

APPENDIX E

**RIVERSIDE OXBOW
ENVIRONMENTAL RESOURCES**

ENVIRONMENTAL SETTING (EXISTING CONDITIONS)

DESCRIPTION OF STUDY AREA

Location

The environmental study area is located just east of downtown Fort Worth, Tarrant County, Texas, on the floodplain of the West Fork of the Trinity River. The oxbow-proper portion of the study area lies downstream of Riverside Drive, extending to a point just downstream of Beach Street, and generally includes the oxbow, the realigned channel that resulted in formation of the oxbow, and adjacent lands between Interstate Highway 30 (IH-30) on the south and the 100-year floodplain boundary to the north. Also included in the study area are the lands known locally as Gateway Park, which lies north of the West Fork, downstream of the oxbow area, and the Tandy Hills area. In addition the environmental study area includes the 100-year floodplain of the West Fork upstream to a recently completed low water dam located just downstream of the Fourth Street crossing. These areas offer a unique opportunity to consider merits of preserving and restoring a large area of riparian woodlands along the West Fork of the Trinity and an upland community that has remnant vegetation from both native prairie and riparian stringers.

Ongoing activities of others in area

Tarrant Regional Water District requested and received a standard individual permit, dated September 2000, under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act, to construct the Beach Street Weir. A water quality certification for the proposal was issued by the State of Texas on December 14, 1999. As permitted, the weir was constructed of roller-compacted and reinforced concrete and has an uncontrolled spillway elevation of 494.5 feet National Geodetic Vertical Datum (NGVD). A series of fifty 18-inch-diameter steel arch pipes combined with a concrete retaining wall maintain a normal water surface elevation of 493.0 feet NGVD. The weir is located within the West Fork River channel approximately 750 feet downstream of Beach Street, just upstream of the confluence of the old Riverside Oxbow with the West Fork. The impoundment inundates approximately 56.6 surface acres and contains 340 acre-feet of water at normal elevation. This project was been reviewed and received concurrence by City of Fort Worth officials that it satisfied Corridor Development Certification requirements.

Modifications to the infrastructure are ongoing along the IH-30 corridor. In addition to recently completed improvements near the IH-35E and IH-30 interchange near downtown Fort Worth, other changes are scheduled or in progress. Demolition of the Beach Street Bridge over IH-30 was accomplished in January 2003 and the replacement structure should

be completed by summer 2003. Other local roadway modifications include the realignment of First Street along the northern edge of Gateway Park. Ultimately, a new crossing of the West Fork on this alignment is proposed for construction.

The City of Fort Worth has proposed modifications at the existing recreational facilities at Gateway Park and a long term plan that would result in the incorporation of additional soccer with associated lighting and parking facilities west of Beach Street within the overall ecosystem restoration study area.

Climate

The Upper 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 (NOAA 1997) 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 maximum precipitation in a 24-hour period was 9.57 inches in September 1932. Precipitation is distributed fairly uniformly throughout the year, with the exception of a slight peak in the spring and a low in mid-to-late summer. The mean relative humidity is 65 percent and the average temperature is 65.8°F. Recent temperature extremes range from -1°F in December 1989 to 115°F in June 1980. The average freeze dates are March 23, which is the last in spring and November 13, which is the first to occur in the fall. The temperature falls below freezing an average of 41 days a year, but this drop is usually followed by daily thaws. The length of the growing season is approximately 235 days.

The major storms experienced in the study area are produced by heavy rainfall from frontal-type storms that generally 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 they are more prevalent in spring and summer months.

Aquatic Resources

Water quality. The Texas Commission on Environmental Quality (TCEQ), charged with the responsibility of maintaining and enhancing the waters in the state, has divided surface waters in the state of Texas into numbered segments for the purpose of organizing water quality data and designated water uses and classifications. This information is used to describe the status and trends of the state's waters.

The segment in the study area is 0806 - West Fork Trinity River (The State of Texas Water Quality Inventory, 1998). The state's water quality inventory contains data on chemical and physical parameters, contaminants such as metals, organics, pathogens, and nutrients. Segment fact sheets also provide descriptions, concerns and information on designated water uses. Information relating to fresh waters of the state is provided below. Surface

waters are classified as “water quality limited” or “effluent limited.” The term “water quality limited” is used if one or more of the following are applicable:

- Surface water quality monitoring data indicate significant violations of criteria in the Texas Surface Water Quality Standards (TSWQS) that are protective of aquatic life, contact recreation, public water supply and fish consumption;
- Advanced waste treatment for point source wastewater discharges is required to meet water quality standards (advanced waste treatment is defined as treatment equal to or more stringent than a 30-day average of 10mg/L CBOD5 and 12 mg/L ammonia nitrogen);
- The segment is a public water supply reservoir (requires special wastewater treatment considerations).

All other water bodies are classified “effluent limited”, indicating that water quality standards are being maintained and that conventional wastewater treatment is adequate to protect existing conditions. In addition to the classification above, the TCEQ rates various uses for the water segments that may include one or more of the following:

- Aquatic Life Use - a category concerned with the ability of waters to support aquatic life. The aquatic life use category has ratings of limited, intermediate, high or exceptional based on physical, chemical and biological characteristics as well as the prevalence and magnitude of toxic chemicals in the water and sediment. The TSWQS includes numerical criteria (as maximum instream concentrations) for 39 toxic pollutants in order to protect aquatic life;
- Contact Recreation Use - includes recreational activities involving a significant risk of ingestion, including wading by children, swimming, water skiing, diving and surfing. This use is assigned to all water bodies except special cases but it is not a guarantee that the water is completely free of disease-causing organisms. A coliform density of 400 colonies/100ml is used as a screening level;
- Noncontact Recreation Use - includes recreational pursuits not involving a significant risk of water ingestion, such as fishing, commercial and recreational boating, and limited body contact incidental to shoreline activity. The noncontact recreation use for these water bodies is protected by the same coliform screening levels assigned to contact recreational waters;
- Fish Consumption Use - human health criteria found in the TSWQS are used to protect the fish consumption use. The standards identify levels at which certain toxic substances dissolved in water pose a significant risk that these toxics may accumulate in the tissues of aquatic species.
- Public Water Supply - this use is assigned for those segments that are to be used as a source for public water systems. The indicators used to measure the safety or usability for drinking water includes the presence or absence of substances such as

metals or pesticides. The concentration of dissolved solids is also measured since treatment to remove them from drinking water is expensive. These uses are rated as fully supporting, partially supporting, or not supporting of the use depending upon the percentage of samples that exceed the screening criteria levels. TCEQ conducts use attainability analyses to determine whether the designated uses listed above are appropriately set and whether those uses are impaired. The analysis identifies the causes of use impairments and the results typically bring about changes in use assignments that are reflected in revisions to the TSWQS.

Water quality impairments are noted on the 1998 State of Texas Clean Water Act 303(d) List. The list is comprised of segments that do not meet or are not expected to meet applicable water quality standards, and includes the reasons for the impairment or threat and whether the impairment is from point sources (PS) or nonpoint sources (NPS). The Texas Department of Health (TDH) is responsible for issuance of fish consumption advisories, aquatic life closures and commercial bans.

The classification of waters in the 33-mile-long reach of the West Fork from the confluence of Village Creek upstream to the dam at Lake Worth (segment 0806) is “water quality limited” due to violations of state water quality standards and the requirement for advanced waste treatment in order to meet water quality standards for this stream. A concern exists for chlorophyll *a*, as screening criterion exceedence occurs through the upper 29 miles. The designated water uses for this river segment are high aquatic life, contact recreation and public water supply. Neither high aquatic life nor the fish consumption use are supported throughout the entire segment because the TDH issued an aquatic life closure in January 1990 due to elevated levels of chlordane in fish tissue. A study by TCEQ is underway to determine the extent and severity of the impairment due to chlordane. The contact recreation use is not supported through a 17-mile reach extending from 5 miles upstream to 12 miles downstream of Beach Street due to elevated fecal coliform bacteria levels. Urban runoff is the main source of contaminants. This segment is on the 1998 303(d) list for nonsupport of the contact recreation and fish consumption uses. Segments designated for public water supply are those to be used as the supply source for public water systems, as defined by Texas Administrative Code Chapter 290 (relating to Water Hygiene). Seven incidents of fish kills have been reported on segment 0806 since 1995. Suspected causes of the kills includes pesticides, industrial waste, dredging, low dissolved oxygen, and bacterial disease. There are five industrial (0.52 MGD) and one domestic (0.002MGD) permitted facilities, which discharge a total of 0.522 MGD into the West Fork. There are no agricultural discharge permits. The point source impact is rated as unknown and the nonpoint source impact is rated as major.

