lands and facilities provide recreational opportunities for residents of the Metroplex, especially those who are unable to travel to recreational sites outside the metropolitan area. Most of the recreational resources within the study area are owned and managed by the City of Dallas, the Dallas Independent School District, and the Dallas County Open Space Board. A list of these resources and their approximate acreages is shown in table 2-6, and in Appendix I.

RECREATION ON THE TRINITY RIVER AND TRIBUTARIES

The most scenic wooded areas in Region 4 are often found in stream and river corridors. Scenic corridors along the Trinity, with natural meandering water courses bordered by riparian hardwoods or dense stands of trees and shrubs, are the most desirable segments of the river and the portions most intensely used by the recreating public. Use of these segments is the heaviest during higher stream flow periods, generally during the spring and fall seasons.

Recreation providers have expressed concern over stream bank erosion, in-stream flows and the quality of the water for contact recreation. In order to give citizens higher quality water resources, some users advocate tighter standards for the designation of stream segments as fishable and swimmable. Minimum in-stream flows are needed to preserve fish and wildlife habitat and historical and recreational resources.

Table 2-6
Recreational Resources Within the Study Area

Recreation Resource / Land Use Type	Number of Facilities	Approximate Acreage
Lakes	1	149
Landfills	1	2,009
Private Parks / Recreational Facilities	1	4
Golf Courses	4	627
Cemeteries	5	340
Public Parks	81	5,617
Natural Parks	2	243
City Open Space	4	765
Large Outdoor Stadiums	2	33
Proposed City Parks / Open Space	16	824
Proposed State Parks / Open Space	5	1,245

The Elm Fork of the Trinity River and its tributaries are currently being used for a variety of recreational activities, though access is limited or restricted. In spite of these limitations, avid canoeists, kayakers, fishermen, bicyclists, and bird watchers have located access points where park areas, roads, and bridges intersect with the river.

The Dallas Parks and Recreation Department conducted a recreational user survey in the communities surrounding the project area. Questionnaires were distributed to area residents through six neighborhood recreation centers. A copy of the questionnaire form and detailed findings are included in Appendix I. The activities most often selected from the list were picnicking, hiking/walking/jogging, bicycling, and fishing. While the survey is not statistically reliable due to the method of sampling, it does provide some insight into the types of activities residents of the area enjoy.

TRINITY RIVER STATE PARK

The Trinity River State Park is authorized by Chapter 22, Subchapter S, of the Parks and Wildlife Code. The Trinity River State Park would be established under the jurisdiction of the Texas Parks and Wildlife Department on property acquired under the 1983 Act of the 68th Legislature. A total of 5 parcels of land has been designated for this purpose, though no land has yet been acquired.

Parcels 1 and 2 consist of a 200-foot corridor extending about 11 miles along the east and west banks of the Trinity River. Parcel 3 includes about 90 acres and is located within the boundaries of Rochester Park. Parcels 4 and 5 designate 320 and 1,152 acres, respectively, for acquisition. In accordance with the 1983 Act, acquisition of the necessary park lands does not restrict the construction of flood control projects.

LAND USE

As is typical of investment in a floodplain, development is scattered. Existing land use within the study area consists of residential structures east of Lamar Street. Industrial properties are located along the west side of Lamar between Corinth Street and U.S. Highway 75 (Central Expressway), and along both sides of U.S. 75. Commercial properties are scattered throughout the study area.

MAJOR TRANSPORTATION ARTERIALS

The entire study area is served by transportation facilities, including public transit, highways, thoroughfares, and rail service. The Dallas Area Rapid Transit (DART) system provides public transportation between the communities within the study area and downtown Dallas. Highways serving the city and the study area are Interstate Highways 30, 35, 45, 67 and 20/635, U.S. Highways 75 (Central Expressway) and 175 (C. F. Hawn Freeway). The arterial street system consists of multiple four-lane roads, and Loop 12, which is a four-lane highway encircling the city. Utilization of the interstate highways have made the D\FW area a major trucking center for a five-state region.

Dallas is also a major hub for many rail routes. The Southern Pacific (SP) railroad has a major rail yard in the study area north of Loop 12 and east of U.S. 75. The Missouri, Kansas and Texas (MKT) railroad extends along IH-45 northward to the Central Business District. The St. Louis Southwestern railroad runs along the east bank of the Trinity River, west of Lamar Street, to its junction with the SP and Union Pacific line near the center of the study area. Burlington Northern railroad also serves the city.

