Final
Environmental Impact Statement for the Dallas Floodway Project

US Army Corps of Engineers

MAIN REPORT

December 2014

City of Dallas

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HOW TO READ THIS ENVIRONMENTAL IMPACT STATEMENT (EIS)

READ ME FIRST

The USACE's goal is to provide you a reader-friendly document that presents a comprehensive, accurate analysis of the Proposed Action. To facilitate your review, the USACE has used tables, text boxes, and figures to summarize key information. A glossary, technical appendices, and other supporting information have also been provided to enhance your reading experience. The adjacent graphic presents the organization of the EIS and can be used as a reference for quickly finding those areas of most interest.

PROJECT SUMMARY

This EIS describes the potential comprehensive environmental consequences resulting from the application of proposed flood risk management elements, ecosystem restoration features, recreation enhancement features, interior drainage plan improvements, and other proposed projects in and around the Dallas Floodway in Dallas, Texas.

PUBLIC INVOLVEMENT SUMMARY

The USACE published a Notice of Intent to prepare the EIS on December 22, 2008. An EIS Public Scoping Meeting was held on November 17, 2009. The Draft EIS Public Review Period was from April 18 to June 17, 2014. A Draft EIS Public Review Meeting was held on May 8, 2014. All comments received during the Public Review Period are provided in Appendix A

FOR MORE INFORMATION

Go to the USACE's project website: http://www.swf.usace.army.mil/Missions/WaterSustainment/DallasFloodway.aspx

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Acronyms and Abbreviations

%	
4-Nitro	4-nitrophenol
AASHTO	American Association of State Highway and Transportation Officials
ACM	asbestos containing material
ADT	average daily traffic
AEP	annual exceedance probability
AQCR	Air Quality Control Region
AR	Army Regulation
ASA CW	Assistant Secretary of the Army for Civil Works
AT&SF	Atchison, Topeka, and Santa Fe
ATR	Agency Technical Review
AU	Assessment Units
BaP	benzo(a)pyrene
BCC	Birds of Conservation Concern
BMP	best management practice
BVP	Balanced Vision Plan
CAA	Clean Air Act
CAR	Coordination Act Report
CDC	Corridor Development Certificate
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CNEL	Community Noise Equivalent Level
CO	carbon monoxide
CO_2	carbon dioxide
CWA	Clean Water Act
CWWTP	Central Wastewater Treatment Plant
DaLMS	Dallas County Local Mitigation Strategy
DART	Dallas Area Rapid Transit
dB	decibels
dBA	A-weighted decibels
DCLID	Dallas County Levee Improvement District
DFE	Dallas Floodway Extension
DFW	Dallas-Fort Worth International Airport
DWU	Dallas Water Utilities
EA	Environmental Assessment
EAP	Emergency Action Plan
EDR	Environmental Data Resources, Inc.
EIS	Environmental Impact Statement
ELIDS	East Levee Interior Drainage System
EO	Executive Order
ER	Engineering Regulation
ESA	Endangered Species Act
EWLIDS	East and West Levee Interior Drainage Systems
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FPPA	Farmland Protection Policy Act
FRM	flood risk management
FTA	Federal Transit Administration
GCR	General Conformity Rule
GHG	greenhouse gases
gpm	gallons per minute
H&H	hydrologic and hydraulic
HABS	Historic American Buildings Survey
HAER	Historic American Engineering Record
HEC-RAS	Hydrologic Engineering Center - River Analysis System
HEP	Habitat Evaluation Procedures
HOV	high-occupancy vehicle
HQ	Headquarters
HSA	Historic Sites Act
HSI	habitat suitability index
HU	habitat unit
IDP	Interior Drainage Plan
IDS	Interior Drainage System
IH	Interstate Highway
IMPLAN	Impact Analysis for Planning
ISTEA	Intermodal Surface Transportation Efficiency Act
ITE	Institute of Transportation Engineers
JD	jurisdictional determination
kV	kilovolt
LBP	lead-based paint
L_{dn}	Day-Night Average Sound Level
L_{eq}	Equivalent Sound Level
LF	linear feet
LOS	Level of Service
LWCF	Land and Water Conservation Fund
MAP-21	Moving Ahead for Progress in the 21st Century
MBTA	Migratory Bird Treaty Act
MC	methylene chloride
MDCP	Maintenance and Deficiency Correction Period
MDFP	Modified Dallas Floodway Project
MGD	million gallons per day
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
MICU	mobile intensive care unit
MLK	Martin Luther King
MOA	Memorandum(a) of Agreement
MPO	Metropolitan Planning Organization
MS4	Municipal Separate Storm Sewer System

NA	not applicable
NAAQS	National Ambient Air Quality Standards
NCA	Noise Control Act
NCTCOG	North Central Texas Council of Governments
NED	National Economic Development
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NIMS	National Incident Management System
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NOA	Notice of Availability
NPS	National Park Service
NTTA	North Texas Transit Authority
O_3	ozone
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
PAR	Planning Aid Report
Pb	lead
PCB	pesticides, polychlorinated biphenyls
PCL	Protective Conservation Levels
PD	Planned Development
PEIS	Programmatic EIS
PI	Periodic Inspection
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
ppm	parts per million
PSD	Prevention of Significant Deterioration
PV	photovoltaic
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROI	region of influence
RSA	Regionally Significant Arterial
SAFETEA-LU	Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users
SCM	special conservation measures
SDWA	Safe Drinking Water Act
SF	square feet
SH	State Highway
SIP	State Implementation Plan
SO_2	sulfur dioxide
SOPs	standard operating procedures
SPF	Standard Project Flood
spp.	species
SVOCs	semi-volatile organic compounds
SWD	Southwest Division
SWF	Fort Worth District
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
TAC	Texas Agriculture Code
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TCP	Traditional Cultural Properties
TDA	Texas Department of Agriculture
TDSHS	Texas Department of State Health Services
THC	Texas Historical Commission
TIP	Transportation Improvement Program
TMDL	total maximum daily load
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TRA	Trinity River Authority
TRB	Transportation Research Board
TRCCC	Trinity River Corridor Citizens' Committee
TRCCLUP	Trinity River Corridor Comprehensive Land Use Plan
TREIS	Trinity River Environmental Impact Statement
TRFCD	Trinity River Flood Control District
TRRP	Texas Risk Reduction Program
TSP	Tentatively Selected Plan
TWMFCD	Trinity Watershed Management Flood Control Division
TX	Texas
TxDOT	Texas Department of Transportation
TXRAM	Texas Rapid Assessment Method
TXU	Texas Utility
$\mu g/m^3$	micrograms per cubic meter
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
UTRB	Upper Trinity River Basin
UTRFS	Upper Trinity River Feasibility Study
VOC	volatile organic compound
WLIDS	West Levee Interior Drainage System
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act
WWTF	wastewater treatment facilities

FINAL
SOUTHWEST DIVISION QUALITY CONTROL
DALLAS FLOODWAY PROJECT
ENVIRONMENTAL IMPACT STATEMENT

Lead Agency for the EIS: United States Army Corps of Engineers, Fort Worth District

Local Sponsor: City of Dallas

Cooperating Agency: Federal Highway Administration

Title of Proposed Action: **Dallas Floodway Project**

Designation: Environmental Impact Statement

ABSTRACT

The United States Army Corps of Engineers (USACE) has prepared this Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act of 1969 and USACE Engineering Regulation 200-2-2. This EIS describes the potential comprehensive environmental consequences resulting from the application of proposed flood risk management elements, ecosystem restoration features, recreation enhancement features, interior drainage plan improvements, and other proposed projects in and around the Dallas Floodway in Dallas, Texas.

Section 5141 of the Water Resources Development Act (WRDA) of 2007, as amended, provides a mechanism through which the USACE can participate in investigations and analyses regarding remediation of the existing Dallas Floodway, consider the need for replacement and reconstruction of features of the existing project, and examine changed conditions and possible engineering or construction deficiencies. Section 5141 of the WRDA of 2007, as amended, provides flexibility to undertake a comprehensive, system-wide analysis to evaluate proposed projects. The results of these investigations and analyses will be used to make determinations as to what work can be implemented pursuant to Section 5141 of the WRDA of 2007, as amended. The USACE, Fort Worth District is the proponent for this EIS, as the proposed project involves federal funding and federal interests in property. The City of Dallas is the non-federal sponsor, and the Federal Highway Administration is a cooperating agency.

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Fort Worth District

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DECEMBER 2014

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EXECUTIVE SUMMARY

INTRODUCTION

The United States Army Corps of Engineers (USACE) has prepared this Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act (NEPA) of 1969 and USACE Engineering Regulation 200-2-2, dated March 4, 1988, *Procedures for Implementing NEPA*. This EIS has been developed as a cooperative effort by the USACE Fort Worth District, the City of Dallas, Texas (non-federal sponsor), and the Federal Highway Administration (FHWA) (cooperating agency). The proposed project is considered a federal action because it involves federal funding and federal interests in property. As such, it requires compliance with applicable environmental policies and regulations.

LOCATION

The Study Area is located within the Upper Trinity River watershed, along the Trinity River, near Dallas, Texas (Figure ES-1). The Upper Trinity River watershed is defined as the area extending from the source of the Trinity River to an area located near the Interstate Highway (IH) 20 Bridge, situated in the southern portion of the City of Dallas. The Upper Trinity River watershed covers approximately 6,275 square miles, and includes the majority of the Dallas-Fort Worth Metroplex.

PURPOSE

The purpose of the Proposed Action is primarily to reduce flood risk through flood risk management (FRM), and secondarily to enhance ecosystems and provide greater recreation opportunities within the Trinity River Corridor in Dallas, Texas. Implementation of the Proposed Action is needed to comply with Section 5141 of the Water Resources Development Act [WRDA] of 2007, as amended.

Flooding events on the Trinity River have historically caused loss of lives and damage to property and structures. The Dallas Floodway Levee System is a federally sponsored project currently maintained by the City of Dallas. The Dallas Floodway currently is estimated to provide FRM benefits associated with passage of a flood event with a 1,500-year recurrence interval without overtopping to areas that include the City of Dallas' Central Business District and West Dallas. This flood event is expressed as having a 0.066 percent (%) annual exceedance probability and has an estimated peak flow of 245,000 cubic feet per second (cfs). The current estimated peak flow for the Standard Project Flood (SPF) event is 269,300 cfs. The predicted future SPF peak flow is 277,000 cfs; thus, the Dallas Floodway is currently not able to contain the current or predicted future SPF event without overtopping the levees. Current hydrologic and hydraulic models predict higher water surface profiles for the Dallas Floodway levees as compared to the 1958 design SPF event (226,000 cfs) due to a number of changes that have occurred since the completion of the 1958 design. Some of these changes include watershed development, land use changes, floodplain encroachments, updated design methods, and improved modeling technology. Recent local severe rainfall events have also demonstrated that improvements to the levee system are needed to reduce the risk of flooding of interior levee developments.

In addition, urbanization and past channelization and clearing of the Dallas Floodway have significantly degraded the natural terrestrial and aquatic habitat of the Dallas Floodway. The Trinity River now reflects little of its historic course, water quality, or habitat. Furthermore, the City of Dallas lacks sufficient recreational opportunities for citizens and visitors. There is inadequate access to the Dallas Floodway, and it is not perceived by the public as a desirable destination for recreation.

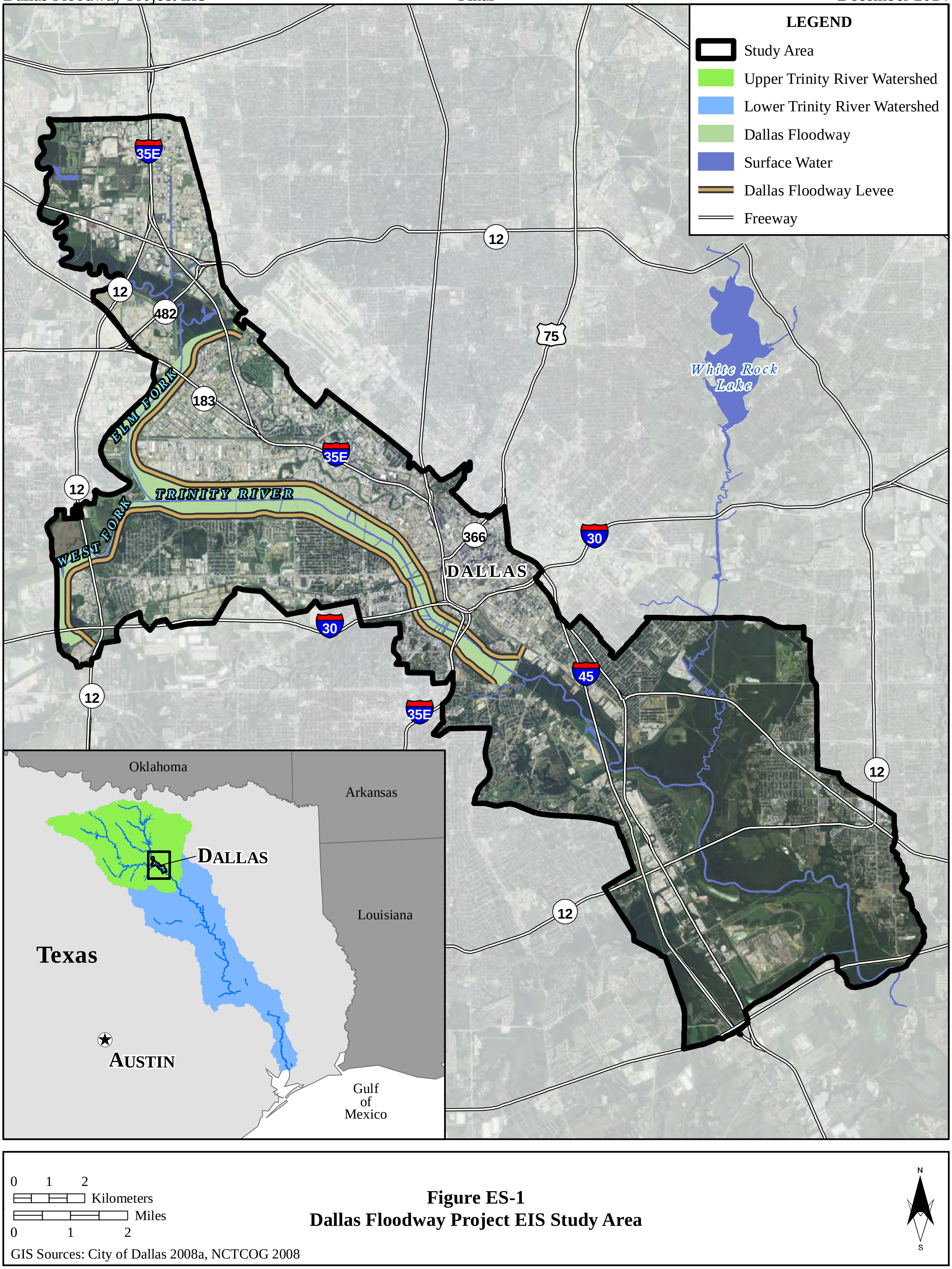

Figure ES-1
Dallas Floodway Project EIS Study Area

GIS Sources: City of Dallas 2008a, NCTCOG 2008

AUTHORITY

This EIS was authorized by Section 5141 of the WRDA of 2007, which reads as follows:

"*(a) In GENERAL.— The project for flood control, Trinity River and tributaries, Texas, authorized by Section 2 of the Act entitled, ''An Act authorizing the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes'', approved March 2, 1945 (59 Stat. 18), is modified to—*

(1) direct the Secretary to review the Balanced Vision Plan for the Trinity River Corridor, Dallas, Texas, dated December 2003 and amended in March 2004, prepared by the non-Federal interest for the project;

(2) direct the Secretary to review the Interior Levee Drainage Study Phase-I report, Dallas, Texas, dated September 2006, prepared by the non-Federal interest; and

(3) if the Secretary determines that the project is technically sound and environmentally acceptable, authorize the Secretary to construct the project at a total cost of $459,000,000, with an estimated Federal cost of $298,000,000 and an estimated non-Federal cost of $161,000,000.

(b) CREDIT.—

(1) IN-KIND CONTRIBUTIONS.—The Secretary shall credit, in accordance with Section 221 of the Flood Control Act of 1970 (42 U.S. Code [USC] 1962d–5b), toward the non-Federal share of the cost of the project the cost of planning, design, and construction work carried out by the non-Federal interest for the project before the date of the partnership agreement for the project.

(2) CASH-CONTRIBUTIONS.—The Secretary shall accept funds provided by the non-Federal interest for use in carrying out planning, engineering, and design for the project. The Federal share of such planning, engineering, and design carried out with non-Federal contributions shall be credited against the non-Federal share of the cost of the project."

Section 5141 of the WRDA of 2007 was amended as part of the Water Resources Reform and Development Act of 2014, which reads as follows:

"(d) TRINITY RIVER AND TRIBUTARIES.—*Section 5141(a)(2) of the Water Resources Development Act of 2007 (121 Stat. 1253) is amended by inserting "and the Interior Levee Drainage Study Phase II report, Dallas, Texas, dated January 2009," after "September 2006."*

Section 5141 of the WRDA of 2007, as amended, outlines authorization for the projects if the Secretary of the Army determines that the project is technically sound and environmentally acceptable. The WRDA-authorized project is the Balanced Vision Plan (BVP) Study dated December 2003, revised March 2004 and the Phase I Interior Drainage System (IDS) Study, dated 2006, and proposed IDS improvements identified for the West Levee IDS in the Phase II IDS Study, dated 2009. This EIS evaluates the environmental acceptability of the BVP Study and its associated features. The companion Feasibility Report prepared by the USACE (USACE 2014), evaluates the technical soundness of the project.

EVOLUTION OF STUDY

The City of Dallas has developed the BVP and Interior Drainage Plan (IDP) features as analyzed in this EIS following decades of iterative and interactive community input, analysis, and evaluation.

The existing Upper Trinity River Feasibility Study (UTRFS) serves as an umbrella study that includes all USACE projects in the Upper Trinity River Basin. The USACE initiated the UTRFS in response to the authority contained in the United States (U.S.) Senate Committee on Environment and Public Works Resolution dated April 22, 1988. This authorizing legislation for the overall study defines the area of investigation as the Upper Trinity River Basin, with specific emphasis on the City of Dallas-Fort Worth Metroplex. The UTRFS identified approximately 90 potential projects addressing FRM, ecosystem restoration, and recreation enhancement within the Upper Trinity River Basin (USACE 1988a).

The North Central Texas Council of Governments (NCTCOG) is the acting non-federal sponsor on the on-going UTRFS. NCTCOG coordinated with the USACE and the City of Dallas in May 1996 to modify the UTRFS Cost Sharing Agreement to include an Interim Feasibility Study of the existing Dallas Floodway that assessed several FRM alternatives. The USACE and the City of Dallas also developed additional environmental quality alternatives to benefit fish and wildlife habitat, water quality, and aesthetic properties while minimizing adverse impacts to existing cultural resources and FRM benefits.

In early 2000, the City of Dallas began development of another variation to the Trinity River Corridor Master Implementation Plan that included similar environmental quality measures and IDS improvements, referred to as the BVP Study. The BVP Study is the City of Dallas' plan to implement FRM, ecosystem restoration and recreation features as defined in the City's report, *The Balanced Vision Plan for the Trinity River Corridor, Dallas, Texas,* dated December 2003, and amended in March 2004.

Section 5141 of the WRDA of 2007, as amended in 2014, authorizes the USACE to incorporate the City of Dallas BVP Study (City of Dallas 2003, 2004) and IDS improvements (City of Dallas 2006, 2009a) within the Dallas Floodway Project. This authorization allows for implementation of BVP Study features and the IDP improvements following preparation of required NEPA documentation.

This EIS serves three purposes:

1. It analyzes the USACE's Modified Dallas Floodway Project (MDFP) as identified in the USACE Feasibility Report (USACE 2014).
2. It analyzes the environmental impacts associated with the remaining non-federal BVP features that the City of Dallas is requesting permission to construct under 33 USC Section 408. While these features that are not part of the MDFP, they are part of the comprehensive plan that the City of Dallas developed and are in the same general footprint as the MDFP. Comprehensively analyzing all of these features is required to ensure that the levee system would continue to function as designed. While the NEPA analysis and decision-making presented herein evaluates the impacts of the non-federal features (the remaining BVP features), the NEPA analysis should not be construed as authorization for construction of those features. Authorization of the non-federal features can only be completed as part of a Section 408 review.
3. It provides NEPA coverage for the USACE to make a decision on a Section 404 permit requested by the City of Dallas for everything the City of Dallas proposes to construct within the Dallas Floodway (i.e., the BVP Study features as proposed and analyzed in this EIS), minus the Trinity Parkway. The potential Trinity Parkway project, analyzed under a separate EIS prepared by the FHWA in conjunction with the Texas Department of Transportation, would require its own Section 408 permit.

This comprehensive approach to analysis aims to ensure that proposed alterations and modifications to the Dallas Floodway would meet the USACE engineering and safety standards, and would not have significant adverse effects on the functioning on the Dallas Floodway.

COORDINATION AND PUBLIC INVOLVEMENT

The USACE prepared and published a Notice of Intent in the Federal Register (Vol. 74, No. 195) on October 19, 2009 (Appendix A) and hosted a public scoping meeting on November 17, 2009. The meeting provided the public and agencies an opportunity to learn about the project and to provide input as to what components of the project are important to them, as well as what environmental resources USACE should consider in their formulation of plans and impact analysis.

The Draft EIS was made available for public comment on April 18, 2014 via a Notice of Availability (NOA) published in the Dallas Morning News, Al Día (a weekly Spanish-speaking publication), and the Federal Register (Vol. 79, No.75). Copies of the Draft EIS were available in four area libraries, including the Central Library, North Oak Cliff Library, Oak Lawn Branch Library, and West Dallas Library. The Draft EIS was also made available on the project website (http://www.swf.usace.army.mil/Missions/WaterSustainment/DallasFloodway.aspx), and via mail for interested parties. The USACE hosted a Public Review Meeting on May 8, 2014. The USACE considered and responded to (as appropriate) all relevant comments received during the Public Review Period and incorporated comments into the Final EIS. Most of the comments were generally beyond the scope of the EIS and were related to the potential Trinity Parkway, a separate action proposed by others.

The USACE has submitted this Final EIS to the U.S. Environmental Protection Agency (USEPA). A NOA for the Final EIS has been published in the Federal Register. Upon publication of the NOA by the USEPA in the Federal Register, a minimum 30-day "no action" review and comment period commences after which the USACE may issue a Record of Decision (ROD). The ROD identifies the USACE's decision regarding the action, the environmentally preferred alternative, the factors considered in making the decision, any mitigation measures, and any monitoring or enforcement program for any measure adopted. In addition, the ROD addresses any substantive comments made during the Final EIS review period. After issuing the ROD, the USACE may initiate the preferred alternative.

EXISTING CONDITIONS

The existing conditions of resource areas analyzed in the EIS are summarized in the following sections. Each resource area has been given an appropriate region of influence (ROI), i.e., the geographic area within which the Proposed Action may exert some influence.

Land Use

Permissible land uses for development within the Study Area are defined by several land use plans, policies, and zoning limitations. The Trinity River Corridor Comprehensive Land Use Plan (TRCCLUP), adopted by the Dallas City Council in 2005, serves as a framework for implementing a coordinated approach to infrastructure improvements, land use, and economic development in the Trinity River Corridor, and any changes in zoning designation are with the goal of bringing a parcel in line with the TRCCLUP.

Land use in the Study Area falls into several categories: Undeveloped (28%), Open Space (23%), Residential (13%), Industrial (12%), Commercial (11%), Government/ Education (8%) Transportation (2%), Utilities (2%), Mixed Use (1%), and Infrastructure (>1%). The Study Area does not include large, consolidated undeveloped areas, but instead densely developed neighborhoods interspersed with small individual, undeveloped lots.

Geology and Soils

The Study Area surface and subsurface is characterized by mostly flat, unconsolidated terrace and floodplain deposits. Within the ROI, the Trinity River and the levees represent major topographical features. Outside of the Floodway, the surrounding City of Dallas is urban, and much of the original topography has been heavily developed, paved, and graded. The river channel and Dallas Floodway in the Study Area are composed of alluvium consisting of sand, silt, clay, and sparse gravel.

To date, both the East and West Levees have performed well at the flood levels that have occurred since the levees were modified by the USACE. While the overall performance of the levees has been good, hundreds of shallow slope failures requiring repair have developed in areas where the levee is predominately constructed with high plasticity clay soils.

Hydrology and Hydraulics

The basis for the original design of the Dallas Floodway Levee System was the SPF design water surface elevation plus 4 feet. The original design SPF flow for the Dallas Floodway was 226,000 cfs.

Land use changes over the decades have resulted in alterations of the hydrology and hydraulics of the Dallas Floodway System, contributing to an increased risk of levee overtopping. Currently, modeling indicates that the Dallas Floodway East and West Levees would contain the 100-year flood event, but the current SPF event (269,300 cfs) would overtop the levees at several locations.

Water Resources

The majority of surface water features in the Floodway have been substantially modified from their natural conditions. The jurisdictional limits of the Trinity River extend to the ordinary high-water mark of the channel. There are approximately 495 acres of jurisdictional waters of the U.S. within and adjacent to the Floodway, of which approximately 309 acres are categorized as emergent wetlands. The increasingly urbanized Upper Trinity River watershed has impacted storm water quality with the addition of oil and grease, heavy metals, chemicals, toxic substances, solid waste (trash and debris), wastewater, effluence, bacteria, sediment, and other waste streams. Consequently, several stream segments within the Trinity River have been listed under Section 303(d) of the Clean Water Act (CWA) as impaired waters.

Biological Resources

There are five habitat types within the ROI for biological resources: aquatic riverine (421 acres), bottomland hardwood (1,414 acres), emergent wetland (419 acres), grassland (4,283 acres), and open water (206 acres).

There are 10 listed birds in the ROI; 5 are federally listed, 3 are federally delisted but remain state-listed, and all 10 are state-listed. There is one federal bird candidate species. In addition, there are three state-listed mollusks and three state-listed reptiles in Dallas County that are likely to, or have a potential to occur in the ROI. More than 20 species of birds listed as Birds of Conservation Concern by the U.S. Fish and Wildlife Service may occur within the general vicinity of ROI.

No federally listed threatened or endangered species are likely residents in the ROI; however, there is suitable habitat for special status species within the area. There is also potential for some special status bird species to transit the ROI, using the grassland, bottomland hardwood, wetland, and riverine habitats for resting and feeding during migration.

Cultural Resources

The Dallas Floodway, as a single engineering system for flood control and reclamation, is a historic and cultural resource with locally significant historical associations with flood control and the history of city planning and community development in Dallas. It is a significant statewide example of an engineering system designed for flood control and development enhancement. Essential physical features of the Dallas Floodway include the levees, diversion channels, and overbank. The Dallas Floodway retains all its essential physical features and its ability to convey its significance. In addition, one bridge (the Houston Street Viaduct) is also a NEPA historic and cultural resource, as is the Tenth Street Historic District, located within the Study Area.

Eight archaeological sites have been previously documented within the Dallas Floodway. Of those, six are not significant under NEPA criteria. The remaining two sites have not been evaluated for NEPA historic and cultural significance.

Recreational Resources

Several existing bike routes and trails link the Study Area to neighboring communities. In addition to the established trails, pedestrian use of the levee maintenance roads and equestrian activities occur within the area. In total, 32 parks, 3 recreational centers, 9 community centers, and 3 community pools provide open space, picnic areas, camps, playgrounds and structures, ball courts, baseball fields, and soccer fields. The Trinity River is used for catch-and-release fishing, boating, canoeing, and kayaking.

The City of Dallas lacks sufficient recreational opportunities for citizens and visitors. There is a strong public need for active recreation facilities in the City of Dallas, in particular playing fields for soccer and other similar activities. In addition, there is inadequate access to the Dallas Floodway, which hampers the public’s ability to enjoy the limited existing recreational opportunities. The Texas Parks and Wildlife Department considers the City of Dallas as “underserved” in terms of recreation opportunities.

Visual Resources

Overall, the visual landscape of the Study Area can be described as a major metropolitan area with pockets of vegetation, divided by an extensive linear area of open space. The Dallas Floodway represents a major visual feature in the area, sharply defining the boundary between the major metropolitan elements and open space. The bridges that span the Dallas Floodway, buildings in the Central Business District, and levee tops provide expansive views of the Study Area. No designated scenic roadway or highway is present within the viewshed.

Socioeconomics

In 2010, the total population within the ROI was 272,761, which represents about 22.8% of the population of the City of Dallas. The ROI population consists of 14.9% white, 39.8% Black or African American, and 42.7% Hispanic or Latino. Seventy-five census block groups within the ROI have minority populations that represent 50% or more of the total resident population. The percentage of population less than 18 years old is 24.8%.

Within the ROI, households generally have lower incomes as compared to other indicators. Fifty census block groups within the ROI have low-income populations that represent 20% or more of the total resident population. Employment in the ROI is just over 108,000 and is concentrated in the construction industry. The ROI has a comparatively lower level of educational attainment (i.e., in terms of high school completion, college attendance, associate degrees, bachelor’s degrees, or advanced degrees) than the other areas considered in this analysis. The vacancy rate of 13.9% for the ROI was greater than the City of Dallas (12.8%), Dallas County (10.7%), the State of Texas (12.1%), and the U.S. (12.2%).

Hazardous Materials and Wastes

In support of this EIS, a Phase I Background Database Search was conducted (Environmental Data Resources, Inc. [EDR] 2013) and a report was prepared (USACE 2013). The 2013 EDR search revealed 1,819 sites with known environmental conditions within the boundary search area (a 2-mile wide area approximately centered on the Trinity River through the Dallas Floodway). Of those, 34 sites are located within the smaller ROI for hazardous materials and wastes, including the Murmur Corporation Site 3/RSR Corporation Superfund Site. All 34 of the identified sites are in varying states of cleanup or closure.

Widespread Texas-Specific Soil Background Concentrations exceedances of lead and arsenic (mostly in low concentrations) were detected in surface soils across the Floodway. The Phase II Environmental Site Assessment report concluded their presence in soils to be associated with airborne deposition (USACE 2008). Hazardous material use within the Study Area is limited to materials used in the operation and maintenance of the levees and the pumping plants.

Safety

Flooding occurs within the ROI, as most of the pump stations and sumps within the Dallas Floodway Project are unable to manage a 100-year, 24-hour flood event. Moreover, damage to the levees continually occurs from erosion, encroachment, weather, and unauthorized access (e.g., off-road vehicle use) to the Dallas Floodway Levee System, furthering flood risk. Currently, the levees reduce flood risk for residential and highly developed commercial and industrial property, which accounts for approximately 17% of the City of Dallas tax base. One of the most notable impediments to Trinity River flow is the wood trestle supports of the abandoned Atchison, Topeka, and Santa Fe (AT&SF) Railroad Bridge, which catch and accumulate debris as the Trinity River flows through the southern end of the Floodway.

Emergency services in the ROI are provided by the Dallas Police Department and Dallas Fire-Rescue Department Dallas County. The Dallas Floodway Project is accessible to emergency services via 10 access points and graded roads along the levee tops.

Transportation

Several major freeways and surface roads traverse the ROI, including IH-35E, IH-30, State Highway 183, and US-75. All freeways and many roadways currently experience substantial traffic congestion. In addition, several of these roads are subject to complete or partial flooding from the 100-year stormwater flood events and/or the Trinity River SPF event. Twenty-two bridges span the Dallas Floodway. A major network of bus routes, light-rail transit, and commuter rail serves the Study Area. In addition, pedestrian paths for walking/biking provide public access to the Floodway. Maintenance roads provide City of Dallas Flood Control District maintenance personnel access to sumps, pumps, and other features of the Floodway.

Utilities

Major utilities within the Study Area include buried gas and petroleum lines; buried and aboveground telecommunications cables (telephone, television, and fiber optic); buried and aboveground electric transmission lines; buried potable water supply lines; buried wastewater lines; and buried and aboveground stormwater management infrastructure (including the IDS).

Atmos Energy provides natural gas service via a network of small and medium sized lines for local distribution and larger main natural gas lines. Existing communications network infrastructure includes telephone, cable television, a cellular tower, and fiber optic lines. Dallas is within the Oncor Electricity Service Area, which provides electric service via 138 kilovolt (kV) and 345 kV aboveground power lines and towers that are prevalent throughout the Study Area. The City of Dallas Water Utilities Department provides potable drinking water to the Study Area, as well as wastewater treatment within the Study Area. Treated wastewater is either reused within treatment plants or discharged directly into the Trinity River.

The City of Dallas Trinity Watershed Management Flood Control Division operates and maintains the Dallas Floodway and the IDS under the regulatory control of the USACE. Flood risk management is the primary service provided by the Flood Control Division, and flood risk reduction is provided through the maintenance and operation of the Dallas Floodway Project consisting of pump stations, pressure sewers, levees, flood walls, drainage/closure structures, channels, Floodway and miscellaneous facilities.

Air Quality

The City of Dallas is in attainment for all criteria air pollutants except ozone (O_3). The applicable criteria pollutant *de minimis* levels are 50 tons/year for volatile organic compounds (VOCs) and oxides of nitrogen (NO_x). VOCs and NO_x are precursors to the formation of O_3. The largest regional sources of VOCs and NO_x emissions are on-road (cars and trucks) and non-road vehicles (construction equipment, airplanes, and locomotives). The Dallas-Fort Worth O_3 “serious” Nonattainment Area consists of the ten counties. The attainment deadline for the 2008 O_3 standard is December 31, 2018.

Emission sources in the Study Area include vehicles, aircraft, industrial operations, and on-going construction activities. Approximately 70% of the Dallas-Fort Worth region’s air pollution comes from mobile sources such as cars, trucks, airplanes, construction equipment, and lawn equipment. The Dallas-Fort Worth region has experienced a steady decline in NO_x levels measured across the Study Area, from reductions in emissions from stationary sources (stack) emissions, cleaner cars and construction equipment, and cleaner fuels.

Noise

The Dallas Floodway is surrounded by a large urbanized area. Vehicle traffic on the bridges crossing the Dallas Floodway account for the majority of noise in the area. Another source of noise that contributes to the ambient noise is air traffic. Dallas Love Field is located approximately 2 miles north of the Dallas Floodway and Dallas-Fort Worth International Airport is located approximately 8 miles west of the Dallas Floodway. The majority of land that falls within the eastern portion of the noise ROI is classified industrial/commercial, whereas the western portion of the ROI is more mixed with industrial and residential uses. Several sensitive noise receptors, including a number of churches, are located within the ROI.

OVERVIEW OF PROPOSED ACTION

The features making up the Proposed Action are derived from the BVP Study (City of Dallas 2003, 2004), the Phase I IDS Study (City of Dallas 2006), and the Phase II IDS Study recommendations (City of Dallas 2009a). In response to Section 5141 of WRDA 2007, as amended, the USACE analyzed the Proposed Action and identified features of the project that could be implemented by USACE. The features the USACE would implement would be cost shared between USACE and the City of Dallas. These features are identified as the MDFP. The City of Dallas made it known early in the study process that they wanted the USACE to analyze the entire project and that if there were components not being recommended for construction by the USACE, then they would like to construct those features under a 33 USC Section 408 request. These features will be identified as the remaining BVP features and will be complete financial responsibility of the City of Dallas if they are approved for construction.

The Proposed Action consists of the following three categories of actions within the Trinity River Corridor in Dallas, Texas:

- BVP Study FRM Elements;
- BVP Study Ecosystem Restoration and Recreation Enhancements; and
- IDP Improvements.

BVP Study FRM Elements

The objective of the FRM elements is to provide cost effective river FRM benefits consistent with USACE national policy. The USACE has been analyzing Dallas Floodway Levees and working with the City of Dallas for several years to develop a plan for levee improvements that would provide the City of Dallas with additional FRM benefits. As detailed in the parallel USACE Feasibility Report (USACE 2014), the USACE identified the 277,000 cfs Levee Raise with the AT&SF Railroad Bridge modifications as being the plan with the most net economic benefits as a stand-alone alternative. In addition, the City of Dallas' plans to flatten the riverside levee side slopes from 3:1 to 4:1 for maintenance purposes is included. Finally, the USACE has also identified nonstructural actions as part of the FRM to include emergency response, public awareness/education, flood forecasting, and warning systems. Specifically, the USACE would provide revised inundation mapping to support the City's Emergency Action Plan and install monitoring equipment in the Floodway. Implementation of the proposed FRM elements would:

- reduce the risk to life and health, and improve the welfare of the residents in the Study Area;
- reduce the risk of property damage in the Study Area;
- reduce the risk of significant national and regional economic losses in the Study Area; and
- provide greater opportunities for increasing the public awareness of residual risk in the Study Area.

BVP Study Ecosystem Restoration and Recreation Enhancements

Proposed BVP Study ecosystem restoration and recreation enhancement features would accommodate a variety of activities - from rest and relaxation in quiet nooks to large open areas for crowds to watch Fourth of July fireworks to bird watching in secluded wetlands to world-class rowing aligned with the downtown skyline. In developing the proposed mix of active, passive, urban and nature-based uses, the BVP Study ecosystem restoration and recreation enhancement features aim to restore Floodway ecosystems and increase recreational opportunities without reducing the level of river FRM. All of the proposed features are expected to result in an increase in public recreation use in the Floodway and adjacent areas.

In identifying and implementing ecologically sound ways to use available water, the BVP Study ecosystem restoration features would maximize ecosystem benefits as well as provide secondary positive recreational benefits. The BVP Study recreation enhancement features would increase the overall recreational opportunities in and around the greater Dallas Floodway area.

IDP Improvements

The IDP consists of proposed improvements to the existing East and West Levee Interior Drainage Systems (EWLIDS). The objective of the IDP improvements is to reduce flood risk for areas served by the EWLIDS from the 100-year storm event.

ALTERNATIVES CONSIDERED

This EIS considers two alternatives: Alternative 1 and Alternative 2. Alternative 1 is the No-Action Alternative (or “Future Without-Project Condition”) that assumes the MDFP and remaining BVP features are not implemented. Potential future conditions in the absence of the Proposed Action (the No-Action Alternative) have been characterized under Alternative 1.

Alternative 2 consists of implementation of the MDFP and the remaining non-federal BVP and IDP features. The first part of Alternative 2 identifies the MDFP and the second part identifies the City’s preferred alternative for the remaining non-federal BVP and IDP features that are being requested by the City of Dallas to be constructed by the City of Dallas. Two design variations are evaluated under Alternative 2: one design that anticipates that the potential Trinity Parkway is constructed and another design that anticipates that the potential Trinity Parkway is not constructed. The MDFP and the non-federal IDP features are identical in both of the designs being considered under Alternative 2. The non-federal BVP features however do, have minor design variations under the two design assumptions.

SUMMARY OF IMPACTS

Table ES-1 presents a summary of the anticipated impacts to each resource area from implementation of either design variation of the Proposed Action (Alternative 2). Impacts are summarized by themselves (“discrete”) as well as in combination with the identified past, present, and reasonably foreseeable projects (“cumulative”). As shown in Table ES-1 and as noted in the resource-specific impact analysis in Chapter 4, some resource areas have different construction and operational impacts, whereas other resource areas have one impact period presented (i.e., construction and operation as indicated by “both”).

Table ES-1. Summary of Environmental Impacts from Implementation of the Proposed Action

Resource Area	*Impact Period*	*Alternative 2*			
		Impacts from Design Anticipating Parkway Construction		*Impacts from Design Not Anticipating Parkway Construction*	
		Discrete	*Cumulative*	*Discrete*	*Cumulative*
Land Use	Both	+	+	+	○
Geology and Soils	Construction	○	○	○	○
	Operation	+	+	+	+
Hydrology and Hydraulics	Both	○	○	○	○
Water Resources	Construction	▲	▲	▲	▲
	Operation	+	+	+	+
Biological Resources	Construction	▲	▲	▲	▲
	Operation	+	+	+	+
Cultural Resources	Both	▲	▲	▲	▲
Recreational Resources	Construction	○	○	○	○
	Operation	+	+	+	+
Visual Resources	Construction	○	○	○	○
	Operation	+	○	+	+
Socioeconomics	Both	+	+	+	+
Hazardous Materials and Wastes	Both	○	○	○	○
Safety	Both	+	+	+	+
Transportation	Construction	○	▲	▲	▲
	Operation	○	▲	○	▲
Utilities	Construction	○	○	○	○
	Operation	+	+	+	+
Air Quality	Construction	▲	▲	▲	▲
	Operation	○	○	○	○
Noise	Both	○	○	○	○

Impact Summary Key: + = Beneficial impacts ○ = Less than significant impacts ▲ = Significant adverse impacts

The following sections summarize the anticipated environmental impacts to each resource area from implementation of the Proposed Action. Any substantial differences in anticipated impacts between the design variations have been identified.

Land Use

Under either Proposed Action design, the proposed FRM elements would be consistent with the current zoning and TRCCLUP use for the area, furthering the goals of the TRCCLUP. The proposed BVP Study features would be consistent with current zoning. As all Land and Water Conservation Fund (LWCF) projects within the Study Area have been completed, no impacts to LWCF projects would occur. The river modifications would further the goals stated within the TRCCLUP for the area. Some areas would first require completion of a "residential adjacency review." However, while a review would be required, the proposed improvements would be consistent with the zoning code and would further the goals stated within the TRCCLUP. The comprehensive plans currently in use (e.g., TRCCLUP and forwardDallas!) incorporate many of the elements included under both Proposed Action designs. Proposed Trinity-Portland sump improvements may be completed without impacting three privately owned parcels; however, the City of Dallas may choose to pursue the purchase the lands following coordination with the property owners, if recommended in later design refinements. Therefore, implementation of the Proposed Action would result in beneficial impacts to land use.

Geology and Soils

Construction related impacts to soils would be minimized with best management practices (BMPs). BMPs would be implemented before, during, and after construction activities. The proposed FRM elements would reduce on-going levee erosion. Material excavated to create major features such as the lakes would be reused as fill for other project elements to the greatest extent practicable. Any excess material would be disposed of offsite. Impacts to geology and soils under the design variation not anticipating the potential Trinity Parkway construction would be slightly greater, but not substantially different, during the construction phase as compared to the design variation that anticipates the potential Trinity Parkway construction because a greater amount of area would be disturbed to create the Urban and Natural lakes. Therefore, implementation of the Proposed Action would result in less than significant impacts to geology and soils during construction and beneficial impacts during operation.

Hydrology and Hydraulics

Implementation of the Proposed Action would support achievement of the desired level of SPF FRM for the City of Dallas. The Trinity River Environmental Impact Statement (TREIS) ROD criteria for water surface rise for the SPF flood event would be met at every location within the Dallas Floodway and upstream. The Proposed Action would not meet the TREIS ROD criteria for water surface elevation rise for the 100-year flood event and for valley storage loss for the 100-year flood event. Water surface elevation rise for the 100-year flood event would be limited to the areas of the Dallas Floodway and the West Fork, and therefore contained by the levees. The USACE and City of Dallas would request a variance from the TREIS ROD requirements, with the demonstration of there being no impact to public safety. The Proposed Action would be implemented in compliance with Executive Order 11988. Therefore, implementation of the Proposed Action would result in less than significant impacts to hydrology and hydraulics.

Water Resources

Under the Proposed Action, a functional analysis indicated there would be net functional gain of 6,115 linear feet for the Trinity River and an increase in wetlands acreage (28.68 acres or 6.10 acres, depending on the design variation – with and without the potential Trinity Parkway construction, respectively) with implementation of the USACE MDFP components. The City of Dallas BVP Study components would result in an impact (loss) to other open waters (20.81 acres or 26.72 acres, depending on the design variation - with and without the potential Trinity Parkway construction, respectively) and wetlands (58.31 acres or 82.41 acres, depending on the design variation - with and without the potential Trinity Parkway construction, respectively). The City of Dallas would be required to purchase credits from an approved mitigation bank to offset these impacts. Construction and operation would have no substantial impact on groundwater aquifers.

Through compliance with the Construction General Permit and implementation of project-specific Storm Water Pollution Prevention Plans (SWPPPs) and associated BMPs, the Proposed Action would minimize potential impacts to surface water quality. Direct impacts to jurisdictional wetlands and other waters of the U.S. from construction would be mitigated through onsite enhancement/creation/restoration, or compensated through the purchase of credits from an approved mitigation bank. Therefore, implementation of the Proposed Action would result in significant adverse impacts to water resources during construction and beneficial impacts to water resources during operation.

Biological Resources

Given the magnitude of the proposed construction activities, which would result in nearly complete disturbance of the Floodway, implementation of the Proposed Action would result in significant adverse impacts to biological resources within the ROI during construction. Post-construction, there would be an increase in key habitat acreage and value. Most, if not all species, are expected to recolonize habitat after construction. No federally listed species are known to reside or breed in the ROI; therefore, no impacts to federally listed species are anticipated. Impacts to state-listed species located within the Mainstem Group would be minimized through the implementation of conservation and mitigation measures. Therefore, implementation of the Proposed Action would result in significant adverse impacts to biological resources during construction, and beneficial impacts to biological resources during operation.

Cultural Resources

The East and West Levees are essential physical features of the Dallas Floodway as a NEPA historic and cultural resource. The removal of large portions of the AT&SF Railroad Bridge would diminish the bridge's ability to convey its significance and resulting in an impact to a NEPA historic and cultural property. The demolition or alteration of contributing features to the Dallas Floodway Historic District would result in impacts to a NEPA historic and cultural structure as well as an impact to the overall integrity of the Dallas Floodway. Known archaeological sites with the Study Area would be avoided. Therefore, implementation of the Proposed Action would result in significant adverse impacts to NEPA historic and cultural resources.

Recreational Resources

Proposed construction activities would result in temporary disruptions to recreational activities within the Study Area. Implementation of the Proposed Action would result in a substantial increase in the number and types of recreation opportunities available to the people in the City of Dallas, significantly reducing the recreation shortfall within the City of Dallas. Furthermore, proposed IDP improvements would reduce the flood risk to recreation areas. The design variation without the potential Trinity Parkway construction would result in greater recreation elements as compared to the design variation with the potential Trinity Parkway construction. Therefore, implementation of the Proposed Action would result in less than significant impacts to recreational resources during construction, and beneficial impacts to recreational resources during operation.

Visual Resources

Implementation of the Proposed Action would result in negative impacts to visual resources within the Floodway during construction, as the visual rating would decrease; however, these impacts would be temporary. The overall visual quality of the Dallas Floodway and the interior drainage area would improve with the implementation of the Proposed Action. Night lighting features would be designed and operated to minimize impacts to nighttime views. Therefore, implementation of the Proposed Action would result in less than significant impacts to visual resources during construction, and beneficial impacts to visual resources during operation.

Socioeconomics

Implementation of the Proposed Action would create approximately 8,553 temporary construction jobs, $662,634,032 in labor income, and increase economic output by $1,264,620,223. The increase in recreational opportunities (and access to them) would directly benefit residents of Dallas. The anticipated increase in visitors to the Study Area would result in more money spent in the local economy and support tourism-related businesses such as hotels and retail establishments. The additional money spent by visitors would generate jobs and income for Dallas residents as well as tax revenues for local governments and the State of Texas. Furthermore, there would be a reduction in flood risk and associated impacts within the Study Area. Therefore, implementation of the Proposed Action would result in beneficial impacts to socioeconomic resources.

Hazardous Materials and Wastes

Implementation of the Proposed Action would avoid directly disturbing any sites with known environmental contamination conditions. Based on previous sampling (USACE 2008), the soil proposed for use as borrow material would be acceptable for use under Texas Risk Reduction Program (TRRP) Tier 1 Residential standards. The USACE has assessed the Hazardous, Toxic, and Radioactive Waste potential of the sites identified in the Phase I Background Database Search, and no Phase II investigations are warranted. Potentially contaminated areas or hazardous materials could be encountered during demolition or constructed-related activities; however, a Soil Management Plan would contain a contingency plan for encountering any potentially contaminated or hazardous material during construction, and material would be handled in accordance with all applicable regulations. Any material that exceeds the TRRP Tier 1 Residential standards for human health exposures to surface soils through the combined ingestion of soils and vegetables, inhalation, and dermal contact pathways would be considered hazardous and would be removed from the site and properly disposed of in accordance with all relevant regulations. All hazardous materials and wastes would be stored, and disposed of in accordance with all applicable local, state, and federal regulations. Therefore, implementation of the Proposed Action would result in less than significant impacts to human health and the environment associated with hazardous materials and wastes.

Safety

Under the Proposed Action, construction would not occur during rain events, and construction personnel would be required to maintain frequent communication with the City of Dallas Flood Control Division to assess the safety of operating within the Floodway. With implementation of the Proposed Action, there would be an increase in access points and safety-related services within the Floodway. Implementation of the Proposed Action would reduce the potential flood-related safety impacts to persons within the Study Area. Therefore, implementation of the Proposed Action would result in beneficial impacts to safety.

Transportation

Implementation of the Proposed Action would increase the number of construction-related traffic (e.g., workers and equipment deliveries) within the ROI. Because the borrow pits are located within the Floodway, the majority of fill material haul trips to and from the levees are expected to be confined to the Floodway, and would not traverse the street network. However, it may be necessary in some instances to transport fill material via public streets. Under the design variation not anticipating the potential Trinity Parkway construction, more than twice as many dump trucks to haul excess fill material would occur, thus impacting transportation networks within the ROI.

Under the Proposed Action, users of the proposed recreational facilities and amenities would create a substantial and recurring daily traffic increase on highways approaching the Floodway and on internal streets that provide access to and from the facilities. With the implementation of minimization measures, operational impacts would be less than significant. Roads potentially subject to flooding would have a reduced risk of flooding-related closure following implementation of the proposed FRM elements and IDP improvements. Therefore, implementation the Proposed Action would result in less than significant impacts to transportation during construction (under the design variation anticipating the potential Trinity Parkway construction) and significant impacts to transportation during construction (under the design variation not anticipating the potential Trinity Parkway construction). Implementation of the Proposed Action (under both design variations) would result in less than significant impacts to transportation during operation.

Utilities

Implementation of proposed construction activities under the Proposed Action would result in temporary and localized impacts to utility services. These impacts would be communicated to customers ahead of the temporary outage. Implementation of the Proposed Action would result in an increase in utility demand; however, this increase is anticipated to be met by local and regional utility providers. The proposed IDP improvements would substantially increase the level of stormwater conveyance and thus result in a beneficial impact to flood risk management. Therefore, implementation of the Proposed Action would result in less than significant impacts to utilities during construction, and beneficial impacts to utilities during operation.

Air Quality

Implementation of the Proposed Action would result in temporary increases in criteria pollutant emissions associated with construction activities. Estimated NO_x emissions generated by construction activities would exceed *de minimis* thresholds for NO_x. Estimated construction emissions under the design variation not anticipating the potential Trinity Parkway construction would be approximately 17% greater during the peak construction years than those emissions estimated under the design variation that anticipates the potential Trinity Parkway construction. No substantial long-term increase in mobile or stationary source emissions in the ROI would occur. Therefore, implementation of the Proposed Action would result in significant adverse impacts to air quality during construction, and less than significant impacts to air quality during operation.

Noise

Proposed construction activities would include the use of various types of construction equipment and machinery (e.g., excavators, bulldozers, compactors, cranes, trucks) over a period of several years. The majority of proposed construction activities would occur in areas that are relatively far away or shielded from identified sensitive noise receptors. Construction noise would be temporary, localized, and subject to the City of Dallas noise ordinance. Proposed BVP Study recreational elements would result in an overall slight increase in ambient noise levels within the Floodway. Operational noise associated with FRM and IDP activities would be relatively minor, temporary, and consistent with existing noise levels associated with on-going flood risk management operations. Therefore, implementation of the Proposed Action would result in less than significant impacts to the noise environment.

PREFERRED ALTERNATIVE

The USACE has identified Alternative 2 as their Preferred Alternative. Based on the analysis contained in this EIS, Alternative 2 is also the environmentally preferred alternative. Chapter 7 presents a summary of the Preferred Alternative and the identified resource conservation measures, mitigation, and monitoring that would occur as part of the Preferred Alternative.

ADDITIONAL INFORMATION

Copies of this EIS and the supporting appendices are available in electronic format from the USACE's project website: http://www.swf.usace.army.mil/Missions/WaterSustainment/DallasFloodway.aspx. Hard copies or compact discs of either the EIS and/or supporting appendices are available upon request.

CONTACT INFORMATION

Questions regarding the Dallas Floodway Project EIS can be addressed to Marcia Hackett, U.S. Army Corps of Engineers, Fort Worth District, 819 Taylor Street, Room 3B05, Fort Worth, Texas 76102-0300. Ms. Hackett can also be reached via phone (817) 886-1373 or email at marcia.r.hackett@usace.army.mil.

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FINAL
DALLAS FLOODWAY PROJECT
ENVIRONMENTAL IMPACT STATEMENT
DECEMBER 2014

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CHAPTER 1
PURPOSE AND NEED FOR PROPOSED ACTION

1.1 INTRODUCTION

The United States Army Corps of Engineers (USACE) has prepared this Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act (NEPA) of 1969 and USACE Engineering Regulation (ER) 200-2-2, dated March 4, 1988, *Procedures for Implementing NEPA*. This EIS has been developed as a cooperative effort by the USACE Fort Worth District, the City of Dallas, Texas (non-federal sponsor), and the Federal Highway Administration (FHWA) (cooperating agency). The proposed project is considered a federal action because it involves federal funding and federal interests in property. As such, it requires compliance with applicable environmental policies and regulations.

Section 5141 of the Water Resources Development Act (WRDA) of 2007, as amended in 2014, authorizes the USACE to incorporate the City of Dallas Balanced Vision Plan (BVP) Study (City of Dallas 2003, 2004) and Interior Drainage System (IDS) improvements (City of Dallas 2006, 2009a) within the Dallas Floodway Project. This authorization allows for implementation of BVP Study features and the Interior Drainage Plan (IDP) improvements following preparation of required NEPA documentation. This EIS describes the potential comprehensive environmental consequences resulting from the application of proposed BVP Study Flood Risk Management (FRM) elements, BVP Study Ecosystem Restoration and Recreation Enhancement features, and IDP improvements in combination with the impacts associated with the implementation of identified past, present, and reasonably foreseeable projects in and around the Study Area.

Purpose and Need Overview

The Proposed Action is to implement flood risk management measures, ecosystem and recreation features, and drainage improvements within the Dallas Floodway Project area in Dallas, Texas.

- ***Purpose & Need:*** The purpose is to reduce flood risk, enhance ecosystems, and provide greater recreation opportunities. The project is authorized by the Water Resources Development Act of 2007.
- ***Background:*** The North Central Texas Council of Governments, USACE, and the City of Dallas have worked together since the mid-1990s to develop flood risk management measures and environmental quality alternatives. The resulting BVP and IDP contain measures that form the core of the Proposed Action.
- ***Public Involvement:*** The USACE hosted a public scoping meeting on November 17, 2009 and a Draft EIS Public Review Meeting on May 8, 2014. Additional information regarding public involvement is provided in Appendix A and the USACE project website: http://www.swf.usace.army.mil/Missions/WaterSustainment/DallasFloodway.aspx.

In accordance with Section 5141 of the WRDA of 2007, as amended and under this authority, the Assistant Secretary of the Army for Civil Works (ASA [CW]) is to determine on the basis of "technically sound" and "environmentally acceptable," the suitability of the City of Dallas' plans for constructing the BVP and IDP within the existing Dallas Floodway Project. This EIS evaluates the environmental acceptability of the BVP Study and its associated features. The companion Feasibility Report prepared by the USACE (USACE 2014a), evaluates the technical soundness of the project. Should the Feasibility Report be approved by the USACE Director of Civil Works, and a Record of Decision (ROD) be signed on this EIS by the ASA(CW), the project could be constructed without additional authorization.

1.2 STUDY AREA

The Study Area is located within the Upper Trinity River watershed, along the Trinity River near Dallas, Texas (Figure 1-1). The Upper Trinity River watershed is defined as the area from its headwaters to approximately Interstate Highway (IH) 20 Bridge, located in south Dallas. The Upper Trinity River watershed covers approximately 6,275 square miles, and includes the majority of the Dallas-Fort Worth Metroplex.

The Trinity River Corridor Comprehensive Land Use Plan (TRCCLUP) (City of Dallas 2005), adopted by the Dallas City Council in March 2005, serves as a framework for implementing a coordinated approach to infrastructure improvements, land use, and economic development in the Trinity River Corridor. The region encompassed by the TRCCLUP generally defines the minimum boundaries of the Study Area. Using the TRCCLUP as a base, the Study Area displayed on Figure 1-2 is an aggregation of EIS resource area regions of influence and covers 48,263 acres, or approximately 19 percent (%) of the City of Dallas.

1.3 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is primarily to reduce flood risk through FRM, and secondarily to enhance ecosystems and provide greater recreation opportunities within the Trinity River Corridor in Dallas, Texas. Implementation of the Proposed Action is needed to comply with Section 5141 of the WRDA of 2007 authorization, as amended.

Flooding events on the Trinity River have historically caused loss of lives and damage to property and structures. The Dallas Floodway currently is estimated to provide FRM benefits associated with passage of a flood event with a 1,500-year recurrence interval without overtopping. This flood event is expressed as having a 0.066% annual exceedance probability (AEP) and has an estimated peak flow of 245,000 cubic feet per second (cfs). The current estimated peak flow for the Standard Project Flood (SPF) event is 269,300 cfs. The predicted future SPF peak flow is 277,000 cfs; thus, the Dallas Floodway is currently not able to contain the current or predicted future SPF event. Current hydrologic and hydraulic (H&H) models predict higher water surface profiles for the Dallas Floodway levees as compared to those modeled in 1958 due to a number of changes that have occurred. Some of these changes include watershed development, land use changes, floodplain encroachments, updated design methodology, and improved modeling technology, as described below. Recent local severe rainfall events have also demonstrated that improvements are needed to reduce the risk of flooding of levee interior developments.

Urbanization and past channelization and clearing of the Dallas Floodway have significantly degraded the natural terrestrial and aquatic habitat of the Dallas Floodway. The Trinity River now reflects little of its historic course, water quality, or habitat. Furthermore, the City of Dallas lacks sufficient recreational opportunities for citizens and visitors. There is inadequate access to the Dallas Floodway, and it is not perceived by the public as a desirable destination for recreation.

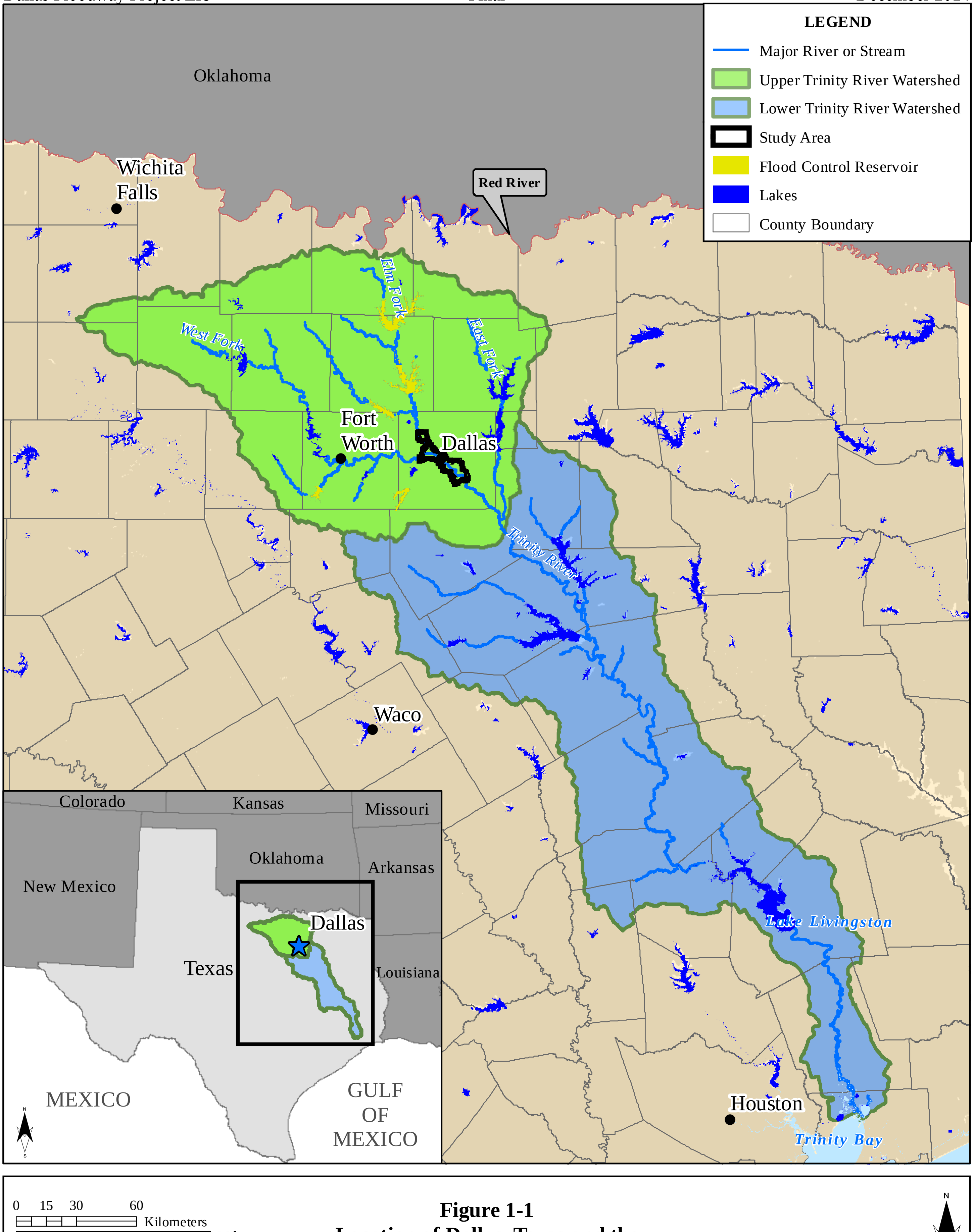

Figure 1-1
Location of Dallas, Texas and the Upper Trinity River Watershed

GIS Sources: City of Dallas 2008a, NCTCOG 2008

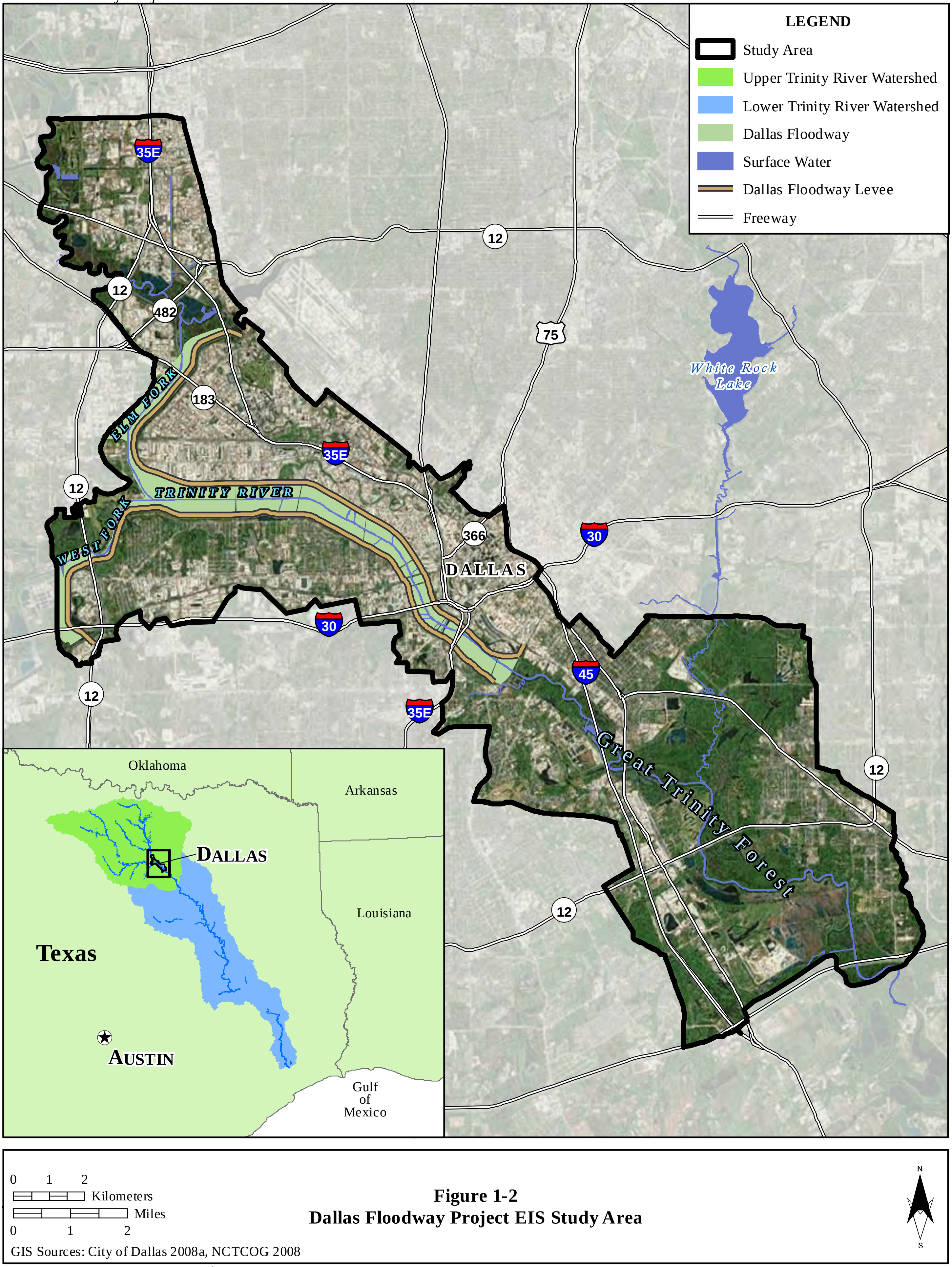

Figure 1-2
Dallas Floodway Project EIS Study Area

GIS Sources: City of Dallas 2008a, NCTCOG 2008

1.4 PROJECT AUTHORITY

1.4.1 Background

The existing Upper Trinity River Feasibility Study (UTRFS) serves as an umbrella study to all USACE projects in the Upper Trinity River Basin. The USACE initiated the UTRFS in response to the authority contained in the United States (U.S.) Senate Committee on Environment and Public Works Resolution dated April 22, 1988. This authorizing legislation for the overall study defines the area of investigation as the Upper Trinity River Basin, with specific emphasis on the City of Dallas-Fort Worth Metroplex. The UTRFS identified approximately 90 potential projects addressing FRM, ecosystem restoration, and recreation enhancement within the Upper Trinity River Basin (USACE 1988a).

The North Central Texas Council of Governments (NCTCOG) is the acting non-federal sponsor on the on-going UTRFS. NCTCOG coordinated with the USACE and the City of Dallas in May 1996 to modify the UTRFS Cost Sharing Agreement to include an Interim Feasibility Study of the existing Dallas Floodway that assessed several FRM alternatives. The USACE and the City of Dallas also developed additional environmental quality alternatives to benefit fish and wildlife habitat, water quality, and aesthetic properties while minimizing adverse impacts to existing cultural resources and FRM benefits.

In early 2000, the City of Dallas began development of another variation to the Trinity River Corridor Master Implementation Plan that included similar environmental quality measures and IDS improvements, referred to as the BVP. The BVP is the City of Dallas' plan to implement FRM, ecosystem restoration and recreation features as defined in the City's report, *The Balanced Vision Plan for the Trinity River Corridor, Dallas, Texas,* dated December 2003, and amended in March 2004.

1.4.2 Water Resources Development Act Authorization

This EIS was authorized by Section 5141 of the WRDA of 2007, which reads as follows:

"*(a) In GENERAL.— The project for flood control, Trinity River and tributaries, Texas, authorized by Section 2 of the Act entitled, ''An Act authorizing the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes'', approved March 2, 1945 (59 Stat. 18), is modified to—*

(1) direct the Secretary to review the Balanced Vision Plan for the Trinity River Corridor, Dallas, Texas, dated December 2003 and amended in March 2004, prepared by the non-Federal interest for the project;

(2) direct the Secretary to review the Interior Levee Drainage Study Phase-I report, Dallas, Texas, dated September 2006, prepared by the non-Federal interest; and

(3) if the Secretary determines that the project is technically sound and environmentally acceptable, authorize the Secretary to construct the project at a total cost of $459,000,000, with an estimated Federal cost of $298,000,000 and an estimated non-Federal cost of $161,000,000.

(b) CREDIT.—

(1) IN-KIND CONTRIBUTIONS.—The Secretary shall credit, in accordance with Section 221 of the Flood Control Act of 1970 (42 U.S. Code [USC] 1962d–5b), toward the non-Federal share of the cost of the project the cost of planning, design, and construction work carried out by the non-Federal interest for the project before the date of the partnership agreement for the project.

(2) CASH-CONTRIBUTIONS.—The Secretary shall accept funds provided by the non-Federal interest for use in carrying out planning, engineering, and design for the project. The Federal share of such planning,

engineering, and design carried out with non-Federal contributions shall be credited against the non-Federal share of the cost of the project."

Section 5141 of the WRDA of 2007 was amended as part of the Water Resources Reform and Development Act (WRRDA) of 2014, which reads as follows:

"(d) TRINITY RIVER AND TRIBUTARIES.—*Section 5141(a)(2) of the Water Resources Development Act of 2007 (121 Stat. 1253) is amended by inserting "and the Interior Levee Drainage Study Phase II report, Dallas, Texas, dated January 2009," after "September 2006."*

Section 5141 of the WRDA of 2007, as amended, outlines authorization for the projects if the Secretary of the Army determines that the project is technically sound and environmentally acceptable. This EIS evaluates the environmental acceptability of the BVP Study and its associated features. The companion Feasibility Report prepared by the USACE (USACE 2014a), evaluates the technical soundness of the project. The WRDA-authorized project is the Balanced Vision Plan (BVP) Study dated December 2003, revised March 2004 and the Phase I Interior Drainage System (IDS) Study, dated 2006, and proposed IDS improvements identified for the West Levee IDS in the Phase II IDS Study, dated 2009.

Due to emergent safety concerns, certain recommended improvements identified in the Phase I and II IDS Studies have been authorized and initiated before the completion of this EIS, under separate NEPA documentation. As identified in the Phase I and II IDS Studies, not repairing the Pavaho, Baker, and Able Pumping Plants as soon as legally and logistically possible would result in risk to human life and property. Thus, the USACE has prepared separate Environmental Assessments (EAs) for all three of these projects (Pavaho EA: USACE 2010, Baker EA: USACE 2012a, and Able EA: USACE 2014b).

1.5 BACKGROUND

The following sections provide a description of flood terminology, information regarding the Trinity River and historical Trinity River flooding, a description of the Dallas Floodway, an overview of the Dallas Floodway Levee System and associated management procedures, and information and data to support the need for the Proposed Action.

1.5.1 Flood Terminology

This EIS describes flood events by their estimated recurrence interval and AEP. Using historical storm and flood data, hydrologists describe the probability associated with a potential flood intensity that could reasonably affect a defined area. The traditional expression of this probability is in terms of a flood event "recurrence interval" expressed in years. However, a more appropriate expression of the likelihood of a particular flood magnitude is the probability that a given flood event will be equaled or exceeded in any given year within a specific area. Thus, a flood event (with a corresponding estimated peak flow) having a recurrence interval of 2 years would have a 50% AEP; a flood with a recurrence interval of 500 years would have a 0.2% AEP. By understanding the range of reasonably foreseeable floods and associated flood elevations that can affect the Study Area, authorities can plan, design, and construct the appropriately sized infrastructure to provide FRM within the Study Area.

This EIS uses both the 100-year flood event and the SPF event for analysis purposes. The 100-year flood event is a flood of a certain height that has a 1% AEP within a specific area. The SPF is defined as the flood that would be expected from the most severe combination of meteorological and hydrologic conditions that are considered reasonably characteristic of the geographical region involved, excluding extremely rare combinations.

1.5.2 Trinity River

The Trinity River is 710 miles long and flows entirely within Texas. It originates in north Texas, a few miles south of the Red River, and it empties into Galveston Bay just east of Houston (refer to Figure 1-1). Within the Study Area, the Trinity River channel has an average depth of 25 feet and an average bottom width of 50 feet, providing a maximum design conveyance capacity of 13,000 cfs. Flows above this level spill out of the defined channel and into the Dallas Floodway.

Annual peak floods measured in the Trinity River at the Dallas Gauge range from the record low flow of 4,540 cfs (in 1978) to the record high flow of 184,000 cfs (in 1908). The normal base flow is approximately 500 cfs. At the confluence of the West and Elm Forks of the Trinity River, the Trinity River Watershed is approximately 6,100 square miles. Upstream of the City of Dallas, 15 reservoirs and lakes regulate the flow of the Trinity River (City of Dallas 2009b).

The Trinity River has experienced dramatic change over the past century as regional authorities have relocated, channelized, and managed the Trinity River. In addition, the watershed has experienced significant changes in land cover and land use, resulting in changes to river hydrology. The most rapid and extensive changes occurred during the construction of the original Dallas Floodway project in the late 1920s, and then again during the subsequent USACE reconstruction of the Floodway in the mid-1950s.

Notable Events

- 1800s-1900s: Large riverine flooding events, averaging once every 17 years
- 1908: Trinity River flood (184,000 cfs)
- 1928-1931: Levees and Interior Drainage System built
- Post 1920s: Gradual elimination of meanders, high-value habitat, and connections to adjacent ecosystems
- 1942: Major storms and urbanization cause severe flooding
- 1945 & 1950: Dallas Floodway project authorized
- 1958: "Dallas Floodway" completed (reconstruction of original levee system)
- 1960: Dallas County accepts responsibility for Dallas Floodway management
- 1968: Responsibility for Dallas Floodway management transferred to the cities of Dallas and Irving
- 1990: Trinity River flood (82,300 cfs - largest since 1908)
- 1990: Statewide recreation plan ranks project area 21st out of 23 regions in recreation land per capita
- 1996: Initiation of Interim Feasibility Study (flood risk management alternatives)
- Late 1990s: Improvements to channel, levees, and Interior Drainage System
- 2000-2004: Development of Balanced Vision Plan (implement flood risk management, ecosystem restoration, and recreation features)
- March 2006: Widespread levee interior flooding
- 2007: Water Resources Development Act, authorizing BVP and preparation of this EIS
- April 2014: Draft EIS released for public review

The Trinity River now reflects little of its historic course, water quality, or habitat. Prior to the 1920s, the Trinity River's morphology through the downtown of the City of Dallas included meandering consistent with a river of its geologic age. The construction of the Dallas Floodway Levee System essentially eliminated these meanders, and with it, high-value habitat and connections to adjacent ecosystems (USACE 2000). Figure 1-3 depicts the historical and current course of the Trinity River through the Study Area.

The Trinity River has produced significant flooding in the City of Dallas, most notably in years 1822, 1841, 1866, 1871, 1890, 1908, 1925, 1935, 1942, and 1990. The flood of 1908 resulted in the loss of five lives and $2.5 million in damage and was the motivation for initial efforts to control the Trinity River through the City of Dallas. At 82,300 cfs, the May 1990 flood was the most recent large flood and represented the largest flood since 1908.

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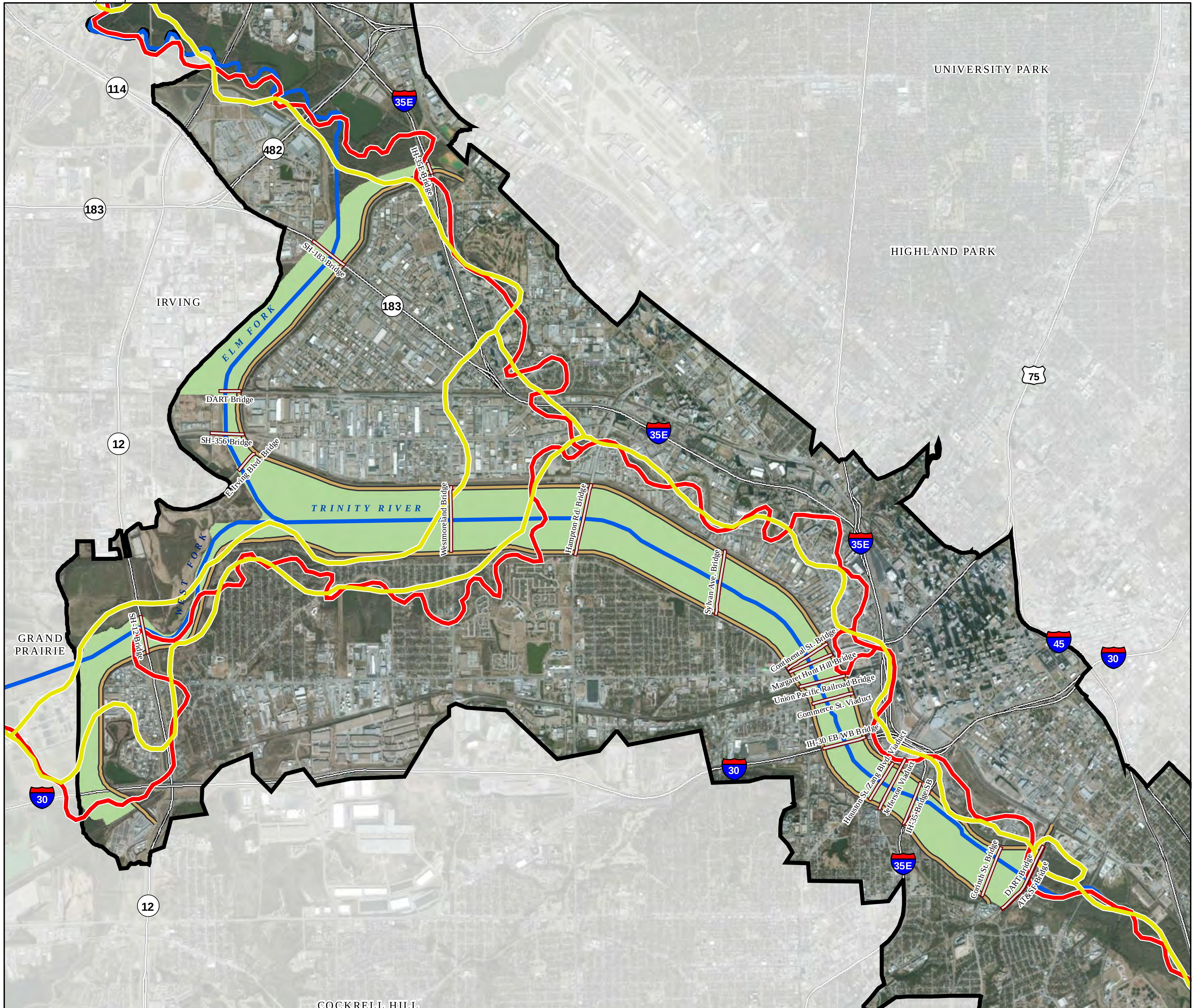
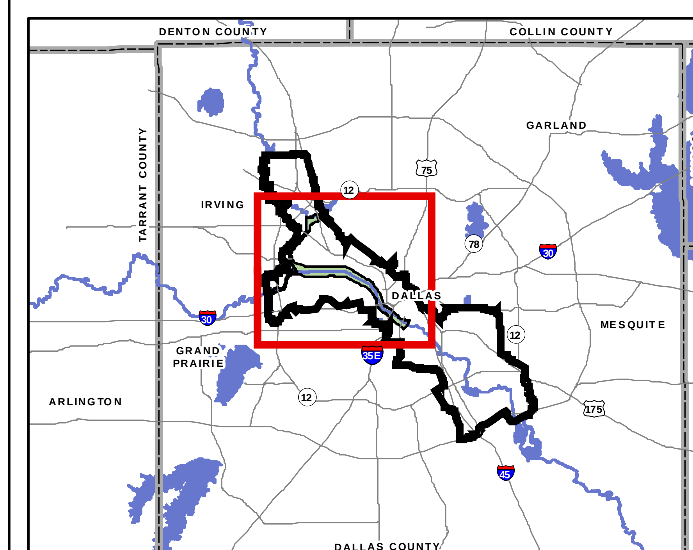


Figure 1-3
Historical and Current Trinity River Courses

LEGEND

Trinity River Courses

- 1891
- 1920
- Present
- Dallas Floodway Levee
- Freeway
- Bridge
- Study Area
- Dallas Floodway



0 0.5 1 Kilometers

0 0.5 1 Miles

GIS Sources: City of Dallas 2008a, 2009; NCTCOG 2008

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1.5.3 Dallas Floodway

1.5.3.1 Flood Risk Management Overview

FRM can be provided through structural means – such as levees – or through nonstructural means – such as floodplain preservation. Both strategies are important in a major urban area. Floodways are composed of levees and other components necessary to provide FRM to the adjacent properties. The levee system is the most visible of the floodway components, and levee systems are designed to reduce flood risk from design storm event water levels. The long-term stability of a levee system is dependent on proper operation and maintenance of the levees and the other components of a floodway system. Levees must be protected from penetration by tree roots, because the roots form pathways for seepage that can result in levee failure, and levees must be mowed routinely to control vegetation. In addition, levees may have periodic slides on their levee side slopes that require repair, and levee crests may settle some over time. Therefore, maintenance may include regularly raising levee crests to their original levels. When properly designed, operated, and maintained, levees provide a safe and stable FRM system (City of Dallas 2003). Figure 1-4 presents an overview of the Dallas Floodway Levee system and adjacent FRM elements, along with associated construction dates.

1.5.3.2 History

The Trinity River was vital to the early development of the City of Dallas. However, numerous large floods, including the catastrophic 1908 flood, led the City of Dallas to seek protection from the Trinity River. Between 1928 and 1932, the Dallas County Levee Improvement District (DCLID) constructed earthen levees and interior drainage pumping plants to reduce the risk of damage to the City of Dallas from river and local rainfall flood events. The original levees had a total length of 22.6 miles, an average crest width of 6 feet, an average height of 26 feet, and a maximum height of 37 feet (USACE 1955). The DCLID relocated the confluence of the West and Elm Forks and either filled the remnant channel or set it aside for sump storage. Despite these efforts, in the mid-1940s, major storms, compounded by continued urbanization in the watershed, resulted in severe flooding in the Study Area.

Congress authorized the flood control project termed the “Dallas Floodway” in 1945 and 1950 in order to reduce the river flood risk within the City of Dallas. The USACE completed building the authorized Dallas Floodway project in 1958, which included significant improvements to the levees to contain the SPF, plus 4 feet of freeboard. Aside from minor repair and improvement activities performed by the USACE and City of Dallas throughout the following decades, the 1958 efforts constitute the Dallas Floodway as it exists today. Currently, the Dallas Floodway includes 22.6 miles of levees, the river channel, six pumping plants, seven pressure sewers, and numerous gravity sluices (Figure 1-5).

Current H&H models predict a higher SPF water surface profile for the Dallas Floodway levees as compared to those modeled in 1958 due to a number of changes that have occurred. Some of these changes include watershed development, land use changes, floodplain encroachments, updated design methodology, and improved modeling technology, as described below.

Watershed Development. The level of development in the upstream drainage basin has increased rainfall runoff rates. Specifically, significant urbanization (i.e., increase in impermeable surfaces) within the City of Dallas/Fort Worth Metroplex during the past four decades has increased the amount of floodwater produced by the Trinity River watershed upstream of the City of Dallas.

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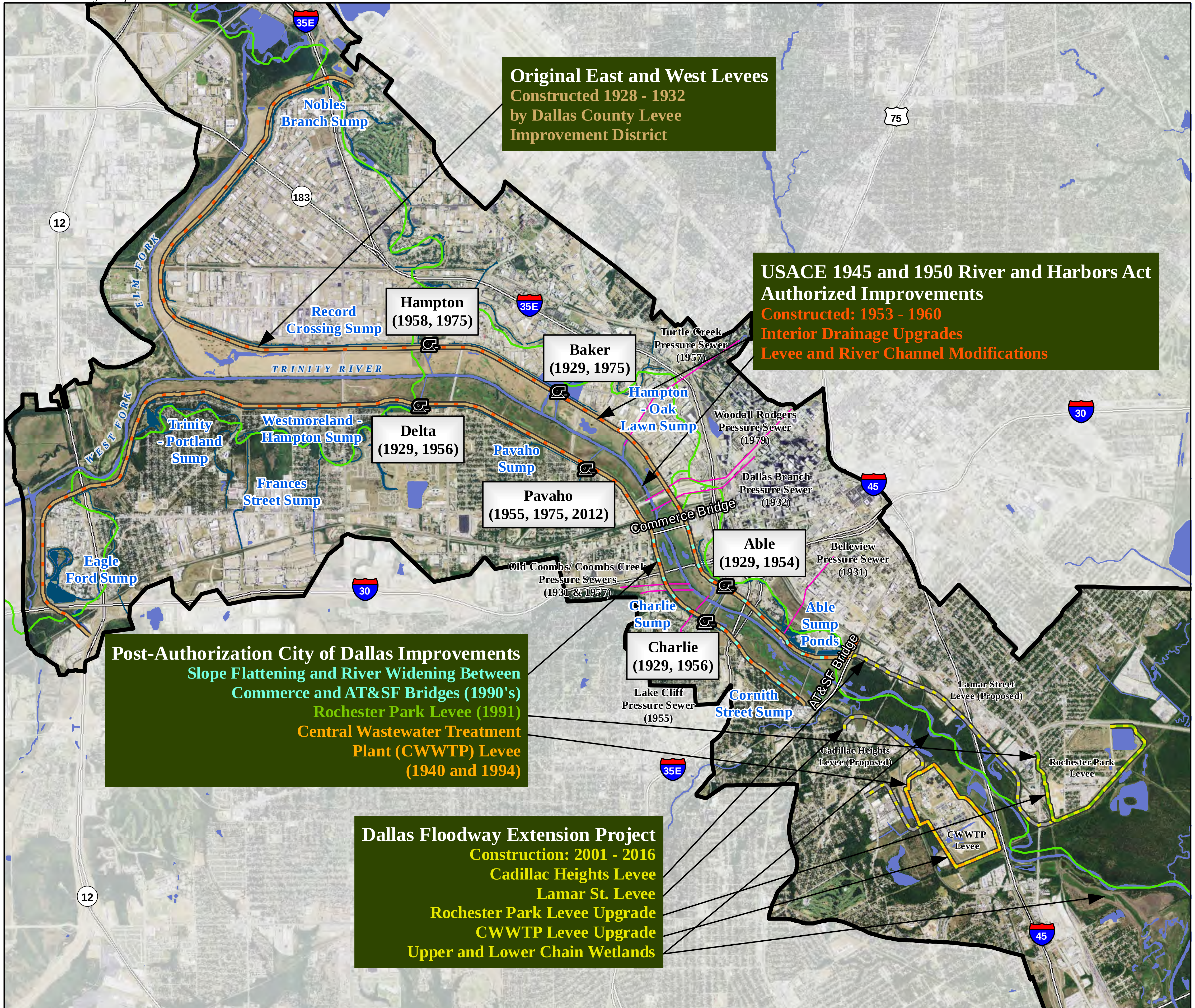
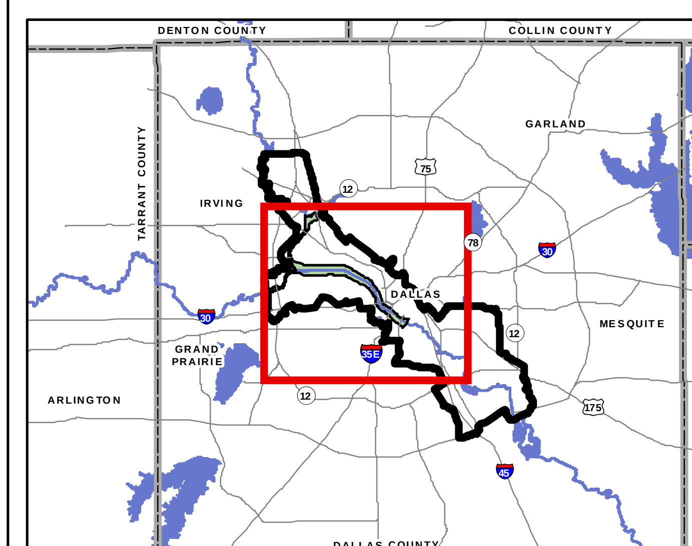


Figure 1-4
Overview of Dallas Floodway Levee System and Adjacent Flood Risk Management Features

LEGEND

- Original Levee
- USACE Authorized Improvements
- City of Dallas Improvements
- Rochester Park Levee
- Central Wastewater Treatment Plant Levee
- Lamar St. and Cadillac Heights DFE Proposed Levees
- Pumping Plant
- Historical Trinity River Course (1920)
- Pressure Sewer
- Freeway
- Sump Storage Ponds
- Surface Water
- Study Area



0 1 2 Kilometers

0 1 2 Miles

GIS Sources: USACE 1955, 1968, 1989, 2003, 2009; City of Dallas 2006, 2008a, 2009d; NCTCOG 2008

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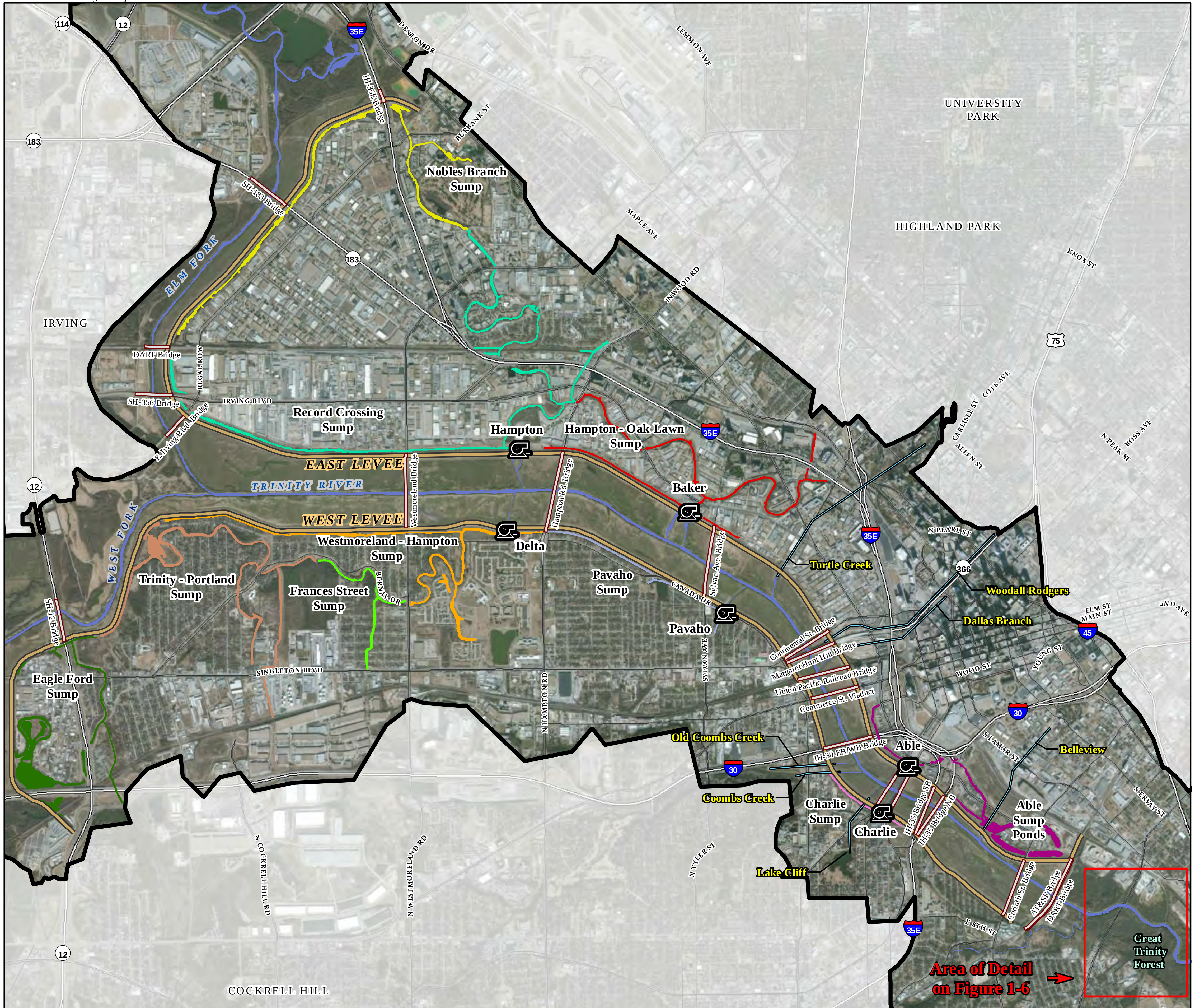
Figure 1-5
Overview of Dallas Floodway



LEGEND

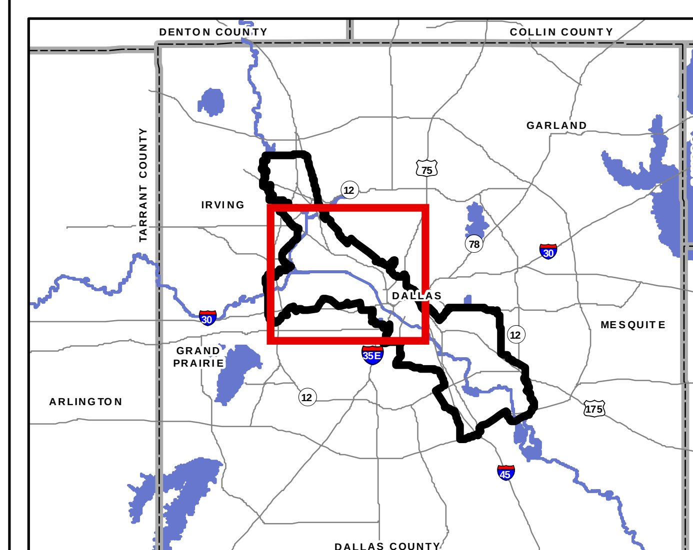
- Pumping Plant
- Dallas Floodway Levee System Levee
- Pressure Sewer
- Freeway
- Bridge
- Street
- Study Area
- Surface Water

East Levee Sumps

- Able
- Hampton - Oak Lawn
- Nobles Branch
- Record Crossing

West Levee Sumps

- Charlie
- Eagle Ford
- Frances Street
- Pavaho
- Trinity - Portland
- Westmoreland - Hampton



0 0.5 1 2 Kilometers

0 0.5 1 Miles

GIS Sources: City of Dallas 2008a, NCTCOG 2008

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Land Use Changes. Since the 1950s, much of the land cover of the floodplain downstream of the Dallas Floodway has reverted to forested land. The USACE analysis in the 1950s did not anticipate these land use changes, most notably the change from agricultural and pasture lands to forest. Forest vegetation acts to slow river flow, whereas agriculture lands allow for greater runoff. Figure 1-6 presents two aerial images of the same area in the Dallas Floodway, taken in 1942 and 2010 (City of Dallas 2009b and ESRI 2012, respectively). As shown in the images, land use has changed in this representative area from agricultural to forest (see Figure 1-5 for the location of these images in the Study Area).

Figure 1-6 Example of Changes in Land Cover between 1942 and 2010 in the Study Area

Floodplain Encroachments. Landfills and other encroachments into the floodplain since the 1950s have reduced floodplain conveyance area and raised flood levels.

Updated Design Methodology. The USACE has updated their methodology for computing the SPF. As a result, while the 1958 design SPF flow for the Dallas Floodway was 226,000 cfs, the current SPF flow is 269,300 cfs, and the Future Without-Project Condition SPF flow is 277,000 cfs.

Improved Modeling Technology. The availability of more detailed mapping data, the higher level of H&H modeling technology, and the opportunity to calibrate models to a recent high flow flood event (i.e., the 1990 flood) have resulted in the computation of more accurate flood profiles that indicate higher water levels.

The Dallas Floodway provides flood damage reduction benefits to the City of Dallas' Central Business District and West Dallas. Specifically, the Dallas Floodway currently reduces flood risk for approximately 10,000 acres of residential and highly developed commercial and industrial property that account for approximately 17% of the City of Dallas tax base. Based on a 2010 level of development, 9,057 structures are estimated to be located within the SPF floodplain limits. These structures have a total estimated investment value of approximately $7.4 billion in structures and $4.8 billion in contents (USACE 2014a).

1.5.3.3 Dallas Floodway Levee System

The Dallas Floodway contains 22.6 miles of earthen levees located along both sides of the main stem of the Trinity River and along the City of Dallas side of the West and Elm Forks of the Trinity River (refer to Figure 1-5). The Dallas Floodway reduced flood risk for approximately 200,000 people who work or live behind the levee and more than $12.2 billion in floodplain investment in private improvements alone (USACE 2012b).

East and West Levees

The downstream end of the 11.7-mile long East Levee is located near the Dallas Area Rapid Transit (DART) Rail Bridge and the abandoned AT&SF Railroad Bridge. The upstream end of the East Levee is at the Union Pacific Railroad embankment near Harry Hines Boulevard and crosses the embankment of IH-35E. The East Levee extends downstream along the Elm Fork, past the confluence of the West and Elm Forks, and thence along the main stem of the Trinity River to the DART Rail Bridge. The East Levee terminal section extends perpendicular to the river to high ground directly beneath and alongside the DART Rail Bridge.

The upstream end of the 10.9-mile long West Levee begins at the high ground adjacent to the Loop 12 Walton Walker Boulevard southbound service road south of IH-30 in the Mountain Creek floodplain. The West Levee extends downstream along Mountain Creek floodplain to the confluence of the Elm Fork and the West Fork, and thence southeastward along the main stem of the Trinity River. The West Levee terminal section ties to high ground located approximately 800 feet upstream of the DART Rail Bridge.

Levee Characteristics

On average, the Dallas Floodway levees are approximately 30-feet high, 16-feet wide at the top, 200-feet wide at the base, and slope at an average ratio of 3:1 (horizontal to vertical) on both sides. Included with the re-construction of the levees by the USACE in 1958 was an 18-inch thick road base maintenance road at the crest of the levees. This maintenance road is included in the existing levee crest profiles shown in Figure 1-7 and included in the levee overtopping hydraulic analysis.

Figure 1-7 presents elevations typical of an existing East Levee segment from the confluence to the Sylvan Street Bridge. As shown on Figure 1-7, for most of this segment of the East Levee, the actual levee height is less than the 1958 design grade and the current SPF water surface profile. Also of note on Figure 1-7 is the approximate top and bottom of the river channel and the 100-year flood surface water level.

In 2012, as part of on-going maintenance and improvements to the levees, the City of Dallas constructed cutoff walls within the Dallas Floodway. Cutoff walls are subsurface thick structures designed to prevent water from seeping under the levee. The City of Dallas constructed 15,700 feet of cutoff walls along the riverside of the East Levee from the East Irving Boulevard crossing of the Elm Fork channel of the Trinity River east to just past the North Hampton/Inwood Road river crossing; 2,600 feet of cutoff walls were constructed on the river side of the West Levee, starting at the eastern end of the levee and continuing northwest along the levee (City of Dallas 2012).

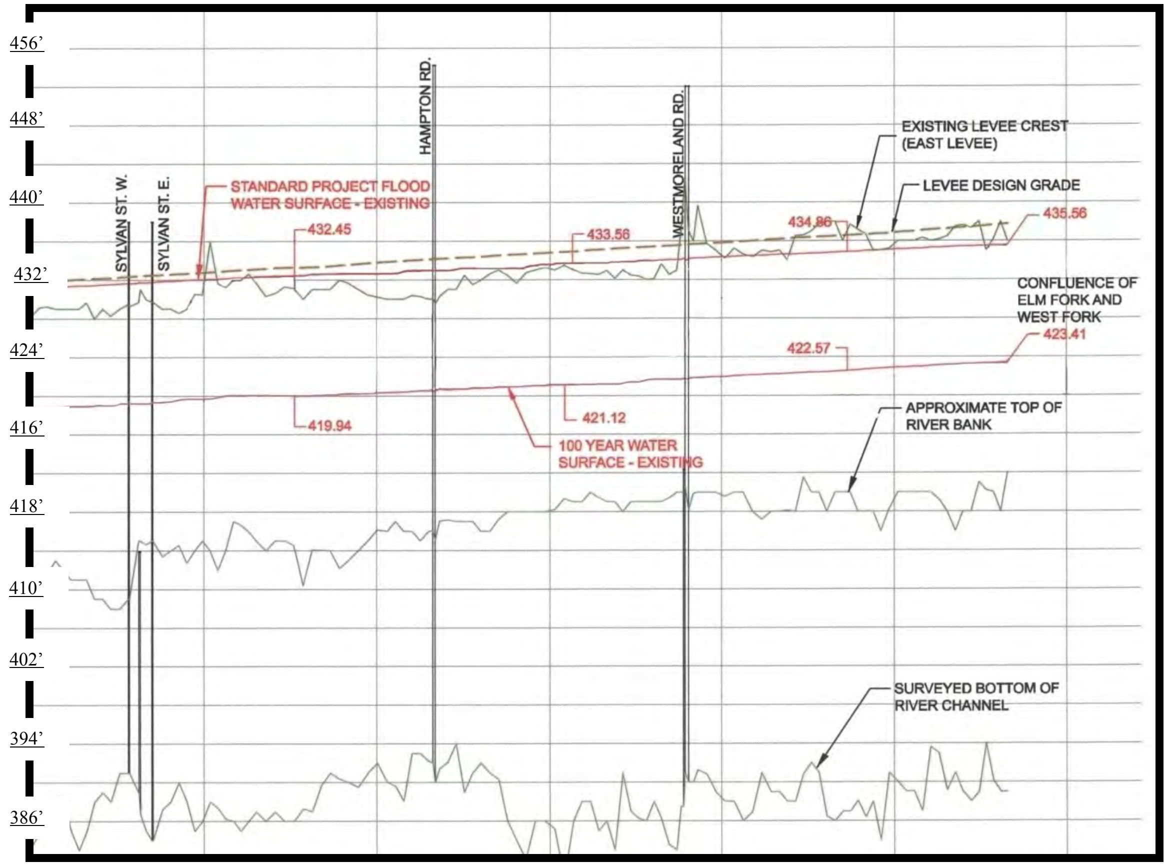

Figure 1-7 Typical Existing Levee Segment

Levee Modifications

Under the terms of 33 U.S. Code (USC) § 408, any proposed levee modification (a "Section 408" project) requires a determination by the Secretary of the Army that the proposed alteration, permanent occupation, or use of a federal project would not be injurious to the public interest and would not impair the usefulness of the levee. Any proposed temporary or permanent alteration, occupation, or use of any public works, including levees, for any purpose is only allowable with the permission of the Secretary of the Army. The authority to make this determination and approve modifications to federal works under 33 USC § 408 has been delegated to the Chief of Engineers, USACE.

1.5.3.4 East and West Levee Interior Drainage Systems

The same levees that reduce the City of Dallas' risk from Trinity River flooding also block local stormwater runoff from the interior (developed) side of the levee from reaching the Trinity River. Thus, the City of Dallas manages interior drainage by allowing the stormwater runoff to pool in sumps (low areas) in interior areas before pumping or gravity feeding it into the Dallas Floodway. For the last 75 years, the City of Dallas (in cooperation with the USACE) has employed this strategy for managing stormwater in the East and West Levee Interior Drainage System (EWLIDS). The EWLIDS contains six pumping plants (Able, Baker, Charlie, Delta, Hampton, and Pavaho), associated sumps, seven pressure sewers, and numerous gravity sluices.

By design, pumping plants can manage (i.e., eject stormwater to the Dallas Floodway) stormwater up to their respective design storm event water levels. Where the predicted 100-year, 24-hour storm event water levels are greater than the original design storm event water levels, it indicates that the associated pumping plant is undersized to handle the predicted volume of stormwater, and flooding is likely. In addition, the 100-year storm event is a certain storm that has a 1% AEP; this storm magnitude was the engineering standard used to assess stormwater flooding impacts (City of Dallas 2006 and 2009a).

Table 1-1 summarizes the predicted number of "potentially affected" and "flooded" structures resulting from water levels associated with the predicted 100-year, 24-hour storm event, based on current conditions, excluding data associated with the Pavaho, Baker, and Able Pumping Plant sumps. "Potentially affected" means that part of the structure is touched by the flood extent. "Flooded" means that part of the structure is touched by floodwaters, and the estimated finished floor elevation of the structure is below the predicted storm event water level. As shown in Table 1-1, the modeled 100-year, 24-hour storm event has the potential to affect 321 structures in the Study Area with interior drainage-related flooding. The structures represent a mix of non-residential (NR), residential (R), and unique (U) (e.g., churches) properties (City of Dallas 2006, 2009a).

Table 1-1. Number and Type of Structures in the Study Area Potentially Affected by Interior Flooding from the 100-year, 24-hour Storm Event under Existing Conditions

Sump[1]	*Potentially Affected Structures*	*Structure Type (NR/R/U)*[2]	*Potentially Flooded Structures*
East Levee			
Record Crossing/Nobles Branch	100	37/61/2	NA[3]
Subtotal	*100*	*37/61/2*	
West Levee			
Eagle Ford	34	31/3/0	0
Trinity-Portland	59	10/49/0	8
Frances Street	11	1/10/0	3
Westmoreland-Hampton	71	5/65/1	3
Charlie	34	0/34/0	3
Corinth Street	12	12/0/0	2
Subtotal	*221*	*59/161/1*	*19*
Total	**321**	**96/222/3**	**19**

Notes: [1] Data for the sumps associated with the Pavaho, Baker, and Able Pumping Plants not included; these pumping plants have been (Pavaho) or are in the process or being improved and reducing the extent of the 100-year flooding. Revised values for potentially affected structures are not yet available for the improved pumping plants.
[2] Types of Structures: NR=Non-residential; R=Residential; U=Unique.
[3] Data for the East Levee are not available (NA).
Sources: City of Dallas 2006, 2009a.

1.5.3.5 Dallas Floodway Management

In 1968, following dissolution of the DCLID, responsibility for the Dallas Floodway transferred to the cities of Dallas and Irving. The City of Dallas is responsible for the Dallas Floodway channel, levees, and sump areas, while the City of Irving manages those reaches within its city limits (outside of the Study Area). While the City of Dallas has been responsible for the operation and maintenance of the Trinity River Levee System within the City of Dallas limits since 1968 (City of Dallas 2013), USACE personnel conduct periodic inspections of the Dallas Floodway.

The City of Dallas Trinity Watershed Management Flood Control Division operates and maintains the Dallas Floodway and the EWLIDS under the regulatory control of the USACE. Flood risk reduction is the primary service provided by the Flood Control Division, via the maintenance and operation of the Dallas Floodway Project consisting of pump stations, pressure sewers, levees, floodwalls, drainage/closure structures, channels, the Floodway itself, and miscellaneous facilities. Other duties include maintenance of Flooded Roadway Warning System, flood gauge sites, retention/detention basins, and Civil Defense sirens. Additional duties include removal of blockages on City-owned creeks/channels, storm sewers, and response to inclement weather emergencies such as snow/ice, windstorms and street flooding (City of Dallas 2013).

The USACE's operating procedures that govern releases from the reservoirs in the Trinity River watershed allow for flood releases when the total discharge in the Trinity River at the Dallas Gauge is less than 13,000 cfs (the design conveyance of the Trinity River channel through the Dallas Floodway). Above 13,000 cfs, the USACE reservoirs do not release any flow unless water levels exceed reservoir capacity. When water levels in upstream reservoirs exceed their capacity, the reservoirs release water into the Trinity River (City of Dallas 2009b).

1.5.3.6 Dallas Floodway Ecosystem

The Study Area is located in the Northern Blackland Prairie ecoregion (Griffith et al. 2004). Very little remains of the original Blackland Prairie ecosystem, except in preserves and small prairie remnants. The former tall grass prairie is now highly developed, cultivated for agricultural crops, or contains introduced (and now naturalized) species such as King Ranch bluestem and Johnson grass (USACE 2000).

Historically, the stream systems of the Northern Blackland Prairie included riparian woodlands composed of hardwoods such as elm, ash, and cottonwood. In addition to providing critical wildlife habitat, especially for migratory songbirds and waterfowl, such "bottomland woodlands" (1) serve as catchments and water retention areas in times of flooding; (2) help control erosion; (3) contribute to the nutrient cycle; and (4) play a vital role in maintaining water quality by serving as a depository for sediments, wastes, and pollutants from runoff. The Great Trinity Forest, located in the southern end of the Study Area represents some of the best remaining bottomland hardwood habitat in the region (USACE 2000).

Past channelization and clearing of the Floodway, along with urbanization, has significantly degraded the natural terrestrial and aquatic habitat of the Floodway. Aquatic habitat in the Dallas Floodway area is limited as most of this reach of the Trinity River flows through a constructed channel. The banks contain sparse vegetation. The sediment consists of slippery, clayey mud to fine sand. Bridge supports, concrete blocks, undercut banks, channel snags, and channel bed shape irregularities all provide limited aquatic habitat in the form of shelter, feeding zones, invertebrate colonization sites, and nursery pools (USACE 2000).

1.5.3.7 Dallas Floodway Recreation

According to a study by the City of Dallas Parks and Recreation and the Texas Parks and Wildlife Department (TPWD), the City of Dallas lacks sufficient recreational opportunities for citizens and visitors (City of Dallas 2002, TPWD 2005). While some people do enjoy the limited recreational opportunities available in the Dallas Floodway (e.g., levee-top trail, Trammel Crow Park), most people do not perceive the Dallas Floodway as a desirable destination for active recreation, festivities, or nature observation. There is a strong public need for active recreation facilities in the City of Dallas, in particular playing fields for soccer and other similar activities. In addition, there is inadequate access to the Dallas Floodway, which hampers the public's ability to enjoy the limited existing recreational opportunities.

Despite being in the top tier for number of TPWD services, the TPWD considers the City of Dallas as "underserved" in terms of recreation opportunities. In a 2005 survey, the TPWD determined that the City of Dallas has a below average supply of almost 70% of the most commonly used facilities and resources (TPWD 2005).

The 1990 Texas Outdoor Recreation Plan prepared by the TPWD identified existing recreational facilities, usage trends, and projected recreational needs for 23 regions within Texas. The Study Area, located in Region 4, ranks 21st out of 23 regions in recreation land per thousand people. The projected per capita outdoor recreation participation generated by Region 4 residents closely matches the statewide figures. Many cities have identified linear corridors within their jurisdictions that are highly desirable for recreation, and sites within the Trinity River floodplain are among those most actively studied. 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 Trinity River and its tributaries (TPWD 2005).

All recreational master plans and sector plans developed by the cities and counties with jurisdiction along the Trinity River call for utilization of the floodplain for open space, linear parks, access areas, active and passive use areas, interpretive areas, natural areas, "urban wilderness" areas, and a system of linked hiking, biking and equestrian trails. A regional goal is to link public lands and open space within the Trinity Corridor and its tributaries and other publicly owned areas (TPWD 2005).

1.6 PRIOR STUDIES, REPORTS AND EXISTING WATER PROJECTS

Relevant water resource studies, reports, and water projects (generally presented in chronological order) prepared by USACE and the City of Dallas are described below.

1.6.1 U.S. Army Corps of Engineers

Trinity River and Tributaries, Texas; House Document Numbered 403, 77th Congress (USACE 1941) and the Rivers and Harbors Act of 1945; and Trinity River at Dallas and Fort Worth, Texas; House Document Numbered 242, 81st Congress (USACE 1949) and the Rivers and Harbors Act of 1950.

In the mid-1940s, major storms, compounded by continued urbanization in the watershed, resulted in severe flooding in the area (USACE 1989). To reduce the riverine flood risk within the City of Dallas, Congress authorized the flood control project (commonly referred to as the Dallas Floodway, Dallas, Texas project, or the Dallas Floodway Levee System) in 1945, and again in 1950. From August 1952 to June 1955, USACE produced six reports for design of the Dallas Floodway improvements to the original (DCLID) levees and interior drainage facilities.

U.S. Army Corps of Engineers District, Fort Worth, Corps of Engineers, Operation and Maintenance Manual, Dallas Floodway, West Fork, Elm Fork, Trinity River, Texas (USACE 1960).

In May 1960, the non-federal sponsor for the Dallas Floodway Levee System, the Dallas County Flood Control District formally accepted the USACE Operation and Maintenance (O&M) Manual for the Dallas Floodway Levee System (USACE 1960). The purpose of the O&M Manual was to furnish detailed information regarding the Dallas Floodway Levee System and its essential features, and to aid local interests in carrying out their obligation under the regulations governing acceptance of a completed project constructed by USACE. The Dallas County Flood Control District formally transferred O&M responsibilities to the City of Dallas in 1968.

Trinity River and Tributaries Regional Environmental Impact Statement (USACE 1987) and Record of Decision (USACE 1988).

The Trinity River and Tributaries Regional Environmental Impact Statement (TREIS) was prepared by USACE Fort Worth District to address the proposed increases in floodplain development occurring in the upper Trinity River basin during the Dallas-Fort Worth Metroplex development boom in the mid-1980s (USACE 1988b). Individually or cumulatively, these projects were considered to have the potential to affect existing FRM afforded to floodplain residents, and to impact wetlands and other natural resources.

The ROD prepared for the TREIS specified criteria that USACE would use to evaluate future Section 404 permit applications in the Trinity River Basin. Specifically, projects located within the SPF floodplain of the Elm Fork, the West Fork, and the main stem of the Trinity River would be subject to the TREIS ROD. The TREIS ROD established criteria for actions that require a USACE permit to address hydrologic and hydraulic impacts and mitigation of habitat losses (USACE 1988b). The findings in the TREIS provided the impetus for follow-on studies under the 1988 Upper Trinity River Study Authority (USACE 1988a).

Regional Trinity River Corridor Development Certificate Process (USACE 1988).

In response to the TREIS and ROD, cities and counties in the Trinity River watershed formed the Trinity River Steering Committee (Steering Committee), facilitated by the NCTCOG. The Steering Committee adopted a Draft Statement of Principles for Common Permit Criteria (in February 1988), a Resolution for a Joint Trinity River Corridor Development Certificate (CDC) Process (in December 1988), and a Regional Policy Position on the Trinity River Corridor (in February 1989).

The CDC and the 1988 ROD hydrologic and hydraulic criteria are currently used to ensure that proposed projects are designed in such a way that there are no flood rises in the water surface profile and that there are no valley storage losses for the 100-year flood and less than 5% valley storage loss for the SPF event. The evaluation process requires that a permit applicant prepare a Hydrologic Engineering Center – River Analysis System (HEC-RAS) hydraulic model for the proposed project using the current CDC HEC-RAS model as a base condition. The CDC HEC-RAS model is maintained and usually distributed by USACE to be used for evaluation of all projects that require a Section 404 permit or a CDC permit.

Upper Trinity River Feasibility Study Activities (1990 - 2007).

The USACE initiated the UTRFS in response to the authority contained in the U.S. Committee on Environment and Public Works Resolution dated April 22, 1988 and the findings of the 1990 Upper Trinity River Basin Reconnaissance Report. The Upper Trinity River Feasibility Study identified approximately 90 potential projects addressing FRM, ecosystem restoration, and recreation within the Upper Trinity River Basin (USACE 1988a). Of these 90 projects, three USACE projects were identified that had local sponsorship and were viewed as reasonably foreseeable, including modifications to the Dallas Floodway Project (USACE 2007).

Upper Trinity River Basin Programmatic Environmental Impact Statement (USACE 2000).

Initiated in 1996, the Upper Trinity River Basin Programmatic EIS focused on various potential USACE projects that were identified and investigated as part of the Upper Trinity River Feasibility Study. Potential USACE projects that were addressed in the Upper Trinity River Basin Programmatic EIS included the Dallas Floodway Extension (DFE) project, Johnson Creek project, Stemmons North Industrial project, Dallas Floodway Project, and the West Fork-Clear Fork project. Potential projects by other entities that were also addressed in the Programmatic EIS include the Trinity Parkway project and Trinity Corridor Master Implementation Plan (USACE 2000).

General Reevaluation Report and Integrated EIS for the Dallas Floodway Extension, Trinity River Basin, Texas (USACE 1999, 2003).

The DFE Project, authorized by the Flood Control Act of 1965, was initiated in December 2001 to construct the Chain of Wetlands, the Cadillac Heights and Lamar Levees, and recreation features immediately downstream of the existing Dallas Floodway Levee System (USACE 2003). Construction of this project is on-going.

Periodic Inspection, Dallas Floodway Project, Trinity River, Dallas, Dallas County, Texas, Report No. 9 (USACE 2009).

The USACE performed Periodic Inspection (PI) No. 9 using a new inspection template on December 3-5, 2007 (USACE 2009). This inspection was the ninth PI for the East Levee and West Levee, and the first PI for both the Rochester Park Levee and the Central Wastewater Treatment Plant (CWWTP) Levee systems, which are components of the DFE Project. All eight prior PIs resulted in an acceptable rating for the Dallas Floodway Levee System. Very specific language and rating criteria described in the new inspection template resulted in an "unacceptable rating" for the Dallas Floodway Levee System.

1.6.2 City of Dallas

Rochester Park and Central Wastewater Treatment Plant Levees.

The approximately 2.8 mile-long Rochester Park Levee was constructed in 1991 and the City of Dallas has since maintained the levee as part of their overall project operation and maintenance program. The Rochester Park Levee provides flood risk benefits to residential and commercial interests in East Dallas. The approximate 2.6 mile CWWTP Levee was constructed by the City of Dallas in the 1940s and the levee was raised by the City in 1994. The CWWTP Levee provides flood risk benefits to critical utility infrastructure in South Dallas. At the direction of Congress, these two levee systems were added to the DFE Project in 1996 (USACE 2009).

Dallas Floodway Phase I Construction.

Beginning in the late 1990s and continuing through 2000, the City of Dallas has made improvements to the Trinity River channel, levees, and IDS. These improvements included widening portions of the existing river channel and increasing the height of some portions of the levees to 2 feet above the USACE-authorized design elevation (USACE 2009).

Balanced Vision Plan (City of Dallas 2003, 2004).

The Trinity River has always represented both the greatest challenge and the greatest opportunity to define the City of Dallas. The Trinity River has posed a physical barrier within the community, separating the City of Dallas. Because of floods in 1989 and 1990, the City of Dallas stated its interest in revitalizing a number of projects to restore and increase FRM along the Trinity River within the City of Dallas limits. In 1994, the City of Dallas (in conjunction with regional stakeholders) began looking at ways to outline a long-range vision for the entire Trinity River Corridor: to reclaim the Trinity River as a great natural resource, create a great public domain, and achieve a model of environmental stewardship. In the subsequent years of planning and community input, the City of Dallas and stakeholders developed concepts for addressing five key issues:

- Flood Risk Management
- Environmental Restoration and Management
- Parks and Recreation

- Transportation
- Community and Economic Development

In 2004, the outcome of this effort cumulated in an update to the 2003 report. The BVP contains the FRM, ecosystem restoration and recreation features defined in the report prepared by the City of Dallas entitled, *The Balanced Vision Plan for the Trinity River Corridor, Dallas, Texas,* dated December 2003, and amended in March 2004.

The BVP Study aims to create an environment that brings residents and development closer to a healthier Trinity River Corridor without diminishing the long-term effectiveness of the Dallas Floodway (City of Dallas 2004). The BVP Study presents a long-range plan for management and development of the Trinity River Corridor and presents both specific goals and notional ideals of improved amenities. The BVP Study preparation process reviewed existing public planning documents, major actions being planned (e.g., the Trinity Parkway), and public opinion in an effort to develop the Floodway as an amenity that balances flood risk reduction, environmental management, recreation, transportation, and community and economic development. Through the collaboration of several agencies, companies, and citizen groups, as well as the identification of activities already planned, the BVP Study was developed as the first comprehensive study to present a cohesive, long-range plan for the City of Dallas Trinity Floodway.

The BVP Study aims to balance diverse and potentially conflicting goals by:

- Providing improved FRM for the full length of the Trinity River Corridor in a way that also allows for the achievement of environmental, recreational, mobility, and economic goals;
- Implementing environmental responsibility, restoration, and proper management initiatives in the midst of an urban setting;
- Creating a recreation and urban open space amenity that does not interfere with vehicle traffic or periodic floodwaters;
- Meeting stated regional transportation goals in a way that supports economic development and air quality improvement; and
- Creating community and economic opportunities for the neighborhoods bordering the Trinity River and thus, forming the centerpiece for a major urban region.

The Trinity River Corridor Project is a City of Dallas organization whose mission is to facilitate the implementation of the BVP Study. Focused on flood control, environmental restoration, recreational amenities, transportation improvements, and economic development, the Trinity River Corridor Project works with regional stakeholders to implement the recommendations as outlined in the BVP Study and the Trinity River Corridor Comprehensive Land Use Plan (City of Dallas 2005). The Trinity River Corridor Project incorporates FRM, ecosystem, recreation, and regional transit improvements as proposed or incorporated by the BVP Study.

With implementation of the BVP Study, the City of Dallas anticipates economic development and neighborhood revitalization to take place all around the Study Area. This comprehensive land use plan was adopted by the City of Dallas in 2005 to guide development and investment decisions in the Trinity River Corridor. The BVP Study's proposed features are integrated into the Proposed Action of this document. For further discussion, refer to Chapter 2. The 2003 BVP Study and 2004 BVP Update are provided in Appendix O, *Supplemental Information*.

Trinity River Corridor Comprehensive Land Use Plan (City of Dallas 2005).

The City of Dallas uses the TRCCLUP as a tool for guiding development and investment decisions in the Trinity River Corridor. The TRCCLUP provides guidance about the appropriate land uses and development patterns for the corridor that can be used by citizens, property owners, and City officials as they review specific development proposals. In this way, the TRCCLUP guides zoning decisions relating to potential future private development towards land uses that complement identified BVP Study features.

Interior Levee Drainage Study – East Levee Phase I Report, Dallas, Texas; and West Levee Phase II Report (City of Dallas 2006 and 2009).

Recent local severe rainfall events have demonstrated that improvements are needed to the EWLIDS to reduce the risk of interior flooding. In March 2006, the need for improving the EWLIDS was demonstrated when a local storm caused widespread stormwater flooding in the City of Dallas, resulting in one fatality and significant property damage. During this storm, City of Dallas Police and Fire-Rescue Departments responded to hundreds of emergency rescue calls from stranded motorists and residents. The Phase I report is provided in Appendix O.

The City of Dallas Interior Levee Drainage Study – Phase I (East Levees) (referred to in this EIS as the "Phase I IDS Study").

This study describes the existing East Levee Interior Drainage System (ELIDS); models reasonably foreseeable local storms against the existing ELIDS; and then, using the model predictions, identifies recommended improvements to the ELIDS so that predicted 100-year, 24-hour stormwater levels do not exceed established City of Dallas design 100-year, 24-hour storm event water levels (and therefore result in flooding). The sister document to the Phase I IDS Study, *The City of Dallas Interior Levee Drainage Study – Phase II (West Levee)* (referred to in this EIS as the "Phase II IDS Study") completed the same assessment and recommendations for the West Levee Interior Drainage System. The Phase II report is provided in Appendix O.

Preliminary Analysis and Design Check of the Levee Systems for the 100-Year Flood Event and Current Standard Project Flood Level) (City of Dallas 2009c).

As a follow-up to PI No. 9, the City of Dallas conducted a preliminary analysis and design check of the Dallas Floodway Levee System for the 100-year riverine flood event and the current SPF event. The report, *Preliminary Analysis and Design Check of the Levee Systems for the 100-Year Flood Event and Current Standard Project Flood Level*, is commonly referred to as the Problem Identification Report (City of Dallas 2009c).

Maintenance Deficiency Correction Period Plan.

The Maintenance Deficiency Correction Period Plan was prepared in response to PI No. 9 in accordance with USACE policy guidance. As of February 2012, the City of Dallas has fixed all of the 198 maintenance O&M items identified in the Maintenance Deficiency Correction Period Plan.

Federal Emergency Management Act/Flood Insurance Rate Maps.

The Dallas Floodway Levee System was examined by USACE in the PI No. 9. Based on this review, USACE withdrew its letter of support for certification provided to the Federal Emergency Management Agency (FEMA). Following completion of levee improvements, a professional engineer certifies that adequate design and operation and maintenance systems are in place so that the levee system is capable of safely passing a 100-year flood event. This certification is then submitted to FEMA for accreditation. The

City of Dallas expects to have system improvements to address the 100-year in place prior to FEMA remapping.

Interim 100-year Levee Improvements Section 408 Package (City of Dallas 2012).

The City of Dallas pursued necessary corrective measures and documentation required by FEMA for certification of the Dallas Floodway Levee System for the 1% AEP flood event. The City of Dallas prepared a Section 408 package analyzing the potential impacts from implementing the interim levee improvements to the Dallas Floodway Levee System (City of Dallas 2012). As described in Section 1.5.3.3, construction of the cutoff walls was completed in June 2013.

1.7 PUBLIC AND AGENCY COORDINATION

1.7.1 Agency Coordination

As part of the NEPA process, the USACE has and continues to reach out to agencies, organizations, and the public in an attempt to solicit input on the Proposed Action. The following paragraphs describe how the USACE has coordinated with government agencies and involved the public.

1.7.2 Public Involvement

The Proposed Action presented in this EIS is the result of over 20 years of public outreach within the City of Dallas. The BVP Study was developed through multiple public meetings to identify the needs of the residential population of the Study Area. After the WRDA Authorization of 2007, further refinement of the Proposed Action was continued by the City of Dallas and the USACE with on-going public input.

The USACE prepared and published a Notice of Intent in the Federal Register (Vol. 74, No. 195) on October 19, 2009 (Appendix A, *Public and Agency Correspondence*) and hosted a public scoping meeting on November 17, 2009. The meeting provided the public and agencies an opportunity to learn about the project and provide input as to what components of the project are important to them, as well as what environmental resources USACE should consider in their formulation of plans and impact analysis. A detailed discussion of the comments received and the USACE responses is included in Appendix A. Comments received generally focused on a few major issues - opposition to having a major roadway inside the levees and to designation of the Dallas Floodway levees, pump stations and area neighborhoods as “historic”; support for additional recreation amenities and flood risk reduction improvements; and interest in protecting and/or improving biological/ecological resources and navigation for canoes, kayaks, etc. The USACE has been and will continue to coordinate with the public, federal, state and other agencies.

The Draft EIS was made available for public comment on April 18, 2014 via a Notice of Availability published in the Dallas Morning News, Al Día (a weekly Spanish-speaking publication), and the Federal Register (Vol. 79, No.75). Copies of the Draft EIS were available in four area libraries, including the Central Library, North Oak Cliff Library, Oak Lawn Branch Library, and West Dallas Library. The Draft EIS was also made available on the project website (http://www.swf.usace.army.mil/Missions/WaterSustainment/DallasFloodway.aspx), and via mail for interested parties. The USACE hosted a Public Review Meeting on May 8, 2014. The USACE considered and responded to (as appropriate) all relevant comments received during the Public Review Period and incorporated comments into the Final EIS. Most of the comments were generally beyond the scope of the EIS and were related to the potential Trinity Parkway. Refer to Appendix A for all relevant comments received and the USACE’s responses.

USACE will submit the Final EIS to the U.S. Environmental Protection Agency (USEPA) and publish a Notice of Availability in the Federal Register. Likewise, the Federal Register will publish a notice of receipt of the EIS. Upon publication of the notice by the USEPA, a minimum 30-day "no action" review and comment period commences after which the USACE may issue a ROD. The ROD identifies the USACE's decision regarding the action, the environmentally preferred alternative, the factors considered in making the decision, any mitigation measures, and any monitoring or enforcement program for any measure adopted. In addition, the ROD addresses any substantive comments made during the Final EIS review period. After issuing the ROD, the USACE may initiate the preferred alternative.

1.8 USACE ENVIRONMENTAL OPERATING PRINCIPLES

The USACE has developed core "Environmental Operating Principles" that guide the USACE in its planning, coordination, and project implementation efforts. The USACE has incorporated the following seven Environmental Operating Principles into the Proposed Action as documented throughout this EIS, notably in Sections 1.7, 1.9, 2.1, and 2.5:

1. Foster sustainability as a way of life throughout the organization.
2. Proactively consider environmental consequences of all Corps activities and act accordingly.
3. Create mutually supporting economic and environmentally sustainable solutions.
4. Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
5. Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
6. Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
7. Employ an open, transparent process that respects views of individuals and groups interested in Corps activities (USACE 2012c).

The USACE strives to incorporate these principles into their projects when applicable. In doing so, the USACE and project stakeholders can work together to ensure proposed projects maximize the "public good" and minimize recognized negative impacts.

1.9 IMPACT ASSESSMENT CRITERIA

The USACE has identified a broad spectrum of general and project-specific criteria with which to assess the potential effects stemming from implementation of a proposed action. This analysis was completed incrementally to address the impacts of specific features associated with each alternative. These criteria, organized into four groups, serve as the basis for the impact analysis. Each criteria group is broadly defined in the following paragraphs and individual criteria are summarized in Table 1-2 and described in detail in Appendix B, *Environmental Impact Assessment Criteria*. As shown in Table 1-2, not all criteria apply to all resources addressed in this EIS. An "x" in the column is used to indicate applicability to the resource identified in the corresponding row. The criteria groups are as follows:

- Institutional Criteria
- Public Criteria
- Engineering Criteria
- Scientific Criteria

Table 1-2 Impact Assessment Criteria Applicability by Environmental Resource Area

Impact Assessment Criteria

Institutional

Resource Areas	NEPA	CEQ Regulations	USACE ER 200-2-2	USACE ER 1165-2-132	USACE EM 1110-2-1913	CAA	CWA	CERCLA	ESA	EO 11988	EO 11990	EO 12898	EO 13045	EO 13112	EO 13175	EO 13186	Fish and Wildlife Coordination Act	HSA	MBTA	MOA (US Army and FAA)	MOA (US Army and USEPA)	Noise Control Act	NHPA	RCRA	RHA	SDWA
Cumulative Projects	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Land Use	X	X	X							X										X	X				X	
Geology and Soils	X	X	X	X	X					X											X					
Hydrology & Hydraulics	X	X	X		X					X											X				X	
Water Resources	X	X	X				X			X	X			X			X				X					X
Biological Resources	X	X	X						X		X			X		X	X		X	X	X					
Cultural Resources	X	X	X												X			X					X			
Recreational Resources	X	X	X									X		X												
Visual Resources	X	X	X									X														
Socioeconomics	X	X	X									X	X	X	X											
Hazardous Materials and Wastes	X	X	X	X				X													X			X		
Safety	X	X	X	X	X							X								X						
Transportation	X	X	X									X														
Utilities	X	X	X									X														
Air Quality	X	X	X			X						X														
Noise	X	X	X									X										X				

Public Criteria

Resource Areas	Aquatic Recreation	Cultural Resources	Flood Risk Management	Geological and Paleontological Resources	River Morphology	Natural Resource Conservation	Wildlife and Plant Diversity	Wetland Restoration
Cumulative Projects	X	X	X	X	X	X	X	X
Land Use								
Geology and Soils				X	X	X	X	
Hydrology & Hydraulics			X		X			
Water Resources	X					X		X
Biological Resources	X					X	X	X
Cultural Resources		X						
Recreational Resources	X				X	X	X	
Visual Resources						X		
Socioeconomics								
Hazardous Materials and Wastes								
Safety			X					
Transportation								
Utilities								
Air Quality								
Noise								

Technical Criteria

Resource Areas	Civil Plans Acceptable	Geotechnically Sound	H&H Modeling and Evaluation Process	Legal Compliance	Levee Stability	Modifications Function per Technical Purpos	NCTCOG CDC	No Degradation of H&H System	Operational Costs	Structure Stability	UTREIS ROD
Cumulative Projects	X	X	X	X	X	X	X	X	X	X	X
Land Use			X	X	X	X				X	
Geology and Soils	X	X		X	X			X		X	
Hydrology & Hydraulics		X	X		X		X	X		X	X
Water Resources				X							
Biological Resources				X							
Cultural Resources				X							
Recreational Resources				X							
Visual Resources				X							
Socioeconomics				X							
Hazardous Materials and Wastes				X							
Safety			X	X	X					X	
Transportation				X							
Utilities				X		X			X		
Air Quality				X							
Noise				X							

Scientific

Resource Areas	Acceptable Environmental Cost/Benefit Ratio	Environmental Stewardship	Environmental Value	Global System	Green Design	No Net Negative Impact to Fish & Wildlife	Section 26, TX Water Code	TCEQ WQC	TX Endangered Species
Cumulative Projects	X	X	X	X	X	X	X	X	X
Land Use	X	X	X	X	X				
Geology and Soils	X	X	X	X	X				
Hydrology & Hydraulics									
Water Resources	X	X	X	X	X		X	X	
Biological Resources	X	X	X	X	X	X			X
Cultural Resources	X	X	X	X	X				
Recreational Resources	X	X	X	X	X				
Visual Resources	X	X	X	X	X				
Socioeconomics	X	X	X	X	X				
Hazardous Materials and Wastes	X	X	X	X	X				
Safety	X	X	X	X	X				
Transportation	X	X	X	X	X				
Utilities	X	X	X	X	X				
Air Quality	X	X	X	X	X				
Noise	X	X	X	X	X				

Note: "X" indicates that impact assessment criteria is applicable.

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1.9.1 Institutional Criteria

Institutional criteria include those criteria required by NEPA for federal agencies to take into consideration when assessing the potential environmental consequences of the Proposed Action in their decision-making process. The intent of NEPA is to protect, restore, or enhance the environment through well-informed federal decisions. Examples include the National Historic Preservation Act of 1966, as amended (16 USC § 470), the Endangered Species Act of 1973, as amended (16 USC §§ 1531 et seq.), and the Clean Water Act (CWA) of 1972, as amended (33 USC §§ 1251 et seq.).

1.9.2 Public Criteria

Public criteria include those criteria deemed important by the public. These criteria include things such as FRM, visual/aesthetic corridors, and recreational opportunities. As part of the public involvement process, the USACE solicited input from the public as to public areas of concern. Examples of areas identified by the public as being of concern and worthy of consideration in this EIS include aquatic recreation, river morphology, and FRM.

1.9.3 Engineering Criteria

Engineering criteria include those criteria developed by the USACE that demonstrate consistency with the technical aspects of the USACE mission, most namely, FRM. These criteria assist in determining the "technical soundness" of the project. Example engineering criteria include levee stability and hydraulic neutrality.

1.9.4 Scientific Criteria

Scientific criteria include those criteria that represent the recognized scientific or environmental qualities specific to the Study Area that assist in determining the "environmental acceptability" of the project. These include criteria that are important to local and state interests, for example, protection of state-listed threatened or endangered species of fish, wildlife, and plants; and that a project must obtain a water quality certification from the State of Texas prior to the start of construction, as required by the CWA.

1.10 ORGANIZATION OF THIS EIS

Chapter 1 describes the Study Area, background, the purpose of and need for the project, the project authority, USACE Environmental Operating Principles, Agency Coordination and Public Involvement actions, and presents the impact analysis criteria. Chapter 2 presents the Proposed Action, the alternative development process, the alternatives to be analyzed within this EIS, and the alternatives considered but eliminated. The past, present, and reasonably foreseeable future projects that have the potential to contribute to resource impacts within the Study Area are also identified and described here.

Chapter 3 contains a description of existing conditions for each of the environmental resource areas analyzed in the EIS. This chapter represents the baseline from which all resource impact analyses are derived.

Chapter 4 presents an analysis of anticipated environmental resource conditions under the Future Without-Project Condition, also referred to as Alternative 1 (the No-Action Alternative). Alternative 1 summarizes the anticipated future cumulative conditions without implementation of the Proposed Action. Chapter 4 also presents the impact analysis for the implementation of the Proposed Action, to include the FRM elements, the BVP Study Ecosystem and Recreation features, and the IDP improvements, under the with and without potential Trinity Parkway in the Dallas Floodway condition (design variations within

Alternative 2). Construction, operational, and cumulative impacts are presented in Chapter 4.

Chapter 5 presents a summary of impacts and compares the design variations under Alternative 2. Chapter 6 contains additional analysis required by NEPA, to include an analysis of irreversible and irretrievable commitment of resources, short-term uses vs. long-term productivity, and climate change. Chapter 7 identifies the USACE's MDFP and presents regulatory measures and/or mitigation identified to reduce potential impacts to environmental resources, due to implementation of the MDFP.

Chapters 8, 9, and 10 contain the references, persons and agencies contacted, and list of preparers. Chapter 11 contains a glossary. Chapter 12 contains an index of key words and phrases used in this EIS. The appendices contain additional information including public scoping and Draft EIS review comments, detailed figures, agency coordination/correspondence letters, the Notice of Intent for the EIS, and technical analysis that supports the discussion presented in the main body of this EIS.

CHAPTER 2
PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

2.1.1 Overview

The Proposed Action presented in this Environmental Impact Statement (EIS) consists of implementing proposed Balanced Vision Plan (BVP) flood risk management (FRM) elements and BVP Study ecosystem and recreation features within the Trinity River Corridor in Dallas, Texas. The project is authorized for analysis under Section 5141 of the Water Resources Development Act (WRDA) of 2007, as amended by the Water Resources Reform and Development Act of (WRRDA) 2014 (Appendix A).

The features making up the Proposed Action are derived from the BVP Study (City of Dallas 2003, 2004), the Phase I Interior Drainage Systems (IDS) Study (City of Dallas 2006), and the Phase II IDS Study recommendations (City of Dallas 2009a). In response to Section 5141 of WRDA 2007, as amended, the United States Army Corps of Engineers (USACE) analyzed the proposed action and identified features of the project that could be implemented by USACE. The features the USACE would implement would be cost shared between USACE and the City of Dallas. These features are identified as the Modified Dallas Floodway Project (MDFP). The City of Dallas made it known early in the study process that they wanted the USACE to analyze the entire project and that if there were components not being recommended for construction by the USACE, then they would like to construct those features under a 33 U.S. Code Section 408 request. These features will be identified as the remaining BVP features and will be the complete financial responsibility of the City of Dallas if they are approved for construction.

This comprehensive approach to analysis aims to ensure that proposed alterations and modifications to the Dallas Floodway would meet the USACE engineering and safety standards, and would not have significant adverse effects on the functioning on the Dallas Floodway. Implementation Guidance for Section 5141 of the WRDA of 2007, as amended, directs the USACE to conduct a comprehensive, system-wide assessment to determine the technical and environmental feasibility for implementing the BVP Study and Interior Drainage Plant (IDP) improvements, while ensuring the Proposed Action would not result in significant adverse effects on the functioning of the Dallas Floodway Levee System.

This EIS serves three purposes:

1. It analyzes the USACE's MDFP as identified in the USACE Feasibility Report (USACE 2014a).
2. It analyzes the environmental impacts associated with the remaining non-federal BVP features that the City of Dallas is requesting permission to construct under 33 USC Section 408. While these features that are not part of the MDFP, they are part of the comprehensive plan that the City of Dallas developed and are in the same general footprint as the MDFP. Comprehensively analyzing all of these features is required to ensure that the levee system would continue to function as designed. While the National Environmental Policy Act (NEPA) analysis and decision-making presented herein evaluates the impacts of the non-federal features (the remaining BVP features), the NEPA analysis should not be construed as authorization for construction of those features. Authorization of the non-federal features can only be completed as part of a Section 408 review.

3. It documents NEPA compliance for the USACE to make a decision on a Section 404 permit requested by the City of Dallas.

2.1.2 Section 408 Permitting

A Section 408 permit is required for all non-federal projects that propose to alter an existing USACE "federal project," such as the Dallas Floodway. The Section 408 permit process includes a technical review of the proposed project, including a geotechnical evaluation, structural design, hydraulic and hydrologic impacts, operation and maintenance requirements, real estate analysis, and risk analysis. Furthermore, the Section 408 review by the USACE includes ensuring compliance with all applicable federal environmental requirements, including (but not limited to) NEPA and the Clean Water Act. Because the remaining BVP Study features propose to modify the Dallas Floodway (a USACE flood management project), those features will be subject to Section 408 permitting.

Section 408 and the BVP Study

- Remaining non-federal BVP Study features would require a Section 408 package.
- If the non-federal BVP Study features Section 408 designs, analysis, or schedule substantially differs from those described within this EIS, additional NEPA analysis may be required.
- This EIS does not authorize the non-federal BVP Study features for implementation.
- Authorization for construction of the remaining non-federal BVP Study features would only be provided after the USACE completes the Section 408 process.

Because the non-federal BVP Study features are connected actions to the MDFP under NEPA, the BVP Study is analyzed within this EIS as a single Proposed Action that includes both federal and non-federal features. All remaining non-federal BVP Study features requested by the City of Dallas as analyzed in this EIS as part of the Proposed Action would be covered under one Section 408 permit, as long as the individual BVP Study features are determined by the USACE to be consistent with the analysis contained herein. If the MDFP is approved and the City of Dallas chooses to implement a feature of the MDFP prior to signing a Project Partnership Agreement as authorized by Section 5141 of WRDA 2007, as amended, the City of Dallas would not need Section 408 permission. Any future revisions to the design or implementation schedule of the remaining non-federal BVP Study features that differ from what is analyzed within this EIS may require additional NEPA review. Any decision document resulting from this EIS should not be considered as authorizing a project that still requires Section 408 approval. As described above, Section 408 approval is contingent on a larger scale analysis than is required under NEPA. Authorization for a Section 408 project would only be provided after the Section 408 process is complete.

2.1.3 Approach to Analysis of BVP Study

The BVP Study presents a long-range plan for management and development of the Trinity River Corridor. The BVP Study is the result of the City of Dallas' desire to develop the Trinity River Corridor as an amenity for the people of Dallas, while also recognizing that there were dozens of previously authorized major actions and planning efforts already overlapping the region. The BVP Study preparation process reviewed existing public planning documents, major actions being planned (e.g., the Trinity Parkway), and public opinion in an effort to develop the Floodway as an amenity that balances riverine FRM, ecosystem, recreation, transportation, and community and economic concerns.