Aquatic Habitat. The types of aquatic systems that are in the Upper Trinity River drainage area include wetlands, shallow ponds, oxbow lakes or their remnants, flooded sand and gravel quarry operations, and larger river systems such as the Trinity River.

Physical features in an aquatic system that yield high aquatic habitat values are those which either directly or indirectly support some aspect of an aquatic organism’s life history. Examples of these are features or objects that provide spawning substrate, shelter, food, or improve the water quality. Specific aquatic features include overhanging vegetation, stable

stream banks with irregular features, silt-free, gravel or sandy bottom and in-stream structures. Aquatic systems of the oxbow study area vary from sites that have low quality, such as that which currently exists within the channelized reach of the West Fork, to slightly more diverse habitats that exist downstream of the low water dam just downstream of Beach Street. Adjoining open water systems that are ecologically and structurally diverse have a number of features representative of higher quality aquatic ecosystems. In addition these systems are frequently overtopped as a result of flooding and serve as areas for recruitment of aquatic resources into the overall system.

Within the oxbow, overhanging vegetation can provide shade, food, shelter or temperature moderation. The oxbow is approximately 8,000 linear feet in length and the bottom of the old channel usually has areas of pooled water; however, the lack of consistent water flow through the oxbow greatly limits the aquatic habitat value of this site. Stream canopy cover varies from very heavy and thick along parts of the oxbow to nonexistent in channelized and impounded sections of the river. In-stream structure of various types can be found throughout the study area, some desirable and some less so. Common in-stream structural habitat features of aquatic systems in the study area include: dead-fall trees and branches; rock-shelf outcrops; overhanging terrestrial vegetation; low water dams; bridge pilings; concrete slabs; and areas where floating debris, mainly litter transported by urban runoff, accumulate.

Land Uses

A vegetation cover and land use map was developed for the oxbow study area. Most of the area is undeveloped due to its tendency to flood. However, the area shows modifications resulting from the flood damage reduction channel, low water weirs, highways, and past agricultural uses. Within the environmental study area, land use was determined on about 1300 acres. Within the areas that were further studied for potential ecosystem restoration, there was a total of 1057.17 acres identified. Within the study area, forest accounted for 301.73 acres or only 28.5 percent. Emergent wetlands and wetland-like areas of grassland along the River channel and oxbow accounted for only 15.09 acres or 1.4 percent of the study area. Urban areas associated with buildings, parking lots and adjacent areas of disturbed bare soils accounted for 170.4 acres or 16.1 percent of the area. The majority (566.79 acres, 53.6 percent) of the area is grassland and grassland/shrubland, varying considerably in species composition and levels of maturity. Table E-1 includes a breakdown of acres and habitat quality by vegetative cover type in each planning zone of the study area.

Table E-1. Summary of Acres and Habitat Units for Existing Conditions

Project Zone	Forested		Wetland		Grassland		Water		Disturbed	Total	
	Acres	HUs	Acres	HUs	Acres	HUs	Acres	HUs	Acres	HUs	Acres
Oxbow North	26.26	15.23	2.22	1.16	68.92	53.07	1.68	0.67	11.85	70.13	110.93
Oxbow Center	0.22	0.03	0.00	0.00	101.94	78.49	0.00	0.00	22.37	78.52	124.53
Oxbow South	0.29	0.16	3.08	1.60	29.17	22.46	0.00	0.00	1.47	24.22	34.01
Gateway Center	9.98	5.29	0.34	0.18	9.22	1.20	0.17	0.06	7.60	6.73	27.31
Gateway South	15.73	8.33	1.13	0.59	25.33	3.29	0.29	0.12	3.45	12.33	45.93
Gateway Beach	23.77	9.51	1.90	0.76	86.91	11.30	0.30	0.12	47.12	21.69	160.00
Gateway Park	68.60	27.40	0.00	0.00	120.09	15.61	0.00	0.00	68.40	43.01	257.09
Gateway East	97.01	62.09	5.62	2.13	34.94	4.54	0.72	0.29	0.43	69.05	138.72
Tandy	59.87	24.55	0.80	0.00	90.27	44.23	0.00	0.00	7.71	68.78	158.65
TOTALS	301.73	152.59	15.09	6.42	566.79	234.19	3.16	1.26	170.40	394.46	1,057.17

Terrestrial Resources

The area of the West Fork from upstream of Riverside Drive in Fort Worth to the Lake Worth Dam has been channelized and leveed as a part of the Fort Worth Floodway project. The vegetation in this area is more reminiscent of manicured parkland than that of a bottomland hardwood community. Very little understory or herbaceous vegetation is present because of the groomed conditions. Trees species represented are the same as those found in other segments, but the numbers are fewer and they are more isolated from one another. In addition, since the trees generally don't have to compete for resources with other species and the seedlings and saplings that would be found in more natural riparian corridors, they tend to be larger in size.

The West Fork and its tributaries are typically bordered by a narrow fringe (50 to 300 feet wide) of bottomland hardwoods composed of oaks, green ash, cottonwood, black willow, and a dense understory of greenbriar, immature hardwoods, and shrubs. Forblands are scattered throughout the floodplain on drier sites which have developed in reclaimed mine areas and on abandoned row-crop agriculture plots. Cattle grazing and horse pasturing are common on some of these areas, particularly where improved grasses such as coastal Bermuda have been introduced.

Wildlife

The river channel, wetlands, open water areas, and bottomland hardwood forests support a variety of wildlife species for cover, food, and den or nesting sites. Bird species which were

observed or have been reported in the area include migratory warblers, sparrows, meadowlark, mourning dove, crow, red-tailed hawk, red-shouldered 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 bird, swallows, blue jay, chickadees, downy woodpecker, red-belly woodpecker, and barred owl. Amphibians, reptiles, and mammals common to the area include frogs, toads, snakes, cottontail rabbit, cotton rat, field mice, opossum, raccoon, bobcat, beaver, nutria, and coyotes.

Threatened and Endangered Species

U. S. Fish and Wildlife Service (USFWS) records indicate that the following threatened (T), endangered (E), proposed threatened (PT), and candidate (C) species have been documented, or are known to occur in Tarrant County: There is no designated critical habitat for listed species in Tarrant County.

- interior least tern (*Sterna antillarum*) - E
- whooping crane (*Grus americana*) - E
- bald eagle (*Haliaeetus leucocephalus*) - T
- mountain plover (*Charadrius montanus*) - PT
- black-tailed prairie dog (*Cynomys ludovicianus*) - C

The endangered interior least tern (*Sterna antillarum*) nests in colonies on bare to sparsely vegetated sandbars along rivers and streams in Texas, from May through August. Nesting areas are ephemeral, changing as sandbars form, move and become vegetated. Because natural nesting sites have become sparse, interior least terns have nested in atypical/non-natural areas, which provide similar habitat requirements (e.g., the colony which has been nesting for several years at the Southside Wastewater Treatment Plant in Dallas). Non-natural nesting sites include sandpits, exposed areas near reservoirs, gravel levee roads, dredged islands, gravel rooftops, and dike-fields. In recent years, terns have been utilizing artificial habitat more frequently within the Dallas-Fort Worth Metroplex area with small colonies being established in highly developed areas. Ground disturbance related to construction activities near the Trinity River may incidentally create areas that are attractive to least terns for use as potential nesting sites.

Endangered whooping cranes (*Grus americana*) may be encountered in any county in north central Texas, including Tarrant, during migration. Autumn migration normally begins in mid-September with most birds arriving on the wintering grounds at Aransas National Wildlife Refuge between late October and mid-November. Spring migration occurs during March and April. Whooping cranes prefer isolated areas away from human activity for feeding and roosting, with vegetated wetlands and wetlands adjacent to cropland being utilized along the migration route. Food usually includes frogs, fish, plant tubers, crayfish, insects, and waste grains in harvested fields.