LANDS IN PUBLIC OWNERSHIP

The city of Dallas has acquired a considerable amount of land in the study area. Over 300 acres of parkland have been acquired, including Moore, Rochester, Grover, and Roosevelt parks, and several miscellaneous parcels scattered throughout the project area. Major acquisitions at the Central Wastewater Treatment Plant, the McCommas Bluff Landfill, Floral Farms, Roosevelt Heights, and the Southeast Service Center have resulted in a total of over 3,000 acres being acquired by the City since 1980.

LANDFILLS

Four significant landfill areas are located within the floodplain in the vicinity of the study area. The McCommas Bluff Landfill, currently operated by the city, is located upstream of Highway 635 (IH-20), and is a primary site for solid waste disposal for the city. The South Loop Landfill is located immediately downstream of Loop 12 on the left overbank and was closed in 1983. The Elam Landfill is located immediately upstream of Loop 12 on the left overbank and was closed in 1980. The Linfield Landfill located on Linfield Road on the right bank of the Trinity River was closed in 1975. The Linfield Landfill has a significant influence on flood elevations due to its close proximity to the river channel, and due to fill placed above the 100-year water surface elevation. This landfill is located opposite the river channel from a natural narrowing of the left overbank, which combine to create a significant encroachment of the floodplain at this location.

INTERRELATIONSHIP TO OTHER PROPOSED ACTIONS

Several proposals within the Dallas area could be considered related to the proposed Dallas Floodway Extension area. The Corps of Engineers has begun studies to address the existing Dallas Floodway and the Stemmons North Industrial area. These studies were initiated to determine if further activities were justified to reduce flood damages within the area and to determine the needs and benefits of ecosystem restoration and other allied measures.

Dallas County has an active Open Space Program in place and, as a result of their activities, extensive acquisitions of key areas along the Trinity River floodplain have occurred. Recently, the citizens of Dallas approved a bond proposal that called for moving forward with actions that would accelerate acquisitions, and other actions that would promote acquisition and preservation of the "Great Trinity Forest".

The Trinity Parkway Corridor Major Transportation Investment Study (MTIS), conducted by the Texas Department of Transportation (TxDOT), was intended to develop a locally-preferred plan of action to solve transportation problems along the Trinity Corridor in Dallas, and to integrate with community plans and goals for the Trinity River Floodway, a major open space resource. The study started with identification of the transportation problem and ended with the selection of a locally-preferred alternative.

The study was focused on transportation needs in the IH-30/IH-35E interchange on the west edge of downtown Dallas, locally known as the "Mixmaster," and the depressed segment of IH-30 south of the downtown, locally known as the "Canyon." The study area was enlarged beyond downtown to cover a reasonable area of influence of the Canyon and Mixmaster on area transportation facilities.

The Recommended Plan of Action, as presented in the "Study Report, Trinity Parkway Corridor, Final Report, March 17, 1998", is comprised of seven elements in the corridor, including the Trinity Parkway, extension of Woodall Rodgers Freeway, and improvements to IH-30/IH-35E. Details of the study and recommended elements can be found in the referenced document.

Of the actions included within TxDOT's recommended plan, a proposed Trinity Parkway along the Trinity River would interface extensively with existing Corps of Engineers project features, including the Dallas Floodway levees. Furthermore, the initial alignment shown in the TxDOT document would run generally parallel to the Southern Pacific Railroad tracks near Lamar Street within the DFE study area.

The transportation planning will continue for several years before being finalized. TxDOT has recognized that additional environmental studies would be needed, and it is likely that an Environmental Impact Statement would be required to address the myriad of issues that the proposal would bring forward. In addition, should any aspect of the plan involve the discharge of dredged and fill material into the waters of the United States, including adjacent wetlands, prior approval from the U.S. Army Corps of Engineers would be required. Additionally, all proposed work within the limits of the existing Dallas Floodway or the Dallas Floodway Extension, if constructed as proposed, would be evaluated and approved by the U. S. Army Corps of Engineers. The evaluation of the proposed project would ensure there are no detrimental affects on the flood carrying capacity of ability to maintain the floodway. Furthermore, any development activity within the Trinity River Corridor must obtain a Corridor Development Certificate prior to construction.