Through the collaboration of several agencies, companies, and citizen groups, as well as the identification of activities already planned, the BVP Study was the first study to present a comprehensive and cohesive long-range plan for the Trinity River Corridor through Dallas. The BVP Study represents an integration of earlier long- and short-range plans, scheduled actions, and new features developed through public outreach. By integrating all these features into a single study, the City is better able to minimize potential conflict amongst planned actions, while also developing a general planning document to use in support of future planning efforts.

This EIS analyzes the impacts of those project features that are proposed by the BVP Study to ensure that they are environmentally acceptable, as directed by Section 5141 of WRDA, as amended. Section 5141 of WRDA of 2007, as amended, also includes a cap on the cost sharing the USACE can contribute to the BVP Study that is substantially less than the estimated full cost of implementation; however, those features specifically proposed by the BVP Study are included in the full NEPA analysis within this EIS. Because the BVP Study is a planning document rather than a discrete list of actions, this EIS presents a comprehensive approach to analysis to ensure that the features specifically proposed within the BVP Study are adequately addressed, while at the same time, providing a framework for the later evaluation of the more notional features identified in the BVP Study.

2.1.4 Sources

Several reports, documents, and drawings have been used to present and analyze the Proposed Action in a consistent and comprehensive manner, reflecting the best available information. For the riverine FRM elements, design drawings (USACE 2013a) and a report (City of Dallas 2010a) have been used to present, describe, and analyze the proposed FRM elements. For the IDP improvements, studies (City of Dallas 2006, 2009a) and design documentation reports (various sources; refer to Section 2.3.2.1) have been used to present, describe, and analyze the proposed IDP improvements.

The Trinity River Corridor Design Guidelines (City of Dallas 2009b) provide the design conceptualization for implementation of all BVP Study features, to include the management and operations of the features. While the Design Guidelines identify conceptual features and their respective locations, subsequent to their publication, 35% designs (approximate for all features) of the BVP Study Ecosystem and Recreation features (both with and without the potential Trinity Parkway) have been developed (USACE 2013b). The 35% design drawings are very similar to the Design Guidelines, but do have some subtle differences, reflecting minor changes in features design in the intervening years. The 35% design drawings for the proposed BVP Study Ecosystem and Recreation features serve as the basis for the analysis contained in this EIS; however, the qualitative description of BVP Study Ecosystem and Recreation features as presented in the Design Guidelines serve as a primary source of descriptive information for the BVP Study Ecosystem and Recreation features.

2.2 ACTION ALTERNATIVE DEVELOPMENT

2.2.1 Overview

Section 5141 of WRDA of 2007, as amended, directed USACE to review the BVP and the Phase I and II IDS Studies for technical soundness and environmental acceptability. If the BVP and IDS features are determined to be technically sound and environmentally acceptable, then the project identified from this evaluation is identified as the MDFP and can be approved for construction in accordance with WRDA 2007, as amended. The USACE has evaluated the technical soundness of the proposed BVP and IDS features in the companion document to this EIS, the Feasibility Report (USACE 2014a). This EIS evaluates the environmental acceptability of the proposed BVP and IDS features.

From this direction, and reflecting the outcome of the City's BVP Study development efforts, only one action alternative was identified (Alternative 2). In addition, the No-Action Alternative (Alternative 1) is analyzed in this EIS. The history of the development of the action alternative (Alternative 2) analyzed in this EIS is detailed in the following sections.

2.2.2 History of the BVP Study Development

2.2.2.1 BVP Study

The notion of the Dallas Floodway being developed as a recreational amenity for the people of Dallas has been discussed for nearly 100 years. The Kessler Plan, published in 1919, is the first official documentation sponsored by the City of Dallas that recommended adding playgrounds and an artificial, on-channel, lake for recreational purposes, to the Floodway. Other evaluators recommended against the lake, and the project was shelved as the national focus changed to World War I.

The City returned to looking at the Floodway as a potential recreational amenity once again in the 1970s, when the City started considering a "Town Lake" to be constructed within the Floodway. Different lake alternatives, ranging from a single large lake to a chain of several 20 to 50 acre lakes, were proposed and analyzed to determine their environmental impacts, water quality ramifications, and sediment quality.

In 1985, the City Council officially designated the Floodway as the "Trinity Park," and appointed the Trinity Park Citizen's Advisory Committee. In 1994, plans were further renewed with the appointment of the Trinity River Corridor Citizens' Committee (TRCCC). The TRCCC then embarked on the development of a vision for the Floodway.

Between September 1994 and January 1995, over 400 people actively participated via two major membership meetings and eight subcommittee meetings to develop the Floodway vision. The recommendations of the TRCCC addressed flood damage reduction, recreation and open space, transportation, economic development, and environmental preservation and restoration within the Floodway. The final report of the TRCCC was issued in March 1995, and was made publicly available. The committee and the City sought additional comments on the vision through a series of townhall meetings. Comments received in the course of those meetings included the emphasis for development of recreational space, protection of historic and cultural resources, development of the interior drainage sumps for recreation, preserving the Westmoreland, Sylvan and Atchison, Topeka, and Santa Fe (AT&SF) bridges for pedestrian uses, and revision of the proposed Trinity Channel Lakes. After this feedback, the TRCCC conducted a series of public meetings to present and refine the vision. The meetings were held on October 18, 1995 and February 28, 1996 in the Lamar and Cadillac Heights areas.

In the following years, the City and Committee continued to refine the vision for the Floodway. In 1998, the TRCCC briefed the City Council with an update of these refinements. Notably, by then the TRCCC had developed four alternatives for lake development, and requested the USACE analyze these alternatives as part of the Upper Trinity River Feasibility Study. The alternatives all considered the Floodway from Commerce Bridge to Houston Bridge and included (1) a single, 80-acre, on-channel lake; (2) a single, 33-acre, off-channel lake on the east side of the river; (3) a single, 70-acre, off-channel lake on the east side of the river; and (4) two lakes on either side of the river totaling 67 acres of lake area. Each of these alternatives would also require some modification of the Trinity River alignment, and included gathering spaces and venues, trails, and vehicular access. These alternatives were compared with respect to FRM with a particular focus on the impact to Standard Project Flood (SPF) conveyance, water quality, impact to wetlands, potential for recreational development, maintenance schedule, accessibility, and implementation schedule. Based on the USACE review and public input, the TRCCC recommended an alternative be adopted as a preliminary step toward enhancing the Floodway.

By May of 1998, the plans for the Floodway had been revised to a "Chain of Lakes" concept that was the subject of a bond election in which the public could review the proposal and vote whether or not to approve funding of the plan. The plan was approved and funded, and further design refinement and modification continued. By mid-1999, the Trinity River Corridor Master Implementation Plan was being developed, and with it, a continued public outreach effort. This included 5 public meetings; 4 TRCCC-wide meetings, 45 Stakeholder Meetings; 4 Dallas "Work Group" Meetings; and numerous coordination meetings with City of Dallas departments and other governmental entities. The TRCCC also maintained a website with citizen ability to respond and comment.

The culmination of this outreach revised the development recommendation to include development of a 135-acre lake that divided the channel to either side, with plans to expand the lake to 235 acres; addition of a "Northern Lake" of 120 acres; use of effluent and well water for supplemental lake water; and development of a gathering space and water feature at Reunion Boulevard and Oak Cliff. This plan was incorporated by the USACE into the Upper Trinity River Programmatic EIS, issued in June 2000. This document was subject to public review and several comments regarding the Floodway plans were received. Comments were generally favorable regarding the lakes and associated recreational amenities, although one commenter was concerned that activities within the Floodway would compromise FRM.

The City of Dallas continued to refine the plans for the Floodway both to respond to public input and to have the plan be technically feasible as design moved beyond the notional stage. The public had generally pushed for more ambitious plans than were proposed with a 33-acre lake. In the summer of 2003, the "Trinity River Urban Design Study" was made available through a series of publicized presentations and public meetings throughout the City. Unlike earlier plans that focused on developing the Floodway between Houston and Commerce Streets near the Central Business District, this study proposed development from the confluence down to the AT&SF Bridge. The goals of the study were expanded beyond the lakes of earlier iterations, and instead focused on five goals:

1. economic and community development;
2. flood control;
3. recreation and open space;
4. environmental management; and
5. multi-modal transportation.

The primary goal was to ensure the plan would result in no net change to flood elevations. The improvements to recreation and open space hybridized the earlier analyzed alternatives to propose a total of three off-channel lakes. These lakes were proposed on either side of the river, with meanders being suggested to augment the Trinity River ecosystem. Additional recreational outlets such as large, manicured playfields accessible to the residential areas of West Dallas were also expanded from earlier plan iterations. This study differed from earlier discussions in that it was more integrated with the surrounding neighborhoods. The study included substantial discussion of proposed "gateway" parks to bring people into the floodway, and emphasized pedestrian access to the Floodway from both sides of the river.

Comments on the Trinity River Urban Design Study focused on the details of the plans. There was some concern about cost, schedule, and uneven development (i.e., more development proposed on the east side than the west side of the river). Several comments noted that the study represented a good compromise among the many earlier proposed designs, while others voiced a preference to return to the Master

Implementation Plan. Comments were also made that the proposed design must not adversely impact the Dallas Floodway Extension (DFE). The potential Trinity Parkway was also part of this plan, and many comments were focused on the Parkway.

By the end of 2003, the City of Dallas had authorized the designs presented in the Trinity River Urban Design Study under the re-branded title of the "Balanced Vision Plan." The BVP Study continued to be modified to better accommodate bridge design, or to design improved water flow among the lakes. By 2009, the City of Dallas had further reviewed and developed the best implementation of the BVP features into 35% design drawings. These drawings remain the most current alignment of Floodway features and are used as the basis for analysis for the Proposed Action.

2.2.2.2 IDP

The City of Dallas released the East Levee Interior Drainage Study (Phase I IDS Study) in 2006, and the West Levee Interior Drainage Study (Phase II IDS Study) in 2009. The objective of the studies was to identify and recommend upgrades to the Dallas Floodway IDS so that the maximum predicted elevations in the sumps for the 100-year, 24-hour storm event do not exceed the established IDS feature design elevations. These studies looked at each drainage basin and pumping plant and provided alternatives for meeting 100-year, 24-hour storm event management, as well as a recommended alternative. The alternative development process for the IDS components analyzes in this EIS is summarized in the following sections.

<u>East Levee Interior Drainage</u>

Nobles Branch Sump

The alternatives investigated for Nobles Branch Sump included increasing the sump storage capacity, increasing the flow out of the sump by adding more gated culverts at Empire Central Drive, and adding a pressure sewer. As described in the Phase I IDS Study, no feasible pressure sewer location was found in the Nobles Branch Sump drainage basin. The Phase I IDS Study considered three potentially feasible alternatives for Nobles Branch Sump improvements: increasing sump storage only, increasing sump storage and adding additional gated culverts, and only adding additional gated culverts. As all three options would provide the necessary capacity, the Phase I IDS evaluated the alternatives for cost efficiency. The option to use gated culverts only was one-twelfth the estimated cost of the next least expensive alternative. Thus, the study recommended moving forward with the gated culvert improvement action only.

Hampton Pumping Plant

The alternatives considered to improve flood management at the Hampton Pumping Plant (to include the Record Crossing Sump area) included increasing pumping capacity, increasing sump storage, pressure sewers, and construction of a floodwall. No alternative evaluated for Record Crossing Sump would provide sufficient FRM so as to eliminate the need for an additional pump station to be built at Hampton Pumping Plant. The construction of a pressure sewer was deemed economically infeasible by the City of Dallas. The construction of a floodwall would not be sufficient to contain floodwaters without substantial construction of the Stemmons Freeway and Inwood Road. Thus, the floodwall and pressure sewer alternatives were eliminated from further consideration.

The Phase I IDS Study considered seven alternatives that combined sump storage and pump capacity. These included one alternative to maintain sump capacity but construct a pumping plant with 500,000 gallons per minute (gpm) additional pumping capacity, one alternative to maintain current pump capacity, but add 639 additional acre-feet of sump storage, and five alternatives that variously balance pump and sump capacity. Based on a cost analysis, the alternative to increase the pump capacity alone became the preferred alternative among these options.

West Levee Interior Drainage

Delta and Pavaho Basins

The Phase II IDS Study evaluated several alternatives for improvements to the Delta Pump Station and associated sumps. First, the study considered demolishing the existing Delta Pump Station and constructing a new pump station in its place. This alternative would also include construction of two box culverts and a gated culvert. The second alternative considered would include the culverts proposed in the first alternative, but also include the construction of a new pump station and the rehabilitation of the existing pump station. The third alternative would be similar to the second, except that it would include improved connectivity to the Trinity-Portland and Eagle Ford sumps. The third alternative would also construct a pump station with a higher capacity than that proposed in the second alternative. A fourth alternative would rehabilitate the existing Delta Pump Station and replace all pumps with new, equivalent capacity pumps.

The Delta and Pavaho basins are connected, and thus, the appropriateness of an alternative to be carried forward is directly impacted by the capacity of the new pump station now operational at the Pavaho Pumping Plant. The New Pavaho Pump Station has a 375,000-gpm capacity and operates alongside the Old Pavaho Pump Station. Based on the capacity at the Pavaho Pumping Plant, the rehabilitation of the Delta Pump Station is projected to provide adequate FRM without requiring increased pump capacity, and this was the only alternative recommended.

Trinity-Portland Basin

The Phase II IDS Study considered construction of a new pump station to drain the Trinity-Portland Sump. Alternatives evaluated construction of a 150,000-gpm or a 250,000-gpm pump station at the sump.

Because the Trinity-Portland Sump is also connected to the Eagle Ford Sump and Pavaho and Delta drainage areas, the recommended improvements for this system were not based solely on the minimum preliminary probable costs, but also on the most effective solutions for FRM. Preliminary analysis included in the Phase II IDS Study established the greatest FRM benefit resulting from the construction of the larger Trinity-Portland Pump Station.

Charlie Basin

The Phase II IDS Study evaluated three alternatives to increase FRM in the Charlie Basin. The first alternative would be to rehabilitate the existing Charlie Pump Station and construct two gravity sluices adjacent to the existing station. The reliance on gravity sluices presents several technical challenges. First, there are design challenges in ensuring a sufficient gradient for gravity flow and reliable performance. Second, gravity sluices would be difficult to construct, as construction would require either breaching the existing levee or tunneling under the existing levee. Both options are very expensive and risky due to the potential for damaging the existing levee. Rehabilitation of the Charlie Pump Station would also be of limited benefit, as its finished floor elevation is below the projected 100-year, 24-hour storm event flood elevation. Because of these challenges, the gravity sluice option was not recommended.

Both the second and third alternatives considered constructing a new pump station at the Charlie Pumping Plant. Under one of these alternatives, the existing pump station would be demolished and a new, larger capacity pump station would be constructed. Under the other alternative, the existing Charlie Pump

Station would be rehabilitated and a second pump station would be constructed alongside it to increase capacity. This second option was not selected due to limitations at the site of the Charlie Pumping Plant that restrict the construction of a second pump station, and also because of the age and condition of the existing Charlie Pump Station. Thus, the alternative to demolish the Charlie Pump Station and construct a new, larger capacity pump station at the same site was recommended.

2.2.3 Trinity Parkway Project Discussion

The Trinity Parkway is a proposed 9-mile long toll road that would extend from the State Highway (SH) 183/Interstate Highway (IH)-35E juncture to US-175/Spur 310. Several route alternatives are currently being reviewed through the Federal Highway Administration (FHWA) NEPA process (a separate and independent EIS; FHWA 2014). The Trinity Parkway would be a tolled route around downtown Dallas, and would assist in managing traffic congestions on IH-30 and IH-35E. As this project has the potential to affect the form and function of the Dallas Floodway Project, the USACE is a cooperating agency in the development of the FHWA Trinity Parkway EIS. This Dallas Floodway Project EIS does not provide NEPA compliance for the Trinity Parkway project.

The USACE is considering the FHWA-recommended Trinity Parkway alignment alternative as part of the cumulative impact analysis in this EIS. Both agencies are required to consider the project's potential impacts on the Dallas Floodway Levee System and other environmental resources. As part of the analysis, the FHWA Trinity Parkway alternative that is within the Dallas Floodway Project is evaluated cumulatively with the impacts associated with the Proposed Action to determine if the combined project impacts would be hydraulically, geotechnically, and structurally sound. The evaluation will also identify the portions/features of the Trinity Parkway alternatives that could provide efficiencies in implementing the Proposed Action by the technically sound and cost effective remediation of the levee deficiencies and or excavation of project features. The USACE will not issue Section 408 construction approval for the potential Trinity Parkway prior to issuance of the Record of Decision (ROD) for this Dallas Floodway Project EIS.

The Trinity Parkway project has satisfied all legally relied upon evidence in considering a project "reasonably foreseeable," in that it has an in-progress public NEPA process, a full project schedule, fully available design plans, a history in the record of activities and planning, and substantial federal, municipal, and private funding. As such, the potential Trinity Parkway project is considered a Future Without-Project Condition project and is analyzed as such in this EIS. On March 21, 2014, the FHWA released the Final EIS for the Trinity Parkway, and identified Alternative 3C as the recommended alternative. A ROD has not yet been issued for the Trinity Parkway project (FHWA 2014).

While the potential Trinity Parkway project and the BVP Study have independent utility, the projects were developed by the City of Dallas at the same time. Recognizing the alternative review process inherent in NEPA, the City of Dallas has prepared preliminary design variations of two different versions of the BVP Study recreation features. Both design variations are presented under Alternative 2. One design alternative anticipates the implementation and alignment of the MDFP and remaining non-federal BVP features taking into consideration that the potential Trinity Parkway is constructed within the Dallas Floodway, consistent with the FHWA recommended alternative. The second design variation, also analyzed under Alternative 2, considers the implementation of the MDFP and remaining BVP features with the consideration that the potential Trinity Parkway is not constructed.

2.2.4 Development of the Proposed Action

This section discusses development of potential project and feature alternatives as well as the process that developed the proposed features of the Proposed Action presented in this EIS.

2.2.4.1 Overall Project

Section 5141 of WRDA 2007, as amended, authorization is specific in directing the USACE to evaluate the proposed features of the 2004 BVP Study and Phase I and II IDS Studies in the Dallas Floodway Project. In that respect, there is little flexibility for alternative project development, as these documents do not prescribe multiple alternatives for analysis, or alternative locations (i.e., outside of the Floodway).

The 2004 BVP Study, as analyzed in this EIS, reflects the identification of the action alternative (Alternative 2) as put forward by the City of Dallas. Alternative 2 was developed by the City of Dallas after over a decade of community outreach, involvement, and project development (refer to Section 1.6.2, prior studies prepared by the City of Dallas). Extensive public involvement occurred in developing the alternatives presented in the 2004 BVP Study, included in Section 5141 of WRDA 2007, as amended, and analyzed in this EIS. None of the comments received during the scoping effort suggested additional alternatives or additional options to those presented during the meetings and public review periods to date. Thus, the USACE has not developed alternatives to the 2004 BVP Study, as doing so would be outside of the scope of Section 5141 of WRDA of 2007, as amended, authorization and no reasonable alternatives were identified by the action sponsor or during the course of project scoping.

The Implementation Guidance for Section 5141 of WRDA 2007, as amended, instructed the USACE to perform economic analysis of the FRM features of the BVP. The detailed analysis and development of FRM alternatives is included in the Feasibility Report (USACE 2014a), and summarized below. Designs that have differing alignments of the recreation facilities and some ecosystem features have been developed by the City of Dallas, consistent with the direction and input received during the public processes described in Section 2.2.2.1. The designs have generally kept to the same footprints and final conditions as summarized in the detailed design descriptions in Section 2.3.2. Therefore, it was determined that different design variations of the BVP features were not sufficiently distinct to warrant evaluation as separate alternatives.

2.2.4.2 BVP Study FRM Alternatives

As presented in detail in the Feasibility Report (USACE 2014a), the USACE evaluated several FRM levee raise alternatives in the National Economic Development (NED) process. Potential alternatives must not increase total risk for the Dallas Floodway System. Second, the alternative with the most net economic benefit would be the NED Plan. Finally, additional alternatives that reduce life safety risk would be considered to see if they are cost effective and can be implemented. As part of this evaluation, the Dallas Floodway Project Feasibility Study considered a range of structural and nonstructural measures.

As detailed in the Feasibility Analysis (USACE 2014a), the USACE evaluated the following potential structural management measures for achieving the necessary level of riverine FRM.

- AT&SF Railroad Bridge modifications
- Levee flattening
- Floodwalls
- Levee height modification
- Controlled overtopping with levee raises

- Levee seepage cutoff walls

The AT&SF Railroad Bridge modifications, levee flattening, and levee height modifications are part of the Proposed Action presented below. While different variations of these were considered, preliminary analysis showed that all variations had very similar environmental impacts to an existing levee system. Thus, to avoid redundancy, only the recommended measures are analyzed in this EIS.

Several structural measures were considered in the Feasibility Analysis (USACE 2014a) and eliminated from further consideration. The Feasibility Analysis evaluated a levee raise with an option for controlled overtopping. However, controlled overtopping would have more environmental damage and less economic benefit than any of the other evaluated measures. Therefore, controlled overtopping was not included.

Conversely, levee seepage cutoff walls are part of the Proposed Action. The levee seepage cutoff walls and floodwalls were determined in the Feasibility Analysis to cost too much for the benefit that they provided and thus could not be implemented under USACE policy for FRM. Thus, the floodwalls were not included. However, the cutoff walls would be required in order to implement certain project features to reduce seepage concerns and thus, the cutoff walls have been included as part of the Proposed Action.

In addition to structural measures, the USACE evaluated the following potential nonstructural management measures for achieving the necessary level of riverine FRM.

- Flood forecasting and warning
- Emergency action planning
- Floodplain management
- Flood proofing
- Raising structures in place
- Structural relocation
- Permanent evacuation

The USACE also considered purchasing properties located along Rockefeller Boulevard adjacent to Moore Park at the southern terminus of the West Levee; however, the USACE determined that doing so was not economically viable or socially desirable and therefore, was not implementable.

With the exception of emergency action planning, all of these nonstructural measures would be typical, valid measures for a standard FRM study; however, because this project includes an existing levee project, and because most of these measures were determined not to be cost effective because of the existing levee project, they were removed from consideration. Emergency action planning is currently being performed by the City of Dallas, and potential improvements are incorporated into the Proposed Action.

As described in detail in the Feasibility Report, the USACE identified a preferred course of action for achievement of FRM; the selected measures are presented in Section 2.3.2. The non-selected measures failed to provide the necessary level of FRM within the identified framework of the study and are not considered further in this EIS.

2.2.4.3 IDP Alternatives

As described in the Phase I and Phase II reports (City of Dallas 2006 and 2009a), several design alternatives were considered for addressing FRM within the IDS for each pumping plant. Each report provides a detailed evaluation of several alternatives identified for each location against a set of screening criteria, which are summarized in Section 2.2.2.2. The outcome of each pumping plant-specific potential alternative against the screening criteria identified a preferred action alternative for each location, as well as detailing why other potential alternatives considered would not be feasible. The associated identified preferred analysis described in the reports for each pumping plant has been carried forward for analysis in this EIS. The other alternatives would not satisfy the purpose and need of the proposed action or would not be feasible, and therefore they are not carried through for further analysis in this EIS.

2.2.4.4 BVP Study Ecosystem and Recreation Alternatives

The placement of many of the BVP Ecosystem Restoration features within the floodway were based on how they function and to take advantage of existing project features. Expanding and improving the existing wetland is the most practical alternative for this project feature. Likewise, the river relocation was based on accommodating other project features and based on hydrogeomorphology studies to ensure that the feature is stable. Finally, as described in Section 2.2.2.1, lakes are placed throughout the Floodway to minimize and balance hydraulic impact of the lakes and the other features included in the Proposed Action. Smaller footprint recreation and ecosystem features are proposed throughout the floodway, with only minor differences among design variations. Based on the combination of larger features being sited for compelling environmental reasons, and smaller features having less impact and similar final conditions, it has been determined that the design variations are not sufficiently different to warrant separate alternative analysis. Therefore, the earlier designs considered and presented in Section 2.2.2.1 are not carried through for further analysis in this EIS; only the design variations of the Proposed Action are analyzed as a potential action alternative (Alternative 2).

Recognizing the on-going policy and funding challenges associated with the construction of the Trinity Parkway, the City of Dallas has developed preliminary designs of two different alignments of the BVP Study recreation and ecosystem features. The first alignment considers the implementation and alignment of the MDFP and remaining non-federal BVP and IDP features taking into consideration the potential Trinity Parkway being constructed within the Dallas Floodway, consistent with the FHWA selected alternative. The second alignment considers the implementation of the MDFP and remaining BVP and IDP features without anticipating the construction of the potential Trinity Parkway within the Dallas Floodway. The two designs are different alignments of the same features with similar environmental footprints and final conditions under different future conditions, and therefore are not sufficiently different to warrant separate alternative analysis. Instead, the two designs are presented under the Proposed Action.

2.2.5 Summary

As presented in the preceding sections, the City of Dallas has a documented history of development of the BVP and IDP features as analyzed in this EIS. The resulting Proposed Action has been developed following decades of iterative and interactive community input, analysis, and evaluation, and recognizes other activities proposed within the Study Area. Therefore, as documented in the preceding discussion, the USACE and City of Dallas is only proposing one action alternative for the Proposed Action with two design variations: a design that anticipates the potential Trinity Parkway construction within the Floodway and a design that does not anticipate the potential Trinity Parkway construction.

2.3 ALTERNATIVES

2.3.1 Alternative 1: The No-Action Alternative

The No-Action Alternative (or "Future Without-Project Condition") is an alternative that assumes the MDFP and remaining BVP features are not implemented. An analysis of the No-Action Alternative is included as required by Council on Environmental Quality (CEQ) regulations to identify the existing baseline conditions against which potential impacts can be evaluated. For planning purposes, the USACE used a 50-year planning horizon. Thus, for the purposes of this analysis, the "future" is defined as the year 2065; however, some resource areas use a different "future" year; these deviations are noted in their respective sections. The analysis and subsequent presentation of the Future Without-Project Condition will help the decision maker decide between alternatives.

2.3.2 Alternative 2: The Proposed Action

Alternative 2 consists of implementation of the MDFP and the remaining non-federal BVP and IDP features. The first part of Alternative 2 identifies the MDFP and the second part identifies the City's preferred alternative for the remaining non-federal BVP and IDP features that are being requested by the City of Dallas to be constructed by the City of Dallas.

Two design variations are evaluated under Alternative 2: one design that anticipates that the potential Trinity Parkway is constructed and another design that anticipates that the potential Trinity Parkway is not constructed. The MDFP and the non-federal IDP features are identical in both of the designs being considered under Alternative 2. The non-federal BVP features however do, have minor design variations under the two design assumptions. These minor variations are described within Section 2.3.2.2 and summarized in Table 2-4 at the end of this section.

2.3.2.1 Modified Dallas Floodway Project

As described in the Trinity River Corridor Design Guidelines (City of Dallas 2009b), the BVP Study aimed to "seamlessly integrate" the Trinity Parkway and the Trinity Lakes Area by: (1) applying shared aesthetic goals, and (2) mitigating vehicle impacts in coordination with BVP Study features and functions. Thus, under the Proposed Action design that anticipates construction of the Trinity Parkway, the Trinity Parkway is assumed to be constructed within the Dallas Floodway Project using the recommended Alternative 3C identified in the 2014 Final Trinity Parkway EIS (FHWA 2014).

The Trinity Parkway proposed action includes excavation of fill material for support and berm building. To maximize construction efficiency, the North Texas Tollway Administration, the City of Dallas, and the USACE would coordinate to determine if the Trinity Parkway could take their fill material from the proposed lake sites. Thus, the excavation needs of the BVP would be decreased, because the potential Trinity Parkway project would excavate a portion of the lakes for use in the parkway berm, thereby resulting in "double-use" for the lakes. All mitigation associated with impacts from construction of the potential Trinity Parkway would occur outside of the Floodway.

Alternative 2 consists of the MDFP and considers that the City of Dallas' preferred alignment of the remaining BVP features have been requested via a Section 408 Request from the City of Dallas.

Alternative 2 includes the following features:

- MDFP:
  - FRM
  - Ecosystem Restoration

- Remaining BVP:
  - FRM
  - Recreation Enhancement
  - Ecosystem Restoration

Table 2-1 summarizes how each major feature is accounted for under Alternative 2. Figure 2-1 presents an overview of Alternative 2, designating the MDFP and the remaining, non-federal BVP features as designed anticipating construction of the potential Trinity Parkway with the Floodway. Appendix D, *Figures of Proposed BVP Study Ecosystem and Recreation Features,* presents details of the notional locations of proposed BVP Study features under the Proposed Action as designed anticipating construction of the Trinity Parkway with the Floodway. Figure 2-2 presents an overview of Alternative 2, but displaying the non-federal BVP features as designed without anticipating construction of the potential Trinity Parkway with the Floodway. Appendix E, *Figures of Proposed BVP Study Ecosystem and Recreation Features,* presents details of the notional locations of proposed BVP Study features under the Proposed Action as designed without anticipating construction of the potential Trinity Parkway with the Floodway. Appendix F, *Differences in BVP Study Ecosystem and Recreation Features between Designs*, presents the differences in BVP Study Ecosystem and Recreation features between the two design variations.

<u>Flood Risk Management</u>

The objective of the riverine FRM elements is to reduce flood risk and limit overtopping of the levees for floods greater than the 277,000 cubic feet per second (cfs) flood event. The USACE has been analyzing Dallas Floodway Levees and working with the City of Dallas for several years to develop a plan for levee improvements that would provide the City of Dallas with reduced flood risk associated with levee overtopping, levee overtopping and subsequent levee breach, and levee breach before levee overtopping. As part of this effort, the USACE has prepared a Feasibility Report (USACE 2014a), which details all alternative approaches evaluated, the results of extensive predictive modeling for those alternatives, and the application of selection criteria as determined by the City of Dallas and the USACE. The riverine FRM elements presented here are the results of that study.

As detailed in the Feasibility Report, the USACE identified the 277,000 cfs Levee Raise with the AT&SF Railroad Bridge modifications as being the plan with the highest net economic benefits as a stand-alone alternative. In addition, the City of Dallas' plans to flatten the riverside side slopes from 3:1 to 4:1 for maintenance purposes has been included as part of the FRM element. Finally, the USACE has also identified nonstructural actions as part of the FRM to include emergency response, public awareness/education, flood forecasting, and warning systems. Specifically, the USACE would provide revised inundation mapping to support the City's Emergency Action Plan (EAP) and install monitoring equipment in the Floodway.

Implementation of the proposed FRM elements would:

- reduce the risk to life and health, and improve the welfare of the residents in the Study Area;
- reduce the risk of property damage in the Study Area;
- reduce the risk of significant national and regional economic losses in the Study Area; and
- provide greater opportunities for increasing the public awareness of residual risk in the Study Area.

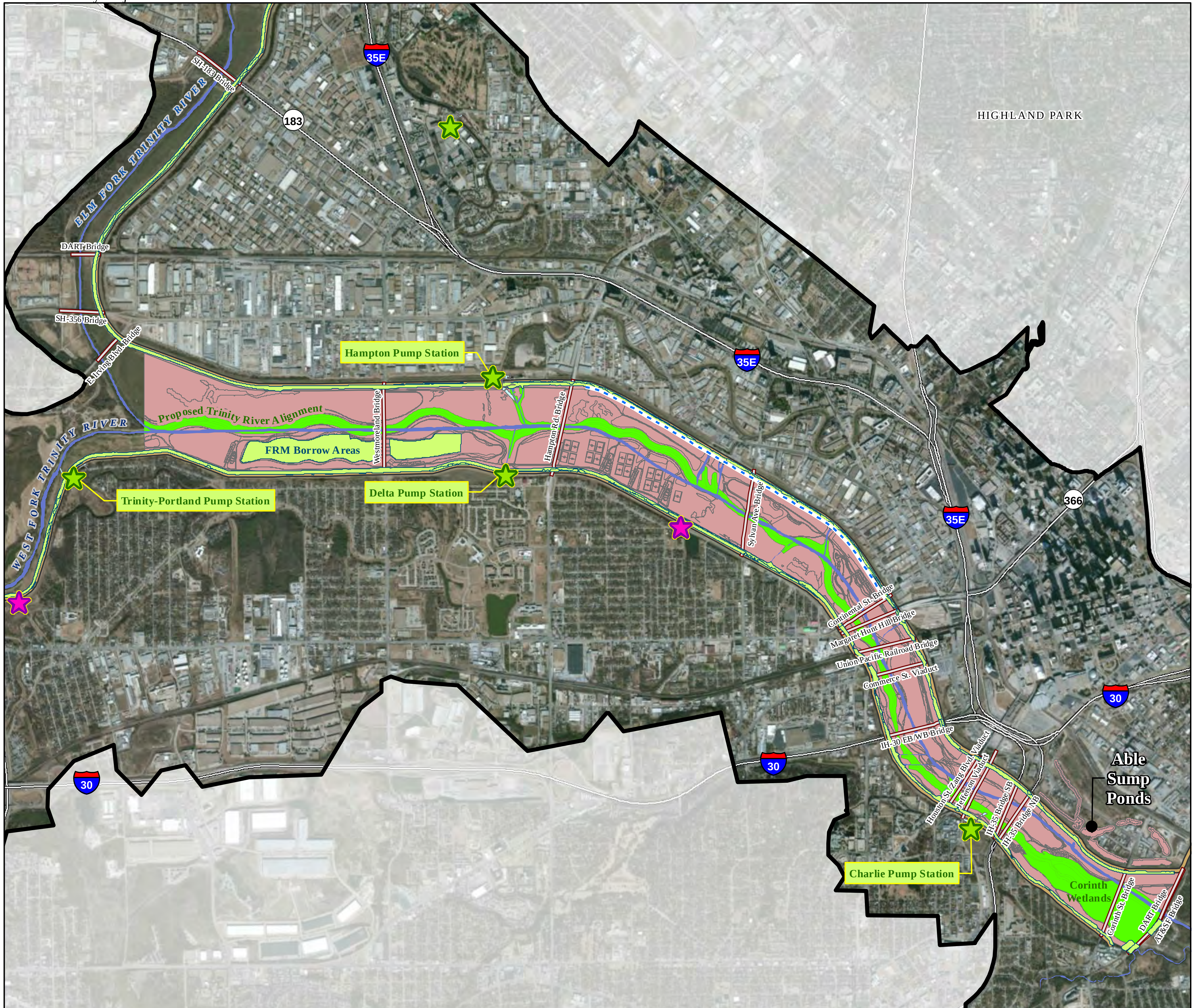
Figure 2-3 presents an overview of the proposed riverine FRM elements. For detailed depictions of the BVP FRM elements, refer to the figures contained in Appendix C, *Figures of Proposed BVP Study Flood Risk Management Elements*.

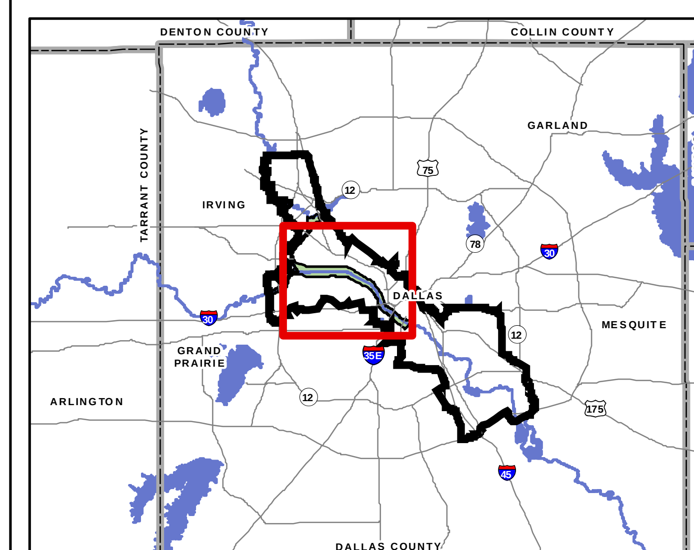
Table 2-1. Proposed Action and Cost Sharing Accounting

Category	*Description*	*WRDA*[1]	*Alternative 2*	
			MDFP	*BVP/IDP*[2]
BVP Study FRM				
Levees	Raise to 277,000 cfs Flood Height	✓	✓	
AT&SF	Removal of Wood Bridge Segment	✓	✓	
	Removal of Concrete Bridge Segment	✓	✓	
	Removal of Embankment Segments	✓	✓	
Levee Flattening	Flattening the Riverside Levee Side Slopes to 4:1	✓	✓[3]	
Cutoff Wall	Extend Cutoff Wall along East Levee[4]	✓	✓	
Nonstructural Flood Control Improvements	Develop Revised Inundation Mapping to Support EAP	✓	✓	
	Install Piezometers in the Floodway	✓	✓	
BVP Study Ecosystem Restoration and Recreation Enhancements				
Lakes	West Dallas Lake	✓		✓
	Urban Lake	✓		✓
	Natural Lake	✓		✓
River	Relocation and Modification	✓	✓	
Wetlands	Marshlands	✓		✓
	Corinth Wetlands	✓	✓	
Athletic Facilities	Potential Flex Fields	✓		✓
	Playgrounds	✓		✓
	River Access Points	✓		✓
General Features	Parking and Public Roads	✓		✓
	Lighting	✓		✓
	Vehicle Access	✓		✓
	Pedestrian Amenities	✓		✓
	Forested Ponds	✓		✓
	Restrooms	✓		✓
Interior Drainage Outfall Modifications	Pump Station Outfalls	✓	✓	
	Pressure Sewer Outfalls	✓	✓	
Able Sump Ponds	Recreation and Ecosystem Enhancements	✓		✓
Interior Drainage Plan Improvements				
East Levee	Demolish Old Hampton Pump Station	✓	✓	
	Construct New Hampton Pump Station	✓	✓	
	Nobles Branch Sump Improvements	✓	✓	
	Construct New Baker Pump Station	✓	✓[5]	
	Construct New Able Pump Station[6]	✓		
West Levee	Demolish Old Charlie Pump Station	✓	✓	
	Construct New Charlie Pumping Station	✓	✓	
	Rehabilitate Existing Delta Pump Station	✓	✓	
	Construct New Trinity-Portland Pumping Plant	✓	✓	
	Construct New Pavaho Pump Station[6]	✓		
	Eagle Ford and Trinity-Portland Sump Improvements	✓		✓
	Pavaho and Delta Sump Improvements	✓		✓

Notes: [1] Includes Section 5141 of the WRDA 2007, as amended by WRRDA of 2014.
[2] Remaining non-federal BVP elements to be completed by the City of Dallas under future Section 408 approval.
[3] Included in the MDFP, and entirely paid for by the City of Dallas as a betterment.
[4] Included in the MDFP as a risk mitigation feature of the River Relocation.
[5] Baker is part of the MDFP but was analyzed for NEPA compliance separately from this EIS (USACE 2012b).
[6] Able and Pavaho are not part of the MDFP. They were analyzed for NEPA compliance separately (USACE 2014b, 2010) and processed under Section 408.

Figure 2-1
Overview of Alternative 2 with the Potential Trinity Parkway





GIS Sources: City of Dallas 2008a; NCTCOG 2008; USACE 2013a, 2013b

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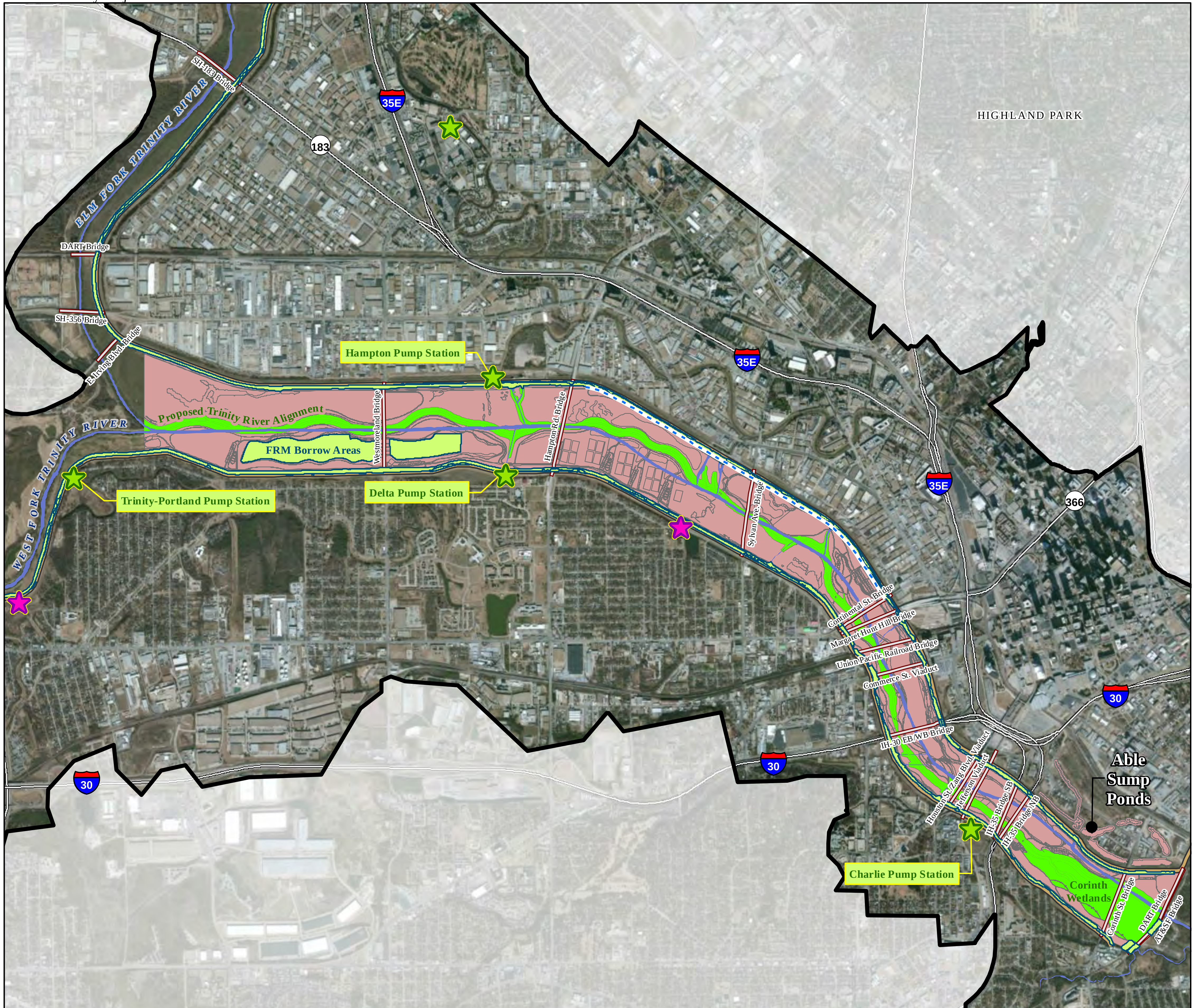
Figure 2-2
Overview of Alternative 2 without the Potential Trinity Parkway



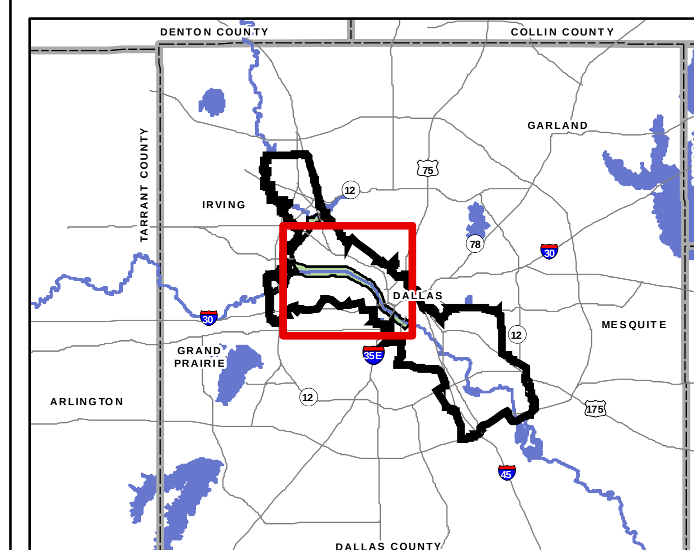
LEGEND

Existing Features
- Dallas Floodway Levee
- Bridge
- Freeway
- Study Area
- Surface Water

Alternative 2 without the Potential Trinity Parkway

MDFP
- BVP Features
- FRM Features
- IDP Improvements
- Cutoff Wall

Remaining BVP and IDP Features
- BVP Features
- IDP Improvements



0 0.5 1 Kilometers
0 0.5 1 Miles

GIS Sources: City of Dallas 2008a; NCTCOG 2008; USACE 2013a, 2013b

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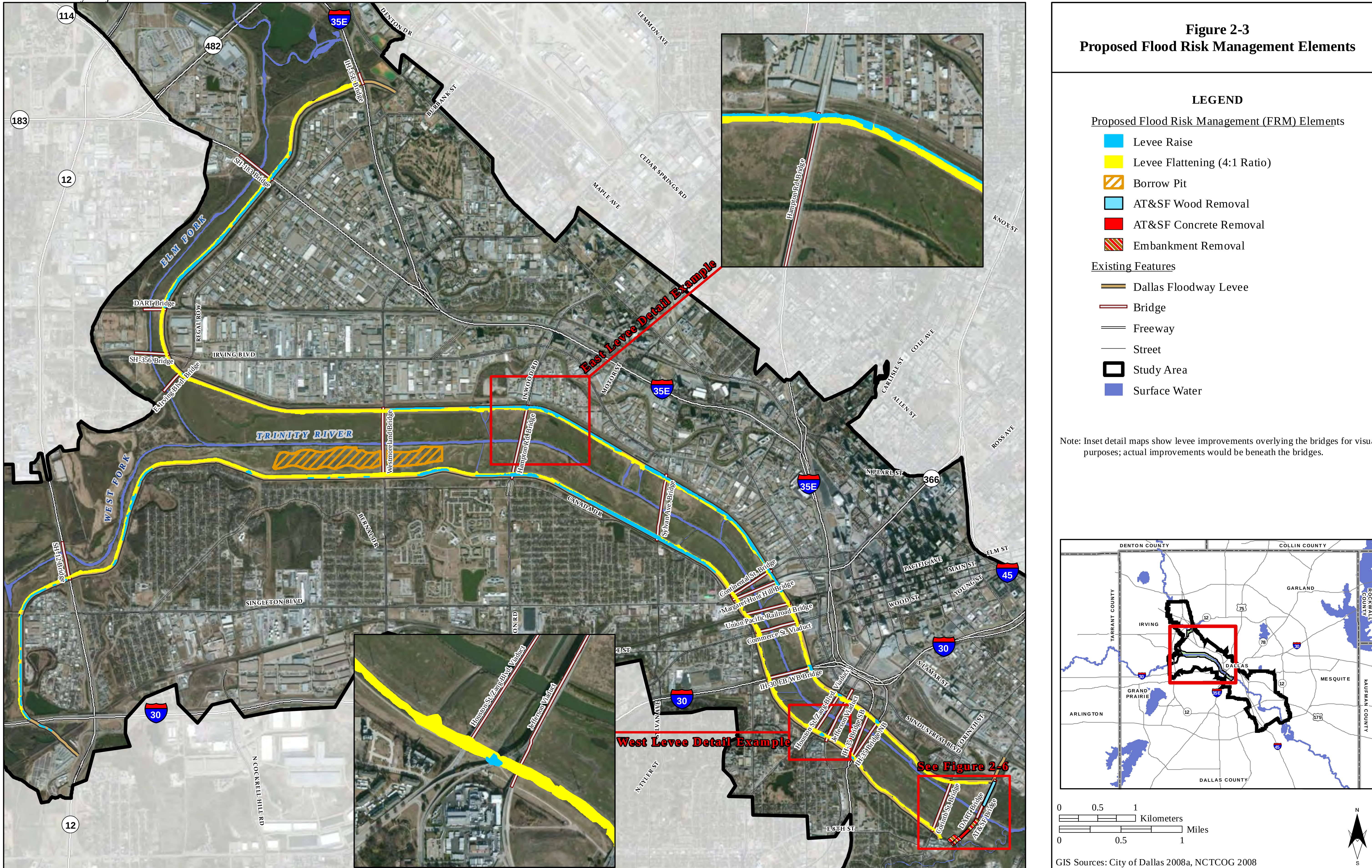
Figure 2-3
Proposed Flood Risk Management Elements



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Levee Height Modification

Under the FRM, the USACE would raise sections of the levee system that have settled to below design height such that the levees could contain a flood event with 277,000 cfs discharge. Several sections of the levee currently meet height and slope requirements, and do not need additional improvement. However, many sections do need improvement to reach the design elevations of the 277,000 cfs flood event. Those sections of the levee that would be improved under the FRM elements are identified on Figure 2-3. The levee raise would occur on portions of the East, West, Elm Fort, and West Fork Levees. The levee raise would also require an evaluation of bridge and utility alterations, as some alteration of the roadway bridge approaches may be necessary. The levee raise does not include the eight-inch thick crushed limestone maintenance levee top road as part of the effective levee height.

The material to be used for the levee raise (and City of Dallas levee flattening) would be excavated from two borrow pits located within the Dallas Floodway. The location and depths of excavation of the borrow pits was determined based on the availability of suitable material and minimizing environmental impact. The two borrow pits would be located in an area generally corresponding to the footprint of the proposed West Dallas Lake, east and west of the Westmoreland Bridge (Figure 2-3). The FRM borrow pits providing fill for the levee raises and flattening would cover approximately 105 acres. The borrow pit design would include adjoining shelves as shown in the cross section depicted on Figure 2-4.

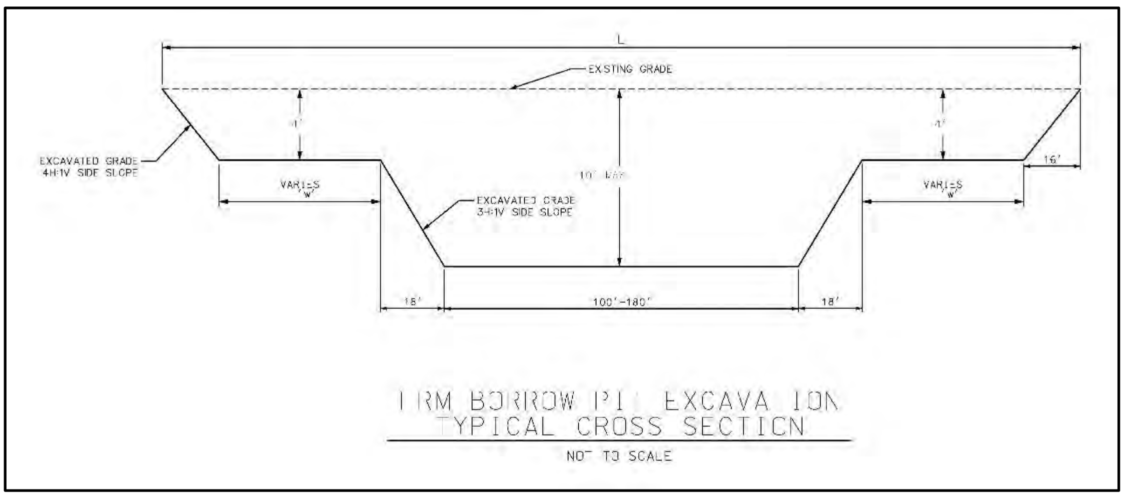


Figure 2-4 Typical Cross Section of the Proposed Borrow Pit

AT&SF Railroad Bridge Modifications

The AT&SF Railroad Bridge is located at the downstream end of the Dallas Floodway. Historically used for rail traffic, it is currently abandoned, as it has not been used for rail traffic since 1992. The AT&SF Railroad Bridge is a steel truss and wooden trestle bridge featuring approaches supported by wood piers and earthen embankments at each end (Figures 2-5a and 2-5b).

Figures 2-5a and 2-5b. AT&SF Railroad Bridge Trestle and Santa Fe Trestle Trail as Viewed from West *(TrailLink 2014)* **and Air** *(Trinity River Corridor Project 2014)*

Stone piers support the central "open" steel trestle span across the Trinity River. Currently, the AT&SF Railroad Bridge causes a rise in the SPF water surface profile due to its closely spaced piers, low deck height, and large earthen embankments in the Dallas Floodway. The wood trestles on the bridge have approximately 14-foot spacing, instead of the 50-foot spacing on most modern bridges. This closer spacing results in the trestle catching large debris during high water periods, thereby impeding water conveyance.

The existing open steel trestle span of the bridge would not be removed. As depicted on Figure 2-6, the proposed AT&SF Railroad Bridge modifications include:

1. removing approximately 1,000 feet of wood trestle bridge on the left bank side of the Floodway from the new Santa Fe Trestle Trail Bridge to the left bridge abutment at the East Levee;
2. removing a 660-foot concrete railroad bridge segment on the right bank side; and
3. removing two embankment segments (measuring 453 and 518 feet) on the right bank side of the Floodway.

In order to maintain hydraulic neutrality and conveyance as required by the Trinity River EIS, the Santa Fe Trestle Trail project (refer to Section 2.6.2) constructed an embankment just upstream of the AT&SF Railroad Bridge (Figure 2-6). This embankment covers approximately 1.9 acres and was designed and constructed to mimic the hydraulic impact of the partial removal of the original AT&SF railroad embankment located downstream of the Dallas Area Rapid Transit (DART) Rail Bridge and on the right bank of the Floodway. The partial removal of this embankment section was necessary for the construction of the Santa Fe Trestle Trail Project. If the embankment had not been constructed, then the increased conveyance created by the Santa Fe Trestle Trail project could have potentially contributed to flood-related safety hazards downstream of the Floodway.

In order to continue to maintain the current floodwater conveyance levels when proposed BVP Study features are implemented, the Santa Fe Trestle Trail embankment would be removed. As part of the removal process, the embankment material would be evaluated for potential reuse within the Floodway. If, however, it is found to not be authorized for reuse within the Floodway, the material would be disposed of in the nearest suitable landfill.

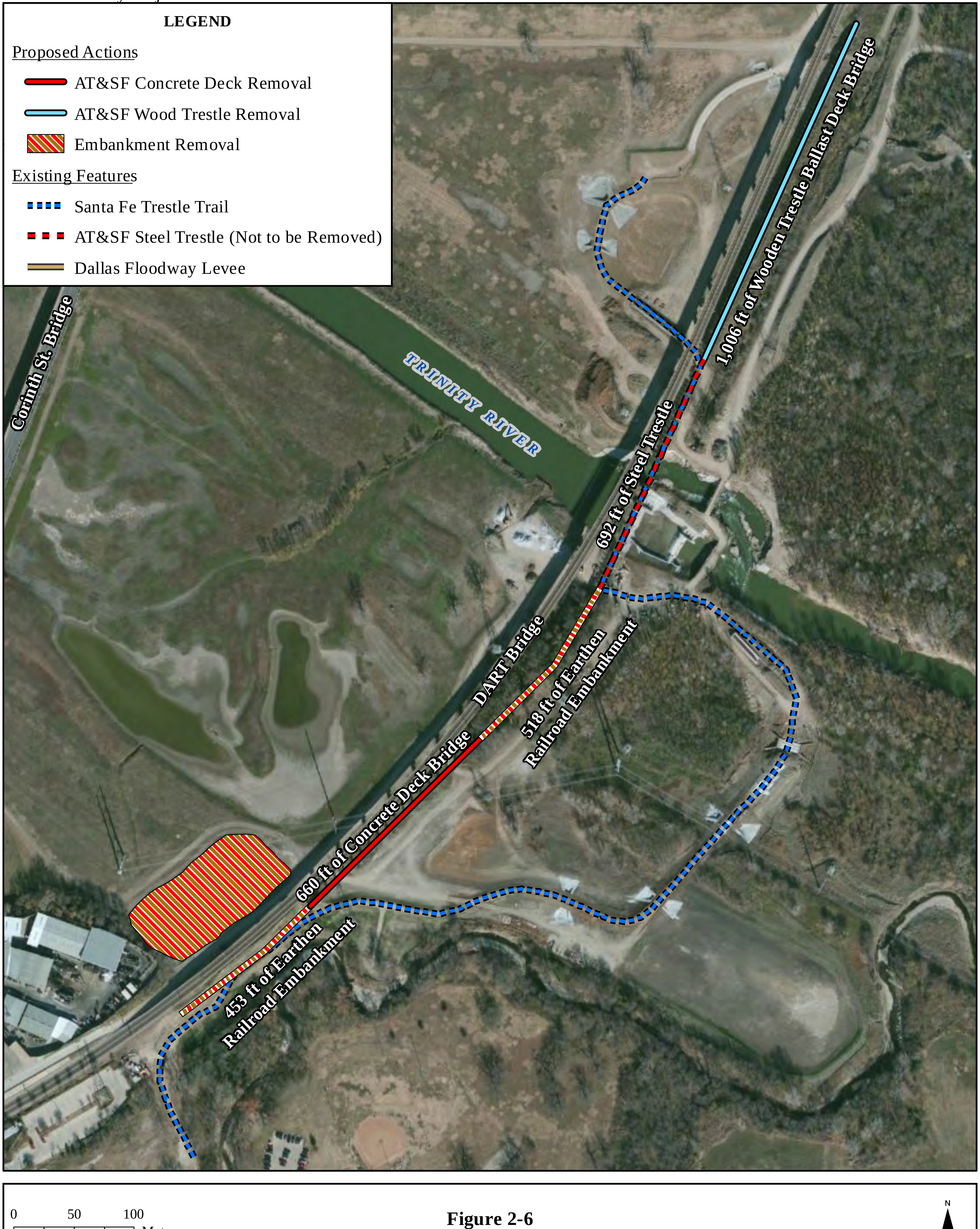


Figure 2-6
FRM Element: Proposed AT&SF Railroad Bridge Modifications

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013a

Levee Flattening to 4:1 Side Slopes

The 2004 BVP Study identified a need to reduce levee side slope operation and maintenance costs, provide increased levels of risk reduction, and enhanced recreational amenities by way of "flattening" the riverside levees to 4:1 slopes (i.e., 1 foot of elevation gain for every 4 feet horizontal distance) for the entire length of the Dallas Floodway. The City of Dallas has a preference to flatten all side slopes of the levees to 4:1 for maintenance purposes, to reduce the hazards of mowing along a steep slope, and to reduce the number of slides and the resultant cost to fix these slides. This side slope flattening plan would satisfy the overall project objective of FRM.

Proposed FRM levee raises would take place on approximately 40% of the linear length of the levee. To avoid disturbing the same sections of levee multiple times and to reduce cost, the flattening of the side slopes would occur concurrently with the FRM levee raise. This addition to the federal project would not require a separate Section 408. These side slope modifications would be done in a manner that is consistent with the 277,000 cfs levee height raise. The side slope flattening includes reconstruction of the access roads to match the new contours of the riverward side of the East and West Levee. The borrow source for the side slope flattening is within the footprint of the proposed West Dallas Lake. An estimated 1,400,000 cubic yards of material is needed for the construction of the 4H:1V (horizontal to vertical ratio of 4 to 1) side slopes, including the NED Plan levee raise quantities. Refer to Figure 2-3 for those levee reaches with slopes steeper than the preferred 4:1 slope.

<u>Nonstructural Flood Response Improvements</u>

The physical impacts of implementing these nonstructural FRM elements are negligible; however, the operational aspects of these measures are included as part of the Proposed Action and have been included in the analysis. The City of Dallas has an existing EAP that identifies elderly populations over age 65, special needs households, and other structures that should be targeted for evacuation during flood events. Nonstructural flood response improvements proposed build on this existing plan.

Emergency Response and Public Awareness/Education

The USACE and City of Dallas have identified nonstructural flood response improvements to support achievement of overall FRM goals. The proposed mobilization rate improvement measures include transportation network improvements, utilization of public transportation, and emergency response improvements. Safe haven/zones would be identified and involve transportation for that portion of the population that cannot mobilize to seek shelter. Measures would also include education of the City's EAP, overcoming obstacles related to age/language, and implementation of a "good neighbor/buddy" system.

Flood Forecasting and Warning Systems

The City of Dallas currently has a flood warning system in place. This flood warning system is described in the City EAP for the Trinity River Federal Levee System, dated April 2010 (City of Dallas 2010b). In the event of flooding, Police and Fire-Rescue Dispatch would issue a warning to affected residents using the Reverse 911 system. In addition, City officials would implement measures such as requesting broadcasters to disseminate Emergency Alert System broadcasts on television and radio stations. As part of the Proposed Action, the City of Dallas would enhance their EAP to reduce response times, increase evacuation rates, or reduce the vulnerabilities of the population that remains during a flooding event.

Nonstructural flood response improvements proposed include the development of revised floodplain inundation maps by the USACE that would be provided to the City. The City could then update the EAP to help them target the areas with populations at greatest risk of flooding under the revised predictions so that evacuations could be more focused and efficient.

The USACE also proposes to install piezometers in critical areas of the Floodway. Piezometers are monitoring devices that track the pressure of groundwater, and aid in estimating groundwater flow. The proposed piezometers would inform the technical team as to the continuity of the sand layer under the levee (for detail about substrate types within the Study Area, refer to Section 3.2.2.4). Piezometers would be installed along the East and West Levee to monitor the sand layer for potential underseepage concerns.

Ecosystem Restoration

Trinity River Modifications

A major ecosystem restoration feature proposed by the BVP Study is the creation of sinuosity (i.e., bends) in the main channel of the river, with the goal of creating a more “natural” river. Approximately 8 miles of river channel would be relocated, from the confluence of the West and Elm Forks of the Trinity River downstream to the DART Rail Bridge. While the existing channel pattern and channel profile would be altered substantially, the intent is to preserve the existing average slope of the channel profile while mimicking historical conditions (refer to Figure 1-3).

The relocated river channel would have a stable channel pattern that would avoid coming within 200 feet of where the toe of the levee would be upon completion of the proposed 4:1 flattening. The channel pattern would be offset from other BVP Study features by a distance sufficient to allow channel adjustments to occur without impacting other features. Where this is not possible, the channel would be strengthened, using bioengineering approaches that incorporate native vegetation and other natural materials.

To minimize the extent of channel bank armoring required in the channel relocation design, the channel pattern would be offset from all sensitive BVP Study features by the maximum migration corridor width described in the Geomorphic Assessment and Basis of Design document (City of Dallas 2009d). A segment of cutoff wall would be installed along the East Levee beginning at near the Continental Bridge and connect upstream to the termination of the existing cutoff wall located near the Hampton Bridge. The cutoff wall is necessitated by the relocation of the Trinity River closer to the East Levee in this area.

Terrace elevations would be set in relation to water surface elevations at effective flow frequencies, with stable slopes given local hydraulic, geotechnical, and vegetation conditions, and would include adequate terrace drainage. Landscape terrace elevations would be constructed to provide river access and views with safe and accessible slopes. Lower elevation (i.e., at or below the base flow water surface elevation) terraces would not be vegetated as frequent flooding would not support vegetation. Conversely, the landscape terraces set at a higher elevation would be vegetated. Species, locations, and planting density on higher geomorphic terraces and landscape terraces would be based on local flood frequency, hydraulics, geotechnical conditions, channel roughness requirements and orientation of the terrace to the river channel and other project features.

River slopes would be designed based on local hydraulic conditions, maximum water force during high flows, local geotechnical conditions, proximity to other BVP Study features, and existing or proposed vegetation. Typical bank slopes would be designed for river reaches with similar conditions and would extend the length of a given reach. Transitions between different bank types would be designed to withstand hydraulic discontinuities and changes in water levels and energy.

The final design of all river modification features would satisfy all applicable standards for channel modifications within the Floodway. These include, but are not limited to, requirements of the USACE, the City of Dallas, and the Texas Department of Transportation (TxDOT).

Corinth Wetlands

The MDFP would improve habitat quality by restoring existing wetlands within the Dallas Floodway. The wetlands would include bottomland hardwood wetlands and emergent wetlands. These wetlands would be designed with the primary goal of increasing both the amount and quality of plant and wildlife habitat in the Floodway with secondary benefits of improving overall water quality by removing nitrogen, phosphorus, and other pollutants from urban runoff.

The Corinth Wetlands already exist at the southeast edge of the project, just before the Trinity River flows into the Great Trinity Forest, but are of poor quality. The Corinth Wetlands would be enhanced through grading and planting. The BVP Study proposes recreational amenities, such as boardwalks and soft-surface trails through these areas, as well as three wildlife observation areas with blind structures to provide visitors with wildlife viewing opportunities and places to rest.

IDP Improvements

The IDP consists of proposed improvements to the existing East and West Levee Interior Drainage System (EWLIDS). The objective of the IDP improvements is to provide stormwater FRM for areas served by the EWLIDS from the 100-year storm event. Implementation of the IDP would reduce the stormwater flood risk for structures located within the interior areas. Figure 2-7 presents an overview of proposed IDP improvements. For detailed depictions of the IDP improvements, refer to the figures contained in Appendix G, *Figures of Proposed Interior Drainage Plan Improvements*. The pumping plant outfalls depicted in the preliminary concept plans (see Appendices D and E) reflect the anticipated future location of the Trinity River, due to the proposed river relocation.

Hampton Basin

Hampton Pumping Plant

The Proposed Action includes construction of a new pump station at the Hampton Pumping Plant, referred to as Hampton 3. The Hampton 3 pump station would consist of five, 140,000-gpm pumps with a total pumping capacity of 700,000 gpm. Each would pump water up and over the levee via a dedicated 84-inch diameter steel pipe. The five pipes would rest on concrete pedestals and the pedestals would be connected to a reinforced concrete bedding slab that would be “notched” into the levee. The stormwater would flow through a concrete headwall, over a concrete spillway, and into a concrete and earthen lined channel to the Trinity River. The river side of the re-constructed embankment over the discharge pipes would be protected from erosion by an articulated concrete revetment mat (URS 2009a). On the sump side, a new intake would be installed and portions of the existing sump channel would be lined. After constructing Hampton 3, the existing Old Hampton Pump Station would be demolished (Figure 2-7) (URS 2009a).

Sump Improvements

Implementation of the Proposed Action would include installing three, 60-inch gated culverts adjacent to the existing single 60-inch gated culvert at the crossing of Empire Central Drive at Nobles Branch Sump to facilitate the movement of stormwater from the Noble Branch Sump into the Record Crossing Sump (Figure 2-7) (URS 2009b).

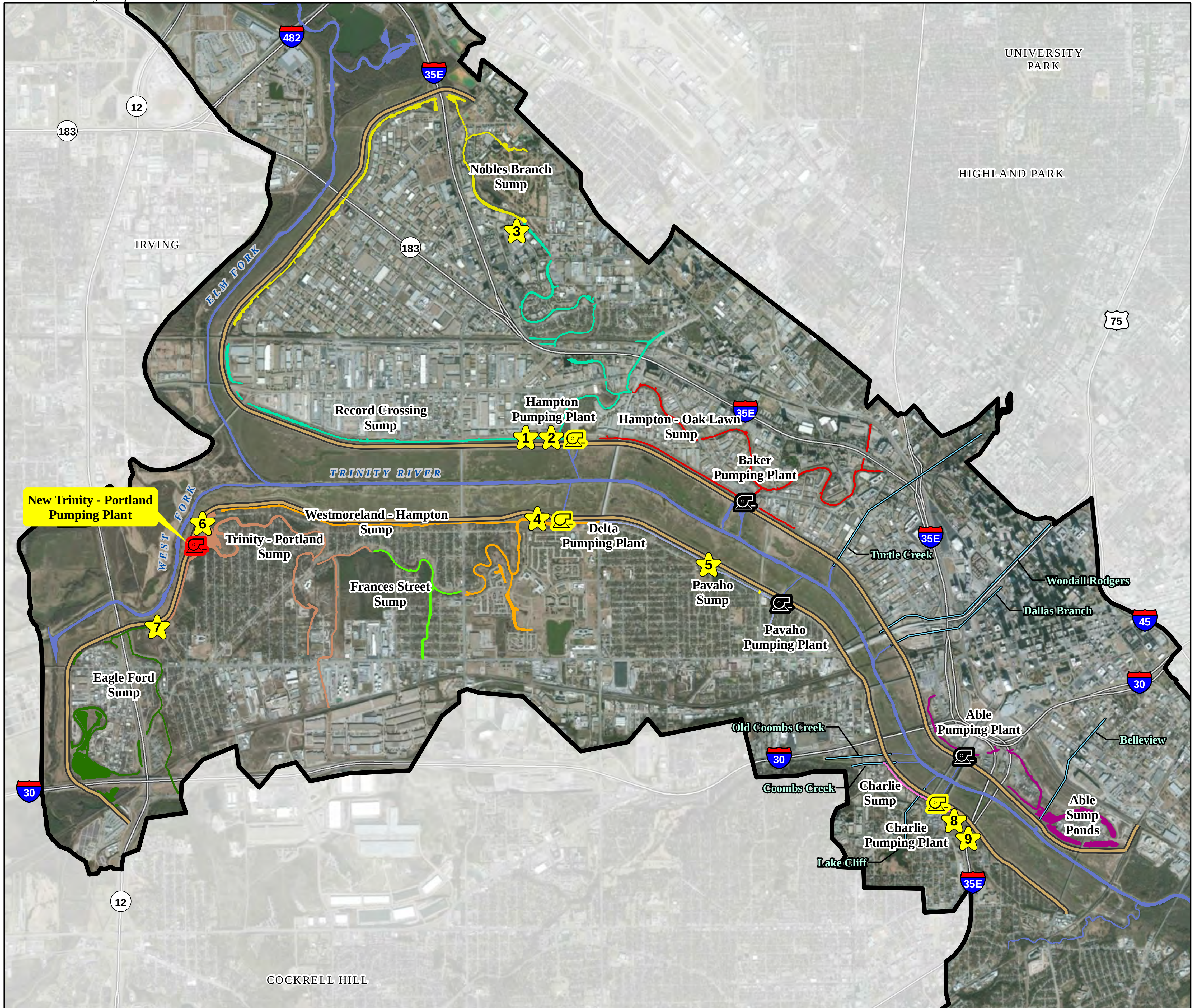


Figure 2-7
Proposed Interior Drainage Plan Improvements

LEGEND

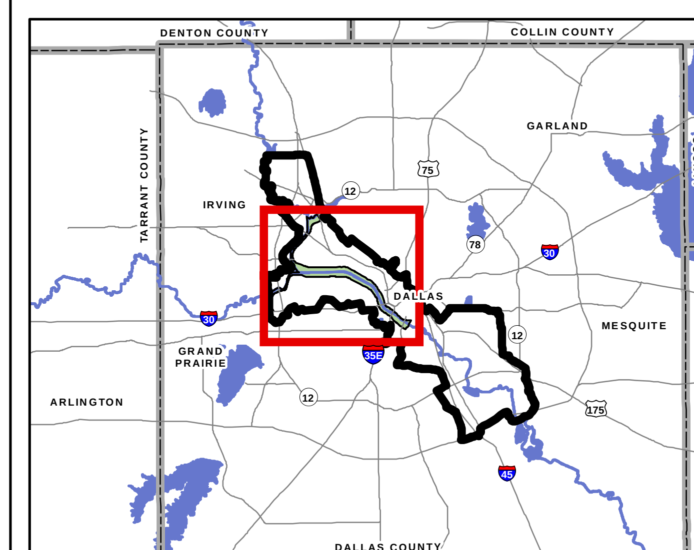
- New Pumping Plant
- Existing Pumping Plant to be Improved
- Existing Pumping Plant
- IDP Improvement
- Study Area
- Surface Water
- Proposed Culvert
- Existing Pressure Sewer
- Dallas Floodway Levee
- Freeway

East Levee Sumps
- Able
- Hampton - Oak Lawn
- Nobles Branch
- Record Crossing

West Levee Sumps
- Charlie
- Eagle Ford
- Frances Street
- Pavaho
- Trinity - Portland
- Westmoreland - Hampton

# on Figure	Hampton Basin
1	Construct new 700,000-gpm Pump Station and Outfall
2	Demolish Old Hampton Pump Station
3	Install 3, 60-inch diameter culverts at Empire Central Drive
	Delta and Pavaho Basins
4	Rehabilitate Existing Delta Pump Station
5	Install 1, 10-ft by 8-ft culvert under Canada Drive
	Trinity-Portland Basin
6	Construct new 250,000-gpm Pump Station
7	Install 1, 6-ft by 6-ft gated conduit structure between Trinity-Portland and Eagle Ford Sumps
	Charlie Basin
8	Construct new 225,000-gpm Pump Station
9	Demolish existing Charlie Pump Station

Note: Locations are approximate; for detailed maps see Appendix G.



0 0.5 1 Kilometers
0 0.5 1 Miles

GIS Sources: City of Dallas 2006, 2008a, 2008b, 2009a; Halff 2008; NCTCOG 2008

Delta and Pavaho Basins

Delta Pumping Plant

The Proposed Action includes rehabilitation of the existing Delta Pump Station to increase the service life and minimize future maintenance. Specifically, the existing pumps would be replaced with pumps of equal capacity (90,000 gpm total pumping capacity). The adjacent sump area and the outfall area would be improved with erosion protection measures to prevent any further erosion and degradation of levee. A new electrical building would be constructed and site improvements would consist of extending the trash rack, installing new steps, conducting limited grading, paving, and concrete work, and installing new security fencing along the perimeter of the site. All of the proposed renovations at the Delta Pump Station would occur within the existing pump station footprint (Figure 2-7) (URS 2009d).

Trinity-Portland Basin

New Trinity-Portland Pumping Plant

The Proposed Action includes construction of a new pumping plant adjacent to the West Levee between Mexicana Road and Canada Drive (Figure 2-7). The Trinity-Portland Pumping Plant would consist of two, 125,000-gpm pumps (250,000 gpm total pumping capacity), and one, 6,000-gpm low flow pump. Each would pump water up and over the levee via a dedicated 78-inch diameter steel pipe. The two pipes would rest on concrete pedestals and the pedestals would be connected to a reinforced concrete bedding slab that would be “notched” into the levee. The stormwater would flow through a concrete headwall, over a concrete spillway, and into a concrete and earthen lined channel to the Trinity River. The river side of the re-constructed embankment over the discharge pipes would be protected from erosion by an articulated concrete revetment mat (URS 2009c).

Access to the pumping plant would be from the east along an existing gravel access road that would be replaced with concrete pavement as part of the project. In addition, a roadway connecting the levee toe roadway to Mexicana Road would be constructed to provide direct access to the site during all-weather conditions. On the sump side, a new intake would be created and portions of the existing sump channel would be lined (URS 2009c).

Charlie Basin

The Proposed Action includes demolition of the existing Charlie Pump Station and replace it with a new pump station at the same location, within the existing footprint. The new Charlie Pump Station would consist of three, 75,000-gpm pumps (225,000 gpm total pumping capacity), and one, 6,000-gpm low-flow pump. Each would pump water up and over the levee via a dedicated 60-inch diameter steel pipe. The three pipes would rest on concrete pedestals and the pedestals would be connected to a reinforced concrete bedding slab that would be “notched” into the levee. The stormwater would flow through a concrete headwall, over a concrete spillway, and into a concrete and earthen lined channel to the Trinity River. The river side of the re-constructed embankment over the discharge pipes would be protected from erosion by an articulated concrete revetment mat. On the sump side, a new intake would be installed and portions of the existing sump channel would be lined (URS 2009e).

<u>Interior Drainage Outfall Connections</u>

The existing stormwater outfalls would need to be modified due to the proposed FRM and BVP Study actions. The existing storm drains convey stormwater from various areas of the City of Dallas, including the Central Business District, to the Trinity River. In several areas of the existing sumps, there is a need to improve stormwater conveyance between the sump ponds to facilitate the flow of runoff to the pump stations.

As shown on Figure 2-8, with the relocation of the river, several of the existing outfall channels would no longer reach the river once it is relocated. Therefore, under the Proposed Action, the outfall channels would be altered as depicted in Table 2-2. The outfall embankments would incorporate appropriate site-specific design measures to protect the outfalls from erosion while providing adequate conveyance.

Table 2-2. Summary of Interior Drainage Outfall Channel Changes

Outfall	*Change in Outfall Length (approximate)*
Hampton Pumping Plant	No change
Baker Pumping Plant	Shorten outfall 700 feet
Turtle Creek Pressure Sewer	Extend outfall 300 feet
Woodall Rodgers Pressure Sewer	Extend outfall 1,100 feet
Dallas Branch Pressure Sewer	Extend outfall 1,100 feet
Bellevue Pressure Sewer	Extend outfall 300 feet
Charlie Pumping Plant	Shorten outfall 200 feet
Delta Pumping Plant	Shorten outfall 600 feet

2.3.2.2 Non-federal IDP Improvements

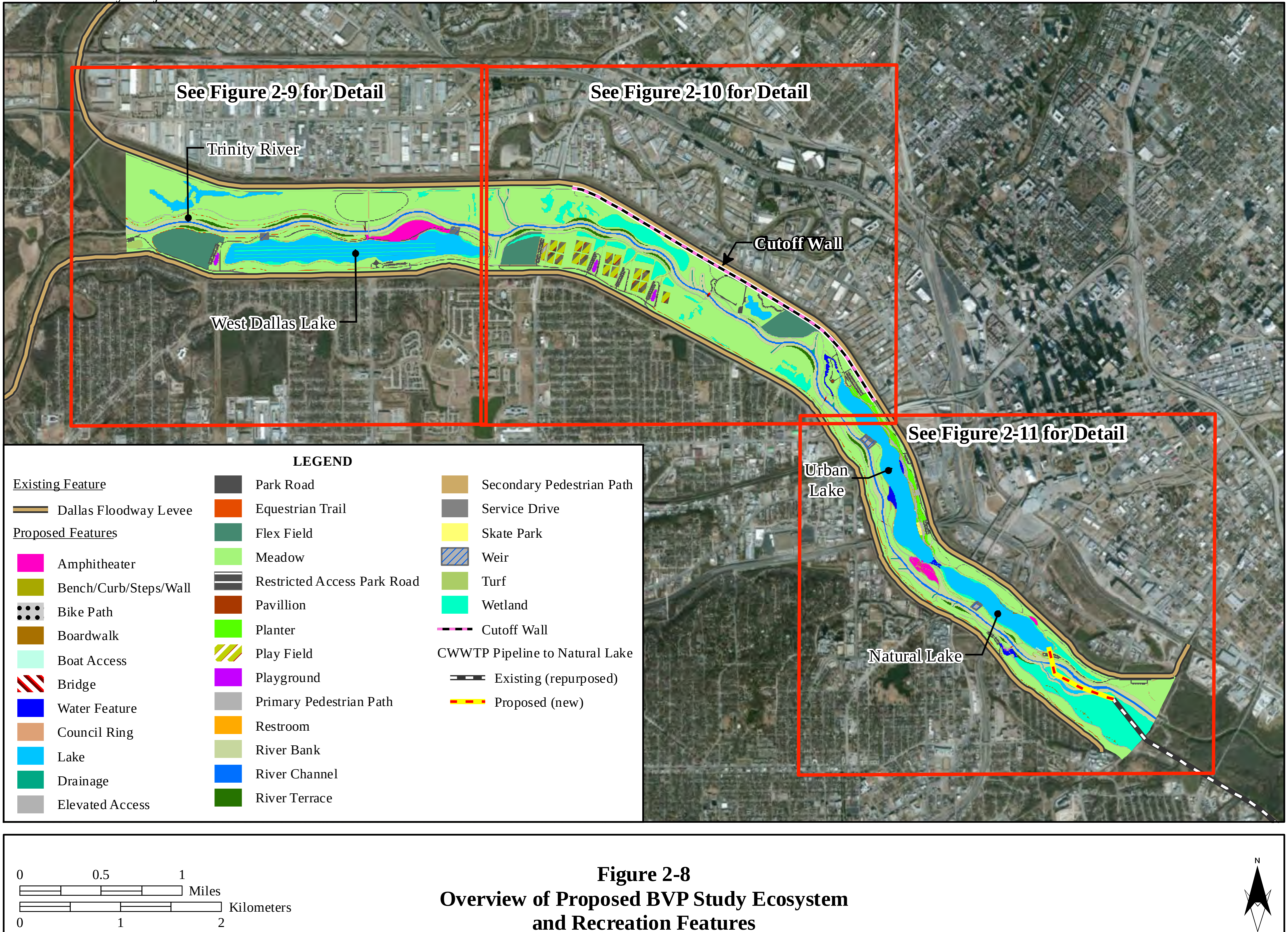
Non-federal IDP improvements include sump improvements that are recommended by the Phase I/Phase II IDS Studies, but that would be implemented by the City of Dallas. The propose sump improvements would enhance drainage between the Delta and Pavaho sumps, and the Eagle Ford and Trinity-Portland Sumps (refer to Figure 2-7).

Delta/ Pavaho Sumps Improvement. A 10-foot by 8-foot culvert would be constructed under Canada Drive (Figure 2-7) (URS 2009d).

Eagle Ford/Trinity-Portland Sumps Improvement. The existing gated opening between the Eagle Ford and Trinity-Portland Sumps would be replaced with a 6-foot-by-6-foot gated conduit structure to facilitate flow between the two sumps during high-water conditions (refer to Figure 2-7) (URS 2009c). These improvements may require the City to purchase three privately owned parcels of land; each parcel currently contains a single family residence. The current design indicates the proposed sump improvements may be completed without impacting the parcels; however, the City of Dallas may choose to pursue the purchase the lands following coordination with the property owners, if recommended in later design refinements.

2.3.2.3 Remaining BVP Study Ecosystem and Recreation Enhancements

Proposed BVP Study Ecosystem and Recreation features would accommodate a variety of activities, from rest and relaxation in quiet nooks to large open areas for crowds to watch Fourth of July fireworks to bird-watching in secluded wetlands to world-class rowing aligned with the downtown skyline. In developing the proposed mix of active, passive, urban and nature-based uses, the BVP Study Ecosystem and Recreation features aim to restore Floodway ecosystems and increase recreational opportunities without reducing the level of riverine FRM. All of the proposed features are expected to result in an increase in activity in the Floodway and adjacent areas. For example, the BVP Study predicts a peak event usage within the Floodway of approximately 175,000 people and a typical weekend usage of approximately 3,300 people, across all key features (City of Dallas 2009b).



GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013b

Figure 2-8
Overview of Proposed BVP Study Ecosystem and Recreation Features

In identifying and implementing ecologically sound ways to use available water, the BVP Study Ecosystem Restoration features would maximize ecosystem benefits as well as provide secondary positive recreational benefits. The BVP Study Recreation Enhancement features would increase the overall recreational opportunities in and around the greater Dallas Floodway area. Figure 2-8 presents an overview of the proposed BVP Study Ecosystem and Recreation features and Figures 2-9 through 2-11 provide details of the features by Floodway segment. For detailed depictions of the BVP Study Ecosystem and Recreation features, refer to the figures contained in Appendices D (*Proposed Action: Design Anticipating Potential Trinity Parkway Construction*) and E (*Proposed Action: Design without Potential Trinity Parkway Construction Anticipated*). Appendix F, *Differences in BVP Study Ecosystem and Recreation Features between Designs*, presents the differences in BVP Study Ecosystem and Recreation features between the two design variations.

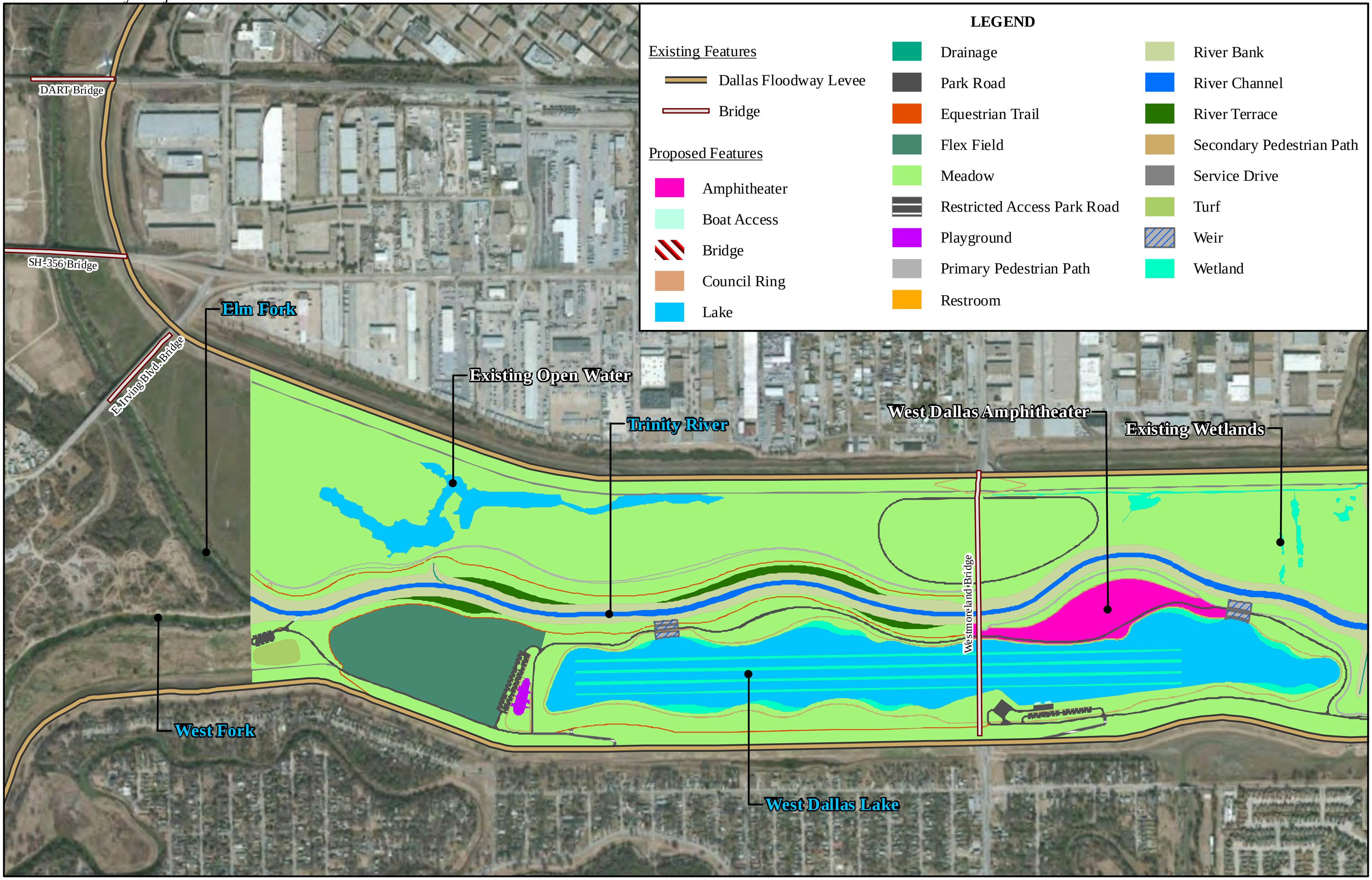
The BVP Study Ecosystem and Recreation features under Alternative 2 consist of the ecosystem and recreation features as proposed under the BVP Study and as presented in this section. Where the MDFP and IDP features are unchanged between the designs being considered, the BVP Study Ecosystem and Recreation features do have minor differences, reflecting the potential presence or absence of the potential Trinity Parkway from the Dallas Floodway. Where there are differences anticipated between the two designs, they are noted within the feature description. A summary of these differences is found at the end of this discussion. These differences are also highlighted in the Appendix F figures.

Lakes

The BVP Study calls for the creation of three off-channel lakes: the paired Natural and Urban Lakes and the West Dallas Lake. The Natural and Urban Lakes would collectively cover approximately 134 acres, with an additional approximately 8 acres of fringe emergent wetlands surrounding the lakes. The West Dallas Lake would cover approximately 123 acres and include an additional approximately 7 acres of fringe emergent wetlands surrounding the lake. In addition, floating wetlands (classified as “open water” habitat) would be installed and used as lane markers for rowing competitions in the West Dallas Lake. All three lakes would be developed to encourage lake recreation, including canoeing, sailing, rowing and fishing. Between the lakes within the Floodway, the BVP Study proposes waterfalls, pedestrian overlooks and wildlife viewing areas. As more people are anticipated to live, work, and play next to the lakes’ zone than any other stretch of the proposed BVP Study features, the lakes have been designed to withstand flood events while minimizing the maintenance associated with urban-oriented features such as shelters, lighting, paving, planters, and furnishings (City of Dallas 2009b). There is no difference in the proposed lake features between the two design variations being considered.

Natural and Urban Lakes

With a diverse array of proposed features, implementation of the BVP Study Ecosystem and Recreation features is expected to attract visitors year-round, from sunup to sundown, especially around the Natural and Urban Lakes. The lakes and their surrounding features – the Downtown Overlook, Promenade, Central Island and Lakes Isthmus – are envisioned as the centerpiece of the BVP Study. The Urban and Natural Lakes are predicted to draw more than half of the planned users, an estimated 85,000 people during a fair weather holiday weekend and approximately 1,600 people during a typical weekend (City of Dallas 2009c).

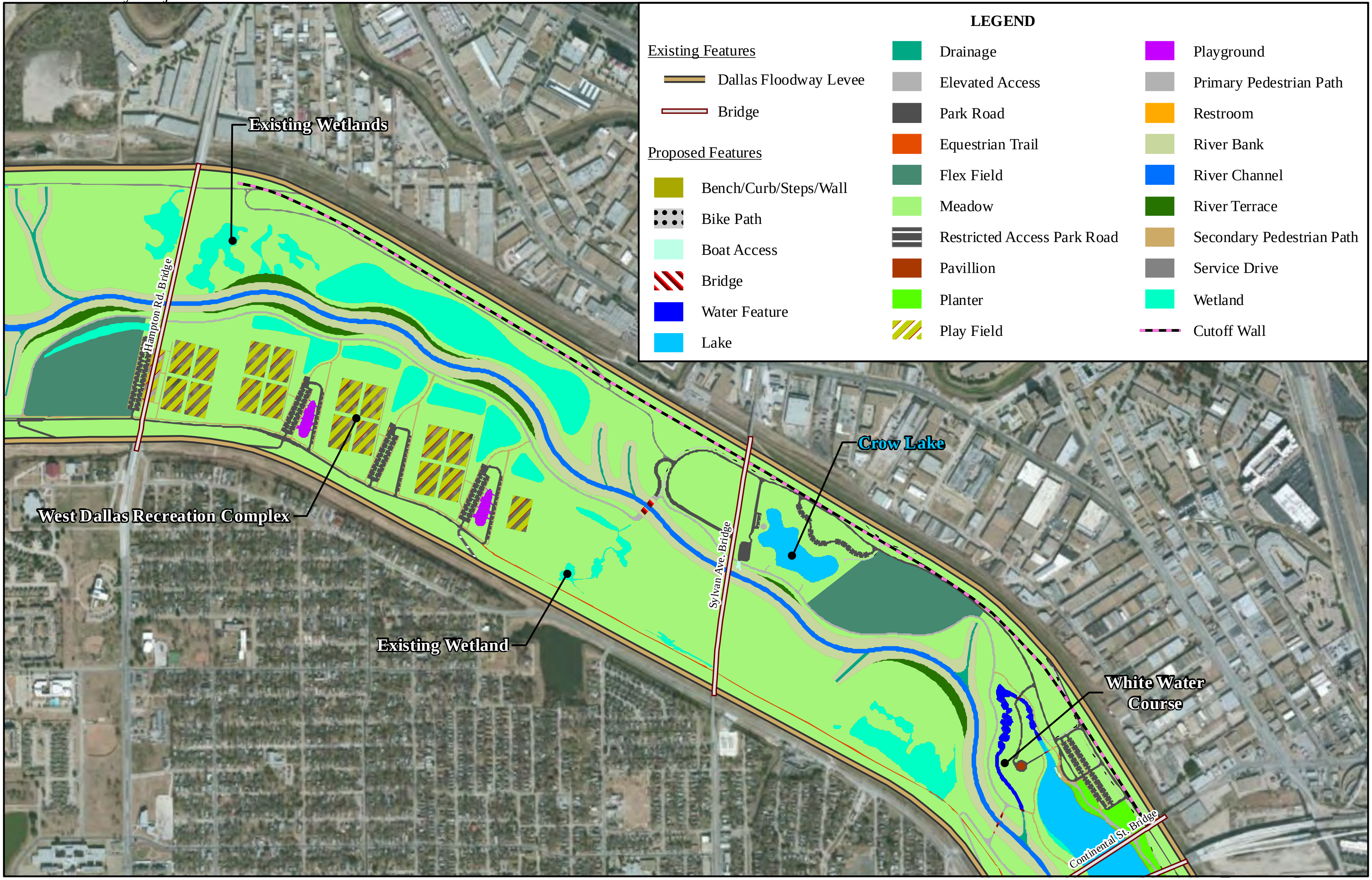


0 0.25 0.5 Miles

0 0.5 1 Kilometers

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013b

Figure 2-9
Proposed BVP Study Ecosystem and Recreation Features: Northern Segment

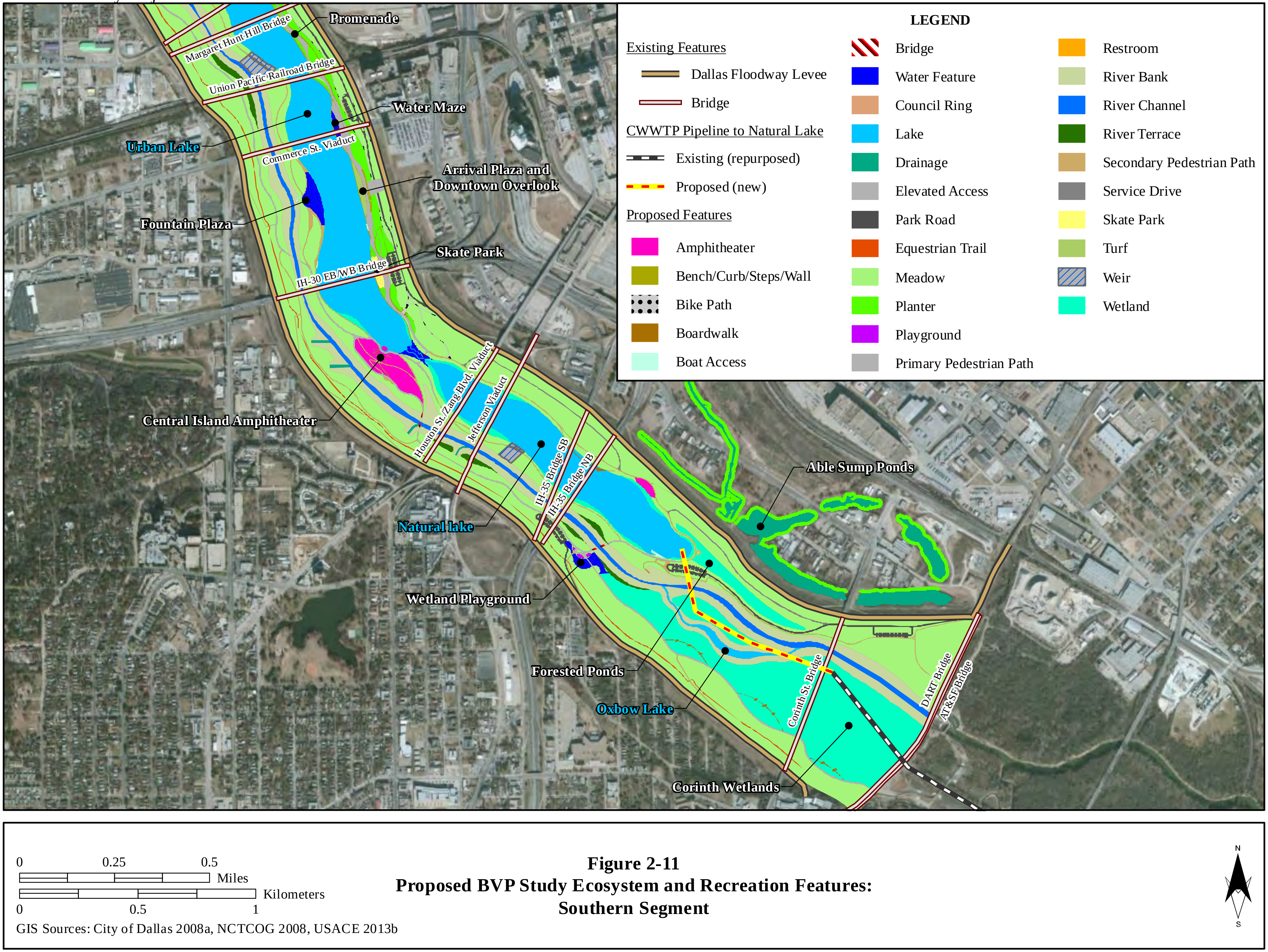


0 0.25 0.5 Miles

0 0.5 1 Kilometers

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013b

Figure 2-10
Proposed BVP Study Ecosystem and Recreation Features: Middle Segment



GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013b

Figure 2-11
Proposed BVP Study Ecosystem and Recreation Features: Southern Segment

The estimated storage volumes for the Natural and Urban Lakes are 630 and 1,020 acre-feet respectively. The two lakes would be connected by a narrow strait referred to as the “isthmus.” Treated effluent from the Dallas Water Utility’s Central Wastewater Treatment Plant (CWWTP) would be conveyed to the south end of the Natural Lake through a combination of an existing repurposed (7,200 linear feet) and proposed (6,750 linear feet) 60-inch diameter pipe. The treated effluent would flow north through the isthmus into the Urban Lake, through the Urban Lake and through an outlet structure at the north end into an outlet channel, and through the outlet channel into the Trinity River. On average, up to 60 million gallons per day of treated effluent would be supplied to the lakes (City of Dallas 2009c).

The proposed lakes would be permitted by Texas Commission on Environmental Quality (TCEQ) as impoundments and meet the current state and federal guidelines for definition of a dam (City of Dallas 2009c). The bottom of the lakes would be lined with clay at a minimum thickness of 18 inches and a maximum thickness of 30 inches.

Natural Lake

The Natural Lake would be located to the southeast of the Urban Lake. It is intended to provide a water recreation experience of a more natural character than the developed Urban Lake. The Natural Lake would be approximately 50 acres in size with an additional 7 acres of wetlands around its shores. The lake’s water level would remain constant at an elevation of 402 feet and provide a depth of approximately 12 feet, as maintained by an overflow weir. The lakeshore would have walking and biking paths and picnic or nature observation areas. Trees, grasses and other vegetation would create habitat for birds and wildlife. Water sports would include canoeing and kayaking, fishing and other family outdoor activities.

Urban Lake

The Urban Lake is proposed to be approximately 84 acres, with an additional 2 acres of wetlands around its banks. The Urban Lake would be approximately one mile in length and average 800 feet in width. The lake would be 12 feet deep, and water elevation would average 399 feet. The Urban Lake would be the most developed of the three lakes, and would be edged with a formal promenade along the downtown side of the lake. The promenade would connect directly to the pedestrian plaza deck at Reunion, so visitors could walk from the Central Business District of downtown Dallas down to the promenade along the Urban Lake. The opposite shore of the Urban Lake would be more “natural” in character. Paddleboats, canoes, kayaks, recreational rowing and small sailing craft are expected to be typical water uses.

The Urban and Natural lake overflow weirs would be armored and controlled as dictated by hydrologic requirements. The overflow weirs would be set at an elevation of 404 feet and placed under existing and proposed bridges to limit hardscape areas of the Central Island.

West Dallas Lake

The West Dallas Lake is intended to provide water recreation and outdoor activity areas appealing to residents of adjacent neighborhoods. The approximately 123-acre lake would provide recreational opportunities for canoeing and walking through an additional 7 acres of wetland habitat. The lake would be a narrow body of water approximately 1.5 miles long and 18 feet deep. The lake would range between 600 to 700 feet in width and the estimated storage volume would be approximately 1,730 acre-feet. Water levels would be maintained between 12 and 18 inches from the top of bank by way of two spillways, one at each end of the lake. Filling water would be supplied to the lake during overflow flood events, when the Trinity River stage exceeds an elevation of 405 feet. Once the lake has been filled and when the Trinity River is below the spillway overflow elevation, make-up water for seepage and evaporation losses would be supplied to the lake by pumping water from either the Trinity River or from groundwater into the lake via a small pump station (City of Dallas 2009c).

The West Dallas Lake would be large enough to support an Olympic-sized seven-lane rowing course and would be shielded from crosswinds by the West Levee. In addition to attracting local use, the West Dallas Lake rowing course would be of sufficient size to host national as well as international events. The lakeshore would be designed with periodic overlooks, picnic areas and recreational access. The BVP Study predicts a peak event usage of approximately 48,000 at the West Dallas Lake, with a typical weekend usage of approximately 600 people (City of Dallas 2009c).

The location of the proposed West Dallas Lake represents a large, viable source of suitable material for levees. The borrow pits identified for the FRM levee raise, side slope flattening, and the potential Trinity Parkway project are within the footprint of the proposed West Dallas Lake. After the excavation of material, the West Dallas Lake would have the majority of its footprint excavated. As part of the Proposed Action, the necessary upgrades to the borrow pits would occur to make it a functioning lake within the Dallas Floodway Levee System. These upgrades would include the installation and construction of a clay liner, earthen berms, overflow weirs, lake drain lines, and a small pump station. In addition, surface treatments would be applied to the West Dallas Lake and its immediate surroundings to include erosion protection, landscape features, and other lake edge treatments.

Wetlands

Floodway Wetlands

The BVP Study would improve habitat quality by both constructing new wetlands and enhancing existing wetlands within the Dallas Floodway. The wetland environments would include newly constructed floodway wetlands, forested wetlands, and marshland wetlands. These environments would also include the enhancement/restoration of existing emergent wetlands already occurring in the floodplain today, resulting in beneficial impacts to surface water resources. Stormwater flowing into the floodway wetland areas would be pre-treated prior to entering these wetland areas. The combination of these pre-treatment measures and the floodway wetland features would play a role in improving overall long-term water quality by removing nitrogen, phosphorus, sediment, and other pollutants from urban runoff, while also increasing both the amount and quality of plant and wildlife habitat in the Floodway. The wetlands would receive supplemental water from the interior drainage pump station outfalls, and from recycled water from the CWWTP.

The design that does not anticipate the construction of the potential Trinity Parkway within the Floodway proposes as much as 5.3 acres more of floodway wetlands than are proposed in the design variation that does anticipate construction of the potential Trinity Parkway.

Marshlands

The marshlands include the wetlands discussed as being incorporated into the design of the West Dallas and Natural Lake. These wetlands would be bordered with boardwalks for recreational and educational use. The marshlands would be planted with species native to North Texas, with appropriate species planted at appropriate levels along the slopes. Invasive species would be treated immediately through either biological or manual control. If chemical control is required, only herbicides approved for aquatic environments would be used. There is no difference in the proposed marshland features between the two design variations being considered.

Athletic Facilities

The BVP Study proposes a substantial amount of managed playing fields, consisting of approximately 115 acres of playing fields for soccer, softball, and groomed "flex" fields for multiple sport usages. The BVP Study predicts a peak event usage of approximately 14,000 people at the athletic fields, with an average weekend usage by approximately 900 people (City of Dallas 2009b). Fields would be accessed from the internal road system.

Event and concessions facilities are also proposed as part of the BVP Study. The Central Island Amphitheater would provide a 12-acre facility of sloped turf and stage structure with utilities, concession pads for seasonal or permanent use, floating concessionaire options on the lakes are all proposed, as are supporting facilities, such as restrooms and storage spaces. The West Dallas Amphitheater would be located adjacent to a 42-acre turf parking area that has an estimated capacity of 4,500 vehicles. Performance and crowd service requirements (e.g., power, lighting, concessions) would be provided by the licensed and permitted event organizers. A third amphitheater (i.e., the Natural Lake Amphitheater) would be constructed along the north side of the Natural Lake, to the east of the IH-35E Bridge crossings of the Floodway. This amphitheater would be substantially smaller than both the West Dallas Amphitheater and the Central Island Amphitheater, and would be provided only as part of the without potential Trinity Parkway design variation under Alternative 2.

Flex Fields and Playgrounds

The hub of the active recreation program - including sports-related or athletic activities - would be the West Dallas Recreation Fields, an approximately 78-acre area designed to accommodate up to 17 regulation-size soccer fields, adaptable for lacrosse, field hockey, rugby, cricket, ultimate frisbee, football, and any other field sport. This area would also feature two playgrounds. Two large areas designated as flex space would provide further venues for field activities requiring large amounts of maintained open space. Another component of the active recreation program is a proposed Skate Park located under the IH-35 Bridge.

"Flex" spaces would be made of managed turf that would be available without reservation and in multiple ways. The largest of these would be located north of the West Dallas Lake and the West Dallas Recreation Complex. Other flex spaces are proposed south of Trammel Lake Park and within the Oak Cliff Parkland. Generally, these areas would be sited above the 2-year flood elevation to reduce the frequency of maintenance.

The design that does not anticipate the construction of the potential Trinity Parkway within the Floodway proposes as much as 10.3 acres more flex field areas and 29.5 acres less meadow areas than are proposed in the design that does anticipate construction of the potential Trinity Parkway.

River Access Points

Water recreation is a major component of the BVP Study. The BVP Study proposes a 12-mile river run between boat ramps at the confluence and the Loop 12 boat launch in the Trinity Forest. A 4-mile long boating loop would be available first northward through the Urban and Natural Lakes then southward through the stretch of river parallel to both lakes. Water access would also be provided to the West Dallas Lake, primarily for rowing. Portaging paths would be concrete, ribbed or heavily textured with a 2% cross-slope minimum to facilitate drainage and washing of sediment.

Three boat ramps are proposed: (1) improving the existing Sylvan Bridge ramp, (2) a new confluence boat ramp facility, and (3) a Loop 12 boat ramp (within the Trinity Forest). At these facilities, trailer parking would be provided. Trailer ramps would be 24-feet wide and would be heavily textured or have ribbed concrete.

Four docks are proposed: (1) the standing wave facility at Corinth Street near Moore Park and the Trinity River, (2) the Natural Lake Headwaters, accessible from the Industrial/Martin Luther King (MLK), Jr. Boulevard, (3) the promenade facility adjacent to the lake outlet channel within the white water run, accessible from the Sylvan gateway, and (4) the rowing dock on the West Dallas Lake, accessible from the Westmoreland and Hampton Gateways. Non-trailer access ramps would be concrete, 12-feet wide, and stepped. Step structures would be designed to resist higher-frequency flood events. Boat tie-ups in the form of posts or rings would be made available at drop-off points.

There is no difference in the proposed river access points between the two design variations being considered.

Venues

The largest dedicated gathering venue is the proposed West Dallas Amphitheater facing the West Dallas Lake. This venue would be able to accommodate approximately 25,000 people for major outdoor concerts. A smaller staging area accommodating between 2,000 and 3,000 people is proposed at the Central Island Amphitheater near the Lakes Isthmus. The Lakes Isthmus would also be designed as a gathering space. Smaller gathering venues include the Group Pavilion on the north end of the Urban Lake and the Fountain Plaza across from the Arrival Plaza on the Urban Lake.

The design that does not anticipate the construction of the potential Trinity Parkway within the Floodway proposes one additional amphitheater than is proposed in the design that does anticipate construction of the potential Trinity Parkway. The third amphitheater would be associated with the Natural Lake.

General Features

Public Roads and Parking

Over 14 miles of roads are proposed. The roads would consist of two lanes, 20 feet in width, paved in concrete of sufficient thickness to support heavy construction and maintenance vehicles. The roadway shoulders would be a flush, 4-foot reinforced turf band with 6- by 24-inch-high bollards placed 5 feet on center. The bollards would be made of recycled materials. Removable bollards and/or gates that are accessible to both emergency services and maintenance personnel would be provided every quarter-mile along both sides of the road. An approximately 5-mile long service drive would also be established, as would an approximately 1-mile long elevated road.

Approximately 1,900 parking spaces divided between 12 paved lots have been identified. Approximately 500 supplementary roadside parking spaces (parallel) are also proposed along roads. To serve major events and gatherings, an additional 6,200 overflow parking spaces are proposed in two separate meadow areas, the majority near the potential West Dallas Amphitheater. Stormwater from the lots would be directed to adjacent bio-swales.

Public vehicle entry points would include Westmoreland Bridge, Hampton Bridge, Sylvan Bridge, Delaney Drive, Moore Park, Riverfront Boulevard and MLK Jr. Boulevard. These entry points would be designed to have signalization and turning lanes as required by the City of Dallas.

Parallel parking is proposed for discrete sections of the road. Roadside parking bays would be reinforced turf; however, they would be edged with 6-inch raised concrete curbs designed with gaps to facilitate the flow of stormwater to adjacent bio-swales. Parking lots would be placed in a raised bench to allow stormwater drainage to exterior bio-swales. Parking lots would be paved in concrete, and a tree would be planted every five stalls. Overflow parking areas would be pervious and stabilized with a subsurface geo-textile material.

The design that does not anticipate the construction of the potential Trinity Parkway within the Floodway proposes as much as 2.2 miles of additional park road and 2 additional acres of parking throughout the Floodway than is proposed in the design that does anticipate construction of the potential Trinity Parkway.

Access

In order to improve the accessibility of the Dallas Floodway to the surrounding populace, the BVP Study proposes several motorized and non-motorized access points. Access points would be established approximately three-quarters of a mile apart to maximize flexibility, connections, and continuity of access into the Floodway by all users. Access points would provide easy access and linkages to neighborhood parks, facilities and citywide and region-wide trail systems. No vehicle access across the levee is planned at any of these access points. In addition, approximately 5 miles of internal roads running the length of the Floodway, and up to 7 acres of distributed parking areas within Floodway, would be developed.

Upon implementation, people would be able to access recreational features at numerous points via foot, bike, automobile and public transit. With so many access points distributed throughout the Floodway, the features would be easily accessible from both the Downtown Dallas and Oak Cliff sides, to include having amenities located throughout so that all adjacent neighborhoods would have sufficient and equitable recreational resources within easy reach.

The design that does not anticipate the construction of the potential Trinity Parkway within the Floodway proposes four additional access points than are proposed in the design that does anticipate construction of the potential Trinity Parkway.

Regional Gateways

Regional Gateways are major points of entry designed for both motorized and non-motorized access. Aspects associated with regional gateways would include external and/or internal parking, restroom facilities, information kiosks and directional aides and, potentially, concessions. All regional gateways would be served externally by public transit to facilitate public attendance at large festivals and events. The proposed Regional Gateways include Westmoreland, Hampton, Sylvan, West Dallas/Continental South, Continental North, Downtown Overlook, Houston Street Ramp, Riverfront/MLK Jr. Boulevard, and Moore Park. There is no difference in the proposed Regional Gateways between the two design variations being considered.

Community Gateways

Community Gateways would provide linkages from community facilities to the Floodway and would be designed for both vehicles and pedestrians. Aspects associated with community gateways would include: access to nearby external parking or internal parking, information kiosks, and directional aides. The proposed Community Gateways include Mockingbird, Charlie Pump Station, Baker Pump Station, Oak Lawn Commerce/Fast Track Overlook, Oak Cliff/Founders Park, and Eloise Lundy. There is no difference in the proposed Community Gateways between the two design variations being considered.

Neighborhood Gateways

Neighborhood Gateways would offer entry for pedestrians and cyclists to access the Floodway. Pedestrian/Cycle gateways provide community and neighborhood connections through nearby access to city parks, city and regional trails and schools. Aspects of pedestrian/cycle gateways would include information and educational kiosks or signage that welcomes the neighborhood user into the park. The proposed Neighborhood Gateways include Pluto/Bernal West, Westmoreland South, Inwood, Pavaho, Coronet, Coombs Creek, Greenbriar, Cedars West, and Corinth. There is no difference in the proposed Neighborhood Gateways between the two design variations being considered.

Pedestrian Amenities (Trails, Boardwalks, and Sidewalks)

A system of primary and secondary trails totaling approximately 30 miles in length is proposed to run through the Floodway, meandering between the Oak Cliff and the Downtown sides and crossing the Trinity River at five key points. The primary trail would provide access for all non-motorized users including pedestrians, cyclists, skaters, and wheelchair users. The primary trail would be 20 feet wide at its narrowest, expanding up to 25 feet in places and/or in stretches and becoming divided into 10-foot lanes separated with a planted median. This trail would also serve as a maintenance and emergency access road as a supplement to the roads. There is no difference in the proposed primary trails between the two design variations being considered.

Secondary trails would be 10- to 12-feet wide. Users are expected to include pedestrians, cyclists, skaters, wheelchair users, and other mobility assistance device users. The secondary trails would also be used for maintenance vehicle access as well as emergency fire, ambulance, and police access. The secondary trail would rest on a 6:1 sloped berm at the 2-year flood elevation. The East Levee-top trail is proposed for cycle transportation uses and would be designated as a component of the Regional Veloweb Multiuse Bikeway. It would connect to all intersecting on-street bike route streets. The levee-top trail would be 12 feet wide, paved in concrete 6 to 9 inches thick, with 2 feet wide compacted gravel shoulders, for a total width of 16 feet. The design that does not anticipate the construction of the potential Trinity Parkway within the Floodway proposes 0.6 miles less secondary trails than are proposed in the design that does anticipate construction of the potential Trinity Parkway. However, the design that does not anticipate the construction of the potential Trinity Parkway within the Floodway proposes 3.4 miles of dedicated bike paths that are not included in the design that does anticipate construction of the potential Trinity Parkway.

An equestrian trail totaling approximately 8 miles would be a single-user bidirectional trail except in constrained areas, trail junctions, bridges, and underpasses. One-way trails would be 5-feet wide, and two-way trails, 10-feet wide. The tread would be stabilized dirt, base rock, crushed rock, or geo-textile material with overlying pea gravel. The equestrian bridges would maintain a tread and shoulder width, and have flat, solid concrete or wood decks that do not bounce. The tread and shoulder width of the primary trail would be maintained. Railings would be 54 inches high. Bridge approaches would also have extended protective railings. There is no difference in the proposed equestrian trails between the two design variations being considered.

Forested Ponds

Constructed Forested Ponds are proposed to bring shade and cooling to the heart of the Floodway, especially alongside the edge of the Urban Lake Promenade. They also would function as biofiltration areas capable of absorbing lake nutrients. These constructed wetland ponds would feature native bottomland hardwoods and other water-tolerant herbaceous plants capable of high rates of biofiltration.

Forested Ponds along the Urban Lake would be periodically filled with water from the bottom third of the Urban Lake. Pumped from the lake under the Promenade, lifted up and over the adjacent water wall, the water would first be aerated by the water wall and then further filtered by the ponds before finally returning to the Urban Lake. Along the Natural Lake, the Forested Ponds would be designed to receive, retain and filter stormwater runoff from the bridge crossings proposed in other projects. Filtered water would return to the Natural Lake.

There is no difference in the proposed Forested Ponds between the two design variations being considered.

Lighting

Illuminated areas would be selective and use cutoff optics to minimize light pollution and glare. Areas of large-scale illumination would be zoned so that lighting fixtures required for that evening's activities could be separately selected. The lighting layout would take into account safe travel as well as the importance of accenting gathering spaces for small group activities. Lighting would differ between the two design variations. The lighting would be designed to provide for safety along roads and trails, as well as serving the gathering spaces that differ between the two alternatives.

Restrooms

Due to the potential impact of flood events on restroom structures, the BVP Study proposes that restrooms consist of mobile or removable units, attached to permanent water and sewer utility lines. Both potable water and sewer pipes would be disconnected in preparation for removal of the units to higher ground prior to flood events. The structures would be at a 2-year flood elevation or higher.

The restroom facilities would be strategically placed in high-traffic areas throughout the park, located wherever possible near roadways and parking areas for easy access and servicing. There are 18 total proposed pad locations and hookups. While hookups and designated restroom areas have been identified in the Proposed Action, concessionaires provide amenities such as toilets and wash stations for your hands; this approach is successfully used at other large events in and around the City, such as the Byron Nelson Championship.

The units would be potentially transported from one site to another depending on need. For example, no units would be permanently located at the potential West Dallas Lake Amphitheater, which would remain largely unused between gatherings, and therefore pose a maintenance and security burden. For performances and such, units could be brought to the applicable amphitheater from other locations, or reserve units would be brought in from storage. Permanent restroom facilities would be provided on the Continental Bridge, Promenade and the Downtown Overlook, above flood levels.

There is no difference in the proposed restrooms between the two design variations being considered.

<u>Able Sump Pond Enhancements</u>

Under the Proposed Action, the existing Able Sump Ponds (in the Lower Cedar area) would be enhanced to provide recreation opportunities. The enhancements would consist of installing bulkheads at the pond edges, and pedestrian trails and related landscaping adjacent to the ponds. Landscaping would include a mix of native trees and aquatic plantings. The proposed enhancements would complement the BVP Study features (Halff Associates 2008). There is no difference in the proposed Able Sump Pond enhancements between the two design variations being considered.

<u>Operation and Maintenance</u>

Operations and maintenance of the proposed features would be the same between the two design variations, but adjusted to reflect the variations in features. For example, the design that does not anticipate the construction of the potential Trinity Parkway would have more road maintenance, as it proposes more road surface.

Operation

Operations during flood events would depend largely on existing and predicted hydrologic conditions, as communicated via National Weather Service and USACE operations centers. Based on forecast flood stages, different measures would be undertaken to best maintain the features and ensure the public's safety. Post-flood, and as the river stage begins to recede, flooded areas of the Floodway would remain closed until inspected by City personnel for hazardous or unsafe conditions. If hazardous or unsafe conditions are noted, then the affected area would be posted as off limits until the hazard or unsafe condition is removed. As the river stage recedes, the Urban and Natural Lakes drain lines may be opened as necessary in order to flush river water before the sediment load is deposited in the lakes. Prior to reopening the lakes for primary contact activities such as boating, water quality monitoring would occur as outlined in the Urban and Natural Lakes Management Plan to ensure that bacteria levels are within water quality standards (City of Dallas 2009c).

Maintenance

Maintenance of the proposed project components would be the responsibility of the City of Dallas. It is estimated that the Natural and Urban Lakes would represent the bulk of the capital and maintenance costs; however, this is not anticipated to be a disproportionate distribution of resources as the greatest concentration of future urban development is anticipated to rise in close proximity to the lakes, both on the Downtown Dallas and Oak Cliff sides of the Floodway.

Because the proposed BVP Study features would be constructed within the Dallas Floodway, a higher level of maintenance and repair would be required than for a comparable amenity that is not subject to periodic flooding. The following describes general cleanup and maintenance requirements and expected return periods for various levels of damage that would apply to the lakes and associated features:

1. Little to No Damage. For flood levels that do not exceed elevations of 403 and 405 feet, the elevation of the proposed overflow spillways at the Urban and Natural and the West Dallas Lakes respectively, and do not overtop the berms separating the lakes from the river, the facilities and operations within the lakes areas are expected to experience little to no damage or interruption. Any time the river overflows its banks into the Floodway; however, there would be cleanup required on the river side of the lake berms.
2. Minor Maintenance. For flood levels that exceed elevations of 403 and 405 feet at the Urban and Natural and West Dallas lakes respectively, but have less than a 5-year return period, features in the lakes areas would be designed so that only minor structural damage would be expected. Some erosion along the lake berms, walkways and access features would be expected, especially where river flows and overflow velocities are concentrated. These areas would be repaired immediately after the flood recedes.
3. Minor Structural Damage. For flood levels that range between the 5- and 25-year return periods, some damage would be expected due to debris related impacts and buildup. In addition to minor maintenance described above, replacement of some non-critical components may be necessary

and sediment removal and cleanup of sediment from areas such as the Promenade may be required in order to restore normal functions in the impacted areas.

4. Moderate Structural Damage. For 25- to 50-year return period floods, damage to or loss of some non-critical components and minor support infrastructure would be expected. Sediment cleanup for areas outside of the lakes would be necessary and some sediment management procedures, such as lake water purging before sediment settles out or dredging after the event concludes, may be required to manage sediment accumulation inside the lakes.
5. Significant Structural Damage. As floodwaters rise to the 50- to 100- year level, greater water velocities and increased debris loads would result in greater damage to important features. Sedimentation may be substantial in certain areas such as parking lots, both inside and outside the lakes, especially for events with long durations. Portions of the Floodway would need to be closed as repairs and cleanup are performed. Some non-critical features would need to be repaired and/or replaced.
6. Major Damage. For major flood events with return periods between 100 years and the SPF, it is anticipated that a number of critical and important non-critical features would receive a significant amount of damage requiring repair or replacement. Large accumulations of sediment may occur requiring Floodway closure for sediment removal and repair.
7. Potential Loss. Storms with return periods greater than the SPF could result in failure or loss of BVP Study features.

Post flood, sediment and trash removal from the Trinity Lakes area would be a major operational item. Removal of trash from within the lakes would require workboats that can be used to move trash nets and log booms around the floating material, to contain and move the material to the shore, so it could be removed from the lakes onto trucks for transport to landfill disposal areas. This work would require mobilization of workboats, and log booms to the lakes after each significant flood. Bottom drag nets also may be necessary to remove semi-buoyant debris.

Removal of sediment deposition would be necessary whenever the river level rises above the natural riverbank. The volume of sediment is expected to be somewhat proportional to the height of the flood above the riverbank and would be concentrated around impediments to flow, such as vegetation, and in areas that are naturally occurring low velocity areas, as well as in flow recirculation zones typically found at both expansions and contractions of the Trinity River channel. The sediment is expected to be fine-grained, plastic, silty/clayey soils mixed with fine sand. Clean up and maintenance following low-return period events would likely be performed by City personnel. Larger crews required for cleanup following more severe flood events may include volunteers and personnel from public agencies such as the National Guard.

The cleanup of trash and debris would be necessary whenever the river level rises above the channel. The volume of trash is expected to be large and generally proportional to the height above the flood above the riverbank. Trash would vary from bottles, plastics and small woody debris, to other floating debris such as building materials, trees, limbs, possibly animal carcasses, etc. Clean up would generally require hand labor, plus machines for removal of sediment and larger pieces of debris.

A Health and Safety Plan identifying potential safety hazards and providing procedures to mitigate for these would be developed and procedures reviewed with all cleanup personnel prior to cleanup operations. Health and safety hazards associated with the site following a flooding event may include unstable areas, biological hazards such as snakes and poison ivy, and hazardous debris delivered to the area by floodwaters.

Summary of Design Differences

Table 2-3 summarizes some of the notable differences in the proposed non-federal BVP Study features under the two design variations being evaluated. Figures F-1 through F-4 in Appendix F depict the differences in the BVP Study features between the two design variations.

Table 2-4. Comparison of Notable Non-federal BVP Study Ecosystem and Recreation Features under the Design Variations

Feature	*Design Anticipating Parkway Construction*	*Design Not Anticipating Parkway Construction*	*Change (from the "With Parkway" to the "Without Parkway")*
Dedicated Bike Path	0 miles	3.4 miles	+ 3.4 miles
Flex Fields	77.8 acres	88.1 acres	+ 10.3 acres
Amphitheaters	2	3	+ 1
Meadow	1,259.5 acres	1,230.0 acres	- 29.5 acres
Park Road	9.6 miles	11.8 miles	+ 2.2 miles
Planter Boxes (raised vegetation)	4.9 acres	14.7 acres	+ 9.8 acres
Secondary Pedestrian Path	17.5 miles	16.9 miles	- 0.6 miles
Wetlands	140.0	145.3	+ 5.3 acres
Parking Area	17.75 acres	19.75 acres	+ 2 acres
Number of Access Gateways	25	29	+ 4

Of note, all excavation for the proposed BVP Study lakes would be completed under the design that does not anticipate the construction of the potential Trinity Parkway within the Floodway. This design would also result in more parking area and four more access gateways (two additional vehicle and two additional pedestrian/bicycle gateways) to the Floodway. The proposed Urban, Natural, and West Dallas Lakes would be the same size and capacity under both designs considered.

2.3.2.4 Anticipated Project Implementation Timeline

Phasing

As would be expected with a project of this magnitude, implementation of the Proposed Action would occur in stages and would involve extensive coordination to minimize construction conflicts as discrete features are constructed. Several variables and constraints would be considered when implementing the Proposed Action. These include site access, funding, utility relocations, permitting, all of which must be balanced with the desire to implement the project in the shortest amount of time to minimize the impact to local residents and business, and environmental resources.

As analyzed in this EIS, implementation of the Proposed Action would occur over an approximately 15-year period, beginning in calendar year 2015. This assumes that capability level funding would be provided. If funds are not provided, then construction could extend out 20 to 25 years or more. Due to the number of interests, funding constraints, and desire to minimize impacts, the implementation plan would sequence the project in a way that allows construction to start on large features (i.e., the river relocation) while other features are still in design phase. It is anticipated that this method of project sequencing would result in multiple design contracts, which would lead to multiple construction packages occurring at any given time. Individual design contract packages are not yet determined, but a general sequence of construction is provided in the following section.

Construction would begin with utility relocation, followed by the proposed FRM elements. Side-slope flattening would occur concurrently with the levee raises. Coordinating the FRM levee raises with the 4:1

side slope flattening would decrease mobilization costs and limit the number of times the levee would be impacted. The West Dallas Lake would be designed and constructed during this time as well. Material would be removed from the borrow pits and transported via dump truck to the levee raise locations. Temporary construction access roads would be used to facilitate the delivery of material to the levees. Any excess borrow material would be utilized as rough grading for BVP Ecosystem and Recreation features that are not part of Section 5141 of WRDA, as amended. The Corinth Wetlands would be designed and constructed to compensate for Floodway wetland losses as they occur as the FRM elements and some of the BVP Study Ecosystem and Recreation features are constructed.

Overview of Project Phasing

- Construction would begin in calendar year 2015.
- Construction would occur over an approximately 15-year period, but could extend out 20-25 years if funding is not provided as currently anticipated.
- Projects would be sequenced to allow large features to be built first, while others are simultaneously under design.
- Construction would begin with utility relocation, followed by FRM elements.
- The construction of the three lakes (Urban, Natural, and West Dallas) would occur in phases.
- River relocation would be constructed in three, 2 to 3 mile long segments, each lasting approximately 3 years.
- The Corinth Wetlands would compensate for wetland losses from FRM and BVP feature construction.
- Once larger features are finished (e.g., river relocation), the relatively smaller "surface" BVP Study features (e.g., boardwalks) would be constructed by the City of Dallas as funding becomes available.
- The AT&SF Bridge modification is not affected by other Proposed Action elements, thus it would be constructed independently of the rest of the Proposed Action.

The river relocation activities would be implemented in three phases, consisting of 2 to 3 mile long segments. Each of these three phases would begin and end at an intersection with the existing channel. During relocation, proper coordination would be conducted to ensure that the Trinity River would be relocated properly while, at all times, maintaining channel integrity and minimizing the potential for erosion, scour, and sedimentation. Initially, a by-pass channel for the river would be constructed and then the existing channel would be reconfigured. Once reconfigured, the by-pass channel would be abandoned and filled in, and the river would be directed into its new main channel. Within each river relocation segment, it is assumed that the entire area from levee toe to levee toe would be impacted. This correlates to a maximum area of impact associated with any single river section of approximately 1,000 acres and for the smallest segment, roughly 350 acres. The proposed river relocation activities are anticipated to last approximately 3 years. After construction activities are completed, the area would be revegetated.

The construction of the three lakes (Urban, Natural, and West Dallas) would occur in phases as material is excavated for other actions, to include the FRM and potentially the Trinity Parkway. The sequencing of construction for the Central Island and West Dallas Lake berms would depend largely in the way in which the project would be packaged for construction in the future. If the Trinity Parkway project is built within the Dallas Floodway Project, the rough lake geometries would be created by the excavation for borrow material by the Trinity Parkway contractor. The borrow pits created by the Trinity Parkway would be created with stable slopes as directed by USACE (City of Dallas 2009b).

The phasing for relocation of the river channel along the Central Island or West Dallas Lake berms would include complete construction packages for the length of each lake at a minimum, and to an extent where end sections would be securely tied into interim measures, such as the borrow slopes left by the Trinity Parkway construction, if necessary. For example, phased construction packages could include the relocation of the river from Corinth upstream to the vicinity of the lakes isthmus, from the lakes isthmus to Sylvan Avenue, from Hampton Road to Westmoreland Road, and from Westmoreland to the confluence of the Elm Fork (refer to Figures 2-8 through 2-10). Depending on the river reach and actual construction sequencing, cofferdams may be required to maintain a dry working area for construction of the overflow weirs.

Once the large features are finished (e.g., FRM, river relocation, lake excavation), the relatively smaller "surface" treatment BVP Study features would be implemented as funding becomes available. As previously noted, variability in the economy and funding availability may stretch the construction schedule for these feature as far as 20 to 25 years from the date of initial construction. As various phases are constructed, hydraulic analysis would be performed for each phase to ensure that approximate hydraulic neutrality (i.e., the ability of the Floodway to convey the SPF and 100-year flood event would be minimally altered) would be maintained as each phase is completed. Refer to the Feasibility Report (USACE 2014a) for additional discussion of hydraulic neutrality.

In addition, each phase would be developed with ecosystem restoration and enhancement elements incorporated to ensure that there is minimal loss in quality to habitat during construction. Construction of the BVP Study features would involve coordination among the design teams and construction contracts in order to protect already constructed features from construction-related impacts (e.g., downstream sedimentation on completed features).

As described in the preceding paragraphs, for the most part, the Proposed Action elements are linked to one another within the Floodway. The one exception to this is the proposed AT&SF Bridge modifications. The proposed AT&SF Bridge modifications would occur on the far downstream end of the Dallas Floodway and would not be affected by the construction of any other features. Thus, this part of the Proposed Action would be conducted independently of the rest of the Proposed Action.

Construction would only occur when Trinity River flows are at an existing and predicted safe level. Prior to construction, contractors would prepare and submit an EAP. The plans would be implemented in the event of imminent flooding during construction and address emergency actions to be implemented during above normal river stages for the entire length of the project and duration of project construction. Equipment or materials actively used in day-to-day construction work may be left in the Floodway overnight with prior written approval from the City of Dallas Flood Control District. Equipment and materials not approved by City of Dallas Flood Control District would be moved out of the Floodway when not in use and stored in staging areas outside of the Floodway or at a designated location authorized by the City of Dallas Flood Control District.

Estimated Cut and Fill Volumes

A rough grading calculation for cut, fill, and balance was completed for the various overall features of the Proposed Action. This was completed in order to verify, on a rough order of magnitude, the costs assigned to the various project features. In addition, it was used to determine the availability of material for the needs of all the various projects within the Dallas Floodway. Table 2-3 presents the rough estimates of cut and fill for each of the three lakes, the recreation fields adjacent to West Dallas Lake, and the relocation of the Trinity River; all provided quantities are in-situ (no bulking factors have been applied) (USACE 2014a).

Table 2-3. Estimated Rough Quantities of Cut and Fill

Feature	*Cut (CY)*	*Fill (CY)*	*Balance (CY)*
Relocated Trinity River	5,779,290	4,730,048	1,049,242
Oxbow Lake	215,293	51,817	163,476
West Dallas Lake	3,502,620	296,590	3,206,030
Urban Lake	1,850,283	333,200	1,517,083
Natural Lake	667,818	221,982	445,836
Recreation Fields	244,168	1,137,964	(893,796)
Totals	**12,259,472**	**6,771,600**	**5,487,871**

Note: CY = cubic yards.

Table 2-3 indicates a net surplus of approximately 5.5 million cubic yards of material. A large amount of this excess volume could be used by other projects within the Floodway, to possibly include the potential Trinity Parkway. For example, the grading of the neighboring features of the West Dallas Lake and the relocation of the Trinity River can be accomplished using some of the material. The bulk of the material is expected to be utilized in the rough grading of the recreation fields downstream of West Dallas Lake. Any material not used within the Floodway would be transported offsite for disposal at an appropriate facility/landfill. No material would be resold for use outside the Floodway. A detailed earthwork plan for borrow and other excavated material would be developed during design to incorporate all of the various features within the Dallas Floodway that would require earthen material.

2.4 PREFERRED ALTERNATIVE

The USACE has identified Alternative 2 as their Preferred Alternative. Based on the analysis contained in this EIS, Alternative 2 is also the environmentally Preferred Alternative. Chapter 7 presents a summary of the Preferred Alternative and the identified resource conservation measures, mitigation, and monitoring that would occur as part of the Preferred Alternative.

2.5 MDFP AND COST SHARING

2.5.1 MDFP and the EIS Proposed Action

The "WRDA Package" includes all actions that are part of the Proposed Action (Alternative 2). Section 5141 of WRDA of 2007, as amended, directed USACE to review the BVP and the Phase I and II IDS Studies for technical soundness and environmental acceptability. As determined in the USACE's Feasibility Report (USACE 2014a), the BVP Study and IDP designs have been found to be technically sound for the current stage of the project and will provide a sound basis for future development of engineering products (USACE 2014a).

USACE identified a subset of the Section 5141 of WRDA 2007, as amended to recommend to the Assistant Secretary of the Army for Civil Works ASA (CW) for construction. This subset of the authorization is the MDFP, also known as the Federal Cost-share Plan. The remaining BVP features are being proposed for construction under a Section 408 request by the City of Dallas and are 100% local responsibility for funding. The process for selection of the MDFP is fully described in the USACE Feasibility Report. The cost-shareable MDFP consists of the riverine FRM elements, 4:1 side slope flattening (100% non-federal), the Trinity River relocation, the Corinth Wetlands, development of a borrow pit in the future proposed West Dallas Lake site, and the IDP improvements. In addition, the MDFP assumes the remaining BVP features would be constructed and the potential Trinity Parkway project would be constructed as currently planned along the riverside toe of the East Levee from the far downstream portion of the Floodway before exiting upstream just before the Hampton Pump Station (the Trinity Parkway would be completed as a separate Section 408 project) (USACE 2014a).

In summary:

- **The EIS Proposed Action:** includes the MDFP and the remaining BVP features identified in the 2004 BVP Study and Phase I and II interior drainage studies as authorized by Section 5141 of WRDA of 2007, as amended.
- **The MDFP:** Those features that the USACE has identified for cost sharing.

While the above-mentioned features would be cost shared, it is assumed that the sponsor, City of Dallas, would continue with plans to construct the remainder of the BVP Study as non-federal features. These non-federal features would be the sole cost and responsibility of the City of Dallas, and would require pre-construction approval from USACE under Section 408 authority (USACE 2014a). This EIS NEPA analysis does not constitute authorization for the non-federal features; rather, it analyzes the impacts that may result from the implementation of those projects as they are currently proposed. Authorization of the non-federal features would only follow from the successful completion of Section 408 review.

As shown in Table 2-1 (refer to Section 2.3.2), the MDFP represents a subset of the total actions included in the Proposed Action. While part of the MDFP, the 4:1 flattening of the riverside levee side slopes feature would be paid for and implemented by the local sponsor (City of Dallas). For additional details relating to the MDFP and cost sharing, refer to Chapter 4 of the USACE Feasibility Report (USACE 2014a). As shown in Appendix J, Detailed Cost Estimate and Cost Analysis of the USACE's Feasibility Report (USACE 2014a), the MDFP is estimated to cost approximately $560,839,000 at October 2013 price levels. The total project cost does not exceed the Section 902 cost limit of $715,823,000, and also remains under the authorized cost inflated through construction cost of $673,064,000.

2.6 PROJECTS INCLUDED IN CUMULATIVE IMPACTS ASSESSMENT

2.6.1 Introduction

Section 5141 of WRDA of 2007, as amended, provides that USACE undertake a comprehensive, system-wide analysis to evaluate the effects of the Proposed Action and other proposed modifications on flood conveyance of the Dallas Floodway System. The comprehensive system-wide analysis in this EIS seeks to determine the degree to which the proposed modifications are environmentally acceptable.

2.6.2 Projects of Others

To support the cumulative analysis, the USACE developed the following assumptions to address the multiple projects under construction or planned in the Study Area that have or may result in changes to the environment. Projects that are complete, or were under construction as of March 31, 2012 are presented under the existing conditions description of the affected area resources and are presented in Section 2.6.2.1. Conversely, projects that are planned, but had not started as of March 31, 2012 are assumed fully constructed under the Future Without-Project Condition for each resource and are presented in Section 2.6.2.2. Figure 2-12 depicts the general geographic location of all of the identified past, present, and reasonably foreseeable projects.

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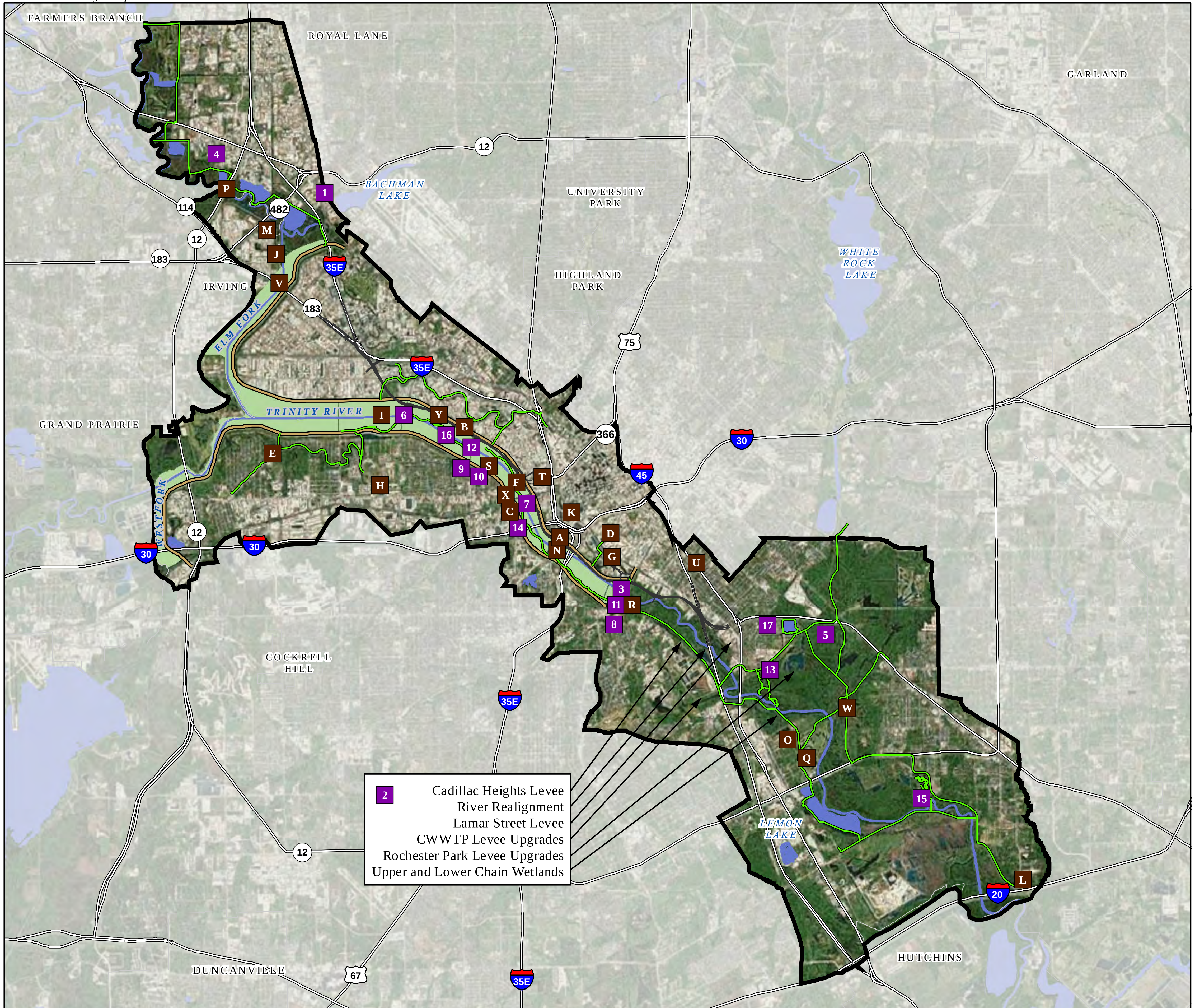


Figure 2-12
Location of Past, Present, and Reasonably Foreseeable Projects

Past and Present Projects

1. Dallas Area Rapid Transit Orange Line
2. Dallas Floodway Extension Project
3. Dallas Wave
4. Elm Fork Athletic Complex
5. Great Trinity Forest Land Acquisition and Trails
6. Hampton Bridge
7. Margaret Hunt Hill Bridge
8. Moore Gateway Park
9. Oncor Transmission Line
10. Pavaho Pumping Plant
11. Santa Fe Trestle Trail
12. Sylvan Avenue Bridge
13. Texas Buckeye Trail
14. Trinity Overlook Park
15. Trinity River Audubon Center
16. Trinity Trails
17. William Blair Gateway Park

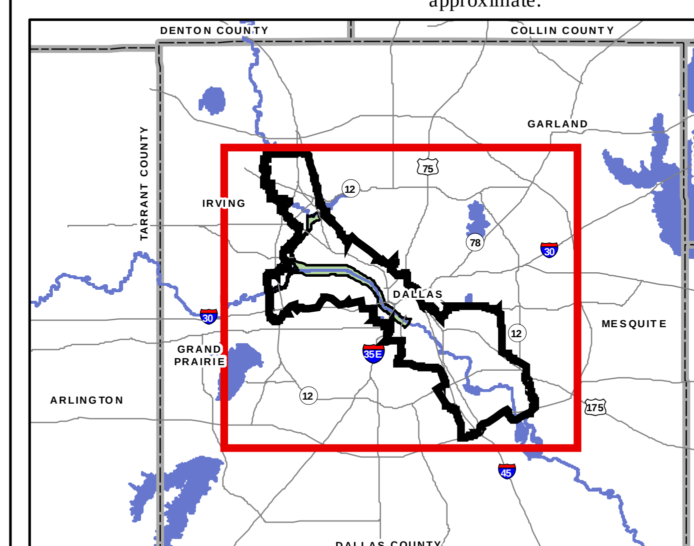
Reasonably Foreseeable Projects

A Able Pumping Plant
B Baker Pumping Plant
C Beckley Avenue Improvements
D Belleview Trail Connector
E Bernal Trail
F Continental Pedestrian Bridge
G Dallas Maritime Museum
H Dallas Watersports Complex
I DWU Waterlines
J EF2 Wastewater Interceptor Line and Laterals
K Horseshoe Project
L IH-20 Gateway Park
M Irving Northwest Levee Repair
N Jefferson Memorial Bridge
O Joppa Gateway Park
P Loop 12 Bridge
Q Loop 12 Gateway Park
R Martin Luther King Jr. Gateway Park and Cedar Crest Bridge Improvements
S Pavaho Wetlands
T Riverfront Boulevard
U S.M. Wright Project
V SH-183 Bridge
W Texas Horse Park
X Trinity Lakes Streetcar Loop
Y Trinity Parkway

LEGEND

Cumulative Trails
Dallas Floodway Levee
Freeway
Trinity Parkway
Study Area
Surface Water

Note: Depicted project locations are approximate.