Bald eagles (*Haliaeetus leucocephalus*) are considered winter and possible spring residents of Tarrant County. Bald eagles nest, roost, and perch in tall trees near water and feed

primarily on fish and waterfowl. Winter habitat includes reservoirs, lakes, playas, rivers, and marshes. The project areas and/or adjacent lands contain large trees suitable for perching and nesting by bald eagles. Nesting bald eagles have been documented at Lake Worth. Most wintering bald eagles migrate north from February through March; however, nesting eagles either stay throughout the entire year or migrate late in the summer.

The mountain plover (*Charadrius montans*) was proposed for listing as threatened in February 1999. Mountain plovers migrate in small numbers throughout northwestern and north-central Texas from early March to mid-May and from early August to late October. Preferred habitat consists of expansive flats of shortgrass prairie where grasshoppers, beetles, crickets and flies are available for the birds to feed upon. In areas of tall grasses, the plover is closely associated with prairie dog towns. Nesting plovers appear to prefer areas that have been intensively grazed by livestock.

The historical range of the black-tailed prairie dog (*Cynomys ludovicianus*), a candidate species, includes the western half of Texas. Typically, prairie dogs inhabit short grass prairies where they feed on grasses and forbs. They are fossorial and locate their colonies in friable soil, usually avoiding areas of heavy brush and tall grass.

Air Quality

This proposed project is located within the Environmental Protection Agency (EPA) Air Quality Control Region (AQCR) 215 for the state of Texas. Air Quality Control Region 215 consists of 19 counties including Dallas, Denton, Collin, and Tarrant counties, Texas. The EPA uses six “criteria pollutants” as indicators of air quality and has established a maximum concentration for each of them above which adverse effects on human health may occur. These threshold concentrations are referred to as the National Ambient Air Quality Standards (NAAQS). The areas of the country where air pollution levels persistently exceed the standards may be designated ‘nonattainment’. Areas of the country where the air pollutant concentration meets the national primary air quality standard are designated as in “attainment”. An “unclassifiable” designation is ascribed to areas of the country that cannot be classified based on available information. A subclassification may be ascribed by the EPA to areas that are currently in nonattainment. This classification describes the level of a particular air pollutant as being Severe 17, Severe 15, Serious, Moderate, Marginal, Submarginal, Section 185A, or Incomplete (no data). Criteria air pollutants, the existing air quality conditions, historical trends, and the relationship of these parameters to NAAQS and state standards are discussed in the following paragraphs.

The information presented for the study area includes Collin, Dallas, Denton, and Tarrant counties. These are the counties where the air monitoring stations are located. The information presented represents the most relevant and accurate description of existing conditions for air quality within the study area since it is not feasible to establish air pollutant monitoring stations at specific project site locations.

Ozone. Ozone (O₃) is a photochemical oxidant and the major component of smog. Ozone is not emitted directly into the air but is formed through chemical reactions between precursor emissions of volatile organic compounds (VOC) and oxides of nitrogen

in the presence of sunlight. These reactions are stimulated by high temperatures so that elevated concentrations of O₃ are typically detected during the warmer months. Precursors for O₃ are emitted by transportation, industrial, and biogenic sources.

The NAAQS threshold value for ozone is 0.12 parts per million (ppm) or 125 parts per billion (ppb), measured as one-hour average concentration. A new eight-hour average concentration standard of 0.08 ppm or .85 ppb was established in 1997. The EPA is phasing out and replacing the previous one-hour standard with the new eight-hour standard to protect public health against longer exposures to the air pollutant. The previous one-hour standard still applies to communities that were not in attainment of that standard in July 1997. Once these communities meet the one-hour standard, the EPA will evaluate them by the new eight-hour standard. This will allow the EPA to use the 3 years of the most available data to make their determination. Air Quality Control Region 215 is classified as a non-attainment area for ozone, and as of February 1998 the status of ozone in this region was reclassified from moderate to serious status. The status of "serious" for ozone indicates that the area has a design value of 0.160 up to 0.180 ppm. In 1998 the ozone readings from monitors across the study area indicated that concentrations of the air pollutant averaged from 0.118 ppm in Denton and Collin Counties to 0.128 ppm in Tarrant County.

Trends in ozone concentrations are influenced by year-to-year alterations in meteorological conditions in addition to changes in emission levels. The EPA conducted a trends analysis on ozone levels across the United States from 1986 to 1995. Results of this analysis indicated that overall, concentrations of the pollutant changed very little. In Texas, ozone concentrations within the metroplex from 1994 to 1998 were highly variable. Overall, the ozone information that is available for the metroplex indicates that concentrations of the contaminant have decreased over the last five years. Additionally, the number of days where the area exceeded the Federal Ozone Standard appears to have decreased since 1974.

These trends in ozone concentrations may seem to contradict the ruling by EPA to reclassify the status of the air quality in the metroplex as serious. The decision to reclassify was based not on an increase in the deterioration of air quality resulting from elevations in ozone concentration, but the region's failure to meet the health-based one-hour standard for ground-level ozone that had a deadline set for 1996.

Carbon Monoxide. Carbon monoxide (CO) is a colorless, odorless and toxic gas produced by the burning of carbon. Over 77 percent of the nationwide CO emissions are from transportation sources, principally motor vehicles. The NAAQS for CO is 9.5 parts per million (ppm) for the eight-hour standard. The project study area is in attainment with the NAAQS for CO. In 1998, eight-hour, carbon monoxide concentrations for Dallas and Tarrant counties were 4.4 and 2.5 ppm, respectively. Average annual concentrations of CO appeared to be decreasing within the region over the period of 1994 to 1998 time period.

Nitrogen Dioxide. Nitrogen dioxide (NO₂) is a brownish, highly reactive gas that is present in all urban environments. Nitrogen dioxide is formed by the oxidation of nitric oxides. Nitric oxides form when fuel is burned at high temperatures. The two major

sources of nitric oxide emission are transportation and stationary fuel combustion sources such as electric utility and industrial boilers. The NAAQS concentration for NO₂ is 0.054 ppm for an annual averaging period. The region is in attainment with the NAAQS for NO₂.

Nationally, the EPA reports that annual NO₂ concentrations have remained relatively constant throughout the 1980's, but that concentrations of the air pollutant significantly decreased in the 1990's. Over the period from 1994 to 1998, annual average NO₂ concentrations ranged from 0.007 ppm in Denton County to 0.021 ppm in Dallas and Tarrant counties. The data for NO₂ in the region over the period of analysis was extremely variable and exhibited no predictable trends.

Particulate Matter. Particles formed in the atmosphere by condensation or the transformation of emitted gases is considered to be particulate matter (PM). The NAAQS separates PM into two groups based on the size of the particle. Particulate matter 10 (PM₁₀) applies to particulate matter 10 microns or less in diameter and PM_{2.5} is for particulate matter 2.5 microns or less in diameter. Concentrations of PM₁₀ required to exceed the NAAQS are 155 µg/m³ and 51 µg/m³ for the 24-hour and annual averaging period, respectively. The NAAQS for PM_{2.5} are 66 µg/m³ and 15.1 µg/m³ for the 24-hour and the annual averaging period, respectively. The region is in attainment for particulate matter. In 1997, an average annual concentration of PM₁₀ within Tarrant County was 20.4 µg/m³.

Noise

The study area is bisected by Riverside Drive and Beach Streets and is bordered on the south by IH-30. Traffic conditions vary but generally are more intense during morning and evening rush hour periods. Traffic on IH-30 generally travels at higher speeds and often consists of trucks in addition to automobiles. Noise levels within the Riverside Oxbow area are often elevated during times of higher speed traffic on IH-30 particularly when wind is out of the south.

Light

The Riverside Oxbow study area has areas of direct lighting from neighborhood encroachments and lighting from a softball complex that is located within the Gateway Park area. The area retains a rural character except for the indirect and reflected evening lighting that is most intense when the area is covered with overhead clouds.

Aesthetics

The Riverside Oxbow study area has mixed aesthetics resulting from the man made features contrasting with the residual natural features associated with the oxbow and downstream riparian areas associated with Gateway Park. Water surface, elevated by the newly constructed Beach Street dam, the riffle area immediately downstream of the dam, and the natural West Fork channel flowing through Gateway Park add to the aesthetic values. Views from the site include roads and some of the urban features associated with

downtown Fort Worth. The noise associated with the roadways intrudes into the otherwise natural setting of the area.