0 2 4 Kilometers
0 2 4 Miles

GIS Sources: City of Dallas 2008a, 2010a; NCTCOG 2008; TxDOT 2010

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2.6.2.1 Projects Included in Existing Conditions

The following section provides a summary description of the identified past and present projects.

DART Orange Line

The DART Orange Line light rail project is 14-miles long and will connect existing DART lines to the Irving/Las Colinas area, ultimately providing rail service to Dallas-Fort Worth International Airport (DFW). Construction began in 2009 and is estimated to reach the Las Colinas Urban Center in 2012 and DFW in 2014 (DART 2012a).

Dallas Floodway Extension Project

The DFE Project consists of the following major components: construction of the Chain of Wetlands, the Lamar Street Levee, the Cadillac Heights Levee, modifications to the Rochester Park Levee and the Central Wastewater Treatment Plant Levee, and ecosystem and recreation features immediately downstream of the existing Dallas Floodway Levee System. The project area covers approximately 9,500 acres. Construction of the DFE Project is on-going (USACE 2012a).

Dallas Wave

This project consists of the construction of an in-stream standing wave for recreational use, and covers approximately nine acres. In addition to the in-stream component, the standing wave includes a shore component consisting of a canoe launch, trails, a parking area, and ingress/egress points (launch and take-out) supported by retaining walls (City of Dallas 2012a, 2012b). The initial construction was completed in 2012 and the project is currently open.

Elm Fork Athletic Complex

The Elm Fork Athletic Complex project includes enacting flood protection improvements, recreation facilities, and environmental restoration in the Elm Fork area. Of note, the project will feature 19 soccer fields and 1 championship field in an athletic complex, a dog park, trails, and associated amenities (City of Dallas 2012a). The Elm Fork Athletic Complex opened in April 2014.

Great Trinity Forest Land Acquisition and Trails

The Great Trinity Forest Master Plan Concept, approved by the Dallas City Council on March 26, 1997, proposed the development of multipurpose trails for recreation, education, and transportation. It also outlined the acquisition and preservation of bottomland hardwood forest within the Trinity River Corridor. The project area covers 6,000 acres; land acquisition and development continues and is expected to be a long-term effort (City of Dallas 2012c).

Hampton Bridge

A new six-lane bridge was constructed to replace the existing four-lane bridge at the Hampton/Inwood crossing. The project area was approximately 28 acres and construction of this project finished in 2010 (TxDOT 2010, 2012a).

Margaret Hunt Hill Bridge

The new "signature" Margaret Hunt Hill Bridge is located between the Continental Avenue and Union Pacific Railroad bridges, connecting Singleton Boulevard in West Dallas across the Trinity River to Woodall Rodgers in downtown Dallas. This bridge is part of the proposed 10 acre Woodall Rodgers extension designed to relieve traffic congestion. The Margaret Hunt Hill Bridge opened to vehicle traffic in March 2012 (City of Dallas 2012d; Dallas Morning News 2012).

Moore Gateway Park

Moore Gateway Park is a regional gateway providing access to the Dallas Floodway. Moore Gateway Park is approximately 28.5 acres and includes athletic fields, a large pavilion, and access to the Dallas Wave. Construction began in January 2012 and was opened for public use on June 13, 2013 (City of Dallas 2012d; Trinity River Corridor Project 2013a).

Oncor Transmission Line

Oncor Electric Delivery installed a new 345-kilovolt power transmission line from West Levee Switching Station located in Dallas, to the Norwood Switching Station, located in Irving. The City of Dallas and Oncor worked cooperatively to avoid routing a new line along the levees of the Trinity River and to relocate existing power transmission lines along the Trinity River. The transmission line covers almost 7 miles, a mile of which is underground. This project was completed in 2010 (City of Dallas 2012d).

Pavaho Pumping Plant

The City of Dallas improved the Pavaho Pumping Plant in order to reduce the stormwater flood risk to people and property in the City of Dallas and extend the service life of the existing facility for at least another 50 years. Improvements included constructing a new pump station, improving the existing Pavaho Pump Station, utilizing the two existing gravity sluices, and installing a new junction box to connect flow from the existing and new Pavaho Pump Stations. The project area was approximately 4 acres. Construction began in September 2010 and was completed in 2012 (USACE 2010).

Santa Fe Trestle Trail

The Santa Fe Trestle Trail is a hike and bike trail providing access to Moore Park, located off East 8th Street south of downtown Dallas. It covers approximately 10 acres and crosses the Trinity River via the abandoned AT&SF Railroad Bridge and portions of the old railroad trestle, and ends as an access road at the north Trinity River levee near downtown Dallas. Construction began July 2010 and was completed in 2012 (City of Dallas 2012d).

Sylvan Avenue Bridge

The Sylvan Bridge will replace the Sylvan Avenue approaches and low water crossing over the Trinity River with a single bridge structure that will span the Dallas Floodway. The project involves the upgrade of the existing two-lane conveyance to a six-lane bridge, a left turn lane, sidewalks, and pedestrian railing along both sides of the bridge. The bridge will also include two shared-use travel lanes (one in each direction) to accommodate a bike route along the bridge, a ramp to provide access to Trammel Crow Park, and the relocation of the existing boat ramp at Trammel Crow Park. The project area covers approximately 15.4 acres. Construction is in process, and the estimated completion date is early 2015 (TxDOT 2010; City of Dallas 2012e).

Texas Buckeye Trail

The City of Dallas added an additional 1.6 miles of hard surface trails to the Texas Buckeye Trail in 2009. The trail is located at the end of Bexar Street in Rochester Park. A three-quarter-mile spur from the trail takes visitors to a large grove of Texas Buckeye trees (*Aesculus arguta*) located adjacent to the Trinity River (City of Dallas 2012d).

Trinity Overlook Park

Completed in October 2008, the Trinity Overlook Park is located just south of the western approach to the Commerce Street Bridge and covers less than half an acre. The Trinity Overlook Park includes shade tents and interpretive displays providing information on the Dallas Floodway, the Trinity Lakes, and the signature bridges (City of Dallas 2012d).

Trinity River Audubon Center

The Trinity River Audubon Center is a 120-acre facility located south of South Loop 12 and east of IH-45. The Trinity River Audubon Center provides a place for presenting educational and environmental interests in the Trinity River Corridor; eco-tourism activities; aquatic, archaeological, and historical exhibits; and theme gardens at the center of the Great Trinity Forest's trail system. The Trinity River Audubon Center opened in 2008 (Trinity River Audubon Center 2012).

Trinity Trails

The Trinity Trails includes an extensive network of trails within the Trinity River Corridor with 3.5 miles of trails that are designed for environmentally sensitive areas, 7 miles of soft surface trails, and 26 miles of hard surface trails with pedestrian bridges across the Trinity River. Phase I consists of 2 miles of 12-foot wide concrete trail beginning at the Loop 12 boat launch and ending at the City of Dallas' Ecopark Facility parking lot on Simpson Stuart Road. Phase II consists of 2.5 miles of concrete trail beginning at the end of Phase I on Simpson Stuart Road and ending at the Trinity River Audubon Center. All construction was completed by December 2013 (Trinity Strand Trail 2013).

William Blair Gateway Park (formerly known as Rochester Gateway Park)

William Blair Jr. Park is a 900-acre park near US-175 that currently has a lake fishing pier and open spaces. The Trinity River Corridor Project has added a gateway and trailhead that includes expanded parking, a kiosk, seating area and a trail that goes over the levees to tie into the Bois d'arc Trail in the Great Trinity Forest. This project began in 2012 and was finished in 2012 (City of Dallas 2012d; Trinity River Corridor Project 2013a).

2.6.2.2 Future Projects

The following projects started construction after March 31, 2012 and are in early design or undergoing environmental analysis. Therefore, they are considered part of the Future Without-Project Condition.

Able Pumping Plant

The City of Dallas and the USACE are planning to relocate and improve the Able Pumping Plant in order reduce the stormwater flood risk to people and property in the Able Basin. The Proposed Action consists of constructing a new 876,000-gpm capacity pump station and outfall, and decommissioning and removing the existing Small Able and Large Able pump stations. The new Able Pumping Plant would be located near the existing Bellevue Pressure Sewer, adjacent to Riverfront Boulevard near the East Levee. In addition, the Proposed Action includes implementing stormwater conveyance improvements in the Able Sump ponds (HDR 2013). The USACE has completed an Environmental Assessment (EA) for the proposed improvements to the Able Pumping Plant and the City of Dallas awarded a construction contract in August 2014 (USACE 2014b, City of Dallas 2014).

Baker Pumping Plant

The City of Dallas and USACE are planning to improve the Baker Pumping Plant in order to reduce the stormwater flood risk to people and property in the City of Dallas and extend the service life of existing facilities for at least another 50 years. Improvements would include constructing a new pump station (which would work along with the 1975 Baker Pump Station), rehabilitating the Baker Pump Station to modernize the electrical system of the building, and decommissioning the Old Baker Pumping Plant. The project area is approximately 4.5 acres. The USACE prepared an EA for this action and the Finding of No Significant Impact was signed in 2012 (USACE 2012b). Construction is began in 2013 and the new Pump Station is slated to open in February 2015 (City of Dallas 2014).

Beckley Avenue Improvements

The City of Dallas plans to improve Beckley Avenue at Commerce Street by adding four new vehicle lanes, reinforced concrete sidewalks, a new major drainage system, and upgraded water and wastewater mains. The project area will cover approximately 3 acres. Construction is estimated to conclude in fall 2014 (City of Dallas 2012f).

Belleview Trail Connector

The City of Dallas proposes to construct a trail connecting development, entertainment, and art districts via mass transit in the Cedars District. The trail would be slightly less than one acre and would connect the proposed Trinity Park to the DART Cedars Station. This project does not currently have an estimated start date (City of Dallas 2012b).

Bernal Trail

The City of Dallas would extend the existing Bernal Trail to link the Westmoreland Heights area to the Trinity Levee Trail along the West Levee. The trail would go from Emma Carter Park to Tipton Park, and would cover approximately 4.6 acres. This project currently has no funding for construction and does not have an estimated start date (City of Dallas 2012b).

Continental Pedestrian Bridge

The existing Continental Avenue Bridge would be converted from vehicle to pedestrian and bicycle use. The vehicle to pedestrian conversion and associated elements would cover 4.6 acres. The project opened in June 2014 (City of Dallas 2012g, 2014).

Dallas Maritime Museum

The Dallas Maritime Museum is a proposed 3.5 acre museum located along the Trinity River, at 1501 Riverfront Boulevard in a currently undeveloped grassland parcel. The $80 million project is sponsored by a non-profit organization, the Dallas Maritime Museum Foundation. The museum plans to acquire and display the 362-foot USS Dallas and other vessels next to the 30,000 square-foot museum building (Dallas Morning News 2013).

Dallas Water Utility Lines

The Dallas waterlines project proposes to relocate four water mains and one drainage pipeline that currently underlie the Floodway and/or the levees. In addition to the relocation of the existing pipelines, the City of Dallas may also remove all or part of three force mains, one wastewater bypass main, two wastewater mains, and four water mains that have previously been abandoned and that currently underlie the Floodway and/or the levees (City of Dallas 2012b).

Dallas Watersports Complex

The Dallas Watersports Complex would include a waterskiing cableway, a pro-shop, snack bar, full-service restaurant, and viewing deck. The Dallas Watersports Complex would be located on Fish Trap Lake at the intersection of Hampton Road and Singleton Boulevard in West Dallas and cover approximately 42 acres. This project does not currently have an estimated start date (Dallas Watersports Complex 2012).

<u>EF2 Wastewater Interceptor Line and Laterals</u>

This project consists of a new 108-inch diameter wastewater interceptor that would be installed parallel to and riverward, of an existing 90-inch diameter wastewater line located within the Dallas Floodway and immediately adjacent to the Northwest Levee in Irving. Also included in this project are four lateral wastewater lines (points of entry) that are proposed to cross beneath the levee and connect to either the existing 90-inch diameter line or the new 108-inch diameter line. The project area would be approximately 3.7 acres. Construction began in 2013 and will last approximately 2 years (Black & Veatch Corporation 2011, City of Dallas 2012d).

<u>Horseshoe Project</u>

A subset of the larger Project Pegasus, the Horseshoe Project would replace two key bridges and connecting roadways crossing the Trinity River at IH-30 and IH-35, as well as upgrading outdated roadway geometry, improving safety and increasing capacity and mobility. The project would begin at Sylvan Avenue on IH-30, extend to the IH-30/IH-35 interchange (commonly referred to as the Mixmaster) and head south on IH-35 to cross the Trinity River, ending just south of Colorado Boulevard. The project construction started in 2013 and is expected to be completed by late 2016 (TxDOT 2012b, City of Dallas 2014).

<u>IH-20 Gateway Park</u>

The City of Dallas proposes to construct the IH-20 Gateway Park north of the intersection of IH-20 and Dowdy Ferry Road. The park would include picnic and fishing stations around the existing pond and canoe access to the Trinity River. The park would cover approximately 75 acres. Construction is completed and the project opened in June 2013. (City of Dallas 2014).

<u>Irving Northwest Levee Repair</u>

This 23-acre project would complete the rehabilitation of the Irving Northwest Levee for re-certification and re-accreditation for protection from up to and including the 100-year riverine flood event. This project consists of installing a slurry wall on the riverside toe of the existing levee (approximately 13,000 feet long and 25 feet deep) to minimize potential seepage issues associated with the levee during major flood events. It would also include the rehabilitation of a portion of the levee, by either overlaying with clay material or grouting the sand to reduce the potential for underseepage of the levee during flood events. This project is currently on hold (Halff Associates 2012).

<u>Jefferson Memorial Bridge</u>

The Jefferson-Memorial Bridge would replace the existing Jefferson Street Bridge; the project is currently in the planning stage at TxDOT. The new bridge would provide direct connects to and from IH-35E (TxDOT 2012a).

<u>Joppa Gateway Park</u>

The City of Dallas plans to construct the Joppa Gateway Park as an expansion and improvement of the existing South Central Park. The park would feature a spray ground, expanded trails, an open play field area, an additional small pavilion with picnic/barbeque stations, site furnishings, and would repair and upgrade the existing basketball court. Construction is underway (City of Dallas 2014h).

Loop 12 Bridge

Under this project, the Loop 12 corridor near the western SH-183 crossing would be reconstructed to accommodate eight general-purpose lanes (plus auxiliary lanes), four continuous frontage road lanes (plus auxiliary lanes near ramp locations and cross-streets), and a reversible High-Occupancy Vehicle (HOV)/Managed facility. The Loop 12 project will be the first in a series of TxDOT reconstruction projects surrounding the former Texas Stadium site, collectively to be known as the Irving Diamond Interchange. The project area would cover approximately 34 acres; various construction components, such as lighting are scheduled to be implemented in 2015/2016, other construction elements are on hold pending funding (Bridgefarmer & Associates 2012, 2013).

Loop 12 Gateway Park

The City of Dallas proposes to construct the Loop 12 Gateway Park in a 2.15-mile long greenbelt running from the intersection of Loop 12 and IH-45, east to the Trinity River. The greenbelt would total approximately 153 acres. This project would be done in three phases. Phase 1 would enhance the entrance to the Trinity River Audubon Center (located at 6500 Great Trinity Forest Way) with an extra entry/exit lane and native landscaping. Phases 2 and 3 would add lighting to Great Trinity Forest Way and provide a large welcoming sign announcing the Great Trinity Forest. This project is currently under design and is expected to begin construction in 2013 (City of Dallas 2008b, 2012i; Trinity River Corridor Project 2013a).

Martin Luther King Jr. Gateway and Cedar Crest Bridge Improvements

The City of Dallas proposes to improve the existing MLK, Jr. Bridge across the Trinity River to accommodate pedestrians and bicyclists. There would also be parking added to the west side of the bridge, and access to a trail that would wind its way past the Upper Chain of Wetlands to Moore Park and the Santa Fe Trestle Trail. This project is under design (Trinity River Corridor Project 2013a).

Pavaho Wetlands

The proposed Pavaho Stormwater Wetland Project would include construction of approximately 64 acres of wetlands consisting of four separate cells located near the Pavaho Pumping Plant outfall. The wetland area is intended to provide water quality improvement for stormwater flows collected in the sump prior to conveyance to the river by the Pavaho Pumping Plant. The primary purpose for the wetland cells located on the river side of the West Levee would be to create diverse, high quality wetland habitat for multiple migratory and resident wildlife and bird species and to a lesser degree provide water quality improvement for stormwater runoff from the adjacent floodplain area as well as river overflows. Construction started in early 2014 and is on-going (USACE 2013c, City of Dallas 2014).

Riverfront Boulevard

This 27-acre project involves converting Riverfront Boulevard (formerly Industrial Boulevard) to a 1.5 mile, eight-lane thoroughfare with a 150-foot wide right of way. Riverfront Boulevard would become a “complete street” and include landscape zones, bicycle lanes, and pedestrian sidewalks. The project would also include an upgrade of the drainage system and replacement/upgrade of existing water and wastewater transmission and distribution lines. Phase I construction is on-going and Phase II is currently in design (City of Dallas 2012d).

S.M. Wright Project

The TxDOT is preparing design plans and environmental studies for improvements to US-175/S.M. Wright Freeway. The 48.5-acre Study Area would include improvements to IH-45 from S.M. Wright

Freeway (US-175) to south of Lamar Street (1.7 miles), S.M. Wright Freeway from IH-45 to SH-310 near Budd Street (2.5 miles), and providing direct connecting ramps between US-175 and IH-45 (1.5 miles). This project would reduce traffic flow and convert the elevated, 10-lane high-speed S.M. Wright Freeway to a 6-lane low-speed, signalized, at-grade arterial without bridges. Subject to funding availability, construction is estimated to run from 2016 through 2018 (TxDOT 2012c).

SH-183 Bridge

The TxDOT is planning a new bridge crossing at the Elm Fork of the Trinity River as part of an overall development plan for SH-183. The TxDOT is studying several alternatives in order to develop a plan for improvements; currently the project would cover approximately 76 acres. In addition to the bridge, alternatives include revising the HOV lanes to provide three lanes in each direction. Subject to funding availability, construction is estimated to begin in January 2017 (TxDOT 2012d).

Texas Horse Park

The 500-acre Texas Horse Park (initially proposed as the Trinity Equestrian Center), would be located northeast of the intersection of Loop 12 and Pemberton Hill Road. The Texas Horse Park would host world-class equestrian competitions of all types, provide riding trails, stabling/boarding, and offer a variety of riding programs. The Dallas City Council is currently evaluating the solicitation of proposals for a private operation of this proposed City facility (City of Dallas 2012j, 2013).

Trinity Lakes Streetcar Loop

The proposed Trinity Lake Streetcar Loop would better connect Oak Cliff and West Dallas to downtown. The approximately 5-mile long route would zigzag from the convention center, down the east-west commercial district, and up to the Arts District. It would create economic development opportunities for downtown along with West Dallas, the Design District, and Oak Cliff (DART 2012b).

Trinity Parkway

The Trinity Parkway is a proposed 9-mile toll road that would extend from the SH-183/IH-35E juncture to US-175/Spur 310. Several route alternatives are currently being reviewed by the FHWA. The North Texas Tollway Authority is has issued a Final EIS for this roadway. The schedule for issuing a ROD and for construction of the potential Trinity Parkway, should a build alternative be approved, is pending further coordination with TxDOT, FHWA and the USACE (FHWA 2014).

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CHAPTER 3
AFFECTED ENVIRONMENT

This chapter describes the existing conditions for each of the following 15 resource areas:

1. Land Use
2. Geology and Soils
3. Hydrology and Hydraulics
4. Water Resources
5. Biological Resources
6. Cultural Resources
7. Recreational Resources
8. Visual Resources
9. Socioeconomics (Note: impacts with respect to Environmental Justice are analyzed in Chapter 6)
10. Hazardous Materials and Wastes
11. Safety
12. Transportation
13. Utilities
14. Air Quality
15. Noise

For each resource area section, the resource is: (1) generally defined, (2) given an appropriate region of influence (ROI), and (3) described for existing conditions. The ROI for each resource is a geographic area within which the Proposed Action may exert some influence. The existing conditions discussion for each resource area presents the condition of the resource within each respective ROI.

The United States Army Corps of Engineers (USACE) has identified a planning horizon for this Environmental Impact Statement (EIS). A planning horizon is a period of time covered by a particular plan or planning cycle, and the period of time plan effects are considered. Per the 1996 USACE Planning Manual, the planning horizon encompasses the study period, construction period, period of analysis, and project life. For this EIS, the USACE has used a planning horizon with a base year of 2015 and an end year, or Future Without-Project Condition year, of 2065. Thus, the Future Without-Project Condition is defined as the year 2065, unless otherwise noted. Some resource areas have different Future Without-Project Condition years as explained in their respective sections. Notably, because the modelling used to support the analysis of biological resources is not intended to include construction, the 50-year planning horizon for that analysis starts in 2029, and continues through 2079. Conversely, transportation analysis is constrained by available regional traffic forecasts, which considers a shorter planning horizon and looks to the year 2035.

3.1 LAND USE

3.1.1 Definition of Resource

Land use comprises the natural conditions and/or human-modified activities occurring at a particular location. Human-modified land use categories include residential, commercial, industrial, transportation, communications and utilities, agricultural, institutional, recreational, and other developed use areas. Management plans and zoning regulations determine the type and extent of land use allowable in specific areas and often intend to protect specially designated or environmentally sensitive areas. Zoning requirements are regulations developed by the city to control potential future development. In determining zoning classifications, a city considers community needs, such as population growth, transportation, education, and infrastructure (Callies et al. 1999). Comprehensive plans evaluate long-term demographic trends to identify how the region of analysis should be developed. Where zoning focuses on immediate trends in development, comprehensive plans attempt to forecast development trends over the course of the future decades. Comprehensive plans are generally less regulatory in nature and often serve as guidance when a current planning department is evaluating applications for development.

Resources used to define land use include all land use plans, policies, and zoning limitations in the Study Area. The Trinity River Corridor Comprehensive Land Use Plan (TRCCLUP), adopted by the Dallas City Council in 2005, serves as a framework for implementing a coordinated approach to infrastructure improvements, land use, and economic development in the Trinity River Corridor. Thus, the region encompassed by the TRCCLUP was generally used to define the boundaries of the Study Area.

3.1.1.1 Methodology

In describing land use, this section applies three scales of review. The finest and most detailed level of review considers the land use as it exists "on the ground" within the Study Area. The next level of analysis reviews the zoning of the affected environment. Lastly, the most general level of review is the comprehensive plan for land use. The ROI for land use is the Study Area.

3.1.1.2 Regulatory Framework

The institutional criteria reviewed for land use include all land use plans, policies, and zoning limitations in the Study Area. The City of Dallas created the Trinity River Corridor Citizens Committee (TRCCC) in 1994, which culminated in the creation of the Balanced Vision Plan (BVP) Study and the TRCCLUP by the City of Dallas. These documents focus on creating a land use development regime that aims to revitalize the Trinity River Corridor and riverfront regions.

In an effort to focus on development within the city center, the City of Dallas released a citywide comprehensive land use plan as part of the forwardDallas! initiative in 2006. This plan seeks to provide mechanisms for the implementation of the BVP (City of Dallas 2006), the TRCCLUP, and over 230 other land use plans that have been in force in the City of Dallas over the past 30 years. The City of Dallas zoning code has requirements for all construction and land use activities within city limits.

In addition to local planning efforts, development is limited by Executive Order (EO) 11988 "*Floodplain Management*," which requires federal agencies to avoid "to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities."

USACE Engineering Regulation (ER) 1165-2-26, *Water Resources Policies and Authorities - Implementation of Executive Order 11988 on Flood Plain Management* dated March 30, 1984, contains the USACE's policy and guidance for implementing EO 11988. Per ER 1165-2-26, the USACE must first determine whether there are practicable alternatives to placing a proposed project in a floodplain. In addition, ER 1165-2-26 specifies that all reasonable factors should be taken into consideration when determining practicability. The City of Dallas controls private development within the Trinity River floodplain through the "Corridor Development Certificate" process as described in Section 3.3, *Hydrology and Hydraulics*.

3.1.2 Existing Conditions

3.1.2.1 Regional Land Use

Land use in the ROI falls into one of several categories as defined by the 2011 City of Dallas land use inventory. These categories include: Undeveloped (vacant and parking), Open Space (public and private), Residential (agricultural, single and multi-family parcels), Industrial (heavy and light industrial, warehouse and distribution), Commercial (commercial, lodging, and office), Government/Education (which may include government managed land such as sump drainage), Transportation, Utilities, Mixed Use (mixed and multiple use parcels), and Infrastructure. The 2011 inventory also includes 1,232 acres of lands that have unknown use. For the purposes of this analysis, the 2007 North Central Texas Council of Governments (NCTCOG) land use inventory was used to supplement the missing information from the 2011 data.

Over one-quarter of the ROI is undeveloped. The ROI does not include large, consolidated undeveloped areas, but instead densely developed neighborhoods interspersed with small individual, undeveloped lots. Less of the ROI is considered open space; the majority is comprised of the Trinity Floodway and the Great Trinity Forest regions, as well as smaller local parks. Residential, industrial, and commercial use comprise much of the remainder of the ROI, with other land uses each contributing to less than 10% of the ROI area. Table 3.1-1 presents the land use categories and associated areas for the entire 43,399-acre ROI. Streets, roads, highways, and larger areas of open water are not included in the land use categories and account for approximately 7,351 acres. Figure 3.1-1 displays the land uses present in the ROI, Figure 3.1-2 presents the zoning designations in the ROI, and Figure 3.1-3 presents the long range planning goals of the TRCCLUP. A more localized description of land use follows for each of the Study Area components.

Table 3.1-1. Land Use Categories within the ROI

Category	*Number of Parcels*	*Acres*	*Percent*
Commercial	2,418	3,905.5	10.8%
Government/Education	489	2,881.5	8.0%
Industrial	2,905	4,157.4	11.5%
Infrastructure	15	159.5	0.4%
Mixed Use	137	241.6	0.7%
Open Space	652	8,279.5	23.0%
Residential	16,725	4,817.3	13.4%
Transportation	80	763.6	2.1%
Undeveloped	12,157	10,237.0	28.4%
Utilities	261	604.6	1.7%
Total	**35,839**	**36,047.5**	**100.0%**

Sources: City of Dallas 2011; NCTCOG 2007.

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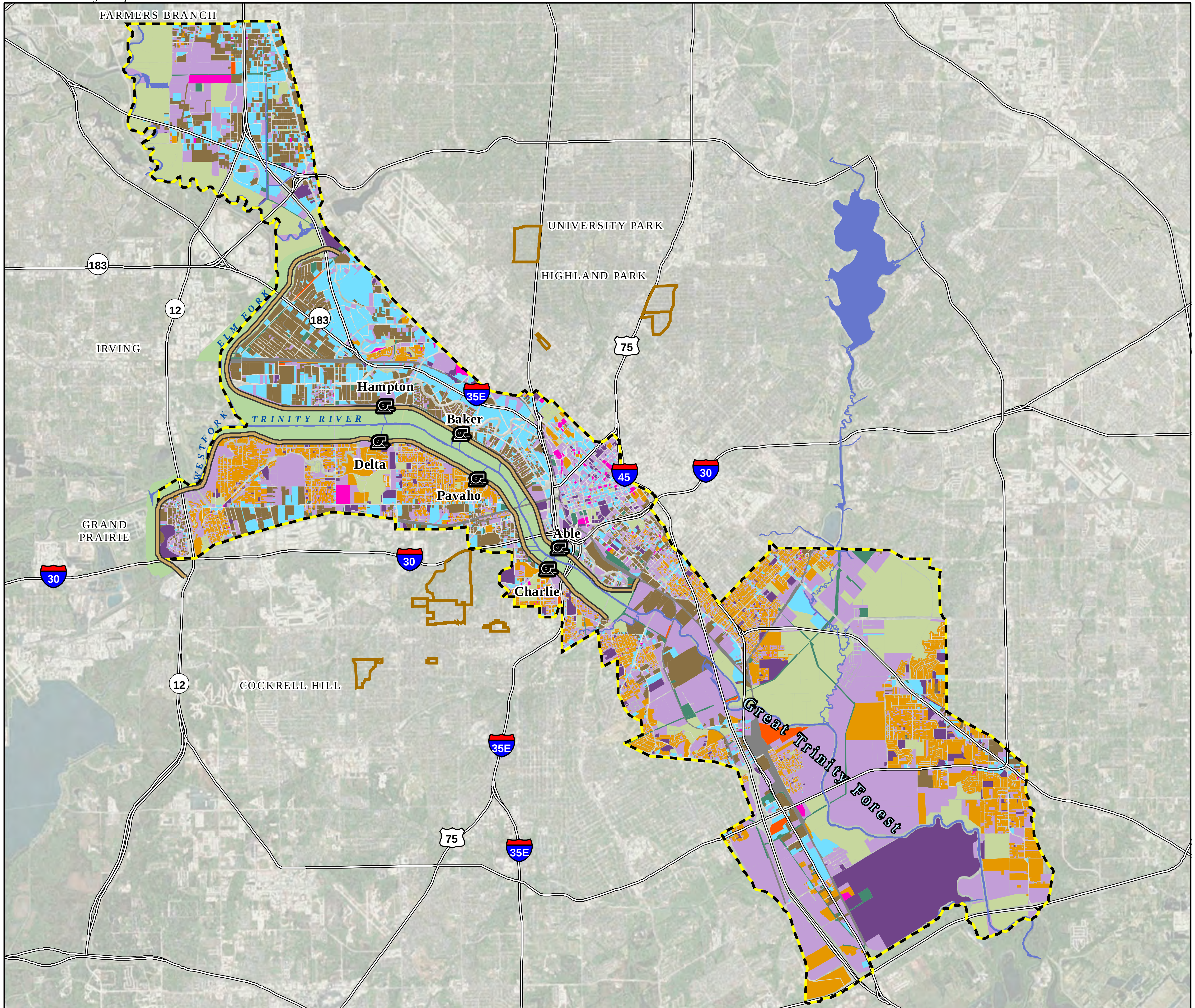


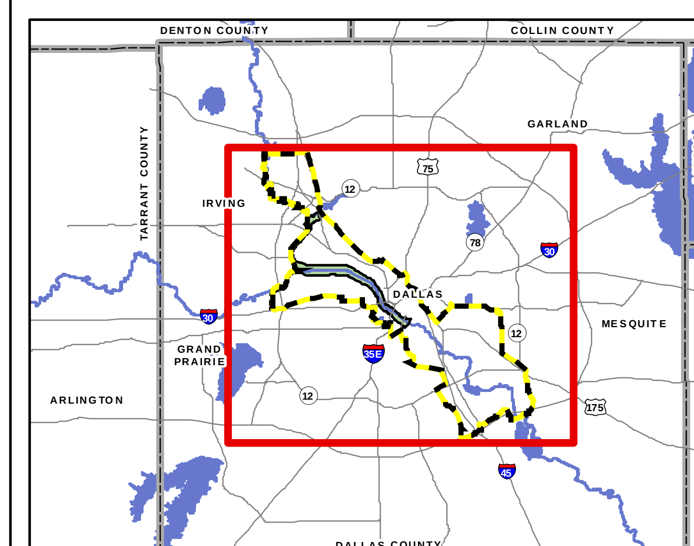
Figure 3.1-1
ROI for Land Use

LEGEND

Land Use

- Commercial
- Government/Education
- Industrial
- Infrastructure
- Mixed Use
- Open Space
- Residential
- Transportation
- Undeveloped
- Utilities
- Conservation Districts
- Pumping Plant
- Dallas Floodway Levee
- Freeway
- ROI
- Surface Water
- Dallas Floodway

Note: Land use data not available for all regions.



0 1 2 Kilometers

0 1 2 Miles

GIS Sources: City of Dallas 2008a, 2011; NCTCOG 2008

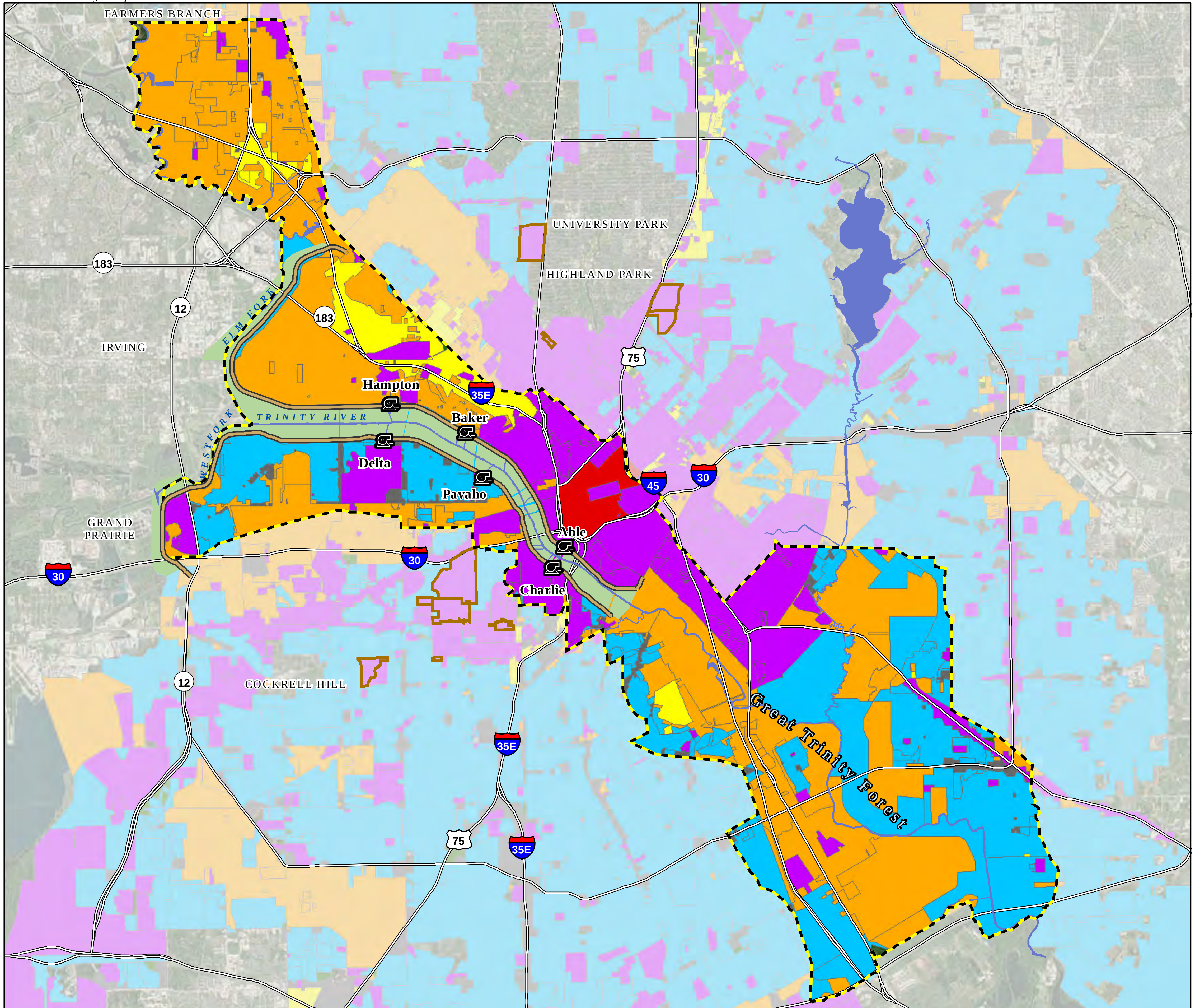
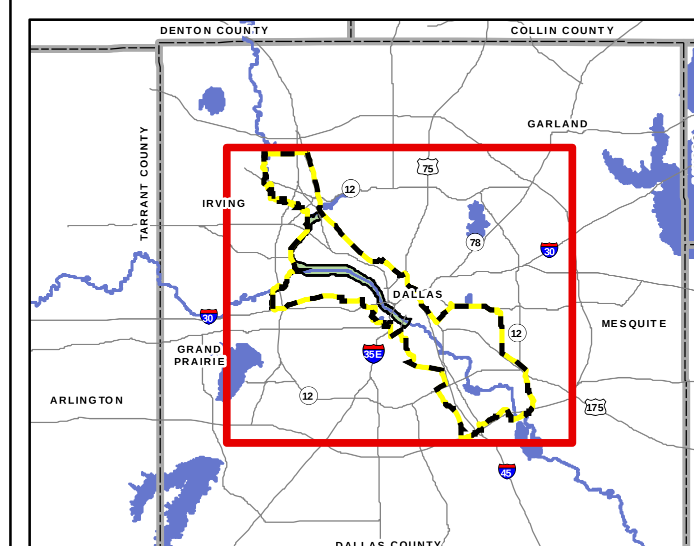


Figure 3.1-2
Current Zoning within the ROI for Land Use

LEGEND

Zoning Districts
- Central Area
- Commercial/Industrial
- Mixed Use
- Office
- Residential
- Retail
- Special Purpose
- Conservation Districts
- Pumping Plant
- Dallas Floodway Levee
- Freeway
- ROI
- Surface Water
- Dallas Floodway

Note: Land use data not available for all regions.



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GIS Sources: City of Dallas 2008a, 2012; NCTCOG 2008

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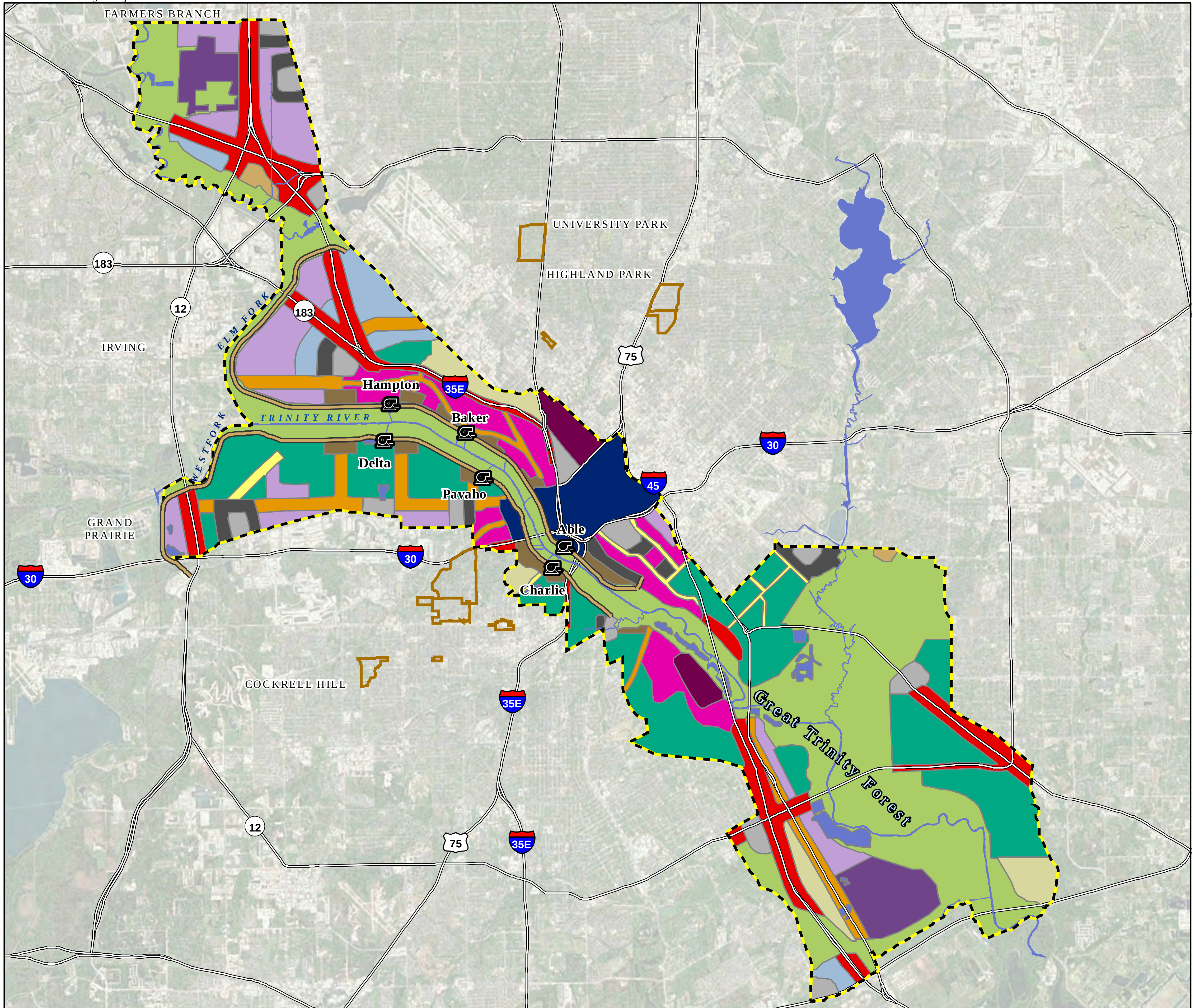


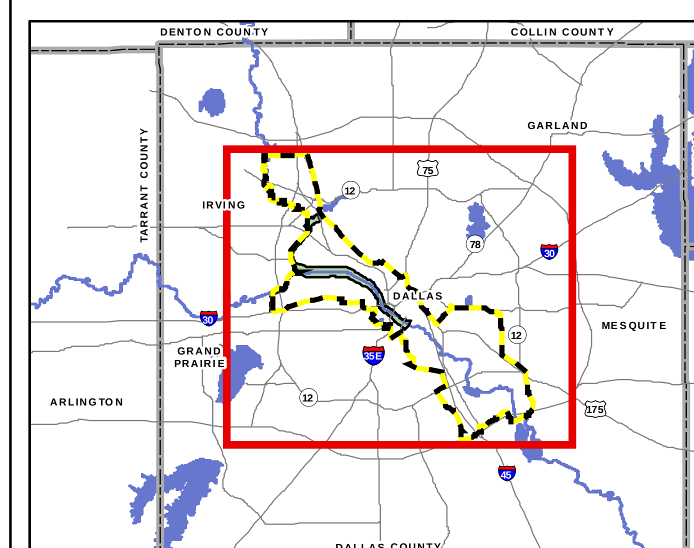
Figure 3.1-3
Trinity River Corridor Comprehensive Land Use Plan

LEGEND

Corridor Modules
- Regional Corridor
- Community Corridor
- Neighborhood Corridor

Land Use Modules
- CBD
- Community Village
- Heavy Industrial
- Lakes
- Light Industrial
- Mixed Use/Adaptive Reuse
- Mixed Use High Density
- Office
- Regional Employment
- Residential Riverside
- Residential Traditional
- Residential Urban
- Transit Center
- Trinity River Flood

Existing Features
- Pumping Plant
- ROI
- Conservation Districts
- Surface Water
- Dallas Floodway Levee
- Freeway



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0 1 2 Miles

GIS Sources: City of Dallas 2008a, 2011; NCTCOG 2008

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3.1.2.2 Land and Water Conservation Fund Projects

The Land and Water Conservation Fund (LWCF) is a federal program to conserve irreplaceable lands and improve outdoor recreation opportunities throughout the nation. The program works in partnership with state and local efforts to acquire and protect inholdings and expansions in our national parks, national wildlife refuges, national forests, national trails, and Bureau of Land Management areas. LWCF grants to states support the acquisition and development of state and local parks and recreational facilities. No LWCF projects are located within the Study Area (Texas Parks and Wildlife Department [TPWD] 2014).

3.1.2.3 Dallas Floodway Project

In an attempt to revitalize the area, current zoning laws and the TRCCLUP focus on planned, mixed-use development for the developed area adjacent to the Dallas Floodway. The implementation of these plans, which is currently in progress, involves maintaining most of the residential area while phasing out industrial use along the riverfront and replacing it with neighborhood-scale commercial and residential development.

3.1.2.4 Dallas Floodway Land Use

Floodway

The TRCCLUP and City of Dallas zoning districts categorize the Dallas Floodway (comprised essentially of the river course, the floodplain, and the levees) as a single unit without separating the individual elements. The TRCCLUP identifies several “districts” for review for future development. The river traverses all of these districts, but maintains the same development regime (called “land use modules” in the TRCCLUP) for the river and floodplain throughout. The Trinity River Floodway land use module plans for the development of recreational, ecosystem, and flood risk reduction enhancements within the Floodway (City of Dallas 2005). The 2011 City of Dallas land use inventory characterizes the Floodway as Open Space – Public (City of Dallas 2011).

As shown on Figure 3.1-2, multiple zoning districts are found within the Dallas Floodway, and are most often a continuation of the zoning on the developed side of the levee. From the westernmost section of the Floodway east to the Commerce Street crossing, the Floodway is in the Agricultural zoning district. The Agricultural zoning district lands are maintained for agricultural purposes and do not have urban services. From the Commerce Street crossing to the IH-30 crossing, the Floodway is in the Industrial Research zoning district. This district is intended to provide for research and development, light industrial, office, and supporting commercial uses in an industrial research park setting (City of Dallas 2012).

From the IH-30 crossing to the IH-35 crossing, the Floodway is in the Planned Development (PD) zoning district PD-468, the Oak Cliff Special Purpose District. PDs are specialized zoning districts with uses incorporated from several different zoning districts. Often times planned developments represent efforts to create full mixed-use communities with common characteristics. From the IH-35 crossing to the Atchison, Topeka, and Santa Fe (AT&SF) Railroad Bridge, the Floodway is primarily in the Industrial Manufacturing zoning district, with some sections in the Industrial Research zoning district. The Industrial Manufacturing zoning district is intended to provide for heavy industrial manufacturing uses with accompanying open storage and supporting commercial uses (City of Dallas 2012).

Trinity River

The Trinity River allows for limited recreational uses such as canoeing and fishing when water levels are high enough. In addition, the river is a drainage point for stormwater and treated water from treatment plants along the channel. The 2011 City of Dallas land use inventory identifies the river course with the land use designation Open Space – Public (City of Dallas 2011).

<u>Floodplain</u>

The floodplain of the Trinity River is a wide, flat grassy area bordered by the East and West Levees to the north and south, respectively. Historic meanders of the river within the floodplain are outside the levees and used as sump storage. The floodplain is largely unimproved. The exceptions include the transportation corridors connecting north and south Dallas (including 17 roadways and 4 rail line bridges), stormwater drainage outfalls, and the Crow Lake Park. The 2011 City of Dallas land use inventory designates the Floodway uses as Open Space – Public (City of Dallas 2011); there are limited recreational uses of the floodplain when conditions allow. Most of the recreation is limited to Crow Lake.

<u>Levees</u>

The 2011 City of Dallas land use inventory characterizes the levees uses as Open Space – Public Land (City of Dallas 2011). In 2009, the USACE and City of Dallas developed a protocol for reviewing construction projects with the potential to encroach upon the levees. Any construction projects within 250 feet of the levee toe trigger a heightened review and permitting process by the City of Dallas Development Services. A building applicant must submit full site plans, technical specifications, and a geotechnical report of the proposed site to Development Services and to the USACE for review and consultation. Development Services requires proof of USACE consultation from the applicant before issuing a permit (City of Dallas 2010).

3.1.2.5 Great Trinity Forest and Surrounding Area

The Great Trinity Forest is downstream of the Dallas Area Rapid Transit (DART) and AT&SF Railroad Bridge crossings, and is within the North Trinity Forest District of the TRCCLUP. The river is not bounded by levees in this region, and thus the majority of the floodplain is a public open space subject to inundation. The zoning in the Great Trinity Forest and surrounding areas is largely Industrial Manufacturing (City of Dallas 2012).

3.1.2.6 Interior Drainage Systems

The Interior Drainage Systems (IDS) area encompasses the City of Dallas, as well as the municipalities of Cockrell Hill, University Park, and Highland Park. Over one-third of the IDS area is currently residential use; almost one-fifth of the area is industrial.

<u>Able Sump Ponds</u>

The TRCCLUP defines the region including the Able Basin as the Downtown-Lakes; the basin includes the City of Dallas' Central Business District (City of Dallas 2005). The northwestern most third of the Able Sump Ponds are located in a PD zoning district described as the "Trinity River Corridor Special Purpose District" and combines uses permitted under Industrial Manufacturing, Commercial Service, Central Area District, and Mixed Use zoning districts. The remaining two-thirds of the sump ponds are in the Industrial Manufacturing zoning district (City of Dallas 2012). To the northeast is an additional PD that applies the new form-based zoning standards to future development (City of Dallas 2012).

While many of the sump ponds are used as flood control, the lands surrounding the features are a combination of Undeveloped, Commercial, and Industrial uses. Much of the Undeveloped land is developed as parking, rather than being truly vacant (City of Dallas 2011).

The southeastern section of the Able Sump Ponds is in the Cedars West Study Area of the Downtown-Lakes District. The TRCCLUP projects this area to be transformed from its current industrial landscape to being a recreational riverwalk area with more residential uses and pedestrian amenities, which require the phasing out of extant uses (City of Dallas 2005). The 2011 City of Dallas land use inventory designates the Able Sump as Open Space – Public, Undeveloped – Vacant, or does not provide a designation for the sump ponds area (City of Dallas 2011).

Hampton Basin

The Hampton Basin is located within the Stemmons District of the TRCCLUP. The Stemmons District is a focus area for redevelopment that builds on the area's existing uses (e.g., the medical district and Love Field) of the area. The Hampton Basin straddles two different zoning districts: the Industrial Research zoning district north of Empire Central Drive, and the Mixed Use 3 district south of Empire Central Drive. The Mixed Use 3 zoning district favors high-density retail, office, hotel, and/or multifamily residential uses in combination with single or contiguous building sites (City of Dallas 2012).

The 2011 City of Dallas land use inventory designates the majority of the Record Crossing Sump as Open Space – Public or Undeveloped – Vacant with smaller areas zoned as Commercial, Residential, Industrial, Government and Education. Flooding of the Record Crossing Sump by a 100-year storm event would potentially affect approximately 801 acres within the ROI. The potentially affected land uses from such an event are included in Table 3.1-2. The acreage values in Table 3.1-2 do not imply that a parcel is potentially subject to total inundation, but rather that the parcel intersects the 100-year flood extent, and thus may be subject to at least partial inundation.

Table 3.1-2. Land Use Categories within Hampton Basin Subject to Flooding by a 100-Year Storm Event

Category	*Acres of Potentially Affected Parcels*	*Percent of Total Category ROI Land Use*
Transportation	145.7	19.1%
Commercial	548.5	14.0%
Industrial	412.6	9.9%
Utilities	17.2	2.8%
Government/Education	58.3	2.0%
Mixed Use	4.58	1.9%
Undeveloped	160.1	1.6%
Residential	52.8	1.1%
Open Space	26.7	0.3%
Total	**1,426.5**	**4.0%**

Sources: City of Dallas 2011; NCTCOG 2007.

The TRCCLUP designates the Hampton Pumping plant and its vicinity as Mixed Use-B/Adaptive Reuse and Residential Riverside development regimes (City of Dallas 2005). The Hampton Pumping Plant straddles two zoning districts: Agricultural and Industrial Research. The property directly north of the Hampton Pumping Plant is in the Industrial Manufacturing zoning district. To the east and northwest of the pumping plant are two separate PDs, which are designated mixed use (City of Dallas 2012). The 2011 City of Dallas land use inventory designates the Hampton Pumping Plant and surrounding land as Open Space – Public (City of Dallas 2011).

Charlie Basin

The Charlie Basin is located in the Downtown-Lakes District of the TRCCLUP. The TRCCLUP has identified the Bottoms for revitalization via residential infill, with a focus on single-family residences and development of a commercial corridor along IH-35E and the DART rail line. The area currently includes dense single-family neighborhoods, multi-family residential housing, educational, retail, and industrial uses. The TRCCLUP focuses on mixed use development in the community with the most intense development to occur along the levee (City of Dallas 2005).

The Tenth Street Bottoms and the Oak Cliff neighborhoods are both serviced by the Charlie Pumping Plant and sumps. The Oak Cliff neighborhood is dominated by single family residential with mixed commercial retail development.

Charlie Sump primarily drains residential (single and multi-family), vacant, industrial, and open space areas. Flooding of these sumps by a 100-year storm event would potentially affect 45.3 acres within the ROI. The potentially affected land uses from such an event are included in Table 3.1-3. The acreage values in Table 3.1-3 do not imply that a parcel is potentially subject to total inundation, but rather that the parcel intersects the 100-year flood extent, and thus may be subject to at least partial inundation.

Table 3.1-3. Land Use Categories within Charlie Basin Subject to Flooding by a 100-Year Storm Event

Category	*Acres of Potentially Affected Parcels*	*Percent of Total Category ROI Land Use*
Industrial	16.2	0.4%
Utilities	2.2	0.4%
Undeveloped	26.3	0.3%
Commercial	6.7	0.2%
Residential	0.2	<0.1%
Total	**51.6**	**0.1%**

Sources: City of Dallas 2011; NCTCOG 2007.

The Charlie Pumping Plant is located on Canada Drive between Sylvan Avenue and Bataan Drive. The Charlie Pumping Plant is in the TRCCLUP Downtown Lakes District in the Residential Riverside development module. The pumping plant is located in the City of Dallas PD zoning district; specifically, in PD-468, the Oak Cliff Special Purpose District. The 2011 City of Dallas land use inventory identifies the use of the pumping plant parcel as overlapping Undeveloped – Vacant and Open Space - Public (City of Dallas 2011).

Delta Basin

The Delta Basin is located partially in the West Dallas District of the TRCCLUP (refer to Figure 3.1-3). The plan designates small areas for Residential Riverside improvement at the places where Westmoreland and Hampton Roads approach the Trinity River levee. The TRCCLUP requires that these developments be designed so they do not have a negative effect on the stability of adjacent neighborhoods (City of Dallas 2005).

The segments of the basin not in the West Dallas District are not within the purview of the TRCCLUP and outside of the ROI. The property between the West Levee and Singleton Boulevard is currently zoned for dense single-family (R-5(A) zoning district) and multi-family residential uses, including a large multifamily residential planned development between North Westmoreland and North Hampton Roads. South of Singleton Boulevard, the zoning is a mix of Industrial Research and Industrial Manufacturing (City of Dallas 2012).

The Delta Basin is a mix of three main land uses: residential (mostly single-family), vacant land, and industrial. Much of the ROI industrial uses are located in this basin. The undeveloped use includes scattered undeveloped lots in the residential sections and parking (City of Dallas 2011).

Many of the surface waters in the Delta service area have been incorporated into recreational amenities in area parks within the Study Area (City of Dallas 2011). Predicted flooding associated with the 100-year storm event would potentially affect approximately 223 acres within the Delta Basin. The potentially affected land uses from such an event are shown in Table 3.1-4. The acreage values in Table 3.1-4 do not imply that a parcel is potentially subject to total inundation, but rather that the parcel intersects the 100-year flood extent, and thus may be subject to at least partial inundation.

Table 3.1-4. Land Use Categories within Delta Basin Subject to Flooding by a 100-Year Storm Event

Category	*Acres of Potentially Affected Parcels*	*Percent of Total Category ROI Land Use*
Residential	148.7	3.1%
Undeveloped	212.3	2.1%
Open Space	130.4	1.6%
Government/Education	12.7	0.4%
Commercial	1.2	<0.1%
Total	**505.3**	**1.4%**

Sources: City of Dallas 2011; NCTCOG 2007.

The TRCCLUP plans to maintain the traditional residential uses for the majority of the area surrounding the Frances Street and Westmoreland-Hampton Sumps; both sumps cross into TRCCLUP "Community Corridors." The TRCCLUP plans high density "Residential Riverside" uses with access to the Floodway at the eastern end of the Westmoreland-Hampton Sump as well as in the area surrounding the Westmoreland Road/Canada Drive intersection (City of Dallas 2005).

The land underlying the Westmoreland-Hampton Sump is zoned Dense Residential, PD, and Agricultural. The Frances Street Sump is zoned R-5(A) (dense residential) and Industrial Research (City of Dallas 2012). The 2011 City of Dallas land use inventory designates the sumps as Open Space – Public, Undeveloped – Vacant, or the sump land is not designated. Undeveloped – Vacant, Mixed Use, and Residential (single and multi-family) land uses are all in the immediate vicinity (City of Dallas 2011; NCTCOG 2007).

The Delta Pumping Plant is located on Canada Drive across from Calypso Park. The Delta Pumping Plant is in the Residential-Traditional development module of the TRCCLUP. The properties adjacent to the pumping plant to the east are in the Residential Riverside development module (City of Dallas 2005). The Delta Pumping Plant straddles two zoning districts: Agricultural and Multifamily 2(A) (which allows a higher density of multifamily units) (City of Dallas 2012). The 2011 City of Dallas land use inventory designates the location of the Delta Pump Station as Open Space – Public. The lands adjacent to the pump station to the south are designated Undeveloped – Vacant (City of Dallas 2011).

<u>Eagle Ford Basin</u>

The Eagle Ford Basin is in the West Dallas District of the TRCCLUP. The West Dallas District is primarily residential, and the TRCCLUP envisions this use to continue. The intention for zoning and future land use of this district is to generally accommodate some multi-family, office, and/or retail development, but not expanding such uses into the single-family neighborhoods. Community Corridor development is planned along Singleton Boulevard. South of Singleton Boulevard, areas are planned to remain in Light Industrial use (City of Dallas 2005). The current zoning for the Eagle Ford Basin is primarily residential, with more industrial and regional retail zoning categories to the south (City of Dallas 2012).

The Eagle Ford and Trinity-Portland sumps are completely within the West Dallas District of the TRCCLUP. The West Dallas District goals are to remain residential while improving the regional, neighborhood, and community retail corridors within West Dallas. Thus, the TRCCLUP envisions changing several modules from Light Industrial to Regional Corridor, Traditional Residential, and Community Corridor, with a small section in the Neighborhood Corridor designation (City of Dallas 2005).

The current zoning for the portion of the Eagle Ford sump along the levee is Agricultural. The majority of the western parts of the sump is zoned Industrial Research, with small segments of the sump to the west of Loop 12 supporting mixed uses. The majority of the sump east of Loop 12 is currently zoned for dense single-family (R-5(A) zoning district) and Multi-Family Residential uses; the northern part of the sump east of Loop 12 is zoned for Light Industrial uses. The current zoning for the Trinity-Portland Sump is Agricultural, dense single-family residential uses, Community Retail, Commercial Service, and Industrial Research (City of Dallas 2012).

The 2011 City of Dallas land use inventory designates the Eagle Ford Sump as Undeveloped – Vacant and Government/Education. The Trinity-Portland Sump is designated as Residential and Undeveloped – Vacant or undesignated and are surrounded by Undeveloped – Vacant and Residential uses, and Commercial or Industrial land use (City of Dallas 2011). Flooding of these sumps by a 100-year storm event would potentially affect approximately 333 acres within the ROI. The potentially affected land uses from such an event are included in Table 3.1-5. The acreage values in Table 3.1-5 do not imply that a parcel is potentially subject to total inundation, but rather that the parcel intersects the 100-year flood extent, and thus may be subject to at least partial inundation.

Table 3.1-5. Land Use Categories within Eagle Ford Basin Subject to Flooding by a 100-Year Storm Event

Category	*Acres of Potentially Affected Parcels*	*Percent of Total Category ROI Land Use*
Undeveloped	361.6	3.5%
Government/Education	70.3	2.4%
Residential	90.8	1.9%
Industrial	67.9	1.6%
Open Space	69.8	0.8%
Commercial	14.5	0.4%
Total	**674.9**	**1.9%**

Sources: City of Dallas 2011; NCTCOG 2007.

Proposed Trinity Portland Pumping Plant Location

The proposed Trinity-Portland Pumping Plant would be located in the Residential-Traditional development regime of the TRCCLUP. The parcel is within the R-5(A) zoning district. This zoning allows local and government utility construction after completion of the special use permit process (City of Dallas 2012). The City of Dallas 2011 land use inventory designates the parcel as predominately Undeveloped – Vacant, with the access roads and intake in Residential – Single Family (City of Dallas 2011).

3.2 GEOLOGY AND SOILS

3.2.1 Definition of Resource

Geological resources are defined as the topography, geology, mining, and soils of a given area. Topography describes the physical characteristics of the land such as slope, elevation, and general surface features. The geology of an area includes bedrock materials and mineral deposits. Mining refers to the extraction of resources (e.g., gravel). The principal geologic factors influencing the stability of structures are soil stability, depth to bedrock, and seismic properties. Soil refers to unconsolidated earthen materials overlying bedrock or other parent material.

This resource section includes a discussion of geotechnical conditions. Geotechnical engineering is defined as the behavior of earthen materials, both natural and man-made. This section summarizes the detailed geotechnical analysis prepared in support of the Dallas Floodway Project Feasibility Report. The findings of that appendix are summarized here; for details on geotechnical conditions, refer to Appendix B, *Geotechnical Engineering* of the USACE Feasibility Report (USACE 2014).

3.2.1.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to geology and soils was established through review of geological and soils studies and reports, and federal and state laws and regulations. The ROI for geological resources is the Study Area.

3.2.1.2 Regulatory Framework

The regulatory framework for geology and soils mainly consists of its potential to affect other resources including air quality and water. The Farmland Protection and Policy Act (FPPA), 7 United States Code (USC) 4201, was enacted to minimize the loss of prime farmland and unique farmlands as a result of federal actions, through conversion of these lands to nonagricultural uses. This includes converting areas that have high quality soil for crop production. Because the Dallas Floodway does not lie within a seismically active area, regulations and policies that relate to geologic hazards and seismic safety do not apply.

The importance of geotechnical considerations and its associated regulations mainly stems from an earthen levee's potential to erode and the ability of the ground to support structures and facilities. USACE Engineering Manual 1110-2-1913, *Engineering and Design - Design and Construction of Levees*, presents basic principles used in the design and construction of earthen levees.

3.2.2 Existing Conditions

3.2.2.1 Topography

Surface topography in the area is generally level to gently rolling, with area hills ranging from approximately 500 to 800 feet above mean sea level. The floodplain within the ROI ranges from approximately 390 to 420 feet above mean sea level, while the top of the levees are roughly 430 feet above mean sea level with elevation variations throughout the ROI (Google Earth 2013). The Study Area surface and subsurface is characterized by mostly flat, unconsolidated terrace and floodplain deposits. Within the ROI, the Trinity River and the levees represent major topographical features. Outside of the Floodway, the surrounding City of Dallas is urban, and much of the original topography has been heavily developed, paved, and graded.

3.2.2.2 Geology

The City of Dallas is located within the Central Lowland and Coastal Plain provinces of northeastern Texas, which is characterized by low rolling terrain with fairly uniform deep, dark-colored alkaline clays, interspersed with some gray acid sandy loams. The City of Dallas lies upon a wedge of Cretaceous age sedimentary rock 2,000 to 4,500 feet thick comprised of four bedrock formations: Woodbine, Eagle Ford, Austin Chalk, and Taylor (Figure 3.2-1). These formations dip to the east and southeast towards the East Texas Embayment at a rate of 50 to 100 feet per mile. Each of these bedrock formations outcrop in Dallas County, and all are thought to underlie the Study Area (City of Dallas 2009).

There are numerous bedrock outcroppings across the Dallas Floodway in several locations downstream of the Westmoreland Bridge. These outcroppings are associated with bedrock banks that are exposed at lower water levels. In many cases, these shale and mud stone bedrock outcrops have formed an impermeable layer (City of Dallas 2008).

Historically, mining operations extracted sand and gravel from the Dallas Floodway, generally from the area between Hampton Road and the end of the levee alignment at the DART Rail Bridge. Although not actively quarried, the presence of Austin Chalk in the area represents a mining resource. Currently there are no active mining activities in the Study Area (Texas State Historical Association 2013).

3.2.2.3 Geologic Hazards

The City of Dallas is located in an area of historically low seismic activity. Moreover, the U.S. Geological Survey Quaternary Fault and Fold Database indicates that there are no known active faults within 60 miles of the Dallas Floodway (Dallas Geological Society 1965). However, the soils within the Floodway have a very high shrink-swell potential (U.S. Department of Agriculture [USDA] 1980).

The extent of shrinking and swelling is influenced by moisture and the amount and kind of clay in the soil. Shrinking and swelling of soils can cause damage to building foundations, roads and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating (USDA 1980).

3.2.2.4 Soils

Although the Study Area consists of numerous soil types, the two major soil map units are the Trinity clay (frequently flooded) and Trinity-Urban land complex, both from the Trinity-Frio Association (USDA 2009). Table 3.2-1 presents the properties of the soil types found within the Study Area.

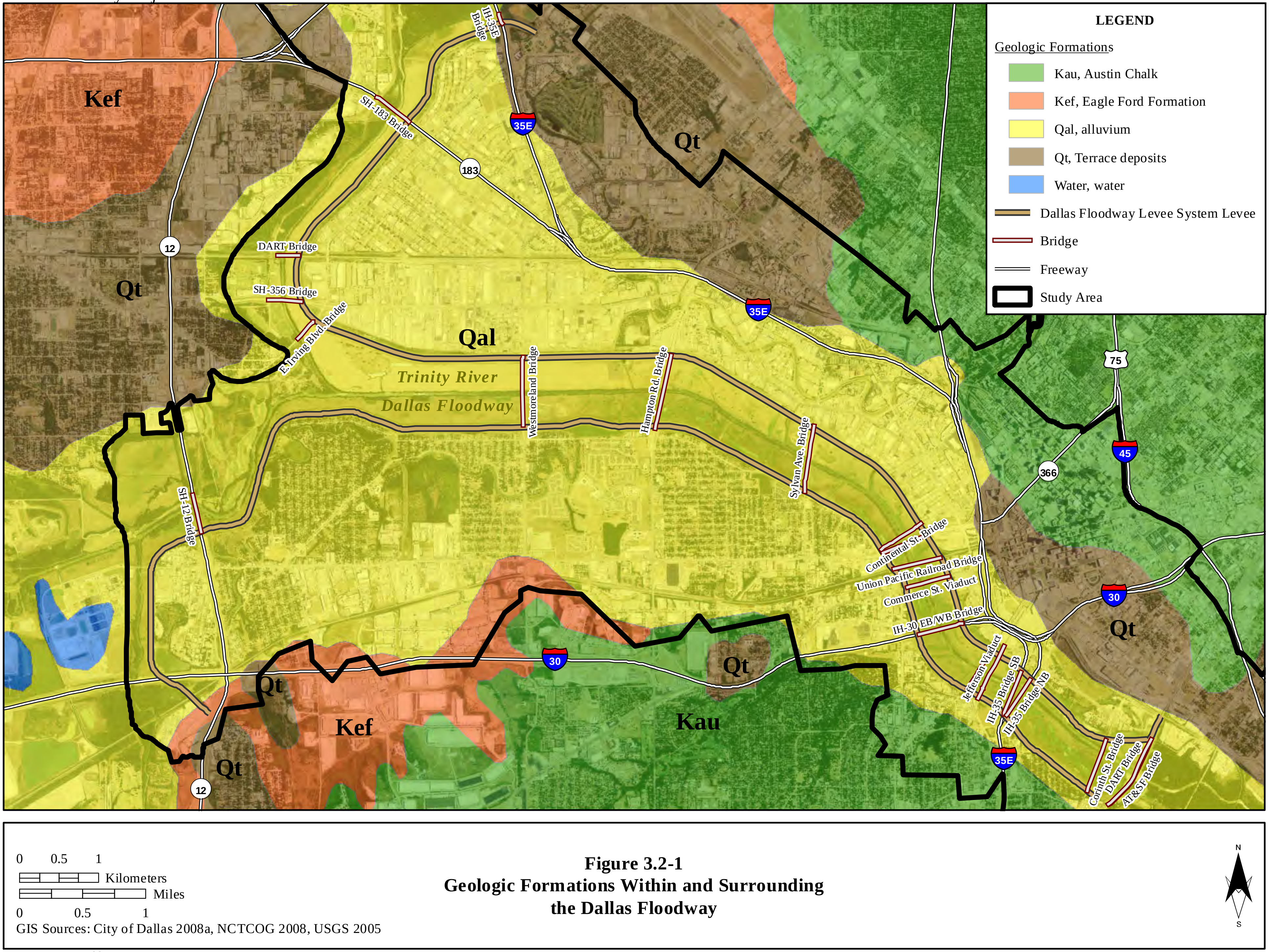

Figure 3.2-1
Geologic Formations Within and Surrounding the Dallas Floodway

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USGS 2005

Table 3.2-1. Soils and Soil Properties in the Study Area for Geological Resources

Soil Type	*Soil Characteristics*	*Soil Potential and Limitation*
Trinity clay, frequently flooded	Deep, nearly level, somewhat poorly drained, located on floodplains. Permeability is very slow, available water capacity is high. Surface layer is a moderately alkaline, dark gray clay 7 inches thick.	Very low potential for urban and recreational use. Limitations include frequent flooding and wetness, corrosivity, very high shrink-swell potential, and clayey texture. Low erosion hazard.
Trinity-Urban land complex	Deep, nearly level soils and Urban land, somewhat poorly drained. Permeability is very slow and available water capacity is high. Surface layer is a moderately alkaline, very dark gray clay 30 inches thick.	Very low potential for urban and recreational use. Limitations include flooding, very high shrink-swell potential, corrosivity, low strength, and wetness of soil. Walls of excavations tend to cave or slough. Low erosion hazard.
Silstid-Urban land complex	Deep, well drained, sloping soils and areas of Urban land. Permeability is moderate, and the available water capacity is medium.	High potential for urban uses. Erosion hazard, corrosivity, and low strength of the soil are limitations, but can be overcome through good design and careful installation. There are few limitations to recreation uses.
Frio-Urban land complex	Deep, nearly level, well drained soils and areas of Urban land on the floodplains of small streams. Typically, the surface layer of Frio soil is a moderately alkaline, dark grayish brown silty clay. Permeability is moderately slow, and the available water capacity is high.	Low potential for urban uses because of the hazard of flooding. However, in most areas of this complex, levees have been constructed to prevent damage by floods.

Source: USDA 1980.

The Floodway is comprised mostly of Trinity clay and Trinity-Urban land complex soils (Figure 3.2-2). Silstid-Urban and Frio-Urban land complex soils are located just inside the West Levee, between the Pavaho and Charlie Pumping Plants. The Trinity-Frio soil type consists of deep, nearly level, clayey soils found in floodplains. Trinity-Frio soils are moderately alkaline, somewhat poorly-drained and well-drained soils that have slopes of 0 to 1%. Trinity clay soils are somewhat poorly-drained, which helps to promote ponding in wetlands long after inundation; hence, they are characterized as hydric soils (USDA 2012). Conversely, Frio soils are well-drained. Both soil types are found along broad bottomlands of the Trinity River (USDA 1980).

Clayey soils, such as the Trinity clay, have low compressive strength, low slope stability, low permeability, high shrink-swell potential, and high corrosion potential. The Urban form of this soil comes from mixed sources, as it is typically very highly disturbed. The clayey texture, very slow to moderately slow permeability of the soils, high shrink-swell potential, and flood hazard of the Trinity series soils present limitations to development uses within the Trinity-Frio unit (USDA 1980).

3.2.2.5 River Channel Morphology

The geology of the Trinity River watershed is important because it characterizes sediment transport to and through the Study Area, which, in turn influences hydrology, and vegetation conditions within the Dallas Floodway and downstream areas. The river channel and Dallas Floodway in the Study Area are composed of alluvium consisting of sand, silt, clay, and sparse gravel.

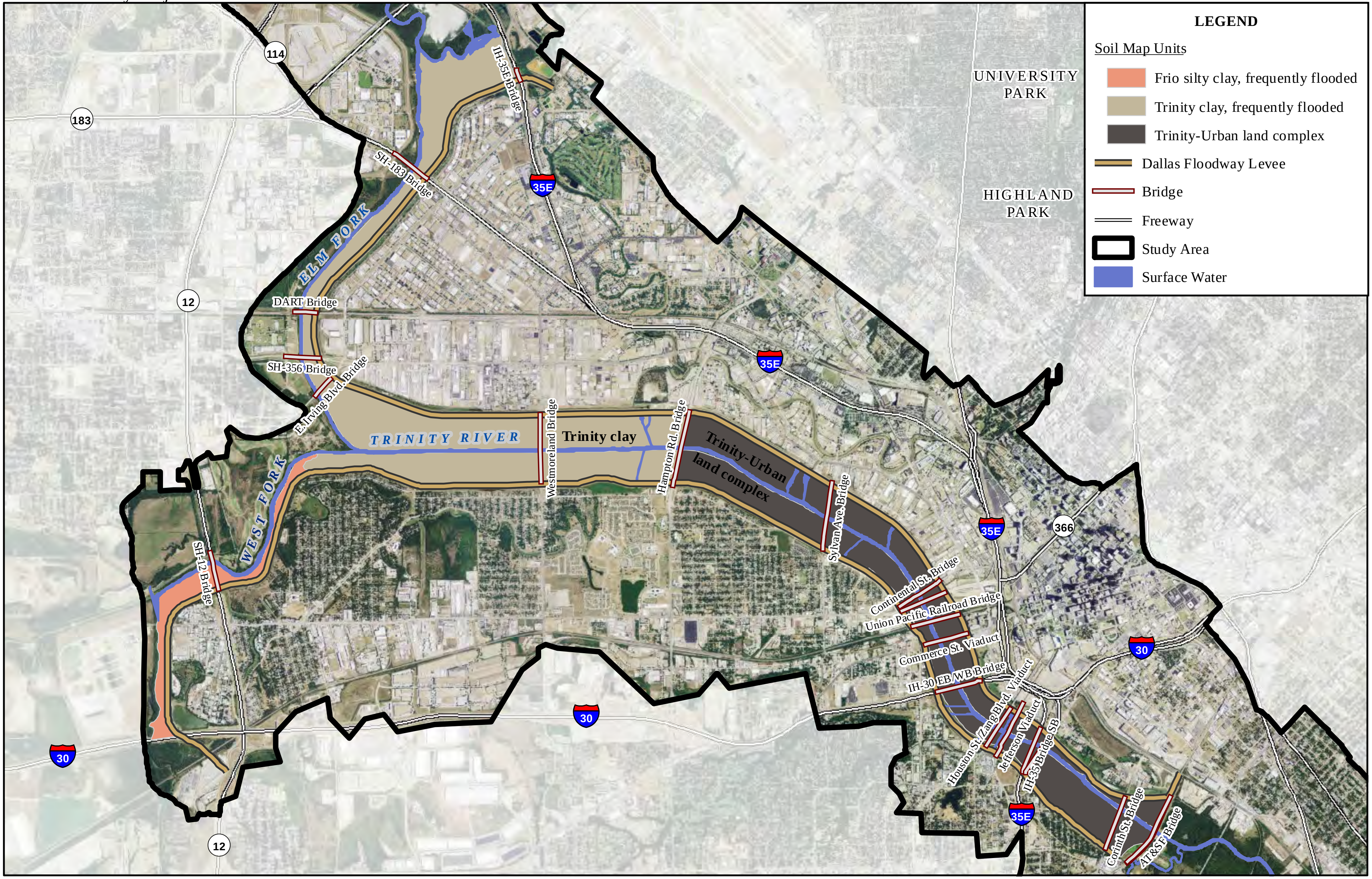

Figure 3.2-2
Soils Located Within the Dallas Floodway

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USDA 2009

Prior to the channelization and straightening actions, the river system was sinuous with large meandering bends that would have migrated across the floodplain over long time periods. The channel located nearer to the edge of the ancestral floodplain valley walls has exposed bedrock outcroppings in some locations, which has limited incision and improved bank stability and resulted in a more stable river channel (City of Dallas 2009).

Currently, there is bank erosion downstream of the Sylvan Bridge and the downstream banks of stormwater outfall channels. Farther downstream at the Houston Street Viaduct and approaching the DART Rail Bridge, the river channel banks appear to be stable with newly deposited sediment. Areas upstream of the Sylvan Bridge appear to have less bank erosion. Erosion at bridges, channel bends, and pump station outfalls appear to be more significant than along the rest of the channel. As a result of the erosion and sedimentation, the Trinity River channel is in a state of dynamic equilibrium and does not appear to be experiencing detrimental erosion (City of Dallas 2009).

3.2.2.6 Levee Stability

To date, both the East and West Levees have performed well at the flood levels that have occurred since the levees were modified by the USACE. All other conditions being equal, levees that have performed well at higher water levels will usually perform well at floods of equivalent or lesser height; as higher floods exert greater forces on the levee. In addition to stability-related concerns generated by these greater forces, seepage is of even greater consequence during higher floods since the higher water pressures may expose previously unidentified weaknesses in the embankment and its foundation. Levee soil type plays a major role in the overall stability of the levee. Landslides on the Trinity River Levee System occur year round with the bulk occurring during the winter months. It has been observed that most of the landslides occur on the riverside of the levee system with the exception of a small number that occur on the landside of the system (USACE 2009).

While the overall performance of the levees has been good, hundreds of shallow slope failures requiring repair have developed, and will likely develop in the future, in areas where the levee is predominately constructed with high plasticity clay soils. Records maintained by the Dallas County Flood Control District show that 283 such slides have been repaired since 1966. Under normal conditions, these slides are considered a recurring maintenance issue; however, under flood conditions, these slides could have an impact on successful functioning of the Dallas Floodway Levee System. Geotechnical field investigations indicate there are no engineering, and/or construction deficiencies for the existing Dallas Floodway Levee System as defined in the original 1945 project authorization (USACE 2009).

In several sections of the levee, foundation soils (i.e., those soils upon which the levee was constructed) are comprised primarily of particulate matter larger than 0.0029 inches, which results in higher seepage concerns. If such foundation soil were to form a continuous layer underneath the levee, there would be the potential for a high amount of water flow under pressure (USACE 2009).

3.2.2.7 Prime Farmland Soils

There are three types of prime farmland soils located within the Floodway: Heiden Clay, Ovan Clay, and Frio Silty Clay soils. However, no prime farmlands, unique farmland, or farmland of local or state importance are designated within the Study Area. According to the FPPA, unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops. The Study Area is located within an area zoned as urbanized, thereby exempting it from the requirements of the FPPA. Other than temporary livestock holding pens adjacent to the East Levee, no land within the Dallas Floodway is currently devoted to agricultural practices.

3.3 HYDROLOGY AND HYDRAULICS

3.3.1 Definition of Resource

Hydrology is the science that deals with the properties, circulation and distribution of water on and under the surface of the earth and in the atmosphere from the moment of precipitation until it returns to the atmosphere through evapotranspiration or is discharged into the ocean. Hydraulics is the science that deals with practical applications of runoff flowing through a channel. Collectively, hydrology and hydraulics are referred to as "H&H." Fluvial geomorphology is the study of river forms and the processes that shape them, and involves consideration of the geological setting, channel morphology, hydrology, hydraulics, sediment transport, and riparian and floodplain vegetation.

This H&H section summarizes the detailed Appendix A, *Hydrology and Hydraulics*, of the USACE Feasibility Report (USACE 2014). This affected environment section analyzes the existing and potential future H&H and fluvial geomorphology conditions associated with the Trinity River within the ROI, focusing on the Standard Project Flood (SPF) event. Conditions relating to the Interior Drainage Plan (IDP) Improvements are not discussed here and are instead presented in Sections 3.13 and 4.13, *Utilities*.

3.3.1.1 Methodology

The following H&H analysis identifies regulatory requirements, describes existing conditions within the Study Area, outlines the approach to analysis, and evaluates potential impacts and mitigation measures related to implementation of the Proposed Action.

The ROI for H&H includes the SPF floodplain within the Study Area. The extent of the regional H&H models extend beyond the Study Area sufficiently both upstream and downstream to characterize any potential impacts due to actions within the Study Area. Primarily, the ROI for H&H as presented in this analysis extends downstream to the limits of the Dallas Floodway Extension (DFE) project at Interstate Highway (IH)-20 and upstream on the Elm Fork Trinity River to beyond the limits of the Dallas Floodway East Levee near IH-35E and upstream on the West Fork Trinity River to beyond the limits of the Dallas Floodway West Levee near IH-30. The ROI for H&H is shown on Figure 3.3-1.

3.3.1.2 Regulatory Framework

EO 11988: Floodplain Management

EO 11988 requires federal agencies to avoid "to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities" for:

- Acquiring, managing, and disposing of federal lands and facilities;
- Providing federally undertaken, financed, or assisted construction and improvements; and
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

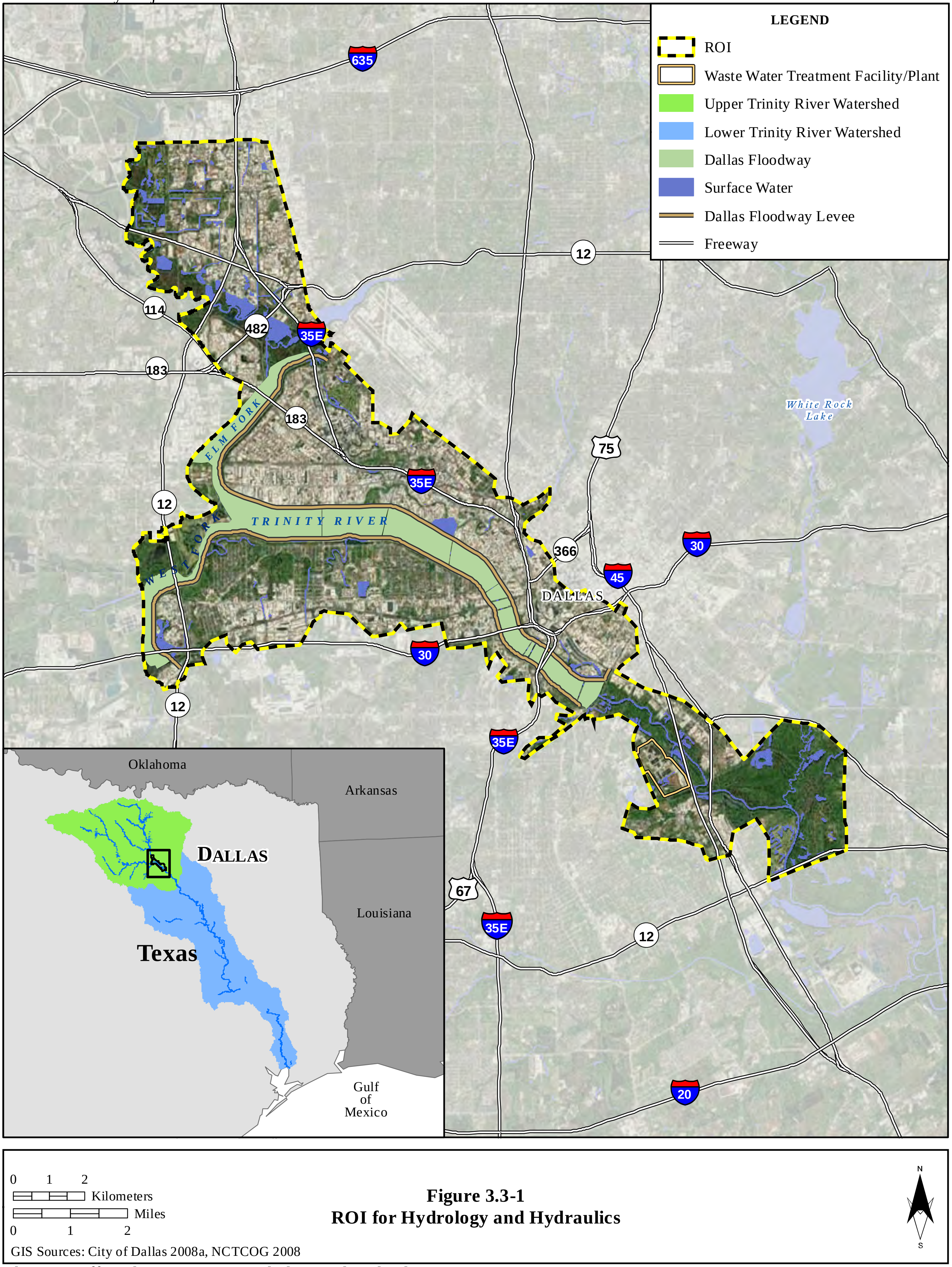

Figure 3.3-1
ROI for Hydrology and Hydraulics

GIS Sources: City of Dallas 2008a, NCTCOG 2008

USACE ER 1165-2-26 contains the USACE's policy and guidance for implementing EO 11988. Per ER 1165-2-26, the USACE must first determine whether there are practicable alternatives to placing a proposed project in a floodplain. In addition, ER 1165-2-26 specifies that all reasonable factors should be taken into consideration when determining practicability. These factors are conservation; economics; visual elements; natural and beneficial values served by floodplains; impact of floods on human safety; locational advantage; the functional need for locating the development in the floodplain; historic values; fish and wildlife habitat values; endangered and threatened species; federal and state designations of wild and scenic rivers, refuges, etc.; and, in general, the needs and welfare of the people.

H&H Modeling and Evaluation Process

The Trinity River Environmental Impact Statement (TREIS) Record of Decision (ROD) criteria were used to ensure that projects are designed in such a way that there would be (1) no flood rises in the water surface profile for the 100-year flood and SPF events, and (2) no valley storage losses for the 100-year flood and less than 5% valley storage loss for the SPF event.

The evaluation process for the hydraulic impacts of a proposed project requires that a permit applicant secure the services of an engineer capable of preparing a Hydrologic Engineering Center-River Analysis System (HEC-RAS) hydraulic model using the current Corridor Development Certificate (CDC) HEC-RAS model as a base condition. The CDC HEC-RAS model is maintained and usually distributed by the USACE to be used for evaluation of all projects that require a Section 408 Permit or a CDC Permit. A detailed description of the H&H model used for analysis of this project and how it was developed is provided in Appendix A of the USACE Feasibility Report (USACE 2014). Section 4.3.1 provides a description of how water surface profiles and valley storage are calculated and compared to determine if the Proposed Action meets the TREIS ROD criteria.

3.3.2 Existing Conditions

3.3.2.1 Hydrology

Watershed Description

The watershed of the Trinity River, from its headwaters to the confluence of Five Mile Creek, near the IH-20 Bridge in south Dallas, contributes to the hydrology of the Floodway and was evaluated during this analysis. This area, which is commonly referred to as the "Upper Trinity" watershed, covers about 6,275 square miles. It includes the majority of the Dallas-Fort Worth Metroplex. Terrain in this watershed varies in elevation from about 1,200 feet National Geodetic Vertical Datum (NGVD) at the headwaters of the West Fork of the Trinity River just northeast of Olney, Texas, to about 380 feet NGVD at the confluence of Five Mile Creek.

Of the five USACE flood control reservoirs in the Upper Trinity watershed, three (Lakes Benbrook, Lewisville, and Grapevine) were impounded in the early 1950s. Impoundments in the other two USACE reservoirs (Lakes Joe Pool and Ray Roberts) were initiated in January 1986 and June 1987, respectively. Additional major USACE flood control projects in the Upper Trinity watershed include the Fort Worth Floodway and the existing Dallas Floodway levee/channel improvement systems (Figure 3.3-2). There are also several non-federal lakes in the Upper Trinity watershed that are not utilized for flood control (Figure 3.3-2).

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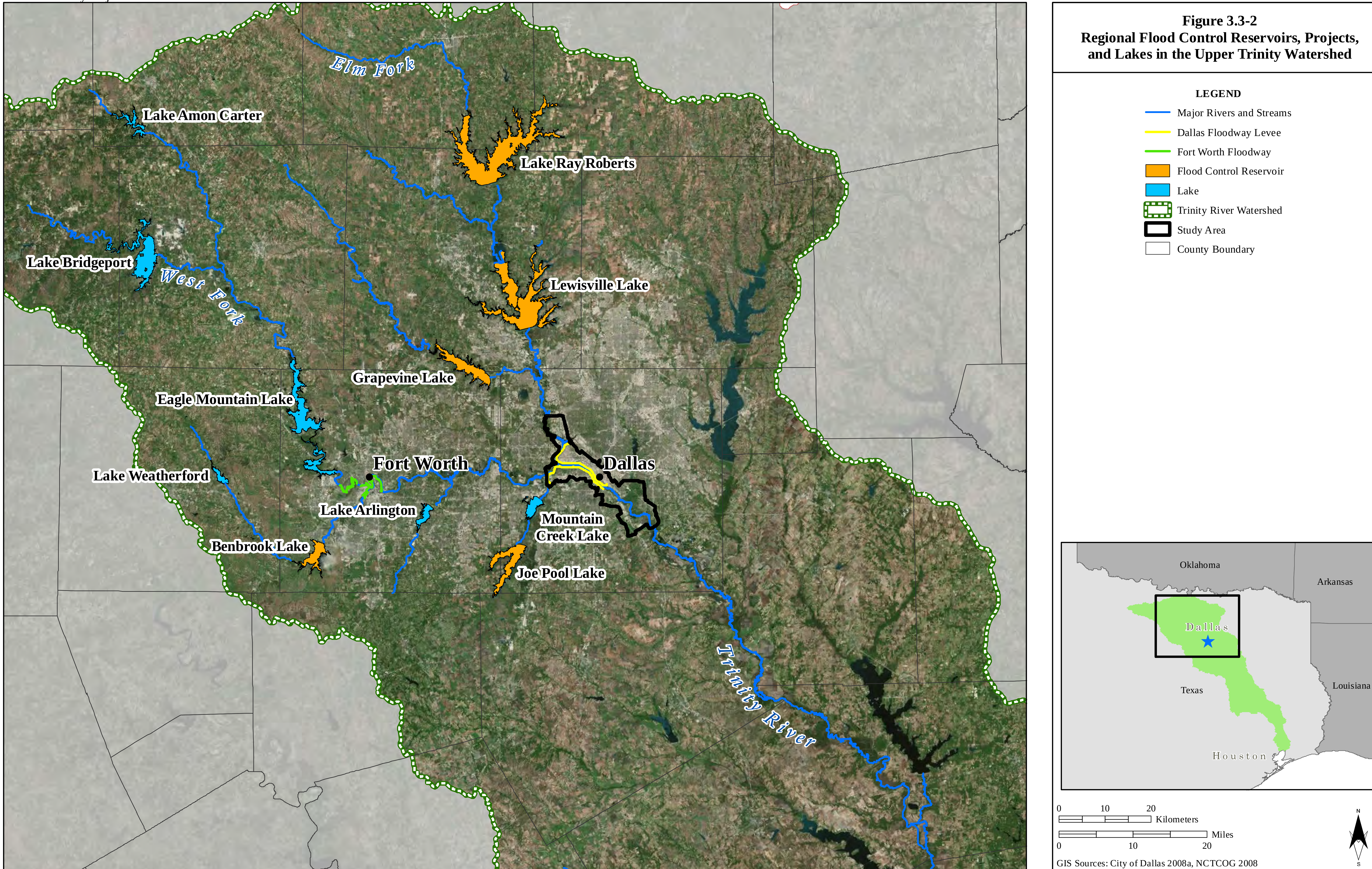
Figure 3.3-2
Regional Flood Control Reservoirs, Projects, and Lakes in the Upper Trinity Watershed



GIS Sources: City of Dallas 2008a, NCTCOG 2008

Climatology

The average annual precipitation over the Upper Trinity watershed varies from about 30 inches at Jacksboro, in the northwestern extremity of the watershed, to about 32 inches in the Dallas-Fort Worth Metroplex. The extreme annual precipitation amounts since 1887 include a maximum of 53.54 inches in 1991 at Dallas-Fort Worth International Airport (DFW) and a minimum of 17.91 inches in 1921 at Fort Worth. The maximum recorded precipitation in a 24-hour period was 9.57 inches, at Fort Worth in September 1932. A large part of the annual precipitation results from thunderstorm activity, with occasional very heavy rainfall over brief periods of time. Thunderstorms occur throughout the year, but are more frequent in the late spring and early summer. Refer to Section 3.14 for additional information on regional climatology.

3.3.2.2 Hydraulics

Existing Levee System

The Dallas Floodway Levee System is a federally sponsored project currently maintained by the City of Dallas. The project consists of earthen levees located along both sides of the main stem of the Trinity River and along the Dallas side of the Elm Fork Trinity River and the West Fork Trinity River. The Dallas Floodway provides flood risk management (FRM) benefits to areas that include the City of Dallas' Central Business District and West Dallas. The basis for the original design of the Dallas Floodway Levee System was the SPF design water surface elevation plus 4 feet. The original design SPF flow for the Dallas Floodway was 226,000 cubic feet per second (cfs).

Dallas Floodway Extension

The DFE Project is located immediately downstream from the existing Dallas Floodway Levees and comprises three major structural FRM components. They are the Lamar Street Levee, the Cadillac Heights Levee, and the Chain of Wetlands. The proposed Lamar Street Levee is designed to provide SPF FRM for portions of the industrial and residential development downstream of the existing Dallas Floodway Levees on the left bank of the Trinity River between the DART Rail Line Trinity River bridge and the Union Pacific Railroad Trinity River bridge. The proposed Cadillac Heights Levee is designed to provide FRM from the SPF flood for the industrial and residential areas located on the right bank of the Trinity River from the confluence of Cedar Creek to the Central Wastewater Treatment Plant (CWWTP). The Chain of Wetlands is divided into Upper Chain of Wetlands and Lower Chain of Wetlands construction segments. The Chain of Wetlands component is a series of wetland swales linked closely together in a longitudinal configuration paralleling the Trinity River on the right overbank extending from State Highway (SH)-12 (Loop 12) upstream to the confluence of Cedar Creek and the Trinity River.

3.3.2.3 H&H Model

A detailed description of the H&H model used for analysis of this project and how it was developed is provided in Appendix A of the USACE Feasibility Report (USACE 2014). The methods for calculating the SPF flood discharge (i.e., the hydrology of the watershed) and the water surface elevations (i.e., the hydraulics of discharge within the Floodway) have been improved and updated with the availability of more detailed mapping data, the higher level of H&H modeling technology, and the opportunity to calibrate these models to a recent high flood event, such as the May 1990 flood (82,300 cfs). In addition, land use changes throughout the watershed have altered the H&H of the Trinity River. Therefore, all of these factors combined have contributed to an increased risk of overtopping of the Dallas Floodway Levees since the existing Floodway was designed.

3.3.2.4 Existing Conditions Modeling Results

Existing Conditions Hydrology

Table 3.3-1 presents the final frequency flows within the Dallas Floodway for existing conditions representing discharge rates calculated for land use conditions estimated for 2015.

Table 3.3-1. Final Frequency Flows with the Dallas Floodway for Existing Conditions

Annual Probability of Exceedance	*Flood Return Interval (Years)*	*Existing Conditions Peak Flow (cfs)*
0.5	2	26,485
0.2	5	36,000
0.1	10	50,000
0.05	20	67,000
0.02	50	92,000
0.01	100	114,000
0.002	500	179,000
0.0004	2500	269,300 (current SPF)

Existing Conditions Hydraulics

Water Surface Profiles

Water surface profiles for existing conditions on the Trinity River Mainstem, Elm Fork, and West Fork for all frequency flows were determined. As shown on Figures 6-6 to 6-9 of Appendix A of the USACE Feasibility Report (USACE 2014), the Dallas Floodway East and West Levees would contain the 100-year flood event but would be overtopped at the following locations during the SPF event:

- Elm Fork between downstream of the SH-183 and Burlington Northern Santa Fe Railroad Bridge (East Levee);
- Main stem at several locations between the Westmoreland Road Bridge and Union Pacific Railroad Bridge (East and West Levee);
- Main stem at the IH-30 Bridge (East Levee); and
- Main stem at the IH-35 Bridge (East Levee).

Water Surface Elevations

The computed existing conditions water surface elevations at specified locations in the Study Area for the 100-year and SPF flood events are provided in Table 3.3-2 and Table 6-1 of Appendix A of the USACE Feasibility Report (USACE 2014).

Table 3.3-2. Water Surface Elevations within the Dallas Floodway (2015 Estimated Discharges)

Condition	*Water Surface Elevation at Location (feet)*			
	West & Elm Fork Confluence	*Hampton Bridge*	*Commerce Bridge*	*DART Rail Bridge*
100-Year Flood Event	422.84	419.84	416.36	413.72
SPF Event	434.94	432.45	428.55	425.06
Levee Design Grade Elevation	437.28	433.91	429.41	425.25

3.3.2.5 Floodplain Inundation

Floodplain inundation maps were used to show the aerial extent of potential flooding for estimated flood frequency events. These maps were created by using the water surface profiles computed in the H&H analysis for flood events that are of primary interest. The predicted extent of flooding for the SPF event under existing conditions is shown on Figure 3.3-3. The map for existing conditions is shown with the potential floodplain area with overtopping/failure of the Dallas Floodway East and West Levees. In this scenario, the potential damage area for both levees is shown with estimated flood depths computed in the H&H analysis for the SPF flood event. While not shown on Figure 3.3-3, the 100-year flood event is contained by the existing Dallas Floodway Levee System (water levels would be approximately half-way up the levees).

As the existing conditions analysis includes the impacts of the DFE Project, the map includes the impacts of the entire DFE Project including both existing levees and proposed levees as designed. These levees include the proposed Lamar Street and Cadillac Heights Levees and the existing CWWTP Levee and the Rochester Park Levee. All of these levees as a system with the exception of the CWWTP Levee are designed to manage flood risk from the SPF flood event.

3.3.2.6 Fluvial Geomorphology

A fluvial geomorphic assessment of the Trinity River within the Dallas Floodway reach was performed in 2009 as part of the on-going City of Dallas BVP Study. The fluvial geomorphic assessment found that in the last 50 years, no substantial channel migration has been documented indicating no substantial change in sediment along the Dallas Floodway (City of Dallas 2009). The Trinity River flow is reported to contain a suspended sediment concentration of approximately 920 milligrams per liter indicating a sediment transport rate of over 28,000 tons/day at 13,000 cfs (bankfull flow). Review of channel migration over a 70-year period indicates that average long-term channel migration rates are 0.25 feet/year to 1.37 feet/year. This is consistent with other geomorphic observations indicating that the existing Trinity River channel is very stable over the long term with no substantial changes to channel width and geometry over a range of normal and flood flows. The primary sediment migration occurred as localized sediment deposition, which did not appear uniform across the floodplain. Most of the local sediment migration occurred as lateral migration, such as bank slumping, in areas with more complex hydraulics or flow obstruction (City of Dallas 2009).

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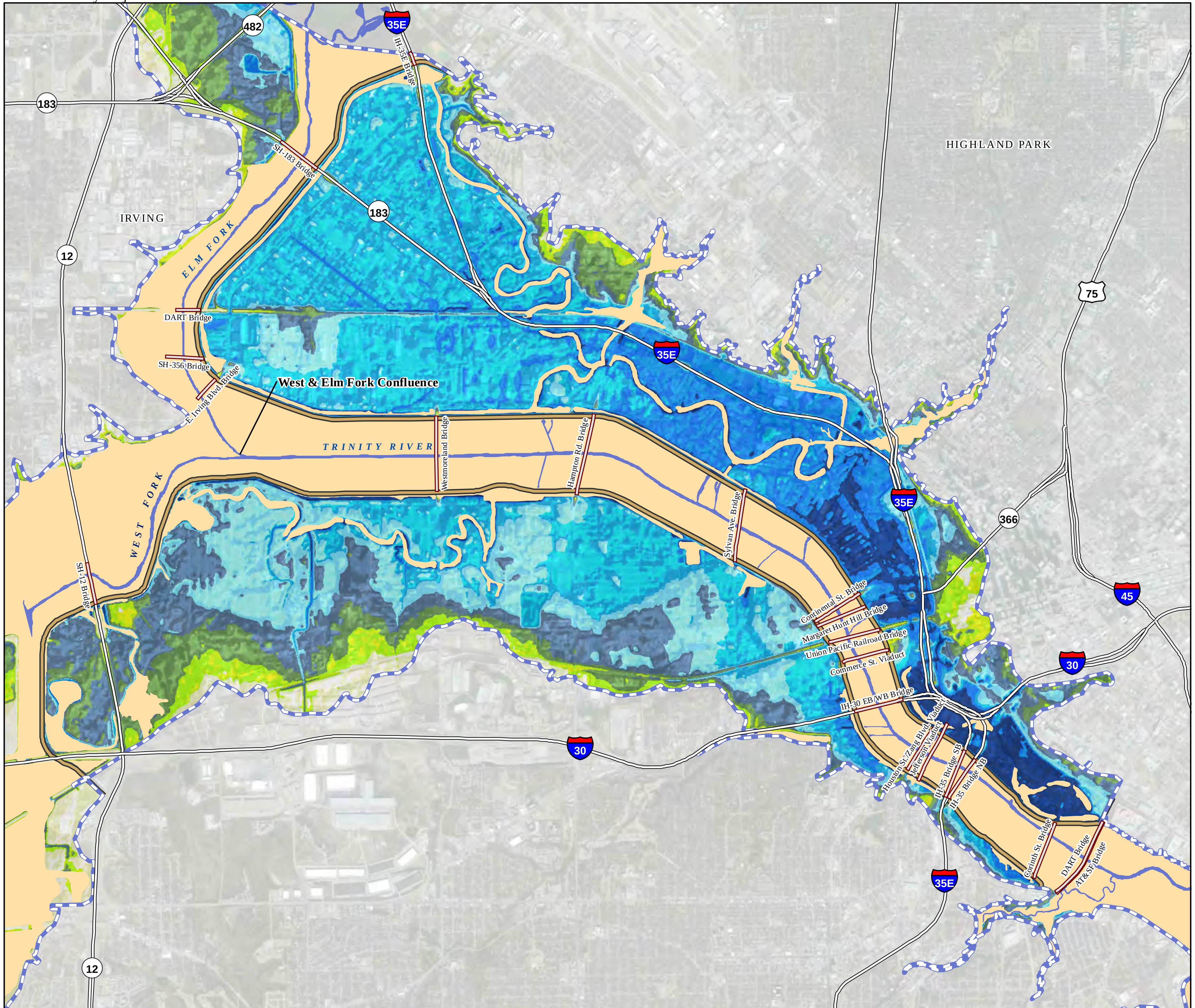


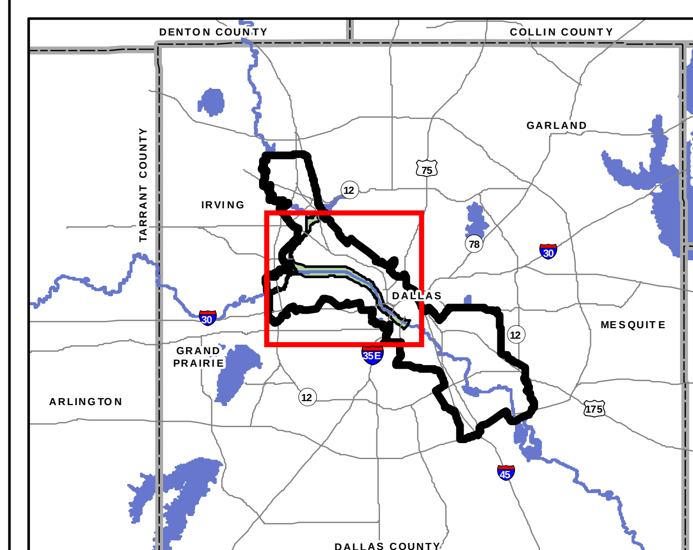
Figure 3.3-3
Existing Predicted Extent of 100-Year Riverine Flood and SPF Event

LEGEND

Estimated SPF Flood Depth

- Minimal to No Flooding
- 0 to 5 Ft
- 5 to 10 Ft
- 10 to 15 Ft
- 15 to 20 Ft
- 20 to 25 Ft
- 25 to 30 Ft
- 30+ Ft
- SPF Extent
- 100-Year Riverine Flood Extent
- Surface Water
- Dallas Floodway Levee
- Bridge
- Freeway

Note: Callouts correspond to Water Surface Elevation locations presented in Table 3.3-1.



0 0.5 1 Kilometers

0 0.5 1 Miles

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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3.4 WATER RESOURCES

3.4.1 Definition of Resource

Water resources include both surface water and groundwater resources and associated water quality. Surface water includes all lakes, ponds, rivers, streams, impoundments, and wetlands within a defined area or watershed. Subsurface water, commonly referred to as groundwater, is typically found in certain areas known as aquifers. Aquifers are areas of mostly high porosity rock where water can be stored within pore spaces. Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities. Impacts on water resources can also influence other issues such as land use, biological resources, socioeconomics, public safety, and environmental justice.

3.4.1.1 Methodology

The following analysis of water resources identifies associated regulatory requirements, describes existing conditions within the ROI and vicinity, outlines the approach to analysis, and evaluates potential impacts and mitigation measures related to implementation of the Proposed Action. The ROI for water resources is the Study Area (Figure 3.4-1). Available literature was used to assess existing conditions and to establish a baseline for the assessment, as described in Section 3.4.2.

3.4.1.2 Regulatory Framework

This water resources analysis has been prepared considering the following federal and state regulations and orders:

<u>Federal</u>

Clean Water Act

The Clean Water Act (CWA) of 1972, as amended (33 USC §§ 1251 et seq.), is the primary federal law that protects the nation's waters, including lakes, rivers, and coastal areas. The CWA prohibits all unpermitted discharge of any pollutant into any jurisdictional waters of the U.S. The U.S. Environmental Protection Agency (USEPA) is responsible for administering the water quality requirements of the CWA. Section 303(d) of the CWA requires all states to identify waters that do not meet, or are not expected to meet, applicable water quality standards. States must develop a total maximum daily load (TMDL) for each pollutant that contributes to the impairment of a listed water body. The Texas Commission on Environmental Quality (TCEQ) is responsible for ensuring that TMDLs are developed for impaired surface waters in Texas.

In addition to the discharge restrictions, the CWA Section 404 requires a USACE issued permit for the dredging and/or filling of jurisdictional waters of the U.S. Areas meeting the "waters of the U.S." definition are under the jurisdiction of the USACE. Anyone proposing to conduct a project that requires a federal permit or involves dredge or fill activities that may result in a discharge to U.S. surface waters and/or waters of the U.S. is required to obtain a CWA Section 401 Water Quality Certification from the TCEQ, verifying that project activities will comply with water quality standards.

Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 (as amended; 33 USC § 403) regulates structures or work that would affect navigable waters of the U.S. Structures include any pier, wharf, bulkhead, etc. Work includes dredging, filling, excavation, or other modifications to navigable waters of the U.S. The USACE issues permits for work or structures in navigable waters of the U.S.

Safe Drinking Water Act

Congress originally passed the Safe Drinking Water Act (SDWA) in 1974 (42 USC §§ 300 et seq.) to protect public health by regulating the nation's public drinking water supply. The law, amended in 1986 and 1996, requires many actions to protect drinking water and its sources.

State

Section 26 of the Texas Water Code

Section 26 of the Texas Water Code requires that a project develop and implement a Stormwater Pollution Prevention Plan (SWPPP) prior to and during construction activities, as required by the CWA.

State of Texas Water Quality Certification

A project must obtain a water quality certification from the TCEQ prior to the start of construction, as required by the CWA.

3.4.2 Existing Conditions

3.4.2.1 Surface Water Resources

Surface water features and wetlands within the Floodway are shown on Figure 3.4-2. For a detailed discussion of the East and West Levee Interior Drainage Systems (EWLIDS), refer to Section 3.13. The majority of surface water features in the Floodway have been substantially modified from their natural conditions. The jurisdictional limits of the Trinity River extend to the ordinary high-water mark of the channel, which varies in width from 100 to 200 feet throughout the Dallas Floodway. The residents in the Trinity River watershed rely heavily on surface water to fulfill water demand due to the relative scarcity of groundwater resources in the region.

Crow Lake is a small man-made lake adjacent to the Trinity River and within the Dallas Floodway, just east of Sylvan Avenue. The lake is located within Crow Lake Park and primarily used for recreation, including boating and fishing. Some of the interior drainage outfall channels associated with the EWLIDS are classified as jurisdictional intermittent open waters (Halff Associates 2011). As flood levels recede, these channels usually drain entirely with the exception of a few isolated pools, depending on local hydrologic conditions.

Waters of the U.S., Including Wetlands

Pursuant to EO 11990, *Protection of Wetlands*, Section 404 of the CWA, and Section 10 of the Rivers and Harbors Act of 1899, an investigation was conducted to identify potential jurisdictional waters of the U.S., including wetlands in the Study Area. According to USACE regulations, wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

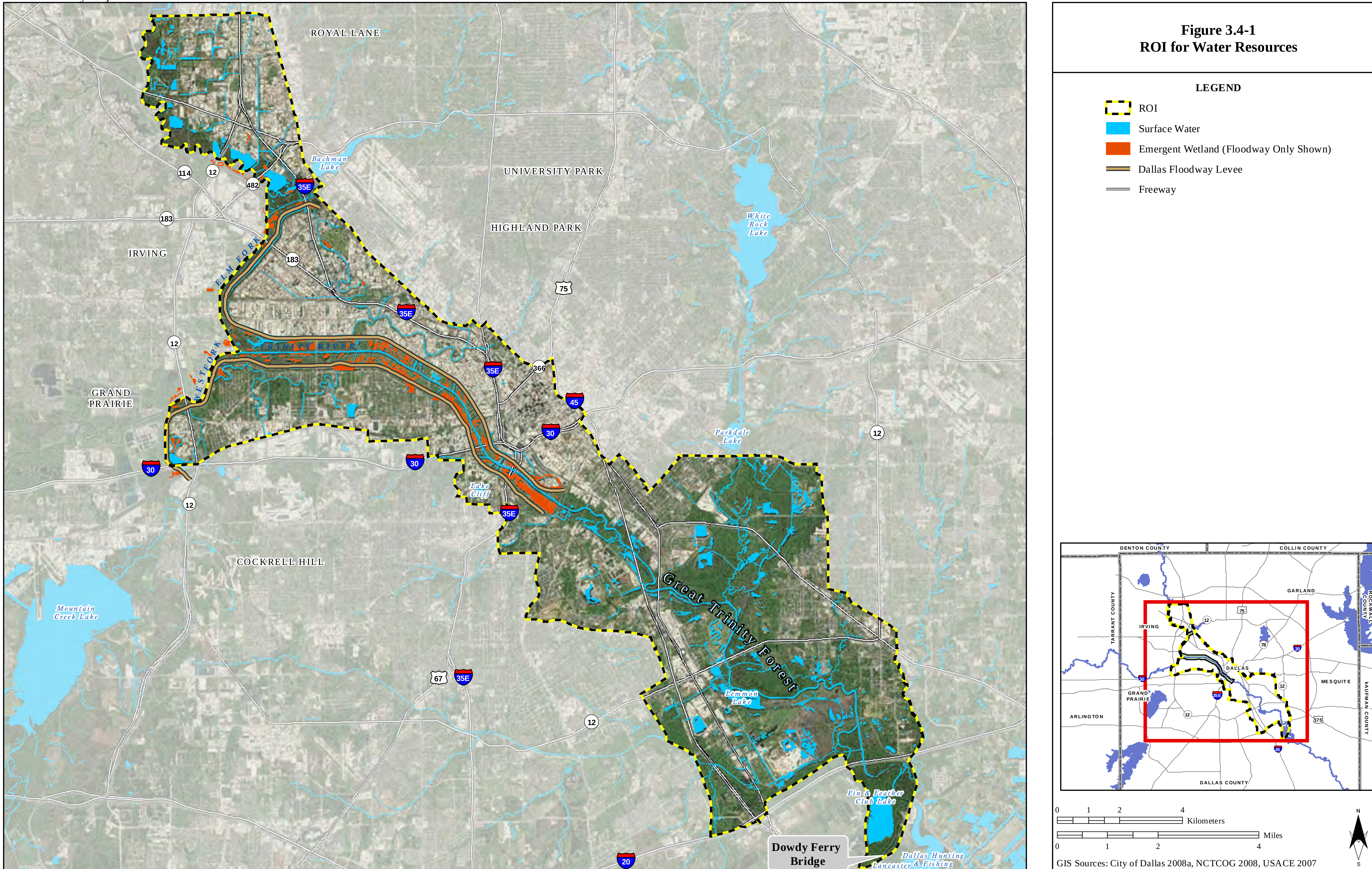

Figure 3.4-1
ROI for Water Resources

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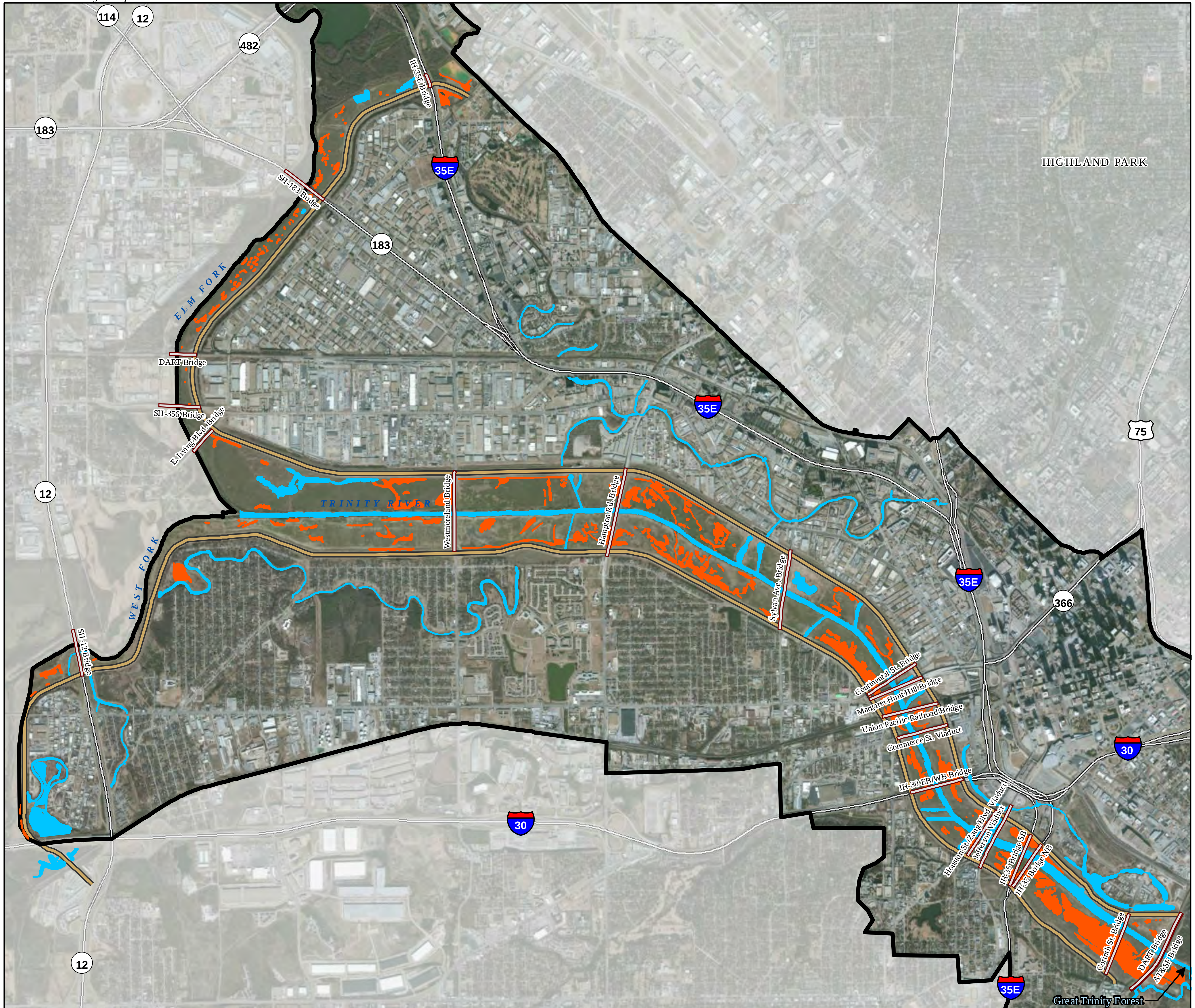
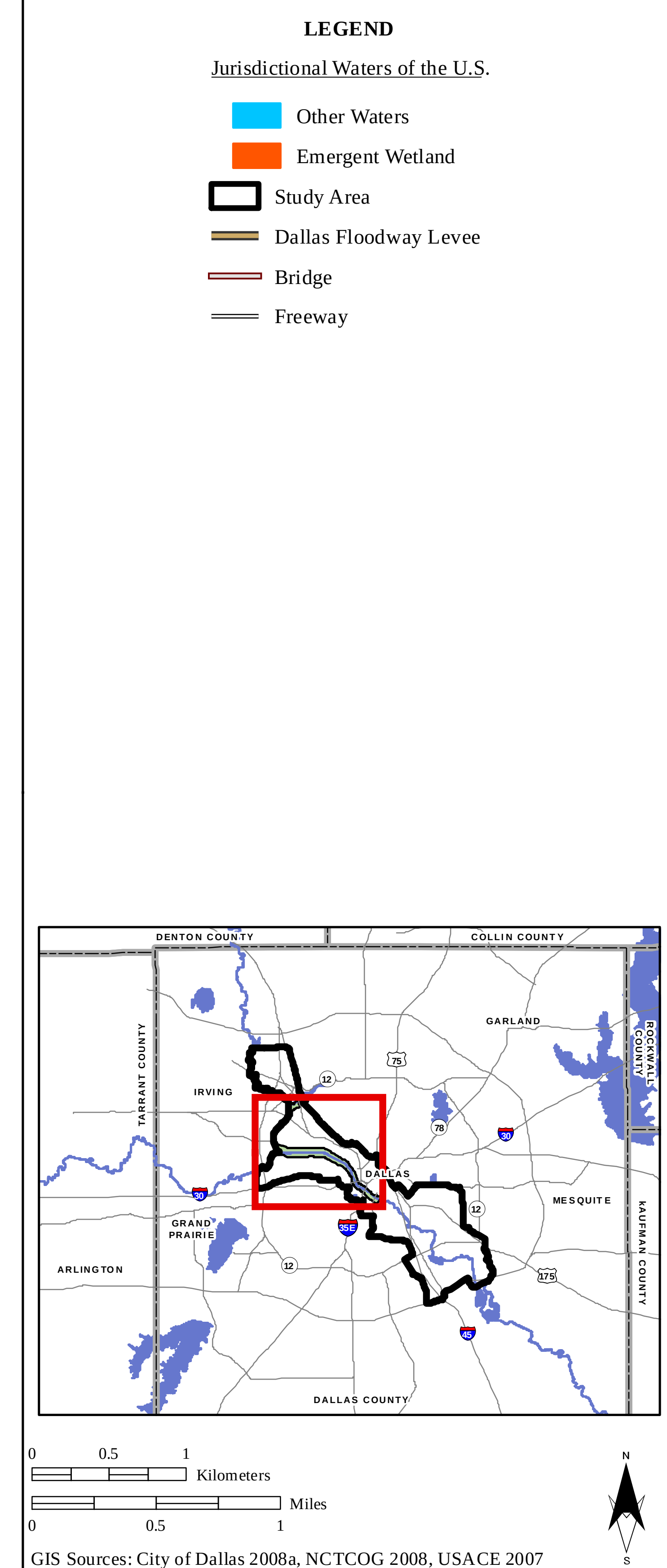


Figure 3.4-2
Surface Water Features in the Dallas Floodway



The currently approved Jurisdictional Determination (JD) for the Dallas Floodway – USACE Project Number SWF-2011-00049, identifies jurisdictional features within the area. This JD was originally approved on June 19, 2006, by the USACE (USACE Project Number SWF-2000-00380). The 2006 report was reviewed, updated, and reapproved on March 24, 2011, and is valid until March 24, 2016 (Halff Associates 2011). The USACE-approved JD identifies jurisdictional features in an area of roughly 3,000 acres within and around the Floodway (refer to Figures 3.4-1 and 3.4-2). Within the JD, there are approximately 495 acres of waters of the U.S. subject to Section 404 regulation. Of these 495 acres, approximately 309 acres are categorized as emergent wetlands and the rest are open waters. In addition, there are approximately 116 acres of aquatic features in the JD that are not jurisdictional waters of the U.S., and thus not subject to Section 404 regulation. Most of these non-regulated waters are man-made linear drainage sumps (Halff Associates 2011).

Emergent wetlands discussed in the Biological Resources section are only based on wetland vegetation and may overlap with but do not necessarily correspond to areas of jurisdictional wetlands. Jurisdictional wetlands must have hydric soil, hydrophytic vegetation, and wetland hydrology. Thus, the wetland acreages presented in the Water and Biological Resources sections are not identical. Appendix C of the 404(b)(1) Analysis (refer to Appendix L) provides the existing functional condition of jurisdictional wetlands and other waters within the Study Area.

3.4.2.2 Groundwater Resources

The primary source of groundwater for the Upper Trinity River watershed (including the Study Area) is supplied by the Trinity Group Aquifer (a major aquifer), which yields between 50 to 1,900 gallons per minute (gpm). The water quality of the Trinity Group is acceptable for most municipal and industrial purposes and ranges from fresh to slightly saline, with salinity increasing with depth. However, this aquifer has been over-used in the Dallas-Fort Worth Metropolitan Area, and therefore the water table is low, in places approximately 1,200 feet below the surface. The movement of groundwater in the Trinity Group is generally in an easterly direction at a rate of a few feet to tens-of-feet per year (City of Dallas 2009).

Groundwater is found in shallow floodplain terraces and deposits that are in hydraulic connection with the Trinity River, its major tributaries, and larger local lakes. The primary source of this shallow groundwater is rainwater infiltration (City of Dallas 2009). The Woodbine Aquifer (a minor aquifer) occurs at an estimated depth of 250 to 350 feet in the Study Area. Sustainable yields from wells penetrating the Woodbine Formation generally range between 50 and 400 gpm. However, the quality of water produced is relatively poor, exceeding 1,500 parts per million (ppm) total dissolved solids in some areas. As a result, the Woodbine Aquifer ranges from slightly to moderately saline. In addition, the groundwater exhibits high levels of fluoride and sulfate, often measuring above the USEPA Secondary and/or Maximum Contaminant Level for drinking water of 4 ppm and 250 ppm, respectively (Texas Water Development Board 2014).

3.4.2.3 Water Quality

The increasingly urbanized Upper Trinity River watershed has impacted stormwater quality with the addition of oil and grease, heavy metals, chemicals, toxic substances, solid waste (trash and debris), wastewater, effluence, bacteria, sediment, and other waste streams. The Study Area has three TCEQ classified State Stream Segments: Upper Trinity River-0805, Elm Fork Trinity River Below Lewisville Lake-0822, and Lower West Fork Trinity River-0841 (Figure 3.4-3). These stream segments are subcategorized into Assessment Units (AUs). In accordance with Section 303(d) of the CWA, which requires the TCEQ to identify water bodies for which effluent limitations are not stringent enough to implement water quality standards, Stream Segments 0805 and 0841 have been listed in the 2012 Texas 303(d) List (TCEQ 2013a).

Table 3.4-1 provides the level of use and support for designated uses and presents the reason for listing (parameter) and pollutant source from the 2012 Texas Integrated Report of Surface Water Quality for Clean Water Act Sections 305(b) and 303(d) associated with each AU located in the Study Area for Stream Segments 0805, 0822, and 0841 (TCEQ 2013a, 2013b). As demonstrated in the Table 3.4-1, all the AUs are listed as "Not Supporting" one or more designated uses (recreation and fish consumption uses) by one or more pollutants. These AUs have a TCEQ designation as either "Category 4a" streams where a TMDL study has been completed and approved by the USEPA or "Category 5a" streams where a TMDL study is either underway, scheduled, or will be scheduled.

On-going research and pilot studies conducted by the USEPA have focused on pharmaceuticals and personal care products (PPCPs) found in surfaces waters (USGS 2002; Ramirez et al. 2009; Texas Water Resources Institute 2010; USEPA 2013). Many wastewater treatment plants in Texas discharge to a surface waterbody and because conventional wastewater treatment technologies do not remove all pharmaceutical compounds completely and more effective advanced treatments are not commonly used, PPCPs are often detected in surface water and fish tissue. Detections of PPCP chemicals are typically in the parts per billion or parts per trillion level and studies have been more focused on presence or absence of pharmaceuticals rather than toxicological impact of these levels (TCEQ 2010).

Fish collected from Trinity River had detections of PPCPs in their tissues and livers, depending on the specific chemical detected (Ramirez et al. 2009; USEPA 2013). Effects from exposure can have adverse reproductive impacts to fish (i.e., abnormal reproductive development or feminization of males) (Wright-Walters and Volz 2007; TCEQ 2010). While exposure to PPCPs has been found to have some adverse effects to aquatic life, the USEPA continues to report that consumption of low concentrations of pharmaceuticals found in drinking water does not represent human health risk (TCEQ 2010).

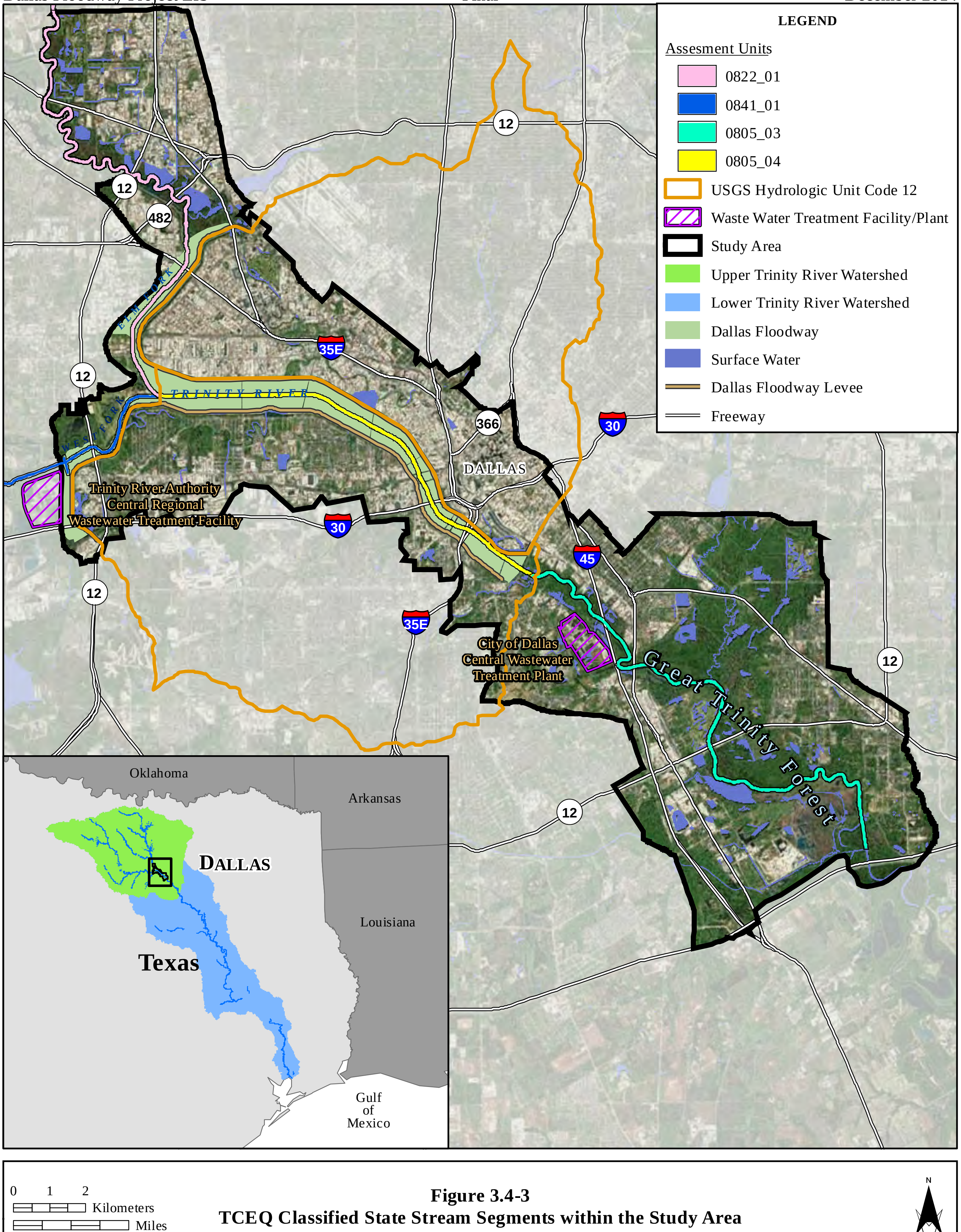


Figure 3.4-3
TCEQ Classified State Stream Segments within the Study Area

GIS Sources: City of Dallas 2008a; NCTCOG 2008; TCEQ 2009, 2010

Table 3.4-1. 2012 Level of Use and Support for Designated Uses and Assessment Unit Category and Status on 2012 303(d) List

Stream Segment (AU)	*Level of Use and Support for Designated Uses*					*Status on 2010 303(d) List*		*AU Category*[1]
	Aquatic Life Use	*Recreation Use*	*General Use*	*Fish Consumption Use*	*Public Water Supply Use*	*Parameter*	*Potential Pollution Source*	
0805 (Upper Trinity River)								5a
03	Fully Supporting or No Concern	Not Supporting	Concern[2]	Not Supporting	Not Assessed[3]	dioxin in edible tissue	Point/Nonpoint	5a
						PCBs in edible tissue	Point/Nonpoint	5a
						bacteria	Point/Nonpoint	4a
04	Fully Supporting or No Concern	Not Supporting	Concern[2]	Not Supporting	Not Assessed[3]	dioxin in edible tissue	Point/Nonpoint	5a
						PCBs in edible tissue	Point/Nonpoint	5a
						bacteria	Point/Nonpoint	4a
0822 (Elm Fork Trinity River Below Lewisville Lake)								5a
01	Concern[2]	Not Supporting	Concern[2]	Fully Supporting	Fully Supporting or No Concern	bacteria	Unknown	4a
0841 (Lower West Fork Trinity River)								5a
01	Fully Supporting or No Concern	Not Supporting	Concern[2]	Not Supporting	Not Assessed[3]	dioxin in edible tissue	Point/Nonpoint	5a
						PCBs in edible tissue	Point/Nonpoint	5a
						bacteria	Unknown	5a
02	Fully Supporting or No Concern	Fully Supporting	Concern[2]	Not Supporting	Not Assessed[3]	dioxin in edible tissue	Point/Nonpoint	5a
						PCBs in edible tissue	Point/Nonpoint	5a
						bacteria	Unknown	5a

Notes: [1] Dependent on the categories of all the AUs that are a part of it. Individual AUs are assigned to categories and based on given parameters. Determinations are then used to assign a category to the entire Stream Segment.
[2] Concern for screening levels for one or more measured parameters.
[3] These stream segments were not assessed because they are not used for public water supply.
PCBs = polychlorinated biphenyls.
Category 4a: TMDL has been completed and approved by USEPA.
Category 5a: A TMDL study is underway, scheduled, or will be scheduled.
Sources: TCEQ 2011, 2013a, 2013b.

Summary

Table 3.4-2 presents a summary of existing water quality conditions in the Trinity River.

Table 3.4-2. Summary of Existing Water Quality Conditions in the Trinity River

Segment	*Designated Use*	*Existing Conditions*
0805 - Upper Trinity River	Aquatic Life Use	Fully Supporting or No Concern
	Recreation Use	Not Supporting
	General Use	Concern
	Fish Consumption Use	Not Supporting
	Public Water Supply Use	Not Assessed
0822 - Elm Fork Trinity River Below Lewisville Lake	Aquatic Life Use	Concern
	Recreation Use	Not Supporting
	General Use	Concern
	Fish Consumption Use	Fully Supporting
	Public Water Supply Use	Fully Supporting or No Concern
0841 - Lower West Fork Trinity River	Aquatic Life Use	Fully Supporting or No Concern
	Recreation Use	Not Supporting
	General Use	Concern
	Fish Consumption Use	Not Supporting
	Public Water Supply Use	Not Assessed

Sources: TCEQ 2011, 2013a, b.

3.5 BIOLOGICAL RESOURCES

3.5.1 Definition of Resource

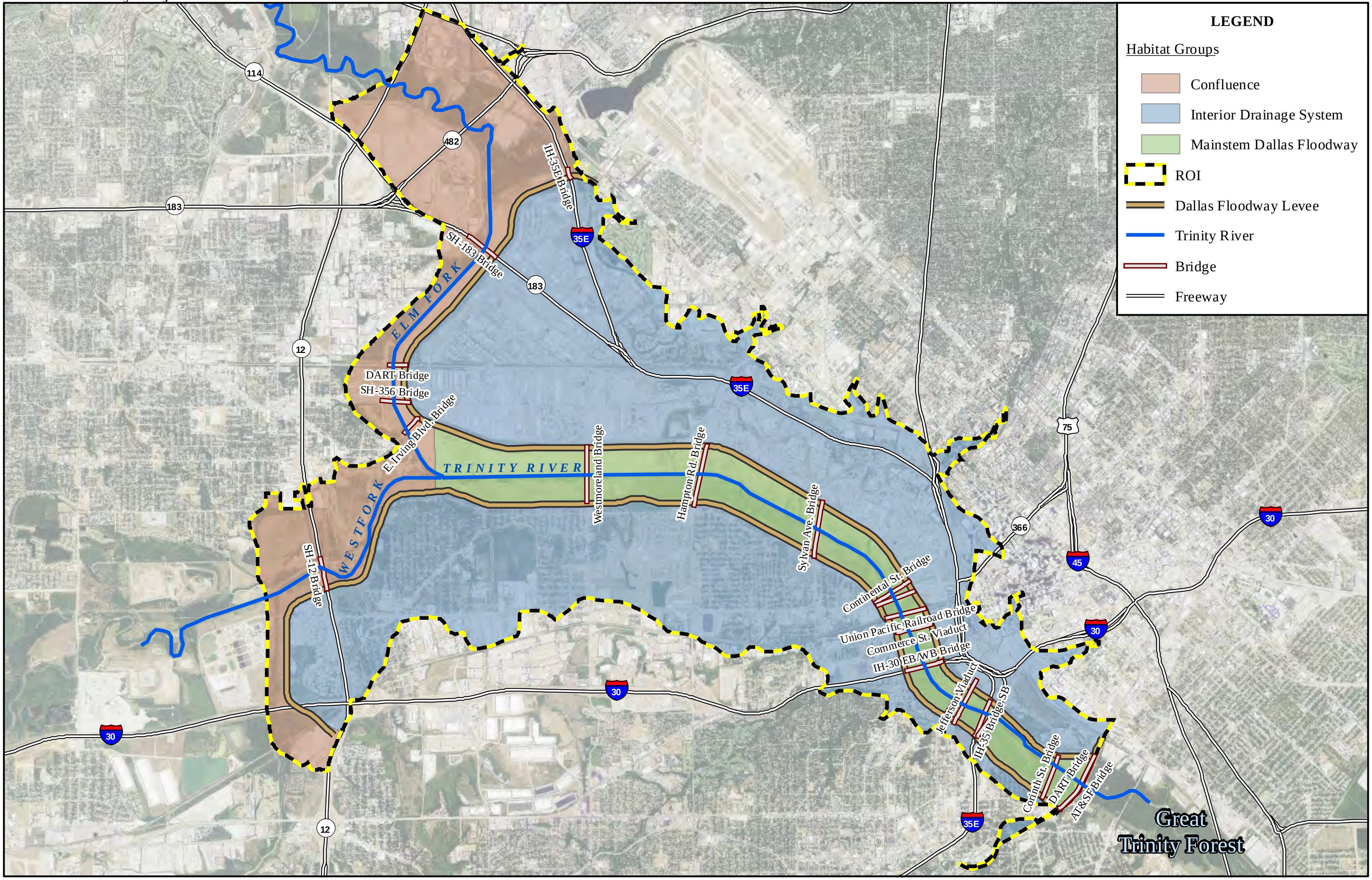
Biological resources include plants and animals and the habitats in which they occur. Biological resources are important because: (1) they influence ecosystem functions and values; (2) they have intrinsic value and contribute to the human environment; and (3) they are the subject of a variety of statutory and regulatory requirements.

3.5.1.1 Methodology

The ROI for biological resources includes: (1) the Confluence Group consisting of the Elm Fork and West Fork of the Trinity River; (2) the Mainstem Group consisting of the main channel of the Trinity River, the floodplain, and levees along the river; and (3) the IDS Group and surrounding commercial and residential areas (Figure 3.5-1). The ROI includes the area evaluated by the United States Fish and Wildlife Service (USFWS) in the Planning Aid Report (PAR (USFWS 2014), and roughly corresponds to the FEMA 500-year flood event level. The USACE and USFWS developed the PAR to evaluate the existing and potential future habitat values in the ROI.

3.5.1.2 Regulatory Framework

- **Endangered Species Act.** The Endangered Species Act (ESA) affords protection for federally listed threatened and endangered species and, where designated, critical habitat for those species.
- **Fish and Wildlife Coordination Act.** The Fish and Wildlife Coordination Act requires the USACE to coordinate with the USFWS and TPWD on water resources related projects to obtain their views toward preservation of fish and wildlife resources and mitigation of unavoidable impacts.



0 0.5 1 2
Kilometers
Miles
0 0.5 1 2

Figure 3.5-1
Evaluation Groups in the ROI for Biological Resources

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USFWS 2006

- **USACE Habitat Mitigation Process.** The USACE has established a goal of no net loss of aquatic resource values for bottomland hardwoods, open water, emergent (herbaceous) wetlands, and aquatic riverine. ER 1105-2-100 (the USACE *Planning Guidance Notebook*) ensures that project-related adverse environmental impacts (i.e., impacts on fish and wildlife resources) have been avoided or minimized to the extent practicable, and that remaining unavoidable significant adverse impacts are compensated to the extent justified. To this end, a mitigation plan would be required. For additional discussion of what is required in a mitigation plan, refer to Chapter 7.
- **Migratory Bird Treaty Act and EO 13186, *Conservation of Migratory Birds.*** The Migratory Bird Treaty Act (MBTA) of 1918 states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, young, feather, or egg in part or in whole, without a federal permit issued in accordance with the MBTA's policies and regulations. Under EO 13186, federal agencies are directed to evaluate the impacts of their actions on migratory birds in National Environmental Policy Act (NEPA) documents and to conserve migratory birds, giving priority to species of concern (listed by USFWS), and their important habitats.
- **EO 13112, *Invasive Species.*** Dated February 3, 1999, this EO directs federal agencies to expand and coordinate their efforts to combat the introduction and spread of "invasive species" (i.e., noxious plants and animals not native to the U.S.). Non-native flora and fauna can cause significant changes to ecosystems, upset ecological processes and relationships, and cause harm to our nation's agricultural and recreational sectors. Those species that are likely to harm the environment, human health, or economy are of particular concern.
- **Parks and Wildlife Code 12.0011, Texas Parks and Wildlife Department**. Parks and Wildlife Code 12.0011 affords protection to Texas threatened and endangered species. Functionally, the TPWD oversees endangered resources through the Wildlife Division.

3.5.2 Existing Conditions

This section is divided into four subsections as follows:

1. **Habitat Types and Value –** the definition, distribution, and acreage of aquatic and terrestrial habitats; and the results of the Habitat Evaluation Procedures (HEP) methodology used to determine quantitative values for habitat quality;
2. **Fish and Wildlife** – general aspects of the fauna of the ROI, including migratory birds;
3. **Special Status Species** – the occurrence of state- and federally listed species, candidate species, and other species of local or regional concern listed by the TPWD; and
4. **Invasive Species** – the occurrence of non-native, invasive species as defined in the 1999 EO 13112.

The 2014 USFWS *Existing Habitat Conditions Planning Aid Report for the Dallas Floodway Project* provides detailed descriptions and tables of biological resources and habitat values in the Dallas Floodway (USFWS 2014). The PAR is summarized in this section; refer to Appendix G, *USFWS Planning Aid Report*, of the USACE Feasibility Report (USACE 2014) for the complete PAR.

3.5.2.1 Habitat Types and Habitat Values

<u>Habitat Types</u>

Past channelization and clearing of the Dallas Floodway, along with urbanization, has significantly degraded the natural terrestrial and aquatic habitats of the Dallas Floodway. Before the 1920s, the Trinity River's morphology through the City of Dallas included significant meanders consistent with a river of its geologic age. The construction of the Dallas Floodway has essentially eliminated these meanders, and with it, high-value habitat and connections to adjacent ecosystems (USACE 2000).

The ROI is located within the Blackland Prairie ecoregion of Texas (Griffith et al. 2004). Pre-settlement conditions were those of a true prairie grassland community dominated by a diverse assortment of perennial and annual grasses and forbs (weeds) with sparsely scattered trees and oak mottes (TPWD 2007). The dominant grass of the true tall grass prairie is little bluestem (*Schizachyrium scoparium*) (TPWD 2007).

The Dallas area is classified as an urban region (TPWD 1984). The area southwest of the Dallas Floodway is primarily residential and industrial. Habitat types, and corresponding qualities and quantities, were developed through field investigations and coordination conducted by an interagency team composed of USACE, TPWD, and USFWS personnel, as described in the PAR (USFWS 2014).

There are five habitat types (aquatic riverine, bottomland hardwood, emergent wetland, grassland, and open water) within the ROI. In addition, while not a habitat type, urban area is discussed in conjunction with the aforementioned habitat types. Of note, the aforementioned habitat types are not to be confused with the USACE regulatory program-specific definition of jurisdictional wetlands. The distribution of habitat types in the ROI, is shown on Figure 3.5-2; acreages and percentages of habitat are shown in Table 3.5-1 and Table 3.5-2. The habitat types in the ROI were mapped by USFWS and USACE in 2007 and updated in 2010 and 2013 (USACE 2007, 2013a, 2013b). Urban areas account for approximately 60% of the ROI. The bottomland hardwoods, emergent wetlands, and grasslands provide the best habitat for wildlife in the ROI. The aquatic riverine, emergent wetlands, and open water areas provide good habitat for fish and other aquatic species. A discussion of these habitats in the ROI follows Tables 3.5-1 and 3.5-2.