Environmental Justice

Executive Order (EO) number 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*" was issued on February 11, 1994. The order states in general that Federal agencies shall specifically analyze environmental effects of Federal actions, including health, economic, and social effects, on minority and low-income populations, as part of the analysis prepared for the National Environmental Policy Act (NEPA). The EO is designed to focus the attention of Federal agencies on the disproportionate impacts to health or environment that could result from undertakings in areas of minority and/or low-income communities. Further, agencies are directed to identify potential effects and possible mitigation measures in consultation with the identified affected communities. In order to determine these potential impacts to minority and/or low-income populations within the study area, the information obtained from a review of the existing demographic and census data should be combined with a series of community participation meetings designed to draw responses from segments of the community which typically will not be responsive to traditional NEPA information requests and meetings. As part of the public involvement process for this study, several public meetings were held to inform the local residents about the study and to solicit input to ensure that potential issues were identified and included the plan formulation process.

Within the overall area associated with the West Fork of the Trinity River, a number of areas within a core portion of the central portion of Fort Worth indicate areas of low income and/or poverty. Median incomes for census tracts 1010, 1017, and 1018 nearest the center of Fort Worth were \$7,002.00, \$4,900.00, and \$4,999.00 respectively. These tracts, plus census tract 1008, all indicate higher percentages of Hispanic and African-American populations and meet the criteria for specific consideration as minority communities that have the potential to be impacted by potential future projects in the area. Of these, part of tract 1017 roughly lies within the Riverside Oxbow study area.

Floodplain Management

Executive Order 11988 has an objective to avoid, to the extent possible, long and short-term adverse impacts associated with occupancy and modification of the base floodplain. Further objectives are the avoidance of direct and indirect support of development in the base floodplain wherever there is a practicable alternative and protection and restoration of natural floodplain functions. Corps of Engineers regulations for implementing EO 11988 (ER 1165-2-26) defines the base floodplain as the one percent chance, or 100-year floodplain. For the most part, lakes and wetland features and flood damage reduction measures require being located within the floodplain to provide their intended function. Some recreational features do not need to be located within the floodplain to fulfill their basic purposes.

PLAN FORMULATION

DESCRIPTION OF ALTERNATIVE STUDY ZONES, EXISTING QUALITY AND POTENTIAL MANAGEMENT

The following information provides a description of existing resources within the study area that effect current habitat quality and future with and without a project conditions. Land use and existing habitat quality in each zone was derived from Table 1.

Oxbow North

The north oxbow zone includes the cutoff channel between Riverside Drive and Beach Street, its associated riparian area, an adjacent ponded area just upstream of Beach Street, restoration area north of the ponded area and a restoration area between Riverside Drive and the upstream end of the cutoff channel. The measure also includes evaluation of the differing means of providing flow to the channel and differing locations for an in-channel dam to provide sufficient impoundment to simulate water availability, depths, and width to provide water quality, aquatic habitat, water for the riparian forest and incidental recreational benefits.

The zone is approximately 111 acres in size and the majority of this site is grassland (68.9 acres). Existing forest covers 26.3 acres and water covers 1.7 acres. Wetlands totaling 2.2 acres were identified along the edges of the existing ponded areas and cutoff channel bottom. Disturbed soils associated with heavy grazing by cattle and horses totaling 11.8 acres was identified surrounding the ponded area. Based upon use of the USFWS Habitat Evaluation Procedures (HEP) this area contains 70.13 habitat units under existing conditions. This area although limited by minimal stream flow, could serve as the primary wildlife corridor upstream of the Gateway Park area. Industrial and residential developments immediately north of the study area have produced direct and indirect effects on this area. Runoff from these disturbed areas contains high silt loads and associated urban debris. The existing wooded corridor is narrow and composed primarily of non-mast bearing trees. Light seeded invaders are common to the Upper Trinity River system having become established following previous land disturbances. Hard mast trees are generally isolated on grasslands at distances up to 200 to 300 yards away from the channel.

The culverted crossing over the cutoff channel has a downstream invert that is several feet higher than the existing downstream water and ground surface severely limiting movement of ground and water based species such as raccoons, opossum, rabbit, beaver, nutria, snakes, turtles and amphibians. Heavy traffic on Beach Street results in numerous road kills at the crossing.

Oxbow South

The terrestrial component of this zone includes a narrow zone between Beach Street along the south bank of the realigned channel and the east bank of the Sycamore Creek north of IH-30 and a broader area between the realigned channel and IH-30 extending from the west bank of Sycamore Creek to Riverside Drive along the south bank. The low water dam downstream of Beach Street is located in the channel adjacent to this zone. The normal water surface of this impoundment is 493.0 feet NGVD with inundation of approximately 56.6 acres. An area within this zone was contoured prior to closure of the low water dam to provide a 3.1-acre shallow area that has wetland features. The most abundant terrestrial vegetation is grassland, covering 29.2 acres, with dispersed wooded areas totaling only 0.29 acres. Disturbed areas cover an additional 1.45 acres. The existing wildlife value of the terrestrial and wetland component of this site is approximately 24.22 habitat units. Most of the habitat value is associated with maintained grasslands. Noise from the adjacent IH-30 and lack of forest within this site limits its value to wildlife.

The existing channel dam and its associated impounded area provide a stable water surface that improves the aquatic habitat value and significantly improves opportunities for diversion of water to the oxbow channel identified in the Oxbow North zone. This reach also includes the confluence of Sycamore Creek with the realigned channel and offers the opportunity to provide additional stream corridor connection within the zone.

Oxbow Center

As the name implies, this zone lies in between the oxbow north and south study reaches. The zone is approximately 124.5 acres in size and currently covered predominately by grasslands. Review of photos of this area reveal that it was apparently used for truck farming in the past, but has been fallow for 3 to 4 years. A partial remnant channel of Sycamore Creek formed following the channelization of the West Fork adjacent to this area holds local runoff for short periods of time each year providing a small seasonal wetland. The imagery used to classify vegetation did not detect the small wetland, however, as it appears to be less than one acre in size. This study zone is best characterized as grassland that is currently used to produce a single hay crop per year. Of the 124.5 acres in this zone, 101.9 acres is grassland and 22.4 acres has been identified as disturbed lands, likely associated with internal roadbeds developed when the area was actively farmed. Currently these roadbeds have become overgrown with grasses due to the lack of use. This zone also has several large individual pecan and bur oak trees scattered along the edges of the remnant Sycamore Creek channel. These trees were only marginally detected (0.22 acres) in the potential ecosystem restoration area by the imagery analysis because of their scattered nature. However, these few mature mast-bearing trees provide a basis for developing habitat values for both the existing wetland and expansion of the wetland through water management and grading of the local area. The trees could also serve as a focal point for the development of tree mottes throughout the grassland as a means of meeting planning objectives of improving and expanding riparian woodlands and wetlands. "Mottes" include using living woody plants whose stems are persistent throughout the winter. Trees with low canopies, half-cut trees, shrub thickets, brambles, and oak mottes are examples. These mottes would be irregular in shape, relatively small, one half to two acres in size, and be established in dense patterns to provide protective cover for hiding and reproduction. Non-uniform scattering of the mottes would also

maintain flood conveyance by not allowing debris buildup and direct resistance to flowing water. Development of a forest over large portions of this flood plain is precluded due to the necessity of providing conveyance during flood events.

The City of Fort Worth has identified a need for future use of a portion of the Oxbow Center zone to provide premium soccer facilities. Based upon this identified future use, the area available for study for ecosystem restoration has been reduced to 85.1 acres, having an existing wildlife habitat value of 54.4 habitat units. The sponsor has expressed a willingness to provide directional lighting and minimize use of fertilizers and other chemicals to maintain the facilities. It was determined, based upon these agreements, that recreational features described would not further decrease potential habitat restoration values.

Sycamore Creek

Habitat evaluations were conducted on a portion of the Sycamore Creek area, which includes a riparian zone along the creek between IH-30 and East Lancaster Street and a disturbed flood plain area about 20 acres in size that lies to the west of the creek. The disturbed area was formerly used as a drive-in movie theater, and retains two screens, in a state of disrepair, located at opposite ends of the open area. The area currently is dominated by a grassland-shrubland complex totaling 15.2 acres. A stockpile of materials removed from the former theater parking area and other debris from on-site buildings occupies about 3.06 acres of the site. Woodlands along Sycamore Creek total approximately 0.5 acres. The area has about 7.3 habitat units in its existing condition. Without a project in this area, it is anticipated that the site would remain degraded for a few years but would ultimately be developed by commercial interests. Inclusion of this area would provide an opportunity to extend the benefits of establishing ecosystem restoration on the Oxbow South zone. However, the significant cleanup and other restoration costs associated with restoration of this area would likely be excessive for the benefits generated and therefore, lacking further sponsor interest, this area was dropped from further evaluation during the plan formulation.