Table 3.5-1. Habitat Types and Associated Acreages Defined in the ROI

Habitat Type	*Acres*	*Percent of Total*
Bottomland Hardwood	1,414	8.2%
Emergent Wetland	419	2.4%
Grassland	4,283	25.0%
Aquatic Riverine	421	2.5%
Open Water	206	1.2%
Urban Area	10,400	60.7%
Total	**17,143**	**100%**

Table 3.5-2. Habitat Evaluation Groups by Habitat Types in the ROI

Habitat Type	*Acres*			
	Confluence	*Mainstem*	*IDS*	*Total*
Bottomland Hardwood	966	95	352	1,413
Emergent Wetland	68	263	88	419
Grassland	1,573	1,752	958	4,283
Aquatic Riverine	132	124	165	421
Open Water	152	6	49	207
Habitat Subtotal	***2,891***	***2,240***	***1,612***	***6,743***
Urban Area	927	36	9,437	10,400
Total	**3,818**	**2,276**	**11,049**	**17,143**

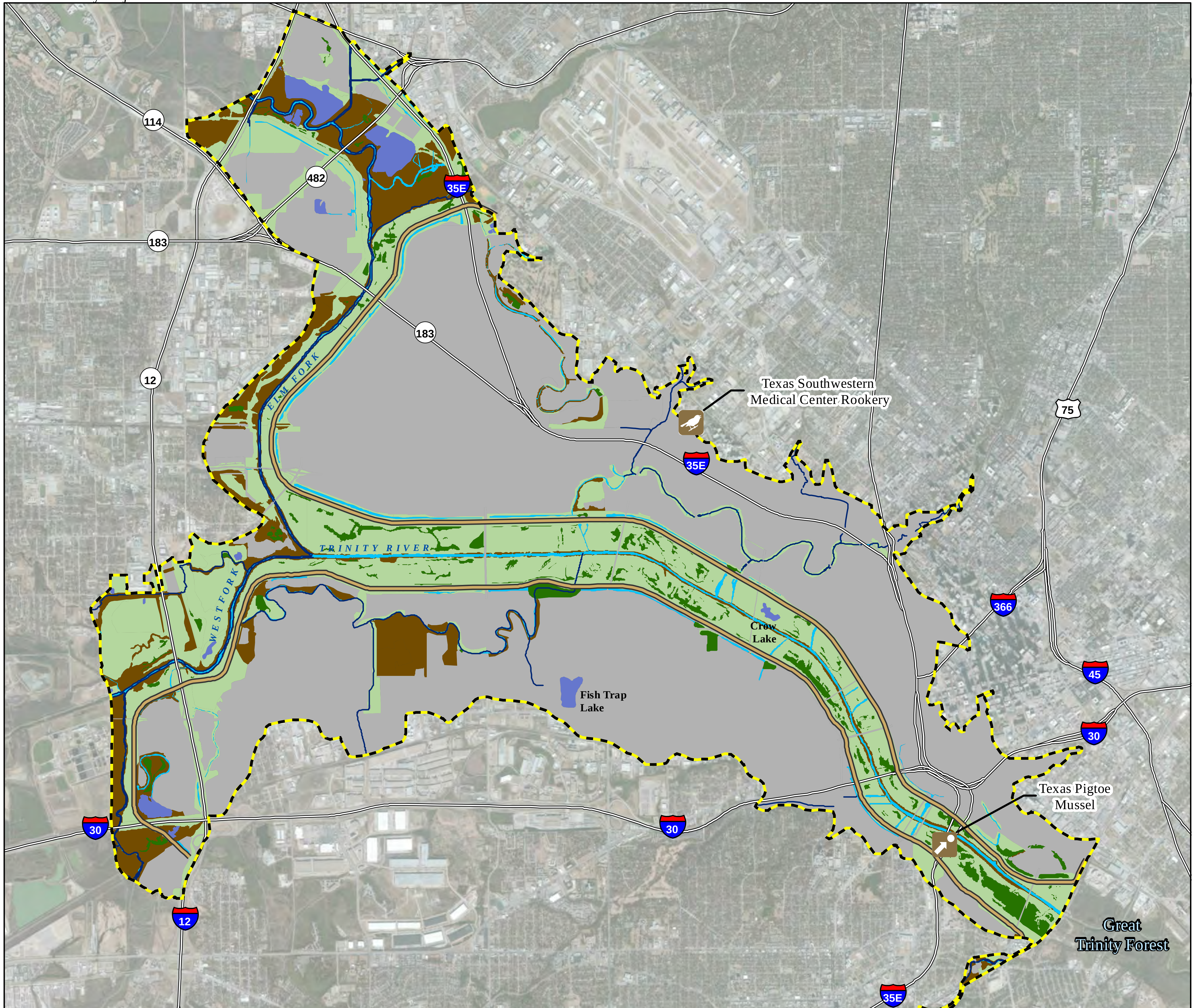
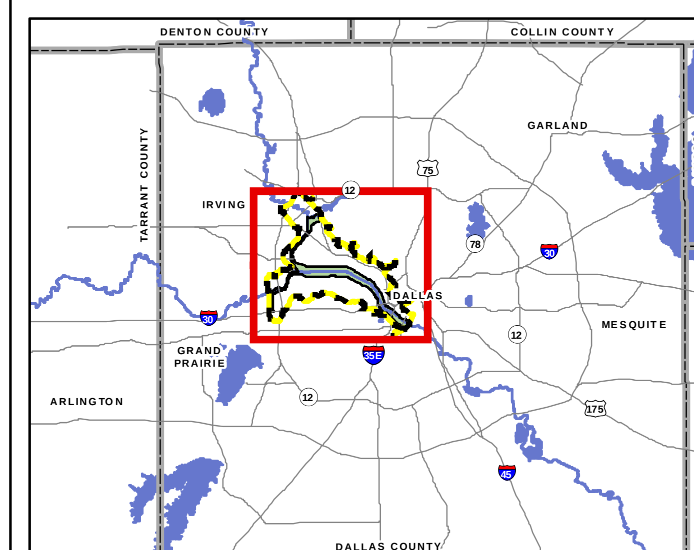


Figure 3.5-2
Existing Habitat Types in the ROI for Biological Resources

LEGEND

Habitat Types (At Year 0)

- Aquatic Riverine
- Bottomland Hardwood
- Emergent Wetland
- Grassland
- Open Water
- Urban
- ROI
- Dallas Floodway Levee
- Freeway



0 0.5 1 2 Kilometers

0 0.5 1 2 Miles

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2007, USFWS 2006

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Bottomland Hardwood

Bottomland hardwood consists of forested, alluvial wetlands. Bottomland hardwood habitat is characterized and maintained by alternating wet and dry periods following seasonal flooding events. These forests support distinct assemblages of plants and animals associated with particular landforms, soils, and hydrologic regimes (Texas Environmental Profile 2009). Dominant tree species include bur oak (*Quercus macrocarpa*), Shumard oak (*Quercus shumardii*), sugar hackberry (*Celtis laevigata*), elms (*Ulmus* species [spp.]), ashes (*Fraxinus* spp.), eastern cottonwood (*Populus deltoides*), and pecan (*Carya illinoensis*) (TPWD 2007).

The ROI consists of 1,414 acres of bottomland hardwood. The majority of the bottomland hardwoods in the ROI are in the Confluence on the upper reach of the Elm Fork (Figure 3.5-2). Bottomland hardwoods are also scattered in the Confluence Group along the Elm Fork and West Fork, in the Mainstem Group along the Trinity River, and along the drainage sumps in the IDS Group.

Fewer than 100 acres of bottomland hardwoods exist within the Mainstem Group. The bottomland hardwoods are narrow and fragmented, primarily due to routine mowing within the Floodway; however, they are relatively mature.

Emergent Wetland

Emergent wetlands occur in shallow depressions that are distinct from the aquatic riverine habitats of the main river channel, but which seasonally flood and dry out, becoming exposed mud flats during dry months. These areas contain emergent (herbaceous) plant species, attract a variety of waterfowl species when inundated, and are popular foraging areas for shorebirds and wading birds as the depressions dry up and the mud flats become exposed. Typical emergent wetland plants include grasses, cattails (*Typha* spp.), rushes (*Schoenoplectus* spp. and *Scirpus* spp.), smartweeds (*Polygonum* spp.), sedges (*Carex* spp.), and spikerushes (*Eleocharis* spp.) (Johnston 1989).

Emergent wetlands discussed in this section are only based on wetland vegetation and may overlap with but do not necessarily correspond to areas of jurisdictional wetlands discussed in the Water Resources section. Jurisdictional wetlands must have hydric soil, hydrophytic vegetation, and wetland hydrology. Thus, the wetland acreages presented in the Water and Biological Resources sections are not identical.

The ROI consists of approximately 419 acres of emergent wetlands. The majority of the emergent wetlands in the ROI are within the floodplain of the Mainstem Group of the Trinity River; however, emergent wetlands are also scattered in the Confluence and IDS. The small emergent wetlands in the Mainstem Group are low quality, fragmented depressions. Emergent wetlands provide FRM and water quality benefits and are important habitats for macroinvertebrates, fish, and other terrestrial and aquatic wildlife.

Grassland

The ROI contains approximately 4,283 acres of tall and short grasslands (refer to Table 3.5-1). The majority of the habitat in the floodplain of the Mainstem Group is disturbed tall grassland and is dominated by giant ragweed (*Ambrosia trifida*).

Short grassland is mostly composed of non-native Bermuda grass (*Cynodon dactylon*), which was likely seeded or introduced on the levees post-construction to stabilize the banks, and is now the dominant vegetation on the Mainstem Group levees and in the IDS Group around the pumping plants. Other grass species typically found in the short grassland include invasive, non-native Johnson grass (*Sorghum halepense*). This grassland habitat also supports a variety of herb species such as morning glory (*Ipomoea* spp.), primroses (*Oenothera* spp.), brown-eyed Susan (*Rudbeckia tribola*), ragweed (*Ambrosia* spp.), and goldenrod (*Solidago* spp.).

Aquatic Riverine

Aquatic riverine habitat within the ROI includes 421 acres of the Elm Fork and West Fork in the Confluence Group, the main channel of the Trinity River and drainage channels from the sumps to the river in the Mainstem Group, and drainage sumps within the IDS Group.

Open Water

Outside of the river and drainage channels, the ROI contains approximately 206 acres of open water, including Crow Lake in the Mainstem Group, Fish Trap Lake in the IDS Group, and other ponds in the IDS and Confluence Groups (refer to Table 3.5-2).

Urban Area

Urban areas of the ROI (approximately 10,400 acres) consist of commercial areas primarily northeast of the Dallas Floodway Levee System, residential areas primarily southwest of the Dallas Floodway Levee System, and disturbed areas devoid of vegetation, including roads and areas around existing pumping plants.

Habitat Value

The ROI and its habitats were divided into three evaluation groups corresponding to three distinct areas: the Confluence, Mainstem, and the IDS Groups (refer to Figure 3.5-1). Habitat suitability and potential impacts have been characterized within each of these three areas. Habitat suitability indexes (HSIs) range from zero to one and are based on USFWS models that relate the various attributes of the habitat to its potential utilization by particular species. The product of a habitat suitability index and the acreage of the corresponding habitat equals “habitat units (HU),” a metric used to determine net gains and losses of habitat value (USFWS 2014). The HUs under existing conditions are presented in Table 3.5-3. For additional details on HSIs and HUs refer to the 2014 PAR (USFWS 2014).

Table 3.5-3. Existing Habitat Units per Habitat Type within ROI

Habitat Type	*Baseline HU*
Bottomland Hardwood	388.92
Emergent Wetland	97.53
Grassland	2,309.00
Aquatic Riverine	345.77
Open Water	143.76
Total	**3,284.98**

Source: USFWS 2014.

Confluence Group

The Confluence Group includes aquatic riverine habitat in the Elm Fork and West Fork of the Trinity River and their tributaries. The majority of the habitat in the Confluence Group is grassland, but large stands of bottomland hardwood forest surround the river channels. The Confluence Group also includes areas of open water, small pockets of emergent wetlands, and urban areas.

Mainstem Group

The Mainstem Group consists of the area from levee to levee and from the confluence of the West and Elm Forks of the Trinity River to the AT&SF Railroad Bridge. The majority of the Mainstem Group consists of disturbed short grasslands on the levees and tall grasslands with pockets of emergent wetlands and bottomland hardwood forest in the floodplain (refer to Table 3.5-2). The majority of the aquatic riverine habitat is the main channel of the Trinity River, which is generally in the center of the floodplain (refer to Figure 3.5-2). The only open water in the Mainstem Group is Crow Lake. Bottomland hardwood habitat occurs as fringes along the edge of the Trinity River. It does not expand because of the routine mowing of the area. Emergent wetlands of the Mainstem Group are disturbed and of relatively low quality. The Mainstem Group floodplain is subject to periodic mowing, but generally of less frequent nature than the mowing of the levees.

The levees within the Mainstem Group are primarily mowed, non-native short grasslands above the floodplain. Typically, the levees and adjacent 50-foot strips are subject to mowing on a frequent schedule. This area is continuously disturbed from mowing as part of regular maintenance, and is thus not considered a sensitive habitat for plant or wildlife species.

IDS Group

The IDS Group generally consists of the area north and south of the Mainstem Group including the pumping plants, sumps, and sump ponds. The majority of the vegetation around the pumping plants in the IDS Group is disturbed. The vegetation at the sumps is aquatic riverine and emergent wetland habitat surrounded by non-native mowed short grassland dominated by Bermuda grass.

3.5.2.2 Fish and Wildlife

The wildlife habitat of Dallas County has been altered drastically in the last 150 years, and many of the original wildlife habitats and associated communities have been eliminated. Remaining riparian corridors are still used by waterfowl, shorebirds, and mammals such as American beaver (*Castor canadensis*) and nutria (*Myocastor coypus*) (USACE 2000).

Dallas County wildlife has been subject to reduction or elimination by habitat destruction through removal, physical alteration, and/or pollution. The surviving fish and wildlife live in a modified natural habitat within the immediate influence of an encroaching urban complex. Wildlife species occurring in the area are those tolerant of human activity such as rabbits, songbirds, squirrels, and small rodents. The Great Trinity Forest, south of the ROI, provides fish and wildlife habitat and is a source area for fish and wildlife to disperse. Seventy-seven wildlife species were documented in the Great Trinity Forest in 2008 and included 1 amphibian, 49 birds, 20 mammals, and 7 reptiles (City of Dallas 2008).

Common bird species observed during a 2008 survey and during habitat evaluation surveys are included in Table 3.5-4 (City of Dallas 2008). The great egret (*Ardea alba*) is especially common in aquatic habitats in the ROI. Because the levees are primarily mowed non-native grasslands, they provide limited habitat for wildlife. Utility lines provide roosting and foraging areas for birds. Common birds include American kestrel, mourning and rock doves, and grackles. Loggerhead shrikes are likely due to the large amount of grasshoppers and crickets in the ROI.

Common mammals that are likely in the ROI include beaver, nutria, fox squirrel (*Sciurus niger*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), Virginia opossum (*Didelphis virginiana*), swamp rabbit (*Sylvilagus aquaticus*), raccoon (*Procyon lotor*), eastern wood rat (*Neotoma floridana*), hispid cotton rat (*Sigmodon hispidus*), white-footed mouse *(Peromyscus leucopus*), and hispid pocket mouse (*Peromyscus penicillatus*). Burrowing rodents are likely to be common.

Table 3.5-4. Bird Species Observed in the Trinity River Floodplain

Common Name	Scientific Name	Common Name	Scientific Name
Great Blue Heron	*Ardea Herodias*	Loggerhead Shrike	*Lanius ludovicianus*
Little Blue Heron	*Egretta caerulea*	Purple Martin	*Progne subis*
Yellow-crowned Night Heron	*Nyctanassa violacea*	Cliff Swallow	*Petrochelidon pyrrhonota*
Black-crowned Night Heron	*Nycticorax nycticorax*	Barn Swallow	*Hirundo rustica*
Great Egret	*Ardea alba*	Chimney Swift	*Chaetura pelagica*
Snowy Egret	*Egretta thula*	Northern Mockingbird	*Mimus polyglottos*
Cattle Egret	*Bubulcus ibis*	Belted Kingfisher	*Ceryle alcyon*
White Ibis	*Eudocimus albus*	Northern Flicker	*Colaptes auratus*
Mallard	*Anas platyrhynchos*	Downy Woodpecker	*Picoides pubescens*
Wood Duck	*Aix sponsa*	Warbling vireo	*Vireo gilvus*
Turkey Vulture	*Cathartes aura*	White-eyed Vireo	*Vireo griseus*
Red-tailed Hawk	*Buteo jamaicensis*	Blue Jay	*Cyanocitta cristata*
Northern Harrier	*Circus cyaneus*	American Crow	*Corvus brachyrhynchos*
American Kestrel	*Falco sparverius*	Carolina Chickadee	*Poecile carolinensis*
Killdeer	*Charadrius vociferous*	Carolina Wren	*Thryothorus ludovicianus*
Mourning Dove	*Zenaida macroura*	European Starling	*Sturnus vulgaris*
Rock Dove	*Columba livia*	Northern Cardinal	*Cardinalis cardinalis*
Eastern Kingbird	*Tyrannus tyrannus*	Red-winged blackbird	*Agelaius phoeniceus*
Western Kingbird	*Tyrannus verticalis*	Common Grackle	*Quiscalus quiscula*
Scissor-tailed Flycatcher	*Tyrannus forficatus*		

Source: City of Dallas 2008.

In Dallas County, 81 species of reptiles and amphibians have been reported including 4 species of salamanders, 20 species of toads and frogs, 1 alligator, 12 species of turtles, 1 anole, 13 species of lizards, and 30 species of snakes. Common reptiles that may occur in the area include red-eared sliders (*Trachemys scripta elegans*), northern green anole (*Anolis carolinensis carolinensis),* ground skink (*Leiolopisma laterale),* broad-headed skink (*Eumeces laticeps),* cottonmouth (*Agkistrodon piscivorus)*, eastern hognose snake (*Heterodon platyrhinos)*, ringneck snake (*Diadophis punctatus arnyi)*, copperhead (*Agkistrodon contortrix)*, Texas rat snake (*Elaphe obsoleta lindheimeri)*, and water snake (*Natrix* spp.). Common amphibians that may occur in the ROI include American bullfrog (*Lithobates catesbeianus***)**, western chorus frog (*Pseudacris triseriata*), cricket frog (*Acris crepitans*), and southern leopard frog (*Lithobates sphenocephalusa*) (National Audubon Society 1998, Stebbins 2003, City of Dallas 2008, Texas A&M University 2009).

Red-eared sliders are common in the aquatic riverine, open water, and emergent wetland habitats in the ROI. River cooter (*Pseudemys concinna*) and spiny softshell turtle (*Apalone spinifera*) are also likely to occur in the aquatic habitats in the ROI.

The aquatic areas within the Dallas-Fort Worth Metroplex support up to 66 species of fish with the most common being gar (*Lepisosteus* spp.), sunfish (*Lepomis* spp.), catfish (*Ictauridae* family), and some bass (*Micropterus* spp.). Eleven species of fish were observed in Crow Lake during June 2010 sampling and include inland silverside (*Menidia beryllina*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), white crappie (*Pomoxis annularis*), bluntnose darter (*Etheostoma chlorosomum)*, logperch (*Percina caprodes*), spottail shiner (*Notropis hudsonius*), red shiner (*Cyprinella lutrensis*), threadfin shad (*Dorosoma petenense*), western mosquitofish (*Gambusia affinis*), and longnose gar (*Lepisosteus osseus*) (USACE 2010).

A fisheries survey was conducted to determine baseline fish-community structure within the Trinity River that could be potentially impacted by stream modifications, development, and/or construction activities associated with Section 5141 of the Water Resources Development Act (WRDA) of 2007 authorization (USFWS 2004). Data from this survey were qualitatively compared to previous fisheries studies conducted within this portion of the Trinity River to evaluate fish community trends within the ROI. In addition, 25 fish collected during this survey were retained for chemical analyses to qualitatively assess current contaminant levels in fish within the area (USFWS 2004).

Results of the baseline fisheries survey characterized the fish assemblages within reaches in the ROI as intermediate to exceptional. In comparing these results with previous studies conducted in the ROI, fish community indices demonstrated a shift to higher aquatic life use values, while a greater number of total species, including more species considered intolerant to poor water quality conditions, were encountered during this assessment than had been observed in the past. Even though the fish assemblages were characterized as intermediate to exceptional and appear to be recovering in comparison to previous studies, all of the fish sampled for chemical analyses contained detectable amounts of organochlorine contaminants (USFWS 2004). Additional contaminants of concern detected in the sample group were polychlorinated biphenyls (PCBs) and polychlorinated dibenzofurans and dibenzo-p-dioxins, both of which were found at levels above the Texas Department of State Health Services (TDSHS) health assessment guidelines. Consumption of fish from the Trinity River may pose a threat to human health (TDSHS 2010a, 2010b, 2010c).

In a study of the relationships between benthic macroinvertebrates and wastewater discharges into the Trinity River, benthic macroinvertebrates were collected in 1988 and again in 2005 from the substrate of the Trinity River just upstream of the Study Area in the West Fork, just downstream in the Mainstem, and at other more distant locations (Slye et al. 2011). In replicate samples of 6 by 6 inches (152 by 152 milllimeters), 50-200 individual invertebrates were typically found, comprising 10 to 20 different taxa. At all sites, various species of Oligochaeta (earthworms, sludge worms) and Chironomidae (midge larvae) were the most dominant taxa. These organisms are the primary consumers of plant matter and detritus in the substrate. The study indicated an increasing diversity of invertebrates as well as water quality improvements in the river during the 1988-2005 period. While no sampling was conducted within the boundaries of the Study Area, macroinvertebrate communities from all of the “metropolitan” sites up- and downstream of the Study Area were similar, suggesting that these results can be generalized to the area of the proposed river relocation.

Freshwater mussels are one of the most imperiled groups of animals in the U.S. with the current decline due to causes ranging from habitat fragmentation to predation and habitat alteration by non-native invasive species (TPWD 2011). At least 16 species of mussels are known to occur in Lewisville Lake and the Elm Fork of the Trinity River northwest of the area (TPWD 2005). Mussels are likely to occur in suitable habitat in the Elm and West Forks in the Confluence and in the Mainstem Groups in the Trinity River.

A presence/absence survey was performed for the state-listed mussel species at IH-30 and IH-35E crossings of the Trinity River (United States Department of Transportation [USDOT] 2012). Scientists performed a Phase I habitat survey and a Phase II presence/absence survey for state-listed mussels. In both survey areas, the primary species collected were yellow sandshell (*Lampsilis teres*) and Western pimpleback (*Quadrula mortoni*). The state-listed (threatened) Texas pigtoe (*Fusconaia askewi*) was found at IH-35E. Other mussel species included fragile papershell (*Leptodea fragilis*), southern mapleleaf (*Quadrula apiculata*), giant floater (*Anodonta grandis*), threehorn wartyback (*Obliquaria reflexa*), bleufer (*Potamilus purpuratus*), pistolgrip (*Quadrula verrucosa*), deertoe (*Truncilla truncata*) and threeridge (*Amblema plicata*). The report stated that additional sampling at each site would likely yield more species at both sites, including state-listed rare species for Dallas County. One specimen collected may have been a Wabash pigtoe; however, the identification remains undetermined as genetic testing would be needed to verify the species (USDOT 2012, TPWD 2013).

3.5.2.3 Special Status Species

Federal- and State-Listed Threatened and Endangered Species

Federal- and state-listed threatened and endangered species that potentially occur in Dallas County are included in Table 3.5-5. Species shown in bold in Table 3.5-5 are reasonably likely to occur in the ROI. There are 10 listed birds in Dallas County - 5 are federally listed, 3 are federally delisted but state-listed, and all 10 are state-listed. There is one federal bird candidate species. There are no federal or state-listed mammals in Dallas County. There are three state-threatened mollusks and three state-listed reptiles in Dallas County (TPWD 2013).

No federally listed species are likely residents in the ROI; however, there is suitable habitat for special status species within the area. Appendix H, *Supplemental Biological Resources Information,* contains a Threatened and Endangered Species Report that concludes that there are no federally listed species known to reside or breed in the ROI. As also presented in Appendix H, the USFWS concurred with this conclusion.

There is also potential for some special status birds species to transit the ROI, using the grassland, forest, wetland, and river habitats for resting and feeding during migration. Three state threatened species of reptiles have the potential to occur in the ROI. State-listed mussels are likely to occur in the Confluence and Mainstem Groups. Detailed descriptions of the species listed in bold in Table 3.5-5 follow.

Table 3.5-5. Dallas County Federal and State Threatened and Endangered Species

Species	*Habitat*	*Federal Status*	*State Status*	*Occurrence in the ROI*
BIRDS				
American Peregrine Falcon *(Falco peregrinus anatum)*	**Nests in the Trans-Pecos region of West Texas; nests on high cliff, often near water where prey species are most common.**	**D**	**E**	**Potential migrant; this species may temporarily use portions of the ROI for resting or foraging during migration.**
Arctic Peregrine Falcon *(Falco peregrinus tundrius)*	**Nests in tundra regions; migrates through Texas; winters along gulf coast. Open areas near water.**	**D**	**T**	**Potential migrant; this species may temporarily use portions of the ROI for resting or foraging during migration.**
Bald Eagle *(Haliaeetus leucocephalus)*	**Nests and winters near rivers and large lakes; nests in tall trees or on cliffs near large bodies of water; all reservoirs in north central Texas are considered potential nesting habitat.**	**D**	**T**	**Potential migrant or winter resident; this species could use the Confluence or Mainstem Groups for migration or wintering.**
Black-capped Vireo *(Vireo atricapilla)*	Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces.	E	E	Not likely due to lack of habitat.
Golden-cheeked Warbler *(Dendroica chrysoparia)*	Oak-juniper woodlands; dependent on mature Ashe juniper (cedar) for long fine bark strips from mature trees in nest construction; nests in various other trees; forage for insects in broad-leaved trees and shrubs.	E	E	Not likely due to lack of habitat.
Interior Least Tern *(Sternula antillarum athalassos)*	**Nests along sand and gravel bars within braided streams and rivers; also known to nest on man-made structures near water.**	**E**	**E**	**Potential; the ROI does not contain sand and gravel bars within braided streams or rivers, however, several man-made structures occur near water.**

Species	*Habitat*	*Federal Status*	*State Status*	*Occurrence in the ROI*
Piping Plover *(Charadrius melodus)*	**Wintering migrant along the Texas Gulf Coast; prefers beaches and bayside mud or salt flats.**	**T**	**T**	**Potential migrant; this species could be migratory through the ROI. Suitable habitat occurs in the floodplain.**
Sprague's Pipit (*Anthus spragueii)*	**Occurs in Texas during migration and winter, mid-September to early April. Strongly tied to native upland prairie.**	**C**	**-**	**Potential migrant; this species could be migratory through the ROI. Low quality grassland habitat occurs in the floodplain.**
White-faced Ibis *(Plegadis chihi)*	**Prefers freshwater marshes, sloughs, and irrigated rice fields; nests in marshes, in low trees, in bulrushes or reeds, or on floating mats.**	**-**	**T**	**Potential migrant; this species could be migratory through the ROI. Suitable habitat occurs in the floodplain.**
Whooping Crane *(Grus americana)*	**Potential migrant via plains throughout most of the state to the coast; winters in Texas coastal marshes in Aransas, Calhoun, and Refugio counties.**	**E**	**E**	**Potential migrant; this species could temporarily use portions of the Confluence and Mainstem Groups as stopover locations during migration.**
Wood Stork *(Mycteria americana)*	**Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water; usually roosts in tall snags.**	**-**	**T**	**Potential migrant; this species could temporarily use portions of the Confluence and Mainstem Groups as stopover locations during migration.**
MOLLUSKS				
Texas pigtoe (*Fusconaia askewi*)	**Rivers with mixed mud, sand, and fine gravel in protected areas. Occurs in western Gulf drainages of Texas and Louisiana. Most Texas records are from the Neches and Sabine rivers in east Texas, but also from the Sabine and San Jacinto Rivers; and it likely occurs in a few dozen localities in the southern portion of the Mississippi Interior Basin drainage in Louisiana.**	**-**	**T**	**Likely to occur in the river channel within the Confluence and Mainstem Groups. Documented under IH-35E in 2011-2012.**
Louisiana Pigtoe (*Pleurobema riddellii)*	**Streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins.**	**-**	**T**	**Likely to occur in the river channel within the Confluence and Mainstem Groups. Documented in the Elm Fork outside of the Project Area in 2012.**
Texas Heelsplitter (*Potamilus amphichaenus)*	**Quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins.**	**-**	**T**	**Potential; the Elm Fork and West Fork in the Confluence Group and the Trinity River in the Mainstem Group provide suitable habitat for this species.**
REPTILES				
Alligator Snapping Turtle *(Macrochelys temminckii)*	**Perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps and ponds near deep running water.**	**-**	**T**	**Potential; the ROI contains perennial water bodies; suitable habitat for this species.**
Texas Horned Lizard *(Phrynosoma cornutum)*	**Open, arid, and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush, or scrubby trees.**	**-**	**T**	**Low potential; this species is not likely to occur in the ROI. The soil on the levees is hard and compacted and majority of the soil in the floodplain is moist. However, there could be pockets of loose sandy soil in the floodplain.**
Timber Rattlesnake *(Crotalus horridus)*	**Swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland, limestone bluffs, sandy soil or black clay. Prefers dense ground cover, i.e., grapevines or palmetto.**	**-**	**T**	**Potential; suitable habitat includes dense bottomland hardwood habitat within the ROI.**

Notes: E = Endangered, T = Threatened, C= Candidate, D = Delisted. Bold = potential to occur in the ROI.
Sources: Campbell 2003; TPWD 2013.

American Peregrine Falcon/Arctic Peregrine Falcon

The American subspecies of the peregrine falcon was federally delisted in 1999 and is listed as endangered in Texas. The Arctic subspecies was federally delisted in 1994 and is listed as threatened in Texas (USFWS 1994, 1999; TPWD 2013). The peregrine falcon nests on cliffs and in cliff-like areas near wetlands and water bodies. The American subspecies breeds throughout the western U.S., Canada, and Mexico, and in the Trans-Pecos region of Texas. The Arctic subspecies breeds within the tundra regions of Alaska, Canada, and Greenland. Both subspecies migrate through Texas and can be found seasonally along the Texas Gulf Coast. This species could use the ROI as a stopover location during migration (TPWD 2013). Either subspecies of the peregrine falcon could roost on the levees and forage in the floodplain or grasslands.

Bald Eagle

The bald eagle was delisted as a threatened species by the USFWS on August 8, 2007 (USFWS 2007a). Eagle management continues under the MBTA and the *Bald and Golden Eagle Protection Act*. In 2009, the USFWS finalized the Federal Register notice for permit regulations to authorize limited take of bald eagles and golden eagles (*Aquila chrysaetos*) and their nests in specific limited circumstances (USFWS 2009a).

The bald eagle is a state threatened species (TPWD 2013). Bald eagles are primarily found near rivers and large lakes. They nest in tall trees (40 to 120 feet) or on cliffs near water. All reservoirs in north central Texas are considered potential nesting habitat (TPWD 2013). In December 2008, a bald eagle was observed by USACE engineers flying over the Lower Chain of Wetlands, Wetland Cell F, within the DFE Project area. This Wetland Cell is very close to the Trinity River and is located off IH-45 South, approximately 1 mile southeast of the southeastern edge of the ROI (City of Dallas 2009). During the winter from 2010 to 2013, one bald eagle had been observed near the south end of the ROI. On February 9, 2013, a bald eagle was observed at the Loop 12 Boat Launch. On April 6, 2013, a bald eagle was observed at the Trinity Audubon Center (Ebird 2013). The most suitable habitat for wintering bald eagles is southeast of the area in the Great Trinity Forest, but the Confluence and Mainstem Groups also provide potential foraging/roosting habitat.

Interior Least Tern

The interior least tern was federally listed as endangered on June 27, 1985 and is listed as endangered by the state of Texas (USFWS 1985a; TPWD 2013). No critical habitat has been designated for this species and the recovery plan was finalized in 1990 (USFWS 1990).

The interior least tern is a colonial nesting species adapted to sand and gravel deposition features associated with inland lakes and rivers. The least tern also nests on man-made surfaces including inland beaches, wastewater treatment plants, and gravel mines (TPWD 2013). Active nesting colonies occur in the Texas Panhandle on the Red and Canadian River systems and in south Texas along the Rio Grande. Because interior least terns use man-made areas near water, there is potential for them to occur within the ROI. Interior least terns are known to nest 9 to 10 miles southeast of the area at the Southside Water Treatment Plant and at a nearby sand and gravel pit. No interior least terns were observed in the Dallas Floodway (North Texas Transit Authority [NTTA] 2008) during a 2008 site visit survey, but the interior least tern has the potential to forage in the ROI.

Piping Plover

The piping plover is both state and federally listed as threatened (TPWD 2013). It was federally listed in December 1985 (USFWS 1985b). Critical habitat includes wintering habitat along the gulf coast of Texas (USFWS 2009b). Dallas County does not contain any critical habitat (USFWS 2009b).

Breeding populations of piping plover exist along the Atlantic Coast, within the Northern Great Plains, and within the Great Lakes region of North America. All populations migrate south for the winter, with individuals from both Northern Great Plains and Great Lakes populations wintering along the Texas Gulf Coast. All populations prefer open, sandy beaches, mudflats, and sparsely vegetated sand and gravel coastlines for nesting. The piping plover winters in south Texas and is a potential migrant through Dallas County. This species could use the ROI as a stopover location during migration for foraging and roosting (TPWD 2013).

Sprague's Pipit

The Sprague's pipit is a federal candidate species (TPWD 2013). This species warrants protection under the ESA but listing the species is precluded by the need of the USFWS to address the listing actions of other higher priority species (USFWS 2010).

This species breeds in Minnesota, Montana, North Dakota, South Dakota, and south-central Canada and winters in southern United States. The Sprague's pipit occurs in Texas during migration and winter, mid-September to early April and is strongly tied to native upland prairie (TPWD 2013; USFWS 2013). As no high quality native grasslands occur in the ROI, the Sprague's pipit has a low potential to briefly stopover in the low quality grasslands that occur in the ROI.

White-faced Ibis

The white-faced ibis is not federally listed, but is state-listed as threatened (TPWD 2013). It prefers freshwater marshes, sloughs, and irrigated rice fields. It nests in low trees, on the ground in bulrushes or reeds, or on floating mats in isolated colonies from Oregon to Kansas. The greatest numbers of nesting white-faced ibis occur in Utah, Texas, and Louisiana. In Texas, it breeds and winters along the Gulf Coast (TPWD 2013). The white-faced ibis migrates through Dallas County. This species could use the ROI as a stopover location for foraging and roosting during migration.

Whooping Crane

The whooping crane is both federally and state-listed as endangered (TPWD 2013). It was federally listed as endangered on March 11, 1967 (USFWS 1967). A revised recovery plan was prepared in 2007 and the USFWS Whooping Crane 5-Year Review was available in 2012 (USFWS 2007b, 2012).

Historically, the whooping crane occurred throughout most of North America. Whooping crane populations increased from a low of 18 in 1938-1939 to 599 (437 wild and 162 captive) in 2011 (Stehn 2011). In 2012 the population size remained in the 500s (Whooping Crane Conservation Association 2013). The only remaining natural breeding area for whooping cranes is in Canada. These birds winter in the coastal wetlands of the Aransas National Wildlife Refuge in Aransas, Calhoun, and Refugio counties, Texas. Dallas County is within the migratory route used by these rare birds (TPWD 2013). This species could use the ROI as a stopover location during migration. However, the USFWS Whooping Crane 5-Year Review states that whooping cranes are unlikely to use large metropolitan areas (USFWS 2012).

Wood Stork

The wood stork is listed as threatened by the state of Texas (TPWD 2013). The preferred habitat of the wood stork consists of low-lying wetland areas that may be seasonably flooded. When natural wetland cycles are disturbed, wood storks often fail to nest successfully. This species usually roosts in tall snags (TPWD 2013).

The majority of wood storks in the U.S. nest in Florida (City of Dallas 2008). Wood storks occur in the Dallas area during migration, usually July through September. In 2009 and 2010, wood storks were only reported at the Trinity Audubon Center, approximately 5 miles southeast of the southeastern edge of the ROI. In 2011 and 2012, additional observations of work storks in the Dallas area were reported. On June 12, 2012 one wood stork was observed in the northern portion of the ROI, near the Elm Fork of the Trinity River and IH-35 (Ebird 2013). Wood storks are observed at the Trinity River Audubon Center during fall migration from late July to October or November. In July 2012, a high of 122 wood storks were observed at the Trinity Audubon Center (Ebird 2013). This species could use the ROI as a stopover location during migration (TPWD 2013).

Mollusks

Three species of state-listed threatened mussels occur in Dallas County and have the potential to occur in aquatic riverine or open water habitat in the ROI (refer to Table 3.5-5) (TPWD 2013). The three species include Texas pigtoe (*Fusconaia askewi*), Louisiana pigtoe (*Pleurobema riddellii*), and Texas heelsplitter (*Potamilus amphichaenus*). These three mussel species have been petitioned for federal listing (TPWD 2013). Louisiana pigtoe and Texas heelsplitter had a USFWS positive 90-day finding[1], but the 12-month finding[2] will not be made until after 2016 (USFWS 2011).

These species are most likely to occur in suitable habitat in the Elm and West Forks in the Confluence and in the Mainstem groups in the Trinity River. Louisiana pigtoe has been identified in the Elm Fork just outside of the Project Area and is likely to occur in both the Confluence and the Mainstem Groups. (TPWD 2013). Texas pigtoe is known to occur in the ROI. It was found at the IH-30 and IH-35E crossings of the Trinity River during 2011 mussel surveys for the Dallas Horseshoe Project (USDOT 2012, TPWD 2013). Texas pigtoe was also observed in 2012 in the Elm Fork, upstream of the ROI (TPWD 2013).

[1] A “positive finding” is issued when the USFWS finds that substantial scientific or commercial information in a petition indicates that the petitioned action may be warranted.

[2] The USFWS is required to promptly commence a review of the status of the species concerned, during which the USFWS conducts a comprehensive review of the best available scientific and commercial information. The outcome of the review is called a 12-month finding; however, the 12-month finding often takes longer than 12 months to complete.

Alligator Snapping Turtle

The alligator snapping turtle is listed as threatened by the state of Texas (TPWD 2013). The alligator snapping turtle is the largest freshwater turtle in North America and one of the largest freshwater turtles in the world. The alligator snapping turtle requires perennial water bodies as it is highly aquatic, spending most of its life submerged. These turtles utilize rivers, creeks, estuaries, ponds, lakes, and wetlands for their habitats and prefer deep water with a mud bottom and abundant aquatic vegetation. Distribution of this species stretches from east Texas through the southeast to the panhandle of Florida, and north along the Mississippi River Valley. Dallas County is the western edge of its range. The ROI contains perennial water bodies that this species could use; however, there is no recent evidence of the alligator snapping turtle in the area (TPWD 2013).

Texas Horned Lizard

The Texas horned lizard is listed as threatened by the state of Texas but is widespread and apparently secure in some areas of south-central U.S. and northern Mexico (TPWD 2013, NatureServe 2009). The preferred habitat of the Texas horned lizard is open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush, or scrubby trees; soil may vary in texture from sandy to rocky. The Texas horned lizard burrows into soil, enters rodent burrows, or hides under rock when inactive (TPWD 2013). This species has a low potential to occur in the ROI. The soil on the levees is hard and compacted and the majority of the soil in the Dallas Floodway is moist; however, there could be pockets of loose sandy soil in the ROI that the Texas horned lizard could use.

Timber Rattlesnake

The timber rattlesnake is listed as threatened by the state of Texas (TPWD 2013). The distribution of the timber rattlesnake stretches from the east coast westward into Texas, and as far north as New England. In the southern portions of its range, this species prefers to make its den in somewhat swampy, wetland habitats. The Dallas-Fort Worth Metroplex represents the far western edge of its range, and is characterized by drier conditions than generally preferred by this snake. Populations tend to be higher in eastern Texas where greater concentrations of wetlands and humid forests are found. Forested areas located near permanent water sources are also used, as fallen debris from trees can act as refuge for the timber rattlesnake. Within the proposed ROI, possible habitat includes bottomland hardwoods (TPWD 2013). Higher quality habitat for this species occurs in southeast of the ROI in the Great Trinity Forest.

State of Texas Species of Concern

The 11 TPWD species of concern that occur in Dallas County are listed in Table 3.5-6 (TPWD 2013). Seven (shown in bold) of the 11 species have the potential to occur or transit through the ROI and are described in the following paragraphs.

Table 3.5-6. Dallas County Species of Concern

Species	*Habitat*	*Occurrence in the ROI*
BIRDS		
Henslow's Sparrow (*Ammodramus henslowii)*	Wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking.	Not likely; no suitable habitat occurs in the ROI.
Western Burrowing Owl (*Athene cunicularia hypugaea)*	**Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows.**	**There is low quality grassland habitat on the levees and around the pumping plants. However, the vegetation is thick with Bermuda and other grasses; therefore, burrowing owl would be unlikely to use the area. They could transit through the area during migration.**
INSECTS		
Black Lordithon Rove Beetle (*Lordithon niger)*	Hardwood forest habitat.	Not known to currently occur in Texas. Historically occurred in hardwood forest habitat.
MAMMALS		
Cave Myotis (*Myotis velifer)*	**Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore.**	**The ROI does not contain caves or rock crevices, but does contain potential man-made habitat (i.e., bridges, etc.).**
Plains Spotted Skunk (*Spilogale putorius interrupta)*	**Catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas, and tall grass prairie.**	**The ROI contains suitable habitat.**
MOLLUSKS		
Fawnsfoot (*Truncilla donaciformis)*	**Small and large rivers especially on sand, mud, rocky mud, and sand and gravel, also silt and cobble bottoms in still to swiftly flowing waters; Red (historic), Cypress (historic), Sabine (historic), Neches, Trinity, and San Jacinto River basins.**	**The Elm Fork and West Fork in the Confluence Group and the Trinity River in the Mainstem Group provide suitable habitat for this species.**
Little Spectaclecase (*Villosa lienosa)*	**Creeks, rivers, and reservoirs, sandy substrates in slight to moderate current, usually along the banks in slower currents; east Texas, Cypress through San Jacinto River basins.**	**The Elm Fork and West Fork in the Confluence Group and the Trinity River in the Mainstem Group provide suitable habitat for this species.**
Wabash Pigtoe (*Fusconaia flava)*	**Creeks to large rivers on mud, sand, and gravel from all habitats except deep shifting sand; found in moderate to swift current velocities; east Texas River basins, Red through San Jacinto River basins; elsewhere occurs in reservoirs and lakes with no flow.**	**The Elm Fork and West Fork in the Confluence Group and the Trinity River in the Mainstem Group provide suitable habitat for this species.**
REPTILES		
Texas Garter Snake (*Thamnophis sirtalis annectens*)	**Wet or moist microhabitats are conducive to the species occurrence, but the species is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August.**	**Suitable habitat occurs in the Confluence and Mainstem Groups.**
PLANTS		
Glen Rose Yucca (*Yucca necopina)*	Grasslands on sandy soils and limestone outcrops.	Not likely due to lack of habitat.
Warnock's Coral Root (*Hexalectris warnockii)*.	Leaf litter and humus in oak-juniper woodlands on shaded slopes and intermittent, rocky creek beds in canyons.	Not likely due to lack of habitat.

Note: **Bold** = potential occurrence in the ROI.
Source: TPWD 2013.

Western Burrowing Owl

The western burrowing owl occurs in the western half of North America. Nesting takes place in warmer temperate and sub-tropical regions from southern California to west Texas and south into Mexico. Typical preferred habitat is low growing vegetation accompanied by abandoned small mammal burrows, which the owl modifies for a burrow. This species rarely creates its own burrows, and is thus associated with known habitat for prairie dogs (*Cynomys* spp.), ground squirrels (*Spermophilus* spp.), foxes (*Vulpes* spp.), and similar ground-dwelling mammals (TPWD 2013). Dallas County is on the eastern edge of the burrowing owl's range (The Cornell Lab of Ornithology 2013). There is low quality potential grassland habitat on the levees and around the pumping plants. However, the vegetation is thick with Bermuda and other non-native grasses; therefore, the burrowing owl would be unlikely to use the area. They could potentially transit through the ROI during migration.

Cave Myotis

The cave myotis is a relatively large myotis bat that occurs primarily at lower elevations of the Southwest, in areas dominated by creosote bush (*Larrea tridentata*), palo verdes (*Cercidium* spp.), brittlebush (*Encelia farinosa)*, and cactus. In Texas, cave myotis occupy the High Plains, Rolling Plains, Trans-Pecos, Edwards Plateau, and South Texas Plains during the summer. The cave myotis bat is colonial and cave dwelling but also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned cliff swallow (*Hirundo pyrrhonota*) nests. It hibernates in limestone caves of Edwards Plateau and gypsum caves of Panhandle during winter (TPWD 2013). Dallas County is at the eastern edge of its range. The ROI does not contain caves, the species' preferred habitat. The cave myotis has a low potential to occur in bridges over the Dallas Floodway; this bat occasionally uses bridges in place of caves.

Plains Spotted Skunk

The plains spotted skunk prefers forested or brushy habitats that provide cover and potential den sites. The species is sometimes seen foraging in more open areas, but utilizes abandoned burrows, brush piles, or hollow logs when bearing young. Range information for this species is incomplete, but the species is known throughout the Midwest (TPWD 2013). There is potential for the plains spotted skunk to occur in the ROI.

Mollusks

The Elm Fork and West Fork in the Confluence and the Trinity River channel in the Mainstem Group provide suitable habitat for the three species of mollusks listed in Table 3.5-6 (TPWD 2013). Fawnsfoot is known to occur in the Trinity River and is likely to occur in the ROI. Little spectaclecase and Wabash pigtoe occur in east Texas and could occur in the area (TPWD 2013). One specimen collected during the IH-30 and IH-35E crossings of the Trinity River surveys may have been a Wabash pigtoe; however, the identification remains undetermined as genetic testing would be needed to verify the species (USDOT 2012).

Texas Garter Snake

The Texas garter snake is a subspecies of the common garter snake. It has a limited distribution in eastern and central Texas and a disjunct population in Kansas and is most abundant in the central Texas portion of its range. This species prefers marshy areas and those associated with permanent sources of water (TPWD 2013). There is a low potential of occurrence of the Texas garter snake in the area; however, if this species were to occur it would likely occur near water.

Birds of Conservation Concern

The USFWS published the *Birds of Conservation Concern* in December 2008. The goal of the Birds of Conservation Concern (BCC) is to identify the migratory and non-migratory bird species, beyond those already designated as federally listed, that represent the highest conservation priorities (USFWS 2008).

In addition to the listed bird species described previously, the following 19 birds species on the BCC list may utilize the habitats or occur within the general vicinity of ROI:

1. Little blue heron – inland marshes and ponds
2. Long-billed curlew (*Numenius americanus*) – open water, prairies, and savannas
3. Hudsonian godwit (*Limosa haemastica*) – inland marshes
4. Buff-breasted sandpiper (*Tryngites subruficollis*) – prairies, margins of lakes
5. Red-headed woodpecker (*Melanerpes erythrocephalus*) – woodlands
6. Scissor-tailed flycatcher – prairies, savannas, and open shrubland
7. Loggerhead shrike – open savanna, shrubland
8. Bell's vireo (*Vireo bellii*) – dense riparian thicket
9. Prothonotary warbler (*Protonotaria citrea*) – riparian woodland
10. Worm-eating warbler (*Helmitheros vermivorus*) – woodlands
11. Swainson's warbler (*Limnothlypis swainsonii*) – riparian woodland
12. Kentucky warbler (*Oporornis formosus*) – riparian woodland
13. Field sparrow (*Spizella pusilla*) – old fields, scrubland, forest edge
14. Henslow's sparrow (*Ammodramus henslowii*) – grasslands with scattered shrub
15. Le Conte's sparrow (*Ammodramus caudacutus*) – thick, damp grassy areas, wetlands
16. Harris' sparrow (*Zonotrichia querula*) – scrub, undergrowth in open woodlands and savanna, thickets, brushy fields, and hedgerows
17. Smith's longspur (*Calcarius pictus*) – short grassland
18. Chestnut-collared longspur (*Calcarius ornatus*) – shortgrass prairie, plowed field, overgrazed pasture
19. Painted bunting (*Passerina ciris*) – riparian and thorn forest, oak woodlands, savanna, brushy pastures, and hedgerows

3.5.2.4 Invasive Species

Until the National Invasive Species Council defines an approved national list of invasive plants, known invasive plants are defined as those on the official noxious weed list of the state in which the activity occurs. The Texas Department of Agriculture (TDA) defines noxious weed seeds as "seeds, bulblets or tubers of certain species designated by the Texas Seed Law Regulations and considered highly objectionable and difficult to eradicate." Consistent with Texas Agriculture Code Title 4, Part 1, Chapter 9, Subchapter T, Section 19.300(a), noxious and invasive plant species that may already occur in the ROI include alligatorweed (*Alternanthera philoxeroides*), balloonvine (*Cardiospermum halicacebum*), Chinese tallow (*Triadica sebifera*), and Japanese dodder (*Cuscuta japonica*) (TDA 2012).

The *Great Trinity Forest Management Plan, Volume 16 Forest Herbicides and Invasive Species,* describes invasive plant species that occur in the Great Trinity Forest and herbicides and other techniques to control them. Invasive plant species known to occur in the Great Trinity Forest and likely to occur in the ROI include tree-of-heaven (*Ailanthus altissima*), Chinaberry (*Melia azedarach*), Chinese tallow, Chinese privet (*Ligustrum sinense*), white mulberry (*Morus alba*), Chinese lespedeza (*Lespedeza cuneata*), and giant reed (*Arundo donax*) (City of Dallas 2008). Other common invasive plant species that occur in Texas and have the potential to occur in the ROI include Japanese honeysuckle (*Lonicera japonica*), bamboo, pyracantha (*Pyracantha* spp.), water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*), water spinach (*Ipomoea aquatic*), watermoss (*Salvinia* spp.), salt cedar (*Tamarix* spp.), Asian jasmine (*Trachelospermum asiaticum*), olive tree cultivar (*Elaeagnus* spp.), and Beckett's water trumpet (*Cryptocoryne becketti*). Aquatic invasive plants are especially problematic because they can slow water flow and lead to an increased flood risk. Invasive species of crayfish, mussels, and crabs are also a problem in Texas (TPWD 2011).

Zebra mussels (*Dreissena polymorpha*), which threaten native habitats and species as well as water supplies, were documented in Lake Texoma in 2008, approximately 75 miles north of the Study Area. In 2010 zebra mussels were found in Lake Ray Roberts in the Trinity River Basin approximately 35 miles northwest of the Study Area (refer to Figure 3.3-2) (TPWD 2013).

3.6 CULTURAL RESOURCES

3.6.1 Definition of Resource

Section 405(a) of the 2010 Supplemental Disaster Relief and Summer Jobs Act (Public Law 111-212) states that the USACE is not required to make determinations under the National Historic Preservation Act (NHPA) for the Dallas Floodway Project. USACE Implementation Guidance dated October 19, 2010 directed the Fort Worth District not to make a determination under NHPA and instead to examine the Dallas Floodway Project as an engineering system with a discussion of the cultural resource's significance without making explicit references to NHPA eligibility criteria. All resources discussed herein are using standards developed for evaluating resources as either significant or not significant under NEPA as a historic and cultural resource.

NEPA historical and cultural resources include archaeological, historic architectural, and Traditional Cultural Properties (TCPs) associated with Native Americans or other groups. A description of each of these resource types, in addition to TCPs follows:

- NEPA archaeological resources are locations where human activity measurably altered the earth or left deposits of physical remains (e.g., stone flakes, arrowheads, or bottles). Archaeological resources are either sites or isolates, and may be either prehistoric or historic in age. Isolates often contain only one or two artifacts, while sites are usually larger and contain more artifacts. These resources can include campsites, roads, trails, dumps, battlegrounds, mines, and other features.
- NEPA architectural resources are standing buildings, dams, canals, bridges, and other structures of historic or architectural significance.
- TCPs are resources associated with the cultural practices and beliefs of a living community that link that community to its past and help maintain its cultural identity. These resources can encompass a variety of subjects including archaeological resources and architectural resources, as well as sacred areas or objects, sources of raw materials, and traditional hunting and gathering areas. TCPs are generally associated with Native American groups.

3.6.1.1 Methodology

The significance of a property under NEPA as a historic and cultural resource can be determined only when it is evaluated within its historic context. Historic contexts compile information about the time period, the place, and the events that created, influenced, or formed the backdrop to the historical resources. A single property may represent more than one historic context, and conversely, numerous property types may represent a single historic context.

In order to be considered a historic and cultural resource as defined by NEPA, a property must demonstrate significance within its historic context. Significance is evaluated by applying the following four criteria, which define the kind of significance that a property can represent. A property need only meet one criterion to be considered a historic and cultural resources under NEPA. The criteria are:

- Association with events that have made a substantial contribution to the broad patterns of our history;
- Association with the lives of persons substantial in our past;
- Embodiment of the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a substantial or distinguishable entity whose components may lack individual distinction; or
- Have yielded, or may be likely to yield, information important in prehistory or history.

An assessment of integrity must be completed on any resource to determine if it retains the ability to represent its significance as a historic and cultural resource under NEPA. A property that retains integrity will embody several, and usually most, of the seven aspects of integrity (NPS 1997):

1. *Location* is the place where the historic property was constructed or the place where the historic event occurred;
2. *Design* is the combination of elements that create the form, plan, space, structure, and style of a property;
3. *Setting* is the physical environment of a historic property;
4. *Materials* are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property;
5. *Workmanship* is the physical evidence of the crafts of a particular culture or people during a given period in history or prehistory;
6. *Feeling* is a property’s expression of aesthetic or historic sense of a particular period of time; and
7. *Association* is the direct link between an important historic event or person and a historic property.

3.6.1.2 Regulatory Framework

Table 3.6-1 presents those laws, regulations, EOs, and policies that protect and preserve historic resources under the jurisdiction of federal agencies.

Table 3.6-1. Laws, Regulations, Executive Orders, and Guidelines

Law/Regulation	*Title*
16 USC 461-467	Historic Sites Act of 1935, and Implementing Regulations
36 CFR § 65	National Historic Landmarks Program
Public Law 89-665	National Historic Preservation Act of 1966
36 CFR § 60	National Register of Historic Places
36 CFR § 67	The Secretary of the Interior's Standards for Rehabilitation
36 CFR § 68	The Secretary of the Interior's Standards for Preservation Projects
36 CFR § 79	Curation of Federally Owned Archaeological Resources
36 CFR § 800	Protection of Historic and Cultural Properties
Public Law 91-190	National Environmental Policy Act of 1969
Public Law 111-212 Section 405(a)	Supplemental Disaster Relief and Summer Jobs Act
Public Law 96-95	Archaeological Resources Protection Act of 1979
32 CFR § 229	Protection of Archaeological Resources
43 CFR §7 Subparts A and B	Protection of Archaeological Resources, Uniform Regulations and Department of the Interior Supplemental Regulations
Public Law 101-601	Native American Graves Protection and Repatriation Act of 1990
43 CFR §10	Native American Graves Protection and Repatriation Regulations
16 USC 469c-2	Archaeological and Historic Preservation Act of 1974
42 USC 1996-1996a	American Indian Religious Freedom Act of 1978
EO 11593 (1971)	Protection and Enhancement of the Cultural Environment
EO 13007 (1996)	Indian Sacred Sites – May 24, 1996
EO 13175 (1998)	Consultation and Coordination with Indian Tribal Governments

Section 405(a) of the 2010 Supplemental Disaster Relief and Summer Jobs Act (Public Law 111-212) states that the USACE is not required to make determinations under NHPA for the Dallas Floodway Project. However, a November 2010 Intensive Engineering Survey Conducted by the USACE determined that the Dallas Floodway, is a historic and cultural resource with locally significant historical associations with flood control/city planning/community development and is a significant statewide example of an engineering system designed for flood control and development enhancement. The essential physical features of the Dallas Floodway are the levees, pump stations, diversion channels, and overbank. The Dallas Floodway meets the NEPA definition of a significant historic and cultural resource that must be considered in assessment of environmental impacts as required under Council on Environmental Quality (CEQ) regulations Part 1502.16.

3.6.2 Existing Conditions

In order to fulfill the federal regulations requirements as part of preparing this EIS, an intensive engineering cultural survey was conducted of the Dallas Floodway for the purpose of identifying and evaluating cultural resources to assess cultural impacts under the NEPA.

The USACE prepared the *Final Intensive Engineering Inventory and Analysis of the Dallas Floodway, Dallas, Texas* in November 2010 (USACE 2010). The report contains a cultural inventory and evaluation of the engineering components associated with the Dallas Floodway Project. It includes a historic context of the Dallas Floodway as a flood control system and as an outgrowth of community planning. Based on an analysis of the field and research data collected as part of the survey, the Dallas Floodway, as a single engineering system for flood control and reclamation, is a historic and cultural resource with locally significant historical associations with flood control and the history of city planning and community development in Dallas. In addition, it is a significant statewide example of an engineering system designed for flood control and development enhancement.

The period of significance of the Dallas Floodway spans from 1928, when Dallas Floodway construction started, to 1959, when the project was completed. Essential physical features of the Dallas Floodway include the levees, diversion channels, and overbank. The Dallas Floodway retains all its essential physical features and its ability to convey its significance. The Dallas Floodway is a significant historic and cultural resource that must be considered in assessment of environmental impacts as required under CEQ Regulations 40 CFR § 1502.16(g) (USACE 2010).

The 2010 report identified the essential/non-essential hydraulic features of the Dallas Floodway and whether they were supporting or non-supporting features of the Floodway. In addition, the report noted the existence of bridges that cross the Floodway (Table 3.6-2).

As shown in Table 3.6-2, a total of eight archaeological sites have been previously documented within the Dallas Floodway. Of those, six are not significant under NEPA criteria. The remaining two sites have not been evaluated for NEPA historic and cultural significance. The sites include several refuse dumps, bridge piers, a well, and a hearth. Further information regarding these sites is protected by Archaeological Resources Protection Act, including their location within the Dallas Floodway.

No TCPs have been identified within the Study Area. For additional information refer to the *Final Intensive Engineering Inventory and Analysis of the Dallas Floodway, Dallas, Texas* (USACE 2010).

Table 3.6-2. Current Status of Cultural Resources*

Cultural Resource	*Current Status*
Hydraulic Physical Features	
Dallas Floodway	Significant under NEPA criteria
Old Baker Pumping Plant	Significant under NEPA criteria
Old Pavaho Pumping Plant	Significant under NEPA criteria
Bridges	
AT&SF Railroad	Significant under NEPA criteria
Union Pacific Railroad	Significant under NEPA criteria
Houston Street Viaduct	Significant under NEPA criteria
Commerce Street Viaduct	Significant under NEPA criteria
Corinth Street Viaduct	Significant under NEPA criteria
Cadiz Street Viaduct/IH-35	Not Evaluated
Continental Avenue Viaduct	Significant under NEPA criteria
Hampton Road	Not Evaluated
Sylvan Avenue	Not Evaluated
Westmoreland	Not Evaluated
Chicago, Rock Island, and Pacific Railroad Bridge/DART	Significant under NEPA criteria
Proctor Street Bridge Pier	Demolished
Jefferson Street	Not Evaluated
Forrest Avenue	Not Evaluated
Missouri, Kansas, and Texas Railroad	Significant under NEPA criteria
IH-45	Not Evaluated
Irving	Not Evaluated
IH-356	Not Evaluated
IH-183	Not Evaluated
US-35 East	Not Evaluated
US-30	Not Evaluated
US-12	Not Evaluated
Neighborhoods	
Tenth Street Historic District	Significant under NEPA Criteria
Archaeological Sites	
Archaeological Site 41DL370, Historic Well and Refuse Dump	Not Significant under NEPA Criteria
Archaeological Site 41DL53	Not Significant under NEPA Criteria
Archaeological Site 41DL220, Historic Well and House Site	Not Significant under NEPA Criteria
Archaeological Site 41DL320, Historic Dump Ground	Undetermined
Archaeological Site 41DL323, Historic, Proctor Street Bridge	Not Significant under NEPA Criteria
Archaeological Site 41DL371, Historic Refuse Dump	Not Significant under NEPA Criteria
Archaeological Site 41DL440, Historic Trash Dump	Not Significant under NEPA Criteria
Archaeological Site 41DL441, Prehistoric Hearth	Undetermined

3.7 RECREATIONAL RESOURCES

3.7.1 Definition of Resource

Recreational facilities are defined as those amenities that provide for relaxation, rest, activity, education, or other opportunities for leisure services and community support that lead to an enhanced quality of life. These include, but are not limited to parks, lakes, trails, athletic fields, playgrounds, and community gardens. Recreational areas may include any type of activity in which area residents, visitors, or tourists may participate. Activities include hiking, boating, picnicking, playground use, and organized or informal sports. Refer to Appendix I, *Recreation Data,* for detailed information on recreation conditions within the Study Area.

3.7.1.1 Methodology

Public use of recreational amenities is correlated tightly with proximity as well as multiple-activity opportunities (i.e., land and water recreation) and has been consistently proven to be the primary driver in an individual's decision-making regarding recreational activities (Lieber and Fesanmaier 1985; Cordell et al. 1999). The ROI for recreational resources is the Study Area.

3.7.1.2 Regulatory Framework

The following local plans related to recreation apply to the Study Area:

- Texas Parks and Wildlife Code (Title 3, Chapter 26)
- City of Dallas 1998 Bond Program
- A Renaissance Plan for Dallas Parks and Recreation in the 21st Century 2002
- Balanced Vision Plan, 2004
- Trinity River Corridor Design Guidelines, 2009

3.7.2 Existing Conditions

The Study Area includes: (1) the West Fork and Confluence of the Elm Fork Trinity River (Figure 3.7-1, Northern Segment); (2) the main stem of the Trinity River, the floodplain, and levees along the river (Figure 3.7-2, Middle Segment); and (3) the IDS and surrounding commercial and residential areas (Figure 3.7-3, Southern Segment). Existing recreational facilities, resources, and associated amenities are listed in Table 3.7-1 and identified on Figures 3.7-1 through 3.7-3. Recreational resources are described below for the Study Area and are subdivided into terrestrial (land) and aquatic (water) recreational resources. The table and figures identifying these resources are at the end of Section 3.7.2.

3.7.2.1 Terrestrial Recreational Resource Activities

Although vehicular, pedestrian, and bicycle access to the Study Area is limited, there are several existing bike routes and trails that link the area to neighboring communities. Other trail systems within the area include the Katy Trail, Santa Fe Trestle Trail, Trinity Levee Trail, Trinity Strand Trail, and Trinity Trail. In addition to the Trinity Trail, pedestrian activities are available on the levee maintenance roads and some equestrian use occurs along existing trails within the area. There are also several recreational activities available within the Study Area that include picnicking, sports (e.g., soccer and volleyball), hiking, off-road biking, horseback riding, and bird watching. There are three greenbelt areas within the Study Area (Elm Fork Greenbelt, Fishing Hole Lake Greenbelt, and The Trinity River Greenbelt). The Trinity River Greenbelt is the largest recreational open space area, encompassing 3,653 acres, and includes the Trinity Trail which is a 6.4-mile primitive trail used for hiking, biking, and equestrian activities (City of Dallas 2012a, 2012b).

Biking within the area is available on surface streets without special bike lane access and on designated bike/pedestrian paths; although there are a few off-street paths currently available for bicycle use (City of Dallas 1992, NCTCOG 2009).

Parks and Recreational Facilities

There are 32 parks and 3 recreation centers within the Study Area that provide open space, picnic areas, playgrounds and structures, ball courts (volleyball, tennis, basketball), baseball fields, and soccer fields. In addition, many of the parks include walking paths that link with existing trails and bike paths (refer to Table 3.7-1 and Figures 3.7-1 through 3.7-3). With a total park acreage of 23,000 acres and a 2010 population of 1,197,816 the current ratio of parkland per 1,000 persons is 19.2.

There are nine public and private community centers in the Study Area that provide activities including athletics, sports, summer playground camps, cultural events, and leisure programs such as life management skills, and wellness programs. Other cultural events and performing arts occur at Teatro Dallas, the Sammons Center for the Arts, and the Trinity River Arts Center. The American Airlines Center is a private stadium that hosts major sporting events, concerts, private events, and festivals. The Dallas Convention Center hosts large and small conventions, music and art performances, exhibitions and shows, ranging from local to national events. There is also one public library (Dallas West Branch Library) and one museum at Dealey Plaza located within the recreation resources ROI (Table 3.7-1 and Figures 3.7-1 through 3.7-3).

Table 3.7-1. Existing Recreational Facilities Within the Study Area

*ID **	*Recreational Resource*	*Location*	*Acreage/ Miles*	*Ownership*	*Recreation Category*	*Major Recreational Attribute*
1	American Airlines Center	2500 Victory Avenue	NA	Private	Stadium	Major sports (basketball and hockey) and concert arena. AT&T Plaza and Woodall Rodgers Plaza hold outdoor events such as festivals, concerts, and private events.
2	Arlington Park	1505 Record Crossing	10.9 acres	Public	Community Park	1 soccer field, 1 basketball court, 1 playground, 2 parking areas, 4 picnic tables, 1 concession stand, a recreation center and trail access. Activities include adult and youth basketball, senior activities, and after-school programs.
3	Bataan Community Center	3232 Bataan Street	NA	Public	Community Center	Part of the West Dallas Community Centers, which offers after-school programs and other activities for school-age children.
4	Benito Juarez Park	3352 N. Winnetka	6.1 acres	Public	Neighborhood Park	1 soccer field, 1 basketball court, 1 playground, 2 parking areas, 2 picnic tables, a sculpture area, plaza, and trail access.
5	Bickers Park	1400 Bickers	2.9 acres	Public	Neighborhood Park	1 baseball diamond, 1 basketball court, 1 playground, 3 picnic tables, a gazebo, open field, and trail access.
6	Bishop Flores Park and Trail	2200 Talleyho	12.2 acres	Public	Neighborhood Park, Trail	1 basketball court, 1 playground, 1 parking area, 3 picnic tables, a gazebo, open areas, and trail access.
7	City Park	1717 Gano Street	22.1 acres	Public	Park	Location of Dallas Heritage Village, a living history village/museum representing buildings and artifacts from Dallas and North Central Texas from 1840-1910. The land was Dallas' first city park, formed in 1876. The first historic building was moved to the park in 1969, and the Dallas Historic Village now has 21 buildings.
8	Coombs Creek Trail	2008 N. Beckley Avenue	0.93 acre	Public	Trail	The Coombs Creek Trail would provide connection to the Proposed Trinity Levee Trail from Kessler Parkway, Stevens Park Golf Course, and the surrounding neighborhoods. Phase I has been completed, from Beckley Avenue to Sylvan Avenue.
9	Crow Lake Park and Trail	3700 Sylvan Avenue	6 acre lake	Public	Lake, Park, Trail	Developed facilities including artistic sculptures, volleyball court, soccer field, and a short walking trail. In addition, the park contains the 6-acre Crow Lake.
10	Dallas West Branch Library	2332 Singleton Boulevard	NA	Public	Library	Public library with teen center, homework help, story times, and free wireless internet.

Table 3.7-1. Existing Recreational Facilities Within the Study Area

ID *	Recreational Resource	Location	Acreage/ Miles	Ownership	Recreation Category	Major Recreational Attribute
11	Dealey Plaza	400 Main Street	3.1 acres	Private	Museum	Completed in 1940 as a Works Progress Administration project to honor prominent Dallas residents. It was the site of President Kennedy's assassination in 1963 and designated a National Historic Landmark District in 1993 to preserve the site and surrounding buildings. Public spaces include fountain and memorial areas.
12	Elm Fork Greenbelt	Loop 12 to Trinity River Confluence	609 acres	Public	Greenbelt	The 7.3-mile long Elm Fork Greenbelt is a natural separation between the cities of Dallas and Irving, Texas, and is part of the Trinity River greenbelt. River fishing access is provided.
13	Eladio R. Martinez Park	2500 Jim Street	1.06 acres	Public	Neighborhood Park	1 basketball court, 1 playground, 3 picnic tables, and an open field.
14	Eloise Lundy Recreation Center	1229 Sabine	3.38 acres	Public	Community Park/ Recreation Center	1 baseball diamond, 1 tennis court, 1 basketball court, 1 playground, 1 parking area, 7 picnic tables, trail access and a recreation center with activities for local residents.
15	Emma Carter Park	4100 Pluto Street	6.3 acres	Public	Neighborhood Park	1 basketball court, 1 playground, 1 parking area, 3 picnic tables, and open fields.
16	Ferris Plaza	412 S. Houston Street	0.92 acre	Public	Park	Formal plaza created in 1925 and restored in 2005, with fountain and seating areas.
17	Fish Trap Lake Park and Trail	2401 Toronto	43.65 acres	Public	Park, Trail	Lake with fishing, multi-use trail, and open spaces.
18	Fishing Hole Lake Greenbelt	Story Road. at the Elm fork of Trinity River	129 acres	Public	Greenbelt	Part of the larger Elm Fork Greenbelt.
19	Founders Square Park	1000 Jackson	6.53 acres	Public	Park	Landscaped park with fountains and plaza.
20	Hammerly Park	4800 Hammerly	NA	Public	Park	Play structure and basketball court.
21	Hattie Moore Park and Recreation Center	3212 N. Winnetka	3.66 acres (Hattie Moore Park)	Public	Community Park, Recreation Center, Pool	2 tennis courts, 2 basketball courts, 1 playground, 1 parking area, 4 picnic tables, 1 swimming pool, 1 concession stand, and a recreation center.
22	Helen Emory Park	2500 Obenchain	0.39 acre	Public	Mini Park	1 basketball court, 1 playground, 1 parking area, and 4 picnic tables.
23	Hines Park	9700 Harry Hines	NA	Public	Conservation Park	1 parking area, 3 picnic tables, and Open space in between Bachman Lake and Fishing Hole Lake.

Table 3.7-1. Existing Recreational Facilities Within the Study Area

*ID **	*Recreational Resource*	*Location*	*Acreage/ Miles*	*Ownership*	*Recreation Category*	*Major Recreational Attribute*
24	Jaycee Zaragoza Community Pool	3125 Tumalo	NA	Public	Community Center, Pool	Swimming pool, concession stand, and recreation center.
25	Jaycee Zaragoza Park and Trail	3114 Clymer	17.7 acres	Public	Community Park, Trail	2 baseball diamonds, 1 soccer field, 2 tennis courts, 2 basketball courts, 1 playground, 3 parking areas, 10 picnic tables, trail access, and sculpture areas.
26	Joseph McMillan Community Center	3730 Ladd Street	NA	Public	Community Center	Part of the West Dallas Community Centers, which offers after-school programs and other activities for school-age children.
27	Katy Trail	5000 Airline Road	3.5 miles	Public	Trail	The Katy Trail is a 3.5-mile long multi-use trail that links the American Airlines Center in downtown Dallas to the Highland Park neighborhood. The trail originates at the American Airlines Center and the other end terminates in Highland Park. This paved trail provides opportunities for walking, jogging, inline skating, and biking. There are plans to extend the trail to more neighborhoods, and connect it to other proposed trails in the region. The trail includes between 15-20 park benches.
28	Kessler Parkway Park	1821 Kessler Parkway	22.16 acres	Public	Park	Open space park with walking paths. Open space areas include 2 tennis courts and 1 playground.
29	Kingsbridge Park	3400 Kingsbridge Street	36.39 acres	Public	Park	Covered group picnic area, multi-use trail, tennis court, play structure, basketball court, and open fields.
30	Lapsley-Leewood Park	5611 Martinez Street	NA	Public	Park	Open space park.
31	Martyr's Park	265 Commerce Street	0.63 acre	Public	Park	Open space park.
32	Mattiemash Community Center	3710 N. Hampton Road	NA	Public	Community Center	Community Recreation Center with activities for youth, teens, adults, and seniors.
33	Nash/Davis Park	3700 N. Hampton Road	11.9 acres	Public	Community Park	1 baseball diamond, 2 tennis courts, 1 basketball court, 1 playground, 1 parking area, 10 picnic tables, 1 concession stand, a recreation center, and trail access.
34	North Hampton Park	3701 N. Hampton Road	NA	Public	Park	Baseball fields and soccer fields.
35	Pegasus Park	3000 Pegasus Park Drive	NA	Public	Park	Park with walking path and open space along water feature.

Table 3.7-1. Existing Recreational Facilities Within the Study Area

*ID **	*Recreational Resource*	*Location*	*Acreage/ Miles*	*Ownership*	*Recreation Category*	*Major Recreational Attribute*
36	Pegasus Trail	3000 Pegasus Park Drive	7.4 acres	Public	Trail	Trail around Pegasus Park.
37	Pointer Park	4100 Pointer	1.24 acres	Public	Neighborhood Park	1 playground, 2 picnic tables, and open space.
38	Pueblo Park	3226 Bataan Street	0.55 acre	Public	Mini Park	1 basketball court, 1 playground, and 2 picnic tables with a covered picnic area.
39	Reunion Arena Park	Reunion Boulevard & Sports Street	2.39 aces	Public	Park	Water feature with seating areas, walking path.
40	Reverchon Park	3505 Maple	41.26 acres	Public	Community Park, Trail, Recreation Center	Named after Julien Reverchon, a prominent local botanist, the park land was acquired in 1915. The park was intended to be a regional draw. The park includes 1 baseball diamond, 2 tennis courts, 2 basketball courts, 1 playground, 2 parking areas, 8 picnic tables, 1 concession stand, an amphitheater, trail access and the Reverchon Recreation Center.
41	Santa Fe Trestle Trail	1850 Atwood Street	0.63 mile	Public	Trail	The extended Santa Fe Trestle Trail would act as a hike and bike trail that provides access to Moore Park, located off East 8th Street south of downtown Dallas, and would be approximately 10.4 acres. It would cross the Trinity River via the AT&SF trestle, continue to a parking lot to be constructed south of the planned Trinity Parkway, and end as an access road at the north Trinity River levee near downtown Dallas. Construction began in 2010.
42	Shaw Park	3600 Ladd Street	0.11 acres	Public	Park	Open space.
43	Sleepy Hollow Park	1200 Sleepy Hollow Lane	0.62 acres	Public	Mini Park	1 basketball court, 1 playground, and 2 picnic tables with a covered picnic table area.
44	Southwest Key Program Youth Center	2351 W. Northwest Highway # 3337	NA	Private	Community Center	Community Center for a Youth Non-Profit Organization.
45	Stemmons Park	1200 Oak Lawn Avenue	4.9 acres	Public	Community Park	Open space park with wooded area.
46	Sylvan Avenue Boat Launch	2700 Sylvan Avenue	NA	Public	Boat Launch	The boat launch was completed in 2002 and constructed using funds from the City of Dallas and Texas Parks and Wildlife Dept. It is located adjacent to Sylvan Ave, and provides access to the main stem of the Trinity River within the Dallas Floodway.

Table 3.7-1. Existing Recreational Facilities Within the Study Area

*ID **	*Recreational Resource*	*Location*	*Acreage/ Miles*	*Ownership*	*Recreation Category*	*Major Recreational Attribute*
47	Teatro Dallas	1331 Record Crossing Road	NA	Private	Performing Arts Center/Theatre	Established in 1985, the Teatro Dallas holds independent arts and entertainment events, including world premiere and American premiere theatrical events.
48	The Dallas Convention Center	650 S. Griffin Street	NA	Public	Convention Center	The Dallas Convention Center was originally constructed in 1957 but has been expanded several times, most recently in 2002. It provides the largest column-free exhibit hall in the U.S. The Convention Center hosts large and small conventions, music and art performances, exhibitions and shows, ranging from local to national events.
49	The Sammons Center for the Arts	3630 Harry Hines Boulevard	NA	Private	Performing Arts Center/Theatre	Non-profit business incubator program for arts organizations, providing office, rehearsal, performance, and meeting space in the historic Turtle Creek Pump Station building.
50	The Sarah Wilke Youth Center	3326 N. Winnetka Avenue	NA	Private	Community Center	Community Center providing academic, social, and community building programs for community members of all ages.
51	Tipton Community Pool	3607 Magdeline	NA	Public	Community Center, pool	Community center and swimming pool.
52	Tipton Park	3607 Magdeline	22.28 acres	Public	Neighborhood Park	1 basketball court, 1 parking area, and 2 picnic tables with a covered picnic area.
53	Trinity Levee Trail	3737 Sylvan Avenue	6.2 miles	Public	Trail	The Trinity Levee Trail includes 6.2 miles of primitive trails in the area that are accessible year-round to hikers, cyclists, and equestrians. Annual events that make use of these trails include the Trinity River Levee Run 10-kilometer race.
54	Trinity Overlook Park	11 W. Commerce Street	0.5 acre	Public	Park	The City of Dallas completed the Trinity Overlook Park in October 2008, which is located just south of the western approach to the Commerce Street Bridge and is less than half an acre. The Trinity Overlook Park includes shade tents and interpretive displays providing information on the Dallas Floodway, the Trinity Lakes, and new signature bridges.
55	Trinity River Arts Center	2600 N. Stemmons Freeway #180	NA	Private	Performing Arts Center/Theatre	Performing arts center, theatre, and exhibit venue that supports youth outreach programs and local performances, now known as the KD Studio Theatre.
56	Trinity River Standing Wave	2225 S. Riverfront Boulevard	9 acres	Public	Boat Launch	This project includes an in-stream standing wave for recreational use, and covers approximately 9 acres. In addition to the in-stream component, this project includes a shore component consisting of a canoe launch, small trails, a parking area, and ingress/egress points (launch and take-out) supported by retaining walls.

Table 3.7-1. Existing Recreational Facilities Within the Study Area

*ID **	*Recreational Resource*	*Location*	*Acreage/ Miles*	*Ownership*	*Recreation Category*	*Major Recreational Attribute*
57	Trinity River Greenbelt	NA	3,242 acres	Public	Conservation Greenbelt	Greenbelt surrounding the Trinity River, which includes the Trinity River Greenbelt Park. The Greenbelt provides over 3,400 acres of open space for trails, wildlife viewing, fishing, and other recreation activities. Three soccer fields, one parking area, sculpture areas, and trail access.
58	Trinity River Mission	1018 Gallagher	NA	Private	Church, Community Center	Volunteer-based community learning center serving children, youth, and families in West Dallas.
59	Trinity Strand Trail	1700 N. Stemmons Freeway	7.8 miles	Public	Trail	The Trinity Strand Trail is a 7.8-mile, hike/bike, commuter, and recreational trail that will run along the course of the original Trinity River, also known as the Old Meanders, through the heart of the Dallas Design District (located on the west side of Stemmons Freeway at Oak Lawn Avenue that consists of over 370 designer shops and showrooms). Construction of the trail began in 2009, and Phase I construction is estimated to begin spring in 2011.
60	Trinity Strand Trail Park	1700 N. Stemmons Freeway	NA	Public	Park	Park, trails, and open space.
61	Trinity Trails	5309 Simpson Stuart Road	3.5 miles, 7 miles, and 26 miles	Public	Trail	The Trinity Trails includes an extensive network of trails within the Trinity River Corridor with 3.5 miles of trails that are designed for environmentally sensitive areas, 7 miles of soft surface trails, and 26 miles of hard surface trails with pedestrian bridges across the river. Phase I includes an EcoPark trailhead and an entry to the Joppa Nature Preserve, Phase II will end at the Trinity River Audubon Center. Construction of Phase I is estimated to conclude spring 2011, and Phase II is estimated to conclude winter 2012.
62	Trinity View Park	2200 E. 6th Street	NA	Public	Park	Soccer fields, football fields, cricket pitch, baseball and softball fields, play structures, and open fields.
63	West Dallas Community Center	3918 N. Hampton Road	NA	Public	Community Center	Community Center that offers after-school programs and other activities for school-age children.
64	West Dallas Housing Park	2401 Toronto	NA	Public	Park	Park and play structure.

Note: * Identification (ID) Number corresponds to the recreation facility number included on Figures 3.7-1, 3.7-2, and 3.7-3. NA= not available.
Sources: City of Dallas 2008a, 2008b; City of Dallas Parks and Recreation 2011; ESRI 2010; FHWA 2009; NCTCOG 2008.

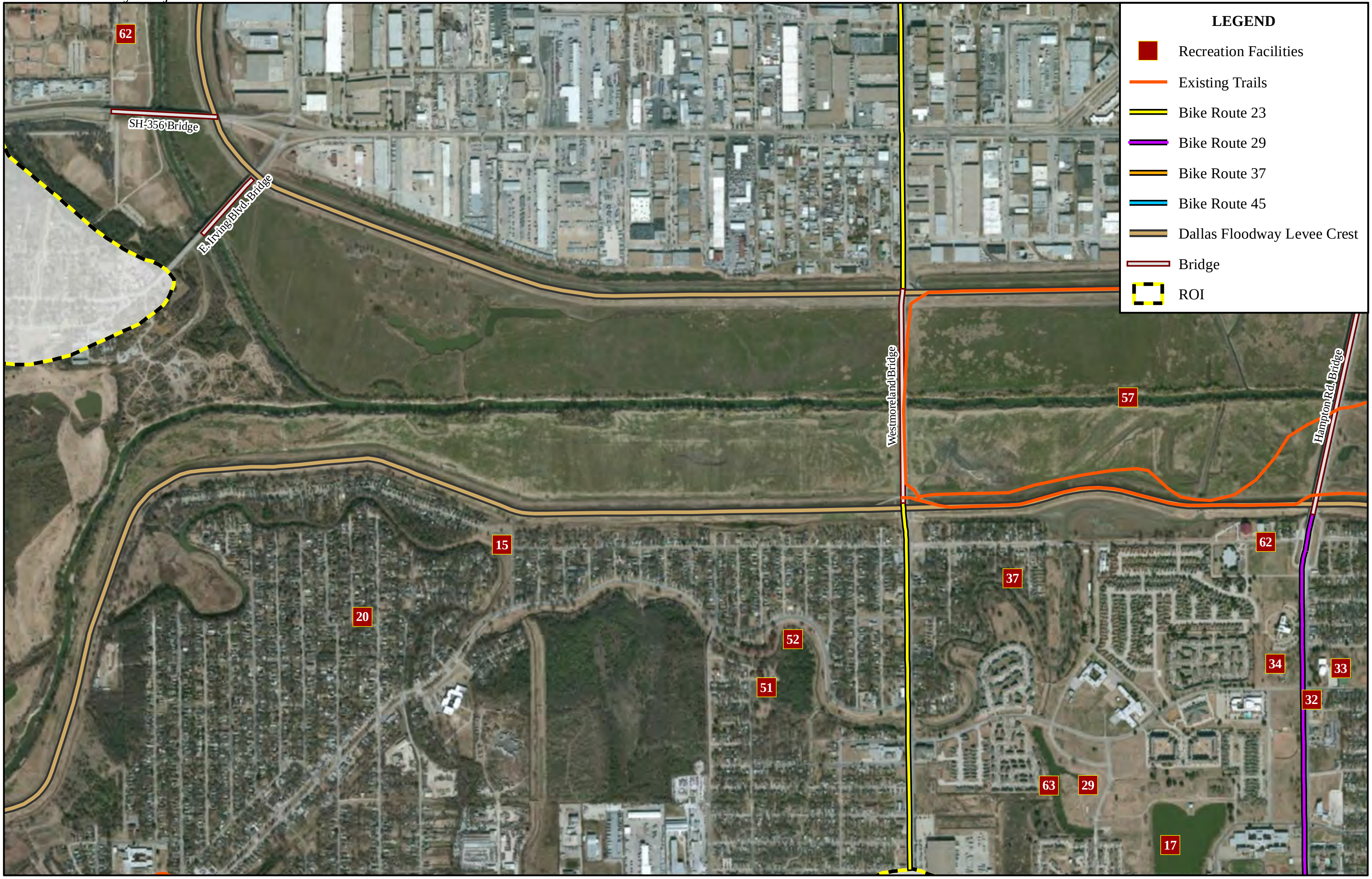


Figure 3.7-1
Existing Recreational Resources: Northern Segment

GIS Sources: City of Dallas 2008a, ESRI 2013, FHWA 2009, NCTCOG 2008

Note: The numbered squares correspond to the recreation features presented in Table 3.7-1.

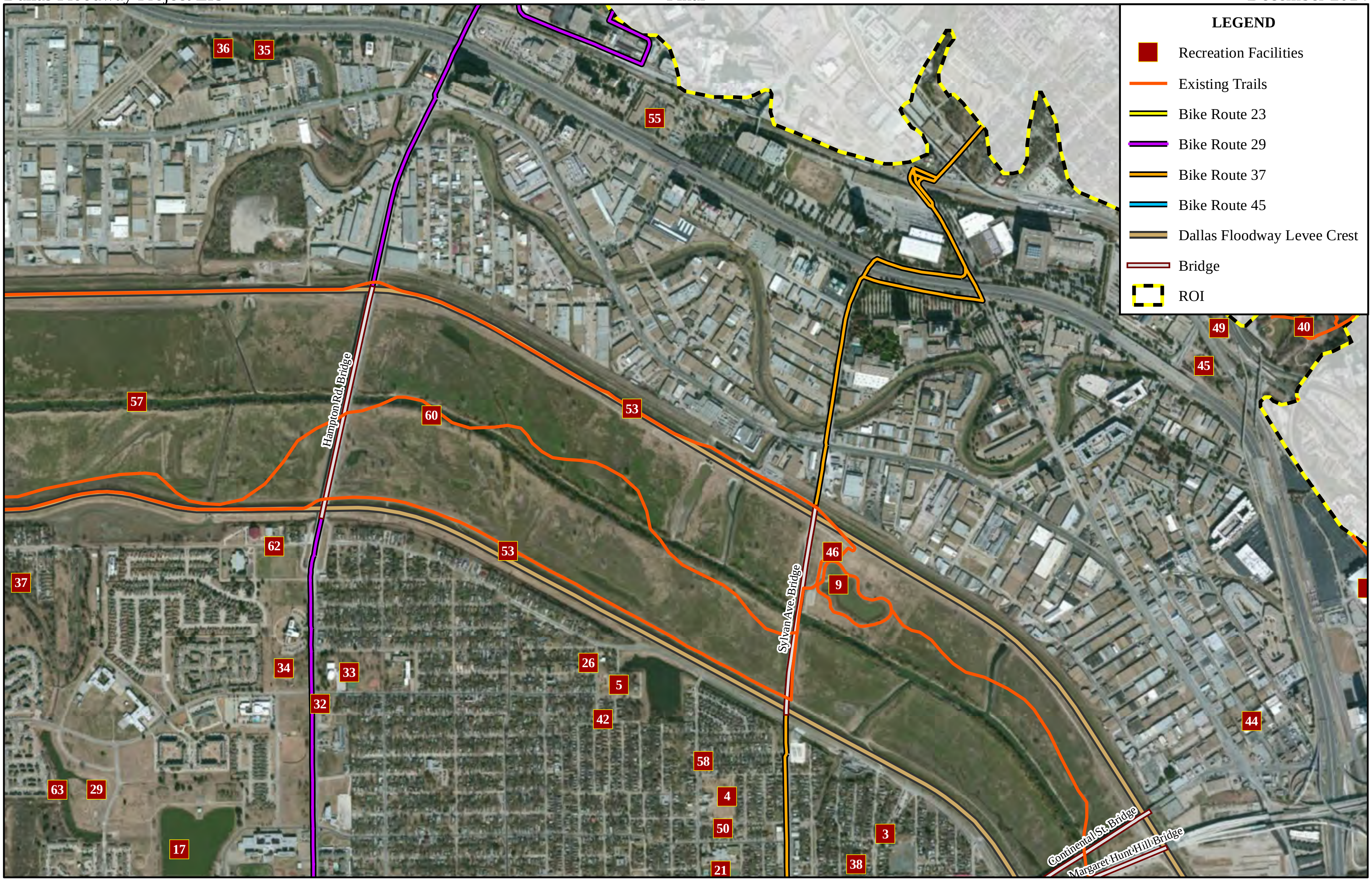


Figure 3.7-2
Existing Recreational Resources: Middle Segment

GIS Sources: City of Dallas 2008a, ESRI 2013, FHWA 2009, NCTCOG 2008

Note: The numbered squares correspond to the recreation features presented in Table 3.7-1.

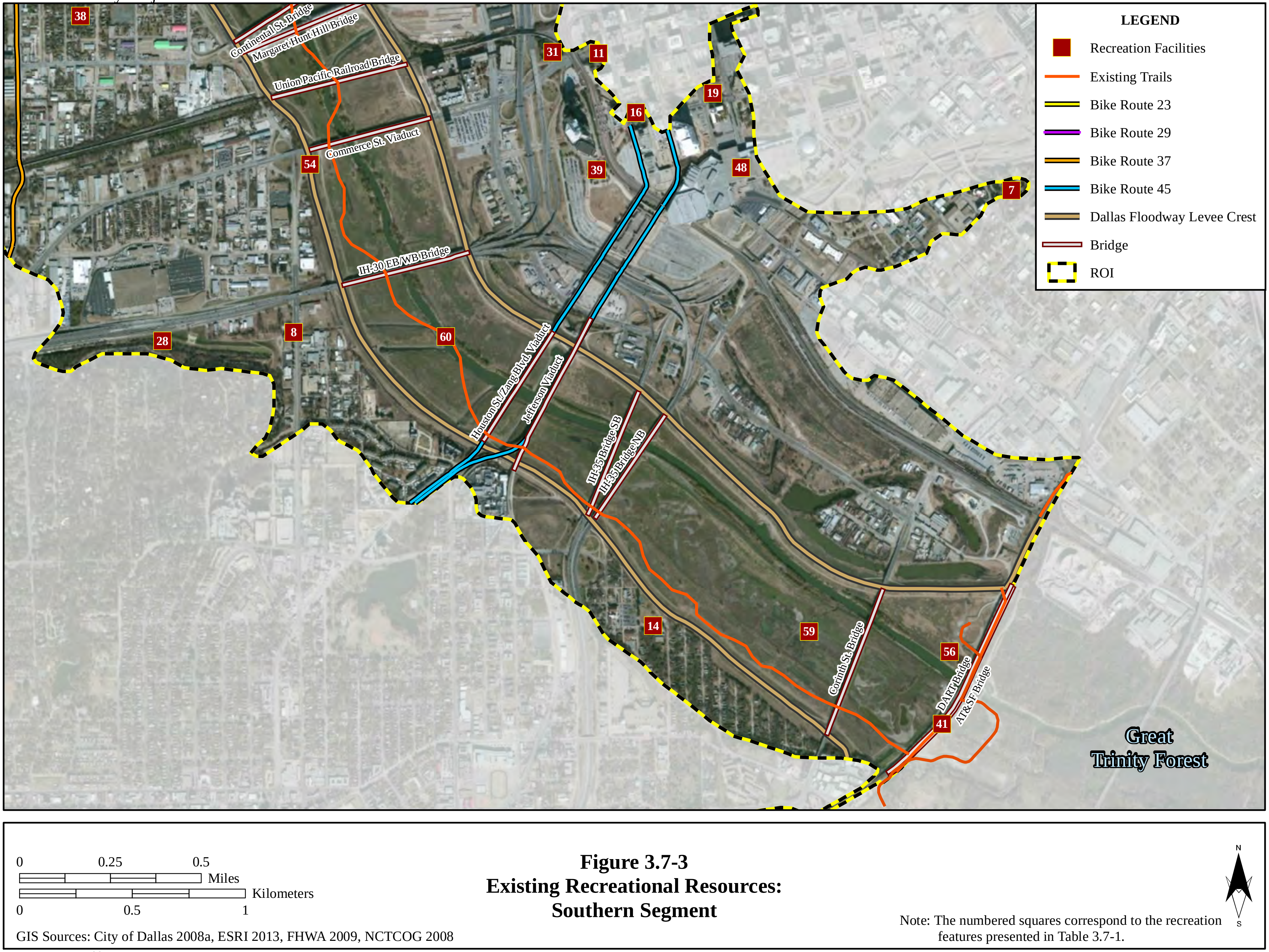


Figure 3.7-3
Existing Recreational Resources: Southern Segment

GIS Sources: City of Dallas 2008a, ESRI 2013, FHWA 2009, NCTCOG 2008

Note: The numbered squares correspond to the recreation features presented in Table 3.7-1.

3.7.2.2 Aquatic Recreational Resource Activities

Swimming Pools

Three community swimming pools (Hattie Moore Recreation Center, Jaycee Zaragoza Community Pool, and Tipton Community Pool) are located in the Study Area (City of Dallas 2009a).

Within the ROI, the sump ponds and Trinity River are not recognized as formal recreational swimming areas. Bacteria concentrations are occasionally elevated in portions of the Upper Trinity River and high concentrations of bacteria can pose a risk to people who swim or wade in them. The state's standards for water quality categorize this as "contact recreation." TMDLs have been adopted for the Upper Trinity River where concentrations of indicator bacteria exceed the criteria used to evaluate attainment of contact recreation use (TCEQ 2011). For further background of TMDLs and existing monitoring conducted in the Trinity River, refer to Section 3.4.

Boating

The Trinity River is used for fishing, boating, canoeing, and kayaking. Pedestrian access to the portion of the Trinity River located in the Study Area is available via Crow Lake Park, two available trailheads off northbound Westmoreland Road, and Trinity Overlook Park (City of Dallas 2009b). Currently, the only official portage to the river channel in the Study Area is the Sylvan Avenue Boat Launch at Crow Lake Park; however, users of small boats and other floatation devices can put in upstream and float through the Study Area before exiting at Crow Lake Park or further downstream (TPWD 2007a). The recently constructed Trinity River Standing Wave includes an in-stream standing wave for recreational use and a shore component consisting of a boat launch area, small trails, and a parking area. The Trinity River Standing Wave is currently closed to users for modifications.

River use typically is made up of paddle craft only (e.g., canoe and kayaks) and rarely includes inner tubes or other flotation devices (City of Dallas 2009b). Some local canoe/kayak clubs use portions of the Trinity River for boating activities and some local businesses rent canoe/kayaks and lead guided paddles down the stretch of the Trinity River from the Elm Fork (Proctor) to Sylvan Avenue (Crow Lake Park portage) and from Sylvan Avenue to Loop 12 (Trinity River Expeditions 2009).

Fishing

Fishing in the Study Area portion of the Trinity River is catch-and-release only due to unsafe levels of dioxins and PCBs (TDSHS 2010). According to the Texas Parks and Wildlife "*River Fishing in Dallas Ft. Worth: Trinity River System Public Access Points*," the only recreational fishing access point within the Study Area is located at Crow Lake Park (TPWD 2007b).

Fish Trap Lake is the only lake within the Study Area that offers fishing opportunities. The TPWD stocks Fish Trap Lake with bass, bluegill, catfish, sunfish, and trout to provide for fishing opportunities. Fishing in Fish Trap Lake is open to the public and fishing licenses are available at numerous locations in the City of Dallas (TPWD 2007a).

3.7.2.3 Special Events

Numerous cultural and sporting events (e.g., parades, foot races, street festivals) that take place within the City of Dallas each year. The City Office of Special Events permits and plans special events throughout the city that attract 75 or more participants. If a special event occurs within a City of Dallas park, the City of Dallas Parks and Recreation Department application process applies. Table 3.7-2 identifies special events that occur within or adjacent to the Dallas Floodway.

Table 3.7-2. Special Events within or in Close Proximity to the Dallas Floodway

Event	*Attendance*	*Month*	*Recurring/Nonrecurring*
Trinity Run	1,800	March	Recurring
All Out Trinity	4,000	March	Recurring
Margaret Hunt Hill Bridge Celebration	>40,000	March 2012	Nonrecurring
Earth Day	60,000	April	Recurring
Trinity River Wind Festival	Unknown	May	Recurring
Trinity River Revel	Unknown	June 2014	Nonrecurring
Dallas Rock and Roll Marathon	50,000	March	Recurring
Metro PCS Dallas Marathon	149,000	December	Recurring
Mayor's Race	6,000	December	Recurring
Veteran's Day Parade & Ceremony	28,000	November	Recurring
Santa Fe Trail 5k	1,200	October	Recurring

Source: City of Dallas 2014.

3.8 VISUAL RESOURCES

3.8.1 Definition of Resource

Visual resources are the natural and man-made features that comprise the visual qualities of a given area, or "viewshed." These features form the overall impression that an observer receives of an area or its landscape character. Topography, water, vegetation, man-made features, and the degree of panoramic view available are examples of visual characteristics of an area.

3.8.1.1 Methodology

Visual resources can be subjective by nature, and therefore the level of the proposed project's visual impacts can be challenging to quantify. Generally, projects that create a high level of contrast to the existing visual character of a project setting are more likely to generate adverse visual impacts due to visual incompatibility. Thus, it is important to assess project effects relative to the existing conditions of the area. On this basis, project components effect on the visual environment are quantified and evaluated for impact assessment purposes based on factors affecting setting compatibility such as changes in visual vividness, intactness, and unity from the existing conditions.

Using the methodology described in the Federal Highway Administration (FHWA) Visual Impact Assessment for Highway Projects (FHWA 1988) the visual quality can be quantified for each visual unit. The methodology produces a visual quality rating based on an area's vividness, intactness, and unity. The visual quality values range from 1 (very low – the area displays no vividness/intactness/unity) to 7 (very high – the area displays extreme vividness/intactness/unity) as follows:

1 = very low
2 = low
3 = moderately low
4 = moderate
5 = moderately high
6 = high
7 = very high

Within a discrete viewshed, an individual's visual perception is a function of the area's spatial properties, visual content, and an individual's previous experiences. The visual character of an area can be altered by actions that would modify the landscape. In addition, views toward a given location in the viewshed can be affected by a proposed action. To provide a baseline for assessing potential visual impacts of actions on a viewshed, the Study Area must be described in terms of its visual characteristics (using visual assessment elements), and a description of the user groups (viewer groups) who would experience any changes in visual character.

Visual Assessment Elements

The following characteristics were used to describe and assess visual resources: viewshed, visual character, visual quality (vividness, intactness, and unity), visual sensitivity, and key observation points.

Viewshed

Viewshed is an area of the landscape that is visible from a particular location (e.g., an overlook) or series of points (e.g., a road or trail). To identify the importance of views of a resource, a viewshed may be broken into distance zones consisting of: (1) foreground, (2) middleground, and (3) background. Generally, the closer a resource is to the viewer, the more visually dominant it is and the greater its significance to the viewer.

Visual Character

Visual character is based on defined attributes of an area. A change in visual character cannot be described as having good or bad attributes until it is compared with the viewer response to that change. If there is public preference for the established visual character of a regional landscape and a resistance to a project that would contrast that character, then changes in the visual character can be evaluated.

Visual Quality

Visual quality is determined by analyzing three elements of the visual environment: vividness, intactness, and unity. None of these is itself indicative of visual quality, and all three must be high to indicate high visual quality. Vividness is the visual power or memorability of landscape components as they combine in striking or distinctive visual patterns. Examples of significant vividness include views of areas such as the Grand Canyon or the Statue of Liberty. Intactness is the visual integrity of the natural and artificial landscape and its freedom from encroaching elements. Intactness can be present in well-kept urban and rural landscapes, as well as in natural settings. Intactness relates to the physical setting. For example, in a natural setting, it is the freedom from development or infrastructure; in a rural setting, it is the freedom from urban influences; and in an urban/suburban setting, it is the freedom from uses such as industrial smokestacks in an area with office buildings or intensive commercial development in a residential area. Unity is the visual coherence and compositional harmony of the landscape considered as a whole; it frequently attests to the careful design of individual components in the artificial landscape. Examples of high unity would include a well-maintained master-planned community or a mixed-use downtown development.

Visual Sensitivity

Visual sensitivity is based on the visibility of resources in the landscape, the proximity of viewers to the visual resource, the relative elevation of viewers to the visual resource, and the types and expectations of individuals and viewer groups. The criteria for identifying the importance of views are related in part to the position of the viewer relative to the resource.

Visual sensitivity also depends on the number and type of viewers and the frequency and duration of views. Generally, visual sensitivity increases with an increase in total number of viewers, the frequency of viewing (e.g., daily or seasonally), and the duration of views (i.e., how long a scene is viewed). In addition, visual sensitivity is higher for views seen by people who are driving for pleasure; people engaging in recreational activities, such as hiking, biking, or camping; and homeowners. Views from recreation trails and areas, scenic highways, and scenic overlooks are generally assessed as having high visual sensitivity.

Key Observation Points

Key observation points are official (e.g., a vista point) or unofficial (e.g., mountain peak) viewing locations that individuals identify as providing a place from which to take in remarkable views.

Viewer Groups

Viewers are placed into one of two groups based on activities and functions within a viewshed: (1) those with a view of the Proposed Action, and (2) those with a view from the Proposed Action. For example, while viewers with a view from an existing roadway will generally experience a similar visual landscape, viewers of a new road could observe a new visual landscape. All viewers can have different types of perception and thus impressions of the viewshed depending on their viewing perspective (e.g., motorist, resident, recreational user, business employees/patrons).

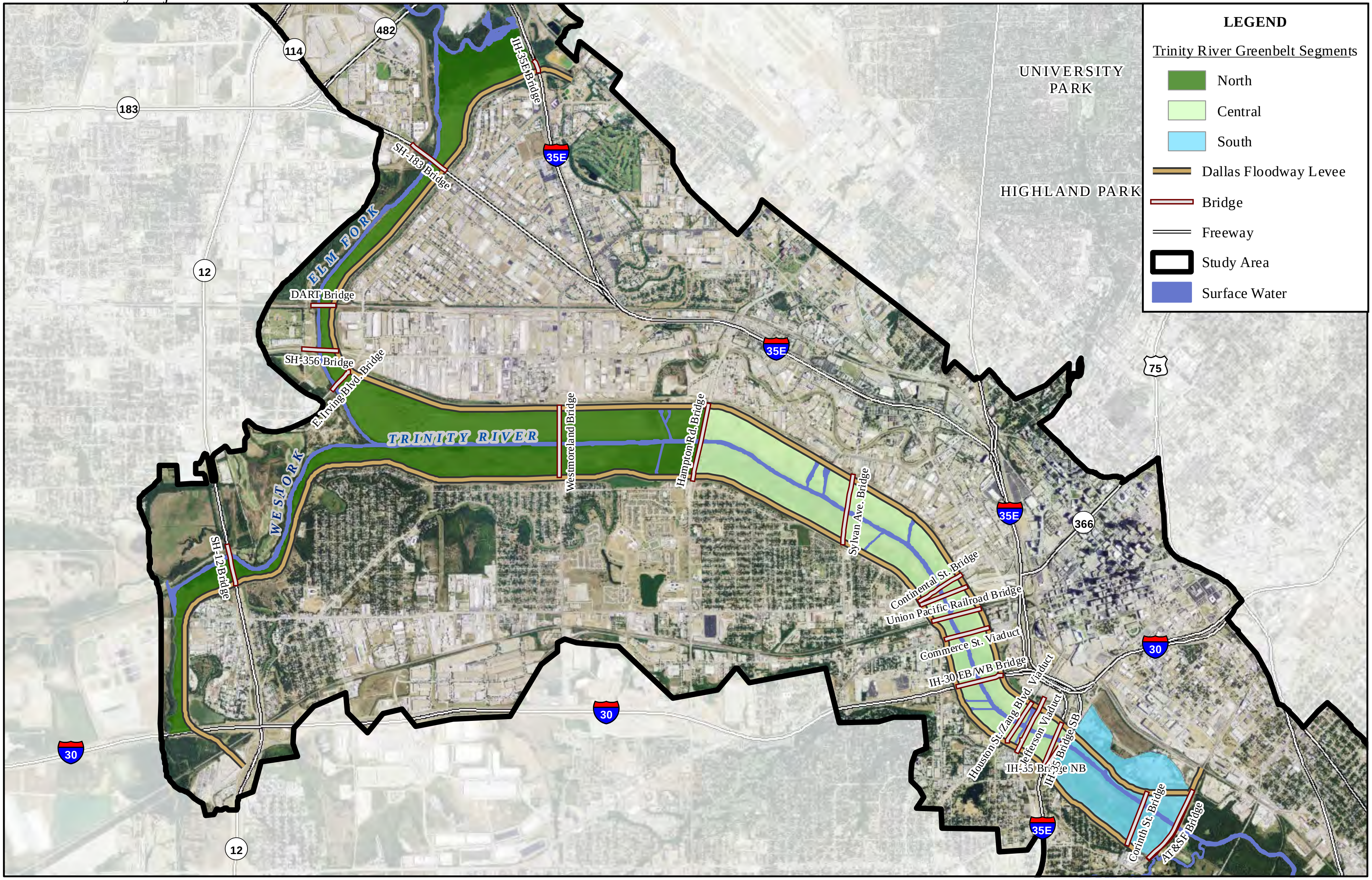
The ROI for visual resources is defined by those parts of the areas in which permanent visual changes could occur. For the Study Area, this includes the Dallas Floodway and adjacent areas, and the IDS pumping plants and associated component features.

3.8.1.2 Regulatory Framework

Visual resources are mentioned in NEPA and CEQ regulations to implement NEPA under the heading of aesthetics. These regulations identify aesthetics as one of the elements or factors in the human environment that must be considered in determining the effects of a project. As prescribed by NEPA and CEQ, it is the “continuous responsibility” of federal and state governments to “assure all Americans” an environment that is composed of “aesthetically pleasing surroundings.”

3.8.2 Existing Conditions

Overall, the visual landscape of the Study Area can be described as a major metropolitan area with pockets of vegetation, divided by an extensive linear area of open space. The Dallas Floodway represents a major visual feature in the area, sharply defining the boundary between the major metropolitan elements and open space. The bridges that span the Dallas Floodway, buildings in the Central Business District, and levee tops provide expansive views of the Study Area. No designated scenic roadways or highway are present within the viewshed. The entire Dallas Floodway can be divided up into three similar, yet unique viewshed segments: the North, Central, and South Trinity River Greenbelts (Figure 3.8-1). A visual setting of the Floodway as one distinct cohesive unit provides the overall regional context of the existing Study Area.



0 0.5 1
Kilometers
Miles
0 0.5 1

Figure 3.8-1
Trinity River Greenbelt Segments

GIS Sources: City of Dallas 2008a, NCTCOG 2008

3.8.2.1 Dallas Floodway

The visual quality of the Dallas Floodway is moderately high (5), as vividness is moderately high (5), intactness is moderately high (5), and unity is high (6). Water, marshes, riparian trees, open meadows, and isolated mature trees, all of which are bound by the earthen, grass-covered levees make up the visual environment of the entire Dallas Floodway (Photos 1 and 2). Crossing the Dallas Floodway are several bridges that stand out as significant visual features. Similarly, overhead utilities and stormwater outfalls (Photos 3 and 4) are located throughout the Dallas Floodway and contribute to the visual environment. In addition, the Trinity River is a defining visual element. Usually the river stays within its channel and serves as a contributing element to the overall visual environment. However, during periods of high water, the Trinity River swells to dominate the visual landscape of the Dallas Floodway.

Photo 1: Trinity River and Riparian Trees

Photo 2: Open Meadow within Floodway

Photo 3: Grass-covered Levee (left) and Overhead Utilities

Photo 4: Stormwater Outfall

Within the regional visual context, the Dallas Floodway is not consistent with the surrounding Dallas-Fort Worth Metropolitan Area; however, when viewed as a discrete visual unit, the Dallas Floodway as a whole is consistent throughout the Study Area. The Floodway is primarily undeveloped open space while the larger Dallas-Fort Worth Metropolitan Area is urban. A unique aspect of the Dallas Floodway is the striking views it provides of the Central Business District. As the Dallas Floodway is viewed by tens of thousands of people every day from a multitude of locations, there is a high level of visual sensitivity. Notable viewpoints include the recently completed Trinity River Overlook, bridge crossings, and high-rise buildings.

3.8.2.2 North Trinity River Greenbelt

The visual quality of the North Trinity River Greenbelt is moderate (4), as vividness is moderately low (3), intactness is moderate (4), and unity is moderate (4).

Beginning in the north, the North Trinity River Greenbelt viewshed includes marshes, riparian trees lining the river channel, and open meadows of mostly native turf grasses, sedges, herbaceous perennials, annuals and isolated woody persistent trees peppered with second-growth mature trees. Structures exterior to the Dallas Floodway, notably power lines, transmission towers, and buildings located in the Trinity Industrial District, contribute to the visual environment of the Dallas Floodway. In addition, the Westmoreland/Mockingbird, Hampton/Inwood and Wycliff/Sylvan Bridges cross the Dallas Floodway in this region and visually frame and divide the landscape. Within the North Trinity River Greenbelt viewshed, the Crow Lake Park area is visually described as a horizontal expanse of native grasses, mature trees, and a small lake with associated park features. From the park, there are expansive, striking views of the Central Business District and the Oak Cliff area. As the North Trinity River Greenbelt is viewed by tens of thousands of people every day from a multitude of locations, there is a high level of visual sensitivity. Notable viewpoints include several bridge crossings across the Floodway.

3.8.2.3 Central Trinity River Greenbelt

The visual quality of the Central Trinity River Greenbelt is moderate (4), as vividness is moderately high (5), intactness is moderate (4), and unity is moderate (4).

The Central Trinity River Greenbelt viewshed is characterized by open meadows consisting of vegetation similar to that found in the North Trinity Greenbelt, riparian trees along the river channel, and stormwater outfall structures. The outfalls dominate the immediate area where they are located, standing as imposing concrete and steel structures and having associated outfall channels that merge with the Trinity River. As this segment of the Dallas Floodway is closer to the Central Business District, the adjacent development in the urban area is more visually imposing and thus is a stronger contributor to the visual environment in this segment of the Dallas Floodway. In addition, several bridges and utility lines cross or encroach upon the Dallas Floodway visual environment through this segment. Specifically, 10 bridges are in this segment of the Dallas Floodway. Four of these structures (the Continental Viaduct, Commerce Street, Houston Street Viaduct, and the northbound IH-35 Bridge) are considered to exhibit historic character in terms of construction style, and are defining visual elements. Also, the Margaret Hunt Hill Bridge is a Santiago Calatrava designed bridge that is over 400 feet high, providing a unique feature to the Dallas skyline. Conversely, the other five bridges are not considered visually unique, though all the bridges do contribute to the visual environment in this segment. As the Central Trinity River Greenbelt area is viewed by tens of thousands of people every day from a multitude of locations, there is a high level of visual sensitivity. Notable viewpoints include several bridge crossings, high-rise buildings, and Trinity Overlook Park.

3.8.2.4 South Trinity River Greenbelt

The visual quality of the South Trinity River Greenbelt is moderately high (5), as vividness is moderate (4), intactness is moderately high (5), and unity is moderately high (5).

The South Trinity River Greenbelt viewshed of the Dallas Floodway is different from the other segments of the Dallas Floodway. Specifically, in this area, the Trinity River channel is much closer to the East Levee and there is a noticeable reduction in riparian vegetation. However, there is a high amount of marshlands through this segment, which is a change from the meadow-dominated upstream segments. Buildings associated with the Central Business District are less imposing through this segment, but they still contribute to the visual environment. The Corinth Street Bridge is visually prominent due to the small number of trees. It also exhibits a historic character in terms of construction style and materials and is a significant contributor to the visual environment. Just south of the DART Rail Bridge is the abandoned wooden AT&SF Railroad Bridge and trestle, which is architecturally distinct from any other bridge in the greenbelt. At the extreme downstream area of Study Area is the Great Trinity Forest, which is a dense growth of trees and shrubs. The dense trees and understory reduce the visual landscape, effectively serving as buffers and blocking the view of areas exterior to the floodplain. The South Trinity River Greenbelt area is viewed by tens of thousands of people every day from a multitude of locations; therefore, there is a high level of visual sensitivity. Notable viewpoints include several bridge crossings and high-rise buildings.

3.8.2.5 IDS Basins

As a whole, the IDS stormwater sumps are visually consistent depressions ringed with vegetation and subject to fluctuating water levels in response to storm events. Similarly, the existing IDS pumping plants are generally visually consistent red-brick masonry pump station(s) set on rectangular concrete footprints surrounded by cyclone fencing. The older pump stations are constructed of red bricks, while the new pump stations are concrete with red brick or brown veneer. The following sections provide site-specific existing visual resources for each of the IDS pumping plants.

<u>Hampton Pumping Station</u>

The visual quality rating of the Hampton Pumping Station is moderately low (3), as vividness, intactness, and unity are moderately low (3). The Hampton Pumping Plant is located next to an industrial park adjacent to the East Levee. As shown in Photo 5, power and utility lines run behind the pumping plant and dominate the area viewshed. The Hampton Pumping Plant is located within the Trinity Industrial District visual landscape unit, which is characterized by generally large, non-descript buildings without any unique visual characteristics. As it is located close to the levee, the pumping plant is primarily in the viewshed of the industrial district and the East Levee; therefore, is consistent with the visual character of the surrounding area. Based on the viewshed and surrounding land use, there is a moderate level of visual sensitivity. There are no key observation points located near the pumping plant.

Photo 5: Hampton Pumping Plant

Charlie Pumping Plant

The visual quality rating of the Charlie Pumping Plant is low (2), as vividness is low (2), intactness is low (2), and unity is low (2). The pumping plant is located in a commercial area between the Jefferson and Houston Street Viaducts. As shown in Photo 6, the pump stations are constructed of red brick and have a box-like appearance. Situated against the West Levee just east of the Oak Farms Dairy, the pumping plant is easily visible from area roads. The Charlie Pumping Plant is located within the Oak Cliff viewshed, which is characterized by multi-family residences and industrial and commercial building. The pumping plant is consistent with the visual character of the surrounding area. Based on the surrounding land use, there is a low level of visual sensitivity. There are no key observation points located near the pumping plant.

Photo 6: Charlie Pumping Plant

Delta Pumping Plant

The visual quality rating of the Delta Pumping Plant is moderate (4), as vividness is low (3), intactness is moderate (4), and unity is moderate (4). The Delta Pumping Plant is located in a residential area adjacent to the West Levee. As shown in Photo 7, the pumping plant is finished with red brick and has a box-like appearance. The Delta Pumping Plant is located within the Westmoreland Heights viewshed, which is characterized by large lots and small houses in a neighborhood setting. The pumping plant is easily visible from nearby roads, but is consistent with the visual character of the surrounding area. Based on the viewshed and surrounding land use, there is a moderate level of visual sensitivity. There are no key observation points located near the pumping plant.

Photo 7: Delta Pumping Plant

Proposed Trinity-Portland Pumping Plant

The visual quality of the Proposed Trinity-Portland Pumping Plant viewshed is moderately high (5), as vividness is moderate (4), intactness is moderately high (5), and unity is moderately high (5). The proposed Trinity-Portland Pumping Plant location is in an open space area adjacent to the West Levee and low-density residences. There are no buildings at the proposed site. The proposed pumping plant location is not easily visible from area roads. The proposed Trinity-Portland Pumping Plant location is within the Westmoreland Heights viewshed, which is characterized by large lots and small houses in a neighborhood setting. The proposed pumping plant location is consistent with the visual character of the surrounding area. Based on the viewshed and surrounding land use, there is a moderate level of visual sensitivity. There are no key observation points located near the proposed pumping plant location.

3.9 SOCIOECONOMICS

3.9.1 Definition of Resource

Socioeconomics is defined as the basic attributes and resources associated with the human environment, particularly population, demographics, and economic development. Demographics entail population characteristics and include data pertaining to race, gender, income, housing, poverty status, and educational attainment. Economic development or activity typically includes employment, wages, business patterns, an area's industrial base, and its economic growth. Impacts on these fundamental socioeconomic components can also influence other issues such as housing availability.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, tasks "each federal agency [to] make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations." EO 12898, dated February 11, 1994, aims to: (1) focus the attention of federal agencies on the environmental and human health conditions in minority communities and low-income communities with the goal of achieving environmental justice; (2) foster non-discrimination in federal programs that substantially affect human health or the environment; and (3) give minority communities and low-income communities greater opportunities for public participation in, and access to public information on, matters relating to human health and the environment.

The USEPA describes environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (USEPA 2010). Fair treatment means that no group of people, including racial, ethnic, or socioeconomic, should bear a disproportionate share of the negative environmental consequences resulting from the execution of federal, state, local, and tribal programs and policies. The goal of fair treatment is not to shift risks among populations but to identify potential disproportionately high and adverse effects and identify alternatives that may mitigate these effects. Federal agencies must provide minority and low-income communities with access to information on matters relating to human health or the environment and opportunities for input in the NEPA process, including input on potential effects and mitigation measures.

Because children may suffer disproportionately from environmental health risks and safety risks, EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, was issued on April 21, 1997 to help ensure that federal agencies' policies, programs, activities, and standards address environmental health and safety risks to children. EO 13045 requires all federal agencies to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and ensure that its policies, programs, activities, and standards address disproportionate risks to children that may result from environmental health risks or safety risks.

The demographic information, including age, race and income of the populace, is vital to framing both a socioeconomic analysis and an analysis of environmental justice conditions. Thus, the existing conditions presented in Section 3.9.2 applies to both areas. However, the analysis of impacts between the concepts is different in scale. While a socioeconomic analysis can be completed separate from other resources, impacts that may affect environmental justice may be tied to several other resources, such as water quality and air quality. Thus, a comprehensive analysis of alternative impacts to environmental justice and environmental health and safety risks for children is presented in Chapter 6, *Other Considerations Required by NEPA*.

3.9.1.1 Methodology

The methodology for socioeconomics and environmental justice consists of establishing an ROI, developing existing conditions (an economic baseline for socioeconomics and a geography-specific minority and low-income population area baseline for environmental justice).

The ROI for socioeconomics and environmental justice are defined by the census tracts that are at least partially located within the boundaries of the City of Dallas TRCCLUP (Figure 3.9-1) and located wholly within the City of Dallas and Dallas County. Seventy census tracts and 142 census block groups make up the ROI. To provide context, the existing conditions section also provides background data for the U.S., the State of Texas, Dallas County and the City of Dallas. Information was collected from published data issued by federal agencies.

Existing demographic data referenced in the sections that follow are contained in Appendix J, *Socioeconomic and Environmental Justice Background Data*.

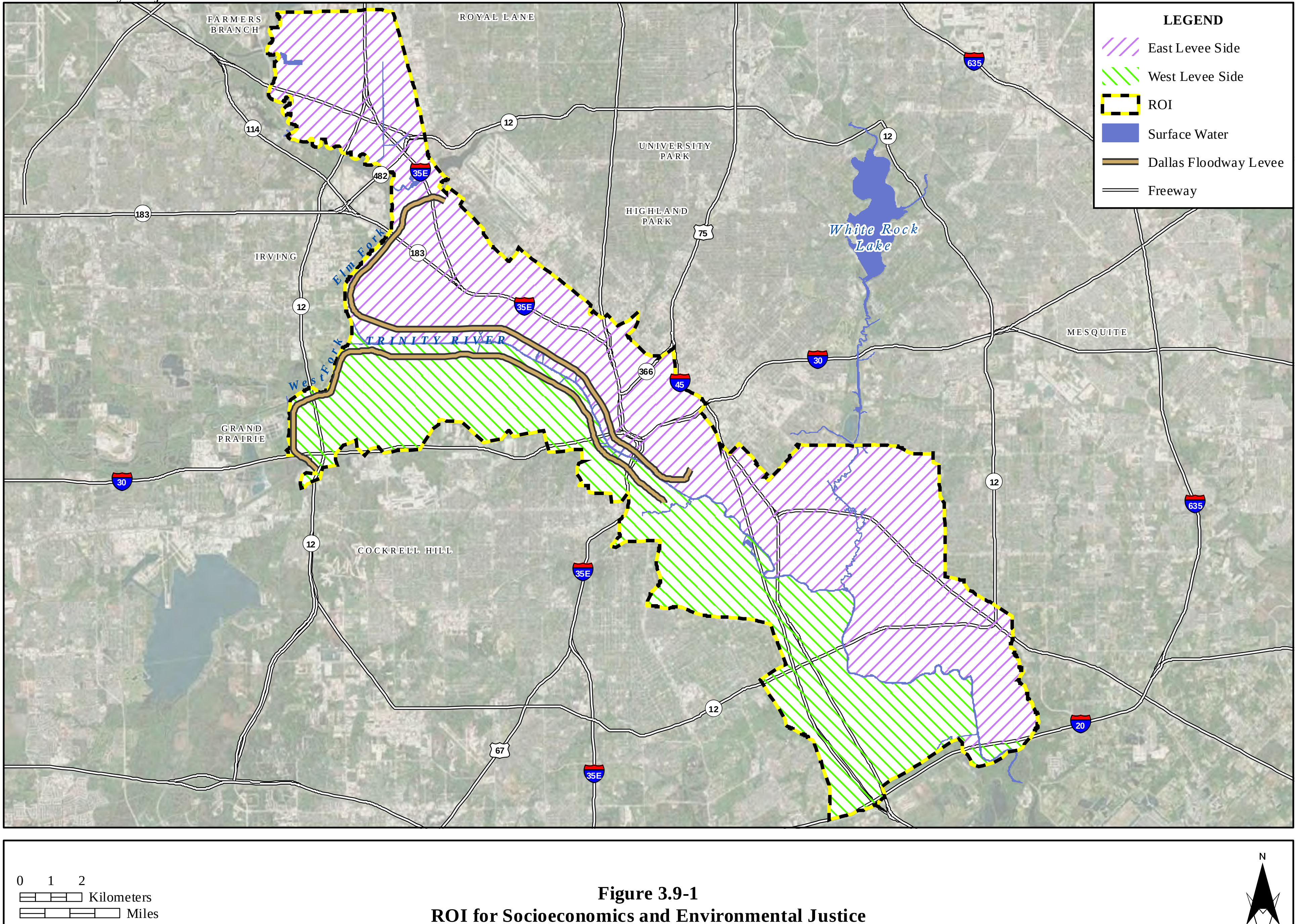


Figure 3.9-1
ROI for Socioeconomics and Environmental Justice

GIS Sources: City of Dallas 2008a, NCTCOG 2008

3.9.1.2 Regulatory Framework

The CEQ regulations implementing NEPA state that when economic or social effects and natural or physical environmental effects are interrelated, the EIS will discuss these effects on the human environment (40 CFR 1508.14). The CEQ regulations further state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." Following from these CEQ regulations, the socioeconomic analysis evaluates how elements of the human environment such as population, employment, education, and housing might be affected by the Proposed Action.

In 1994, EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was issued to focus the attention of federal agencies on human health and environmental conditions in minority and low-income communities. In addition, EO 12898 aims to ensure that the environmental effects of federal actions do not fall disproportionately on low-income and minority populations. To support an evaluation of environmental justice issues, this section includes data related to the existence of minority and low-income populations in the vicinity of the Proposed Action that could potentially be disproportionately affected. For an analysis of impacts to minority, low-income, and child populations, refer to Chapter 6, *Other Considerations Required by NEPA*.

3.9.2 Existing Conditions

3.9.2.1 Socioeconomics

Population

As shown in Table 3.9-1, the total population for the ROI in 2010 was 272,761 (U.S. Census Bureau 2010a), representing about 22.8% of the population of the City of Dallas (1,197,816). Dallas County, the second largest county in Texas, had a 2010 population of 2,368,139, making it the second largest county in Texas and ninth largest county in the nation.

Table 3.9-1. Population, 2010

Region	*Population*
ROI	272,761
City of Dallas	1,197,816
Dallas County	2,368,139
Texas	25,145,561

Source: U.S. Census Bureau 2010a.

Employment

As shown in Table 3.9-2, in 2010, employment in Dallas County was 1.1 million, more than half of which was in the City of Dallas (563,170). Employment in the ROI was just over 108,000. Employment in the ROI was concentrated in the construction industry (15.1% of employment); the Education, Health Care industry (14.6% of employment); the Professional, Scientific, Management industry (12.9% of employment); and the Retail Trade industry (10.6% of employment). As of 2010, the ROI had an unemployment rate of 11.4% compared to 7.8% in Dallas County and 8.2% in the City of Dallas (U.S. Census Bureau 2010a).

Table 3.9-2. Employment in the ROI, by Industry, 2010

Industry	*Dallas County*		*City of Dallas*		*ROI*	
	No. of Employees	*Percent*	*No. of Employees*	*Percent*	*No. of Employees*	*Percent*
Total Civilian Employed Population 16 Years and Older	**1,114,379**	**100**	**563,170**	**100**	**108,229**	**100**
Agriculture, Extraction	6,982	0.6	3,284	0.6	594	0.5
Construction	109,444	9.8	61,658	10.9	16,296	15.1
Manufacturing	109,533	9.8	49,048	8.7	10,057	9.3
Wholesale Trade	35,145	3.2	16,456	2.9	4,049	3.7
Retail Trade	123,586	11.1	61,330	10.9	11,448	10.6
Transportation, Warehousing, Utilities	62,682	5.6	26,751	4.8	6,342	5.9
Information	30,615	2.7	13,658	2.4	2,290	2.1
Finance, Insurance, Real Estate	101,082	9.1	53,665	9.5	8,659	8.0
Professional, Scientific, Management	150,510	13.5	83,204	14.8	13,936	12.9
Education, Health Care	193,417	17.4	94,082	16.7	15,816	14.6
Arts, Entertainment, Accommodation, Food Services	101,126	9.1	55,441	9.8	10,076	9.3
Other Services	59,737	5.4	31,584	5.6	5,830	5.4
Public Administration	30,520	2.7	13,009	2.3	2,836	2.6

Source: U.S. Census Bureau 2010a.

Education

In terms of school enrollment in 2010, the ROI had a higher percentage of enrolled students in Grades 1-8 and high school than the City of Dallas, Dallas County, the State of Texas, and the U.S. Conversely, the ROI had a lower percentage of its enrolled students that were enrolled in college or graduate school. The ROI has a comparatively lower level of educational attainment (i.e., in terms of high school completion, college attendance, associate degrees, bachelor's degrees, or advanced degrees) than the other areas considered in this analysis. Refer to Appendix J for additional detail and data.

Housing

In 2010, there were 104,247 housing units in the ROI, of which 86.1% of the units were occupied and 13.9% were vacant (refer to Appendix J). The vacancy rate of 13.9% for the ROI was greater than the City of Dallas (12.8%), Dallas County (10.7%), the State of Texas (12.1%), and the U.S. (12.2%). Also in 2010, as a percentage of occupied housing units, the ROI had fewer units occupied by homeowners (42.8%) and more units occupied by renters (57.2%) than any other region. The median value of housing units in the ROI was $119,757 compared to $129,700 in Dallas County and $129,800 in the City of Dallas (U.S. Census Bureau 2010a).

3.9.2.2 Environmental Justice and Protection of Children

Minority Status

Race and Ethnicity

In 2010, the population in the ROI consisted of 14.9% white, 39.8% Black or African American, and 42.7% Hispanic or Latino. Only a small proportion of the population of the ROI was comprised of American Indian and Native Alaskans, Asians, and Native Hawaiian and other Pacific Islanders or some other race (a total of 1.84%). The population in the ROI consisted of less White, more Black or African American, and more Hispanic or Latino than each of the other regions considered in the analysis.

In general, in 2010, the ROI had a relatively high proportion of minority residents than the City of Dallas, Dallas County, and the U.S. Appendix J contains additional data.

Minority Population Areas

Figure 3.9-2 displays census block groups in the ROI that are considered environmental justice minority population areas. A census block group is considered an environmental justice minority population area if 50% or more of the residents are Black of African American, Asian, American Indian or Native Alaskan, Native Hawaiian or Other Pacific Islander, or Hispanic or Latino (CEQ 1997). Seventy-five census block groups within the ROI have minority populations that represent 50% or more of the total resident population.

Low-Income Status

Household Income

As shown in Table 3.9-3, in 2010, households in the ROI generally had lower incomes as compared to the City of Dallas, Dallas County, the State of Texas, and the U.S. As a proportion of total households, more households in the ROI had annual incomes below $10,000 (13.9%), between $10,000 and $24,999 (23.4%), and between $25,000 and $49,000 (29%) than any other region. Also, as a proportion of total households, the ROI had fewer households with annual incomes between $50,000 and $74,999 (14.5%), between $75,000 and $149,000 (14.3%), and $150,000 or more (4.8%) than any other region.

Table 3.9-3. Household Income (2010 Inflation-Adjusted Dollars)

Household Income	*ROI*	*City of Dallas*	*Dallas County*	*Texas*	*U.S.*
Less than $10,000	13.9%	9.3%	7.2%	7.7%	7.2%
$10,000 to $24,999	23.4%	19.7%	17.2%	17.1%	16.3%
$25,000 to $49,999	29.0%	28.5%	27.5%	25.5%	24.7%
$50,000 to $74,999	14.5%	16.3%	18.3%	18.1%	18.6%
$75,000 to $149,999	14.3%	17.4%	21.3%	23.4%	24.7%
$150,000 or more	4.8%	8.8%	8.6%	8.2%	8.6%
Median Income	**NA[1]**	**$41,682**	**$47,974**	**$49,646**	**$51,914**

Notes: [1] Data unavailable to determine ROI median income at census tract level. NA = not available.
Source: U.S. Census Bureau 2010b.

Low-Income Population Areas

Figure 3.9-3 displays census block groups in the ROI that are considered environmental justice low-income population areas. A census block group is considered an environmental justice low-income area if 20% or more of the residents have incomes that place them below the poverty line (U.S. Census Bureau 2011). The poverty line is determined by the U.S. Census and is not equivalent to a singular level of median income; rather it varies based on things such as age and family size. Fifty census block groups within the ROI have low-income populations that represent 20% or more of the total resident population.

Gentrification

Gentrification, a process where low-income populations are displaced from areas that are being redeveloped, has been occurring in downtown Dallas for decades. In 1982, the city of Dallas launched a planning effort called "Dallas 2000" and the trend and land use maps that accompanied the plan did not included the historic African American community of North Dallas. Over time, with the help of government tax incentives, private developers actualized the disappearance of the North Dallas community (Prior 2005). In North Dallas' place were the Dallas Arts District, Cityplace, and the State-Thomas area. Public housing units, which were the homes of low-income and minority residents of North Dallas were torn down and replaced by more upscale housing units for residents of the Arts District and Cityscape (Prior 2005). An example of the magnitude of the change is illustrated in Census data: in 1980 Census Tract 16 (in the area formerly known as North Dallas) had 2,993 African American residents (92.9% of the population), by 1990 the Census Tract had 2,012 African Americans (74.1% of the population), and by the year 2000 (the culminating year of the Dallas 2000 plan), the African American population of Census Tract 16 had fallen to 1,125 (45% of the population); in total, from 1980 to 2000, the African American population of Census Tract 16 fell by 62% (Prior 2005). Numerous studies have identified problems associated with gentrification such as displacement, loss of affordable housing, community conflict, and harassment/eviction (Atkinson 2002). However, there are some noted benefits and outcomes may differ from place to place, so continued study of potential gentrification effects of urban renewal should be monitored (Atkinson 2002).

Protection of Children

The percentage of population less than 18 years old in the ROI was 24.8% in 2010. The largest age group among children in the ROI was 5 years old to 9 years old (7.6% of total population). The age group distribution for children was generally consistent between each region (refer to Appendix J).

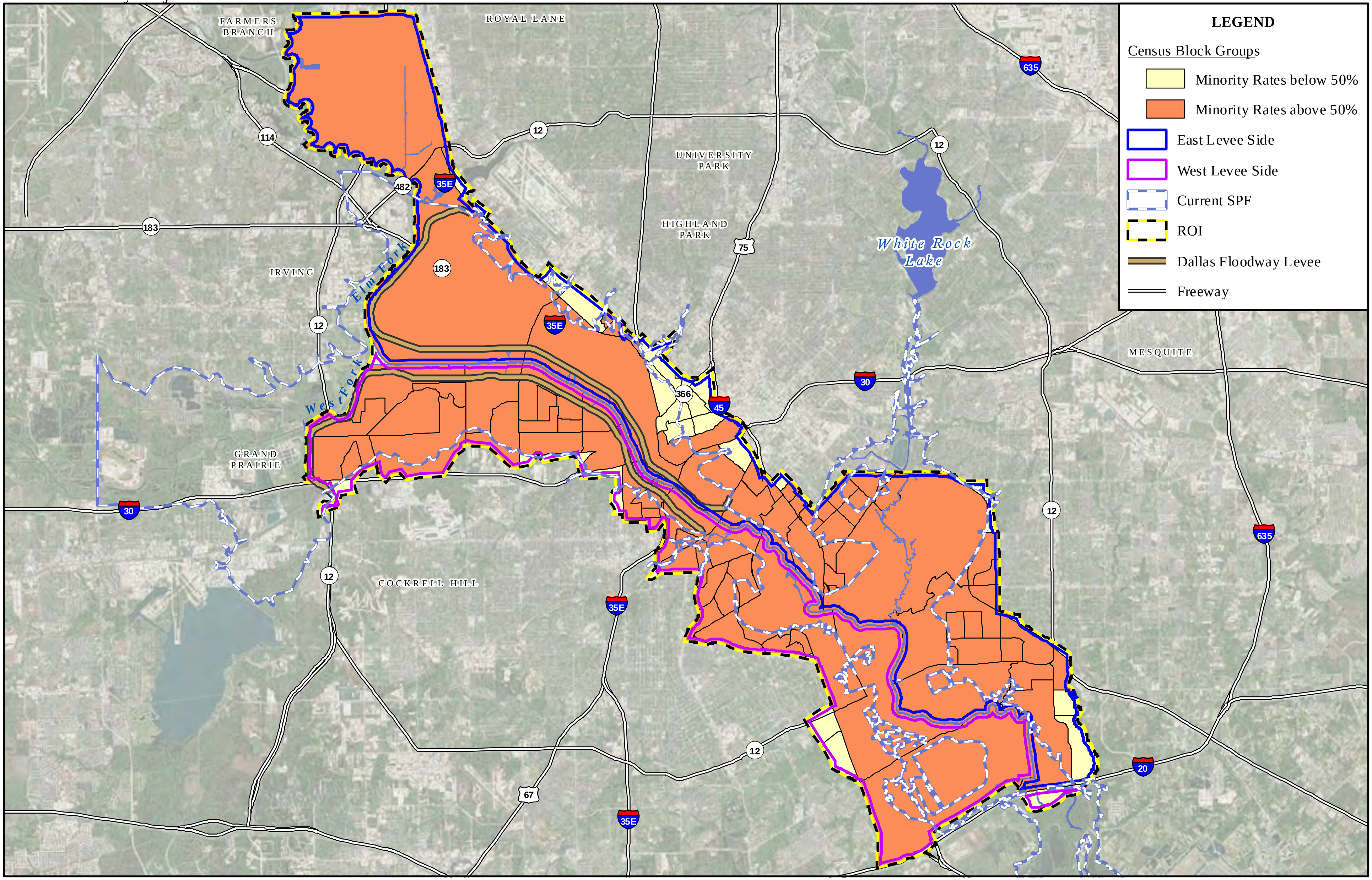


Figure 3.9-2
Environmental Justice Minority Population Areas in the ROI

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USCB 2011a

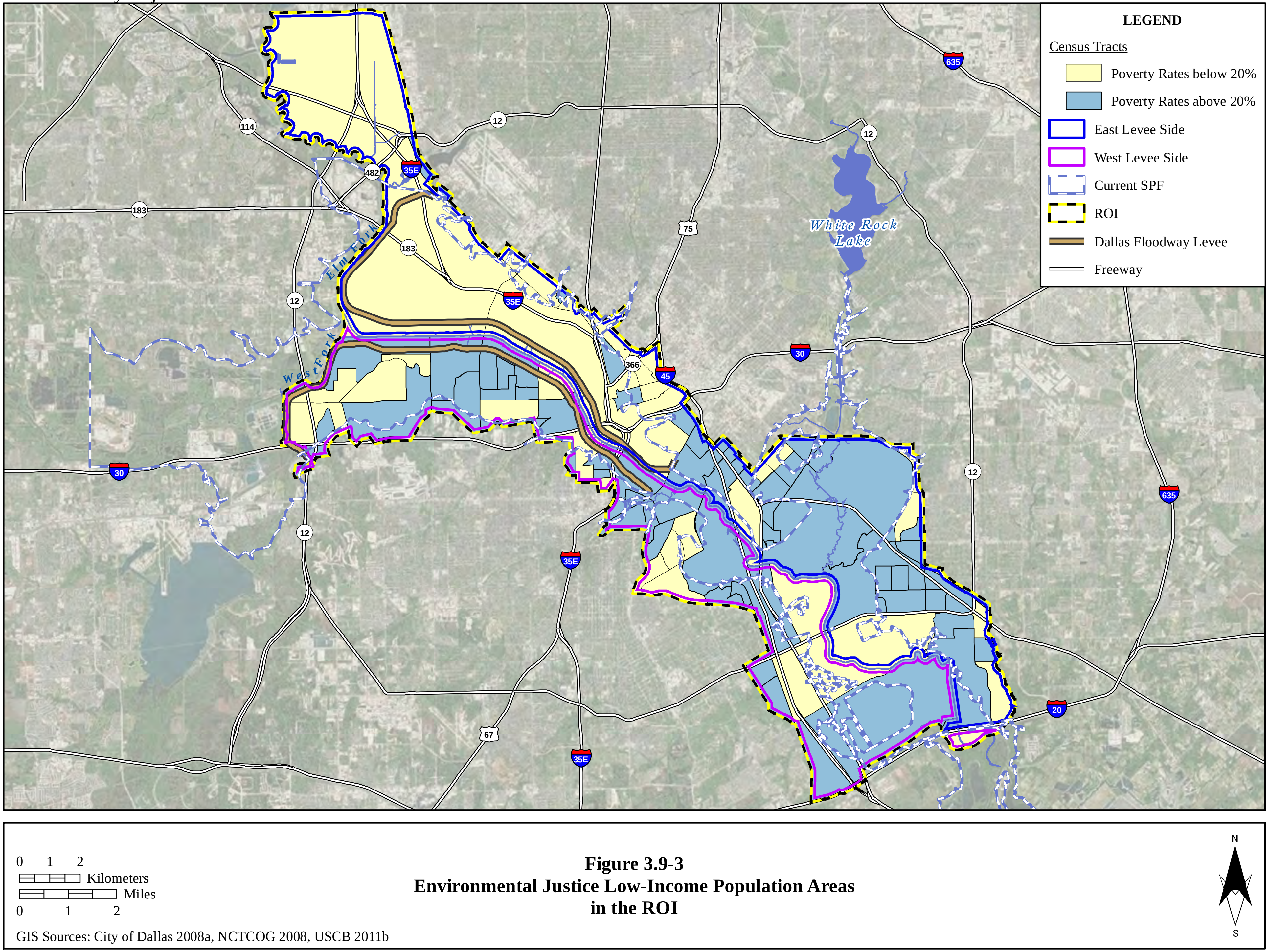


Figure 3.9-3
Environmental Justice Low-Income Population Areas in the ROI

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USCB 2011b

3.10 HAZARDOUS MATERIALS AND WASTES

3.10.1 Definition of Resource

Hazardous materials include, but are not limited to, hazardous and toxic substances (biological, chemical, and/or physical) and waste, and any materials that pose a potential hazard to human health and the environment due to their quantity, concentration, or physical and chemical properties. Hazardous wastes are characterized by their ignitability, corrosivity, reactivity, and toxicity. Hazardous materials and wastes, if not controlled, may either (1) cause or significantly contribute to an increase in mortality, serious irreversible illness, or incapacitating reversible illness, or (2) pose a substantial threat to human health or the environment.

3.10.1.1 Methodology

The following analysis of hazardous materials and wastes includes a description of existing contamination and the risk of exposure to hazardous materials and waste related to the contamination and to routine use, storage, and transportation of hazardous materials, along with the associated regulatory framework. The ROI for hazardous materials and wastes is defined as a 100-yard wide boundary extending from the Dallas Floodway Levee System and proposed project elements.

3.10.1.2 Regulatory Framework

The primary relevant federal regulations include those promulgated under the Resource Conservation and Recovery Act (RCRA) of 1974 and the Comprehensive Environmental Response, Compensation and Liability Act of 1980.

Within Texas, the TCEQ and the TDSHS administer the Texas Health and Safety Code, including the Solid Waste Disposal Act, which controls the management of solid and hazardous waste by requiring hazardous waste to be stored, processed and disposed of only at permitted hazardous industrial solid waste facilities. The State rules regarding asbestos adopt existing federal Occupational Safety and Health Administration (OSHA) and USEPA regulations and apply them to all public facilities in which activities involving the disturbance or removal of asbestos containing material (ACM) may occur. The USEPA maintains guidance on management inspection of facilities that may have lead-based paint (LBP). The TDSHS regulates LBP inspection, remediation and management. The state rules regarding LBP adopt existing OSHA and USEPA regulations and apply them to all public facilities in which activities involving the disturbance or removal of LBP may occur.

3.10.2 Existing Conditions

In support of this EIS, a Phase I Background Database Search was conducted (Environmental Data Resources, Inc. [EDR] 2013) and a report was prepared (USACE 2013). The July 2013 EDR search reviewed 94 federal, state, local and tribal databases for sites with known environmental conditions within the boundary search area. The July 2013 search was an update to an EDR search conducted in 2010 (EDR 2010). The boundary search area corresponded to a 2-mile wide area approximately centered on the Trinity River through the Dallas Floodway. The 2013 EDR search revealed 1,819 sites with known environmental conditions within the boundary search area. However, only 34 sites are located within the smaller ROI for hazardous materials and wastes, which is a subset of the larger boundary search area. Table 3.10-1 lists the 34 sites that are located within the ROI for hazardous materials and wastes. The 34 sites are also depicted on Figure 3.10-1.