Gateway Center

This zone is located in the area immediately downstream of Beach Street crossings of the cut channel and the remnant oxbow channel. It includes a triangular shaped tract of land that contains the riparian zone of the south side of the oxbow and the north side of the channelized segment of West Fork of the Trinity. The zone contains low quality woodlands and highly manicured grasslands. In total the area consists of 27.3 acres and provides only about 6.7 habitat units. This site has about 10 acres of existing forest, 9.2 acres of grassland, and 7.6 acres of disturbed land associated with channel maintenance activities, and less than half an acre each of water and wetlands. The location of the zone provides an important link between upstream resources and those associated with riparian forest located downstream within Gateway Park. Ecosystem restoration by providing

mottes and improvement of existing forested areas within the riparian zone would be highly beneficial to this site, and provide positive cumulative benefits to the upstream reaches.

Gateway South

This zone is adjacent to the Gateway Center zone and covers the outside riparian corridors of the two channels. This zone consisting mainly of manicured grasslands, 25.33 in size. The riparian woodlands comprise 15.73 acres. Water and wetlands total less than 2.0 acres on this tract. Total habitat quality on this reach was determined to be 12.33 habitat units. This tract has linkages to Gateway Beach and all components of the oxbow. Provision of ecosystem measures, such as developing native grassland, adding mottes to the grassland, and improving the existing riparian zone, would provide direct benefits to the area and cumulative positive benefits downstream.

Gateway Beach

This is a large zone, located just east of Beach Street and north of the oxbow that has been heavily disturbed by past activities. Gravel and soil mining activities resulted in the creation of several large areas of waters and wetlands, some of which were subsequently filled and raised under Section 404 permit conditions issued in November 1987. Although no pads or buildings have been constructed on the fill, future without project conditions indicate that little additional filling would be required to make the portion of the tract that fronts Beach Street a potentially desirable location for commercial development. A small wetland area was contoured to connect to one of the residual lakes and some bank sloping was conducted to foster moist soil development. These areas provided adequate mitigation for the past filling activities; however, substantial improvements could still be implemented to provide substantially greater fish and wildlife habitat benefits. The larger pond has been observed to support winter stopovers of teal, gadwall and mallards numbering close to a hundred individuals. Some of the native vegetation around the edges also supports red-winged blackbirds, cardinals and other songbirds. Non-native shrubs have begun to proliferate the higher banks of the pond and, left unchecked, will greatly reduce future wildlife habitat values. In addition, the pond only provides these waterfowl values following years of abundant late summer-early fall rainfall events. The smaller pond had no water during the first late winter visit and only a slight amount after a 5-inch rainfall event in the area.

The filled portion of the zone has largely reestablished a grass cover, however, bermudagrass, which provides low quality habitat conditions, dominates.

This study zone as a whole, which is approximately 160 acres in size, has only 21.69 habitat units under existing conditions. The imagery used for the vegetation cover classification indicated that there is approximately 0.3 acres of water, 1.9 acres of wetland, 23.77 acres of woodlands, 86.9 acres of grasslands, and 47.1 acres of disturbed area. Restoration opportunities through development of wooded mottes, provisions of water control and water supply structures for the ponds and associated wetlands, removal of non-native vegetation coupled with establishment of native plants beneficial to wildlife, and

additional sloping of the steep banks around the existing ponds shoreline would potentially produce substantial wildlife benefits. Restoration of this zone would add significant benefits over the without project condition scenario.

Gateway East

This study zone extends downstream of the Gateway Center study reach to the First Street Bridge. Added later during the study period, the reach was found to contain areas of high quality riparian woodlands, and areas that are severely degraded due to abandoned drying beds and some areas where there is a very narrow riparian corridor comprised of non-mast producing light seeded invader trees and shrubs. The entire Gateway East zone contains about 138.72 acres providing a combined 69.05 habitat units. This zone is more heavily wooded than other zones in the study, containing 97.0 acres of riparian forest. The remainder of the site consists of 0.7 acres of water, 5.62 acres of wetlands and 34.9 acres of grassland. Only 0.4 acres of disturbed soil was identified.

Access through the zone is relatively easy due to presence of a small recreation trail. The trail is narrow and trail activity does not appear to conflict with existing or potentially improved future wildlife uses. Early spring reconnaissance of the zone resulted in the observation of numerous chickadees, warblers, wrens, cardinals, crows, hawks, and other birds within the better quality woodlands. Another feature observed adjacent to the better quality woodlands was an old, naturally occurring oxbow remnant that only receives water from the Trinity during periods of high flows, nearing out of bank levels. The oxbow contained water during the site visit and debris and direct of the lean of soft stemmed vegetation indicated that the water had entered the oxbow through a channel located between the eastern end of the oxbow and the West Fork. Fish and amphibians were observed utilizing the newly inundated areas in the bottom of the oxbow.

One other small body of water is located at the extreme northern end of the drying beds. While the original function of this area is unclear, it apparently fluctuates in depth during the course of the year. While inundated over about 25 percent of the area during the site visit, stubble from mowing was visible in some of the inundated area and all the non-inundated area. About a dozen teal and wood duck were observed on this small pond. Although somewhat sheltered to the north, little forested vegetation near the site and a lack of tall grasses around the perimeter of the wet area likely preclude more use of the area by waterfowl. The remaining drying beds associated with the abandoned wastewater treatment facility are over grown with grasses and some young trees including willows, hackberry and boxelder.

The lands in this zone are owned by the City of Fort Worth and operated as a park. Softball and soccer leagues are very active users of established facilities. Future plans for development of recreational facilities include development of a system of BMX bicycle trails within part of the wet area located at the northern end of the drying beds. Some fill would be required to achieve the desired jumps, however, most of the area appears to be non-jurisdictional and possibly could be constructed without need of a Section 404 permit. Development of the this area as a larger water body, which could store water for use in a created wetland complex in the area occupied by the existing drying beds would provide

significant wildlife benefits for migratory waterfowl, shore, and wading birds. Creation of the wetlands would also benefit the adjacent riparian zone, which is very narrow in places, by providing a greater continuum of favorable habitat for a cross section of species known to utilize the area. Improvement of the remainder of the riparian zone on both sides of the river through selective plantings would also be highly beneficial.

Tandy

The Tandy zone contains about 158.6 acres of mixed grassland, shrubland, and trees over a high diverse terrain. The study area contains all of Tandy Hills Park and an area in private ownership located to the west of the park boundary. The entire site is unique within the area due to the steepness of the slopes and the presence of a native prairie, which is being slowly modified due to disturbances, particularly on the privately owned land and the changes brought about due to control of fire, which historically helped maintain prairie areas.

City of Fort Worth resource specialists developed the following description of the soil/vegetation cover that should exist on the Tandy Hills and Stafford Natural Area adjacent to Tandy Hills.

“Three soil types are found at Tandy Hills and Stafford Natural Area: Aledo, Aledo-Bolar and Frio. Each of these soil types has a characteristic natural plant community (as determined by the Natural Resources Conservation Service), which gives the base line for judging the condition of each site and determines the disturbance (if any). The Aledo soil is situated on the upper shelves of high ground. The climax plant community should be a prairie of mid and tall grasses interspersed with an abundance of forbs (wildflowers). By weight, the composition is 95 percent grasses, 5 percent forbs, and 0 percent trees. Little bluestem makes up about 45 percent of the composition and Indian grass, big bluestem, and switchgrass make up 15 percent. Other grasses are sideoats grama, tall dropseed, slim tridens, silver bluestem, Texas cupgrass, hairy grama, buffalo grass, Texas wintergrass, and vine-mesquite. Forbs are numerous and include purple paintbrush, Engleman daisy, prairie clover, Maximillian sunflower, heath aster, compass plant, golden dalea, penstemon, and gay feather.