In 2008, a Phase II Environmental Site Assessment was completed for the USACE as part of the Upper Trinity River Interim Feasibility Study. The assessment was conducted to characterize floodplain soils near bridges and utilities, to identify the presence of contamination, and to evaluate the potential to use soils within the Dallas Floodway as part of levee construction. Soils were investigated in the Dallas Floodway along bridges, in locations where utilities cross the levees, and in the area of the proposed Trinity Lakes. One of the purposes of the Phase II Environmental Site Assessment was to determine whether potentially hazardous contaminants were present in floodplain soils at levels that exceed the Texas Risk Reduction Program (TRRP) Tier I Residential Protective Concentration Levels (PCLs) for a 30-acre source area (USACE 2008). The TRRP Tier 1 Residential PCLs are defined as follows:

- ${}^{Tot}Soil_{Comb}$ – PCL for human health exposures to surface soils through the combined ingestion of soils and vegetables, inhalation, and dermal contact pathways.
- ${}^{GW}Soil_{Ing}$ – PCL for protection of Class 1 and Class 2 groundwater (suitable for ingestion) through contaminants leaching from soils.
- ${}^{Air}Soil_{Inh\text{-}v}$ – PCL for inhalation exposures through contaminant volatilization from soil to ambient air.
- ${}^{Air}GW_{Inh\text{-}v}$ – PCL for inhalation exposures through contaminants leaching from soil to groundwater and then volatilizing to ambient air.

The Phase II Environmental Site Assessment field investigation included drilling at 96 boring locations within the Dallas Floodway and collecting 192 soil samples for laboratory analysis. The soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PCBs, RCRA metals, and herbicides. Analytical results were evaluated against the TRRP Tier 1 Residential PCLs (USACE 2008).

Although detected at a few locations, no herbicides or PCBs exceeded the TRRP Tier 1 Residential PCLs. Detections of VOCs, SVOCs, and pesticides were more widespread, but PCL exceedances were limited to a few locations. The VOCs methylene chloride (MC), tetrachloroethene, and trichloroethene; the SVOC 4-nitrophenol; and the pesticide dieldrin exceeded the respective ${}^{GW}Soil_{Ing}$ TRRP Tier 1 Residential PCLs (Figure 3.10-2). However, it was determined that the detection of methylene chloride may have been a laboratory artifact rather than an indicator of actual onsite contamination. The SVOC benzo(a)pyrene exceeded the ${}^{Tot}Soil_{Comb}$ (i.e., a combination of ingestion, inhalation, and dermal contact pathways) TRRP Tier 1 Residential PCL at two locations. Widespread exceedances of lead and arsenic Texas-Specific Soil Background Concentrations were detected in surface soils across the Floodway. The Phase II Environmental Site Assessment report concluded their presence in soils to be associated with airborne deposition due to their mostly low concentrations. The lead concentration in one sample also exceeded the ${}^{Tot}Soil_{Comb}$ TRRP Tier 1 Residential PCL, and was associated with elevated levels of benzo(a)pyrene (USACE 2008). Consistent with the criteria used for the Dallas Floodway Extension Project located immediately downstream, soils within the Dallas Floodway must meet ${}^{Tot}Soil_{Comb}$ TRRP Tier 1 Residential PCLs for reuse.

3.10.2.1 Summary of Sites with Known Environmental Conditions

The following paragraph summarizes the current status of the identified sites with known environmental conditions located within the ROI. For more detail on a specific site, refer to USACE 2013; however, given it is an active Superfund site, a description of Site #0 is provided whereas the other 33 sites are summarized.

Table 3.10-1. Sites with Known Environmental Conditions within the ROI

Number	*Map ID/ Site #[a]*	*Site Name (Address)*	*Site Type*	*Database(s)*
1	0	Murmur Corporation Site 3/RSR Corporation (Westmoreland Road and Singleton Boulevard)	Superfund Site (former lead smelter)	NPL CERCLIS LIENS 2 CORRACTS RCRA-TSDF RCRA-NonGen US ENG CONTROLS ROD PRP
2	31	Xerox Corp FMI Recycling Rock Crusher DES4 Destructors-Inwood Plant (1137 Conveyor Lane)	Solid waste facility/landfill site	TX UST FINDS TX SWF/LF TX SWRCY FINDS
3	37	HMIRS 96040313 (4800 Irving Boulevard)	Hazardous spill response	HMIRS
4	55	ERNS 2006784574 (3700 Sylvan Avenue)	River discharge	ERNS
5	62	ERNS 2010962995 (3500 Sylvan Avenue)	Motor oil spill into river	ERNS
6	68	ERNS 2012007835 (400 Canada Drive)	River discharge	ERNS
7	74	Station 23 (2920 N. Beckley Avenue)	Brownfield site with historic underground storage tank use	US Brownfields UST FINDS
8	75	Trinity River Authority of Texas (6500 Singleton Boulevard)	Industrial hazardous waste site	RCRA-Nongen ERNS ICIS FINDS US AIRS TX LPST TX UST TX AST NY MANIFEST TX SPILLS TX ENF TX Ind. Haz Waste TX AIRS TX TIER 2
9	82	Lew Sterrett Justice Center Dallas County Detention Center South Tower (111 Commerce Street)	Leaking underground storage tank	FINDS TX LPST TX UST TX TIER 2 FINDS
10	87	Fuel City II (801 S. Riverfront Boulevard)	Leaking underground storage tank	TX UST
11	89	James Bishop (106 N. Corinth Street)	Leaking underground fuel storage tank	TX LPST TX UST
12	89	Bill Poston & Don Jenny/Ace Brass and Aluminum Co./RedCat Scrap Tires (1208 & 1217 Riverfront Boulevard)	Leaking underground storage tank	TX UST ICIS FINDS
13	89	Sherwin-Williams/Texas Western Plastics Division (1824 Riverfront Boulevard)	Industrial hazardous waste site	CERC-NFRAP FINDS TX Ind. Haz Waste RCRA-Nongen

Number	*Map ID/ Site #*[a]	*Site Name (Address)*	*Site Type*	*Database(s)*
14	89	Undeveloped Property (2214 Riverfront Boulevard)	Brownfield site	US Brownfield FINDS
15	89	Buckley Oil Co. (1809 Rock Island Street)	Industrial hazardous waste site	TRIS ICIS FINDS TX LPST TX UST TX AST NY MANIFEST TX ENF TX Ind. Haz Waste TX TIER 2 TX MSD TX GCC TX IHW CORR ACTION EDR ERNS
16	89	Atlas Iron & Metal Co. (2209 Riverfront Boulevard)	Soil contamination	FTTS FINDS TX AUL TX VCP NY MANIFEST
17	89	Ace Brass and Aluminum (1203 Riverfront Boulevard)	Small quantity hazardous waste generator	ICIS FINDS
18	89	Crescent Machinery Co. (1919 Riverfront Boulevard)	Industrial facility	FINDS TX Ind. Haz Waste RCRA-Nongen
19	89	Kwik Stop/Dearing David (418 Corinth Street)	Leaking underground storage tank	FINDS TX UST TX GCE TX LPST
20	89	EH Teasley (509 Corinth Street)	Active underground petroleum storage tank	FINDS TX UST
21	89	TXI Operations (580 Corinth Street)	Cement manufacturing facility	FINDS TX TIER 2
22	89	Whitlock Corp./Pyle Service Station (401 Corinth Street)	Leaking underground petroleum storage tank	TX LPST TX UST US Hist Auto Stat
23	89	Refrigerated Transport Inc. (1700 Riverfront Boulevard)	Industrial facility	TX LPST
24	89	Universal Automotive Products (1104 Rock Island Street)	Hazardous waste generation site	TX Ind. Haz Waste RCRA-Nongen
25 - 34	89	10 Misc. Historic Automotive Stations (Corinth Street, Riverfront Boulevard, Rock Island Street)	Historic automotive stations	US Hist Auto Stat

Note: [a] Multiple sites are represented by single EDR numbers.
Source: EDR 2013.

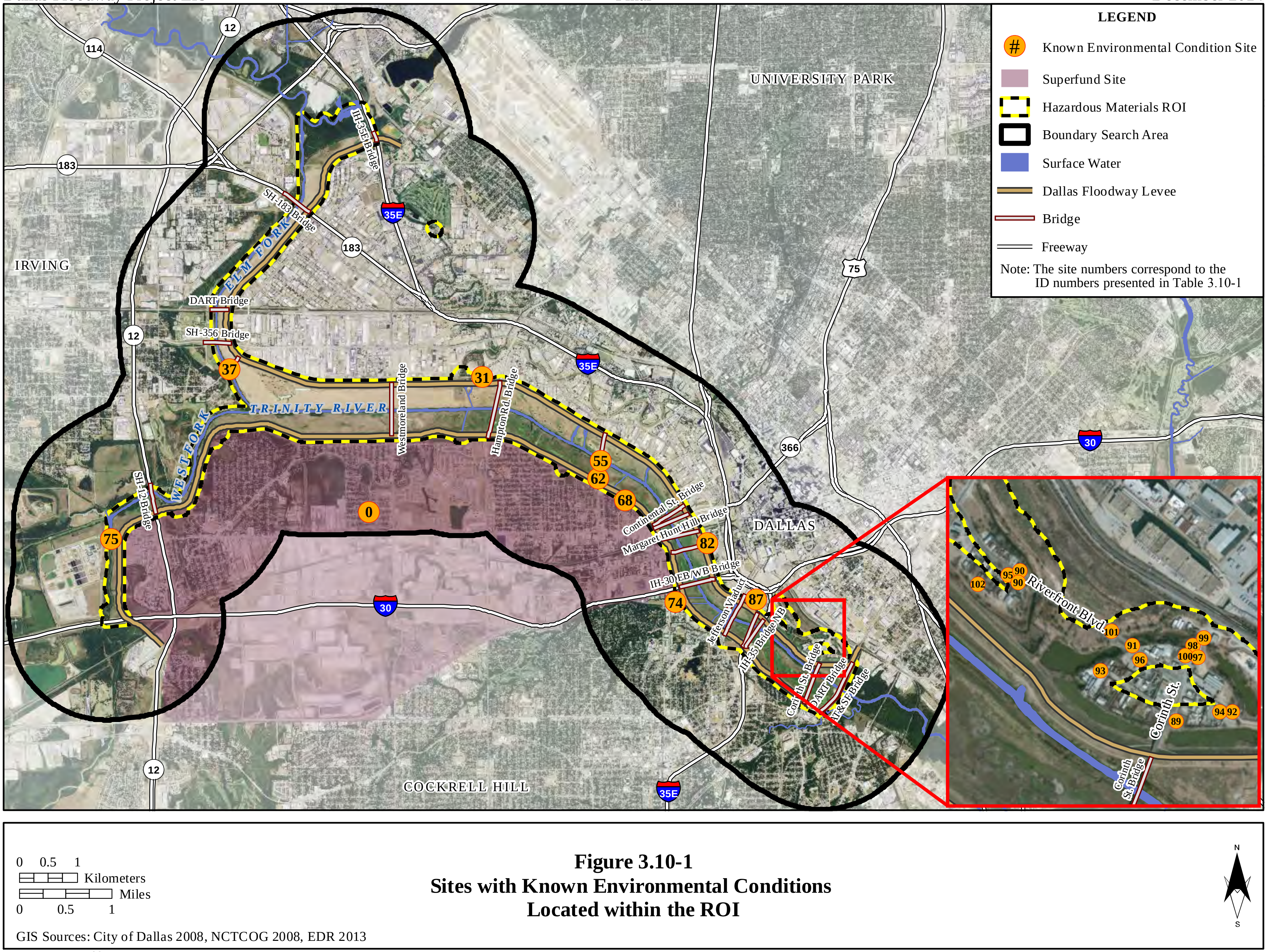


Figure 3.10-1
Sites with Known Environmental Conditions Located within the ROI

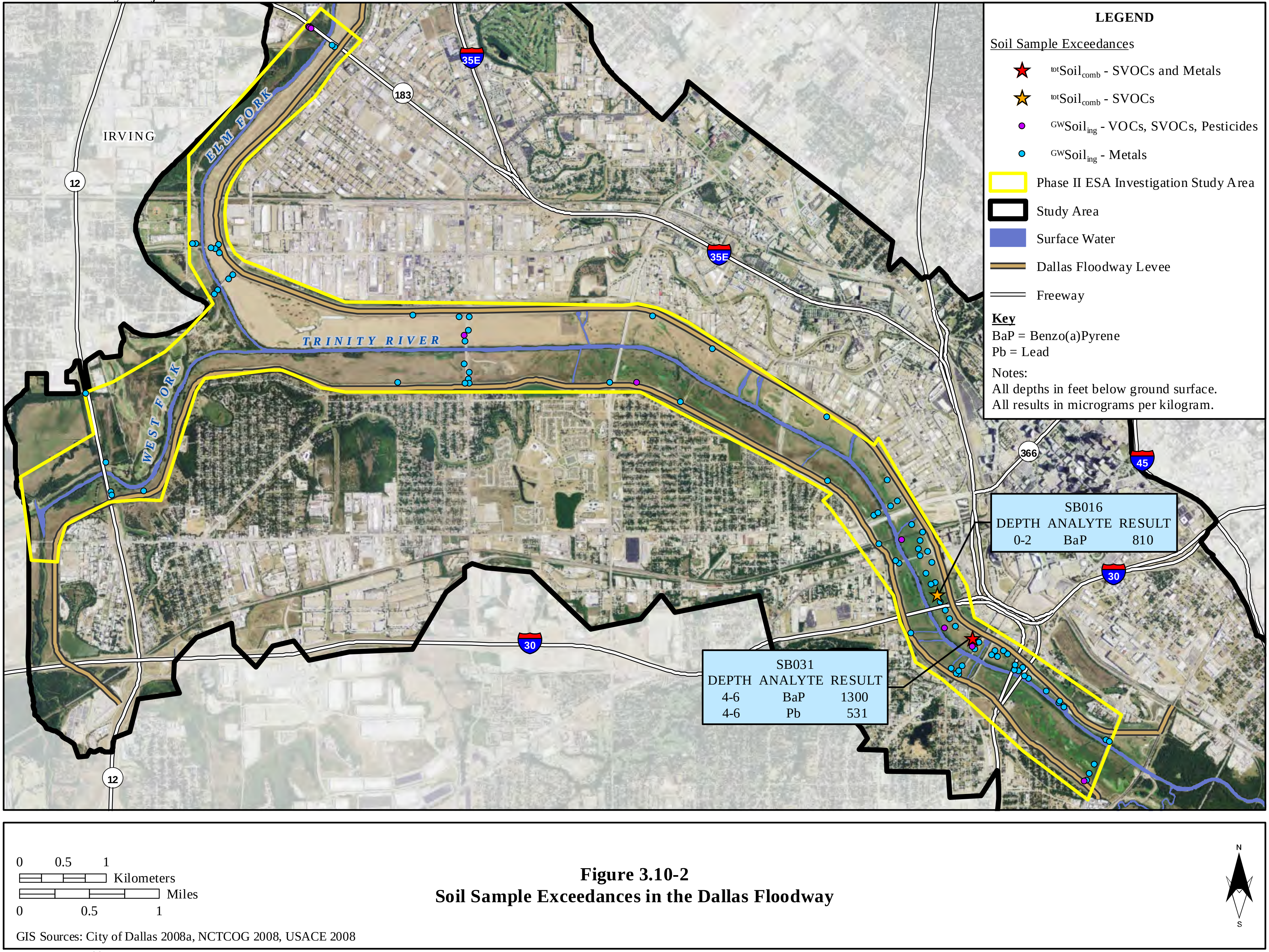


Figure 3.10-2
Soil Sample Exceedances in the Dallas Floodway

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2008

3.10.2.2 Murmur Corporation Site 3/RSR Corporation Superfund Site

Site #0, Murmur Corporation Site 3/RSR Corporation Superfund Site's plume encompasses approximately 13.6 square miles of West Dallas and is the largest of the above sites. The site was an abandoned secondary lead smelting facility, and is located at the intersection of Singleton Boulevard and Westmoreland Road. The site includes residential neighborhoods, public housing areas, and commercial and retail establishments. For approximately 50 years, the secondary lead smelting facility processed used batteries and other lead-bearing materials into pure lead, lead alloys, and other lead products. Another industrial property related to the smelter, the former battery wrecking facility, is located on the southwest corner of the Westmoreland Road and Singleton Boulevard intersection.

The primary contaminated medium of concern was soil. The smelting operations ceased in 1984 (USEPA 2012). Since 1995, the cleanup of over 400 residential properties and over 300 acres of commercial property in west Dallas has resulted in elimination of the source of contamination related to the RSR Corporation Superfund Site. The USEPA correlates the cleanup of the residential properties and commercial properties with the lowering of blood lead levels of the children that reside in the west Dallas community. Several portions of the Murmur Corporation Site 3/RSR Corporation Superfund Site have been determined to be "Ready for Reuse" by the TCEQ. However, cleanup continues in some parts of the site and there remain areas that are considered contaminated. As a result of the smelter closing in 1984 and the cleanup of residential properties in the early 1990s, blood lead analyses conducted in 1993, indicate that blood lead levels in children have been significantly reduced (USEPA 2012). As of 2010, the USEPA was responsible for the continuing operation and maintenance of remediation due to the Murmur Corporation's lack of financial viability (USEPA 2010).

3.10.2.3 Other Sites

All leaking underground fuel storage tank cases (#74, #82, and #89) are closed. The industrial hazardous waste site (#75) is slated for cleanup, while the leaking underground fuel storage tank cases are closed. The Brownfield site (#74) is vacant and awaiting cleanup with known underground storage tanks removed or filled-in. The other Brownfield site (#89) has no reported contamination and is available for redevelopment. The solid waste facility/landfill site (#31) is currently active with all known underground storage tanks removed from the site. Several underground storage tank sites (#74, #82, #87, and #89) are currently in operation with no known leaks. The three river discharge sites (#55, #62, and #68) are closed, with no reported action taken. The hazardous spill site (#37) has been cleaned up. The hazardous waste generation sites (#75 and #89) are active and properly regulated with no known violations or associated fuel leaks. The industrial facilities (#89) with no hazardous waste generation have no reports of spills or violations. The hazardous waste facility (#89) with soil contamination and several violations has been remediated and is frequently inspected. The historic automotive stations (#89) have no reports of contamination (USACE 2013).

As a follow-up to the 2010 EDR search results, in April 2013 qualified USACE personnel visited 7 of the 10 sites (Sites 2, and 7 through 12) that were identified in the 2010 EDR report (two historic river discharge sites [4 and 5] and the Superfund site were not visited).

Supplemental site visits were performed on October 24, 2013 to follow-up results from the 2013 EDR Report. In total, 16 sites were visited including Sites 12-24. Together with the April 2013 site visits, all listed facilities have now been assessed by the USACE Site Assessment team. It has been concluded that there is no evidence of further contamination at the listed sites, and a Phase II investigation is not warranted.

3.11 SAFETY

3.11.1 Definition of Resource

The safety resource examines those elements of the Study Area that may be at risk of harm from a flood event, as well as the emergency response systems in place to respond to such events. Intense, heavy rainfall that leads to flooding has the ability to cause property damage and destruction, life-threatening injuries, and the possibility of loss of life for those affected. Flood events that exceed the predicted base flood event for which the levees were designed represent greater risk of levee failure or levee systems being overtopped. The 3-foot freeboard required by FEMA provides a greater safety factor, but major floods of long duration such as the 1993 Mississippi River Flood can result in major damage and potential loss of life (NCTCOG 2008).

Trees and other woody vegetation, such as shrubs and vines, can create both structural and seepage instabilities, prevent adequate inspection, and create obstacles to maintenance and flood-fighting/flood-control activities on and around the levees. Tree roots that penetrate the levee may result in shortened seepage paths through embankments and/or foundations; voids in embankments and/or foundations due to decayed roots or fallen trees; and clogged seepage collector systems (USACE 2009).

3.11.1.1 Methodology

In reviewing public safety, the safety of the public may be evaluated in terms of flood risk to life and property. This analysis considers flood extents and identifies structures potentially affected by a major flood event. For Floodway improvements, the major flood event is the SPF. For the interior drainage, the major flood event considered is the 100-year storm event. Safety is evaluated in terms of initial risk, emergency response, and communication of emergency procedures to the potentially affected population. The potentially affected population consists of the public at risk of harm from flooding, including those working on project implementation and construction within the Floodway.

In September 2012, the USACE conducted a Risk Assessment evaluating risk to life and property associated with extreme, catastrophic riverine flood events, such as the SPF, in the Study Area (USACE 2012). The Rick Assessment used models to quantify potential damage (including estimated loss of life) from the most likely to occur extreme catastrophic flood events. For detail on the methodology and thresholds used in the analysis, refer to Appendix C, *Risk Assessment* of the USACE Feasibility Report (USACE 2014). The findings of the Risk Assessment are incorporated into this analysis, but are limited to risk from extreme riverine flooding, such as the SPF.

Likewise, safety includes issues of personal safety resulting from criminal activity. This aspect of public safety is evaluated based on anti-crime features, such as police patrolling, video cameras, emergency call boxes, and area lighting. The ROI for public safety is the Study Area.

3.11.1.2 Regulatory Framework

The FEMA regulations found in 44 CFR Section 65.10 outline the requirements for mapping areas protected by levee systems. For the purposes of the National Flood Insurance Program, FEMA will only recognize in its flood hazard and risk mapping effort those levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with the level of FRM from the base flood (NCTCOG 2008). Furthermore, the Disaster Mitigation Act of 2000 (Public Law 106-390) and the FEMA Hazard Mitigation Planning and Hazard Mitigation Grant Program Interim Final Rule (44 CFR 201.6) requires all local jurisdictions nationwide to draft a FEMA approved hazard mitigation plan to ensure eligibility for pre-disaster and post-disaster mitigation funds.

The Risk Assessment evaluates risk in accordance with the "Tolerable Risk Guidelines" in ER 1110-2-1156. While there are no USACE ERs developed for levee risk assessments, ER 1110-2-1156 was used as a guideline to develop the Risk Assessment for the Dallas Floodway Levee System. A Tolerable Risk Guideline for Dallas, as detailed in ER 1110-2-1156, is used as a guide to establish whether a potential failure mode has tolerable risk or does not fall within a tolerable level of risk in terms of life safety. Based on this guidance, tolerable risks are:

- risks that society is willing to accept to secure certain benefits,
- risks that society does not regard as something it might ignore,
- risks that society is confident are being properly managed by the owner, and/or
- risks that the owner keeps under review and reduces still further if and as practicable.

Risk may also be quantified as "broadly acceptable." "Broadly acceptable risk" is generally regarded as insignificant and adequately controlled. The USACE evaluates risk as it relates to dams and levees with respect to the annual probability of failure, life safety risk, economic risk, environmental or other risk, and additional, context-specific additional considerations (USACE 2011).

In an effort to curtail damage to the levee systems from vegetation (i.e., trees, shrubs, and vines), the USACE issued Technical Letter No. 1110-2-571 regarding vegetation on levees. The Technical Letter supersedes prior USACE guidance found at Environment Manual 1110-2-301. The letter provides basic requirements for vegetation-free and root-free zones in levee systems to protect levee integrity. The vegetation-free zone limits levee vegetation to grasses for the entire width of the levee, plus a buffer of 15 feet on either side of the levee, to minimize root growth that may penetrate the levee. In addition, the buffer extends vertically eight feet, such that an adjacent tree may not have a branch overhang less than 15 feet from the levee toe (USACE 2009). Section 3.5 presents a detailed discussion of the trees in the Dallas Floodway Project that may be impacted by the establishment of these zones.

3.11.2 Existing Conditions

3.11.2.1 Riverine Flood Risk

Currently, the risks associated with the Trinity River channel for flooding result from impediments, such as vegetation or trash, which slow river flow. The resulting higher water levels have the potential to cause local flooding. Trees within 50 feet of the levee toes and top of channel banks contribute to this risk, as trees and large shrubs slow water movement at flood stage and trap debris. As more debris is trapped, water movement is further inhibited, and the risk of flooding increases. At the time of the 2007 levee inspection, siltation was abundant; the USACE recommended removal of the silt and debris to maximize discharge capacity of the Dallas Floodway Project (USACE 2007).

One of the most notable impediments to Trinity River flow is the wood trestle supports of the abandoned AT&SF Railroad Bridge. The supports (Figure 3.11-1) act as a sieve that catches and accumulates debris across the width of the Dallas Floodway Project (refer to Figure 2-3). The slower water movement and frequency of flooding at this location has also resulted in increased tree and other vegetation growth that exacerbates the impediment (USACE 2007).

Figure 3.11-1 AT&SF Railroad Bridge Wood Trestle

In the Dallas Floodway Project, the stream channels are eroded by the energy of flowing water. As water diverts around impediments, the main channel may begin to diverge from its current path and result in localized erosion. Stream erosion is especially concerning as there are several points within the Dallas Floodway Project where the erosion has the potential to compromise levee integrity. This potential is especially evident at stormwater outfalls within the Dallas Floodway Project. The existing stormwater outfalls have insufficient or no structural control of discharge, and consequently discharge near the toe of the levee rather than at the river channel. As stormwater discharge flows towards the main channel of the Trinity River, the water also erodes the outfall point at the levee toe and the stream banks. The erosion at the outfalls increases the risk of levee failure, slides, and slumps within the Dallas Floodway Project (USACE 2007).

Levee Integrity

The Dallas Floodway Project currently reduces flood risk for 10,000 acres of residential and highly developed commercial and industrial property, which accounts for approximately 17% of the City of Dallas tax base (City of Dallas 2009a). Based on a 2010 level of development, 9,057 structures are estimated to be located within the SPF floodplain limits if the Levee System experiences an overtopping and subsequent breach or breach prior to overtopping under the SPF conditions. These structures have a total estimated investment value of approximately $7.4 billion in structures and $4.8 billion in contents (USACE 2014). The PI No. 9 identified a levee height deficiency based on a survey performed in 2003 that indicated portions of the existing levee were below the originally constructed height of the levee system. This led to a concern that the levee height was also below the water surface profile associated with the SPF (assuming future flows) (USACE 2007).

The semi-arid, windy environment found in the North Central area of Texas renders the clays that comprise the levees prone to desiccation. Desiccation cracks are the usual condition for the Dallas Floodway Project Levee System. Seasonal drying out of the levee can result in desiccation cracks up to four feet deep. This seasonal desiccation and cracking can significantly undermine levee integrity and structure and are believed to be a substantial contributing factor in the development of shallow slides of the levees. Slides as deep as 15 feet are reported to have occurred after cracks have become filled with water. These slides occasionally remove a portion of the levee crest. More than 300 slides have occurred (and been repaired) since 1958 (USACE 2007).

Several transportation, building, and utilities infrastructure improvements within the Dallas Floodway Project footprint encroach on the levees. Encroachments found along the levees include bridges (19), electric power poles and towers, and numerous construction areas. Bridge support structures lie on the levee crests and support piers penetrate both sides of the levees. At several sites, bridge drainage has eroded the levee and seepage around the piers penetrating the levee threatens levee integrity. The Lew Sterrett Justice Center (county jail) encroaches on the East Levee, and construction at the jail has removed material from the foundation adjacent to the levee toe. There are electric transmission towers on the landside and riverside slopes of the levees, and vegetation grows unchecked at the base of the towers. These encroachments inhibit operation and maintenance, and emergency response actions, and may affect the integrity and performance of the levees. Finally, utilities penetrate and traverse the levees laterally. In instances of older crossings, the type of the utility is unlabeled (USACE 2007). In addition to providing seepage paths that increase the potential for levee damage, any damage to the infrastructure has potential ramifications to levee stability. In December 2009, a leaking Dallas Water Utilities pipe in the levee caused a slump (Dallas Morning News 2009).

Additional damage to levee system results from unauthorized access to the Dallas Floodway Project. Off-road vehicle use has caused rutting within the Dallas Floodway Project and on the levees, which increase instability and erosion potential. The authorized mowing operations have also caused rutting on the levees and in the Dallas Floodway Project (USACE 2007).

During flooding in summer of 2007, 20 shallow slides developed in the Dallas Floodway Project. Fifteen of those slides occurred on the levees while five occurred in the sumps. While the slides were repaired, at least four required substantial remediation to avoid a second failure (USACE 2007).

Deficiencies were documented in the PI No. 9 performed on the Dallas Floodway Project. The PI No. 9 resulted in unacceptable ratings for the Dallas Floodway Project. Some of the deficiencies are described above. The City of Dallas prepared a Maintenance Deficiency Correction Period (MDCP) Plan in response to PI No. 9 in accordance with Corps policy guidance. As of February 2012, the City of Dallas has completed all of the 198 deficiency maintenance O&M items identified in the MDCP Plan. Twenty-one items identified in the PI No. 9 were deferred to the USACE Feasibility Report accompanying this EIS since they could be considered beyond routine maintenance and repair. The remaining PI No. 9 items were considered by USACE in the Risk Assessment.

The Risk Assessment identified risk for two probable failure modes (PFMs) that, while still highly unlikely, exceed the recommended tolerable risk guideline established for dams. These failure modes are overtopping with breach of the East and West Levees, and overtopping of the floodwall on the East Levee. Two other PFMs do not exceed the recommended tolerable limits but have estimated risks to life safety associated that plot close to the limit of tolerability and are therefore considered problems to investigate further. The full investigation of the existing and future without-project investigation is provided in the Feasibility Report in Chapter 2 (USACE 2014).

Emergency Services

The Dallas Floodway Project is accessible to emergency services via graded access roads along the levee tops. These roads are maintained primarily for levee inspection traffic. There are 10 different access points each along the length of the East Levee and West Levee. Emergency response services may use any of these access points as appropriate.

For water rescue, the City of Dallas Fire-Rescue department maintains a swift water rescue unit, as well as nine rescue boats. All of the Fire-Rescue stations within the Study Area include “rescue” units to provide emergency medical assistance and transportation to hospitals as needed. The swift water rescue unit is based out of Fire Station 34, located east of the Study Area in the Pleasant Grove neighborhood of southeast Dallas. In addition to the official unit, several stations have personnel trained in swift water rescue for emergency response. Within the Study Area, Fire Station 15 in the southern part of the Oak Cliff neighborhood includes personnel trained to perform swift water rescue; Fire Station 42 at the southeast end of Dallas Love Field includes a boat rescue unit (Dallas Fire-Rescue 2010).

Bird/Wildlife Aircraft Strike Hazard

Wetlands provide a variety of functions and are attractive to many types of wildlife, including birds. Bird species are a risk both on the ground and in the air, as birds may disable aircraft by striking jet engines, propellers, or the windows or the fuselage of smaller craft. During the past century, bird/wildlife aircraft strikes have resulted in the loss of hundreds of lives worldwide, as well as billions of dollars in aircraft damage. Seventy-eight percent of strikes occur under 1,000 feet above ground level, and 90% occur under 3,000 feet above ground level. Federal Aviation Administration (FAA) Advisory Circular 150/5200-338 (August 2007) identifies 25 wildlife species most likely to be a hazard to safe operations of aircraft, all but two of which are birds (FAA 2007).

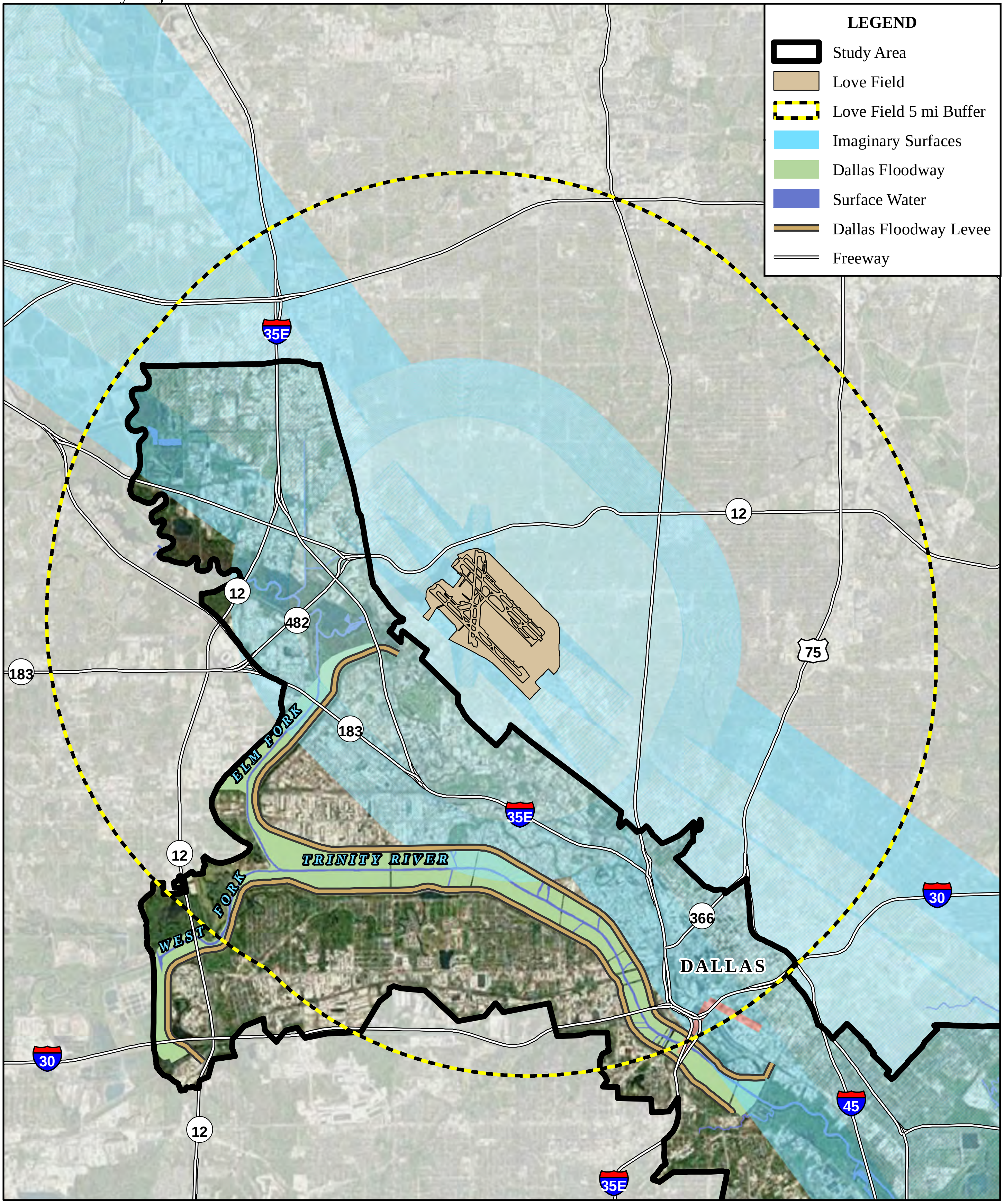
The FAA considers environmental features that provide habitat to these species to be “hazardous wildlife attractants,” as the presence of such features potentially attracts wildlife that may, in turn, increase strike hazard risk to aircraft. Constructed or natural areas—such as poorly drained locations, detention/retention ponds, roosting habitats on buildings, landscaping, or wetlands—can provide wildlife with ideal locations for feeding, loafing, reproduction, and escape (FAA 2007).

For all airports, the FAA recommends a distance of 5 miles between the farthest edge of the airport’s air operations area and any hazardous wildlife attractant, if the attractant could cause wildlife movement into or across the approach or departure airspace. The 5-mile range is designed to protect the approach, departure, and airport circling airspace. For airports serving turbine-powered aircraft, hazardous wildlife attractants must be 10,000 feet from the nearest air operations area, and for airports serving piston-powered aircraft, hazardous wildlife attractants must be 5,000 feet from the nearest air operations area (FAA 2007).

Both Dallas Love Field and DFW serve turbine and piston powered aircraft. The northern end of the Elm Fork area is approximately 3,000 feet from Dallas Love Field. The main stem is as close as 2 miles from Dallas Love Field. The closest reach of the Study Area to DFW is 6.5 miles; the main stem is 7.6 miles from the airport.

3.11.2.2 Interior Drainage Systems

In May 1990, an approximately 45-year flood event (82,300 cfs) inundated Dallas and several municipalities downstream, causing over one billion dollars in damage regionally. The May 1990 storm is considered the storm of record, as it is the most significant event to occur since the most recent modifications (in 1958) to the Dallas Floodway Project (USACE 2009).



0 1 2 Kilometers

0 1 2 Miles

Figure 3.11-2
Airfields within the Vicinity of the Dallas Floodway Project

GIS Sources: City of Dallas 2008a, NCTCOG 2008

Stormwater Flooding 100-year, 24-hour Storm Event

Outside of the Dallas Floodway Project, the same levees that aid in flood conveyance and reduce risk to the surrounding area from riverine flooding also block stormwater from local weather events from draining directly into the Trinity River. Instead, the City of Dallas relies on a network of sumps, pump stations, and pressure sewers to drain local stormwater into the Trinity River. The ROI is highly developed with urban, industrial, and dense residential uses. The dominant land uses exacerbate flood damage, as the development eliminates much of the permeable ground surface that could otherwise mitigate flooding. As land area is developed with improvements and paved surfaces, rainfall collects on the surface as ponds or in runoff without dissipation. This results in an increased need for a well-maintained IDS. For a discussion of land uses subject to inundation from interior flooding, refer to Section 3.1.

Most of the pump stations and sumps are unable to manage a 100-year, 24-hour flood event, as the estimated flood stage from such an event is greater than the original design elevations of the stations (for a detailed discussion of the pump stations and their function, refer to Section 3.13). Table 3.11-1 describes the number of potentially affected and potentially flooded structures in the IDS broken out by sump area. As identified within Table 3.11-1, the Able Sump has the potential to flood the greatest number of structures, while the Hampton-Oak Lawn Sump has the potential to cause the greatest amount of financial damage. Figure 3.11-3 shows the predicted inundation and flood risk extents from a 100-year storm event based on current pump capacity and design elevations of the IDS. A pump station was added to the Pavaho Pumping Plant in 2012; extents of the resulting improved drainage are not yet available.

Table 3.11-1. Potentially Affected Structures and Their Appraised Values for the 100-year, 24-hour Storm Event

Sump	*Predicted 100-year, 24-hour Flood Elevation (feet)*	*Potentially Affected Structures (Appraised Value[1])*	*Potentially Flooded Structures (Appraised Value[1])*
East Levee			
Able	399.2	208 ($56.2 M)	131 ($42.5M)
Hampton-Oak Lawn	403.7	329 ($958.5 M)	104 ($291.7 M)
Record Crossing	405.8	444 ($544.0 M)	94 ($32.7 M)
Nobles Branch	409.3	49 ($92.0 M)	8 ($27.2 M)
West Levee			
Charlie	403.5	34 ($4.4 M)	3 (<$0.1 M)
Pavaho[2]	405.5	unknown	unknown
Westmoreland-Hampton	408.5	71 ($8.5 M)	3 (<$0.1 M)
Frances Street	410.1	11 ($0.2 M)	3 ($0.1 M)
Trinity-Portland	412.0	59 ($4.3 M)	8 ($0.3 M)
Eagle Ford	417.2	34 ($11.4 M)	0
Corinth Street	402.1	12 ($0.2 M)	2 (<$0.1 M)

Notes: [1] Appraised value given in millions (M) of dollars. Values based on 2009 appraisal data.
[2] The design elevation for the Pavaho Sump is shown here for reference only. With the construction of the new Pavaho Pumping Plant in 2013, the elevation has been lowered from the flood elevation shown here.

Sources: City of Dallas 2006a, 2009b.

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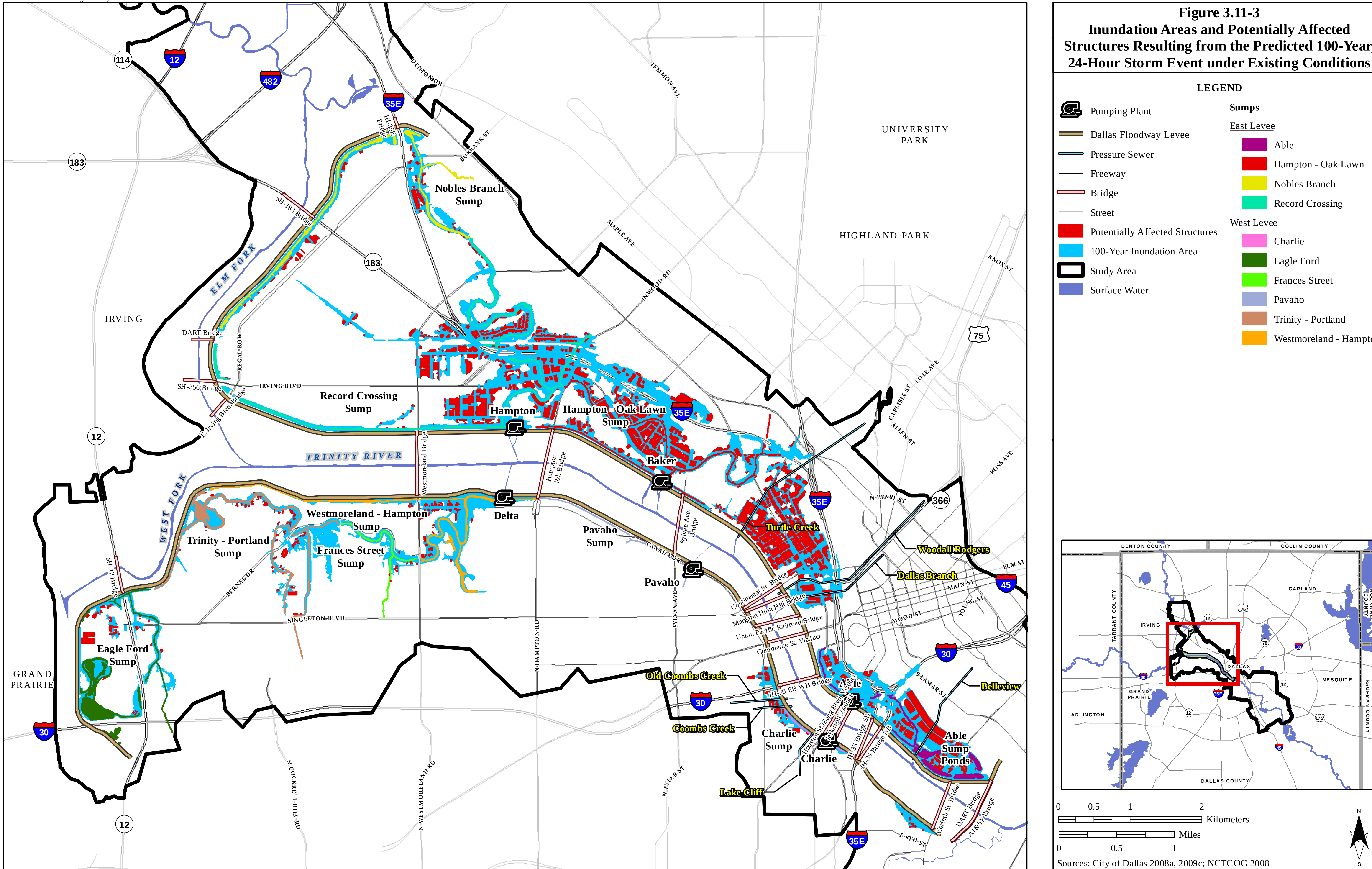
Figure 3.11-3
Inundation Areas and Potentially Affected Structures Resulting from the Predicted 100-Year, 24-Hour Storm Event under Existing Conditions



Sources: City of Dallas 2008a, 2009c; NCTCOG 2008

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March 2006 Event

Data from this flood event show that only Able and Hampton-Oak Lawn (East Levee) sumps exceeded the intended 100-year design elevation at the pumping plant (Table 3.11-2) (City of Dallas 2009b). Flooding elsewhere was largely tied to impediments to sump drainage, such as debris blocked culverts and vegetation slowing stormwater runoff. Furthermore, those houses with finished floor elevations higher than the flood still had damage to structure foundation; even where the residences were above flood level, many accessory structures were not and thus suffered damage to sheds and garages associated with the main house.

Table 3.11-2. Sump Elevations Observed During March 18-19, 2006 Flood Event

Sump	*Design Elevation (feet)*	*Maximum Sump Elevation, March 19, 2006 (feet)*
East Levee		
Able	392.5	393.99
Hampton-Oak Lawn	402.5	403.87
Record Crossing	405.0	404.51
Nobles Branch	408.1	407.1
West Levee[a]		
Charlie	404.1	402.27
Pavaho	408.7[b]	405.63
Westmoreland-Hampton	406.9	406.17
Frances Street	410.1	408.0
Trinity-Portland	413.0	411.9
Eagle Ford	416.0	416.2

Notes: [a] Corinth Street data not available.
[b] The design elevation for the Pavaho Sump is shown here for reference only. With the construction of the new Pavaho Pumping Plant in 2013, the elevation has been raised from the elevation shown here.
Sources: City of Dallas 2006a, 2009b.

The March 18-19, 2006 flooding also made clear that the West Levee sump infrastructure was unable to draw down water levels as rapidly as the East Levee sump infrastructure. By March 21, 2006, the East Levee sumps were at normal levels, whereas the West Levee sumps continued to have increased water levels. The Westmoreland-Hampton Sump continued to have elevated water levels 4 days after the peak of the rainfall and despite nearly continuous pumping (City of Dallas 2009b). Thus, the West Levee Interior Drainage Study concluded that the Delta Pump Stations lacked sufficient capacity to dewater their associated sumps in a timely manner.

<u>Emergency Services</u>

Police Department

Police protection for the citizens of and visitors to the City of Dallas is provided by the Dallas Police Department, which is made up of 2,977 sworn police officers and 556 civilian employees. The department is capable of responding to all emergency incidents throughout the city that require police intervention, including natural disasters. The department is geographically divided into seven patrol divisions. Each division acts independently of the other six. Police administration and investigation operations are located at Jack Evans Police Headquarters, just south of downtown (City of Dallas 2009a).

The Study Area includes all seven of the divisions. Each division is divided into “sectors” and each sector into “beats,” with 63 out of the 234 beats operating within the Study Area. For the 2007-2008 fiscal year, the Dallas Police Department set a goal response time of 12 minutes. By July 2008, the response time was

13.65 minutes. This represents a 22% reduction in response time from October 2007 (Dallas Police Department 2008).

Fire-Rescue Services

Fire protection, fire suppression, rescue, and emergency medical services for the City of Dallas are provided by the Dallas Fire-Rescue Department, which is made up of 1,705 firefighters and paramedics and responds to over 270,000 calls annually. Dallas Fire-Rescue is capable of responding to all hazards and emergencies, including technical rescue and water rescue incidents, and all types of medical emergencies. The department is geographically divided into two operations divisions (north and south), which encompass nine battalions, overseeing 56 fire stations. Eleven of the 56 stations are located within the Study Area (City of Dallas 2009a).

The Dallas Fire-Rescue Department's special operations division responds to all water emergencies. The Swift Water Rescue team responds to all water emergencies, especially incidents where people are trapped in fast moving water. Swift Water personnel are trained in advanced water rescue operations and utilize special vehicles and watercrafts to carry out their mission. The swift water rescue unit is based out of Station 34 in Pleasant Grove neighborhood of southeastern Dallas. Additional personnel in various stations throughout Dallas also have swift water rescue training, and four other stations have boat units assigned to them (Dallas Fire-Rescue 2010).

Dallas Fire-Rescue provides the initial emergency medical response within the Dallas city limits via mobile intensive care units. The mobile intensive care units response time averages 5.3 minutes (Dallas Fire-Rescue 2010). In the event that additional resources are needed, private ambulance providers are requested to respond either to individual incidents or to the location of a major incident. These units are capable of transporting and performing medical treatment for patients at the level in which they are trained. In addition, private ambulance providers also provide standby services at some public and special events in the city (City of Dallas 2009a). Ambulance services can transport patients to one of four hospitals within the Study Area. However, access to the local hospitals may be restricted in the event of a major flood event.

Emergency Management

The City of Dallas has three complementary hazard analyses/emergency management plans. The Dallas County Local Mitigation Strategy, developed with the NCTCOG, reviews hazards and emergency response for the entire Dallas County, including the City of Dallas. The City of Dallas Hazard Analysis Plan is the City's incorporation of the hazards discussed in Dallas County Local Mitigation Strategy and annual updates to that plan. The City of Dallas Emergency Management Basic Plan and Emergency Action Plan is the City's handbook for emergency response and the establishment of communications, duties, and responsibilities in the event of an emergency.

The City of Dallas has adopted the National Incident Management System to provide a consistent approach to the effective management of situations involving natural or man-made disasters, or terrorism. National Incident Management System creates a standardized organizational structure designed to improve interoperability between all levels of government, private sector, and nongovernmental organizations (City of Dallas 2006b).

The City of Dallas Emergency Action Plan describes the City's flood warning system for the Trinity River Federal Levee System (City of Dallas 2010). In the event of flooding, Police and Fire-Rescue Dispatch would issue a warning to affected residents using Reverse 911. In addition, city officials would implement measures such as requesting broadcasters to disseminate Emergency Alert System broadcasts, issue news through cable override, special news advisories to radio, television, and cable news stations.

In responding to an emergency situation, the Emergency Management Basic Plan defines the general responsibilities to be applied regardless of the hazard. All designated emergencies require the identification of an Incident Commander to manage emergency response resources and operations at the incident site command post to resolve the emergency situation. The Emergency Management Basic Plan also assigns warning functions to an Emergency Management Coordinator. The Emergency Management Coordinator is then responsible for collecting all available information on the emergency, alerting the relevant officials about the emergency, and disseminating instructions to the public and facilities needed for response. Communication with the public is accomplished primarily through the Emergency Management Broadcast system. The Emergency Management Coordinator is also responsible for managing any additional communications element of emergency response (City of Dallas 2006b).

As part of the Emergency Management Basic Plan, the Police Chief is responsible for evacuation planning. The Police Chief has identified areas where evacuation has been required in the past and recommended evacuation routes for high-risk areas. In addition, the Emergency Management Basic Plan includes general evacuation plans for special needs facilities (e.g., hospitals, schools, nursing homes), public information requirements, and planning for traffic control issues. Under the Emergency Management Basic Plan, the Fire Chief provides evacuation support as needed. In the event temporary shelter is required for evacuees, the Director of Parks and Recreation, in conjunction with the American Red Cross, would plan for management of the displaced population (City of Dallas 2006b).

The Emergency Management Basic Plan divides health services into public health duties to be managed by Director of Environmental and Health Services and emergency medical response to be managed by the Fire Chief and the Dallas Fire-Rescue Emergency Medical Services division. In addition to coordinating emergency medical response, the Emergency Medical Services division is responsible for public health information and education, inspection of food and water supply, and planning for casualty management. The Fire Chief is also primarily responsible for all search and rescue coordination and implementation (City of Dallas 2006b).

3.12 TRANSPORTATION

3.12.1 Definition of Resource

Transportation refers to the operational characteristics of a transportation network, including the network’s capacity to accommodate existing and projected future travel demand. Networks may encompass many different types of facilities that serve a variety of transportation modes, such as vehicular traffic, public transit, and non-motorized travel. Access to and from the Study Area is provided via a network of freeways, tollways, and surface streets (including arterial highways, collector streets, local roadways, and maintenance access roads), public transit services (including local bus routes, light rail transit lines, and commuter rail lines), freight rail lines, and non-motorized transportation facilities (including bicycle lanes, sidewalks, and pedestrian trails).

3.12.1.1 Methodology

Because 89% of all commuting trips in Dallas are made using passenger vehicles (American Association of State Highway and Transportation Officials [AASHTO] 2010), it is anticipated that the majority of trips associated with the construction and operation of the Proposed Action would be in the form of vehicular traffic on freeways and other streets and highways, while a relatively smaller number of trips would use public transit or other non-passenger car modes of travel. For this reason, the analysis of transportation-related impacts is focused on freeway capacity.

Roadway operating conditions, and the adequacy of existing roadway systems to accommodate projected future traffic, are described in terms of Level of Service (LOS) ratings. Developed by the Transportation Research Board (TRB), and documented in various editions of the *Highway Capacity Manual* (TRB 2010) since 1950, LOS is a method used to rate the performance of streets, intersections, and other highway facilities. LOS rates performance on a scale of A to F, with LOS A reflecting free-flowing conditions and LOS F representing heavily congested conditions. Table 3.12-1 summarizes the general traffic conditions associated with each LOS rating, while Figure 3.12-1 is an illustration of representative levels of congestion for each LOS grade. Figure 3.12-2 presents the regional transportation network.

Table 3.12-1. Traffic Conditions Associated with LOS Ratings

LOS Rating	*Description of Traffic Conditions*
A	Traffic flows freely, with little or no restrictions to vehicle maneuvers within the traffic stream.
B	Reasonably free-flowing conditions, with slight restrictions to vehicle maneuvers within the traffic stream.
C	Traffic speed approaches free-flowing conditions, but freedom to maneuver within the traffic stream is noticeably restricted.
D	Traffic speed begins to be reduced, and freedom to maneuver is seriously limited due to a high concentration of traffic.
E	Unpredictable traffic flow, with virtually no usable gaps in the traffic stream to accommodate vehicle maneuvers.
F	Unstable traffic flow resulting in delays and the formation of queues in locations where traffic demand exceeds roadway capacity.

Source: TRB 2010.

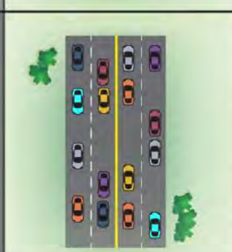
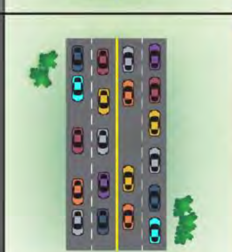
The ROI for transportation consists of the freeways, surface streets, freight and passenger rail lines, bus routes, and pedestrian and bicycle facilities that are located within the Study Area. In addition to streets that are open to vehicular access by the general public, the ROI encompasses maintenance roads that are used by City of Dallas Flood Control District personnel in order to access the various elements of the Dallas Floodway. Some major freeway facilities that are located outside the ROI boundary are included in the analysis to provide a complete picture of anticipated traffic-related impacts. Figure 3.12-2 depicts the transportation facilities comprising the ROI.

The ROI for transportation includes bridges over the Trinity River, the Elm Fork or the West Fork, 11 of which currently have low-beam bridge elevations below the projected SPF elevation. Also, a number of the facilities presented on Figure 3.12-2 are situated within the 100-year flood inundation area (refer to Section 3.11 for additional details).

3.12.1.2 Regulatory Framework

<u>Federal</u>

On August 10, 2005, the President signed into law the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)*. SAFETEA-LU builds upon two previous landmark bills – the *Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991* and the *Transportation Equity Act for the 21st Century* – to supply the funds and programmatic framework for investments needed to maintain and develop a vital transportation infrastructure.

LEVEL OF SERVICE (LOS)		
LOS	Roadway Segment	
A		• Free-flow conditions. • Vehicles unaffected by other vehicles. • No restrictions on vehicle maneuvers. • Minor disruptions to flow are absorbed without causing congestion.
B		• Reasonably free-flow conditions. • Other vehicles slightly noticeable. • Less freedom to maneuver. • Minor disruptions to flow are still absorbed without causing congestion.
C		• Near free-flow conditions. • Traffic becomes affected by other vehicles. • Noticeable restrictions to freedom vehicle maneuvers. • Queuing may occur behind any significant blockage.
D		• Speed reduced with increasing flows. • High traffic concentration. • Freedom to maneuver seriously limited. • Minor incidents may result in queuing.
E		• Unpredictable speed and traffic flow. • Traffic demand equals roadway capacity. • Little room to maneuver; virtually no usable gaps. • Any incident results in substantial queuing and delay.
F		• Unstable traffic flow. • Traffic demand exceeds roadway capacity. • Severe traffic congestion, resulting in extreme delays and queues.

Source: TRB 2010.

Figure 3.12-1 Representative Traffic Levels for Each LOS Rating

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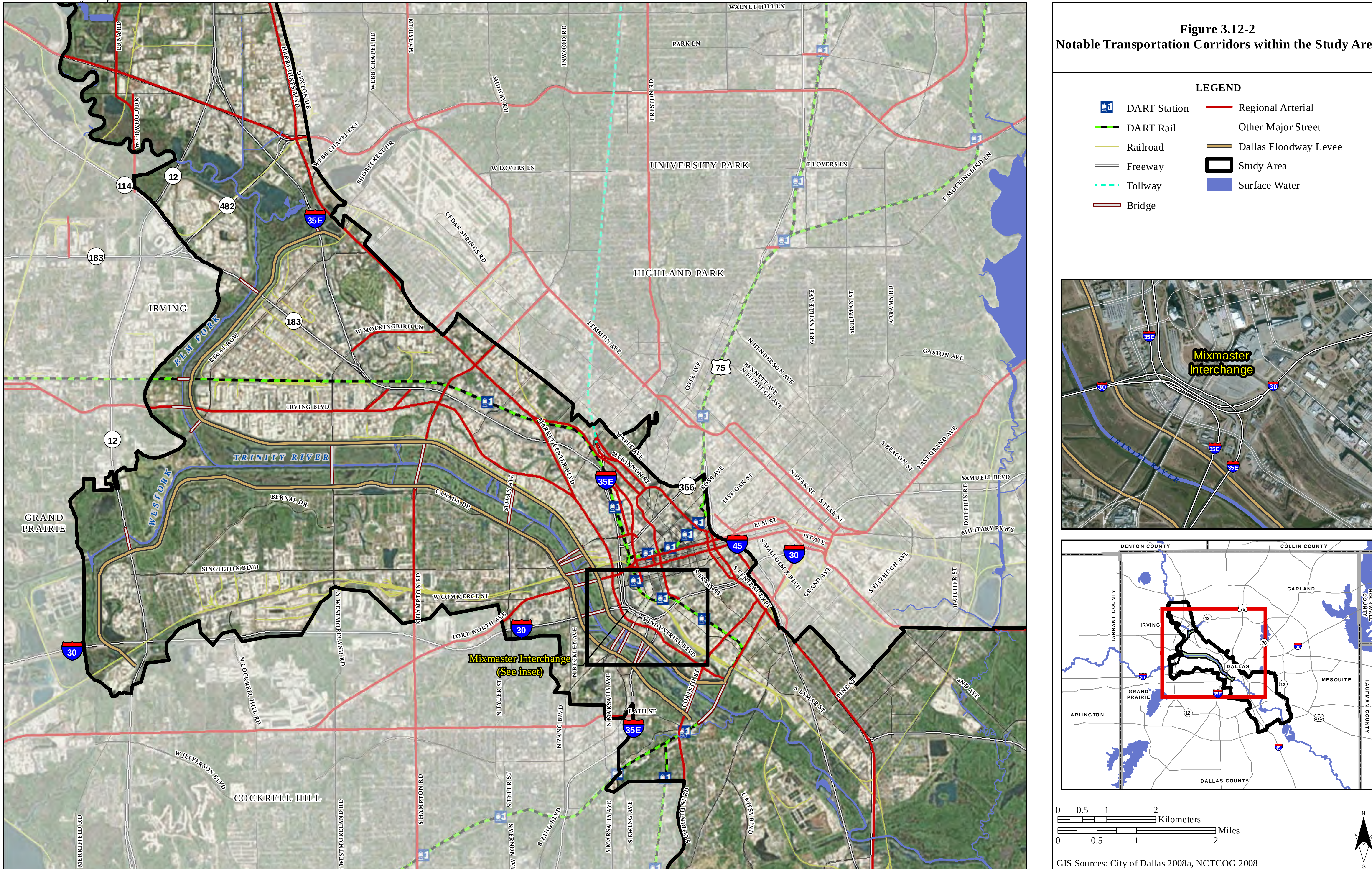
Figure 3.12-2
Notable Transportation Corridors within the Study Area



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Effective October 1, 2012, *Moving Ahead for Progress in the 21st Century (MAP-21)* funds federal transportation programs until September 30, 2014, and includes funding for federally supported highway, transit and bridge programs. *MAP-21* reauthorizes the federal-aid highway program equal to current funding levels plus inflation for two fiscal years. *MAP-21* consolidates the number of federal programs by two-thirds to focus resources on key national goals and reduce duplicative programs. *MAP-21* eliminates earmarks, expedites project delivery while protecting the environment; creates a new title called "America Fast Forward," which strengthens the Transportation Infrastructure Finance and Innovation Program to leverage federal dollars. Under *MAP-21*, the metropolitan and statewide transportation planning processes are continued and enhanced to incorporate performance goals, measures, and targets into the process of identifying needed transportation improvements and project selection. Public involvement remains a hallmark of the planning process under this program.

State

The *Statewide Long-Range Transportation Plan 2035* is a 24-year blueprint for the transportation planning process that will guide the collaborative efforts between Texas Department of Transportation (TxDOT), local and regional decision-makers, and all transportation stakeholders to reach a consensus on needed transportation projects and services. The plan covers the period from 2011 through 2035, and provides an inventory and addresses the need for improvements to the state's transportation system, including roadways, pedestrian and bicycle facilities, transit, freight and passenger rail, airports, waterways and ports, pipelines, and intelligent transportation systems.

On June 28, 2012, the Texas Transportation Commission adopted the *Texas Department of Transportation Strategic Plan, 2013-2017*. This document outlines TxDOT's philosophy on its mission, values, goals, objectives, budgetary performance measures, strategies, and key planning and contextual information that will guide this agency during the 5-year planning horizon. *The Texas Department of Transportation Strategic Plan, 2013-2017* articulates the following goals:

- Maintain a safe transportation system;
- Address congestion;
- Connect Texas communities; and
- Become a "best in class" state agency.

TxDOT's priorities include being the safest state department of transportation in the U.S., implementing congestion mitigation projects, strengthening its relationship with Metropolitan Planning Organizations, counties, key stakeholders, and others.

Regional

Mobility 2035: The Metropolitan Transportation Plan for North Central Texas is a comprehensive, multimodal blueprint for transportation systems and services aimed at meeting the mobility needs of the Dallas-Fort Worth Metropolitan Area. This long-range plan is based on projected conditions in the year 2035 (NCTCOG 2013), and incorporates future transportation improvements planned to be in place by 2035. This document has been prepared by NCTCOG and the Regional Transportation Council in their capacity as the Metropolitan Planning Organizations, and in accordance with the metropolitan planning regulations provided in *ISTEA* and *SAFETEA-LU*. *Mobility 2035* was adopted in 2011, and the Regional Transportation Council adopted an Amendment to the plan in June 2013.

The *Transportation Improvement Program (TIP), 2013-2016* is a staged, multi-year program of projects proposed for funding by federal, state, and local sources within the Dallas-Fort Worth Metropolitan Area.

The *TIP, 2013-2016* identifies roadway and transit projects programmed for construction within the next four years in the Dallas-Fort Worth Metropolitan Area. The *TIP, 2013-2016* was developed by NCTCOG in cooperation with local governments, TxDOT, and local transportation agencies. The *TIP, 2013-2016* is developed in accordance with the metropolitan planning requirements set forth in the Statewide and Metropolitan Planning Final Rule (23 CFR Part 450, 49 CFR Part 613) promulgated in the October 1, 2009 Federal Register as required by *SAFETEA-LU*. The *TIP, 2013-2016* was prepared under guidelines set forth in the CFRs (referenced above) as updated on June 9, 2006, and in *SAFETEA-LU*.

3.12.2 Existing Conditions

3.12.2.1 Vehicular Traffic

Freeways

Freeways are limited access facilities that are designed to accommodate the regional movement of people and goods. Major freeways within the ROI include the following:

- IH-35E (also known as the R.L. Thornton Freeway/Stemmons Freeway): a major north-south freeway through the City of Dallas.
- IH-30 (also known as the Tom Landry Freeway/R.L. Thornton Freeway): a major east-west freeway through the City of Dallas.
- SH-183 (also known as the John W. Carpenter Freeway): a major east-west freeway running between DFW and Dallas Love Field Airport.
- US-75 (also known as the Central Expressway): a major north-south freeway located to the east of the “Mixmaster” Interchange.

Although the majority of travel lanes on the freeway network are general purpose lanes open to all passenger vehicles, some lanes have been set aside for the exclusive use of high-occupancy vehicles (HOVs). There are 75 miles of HOV lanes on various freeway facilities, including portions of IH-30, IH-35E, and US-75 (DART 2012a). Table 3.12-2 presents the Average Daily Traffic (ADT) volumes and LOS on freeways in the year 2012 (NCTCOG 2012a).

Table 3.12-2. 2013 Freeway Traffic Volumes and LOS

Freeway	*2013 ADT*[1]	*2013 LOS*
IH-35E		
North of SH-183	139,000	D-F
SH-183 to Dallas North Tollway	303,000	F
Dallas North Tollway to IH-30	319,000	D-F
South of IH-30	234,000	F
IH-30		
West of IH-35E	165,000	F
East of IH-35E	249,000	F
East of IH-45	250,000	F
SH-183		
West of IH-35E	194,000	D-F
US-75		
North of Spur-366	279,000	F

Note: [1] Average daily traffic volume or the number of vehicles traversing a given freeway segment in both directions of travel during a 24-hour period.
Source: FHWA 2014.

The freeway-to-freeway interchange known as the "Mixmaster," located at the junction of IH-35E and IH-30, is one of several major freeway junctions located within the Study Area. Other significant freeway interchanges within the Study Area include:

- IH-35E with SH-183;
- IH-35E with the Dallas North Tollway;
- IH-35E with Spur 366; and
- IH-30 with Loop 12 (also known as Walton Walker Boulevard).

Regionally Significant Arterials

The ROI also contains Regionally Significant Arterials (RSA), as defined in Appendix E of *Mobility 2035* (NCTCOG 2013). These RSAs are projected to carry approximately 20% of all vehicular traffic in the region by the year 2035 (NCTCOG 2013). Notable RSAs within the ROI include Commerce Street, Harry Hines Boulevard, and Riverfront Boulevard (NCTCOG 2013).

City of Dallas Street Classifications

Streets are classified by the City of Dallas based on their function and volume of traffic they accommodate. Class 1 streets are residential streets that usually serve less than five other streets. Class 2 streets are commercial/collector streets used for accessing businesses or providing access to residential streets. Class 3 streets are secondary thoroughfares: a secondary transportation corridor but not the main street through an area. Class 4 streets are thoroughfares: representing the main transportation corridor through an area. Class 5 streets are freeways.

Movement of Freight

The movement of freight is a major contributor to the economy of the Dallas-Fort Worth area. Freight moves throughout the Dallas-Fort Worth area and on to national and international destinations by a combination of trucks, trains, and aircraft. For the most part, truck traffic is intermixed with passenger vehicles on the freeway and surface street networks. However, as indicated in Appendix E of *Mobility 2035*, truck lane restrictions have been implemented on selected freeways in Dallas County, including IH-45 (also known as the Julius Schepps Freeway) and IH-20. By 2015, additional restrictions are planned on IH-30, IH-35E, and Loop 12 (NCTCOG 2013).

Three major active freight railroad corridors are located within the Study Area, and one borders the Study Area to the north and east (refer to Figure 3.12-2). Several railroad companies own or control the rights-of-way and others operate trains on the corridors including Burlington Northern Santa Fe Railway, Dallas, Garland and Northeastern, DART, Amtrak, and Union Pacific Railroad. Air cargo is transferred via area airports (i.e., DFW and Dallas Love Field).

3.12.2.2 Public Transportation

A major network of bus routes, light-rail transit, and commuter rail serves the Study Area (refer to Figure 3.12-2). DART has a geographic service area of 13 cities and 700 square miles, and serves more than 220,000 passengers per day (DART 2012b). Most of the routes are oriented to bring riders from the outer neighborhoods of Dallas and 12 other cities (including Fort Worth, Plano, Irving, and Garland) to the City of Dallas Central Business District. DART provides more than 12,500 bus stops, 77 miles of light rail and commuter rail, and paratransit services for the mobility impaired. In 2011, DART system-wide ridership for all modes of transportation was 111.8 million passenger trips (DART 2012b).

3.12.2.3 Non-motorized Transportation: Pedestrian and Bicycle Use

Major pedestrian paths in the Study Area include the Bernal Trail, a walking/biking pathway connecting Norwich Lane and Tipton Park to Westmoreland Road on the West Levee side; a pedestrian walkway over the Floodway on Westmoreland Road; and a pedestrian walkway over the Floodway on Hampton Road (City of Dallas 2008, 2009).

The Greater Dallas Bike Plan Map details major on-street routes with signs designating that the City of Dallas recommends the route for bicycle use. The on-street routes known as the Dallas Bike Route System, may or may not have, separate lanes for bicycles. There are several major Dallas Bike Route Systems in the Study Area (City of Dallas 1992).

3.12.2.4 Floodway Bridges

Bridges that cross the Dallas Floodway rely on a system of pier supports to elevate the driving surface above the Floodway. The piers extend below ground level to supply structural support for the weight of the bridge, the vehicles that travel over it, and the forces of wind and water (USACE 2009). In the vicinity of the Proposed Action, there are 22 bridges that span the Floodway, the downstream Trinity River and the West Fork. In addition, a low water crossing (Sylvan Avenue Bridge) traverses the Floodway. Table 3.12-3 lists all of the Dallas Floodway Levee System crossings addressed in Appendix A of the USACE Feasibility Report (USACE 2014), and their low beam elevations and elevation difference with respect to the current SPF elevation (i.e., freeboard). See Figure 3.12-3 for a map depicting the location of each bridge in this table. As shown in Table 3.12-3, 11 of the 22 existing bridges have a low beam elevation below the current SPF elevation.

Table 3.12-3. Dallas Floodway Levee System Bridge Low Beam Elevations Relative to the Current SPF Elevation, Existing Conditions

Bridge		SPF[1] Elev. (feet)	West Levee		East Levee	
			Low Beam Elev. (feet)	Low[2] Beam Freeboard (feet)	Low Beam Elev. (feet)	Low Beam Freeboard (feet)
Trinity River						
1	AT&SF[4] (abandoned)	423.69	*	*	*	*
2	DART[3,4]	425.42	*	*	431	5.58
3	Corinth	425.46	424.37	-1.09	424	-1.46
4	IH-35E (Northbound)	425.65	424.13	-1.52	423	-2.65
5	IH-35E (Southbound)	425.65	425.01	-0.64	424.11	-1.54
6	Houston	426.32	418.5	-7.82	430.1	3.78
7	IH-30 Exit[4]	428.49	*	*	426.54	-1.95
8	IH-30 (Eastbound)	428.49	428.89	0.4	427.29	-1.2
9	IH-30 (Westbound)	428.49	428.89	0.4	428.4	-0.09
10	IH-30 Entrance[4]	428.49	*	*	427.5	-0.99
11	Commerce	429.04	430.15	1.11	428.54	-0.5
12	Union Pacific Railroad	429.62	430.22	0.6	428.61	-1.01
13	Margaret Hunt Hill	429.89	434.22	4.33	436.27	6.38
14	Sylvan (new)[5]	431.53	-	-	-	-
15	Hampton/Inwood	432.93	439.23	6.3	438.84	5.91
16	Westmoreland	434.02	436.04	2.02	435.71	1.69

	Bridge	SPF[1] Elev. (feet)	West Levee		East Levee	
			Low Beam Elev. (feet)	Low[2] Beam Freeboard (feet)	Low Beam Elev. (feet)	Low Beam Freeboard (feet)
Elm Fork						
17	Shady Grove/ E. Irving Boulevard[4]	436.02	*	*	436.94	0.92
18	SH-356 (Irving Boulevard)[4]	436.07	*	*	434.31	-1.76
19	DART Trinity Rail Express[4] Chicago, Rock Island and Pacific Railroad (old bridge)	436.15	*	*	440.68	4.53
20	DART Trinity Rail Express[4] Chicago, Rock Island and Pacific Railroad (new bridge)	436.15	*	*	438.44	2.29
21	SH-183[4]	436.15	*	*	438.44	2.29
West Fork						
22	Loop 12[4]	438.17	441.22	3.05	*	*

Notes: [1] SPF elevations are based on the current hydraulic model including future flows.
[2] Low Beam Freeboard refers to the amount of distance between the low beam and the SPF elevation. A negative number indicates that the low beam is below the SPF elevation.
[3] The East Levee turns and extends northeast, parallel to and beneath the DART Rail Bridge for approximately 1,100 feet. The DART Rail Bridge is on a grade that ascends toward the east, so most of the 1,100 feet of levee under the bridge has more clearance than implied by the elevation listed in the table.
[4] An asterisk (*) in the table indicates that the levee is not crossed by a bridge at this location.
[5] The existing Sylvan Bridge is below the current SPF; the new Sylvan Bridge is above the current SPF (TxDOT 2010).

3.12.2.5 Floodway Maintenance Access

Maintenance roads provide City of Dallas Flood Control District maintenance personnel access to sumps, pumps, and other features of the Floodway. Nearly all of the levee-top roads are 16-foot wide gravel roads used by maintenance personnel and equipment. Some of the maintenance roads have ramps that allow for access to maintenance roads at the toe of the wet (i.e., river) side of the levee. The roads at the toes of the levees tend to be more primitive due to their location in the Floodway and frequent flooding. The West Levee top roads used for maintenance access up and down the levee is identified as the “Perimeter Road” and the East Levee top road is known as “Levee Road.”

The maintenance access roads throughout the Floodway are in good condition; however, numerous bridge crossings interrupt continuous travel/access along the crest of both the East and West Levees. In several locations, the bridges are at or below the levee crest, and when this happens, the maintenance access is re-routed down the levee slopes to the wet and/or dry side levee toes. These alternate routes are problematic during flood events as the wet side roads would be underwater and the dry side access does not allow visual observation of the Floodway (USACE 2009). Most of the access points are gated to discourage motorized vehicle travel by the public on the levee-top roads, but allows for pedestrian and bicycle access.

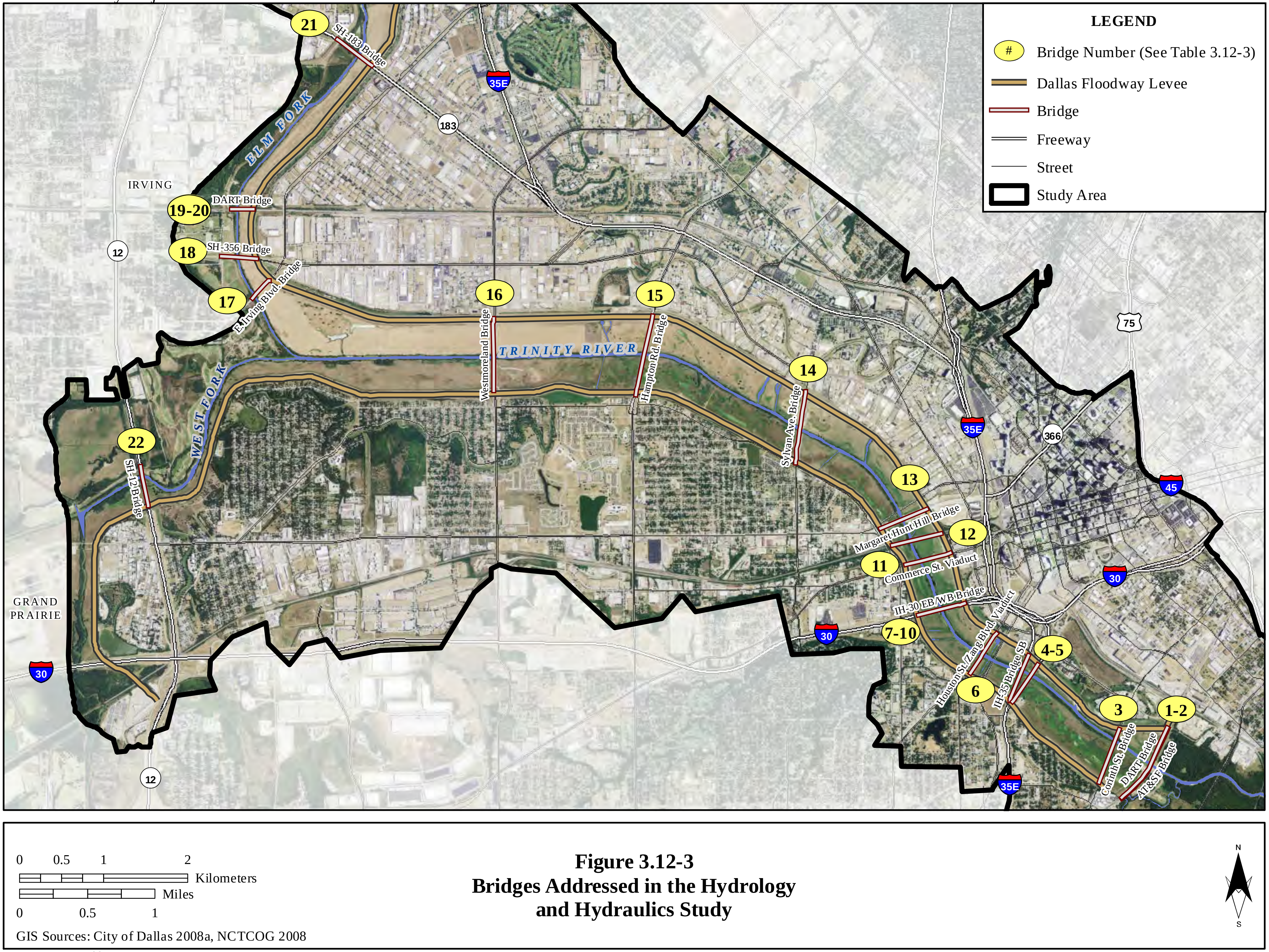

Figure 3.12-3
Bridges Addressed in the Hydrology and Hydraulics Study

3.12.2.6 Public Access

Most of the Floodway is open to public non-motorized access. The public can access the Floodway on foot from various locations throughout the Floodway and traverse the Floodway on their way to another location. In addition, several bike paths are located within 0.5 mile of either side of the Floodway.

The only public vehicle roadway access to the Floodway is via Sylvan Avenue to Crow Lake Park. Vehicle parking is available at Crow Lake Park and can accommodate approximately 50 vehicles, including 16 stalls for vehicles with trailers. This is the only parking lot designed to provide public vehicle parking in the Dallas Floodway (City of Dallas 2009). Several public transportation stops are located within 0.5 miles of Floodway (Tele Atlas 2009, DART 2013).

During special events as described in Section 3.7.2.3, parking is handled on a case-by-case basis. Depending on the size and location of the event, parking is accommodated using on-street spaces, or using commercial parking lots and/or empty lots. At times, shuttles are used to transport participants from a parking area to an event. Parking arrangements and planning are handled independently by the individual event organizers. Special event organizers follow the existing City of Dallas Parks and Recreation Department Special Event Permit Application process, including the identification of proposed road closures, traffic control, and a parking accommodations.

3.12.2.7 Interior Drainage System

The following sections focus on the roadways subject to flooding within the IDS and the streets that provide access to the current and proposed pumping plants (Figure 3.12-4). During the 100-year, 24-hour storm event, modeling and geographic information system analysis indicates that numerous transportation facilities within the ROI would have segments completely or partially flooded, making homes, businesses, and commuter routes temporarily inaccessible. Specifically, 3.4 miles of freeways, 7.4 miles of RSAs, 21.1 miles of other major streets, 0.5 mile of DART rail line facilities, and 5.6 miles freight rail lines would be located within the inundated area.

For each basin, major roadways (i.e., Street Class 3 or higher) potentially subject to flooding during the 100-year, 24-hour storm event are identified along with their street classification and existing estimated ADT volumes. The bulk of the presented existing ADT values (when available) are based on traffic data collected in 2004 from the TxDOT’s 2004 Saturation Count Program (NCTCOG 2012b). Year 2004 counts were then adjusted to reflect estimated traffic growth through the year 2013 based on population growth in the Dallas Fort Worth-Arlington Metropolitan Area (U.S. Census Bureau 2011). Table 3.12-4 summarizes this information.

Table 3.12-4. Major Roads Potentially Subject to Flooding, by Basin

Road	*Street Class*	*2013 ADT*
Hampton Basin		
Commonwealth Drive	4	7,100
W. Mockingbird Lane	4	46,200
Regal Row	4	9,200
IH-35E Northbound On-ramp	5	8,800
SH-183 Southbound Off-ramp	5	13,400
Charlie Basin		
Corinth Street	4	8,400
East Jefferson Boulevard	4	15,000
North Zang Boulevard	4	4,800
Delta Basin		
Bernal Drive	3	4,900
Kingbridge Street	3	400
Norwich Lane	3	1,900
North Westmoreland Road	4	33,300
Eagle Ford Basin		
Loop 12 Northbound	5	175,500
Singleton Boulevard	4	24,600

Sources: NCTCOG 2012a, 2012b; U.S. Census Bureau 2011.

Existing traffic volumes on roadways that provide access to the IDP pumping plants are provided below in Table 3.12-5. A search of NCTCOG's historical traffic counts database did not locate any existing traffic counts for facilities serving the Charlie Pumping Plant.

Table 3.12-5. Traffic Volumes on Roadways Leading to Pumping Plants

Road	*2013 ADT*
Hampton Pumping Plant	
Inwood Road, south of Irving Boulevard	48,600
Irving Boulevard, east of Inwood Road	19,500
Delta Pumping Plant	
Canada Drive, west of Hampton Road	3,300
Hampton Road, south of Canada Drive	43,500
Trinity-Portland Pumping Plant	
Westmoreland Road, south of Canada Drive	28,400
Singleton Boulevard, east of Perimeter Road	1,300

Sources: NCTCOG 2012b; U.S. Census Bureau 2011.

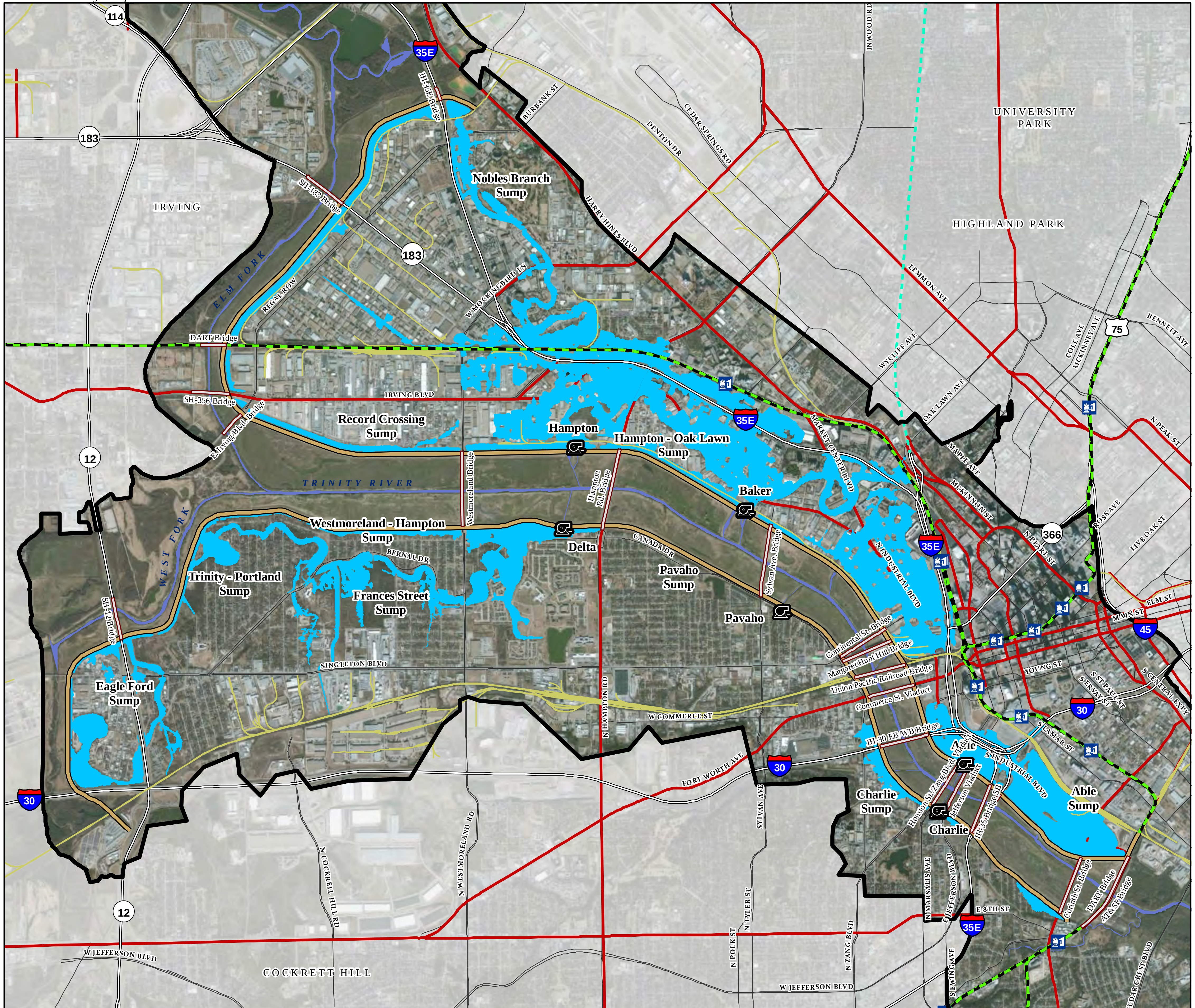

Figure 3.12-4
Location of Transportation Corridors within the Existing Predicted IDS 100-Year, 24-Hour Storm Event Inundation Area

LEGEND

- Pumping Plant
- DART Station
- DART Rail
- Railroad
- Freeway
- Tollway
- Bridge
- Regional Arterial
- Other Major Street
- 100-Year Flood Inundation Area
- Dallas Floodway Levee
- Study Area
- Surface Water

0 0.5 1 Kilometers

0 0.5 1 Miles

GIS Sources: City of Dallas 2006, 2008a, 2009a; NCTCOG 2008

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3.13 UTILITIES

3.13.1 Definition of Resource

This section focuses on the following utilities within the Study Area: gas and petroleum, communications, electricity, potable water, wastewater, and stormwater management. The City of Dallas and regional franchise utility companies have provided utility services to Dallas since 1873, when the Texas and Pacific railroads were first connected to the City and the population soared (Dallas Historical Society 2009).

3.13.1.1 Methodology

The following analysis of utilities describes regional utility conditions within the Study Area, describes the IDS of the Dallas Floodway, and identifies Floodway utility encroachments. Potential impacts and mitigation measures related to implementation of the Proposed Action are assessed based on their affects in relation to the existing utility system. The ROI for utilities is the Study Area.

3.13.1.2 Regulatory Framework

The Underground Facility Damage Prevention and Safety Act (1999) and the Underground Pipeline Damage Prevention Program regulate the notification, reporting, and management of excavation activities within Texas.

3.13.2 Existing Conditions

3.13.2.1 Utilities Within the Study Area

Major utilities within the Study Area include:

- Buried gas and petroleum lines;
- Buried and aboveground telecommunications cables (telephone, television, and fiber optic);
- Buried and aboveground electric transmission lines;
- Buried potable water supply lines;
- Buried wastewater lines; and
- Buried and aboveground stormwater management infrastructure (including the IDS) (City of Dallas 2006a; USACE 2009).

Figures 3.13-1 to 3.13-15, shown at the end of this section, depict the locations of utilities within the Floodway. These figures are for representation purposes only and should not be used as a substitute for utility location services prior to ground disturbances.

Gas and Petroleum

Atmos Energy provides natural gas service in the Study Area via a network of small and medium sized lines for local distribution and larger main natural gas lines. Also within the Study Area, United Gas owns abandoned gas pipelines, Explorer Pipeline Company owns petroleum pipelines, Chevron Corporation owns underground oil pipelines, and Magellan Pipeline Company owns a jet fuel pipeline, located within the western portion of the Study Area (FHWA 2014).

Communications

Existing communications network infrastructure includes telephone, cable television, a cellular tower, and fiber optic lines. The lines are all corporately owned and maintained. One licensed Federal Communications Commission cellular tower owned by AT&T is located north of the IH-30 Bridge. Companies maintaining buried communication cables include but are not limited to Comcast, Time Warner Cable, Verizon, AT&T, Hughes Net, Sage Telecom, and Primus Telecommunications Group (WhiteFence 2013).

Electricity

Dallas is within the Oncor Electricity Service Area, which provides electric service via 138 kV and 345 kV aboveground power lines and towers that are prevalent throughout the Study Area. Correspondingly, there are two electrical substations, one is located northwest of the Houston Street Viaduct, and the other is east of the IH-35 Bridge. Texas allows consumers to choose from Retail Electricity Providers that purchase energy from Oncor for transmission and distribution (State of Texas 2013). In the City of Dallas, the Retail Electricity Providers include Texas Utility (TXU) Energy, Reliant Energy, Bounce Energy, Direct Energy, Dynowatt, First Choice Power, Green Mountain Energy, Just Energy, Cirro Energy, New Leaf Energy, and Amigo Energy (WhiteFence 2013). TXU Energy is the main electricity supplier to the Dallas Floodway IDS.

Potable Water

The City of Dallas Water Utilities (DWU) Department provides potable drinking water to over 2.3 million people in a service area of approximately 700 square miles. The Study Area is located within the DWU service area. The DWU water supply is derived from a system of surface water reservoirs including Ray Roberts Lake, Lewisville Lake, Grapevine Lake, Lake Ray Hubbard, Lake Tawakoni, and Lake Fork. The DWU estimates its service population will grow to over 4.5 million individuals by the year 2060; thus, the conservation of water and beneficial water reuse are important strategies for future water supply planning efforts (City of Dallas 2006b).

Three water treatment plants (East Side, Elm Fork, and Bachman) provide potable water at a combined production capacity of 900 million gallons per day (MGD). The DWU has roughly 4,700 miles of buried water mains, 23 pump stations, and 21 water storage tanks to distribute the potable water to its customers (City of Dallas 2006c).

Wastewater

In addition to providing potable water, the DWU maintains two wastewater treatment plants, the CWWTP and Southside Wastewater Treatment Plant. Combined, these plants treat on average approximately 260 MGD of wastewater. Both plants produce tertiary treated wastewater that is either reused within the plants or discharged directly into the Trinity River. The DWU wastewater collection system is separate from the stormwater system. The DWU maintains 4,100 miles of wastewater mains and 14 wastewater pump stations that transport wastewater from the point of generation to one of the wastewater treatment plants (City of Dallas 2006c). Six pumping plants and nine wastewater mains are located within the Study Area. Currently, demand for wastewater services is being met by the DWU (City of Dallas 2013a).

The CWWTP is located 3 miles south of downtown Dallas adjacent to the Trinity River in the southern portion of the Study Area. Riverine flood risk to the CWWTP is reduced by an encircling levee, separate from the Dallas Floodway levee system, which provides FRM for floods up to the 100-year flood event.

3.13.2.2 Interior Drainage System

The following sections describe the existing stormwater management system and the locations and types of existing utility service lines, electric substations, and high-voltage overhead lines that directly cross or are located near the sumps and pump stations.

The stormwater runoff control system in the City of Dallas consists of a wide array of physical components including overland flow paths, channels, detention storage, floodplains, and larger downstream storage areas. The stormwater control system physical components include the following:

- Levees equipped with pump stations and gravity sluices (e.g., the East Levee Interior Drainage System and the Levee Interior Drainage System constructed in the early 1930s and collectively known as the EWLIDS);
- Sump ponds (natural topographically low areas in the terrain that collect, convey, and store stormwater);
- Major drainage ways (e.g., large concrete-lined surface channels leading toward sumps, and natural channels);
- Streets (part of overland flow, or the flow of stormwater on the surface until it reaches an inlet or a detention facility);
- Storm sewers (e.g., pressure sewers featured as part of the EWLIDS and smaller gravity storm sewers that gather portions of the basin and convey water to major drainage ways);
- Flow control devices (e.g., stormwater gates and gravity sluices (sluice gates) and pumps);
- Trash racks, storm inlets, or grates (e.g., trash racks installed near pumping plants remove large debris from the sump basins prior to pumping); and
- Detention facilities (e.g., water storage sumps and detention ponds that hold stormwater either until it is evaporated or allowed to flow or be pumped elsewhere).

In 1968, the City of Dallas assumed from the Dallas County Flood Control District responsibility for the operation and maintenance of the Trinity River Levee System within the City of Dallas limits.

The City of Dallas Trinity Watershed Management Flood Control Division (TWMFCD) operates and maintains the Dallas Floodway and the EWLIDS under the regulatory control of the USACE. FRM is the primary service provided by the Flood Control Division, and flood risk reduction is provided through the maintenance and operation of the Dallas Floodway Project consisting of pump stations, pressure sewers, levees, flood walls, drainage/closure structures, channels, Floodway and miscellaneous facilities. Other duties of the TWMFCD include: maintenance of Flooded Roadway Warning System, flood gauge sites, retention/detention basins, and Civil Defense sirens; removal of blockages on City-owned creeks/channels, storm sewers; and response to inclement weather emergencies such as snow/ice, wind storms and street flooding (City of Dallas 2013b).

The City of Dallas TWMFCD manages interior stormwater drainage in the EWLIDS to the Floodway in several ways. These methods include the following:

- Allowing the stormwater runoff to pool in sumps before pumping the water over the levee into the Floodway;
- Allowing the stormwater runoff to pool in sumps and then allowing it to flow through the levee via pipes; and

- Collecting the stormwater runoff higher in the drainage basin and conveying it into the Floodway through pressure sewers.

Each basin either drains to a specific sump where water is conveyed to the Floodway through a pumping plant or via a gravity sluice (Table 3.13-1). Many of the sump ponds are old river channels that have been cut off from the West Fork, Elm Fork, and main stem of the Trinity River by levees. These old channels are natural topographically low areas in the terrain that collect, convey, and store stormwater. In addition, there are storage ponds and levee borrow ditches that run adjacent to the levees and accumulate stormwater. Some stormwater runoff is captured higher up the basin in creeks and conveyed to the Floodway via pressure sewers.

Table 3.13-1. Pumping Plant to Sump to Basin Relationship

Basin	*Sump*	*Pumping Plant*
East Levee Interior Drainage System		
Hampton	Records Crossing/Nobles Branch	Hampton
Baker	Hampton-Oak Lawn	Baker
Able	Able	Able
West Levee Interior Drainage System		
Eagle Ford	Eagle Ford	None - sluice gate
Delta	Trinity Portland/Westmoreland-Hampton/ Frances Street	Delta
Pavaho	Pavaho	Pavaho
Charlie	Charlie/Corinth Street	Charlie

Sources: City of Dallas 2006a, 2009.

Table 3.13-2 presents the predicted and design 100-year, 24-hour storm event water levels for each of the sumps. The design water levels correspond to original (1960s- and 1970s-era) 100-year, 24-hour storm events, which reflected stormwater basin conditions at that time. Primarily due to changes in the stormwater basins, the design storm event water levels no longer reflect current stormwater basin conditions (City of Dallas 2006a, 2009).

Table 3.13-2. Original Design and Predicted 100-year, 24-hour Storm Event Water Levels

Sump[1]	*Design Storm Event Water Level (feet)*	*Predicted Storm Event Water Level (feet)*
East Levee		
Record Crossing/Nobles Branch	405.0/408.1	405.8/409.3
West Levee		
Eagle Ford	416.0	417.3
Trinity-Portland	413.0	411.9
Frances Street	410.1	410.2
Westmoreland-Hampton	406.9	408.4
Charlie	404.1	403.5
Corinth Street	404.3	402.1

Note: [1] Data for the sumps associated with the Pavaho, Baker, and Able Pumping Plants not included.
Sources: City of Dallas 2006a, 2009.

By design, pumping plants can manage stormwater (i.e., eject stormwater to the Floodway) up to their respective design storm event water levels. Where the predicted 100-year, 24-hour storm event water levels are greater than the original design storm event water levels, it indicates that the associated pumping plant is undersized to handle the predicted volume of stormwater, and flooding is likely. For a detailed discussion of property damage potentially cause by the 100-year, 24-hour storm event, refer to Section 3.11.

Hampton Basin

The Hampton Basin consists of approximately 6,355 acres. Stormwater within the Hampton Basin flows through various stormwater runoff control system components into either the Record Crossing Sump or the Nobles Branch Sump. The sump area for the Hampton Basin consists of the old Elm Fork and Trinity River channels between Empire Central Drive and Inwood Road, and levee borrow ditches adjacent to the East Levee. A gated culvert structure (Grauwyler Gate) located at Empire Central Drive divides the lower part of the sump (Record Crossing Sump) from the upper part (Nobles Branch Sump). When water levels rise high enough in Record Crossing Sump, water flows to the low point of Inwood Road at the Trinity Railway Express underpass, creating a significant hazard to motorists and jeopardizing adjacent property (City of Dallas 2006a). The Record Crossing/Nobles Branch Sump design storm event water levels (405.0/408.1 feet) are below the current predicted storm event water levels (405.8/409.3 feet), indicating the pumping plant is undersized to handle the predicted volume of stormwater, and flooding is likely (City of Dallas 2006a, 2009).

The Hampton Pumping Plant is located on the West Levee southwest of the intersection of Irving Boulevard and Inwood Road, and consists of two pump stations, Old Hampton and New Hampton. Old Hampton was constructed in 1958 with four, 50,000-gpm pumps. One additional 2,500-gpm sump pump was added by the City of Dallas in 1969. The New Hampton Pumping Plant was constructed in 1975 and has five, 80,000-gpm pumps and one, 6,000-gpm sump pump. The Hampton Pumping Plant outfall passes under the East Levee at a depth of approximately 40 feet below the levee crest and discharges approximately 57 feet from the toe of the levee (City of Dallas 2006a).

Major utilities that provide more than local service and are located in the Hampton Basin include the following:

- A high-pressure gas line that parallels the East Levee;
- Natural gas trunk lines that go through the Hampton Basin and cross under the East Levee and the Elm Fork;
- A 138 kV overhead electric line; and
- An underground jet fuel pipeline (USACE 2009; City of Dallas 2008).

Delta Basin

The Delta Basin consists of approximately 4,414 acres and drains to three sumps: the Trinity-Portland Sump, the Westmoreland-Hampton Sump, and the Frances Street Sump. The sumps generally convey stormwater eastward, toward the Delta Pumping Plant where stormwater runoff is then pumped to the Floodway. Several culverts connect the Westmoreland-Hampton Sump and Frances Street Sump, most notably two reinforced concrete pipe culverts located beneath North Westmoreland Road (City of Dallas 2009).

The Delta Pumping Plant is located off Canada Drive west of North Hampton Road on the West Levee. Constructed in the 1930s, the Delta Pumping Plant was originally equipped with two, 30,000-gpm pumps. In 1963, the City of Dallas added two 42,000-gpm pumps to the Delta Pumping Plant. In 1979, an additional 6,000-gpm sump pump was added. The Delta Pumping Plant station is outfitted with automated trash racks. The Delta Pumping Plant outfall passes under the West Levee at a depth of approximately 46 feet below the levee crest and discharges approximately 46 feet from the toe of the levee. Two of the sumps in the Delta Basin, Frances Street and Westmoreland-Hampton, were designed for storm event water levels (410.1 feet and 406.9 feet, respectively) that are below the current predicted storm event levels (410.2 feet and 408.4 feet), indicating the pumping plant is undersized to handle the predicted volume of stormwater, and flooding is likely (City of Dallas 2006a, 2009).

Underground utilities including communication lines, drinking water, sanitary sewer, stormwater, and gas traverse the Delta Basin (USACE 2009). The Delta Pumping Plant is powered via an underground electrical line (City of Dallas 2009).

Charlie Basin

The Charlie Basin consists of approximately 779 acres. Stormwater runoff collects in the Charlie Sump or Corinth Sump and is subsequently pumped into the Floodway via the Charlie Pumping Plant. In addition to the Charlie Pumping Plant, two 6-foot by 8-foot gravity sluices located on either side of the Lake Cliff Pressure Sewer outfall structure provide additional drainage of the Charlie Sump to the Floodway (City of Dallas 2009).

The Charlie Pumping Plant is located between the Houston Street Viaduct and the Jackson Street Viaduct on the West Levee. Constructed in the early 1930s, the Charlie Pumping Plant was originally equipped with two, 30,000-gpm pumps. In 1963, the City of Dallas added two, 40,000-gpm pumps. In 1979, a 6,000-gpm sump pump was built. The Charlie main pump station is outfitted with an automated trash rack. The Charlie Pumping Plant outfall passes under the West Levee at a depth of approximately 40 feet and discharges approximately 77 feet from the toe of the levee (City of Dallas 2006a). The Charlie and Corinth Street Sumps meet the design storm event water levels; however, the potential for flood waters to affect structures in these basins still exists (City of Dallas 2006a, 2009).

A major underground gas line crosses the West Levee north of the Houston Street Viaduct and continues south into the Charlie Basin (USACE 2009). The Charlie Pumping Plant is powered via an overhead electrical line (City of Dallas 2009).

Eagle Ford Basin

The Eagle Ford Basin consists of approximately 2,000 acres and covers the southwestern most portion of the Study Area. The Eagle Ford Sump consists of a series of ponds connected by various culverts. The Eagle Ford Sump is the westernmost sump area in the West Levee Interior Drainage System. The West Levee contains the sump to the west and north, and IH-30 and SH-12 enclose the sump from the south and east, respectively.

Water from Eagle Ford Sump drains to the West Fork of the Trinity River through two, 4-foot, 6-inch square gravity sluices located just upstream of Loop 12. The Eagle Ford Sump has an emergency overflow into the Trinity-Portland Sump via a concrete drop inlet located just east of Loop 12. During periods of high water (above 417.5 feet), a 24-inch gated opening is designed to convey water from the sump into the adjacent Trinity-Portland Sump. However, the inlet routinely fills with silt and debris, and its position high above the ground surface makes routine cleaning out of the silt and debris difficult. Consequently, the normal condition is practically no movement of stormwater between Eagle Ford Sump and Trinity-Portland Sump. The Eagle Ford Sump design storm event water level (416.0 feet) is below the predicted storm event water level (417.3 feet), indicating the pumping plant is undersized to handle the predicted volume of stormwater, and flooding is likely (City of Dallas 2006a, 2009).

Major utilities (larger than local service pipelines and wires) in the Eagle Ford Basin consist of two underground petroleum pipelines located approximately 0.5 mile west of Loop 12 (just outside of the Study Area) and overhead power lines (USACE 2009). In addition, an underground fiber optic line runs under the levee at approximately the terminus of Mexicana Road. The approximate locations of the utilities are shown in relationship to streets and the levee on Figures 3.13-1 through 3.13-15. These figures are located at the end of this section to facilitate reading.

3.13.2.3 Floodway Utility Encroachments

There are hundreds of utility crossings within, through, above, or adjacent to the Floodway. For example, more than 50 fiber optic communications lines cross the Floodway. Six interceptor sewer mains, which are large pipes for conveying wastewater to treatment plants, are located within the Study Area, along with an extensive network of smaller service lines (City of Dallas 2006b).

Utility crossings and encroachments are not considered to diminish proper functioning of the levees if they are designed and constructed in accordance to USACE guidance related to construction within Floodways and pipelines and other utility lines crossing levees. All utility work performed between the East and West Levees is subject to USACE criteria set forth in *USACE Pamphlet 1150-2-1, Criteria for Construction within the Limits of Existing Federal Flood Protection Projects*. Recommendations from *USACE Engineer Manual 110-2-1913* are also being considered when determining if potential diminished functioning of the levees would result from utility encroachment. The proposed utility encroachments that would alter or modify the Dallas Floodway levees require a Section 408 permit from the USACE, and the USACE would determine if the proposed activities are likely to inhibit operation and maintenance, emergency operations, or would result in potential negative impacts on the integrity of the levees (City of Dallas 2008). Some existing encroachments within the Study Area are considered unauthorized, as the project proponents did not obtain authorization through the USACE permitting process.

Utility encroachments rated as “minimally acceptable” along the East Levee include fiber optic cables east of the Hampton/Inwood Road Bridge and west of the Westmoreland Road Bridge. Along the West Levee, “minimally acceptable” utility encroachments in place include fiber optic lines east of both Westmoreland Avenue Bridge and Hampton/Inwood Road Bridge (USACE 2009). A minimally acceptable rating equates to one or more minor deficiencies that would not seriously impair the functioning of the levee during the next flood event.

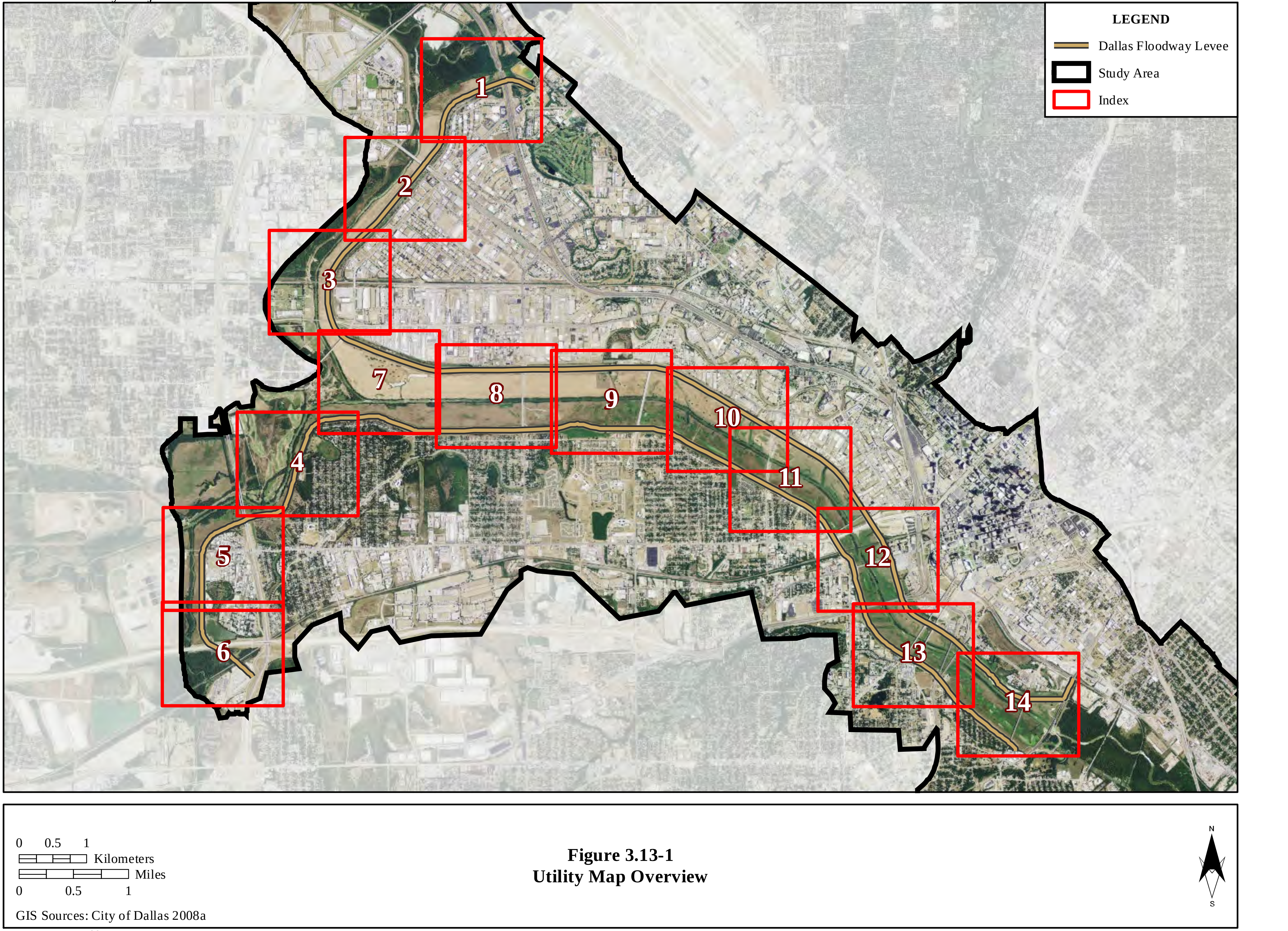


Figure 3.13-1
Utility Map Overview

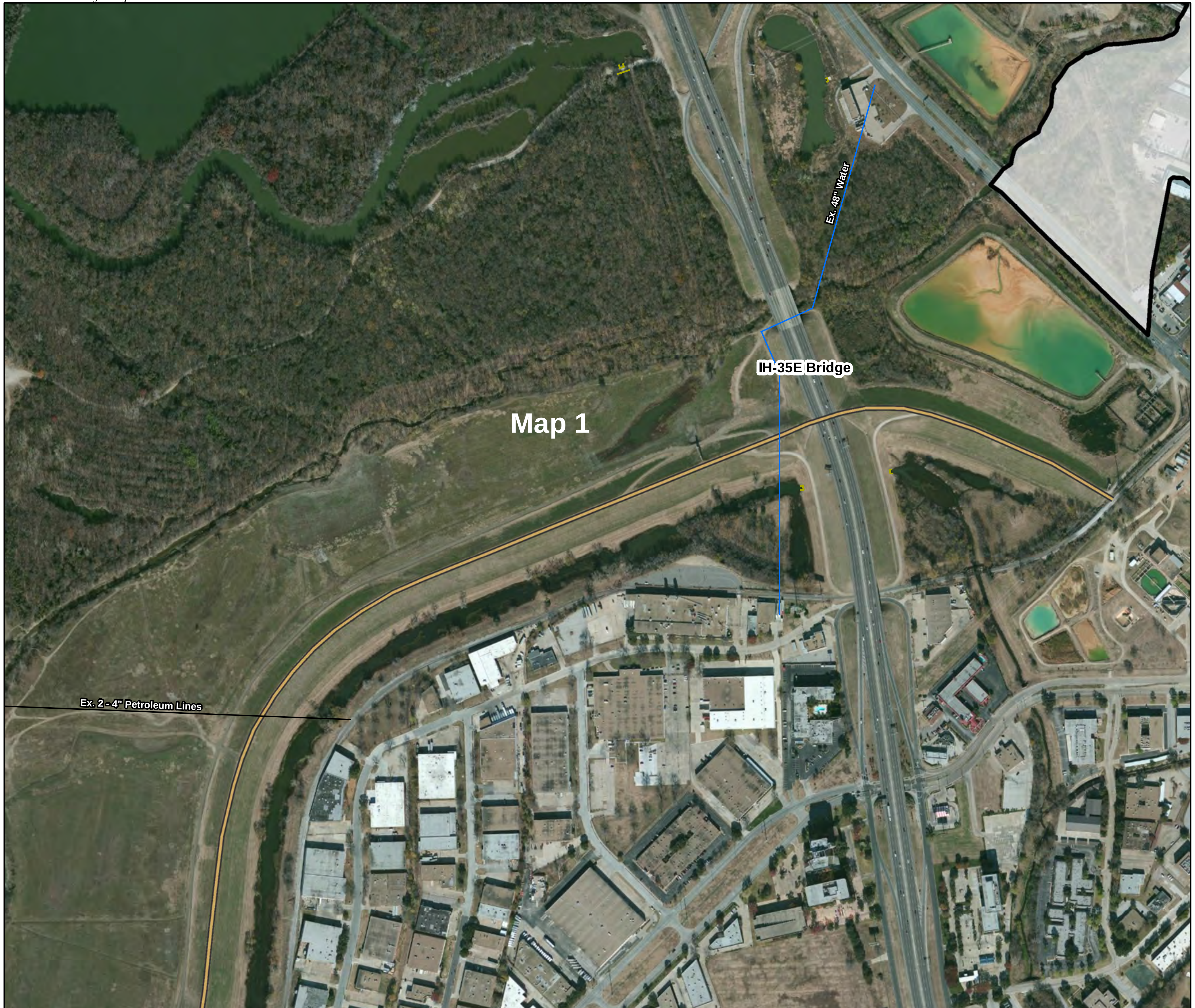


Figure 3.13-2
Existing Utilities Detail: Map 1

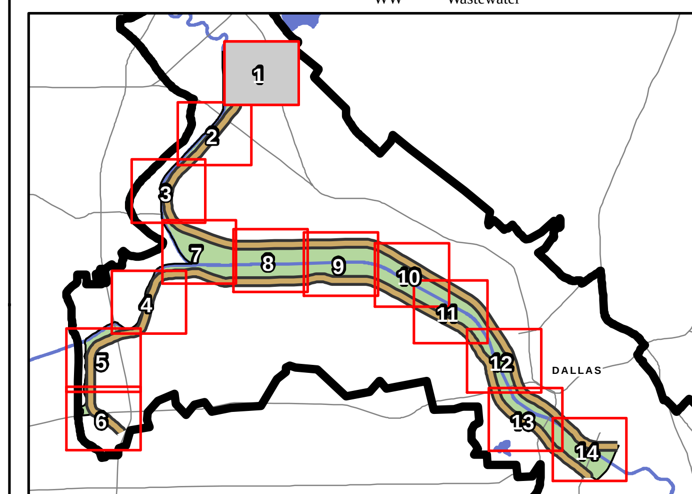
LEGEND

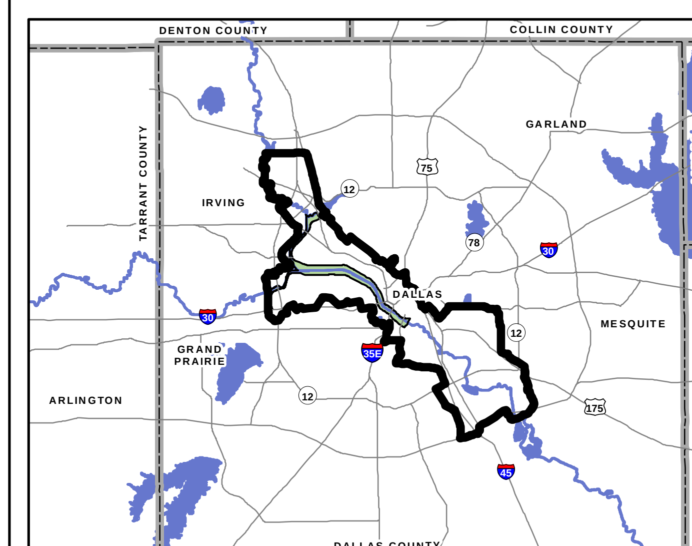
Utility Lines

- Petroleum
- Sewer
- Water
- Dallas Floodway Levee Crest
- Study Area

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





0 100 200 Meters

0 250 500 Feet

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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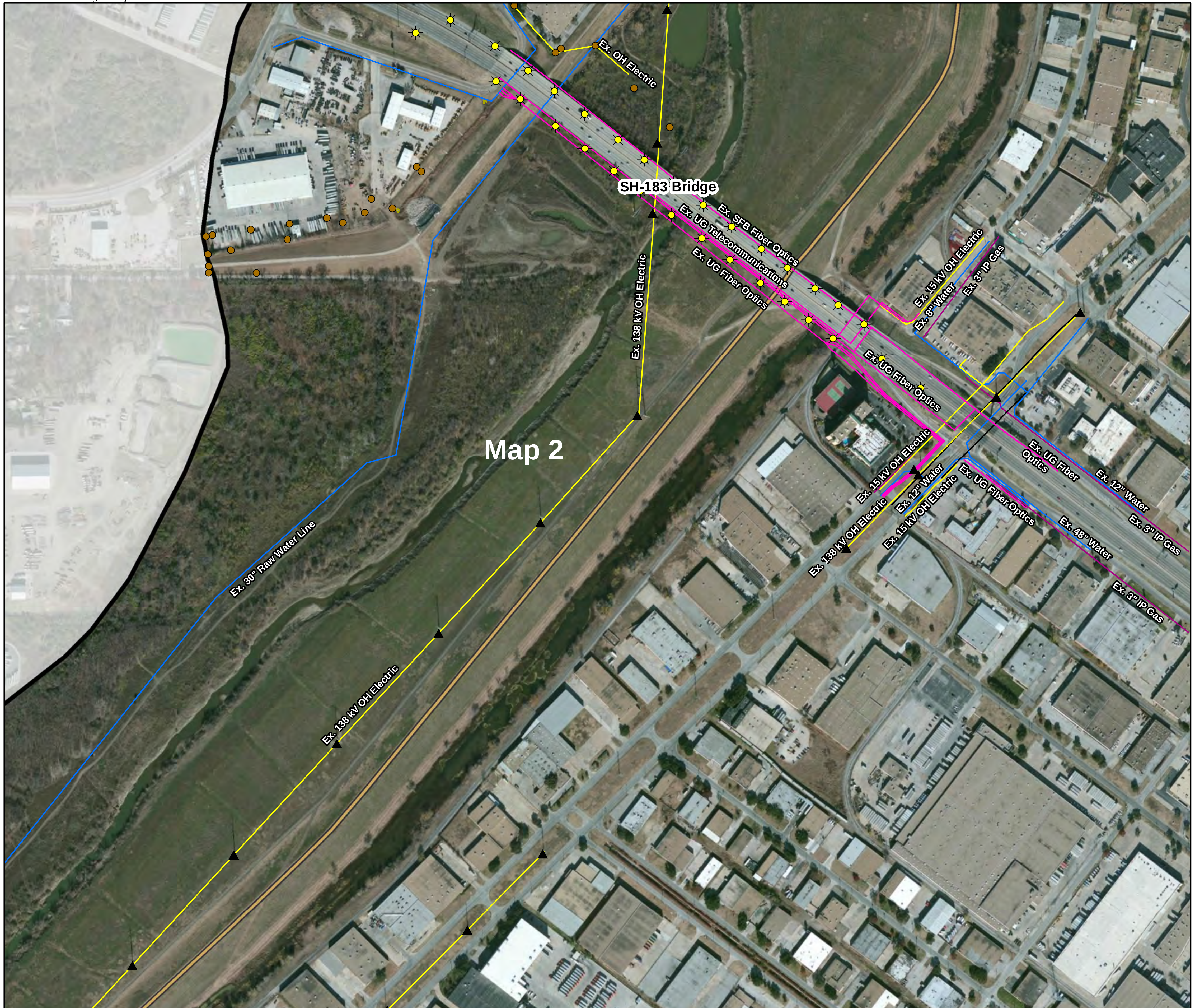
Figure 3.13-3
Existing Utilities Detail: Map 2



LEGEND

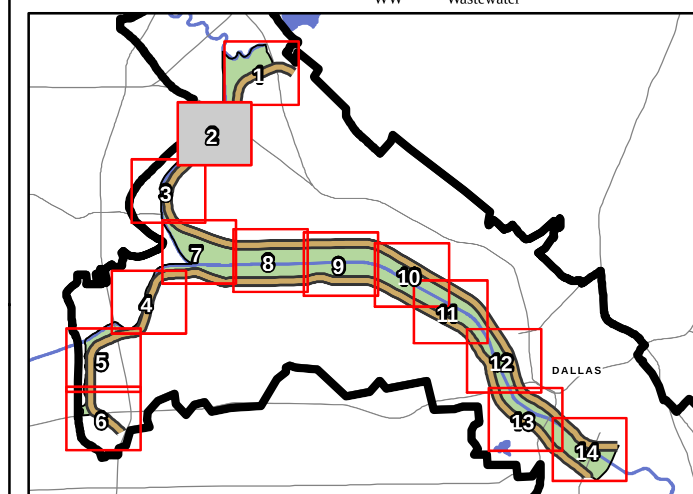
- Exterior Light
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

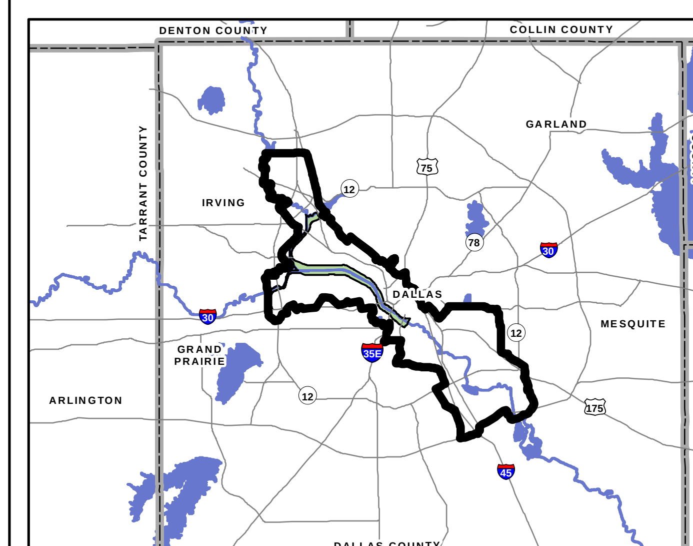
Utility Lines

- Communication
- Electrical
- Natural Gas
- Petroleum
- Sewer
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





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GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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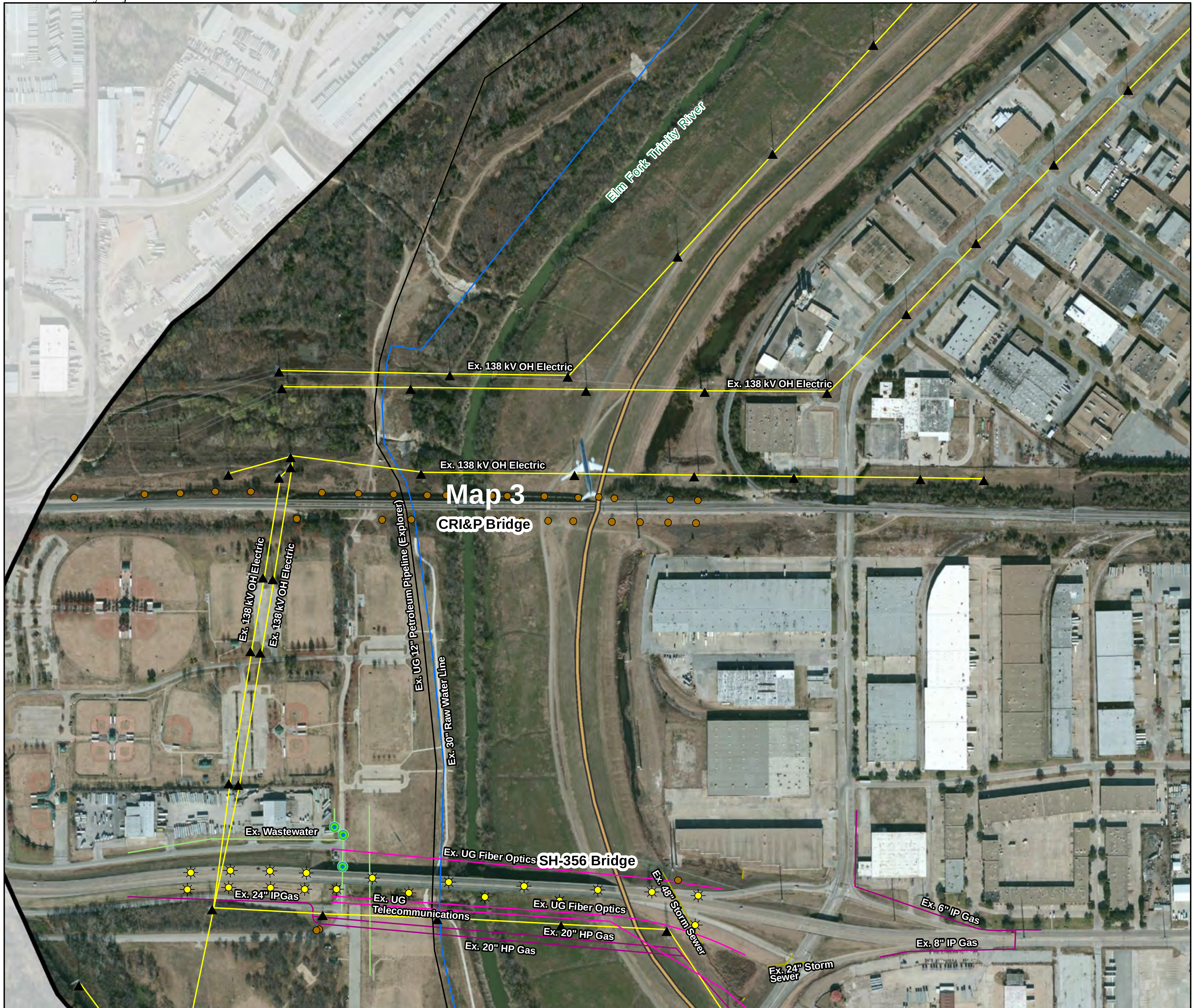
Figure 3.13-4
Existing Utilities Detail: Map 3



LEGEND

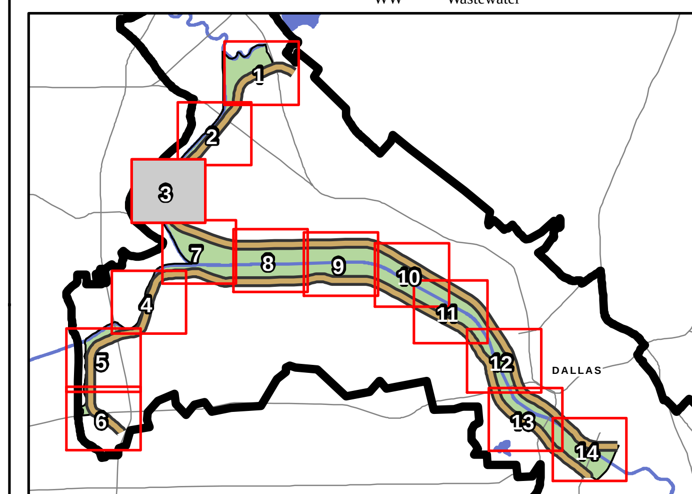
- Manhole
- Exterior Light
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

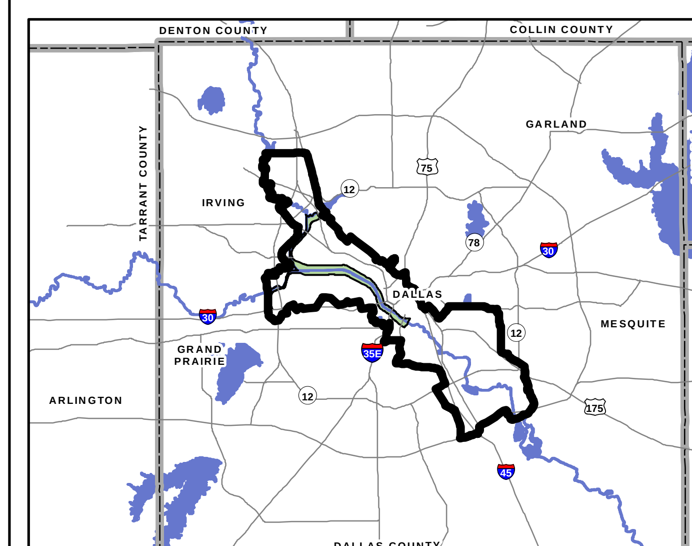
Utility Lines

- Communication
- Electrical
- Natural Gas
- Petroleum
- Sewer
- Wastewater
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





0 100 200 Meters

0 250 500 Feet

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

Figure 3.13-5
Existing Utilities Detail: Map 4

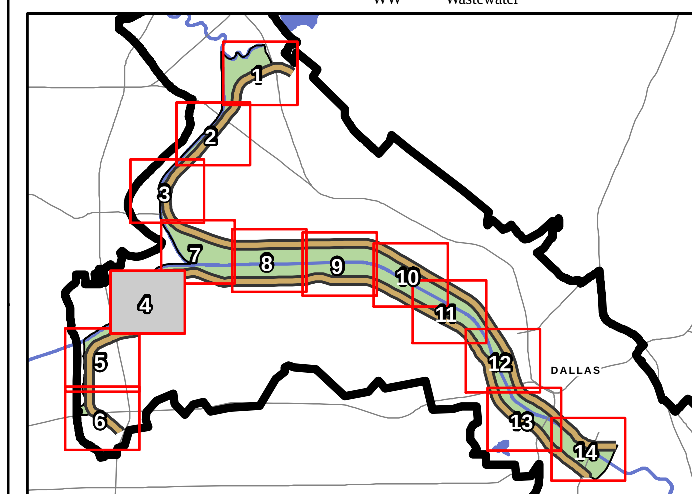
LEGEND

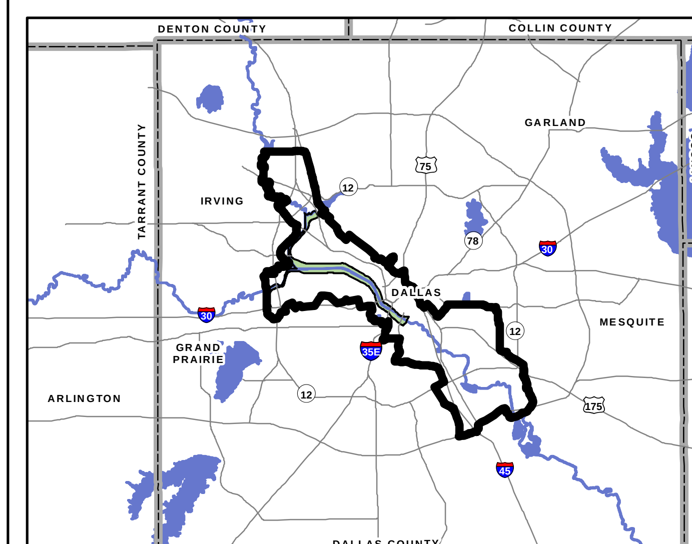
Power Pole
Transmission Tower
Dallas Floodway Levee Crest
Study Area

Utility Lines
Communication
Electrical
Petroleum
Sewer

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





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0 250 500 Feet

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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Figure 3.13-6
Existing Utilities Detail: Map 5

LEGEND

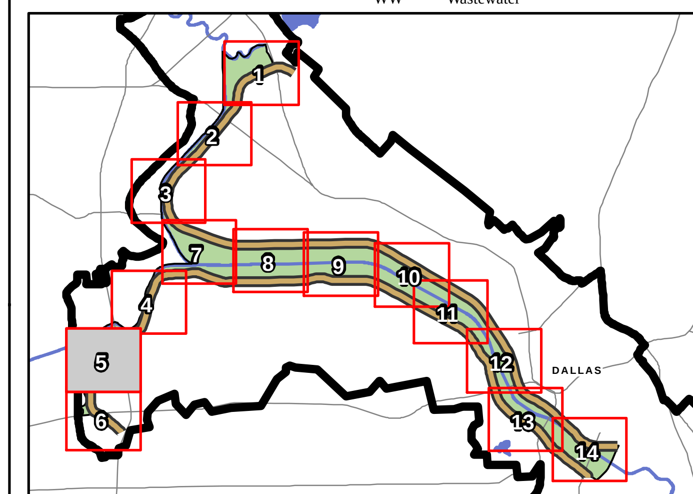
- ▲ Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

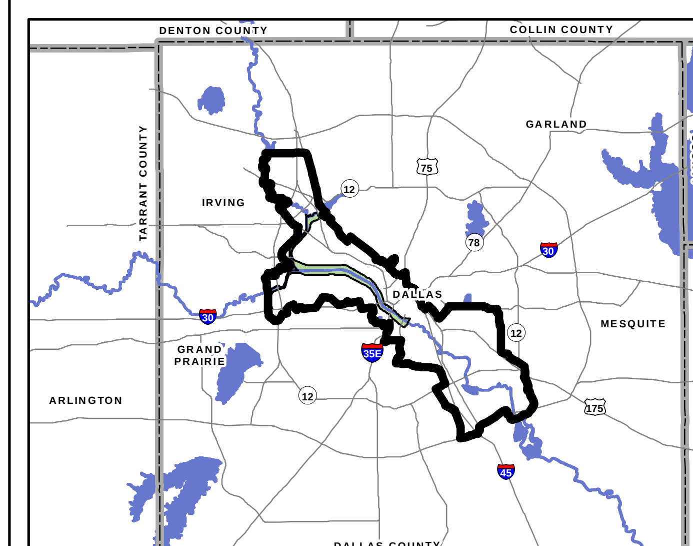
Utility Lines

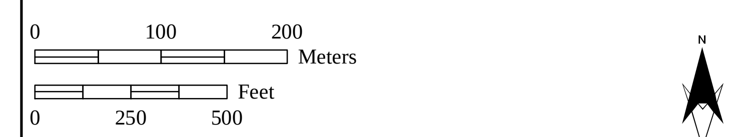
- Electrical
- Sewer
- Wastewater

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater







GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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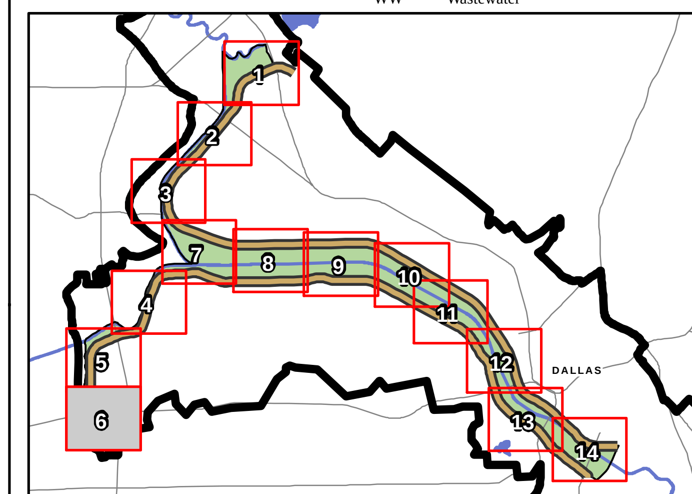
Figure 3.13-7
Existing Utilities Detail: Map 6

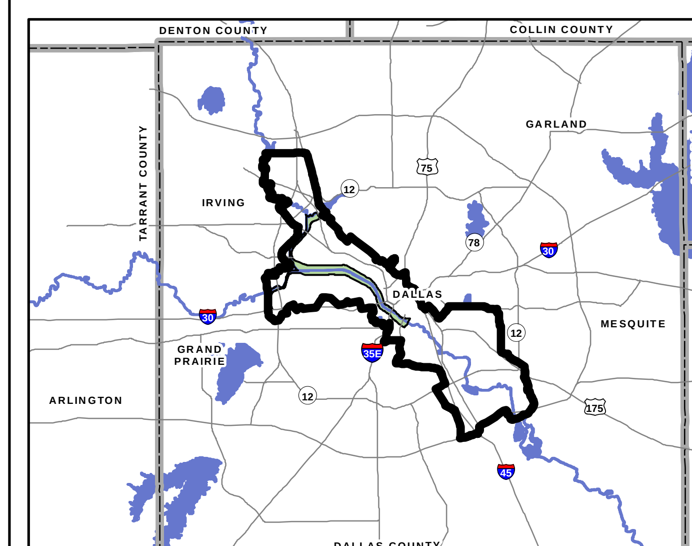
LEGEND

Dallas Floodway Levee Crest
Study Area

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





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GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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Figure 3.13-8
Existing Utilities Detail: Map 7

LEGEND

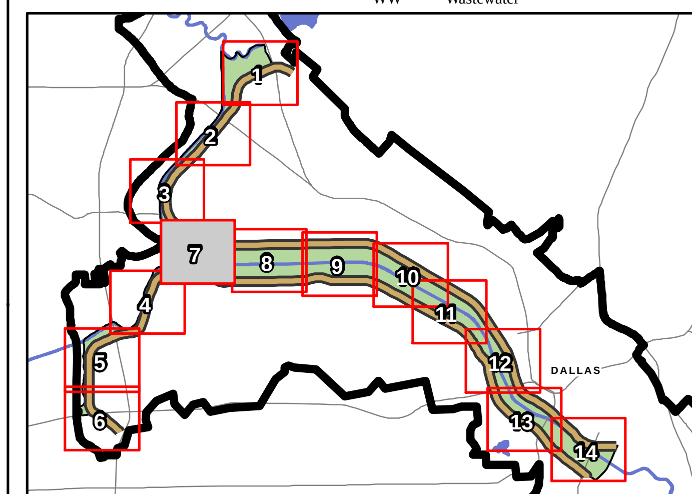
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

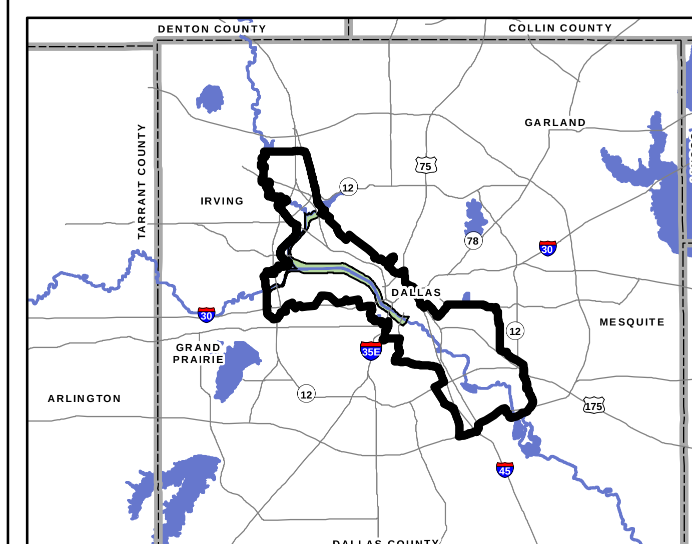
Utility Lines

- Abandoned Oil and Gas
- Communication
- Electrical
- Natural Gas
- Petroleum
- Sewer
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





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GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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Figure 3.13-9
Existing Utilities Detail: Map 8

LEGEND

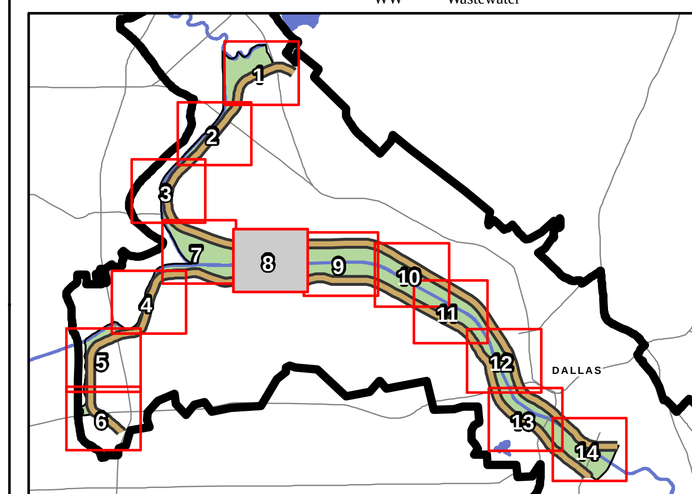
- Exterior Light
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

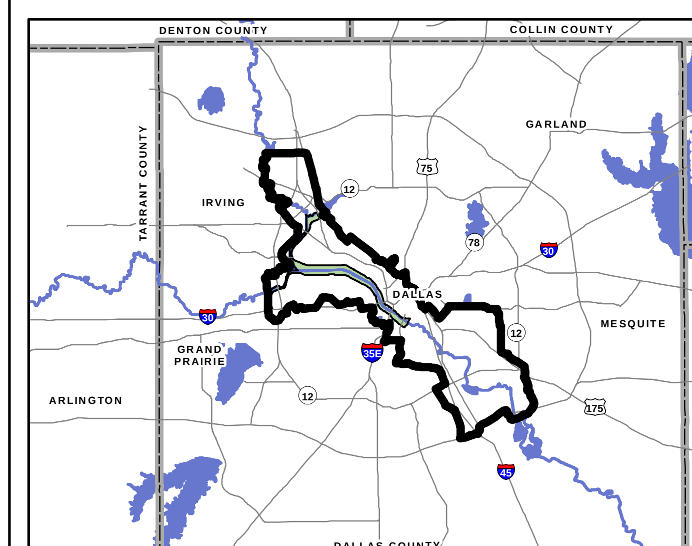
Utility Lines

- Abandoned Oil and Gas
- Communication
- Electrical
- Natural Gas
- Petroleum
- Sewer
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





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0 250 500 Feet

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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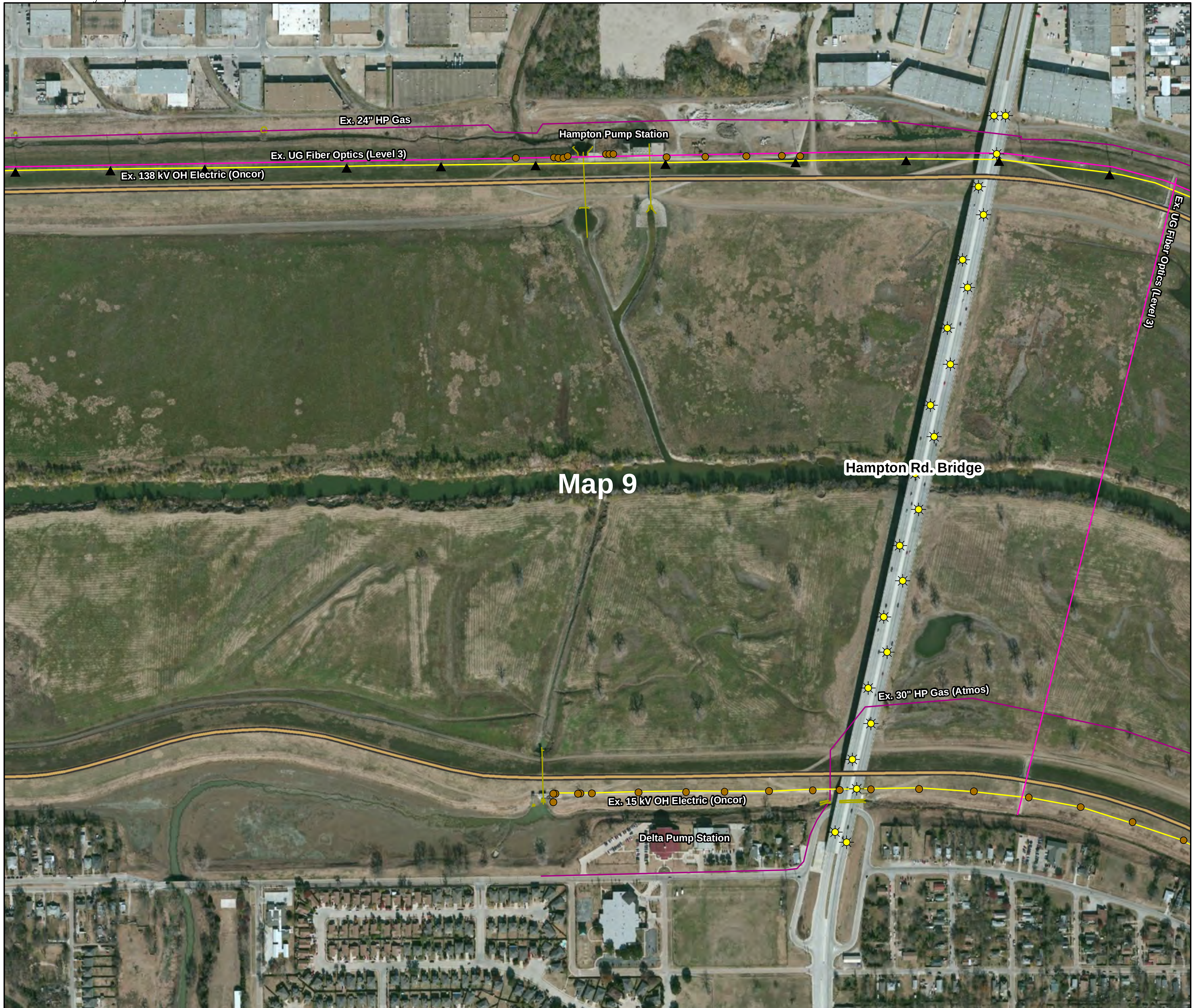


Figure 3.13-10
Existing Utilities Detail: Map 9

LEGEND

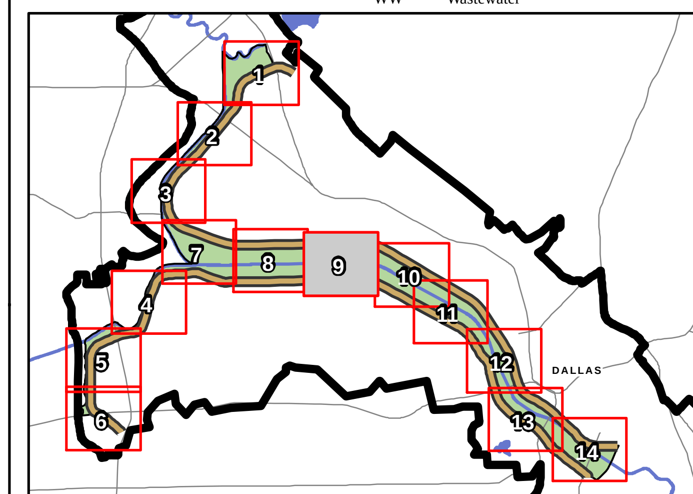
- Exterior Light
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

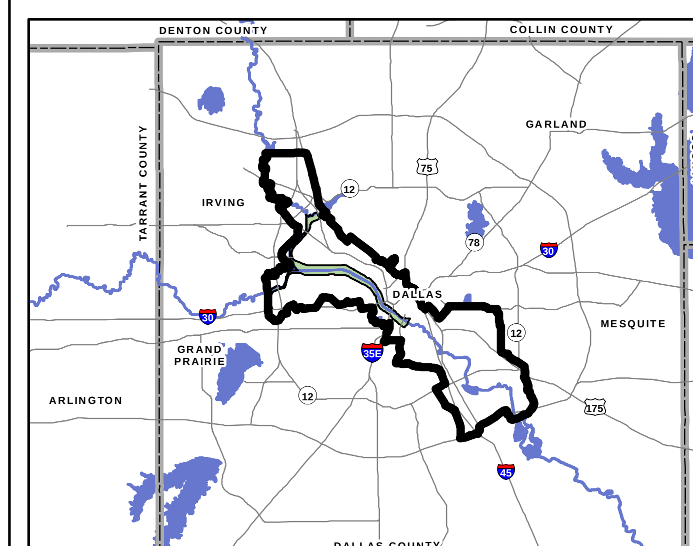
Utility Lines

- Communication
- Electrical
- Natural Gas
- Sewer

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater



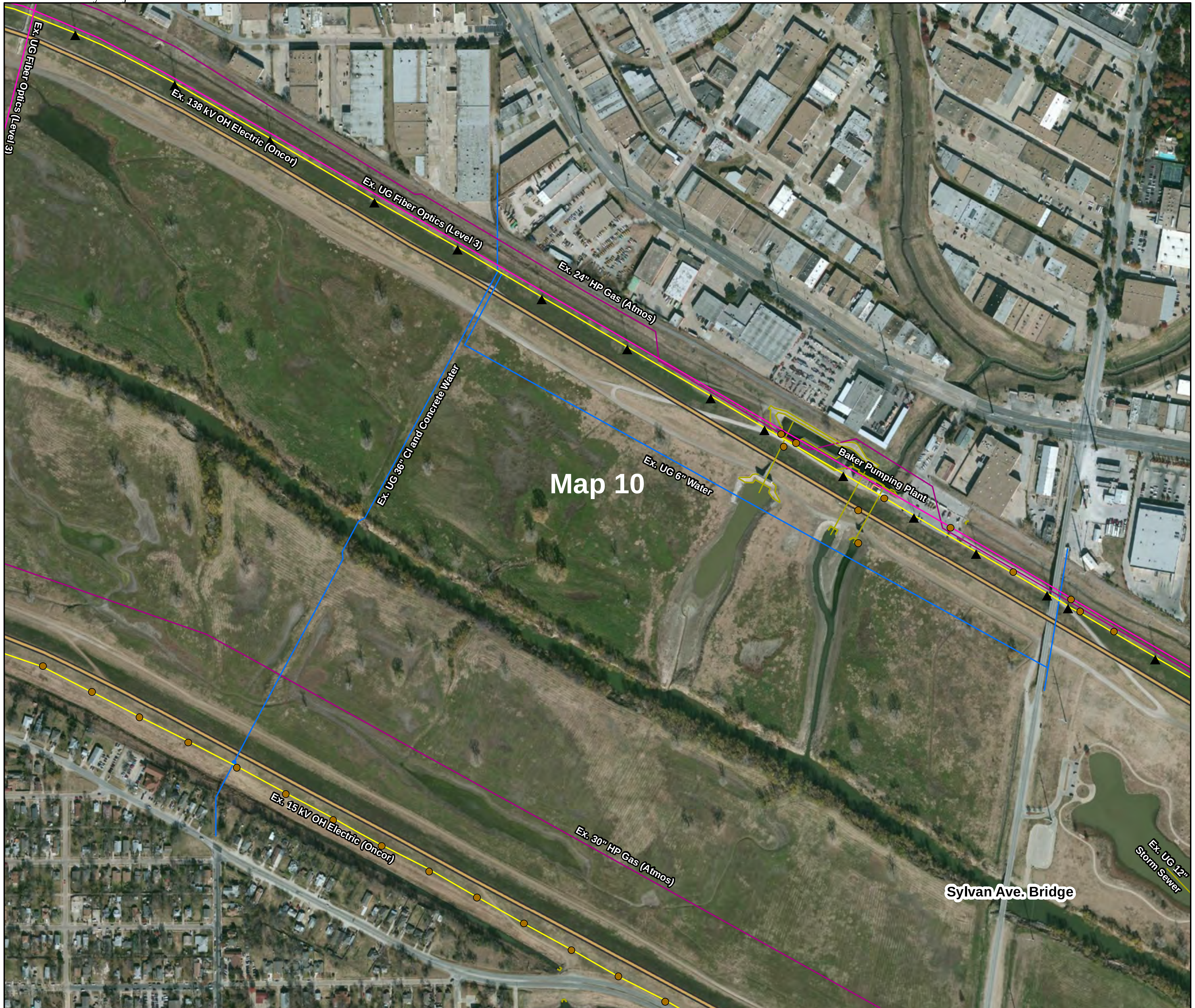


0 100 200 Meters

0 250 500 Feet

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

Figure 3.13-11
Existing Utilities Detail: Map 10



LEGEND

- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

Utility Lines

- Communication
- Electrical
- Electrical Substation
- Natural Gas
- Sewer
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
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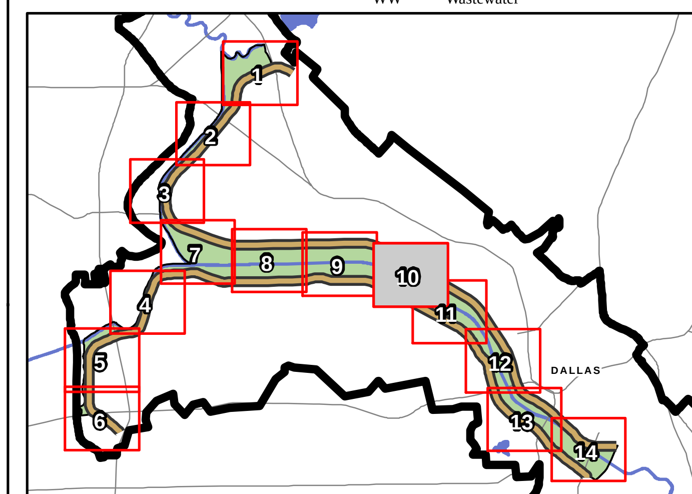

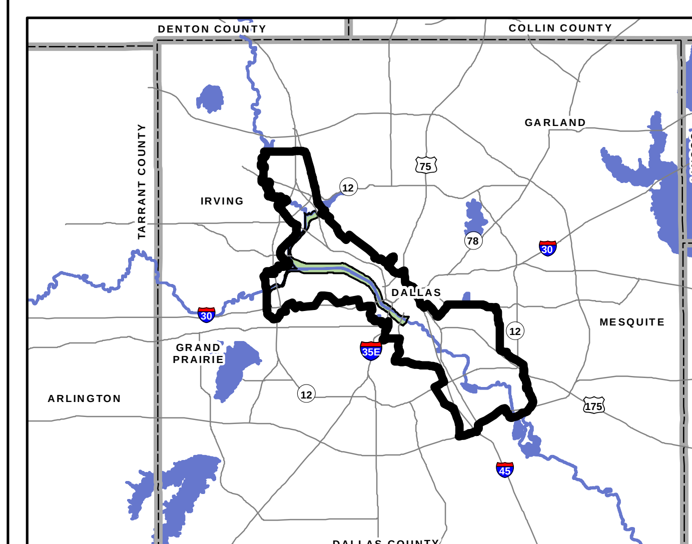

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0 250 500 Feet

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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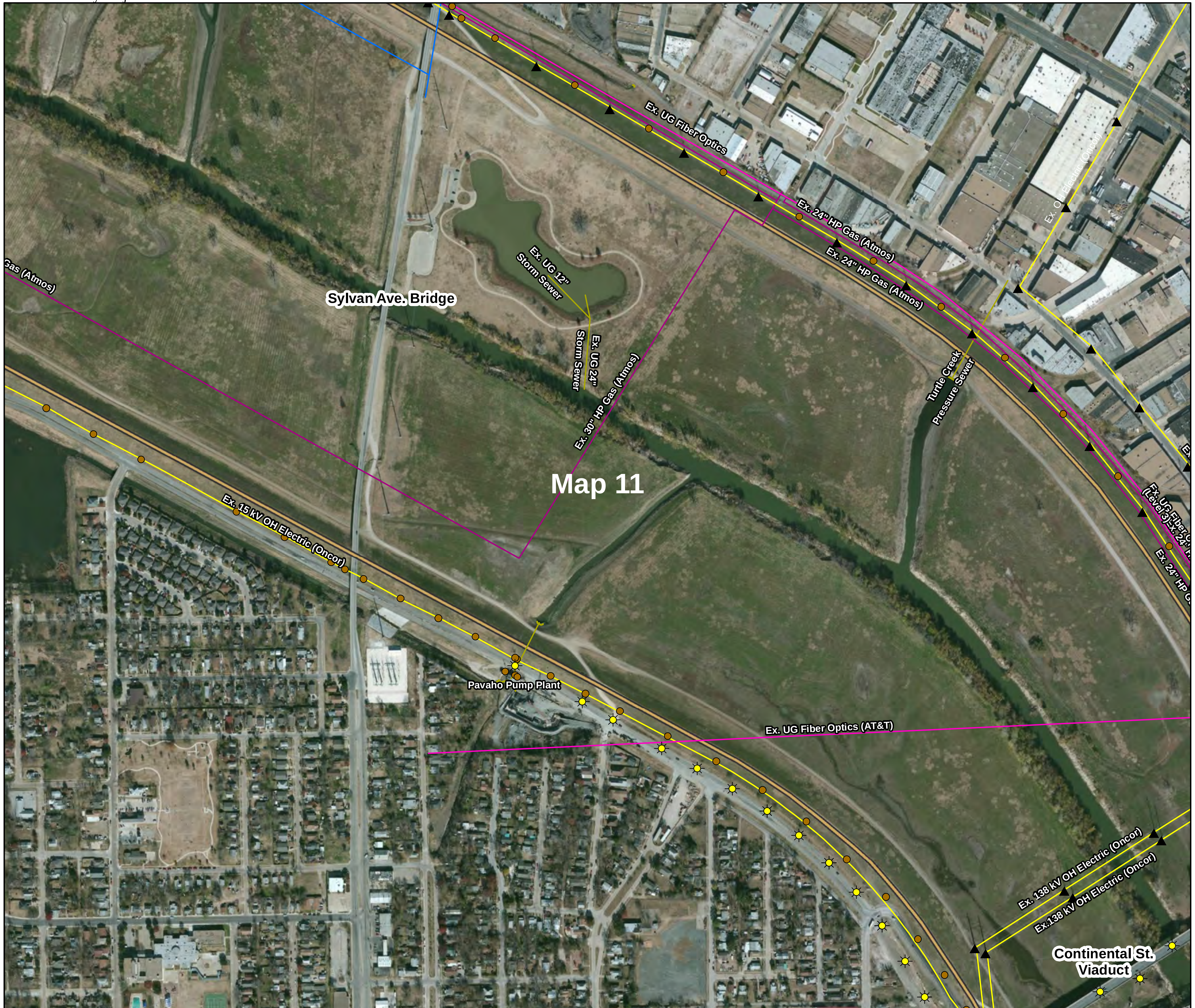
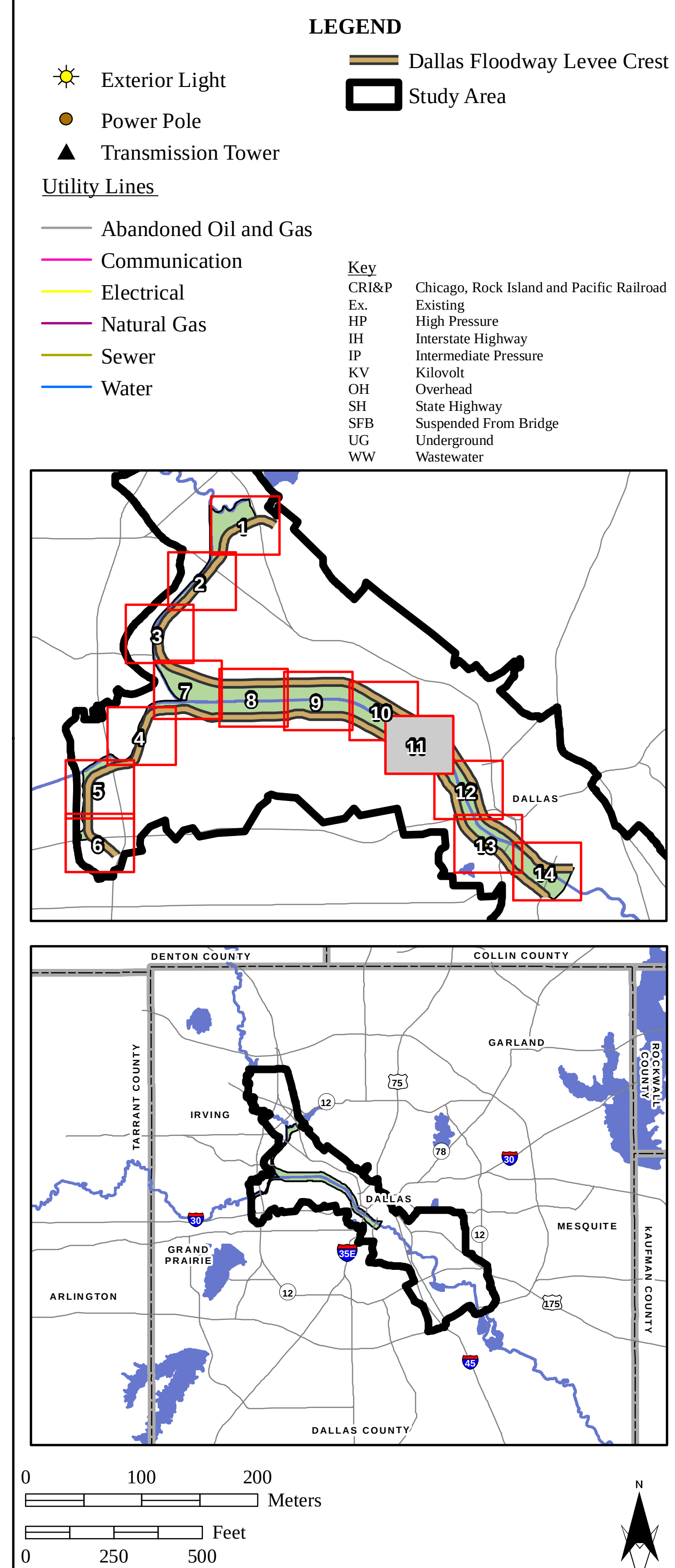


Figure 3.13-12
Existing Utilities Detail: Map 11



GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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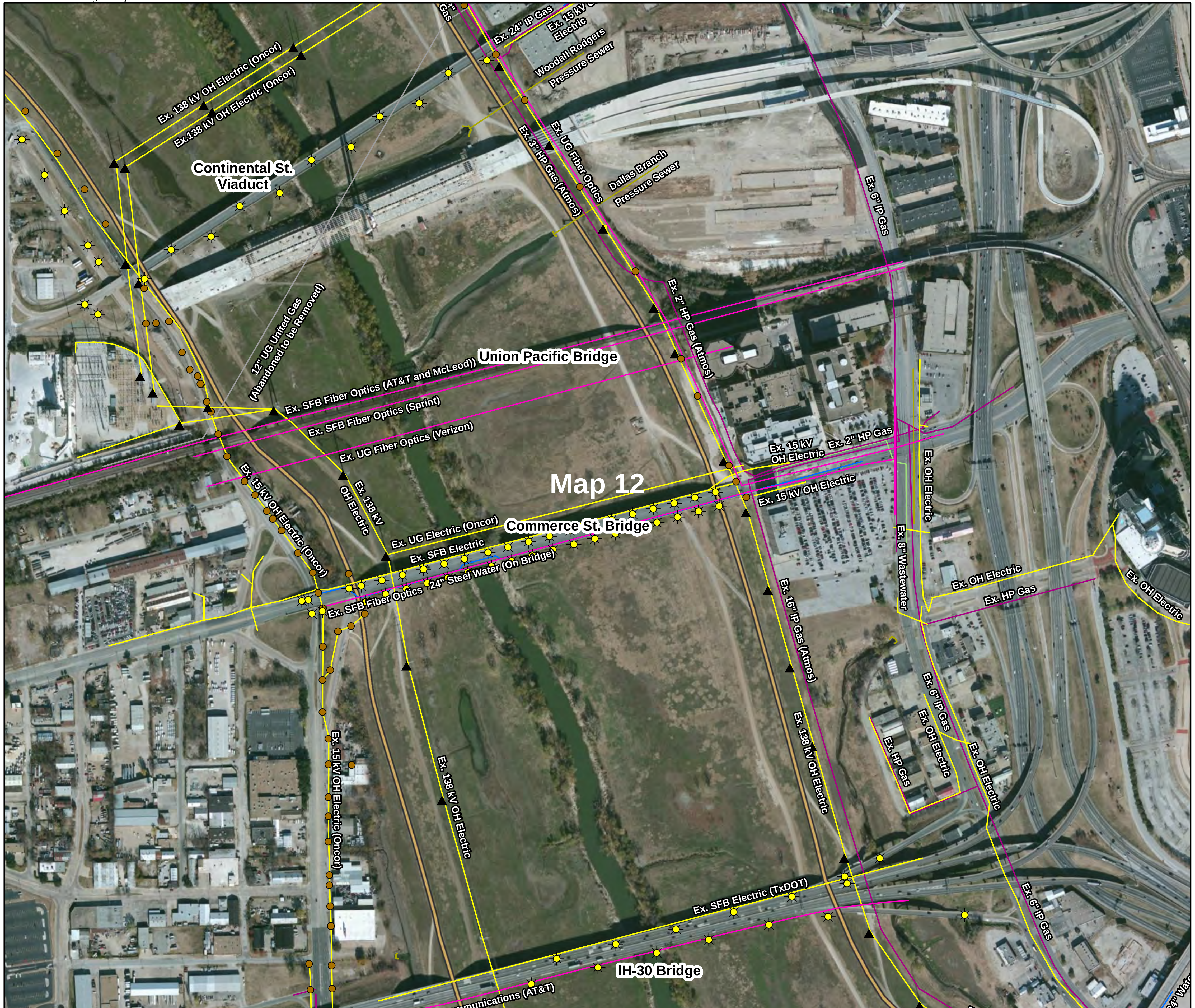


Figure 3.13-13
Existing Utilities Detail: Map 12

LEGEND

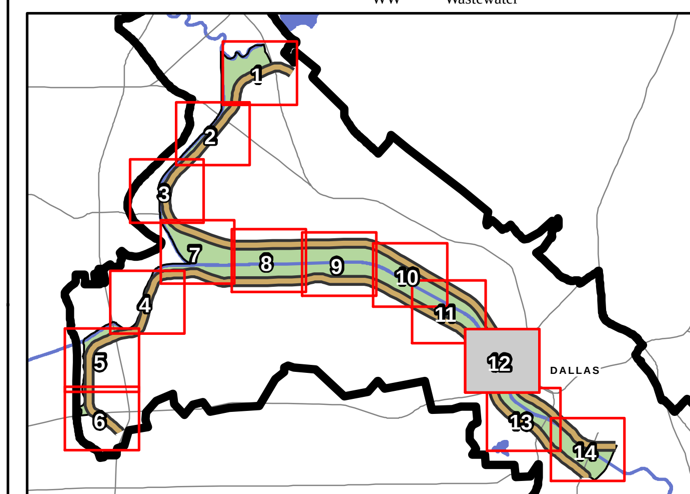
- Exterior Light
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

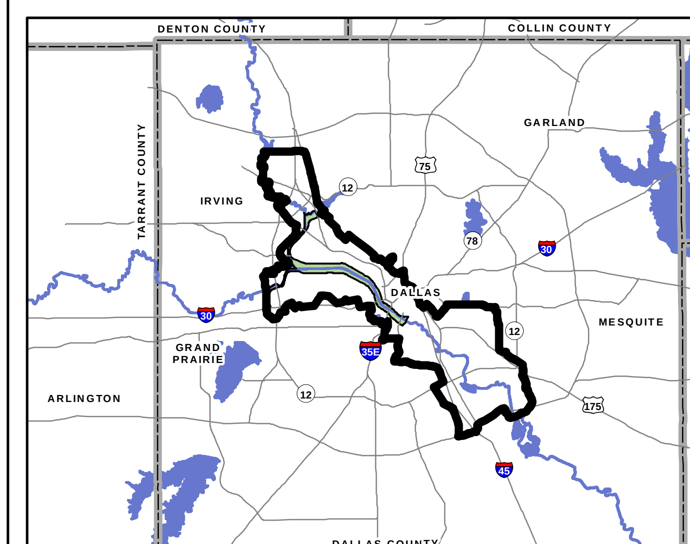
Utility Lines

- Abandoned Oil and Gas
- Communication
- Electrical
- Natural Gas
- Sewer
- Wastewater
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





0 100 200 Meters

0 250 500 Feet

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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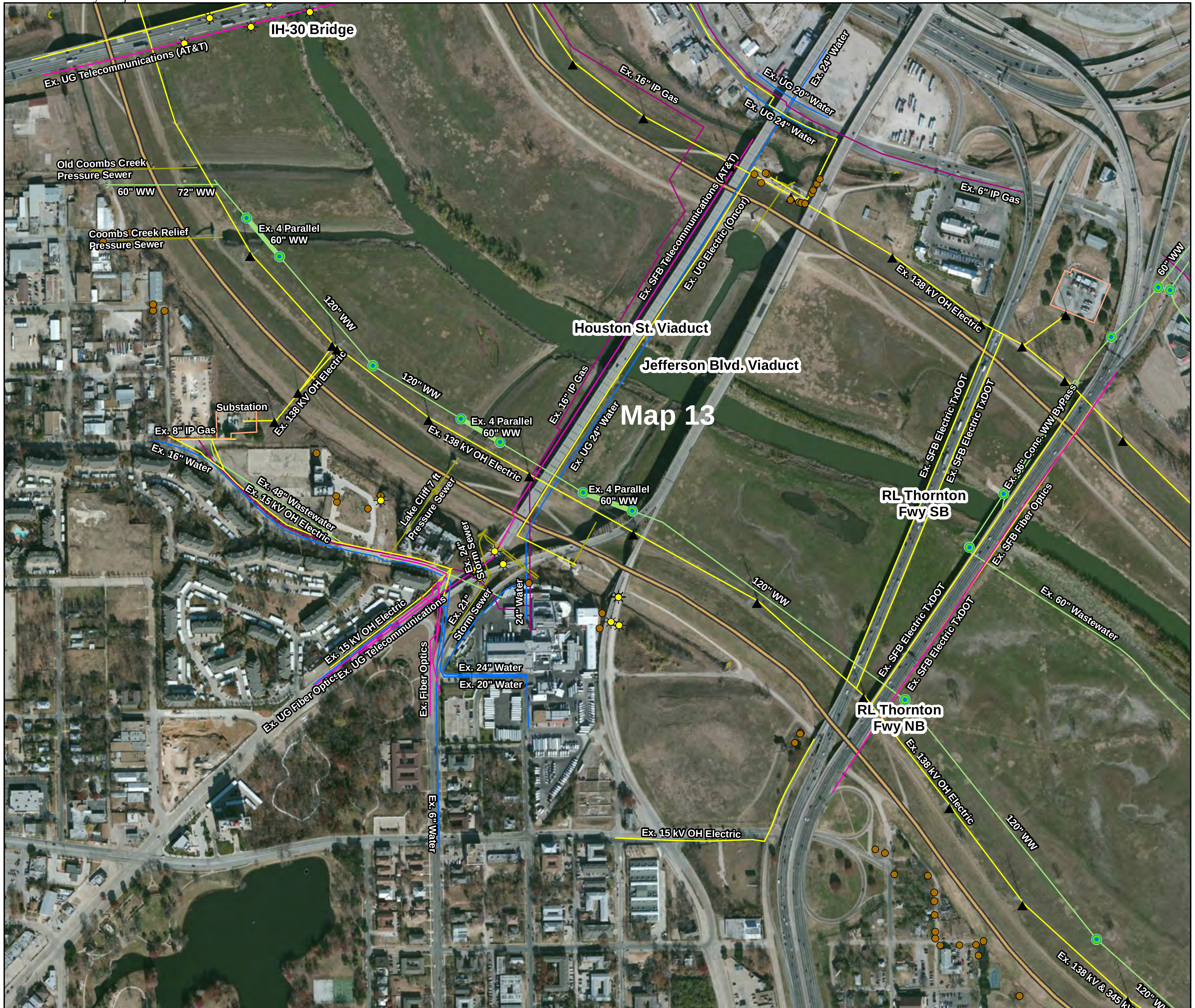


Figure 3.13-14
Existing Utilities Detail: Map 13

LEGEND

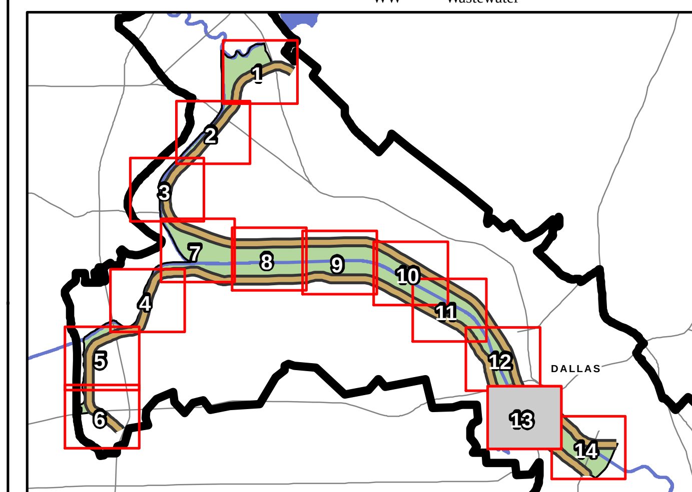
- Manhole
- Exterior Light
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

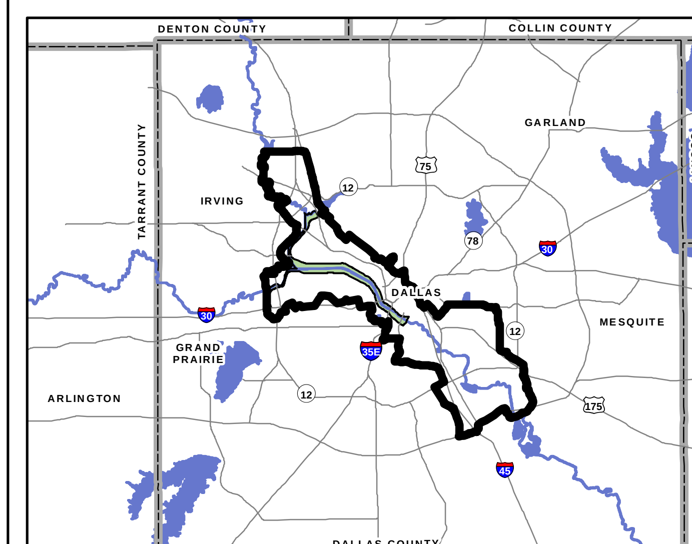
Utility Lines

- Communication
- Electrical
- Electrical Substation
- Natural Gas
- Sewer
- Wastewater
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





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GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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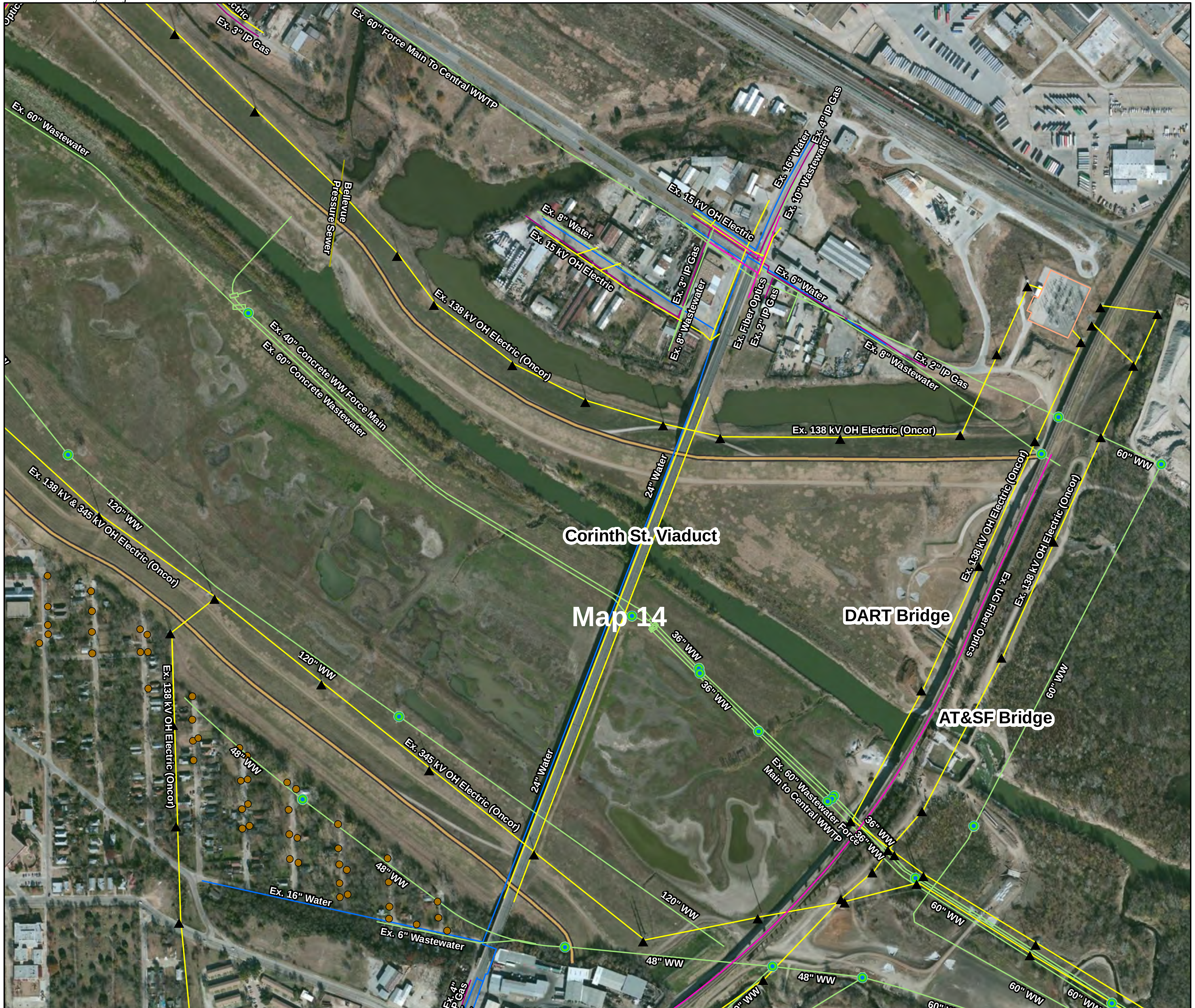


Figure 3.13-15
Existing Utilities Detail: Map 14

LEGEND

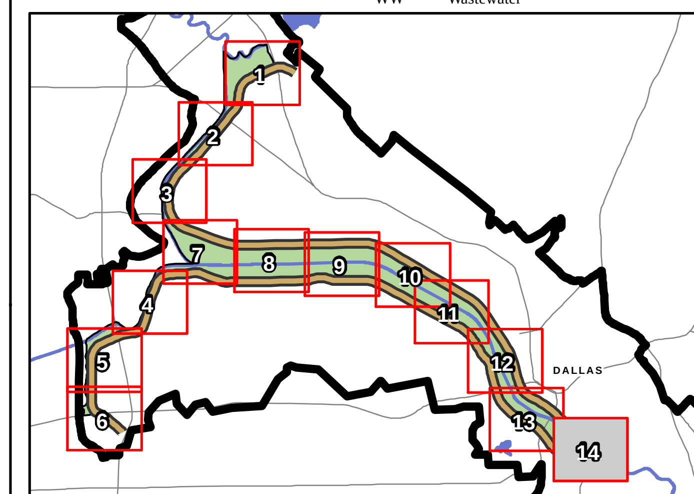
- Manhole
- Power Pole
- Transmission Tower
- Dallas Floodway Levee Crest
- Study Area

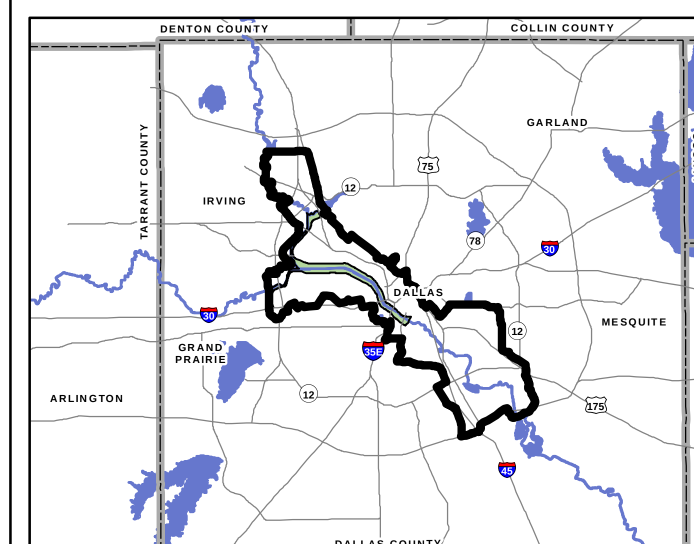
Utility Lines

- Communication
- Electrical
- Electrical Substation
- Natural Gas
- Sewer
- Wastewater
- Water

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater





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GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2011

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3.14 AIR QUALITY

3.14.1 Definition of Resource

Existing air quality at a given location can be described by the concentrations of various pollutants in the atmosphere. The USEPA defines air quality as the ambient air concentrations of specific pollutants determined by the USEPA to be of concern to the health and welfare of the public. These “criteria pollutants” include ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), particulate matter less than or equal to 10 microns in aerodynamic diameter (PM_{10}), and lead (Pb).

3.14.1.1 Methodology

Criteria Pollutants

Ozone. The majority of ground-level O_3 (commonly known as “smog”) is formed from the complex photochemical reactions in the atmosphere between VOCs, oxides of nitrogen (NO_x), and oxygen. VOCs and NO_x are considered precursors to the formation of O_3, a highly reactive gas that can damage lung tissue and affect respiratory function (USEPA 2012a).

Carbon Monoxide. CO is a colorless, odorless, poisonous gas produced by the incomplete combustion of fossil fuels. Elevated levels of CO can result in harmful health effects, and can contribute to global climate change (USEPA 2012a).

Nitrogen Dioxide. NO_2 is a brownish, highly reactive gas produced primarily from the burning of fossil fuels. NO_2 can also lead to the formation of O_3 in the lower atmosphere (USEPA 2012a).

Sulfur Dioxide. SO_2 is emitted primarily from the combustion of coal and oil by steel mills, pulp and paper mills, and from non-ferrous smelters. High concentrations of SO_2 can aggravate existing respiratory and cardiovascular diseases, and also contribute to acid rain, which can, in turn, lead to the acidification of lakes and streams (USEPA 2012a).

Particulate Matter. $PM_{2.5}$ is referred to as fine particles, which are believed to pose significant health risks as they can lodge deeply into the lungs. Studies have linked increased exposure to $PM_{2.5}$ to respiratory and cardiovascular disease. PM_{10} is typically comprised of dust, ash, soot, smoke, or liquid droplets emitted into the air. Fires, dust from paved or unpaved roads, construction activities, and natural sources (wind and volcanic eruptions) can contribute to increased PM_{10} concentrations (USEPA 2012a).

Lead. Sources of Pb include pipes, fuel, and paint although the use of lead in these materials has declined dramatically in recent years. Pb can be inhaled directly or ingested indirectly by consuming lead-contaminated food, water, or dust (USEPA 2012a).

Criteria pollutant emissions affecting air quality in a given region can be characterized as being from either stationary or mobile sources. Stationary sources of emissions, also known as point sources, are typified by emissions from smokestacks. Mobile sources of emissions, also termed non-point sources, categorize emissions from vehicles and aircraft. Air quality for a region is a function of the type and concentration of pollutants in the atmosphere, the size and topography of the air basin, and local and regional meteorological influences. The significance of a pollutant concentration in a region or geographical area is determined by comparing it to federal and/or state ambient air quality standards.

Greenhouse Gas Emissions

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The accumulation of GHGs in the atmosphere can influence the earth's temperature. Predictions of long-term environmental impacts due to global climate change include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems including the potential loss of species, and a significant reduction in winter snow pack. In Texas, predictions of these effects include exacerbation of air quality problems, increased storm frequency, and drastic impacts from sea level rise (USEPA 2012c).

Federal agencies are, on a national scale, addressing emissions of GHGs by reductions mandated in federal laws and EOs, most recently, EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. Several states have promulgated laws as a means to reduce statewide levels of GHG emissions. In particular, Senate Bill 184 (September 1, 2009), required the State Comptroller to develop strategies to reduce GHG emissions by December 31, 2010, and the Texas Emission Reductions Plan, established in 2001, provides incentives to reduce vehicle and equipment emissions and improve and maintain air quality in Texas (Texas Comptroller of Public Accounts 2012). In addition, the City of Dallas initiated the "Green Dallas" program in 2005, which includes initiatives to reduce GHG emissions from both municipal and private sectors of the City of Dallas (City of Dallas 2005). Impacts associated with GHG emissions are discussed in a cumulative context in Section 6.6. The ROI for air quality is the Metropolitan Dallas-Fort Worth Air Quality Control Region (AQCR).

3.14.2 Regulatory Framework

3.14.2.1 Federal Requirements

Under the authority of the Clean Air Act (CAA), the USEPA has established ambient air quality standards to protect public health and welfare, with an adequate margin of safety. These federal standards, the National Ambient Air Quality Standards (NAAQS), are defined in terms of concentration (e.g., ppm, ppb, micrograms per cubic meter [$\mu g/m^3$]) determined over various periods of time (averaging periods). The TCEQ has adopted the NAAQS, which are presented in Table 3.14-1. In addition, the City of Dallas Air Pollution Control Program is the authority for compliance assessment, ambient air monitoring, and enforcement within City limits for the State's Air Pollution Control Rules and Regulations.

Short-term standards (1-hour, 3-hour, 8-hour, or 24-hour periods) are established for pollutants with acute health effects and may not be exceeded more than once a year. Long-term standards (annual periods) are established for pollutants with chronic health effects and may never be exceeded.

The USEPA designates areas of the U.S. as having air quality equal to or better than the NAAQS (attainment) or worse than the NAAQS (nonattainment), based on measured ambient criteria pollutant data. Upon achieving attainment, areas that were previously in nonattainment are considered to be in maintenance status. Areas are designated as unclassifiable for a pollutant when there is insufficient ambient air quality data for the USEPA to form a basis of attainment status; unclassifiable areas are treated similar to areas that are in attainment of NAAQS.

Table 3.14-1. National Ambient Air Quality Standards

Air Pollutant	*Averaging Time*	*NAAQS*	
		Primary	*Secondary*
Ozone (O_3)	8-hour	0.075 ppm (2008 standard)	Same as Primary Standard
Carbon Monoxide (CO)	8-hour 1-hour	9 ppm 35 ppm	- -
Nitrogen Dioxide (NO_2)	Annual Average 1-hour	53 ppb 100 ppb	Same as Primary Standard -
Sulfur Dioxide (SO_2)	1-hour 3-hour	75 ppb -	- 0.5 ppm
Particulate Matter (PM_{10})	24-hour	150 $\mu g/m^3$	Same as Primary Standard
Particulate Matter ($PM_{2.5}$)	Annual Average 24-hour	12 $\mu g/m^3$ 35 $\mu g/m^3$	15 $\mu g/m^3$ Same as Primary Standard
Lead (Pb)	Rolling 3-month Average	0.15 $\mu g/m^3$	Same as Primary Standard

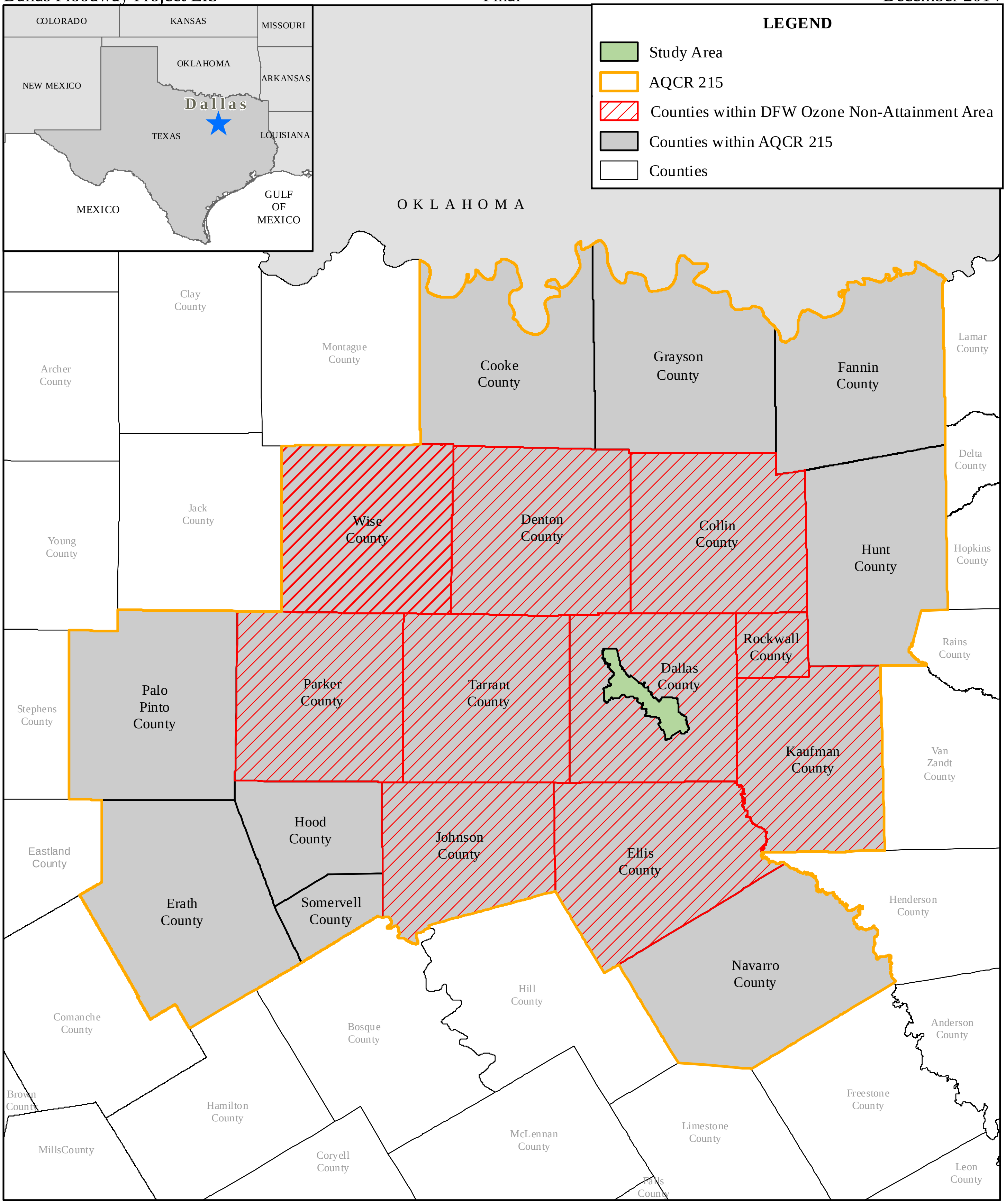
Notes: ppm = parts per million; ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; - = no standard established.
Source: USEPA 2012b.

The General Conformity Rule (GCR) was established under Section 176(c)(4) of the CAA and delineates certain statutory requirements for federal agencies to demonstrate conformity of any proposed actions with the State Implementation Plan (SIP) or Tribal Implementation Plan for attainment of the NAAQS. The GCR establishes *de minimis,* emission levels in tons per year based on the severity of an area's air quality problem. The exceedance of a *de minimis* threshold requires a conformity determination. In 1993, the USEPA issued the initial GCR. The GCR was substantially revised in 2010 to improve the process federal entities use to demonstrate that their actions would not contribute to a NAAQS violation. Under the GCR, certain actions are exempted from conformity determinations, while others are presumed to be in conformity if total project emissions are below *de minimis* levels established under 40 CFR Section 93.153. Total project emissions include both direct and indirect emissions that can be controlled by a federal agency. Any new project that may lead to nonconformance or to a violation of the NAAQS requires a conformity analysis before initiating the action. The general conformity requirements apply only to nonattainment and maintenance areas.

3.14.2.2 State and Local Requirements

Through the CAA Amendments of 1990, the USEPA requires each state with nonattainment designations to develop a SIP designed to eliminate or reduce the severity and number of NAAQS violations, with an underlying goal to bring state air quality conditions into (and maintain) compliance with the NAAQS by specific deadlines. The SIP is the primary means for the implementation, maintenance, and enforcement of the measures needed to attain and maintain the NAAQS in each state.

The Study Area is located in Dallas County, which is included in the Metropolitan Dallas-Fort Worth AQCR 215 (Figure 3.14-1).



0 10 20
Kilometers
Miles
0 10 20

Figure 3.14-1
The Metropolitan Dallas-Fort Worth Intrastate AQCR 215

N
S

GIS Sources: NCTCOG 2008, CFR 2010, USEPA 2010

3.14.3 Existing Conditions

3.14.3.1 Attainment Status

The TCEQ regulates the Metropolitan Dallas-Fort Worth AQCR, by authority of the USEPA (Region 6), and promulgated in the Texas SIP. Dallas is in attainment for all criteria air pollutants except O_3 for which the Dallas area is designated as subpart 2/serious nonattainment for the 1997 8-hour standard and designated moderate nonattainment for the 2008 8-hour standard (USEPA 2012c; TCEQ 2012a). The applicable criteria pollutant *de minimis* levels are 50 tons/year for VOCs and NO_x. VOCs and NO_x are precursors to the formation of O_3.

The Dallas-Fort Worth O_3 Nonattainment Area consists of the following ten counties: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise (USEPA 2012c, TCEQ 2012a). Dallas-Fort Worth did not attain the 1997 8-hour ozone standard by the deadline of June 15, 2010. As a result, the area was reclassified from moderate to serious, and the state is required to submit new attainment demonstration and reasonable further progress SIP revisions for the area and implement the previously adopted contingency measures for the area (TCEQ 2012a). The attainment deadline for the 2008 O_3 standard is December 31, 2018 (TCEQ 2012a).

3.14.3.2 Emission Inventory and Monitoring Data

The TCEQ periodically updates emission inventories for certain areas within Texas for purposes of forecasting future emissions, analyzing emission control measures, and for use in regional air quality modeling. Table 3.14-2 presents the emissions inventory data for the Dallas-Fort Worth O_3 Nonattainment Area for 2002 (base year), 2008, 2011 and 2012. These emissions inventories were used in the episode modeling for the most recent revisions to the SIP for the control of O_3 air pollution. Recent emissions inventory data are only available for VOCs and NO_x emissions. The largest regional sources of VOCs and NO_x emissions are non-road vehicles (construction equipment, airplanes, and locomotives) and on-road (cars and trucks) (TCEQ 2011).

Table 3.14-2. Summary of Annual Ozone Season Weekday NOx and VOC Emissions ([1]post-control data): Dallas-Fort Worth Ozone Nonattainment Area (tons/day)

Emission Type	*2002 (base year)*		*2008*		*2011*		*2012*	
	VOC	*NO_x*	*VOC*	*NO_x*	*VOC*	*NO_x*	*VOC*	*NO_x*
Point Sources	26.43	79.24	31.19	49.21	39.73	62.79	40.58	58.87
Area Sources	247.03	38.63	320.44	150.39	346.64	40.56	356.15	41.34
Non-Road Mobile Sources	82.05	153.41	62.80	130.29	51.98	111.43	49.84	104.23
On-Road Mobile Sources	139.70	354.01	104.67	235.30	89.54	197.05	82.20	177.63
Total of All Sources	**495.21**	**625.29**	**519.10**	**565.18**	**527.88**	**411.84**	**528.77**	**382.07**

Note: [1] Post-control data refers to 2008, 2011 and 2012 inventory data that represent growth from the 2002 base year with all reasonable further progress (RFP) emission controls taken into account. These include controls not used or not creditable to demonstrate RFP.

Source: TCEQ 2011a.

The TCEQ maintains air quality monitoring information, including real-time monitoring and monthly and yearly summary reports. The nearest monitoring location within the Study Area is the Hinton Street Monitoring Station (TCEQ 2012b). Table 3.14-3 presents the available representative monitoring data for criteria pollutants from this station.

Table 3.14-3. Representative Air Quality Data for the Study Area (2010-2012)

Criteria Pollutant	*2010*		*2011*		*2012*	
	Yearly Average	*Yearly Maximum*	*Yearly Average*	*Yearly Maximum*	*Yearly Average*	*Yearly Maximum*
O_3 *measured in ppb*	25	96	28	101	30	114
CO *measured in ppm*	0.3	2.4	0.3	1.7	0.2	1.6
$PM_{2.5}$ *measured in* $\mu g/m^3$	9.62	43.78	10.10	64.22	9.43	74.85
SO_2 *measured in ppb*	0.7	17.3	0.7	11.2	0.3	6.6
NO_2 *measured in ppb*	13.2	68.6	12.9	60.8	10.5	55.6

Notes: Data from the Hinton Street Monitoring Station C401/C60/AH161.
Monitoring data not available for VOCs and PM_{10}.
Source: TCEQ 2012c.

3.14.3.3 Major Emission Sources

Emissions in the Study Area come from a variety of stationary and mobile sources. Emission sources include vehicles, aircraft, on-going construction activities, and industrial operations. For example, there are several industrial facilities along and near the Trinity River that contribute to the ambient air quality of the region. These facilities include, but are not limited to, chemical plants, cement plants, semi-conductor facilities, printing operations, and oil and gas facilities.

The six existing EWLIDS pumping plants are electrically powered; thus, the pumping plants do not directly contribute significant emissions to the Study Area (City of Dallas 2009).

Approximately 70% of the Dallas-Fort Worth region's air pollution comes from mobile sources such as cars, trucks, airplanes, construction equipment, and lawn equipment. The majority of pollutants emitted from motor vehicles include VOCs, NO_x, CO, PM_{10}, and $PM_{2.5}$. The City of Dallas is implementing several initiatives to improve air quality and reduce O_3 levels, including green fleet/vehicles, ordinances, commute solutions, and outreach programs. As shown in Table 3.14-2, the Dallas-Fort Worth region has experienced a steady decline in NO_x levels measured across the Study Area, most notably from reductions in emissions from stationary sources (stack) emissions, cleaner cars and construction equipment, and cleaner fuels (Green Dallas 2012).

3.15 NOISE

3.15.1 Definition of Resource

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity and that interferes with or disrupts normal activities. The human environment is generally characterized by a certain consistent noise level that varies by area. This is called ambient, or background, noise. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise; perceived importance of the noise and its appropriateness in the setting; time of day and type of activity during which the noise occurs; and sensitivity of the individual.

3.15.1.1 Noise Characteristics

Sound is generally characterized by several variables, including frequency and intensity. Frequency describes the sound's pitch and is measured in cycles per second, or hertz (Hz). Intensity describes the sound's loudness and is measured in decibels (dB). Decibels are measured using a logarithmic scale; thus, the average person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness. This relation holds true for sounds of any loudness.

The normal human ear can detect sounds that range in frequency from about 20 Hz to 20,000 Hz. However, all sounds in this wide range of frequencies are not heard equally well by the human ear, which is most sensitive to frequencies in the range of 1,000 Hz to 4,000 Hz. This frequency dependence can be taken into account by applying a correction to each frequency range to approximate the human ear's sensitivity within each range. This is called A-weighting and is commonly used in measurements of community environmental noise. The A-weighted sound pressure level (abbreviated as dBA) is the sound level with the "A-weighting" frequency correction.

As shown in Table 3.15-1, typical noise levels range from approximately 40 dBA for an urban setting to approximately 100 dBA for loud power equipment at close range. Normal speech registers at approximately 65 dBA. At a constant level of 70 dBA, noise can be irritating and disruptive to speech; at louder levels, hearing loss can occur. Noise from a point source attenuates (declines) over distance at a rate of 6 dBA for each doubling of distance between the noise receptor and the source. Thus, a noise level of 85 dBA at 50 feet would be measured as 79 dBA at 100 feet and 73 dBA at 200 feet from the source (Caltrans 2009)[3].

Noise can be categorized as being generated from line or point sources. Vehicle and rail traffic represent line noise sources. Noise from highway traffic is generated primarily from a vehicle's tires, engine, and exhaust, and spreads in a cylindrical pattern from the edge of the roadway. Conversely, a point source of noise emanates spherically from a particular source that is static. Much of the noise people encounter on a daily basis comes from point sources. Examples of point sources are construction sites, loudspeakers, loud bars/nightclubs, etc.

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[3] The reduction in sound by 6 dBA per doubling of distance is referred to as the "inverse square law," which is denoted as $dBA_2 = dBA_1 + 20\log_{10}(D1/D2)$ for point sources; where dBA_1 is the noise level at distance D_1, dBA_2 is the noise level at distance D_2, and $\log_{10}$ is the base-10 logarithm. Applying this equation to the gas lawn mower example in Table 3.15-1 indicates that the noise level from the gas lawn mower would be 89 dBA at 6 feet, and 83 dBA at 12 feet. (For line sources, the equation is $dBA_2 = dBA_1 + 10\log_{10}[D1/D2]$.)

Table 3.15-1. Examples of Typical Noise Levels

Noise Source	*dBA (approximate)*	*Perception*
Jet flyover at 985 feet	110+	Uncomfortable
Jack Hammer	100	Very Loud
Gas lawn mower at 3 feet	95	
Downtown (large city)	80	Moderate
Shouting at 3 feet	75	
Normal speech at 3 feet	65	
Large office	55	Quiet
Quiet urban (daytime)	50	
Quiet urban (nighttime)	40	
Human Perception	10-20	Threshold of hearing

Sources: TxDOT 2011; Harris 1979.

Because noise levels vary widely during the day, they are generally reported as an average over time. Shorter measurement durations (typically 1 hour) are described as Equivalent Sound Levels (L_{eq}), indicating the total energy contained in the sound over a given sample period. The L_{eq} for 1 hour is the average noise level during the hour; specifically, the average noise based on the energy content (acoustic energy) of the sound. The L_{eq} is the level of a continuous noise that has the same energy content as the fluctuating noise level.

3.15.1.2 Methodology

The impact analysis of the Proposed Action is focused upon potential noise increases at sensitive noise receptors resulting from the construction and operation of the various project components. Noise sensitive receptors are buildings or parks where quiet forms a basic element of their purpose; residences and buildings where people normally sleep (e.g., homes, hotels, hospitals), where nighttime noise is most annoying; and institutional land uses (e.g., schools, libraries, parks, churches) with primarily daytime and evening use. Because noise levels at sensitive receptors are reduced by obstructions (such as sound walls) lying between them and the noise source, special emphasis is placed on sensitive receptors having a direct line of sight to the Proposed Action construction sites and facilities. The ROI for noise analysis consists of the Dallas Floodway and the proposed IDP improvement locations.

3.15.1.3 Regulatory Framework

Section 4(b) of the *Noise Control Act (NCA) of 1972* (42 USC §§ 4901-4918) directs federal agencies to comply with applicable federal, state and local noise requirements with respect to the control and abatement of environmental noise. Congress defined environmental noise in the *NCA of 1972* to include the intensity, duration, and character of sounds from all sources. Applicable federal guidelines for noise regulation derive from the USDOT or, more specifically, the Federal Transit Administration and the FHWA.

Neither the State of Texas nor the TCEQ has adopted any noise regulations. The City of Dallas, however, does have a local noise ordinance (*Dallas City Code: Volume II, Chapter 30*). This ordinance contains time restrictions on specific types of noise producing activities, such as construction, and aims to protect citizens from offensively loud noise and vibration.

3.15.2 Existing Conditions

3.15.2.1 Floodway

The Dallas Floodway is surrounded by a large urbanized area. Even though the Dallas Floodway itself is a large undeveloped area, it is exposed to numerous noise sources associated with the surrounding urban area. Vehicle traffic on the bridges crossing the Dallas Floodway account for the majority of noise in the area. Another source of noise that contributes to the ambient noise is air traffic. Dallas Love Field is located approximately 2 miles north of the Dallas Floodway and DFW is located approximately 8 miles west of the Dallas Floodway. The noise associated with aircraft overflight and other line and point sources of noise are included in the ambient noise measurements described in the paragraphs below.

Sensitive Noise Receptors

The majority of land that falls within the eastern portion of the noise ROI is classified industrial/ commercial, whereas the western portion of the ROI is more mixed with industrial and residential uses. Several sensitive noise receptors, including a number of churches, are located within the ROI.

3.15.2.2 Interior Drainage Plan

The six EWLIDS pumping plants are situated adjacent to the levees, outside of the Floodway. When the pumping plants and/or trash screens are operating, they can contribute to the local noise environment around each pumping plant.

Sensitive Noise Receptors

Land uses in the vicinity of the proposed IDP improvements are characterized by a mix of commercial and industrial developments. In several instances, the closest sensitive receptors lie outside the limits of the ROI. The nearest sensitive receptor to the Hampton Pumping Plant is a physical therapy/rehabilitation facility, which is located approximately 1,500 feet to the northwest of the pumping facilities. A church is located approximately 100 feet to the south from the proposed improvements at the Nobles Branch culvert. At the Charlie Pumping Plant, the closest sensitive receptor (a multi-family residential development) is situated 550 feet to the north and west of the project. There is a church about 620 feet southeast of the Delta Pumping Plant, and there are residences roughly 400 feet to the east of the proposed Trinity-Portland Pumping Plant. (Refer to Figure 2-9 for the location of the IDP improvements in a regional context, and to Appendix G for figures showing the proposed IDP improvements and adjacent land uses.)

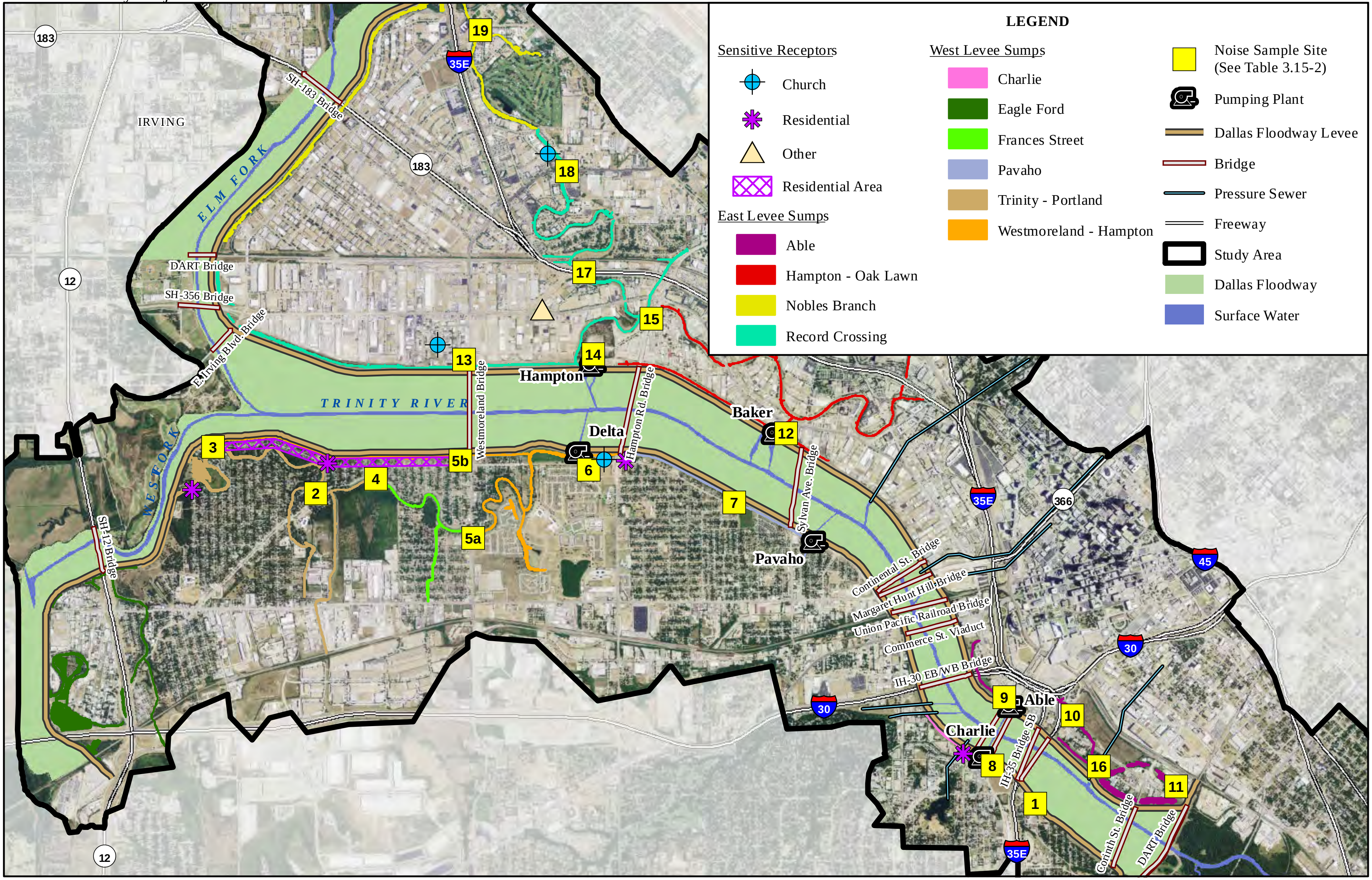
3.15.2.3 Baseline Noise Levels

On September 14-16, 2009, noise levels were recorded over a 5-minute period at representative areas within the ROI to characterize baseline noise conditions (Cardno TEC 2009). Figure 3.15-1 presents the noise recording locations. Table 3.15-2 presents the noise data collected from the sites depicted on Figure 3.15-1. Noise levels ranged from the mid-40s (dBA) to the high 80s (dBA). Of note, noise levels at the Able Pumping Plant were recorded while the pumps and trash screens were operating. These noise levels (ranging from 66.3 dBA to 73.1 dBA at a distance of 30 feet) are considered representative of pumping plant operations when their pumps and trash screens are in use. Figure 3.15-1 also shows the location of noise sensitive receptors referenced in this section and in Section 4.15.

Table 3.15-2. Representative Baseline Noise Levels within the ROI

Sample Site	*dBA (L_{eq}) max*	*min*	*Start Time*	*Date*	*Location Details*	*Near Sensitive Receptor?*
Dallas Floodway						
1	77.0	74.0	9:20 AM	9/15/09	West Levee, approximately 100 feet from IH-35E Bridge	No
Trinity-Portland Sump						
2	67.0	53.0	11:04 AM	9/15/09	50 feet from Trinity-Portland sump and 20 feet from Bernal Drive	Yes
3	58.0	44.6	11:27 AM	9/15/09	End of Mexicana Road	Yes
4	67.0	53.0	11:30 AM	9/15/09	Adjacent to Bernal Drive	Yes
Frances Street Sump						
5a	83.1	55.4	11:45 AM	9/15/09	15-20 feet from Westmoreland Road culvert	Yes
Westmoreland-Hampton Sump						
5b	83.1	55.4	11:45 AM	9/15/09	Adjacent to Westmoreland Road near levee	Yes
6	73.7	50.5	11:58 AM	9/15/09	In church parking lot	Yes
Pavaho Sump						
7	75.1	48.0	12:28 PM	9/15/09	At sump culvert, 15-20 feet from Canada Drive	Yes
Charlie Sump						
8	65.0	NA	1:10 PM	9/15/09	Adjacent to Jefferson Boulevard Bridge	Yes
Able Sump						
9	73.1	66.3	2:40 PM	9/15/09	At Able Pump Station (between Houston Street and Jefferson Boulevard Bridges)	No
10	75.4	64.3	3:00 PM	9/15/09	On sidewalk of Riverfront Boulevard., south of IH-30	No
11	66.0	53.9	3:07 PM	9/15/09	End of sump approx. 1,000 feet west of DART Rail Bridge	No
16	80.6	57.1	1:15 PM	9/16/09	Along Riverfront Boulevard west of Corinth Street	No
Hampton-Oak Lawn Sump						
12	65.6	55.3	3:35 PM	9/15/09	Adjacent to Irving Boulevard	No
Record Crossing Sump						
13	80.0	65.1	4:01 PM	9/15/09	Adjacent to Mockingbird Road	Yes
14	60.4	50.2	4:25 PM	9/15/09	Adjacent to Hampton Pumping Plant	No
15	81.8	57.4	4:40 PM	9/15/09	South corner of Inwood Road and Irving Boulevard	No
17	87.1	67.0	2:00 PM	9/16/09	Adjacent to culvert at Commonwealth Drive	No
18	82.8	62.6	2:10 PM	9/16/09	Along Mockingbird Lane	Yes
Nobles Branch Sump						
19	80.0	59.2	2:25 PM	9/16/09	At culvert along Regal Row	No

Notes: Noise data measurements were recorded for 5-minute intervals; refer to Figure 3.15-1 for locations.
Source: Cardno TEC 2009.



0 0.5 1 Kilometers

0 0.5 1 Miles

Figure 3.15-1
Location of Noise Sample Sites and Sensitive Receptors

GIS Sources: City of Dallas 2008a, NCTCOG 2008, Cardno TEC 2009

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CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the impacts associated with implementation of two possible alternatives - the Future Without-Project Alternative (Alternative 1) and the Proposed Action (comprised of the Modified Dallas Floodway Project [MDFP], the remaining Balanced Vision Plan [BVP] Study features, and the remaining Interior Drainage Plan [IDP] elements). Alternative 1 is a forecast of the most likely future cumulative conditions that would exist in the Study Area if the Proposed Action is not implemented, but past, present, and reasonably foreseeable future actions associated with projects (as described in Section 2.7.2) unrelated to the Proposed Action are implemented (otherwise known as the "no action" alternative). The presentation of Alternative 1 helps the decision maker understand the future conditions in the absence of the Proposed Action, and how implementation of alternative plans may alter that future condition. Unless otherwise noted, the Future Without-Project Condition is defined as the year 2065; however, some resource areas use a different "future" year; these deviations are noted in their respective sections.

The United States Army Corps of Engineers (USACE) has not developed action alternatives to the 2004 BVP Study, as doing so would be outside of the scope of Section 5141 of the Water Resources Development Act (WRDA) of 2007, as amended. Recognizing the on-going policy and funding challenges associated with the construction of the potential Trinity Parkway, the City of Dallas has initiated preliminary design of two different alignments of the BVP Study recreation features. The first alignment considers the implementation and alignment of the MDFP and remaining non-federal BVP and IDP features taking into consideration the potential Trinity Parkway being constructed within the Dallas Floodway, consistent with the Federal Highway Administration (FHWA) selected alternative. The second alignment considers the implementation of the MDFP and remaining BVP and IDP features with the consideration that the potential Trinity Parkway would not be constructed within the Dallas Floodway. Both alignments are evaluated here, and both potential future conditions (i.e., with or without the Parkway) are considered as part of the Proposed Action cumulative analysis.

The MDFP and non-MDFP IDP elements would not change under either design alignment considered; however, there are minor variations in the proposed alignments for the remaining BVP Study features as described in Chapter 2. The differing designs also take into consideration the different conditions that would be present at the start of implementing the Proposed Action if the potential Trinity Parkway is or is not constructed. For example, under the design anticipating Trinity Parkway construction, the City of Dallas would be able to maximize construction efficiencies and minimize construction impacts by improving on the Trinity Parkway Project footprint. Conversely, the design that does not anticipate the construction of the Trinity Parkway within the Floodway would have access to greater undeveloped space within the Floodway, allowing for varying alignments of BVP Study ecosystem and recreation features. Regardless of the design alignment that is implemented, there would be no change to the flood risk management (FRM) elements or IDP improvements.

For each resource area, impacts have been presented for each of the three main components of the Proposed Action: the FRM elements, BVP Study features, and IDP improvements. Within each component section, impacts have been presented at "descriptive element" level as presented in Table 2-1. Furthermore, the descriptive elements impacts have been generally presented for the discrete construction and operational phases; however, where it has made sense to do so, some impact discussions have been combined. Construction impacts would not necessarily be "short-term" as construction of the Proposed

Action could take the full implementation period of approximately 15 years to complete. Operational, or post-construction impacts are presented as being enduring or "long-term."

A summary of impacts discussion has been provided at the end of each impact section considering the designs anticipating both the potential Trinity Parkway being constructed and it not being constructed within the Floodway. The summary of impacts discussion provides an overall assessment as to the potential context and intensity of the impact to the resource area from implementation of each action alternative. Identified mitigation measures and/or special conservation measures (SCMs) that would be implemented as part of the selected recommended plan are presented in Chapter 7.

The potential cumulative impacts considering a future condition both with and without the Trinity Parkway being constructed, in combination with the remaining identified past, present, and reasonably foreseeable projects, are presented at the end of each resource analysis in this chapter. The impacts are also summarized in Chapter 5.

4.1 LAND USE

4.1.1 Approach to Analysis

Impacts to land use occur whenever there is a change to the existing land use. As stakeholders vary in how they value different land uses, it can be difficult to determine if a given change in land use is beneficial, adverse, or if it is a neutral change. However, the application of zoning laws is subject to public review, and long-range plans are created after substantial public input and workshop meetings with the public. Thus, the zoning laws of the City of Dallas and the Trinity River Corridor Comprehensive Land Use Plan (TRCCLUP) serve as the basis for significance threshold in the current analysis.

Activities within the Region of Influence (ROI) include modification of existing improvements and new construction. Modifications to existing improvements that do not change the use of that land do not constitute an impact to land use. New construction or demolition that changes how land is used may be a beneficial or adverse impact. If activities change the use of the land to another use within the same zoning classification (e.g., an office park changing to a research facility within the Light Industrial zoning district), then impact is neither adverse nor beneficial, nor is it significant. If however, the change also requires a zoning variance, then the change may be significant. The next step of analysis would be whether the change is counter to the TRCCLUP. Activities requiring zoning variances that are also inconsistent with the TRCCLUP are considered significant adverse changes. Activities requiring zoning variances that are in line with the TRCCLUP are considered beneficial changes.

It is relevant to note that the land use analysis does not consider the intensity of use when determining significance. For example, an area previously designated as Open Space – Public that was simply mown lawn may have much more intense usage if it is converted to a soccer field. However, the use itself remains the same; the land continues to be a public recreational amenity, and thus there is minimal impact to land use. The change in intensity and type of use within the overarching category (e.g., from picnic field to soccer field) is captured in the analysis of the resource tied to that category. For the soccer field improvement used in this example, the change in degree and intensity of use is captured in the analysis provided in Section 4.7.

4.1.2 Alternative 1: Future Without-Project Condition

Under the Future Without-Project Condition, current land use patterns within the Study Area would generally remain the same, consistent with prevailing land use and zoning plans. The identified Future Without-Project Condition projects would comply with existing land use and zoning requirements and would result in compatible land uses. Several of the identified Future Without-Project Condition projects would result in minor changes to land use. Those Future Without-Project Condition projects not listed would not result in a change from existing land use. As summarized in Table 4.1-1, the overall changes in land use acres would not result in a dramatic change in land use for each of the identified categories. The largest changes are an increase in Transportation and a decrease in Open Space. The primary driver for both of these changes would be the potential Trinity Parkway construction within the Dallas Floodway.

Table 4.1-1. Change in Land Use Category Acreage Under the Future Without-Project Condition

Land Use Category	*Existing Conditions*	*Future Without-Project Condition*	*Changes in Land Use Category*
Commercial	3,905.5	3,905.5	- <0.1
Government/Education	2,881.5	2,887.1	+5.6
Industrial	4,157.4	4,137.7	-19.7
Infrastructure	159.5	159.5	0
Mixed Use	241.6	241.6	0
Open Space	8,279.5	8,219.6	-59.9
Residential	4,817.3	4,817.2	-0.1
Transportation	763.6	845.1	+81.5
Undeveloped	10,237.0	10,230.0	-7.0
Utilities	604.6	604.2	0.4
Total	**36,047.5**	**36,047.5**	**174.2 total change**

Sources: City of Dallas 2011; NCTCOG 2007.

The comprehensive plans currently in use (e.g., TRCCLUP and forwardDallas!) incorporate many of the elements included under the Proposed Action. The comprehensive plans represent a review of Dallas land use goals and projections through the year 2030. Thus, the Future Without-Project Condition would be incompatible with the plans and policies of the City of Dallas, the plans and projects for Dallas County, and those being considered by the North Central Texas Council of Governments (NCTCOG). Under the Future Without-Project Condition, these agencies would have to modify their land use plans within the Study Area and revise projects designed for consistency with planned future land use. Furthermore, under the Future Without-Project Condition, those factors that have historically defined the economic activity within the Study Area are expected to continue to do so. Specifically, physical isolation due to the levees, the continued threat of river flooding, inadequate interior drainage, and the potential for environmental contamination are all expected to constrain urban revitalization in the Study Area under the Future Without-Project Condition.

4.1.3 Alternative 2: Proposed Action

4.1.3.1 Design Anticipating Potential Trinity Parkway Construction

Construction is considered consistent with zoning only if the ultimate, operational feature is consistent. Thus, this land use section does not separate construction from operation, but instead considers them as part of a single consistency analysis. Construction impacts are mentioned if they have a particular impact separate from the operational impact.

<u>BVP Study FRM Elements</u>

Levee Raise Modification and Levee Flattening

The construction and operation of the levee modifications would not constitute changes in the use of the land. The levees would continue to operate as flood control structures throughout construction and operation. The modifications would not require a zoning variance, nor are the modifications contrary to the TRCCLUP. Modifications to existing levees that do not change the use of that land do not constitute an impact to land use.

Atchison, Topeka, and Santa Fe Railroad Bridge Modifications

Upon completion of the Atchison, Topeka, and Santa Fe (AT&SF) Railroad Bridge modifications, the bridge would once again be accessible to pedestrians and trail users. The land use itself would not change with the operation of the site. Instead, it would revert to its preconstruction use by pedestrians on the Santa Fe Trestle Trail.

Modifications to the existing AT&SF Railroad Bridge that do not change the use would not constitute an impact to land use. The removal of the AT&SF Railroad Bridge embankments would create a new surface under the bridge supports. Rather than having open space cut by a transportation use, the open space would continue under the bridge and be more accessible to visitors of the Floodway. The land use classification would remain within the Open Space – Public category.

The operation of the site for use as a public recreational amenity would be consistent with the current zoning of the AT&SF Railroad Bridge and its embankments. Likewise, the operation would be consistent with the TRCCLUP use for the area and would further the goals within that long range plan.

The embankments would not be accessible during demolition, and demolition may prevent access to the river. Following embankment removal, the operation of the site for use as a public recreational amenity would be consistent with the current zoning of embankments for industrial purposes. Likewise, the operation would be consistent with the TRCCLUP use for the area and would further the goals within that long range plan.

Nonstructural Flood Control Improvements

The nonstructural flood control improvements are improvements to the Emergency Action Plans (EAPs). As no construction or change in land use is proposed, there would be no impacts to land use.

<u>BVP Study Ecosystem and Recreation Features</u>

Lakes

The construction of the three lakes would maintain approximately 270 acres of land designated as Open Space - Public land use. While the designation would remain the same, the nature of the space would change from terrestrial to aquatic open space uses (City of Dallas 2011).

The area planned for the West Dallas Lake is currently zoned Agricultural, which allows not only agricultural development, but also public recreational amenities (City of Dallas 2012a). Therefore, the West Dallas Lake would be consistent with current zoning. Similarly, the Urban Lake straddles the Agricultural zoning district, the Industrial Research zoning district, and the Planned Development zoning district for the Trinity River Corridor Special Purpose District. Development within the Trinity River Corridor Special Purpose District is permitted if it is in support of Central Area District uses, including recreation. Likewise, public recreational amenities are permissible within the Industrial Research zoning district (City of Dallas 2012a). Thus, the Urban Lake would be consistent with all the zoning designations it would overlay. The upstream end of the Natural Lake would also fall within the Trinity River Corridor Special Purpose District; the lower end of the Natural Lake would be within the Industrial Manufacturing zoning district, which also permits public recreational facilities (City of Dallas 2012a). Therefore, the Natural Lake would be consistent with the current zoning. In addition, the three lakes would further the goals stated within the TRCCLUP for the area. As all Land and Water Conservation Fund (LWCF) projects within the Study Area have been completed, no impacts to LWCF projects would occur. Coordination between the City of Dallas, USACE, and the TPWD would occur if future LWCF conservation and enhancement projects are proposed.

River Modification

The river modification would convert some land previously designated as Open Space – Public into Water, and other sections from Water to Open Space - Public. The corridor along the existing and proposed channel footprint incorporates all zoning districts found within the Floodway, including the Agriculture, Industrial Manufacturing, Planned Development, and Industrial Research zoning districts. All of these zoning districts permit the construction of public recreational amenities, and thus the change in land use would be consistent with the existing zoning (City of Dallas 2012a). In addition, the river modification would further the goals stated within the TRCCLUP for the area.

Wetlands

The proposed wetlands would convert some land previously designated as Open Space – Public into Water; wetlands that are not designed to maintain water levels throughout the year may maintain their Open Space – Public designation. The proposed wetlands would occur within all zoning districts found within the Floodway, including the Agriculture, Industrial Manufacturing, Planned Development, and Industrial Research zoning districts. The consistency of the wetlands with existing zoning would be dependent on the ultimate zoning classification of the wetlands by the City of Dallas Planning Department. If the wetlands are considered "public parks," they would be consistent with existing zoning (City of Dallas 2012a). Regardless of the ultimate zoning outcome, the wetlands would further the goals stated within the TRCCLUP for the area.

Athletic Facilities

The establishment of athletic fields and associated facilities would not change the 2011 City of Dallas land use designation (Open Space – Public). The usage of land as flex fields, playgrounds, and similar public recreational amenities is permissible within the Agriculture zoning district (City of Dallas 2012a), and thus the fields would be consistent with the existing zoning. In addition, the athletic fields would further the goals stated within the TRCCLUP for the area.

General Features

Proposed general features including trails, lighting, and restrooms would not result in a change in land use from the pre-existing Open Space - Public designation. These features would all be considered public recreation amenities and be permissible in all zoning districts, thus would be consistent with existing zoning.

Classifying the roads and parking facilities as part of the recreational amenity would bring them into compliance with zoning; however, the determination of whether or not that classification is appropriate is the responsibility of the City of Dallas Planning Department. Regardless of the ultimate zoning outcome, the roads and parking, in addition to the other general features considered, would further the goals stated within the TRCCLUP for the area.

Interior Drainage Outfall Modifications

Modifications to the interior drainage outfalls would change land use designations from Open Space – Public to Government – Public Facilities. Outfalls are considered public utilities under the City of Dallas zoning code, and are permitted by Dallas City Code. Because of the size of the outfalls, they would require completion of a "residential adjacency review" where the Floodway is zoned for Agriculture, as Agriculture is considered a residential zoning category by the City of Dallas (City of Dallas 2012c). While the review would be required, the outfall modifications would be consistent with the zoning code, and would further the goals stated within the TRCCLUP for the area.

<u>IDP Improvements</u>

Hampton Pump Station and Sump Improvements

The proposed improvements at the Hampton Pumping Plant would occur on land designated as Open Space – Public (City of Dallas 2011). The construction of the New Hampton Pump Station within this land use designation would constitute a change in land use. Pump stations are considered public utilities under the City of Dallas zoning code, and are permitted by right in all zoning districts. Because of the size of the proposed improvements and because the site abuts a residential parcel, a "residential adjacency review" would be required (City of Dallas 2012b). While the review may be required, the new pump station and associated improvements would be consistent with the zoning code, and would further the goals stated within the TRCCLUP for the area by supporting stormwater supplies to the Floodway.

Charlie Pump Station and Sump Improvements

The proposed improvements at the Charlie Pumping Plant would occur on land previously designated as Undeveloped – Vacant, with the access road connections on Open Space – Public land (City of Dallas 2011). The construction of a new pump station within this land use designation would change the land use to Government – Public Facilities. Pump stations are considered public utilities under the City of Dallas zoning code, and are permitted by right in all zoning districts. In this case, the residential adjacency review may be triggered by a construction site being within the Planned Development Oak Cliff Gateway zoning district, as this district allows for multiple uses, including residential. At the time of the 2011 City of Dallas land use inventory; however, the proposed improvement site was not adjacent to any residential parcels. While the review may be required, the pump station and associated improvements would be consistent with the zoning code, and would further the goals stated within the TRCCLUP for the area by supporting stormwater supplies to the Floodway.

Delta Pump Station and Sump Improvements

The construction and operation of the Delta Pump Station improvements would not constitute changes in the use of the land. The pump station would continue to operate as a flood control structure throughout construction and operation. The modifications would not require a zoning variance, nor would the modifications be contrary to the TRCCLUP. Modifications to the pump station that would not change the use of that facility would not constitute an impact to land use.

Trinity-Portland Pumping Plant and Sump Improvements

The proposed Trinity-Portland Pumping Plant would occur on land previously designated as Open Space – Public and Undeveloped – Vacant bordering on Residential designations (City of Dallas 2011). The construction of a new pump station within this land use designation would change the land use to Government – Public Facilities. Pump stations are considered public utilities under the City of Dallas zoning code, and are permitted by right in all zoning districts. In this case, the residential adjacency review would be triggered by the construction site being within an Agriculture zoning district and crossing into an area zoned dense residential (City of Dallas 2012c). While the review would be required, the pump station and associated improvements would be consistent with the zoning code, and would further the goals stated within the TRCCLUP for the area by supporting stormwater supplies to the Floodway.

Improvements to the Eagle Ford/Trinity-Portland Sumps connection may require the City to purchase three privately owned parcels of land; each parcel currently contains a single-family residence. The current design indicates the proposed sump improvements may be completed without impacting the parcels; however, the City of Dallas may choose to pursue the purchase the lands following coordination with the property owners, if recommended in later design refinements.

4.1.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential impacts to land use from implementation of the proposed FRM elements and IDP improvements would be the same as presented under the design anticipating the construction of the potential Trinity Parkway, as there would be no change in these components. Therefore, refer to the sections titled "BVP Study FRM Elements" and "IDP Improvements" within Section 4.1.3.1 for a discussion of impacts to land use associated with implementation of those elements and improvements. Similarly, no impacts to LWCF projects would occur with the implementation of the design without potential Trinity Parkway construction anticipated. Coordination between the City of Dallas, USACE, and the Texas Parks and Wildlife Department (TPWD) would occur if future LWCF conservation and enhancement projects are proposed. The following section presents the potential impacts to land use from implementation of the BVP Study Ecosystem and Recreation features as designed without anticipating construction of the potential Trinity Parkway. These features are slightly different from those presented under the design that does anticipate the potential Trinity Parkway being constructed.

<u>BVP Study Ecosystem and Recreation Features</u>

The Proposed Action designed without the potential Trinity Parkway construction being anticipated includes the creation of 1.9 additional acres of wetlands as compared to the design that does anticipate the potential Trinity Parkway being within the Floodway. The proposed wetlands would convert some land previously designated as Open Space – Public into Water; wetlands that are not designed to maintain water levels throughout the year may maintain their Open Space – Public designation. The consistency of the wetlands with existing zoning would be dependent on the ultimate zoning classification of the wetlands by the City of Dallas. If the proposed wetlands are considered "public parks," they would be consistent with existing zoning (City of Dallas 2012a). Regardless of the ultimate zoning outcome, the proposed wetlands would further the goals stated within the TRCCLUP for the area.

The recreational features designed without potential Trinity Parkway construction anticipated include 2.1 more miles of park roads. Surface parking is not permitted in the Agriculture, Industrial Manufacture, or Industrial Research zoning districts. Public roads are not included in the zoning use analysis, and private roads likewise are not permitted in any of these zoning districts (City of Dallas 2012a). Classifying the roads and parking facilities as part of the recreational amenity would bring them into compliance with the zoning; however, classification of the roads and parks is the responsibility of the City of Dallas Planning Department. Thus, the design without potential Trinity Parkway construction anticipated results in greater inconsistency with the current zoning code than does the design that anticipates the potential Trinity Parkway being within the Floodway.

4.1.3.3 Summary

Under either Proposed Action design, the proposed FRM elements would be consistent with the current zoning and TRCCLUP use for the area, furthering the goals of the TRCCLUP. The proposed BVP Study features would be consistent with current zoning. As all LWCF projects within the Study Area have been completed, no impacts to LWCF projects would occur. The river modifications would further the goals stated within the TRCCLUP for the area. Some areas would first require completion of a "residential adjacency review." However, while a review would be required, the proposed improvements would be consistent with the zoning code and would further the goals stated within the TRCCLUP. The comprehensive plans currently in use (e.g., TRCCLUP and forwardDallas!) incorporate many of the elements included under both Proposed Action designs.

Regardless of the ultimate zoning outcome or "residential adjacency review," the roads and parking, in addition to the other general features considered, would further the goals stated within the TRCCLUP for the area. Therefore, implementation of either design would result in beneficial impacts to land use. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.1.3.4 Cumulative Impacts

<u>Design Anticipating Potential Trinity Parkway Construction</u>

Under the Proposed Action design anticipating potential Trinity Parkway construction, current land use patterns within the Study Area would generally remain the same, consistent with prevailing land use and zoning plans. The changes anticipated are primarily improvements within the pre-existing land use category. For example, the BVP Study Ecosystem and Recreation features would occur within the Open Space land use designation. While the recreation within the Open Space may change to more active or directed uses allowed by improved infrastructure and recreational facilities, the categorization remains within the overall Open Space – Public designation. The Proposed Action design anticipating potential Trinity Parkway construction in combination with the identified reasonably foreseeable projects would comply with existing land use and zoning requirements and would result in compatible land uses. Several of the identified projects would result in minor changes to land use. Those changes are as summarized in Table 4.1-1, including the predicted increase in Transportation and decrease in Open Space. The primary driver for both of these changes would be the potential Trinity Parkway construction within the Floodway.

The potential Trinity Parkway project includes land acquisition and the change of private commercial, industrial, and other uses to Transportation. The Trinity Parkway right-of-way covers 559 acres. Of that area, 100 acres are currently privately owned and used for residential, commercial, industrial, or rail transportation purposes. The remainder is owned by the City of Dallas and is undeveloped Open Space, with the exception of the Trinity Portland Sump. While this project would result in a substantial change in land use, the potential Trinity Parkway is incorporated into the TRCCLUP and other land use plans (FHWA 2014).

The comprehensive plans currently in use (e.g., TRCCLUP and forwardDallas!) incorporate many of the past, present, and reasonably foreseeable projects. Thus, the cumulative contribution of Proposed Action design anticipating the potential Trinity Parkway construction would substantially further the plans and policies of the City of Dallas, the plans and projects for Dallas County, and those being considered by the NCTCOG. Therefore, implementation of the Proposed Action design anticipating potential Trinity

Parkway construction in combination with the identified past, present and reasonably foreseeable projects would result in beneficial cumulative impacts to land use.

Design Without Potential Trinity Parkway Construction Anticipated

As with the design anticipating the potential Trinity Parkway construction, the Proposed Action design without potential Trinity Parkway construction anticipated would generally maintain current land use patterns within the ROI, consistent with prevailing land use and zoning plans. The Proposed Action design without potential Trinity Parkway construction anticipated in combination with the identified reasonably foreseeable projects would comply with existing land use and zoning requirements and would result in compatible land uses. Several of the identified projects would result in minor changes to land use.

While the Proposed Action would not contribute to an adverse impact to land use, this design (and associated cumulative condition) assumes that the potential Trinity Parkway would not be built. This would be inconsistent with the land uses anticipated by the plans and policies of the City of Dallas, the plans and projects for Dallas County, and those being considered by the NCTCOG. Under the design without potential Trinity Parkway construction anticipated cumulative condition, these agencies would have to modify their land use plans within the ROI and revise development plans to no longer include the potential Trinity Parkway. The Proposed Action would not drive this effort, rather it would be driven wholly by the failure to construct the potential Trinity Parkway. Therefore, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated, in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant impacts to land use.

4.2 GEOLOGY AND SOILS

4.2.1 Approach to Analysis

The protection of topography, geomorphology, unique geologic features, soils, and siting of structures away from potential geological hazards are considered when evaluating impacts on geological resources. Generally, geological resource impacts can be avoided or minimized if proper construction techniques, erosion control measures, and structural engineering components are incorporated into project design.

4.2.2 Alternative 1: Future Without-Project Condition

Under the Future Without-Project Condition, there would be no change to the geologic character of the area. There are currently no prime farmlands in the Study Area; thus, there would be no impact to prime farmlands under the Future Without-Project Condition. The topography of the area would largely go unchanged besides on-going levee maintenance, which may slightly alter levee heights. As shrink-swell potential within the Floodway soils would remain high; geotechnical investigations are anticipated to occur to ensure structure stability for the identified future projects.

As the Trinity River flows year round, the natural morphological processes of erosion and siltation would continue to occur. These changes would be typical of large a river system. Under the Future Without-Project Condition, levee slides and erosion are anticipated to continue to occur; these areas would continue to be addressed as part of on-going, enduring maintenance activities.

4.2.3 Alternative 2: Proposed Action

4.2.3.1 Design Anticipating Potential Trinity Parkway Construction

BVP Study FRM Elements

There is no difference in impacts between the design variations being considered for the Proposed Action for BVP Study FRM Elements.

Construction Impact Overview

Construction activities including clearing, grading, and excavating that result in land disturbance of equal to or greater than 1 acre would be required to comply with the Construction General Permit (TXR150000), per the requirements of the Texas Parks and Wildlife Department (TPDES) program as administered by the Texas Commission on Environmental Quality (TCEQ). Construction activities that result in land disturbance of equal to or greater than 1 acre and less than 5 acres of land are considered “small construction activities.” Construction activities that result in land disturbance of equal to or greater than 5 acres of land are considered “large construction activities.” Construction activities include the disturbance of total land area that is part of a larger common plan of development or sale. Some individual construction activities may be constructed separate from the larger common plan of development (e.g., IDP Improvements). If this occurs, and the individual project disturbs equal to or greater than 1 acre, then the individual would comply with the Construction General Permit (TXR150000), as required.

Construction activities within the Floodway would be considered part of the same common plan of development, would disturb more than 5 acres of land, and would therefore comply with the requirements of a large construction activity. Before construction, a Notice of Intent would be submitted to TCEQ for compliance with the General Stormwater Permit for Construction Activities and a Stormwater Pollution Prevention Plan (SWPPP) would be developed. The SWPPP would outline site-specific best management practices (BMPs) in accordance with TXR150000, which would minimize erosion and control sediment resulting from construction activities.

BMPs include schedules of activities, prohibitions of practices, maintenance procedures, structural controls, local ordinances, and other management practices to prevent or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control construction site runoff, spills or leaks, waste disposal, or drainage from raw material storage areas (TCEQ 2013). The use of BMPs such as silt fencing and sediment traps, the application of water sprays, and the prompt revegetation of disturbed areas would reduce potential impacts. Implementation of sediment and erosion controls during construction activities would maintain runoff water quality at levels comparable to existing conditions.

The Proposed Action would temporarily disturb soils during construction. There would be an associated risk of increased rate of erosion and soil loss from physical disturbance with construction activity; however, compliance with standard operating procedures and the SWPPP would minimize impacts. Soils within the Study Area have low erosion factors and construction would not occur on steep slopes. Proposed construction activities would include clearing, grading, and grubbing, demolition, earthwork, and landscaping around predominately previously disturbed areas. Whenever possible, cut soil would be used for fill on-site or at nearby projects to minimize impacts to soil. Disturbed areas would be seeded or re-sodded and then would be checked periodically to ensure that grass coverage is properly maintained and, when necessary, the site would be watered, fertilized, and reseeded or sodded. These additional actions would help reduce erosion.

Levee Raise Modification and Levee Flattening: 4:1 Side Slopes

Construction

Surface disturbance as a result of excavating approximately 105 acres for the borrow pits would be approximately 115 acres. The proposed access roads would be 10-feet wide and comprised of crushed limestone aggregate to a depth of 8 inches. Beneath the limestone, a geo-textile liner would be placed as part of the road structure to prevent seepage. After completion of the access roads and levee raise activities, scarification and seeding would finalize the levee improvements and flattening. Any remaining cut material would be rough graded into other areas of the Floodway, and/or transported off-site to a designated landfill.

Operation

Impacts to topography would result from borrow pit excavation; however, the western pit would remain and eventually be incorporated into the proposed West Dallas Lake. The eastern borrow pit would be incorporated into the proposed river sinuosity. The levees, which are already a prominent topographic feature in the Floodway, would be raised in certain areas, creating greater topographic relief. Although changes in topography would occur, those impacts would be minimal and the area would remain relatively flat. The proposed levee raise and flattening actions would strengthen the levees.

Slope improvements by way of levee flattening would reduce riverside slopes from 3:1 to 4:1. The flattened slopes would reduce the risk of levee erosion.

AT&SF Railroad Bridge Modifications

Construction

Proposed demolition activities would require grading and dirt moving to level an access road before activities could begin. Total soil disturbance would be approximately 1.5 acres. In addition, three embankments would be removed. As part of the removal process, the embankment material would be evaluated for potential reuse within the Floodway. If, however, it is found to be not authorized for reuse within the Floodway, the material would be disposed of in the nearest suitable landfill. The proposed activities would cause sedimentation and erosion due to clearing and disturbance of soils until they are revegetated. Disturbed areas that are seeded or resodded would be checked periodically to ensure that coverage is properly maintained and would be watered, fertilized, and reseeded or sodded if necessary.

Operation

Topography would be slightly impacted from the embankment removals. However, the embankments are not natural geologic features. The Santa Fe Trestle Trail embankment was constructed as a result of the Santa Fe Trestle Trails Project (completed in 2012), while the earthen railroad embankment was constructed in 1926; therefore, there would be no impacts to natural topography. No geologic units, soils, or prime farmland would be impacted by the AT&SF Railroad Bridge modifications, as none are located in the Study Area.

<u>BVP Study Ecosystem and Recreation Features</u>

Construction

Proposed construction activities would require excavation, and grading to establish desired building pads, recreational fields, trails, lakes, river relocation, roads, wetlands, and boardwalks. Also, contractors would remove any potential underground obstacles and place any needed fill material in the area. The relatively flat topography of the Study Area would alleviate some excessive cut and fill excavation; however, the nature of the construction and scale of the BVP Study features would include excavation and grading throughout much of the Dallas Floodway, resulting in the potential for erosion. The Trinity clay and Trinity-Urban land complex found throughout the Floodway contain a low erodibility hazard.

The excavation necessary to re-create meanders in the Trinity River, combined with the excavation of the lakes would be approximately 6.1 million cubic yards. Concurrently, the fill needed for FRM levee raise elements would be 860,000 cubic yards and the potential Trinity Parkway project would be 4.1 million cubic yards. Therefore, under the design anticipating potential Trinity Parkway construction, approximately 2 million cubic yards of fill would need to be relocated off-site to a designated landfill or re-used within the Floodway for other proposed features. The excess fill would not be sold.

Operation

Topography

The majority of the BVP Study features would have little to no impact on the existing site topography. However, areas nearest the proposed Urban and Natural Lakes would be transformed; formerly flat regions of the Floodway would become lakes. Terraced playing fields would also be created upstream of Sylvan Road. While the proposed BVP Study features would slightly alter the existing topographic setting of the Dallas Floodway, these impacts would be minimal and remain consistent with the existing topography.

Geology

Implementation of the proposed BVP Study features would not substantially affect the geologic units underlying the Dallas Floodway. As mining operations have not taken place in the Floodway since the 1960s and quarrying efforts are not planned, the operation of the BVP Study features would not impact quarrying operations or mining resources in the area.

Geologic Hazards

The City of Dallas is located in an area of historically low seismic activity and with no known active faults within 60 miles of the Dallas Floodway. As soils within the Floodway have a very high shrink-swell potential, geotechnical studies would be completed at the proposed building locations during the planning/design phase. Recommendations based on the geotechnical study should include appropriate siting and building requirements to minimize soil shrink-swell hazards.

Soils

Slope stabilization measures and scour reduction would be incorporated into BVP Study features. These measures would include but would not be limited to riprap, stone slabs/boulders, riparian buffer plantings, articulating concrete block mats, or retaining walls. The addition of nine miles of walking/biking trails would have the potential to increase erosion, as previously vegetated areas would have exposed soils. However, many of the areas along the Floodway are currently sparsely vegetated and susceptible to erosion. The proposed landscaped and engineered areas would have lower runoff rates and consequently lower erosion levels. Overall, areas along the Floodway would likely have reductions in erosion levels from decreases in erosion and increased vegetative cover.

Geomorphology

The Proposed Action includes substantial physical changes to the channel and Floodway including the restoration of channel meanders, creation of a mid-channel island, alterations to channel geometry, and general enhancement of aquatic and riparian habitat throughout the corridor. All of the proposed meander bends for the relocated Trinity River would fall within a naturally stable channel. However, meander bends in rivers are typically the result of lateral channel migration driven by long-term processes of erosion and deposition. While channel migration rates are anticipated to be relatively low, meander bends would be protected with bank treatments designed to prevent lateral migration and channel instability. Furthermore, where feasible, channel bank slopes would be flattened to 4:1 on the insides of the meander bends and remain at 3:1 on the outsides of the meander bends. This configuration would approximate a more natural geomorphic condition typical of meandering rivers. Areas upstream and downstream of the Study Area would retain their more complex channel alignment and geometry (City of Dallas 2009).

The creation of lakes within the Floodway would create a “smoother” surface for flood waters (compared to the vegetated surface that currently exists). Because this condition would result in downstream effects, features such as berms and trees would be introduced into the Floodway to slow flood velocity so that there would be no net increase or decrease in flood conveyance, resulting in a natural erosional and depositional channel migration processes.

Levee Stability

Proposed river meanders and lakes could create seepage issues as water pressure would be closer to the toe of the levees, increasing the likelihood that the levees could become destabilized. In determination of the potential issues that could arise from seepage, the USACE Geotechnical Section has determined, in conjunction with the geotechnical report, that a 150-foot buffer area from the proposed levee toe should be sufficient to reduce the seepage failure mechanism.

The depth of excavation for West Dallas Lake is quite substantial at 24 feet from the existing grade; the lake itself from top of bank to bottom depth is 22 feet in depth. Further seepage analysis may need to be completed at this location to determine appropriate offset distances for the depth of this lake. At this stage of feasibility there is no definitive requirement for cutoff walls pending future seepage studies. If the footprint of the lakes changes to any extent, the cutoff wall option would have to be re-evaluated at that juncture to prevent levee instability.

Prime Farmland Soils

As there is currently no designated prime farmland in the Study Area, implementation of proposed BVP Study features would be exempt from the requirements of the Farmland Protection Policy Act, and a Farmland Conversion Impact Rating Form (Form AD-1006) would not be required.

<u>IDP Improvements</u>

There is no difference in geology and soils impacts between the design variations being considered for the Proposed Action for IDP Improvements.

Hampton Pump Station and Sump Improvements

The construction of the New Hampton Pump Station would minimally increase impervious surfaces, which would increase stormwater runoff and erosion rates. However, these increases would be minimized through engineering design and BMPs. A retaining wall would be constructed to prevent erosion and protect the sides of the proposed New Hampton Pump Station, which would also help reduce erosion. Implementation of the Proposed Action would include the installation of stormwater and associated runoff management design features (e.g., catch basins and channels) to prevent potential erosion associated with stormwater drainage. Stormwater would flow up and over the levee via dedicated pipes. The pipes would rest on concrete pedestals and the pedestals would be connected to a reinforced concrete bedding slab that would be “notched” into the levee in accordance with geotechnical requirements. The river side of the re-constructed embankment over the discharge pipes would be protected from erosion by an articulated concrete revetment mat (URS 2009a).

No changes in topography would occur under the construction of the New Hampton Pump Station. As no unique geologic features or prime farmland soils are located within the Study Area, no impact to these geological resources would occur.

Charlie Pump Station and Sump Improvements

Excavation of the Charlie Pump Station would remove approximately 12,000 cubic yards of soil. Roughly 10,000 cubic yards of soil would be brought from off-site for backfill. The New Charlie Pump Station would remedy the current erosional issues of the Old Charlie Pump Station. Furthermore, the unstable loose soil that continually erodes from around the existing outfall structure would be stabilized (URS 2009b). Stormwater pipes would be secured to the levee as described above for the Hampton Pump Station.

The Proposed Action would include the installation of stormwater and associated runoff management design features (e.g., catch basins and channels) to prevent potential erosion associated with stormwater drainage. No changes in topography would occur as a result of the demolition or construction of the Old and New Charlie Pump Station. Also, as no unique geologic features or prime farmland are located within the Study Area, no impacts to these geological resources would occur.

Delta Pump Station and Sump Improvements

Construction

Excavation of the Delta Pump Station would remove approximately 12,000 cubic yards of soil. Roughly 10,000 cubic yards of soil would be brought from off-site for backfill (URS 2009c). Construction of the electrical building would include installation of stormwater and associated runoff management design features (e.g., catch basins and channels) to prevent potential erosion associated with stormwater drainage. Stormwater pipes would be secured to the levee as described above for the Hampton Pump Station. No changes in topography would occur under the construction of the Delta Pump Station. Also, as no unique geologic features or prime farmland are located within the Study Area, no impacts to these geological resources would occur.

Trinity-Portland Pumping Plant and Sump Improvements

Construction

Similar to the Delta and Charlie Pump Stations, excavation for the Trinity-Portland Pumping Plant would remove approximately 12,000 cubic yards of soil and require approximately 10,000 cubic yards of backfill (URS 2009d). Construction would include installation of stormwater and associated runoff management design features (e.g., catch basins and channels) to prevent potential erosion associated with stormwater drainage. Stormwater pipes would be secured to the levee as described above for the Hampton Pump Station. As the existing area is relatively undeveloped, construction of the Trinity-Portland Pumping Plant would result in a minor localized change in topography. Also, as no unique geologic features or prime farmland are located within the Study Area, no impacts to these geological resources would occur.

4.2.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential impacts to geology and soils from implementation of the proposed FRM elements and IDP improvements would be the same under both design variations, as there would be no change in these components. Therefore, refer to Section 4.2.3.1 for a discussion of impacts to geology and soils associated with implementation of the FRM elements and IDP improvements under the design anticipating potential Trinity Parkway construction.

BVP Study Ecosystem and Recreation Features

The construction of the BVP Study features under the design without the potential Trinity Parkway construction anticipated would involve the increased relocation of cut and fill material within the Floodway, as compared with the design anticipating the potential Trinity Parkway construction. Approximately 6.1 million cubic yards would be excavated for the lakes and other features, with 860,000 cubic yards of those soils being utilized for the levee raise modification and levee flattening. The remaining 5.2 million cubic yards would be relocated off-site to a designated landfill and/or rough graded into other areas of the Floodway in support of other proposed features. The excess fill would not be sold. The design without the potential Trinity Parkway construction anticipated would require the same SWPPP and BMP requirements to mitigate erosion during construction activities as would be required for the design anticipating the potential Trinity Parkway construction. Operational impacts would be the same under both design variations.

4.2.3.3 Summary

Impacts to geology and soils under the design without potential Trinity Parkway construction anticipated would be slightly greater, but not substantially different, during the construction phase as compared to the design with the potential Trinity Parkway because a greater amount of area would be disturbed to create the lakes. There would be no change in operational conditions between the design options.

Construction related impacts to soils would be minimized through the use of BMPs as required and developed through the SWPPP and engineering designs. BMPs would be implemented before, during, and after construction activities in accordance with TXR150000. The proposed FRM elements would reduce on-going levee erosion. Furthermore, the resulting levees would be strengthened as compared to existing conditions. The proposed FRM elements would include slope stabilization and erosion control measures. The proposed IDP improvements would not affect levee stability. Also, as no unique geologic features or prime farmland are located within the Study Area, no impacts to these geological resources would occur.

Once complete, the levees with the “flattened” slopes would have less erosion potential and be more stable, thus reducing risk associated with geologic hazards (e.g., slumps and slides). Similarly, the proposed landscaping and recreation elements would further stabilize soils without reducing soil productivity. Therefore, the Proposed Action would result in less than significant impacts to geology and soils, and beneficial impacts to levee stability. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.2.3.4 Cumulative Impacts

Design Anticipating Potential Trinity Parkway Construction

Implementation of the design anticipating potential Trinity Parkway construction would result in less than significant impacts to geology and soils, and beneficial impacts to levee stability. Reasonably foreseeable projects that would result in the disturbance of equal to or more than 1 acre would be required to develop SWPPPs in accordance with TXR150000, thus minimizing the potential for negative impacts to soils in the ROI. Any modification to the Dallas Floodway Levee System from a project must apply for a Section 408 Application from the USACE, ensuring that any proposed alteration would not be injurious to the public interest and would not impair the usefulness of the levees, limiting cumulative impacts to the levees. No cumulative impacts to unique geologic features or prime farmland would occur.

Potential impacts from the implementation of the Trinity Parkway would result in changes in surface topography due to cut and fill of slopes, embankment material, excavation, ditching, and/or trenching. Similarly, any action within the levees would require compliance with 33 U.S. Code (USC) Section 408 and USACE Pamphlet No. 1150-2-1. The potential Trinity Parkway would be subject to TXR150000 permit compliance, mandating the use of BMPs and limiting erosion of soils, as none are located in the Study Area. No impacts to unique geologic features or prime farmland would occur. Extensive coordination among the project partners has occurred especially in recent years to ensure the potential Trinity Parkway would not interrupt flood control operations or impact the existing Dallas Floodway levees (FHWA 2014). Therefore, implementation of the design anticipating the potential Trinity Parkway construction in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant cumulative impacts to geology and soils, and beneficial cumulative impacts to levee stability.

Design Without Potential Trinity Parkway Construction Anticipated

The cumulative impacts of the design without the potential Trinity Parkway construction anticipated would be similar to those described for the design that does anticipate the Trinity Parkway. The absence of the potential Trinity Parkway from the Dallas Floodway would reduce the amount of soil disturbance within the Floodway. Furthermore, topography would be more consistent with existing conditions. Implementation of the design without the potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant cumulative impacts to geology and soils, and beneficial cumulative impacts to levee stability.

4.3 HYDROLOGY AND HYDRAULICS

4.3.1 Approach to Analysis

The environmental consequences evaluation for hydrology and hydraulics (H&H) included the application of criteria from the Trinity River Environmental Impact Statement (TREIS) Record of Decision (ROD) and compliance with Executive Order (EO) 11988: *Floodplain Management*. The ROD criteria were used to ensure that projects are designed in such a way that there are no flood rises in the water surface profile for the 100-year flood and Standard Project Flood (SPF) events and that there is no valley storage loss for the 100-year flood event and less than 5 percent (%) valley storage loss for the SPF event.

Water surface profiles were computed for the Revised Corridor Development Certificate (CDC) Model and the With-Project Model through the river reach affected by the proposed development and a comparison of the water surface elevations is made on a cross section by cross section basis. The changes in valley storage represent changes in floodplain volume due to developments that can result in changes in the timing of flood peaks and potentially increase the flood event peak flow. A substantial loss of valley storage may in turn increase the risk of flood damage downstream of the proposed development. The valley storage analysis compared the valley storage that originally exists on a project site against the predicted amount of valley storage under the Proposed Action. While the TREIS ROD criteria limit the impacts of proposed projects to no rise in the water surface profile for the 100-year flood and SPF events, it does not preclude a lowering of the water surface profile. However, if a proposed project would result in a lowering of the water surface profile off-site, this would be regarded as a loss in valley storage and must be computed in the total valley storage change. Loss in valley storage could result in an increase to the water surface profile downstream of the project site, so this was also considered in determining potential impacts.

The following designations were used to describe the level of project impacts:

- *Potentially significant impact (positive or negative)*: Any impact that would result in change to water surface elevation and/or valley storage that exceeds the TREIS ROD criteria and would increase flooding within the Study Area or downstream.
- *Less than significant impact*: Any impact that would result in change to water surface elevation and/or valley storage that exceeds the TREIS ROD criteria but would not substantially increase flooding within the Study Area or downstream.
- *No impact*: The project would meet the TREIS ROD criteria and would have no impact on flooding potential.

4.3.2 Alternative 1: Future Without-Project Condition

4.3.2.1 Hydrology

To account for the effects of future urbanization on the Upper Trinity watershed, projections must be made about future land use. This estimate of future conditions represents watershed conditions in the year 2040. Table 4.3-1 presents the final frequency flows at Dallas for existing and future conditions based on projected 2040 land use changes.

Table 4.3-1. Final Frequency Flows at Dallas for Existing and Future Conditions

Annual Probability of Exceedance	*Flood Return Interval (Years)*	*Existing Conditions Peak Flow (cubic feet per second [cfs])*	*Future Conditions Peak Flow (cfs)*
0.5	2	26,485	30,000
0.2	5	36,000	41,000
0.1	10	50,000	55,000
0.05	20	67,000	72,000
0.02	50	92,000	96,000
0.01	100	114,000	119,000
0.002	500	179,000	184,000
0.0004	2500	269,300 (current SPF)	277,000 (future SPF)

4.3.2.2 Hydraulics

Several of the projects listed for the Future Without-Project Condition are located outside of the Trinity River floodplain and thus have no river hydraulic impact. For the projects located within the floodplain that have detailed enough design plans, the existing channel cross section geometry in the Hydrologic Engineering Center - River Analysis System (HEC-RAS) model has been modified, as appropriate. For some of the other projects located within the floodplain, there was no modeling information available prior to the development of the Future Without-Project Condition model, and therefore no modifications to the Future Without-Project Condition model were made for these projects. Future projects are required to meet TREIS ROD criteria by demonstrating through hydraulic modeling that the project results in no significant H&H impact to the existing floodplain.

Water Surface Profiles

The water surface profiles for the Future Without-Project Condition compared to the Existing Condition for the Trinity River Mainstem and the Elm and West Forks are shown on Figures 1 to 6 of Appendix K, *Hydrology and Hydraulics Figures*. Under the Future Without-Project Condition, the Dallas Floodway East and West Levees would be overtopped at the following locations during the SPF event:

- Elm Fork between downstream of the State Highway (SH)-183 and Burlington Northern Santa Fe Railroad Bridge (East Levee);
- Mainstem at several locations between the Westmoreland Road Bridge and Union Pacific Railroad Bridge (East and West Levee);
- Mainstem at the Interstate Highway (IH)-30 Bridge (East Levee); and
- Mainstem at the IH-35 Bridge (East Levee).

Water Surface Elevations

The computed Future Without-Project Condition water surface elevations at specified locations in the Study Area for the 100-year and SPF flood events are provided in Table 4.3-2. Because the future hydrology is expected to change due to changes in land use, the surface water elevations for both existing and future channel conditions reflects the future increases in runoff. This allows for a comparison with the 100-year flood event and the SPF based solely on changes to floodplain geometry.

Table 4.3-2. Water Surface Elevations in the Floodway under the Existing Conditions (2040 Discharges) and the Future Without-Project Condition (2040 Discharges)

Location	*East Levee Height*	*100-Year Flood Event Water Surface Elevation (feet)*			*SPF Flood Event Water Surface Elevation (feet)*		
		Existing Condition	*Future Without-Project Condition*	*Difference*	*Existing Condition*	*Future Without-Project Condition*	*Difference*
West & Elm Fork Confluence	437.28	423.27	422.75	-0.52	435.43	434.93	-0.50
Hampton Bridge	433.91	420.32	420.55	+0.23	432.93	432.81	-0.12
Commerce Bridge	429.41	416.83	416.95	+0.12	429.04	428.66	-0.38
DART Rail Bridge	425.25	414.17	414.28	+0.11	425.42	424.35	-0.07

As indicated in Table 4.3-2 and Table 1 in Appendix K, water surface elevations would rise slightly for the 100-year flood event at some locations and either remain the same or drop for the SPF event except for small rise along a short reach upstream of the Corinth Street Bridge. There would be rises in the water surface profile for the 100-year flood event at several locations on the main stem of the Trinity River, with a maximum rise of 0.27 feet. This rise occurs within the Floodway on the Trinity River Mainstem where both levees provide flooding risk reduction for the 100-year flood event to the City of Dallas. The small rise for the SPF event along a short reach upstream of the Corinth Street Bridge has been computed to average 0.05 foot and is regarded as computationally insignificant.

This analysis indicates that because no rise occurs for either flood event for areas upstream of the project, there would be no increase in flood risk for these areas upstream of the project. However, because water surface rises occur for the 100-year flood event, this plan as currently designed fails to meet the requirements of the TREIS ROD criteria for water surface rise.

Valley Storage

The valley storage change for Future Without-Project Condition has been computed at approximately +0.80% for the 100-year flood event and -2.1% for the SPF event compared to the existing channel conditions with future runoff (i.e., 2040 discharges). This means that the Future Without-Project Condition would result in a valley storage loss for the SPF flood event but results in a valley storage gain for the 100-year flood event. The Future Without-Project Condition as currently designed meets the valley storage TREIS ROD criteria for both flood events because the valley storage loss for the SPF is less than the 5% valley storage loss allowed in the ROD criteria and there is no valley storage loss for the 100-year flood event.

4.3.2.3 Floodplain Impacts

The floodplain inundation maps for the Future Without-Project Condition are effectively the same as those presented in Existing Conditions (refer to Figure 3.3-3).

4.3.2.4 Fluvial Geomorphology

Under the Future Without-Project Condition, some projects would be located in the Floodway and require some modifications to the Floodway, and therefore have the potential to affect (or alter) the fluvial geomorphology of the Trinity River. However, these projects would result in minimal, if any, modifications to the bankfull channel, which has remained relatively stable for the past 70 years (refer to Section 3.3.2.6).

4.3.3 Alternative 2: Proposed Action

4.3.3.1 Design Anticipating Potential Trinity Parkway Construction

Unlike other resource areas, the analysis contained in this H&H section looks at the implementation of the BVP Study FRM elements, BVP Study Ecosystem and Recreation Features, and IDP improvements implemented as one unit and does not separate the individual main components into separate analyses. This is due to the models and modeling requirements used to determine potential H&H impacts from implementation of the design anticipating potential Trinity Parkway construction. Therefore, impacts to H&H under the design anticipating potential Trinity Parkway construction have been presented for the construction and operational phases and not by the three main components.

<u>Construction</u>

The FRM elements would result in temporary and minor impacts on the H&H of the Study Area. There would be potential for localized increase in runoff related to construction activities; however, these temporary and minor changes would have minimal impacts on 100-year and SPF flood event levels.

<u>Operation</u>

The FRM elements under the design anticipating potential Trinity Parkway construction have been designed to provide FRM for the future SPF event estimated to be 277,000 cubic feet per second (cfs) by way of implementing the levee height modification, AT&SF Railroad Bridge modifications, levee flattening, and nonstructural flood response improvements. Therefore, the desired level of SPF FRM would be achieved under the design anticipating potential Trinity Parkway construction. The BVP Study features under the design anticipating potential Trinity Parkway construction including the lakes, river channel relocations, ecosystem, and recreation features, would be primarily located within the Floodway and would directly influence the hydraulics of the Floodway. However, the BVP Study features have been designed to minimize effects on the hydraulics of the Floodway.

Hydrology

The majority of the project development would be in the Floodway and would result in minimal, if any, changes to the hydrology of the Upper Trinity watershed. Other factors such as changes in land use of the upstream watershed would have substantially greater effect on runoff. Changes to the hydrology of the Upper Trinity watershed have been based on estimates of future land use conditions in the year 2040. These land use changes are estimated to result in a change from 114,000 cfs to 119,000 cfs for the 100-year flood event and from 269,300 cfs to 277,000 cfs for the SPF event (refer to Table 4.3-1).

Hydraulics

The analysis below compares the design anticipating potential Trinity Parkway construction results to the Existing Condition results and both are for future year 2040 conditions.

Water Surface Profiles

The water surface profiles for the design anticipating potential Trinity Parkway construction compared to the Existing Condition for the Trinity River Mainstem and the Elm and West Forks are shown on Figures 7 to 10 of Appendix K. The profiles shown in these figures include the 100-year flood event and the SPF event. The profiles show the relationship between the SPF water surface and the proposed levee crest height for both the East and West Levees. Within the Floodway, the water surface profile for the design anticipating potential Trinity Parkway construction for the 100-year flood event is generally below the Existing Condition water surface profile except in an area between Commerce Street and Houston Street. Within the Floodway, the water surface profile for the design anticipating potential Trinity Parkway construction for the SPF event is also generally below the Existing Condition water surface profile except for in the vicinity of the AT&SF Railroad Bridge.

Water Surface Elevations

The computed water surface elevations for the design anticipating potential Trinity Parkway construction at specified locations in the Study Area for the 100-year and SPF flood events are provided in Table 4.3-3. Refer to Table 2 in Appendix K for water surface elevations at additional locations.

Table 4.3-3. Water Surface Elevations in the Floodway under the Existing Condition (2040 Discharges) and the Design Anticipating Potential Trinity Parkway Construction Condition (2040 Discharges)

Location	*100-Year Flood Event Water Surface Elevation (feet)*			*SPF Flood Event Water Surface Elevation (feet)*		
	Existing Condition	*Design Anticipating Potential Trinity Parkway Construction*	*Difference*	*Existing Condition*	*Design Anticipating Potential Trinity Parkway Construction*	*Difference*
West & Elm Fork Confluence	423.27	423.09	-0.18	435.43	435.01	-0.42
Hampton Bridge	420.32	419.91	-0.41	432.93	432.31	-0.62
Commerce Bridge	416.83	416.64	-0.19	429.04	428.57	-0.47
DART Rail Bridge	413.91	413.63	-0.28	425.42	424.51	-0.91

As indicated in Table 2 of Appendix K, water surface elevations within the Floodway and upstream of the ROI would rise for the 100-year flood event at some locations and there would be no rise for the SPF event compared to the Existing Condition. The maximum rise for the 100-year flood event would be 0.33 foot. This rise occurs within the Floodway on the Trinity River Mainstem where both levees provide flooding risk reduction for the 100-year flood event to the City of Dallas. Another rise is indicated upstream of the Elm Fork and West Fork confluence on the West Fork (refer to Table 2 in Appendix K). The 0.06 foot rise on the West Fork is considered insignificant from the standpoint that further design refinement could likely eliminate such as small rise upstream of the confluence for the 100-year flood event.

This analysis indicates that because water surface rises occur for the 100-year flood event, this plan fails to meet the requirements of the TREIS ROD criteria; however, the rises for the 100-year flood event occur within the Floodway on the Trinity River Mainstem where the levees would provide FRM to the City of Dallas. For the SPF flood event, this analysis indicates that since no rise occurs for areas upstream of the project, there would be no increase in flood risk for these areas for the SPF flood event.

Valley Storage

The valley storage change for the design anticipating potential Trinity Parkway construction has been computed at approximately -0.44% for the 100-year flood event and more than -3.1% for the SPF event, as compared to the Existing Condition. This means that implementation of the design anticipating potential Trinity Parkway construction would result in a valley storage loss for both flood events. The project as currently designed does not meet the TREIS ROD criteria for the 100-year flood event because no valley storage loss is allowed for the 100-year flood event. However, the estimated valley storage loss for the SPF is less than the 5% valley storage loss allowed in the TREIS ROD criteria.

The valley storage loss for the 100-year flood event and the SPF flood event would cause a slight rise in water surface level of downstream of the Dallas Floodway. While this would technically be regarded as a potential increase in flood risk, it would be considered less than significant when considering for actual damages that potentially could be realized for the following reasons. First, the immediate areas downstream of the Dallas Floodway are affected by the Dallas Floodway Extension (DFE) project, which is designed to provide flood risk benefits up to the SPF flood event with completion of the proposed levees. Because the levees have not been constructed, the very small rise estimated for the SPF flood event may be compensated for in the final design for the DFE levees at a reasonable additional cost. If the levee construction components for the DFE are extensively delayed or eliminated, the hydraulic benefits currently realized by completion of the Chain of Wetlands components of the DFE Project would more than compensate for any expected rise due to the estimated valley storage loss for the Dallas Floodway proposed projects. Secondly, downstream of the DFE Project, there are few structures subject to flooding by the 100-year or SPF flood events.

Summary of Hydraulic Impacts

The design anticipating potential Trinity Parkway construction would support achievement of the desired level of SPF FRM for the City of Dallas. In doing so, the design anticipating potential Trinity Parkway construction would not meet the TREIS ROD criteria for water surface elevation rise for the 100-year flood event and for valley storage loss for the 100-year flood event. The analysis indicates that the water surface elevation rise indicated for the 100-year flood event would be limited to the areas of the Dallas Floodway on the Trinity River Mainstem and the West Fork. Therefore, there would be no increased risk of flooding for this reach of the Trinity River because the East and West Levees would be reducing flood risk on both sides of the floodplain and the small rise (i.e., 0.06 foot) on the West Fork could be eliminated with further design refinement. The TREIS ROD criteria for water surface rise for the SPF flood event would be met at every location within the Dallas Floodway and upstream.

Additional design refinement efforts may be able to reduce the valley storage losses and/or reduce the water surface rises for the 100-year flood event within the Dallas Floodway on the Trinity River Mainstem; however, meeting the TREIS ROD criteria on every point would likely not be achievable for such a large and complex combination of projects. Further reducing the negative impacts for valley storage loss to some extent may be achievable, but since these estimated impacts are relatively insignificant, efforts to further reduce them are not likely to be cost effective at this level of design. At the current level of design for the various project components considered, the level of compliance with regard to meeting the goals of the TREIS ROD criteria is estimated to be very nearly optimal and technically sound from a hydraulic standpoint. Further hydraulic analysis would be prepared to ensure that these documented potential flood risk increases do not increase further. This on-going analysis would be utilized to further reduce or minimize potential flood risk increases as design opportunities arise during the final design stages of the various project components. Therefore, impacts from increased flood risk due to hydraulics would be less than significant.

Floodplain Impacts

Following proposed modifications, the Dallas Floodway Levee System would provide FRM to the City of Dallas for flooding from the SPF. In addition, the City of Dallas would also have flood risk reduction during the 100-year flood event.

As discussed above under the *Hydraulics* impact analysis, the design anticipating potential Trinity Parkway construction would not result in substantial increase in downstream flooding during the 100-year flood event. The designs of the BVP Study features would reflect the SCMs listed in Chapter 7. Implementation of these SCMs would minimize flood-related impacts to BVP Study features. Therefore, the design anticipating potential Trinity Parkway construction would be in compliance with EO 11988.

Fluvial Geomorphology

The river channel relocation portion of the BVP Study would result in the most substantial change to the Trinity River channel in many decades. The existing channel appears to have remained relatively stable since the USACE reconstruction of the channel in the 1950s. The BVP Study features proposes physical changes to the channel and Floodway including restoration of channel meanders, creation of a mid-channel island, alterations to channel geometry, and construction of three lakes in the Floodway adjacent to the channel.

The new river channel pattern would be offset from all sensitive park features in the floodplain by a distance sufficient to allow for channel adjustments to occur without impacting park features over the life of the project. Where this is not possible, channel geometry should be strengthened, using bioengineering approaches that incorporate native vegetation and other natural materials (City of Dallas 2009a). Because channel bank erosion is a natural and ecologically valuable process in river corridors, the bank treatments described above would not be intended to prevent all erosion throughout the project area. The proposed bank treatments would instead be designed to manage erosion in a way that optimizes protection of park features adjacent to the river channel and creation of aquatic and riparian habitat in areas located away from park features.

The river channel design has undergone hydraulic analysis to ensure that the channel would be stable under a range of flow conditions (City of Dallas 2009b). The final design would incorporate SCMs identified in the *Trinity River Corridor Project Fluvial Geomorphic Assessment and Basis of River*

Realignment Design (City of Dallas 2009b) and listed in Chapter 7; the final design would also be subject to review by the USACE.

4.3.3.2 Design Without Potential Trinity Parkway Construction Anticipated

As noted in Section 4.3.3.1, all main component features have been combined and analyzed as a unit in the models. Therefore, the following analysis differs from that presented under the design anticipating potential Trinity Parkway construction, except for construction, which would be the same as presented under the design anticipating potential Trinity Parkway construction in Section 4.3.3.1, *Construction*.

<u>Operation</u>

The HEC-RAS model was updated to reflect modifications to channel geometry under conditions of the design without potential Trinity Parkway construction anticipated, based on the changes to the BVP Study Ecosystem and Recreation Features as compared to the design anticipating potential Trinity Parkway construction.

Hydrology

The majority of the project development would be in the Floodway and would result in minimal, if any, changes to the hydrology of the Upper Trinity watershed. The changes in hydrology due to future land use would be the same under the design without potential Trinity Parkway construction anticipated as described under the design anticipating potential Trinity Parkway construction.

Hydraulics

The design without potential Trinity Parkway construction anticipated would be very similar to the design anticipating potential Trinity Parkway construction but has some proposed land use revisions that are based on the assumption that the Trinity Parkway project would not be built. Specific terrain data was not available for development of a detailed hydraulic model for the design without potential Trinity Parkway construction anticipated, however, the differences between the design without potential Trinity Parkway construction anticipated and the design anticipating potential Trinity Parkway construction are expected to be predominantly associated with minor relocation of access roads, trails, and parking lots. From the H&H perspective, these changes are not expected to result in significant differences in computed water surface profiles, water surface elevations, or valley storage for the 100-year and SPF flood events. Therefore, the hydraulic modeling results presented in Section 4.3.3.1, *Operation*, for the design anticipating potential Trinity Parkway construction are considered valid for the design without potential Trinity Parkway construction anticipated.

The summary of hydraulic impacts under the design without potential Trinity Parkway construction anticipated would be the same as under the design anticipating potential Trinity Parkway construction. Therefore, impacts from increased flood risk due to hydraulics would be less than significant under the design without potential Trinity Parkway construction anticipated.

Floodplain Impacts

The SPF event extent of flooding for the design without potential Trinity Parkway construction anticipated would be essentially the same as for the design anticipating potential Trinity Parkway construction. The City of Dallas would have flood management for the SPF event by the Dallas Floodway Levee System following proposed modifications. In addition, the City of Dallas would also have reduced flood risk during the 100-year flood event.

As discussed under the design anticipating potential Trinity Parkway construction, the design without potential Trinity Parkway construction anticipated would not result in substantial increase in downstream flooding during the 100-year flood event. Implementation of SCMs would minimize flood-related impacts to BVP Study features. Therefore, the design without potential Trinity Parkway construction anticipated would be in compliance with EO 11988.

Fluvial Geomorphology

The impacts to fluvial geomorphology under the design without potential Trinity Parkway construction anticipated would be the same as described under the design anticipating potential Trinity Parkway construction; the final design of the river channel relocation would incorporate SCMs listed in Chapter 7 and be subject to review by the USACE.

4.3.3.3 Summary

The H&H impacts under the design without potential Trinity Parkway construction anticipated and the design anticipating potential Trinity Parkway construction would be essentially the same. The Proposed Action would support achievement of the desired level of SPF FRM for the City of Dallas. In doing so, the Proposed Action would not meet the TREIS ROD criteria for water surface elevation rise for the 100-year flood event and for valley storage loss for the 100-year flood event. However, water surface elevation rise for the 100-year flood event would be limited to the areas of the Dallas Floodway and the West Fork, and therefore contained by the levees. Furthermore, the USACE and City of Dallas would request a variance from the TREIS ROD requirements, with the demonstration of there being no impact to public safety.

Increased flood risk associated with loss of valley storage would be reduced to less than significant through either the implementation of the DFE Project (which can be modified, as needed, to contain the SPF event) or the hydraulic benefits currently realized by completion of the Chain of Wetlands components of the DFE Project. The TREIS ROD criteria for water surface rise for the SPF flood event would be met at every location within the Dallas Floodway and upstream. The Proposed Action would be in compliance with EO 11988. Therefore, implementation of the Proposed Action would result in less than significant impacts to H&H. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.3.3.4 Cumulative Impacts

<u>Design Anticipating Potential Trinity Parkway Construction</u>

Hydrology

The design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects (including the Trinity Parkway) would have the potential to result in increased stormwater runoff. This increase would be additive to other development throughout the Upper Trinity watershed and the 2040 land use estimates used to develop future hydrology would represent conditions that include the cumulative impacts associated with the design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects. Overall, 2040 land use changes are estimated to result in a change from 114,000 cfs to 119,000 cfs for the 100-year flood event and 269,300 cfs to 277,000 cfs for the SPF event. This increase would be considered significant; however, impacts would be reduced to less than significant through the application of FRM elements under the design anticipating potential Trinity Parkway construction to increase the level of FRM for the SPF event.

Hydraulics

A portion of the potential Trinity Parkway would be located within the Floodway and would be subject to meeting the TREIS ROD criteria. The hydraulic analysis prepared for the Trinity Parkway Final Environmental Impact Statement (EIS) indicated that there would be maximum water surface rise of 0.27 feet for the 100-year flood event within the Floodway, no rise for the SPF event, a 0.4% gain in valley storage for the 100-year flood event, and a 4.0% loss in valley storage for the SPF event. The Trinity Parkway would not meet TREIS ROD criteria for the rise in water surface for the 100-year flood event; however, the rise would occur within the Floodway and present no increased risk of flood damage to existing structures. The Trinity Parkway meets all other TREIS ROD criteria (FHWA 2014).

Water Surface Profiles

The water surface profiles for the design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects compared to the Future Without-Project Condition for the Trinity River Mainstem and the Elm and West Forks are shown on Figures 6-30 to 6-35 of Appendix A of the USACE Feasibility Report (USACE 2014). The profiles shown in these figures are for the 100-year flood event and the SPF event. The profiles show the relationship between the SPF water surface and the proposed levee crest height for both the East and West Levees. Within the Floodway, the water surface profile for the design anticipating the potential Trinity Parkway construction and past, present, and reasonably foreseeable projects for the 100-year flood event would be generally below the Future Without-Project Condition water surface profile except in an area between Commerce Street and Houston Street. Within the Floodway, the water surface profile for the design anticipating the potential Trinity Parkway construction and past, present, and reasonably foreseeable projects for the SPF event would also be generally below the Future Without-Project Condition water surface profile except for in the vicinity of the AT&SF Railroad Bridge.

Water Surface Elevations

The computed water surface elevations for the design anticipating the potential Trinity Parkway construction and past, present, and reasonably foreseeable projects at specified locations in the Study Area for the 100-year and SPF flood events are provided in Table 4.3-4.

Table 4.3-4. Water Surface Elevations in the Floodway under the Future Without-Project Condition (2040 Discharges) and the Design Anticipating the Potential Trinity Parkway Construction Cumulative Condition (2040 Discharges)

Location	*100-Year Flood Event Water Surface Elevation (feet)*			*SPF Flood Event Water Surface Elevation (feet)*		
	Future Without-Project Condition	*Design Anticipating Trinity Parkway Construction and Past, Present, and Reasonably Foreseeable Projects*	*Difference*	*Future Without-Project Condition*	*Design Anticipating Trinity Parkway Construction and Past, Present, and Reasonably Foreseeable Projects*	*Difference*
West & Elm Fork Confluence	423.27	423.06	-0.21	435.40	434.79	-0.61
Hampton Bridge	420.31	420.25	-0.06	432.87	432.19	-0.68
Commerce Bridge	416.86	416.88	+0.02	428.99	427.87	-1.12
DART Rail Bridge	414.17	413.81	-0.36	425.42	424.57	-0.85

Water surface elevations within the Floodway and upstream of the ROI would rise for the 100-year flood event at some locations and there would be no rise for the SPF event compared to the Future Without-Project Condition except in the vicinity of the AT&SF Railroad Bridge. The maximum rise for the 100-year flood event would be 0.56 foot. This analysis indicates that because water surface rises occur for the 100-year flood event, this plan fails to meet the requirements of the TREIS ROD criteria; however, the rises for the 100-year flood event occur within the Floodway on the Trinity River Mainstem where the levees would provide FRM to the City of Dallas.

Valley Storage

The valley storage change for the design anticipating the potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects has been computed at approximately -2.1% for the 100-year flood event and more than -6% for the SPF event, as compared to the Future Without-Project Condition. This means that implementation of the design anticipating the potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects would result in a valley storage loss for both flood events. Therefore, the design anticipating the potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects would not meet the TREIS ROD criteria for valley storage for the 100-year flood event or the SPF event.

The valley storage loss impacts would cause a rise in water surface level of 0.07 foot for the 100-year flood event and 0.12 foot for the SPF event downstream of the Dallas Floodway. While this would technically be regarded as a potential increase in flood risk, it would be considered less than significant when considering for actual damages that potentially could be realized for the following reasons. First, the immediate areas downstream of the Dallas Floodway are affected by the DFE Project, which is designed to provide flood risk benefits up to the SPF flood event with completion of the proposed levees. Because the levees have not been constructed, the very small rise estimated for the SPF flood event may be compensated for in the final design for the DFE levees at a reasonable additional cost. If the levee construction components for the DFE are extensively delayed or eliminated, the hydraulic benefits currently realized by completion of the Chain of Wetlands components of the DFE Project would more than compensate for any expected rise due to the estimated valley storage loss for the Dallas Floodway proposed projects. Secondly, downstream of the DFE Project, there are few structures subject to flooding by the 100-year or SPF flood events.

Summary of Hydraulic Impacts

The design anticipating the potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects would support achievement of the desired level of SPF FRM for the City of Dallas. In doing so, the design anticipating the potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects would not meet the TREIS ROD criteria for water surface elevation rise for the 100-year flood event and for valley storage loss for the 100-year flood event and the SPF event. The analysis indicates that the water surface elevation rise indicated for the 100-year flood event would be limited to the areas of the Dallas Floodway on the Mainstem Trinity River. Therefore, there would be no increased risk of flooding for this reach of the Trinity River because the East and West Levees would be reducing flood risk on both sides of the floodplain. No water surface rises would occur for the 100-year flood event upstream of the confluence. Therefore, no increased risk of flooding would occur to areas upstream of the Dallas Floodway that do not have levees. The TREIS ROD criteria for water surface rise for the SPF flood event would be met at every location within the Dallas Floodway and upstream.

Additional design refinement efforts may be able to reduce the valley storage losses and/or reduce the water surface rises for the 100-year flood event within the Dallas Floodway on the Trinity River

Mainstem; however, meeting the TREIS ROD criteria on every point would likely not be achievable for such a large and complex combination of projects. Further reducing the negative impacts for valley storage loss to some extent may be achievable, but since these estimated impacts are relatively insignificant, efforts to further reduce them are not likely to be cost effective at this level of design. At the current level of design for the various project components considered, the level of compliance with regard to meeting the goals of the TREIS ROD criteria is estimated to be very nearly optimal. Further hydraulic analysis would be prepared to ensure that these documented potential flood risk increases do not increase further. This on-going analysis would be utilized to further reduce or minimize potential flood risk increases as design opportunities arise during the final design stages of the various project components. Therefore, impacts from increased flood risk due to hydraulics would be less than significant.

Floodplain Impacts

As discussed above under the *Hydraulics* impact analysis, the design anticipating the potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects would not result in substantial increase in downstream flooding during the 100-year flood event. Implementation of SCMs under the design anticipating the potential Trinity Parkway construction would minimize flood-related impacts to BVP Study features. Reasonably foreseeable projects located within the Floodway would follow similar conservation measures to minimize potential increases in flood risk and flood damage. The Trinity Parkway would involve substantial encroachment into the floodplain and was subject to a practicability analysis as required by FHWA regulations to implement EO 11988. Therefore, the design anticipating the potential Trinity Parkway construction and the reasonably foreseeable projects would be in compliance with EO 11988.

Fluvial Geomorphology

The past, present, and reasonably foreseeable projects listed under *Hydraulics* would be located in the Floodway and require some modifications to the Floodway, and therefore have the potential to affect (or alter) the fluvial geomorphology of the Trinity River. However, the modification to the river channel under the design anticipating the potential Trinity Parkway construction would provide the greatest potential for impact to the fluvial geomorphology of the Trinity River, as described in Section 4.3.3.1. The final design of the river channel relocation would consider any potential effects from past, present, and reasonably foreseeable projects on fluvial geomorphology and would incorporate SCMs listed in Chapter 7 and be subject to review by the USACE.

Summary

Implementation of the design anticipating the potential Trinity Parkway construction in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant cumulative impacts to H&H.

<u>Design Without the Potential Trinity Parkway Construction Anticipated</u>

Hydrology

Cumulative impacts to hydrology under the design without the potential Trinity Parkway construction anticipated would be the same as described under the design anticipating potential Trinity Parkway construction.

Hydraulics

The design without the potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would have the potential to result in changes to surface water elevations and valley storage associated with the 100-year flood event and the SPF event. The Trinity Parkway would be located outside the Floodway and would not impact the hydraulics of the Trinity River. The analysis below compares the design without potential Trinity Parkway construction anticipated and past, present, and reasonably foreseeable projects results to the Future Without-Project Condition at year 2040.

Water Surface Profiles

Within the Floodway, the water surface profile for the design without potential Trinity Parkway construction anticipated and past, present, and reasonably foreseeable projects for the 100-year flood event would generally be below the Future Without-Project Condition water surface profile except in an area just downstream of the IH-30 Bridge. Within the Floodway, the water surface profile for the design without the potential Trinity Parkway construction anticipated and past, present, and reasonably foreseeable projects for the SPF event would also generally be below the Future Without-Project Condition water surface profile except for in the vicinity of the AT&SF Railroad Bridge.

Water Surface Elevations

The computed water surface elevations for the design without the potential Trinity Parkway construction anticipated and past, present, and reasonably foreseeable projects at specified locations in the Study Area for the 100-year and SPF flood events are provided in Table 4.3-5.

Table 4.3-5. Water Surface Elevations in the Floodway under the Future Without-Project Condition (2040 Discharges) and the Design Without the Potential Trinity Parkway Construction Anticipated Cumulative Condition (2040 Discharges)

Location	*100-Year Flood Event Water Surface Elevation (feet)*			*SPF Flood Event Water Surface Elevation (feet)*		
	Future Without-Project Condition	*Design Without Trinity Parkway Construction Anticipated and Past, Present, and Reasonably Foreseeable Projects*	*Difference*	*Future Without-Project Condition*	*Design Without Trinity Parkway Construction Anticipated and Past, Present, and Reasonably Foreseeable Projects*	*Difference*
West & Elm Fork Confluence	423.27	423.05	-0.22	435.40	434.70	-0.70
Hampton Bridge	420.31	419.83	-0.48	432.87	431.88	-0.99
Commerce Bridge	416.86	416.60	-0.26	428.99	428.06	-0.93
DART Rail Bridge	414.17	413.64	-0.54	425.42	424.51	-0.91

Under the design without the potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects, water surface elevations within the Floodway and upstream of the ROI would rise for the 100-year flood event at two locations and there would be no rise for the SPF event compared to the Future Without-Project Condition except in the vicinity of the AT&SF Railroad Bridge. The maximum rise for the 100-year flood event would be 0.27 foot. This analysis indicates that because water surface rises occur for the 100-year flood event, this alternative would fail to meet the requirements of the TREIS ROD criteria; however, the rises to 100-year flood event would occur within the Floodway on the Trinity River Mainstem where the levees would provide FRM to the City of Dallas.