The Aledo-Bolar soil is on the slopes with occurrences of Aledo soils (described above) within Bolar soils. The Bolar soil climax plant community is true prairie consisting mainly of tall grasses. The composition by weight is about 90 percent grass, 5 percent forbs, and 5 percent woody plants (trees or shrubs). Little bluestem, switchgrass, big bluestem and Indian grass make up about 70 percent of the vegetation. Other grasses are wild rye, sideoats gramma, Texas wintergrass, vine mesquite, Texas cupgrass, white tridens, meadow and tall dropseed, and silver bluestem. Forbs include Engleman daisy, Maximillian sunflower, prairie clover, heath aster, salvia, purple coneflower, golden dalea, big top dalea, gay feather, and bundle flower. Woody vegetation includes elm, hackberry, plum, live oak, aromatic sumac, New Jersey tea, and white honeysuckle.

The Frio soil occurs in the creek bottom in the lower reaches of the Tandy Hills and Stafford Natural Area. The climax plant community for the Frio soil is mid and tall grass

with a tree canopy of pecan, elm, bur oak, cottonwood, and others shading about 25 percent of the ground. The vegetation is 70 percent grasses, 20 percent woody plants, and 5 percent forbs. Little bluestem, big bluestem, Indian grass, switchgrass, purple top tridens, and wild rye make up most of the grasses. The rest of the grasses are tall and meadow dropseed, vine mesquite, Texas blue grass, and beaked panicum. Forbs include Engleman daisy, maximillian sunflower, gay feather, dalea, penstemon, and tick clover.”

The City’s 1987 report also indicated that on most of the areas where prairie still exists in the vicinity, the land is situated on slopes that were less desirable for livestock grazing and unsuitable for farming as is the case with Tandy Hills Park. Examination of aerial photos from the early 1940s indicated that Tandy Hills Park was in excellent shape and, at that time, had less woody growth than nearby similar areas. Currently there appears to be much more invasion from eastern red cedar, woody shrubs, including non-native privet, and even increases of some trees such as live oak, which in most other habitat compositions would be considered beneficial, than was indicated in the prior report.

While steps have been taken over the years to reduce disturbances to the Tandy zone, there are still signs of erosion and the presence of invaders diminish the wildlife value of the area. On the private land adjacent to Tandy Hills Park, the damage has been much more severe. A former business, once located on top of the hill between the two areas, has been removed but considerable disturbance, in the form of the remnant slab, parking lots, and bulkheading to protect the foundation, remains. Other slope alterations in the vicinity and trash dumping at the end of the cul-de-sac access have decreased habitat quality of the area. A large area of disturbance from what appears to be an attempt to make an access route has significantly damaged the western end of the zone. Erosion and transportation of seeds from the invaders that are occupying this study zone pose a significant threat to the other zones, the West Fork of the Trinity, and areas further downstream.

In this zone, consisting of 158.6 acres, which by previous description should be mostly grassland prairie, 59.9 acres are wooded. Grassland occupies about 90.3 acres. In the absence of corrective management, part of this grassland, which has been invaded with shrubs; will convert to low quality woodlands. Disturbed areas totaling 7.7 acres were identified from the imagery, however, it is believed that the amount of disturbed soils have more than doubled since the date of the imagery was collected. Approximately 0.8 acres of moist soils associated with the many small tributaries originating on this steep hillside were identified as wetlands. Total existing habitat value of this zone is 68.78 habitat units.

Benefits that could be obtained from restoration of this zone would predominantly occur to uplands, which traditionally have not been a high priority for U.S. Army Corps of Engineers restoration project; however, the proximity of the zone and the potential for degradation of the zone to have adverse impacts on the higher priority resources, such as the riparian, wetland, and aquatic habitats associated with the West Fork of the Trinity River, should be considered. Potential restoration opportunities include removal of invader brush species in both the grasslands and the understory of the riparian stringers, replanting with native woody stemmed shrubs to compete with the invaders, considering use of fire on small areas conducted over a number of years, removing trash and remaining

components of the removed restaurant, stabilizing slopes damaged by recent access attempts and replanting native grasses on restored slopes.

COST EFFECTIVENESS AND INCREMENTAL ANALYSIS

A cost effectiveness and incremental analysis (CEIA) was conducted that evaluated the potential habitat restoration measures identified by the study team to improve the habitat value in various segments of the Riverside Oxbow study area. Multiple measures and scales were considered in the CEIA as documented in the Addendum to this appendix. Table E-2 provides a summary of existing, future without, and future with proposed habitat conditions by planning zone

**Table E-2 Riverside Oxbow Study Zones
Existing Versus Future With and Without Habitat Conditions**

Study Areas	Existing Acres	Future without (50 yr)		Future With Restoration
		HU s	AAHUs	(50 yr) AAHUs
Oxbow North	104.90	67.38	23.57	88.11
Oxbow Central	85.10	54.42	10.99	60.56
Oxbow South	28.71	20.9	4.21	17.02
Gateway Central	27.30	6.73	3.93	20.75
Gateway South	45.93	12.33	3.57	33.11
Gateway Beach	138.00	18.38	10.09	91.93
Gateway East Corridor	138.72	69.05	63.48	109.97
Sycamore Creek*	20.00	7.30	4.42	15.36
Tandy**	158.60	68.78	64.00	109.09
Tandy East***	112.04	48.58	45.21	74.44

* Dropped from Plan Formulation due to lack of sponsor interest

**Included City owned Park/preserve lands and private owned lands to west

***Not part of NER but included in LPP. Tandy Hills West not included in either plan.

ENVIRONMENTAL EFFECTS OF NER AND LPP

General

The basis of the plan formulation planning objectives for the Riverside Oxbow study was to restore ecosystem values through modification of existing resource features in the area. Following design of the restoration alternatives, minor recreational components that do not reduce restoration benefits were evaluated and added into the National Ecosystem Restoration plan. If the ecosystem restoration project is not built, it is expected that a less environmentally sensitive use of the area would occur. More mowing, less management of invading non-native trees and shrubs in the riparian zone, and the continued fragmentation of riparian resources caused by the Beach Street bridge would reduce fish and wildlife resources of the area during the study period. The project sponsor has developed a locally preferred plan that is based upon the NER but would also include additional restoration located within the Tandy Hills area south of IH-30. Increasing the size of the entire ecosystem restoration area would be expected to increase habitat benefits for the riparian ecosystem and provide an example of upland management that could prompt land owners, public and private, to consider removal of non-native vegetation from open areas upstream of the study area. Should that happen, resources of the Upper Trinity River basin would be further improved. It is also anticipated that the LPP would provide some, but currently non-quantifiable reduction in maintenance costs in the NER area due to anticipated future reduction of non-native invading plant species.

Land Use

The study area includes undeveloped private lands and public-owned properties. The private land in the study area has been through several previous changes including extraction of sand and gravel, followed by restoration for potential development. Two areas that would be most beneficial for long-term development of high-density recreational use were identified early in the study and were not further considered for ecosystem restoration. There currently is low demand for business development along the private lands and therefore implementation of the restoration plan would have minimal negative impact on future land use. Land use on the ecosystem restoration areas would remain essentially the same as currently conducted however; placing the entire area in public ownership and management for restoration and improvement of ecosystem values would provide a positive environmental benefit.

Air Quality

One parameter to be potentially effected by the future conditions with the recommended project plan would be air quality. Implementation of the recommended plan entails increasing existing forest acreage by converting grasslands to forest.

The proposed increase to the size of the forest in the project area would add additional air pollutant removal capabilities to the existing forest and improve the quality of air. A computer model developed by the United States Department of Agriculture's (Urban Forest Effects [UFORE]) has been used to describe the effects which trees have on the removal of the five gaseous criteria pollutants in the Johnson Creek and Dallas Floodway Extension study areas. Although this modeling effort was not conducted for the Riverside Oxbow, the past research has established that healthy riparian forest and grasslands have the capability to remove air pollutants.

No significant adverse impacts to air quality would occur from implementation of the LPP or NER Plan, rather, either should help to improve air quality in the area.

Vegetation

Since the project, as proposed, is an ecosystem restoration plan including acquisition, preservation and management of bottomland hardwoods and grass and shrubs lands for ecosystem restoration and passive recreational features such as a linear hiking trail and parking, picnic and facilities development, the overall environmental effects are expected to be positive.