Valley Storage

The valley storage change for the design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects has been computed at approximately -0.80% for the 100-year flood event and more than -5.1% for the SPF event compared to the Future Without-Project Condition. This means that the project would result in a loss of valley storage for both events. The design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects, as currently designed, would not meet the TREIS ROD criteria for valley storage for the 100-year flood event or the SPF event.

Summary of Hydraulic Impacts

The summary of impacts under the design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects would be the same as under the design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects. Therefore, implementation of the design without potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant impacts to hydrology and hydraulics.

Floodplain Impacts

As discussed above under the *Hydraulics* impact analysis, the design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects would not result in substantial increase in downstream flooding during the 100-year flood event. The BVP Study features located within the Floodway have been designed based on SCMs listed in Chapter 7. Implementation of SCMs under the design without potential Trinity Parkway construction anticipated would minimize flood-related impacts to BVP Study features. Reasonably foreseeable projects located within the Floodway would follow similar conservation measures to minimize potential increases in flood risk and flood damage. Therefore, the design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects would be in compliance with EO 11988.

Fluvial Geomorphology

The reasonably foreseeable projects located in the Floodway and would require some modifications to the Floodway, and therefore have the potential to affect (or alter) the fluvial geomorphology of the Trinity River. However, the modification to the river channel under the design without potential Trinity Parkway construction anticipated would provide the greatest potential for impact to the fluvial geomorphology of the Trinity River. The final design of the river channel relocation would consider any potential effects from past, present, and reasonably foreseeable projects on fluvial geomorphology and would incorporate SCMs listed in Chapter 7 and be subject to review by the USACE.

Summary

Implementation of the design without potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant cumulative impacts to H&H.

4.4 WATER RESOURCES

4.4.1 Approach to Analysis

The environmental consequences evaluation for water resources includes a qualitative and quantitative analysis of surface water and groundwater resources and water quality to the extent possible given available project data. Environmental impacts were assessed and compared to baseline conditions, items of public concern, and significance criteria to determine the magnitude of potential impacts to water resources. The analysis of potential impacts considers both direct and indirect impacts. Direct impacts are those that may occur during the construction phase of the project and cease when the project is complete or those that may occur as a result of project operations following the completion of construction. Indirect impacts are those that may occur as a result of construction or during operations but not as a direct result of the construction or operational action. Water resources impacts can be negative or beneficial.

Impacts to surface waters (including wetlands) were evaluated by examining the potential of the Proposed Action to reduce the extent or functionality of waters. For jurisdictional wetlands and waters of the U.S., the loss of area was assessed by the total area that would be directly removed either through excavation or fill or by loss of function as a result of the Proposed Action. Functionality refers to the ability of the wetland or other waters of the U.S. to trap sediment and nutrients, maintain wildlife habitat (both flora and fauna), provide recreational uses, and receive, retain, and/or convey water.

Impacts to groundwater were evaluated by examining the potential to alter flow pattern, recharge or dewatering rates, or result in contamination to the aquifer as a result of the Proposed Action.

Negative water quality impacts were evaluated by examining the potential increase of contamination including chemicals, heavy metals, nutrients, and/or sediments in the surface water and groundwater as a result of construction and operation under the Proposed Action. Beneficial water quality impacts were evaluated by examining reduction in pollutant concentrations as a result of project components. The analysis was performed by comparing existing water quality data with possible changes in water quality due to the Proposed Action. Generally, negative impacts to water quality can be avoided or minimized through compliance with regulations under the Clean Water Act (CWA).

4.4.2 Alternative 1: Future Without-Project Condition

4.4.2.1 Surface Water Resources

Surface water features (i.e., river, streams, lakes, ponds, impoundments, and wetlands) in the Study Area have already been substantially modified from their natural conditions. These modifications have reduced the health of the streams and wetlands within the Floodway by changing their location, vegetation, hydrology, and surface connections, effectively lowering the functional value of the system as a whole from pre-development conditions. The system would continue to function in this reduced state under Future Without-Project Condition as reasonably foreseeable future projects are implemented. Within the Study Area, most of these modifications would be subject to USACE regulatory permitting authority. Climate change is also expected to affect surface water patterns; impacts of climate change on the regional water resources is discussed in Chapter 6.

4.4.2.2 Groundwater Resources

Groundwater is not extensively pumped in the ROI; under the Future Without-Project Condition, this situation would not change. There would be no anticipated change to groundwater quality.

4.4.2.3 Water Quality

Under the Future Without-Project Condition, urbanization in the Upper Trinity River watershed and the potential for release of pollutants into stormwater runoff would increase. However, federal and state agencies (e.g., U.S. Environmental Protection Agency [USEPA] and TCEQ) would continue to address the effects of these pollutants on water quality and designated beneficial uses. Therefore, conditions affecting beneficial uses that are currently listed as not impaired (i.e., aquatic life use and public water supply use) or listed as “concern” (i.e., general use), are expected to remain the same or gradually improve over time. With the implementation of scheduled total maximum daily load evaluations for bacteria and pesticides, polychlorinated biphenyls (PCBs) by the TCEQ, impairments to beneficial uses in the Trinity River (i.e., fish consumption use and contact recreation) would likely be reduced or eliminated over time. In addition, projects such as the City of Dallas Pavaho Wetlands could potentially help improve water quality of surface waters within the Study Area. However, PCBs and dioxins degrade slowly in the environment (Texas Department of State Health Services 2010), and therefore the effects to the fish consumption beneficial use may be long-term.

4.4.3 Alternative 2: Proposed Action

4.4.3.1 Design Anticipating Potential Trinity Parkway Construction

Under the design anticipating potential Trinity Parkway construction, construction activities within the Floodway would comply with the Construction General Permit (TXR150000) as described in Section 4.2.3. Under the design anticipating potential Trinity Parkway construction, site-specific BMPs, special conservation measures, and mitigation measures would be applied to minimize potential impacts. Implementation of the design anticipating potential Trinity Parkway construction would also require a Texas Water Quality Certification. The TCEQ has reviewed the Proposed Action and has issued a State Water Quality Certificate (refer to Appendix A) for the federal MDFP. Prior to implementation of the non-federal elements, the City of Dallas would obtain water quality certification from the TCEQ.

BVP Study FRM Elements

Construction

Surface Water Resources

Excavation of material from the borrow pits would result in direct, permanent impacts (excavation) to 0.81 acre of jurisdictional emergent palustrine wetlands. Levee flattening would result in direct, permanent impacts (fill) to 0.13 acre of jurisdictional emergent palustrine wetlands and 0.70 acre of other jurisdictional waters of the U.S. in the Floodway along the river-side base of the levees (summarized in Table 4.4-1). The impacts to 0.94 acre of wetlands and 0.70 acre of other waters of the U.S. that would be directly impacted by the FRM component would be offset by the proposed MDFP ecosystem restoration features.

Jurisdictional wetlands and other waters of the U.S. adjacent to (but outside of) the AT&SF Railroad Bridge embankment removal areas, would be flagged so workers would recognize and avoid them. Stormwater runoff from construction activities could indirectly affect these adjacent wetlands or other waters of the U.S. located downstream. However, through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the project would minimize potential indirect impacts to wetlands and other waters of the U.S.

There would also be direct impacts (fill) to 0.03 acre and 0.05 acre of non-jurisdictional wetlands and other waters, respectively (not shown in table).

Table 4.4-1. Impacts to Jurisdictional Wetlands and Other Waters of the U.S. in the Study Area under the Design Anticipating Trinity Parkway Construction, FRM Elements

Project Component	*Other Waters (acre)*	*Wetlands (acre)*
Project Impacts		
BVP Study FRM	0.70	0.94
Total Impact Subject to Mitigation	**0.70**	**0.94**

Groundwater Resources

Excavation would have the potential to intercept shallow groundwater found in shallow floodplain terraces and deposits that are in hydraulic connection with the Trinity River. However, compliance with the Construction General Permit (TXR150000) and implementation of a SWPPP and associated BMPs would protect groundwater resources during construction. The impacts to this shallow groundwater would be localized and temporary, and groundwater would return to pre-construction levels following construction. Construction would have no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer.

Water Quality

Construction activities may result in the generation of pollutants including sediment and other construction-related constituents (e.g., nutrients, trace metals, oil and grease, miscellaneous waste, and other toxic chemicals). Without controls, the pollutants could potentially enter receiving waters. However, through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the project would minimize potential impacts to surface water quality.

Operation

The FRM modifications would not contribute to long-term effects on surface water, groundwater, or water quality and the Floodway would continue to convey runoff from the Trinity River. The borrow pits south of Trinity River would be repurposed as the West Dallas Lake.

BVP Study Ecosystem and Recreation Features

Construction

Surface Water Resources

Existing emergent palustrine wetlands and other waters would be modified and/or filled, and new wetlands and other waters would be created or enhanced within the Floodway. Impacts to jurisdictional waters of the U.S. are subject to protection under Sections 401 and 404 of the CWA. Although a USACE Section 404 permit would not be issued for the project (USACE cannot permit its own actions), the project has been reviewed by the USACE (Fort Worth District Regulatory Branch). The USACE has prepared a comprehensive 404(b)(1) Analysis (Appendix L, *404(b)(1) Analysis*).

The BVP Study Ecosystem features include restoration elements to be completed as part of the MDFP (notably, the river relocation and Corinth Wetlands), as well as the remaining ecosystem features to be implemented by the City of Dallas. Figure 4.4-1 shows the proposed jurisdictional surface water features within the Floodway following implementation of the design anticipating potential Trinity Parkway construction (refer to Figure 3.4-2 for existing surface water features). The modification of the river channel from the existing straightened stream to a more natural meandering stream would require excavation of a new channel and eventual diversion of the water from the old channel into the new channel. A portion of West Dallas Lake would already be excavated as a result of the proposed borrow pit located south of the existing Trinity River channel.

Impacts Associated with the MDFP. As shown in Table 4.4-2, the river relocation and construction of the Corinth Wetlands under the design anticipating potential Trinity Parkway construction would result in direct, permanent impacts to 31,742 linear feet/115.2 acres of the existing Trinity River channel, 14.31 acres of other waters, and 73.79 acres of jurisdictional wetlands. No forested wetlands are currently found within the Floodway, and therefore, no impact to forested wetlands would occur. The river relocation and construction of the Corinth Wetlands is considered ecosystem restoration and would result in an overall improvement in function over existing conditions. The restoration of the river would increase river channel sinuosity, providing a total of 33,455 linear feet/176.1 acres of new channel for an overall net gain of 1,713 linear feet/60.9 acres for the Trinity River. This restoration of the river would also improve habitat quality by enhancing/restoring 6.07 acres of other open waters (Oxbow Lake and drainage sumps) and by creating/restoring 24.70 acres of forested wetlands (river terraces), and the construction of the Corinth Wetlands would enhance 34.26 acres and create/restore 49.42 acres of emergent wetlands. This would result in an overall net loss of 9.00 acres of other open waters and a net gain of 0.43 acre of wetlands.

Table 4.4-2. Impacts to and Creation/Enhancement of Jurisdictional Wetlands and Other Waters of the U.S. in the Study Area under the Design Anticipating Potential Trinity Parkway Construction, MDFP Restoration

Project Component	*Trinity River (linear feet/acres)*		*Other Waters (acres)*		*Wetlands (acres)*	
	Temporary/ Enhanced	*Permanent/ Created*	*Temporary/ Enhanced*	*Permanent/ Created*	*Temporary/ Enhanced*	*Permanent/ Created*
BVP Study Ecosystem Impacts under MDFP						
River Relocation	6,490/19.0	31,742/115.2	2.02	14.31	-	71.52
Corinth Wetlands	-	-	-	-	34.26	2.27
Total Impact	**6,490/19.0**	**31,742/115.2**	**2.02**	**14.31**	**34.26**	**73.79**
Wetlands or Other Waters Created or Enhanced by the BVP Study						
River Relocation	6,490/19.0	33,455/176.1	-	-	-	-
Oxbow Lake	-	-	-	2.99	-	-
Drainage Sumps	-	-	2.02	3.08	-	-
Corinth Wetlands	-	-	-	-	34.26	49.52
River Terraces	-	-	-	-	-	24.70
Total Created or Enhanced	**6,490/19.0**	**33,455/176.1**	**2.02**	**6.07**	**34.26**	**74.22**
Net Gain (Loss)	**0/0**	**+1,713/60.9**	**0**	**(-9.00)**	**0**	**+0.43**
Net Functional Gain (Loss)*	**+6,115**		**N/A**		**+28.68**	

Note: * Derived from Texas Rapid Assessment Method (TXRAM) functional analysis. TXRAM assesses ecological condition and potential impact of jurisdictional waters and wetlands, but does not serve to evaluate full habitat function and impacts. For an analysis of habitat impacts including non-jurisdictional waters and wetlands, refer to Section 4.5, *Biological Resources*.

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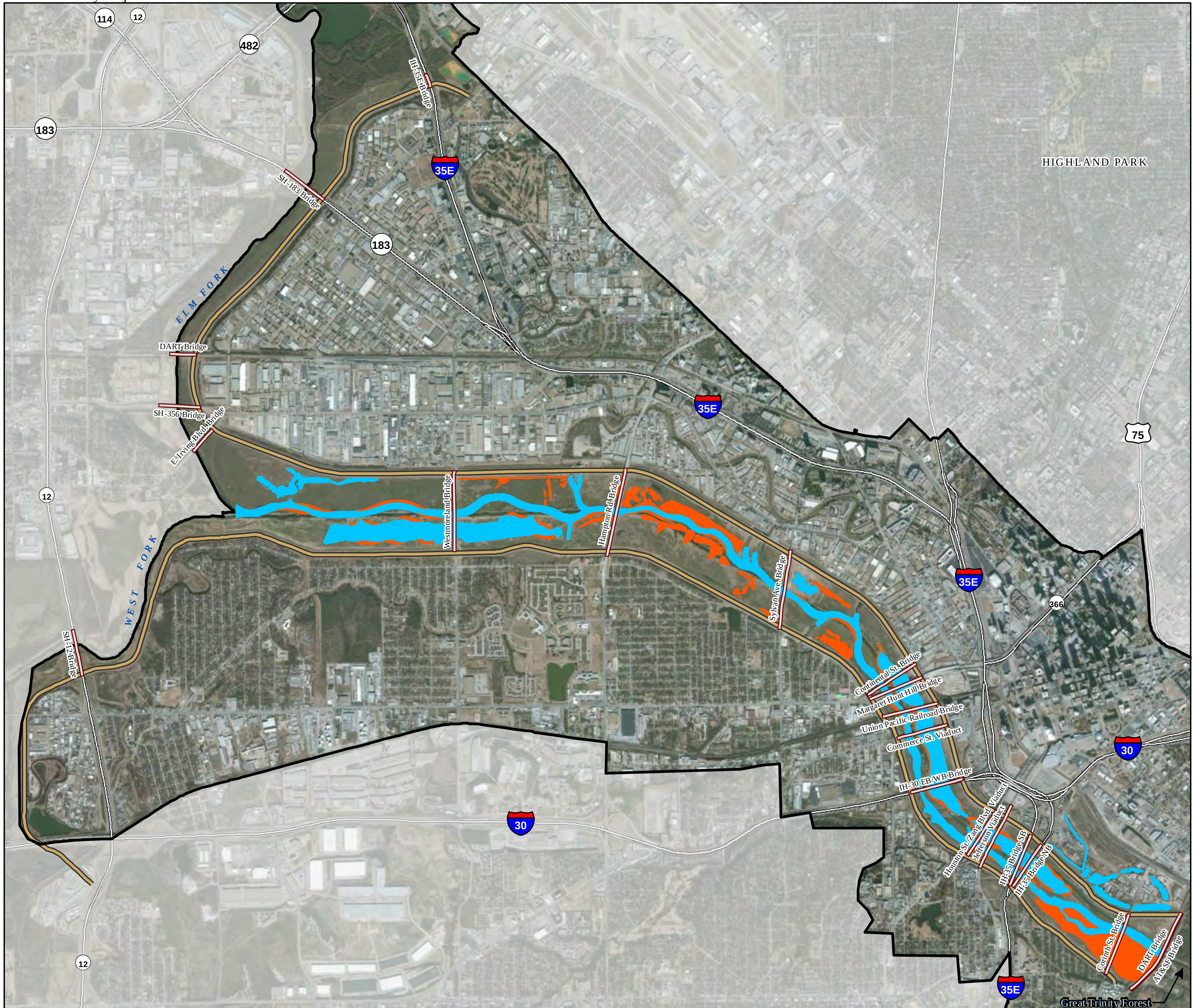
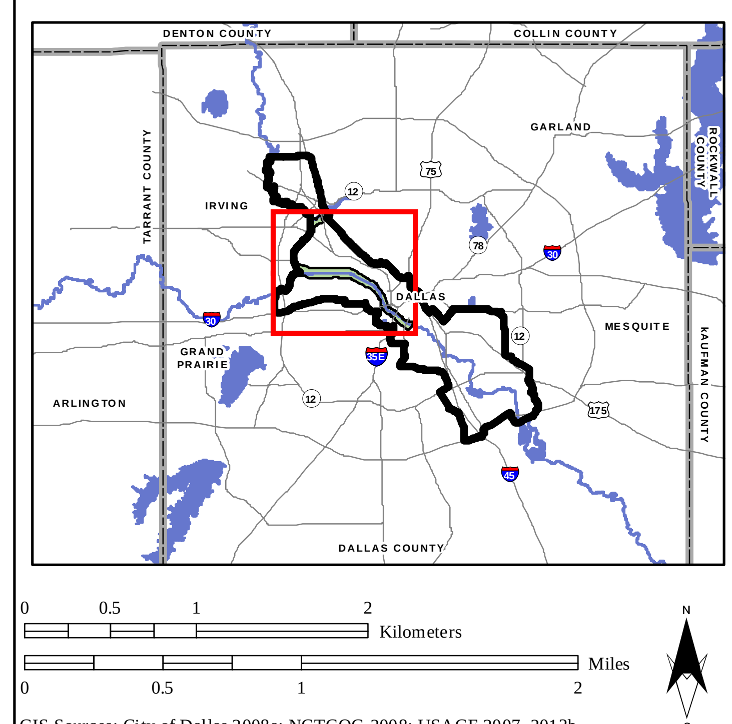
Figure 4.4-1
Jurisdictional Wetlands and Waters of the U.S. under the Design Anticipating Trinity Parkway Construction



LEGEND

Jurisdictional Features

- Wetlands
- Other Waters
- Study Area
- Dallas Floodway Levee
- Bridge
- Freeway



GIS Sources: City of Dallas 2008a; NCTCOG 2008; USACE 2007, 2013b

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Texas Rapid Assessment Method (TXRAM) scores were used to perform a functional analysis of impacts to the Trinity River and wetlands impacted by the river relocation and construction of the Corinth Wetlands as part of the Section 404(b)(1) Analysis (refer to Appendix L). TXRAM is a modelling approach developed by the Fort Worth and Tulsa USACE districts to provide a rapid, repeatable, field-based conditional assessment methodology for evaluating the ecological condition of jurisdictional wetlands and streams, as well as predicting impacts and future conditions. The TXRAM approach is used by the USACE to estimate regulatory impacts and determine expected mitigation needs for jurisdictional waters and wetlands. TXRAM is not used to estimate habitat function or impacts, and does not include non-jurisdictional waters and wetlands. For a discussion of habitat function and impacts of all waters and wetlands within the Study Area, refer to Section 4.5, *Biological Resources*.

This regulatory-impact focus of the TXRAM is the biggest distinction between the U.S. Fish and Wildlife Service (USFWS) Habitat Evaluation Procedures (HEP) approach used in Section 4.5, Biological Resources. Because the two models have different underlying priorities, both the existing conditions and predicted impacts may result in different impact determinations. Numbers and valuations are also different because, while TXRAM only evaluates jurisdictional wetlands and waters of the U.S., the HEP analysis considers jurisdictional and non-jurisdictional features.

The TXRAM functional analysis estimated that the design of the relocated river channel and the enhanced or created/restored wetlands would result in an overall increase of riverine and wetland function. Based on the TXRAM functional analysis (refer to Appendix L), and as shown in Table 4.4-2, there would be a predicted net functional gain of 6,115 linear feet for the Trinity River and 28.68 acres for wetlands that would result from the river relocation and the construction of the Corinth Wetlands, indicating an increase in both area and quality of riverine and wetland habitats[4]. Therefore, restoration efforts proposed as part of the MDFP would result in functional lift, and thus no additional compensatory mitigation would be required for impacts to the Trinity River and jurisdictional wetlands associated the river relocation and construction of the Corinth Wetlands. The impacts to 9.00 acres of jurisdictional other open waters would be offset by the proposed MDFP ecosystem restoration features.

Stormwater runoff from construction activities could indirectly affect adjacent wetlands or other waters of the U.S. located downstream. However, through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the project would minimize potential indirect impacts to wetlands and other waters of the U.S.

Impacts Associated with Non-MDFP Project Features. Those features not associated with the MDFP would result in a total loss of 5.74 acres of jurisdictional other open waters (5.49 acres for the Ecosystem Component and 0.25 acre for the Recreation Component) and 57.10 acres of jurisdictional wetlands (38.90 acres for Ecosystem Component and 18.20 acres for Recreation Component) (Table 4.4-3). The Natural Lake, Urban Lake, West Dallas Lake, floodway wetlands, and fringe wetlands that are not part of the MDFP would also be constructed within the Floodway, for a total area of up to 256.73 acres of other open waters and 60.06 acres of wetlands. These open waters and wetlands are design features not intended to be considered as onsite mitigation, but intended to enhance the habitat, wetlands, and open water of the overall Floodway in the future condition.

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[4] A TXRAM functional analysis equivalent to that of the Trinity River or wetlands was not performed for the other waters because TXRAM only applies to streams and wetlands, but not other aquatic features.

The City of Dallas would purchase credits from an approved mitigation bank to offset the 57.10 acres of wetlands and 5.74 acres of other waters of the U.S. that would be directly impacted by the non-MDFP ecosystem and recreation elements. The negative impact associated with construction would become a beneficial operational impact to jurisdictional wetlands and waters of the U.S., as the compensation for the impacts from non-MDFP elements would result in functional lift to the project area, and the non-MDFP elements include the construction of 256.73 acres of other open waters and 61.73 acres of new wetlands.

Stormwater runoff from construction activities could indirectly affect adjacent wetlands or other waters of the U.S. located downstream. However, through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the project would minimize potential indirect impacts to wetlands and other waters of the U.S.

Table 4.4-3. Impacts to and Creation/Restoration of Jurisdictional Wetlands and Other Waters of the U.S. in the Study Area under the Design Anticipating Potential Trinity Parkway Construction, BVP Ecosystem and Recreation Features

Project Component	*Other Waters (acres)*	*Wetlands (acres)*
Project Impacts		
BVP Study Ecosystem (not including River Relocation or Corinth Wetlands)[1]	5.49	38.90
BVP Study Recreation	0.25	18.20
Total Impact Subject to Mitigation	**5.74**	**57.10**
Wetlands or Other Waters Created or Restored by the BVP Study		
West Dallas Lake	122.87	7.07
Urban Lake	84.19	2.01
Natural Lake	49.45	6.53
Other Open Waters	0.22	-
Floodway Wetlands	-	46.12
Total Created or Enhanced	**256.73**	**61.73**

Note: [1] These features are described in detail in Table 4.4-2.

Groundwater Resources

Excavation associated with construction would have the potential to intercept shallow groundwater found in shallow floodplain terraces and deposits that are in hydraulic connection with the Trinity River. However, compliance with the Construction General Permit (TXR150000) and implementation of a SWPPP and associated BMPs would protect groundwater resources during construction. The impacts to this shallow groundwater would be localized and temporary and groundwater would return to pre-construction levels following construction. Construction would have no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer.

Water Quality

The use of BMPs such as silt fencing and sediment traps, the application of water sprays, and the prompt revegetation of disturbed areas would reduce potential impacts. Implementation of sediment and erosion controls during construction activities would maintain runoff water quality at levels comparable to existing conditions. Through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the project would minimize impacts to surface water quality.

Operation

Lakes

Surface Water Resources. The Natural, Urban, and West Dallas Lakes would account for a total of 256 acres of open water within the Floodway, and the lakes would be surrounded by over 15 acres of fringe wetlands. The source of water for both the Natural and Urban Lakes would be the treated effluent pumped from the Dallas Central Wastewater Treatment Plant (CWWTP), with approximately 60 million gallons per day (MGD) passing through the two lakes (City of Dallas 2009a). The treated effluent discharged into the Natural and Urban Lakes is permitted flow that Dallas Water Utilities (DWU) is required to return to the Trinity River and any water lost to seepage or evaporation would count against the amount of flow that DWU could sell or use for other purposes. Therefore, the lakes would be lined with clay to prevent seepage and satisfy water management requirements at each of the lakes (City of Dallas 2009b).

The source of water for West Dallas Lake would be groundwater and rainwater and supplemented by water drawn from the river so that the lake would have a constant level, sustaining recreation throughout the seasons. Because the water surface elevation of West Dallas Lake would be higher than the adjacent Trinity River, the lake would be designed to include appropriate lining and anti-seepage protection to prevent the formation of sinkholes or slope failures in the strip of land separating the lake from the river (City of Dallas 2009a).

Groundwater Resources. The proposed clay linings for the Natural, Urban, and West Dallas Lakes would also prevent seepage to groundwater.

Water Quality. The Natural, Urban, and West Dallas Lakes would be designed and operated to meet all applicable state water quality standards and additional water quality criteria, as needed, to meet the proposed uses of the lakes (City of Dallas 2009a). The Dallas CWWTP effluent entering Natural and Urban Lakes would be treated and disinfected in compliance with state and federal regulations and would be suitable for primary contact recreation purposes. The effluent would be clear with a low suspended solids concentration; however, the effluent would have nitrogen and phosphorus concentrations that are typically associated with algal blooms and high chlorophyll levels in lakes. The high flow rate through the lakes would help minimize algal concentrations (City of Dallas 2009b).

The planted riparian edges, floating wetlands, solar-powered aerators and aeration water walls would be used to further improve and maintain the water quality within the lakes. The floating wetland plant communities selected for use would promote aquatic life and maximize nutrient absorption, especially nitrogen and phosphorus. The Urban Lake would be prone to algal blooms due to its more remote location from the incoming treated water source. In addition to the floating wetlands and aerators, water treated chemically within the park would be the method of last resort (City of Dallas 2009a).

Modeling conducted for the Natural and Urban Lakes indicates that dissolved oxygen concentrations should remain high enough to meet the water quality criterion and to support aquatic life in the lakes. This is primarily due to the anticipated short residence time in the lakes, algal production of oxygen and absence of thermal stratification in the water column. In addition, floating aerators will provide vertical and horizontal mixing within the lake, which will promote uniform dissolved oxygen concentrations and further minimize the potential for thermal stratification. The bubbler fountains proposed for distribution throughout the Urban Lake would also help to aerate the water and enhance circulation (City of Dallas 2009b).

A Lake Management Plan would be developed to address water quality including nutrient loading and seasonal stratification. The recommended monitoring activities include sampling and analyses for water and sediment quality, quantitative surveys of sediment accumulation, fish and vegetation communities, and visual inspections of conditions in the lakes. Baseline monitoring is intended to provide sufficient information to track conditions in the lakes during the initial 5 years of operation and to refine the management activities as needed (City of Dallas 2009b).

Following flood events, Natural and Urban Lakes may be opened, as necessary, to drain the lakes and minimize the deposition of sediment within the lakes. Prior to reopening the lakes for primary contact activities such as boating, water quality monitoring would occur as outlined in the Urban Lake and Natural Lake management plans to ensure that bacteria levels are within water quality standards (City of Dallas 2009a).

Within West Dallas Lake, proposed rowing lanes would be defined by 20-foot-wide intermittent bands of floating wetlands that would also provide a nutrient-absorbing function. Other water quality improvement methods within the lake would consist of edge marshlands; "solar bees," which are floating and photovoltaic-powered aeration devices; and chemical applications. Chemical applications would be selected and implemented so as not to be a detriment to the health and vitality of edge marshlands and floating wetlands (City of Dallas 2009a).

River Modification

Surface Water Resources. The river channel would be modified to a more natural pattern, resulting in a beneficial impact to the Trinity River. The proposed modifications would maintain the Trinity River's classification as navigable under the Section 10 of the Rivers and Harbors Act.

Groundwater Resources. The river modification would maintain the average slope and surface flow rates through the length of the Floodway. This would maintain similar surface water elevations as the existing river channel, resulting in minimal, if any changes in migration of groundwater in the shallow aquifer. The river modification would have no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer.

Water Quality. The relocated river channel would have a stable channel pattern with areas subject to erosion being armored or strengthened, using bioengineering approaches that incorporate native vegetation and other natural materials (City of Dallas 2009c). This would result in minimal bank erosion and would not substantially contribute to suspended sediment concentrations. The proposed ecosystem restoration associated with the river modification (and other BVP Study features) would diminish the negative water quality impact of stormwater flows through reestablishment of native riparian vegetation along banks and river terraces. Plantings in the riparian zone would act as effective vegetative filters, reducing amounts of nutrients, sediment, and other contaminants that would otherwise flow directly into the river and downstream, resulting in the improved water quality over existing conditions and a long-term beneficial impact to water quality.

Wetlands

Surface Water Resources. The BVP Study wetland environments would include newly constructed floodway wetlands, forested wetlands, and marshland wetlands. These environments would also include the enhancement/restoration of existing emergent wetlands already occurring in the floodplain today, resulting in beneficial impacts to surface water resources.

Groundwater Resources. The wetland features would collect pre-treated stormwater runoff from BVP Study features that would otherwise contribute to recharging the shallow aquifer. However, a portion of water stored in the wetland features recharge the shallow aquifer and overall shallow groundwater levels would be maintained within the Floodway. The wetland features would have no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer.

Water Quality. Stormwater flowing into the floodway wetland areas would be pre-treated for velocity attenuation (to non-erosive) and water quality (removal of sediment, garbage, and to some extent nutrients) prior to entering these wetland areas. The pre-treatment would utilize green infrastructure measures such as vegetated bio-swales, filter strips, soil amendments, forebays, permeable or porous pavements, stormwater tree vaults/pits or other measures as appropriate for site conditions and constraints. The combination of these pre-treatment measures and the floodway wetland features would play a role in improving overall long-term water quality by removing nitrogen, phosphorus, sediment, and other pollutants from urban runoff.

Athletic Facilities and General Features

Surface Water Resources. The locations and types of athletic facilities and the general features have been designed to integrate with the BVP Study water features (i.e., lakes, river, and wetlands) and would have no impact on surface water or wetlands.

Groundwater Resources. As discussed under *Wetlands*, runoff from BVP Study features, including athletic facilities and general elements, would be pretreated and collected in wetlands and would have minimal effect on the shallow groundwater and no impact on deeper groundwater aquifers.

Water Quality. The turf and paved areas associated with the athletic facilities and general elements would be graded to drain into bio-swales or other appropriate green infrastructure feature based on site conditions and then discharge into wetlands that can receive and filter additional contaminants, and ultimately drain their stormwater to downstream receiving waters. The proposed boating activities would not degrade water quality below existing conditions or affect designated uses.

Interior Drainage Outfall Modifications

Surface Water Resources. The interior drainage outfall modifications would continue to function as they do currently, with no change to surface water resources.

Groundwater Resources. The interior drainage outfall modifications would maintain the similar surface water elevations as the existing outfalls, resulting in minimal, if any changes in migration of groundwater in the shallow aquifer. The interior drainage outfall modifications would have no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer.

Water Quality. Stormwater runoff entering the Floodway from the interior drainage outfall modifications would continue to be covered under the City of Dallas Stormwater Management Plan (SWMP) (City of Dallas 2012). The SWMP is intended to ensure compliance with Section 402 of the CWA, Chapter 26 of the Texas Water Code, applicable USEPA and TCEQ regulations, and the requirements of the Phase I Municipal Separate Storm Sewer System (MS4) permit (TCEQ 2013).

IDP Improvements

The following sections provide a general overview of impacts to water quality associated at each location. Direct impacts to jurisdictional wetlands and waters of the U.S. are presented on a site-by-site basis. Table 4.4-4 presents the total impact to jurisdictional wetlands and other waters under the design anticipating potential Trinity Parkway construction, from implementation of proposed IDP improvements at all locations. No impacts to jurisdictional wetlands are anticipated from reducing the extent of the 100-year floodplain as a result of IDP improvements.

Table 4.4-4. Impacts to Jurisdictional Wetlands and Other Waters of the U.S. in the Study Area under the Design Anticipating Potential Trinity Parkway Construction, IDP Improvements

Project Component	*Other Waters (acres)*	*Wetlands (acres)*
Project Impacts		
IDP Improvements	0.06	0.27
Total Impact Subject to Mitigation	**0.06**	**0.27**

Overall IDP Improvement Impacts to Water Resources

Construction of IDP improvements would have minimal, if any, impact on shallow groundwater and would have no impact on deeper groundwater aquifers. The construction contractor would prepare and implement a project-specific SWPPP for construction associated IDP improvements in compliance with the Construction General Permit (TXR150000). The SWPPP would implement all applicable BMPs in accordance with the permit from initiation through completion of construction activities. Therefore, the project would minimize potential impacts to water quality.

The pump stations would continue to convey stormwater runoff to the Trinity River and would not contribute to long-term effects on surface water or groundwater resources. Stormwater runoff would continue to be covered under the City of Dallas SWMP (City of Dallas 2012). The SWMP is intended to ensure compliance with Section 402 of the CWA, Chapter 26 of the Texas Water Code, applicable USEPA and TCEQ regulations, and the requirements of the Phase I MS4 permit.

Hampton Pump Station and Sump Improvements

Construction of the New Hampton Pump Station would result in direct impacts to 0.11 acre and 0.06 acre of jurisdictional emergent palustrine wetlands and other waters of the U.S., respectively, and 0.14 acre of non-jurisdictional other waters (Figure 4.4-2).

Construction associated with the Nobles Branch Sump improvements would result in direct impacts to 0.17 acre of potentially jurisdictional waters of the U.S. (*Note*: a jurisdictional delineation has not been completed for this site, but these waters are assumed to be jurisdictional as they are within the historic creek channel, but are not included in Table 4.4-4) (Figure 4.4-2). Impacts of 0.11 acre of wetlands and 0.23 acre of other waters of the U.S. that would be directly impacted by construction of the New Hampton Pump Station and Nobles Branch Sump would be offset by the proposed MDFP ecosystem restoration features.

Charlie Pump Station and Sump Improvements

Construction of the Charlie Pump Station would result in direct impacts to 0.16 acre of jurisdictional emergent palustrine wetlands and 0.32 acre of non-jurisdictional other waters (Figure 4.4-3). Impacts of 0.16 acre of jurisdictional wetlands that would be directly impacted by construction of the Charlie Pump Station would be offset by the proposed MDFP ecosystem restoration features.

Delta Pump Station and Sump Improvements

Construction of the Delta Pumping Plant would result in no additional direct impacts to jurisdictional wetlands or other waters of the U.S. (Figure 4.4-4) because impacts to waters of the U.S. located within the footprint of the Delta Pumping Plant are already accounted for under the construction of the FRM Elements.

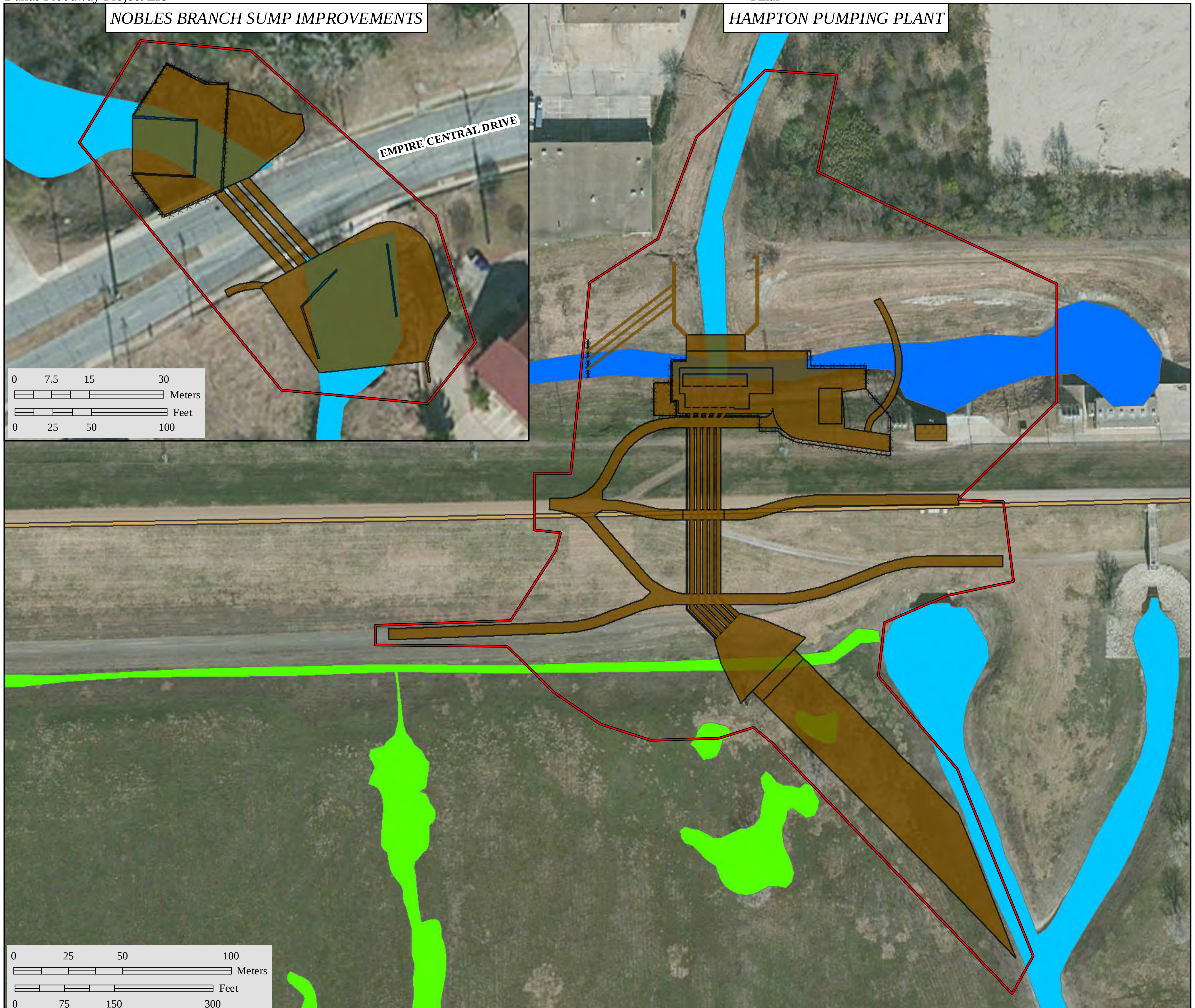
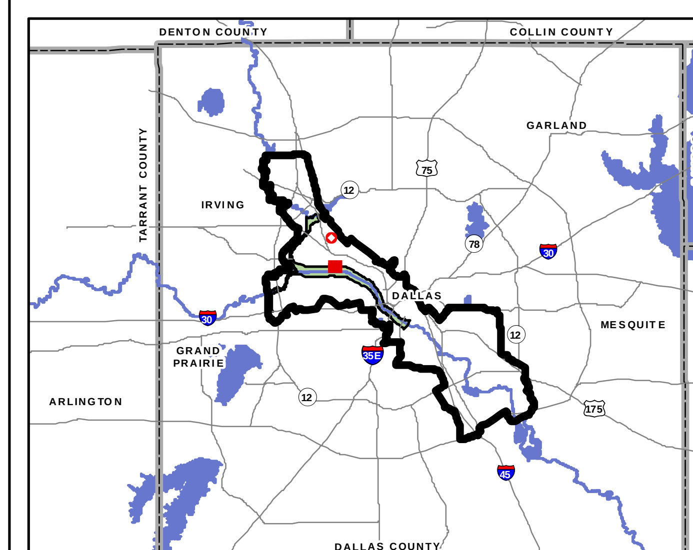


Figure 4.4-2
Jurisdictional Wetlands and Waters of the U.S. in the Vicinity of the Hampton Pumping Plant and the Nobles Branch Sump Improvements



GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2007

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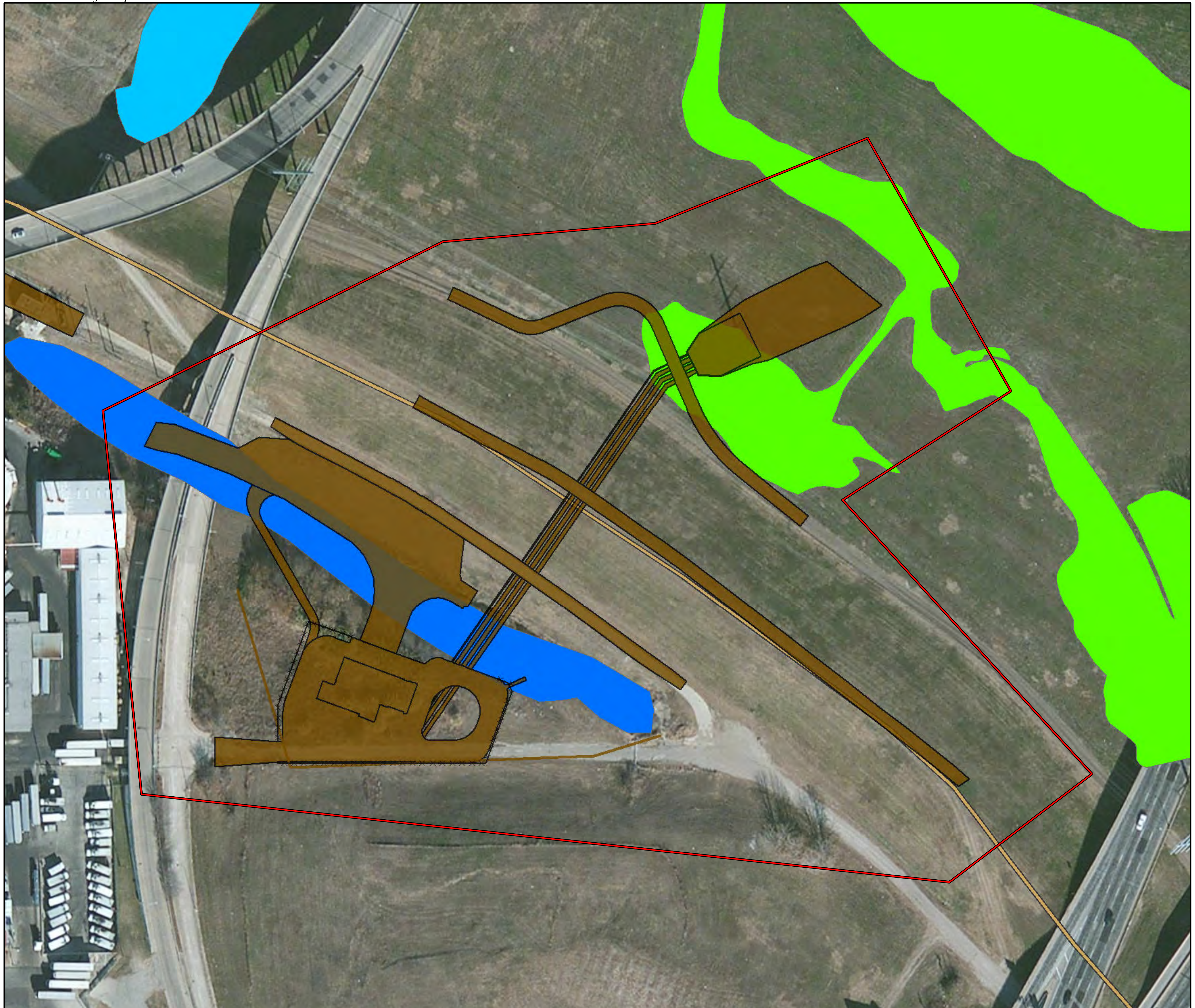


Figure 4.4-3
Jurisdictional Wetlands and Waters of the U.S. in the Vicinity of the Charlie Pumping Plant

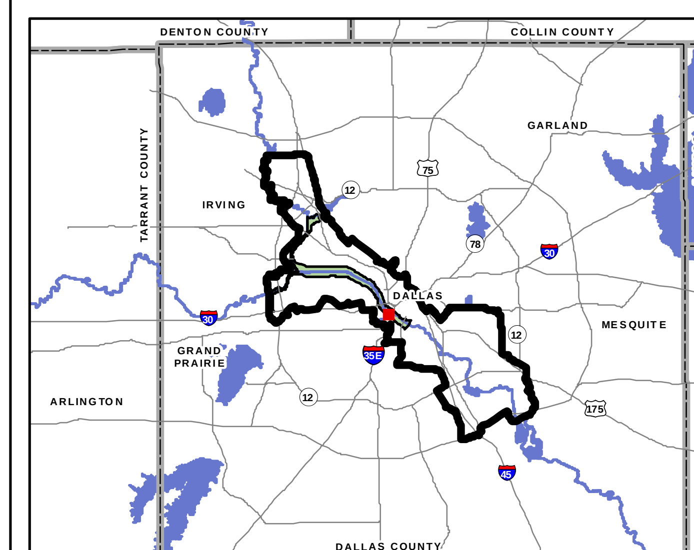
LEGEND

Proposed IDP Improvements
- Footprint
- Limit of Construction
- Fence

Jurisdictional Features
- Wetland
- Other Water

Non-Jurisdictional Features
- Other Water

Dallas Floodway Levee Crest



0 25 50 100 Meters

0 50 100 200 Feet

N S

GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2007

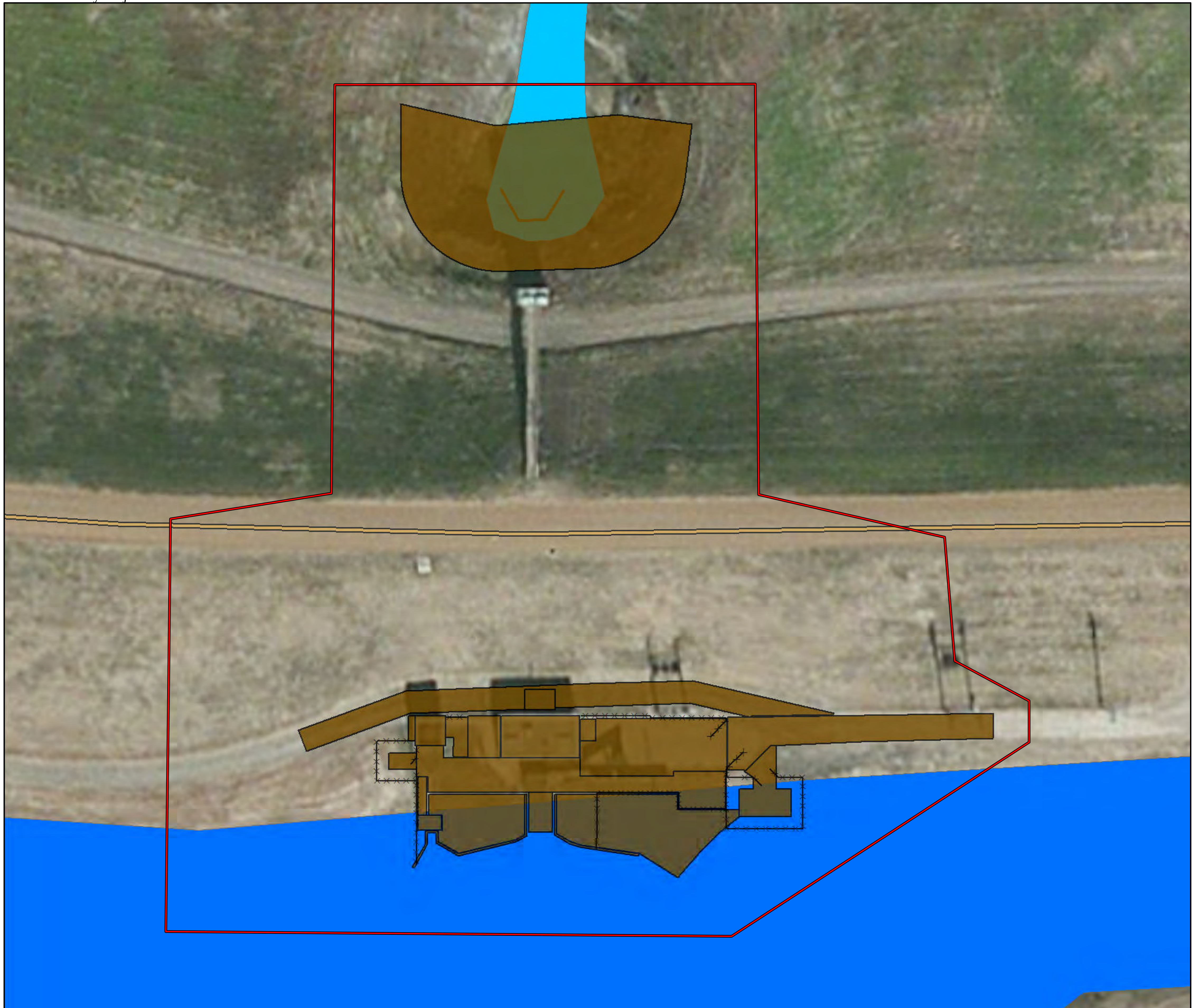


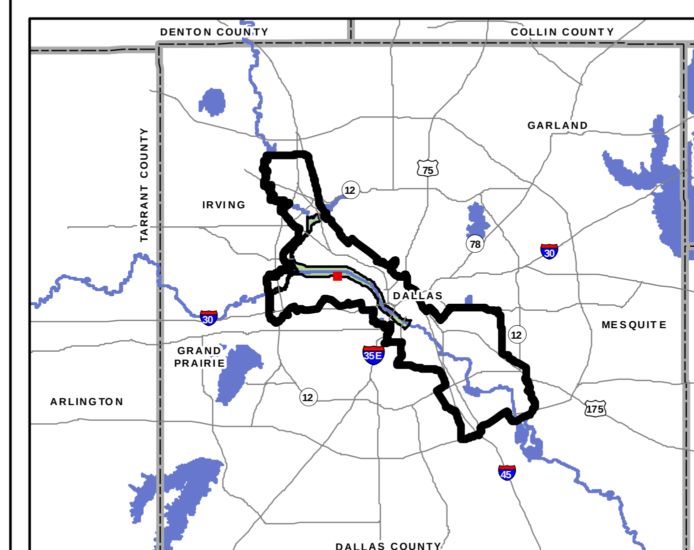
Figure 4.4-4
Jurisdictional Waters of the U.S. in the Vicinity of the Delta Pumping Plant

LEGEND

Proposed IDP Improvements
- Footprint
- Limit of Construction
- Fence

Jurisdictional Features
- Other Water

Non-Jurisdictional Features
- Other Water
- Dallas Floodway Levee Crest



0 5 10 20 Meters

0 25 50 100 Feet

GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2007

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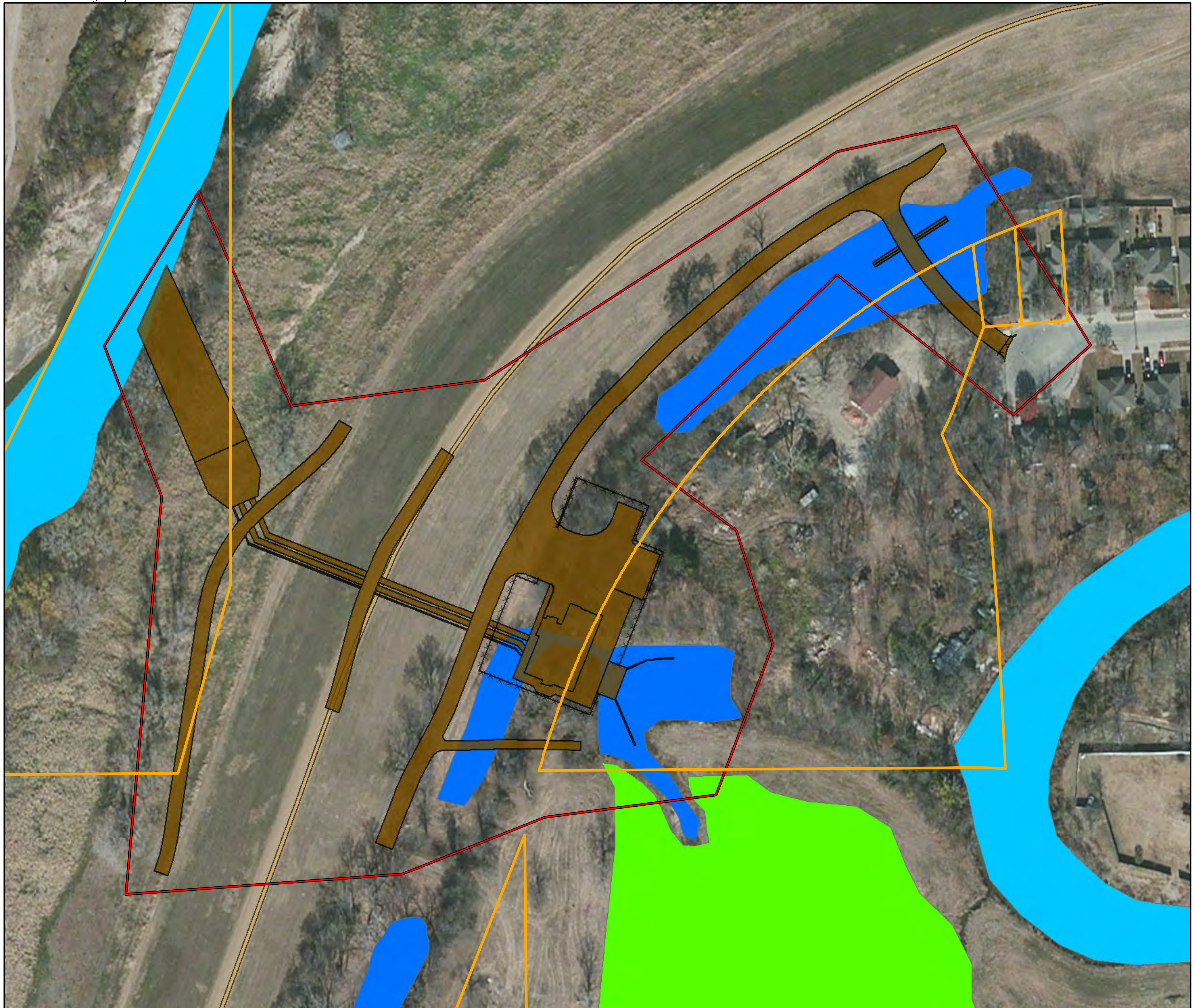


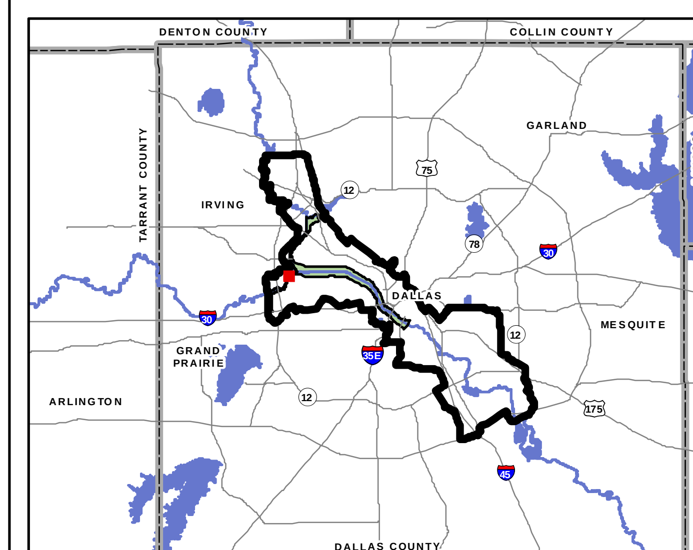
Figure 4.4-5
Jurisdictional Wetlands and Waters of the U.S. in the Vicinity of the Trinity-Portland Pumping Plant

LEGEND

Proposed IDP Improvements
- Footprint
- Limit of Construction
- Fence

Jurisdictional Features
- Wetland
- Other Water

Non-Jurisdictional Features
- Other Water
- Dallas Floodway Levee Crest
- Parcels Considered for Potential Purchase by the City of Dallas



0 12.5 25 50 Meters

0 50 100 200 Feet

N S

GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2007

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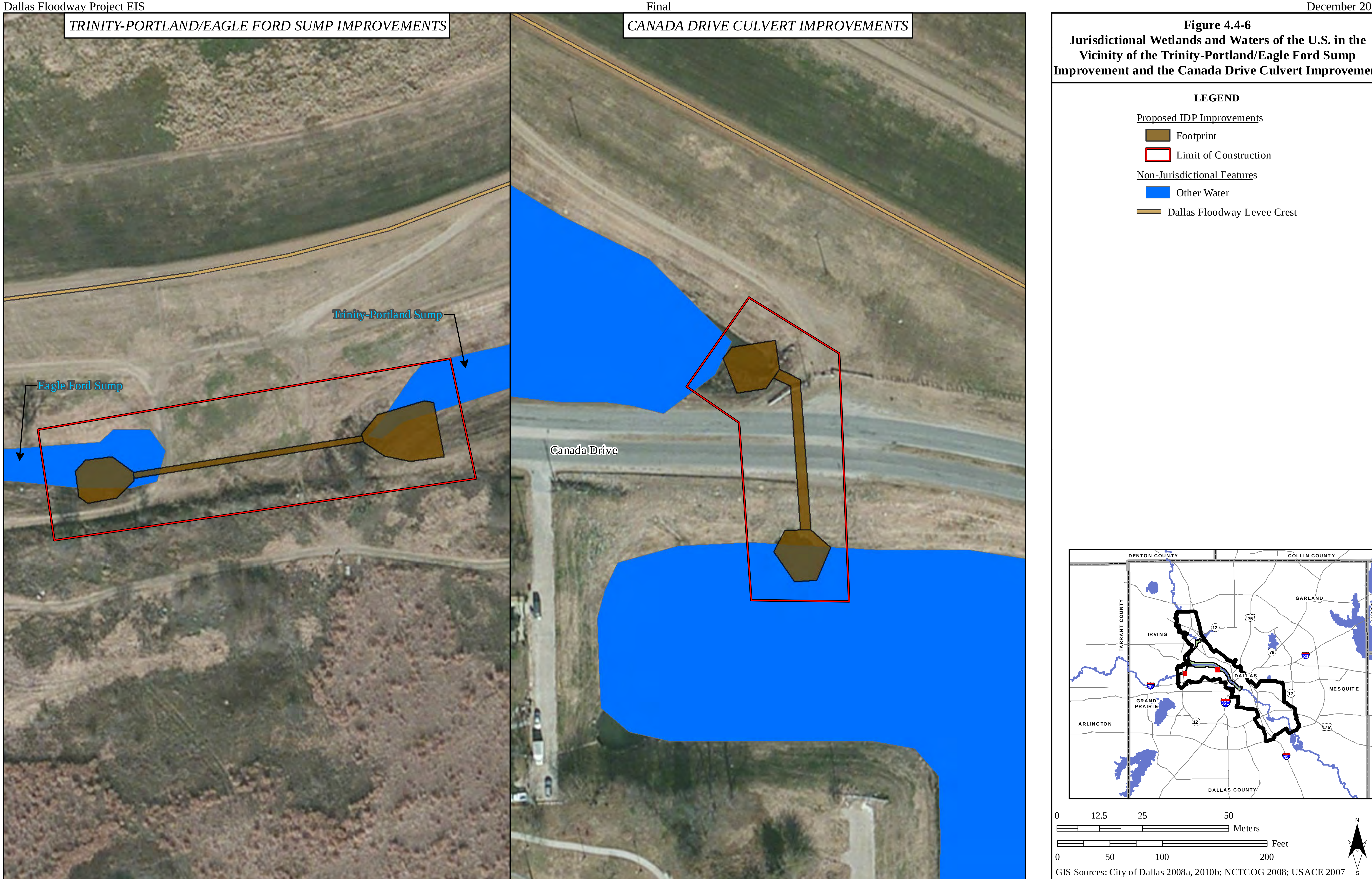
Figure 4.4-6
Jurisdictional Wetlands and Waters of the U.S. in the Vicinity of the Trinity-Portland/Eagle Ford Sump Improvement and the Canada Drive Culvert Improvement



GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2007

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Trinity-Portland Pumping Plant and Sump Improvements

Construction of the Trinity-Portland Pumping Plant would result in no additional direct impacts to jurisdictional wetlands or other waters of the U.S. would occur (Figures 4.4-5 and 4.4-6) because impacts to waters of the U.S. located within the footprint of the Trinity-Portland Pumping Plant are already accounted for under the construction of the FRM Elements.

4.4.3.2 Design Without Potential Trinity Parkway Construction Anticipated

Overview

Under the design without potential Trinity Parkway construction anticipated, the potential impacts to water resources from implementation of the proposed FRM elements and BVP Study component would be greater due to the absence of the potential Trinity Parkway in the Floodway. This is because the borrow pit areas would not already have been excavated to provide fill for the Trinity Parkway under this design option, and therefore would be included as impacts under this project. Proposed IDP improvements would result in the same impacts to waters as presented under the design anticipating potential Trinity Parkway construction, as there would be no change in these components between the two design options with or without the potential Trinity Parkway. Table 4.4-5 summarizes the impacts to jurisdictional wetlands and other waters of the U.S. under the design without potential Trinity Parkway construction anticipated. Table 4.4-5 also presents the total acres of jurisdictional wetlands and other waters created under implementation of the design without potential Trinity Parkway construction anticipated.

Table 4.4-5. Impacts to and Creation/Restoration of Jurisdictional Wetlands and Other Waters of the U.S. in the Study Area under the Design Without Potential Trinity Parkway Construction Anticipated

Project Component	*Other Waters (acres)*	*Wetlands (acres)*
Project Impacts		
BVP Study FRM	1.11	7.23
BVP Study Ecosystem (not including River Relocation or Corinth Wetlands)[1]	7.73	49.17
BVP Study Recreation	1.41	25.74
IDP Improvements	0.06	0.27
Total Impact	**10.31**	**82.41**
Wetlands or Other Waters Created or Enhanced by the BVP Study		
West Dallas Lake	122.42	7.02
Urban Lake	83.82	1.85
Natural Lake	50.71	6.27
Other Open Waters	0.22	-
Floodway Wetlands	-	47.22
Total Created or Enhanced	**257.17**	**62.38**

Note: [1] These features are described in detail in Table 4.4-2.

Impacts to groundwater and water quality associated with implementation of the FRM elements and IDP improvements would be the same for the two design options with or without the potential Trinity Parkway; refer to Section 4.4.3.1 for a discussion of these impacts.

BVP Study Ecosystem and Recreation Features

Construction

Surface Water Resources

Construction impacts to surface water resources would be essentially the same for two design options with or without the potential Trinity Parkway, with slight changes to impacted acreage of jurisdictional surface water features.

Impacts Associated with the MDFP. As shown in Table 4.4-6, the river relocation and construction of the Corinth Wetlands under the design without potential Trinity Parkway construction anticipated would result in direct, permanent impacts to 31,742 linear feet/115.2 acres of the existing Trinity River channel, 16.41 acres of other waters, and 94.42 acres of jurisdictional wetlands. The restoration of the river would increase river channel sinuosity, providing a total of 33,455 linear feet/176.1 acres of new channel for an overall net gain of 1,713 linear feet/60.9 acres for the Trinity River. This restoration of the river would also improve habitat quality by enhancing/restoring 6.83 acres of other open waters (Oxbow Lake and drainage sumps) and by creating/restoring 23.21 acres of forested wetlands (river terraces) and the construction of the Corinth Wetlands would enhance 37.67 acres and create/restore 47.47 acres of emergent wetlands. This would result in an overall net area loss of 10.48 acres of other open waters and 29.79 acres of wetlands.

Table 4.4-6. Impacts to and Creation/Enhancement of Jurisdictional Wetlands and Other Waters of the U.S. under the Design Without Potential Trinity Parkway Construction Anticipated MDFP Restoration

Project Component	*Trinity River (linear feet/acres)*		*Other Waters (acres)*		*Wetlands (acres)*	
	Temporary/ Enhanced	*Permanent/ Created*	*Temporary/ Enhanced*	*Permanent/ Created*	*Temporary/ Enhanced*	*Permanent/ Created*
BVP Study Ecosystem Impacts under MDFP						
River Relocation	6,490/19.0	31,742/115.2	2.28	16.41	-	87.77
Corinth Wetlands	-	-	-	-	37.67	6.65
Total Impact	**6,490/19.0**	**31,742/115.2**	**2.28**	**16.41**	**37.67**	**94.42**
Wetlands or Other Waters Created or Enhanced by the BVP Study						
River Relocation	6,490/19.0	33,455/176.1	-	-	-	-
Oxbow Lake	-	-	-	2.99	-	-
Drainage Sumps	-	-	2.28	3.84	-	-
Corinth Wetlands	-	-	-	-	37.67	47.47
River Terraces	-	-	-	-	-	23.21
Total Created or Enhanced	**6,490/19.0**	**33,455/176.1**	**2.28**	**6.83**	**37.67**	**72.13**
Net Gain (Loss)	**0/0**	**+1,713/60.9**	**0**	**(-10.48)**	**0**	**(-29.79)**
Net Functional Gain (Loss)*	**+6,115**		**N/A**		**+6.10**	

Note: * Derived from TXRAM functional analysis.

Based on the TXRAM functional analysis (refer to Appendix L), there would be a predicted net functional gain of 6,115 linear feet for the Trinity River and 6.10 acres for wetlands that would result from the river relocation and the construction of the Corinth Wetlands, indicating an increase in both area and quality of riverine and wetland habitats. Therefore, restoration efforts proposed as part of the MDFP would result in functional lift, and thus no additional compensatory mitigation would be required for impacts to the Trinity River and jurisdictional wetlands associated the river relocation and construction of the Corinth Wetlands.

Stormwater runoff from construction activities could indirectly affect adjacent wetlands or other waters of the U.S. located downstream. However, through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the project would minimize potential indirect impacts to wetlands and other waters of the U.S.

Impacts Associated with Non-MDFP Project Features. Those features not associated with the MDFP would result in a total loss of 9.14 acres of jurisdictional other open waters (7.73 acres for Ecosystem Component and 1.41 acres for Recreation Component) and 74.91 acres of jurisdictional wetlands (49.17 acres for the Ecosystem Component and 25.74 acres for the Recreation Component) (refer to Table 4.4-5). Natural Lake, Urban Lake, West Dallas Lake, the floodway wetlands, and fringe wetlands that are not part of the MDFP would also be constructed within the Floodway, for a total area of up to 257.17 acres of other open waters and 62.38 acres of wetlands (refer to Table 4.4-5). These open waters and wetlands are design features not intended to be considered as onsite mitigation, but intended to enhance the habitat, wetlands, and open water of the overall Floodway in the future condition.

The City of Dallas would purchase credits from an approved mitigation bank to offset the 74.91 acres of wetlands and 9.41 acres of other waters of the U.S. that would be directly impacted by the non-MDFP ecosystem and recreation elements. The negative impact associated with construction would become a beneficial operational impact to jurisdictional wetlands and waters of the U.S., as the compensation for the impacts from non-MDFP elements would result in functional lift to the project area, and the non-MDFP elements include the construction of 257.17 acres of other open waters and 62.38 acres of new wetlands.

Stormwater runoff from construction activities could indirectly affect adjacent wetlands or other waters of the U.S. located downstream. However, through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the project would minimize potential indirect impacts to wetlands and other waters of the U.S.

Groundwater Resources and Water Quality

Construction impacts to groundwater resources and water quality would be the same for two design options with or without the potential Trinity Parkway, as described in Section 4.4.3.1.

Operation

Operational impacts to surface water, groundwater, and water quality would be the same for two design options with or without the potential Trinity Parkway, as described in Section 4.4.3.1.

4.4.3.3 Summary

Through compliance with the Construction General Permit (TXR150000) and implementation of project-specific SWPPP and associated BMPs, the Proposed Action would minimize potential impacts to surface water quality. Construction would have no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer. The Natural, Urban, and West Dallas Lakes would be designed and operated (following their Lake Management Plan guidelines) to meet all applicable state water quality standards and additional water quality criteria, as needed, to meet the proposed uses of the lakes.

Tables 4.4-7 and 4.4-8 summarize the total impacts to jurisdictional wetlands and other waters from implementation of the two design options with or without the potential Trinity Parkway, respectively. Direct impacts to jurisdictional wetlands and other waters of the U.S. from construction would be either self-mitigating through onsite enhancement/creation/restoration or compensated through the purchase credits from an approved mitigation bank, as indicated in the two tables.

Table 4.4-7. Total Impacts to Jurisdictional Wetlands and Other Waters of the U.S. in the Study Area under the Design Anticipating Potential Trinity Parkway Construction, MDFP Restoration

Project Component	*Permanent Impacts that would be Mitigated through Onsite Enhancement or Creation/Restoration*			*Permanent Impacts that would be Mitigated through Purchase of Mitigation Bank Credits*		
	Trinity River (linear feet/acres)	*Other Open Waters*	*Wetlands (acres)*	*Trinity River (linear feet/acres)*	*Other Open Waters*	*Wetlands (acres)*
MDFP (Federal)						
FRM Component	-	-	-	-	0.70	0.94
IDP Component	-	-	-	-	0.06	0.27
BVP Ecosystem Component (River Relocation and Corinth Wetlands)	31,742/115.2	-	73.79	-	14.31	-
Federal Total	**31,742/115.2**	**-**	**73.79**	**-**	**15.07**	**1.21**
City-Sponsored Project Elements (non-Federal)						
BVP Ecosystem Component	-	-	-	-	5.49	38.90
BVP Recreation Component	-	-	-	-	0.25	18.20
Non-Federal Total	**-**	**-**	**-**	**-**	**5.74**	**57.10**
Project Total	**31,742/115.2**	**0**	**73.79**	**0**	**20.81**	**58.31**

Table 4.4-8. Total Impacts to Jurisdictional Wetlands and Other Waters of the U.S. in the Study Area under the Design Without Potential Trinity Parkway Construction Anticipated

Project Component	*Permanent Impacts that would be Mitigated through Onsite Enhancement or Creation/Restoration*			*Permanent Impacts that would be Mitigated through Purchase of Mitigation Bank Credits*		
	Trinity River (linear feet/acres)	*Other Open Waters*	*Wetlands (acres)*	*Trinity River (linear feet/acres)*	*Other Open Waters*	*Wetlands (acres)*
MDFP (Federal)						
FRM Component	-	-	-	-	1.11	7.23
IDP Component	-	-	-	-	0.06	0.27
BVP Ecosystem Component (River Relocation and Corinth Wetlands)	31,742/115.2	-	94.42	-	16.41	-
Federal Total	**31,742/115.2**	**-**	**94.42**	**-**	**17.31**	**7.50**
City-Sponsored Project Elements (non-Federal)						
BVP Ecosystem Component	-	-	-	-	7.73	49.17
BVP Recreation Component	-	-	-	-	1.41	25.74
Non-Federal Total	**-**	**-**	**-**	**-**	**9.41**	**74.91**
Project Total	**31,742/115.2**	**0**	**94.42**	**0**	**26.72**	**82.41**

The river relocation and construction of the Corinth Wetlands under the MDFP is considered ecosystem restoration and would be self-mitigating through onsite enhancement or creation/restoration, with a net gain of 1,713 linear feet/60.9 acres for the Trinity River for both design options and net gain of 0.43 acre or net loss of 29.79 acres of wetlands, depending on the design variation - with and without the potential

Trinity Parkway, respectively. Based on the TXRAM functional analysis, there would be a predicted net functional gain of 6,115 linear feet for the Trinity River for both design options and 28.68 acres or 6.10 acres of wetlands, depending on the design variation - with and without the potential Trinity Parkway, respectively. This net gain under both design options indicates an increase in both area and quality of riverine and wetland habitats, with the design anticipating potential Trinity Parkway construction having the greater net gain of the two design options.

Negative impacts (excavation and fill) to jurisdictional wetlands and other waters of the U.S. from construction of other components of the project would result in a total loss of 20.81 acres of jurisdictional other open waters and 58.31 acres of wetlands for the design option with the Trinity Parkway (Table 4.4-7) and 26.72 acres of jurisdictional other open waters and 82.41 acres of jurisdictional wetlands for the design option without the Trinity Parkway (Table 4.4-8). The City of Dallas would purchase credits from an approved mitigation bank to offset these permanent impacts to open waters and wetlands for whichever design option is implemented.

Therefore, implementation of the Proposed Action would result in significant adverse impacts to water resources during construction, and beneficial impacts to water resources during operation. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures including long term monitoring as outlined in the required permits and detailed in Chapter 7.

4.4.3.4 Cumulative Impacts

<u>Design Anticipating Trinity Parkway Construction</u>

Surface Water Resources

The potential Trinity Parkway project would directly impact 65.5 acres (fill of 28.5 acres and excavation of 37.0 acres) of jurisdictional wetlands and other waters of the U.S. (FHWA 2014). These direct impacts to jurisdictional wetlands and other waters of the U.S. would require a Section 404 permit, which would include any mitigation requirements. Direct impacts to navigable waters would also be subject to and comply with Section 10 requirements. All mitigation for impacts to jurisdictional features would occur outside of the Dallas Floodway.

The Pavaho Stormwater Wetlands would add approximately 64 acres of wetlands to the Study Area. Approximately 8.8 acres of the Pavaho Stormwater Wetlands would be constructed adjacent to the Pavaho Pump Station, while the remainder would be within the Floodway adjacent to the Pavaho Outfall.

The design anticipating potential Trinity Parkway construction and some of the other past, present, and reasonably foreseeable projects would also directly impact jurisdictional wetlands and other waters of the U.S. However, the net gains of functions of aquatic resources under the BVP Study features would offset temporal losses associated with the MDFP, and the City of Dallas would be responsible for compensatory mitigation required for direct impacts to jurisdictional wetlands and other waters of the U.S. resulting from non-MDFP activities under the design anticipating potential Trinity Parkway construction. However, the BVP Study does include a significant amount of new wetlands to be constructed within the Floodway that would enhance and provide habitat. Overall, the construction-related negative impacts to wetlands and other waters of the U.S. under the design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects would become an operational beneficial impact to jurisdictional wetlands and other waters of the U.S.

Groundwater Resources

The potential Trinity Parkway project has the potential to impact shallow groundwater resources during construction and operation. However, groundwater resources would be protected through compliance with the Construction General Permit (TXR150000) and implementation of a SWPPP and associated BMPs during construction and through compliance with the MS4 permit during operation.

Construction associated with the design anticipating potential Trinity Parkway construction and the other past, present, and reasonably foreseeable projects would potentially have localized and temporary impacts on shallow groundwater and no impacts on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer. Compliance with the Construction General Permit (TXR150000) and implementation of a SWPPP and associated BMPs would protect groundwater resources during construction. Shallow groundwater would return to pre-construction levels following construction and there would be less than significant impacts to groundwater due to construction. Operations under the design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects would result in minimal, if any changes in migration of groundwater in the shallow aquifer and no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer. There would be no anticipated increase in groundwater production.

Water Quality

The potential Trinity Parkway project has the potential to impact surface water quality during construction and operation. To minimize adverse effects to water quality during construction, the Trinity Parkway would utilize temporary erosion and sedimentation control practices from the Texas Department of Transportation's (TxDOT) standard specifications for highway construction. Highway runoff abatement measures would be incorporated into construction planning for the project in accordance with Construction General Permit (TXR150000) requirements, which require the implementation of a SWPPP and the use of stormwater BMPs that would control negative impacts on water quality from the project. During operation, the Trinity Parkway project would comply with applicable MS4 permit requirements.

Construction associated with the design anticipating potential Trinity Parkway construction and the other past, present, and reasonably foreseeable projects may result in the generation of pollutants including sediment and other construction-related constituents (such as nutrients, trace metals, oil and grease, miscellaneous waste, and other toxic chemicals). However, the design anticipating potential Trinity Parkway construction and any of the other past, present, and reasonably foreseeable projects that disturb equal to or greater than 1 acre would comply with the Construction General Permit (TXR150000) as described in Section 4.2.3. Through compliance with the Construction General Permit and implementation of a project-specific SWPPP and associated BMPs, the potential impacts to surface water quality would be minimized; however, significant adverse impacts to water resources during construction would occur with the design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects.

Operations under the design anticipating potential Trinity Parkway construction and the Pavaho Wetlands would play a role in improving overall long-term water quality by removing nutrients, sediment, and other pollutants from urban runoff and river flows. The pump stations associated with the IDP improvements and past, present, and reasonably foreseeable projects (i.e., Able and Baker pumping plants) would continue to convey stormwater runoff to the Trinity River and would be covered under the City of Dallas SWMP (City of Dallas 2012). Other past, present, and reasonably foreseeable projects would contribute additional pollutants to urban runoff; these would be relatively minimal and also be covered under the City of Dallas SWMP. The SWMP is intended to ensure compliance with Section 402 of the CWA, Chapter 26 of the Texas Water Code, applicable USEPA and TCEQ regulations, and the requirements of the Phase I MS4 permit. Increased pollutant removal by wetlands and continued coverage under the City of Dallas SWMP would provide a long-term beneficial impact to water quality in the Trinity River.

Design Without Trinity Parkway Construction Anticipated

Cumulative impacts under the design without potential Trinity Parkway construction anticipated would be similar to those described under the design anticipating potential Trinity Parkway construction. Similar acreages of wetlands and other waters of the U.S. would be impacted for both design options, with negative construction-related impacts to wetlands and other waters of the U.S. under the design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects becoming a beneficial impact during operations. Construction and operation under the design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects would result in less than significant impacts to shallow groundwater and no impact on deeper groundwater aquifers such as the Trinity Group Aquifer and the Woodbine Aquifer.

Through compliance with the Construction General Permit (TXR150000) and implementation of a project-specific SWPPP and associated BMPs, the potential impacts to surface water quality would be minimized; however, significant adverse impacts to water resources during construction would occur under the design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects. Increased pollutant removal by wetlands and continued coverage under the City of Dallas SWMP would provide a long-term beneficial impact to water quality in the Trinity River.

4.5 BIOLOGICAL RESOURCES

4.5.1 Approach to Analysis

The impacts of the alternatives have been assessed primarily through the application of the USFWS HEP in the Planning Aid Report (PAR) (USFWS 2014) to the ROI to (a) quantitatively characterize existing fish and wildlife resources in the ROI in terms of acreage and habitat values; and (b) to estimate the area and condition of those resources over time in the future in order to compare quantitatively the net gains and losses of habitat that would occur under the different alternatives.

HEP is a USFWS-developed model used for habitat-based impact assessment, with a focus on impacts to the habitat resources on which fish and wildlife are dependent. To this end, HEP modelling is not a single approach to all systems, but instead relies on the identification of several indicator species for each habitat, and then applying the models that are unique to each individual species. The species-focus also allows the analysis to evaluate the health of multiple habitats, as well as the interaction among habitats by selecting species that use multiple habitat types. The wood duck, for example, requires both wetland and bottomland hardwood habitats. This species-use focus on the habitat elements is the biggest distinction between the HEP approach and the TXRAM modeling used in Section 4.4, *Water Resources*. Because the two models have different underlying priorities, both the existing conditions and predicted impacts may result in different impact determinations. Numbers and valuations are also different because, while TXRAM only evaluates jurisdictional wetlands and waters of the U.S., HEP analysis considers includes jurisdictional and non-jurisdictional features.

The HEP evaluates changes in habitat acreages and values (as measured by habitat suitability indexes [HSIs]) over a 50-year period that begins at the conclusion of construction (Year “0”). Details of the HEP analysis are provided in the PAR (USFWS 2014). In addition to the broad, quantitative aspects of the HEP, the analysis also considers potential impacts on special status species or potential impacts that may result from invasive species. The USFWS has prepared a Final Fish and Wildlife Coordination Act Report (refer to Appendix M, *Final Fish and Wildlife Coordination Act Report*).

Under the National Environmental Policy Act (NEPA), the significance of project impacts is a function of context and intensity. For biological resources, context refers to the importance (ecological, commercial, scientific, recreational, etc.) or regulatory (i.e., legally protected) status of the resource, and intensity refers to the magnitude – scale and duration – of the impact. Both beneficial and adverse impacts are recognized; either can be significant. In the ROI, the habitats of greatest importance are aquatic riverine, emergent wetlands, and bottomland hardwoods. Substantial long-term net changes in the acreage and/or value of these habitats would represent significant adverse impacts; impacts to open water and grassland habitats are of lesser concern and unlikely to be significant, especially if areas of these habitats are converted to more valuable habitat. Losses or gains of population and habitat for special status species may also be significant, depending on the magnitude of the impact relative to the population size and distribution of the species in the region. Finally, an impact that led to new introductions or the expansion of invasive species in the ROI would also be considered significant in terms of potential far-reaching effects on the ecosystem as a whole.

4.5.2 Alternative 1: Future Without-Project Condition

4.5.2.1 Habitat Types and Values

Through the USFWS HEP process, habitat quality or habitat units (HUs) were determined. HUs are determined by multiplying HSIs by the habitat acreages, which give a habitat value. The implementation of Alternative 1, 19 Future Without-Project Condition projects, would negatively impact emergent wetlands, grasslands, aquatic riverine, and open water (Tables 4.5-1 and 4.5-2) (Figure 4.5-1). Bottomland hardwood acreages and values would increase under Alternative 1 due to the increased value in the Confluence over 50 years. As presented in Table 4.5-2, overall HUs would decrease over 50 years under the Future Without-Project Condition. The greatest loss of HUs would occur to grassland habitat.

Table 4.5-1. Estimated Change in Habitat Units per Habitat Evaluation Group under Alternative 1

Metric	*Existing Conditions*	*Year*				*Change*
		0	5	10	50	
CONFLUENCE GROUP						
Bottomland Hardwood						
HSI	0.24	0.24	0.24	0.24	0.24	N/A
Acres	966.49	963.41	963.41	973.13	1,011.20	44.71
HUs	231.96	231.22	231.22	233.55	242.69	10.73
Emergent Wetland						
HSI	0.30	0.30	0.30	0.30	0.31	N/A
Acres	67.95	67.95	67.95	67.95	67.27	-0.68
HUs	20.39	20.39	20.39	20.39	20.85	0.46
Grassland						
HSI	0.43	0.43	0.43	0.43	0.45	N/A
Acres	1,573.16	1,501.04	1,501.04	1,471.02	1,412.86	-160.30
HUs	676.46	645.45	645.45	632.54	635.79	-40.67
Aquatic Riverine						
HSI	0.90	0.90	0.90	0.90	0.93	N/A
Acres	132.42	132.36	132.36	131.04	124.49	-7.93
HUs	119.18	119.12	119.12	117.94	115.78	-3.40

Table 4.5-1. Estimated Change in Habitat Units per Habitat Evaluation Group under Alternative 1

Metric	*Existing Conditions*	*Year*				*Change*
		0	5	10	50	
Open Water						
HSI	0.71	0.71	0.71	0.71	0.71	N/A
Acres	151.93	150.93	150.93	147.91	136.08	-14.85
HUs	107.16	107.16	107.16	105.02	96.62	-10.54
Mainstem Group						
Bottomland Hardwood						
HSI	0.21	0.22	0.21	0.21	0.21	N/A
Acres	94.64	87.35	87.35	88.50	94.19	-0.45
HUs	19.87	19.22	18.34	18.59	19.78	-0.09
Emergent Wetland						
HSI	0.22	0.22	0.22	0.22	0.22	N/A
Acres	262.91	260.41	260.41	260.41	257.81	-5.10
HUs	57.84	57.29	57.29	57.29	56.72	-1.12
Grassland						
HSI	0.62	0.62	0.62	0.62	0.64	N/A
Acres	1,752.15	1,669.64	1,669.64	1,669.64	1,672.24	-79.91
HUs	1,086.33	1,035.18	1,035.18	1,035.18	1,070.23	-16.10
Aquatic Riverine						
HSI	0.83	0.83	0.83	0.83	0.86	N/A
Acres	123.73	114.95	114.95	113.80	108.11	-15.62
HUs	102.70	95.41	95.41	94.45	92.97	-9.73
Open Water						
HSI	0.71	0.71	0.71	0.71	0.71	N/A
Acres	6.41	6.41	6.41	6.41	6.41	0.00
HUs	4.55	4.55	4.55	4.55	4.55	0.00
Interior Drainage Systems Group						
Bottomland Hardwood						
HSI	0.39	0.39	0.39	0.39	0.39	N/A
Acres	351.50	351.47	347.96	339.66	325.97	-25.53
HUs	137.09	137.07	135.70	132.47	127.13	-9.96
Emergent Wetland						
HSI	0.22	0.23	0.22	0.22	0.19	N/A
Acres	87.72	89.00	89.00	89.00	89.00	1.28
HUs	19.30	20.47	19.58	19.58	16.91	-2.39
Grassland						
HSI	0.57	0.57	0.57	0.57	0.62	N/A
Acres	958.26	941.32	931.91	903.95	840.67	-117.59
HUs	546.21	536.55	531.19	515.25	521.22	-24.99
Aquatic Riverine						
HSI	0.75	0.70	0.70	0.75	0.80	N/A
Acres	165.18	164.92	164.92	163.27	155.11	-10.07
HUs	123.89	115.44	115.44	122.45	124.09	0.20
Open Water						
HSI	0.65	0.65	0.65	0.65	0.65	N/A
Acres	49.30	49.02	49.02	48.04	44.20	-5.10
HUs	32.05	31.86	31.86	31.23	28.73	-3.32

Note: N/A = not applicable.
Source: USFWS 2014.

Table 4.5-2. Estimated Change in Habitat Units per Habitat Type under the Future Without-Project Condition

Habitat Types	Habitat Units		
	Existing Conditions	*FW/OPC (Year 50)*	*Change*
Bottomland Hardwood	388.92	389.6	0.68
Emergent Wetland	97.53	94.48	-3.05
Grassland	2,309.00	2,227.24	-81.76
Aquatic Riverine	345.77	332.84	-12.93
Open Water	143.76	129.9	-13.86
Total	**3,284.98**	**3,174.06**	**-110.92**

Note: FW/OPC=Future Without-Project Condition.
Source: USFWS 2014.

4.5.2.2 Fish and Wildlife

The distribution of fish and wildlife under the Future Without-Project Condition would be similar to the distribution of fish and wildlife under existing conditions. Common fish, amphibians, aquatic reptiles, and shorebirds would continue to utilize the aquatic riverine, emergent wetland, and open water habitats. Common birds and mammals would continue to utilize the terrestrial habitat.

If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities would comply with the Migratory Bird Treaty Act (MBTA) to avoid impacts to nesting migratory birds.

4.5.2.3 Special Status Species

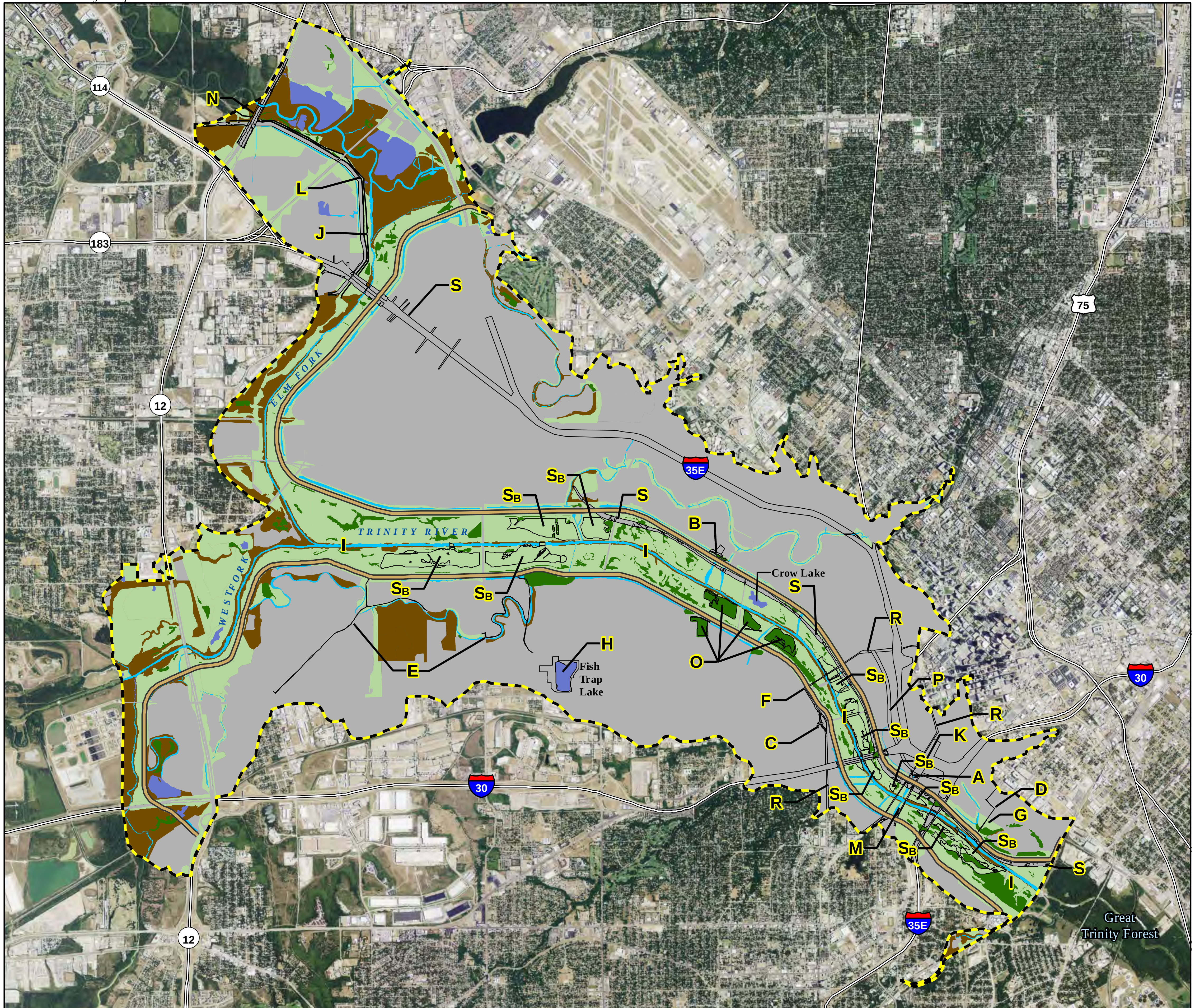
Based on surveys, mussel beds and state-listed mussels are known to occur in the Trinity River, in the Horseshoe Project area, and upstream of the Elm Fork. The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar method to minimize impacts to mussel beds and other sensitive aquatic resources (TPWD 2013).

Some species of Birds of Conservation Concern (BCC) birds listed in Section 3.5 are likely to occur in the ROI. Impacts to special status species, including mussels and birds, during the construction and operation of the Future Without-Project Condition would be minimized through the implementation of BMPs and SCMs as determined applicable for each specific project.

4.5.2.4 Invasive Species

SCMs, as determined applicable for each specific project, would be implemented to minimize the spread of invasive species under the Future Without-Project Condition.

Figure 4.5-1
Habitat Types Under the Future Without Project Condition



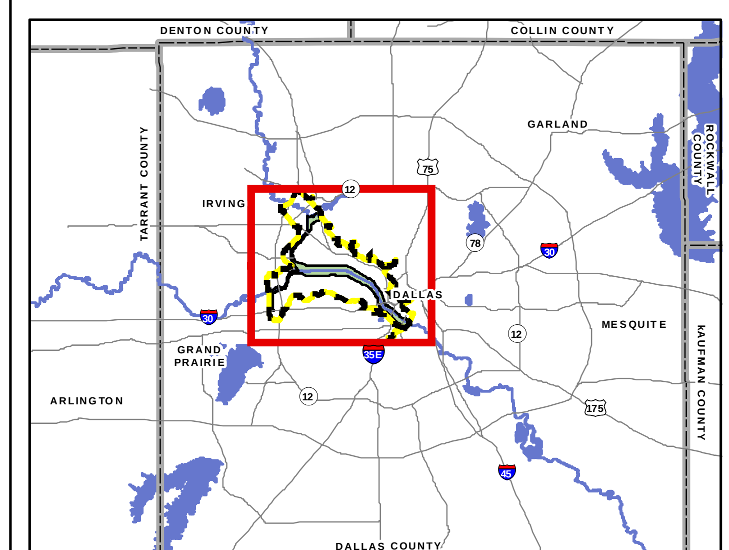
Future Without Project Condition Projects

- A Able Pumping Plant
- B Baker Pumping Plant
- C Beckley Avenue Improvements
- D Belleview Trail Connector
- E Bernal Trail
- F Continental Pedestrian Bridge
- G Dallas Maritime Museum
- H Dallas Watersports Complex
- I Dallas Water Utility Lines
- J EF2 Wastewater Interceptor Line & Laterals
- K Horseshoe Project
- L Irving Northwest Levee Repair
- M Jefferson-Memorial Bridge
- N Loop 12 Bridge
- O Pavaho Wetlands
- P Riverfront Boulevard
- Q SH-183 Bridge
- R Trinity Lakes Streetcar Loop
- S Trinity Parkway
- SB Trinity Parkway Borrow Pits

ROI
Dallas Floodway Levee
Freeway

Habitat Types

- Aquatic Riverine
- Bottomland Hardwood
- Emergent Wetland
- Grassland
- Open Water
- Urban



0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

GIS Sources: Black and Veatch 2010; City of Dallas 2008a, 2010a; TxDOT 2010; USACE 2007; USFWS 2006

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4.5.3 Alternative 2: Proposed Action

4.5.3.1 Design Anticipating Potential Trinity Parkway Construction

Impacts are analyzed based on project categories, not geography, unlike the PAR that provides impact assessments for each of the three habitat groups. Impacts to habitat types for each project category have been presented cumulatively across the three habitat type groups. For example, because there are no BVP Ecosystem and Recreation features proposed within the Confluence Group, no impacts to habitat types in this area would occur and as such, no table is presented.

BVP Study FRM Elements

Habitat Types and Values

Construction

The levee raise, AT&SF Railroad Bridge modifications, and levee flattening would temporarily impact habitat in the Mainstem (Dallas Floodway) and the Confluence (Elm and West Forks) Groups but would result in overall minimal changes in habitat acreage. Table 4.5-3 presents the approximate existing habitat area, area of impacts, and change to each existing habitat type within the Mainstem and Confluence Groups associated with the levee modifications. The levee raise would permanently impact a swath on average 210 feet wide (excluding the 50-foot wide temporary construction buffer areas on each side) for approximately 11,100 linear feet of the East Levee and 9,400 linear feet of the West Levee.

Table 4.5-3. Estimated Existing, Proposed, and Change in Habitat Types under Proposed Action Design Anticipating Potential Parkway Construction, FRM

Habitat Type	*Existing Habitat (acres)*	*Proposed Habitat (acres)*	*Change in Habitat (acres)*
Emergent Wetland	0.53	0.00	-0.53
Grassland	290.83	292.75	1.92
Aquatic Riverine	1.39	0.00	-1.39
Total	**292.75**	**292.75**	**0.00**

Note: Because the borrow pits would be the site for lake development for the BVP Study Ecosystem and Recreation features, impacts associated with the borrow pits are not included in these values.

Temporary and permanent impacts to wetland, grasslands and aquatic riverine habitats would occur from the implementation of the levee raise. The majority of the habitat temporarily impacted would be low quality mowed grassland. The grassland habitat would return after the completion of the levee raise modifications. Less than one acre of emergent wetlands would be eliminated and replaced with grassland. BMPs and SCMs would be implemented to minimize impacts to wetlands to the greatest extent possible. The material for the levee raise would come from two borrow pits located in the Mainstem (refer to Figure 2-1). The borrow areas would also serve as the preliminary excavation associated with the West Dallas Lake, and thus impacts specific to the borrow areas are not discussed here.

No change to grassland habitat values from the implementation of the FRM elements would occur. Low quality mowed grasslands would be temporarily impacted during construction and the area would return to low quality mowed grassland habitat after the improvements are finished. There would be a temporary decrease to emergent wetland habitat values during construction but this impact would be offset by the proposed Corinth Wetlands in the Mainstem Group.

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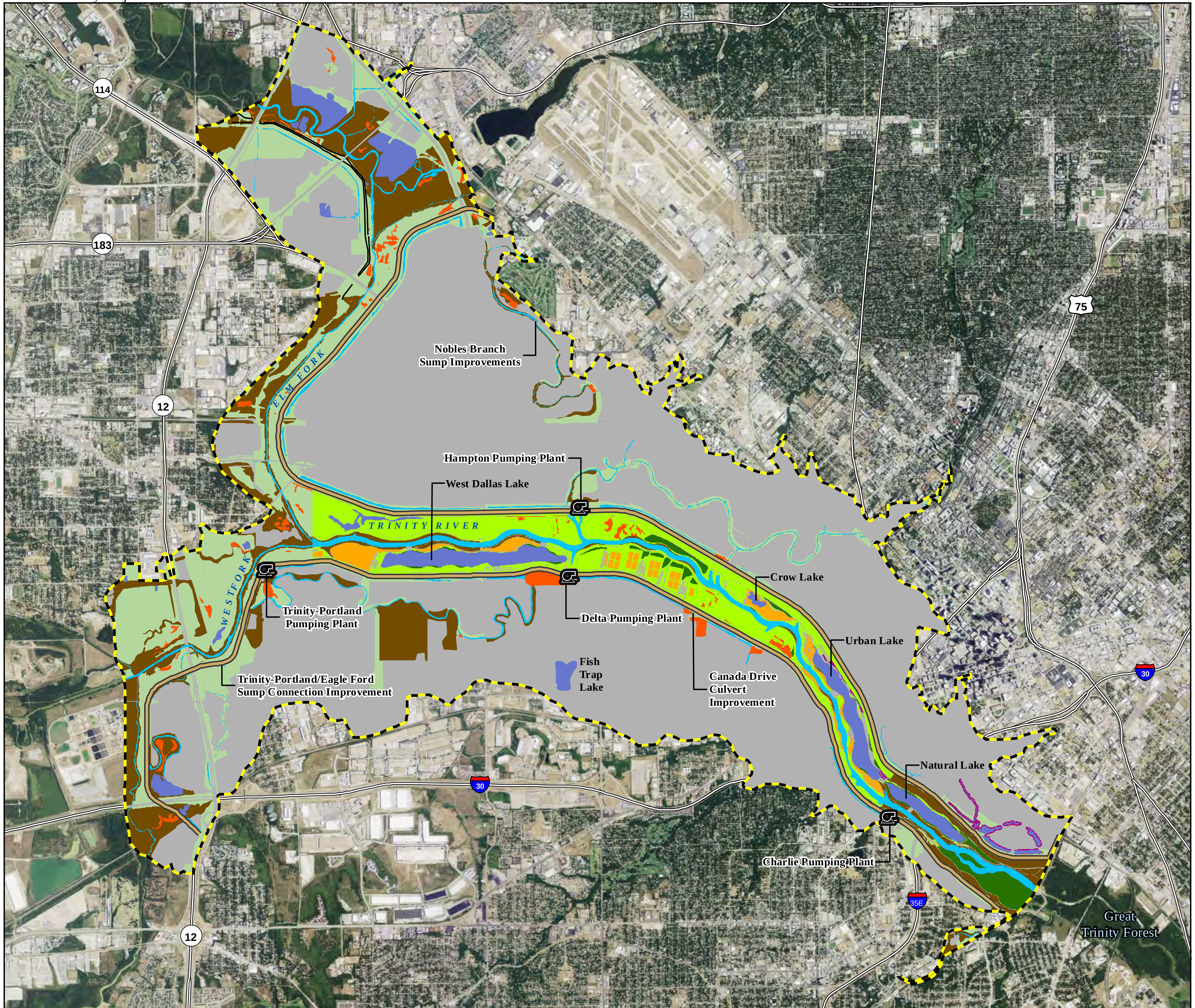


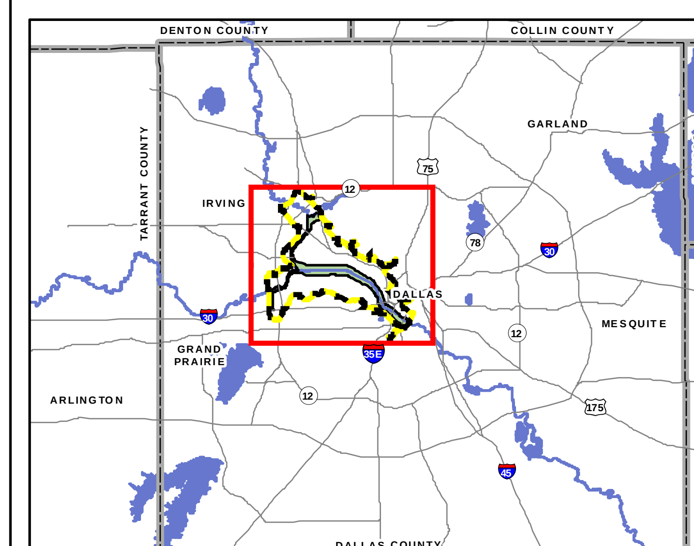
Figure 4.5-2
Habitat Types Under Proposed Action Design
Anticipating Potential Trinity Parkway Construction

LEGEND

- ROI
- Dallas Floodway Levee
- IDP Pumping Plant
- Freeway

Habitat Types (At Year

- Aquatic Riverine
- Bottomland Hardwood
- Emergent Wetland
- Remaining Existing Emergent Wetland
- Grassland
- Meadow
- Turf
- Urban Forest
- Open Water
- Urban



0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

GIS Sources:City of Dallas 2008a, NCTCOG 2008, USACE 2013b, USFWS 2006

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Operation

Impacts to habitats during the operation of the FRM elements would be similar to current impacts. The grasslands along the levees would still be mowed and maintained and access roads would be utilized for maintenance.

Fish and Wildlife

Construction

During the construction of the levee raise, AT&SF Railroad Bridge modifications, and levee flattening, terrestrial wildlife would temporarily be affected in the Mainstem and Confluence Groups. Minimal impacts to the fragmented bottomland hardwood and low quality wetlands would occur with the implementation of the FRM elements. Most of the species utilizing the mowed grasslands are common, opportunistic species. Most, if not all species would recolonize the area after construction. Minimal impacts to fish and other aquatic species are expected, as most FRM construction would avoid aquatic habitats. Furthermore, identified BMPs and SCMs would minimize potential construction-related indirect impacts to aquatic areas. Impacts to nesting bird species would be minimized to the greatest extent possible. If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities would comply with the MBTA to avoid impacts to nesting migratory birds within the ROI. Specifically, a biologist would check the proposed construction sites, including laydown areas, for nests (in trees, shrubs, and on the ground) before construction begins. If the biologist finds an active nest, construction workers would not directly or indirectly disturb the nest or adjacent areas until the biologist determines the nest is no longer active.

Operation

The impacts to fish and wildlife under the Proposed Action design anticipating potential Trinity Parkway construction from continued mowing of low quality grasslands would be similar to the impacts from the current mowing regime. Common birds, amphibians, reptiles, and mammals adapted to human disturbance would continue to use the terrestrial habitat.

Special Status Species

No federally or state- listed species are known to reside or breed in area of proposed FRM elements. Some of the BCC bird species listed in Section 3.5 is likely to occur in the area. The loggerhead shrike occurs in the ROI. If these species occur in the area during construction, they could fly to other areas of the Floodway or the Confluence. If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities would comply with the MBTA to avoid affects to nesting migratory and/or special status birds within the ROI. Any impacts to special status species during the construction and operation of the FRM elements would be minimized through the implementation of SCMs.

Invasive Species

Monitoring for invasive species and the application of appropriate control measures would minimize the risk from invasive species. SCMs would be implemented to minimize the spread of invasive species during construction and operation of the FRM elements.

BVP Study Ecosystem and Recreation Features (Mainstem Group)

Under the Proposed Action design anticipating potential Trinity Parkway construction, implementation of the BVP Study Ecosystem and Recreation features in the Mainstem Group would result in temporary negative impacts to biological resources during construction. However, following construction, beneficial impacts to habitat are expected. Most sensitive aquatic habitat types (aquatic riverine, bottomland hardwood, and open water) would increase in area and value under the implementation of the BVP Study Ecosystem and Recreation features. For a specific description of proposed BVP habitats and plant species, please refer to Appendix H. A Monitoring and Adaptive Management Plan for the BVP Study Ecosystem features is also included in Appendix H.

Habitat Types and Values

Construction

The BVP Study Ecosystem and Recreation features would be implemented in the Mainstem Group (Dallas Floodway) (refer to Figures 4.5-1 and 4.5-2). The habitat in the Mainstem Group has existed in its current state for the last 50 years. Under the Proposed Action design anticipating potential Trinity Parkway construction, most of the habitat in the Mainstem Group would be temporarily impacted during the implementation of the BVP Study Ecosystem and Recreation features. However, small, low quality emergent wetlands within the project area are anticipated to be developed or converted into other habitat types (open water, aquatic riverine, meadow) during the implementation of BVP Study Ecosystem and Recreation features.

Operation

After an approximately 15-year construction period (2015-2030), most of the native habitat would be restored to a higher habitat value than its current state. Table 4.5-4 presents the estimated habitat acreages and habitat values from the implementation of the BVP Study Ecosystem and Recreation features in the Mainstem Group over a 50-year period beginning with the completion of construction. As shown in Table 4.5-4, different native habitats take different amounts of time post-construction to recover to existing or better habitat quality. All habitats except grasslands would be at or better than existing habitat quality levels within 10 years of construction being completed.

Table 4.5-4. Estimated Habitat Suitability Indices, Acreages, and Habitat Units for Habitat Types in the Mainstem Group under Proposed Action Design Anticipating Potential Trinity Parkway Construction

Metric	*Existing Conditions*	*Year*						*Change*
		0	*1*	*5*	*10*	*25*	*50*	
Bottomland Hardwood								
HSI	0.21	0.09	0.09	0.09	0.13	0.21	0.43	N/A
Acres	94.64	195	195	195	198	203	215	120
HUs	19.87	17.55	17.55	17.55	25.74	42.63	92.45	72.58

Table 4.5-4. Estimated Habitat Suitability Indices, Acreages, and Habitat Units for Habitat Types in the Mainstem Group under Proposed Action Design Anticipating Potential Trinity Parkway Construction

Metric	*Existing Conditions*	*Year*						*Change*
		0	*1*	*5*	*10*	*25*	*50*	
Emergent Wetland								
Existing								
HSI	0.22	0.22	0.22	0.22	0.22	0.22	0.22	N/A
Acres	262.91	32	32	32	32	32	32	231
HUs	57.84	7.04	7.04	7.04	7.04	7.04	7.04	-50.80
Proposed								
HSI	-	0.13	0.13	0.34	0.42	0.47	0.52	N/A
Acres	-	152	152	152	152	152	150	150
HUs	0.00	19.76	19.76	51.68	63.84	71.44	78.00	78.00
Total Wetland HU	***57.84***	***26.8***	***26.8***	***58.72***	***70.88***	***78.48***	***85.04***	***27.20***
Grassland								
Existing Maintenance Levels								
HSI	0.62	0.40	0.40	0.40	0.40	0.40	0.40	N/A
Acres	1,752.15	192	192	192	192	192	194	-1,558
HUs	1,086.33	76.8	76.8	76.8	76.8	76.8	77.6	-1,008.73
Meadow								
HSI	-	0.50	0.60	0.70	0.65	0.70	0.85	N/A
Acres	-	887	887	887	887	887	887	887
HUs	0.00	443.50	532.20	620.90	576.55	620.90	753.95	753.95
Landscaping: Turf								
HSI	-	0	0	0.4	0.4	0.4	0.4	N/A
Acres	-	158	158	158	158	158	158	158
HUs	-	0.00	0.00	63.20	63.20	63.20	63.20	63.20
Landscaping: Urban Forest								
HSI	-	0.50	0.50	0.40	0.40	0.40	0.40	N/A
Acres	-	5	5	5	5	5	5	5
HUs	-	2.50	2.50	2.00	2.00	2.00	2.00	2.00
Total Grassland HU	***1,086.33***	***522.8***	***611.5***	***762.9***	***718.55***	***762.9***	***896.75***	***-189.58***
Aquatic Riverine[1]								
HSI	0.83	0.83	0.75	0.83	0.85	0.87	0.90	N/A
Acres	123.73	250	250	250	247	242	230	106
HUs	102.70	207.50	187.50	207.50	209.95	210.54	207.00	104.30

Table 4.5-4. Estimated Habitat Suitability Indices, Acreages, and Habitat Units for Habitat Types in the Mainstem Group under Proposed Action Design Anticipating Potential Trinity Parkway Construction

Metric	*Existing Conditions*	*Year*						*Change*
		0	*1*	*5*	*10*	*25*	*50*	
Open Water								
Crow Lake								
HUs	4.55	4.55	4.55	4.55	4.55	4.55	4.55	0.00
Urban Lake & West Dallas Lake								
HSI	-	0.00	0.00	0.43	0.77	0.77	0.77	N/A
Acres	-	207	207	207	207	207	207	207
HUs	-	0.00	0.00	89.01	159.39	159.39	159.39	159.39
Natural Lake								
HSI	-	0.00	0.00	0.60	0.77	0.77	0.77	N/A
Acres	-	50	50	50	50	50	50	50
HUs	-	0.00	0.00	30.00	38.50	38.50	38.50	38.50
Total Open Water HU	***4.55***	***4.55***	***4.55***	***123.56***	***202.44***	***202.44***	***202.44***	***199.89***

Notes: [1] Aquatic riverine habitat under the Proposed Action design anticipating potential Trinity Parkway construction includes fringe riparian and wetland habitat.
Source: USFWS 2014.

For detailed discussions regarding the predicted 50-year progression of BVP Study Ecosystem and Recreation features HSIs, acres, and HUs for the Mainstem Group for bottomland hardwood, emergent wetland, grassland, aquatic riverine, and open water habitat, refer to the 2014 PAR (USFWS 2014). With the implementation of the BVP Study Ecosystem and Recreation features, most of the habitat in the Mainstem Group would be temporarily disturbed. Following the implementation of the BVP Study Ecosystem and Recreation features (Years 0, 1, and 5), the bottomland hardwood, emergent wetland, and urban forest HSIs would be low because the habitats would have just been created, and would take time to become established.

Bottomland Hardwoods. Bottomland hardwoods would primarily be planted at the southeastern portion of the Mainstem Group. The bottomland hardwood HSIs would be expected to increase over time as the trees mature, and the emergent wetland HSIs would be expected to increase over time as wetland vegetation, habitat structure, and food resources for wildlife become more established. In addition, over the 50-year period bottomland hardwoods are expected to increase in acreage and value from the conversion of aquatic riverine to bottomland hardwood because of climate change creating warmer, drier conditions (USFWS 2014).

Emergent Wetlands. Under the implementation of BVP Study Ecosystem and Recreation features, emergent wetland acreages would decrease but wetland quality would increase (refer to Table 4.5-4).

Grasslands. The Mainstem Group grasslands would consist of native meadow, turf, and urban forest. The meadows would be planted with a diverse range of native grasses and forbs, consistent with the numbers and species found in the north Texas Blackland Prairie Ecoregion (refer to the species list in Appendix H). Therefore, the resulting planted meadows would be a higher quality habitat than the existing non-native grasslands and would be expected to increase in value over the 50-year period from increased native species diversity. Meadows would be mowed annually in the late winter/early spring. This would allow the meadows to grow and thrive, and prevent shrubs and woodland species from establishing in the meadow areas (USACE 2013a, 2013b).

Turf would include mowed grasses at the parks and athletic fields. The turf HSI would not be expected to change over time because mowed grass would be expected to remain at the same low habitat value over the 50-year period.

Urban forests are included under grasslands because they would have a habitat value closer to a grassland than a native forest. The urban forest would be expected to take 10 to 25 years to mature; therefore, HSIs would be expected to increase from years 5 to 25. Urban forest is considered a subset of grassland because the majority of the proposed trees would be non-native ornamental trees and do not provide the same habitat value as a native forest (USFWS 2014).

Grassland habitat would be expected to increase over the 50-year period from the conversion of emergent wetlands to grasslands because of climate change creating warmer, drier conditions (USFWS 2014).

Aquatic Riverine. Aquatic riverine habitat would increase with the implementation of the BVP Study Ecosystem and Recreation features (refer to Table 4.5-4). The greatest increase to aquatic riverine under the implementation of the Proposed Action design anticipating potential Trinity Parkway construction would be due to the relocation of the Trinity River. The edge of the relocated Trinity River would be terraced and planted to create riparian and wetland habitat. The relocation of the Trinity River would result in adverse impacts on the aquatic riverine habitat during construction; however, impacts would be beneficial once the new alignment is complete. The edge of the aquatic riverine habitat would be expected to decrease over the 50-year period from the conversion of aquatic riverine to bottomland hardwood because of climate change creating warmer, drier conditions (USFWS 2014).

Aquatic riverine HSIs are not expected to increase much over time because they would contain water and are expected to be functioning aquatic ecosystems once the BVP Study Ecosystem and Recreation features are completed. At year 50, the aquatic riverine HSI would increase (USFWS 2014).

Open Water. With the creation of the lakes, the acreage of open water habitat would increase dramatically (refer to Table 4.5-4). Open water habitat in the BVP lakes would have an HSI of zero at years 0 and 1 due to the limited fish abundance and diversity. Open water would take approximately 5 years to establish fish diversity and abundance. The fish diversity and abundance would be expected to increase in the lakes after flood events result in the dispersal of fish into the new habitats. The open water HSI was determined by referring to the 2010 fisheries sampling in Crow Lake, Bart Simpson Lake, and Cell D of the DFE (City of Dallas 2010; USACE 2010; USFWS 2014). Overall, habitat values would increase from the implementation of the BVP Study Ecosystem and Recreation features.

Urban Area. With the installation of roads, parking lots, and park facilities, urban areas would increase in acreage (USFWS 2014).

Fish and Wildlife

Construction

The implementation of the BVP Study Ecosystem and Recreation features would temporarily affect fish and wildlife in the Mainstem Group during construction. Fish, mussels, and aquatic species are likely to experience high mortality during the relocation of the Trinity River. Reptiles and amphibians would likely experience mortality during construction. Most mammals and birds would be displaced but would likely colonize adjacent habitat.

Mussel beds occur in the Trinity River in the Horseshoe Project area and in the Elm Fork and are likely to occur in other areas of the Biological Resources ROI. The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar method to minimize impacts to mussel beds and other sensitive aquatic resources (TPWD 2013).

Impacts to nesting bird species would be minimized to the greatest extent possible and would comply with the MBTA. If proposed construction activities occur during the avian breeding season (February 15 through August 31), a biologist would check the proposed construction sites, including laydown areas, for active nests (in trees, shrubs, and on the ground) of MBTA-protected species before the construction phase begins. If the biologist finds an active nest, the area surrounding the nest would be marked with flagging and marked on maps; and construction workers would avoid that area until the biologist determines the nest is no longer active.

Operation

Once the BVP Study Ecosystem and Recreation features are established, the lakes (open water), aquatic riverine, and emergent wetlands are expected to provide high quality habitat for fish, mussels, amphibians, and other aquatic species, and foraging habitat for birds, reptiles, and mammals.

Special Status Species

Construction

If a federally listed bird species is observed in the Mainstem during the breeding season, the USFWS would be notified to discuss alternative development plans or the need for consultation under Section 7 of the Endangered Species Act (ESA). If a state-listed species is encountered in the project area of project elements sponsored by the City of Dallas, TPWD would be notified to discuss ways to minimize any potential impact. State-listed mussel species such as the Texas pigtoe occur in the Horseshoe Project area and in the Elm Fork and are likely to occur in other areas of the Biological Resources ROI. The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar method to minimize impacts to mussel beds and other sensitive aquatic resources (TPWD 2013).

Some of the BCC bird species listed in Section 3.5 are likely to occur in the ROI. The loggerhead shrike and little blue heron are known to occur in the ROI. Impacts to nesting bird species would be minimized to the greatest extent possible. If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities would comply with the MBTA to avoid impacts to nesting migratory birds within the Mainstem. Specifically, a biologist would check the proposed construction sites, including laydown areas, for nests (in trees, shrubs, and on the ground) once before the construction phase begins. If the biologist finds an active nest, construction workers would not directly or indirectly disturb the nest or adjacent areas until the biologist determines the nest is no longer active. Impacts to special status species, including mussels and birds, would be minimized through the implementation of SCMs.

Operation

Increased habitat acreages and value in the Mainstem Group could provide habitat for special status species. The ecosystem restoration features will be monitored after construction to ensure that they meet success criterion (refer to Appendix H).

Invasive Species

Construction and Operation

Invasive zebra mussels occur upstream of the ROI and are a major threat to native aquatic species. TPWD recommends that users of Texas waters, especially boaters, adopt the “Clean, Drain, and Dry” protocol to prevent zebra mussel larvae from spreading among Texas waters. Simply, this protocol is that a boat owner should thoroughly clean, drain, and dry his boat after each and every put-in. Possession and transport of zebra mussels—even if accidental—is a criminal offence punishable by fine and/or jail time (TPWD 2013).

Non-native invasive plants pose a threat to native habitats. Monitoring for invasive species and the application of appropriate control measures would minimize the risk from invasive species. Monitoring and reporting guidelines are described in the SCMs. SCMs would be implemented to minimize the spread of invasive species during construction and operation of the BVP Study Ecosystem and Recreation features.

IDP Improvements

Habitat Types and Values

Construction

Impacts to aquatic riverine and wetlands would be avoided where possible and minimized otherwise. These aquatic habitats are part of the 100-year floodplain. Pursuant to the CWA and EO 11990, activities impacting wetlands would only occur if the USACE determines that there is no practicable alternative to the activity, and that the activity includes all practical measures to minimize harm to the wetlands.

Operation

Table 4.5-5 presents the Interior Drainage Systems (IDS) Group HSIs, acres, and HUs for habitat types over the 50-year period following construction of the Proposed Action design anticipating potential Trinity Parkway construction. The presented HSIs, acres, and HUs reflect implementation of the federal and City of Dallas IDP elements.

Table 4.5-5. Estimated Habitat Suitability Indices, Acreages, and Habitat Units for Habitat Types in the Interior Drainage Systems Group under the Proposed Action Design Anticipating Potential Trinity Parkway Construction

Metric	*Existing Conditions*	*Year*				*Change*
		0	*5*	*10*	*50*	
Bottomland Hardwood						
HSI	0.39	0.39	0.39	0.39	0.39	N/A
Acres	351.50	350	347	339	326	-26
HUs	137.09	136.50	135.33	132.21	127.14	-9.95
Emergent Wetland						
HSI	0.22	0.23	0.22	0.22	0.19	N/A
Acres	87.72	67	67	67	67	-21
HUs	19.3	15.41	14.74	14.74	12.73	-6.57
Grassland						
Existing Maintenance Levels						
HSI	0.57	0.57	0.57	0.57	0.62	N/A
Acres	958.26	945	936	908	844	-114
HUs	546.21	538.65	533.52	517.56	523.28	-22.93

Table 4.5-5. Estimated Habitat Suitability Indices, Acreages, and Habitat Units for Habitat Types in the Interior Drainage Systems Group under the Proposed Action Design Anticipating Potential Trinity Parkway Construction

Metric	*Existing Conditions*	*Year*				*Change*
		0	*5*	*10*	*50*	
Landscaping: Urban Forest						
HSI	N/A	0.50	0.40	0.40	0.40	N/A
Acres	0	22	22	22	22	22
HUs	0	11	8.8	8.8	8.8	8.8
Total Grassland HU	***546.21***	***549.65***	***542.32***	***526.36***	***532.08***	***-14.13***
Aquatic Riverine[1]						
HSI	0.75	0.70	0.70	0.75	0.80	N/A
Acres	165.18	162	162	160	152	-13
HUs	123.89	113.40	113.40	120.00	121.60	-2.29
Open Water						
HSI	0.65	0.65	0.65	0.65	0.65	N/A
Acres	49.30	72	72	71	65	16
HUs	32.05	46.80	46.80	46.15	42.25	10.20

Notes: Existing conditions acreages are to 100th of an acre to be consistent with the existing condition HUs in Chapter 3. The Proposed Action design anticipating potential Trinity Parkway construction acreages are presented in whole numbers.

[1] Aquatic riverine habitat under the design anticipating potential Trinity Parkway Construction includes fringe riparian and wetland habitat.

Source: USFWS 2014.

The majority of the bottomland hardwoods occur along the drainage channels. The quality (HSI) of the bottomland hardwoods is expected to remain consistent over time. Bottomland hardwood areas within the IDS are expected to decrease over time due to development. Bottomland hardwood habitats do not have any special protection from development.

The emergent wetlands are part of the sump pump areas and would not be impacted. Little change to emergent wetland quality (HSI) or acreage would occur over the 50-year period. The primary purpose of the emergent wetland areas are flood control, not to provide habitat.

The majority of the grasslands occur along the drainage channels. The quality (HSI) of the grassland habitat is expected to remain much the same over time due to edge effects and non-native species. Grassland areas are expected to decrease over time because of development. Grassland habitats do not have any special protection from development.

The IDS is smaller than the Trinity River, has less species diversity, and is not connected to the Trinity River for species dispersal; therefore, the aquatic riverine HSI for the IDS Group would have a lower HSI than the Trinity River. The HSI would remain at 0.70 from year 0 to 5 because of siltation, erosion, and other temporary impacts from construction. At year 10, the HSI would return to 0.75 (pre-construction conditions). By year 50, the HSI would increase to 0.80 (USFWS 2014).

Because the open water in the IDS Group is not connected to the Trinity River like the open water in the Mainstem Group, the open water HSI in the IDS Group would be lower for the IDS Group than the Mainstem Group. The water quality in the open water would not change in the next 50 years; therefore, the HSI would remain the same for the next 50 years (USFWS 2014).

HUs for all habitats except open water would decrease from the implementation of the IDP improvements (see Table 4.5-5).

Hampton Pump Station and Sump Improvements

Construction

Construction of the New Hampton Pump Station and Sump Improvements would directly impact up to 0.1 acre of emergent wetland, 0.2 acre of aquatic riverine, and 2.7 acres of grassland (USACE 2013a, 2013b). SCMs would be implemented to minimize impacts to wetlands and aquatic riverine habitat and meet the requirements of the CWA and EO 11990.

Operation

The operation of the New Hampton Pump Station would not impact aquatic or terrestrial habitat.

Charlie Pump Station and Sump Improvements

Construction

Construction of the Charlie Pump Station and Sump Improvements would directly affect up to 0.2 acre of emergent wetland, 0.3 acre of aquatic riverine, and 2.6 acres of grassland (USACE 2013a, 2013b). Impacts to aquatic riverine and wetlands would be minimized to the maximum extent possible. SCMs would be implemented to minimize impacts to wetlands and aquatic riverine habitat and meet the requirements of the CWA and EO 11990.

Operation

The operation of the Charlie Pump Station would not affect aquatic or terrestrial habitat.

Delta Pump Station and Sump Improvements

Construction

Construction of the Delta Pump Station and Sump Improvements would directly affect up to 0.1 acre of emergent wetland, 0.1 acre of aquatic riverine, and 0.3 acre of grassland (USACE 2013a, 2013b). Impacts to aquatic riverine and wetlands would be minimized to the maximum extent possible. SCMs would be implemented to minimize impacts to wetlands and aquatic riverine habitat and meet the requirements of the CWA and EO 11990. Permanent impacts to wetlands would be mitigated at the Corinth Wetland site in the Mainstem Group.

Operation

The operation of the Delta Pump Station would not affect aquatic or terrestrial habitat.

Trinity-Portland Pumping Plant and Sump Improvements

Construction

Construction of the Trinity Portland Pump Station and Sump Improvements would directly affect up to 0.2 acre of aquatic riverine and 1.2 acres of grassland (USACE 2013a, 2013b). SCMs would be implemented to minimize impacts to aquatic riverine habitat. No impacts to emergent wetlands are expected.

Operation

The operation of the Trinity Portland Pump Station would not affect aquatic or terrestrial habitat.

Fish and Wildlife

Construction

Implementation of the IDP improvements would disturb or displace wildlife from the areas of construction and immediately surrounding areas. These activities could cause mortality to individuals of the smaller, less mobile and burrowing species, whereas mobile species would disperse to surrounding areas. Individuals dispersing away from the activity would likely experience increased risks of predation, reduced foraging or reproductive success, and energetic costs. The overall impact on wildlife populations would be relatively small, proportional to the relatively small areas of habitat affected. In areas temporarily impacted, wildlife species would recolonize available habitat area after construction. No long-term impacts to wildlife populations are likely. Due to the low quality of the habitat surrounding the majority of ROI and the small area of impact, the impacts to fish and wildlife, including migratory birds, would be minor.

Impacts to nesting bird species would be minimized to the greatest extent possible. If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities would comply with the MBTA to avoid impacts to nesting migratory birds within the ROI. Specifically, a biologist would check the proposed construction sites, including laydown areas, for nests (in trees, shrubs, and on the ground) once before the construction phase begins. If the biologist finds an active nest, construction workers would not directly or indirectly disturb the nest or adjacent areas until the biologist determines the nest is no longer active.

Operation

No long-term impacts to fish and wildlife are anticipated from the implementation of the IDP improvements.

Special Status Species

Construction and Operation

No federally or state- listed species are known to reside or breed in the area proposed for IDP improvements. If a federally listed bird species is observed in the Mainstem during the breeding season, the USFWS would be notified to discuss alternative development plans or the need for consultation under Section 7 of the ESA. If a state-listed species is encountered in the project area of project elements sponsored by the City of Dallas, TPWD would be notified to discuss ways to minimize any potential impact.

Some of the BCC bird species listed in Section 3.5 is likely to occur in the IDP improvement impact area. If these species occur in the area during construction, they could fly to other areas. Any impacts to special status species during the construction and operation of the IDP improvements would be minimized through the implementation of SCMs.

Invasive Species

Construction and Operation

Monitoring for invasive species and the application of appropriate control measures would minimize the risk from invasive species. SCMs (refer to Chapter 7) would be implemented to minimize the spread of invasive species during construction and operation of the IDP improvements.

4.5.3.2 Design Without Potential Trinity Parkway Construction Anticipated

Under the Proposed Action, the potential impacts to biological resources from implementation of the proposed FRM elements and IDP improvements would be the same regardless of the design variation used, as there would be no change in these components in either design. Therefore, refer to Section 4.5.3.1 for a discussion of impacts to biological resources associated with implementation of the FRM elements and IDP improvements. The following section presents the potential impacts to biological resources from implementation of the BVP Study Ecosystem and Recreation features associated with the Proposed Action design without potential Trinity Parkway construction anticipated, as they are slightly different from those presented under design anticipating potential Trinity Parkway construction.

BVP Study Ecosystem and Recreation Features

This biological resources section analyzes the impacts of the Proposed Action design without potential Trinity Parkway construction anticipated BVP Study Ecosystem and Recreation features on habitat types and value, fish and wildlife, special status species, and invasive species. Figure 4.5-3 depicts the future distribution of habitat types that would result from implementation of the Proposed Action design without potential Trinity Parkway construction anticipated.

Habitat Types and Values

The BVP Study Ecosystem and Recreation features would be implemented in the Mainstem Group (Dallas Floodway) (Figure 4.5-3). Under the design without potential Trinity Parkway construction anticipated, most of the habitat in the Mainstem Group would be temporarily impacted during the implementation of the BVP Study features. After the approximately 15-year construction period (2015-2030), most of the habitat would be restored to a higher habitat value than its current state. Three large lakes, re-alignment of the Trinity River, fringe riparian habitat, native grassland meadows, additional bottomland hardwoods, and additional higher quality wetlands would be created with the implementation of the BVP Study features (Figure 4.5-3).

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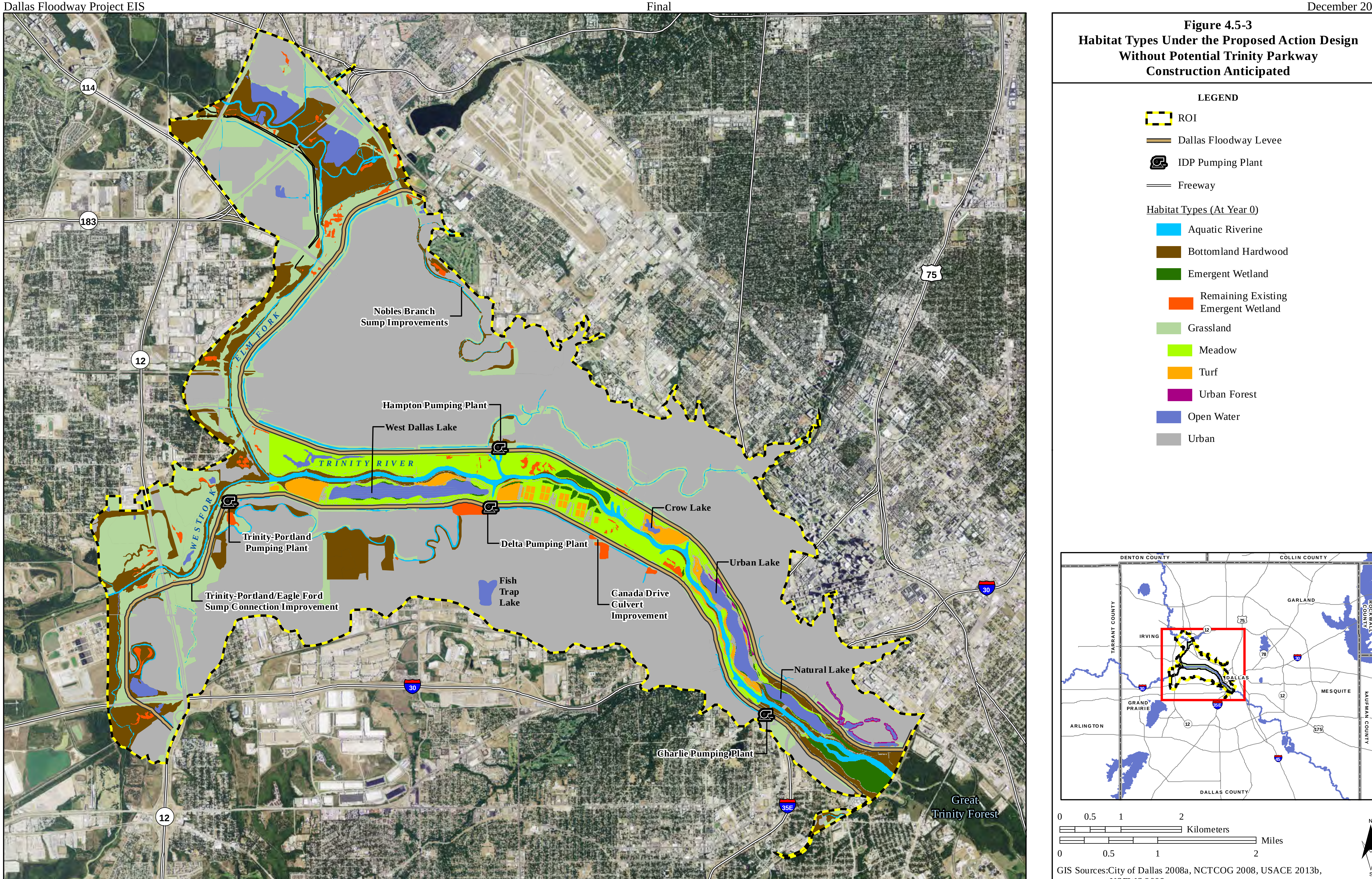

Figure 4.5-3
Habitat Types Under the Proposed Action Design Without Potential Trinity Parkway Construction Anticipated
LEGEND
ROI
Dallas Floodway Levee
IDP Pumping Plant
Freeway
Habitat Types (At Year 0)
Aquatic Riverine
Bottomland Hardwood
Emergent Wetland
Remaining Existing Emergent Wetland
Grassland
Meadow
Turf
Urban Forest
Open Water
Urban
Nobles Branch Sump Improvements
Hampton Pumping Plant
West Dallas Lake
ELM FORK
TRINITY RIVER
WEST FORK
Trinity-Portland Pumping Plant
Delta Pumping Plant
Crow Lake
Urban Lake
Trinity-Portland/Eagle Ford Sump Connection Improvement
Fish Trap Lake
Canada Drive Culvert Improvement
Natural Lake
Charlie Pumping Plant
Great Trinity Forest
114
183
12
75
30
35E
DENTON COUNTY
COLLIN COUNTY
GARLAND
TARRANT COUNTY
ROCKWALL COUNTY
IRVING
DALLAS
GRAND PRAIRIE
MESQUITE
KAUFMAN COUNTY
ARLINGTON
DALLAS COUNTY
0 0.5 1 2 Kilometers
0 0.5 1 2 Miles
N
S
GIS Sources:City of Dallas 2008a, NCTCOG 2008, USACE 2013b, USFWS 2006

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Table 4.5-6 presents the predicted acreages for the habitat types in the Mainstem Group over the 50-year period following implementation of the design without potential Trinity Parkway construction anticipated. The greatest decrease of habitat would be to grassland. The greatest increase would be to open water from the creation of the BVP Study lakes. Bottomland hardwood habitat would also increase with the highest quality habitat at the southeastern end of the Floodway. Aquatic riverine habitat would increase from the relocation of the river.

Table 4.5-6. Estimated Changes in Habitat Acreages in the Mainstem Group under the Proposed Action Design Without Potential Trinity Parkway Construction Anticipated

Habitat Type	*Existing Conditions*	*Year (acres)*						*Change*
		0	*1*	*5*	*10*	*25*	*50*	
Bottomland Hardwood								
Bottomland Hardwood	95	**194**	**194**	**194**	**197**	**202**	**214**	**20**
Emergent Wetland								
Existing	263	32	32	32	32	32	32	-231
Proposed	-	154	154	154	154	154	152	152
Wetland Subtotal	263	**186**	**186**	**186**	**186**	**186**	**184**	**-77**
Grassland								
Existing	1,752	191	191	191	191	191	193	-1,559
Meadow	-	844	844	844	844	844	844	844
Urban Forest	-	15	15	15	15	15	15	15
Turf	-	186	186	186	186	186	186	186
Grassland Subtotal	*1,752*	**1,236**	**1,236**	**1,236**	**1,236**	**1,236**	**1,238**	**-514**
Aquatic Riverine								
Aquatic Riverine[1]	124	250	250	250	247	242	230	106
Open Water								
Existing-Crow Lake	6	6	6	6	6	6	6	0
Natural Lake	-	50	50	50	50	50	50	50
Urban Lake and West Lake	-	207	207	207	207	207	207	207
Open Water Subtotal	*6*	*263*	*263*	*263*	*263*	*263*	*263*	*257*
Habitat Subtotal	*2,240*	*2,129*	*2,129*	*2,129*	*2,129*	*2,129*	*2,129*	*-111*
Urban Area								
Urban Area	36	147	147	147	147	147	147	111
Total	**2,276**	**2,276**	**2,276**	**2,276**	**2,276**	**2,276**	**2,276**	**N/A**

Note: [1] Aquatic riverine habitat under the Proposed Action design without potential Trinity Parkway construction anticipated includes fringe riparian and wetland habitat.
Source: USFWS 2014.

As shown in Table 4.5-7, the increase in aquatic habitat (aquatic riverine, open water, and bottomland hardwood) would be a beneficial impact from the implementation of the design without potential Trinity Parkway construction anticipated. The grassland habitat is primarily non-native and mowed; therefore, the loss of grassland habitat would not be an adverse impact.

Table 4.5-7. Estimated Changes to Habitat Acreages under the Proposed Action Design Without Potential Trinity Parkway Construction Anticipated

Habitat Type	*Existing Conditions (acres)*	*Design Not Anticipating Parkway Construction, Year 0 (acres)*	*Design Not Anticipating Parkway Construction, Year 50 (acres)*
Bottomland Hardwood	1,414	1,510	1,556
Emergent Wetland	419	321	318
Grassland	4,283	3,777	3,586
Aquatic Riverine	421	545	507
Open Water	206	486	464
Habitat Subtotal	*6,743*	*6,639*	*6,431*
Urban Area	10,400	10,504	10,712
Total	**17,143**	**17,143**	**17,143**

Note: [1] Aquatic riverine under the Proposed Action design without potential Trinity Parkway construction anticipated includes fringe riparian and wetland habitat.
Sources: USACE 2007, 2013a, 2013b; USFWS 2014.

With the implementation of the BVP Study Ecosystem and Recreation features, most of the habitat in the Mainstem Group would be temporarily disturbed. As presented in Table 4.5-8, overall HUs would increase in 50 years under the design without potential Trinity Parkway construction anticipated. The greatest decrease of HUs would occur to grassland habitat. The greatest increase would be to open water from the creation of the BVP Study Ecosystem and Recreation features' lakes. Bottomland hardwood habitat would also increase with the highest quality habitat at the southeastern end of the ROI. Aquatic riverine habitat would increase from the relocation of the river.

Table 4.5-8. Estimated Changes to Habitat Units per Habitat Type under the Proposed Action Design Without Potential Trinity Parkway Construction Anticipated

Habitat Types	*Habitat Units*		
	Existing Conditions	*Year 50*	*Change*
Bottomland Hardwood	388.92	463.00	74.08
Emergent Wetland	97.53	119.58	22.05
Grassland	2,309.00	2,073.98	-235.02
Aquatic Riverine	345.77	444.85	99.08
Open Water	143.76	341.25	197.49
Total	**3,284.98**	**3,442.66**	**157.68**

Source: USFWS 2014.

Fish and Wildlife, Special Status Species, and Invasive Species

Impacts to fish and wildlife, special status species, and invasive species under the Proposed Action design without potential Trinity Parkway construction anticipated is expected to be similar to the design anticipating potential Trinity Parkway construction.

4.5.3.3 Summary

Under either Proposed Action design, potential impacts to biological resources from implementation of the proposed federal MDFP FRM elements and federal IDP improvements would be the same as there would be no change in these components under either design. Short-term temporary impacts to habitat would occur during construction. With respect to operations, sensitive aquatic habitat types, aquatic riverine, bottomland hardwood, and open water, would increase in the area and non-sensitive grassland habitat would decrease in acreage under both Proposed Action designs.

Overall, HUs would increase under both Proposed Action designs for the non-federal BVP and IDP features, resulting in beneficial impacts to habitat value. The Proposed Action design without potential Trinity Parkway construction anticipated would require more excavation of existing habitat. However, post-construction would result in the greatest increase to open water HUs from the creation of the BVP Study lakes, Urban, Natural, and West Dallas lakes. Bottomland hardwood habitat would also increase with the highest quality habitat at the southeastern end of the Floodway. Aquatic Riverine habitat would increase from relocating the river. The greatest decrease of acreage and HUs would be to grassland habitat (USFWS 2014).

MDFP

As described in Chapter 2, the Proposed Action includes some elements that would be implemented via cost-sharing with the USACE, i.e., the MDFP, and elements that would be the sole responsibility of the City of Dallas to implement. The values displayed in Table 4.5-9 reflect improvement of HUs in the project area for the complete Proposed Action (with or without construction of the Trinity Parkway anticipated). It is worth noting, however, that if the MDFP is considered alone, the habitat conditions for high-value habitats are improved. Table 4.5-9 compares the change in HUs in the Study Area between the Existing Conditions and the MDFP conditions (at year 50).

Table 4.5-9. Estimated Changes to Habitat Units per Habitat Type under the MDFP

Habitat Types	*Habitat Units*		
	Existing Conditions	*MDFP, Year 50*	*Change*
Bottomland Hardwood	388.92	419.74	30.82
Emergent Wetland	97.53	117.69	20.16
Grassland	2,309.00	1,824.02	-484.98
Aquatic Riverine	345.77	515.77	170.00
Open Water	143.76	130.07	-13.69
Total	**3,284.98**	**3,007.29**	**-277.69**

While the total change is negative, this is primarily due to impacts to non-native grasslands being modified to high-value aquatic riverine or emergent wetland habitats. If the change to HU were not to include impacts to non-native grassland habitat, the change would be positive 207.29.

Conclusion

Under both Proposed Action designs with and without potential Trinity Parkway construction, impacts to biological resources would be minimized through the application of SCMs and mitigation measures. However, given the magnitude of the proposed construction activities, which would result in nearly complete disturbance of the Floodway, significant adverse impacts to biological resources within the ROI during construction would occur. Under the Proposed Action design without potential Trinity Parkway construction anticipated, significant adverse impacts would extend within the areas of the proposed lakes. However, post-construction, there would be an increase in key habitat acreage and value under either proposed design. No federally listed species are known to reside or breed in the ROI; therefore, no impacts to federally listed species are anticipated. If a federally listed bird species occurs in the ROI during the breeding season, the USFWS would be notified to discuss additional minimization measures.

Impacts to state-listed species located within the Mainstem Group would be minimized through the implementation of SCMs and mitigation measures. Identified SCMs would be applied to reduce the potential for impacts to fish and wildlife, as well as reducing the risk for introducing invasive species in the ROI.

Most, if not all species are expected to recolonize habitat after construction. For these reasons, there would be beneficial long-term impacts to biological resources. Therefore, implementation of the Proposed Action would result in significant adverse impacts to biological resources during construction, and beneficial impacts to biological resources during operation or post-construction. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.5.3.4 Cumulative Impacts

Design Anticipating Potential Trinity Parkway Construction

Under the design anticipating potential Trinity Parkway construction, five of the past, present, and reasonably foreseeable projects' footprints (Able Pumping Plant, Baker Pumping Plant, Continental Pedestrian Bridge, Horseshoe Project, and Jefferson Memorial Bridge), overlap so the cumulative impacts from the projects and Trinity Parkway construction are less than the sum of the two (design anticipating Trinity Parkway construction and past, present, and reasonably foreseeable projects) totals. Estimated changes to habitat acreages are depicted in Table 4.5-10.