The recommended plan would utilize the qualities of the existing topography and soils to develop additional forested habitat. Reforestation would be accomplished through forestry techniques for the trees, shrubs and seedlings, which would cause minimal disturbance to the soil. Disturbance to the existing habitat from the construction of recreation features would be kept to the minimal amount and size of disturbance possible. Safeguards to reduce soil erosion would be implemented as need during the construction of the recreational features and during the demolition and removal of structures in the evacuation/buyout area. The disturbed soils along the construction sites and in the buyout areas would be stabilized with native vegetation.

No significant adverse impacts to soils would occur from implementation of the plan and overall, would significantly increase the quality, size and continuity of the riparian bottomland forest in the project area, even when taking into consideration the provision of the recreational elements.

Wildlife Resources

The Riverside Oxbow lies within a highly developed metropolitan area that has been highly impacted by human activities. Generally the wildlife species found there are typical of those found in highly urbanized areas. The numbers and species of wildlife found in the area can be directly attributed to the habitat available for nesting, foraging, shelter, reproduction and rearing of offspring. Any improvements to the quality of the existing habitat or increases in the quantity of habitat would have positive effects on wildlife numbers and species.

Demolition and construction activities associated with the reconstruction of the Beach Street bridge, construction of wetlands and restoration of riparian forests within the project area and minor recreational trail access and subsequent activities associated with maintenance of ecosystem restoration and recreational features are expected to have insignificant short term negative impact on existing wildlife species. The acquisition of lands for ecosystem restoration and the increases in habitat quality and quantity are expected to positively impact the wildlife resources, especially neotropical songbirds, small mammals, fish that require local seasonal migration, amphibians and reptiles. Although not considered in the benefits at this time, the bridge replacement design will consider the potential for adding roosting habitat for bats and swallows. The grassland/wetland/riparian complex that would result from the ecosystem restoration would provide an abundance of food, primarily small hovering insects that would be ideal prey. Currently little to no roosting habit occurs for bats and swallows in the study area.

No significant adverse impacts to wildlife resources would occur from implementation of the plan and it would significantly increase the quality and quantity of habitat in the project area. No environmental mitigation is needed for any aspect of the NER or LPP.

Aquatic Resources

Demolition and removal of the Beach Street bridge culvert coupled with restoration continuous flow through the oxbow vegetation would significantly improve the quality of aquatic habitat in the Riverside Oxbow and contribute to improvements within the West Fork downstream of the confluence of the oxbow. The oxbow would also provide a beneficial low velocity hiding area for fisheries resources during West Fork during flooding events.

Development of forested areas around and over the stream would provide shade to help maintain water temperatures within optimum ranges for growth and development of aquatic organisms. More trees and vegetation within the riparian zone plus the native grass buffer along the wooded riparian area of the oxbow would improve the ability of corridor to provide buffering against environmental pollutants in stormwater runoff and balance the input of organic nutrients to the oxbow and ultimately the West Fork. Permanent aquatic resources of the Riverside Oxbow, aquatic resources of the ponded areas, and deeper pools of the proposed emergent wetlands would provide refugia during drought and intentional wetland management activities and would support a high diversity and resilient aquatic biota. Aquatic biota such as largemouth and spotted bass, white bass, bluegill, crappie, channel catfish, shiners, darters, zooplankton, aquatic insects, mussels, and various species of snails could ultimately inhabit the study area.

Implementation of the plan might also cause minor short-term negative impacts to the aquatic resources in the study area during the demolition and construction phase of the project until channel conditions stabilize. However, in the long run, because of the buffering and shading effects of vegetation along the riparian zone, the long-term impacts are expected to be positive.

No significant adverse impacts to aquatic resources would occur from implementation of the plan and over time the project would result in significantly increased quality of aquatic habitat in the project area

Wetlands

Within the project area, 15.1 acres of vegetated emergent wetlands were identified. The wetlands identified are in remnant depressions caused by disturbances related to implementation of the previous West Fork channelization within the drying beds of the abandoned wastewater treatment plant in the existing Gateway Park. Some additional wetland vegetation was observed along the banks of the existing West Fork of the Trinity River channel. A gravel pit and associated wetlands complex in the Gateway Beach zone are currently the most active from a wildlife utilization perspective. The project as proposed would modify the drying beds, enlarge a small ephemeral wetland in the Oxbow Central area provide hydraulic stabilization at an existing pond in Oxbow North zone and provide grading and dependable water supply for wetlands in the Gateway Beach zone. Modifications at these sites would improve the quality of the existing wetlands through enlargement and through operation and management. Following project implementation there would be a complex of wetlands, including deeper water refugia and riparian fringe. Wetlands would comprise 56.5 acres of the 69.6- acre wetland complex.

Water Quality

The recommended plan involves increasing the amount of existing forest in the study area through the conversion of grass and shrub lands to forest. It also calls for the demolition and removal of the Beach Street bridge over the oxbow. Initially, construction and planting of vegetation could temporarily result in a slight increase in the suspended sediment load in the study area from stormwater runoff across newly vegetated areas. In addition, activities associated with the construction of the linear hiking trail and pedestrian bridge crossings could increase the sediment load on a temporary basis. The reconstructed bridge would span the stream channel and is not expected to cause any lasting adverse impacts on the water quality of the study area.

Numerous studies have addressed the buffering effects of vegetation. Iowa State University research shows that buffer strips are capable of removing more than 70 percent of the sediment from runoff flowing from slopes with grades as high as 12 percent. By slowing runoff, buffers give water time enough to soak into the soil, thereby reducing runoff volume. The vegetation then acts as a filter, removing sediments, heavy metals and hydrocarbons

Implementation of the plan would have short-term negative impacts because of the demolition, reconstruction and vegetation management activities. The long-term effects of the buffering and filtering of vegetation as a result of restoration activities would offset any short-term negative impacts. There would be no significant adverse impacts to the

water quality of the West Fork of the Trinity River from implementation of the plan, except on a temporary basis, and the restoration activities would positively impact water quality in the long-term.

General Aesthetics

Noise

Sound levels within the Riverside Oxbow study area are typical of those found in urban neighborhoods within the Dallas-Fort Worth Metroplex. Noise levels in the area would be expected to increase for a short time while demolition and construction activities are ongoing as a result of the added noise of heavy equipment and workers in the area. However, over the long run increasing the amount of forest in the area along the Riverside Oxbow corridor, associated with the grasslands and the more linear tree planting along IH-30 should serve to buffer the sounds of traffic and general noise to and from the area.

There would be short-term negative impacts during the construction phase. There would be no significant adverse impacts to noise levels in the proposed project area along the West Fork study area near Riverside Oxbow from implementation of either the LPP or the NER plan, except on a temporary basis. Either plan would positively impact noise levels in the long-term due to buffering from tree growth associated with the restoration area.

Light

The only lighting proposed for the recommended plan would be located in the parking lots at the access areas. The lighting would be to provide security only and would be of a low light type mounted high with cut-offs to prevent stray light from impacting adjacent residential areas. Therefore, there would be no significant adverse impacts caused by lighting requirements for the proposed project with either plan. Projects proposed by others might cause additional lighting impacts, however, lighting affecting the area would be required to be directional thereby minimizing any affects to ecosystem restoration benefits.

Traffic Patterns

There would be temporary impacts to traffic patterns caused by the reconstruction of Beach Street Bridge. There would be no significant adverse impacts on local traffic patterns with implementation of other measures of either the LPP or NER plans. Motorized vehicles would be restricted to the streets leading to the parking lots and access points. Efforts to notify the public of the temporary disruption of traffic flow across this area and to alert the public to alternative travel means will be conducted to minimize public inconvenience.

Hydrology and Hydraulics

Ecosystem restoration activities as proposed in the NER would increase wooded vegetation thereby slowing floodwaters and affecting valley storage in the study area. The NER plan incorporates hydraulic mitigation consisting of excavation of floodplain material near the south shoreline of the existing channelized segment of the West Fork. With the mitigation, the plan meets the criteria of the Environmental Impact Statement and Record of Decision (ROD) in 1988. Meeting these criteria minimize the cumulative hydraulic and hydrologic impacts of the project to the Upper Trinity River Basin. No significant impacts to hydrology or hydraulics would occur from implementation of the project.

Sustainability

Ecosystem restoration features proposed would facilitate long-term sustainability of resources with minimal exterior inputs. Some additional maintenance would be required during establishment of vegetation and riddance of nuisance invaders, however, the overall plan would ultimately result in a mature riparian ecosystem that is stable needing less maintenance that would be required to maintain other land uses. The proposed grassland buffer zone adjacent to the oxbow in itself would require low maintenance and would provide wildlife habitat in addition to improving water quality from localized runoff. This improved water quality would further the goals of aquatic habitat restoration component of the overall project. The emergent wetlands proposed would require a higher rate of maintenance due to the need to provide an artificial watering regime to optimize habitat benefits. Due to the overall management of the Upper Trinity River system that has produced tremendous economic benefits to the public by reducing flood damages, no other means other than pumping appear feasible for restoring the emergent wetlands. The incremental analysis conducted during this study support the wetland restoration due the high quality and diversity these features would provide.

STATUS OF ENVIRONMENTAL COMPLIANCE

Section 404 - Clean Water Act

The proposed project has been reviewed in accordance with Section 404 of the Clean Water Act. The recommended plan is primarily an ecosystem restoration plan with associated minor recreational trail development. The proposed project meets the terms and conditions of nationwide permit 27 for Stream and Wetland Restoration Activities. The State of Texas has reviewed and provided water quality certification for nationwide permit 27, and no further evaluation of Section 404 of the Clean Water Act is necessary.

Section 10 of Rivers and Harbors Act

Navigability extends up the West Fork of the Trinity River to Riverside Drive; therefore, the project has been reviewed for compliance with Section 10. Stream flow diversion from the impounded section of the channelized West Fork would be diverted for stream restoration within Riverside Oxbow. During low flow events the diversion would be approximately 2 to 3 cubic feet per second or approximately 25 percent of the flow in the

West Fork during those events. However, because of the existing dam structure below Beach Street on the channelized segment, no modification to depths or navigability would result. The proposed restoration activities would not affect navigability and therefore the project is in compliance with Section 10.

Executive Order 11988 - Flood Plain Management

In addition to Section 404, Executive Order 11988, Floodplain Management, was considered during the development of the proposed project. There are no practical alternatives to achieve the project purposes of ecosystem restoration and recreation trail development without placing fill within the floodplain. Material removed from the project area requiring disposal, as part of the plan, would be placed in approved landfills for the types of materials involved. The proposed fill actions would not result in adverse environmental impacts and further, floodplain fill for recreational trail and ecosystem restoration would not directly or indirectly induce additional development in the floodplain and would therefore be in compliance with Executive Order 11988.

Executive Order 11990 - Protection of Wetlands

Executive Order 11990, Protection of Wetlands was considered during the development of the proposed project. The proposed project would increase the size and quality of wetlands in the area without adversely impact existing wetland areas so the project is in compliance with Executive Order 11990.

Construction Storm Water

The Texas Pollutant Discharge Elimination System (TPDES) program as of March 5, 2003 implements the National Pollutant Discharge Elimination System. The TPDES Construction General Permit is administered by TCEQ for two different phases of construction based upon size of the disturbance. The project as proposed will likely cause disturbance to more than one acre of soils, and prior to commencement of construction a stormwater pollution prevention plan will be developed a Notice of Intent will be submitted to the TCEQ, followed by submittal of a Notice of Termination once the construction site has reached final stabilization.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service has reviewed the proposed project and provided concurrence that the proposed the project is not likely to adversely affect threatened or endangered species. Prior to construction, a review would be conducted to determine if additional new species or impact information become available sufficient to warrant further consultation.

Environmental Justice

Implementation of the proposed project would not cause any adverse impacts to the economically depressed or minority areas adjacent to the study area. The project would improve existing environmental conditions that could enhance the values of adjacent lands. Other than the temporary impacts attributable to impaired traffic flow associated with the Beach Street bridge removal, no impacts to residents adjacent to the area should occur. The project is compliance with the Executive Order on Environmental Justice.

Cultural Resources

Cultural resources compliance issues for the Riverside Oxbow study have been addressed through consultation with the Texas State Historic Preservation Office (SHPO) in accordance with Section 106 of the National Historic Preservation Act. On site investigations (Cultural Resources Assessment of Riverside Oxbow Environmental Restoration, Fort Worth, Tarrant County, Texas) resulted in the identification of historic archeological properties that could be impacted by excavation of the proposed return channel from the Oxbow Central Zone wetlands. As a result of that finding, the channel's alignment was modified to avoid those historic properties. The SHPO has tentatively concurred with the Corps' proposal to survey the modified alignment prior to construction so that final adjustments can be made as required to avoid any undiscovered historic properties. Correspondence related to the Cultural Resources consultation is located within the correspondence section of the Feasibility Report.

Cumulative Impacts

The Corps of Engineers has conducted a Programmatic Environmental Impact assessment (PEIS, 2000) that addresses cumulative impacts of Corps of Engineers proposed activities associated with the Upper Trinity River Basin. That document identified concern related to the continued loss of riparian or bottomland forests and wetlands within the study area. Proposed Recreational development by others and road and bridge improvements adjacent to the study area have been identified and evaluated. The NER and the LPP when considered in respect to these reasonably foreseeable projects of others would not result in adverse cumulative impacts to the resources identified as important in the PEIS. The project would provide improvement to those resources. The hydraulic and hydrologic impacts would be mitigated as identified in the plan and therefore would also be in compliance with criteria identified during a previous Programmatic EIS for the Corps Regulatory program. Therefore the NER and LPP would not cause negative cumulative impacts to resources of significance as identified during this and past studies.

**COST EFFECTIVENESS AND INCREMENTAL COST ANALYSES
ADDENDUM**

COST EFFECTIVENESS AND INCREMENTAL ANALYSIS. In cost effectiveness and incremental analysis (CE/IA) models, a “no action” measure was developed for each of the separate measures identified. Next average annualized habitat unit gains for each measure and/or scale and their “no action” counterparts were computed over a 50-year period. In addition, annualized costs, including real estate and operations and maintenance costs, were computed for each of the measures. This data was then input into a comparative analysis model. The model used to run cost effectiveness and incremental cost analysis was the IWR-Plan: Decision Support Software, Version 3.3. The final analysis identifies a list of “best buy” plans, which represent the most cost effective plans in terms of costs per habitat units gained. Interim cost effectiveness and incremental analysis were run for 9 alternative combinations for created wetland complexes in both Oxbow Center and in Gateway East. In each case, the study team determined that the medium-sized wetland complexes, 12.3 and 26.8 acres, respectively, along with the addition of quality wetland plants, water control structures that would allow manipulation of water levels to optimize for habitat values during different seasons, and a permanent water supply to be used when necessary to ensure the function and quality of the wetland complex over time, were the “best buy” plans of choice. The AAHUs and annualized costs for each of the selected created wetland complex “best buy” plans for Oxbow Center and Gateway East were added to the AAHUs and annualized costs for the other restoration measures identified for that respective zone and included in final overall analyses.

In addition, interim cost effectiveness and incremental analysis were run for 113 different combinations of land acquisition and restoration measures identified for the Tandy zone. The “best buy” plan combinations identified by the interim analyses for Tandy were shown in Table 9. All three “best buy” combinations were carried forward into the final analysis. The results of the interim and overall cost effectiveness and incremental analyses are included in this addendum to the Environmental Appendix (Appendix E) in this report. This addendum also includes the existing conditions vegetation analysis summary with HSIs and HUs by zone, average annual habitat unit tables for each restoration measure by zone, the annualized cost tables for restoration measures and real estate, copies of the interim CE/IA completed for reforestation and habitat improvement plant densities and materials, the Oxbow Center and Gateway East wetland complexes, respectively, and the Tandy zone, and a copy of the final study wide CE/IA.

FINAL ARRAY OF ALTERNATIVE BEST BUY PLANS. With 8 zones, 11 measures, and several possible scales for some measures, IWR-Plan analyzed over 15,728,640 possible combinations. Final results determined that there were with 162 cost effective plan combinations and 11 plan combinations considered to be “best buy” alternatives. The best buy plan results start with the combination plan that provides the greatest number of average annual habitat units (AAHUs) for the least cost and continues to the next plan combination that would increase the number of AAHUs for the next least cost increment until the final plan, which represents the greatest number of AAHUs that can be gained for the last added increment of costs. Table 12 of the report provides a summary of the restoration measures identified in each of these combination plans, along with the AAHUs, incremental AAHUs, annualized costs, incremental annualized costs, and

incremental cost per output. Figure 9 of the report is a graphic representation showing the AAHUs and annualized incremental costs for all the best buy plans.