Table 4.5-10. Estimated Changes to Habitat Acreages under the Proposed Action Design Anticipating Potential Trinity Parkway Construction and the Past, Present, and Reasonably Foreseeable Projects

Habitat Type	*Existing Conditions (acres)*	*Design Anticipating Trinity Parkway Construction Year(acres)*	
		0	*50*
Bottomland Hardwood	1,414	1,480	1,525
Emergent Wetland	419	371	368
Grassland	4,283	3,565	3,380
Aquatic Riverine[1]	421	546	508
Open Water	206	486	464
Habitat Subtotal	*6,743*	*6,448*	*6,245*
Urban Area	10,400	10,695	10,898
Total	**17,143**	**17,143**	17,143

Note: [1] Aquatic riverine habitat under Proposed Action design anticipating potential Trinity Parkway construction includes fringe riparian and wetland habitat.
Sources: USACE 2007, 2013a, 2013b; USFWS 2014.

Temporary impacts to habitat from the implementation of the BVP Study Ecosystem and Recreation features are expected to be significant during construction. The majority of the Mainstem Group would be temporarily impacted for up to approximately 15 years. Temporary impacts in the Mainstem Group from the past, present, and reasonably foreseeable projects including the potential Trinity Parkway would be primarily from road and bridge construction.

Permanent impacts to habitats would increase sensitive habitat (bottomland hardwood, emergent wetland, and aquatic riverine) acreage and are expected to be beneficial. Bottomland hardwood acreage would increase by 66 acres from the BVP Study Ecosystem and Recreation features with hardwoods planted along the Trinity River; the largest amount of hardwoods would be planted at the southeastern end of the

Floodway. Two acres of bottomland hardwood would be permanently impacted from the implementation of the past, present, and reasonably foreseeable projects; however, there would be a cumulative gain of 66 acres of bottomland hardwood.

Aquatic riverine acreage would increase from the relocation of the river under the BVP Study Ecosystem and Recreation features. No impacts to aquatic riverine are anticipated from the implementation of the potential Trinity Parkway. Open water habitat would increase from the BVP Study Ecosystem and Recreation features creation of the Urban, Natural, and West Dallas lakes. No impacts to open water are expected to occur from the implementation of the Proposed Action design anticipating potential Trinity Parkway construction (refer to Table 4.5-10).

The greatest decrease of habitat would be to grassland habitat. While the overall acreage of habitat would decrease from the implementation of the Proposed Action design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects, the amount of bottomland hardwood, open water, and aquatic riverine habitat would increase, resulting in a long-term beneficial impact to habitat types. Emergent wetland and grassland would decrease in acreage. Small, low quality emergent wetlands within the project area will be developed or converted into native grassland (meadow) habitat during the implementation of the Proposed Action design anticipating potential Trinity Parkway construction. The remaining and created emergent wetland habitat would have increased habitat value because of the wetland habitat improvements. In addition, as noted in Table 4.5-10 additional riparian and wetland habitat would occur along the edges of the Trinity River. Grassland is a common habitat currently dominated by non-native grasses.

As presented in Table 4.5-11, overall HUs would increase under the Proposed Action design anticipating potential Trinity parkway construction and all past, present, and reasonably foreseeable projects, resulting in beneficial impacts to habitat value. The changes in HUs result primarily from the implementation of the Proposed Action design anticipating potential Trinity Parkway construction and secondarily from the implementation of the potential Trinity Parkway project. The greatest increase would be to open water from the creation of the BVP Study lakes. Bottomland hardwood habitat would also increase with the highest quality habitat at the southeastern end of the Floodway. Aquatic riverine habitat would increase from the relocation of the river. The greatest decrease of HUs would be to grassland habitat.

Table 4.5-11. Estimated Changes to Habitat Units per Habitat Type under the Proposed Action Design Anticipating Potential Trinity Parkway Construction and the Past, Present, and Reasonably Foreseeable Projects

Habitat Types	*Habitat Units*		
	Existing Conditions	*Design Anticipating Parkway Construction, Year 50*	*Change*
Bottomland Hardwood	388.92	449.67	60.75
Emergent Wetland	97.53	145.55	48.02
Grassland	2,309.00	1,952.33	-356.67
Aquatic Riverine	345.77	445.75	99.98
Open Water	143.76	341.25	197.49
Total	**3,284.98**	**3,334.55**	**49.57**

Note: The presented HUs are for the entire Proposed Action (all federal and non-federal BVP and IDP elements); however, the HUs do not reflect HU changes as a result of wetland enhancement/creation done outside of the Study Area in regional wetland banks.
Source: USFWS 2014.

Fish and Wildlife

The ultimate distribution of fish and wildlife under the Proposed Action design anticipating potential Trinity Parkway construction and the other past, present, and reasonably foreseeable projects would be similar to the distribution of fish and wildlife under existing conditions. Common fish, amphibians, aquatic reptiles, and shorebirds would continue to utilize the aquatic riverine, emergent wetland, and open water habitats. Common birds and mammals would continue to utilize the terrestrial habitat. Impacts to fish and wildlife would be minimized through the application of SCMs and mitigation measures (refer to Chapter 7). Impacts to nesting bird species would be minimized to the greatest extent possible. If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities would comply with the MBTA to avoid impacts to nesting migratory birds. Specifically, a biologist would check the proposed construction sites, including laydown areas, for nests (in trees, shrubs, and on the ground) once before the construction phase has begun. If the biologist finds an active nest, construction workers would not directly or indirectly disturb the nest or adjacent areas until the biologist determines the nest is no longer active.

However, given the magnitude of the proposed construction activities, which would result in nearly complete disturbance of the Floodway, implementation of the Proposed Action design anticipating potential Trinity Parkway construction would result in adverse impacts to fish and wildlife during construction. Temporary impacts from the past, present, and reasonably foreseeable projects would be minimal for BVP Study Ecosystem and Recreation features under the Proposed Action design anticipating potential Trinity Parkway construction.

Based on surveys, special aquatic resources including fishery habitat, mussel beds, and state-listed mussel species are known to occur in the Trinity River. Mussels are specifically known to occur in the Horseshoe Project area and in the Elm Fork. The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar method to minimize impacts to mussel beds and other sensitive aquatic resources (TPWD 2013).

Construction of the identified projects would result in adverse impacts on fish and wildlife during construction activities. The past, present, and reasonably foreseeable projects outside the Mainstem are primarily surrounded by urban areas (Figure 4.5-4). Ultimately, there would be an increase in sensitive habitat acreage and value. Most, if not all species are expected to recolonize habitat after construction. For these reasons, there would be beneficial long-term impacts to fish and wildlife.

Special Status Species

The implementation of the Proposed Action design anticipating potential Trinity Parkway construction, the Horseshoe Project, the Trinity Parkway, and any other past, present, and reasonably foreseeable projects in the Trinity River, would likely adversely affect mussel beds and state-listed mussel species. Based on surveys for the Horseshoe Project and surveys in the Elm Fork, mussel beds and state-listed mussels occur in the Trinity River. The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar method to minimize impacts to mussel beds and other sensitive aquatic resources (TPWD 2013).

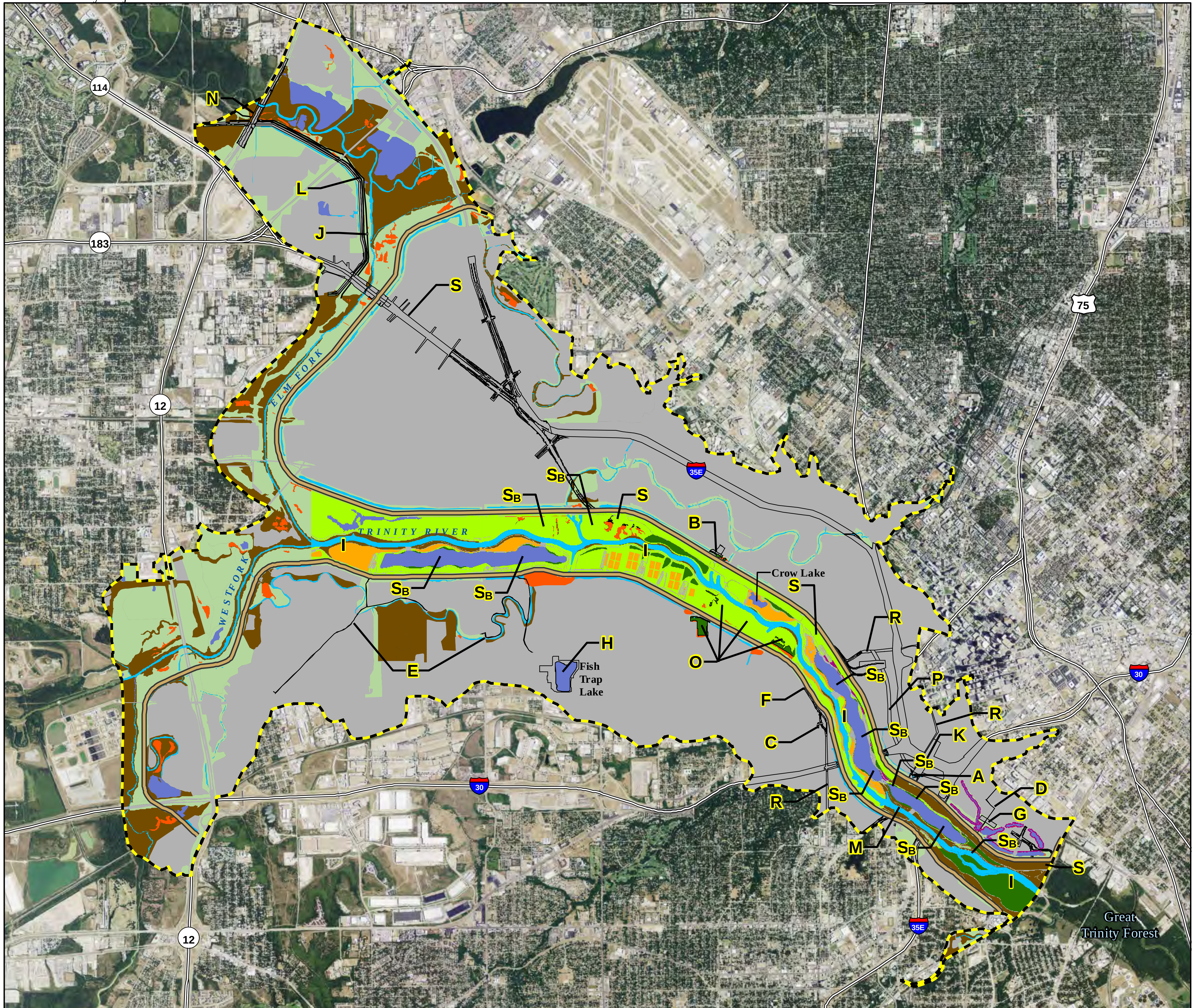


Figure 4.5-4
Habitat Types Under the Proposed Action Design Anticipating Potential Trinity Parkway Construction with Past, Present, and Reasonably Foreseeable Projects

Future Without Project Condition Projects

- A Able Pumping Plant
- B Baker Pumping Plant
- C Beckley Avenue Improvements
- D Belleview Trail Connector
- E Bernal Trail
- F Continental Pedestrian Bridge
- G Dallas Maritime Museum
- H Dallas Watersports Complex
- I Dallas Water Utility Lines
- J EF2 Wastewater Interceptor Line & Laterals
- K Horseshoe Project
- L Irving Northwest Levee Repair
- M Jefferson-Memorial Bridge
- N Loop 12 Bridge
- O Pavaho Wetlands
- P Riverfront Boulevard
- Q SH-183 Bridge
- R Trinity Lakes Streetcar Loop
- S Trinity Parkway
- SB Trinity Parkway Borrow Pits

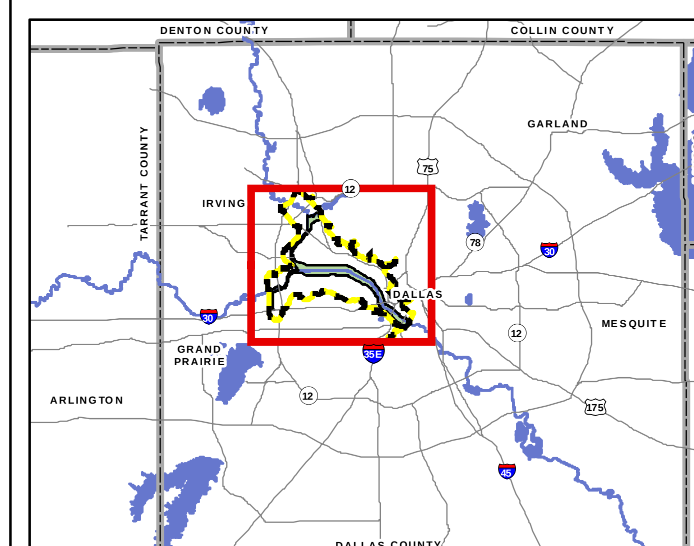
ROI

Dallas Floodway Levee

Freeway

Habitat Types (At Year

- Aquatic Riverine
- Bottomland Hardwood
- Emergent Wetland
- Remaining Existing Emergent Wetland
- Grassland
- Meadow
- Turf
- Urban Forest
- Open Water
- Urban



0 0.5 1 2 Kilometers

0 0.5 1 2 Miles

GIS Sources: Black and Veatch 2010; City of Dallas 2008a, 2010a; TxDOT 2010; USACE 2007, 2013b; USFWS 2006

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No federally listed species are known to reside or breed in the ROI; therefore, no impacts to federally listed species are anticipated. If a federally listed bird species were observed in the project areas during the breeding season, the USFWS would be notified to discuss additional minimization measures. Some of the BCC bird species listed in Section 3.5 is likely to occur in the ROI and be affected by the Proposed Action design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects.

Impacts to special status species, including mussels and birds, during the construction and operation of the Proposed Action design anticipating potential Trinity Parkway construction would be minimized through the implementation of BMPs and SCMs. The other past, present, and reasonably foreseeable projects would adhere to laws and regulations to minimize impacts to special status species. Therefore, impacts to special status species are expected to be less than significant.

Invasive Species

Invasive zebra mussels occur upstream of the ROI and are a major threat to native aquatic species. TPWD recommends that users of Texas waters, especially boaters, adopt the “Clean, Drain, and Dry” protocol to prevent zebra mussel larvae from spreading among Texas waters. Simply, this protocol is that a boat owner should thoroughly clean, drain, and dry his boat after each and every put-in. Possession and transport of zebra mussels—even if accidental—is a criminal offence punishable by fine and/or jail time (TPWD 2013). Monitoring for invasive species and the application of appropriate control measures would minimize the risk from invasive species. The USACE and City of Dallas would coordinate with the USFWS, TPWD, and TCEQ to minimize the spread of invasive species. Monitoring and reporting guidelines are described in the SCMs. SCMs would be implemented to minimize the spread of invasive species during construction and operation of the Proposed Action design anticipating potential Trinity Parkway construction.

Conclusion

Under the implementation of the Proposed Action design anticipating potential Trinity Parkway construction and the past, present, and reasonably foreseeable projects, impacts to biological resources would be minimized through the application of SCMs, mitigation measures, and adherence to local, state, and federal laws and regulations to minimize impacts to biological resources.

Given the magnitude of the proposed construction activities, which would result in nearly complete disturbance of the Floodway, significant adverse impacts to biological resources would result. These impacts would limited to during construction; post-construction, there would be an increase in key habitat acreage and value. No federally listed species are known to reside or breed in the ROI; therefore, no impacts to federally listed species are expected. Impacts to state-listed species located within the Mainstem Group would be minimized through the implementation of SCMs, mitigation measures, and coordination with the TPWD and TCEQ.

Identified SCMs for the Proposed Action design anticipating potential Trinity Parkway construction would be applied to reduce the potential for impacts to fish and wildlife, as well as reducing the risk for introducing invasive species to the Study Area. Most, if not all species are expected to recolonize habitat after construction. For these reasons, there would be beneficial long-term impacts to biological resources. Therefore, implementation of the Proposed Action design anticipating potential Trinity Parkway construction in combination with the identified past, present, and reasonably foreseeable projects would result in significant adverse impacts to biological resources during construction, and beneficial impacts to biological resources during operation.

Design Without Potential Trinity Parkway Construction Anticipated

Under the Proposed Action design without potential Trinity Parkway construction anticipated, temporary impacts to habitat from the implementation of the BVP Study Ecosystem and Recreation features are expected to be significant during construction. The majority of the Mainstem Group habitat would be temporarily impacted for up to approximately 15 years. Temporary impacts from the past, present, and reasonably foreseeable projects would be minimal compared to the Proposed Action design without potential Trinity Parkway construction anticipated, BVP Study Ecosystem and Recreation features temporary impacts.

Long-term permanent impacts to most sensitive habitats would increase in acreage and habitat value (bottomland hardwood, open water, and aquatic riverine) would increase in acreage and habitat value and are expected to be beneficial (Tables 4.5-12 and 4.5-13). Bottomland hardwood acreage would increase from the BVP Study features with hardwoods planted along the Trinity River; the largest amount of hardwoods would be planted at the southeastern end of the Floodway.

Aquatic riverine acreage and habitat value would increase from the relocation of the river under the BVP Study features. No impacts to aquatic riverine are anticipated from the implementation of the past, present, and reasonably foreseeable projects. Open water habitat acreage and value would increase from the BVP Study features creation of the Urban, Natural, and West Dallas lakes (Table 4.5-12). No impacts to open water are expected to occur from the implementation of the past, present, and reasonably foreseeable projects.

The greatest decrease of habitat would be to grassland habitat from the implementation of the Proposed Action design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects. The acreages of bottomland hardwood, open water, and aquatic riverine habitat would increase, resulting in a long-term beneficial impact to habitat types and values. Grassland is a common habitat currently dominated by non-native grasses.

Table 4.5-12. Estimated Changes to Habitat Acreages under the Proposed Action Design Without Potential Trinity Parkway Construction Anticipated and the Past, Present, and Reasonably Foreseeable Projects

Habitat Type	*Existing Conditions (acres)*	*Design Not Anticipating Parkway Construction, Year (acres)*	
		0	*50*
Bottomland Hardwood	1,414	1,502	1,547
Emergent Wetland	419	375	372
Grassland	4,283	3,624	3,439
Aquatic Riverine[1]	421	546	508
Open Water	206	486	464
Habitat Subtotal	*6,743*	6,533	*6,330*
Urban Area	10,400	10,610	10,813
Total	**17,143**	**17,143**	**17,143**

Note: [1] Aquatic riverine under the Proposed Action design without potential Trinity Parkway construction anticipated includes fringe riparian and wetland habitat.
Sources: USACE 2007, 2013a, 2013b; USFWS 2014.

Table 4.5-13. Estimated Changes to Habitat Units per Habitat Type under the Proposed Action Design Without Potential Trinity Parkway Construction Anticipated and the Past, Present, and Reasonably Foreseeable Projects

Habitat Types	**Habitat Units**		
	Existing Conditions	*Design Not Anticipating Parkway Construction, Year 50*	*Change*
Bottomland Hardwood	388.92	459.32	70.40
Emergent Wetland	97.53	147.66	50.13
Grassland	2,309.00	1,982.68	-326.32
Aquatic Riverine	345.77	445.75	99.98
Open Water	143.76	341.25	197.49
Total	**3,284.98**	**3,376.66**	**91.68**

Note: The presented HUs are for the entire Proposed Action (all federal and non-federal BVP and IDP elements); however, the HUs do not reflect HU changes as a result of wetland enhancement/creation done outside of the Study Area in regional wetland banks.

Source: USFWS 2014.

As presented in Table 4.5-13, overall HUs would increase under the Proposed Action design without potential Trinity Parkway construction anticipated and all past, present, and reasonably foreseeable projects, resulting in beneficial impacts to habitat value. The changes in HUs result primarily from the implementation of Trinity Parkway construction. The greatest increase would be to open water from the creation of the BVP Study lakes. Bottomland hardwood habitat would also increase with the highest quality habitat at the southeastern end of the Floodway. Aquatic riverine habitat would increase from the relocation of the river. The greatest decrease of HUs would be to grassland habitat, primarily resulting from the implementation of the Proposed Action design without potential Trinity Parkway construction anticipated (USFWS 2014).

Fish and Wildlife

The ultimate distribution of fish and wildlife under the Proposed Action design without potential Trinity Parkway construction anticipated and the other past, present, and reasonably foreseeable projects would be similar to the distribution of fish and wildlife under existing conditions. Common fish, amphibians, aquatic reptiles, and shorebirds would continue to utilize the open water, aquatic riverine and emergent wetland habitat. Common birds and mammals would continue to utilize the terrestrial habitat.

Under the Proposed Action design without potential Trinity Parkway construction anticipated, impacts to fish and wildlife would be minimized through the application of SCMs and mitigation measures. Impacts to nesting bird species would be minimized to the greatest extent possible. If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities would comply with the MBTA to avoid impacts to nesting migratory birds. Specifically, a biologist would check the proposed construction sites, including laydown areas, for nests (in trees, shrubs, and on the ground) once before the construction phase has begun. If the biologist finds an active nest, construction workers would not directly or indirectly disturb the nest or adjacent areas until the biologist determines the nest is no longer active. However, given the magnitude of the proposed construction activities, which would result in nearly complete disturbance of the Floodway, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated would result in significant adverse impacts to fish and wildlife during construction.

Based on surveys, special aquatic resources including fishery habitat, mussel beds, and state-listed mussel species are known to occur in the Trinity River. Mussels are specifically known to occur in the Horseshoe Project area and in the Elm Fork. The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar method to minimize impacts to mussel beds and other sensitive aquatic resources (TPWD 2013).

The implementation of the past, present, and reasonably foreseeable projects would result in adverse impacts on fish and wildlife. The past, present, and reasonably foreseeable projects outside the Mainstem Group are primarily surrounded by urban areas (Figure 4.5-5). Ultimately, there would be an increase in sensitive habitat acreage and value. Most, if not all species are expected to recolonize habitat after construction. For these reasons, there would be beneficial long-term impacts to fish and wildlife.

Special Status Species

The implementation of the Proposed Action design without potential Trinity Parkway construction anticipated, the Horseshoe Project, and any other past, present, and reasonably foreseeable projects in the Trinity River, would likely adversely affect mussel beds and state-listed mussel species. Based on surveys for the Horseshoe Project and surveys in the Elm Fork, mussel beds and state-listed mussels occur in the Trinity River. The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar method to minimize impacts to mussel beds and other sensitive aquatic resources (TPWD 2013).

No federally listed species are known to reside or breed in the ROI; therefore, no impacts to federally listed species are anticipated. If a federally listed bird species is observed in the ROI during the breeding season, the USFWS would be contacted to discuss additional minimization measures.

Some of the BCC bird species listed in Section 3.5 is likely to occur in the ROI and be impacted by the Proposed Action design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects. Impacts to special status species, including mussels and birds, during the construction and operation of the Proposed Action design without potential Trinity Parkway construction anticipated would be minimized through the implementation of BMPs and SCMs. The past, present, and reasonably foreseeable projects would adhere to laws and regulations to minimize impacts to special status species. Therefore, impacts to special status species are expected to be less than significant.

Invasive Species

Invasive zebra mussels occur upstream of the ROI and are a major threat to native aquatic species. TPWD recommends that users of Texas waters, especially boaters, adopt the “Clean, Drain, and Dry” protocol to prevent zebra mussel larvae from spreading among Texas waters. Simply, this protocol is that a boat owner should thoroughly clean, drain, and dry his boat after each and every put-in. Possession and transport of zebra mussels—even if accidental—is a criminal offence punishable by fine and/or jail time (TPWD 2013). Non-native invasive plants pose a threat to native habitats. Monitoring for invasive species and the application of appropriate control measures would minimize the risk from invasive species. The USACE and City of Dallas would coordinate with the USFWS, TPWD, and TCEQ to minimize the spread of invasive species. Monitoring and reporting guidelines are described in the SCMs. SCMs would be implemented to minimize the spread of invasive species during construction and operation of the Proposed Action design without potential Trinity Parkway construction anticipated.

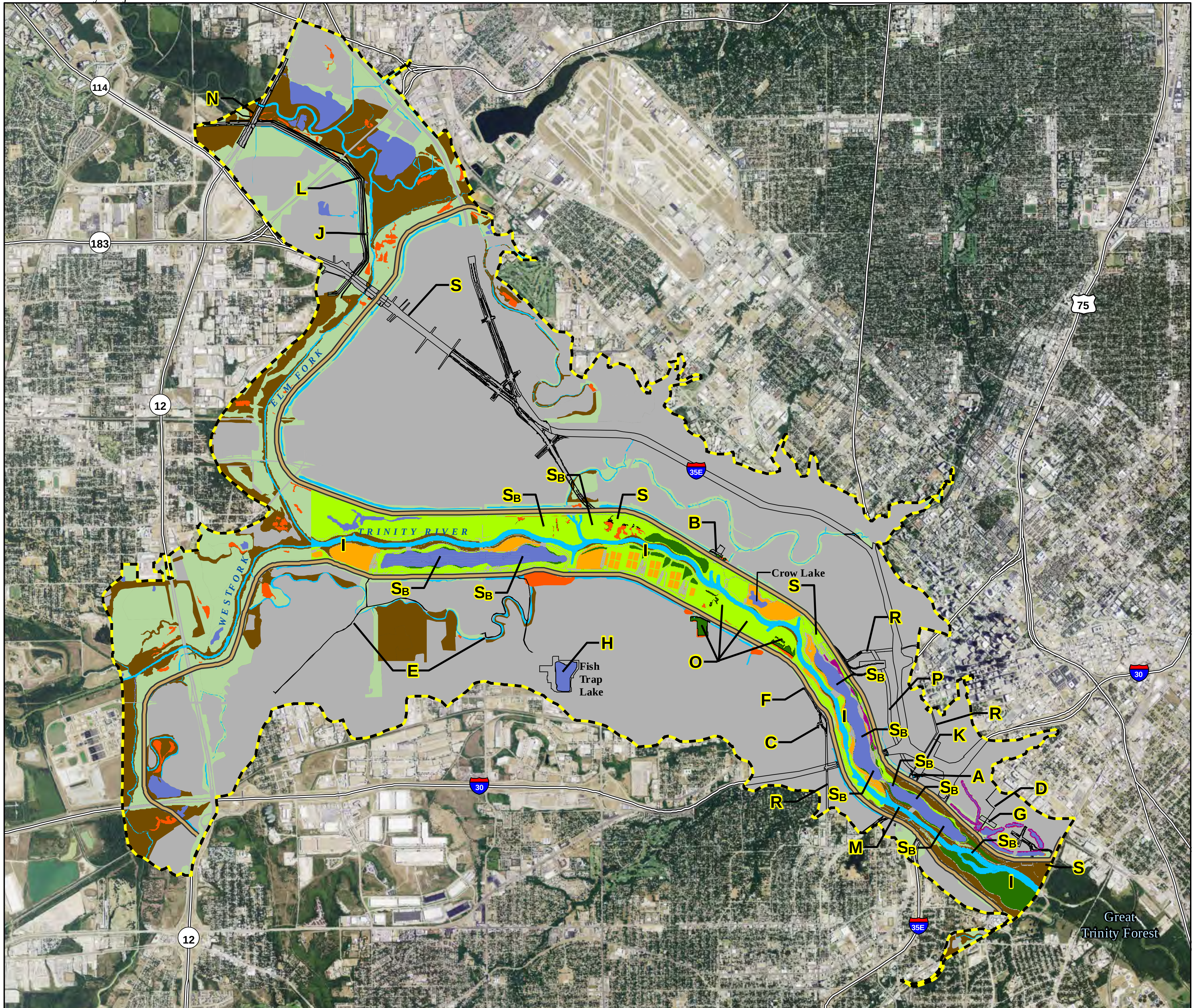


Figure 4.5-5
Habitat Types Under the Proposed Action Design Without Potential Trinity Parkway Construction Anticipated with Past, Present, and Reasonably Foreseeable Projects

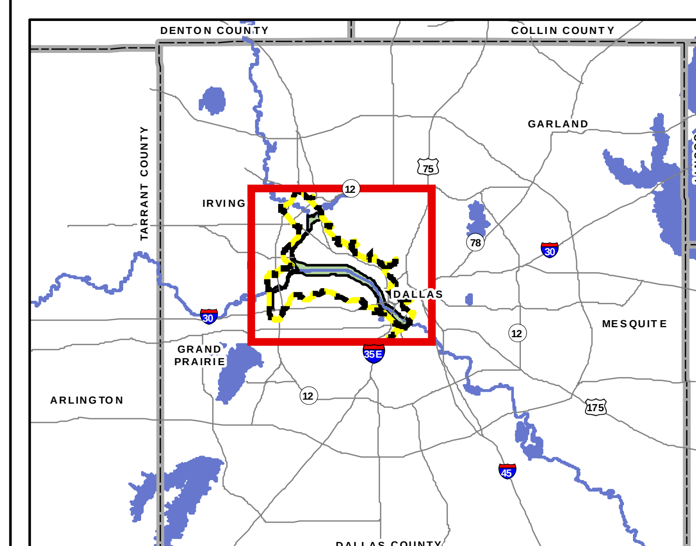
Future Without Project Condition Projects

- A Able Pumping Plant
- B Baker Pumping Plant
- C Beckley Avenue Improvements
- D Belleview Trail Connector
- E Bernal Trail
- F Continental Pedestrian Bridge
- G Dallas Maritime Museum
- H Dallas Watersports Complex
- I Dallas Water Utility Lines
- J EF2 Wastewater Interceptor Line & Laterals
- K Horseshoe Project
- L Irving Northwest Levee Repair
- M Jefferson-Memorial Bridge
- N Loop 12 Bridge
- O Pavaho Wetlands
- P Riverfront Boulevard
- Q SH-183 Bridge
- R Trinity Lakes Streetcar Loop
- S Trinity Parkway
- SB Trinity Parkway Borrow Pits

ROI
Dallas Floodway Levee
Freeway

Habitat Types (At Year 0)

- Aquatic Riverine
- Bottomland Hardwood
- Emergent Wetland
- Remaining Existing Emergent Wetland
- Grassland
- Meadow
- Turf
- Urban Forest
- Open Water
- Urban



0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

GIS Sources: Black and Veatch 2010; City of Dallas 2008a, 2010a; TxDOT 2010; USACE 2007, 2013b; USFWS 2006

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Conclusion

Under the implementation of the Proposed Action design without potential Trinity Parkway construction anticipated and the past, present, and reasonably foreseeable projects, impacts to biological resources would be minimized through the application of SCMs, mitigation measures, and adherence to local, state, and federal laws and regulations to minimize impacts to biological resources.

Given the magnitude of the proposed construction activities, which would result in nearly complete disturbance of the Floodway, significant adverse impacts to biological resources would result. These impacts would limited to during construction; post-construction, there would be an increase in key habitat acreage and value. No federally listed species are known to reside or breed in the ROI; therefore, no impacts to federally listed species are expected. Impacts to state-listed species located within the Mainstem Group would be minimized through the implementation of SCMs, mitigation measures, and coordination with the TPWD and TCEQ.

Identified SCMs for the Proposed Action design without potential Trinity Parkway construction anticipated would be applied to reduce the potential for impacts to fish and wildlife, as well as reducing the risk for introducing invasive species to the Study Area. Most, if not all species are expected to recolonize habitat after construction. For these reasons, there would be beneficial long-term impacts to biological resources. Therefore, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in significant adverse impacts to biological resources during construction, and beneficial impacts to biological resources during operation.

4.6 CULTURAL RESOURCES

4.6.1 Approach to Analysis

The analysis of potential impacts to historic and cultural resources and defined by NEPA considers both direct and indirect impacts. Direct impacts include physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the importance of the resource; introducing visual or audible elements that are out of character for the period the resource represents (thereby altering the setting); or neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the type and location of a proposed action and by determining the exact locations of cultural resources that could be affected. Indirect impacts are those that may occur as a result of the completed project, such as increased vehicular or pedestrian traffic in the vicinity of the resource. Direct and indirect impacts may be classified as adverse impacts or no adverse impacts, as such often direct impacts and adverse impacts appear very similar in nature.

A proposed action would result in significant adverse impacts to NEPA historic and cultural resources if it would alter the characteristics that make the resource significant. Significant adverse impacts are most often a result of physical destruction, damage, or alteration of a resource; alteration of the character of the surrounding environment that contributes to the resource's integrity; introduction of visual, audible, or atmospheric intrusions out of character with the resource or its setting; and neglect of the resource resulting in its deterioration or destruction; or transfer, lease, or sale of the property. In addition, a proposed action or alternative could affect Traditional Cultural Properties (TCPs) that are protected under a number of other federal laws. Tribal coordination will take place under EO 13175 – *Consultation and Coordination with Indian Tribal Governments*. The potential impacts to cultural resources have been evaluated consistent with NEPA requirements.

4.6.2 Alternative 1: Future Without-Project Condition

Under the Future Without-Project Condition, elements of the NEPA historic and cultural significant Dallas Floodway would continue to deteriorate from age, wear, and erosion. A major flood event could impact the hydraulic physical features of the Dallas Floodway, which could affect the value of the essential physical features of the Dallas Floodway. An SPF event could also result in damage to some or all of the eight historic bridges that cross the Dallas Floodway. In addition, if the levees are breached during a major flood event, floodwaters could inundate developed areas of the City of Dallas and impact numerous historic buildings and historic districts within the Study Area. Historic buildings and structures that could potentially sustain impacts include the contributing resources in the significant Dallas Floodway and the National Register of Historic Places-eligible Oak Cliff Tenth Street Historic District. Floodwaters in these areas could cause structural damage and material loss to these historic resources. No impacts to known archaeological resources would occur under the Future Without-Project Condition.

4.6.3 Alternative 2: Proposed Action

4.6.3.1 Design Anticipating Potential Trinity Parkway Construction

BVP Study FRM Elements

Levee Raise Modification

The East and West Levees are essential physical features of the Dallas Floodway as a historic and cultural resource. The modification of the levee height would affect the design and material integrity of this resource. Although the height modification would impact the resource, the impact would not diminish the ability of the levee to convey its significance and therefore not be a significant impact to cultural resources.

Although the borrow pits would be located in the overbank portion of the Floodway, the impact to the overbank would not be significant as the borrow pits would not detract from the resource's continued use, nor would it significantly alter the current landscape.

An archaeological site, 41DL441, is located in the vicinity of the southeastern borrow pit and would not be directly impacted. Borrow activities would reach depths approximately 10 feet below the surface (refer to Figure 2-2). As there is a potential for buried deposits to be encountered, archaeological testing would be conducted prior to construction. Should significant sites be discovered, mitigation would be required.

AT&SF Railroad Bridge Modifications

The AT&SF Railroad Bridge is a NEPA historic and cultural resource. The removal of large portions of the AT&SF Railroad Bridge would affect the design, materials, and setting of the resource, diminishing its ability to convey its significance. These modifications to the bridge would result in a significant impact to a historic property. Internal USACE design reviews will take place during permitting to avoid or minimize impacts. Appropriate mitigation will be determined by USACE should significant impacts occur to the AT&SF Bridge. Should the project proceed, appropriate mitigation would be implemented.

Appropriate mitigation would likely include high quality photographic recordation of the resource and a written narrative of the resource to the level of Historic American Buildings Survey (HABS) and Historic American Engineering Record (HAER) Level II documentation. This documentation will be provided to local area libraries and the Texas State Historic Preservation Officer. Due to prior ground disturbance at this location by the original construction of the bridge, the removal has no potential to impact archaeological historic properties. Once completed, there would be no impact to historic resources.

The embankments are not a NEPA historic or cultural resource; thus, removal of the embankments would not impact historic properties. Once completed, there would be no impact to historic resources. The embankments consists of fill material and would be removed down to the surrounding surface grade of the Floodway. Should significant sites be discovered, mitigation would be required.

Levee Flattening: 4:1 Side Slopes

The modification of the levee slopes would affect the design and material integrity of this resource. Although the slope modification would impact the resource, the impact would not diminish the ability of the levee to convey its significance and therefore not be a significant impact to cultural resources.

The fill for flattening would originate from borrow pits near the Westmoreland Bridge. Although the borrow pits would be located in the overbank portion of the Floodway, the impact to the overbank would not be significant as the borrow pits would not detract from the resource's continued use, nor would it significantly alter the current landscape.

An archaeological site, 41DL441, is located in the vicinity of the southeastern borrow pit and would not be directly impacted. Archaeological testing would be conducted prior to construction. Should significant sites be discovered, mitigation would be required.

Nonstructural Flood Control Improvements

The nonstructural actions associated with Alternative 2 would have no impact on cultural resources.

BVP Study Ecosystem and Recreation Features

The BVP Study represents the achievement of the Dallas Floodway plan envisioned by George Dealey in the early 1900s.

Lakes, River Relocation, Wetlands, and Athletic Facilities

Construction of the proposed BVP Study features, notably the proposed lakes and river relocation, has the potential to impact archaeological sites within the Floodway. Construction of the lakes could reach depths of approximately 20 feet and relocation of the river could reach approximately 30 feet. Construction of the wetlands and athletic facilities would be surficial (e.g., generally 2 to 6 feet deep). Because deeply buried deposits may exist, archaeological testing would be conducted prior to construction. Should significant sites be discovered, mitigation would be required. Once constructed, the lakes would have no impact on cultural resources.

The operation of playing fields and additional facilities has the potential to have significant visual impacts to historic resources within the Floodway. The proposed West Dallas Amphitheater, the Central Island Amphitheater, the Lakes Isthmus gathering space, the Arrival Plaza, the Group Pavilion, and the Fountain Plaza all serve as gathering areas for large groups of people. The construction of these facilities has the potential to have significant visual impacts to historic resources within the Floodway. Mitigation of these impacts will be the distribution of 250 hard-bound copies of a revised version of the 2010 *Intensive Engineering Inventory and Analysis of the Dallas Floodway, Dallas, Texas.* The hard-bound copies of this book will be distributed to all branches of the Dallas Public Library system.

General Features

Construction of public roads and parking has the potential to significantly impact historic resources including buried archaeological deposits and architectural features such as historic bridges and pump stations. Impacts to architectural features during construction would result in a visual impact to historic properties until construction is completed.

Operation of these roads and parking areas would increase access to the area; however, there would be no significant impact to historic properties. Impacts to architectural features would be visual in nature and detract from the overall appearance of the Dallas Floodway, including the appearance of these architectural features on the landscape as well as the overall appearance of the landscape as a whole. Mitigation of these impacts will be the distribution of 250 hard-bound copies of a revised version of the 2010 *Intensive Engineering Inventory and Analysis of the Dallas Floodway, Dallas, Texas.* The hard-bound copies of this book will be distributed to all branches of the Dallas Public Library system.

Interior Drainage Outfall Modifications

Alteration of the outfalls would result in a significant impact to NEPA historic and cultural properties determined contributing to the Dallas Floodway Historic District. All of the outfalls planned for alteration are associated with features of the Dallas Floodway, which were determined essential to the function of the Floodway and supporting to the overall landscape of the Dallas Floodway. Once completed, the alterations to the Interior Drainage Outfalls would constitute an alteration to the landscape of the Dallas Floodway and be identified as a significant impact to the Floodway. Mitigation of these impacts will be the distribution of 250 hard-bound copies of a revised version of the 2010 *Intensive Engineering Inventory and Analysis of the Dallas Floodway, Dallas, Texas.* The hard-bound copies of this book will be distributed to all branches of the Dallas Public Library system.

<u>IDP Improvements</u>

Hampton Pump Station and Sump Improvements

Implementation of the Proposed Action design anticipating potential Trinity Parkway construction would impact two historic properties within the Study Area: the Old and New Hampton Pump Stations (refer to Photo 5, Section 3.8.2.5). Demolition of the Old Hampton Pump Station would result in an impact to a NEPA historic and cultural property as the Old Hampton Pump Station was determined an essential, supporting feature of the overall Dallas Floodway. The construction would create a new feature; however, the resulting pump station would be visually consistent with the existing hydraulic features of the Dallas Floodway. The sump improvements would have no impact to NEPA historic and cultural resources. Mitigation for the demolition of the Old Hampton Pump Station will be the development of HABS/HAER Level II written documentation and high quality digital photography of the resource.

Once completed the New Hampton Pump Station (Hampton 3 Pump Station) and the new 60-inch gated culverts would have no impact on significant cultural resources.

Charlie Pump Station and Sump Improvements

The Old Charlie Pump Station (refer to Photo 6, Section 3.8.2.5) would be demolished and replaced with a new pump station. The New Charlie Pump Station would consist of a 225,000-gallons per minute (gpm) pump station. The Old Charlie Pump Station was previously evaluated as supporting the Dallas Floodway. Demolition of the Old Charlie Pump Station would result in an impact to a historic structure as well as an impact to the overall integrity of the Dallas Floodway. Once completed, the New Charlie Pump Station and associated features would have no impact on historic properties. Mitigation for the demolition of the Old Charlie Pump Station will be the development of HABS/HAER Level II written documentation and high quality digital photography of the resource.

Delta Pump Station and Sump Improvements

All proposed renovations would occur within the existing footprint of the Delta Pump Station and would not be visible on the exterior of the structure. The alterations would not be visible, and therefore would not impact the structure's ability to support the overall function and historic integrity of the Dallas Floodway.

The construction of a new electrical building would constitute an impact to a NEPA historic and cultural resource, as it would constitute an alteration of the original design. The new electrical building would result in a visual impact to the overall landscape of the Floodway as well as to the Delta Pump Station itself, but would be consistent with the hydraulic features of the Dallas Floodway.

Improvements to the Eagle Ford and Trinity-Portland Sumps would not impact a historic structure. The operation of the Delta Pump Station, the electrical building, and the sump improvements would have no impact to historic resources.

Trinity-Portland Pumping Plant and Sump Improvements

The construction of the new Trinity-Portland Pumping Plant would impact the integrity of the existing Floodway. The construction would create a new feature within the Floodway; however, the resulting pumping plant would be visually consistent with the existing hydraulic features of the Dallas Floodway. Operation of the Trinity-Portland Pumping Plant would have no impact to NEPA historic and cultural resources.

4.6.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The Proposed Action design without potential Trinity Parkway construction anticipated differs from the design constructing the parkway primarily in the number of bicycle and pedestrian paths, athletic fields, and meadows, and the amount of landscaping. The change in BVP Study features from constructing to not constructing the parkway would result in nearly identical impacts to cultural resources under the Proposed Action design without potential Trinity Parkway construction anticipated as described for the design anticipating construction of the potential Parkway. Therefore, the cultural resources impact analysis presented in Section 4.6.3 for the Proposed Action design anticipating potential Trinity Parkway construction is also valid for the design that would not include construction of the potential Parkway.

4.6.3.3 Summary

Under either Proposed Action design, known archaeological sites within the Study Area would be avoided; however, deeply buried deposits may exist. Archaeological testing would be conducted prior to excavation. The East and West Levees are essential physical features of the Dallas Floodway as a historic and cultural resource. Although the height modification would impact the resource, the impact would not alter the resource's current significance nor would it detract from its current and future purpose. The removal of large portions of the AT&SF Railroad Bridge would affect the design, materials, and setting of the resource, diminishing its ability to convey its significance and resulting in an impact to a historic property.

The demolition or alteration of contributing features to the Dallas Floodway Historic District would result in impacts to a historic structure as well as an impact to the overall integrity of the Dallas Floodway. The USACE will complete HABS/HAER Level II written documentation and high quality digital photography of any resource adversely impacted. For resources impacted under the BVP, mitigation will consist of the distribution of 250 hard-bound copies of a revised version of the 2010 *Intensive Engineering Inventory and Analysis of the Dallas Floodway, Dallas, Texas.* The hard-bound copies of this book will be distributed to all branches of the Dallas Public Library system. The City of Dallas would comply with all relevant and applicable laws and regulations. Implementation of either Proposed Action design would result in significant adverse impacts to NEPA historic and cultural resources. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.6.3.4 Cumulative Impacts

Design Anticipating Potential Trinity Parkway Construction

The implementation of proposed improvements at the Able Pumping Plant include demolition of the Small Able Pump Station. This demolition, combined with Proposed Action's demolition of the Old Hampton and Old Charlie Pump Stations would result in significant adverse impacts to NEPA historic and cultural resources. In addition, the removal of large portions of the AT&SF Railroad Bridge would also result in an impact to a NEPA historic and cultural resource. The potential for impacts to archaeological sites exists; however, the probability of finding any archaeological sites within the Floodway is low.

The implementation of the potential Trinity Parkway project would result in a significant adverse visual impact to the overall Floodway due to its construction within the boundaries of the levees. In addition, flood barrier walls proposed around existing bridges to minimize the possibility for flooding on the potential Trinity Parkway project would significantly alter the landscape of the Dallas Floodway. The completion of the potential Trinity Parkway project would result in a significant impact to the Continental Avenue Viaduct, and historic and cultural resource under NEPA. Potential mitigation measures identified by the potential Trinity Parkway project to minimize the impact to cultural resources include ensuring the replacement bridge section compliments the historic bridge or providing an interpretive plaque discussing the historic viaduct. Additional potential mitigation measures include the completion of Historic American Engineering Record documentation for the viaduct (FHWA 2014). Implementation of the Proposed Action design anticipating potential Trinity Parkway construction in combination with the identified past, present, and reasonably foreseeable projects would result in significant adverse impacts to cultural resources.

Design Without Potential Trinity Parkway Construction Anticipated

Under the Proposed Action design without construction of the potential Parkway, impacts to NEPA historic and cultural resources would be the same as described above for the design anticipating potential Parkway construction without the added impacts to the Continental Avenue Viaduct or visual impacts associated with the Trinity Parkway project. Implementation of the Proposed Action design without potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in significant adverse cumulative impacts to NEPA historic and cultural resources.

4.7 RECREATIONAL RESOURCES

4.7.1 Approach to Analysis

In order to provide an overall framework for evaluating recreational resources within the Study Area, recreational opportunities were also identified within a 30-mile radius of the Study Area (including the City of Dallas). The purpose for this approach was to assess the deficiencies and needs based on demographics of all the communities within the Study Area. Table 4.7-1 identifies the type and number of recreational amenities located within a 30-mile radius of the Study Area.

Table 4.7-1. Type and Number of Recreational Amenities Located within a 30-Mile Radius of the Study Area

Amenity Type	*Count*	*Amenity Type*	*Count*
Amusement Park	3	Museum	34
Boat Launch	81	Nature Center	1
Botanical Garden	7	Park/Playground	938
Camp	4	Performing Art Center/Theater	33
Campground	16	Preserve	4
Church	241	Recreational Center	5
City Hall	1	Sports Center	7
Community Center	9	Stadium	1
Convention Center	1	State Park	1
Cultural Center	5	Trails	13
Golf Course	119	Trail	1
Greenbelt	5	Zoo	1
Lake	17	**Total Amenities**	**1,550**
Library	2		

Sources: ESRI 2010; TPWD 2012.

The Renaissance Plan evaluated existing service and equity levels to determine how well the City of Dallas was meeting the needs of the populace from a demographic and geographic perspective (City of Dallas 2002). An analysis of the demographic data profile of Dallas was conducted to give better insight in meeting citizen needs for park facilities and programs. Based on recommended facilities per population, *The Renaissance Plan* identified major gaps in public athletic facilities (e.g., soccer field, volleyball courts, basketball courts), as well as recreational options such as trails, playgrounds, and pavilions (Table 4.7-2).

Table 4.7-2. 2002 and Recommended 2005 Recreational Facilities for the City of Dallas

Facility	*Recommended Facilities per Population*	*2002 Facilities in Dallas Park & Recreation*	*Recommended Facilities[1] for 2005 Population of 1,250,016*	*Shortfall Between 2002 and 2005 Recommendations*
Soccer Fields	1 per 5,000	130	250	- 120
Baseball, Youth	1 per 7,000	9	179	- 170
Baseball, Adults	1 per 15,000	21	83	- 62
Softball, Youth	1 per 5,000	37	250	- 213
Softball, Adults	1 per 8,000	44	156	- 112
Football	1 per 20,000	11	63	- 52
Tennis	1 per 4,000	254	313	- 59
Outdoor Basketball	1 per 4,000	154	313	- 159
Volleyball	1 per 5,000	19	250	- 231
Playground	1 per 3,000	267	417	- 150
Pavilions	1 per 4,000	104	313	- 209
Trails	1 mile per 5,000	146	250	- 104
Recreation Centers	1 square foot (sf) per person	699,649 sf	1,250,016 sf	- 550,367

Notes: [1] As recommended in *The Renaissance Plan*.
Source: City of Dallas 2002.

4.7.2 Alternative 1: Future Without-Project Condition

The Renaissance Plan (City of Dallas 2002) assessed recreational amenities within the City and determined then that parks in general were dated, contained older equipment and structures, and lacked regular maintenance. Neighborhood parks were found to be overcrowded and necessitated reclassification as community parks. The assessment also found that access to existing parks was limited, had poor lighting, and overused sports fields with limited maintenance and upkeep. A survey by TPWD (2005) determined that most people do not perceive the Dallas Floodway as desirable for active recreation, festivities, or nature observation. The survey also determined that the City of Dallas has a below average supply of almost 70% of the most commonly used facilities and resources. Thus, Alternative 1: Future Without-Project Condition was evaluated based on the City of Dallas's goal of 19.7 acres of parkland per 1,000 residents by year 2050.

The population of Texas is growing at twice the national rate, and the City of Dallas is one of the country's fastest growing cities (U.S. Census Bureau 2010). Under the Future Without-Project Condition, approximately 5,890 additional acres of parks and recreation land would be developed within the City of Dallas. In addition, there would be economic growth that would likely result in an increase in the quality of life for people within the Study Area and region. With its current appeal of low cost of living, low tax rates, attractive economic and cultural opportunities, Dallas would continue to attract new businesses, residents, and visitors. By the year 2050, the population within the Study Area is expected to increase, and the quality of living and household incomes are also expected to rise. Based on population growth trends and accounting for those Future Without-Project Condition projects that would increase parkland acreage, the total amount of parkland in 2050 would be approximately 28,890 acres for a proposed population increase of approximately 1,722,902 (U.S. Census Bureau 2010).

As presented in Table 4.7-3, the Future Without-Project Condition would likely result in an increase in recreation facilities, aquatic resources and access, trail networks, and recreation acreage. Some of these increases have been quantified, reflecting at a minimum the known elements of the identified Future Without-Project Condition projects. However, under the Future Without-Project Condition, the ratio of parkland per 1,000 persons would be 16.76 in 2050, 12.6% lower than the current ratio (192) of parkland per 1,000 persons and less than the City of Dallas' goal of 19.7 acres of parkland per 1,000 persons. Under the Future Without-Project Condition, the increased population and associated demand on all recreational amenities would likely result in a greater recreation shortfall than currently exists.

Special events as described in Section 3.7.2.3 would continue to occur within the Floodway. Presumably as the City of Dallas' population continues to grow, event participants and the number of events would also increase.

Table 4.7-3. Summary of Estimated Change in Recreational Resources in the City of Dallas Under the Future Without-Project Condition

Recreational Resource	*Existing Conditions*	*Change Under the Future Without-Project Condition*
Recreational Facilities		
Neighborhood, Community, and Regional Parks	374	Increase (381+)
Tennis Courts	258	Increase
Playgrounds	183	Increase
Soccer Fields	128	Increase (150+)
Multipurpose Fields	321	Increase
Softball Diamonds	87	Increase
Picnic Pavilions	115	Increase (119+)
Community Pools	22	Increase
Sandlots	15	Increase
Recreation Centers	47	Increase
Football Fields	12	Increase
Baseball Diamonds	30	Increase
Golf Courses (18-hole)	6	Increase
Tennis Centers	5	Increase
Spraygrounds	7	Increase (8+)
Water Parks	1	Increase (3+)
Boating Access		
Boat Ramps	1	Increase (4+)
Trail Network		
All Trails	97.9 miles	Increase (141.1+ miles)
Sidewalk/Street Connection	24.7 miles	Increase
Neighborhood Park Trails	19.3 miles	Increase
Existing Major Nature Trails	23.0 miles	Increase (30.8 miles)
Recreation		
Total Parkland Acreage in the City of Dallas	23,000 acres	Increase (28,890 acres)
Acreage per 1,000 population (2010 population)	19.2 acres	Decrease (16.76 acres)

Sources: City of Dallas 2002, 2010; NCTCOG 2008.

4.7.3 Alternative 2: Proposed Action

4.7.3.1 Design Anticipating Potential Trinity Parkway Construction

BVP Study FRM Elements

Levee Raise Modification

The proposed locations for levee modifications are not expected to directly impact recreational areas. Two existing trails, Trinity and Crow Lake Park trail are within approximately 0.5 to 1 mile from levee modification sites. However, access to these trails would not be affected. Temporary impacts from construction would occur with the increased noise but would likely attenuate down to baseline levels (refer to Section 4.15) before reaching recreational facilities. Following construction, long-term beneficial impacts would result with improved FRM to upland recreational facilities and trails.

AT&SF Railroad Bridge Modifications

The AT&SF Railroad Bridge modifications would have temporary impacts to adjacent trails, notably the Santa Fe Trestle Trail during construction activity (i.e., noise, staging, increased workers and activity). In addition, in-water access from recreational boating activity may be temporarily blocked/prohibited for safety reasons during construction. However, these disruptions to recreation would be temporary (approximately 6 months) and proper advanced notification of potential disruption to recreational areas would be provided to the public.

Removal of the embankments would have only temporary construction impacts in terms of noise and access to the trestle. The project would take approximately 6 months and be completed before summer when more recreational use in the area occurs.

Levee Flattening: 4:1 Side Slopes

Construction activity would occur in stages and may cause noise disturbance as well as limit access to nearby recreational areas. Impacts from construction activities would be temporary. Levee flattening would enhance recreational amenities thereby resulting in a long-term beneficial impact to recreation.

Nonstructural Flood Control Improvements

The physical impacts of implementing these nonstructural elements would be negligible. Operational aspects that include improved mobilization rates, transportation network improvements, emergency response improvements and implementing EAP procedures as well as a flood warning system would ensure safety to residents enjoying nearby recreational resources and amenities.

BVP Study Ecosystem and Recreation Features

Construction

Construction associated with the proposed BVP Study features would result in temporary disruptions to hiking, picnicking, equestrian areas, and special events within the Dallas Floodway. Construction of the river meanders would likely result in temporary disruptions to recreational river access and public use at the point of activity. Disruption would also arise from closed public access points and staging areas. In addition, proximity to construction equipment and activities would degrade recreation experiences on the river, as well as the trails. However, these impacts would be temporary and only effect a small portion of existing recreation areas at a time as construction would occur in stages throughout the Floodway. Proper advanced notification of potential disruption to recreational areas would be provided to the public.

Operation

As presented in Table 4.7-4, implementation of proposed BVP Study features would result in substantial increases in City of Dallas Parks and Recreation amenities to soccer fields, football fields, and trails. Specifically, there would be an increase in the total city inventory of soccer fields by 17, or 12%, reducing the shortfall by 7%. The addition of "flex spaces" to be groomed and maintained for a variety of field sport usage would result in an increase of 11 football fields, or a 100% increase in inventory, and an 18% reduction in facility shortfall. The trail network proposed within the Floodway would increase trail opportunities by 36%, and decrease the shortfall by 17%.

Table 4.7-4. Change in Recreational Facilities under the BVP Study Design Anticipating the Potential Trinity Parkway Construction for the City of Dallas

Facility	*Recommended Facilities per Population*[1]	*2009 Facilities in Dallas Park & Recreation*	*Recommended Facilities for 2010 Population of 1,197,816*	*Number of Facilities under Design Anticipating Parkway Construction (increase)*	*Shortfall Between Design Proposal and Recommendations*
Soccer Fields	1 per 5,000	146	240	+17	- 77
Baseball, Youth	1 per 7,000	10	171	NC	- 161
Baseball, Adults	1 per 15,000	21	80	NC	- 59
Softball, Youth	1 per 5,000	44	240	NC	- 196
Softball, Adults	1 per 8,000	44	150	NC	- 106
Football	1 per 20,000	11	60	+11*	- 38
Tennis	1 per 4,000	258	299	NC	- 41
Outdoor Basketball	1 per 4,000	154	299	+6	- 139
Volleyball	1 per 5,000	19	240	NC	- 221
Playground	1 per 3,000	267	399	+4	- 128
Pavilions	1 per 4,000	104	299	+6	- 189
Trails	1 mile per 5,000	112 miles	240 miles	+40	- 88
Recreation Centers	1 sf per person	699,649 sf	1,197,816 sf		- 498,167

Notes: [1] As recommended in the Renaissance Plan. sf = square feet. NC = no change.
* The addition of "flex spaces" to be groomed and maintained for a variety of field sport usage is captured here, under "football fields."
Sources: City of Dallas 2002, 2003.

Implementation of the BVP Study features would also contribute to increasing the number of basketball courts, playgrounds, and outdoor pavilions, albeit to a lesser degree. Outdoor basketball opportunities would increase by 4%, reducing shortfall by 2%. The implementation of the BVP Study features would increase playground inventory by 1%, reducing shortfall by 1%. Lastly, there would be an increase in the number of pavilions through the addition of plazas, council rings, and similar gathering spaces by 6%, and therefore reduce the shortfall by 2%.

BVP Study features would serve as a community venue for special events. Tens of thousands of people are expected to gather for celebrations in the Central Island, spilling across the river into the Oak Cliff Parkland. The largest dedicated gathering venue would be the West Dallas Amphitheater. This venue would be able to accommodate approximately 20,000 people for major outdoor concerts. Between 2,000 and 3,000 people would also gather in the more intimate Central Island Amphitheater near the Lakes

Isthmus. The Arrival Plaza at the foot of the Downtown Overlook would be another gathering venue, with a capacity for another 2,000 or 3,000 people to come together. Smaller gathering venues include the Group Pavilion on the north end of the Urban Lake and the Fountain Plaza across from the Arrival Plaza on the Urban Lake as well. Well above the Floodway is the Continental Bridge, envisioned as a major regional attraction for outdoor gathering. Given the increase in recreational gathering places with the implementation of the BVP features, special event recreational opportunities (e.g., foot races, regattas, concerts, etc.) for City of Dallas residents and visitors is expected to increase.

Both of the amphitheaters described above would be located near proposed recreational facilities, including pedestrian paths and equestrian trails. Noise from concerts or other activities at the amphitheaters could have an effect on the users of these facilities. However, as discussed in Section 4.15, noise from concerts or events at the amphitheaters would be infrequent, and would not constitute a permanent and continuous source of noise. In addition, trail users are expected to be mobile; if they did not care for the amphitheater noise, they would be able to continue moving through the area, thus minimizing their exposure to noise.

Lakes

The addition of the off-channel lakes would create approximately 233 new acres of recreational opportunities (Figures 4.7-1 through 4.7-3). The proposed 123-acre West Dallas Lake would include 7 acres of marshlands and feature floating wetlands that could be used as lane markers for rowing competitions along the 1.5 mile long narrow body of water. Due to the proposed size of the West Dallas Lake, it could support an array of national and international aquatic events. This would be the main lake to provide recreational opportunities to nearby communities residing on the west side of the Dallas Floodway.

The construction of Urban Lake (84 acres) and Natural Lake (49 acres) would result in an additional 133 acres of lake. Both lakes would be ringed with approximately 9 acres of wetlands and would include a navigable channel connecting the two lakes via an isthmus that would provide easy boating access between both lakes. In addition, these lakes would support small boating activity such as canoeing and kayaking and within a convenient location for residential communities along the east side of the Dallas Floodway. Urban Lake would also include a mile-long promenade that would meander along the entire length of Urban Lake’s Downtown edge. The promenade would provide a path for joggers, walkers, and cyclists as well as various relaxing and gathering spots. It would also provide a scenic route for triathlons, 5K races, or other such events. The proposed Natural Lake would allow boating for canoeists and kayakers, while boardwalks and soft surface trails would provide visitors access to the water and wildlife viewing opportunities there.

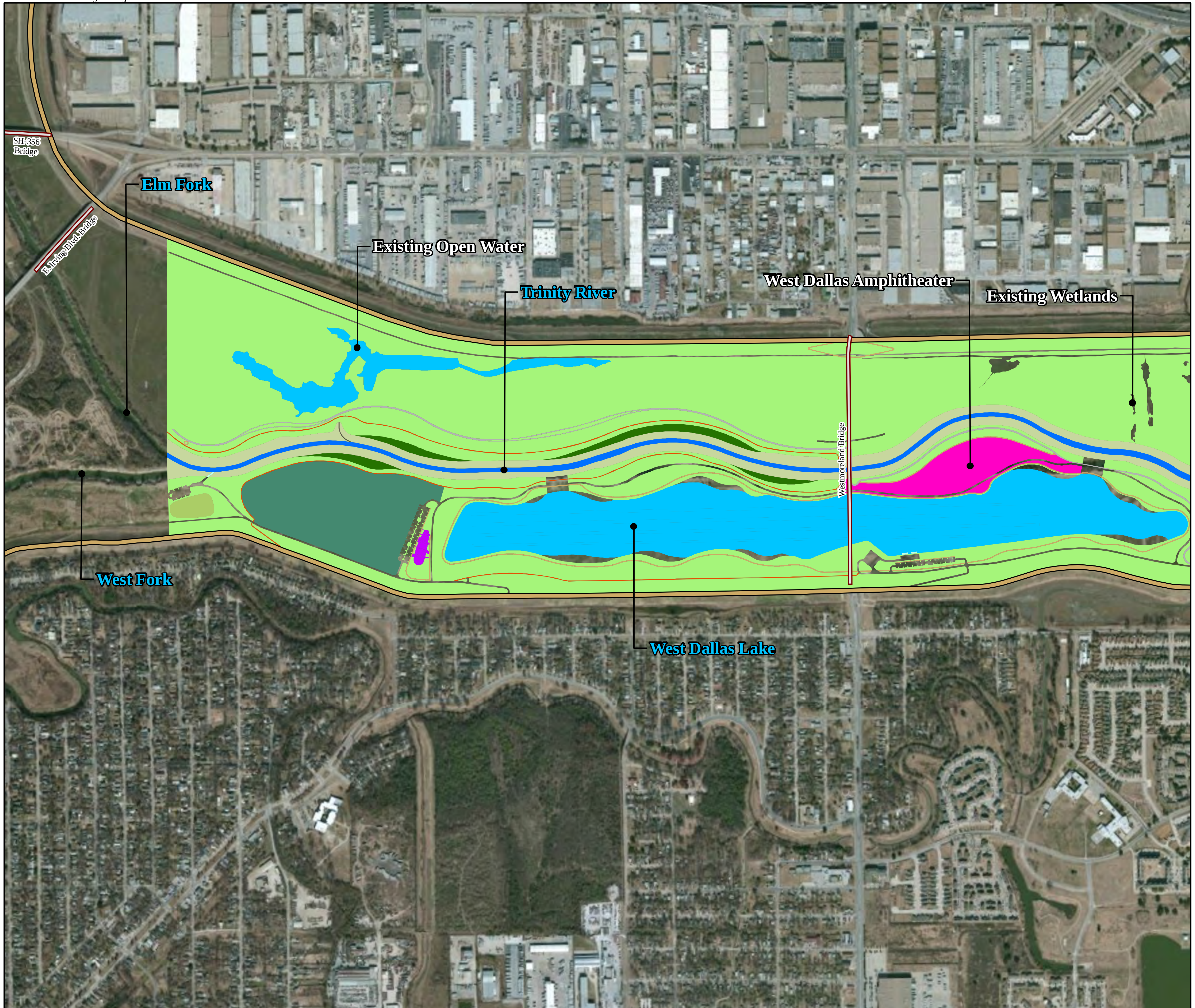
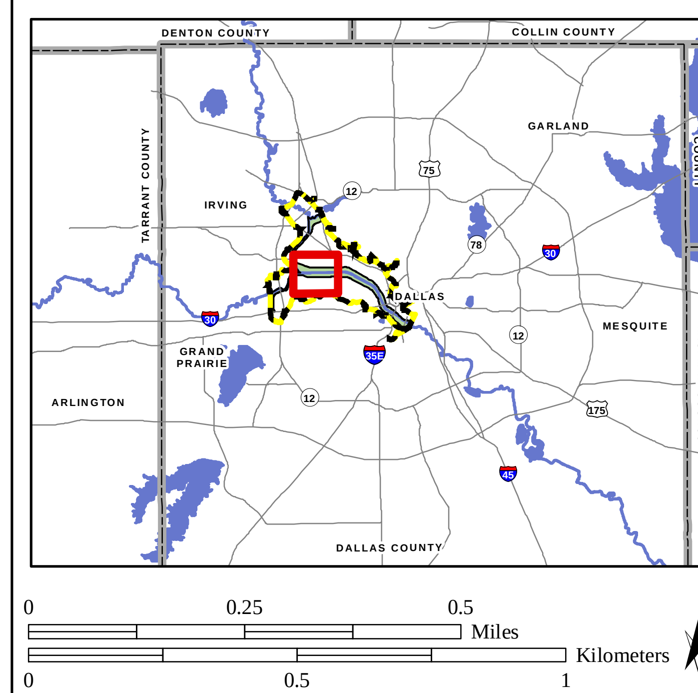


Figure 4.7-1
Proposed Recreational Resources: Northern Segment

LEGEND

Existing Features
- Dallas Floodway Levee Crest
- Bridge
- ROI

Proposed Features
- Amphitheater
- Boat Access
- Bridge
- Council Ring
- Lake
- Equestrian Trail
- Flex Field
- Meadow
- Playground
- Primary Pedestrian Path
- River Bank
- River Channel
- River Terrace
- Secondary Pedestrian Path
- Turf



GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013b

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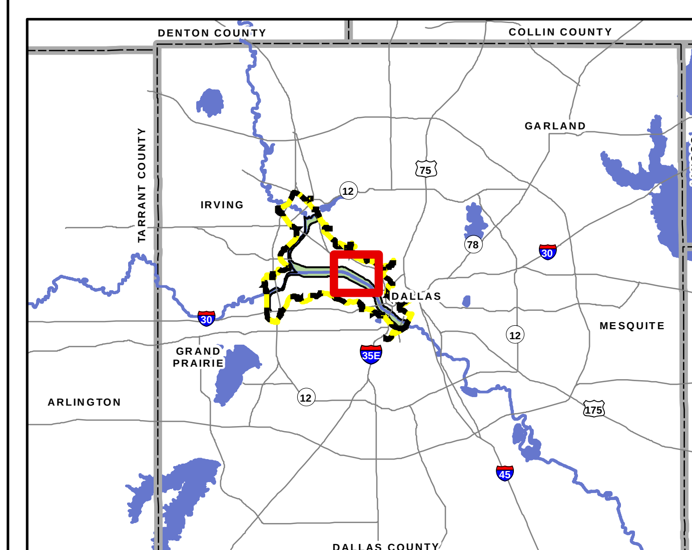
Figure 4.7-2
Proposed Recreational Resources: Middle Segment

LEGEND

Existing Features
- Dallas Floodway Levee Crest
- Bridge
- ROI

Proposed Features
- Bench/Curb/Steps/Wall
- Bike Path
- Boat Access
- Bridge
- Water Feature
- Lake
- Equestrian Trail
- Flex Field
- Meadow
- Pavillion
- Planter
- Play Field
- Playground
- Primary Pedestrian Path
- River Bank
- River Channel
- River Terrace
- Secondary Pedestrian Path



0 0.25 0.5 Miles
0 0.5 1 Kilometers

GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013b

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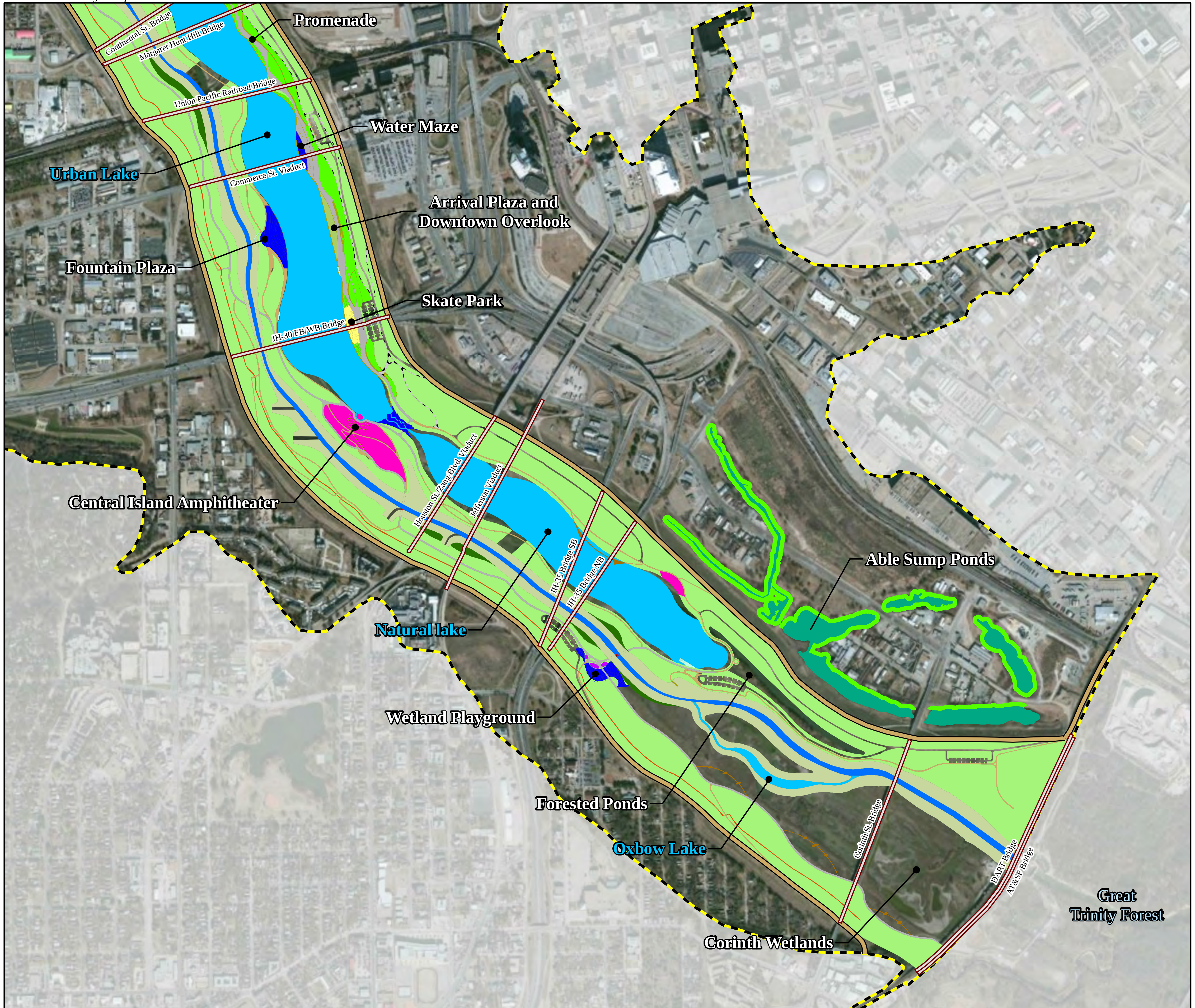
Figure 4.7-3
Proposed Recreational Resources: Southern Segment



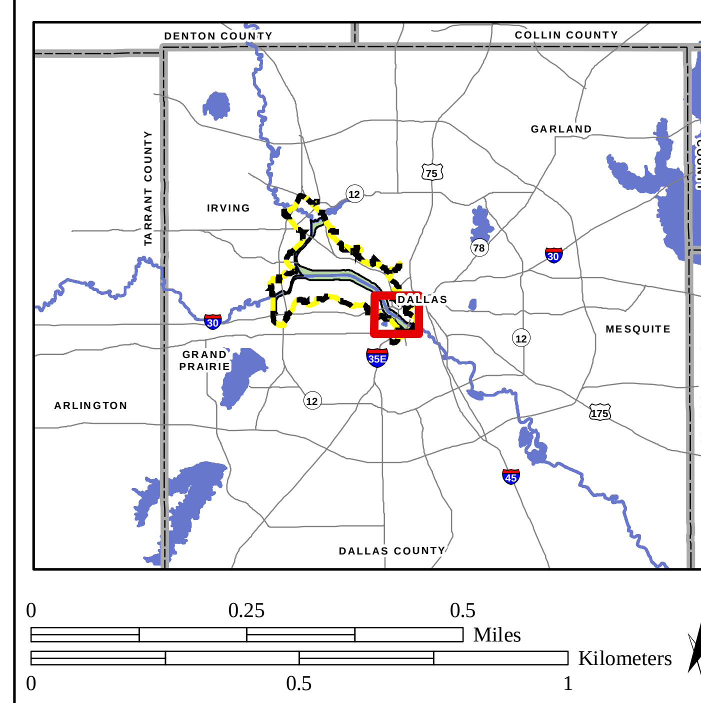
LEGEND

Existing Features

- Dallas Floodway Levee Crest
- Bridge
- ROI

Proposed Features

- Amphitheater
- Bench/Curb/Steps/Wall
- Bike Path
- Boardwalk
- Boat Access
- Bridge
- Water Feature
- Council Ring
- Lake
- Equestrian Trail
- Meadow
- Planter
- Playground
- Primary Pedestrian Path
- River Bank
- River Channel
- River Terrace
- Secondary Pedestrian Path
- Skate Park
- Turf



GIS Sources: City of Dallas 2008a, NCTCOG 2008, USACE 2013b

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Oxbow Lake is the smallest of the lakes proposed (3 acres) and would be located downstream just before the Trinity River enters the Trinity Forest. This small lake would provide quiet backwater exploring opportunities for recreational boaters as well as wildlife viewing opportunities. Table 4.7-5 presents the projected recreational usage of the lakes and their connected amenities (City of Dallas 2009).

Table 4.7-5. Predicted Usage of Lakes and Connected Amenities

Amenity	*Typical Activities*	*Typical Weekend Usage*[1]	*Peak/Event Usage (maximum capacity)*
West Dallas Lake			
West Dallas Lake (Sculling and Rowing)	Sculling, small craft boating, fishing and observation	50	3,000
West Dallas Amphitheater	Concerts and other large special events	150	20,000
Picnic	Picnic structures, restrooms and parking	50	3,400
Flex Space	Rugby fields to be shared with flex space, potential event space	280	8,626
Play Areas	Active and passive play areas	50	350
Open Fields	Passive recreation, nature walks	20	500
	Total	**600**	**35,876**
Urban Lake			
Urban Lake (Boating)	Kayaking, canoeing, paddle boat rental	10	330
Downtown Overlook	Trinity Lakes Center, concessions, welcome center	200	2,950
Promenade	Strolling, biking, observation of Urban Lake, events	300	16,700
Skate Park (Event)	Skateboard Park (under IH-30) capacity includes audience	30	2,500
Lakes Isthmus	Crossing between lakes, active area, interpretation	75	350
Central Island (Houston - Continental)	Observation of the Urban Lake, strolling	300	45,000
Central Island Trail (Bikes and Pedestrians)	Active, bike trails separate from pedestrian usage	75	704
Group Pavilion	Active, canoeing, kayaking, events	30	300
Levee Top Park	Passive recreation	80	6,830
Downtown Levee Trail (Continental to Houston)	Biking and pedestrian trails, strolling, observation	60	590
Central Island Amphitheater	Concerts and special events	100	2,500
	Total	**1,260**	**78,754**
Natural Lake			
Natural Lake (Boating)	Fishing, kayaking, canoeing, and education	20	120
Central Island (Houston to Headwaters)	Observation of Natural lake, strolling, fishing	100	1,440
Natural Lake Trail	Observation of Natural lake, strolling	50	633
Headwaters Forested Pond	Walking/trail use, wildlife observation	10	90
	Total	**180**	**2,283**
Oxbow Lake			
Oxbow Lake (Boating)	Kayaking, canoeing, wetlands, nearby trails, wildlife observation	**10**	**40**
	Total	**10**	**40**

Note: [1] usage reflected in number of people.
Source: City of Dallas 2009.

River Modification

The proposed Trinity River relocation, riverbank treatments, and terracing would bring back the high-valued habitat and connection to adjacent ecosystem that was lost from previous Floodway construction. Existing sparse vegetation, channel snags, clayey mud to fine sand, and channel bed shape irregularities would be replaced with native channel bed plant species and substrate thereby creating shelter, feeding zones, invertebrate colonization sites, and nursery pools. The resulting modification of the river would provide scenic, picnicking, and wildlife viewing opportunities for residents, increasing recreational opportunities along the river. Following construction, the long-term navigability of the river would be the same as existing conditions.

Wetlands

The proposed wetlands would be accented with boardwalks and soft surface trails for residents to use for biking or walking. In addition, wetlands provide habitat for birds and other wildlife, thereby presenting recreational bird or wildlife observation opportunities. The creation of wetlands and improvements to existing wetlands would reduce urban runoff from stormwater pollutants that would, in turn, improve quality of wildlife habitat and provide wildlife observing opportunities for residents along the Dallas Floodway.

Athletic Facilities

Flex Fields, Playgrounds, Venues

The proposed West Dallas Recreation Complex would result in approximately 90 additional acres of playing fields (refer to Figure 4.7-2). The Complex would accommodate 17 regulation-sized soccer fields and would be adaptable for other sports activities such as lacrosse, field hockey, rugby, cricket, and many other sports uses. This would increase existing playing fields within the Study Area by approximately 30%. This complex would also provide two additional playgrounds, which would total 23 playgrounds or structures available to children and their families within the Dallas Floodway. Furthermore, a skate park would be another feature adjacent to Urban Lake that residents would experience (refer to Figure 4.7-3).

In addition to the West Dallas Recreation Complex, approximately 70 additional acres of flex fields would be located south of Crow Lake, within the Oak Cliff Parkland and would provide multiple sport uses. Combined, this increase in athletic facilities would provide a net increase in recreational opportunities for residents. The Central Island Amphitheater would provide major outdoor concerts or other large venues for approximately 2,500 people. The Amphitheater would also provide scenic views of the proposed Urban Lake for viewing water events or photography opportunities.

Lastly, the downtown overlook proposed on the north side of Urban Lake and overlooking the lake would provide a place for gatherings, performances, concessions, and scenic views (refer to Figure 4.7-3). The proposed net increase in flex fields, playgrounds, and venues would greatly increase recreation opportunities within the Floodway.

River Access Points

The addition of three boat ramps and four new docks would increase launching and docking options along the entire Dallas Floodway as compared to existing conditions where only the official portage is at the Sylvan Avenue Boat Launch at Crow Lake Park. Although smaller boats currently are able to launch upstream, the addition of the launches, located in the north and south end of the Floodway would provide launching accesses to a greater variety of watercraft.

General Features

The addition of public roads (over 7 miles), 12 parking lots, and 7 vehicular entry points would provide overall improvements to existing access to recreation facilities and opportunities within the Floodway. Previously inadequate access to the Dallas Floodway would be improved by an addition of 40 miles of trails, which would result in a net increase of approximately 40% from existing trails. These trails would include biking, jogging, and equestrian trails.

The net increase in trails, public roads, and vehicular access would also result in achieving the regional goal of linking public lands and open space within the Trinity Corridor and its tributaries and other publicly owned areas (TPWD 2005). The addition of these general features in support of the proposed venues and facilities would enhance access to recreational elements.

Interior Drainage Outfalls

While the proposed outfall changes would have no direct impact on recreation within the Floodway, the water they supply to the Floodway wetlands and river amenities maintains these habitats and thus supports the wildlife viewing and trail recreation opportunities at those sites.

Able Sump Improvements

These improvements to the Able Sump complex aim to provide access to the sumps as recreation amenities that would provide interpretive trails and boardwalks, water features, gathering spaces, canoe access, and trail linkage to the Levee Top and Santa Fe Trestle Trail. These improvements would provide outdoor recreational opportunities in a previously inaccessible region, and would complement the land use planning developments along Riverfront Boulevard that focus on the changing character of the river front from industrial uses to mixed-use residential communities.

<u>IDP Improvements</u>

Some existing recreational facilities and amenities are located within the 100-year storm event and have been vulnerable to flooding in the past. Notably are the greenbelts, some trails, Reverchon Park, the Sammons Center for the Arts, and the West Dallas Community Center. Implementation of the proposed IDP improvements would minimize the possibility of flooding these existing recreational facilities and the proposed new recreational facilities and amenities.

Hampton Pump Station and Sump Improvements

The construction footprint of the proposed IDP improvements within the Hampton Drainage Basin would not overlap or limit access to any existing recreational facilities. The proposed improvements are located adjacent to a portion of the Trinity Trail, which is located on the top of the East Levee. Project construction would expose trail users to construction noise (refer to Section 4.15); however, the noise would be temporary and generally localized.

Charlie Pump Station and Sump Improvements

IDP improvements within the Charlie Drainage Basin would not overlap, or be located adjacent to any existing recreational facilities.

Delta Pump Station and Sump Improvements

Similar to improvements in the Hampton Drainage Basin, the proposed IDP improvements in the Delta Drainage Basin would not overlap or restrict access to any existing recreational facility. However, because a portion of the Trinity Trail passes adjacent to the Delta Pumping Station, trail users would be exposed to construction noise. In addition, portions of the North Hampton Park, located to the south and east of the pumping plant, would be exposed to noise from construction activities. Construction noise would be temporary and generally localized.

Trinity-Portland Pumping Plant and Sump Improvements

The proposed improvements in the Trinity-Portland Basin are not located within or near any existing recreational facilities.

4.7.3.2 Design Without Potential Trinity Parkway Construction Anticipated

Under the Proposed Action design without potential Trinity Parkway construction anticipated, the potential impacts to recreational resources from implementation of the proposed FRM elements and IDP improvements would be the same as the design anticipating construction of the potential Parkway, as there would be no change in these components between the Proposed Action designs. Therefore, refer to Sections 4.7.3.1.1 and 4.7.3.1.3 for a discussion of impacts to recreational resources associated with implementation of the FRM elements and IDP improvements, respectively,

With respect to BVP Study Ecosystem and Recreation features under the Proposed Action design without potential Trinity Parkway construction anticipated, construction impacts would be similar to the Proposed Action design that includes potential Parkway construction. The difference under this design (not constructing the Trinity Parkway) would result in a net gain of 10.3 acres and 2.8 miles for recreational facilities and pathways as compared to the design anticipating potential Parkway construction. Further, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated would involve one additional amphitheater (i.e., the Natural Lake Amphitheater), which would be constructed along the north side of the Natural Lake, to the east of the IH-35E bridge crossings of the Floodway. There would also be additional space for a larger amphitheater and more room to add additional sports/flex spaces or increase the size of proposed flex spaces. In addition, there would be an increase in park roads (2.1 miles), parking (3 acres), and Floodway Access Gateways (4).

4.7.3.3 Summary

In general, construction impacts to recreational resources from implementation of BVP Study FRM Elements and IDP Improvements under both Proposed Action designs would be the same. The proposed construction activities would result in temporary disruptions to recreation. However, these impacts would be temporary and only effect a small portion of existing recreation areas at a time as construction would occur in stages. Proper advanced notification of potential disruption to recreation areas would be provided to the public.

Both of the Proposed Action designs would result in a substantial increase in the number and types of recreation opportunities available to the people in the City of Dallas. In addition, proposed IDP improvements would reduce the flood risk to some existing and proposed recreation areas. The implementation of the BVP Study would result in substantial increases in City of Dallas Parks and Recreation amenities in terms of soccer fields, football fields, and trails, significantly reducing the recreation shortfall within the City. Notably, the new lakes and associated amenities would provide new and enhanced recreation and interpretive opportunities and provide scenic, picnicking, and wildlife viewing opportunities. As discussed in Section 4.7.3.2, the Proposed Action design without potential Trinity Parkway construction anticipated would result in a net gain of 10.3 acres and 2.8 miles for recreational facilities and pathways as compared to the design anticipating Parkway construction. Further, this net gain would provide space for one additional amphitheater. There would also be additional space for a larger amphitheater and more room to add additional sports/flex spaces or increase the size of proposed flex spaces. In addition, there would be an increase in park roads (2.1 miles), parking (3 acres), and Floodway Access Gateways (4). Therefore, implementation the Proposed Action design without potential Trinity Parkway construction anticipated would result in a small net increase in recreation acreage as compared to the design anticipating potential Parkway construction. Table 4.7-6 compares recreational feature availability between the two Proposed Action designs.

Table 4.7-6. Comparison of Notable BVP Study Recreation Features under Proposed Action Design With and Without Construction of the Potential Trinity Parkway

Feature	*Design with Construction of Trinity Parkway*	*Design without Construction of Trinity Parkway*	*Change*
Dedicated Bike Path	0 mile	3.4 miles	+ 3.4 miles
Flex Fields	77.8 acres	88.1 acres	+ 10.3 acres
Park Road	13.7 miles	15.8 miles	+ 2.1 miles
Secondary Pedestrian Path	17.5 miles	16.9 miles	- 0.6 mile
Parking Area	18.48 acres	21.48 acres	+ 3 acres
Number of Access Gateways	25	29	+ 4

Under either Proposed Action designs, new vehicular and pedestrian entry points would provide overall improvements to existing access to recreation facilities and opportunities within the Floodway. New boat launches and docks would increase the amount of Trinity River access to a greater variety of watercraft. Therefore, Both Proposed Action designs would result in less than significant impacts to recreation during construction, and beneficial impacts to recreation during operation with a slight increase for the design not anticipating potential Parkway construction. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.7.3.4 Cumulative Impacts

Design Anticipating Potential Trinity Parkway Construction

Construction activity proposed in the Proposed Action design anticipating potential Trinity Parkway construction has the potential to overlap with reasonably foreseeable future projects described in Section 2.7. More specifically, three recreational-based projects are currently in the design phase and may be under construction simultaneously with elements of Parkway construction design. These reasonably foreseeable future projects include: Belleview Trail Connector, Bernal Trail, and Martin Luther King Jr. Gateway Park and Cedar Crest Bridge Improvements. Impacts of the Proposed Action potentially occurring simultaneously could limit access to existing recreational areas and venues or cause residents or tourists to avoid certain parks or boating areas due to noise and construction occurring adjacent to existing parks or recreational areas. The potential Trinity Parkway project could also cumulatively impact existing parks by way of construction noise and access. Specifically, access to and use of Trinity River Greenbelt Park could be restricted if an operating agreement with the City of Dallas is implemented during Parkway construction. Furthermore, pedestrian bike paths proposed under the Proposed Action design anticipating potential Parkway construction may need modification to accommodate the potential Trinity Parkway project as proposed under the current build alternatives.

Cumulative impacts to recreation would be beneficial when combined with other past and present projects. More specifically, access to and tourist views of the recreational elements of the Proposed Action would be significantly improved with implementation of the Trinity Parkway. The implementation of the BVP Study would result in substantial increases in City of Dallas Parks and Recreation amenities in terms of soccer fields, football fields, and trails, significantly reducing the recreation shortfall within the city. Therefore, implementation of the Proposed Action design anticipating Trinity Parkway construction in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant impacts to recreation during construction, and beneficial impacts to recreation during operation.

<u>Design Without Potential Trinity Parkway Construction Anticipated</u>

As described above, construction activity proposed has the potential to overlap with reasonably foreseeable future projects presented in Section 2.7. Under the Proposed Action without potential Trinity Parkway construction anticipated, the floodway would have more acreage available for parks, trails, etc. Construction-related traffic from the reasonably foreseeable projects would present impacts to recreation and recreation access. However, the additional acreage available for recreational areas would move the City of Dallas closer to their goal of 19.7 acres of parkland per 1,000 residents than proposed under the Proposed Action design anticipated construction of the potential Parkway, but only by 0.04%. Therefore, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in less than significant impacts to recreation during construction, and beneficial impacts to recreation during operation.

4.8 VISUAL RESOURCES

4.8.1 Approach to Analysis

The potential for a proposed action to alter the visual quality of a viewshed is considered when evaluating impacts on visual resources. By identifying the existing visual conditions (character and quality) of the viewshed potentially affected by a proposed action, an estimate of the visual impact can be assessed. The following designations were used to describe the level of potential impacts to visual resources:

- *Potentially significant impact (positive or negative)*: Any impact with the potential to permanently lower or heighten the visual quality of a viewshed.
- *Less than significant impact*: Any visible impact that would not potentially alter the visual quality of a viewshed. Typically, this occurs when a project's visual modifications can be seen but do not dominate, contrast with, or strongly degrade a viewshed.
- *No impact*: The project would not impact a viewshed. This occurs if a project's visual modifications do not happen or cannot be seen.

4.8.2 Alternative 1: Future Without-Project Condition

The identified Future Without-Project Condition projects would be typical of a major metropolitan area and would be consistent with the overall existing visual environment of the Study Area. The identified trails, parks, and recreation amenities, while subjective to individual viewer group perceptions, can generally be described as consistent with the overall visual environment and would not result in a dramatic change to the visual environment or change to visual sensitivity.

The identified Future Without-Project Condition bridges would alter the overall visual setting of the Dallas Floodway. Depending on the viewer group, the signature bridges would be visually pleasing in a man-made perspective, but could diminish the overall open space views of and from the Floodway for some viewers. The overall visual quality of the Dallas Floodway would continue to be moderately high (5), as vividness, intactness, and unity would likely remain moderately high (Table 4.8-1).

Table 4.8-1. Estimated Visual Quality Ratings under the Future Without-Project Condition

Viewshed	*Existing Conditions*	*Future Without-Project Condition*
Dallas Floodway	5	5
North Trinity River Greenbelt	4	4
Central Trinity River Greenbelt	4	4
South Trinity River Greenbelt	5	5
Hampton Pumping Plant	3	3
Charlie Pumping Plant	2	2
Delta Pumping Plant	4	4
Proposed Trinity-Portland Pumping Plant	5	5

Note: The visual quality rating scale (FHWA 1988) ranges from 1 (very low) to 7 (very high).

4.8.3 Alternative 2: Proposed Action

4.8.3.1 Design Anticipating Potential Trinity Parkway Construction

BVP Study FRM Elements

There is no difference in visual resource impacts between the design variations being considered for the Proposed Action for BVP Study FRM Elements.

Levee Raise Modification and Levee Flattening: 4:1 Side Slopes

Construction

Construction activities for the proposed levee improvements would result in temporary impacts to the visual environment of the Dallas Floodway. Generally, impacts from construction would include, but not be limited to, the staging of construction equipment, stockpiles of excavated material, erosion control materials, stored materials, exposed soil, dust and exhaust, increased vehicular traffic, nighttime illumination, grading, and earth moving activities. Negative impacts to the visual environment from construction would be temporary and depend on the viewer's proximity and line-of-sight of the individual projects. The construction within the Floodway would be localized as individual FRM elements are implemented; not all elements would be constructed at the same time. Therefore, the location of the visual impact would be highly variable throughout the construction period.

Operation

Following construction, impacts to the visual environment would be minimal as the levee height and slope changes would be nearly imperceptible from existing conditions. Therefore, there would be no noticeable change in the visual environment.

AT&SF Railroad Bridge Modifications

Construction

Impacts from construction would include, but not be limited to, the staging of construction equipment, stockpiles of excavated material, erosion control materials, stored materials, exposed soil, dust and exhaust, increased vehicular traffic, nighttime illumination, grading, and earth moving activities. Negative impacts to the visual environment from construction would be temporary and depend on the viewer's proximity and line-of-sight of the individual projects.

Operation

The 692 feet of existing steel truss (Photo 1) that crosses the Trinity River would be preserved. The removal of the bridge features and the embankment would enlarge the viewshed within the South Trinity River Greenbelt by eliminating visual barriers to the Great Trinity Forest. Viewer groups looking south within the Floodway would observe more intactness and vividness as a result of these FRM elements.

Photo 1: Existing AT&SF Railroad Bridge Steel Truss

Nonstructural Flood Control Improvements

Nonstructural measures associated with the implementation of the Proposed Action would not affect visual resources.

<u>BVP Study Ecosystem and Recreation Features</u>

Construction

Construction activities for the proposed BVP Study features would result in temporary impacts to the visual environment of the Dallas Floodway over the course of approximately 15 years. There are approximately 30 major features proposed as part of the BVP Study and impacts to the visual environment would be different depending on the action. Generally, visual impacts from construction would include, but not be limited to, the staging of construction equipment, stockpiles of excavated material, scaffolding, erosion control materials, stored materials, exposed soil, dust and exhaust, increased vehicular traffic, nighttime illumination, grading, and earth moving activities.

Construction in the Floodway would be extensive and vastly alter the visual environment for a period of several years. The construction within the Floodway would be localized as individual features of the BVP Study are implemented; not all elements would be constructed at the same time. Therefore, the location of the visual impact would be highly variable throughout the construction period. Negative impacts to the visual environment from construction would be temporary and depend on the viewer's proximity and line-of-sight of the individual projects.

Operation

Dallas Floodway

The BVP Study proposes features within the Floodway that would considerably alter the existing visual environment into an urban park setting (Photos 2 and 3). These proposed features would offer context sensitive design that would reduce any aesthetic impacts. The sinuosity of the relocated river would enhance the aquatic environment and provide the foundation for other environmental improvements, thereby increasing the aesthetic characteristics of the Floodway. The proposed headwaters, lakes, wetlands, and Trinity River would be maintained to limit aesthetic concerns including algal growth, sedimentation, and floatable material. The BVP Study's ultimate design goal is to pronounce the "quality, use, and aesthetic character" of the Floodway. Viewers of the Floodway would primarily be in downtown skyscrapers, levee-top trails, pedestrian overlooks, gateway parks, inside the Floodway, or traveling over bridges and nearby roadways.

Photo 2: Existing Dallas Floodway, looking north with Great Trinity Forest in the foreground

Photo 3: Dallas Floodway, with Implementation of Alternative 2 (with the design anticipating the potential Trinity Parkway construction), looking northeast towards the Central Business District

Source: City of Dallas 2003.

To preserve the nighttime views across the Floodway of downtown skyline, illuminated areas would be selective and use cutoff optics to minimize light pollution and glare. Lighted features, including bridges crossing the corridor, would provide visitors with an understanding of scale and place; meanwhile, areas along the Promenade would be treated with smaller scaled illuminated amenities such as lighted benches to create welcoming destinations. These methods would enhance the corridor and bring it "alive at night"—with both people and light (City of Dallas 2009).

Furthermore, light fixtures would be strategically located to minimize their physical impact on vegetation and wildlife. Light levels in these areas would strike a balance between a desired lighting aesthetic that supports the nighttime activities of the Floodway for visitors and the need to provide an acceptable environment for plants and wildlife. Lighting would respond dynamically to seasonal light levels (City of Dallas 2009).

North Trinity River Greenbelt

Numerous actions under the BVP Study features would affect the viewshed of the North Trinity River Greenbelt. The largest modification would be the construction of the 80-acre West Dallas Lake with its additional 7 acres of wetland habitat (Photo 4 [existing] and Photo 5 [proposed]). The Trinity River relocation, floodway wetlands, recreational fields (Photo 6) trail connections, and boat launch would also aesthetically affect the area. The relocation of the river along with increased wetland habitat would provide the foundation for other environmental improvements, thereby increasing the aesthetic characteristics of the Floodway. In contrast to the existing Floodway, the Proposed Action would provide a more complex and hospitable mosaic of visually unique and interesting urban park settings. The vividness, intactness, and unity would increase as a result of implementation of the Proposed Action.

Photo 4: Existing Dallas Floodway, looking south with the Central Business District skyline in the background

Photo 5: Proposed West Dallas Lake in the foregound with the Central Business District in the background

Photo 6: Proposed recreational field in the foreground with West Dallas Lake and the Central Business District in the background

Sources: City of Dallas 2003, 2009.

Central Trinity River Greenbelt

Proposed BVP Study features in the Central Trinity River Greenbelt include two terraced lakes. The Urban Lake would be edged with a formal promenade along the downtown side (Photo 7 [existing] and Photos 8 [proposed], 9 [existing], and 10 [proposed]). The opposite shore of the Urban Lake would be more natural in character with a gently sloping berm, protecting it from the Trinity River. The berm would be landscaped to provide wildlife habitat near the river and would include trails or pathways.

The Natural Lake would be located to the southeast of the Urban Lake and would provide a water recreation experience of a more natural character. The lake would be approximately 75 acres in size, with an additional 15 acres of wetlands around its shores. A water feature with three feet of drop would flow towards the Urban Lake and would add enhanced aesthetics for the viewer. The lakeshore would be composed of paths, picnic, and nature observation areas. Trees, grasses, and other vegetation would be planted to create habitat for birds and wildlife. As the lake waters enter the Trinity River east of Cadiz Street, the river would be divided into multiple braided river channels with low-lying wetlands and protected islands for wildlife. The Central Trinity River Greenbelt would have the most visual exposure, as this is envisioned to be the centerpiece of the BVP Study features. A Downtown Promenade and Overlook would offer key observation points for views of the Central Trinity River Greenbelt and the surrounding Dallas Floodway elements. Another viewing point includes the Oak Cliff Levee Top Road, which would provide pedestrian entry into the park and on-street vehicle parking (Photo 11 [existing] and Photo 12 [proposed]).

Illumination of the Trinity Lakes Area would provide a stimulating and legible nighttime landscape. With the proper levels of brightness and contrast, lighting would contribute to the visitor's sense of a safe and welcoming nighttime environment. In support of these goals, the proposed lighting is divided into two major categories: lighting for circulation and lighting for features. For circulation purposes, corridors of light are proposed to mark the central portion of the Primary Trail and Urban Lake Promenade. For key park features such as the Lakes Isthmus, Downtown Overlook, and Natural Lake Headwaters, pools of light are proposed to emphasize their importance as park destinations. This strategy, both aesthetic and user-friendly, would help orient visitors through rhythmic lines of light along paths and through lighted features that can "punctuate" the nighttime environment. The dark sky preservation guidelines would be incorporated where appropriate to minimize glare, light trespass, off-site lighting, and night sky pollution (City of Dallas 2009).

Changes in the aesthetic environment of the Central Trinity River Greenbelt would be substantial and would show only slight similarities with the existing conditions. However, these changes would likely improve the visual character of the viewshed through greater vividness, intactness, and unity of an urban park setting.

Photo 7: Existing conditions with the Union Pacific Railroad Bridge in the foreground and the Reunion Tower in the background

Photo 8: Proposed downtown promenade (with design anticipating the potential Trinity Parkway construction)

Photo 9: Existing conditions looking north on the west side of the Dallas Floodwaywith the Margaret Hunt Hill Bridge in the background

Photo 10: Proposed Urban Lake in the foregound, looking north, with the Margaret Hunt Hill Bridge in the background

Photo 11: Existing conditions looking north on the west side of the Dallas Floodway with the Margaret Hunt Hill Bridge in the background

Photo 12: Proposed Oak Cliff Levee-Top Road with future development along it. The Houston Viaduct is in the foreground and the Calatrava Bridge is in the background

Sources: City of Dallas 2003, 2009.

South Trinity River Greenbelt

Proposed BVP Study features in this area are minimal when compared to the other Trinity Greenbelt viewsheds. Actions include the construction of a boardwalk and wildlife observation areas (Photo 13 [existing] and Photo 14 [proposed]). The existing emergent wetlands at Corinth Street are of poor quality and would be enhanced through grading and planting. Wildlife observation areas would be constructed to provide visitors with viewing opportunities. The BVP Study features in this area would largely improve the visual environment of the area by offering habitat enhancement and added observation points.

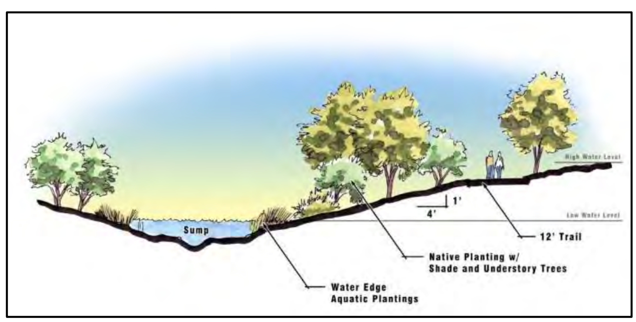
To the east of the Floodway, improvements within the Able Sump Ponds would include enhancements to provide recreational opportunities. Landscaping, trails, bulkheads, and boardwalks would complement other BVP Study features with a similar visual setting (Photos 15 [existing] and 16 [proposed]).

Photo 13: Existing Dallas Floodway looking north with the grassy meadow in the foreground, Houston Viaduct in the middleground, and the Central Business District in the background

Photo 14: Proposed Corinth Wetlands in the foreground and the Central Business District in the background

Photo 15: Able Sump; looking northeast

Photo 16: Proposed Able Sump Enhancements



Sources: City of Dallas 2003, 2009; Halff Associates 2008.

<u>IDP Improvements</u>

There is no difference in visual resource impacts between the design variations being considered for the Proposed Action for IDP Improvements.

Hampton Pump Station and Sump Improvements

Construction

Proposed rehabilitation activities associated with Alternative 2 would result in impacts to visual resources due to the presence of construction equipment, vehicles, and building activities.

Operation

The New Hampton Pump Station would be constructed next to an industrial park with power and overhead utility lines running behind it, dominating the area viewshed. The rehabilitation of the Old and New Hampton Pump Station includes aesthetic improvements, such as replacing roofs, cleaning and painting exterior concrete, new lighting, and others. Overall, the construction of the new pump station and the supplemental aesthetic improvements would not substantially alter or degrade the existing visual environment.

Charlie Pump Station and Sump Improvements

Construction

Under Alternative 2, the existing Old Charlie Pump Station would be demolished and New Charlie Pump Station would be constructed. The proposed demolition and construction activities associated with Alternative 2 would result in impacts to visual resources due to the presence of construction equipment, vehicles, and storage.

Operation

The New Charlie Pump Station would be located on the West Levee, adjacent to the existing Charlie Pump Station, between Houston and Jefferson Streets. It would be configured to use the existing 4 foot by 4 foot gravity sluices as an outfall to the river. The foundation of the pump station would consist of a 5-foot thick concrete slab to which the walls would be attached. The superstructure of the pump station would consist of cast-in-place concrete and beams incorporated into the structure to accommodate the installation of a bridge crane for maintenance. The pump station roof would have double tees, which increases the stiffness of the structure and simplifies construction and maintenance. The New Charlie Pump Station would not substantially alter or degrade the existing visual environment; resulting in no change to the visual quality rating. Thus, overall impacts to visual resources from the construction of the New Charlie Pump Station would be less than significant.

Delta Pump Station and Sump Improvements

Construction

Proposed rehabilitation activities would result in impacts to visual resources due to the presence of construction equipment, vehicles, and building activities.

Operation

Alternative 2 would rehabilitate the existing Delta Pump Station and construct a new electrical building. The new electrical building would be approximately 14-feet wide by 18-feet long and 14-feet high to the top. The new building would have brick veneer to match the existing pump station building.

Rehabilitation of the existing Delta Pump Station would also not alter the character of the viewshed or substantially alter or degrade the existing visual environment.

Trinity-Portland Pumping Plant and Sump Improvements

Construction

Proposed construction activities in the Trinity-Portland Basin associated with Alternative 2 would result in impacts to visual resources due to the presence of construction equipment, vehicles, and building activities.

Operation

The pump station would be a cast-in-place concrete and beams to accommodate the installation of a bridge crane for maintenance. The roof would have double tees, a two-inch layer of grout, and a membrane. The proposed pumping plant location would not be easily visible from area roads, but would be visible from inside the Floodway. The addition of the Trinity-Portland Pump Station and the proposed gate conduit structure between sumps would not substantially alter or degrade the existing visual environment.

4.8.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential visual resource impacts from the FRM Elements and IDP Improvements would be the same under both design variations. Therefore, refer to Section 4.8.3.1 for a discussion of impacts to visual resources associated with implementation of the FRM elements and IDP improvements under the design anticipating the potential Trinity Parkway construction.

<u>BVP Study Ecosystem and Recreation Features</u>

Visual impacts during construction would be the same as those described under the design anticipating Trinity Parkway construction. Impacts to the North Trinity River Greenbelt visual resources would also remain the same under both design variations, as no change to the BVP Study features would occur in this area. The design without Trinity Parkway construction anticipated would increase the visual unity, intactness, vividness, and quality of the Central and North Trinity River Greenbelts because without the Trinity Parkway, there would be more areas for constructing visually pleasing features within the eastern portion of the Floodway. Therefore, the design without Trinity Parkway construction anticipated would have slightly greater beneficial impacts compared to the design anticipating Trinity Parkway construction.

4.8.3.3 Summary

Construction would negatively impact visual resources within the Floodway, but these impacts would be temporary. Table 4.8-2 shows the anticipated visual impacts from the implementation of each of the BVP Study features and Table 4.8-3 summarizes impacts to the visual setting with implementation of proposed IDP improvements. Under the design without potential Trinity Parkway construction anticipated, there would be a slightly greater area of BVP Study features within the Study Area, thus resulting in slightly more beneficial impacts with increased visual unity, intactness, vividness, and quality. However, the visual quality rating would remain the same under both design variations. Night lighting features would be designed and operated to minimize impacts to nighttime views. Therefore, implementation of the Proposed Action would result in less than significant impacts to visual resources during construction, and beneficial impacts to visual resources during operation. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

Table 4.8-2. Estimated Resulting Visual Quality Ratings from Implementation of Proposed BVP Study Features under Alternative 2 (the Proposed Action)

Viewshed	*Existing Conditions*	*Implementation of BVP Study Features*
Dallas Floodway	5	6
North Trinity River Greenbelt	4	5
Central Trinity River Greenbelt	4	5
South Trinity River Greenbelt	5	6

Note: The visual quality rating scale (FHWA 1988) ranges from 1 (very low) to 7 (very high).

Table 4.8-3. Estimated Resulting Visual Quality Ratings from Implementation of Proposed IDP Improvements under Alternative 2 (the Proposed Action)

Drainage Basin	*Existing Conditions*	*Implementation of IDP Improvements*
Hampton	3	4
Charlie	2	2
Delta Pumping	4	4
Trinity-Portland	5	5

Note: The visual quality rating scale (FHWA 1988) ranges from 1 (very low) to 7 (very high).

4.8.3.4 Cumulative Impacts

Design Anticipating Potential Trinity Parkway Construction

Implementation of the Proposed Action design anticipating the potential construction of the Trinity Parkway would result in beneficial, but less than significant, impacts to the visual environment, mostly as a result of the aesthetic alterations from BVP Study features. When combined with identified past, present, and reasonably foreseeable projects, including trails, parks, signature bridges, and recreation amenities, while subject to individual viewer group perceptions; these projects would be consistent with the proposed overall visual environment of the BVP Study features, and other associated elements and improvements. Such cumulative changes would occur in areas that are already urbanized.

The potential Trinity Parkway would be a notable visual alteration within the ROI, particularly within the Floodway. The potential Trinity Parkway would traverse along the eastern levee through the Southern and Central Trinity River Greenbelts. As such, the potential Trinity Parkway would be visible to visitors within the Floodway and those outside of the Floodway at elevation (e.g., Central Business District buildings). The visual characteristics of the Dallas Floodway would be significantly changed with the addition of the Trinity Parkway by altering the visual character and quality of the ROI, specifically intactness and unity.

Therefore, when combined with the Proposed Action design anticipating the potential construction of the Trinity Parkway, the overall visual quality of the Dallas Floodway would be moderately high (5), as vividness would be high and intactness and unity would be moderately high with the addition of the past, present, and reasonably foreseeable projects. The estimated visual quality rating of moderately high (5) would be the same as the existing Dallas Floodway. Therefore, implementation of the Alternative 2 design anticipating the potential construction of the Trinity Parkway, in combination with the identified past, present, and reasonably foreseeable projects, would result in less than significant impacts to the visual environment.

Design Without Potential Trinity Parkway Construction Anticipated

The cumulative impacts would be the same under both design variations, except the design without the Trinity Parkway construction anticipated considers the potential future in which the Trinity Parkway is not constructed. Without the Trinity Parkway, the overall visual quality of the Dallas Floodway would be higher than it would be with the Parkway constructed. Without the potential Trinity Parkway, there would be more opportunity to build visually pleasing features, thereby improving visual unity and intactness. Furthermore, the design without the potential Trinity Parkway construction anticipated, and the past, present, and reasonably foreseeable projects that are similar in design and character (i.e., trails, parks, signature bridges, and recreation amenities), would increase vividness, intactness, and unity within the ROI. The overall visual quality of the Dallas Floodway would be high (6), as vividness, unity, and intactness would be high with the addition of the identified past, present, and reasonably foreseeable projects. Therefore, the Alternative 2 design without potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in beneficial cumulative impacts to the visual environment.

4.9 SOCIOECONOMICS

4.9.1 Approach to Analysis

The analysis of impacts to socioeconomics under the Future Without-Project Condition is a qualitative assessment of potential changes in socioeconomic factors that would likely occur if the Proposed Action did not occur. The analysis was conducted for the construction phase and the operations phase. The operations phase was analyzed qualitatively using information on historical economic growth patterns in the Dallas area and how those patterns might interact with the Proposed Action. The construction phase of the project alternatives were analyzed quantitatively using the Impact Analysis for Planning (IMPLAN) economic model (Minnesota IMPLAN Group 2013) to generate estimates of economic impacts. Quantified economic impact results for the construction phase are presented for Dallas County as a whole.

Refer to Chapter 6 for an analysis of the potential impacts from implementation of the alternatives on environmental justice and environmental health and safety risks for children within the ROI.

Input Data for Economic Impact Analysis

Primary economic data were provided by the USACE. Data that were provided were exclusively related to construction activities. Data was provided for each of the three primary aspects of the project: the BVP Study features, FRM elements, and the IDP improvements. A general timeline was also provided. Table 4.9-1 shows the estimated construction expenditures that were incorporated into the economic model and the general construction period for each of the three primary aspects of the Proposed Action.

Table 4.9-1. Estimated Construction Expenditures and Timelines for the Proposed Action

Proposed Action Component	*Construction Expenditures*	*Construction Period*	*Construction Period in Years (used to calculate annual averages)*
FRM Elements	$60,335,418	(Mid) 2017-2019	2.5
BVP Study Ecosystem and Recreation Features	$596,904,148	2016-2027 (1st Quarter)	11.25
IDP Improvements	$97,835,525	(1st Quarter) 2016-2021	5.75

Note: Construction expenditures used for economic modeling do not equal total construction costs. Costs related to "contingency," "escalation," and other non-direct factors were excluded from economic impact analysis.
Source: USACE 2013.

Result Variables and Key Concepts

Economic impact variables that are presented as results include: Jobs, Labor Income, and Economic Output. Each of the result variables consists of a direct, an indirect, and an induced impact as described below.

Jobs

Jobs impacts represent the number of jobs that would be created or sustained within the ROI as a result of construction activities. The IMPLAN model generates jobs numbers that include part-time jobs; therefore, numbers calculated are for all jobs rather than full-time equivalent jobs.

Labor Income

Labor income impacts represent the income generated through the jobs that would be created or sustained within the ROI as a result of construction activities.

Economic Output

Economic output impacts represent total production and sales volume that would be generated in the ROI as a result of construction activities. Economic output is generated by increases in personal expenditures.

Direct Impacts

Direct impacts are associated with the construction projects themselves. Direct jobs include jobs building and/or constructing the proposed projects. Direct labor income is the incomes earned by workers who are building/constructing on the proposed projects. Direct economic output is associated with initial purchases of local construction materials and supplies.

Indirect Impacts

Indirect impacts are the jobs, income, and economic output generated by the businesses that would supply construction materials and supplies. Indirect jobs include jobs at companies that supply construction materials/supplies or sell or rent construction equipment. Indirect jobs can extend to include jobs related to the manufacture of products used for construction (if the manufacture is within the ROI). Indirect labor income includes the income earned by people working indirect jobs. Indirect output includes the total sales volume related to the supply of goods and services to construction contractors.

Induced Impacts

Induced impacts are the result of spending of the wages and salaries of the direct and indirect employees on items such as food, housing, transportation, and medical services. This spending creates induced employment in nearly all sectors of the economy, especially service sectors.

4.9.2 Alternative 1: Future Without-Project Condition

Under the Future Without-Project Condition, there would be an anticipated increase in both temporary construction jobs, as well as permanent jobs, as multiple large-scale projects would occur within the ROI. In addition, even without implementation of the identified future projects, increases in economic development in the ROI are currently anticipated. The City of Dallas Office of Economic Development has the primary goal to grow the economy of Dallas. To achieve this goal, prospects for future economic growth, and the tasks needed to capitalize on those prospects were identified in a 2013 presentation (City of Dallas 2013) as summarized below.

Prospects for future growth include:

- Leveraging public sector funding in key southern Dallas focus areas to stimulate private investment;
- Coordinating planning and development programs;
- Building new and upgrading existing infrastructure;
- Demolishing aging apartments to pave the way for mixed-use redevelopment;
- Growing corporate interest in Downtown, Uptown and other key office markets;
- Completing the Arts District vision with complementary private development;
- Increasing focus on quality of life and sustainability - bike plan, complete streets and the Trinity River Corridor;
- Embracing the long-term changes in housing markets that favor urban multi-family options; and
- Mirroring Texas growth projections that continue favorable economic/social trends.

Tasks to capitalize on these prospects include:

- Build SourceLinkDallas program to provide enhanced coordination of small business services;
- Secure financing from multiple sources for business and development projects;
- Publicize and market Dallas' advantages to investors, developers and businesses;
- Facilitate business efforts to comply with regulatory and other city processes;
- Maintain a competitive set of targeted business incentives to support job and tax base growth;
- Provide rapid, thorough responses to requests from prospective businesses;
- Provide individualized technical assistance through business assistance centers;
- Explore potential efforts to increase small business recognition; and
- Market downtown as a corporate headquarters, business services and entrepreneurial small business destination.

Most economic growth in Dallas is expected to take place in the downtown area, in locations such as currently undeveloped urban lots (i.e., greenfield sites) near the University of North Texas Dallas campus and the inland port (City of Dallas 2010). Also, the NCTCOG *developed Mobility 2035: The Metropolitan Transportation Plan for North Central Texas* (NCTCOG 2013), which identified potential Transit Oriented Development. Transit oriented development/improvements in areas near to transit stations resulting from additional demand for goods and services from commuters could also spur economic growth in a future without the project.

Under the Future Without-Project Condition economic growth would likely result in an increase in the quality of life for people within the ROI. With its current appeal for its low cost of living, low tax rates, attractive economic and cultural opportunities, Dallas would continue to attract new businesses, residents, and visitors.

Table 4.9-2 presents the anticipated changes to socioeconomic resources under the Future Without-Project Condition. As with the predicted increase in economic prosperity and quality of living in the future conditions, household income and high school graduation rates within the ROI are also expected to increase. As expected, these predicted increases in population and income would likely put stresses on housing supply, which may lead to higher rental prices and/or crowding of existing units. However, it is likely that new housing units would be constructed to meet additional demand. Furthermore, many of the identified Future Without-Project Condition projects would increase the amount of parks in the southern portion of the ROI, resulting in a beneficial impact to minority populations and children.

Table 4.9-2. Socioeconomic Resources under Existing Conditions and Future Without-Project Condition in ROI

Socioeconomic Category	*Existing Conditions*	*Change under Future Without-Project Condition*
Population (Number)		
	272,761	Increase
Race/Ethnicity (Percentage)		
White	14.9	Decrease
Black or African American	39.8	Increase
American Indian and Alaska Native	0.3	Increase
Asian	1.4	Increase
Native Hawaiian and Other Pacific Islander	0.04	Increase
Hispanic or Latino	42.7	Increase
Some other race	0.1	Increase
Two or more races	0.8	Increase
Median Household Income (Dollars)		
	NA	Increase
Occupied Housing Units (Percentage)		
	86.1	Increase
High School Graduate and Higher Rates (Percentage)		
	61.8	Increase

Note: NA = not available.
Sources: U.S. Census Bureau 2010a; Texas State Data Center, Office of the State Demographer 2011.

By the year 2065, the overall City of Dallas and ROI populations are expected to increase, most notably Hispanic/Latino, and the quality of living and household incomes is expected to rise. Under the Future Without-Project Condition, the risk for river flooding would remain. If current trends continue, the SPF would impact minority populations, and to a lesser extent low-income populations. Without future FRM elements, these potential flood impacts would likely become worse because of estimated population increases.

In the absence of comprehensive FRM actions, under the Future Without-Project Condition there would be a potential for the SPF event to affect the ROI, and with it, impacts to socioeconomic resources from flooding. More than $12.2 billion in floodplain investment could be affected. Potential secondary impacts to socioeconomic resources would also occur (e.g., loss of jobs).

4.9.3 Alternative 2: Proposed Action

4.9.3.1 Design Anticipating Potential Trinity Parkway Construction

BVP Study FRM Elements

Construction

Table 4.9-3 presents the estimated total number of jobs and the annual average number of jobs that would be generated or sustained in the ROI from mid-2017 through 2019. Over the 2.5-year period, 680 jobs would be associated with the FRM elements, an average of 272 jobs per year. Most of the jobs (438) would be direct (e.g., construction jobs). An additional 242 jobs (93 indirect and 149 induced), mostly non-construction jobs, would be generated or sustained over the 2.5-year construction period.

Table 4.9-3. Jobs Impacts from FRM Elements, 2017-2019

Impact Type	*Total*	*Annual Average*
Direct	438	175
Indirect	93	37
Induced	149	60
Total	**680**	**272**

Table 4.9-4 presents the estimated total labor income and the annual average labor income that would be generated or sustained in the ROI from mid-2017 through 2019. Over the 2.5-year period, $52.7 million in labor income would be associated with the FRM elements, an average of $21 million per year. Most of the labor income ($36 million) would be direct, comprised of construction worker income. An additional $16.5 million ($7.4 million indirect and $9.1 million induced) would be generated or sustained over the 2.5-year construction period.

Table 4.9-4. Labor Income Impacts from FRM Elements, 2017-2019 (2014 Constant $s)

Impact Type	*Total*	*Annual Average*
Direct	$36,160,483	$14,464,193
Indirect	$7,409,764	$2,963,906
Induced	$9,106,748	$3,642,699
Total	**$52,676,995**	**$21,070,798**

Table 4.9-5 presents the estimated economic output and the annual average economic output that would be generated or sustained in the ROI from mid-2017 to 2019. Over the 2.5-year period, $100.5 million in economic output would be associated with the FRM elements, an average of $40 million per year. Most of the economic output ($61 million) would be direct (associated with the actual construction of FRM). An additional $39.1 million ($16.2 million indirect and $22.9 million induced) would be generated or sustained over the 2.5-year construction period.

Table 4.9-5. Economic Output Impacts from FRM Elements, 2017-2019 (2014 Constant $s)

Impact Type	*Total*	*Annual Average*
Direct	$61,385,421	$24,554,168
Indirect	$16,219,192	$6,487,677
Induced	$22,928,093	$9,171,237
Total	**$100,532,707**	**$40,213,083**

Improvements to the Eagle Ford/Trinity-Portland Sumps connection may require the City to purchase three privately owned parcels of land; each parcel currently contains a single-family residence valued above median home price for the area. The current design indicates the proposed sump improvements may be completed without impacting the parcels; however, the City of Dallas may choose to pursue the purchase the lands following coordination with the property owners, if recommended in later design refinements.

Operation

Operational aspects include structural and nonstructural components.

Structural

Structural aspects of the FRM elements would provide FRM benefits, resulting in beneficial impacts to health, safety, and personal finance.

Nonstructural

Nonstructural components would increase the amount of information that Dallas residents have in regards to emergency readiness and allow them to be better prepared for emergencies and other unforeseen events related to the Floodway. Also, the capacity of the City of Dallas to provide public safety services to residents, as well as critical infrastructure, would improve. Overall, nonstructural actions would serve to benefit residents of Dallas.

BVP Study Ecosystem and Recreation Features

Construction

Table 4.9-6 presents the estimated total number of jobs and the annual average number of jobs that would be generated or sustained in the ROI from 2016 to early 2027. Approximately 6,732 jobs would be associated with construction of the BVP Study Ecosystem and Recreation features, an average of 598 jobs per year. Most of the jobs (4,334) would be direct (e.g., construction jobs). An additional 2,397 jobs (921 indirect and 1,476 induced), mostly non-construction jobs, would be generated or sustained over the construction period.

Table 4.9-6. Jobs Impacts from BVP Study Ecosystem and Recreation Features, 2016-2027

Impact Type	*Total*	*Annual Average*
Direct	4,334	385
Indirect	921	82
Induced	1,476	131
Total	**6,732**	**598**

Table 4.9-7 presents the estimated total labor income and the annual average labor income that would be generated or sustained in the ROI from 2016 to early 2027. Approximately $521 million in labor income would be associated with the BVP Study Ecosystem and Recreation feature construction, an average of $46 million per year. Most of the labor income ($358 million) would be direct, comprised of construction worker income. An additional $163.5 million ($73 million indirect and $90 million induced) would be generated or sustained over the construction period.

Table 4.9-7. Labor Income Impacts from BVP Study Ecosystem and Recreation Features, 2016-2027 (2014 Constant $s)

Impact Type	*Total*	*Annual Average*
Direct	$358,019,880	$31,823,989
Indirect	$73,363,036	$6,521,159
Induced	$90,164,637	$8,014,634
Total	**$521,547,552**	**$46,359,782**

Table 4.9-8 presents the estimated economic output and the annual average economic output that would be generated or sustained in the ROI from 2016 to early 2027. Approximately $995 million in economic output would be associated with the BVP Study features, an average of $88 million per year. Most of the economic output ($607.8 million) would be direct and associated with actual construction. An additional $387 million ($160 million indirect and $227 million induced) would be generated or sustained over the construction period.

Table 4.9-8. Economic Output Impacts from BVP Study Ecosystem and Recreation Features, 2016-2027 (2014 Constant $s)

Impact Type	*Total*	*Annual Average*
Direct	$607,768,462	$54,023,863
Indirect	$160,583,951	$14,274,129
Induced	$227,007,845	$20,178,475
Total	**$995,360,258**	**$88,476,467**

Operation

According to a study by the TPWD (TPWD 2005), the City of Dallas lacks sufficient recreational opportunities for citizens and visitors. As recreational activities are generally considered valuable to a community, improvements to recreational opportunities (and access to them) would directly benefit residents of Dallas. In addition, the improvements would be expected to attract visitors to the area (for sporting events, concerts etc.); visitors to the area would spend money in the local economy and support tourism-related businesses, such as hotels and retail establishments. The additional money spent by visitors would generate jobs and income for Dallas residents as well as tax revenues for local governments and the State of Texas. Additional tax revenues may serve to improve the services that are provided by these governments, such as police and fire protection services, and education.

IDP Improvements

Construction

Table 4.9-9 presents the estimated total number of jobs and the annual average number of jobs that would be generated or sustained in the ROI from early 2016 through 2021 as a result of IDP improvements. Over the approximately 6-year period, 1,141 jobs would be associated with IDP improvements, an average of 198 jobs per year. Most of the jobs (735) would be direct (construction jobs). An additional 406 jobs (156 indirect and 250 induced), mostly non-construction jobs, would be generated or sustained over the 6-year construction period.

Table 4.9-9. Jobs Impacts from IDP Improvements, 2016-2021

Impact Type	*Total*	*Annual Average*
Direct	735	128
Indirect	156	27
Induced	250	44
Total	**1,141**	**198**

Table 4.9-10 presents the estimated total labor income and the annual average labor income that would be generated or sustained in the ROI from early 2016 through 2021 as a result of IDP improvements. Over the approximately 6-year period, approximately $88 million in labor income would be associated with the IDP improvements, an average of $15 million per year. Most of the labor income ($60.7 million) would be direct, comprised of construction worker income. An additional $27.7 million ($12.4 million indirect and $15.3 million induced) would be generated or sustained over the 6-year construction period.

Table 4.9-10. Labor Income Impacts from IDP Improvements, 2016-2021 (2014 Constant $s)

Impact Type	*Total*	*Annual Average*
Direct	$60,689,295	$10,554,660
Indirect	$12,436,044	$2,162,790
Induced	$15,284,146	$2,658,112
Total	**$88,409,485**	**$15,375,563**

Table 4.9-11 presents the estimated economic output and the annual average economic output that would be generated or sustained in the ROI from early 2016 through 2021 as a result of IDP improvements. Over the approximately 6-year period, approximately $168.7 million in economic output would be associated with the IDP improvements, an average of $29.3 million per year. Most of the economic output ($103 million) would be direct (associated with actual construction). An additional $65.7 million ($27.2 million indirect and $38.5 million induced) would be generated or sustained over the 6-year construction period.

Table 4.9-11. Economic Output Impacts from IDP Improvements, 2016-2021 (2014 Constant $s)

Impact Type	*Total*	*Annual Average*
Direct	$103,025,116	$17,917,411
Indirect	$27,221,189	$4,734,120
Induced	$38,480,953	$6,692,340
Total	**$168,727,258**	**$29,343,871**

Operation

Implementation of the IDP improvements would reduce the stormwater flood risk for structures located within the interior areas. All of the structures subject to flood risk presented in Table 1-1 are located in areas with a higher proportion of minority or low income residents. The IDP improvements would improve the capability of the Dallas Floodway to reduce risk to the lives and property of Dallas residents from flood, which would provide beneficial impacts to them in terms of health, safety, and personal finance, especially for populations with a higher proportion of minority of low income residents.

4.9.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The Proposed Action design without Potential Trinity Parkway construction anticipated would create slightly more ecosystem and recreation features (refer to Table 2-4) as compared to the design including potential Parkway construction. These additional improvements would be minor and impacts related to socioeconomics would be very similar to those described under the Proposed Action design anticipating potential Trinity Parkway construction in Section 4.9.3.1. Under this Proposed Action design, there would be slightly more construction activity which would develop into slightly more construction-related economic activity. However, any difference would be minimal and thus the economic impact results presented under the Proposed Action design anticipating potential Trinity Parkway Construction in Section 4.9.3.1 are valid for this design without potential Trinity Parkway construction. Under the Proposed Action design without potential Trinity Parkway construction, there would be a slightly greater direct benefit to residents accrued through additional recreational amenities. No difference in indirect effects generated through increased tourism would be expected, as the additional amenities associated with the Proposed Action design would not be likely to attract additional visitors given that they are relatively minor as compared with the design anticipating potential Trinity Parkway construction.

4.9.3.3 Summary

Although a slight increase would occur in jobs and recreational benefit under the Proposed Action design without potential construction of Trinity Parkway anticipated, there is no measureable difference in jobs created, labor income, or economic output between the Proposed Action designs. Therefore, implementation of either Proposed Action design would create 8,553 jobs (Table 4.9-12), and $662,634,032 in labor income (Table 4.9-13), and increase economic output by $1,264,620,223 (Table 4.9-14). The increase in recreational opportunities (and access to them) would directly benefit residents of

Dallas. The anticipated increase in visitors to the Study Area would result in more money spent in the local economy and support tourism-related businesses such as hotels and retail establishments. The additional money spent by visitors would generate jobs and income for Dallas residents as well as tax revenues for local governments and the State of Texas. Furthermore, there would be a reduction in flood risk and associated impacts within the Study Area. Therefore, implementation of either Proposed Action design would result in beneficial impacts to socioeconomic resources. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

Table 4.9-12. Total Jobs Impacts under the Proposed Action, 2016-2027

Component	*Total*	*Annual Average*
FRM Elements	680	272
BVP Study Features	6,732	598
IDP Improvements	1,141	198
Total	**8,553**	**-**

Table 4.9-13. Total Labor Income Impacts under the Proposed Action, 2016-2027 (2014 Constant $s)

Component	*Total*	*Annual Average*
FRM Elements	$52,676,995	$21,070,798
BVP Study Features	$521,547,552	$46,359,782
IDP Improvements	$88,409,485	$15,375,563
Total	**$662,634,032**	**-**

Table 4.9-14. Total Economic Output under the Proposed Action, 2016-2027 (2014 Constant $s)

Component	*Total*	*Annual Average*
FRM Elements	$100,532,707	$40,213,083
BVP Study Features	$995,360,258	$88,476,467
IDP Improvements	$168,727,258	$29,343,871
Total	**$1,264,620,223**	**-**

4.9.3.4 Cumulative Impacts

Design Anticipating Potential Trinity Parkway Construction

When considered in conjunction with the past, present, and reasonably foreseeable projects identified in Section 2.7, the Proposed Action design anticipating potential Trinity Parkway construction would have beneficial cumulative impacts to local and regional economic conditions. The construction activity associated with implementation of the design has the potential to overlap with reasonably foreseeable future projects. The projects would generate economic impacts that would be additive to the economic impacts summarized above. The projects would help fuel and sustain the local and regional economy by creating jobs, business revenue, personal income, and fueling indirect and induced effects in various industries. In terms of operations, reasonably foreseeable projects related to Floodway improvements would marginally improve public safety infrastructure for Dallas residents.

In terms of social impacts, the Trinity Parkway project would have impacts on a number of existing communities, which would potentially degrade community cohesion. These impacts include the displacement and required relocation of residences, business, and/or community facilities. Other social impacts associated with the Trinity Parkway project would include increased noise, visual intrusion, and/or increased traffic on local streets (FHWA 2014). In terms of economic impacts, the Trinity Parkway project would provide a much larger amount of economic impact than the combined effect of all elements in the Proposed Action design anticipating potential construction of the Parkway. Therefore, implementation of the Proposed Action design anticipating potential Trinity Parkway construction in combination with the identified past, present, and reasonably foreseeable projects would result in beneficial cumulative impacts to socioeconomic resources.

Design Without Potential Trinity Parkway Construction Anticipated

When considered in conjunction with the past, present, and reasonably foreseeable projects identified in Section 2.7, the Proposed Action design without potential Trinity Parkway construction anticipated would have beneficial cumulative impacts to local and regional economic conditions. The construction activity associated with implementation of this Proposed Action design has the potential to overlap with reasonably foreseeable future projects. The projects would generate economic impacts that would be additive to the economic impacts summarized above. The projects would help fuel and sustain the local and regional economy by creating jobs, business revenue, personal income, and fueling indirect and induced effects in various industries. In terms of operations, reasonably foreseeable projects related to Floodway improvements would marginally improve public safety infrastructure for Dallas residents. Therefore, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated in combination with the identified past, present, and reasonably foreseeable projects would result in beneficial cumulative impacts to socioeconomic resources.

4.10 HAZARDOUS MATERIALS AND WASTES

4.10.1 Approach to Analysis

The increase in likelihood of exposure to hazardous materials and wastes on the environment and/or humans is considered when evaluating impacts from hazardous materials and wastes. Generally, through mitigation, minimization, and avoidance, impacts can be avoided. The following designations were used to assess the potential impacts from the alternatives on hazardous materials and wastes:

- *Potentially significant impact*: Any impact that could potentially increase the likelihood of environmental and/or human exposure to hazardous materials and wastes.
- *Less than significant impact*: Any impact that could potentially increase the likelihood of exposure to hazardous materials and wastes; however, with identified mitigation, minimization, and avoidance, the impacts would be considered less than significant.
- *No impact*: The project would have no potential for an increase in exposure to hazardous materials and wastes.

4.10.2 Alternative 1: Future Without-Project Condition

Several of the identified future projects in the Study Area have a project footprint that would present the potential to come in contact or disturb existing hazardous sites. Through proper planning, investigation and if necessary, action, some sites would likely be remediated while others would be avoided. Specifically, as part of any necessary remediation plan, the action proponent (in coordination with applicable regulatory agencies) would prepare a Corrective Measures Study, Implementation Work Plan, and Report and Progress Reports. This series of documents would be open for public review and comment and would detail the intended remediation approach (TCEQ 2009). Furthermore, the identified future projects would adhere to applicable regulations regarding the use, storage, and transportation of hazardous materials and disposal of hazardous wastes.

Under the Future Without-Project Condition, if contaminated soil is encountered during soil disturbing activities within the Study Area, the activity proponents would be required to ensure that the contaminated soil would be managed and disposed of in accordance with applicable regulations. Within the Study Area, hazardous materials and wastes would continue to be used, generated, and disposed of in much the same manner as they are currently used, generated, and disposed.

4.10.3 Alternative 2: Proposed Action

4.10.3.1 Design Anticipating Potential Trinity Parkway Construction

<u>BVP Study FRM Elements</u>

Construction Impact Overview

Prior to the start of construction activities, a Contingency Action Plan reflecting the requirements of Army Regulation (AR) 200-1, *Environmental Protection and Enhancement,* and USACE Engineering Regulation (ER) 1165-2-132, *Hazardous, Toxic, and Radioactive Waste Guidance for Civil Works Projects*, would be prepared to ensure compliance with reporting and communication protocols in the event hazardous materials are encountered during the course of construction activities.

If during construction or ground disturbing activities any potential hazardous materials/contaminants or wastes are discovered, work would cease immediately pending further assessment. Furthermore, contract workers would be required to adhere to the requirements outlined in the USACE Safety and Health Requirements Manual EM 385-1-1 and AR 200-1: *Environmental Protection and Enhancement* to minimize the potential for fuel, oil, and/or lubricant spills during construction activities.

Levee Raise and Flattening

During the Phase II Environmental Site Assessment, several soil borings located near the borrow pit locations were found to contain heavy metals, perchloroethylene (PCE), and trichloroethene (TCE) at levels that exceeded the current Texas Risk Reduction Program (TRRP) Tier 1 Residential Protective Conservation Levels (PCLs) (PCE and TCE) and Texas-Specific Soil Background Concentrations (heavy metals) (USACE 2008). However, these exceedances are below ${}_{Tot}Soil_{Comb}$ TRRP Tier 1 Residential PCLs. The USACE has assessed the investigations completed to date, and no additional Phase II investigations are warranted. Potentially contaminated areas or hazardous materials could be encountered during demolition or constructed-related activities; however, a Soil Management Plan would contain a contingency plan for encountering material during construction, and material would be handled as appropriate. Any material that exceeds the TRRP Tier 1 Standard for ${}^{Tot}Soil_{Comb}$ – PCL (combined) would be considered hazardous and would be removed from the site and properly disposed of in accordance with all relevant regulations.

AT&SF Railroad Bridge Modifications

Before initiating demolition activities, the construction contractor would inspect the bridge for the presence of lead-based paint (LBP). If the inspection reveals the presence of LBP, the construction contractor would be required to submit the necessary notifications and abate the hazards in accordance with applicable federal, state, and local regulations. If contract workers discover any potentially hazardous materials or generate any regulated wastes (e.g., LBP-containing demolition debris) during construction activities, work would cease immediately pending further assessment by City of Dallas. Oversight would be provided by the City of Dallas to ensure that the LBP and associated project-generated wastes would be handled and disposed of in accordance with applicable regulations, including but not limited to Occupational Safety and Health Administration (OSHA) (29 Code of Federal Regulations [CFR] § 1926.62) and USEPA (40 CFR § 745 and 40 CFR § 261.4(b)(1)) regulations.

Based on information provided in the Environmental Data Resources (EDR) database search report, no sites with known environmental conditions are located within 500 feet of the AT&SF Railroad Bridge modifications. Phase II Environmental Site Assessment sampling conducted just upstream at the Corinth Street Bridge identified several heavy metals at levels exceeding TCEQ Tier 1 PCLs (USACE 2008). However, these exceedances are below ${}_{Tot}Soil_{Comb}$ TRRP Tier 1 Residential PCLs. Any material that exceeds the TRRP Tier 1 Standard for ${}_{Tot}Soil_{Comb}$ – PCL (combined) would be considered hazardous and would be removed from the site and properly disposed of in accordance with all relevant regulations.

BVP Study Ecosystem and Recreation Features

Construction

Given the extent of proposed Floodway excavation, there could be a chance that contaminants of concern could be encountered during demolition or constructed-related activities; however, a Soil Management Plan would contain a contingency plan for encountering material during construction, and material would be handled as appropriate. Any material that exceeds the TRRP Tier 1 Standard for ${}^{Tot}Soil_{Comb}$ – PCL (combined) would be considered hazardous and would be removed from the site and properly disposed of in accordance with all relevant regulations. In the event that disposal would be required, a landfill or treatment facility that meets the relevant state and federal regulatory standards for waste treatment and disposal would be used.

Operation

Land use within the Dallas Floodway, in the future condition with the implementation of the BVP Study features, would primarily consist of parks and recreation. For reuse purposes, the TCEQ requires soil designated for use in parks and recreation land to meet the same standards as residential use (below all Tier 1 Residential PCLs). However, consistent with prior USACE-TCEQ coordination for actions within the Floodway, soils within the Dallas Floodway must meet ${}_{Tot}Soil_{Comb}$ TRRP Tier 1 Residential PCLs for reuse. The use of soils that meet the ${}_{Tot}Soil_{Comb}$ TRRP Residential Tier 1 levels would limit the potential for human exposure to potential hazardous or toxic materials associated with previously identified contaminants within the BVP Study area during long-term operation.

The operation of the BVP Study features, once completed, would likely involve the routine use, transport, and/or storage of hazardous materials. The long-term maintenance of parks, recreational facilities, trails, and lakes, as well as the gateways, roads, and parking areas providing access to these new features, would require the use of materials such as gasoline, oil, paint, pesticides, herbicides, and others. All hazardous materials and wastes would be used and managed in accordance with federal, state, and local regulatory requirements.

IDP Improvements

Hampton Pump Station and Sump Improvements

The site identified in the database search as "31" is located approximately 400 feet from the proposed Hampton Pump Station and Sump Improvements and would not be impacted by the project. It would be unlikely that proposed ground disturbing activities associated with improvements at the Hampton Pump Station would expose workers, nearby residents, or the environment to hazardous materials/contaminants or waste.

The Hampton Pumping Plant would continue to be a user or generator of small-quantities of hazardous materials/wastes, including oils, solvents, paints, etc. as part of the routine operation and maintenance of the pumping systems within the pumping station and other associated features. These materials would be managed in accordance with applicable local, state, and federal regulations.

Charlie Pump Station and Sump Improvements

Before initiating demolition activities, the construction contractor would inspect the building for asbestos containing materials (ACM) and LBP. If the inspection would reveal the presence of ACM and/or LBP, the construction contractor would be required to submit the necessary notifications and abate the hazards in accordance with applicable federal, state, and local regulations. If contract workers would discover any potentially hazardous materials or generate any regulated wastes (e.g., ACM or LBP-containing demolition debris) during construction activities, work would cease immediately pending further assessment by City of Dallas. Any ACM would be handled and disposed of in accordance with OSHA (29 CFR § 1910.1001) and USEPA (40 CFR § 61 Subpart M) regulations. Any LBP would be handled and disposed of in accordance with applicable regulations, including but not limited to OSHA (29 CFR § 1926.62) and USEPA (40 CFR §745 and 40 CFR § 261.4(b)(1)) regulations.

The construction of the New Charlie Pump Station would be located on the West Levee, adjacent to the existing Charlie Pump Station, between Houston and Jefferson Street. Although no known contaminated sites are located within the area, the proposed construction area is located close to the boundary of the Murmur Corporation Site 3/RSR Corporation Superfund Site contamination plume. However, the portions of the Murmur Corporation/RSR Corporation Superfund Site contamination plume closest to the New Charlie Pump Station have been remediated with no further Remedial Action necessary. Remaining clean-up activities are approximately 1 mile (1.6 kilometers) to the south (USEPA 2010).

The Charlie Pump Station would be a user or generator of small quantities of hazardous materials/wastes, including oils, solvents, paints, etc. during routine operation and maintenance of the pumping systems within the pumping station and other associated features. These materials would be managed in accordance with all applicable local, state, and federal regulations.

Delta Pump Station and Sump Improvements

There are no known hazardous material sites located in the area; however, the boundary of the Murmur Corporation Site 3/RSR Corporation Superfund Site contamination plume is located just to the south of the West Levee. The Delta Pump Station is not expected to impact potential contaminated soil due to its close proximity to the Murmur Corporation site. The remaining clean-up locations of the Superfund Site are not near the Delta Pump Station.

The Delta Pump Stations would be a user or generator of small-quantities of hazardous materials/wastes, including oils, solvents, paints, etc., during routine operation and maintenance of the pumping systems within the pumping station and other associated features. These materials would be managed in accordance with all applicable local, state, and federal regulations.

Trinity-Portland Pumping Plant and Sump Improvements

There are no known hazardous material sites located in area; however, the boundary of the Murmur Corporation Site 3/RSR Corporation Superfund Site contamination plume is located just to the south of the West Levee. The New Trinity Portland Pump Station is not expected to impact potential contaminated soil due to its close proximity to the Murmur Corporation site. The remaining clean-up locations of the Superfund Site are not near the New Trinity Portland Pump Station.

The Trinity-Portland Pump Station would be a user or generator of small-quantities of hazardous materials/wastes, including oils, solvents, paints, etc. during routine operation and maintenance of the pumping systems within the pumping station and other associated features. These materials would be managed in accordance with all applicable local, state, and federal regulations.

4.10.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential impacts to hazardous materials and wastes from implementation of the proposed FRM elements, BVP Study Ecosystem and Recreation Features, and IDP improvements would be the same under both design variations, as there would be no change in these components with respect to this resource area. Therefore, the discussion of impacts presented in Section 4.10.3 also applies to the design without potential Trinity Parkway construction anticipated.

4.10.3.3 Summary

Impacts to human health and the environment associated with hazardous materials and wastes would be the same under both design variations. The Proposed Action would avoid directly disturbing any sites with known environmental conditions. The soil proposed for use as borrow material and reuse in the Floodway would be acceptable for use under ${}_{Tot}Soil_{Comb}$ TRRP Tier 1 Residential standards. Any material that exceeds the TRRP Tier 1 Standard for ${}_{Tot}Soil_{Comb}$ – PCL (combined) would be considered hazardous and would be removed from the site and properly disposed of in accordance with all relevant regulations. The USACE has assessed the investigations completed to date, and no additional Phase II investigations in the Floodway are warranted. Potentially contaminated areas or hazardous materials could be encountered during demolition or constructed-related activities; however, a Soil Management Plan would contain a contingency plan for encountering material during construction, and material would be handled as appropriate in accordance with all applicable regulations.

Before demolition activities, structures would be surveyed for ACM and LBP. Any ACM would be handled and disposed of in accordance with applicable regulations, including but not limited to OSHA (29 CFR § 1910.1001) and USEPA (40 CFR § 61 Subpart M) regulations. Any LBP would be handled and disposed of in accordance with OSHA (29 CFR § 1926.62) and USEPA (40 CFR §745 and 40 CFR § 261.4(b)(1)) regulations. All hazardous materials and wastes would be used, stored, and disposed of in accordance with all applicable local, state, and federal regulations. Therefore, implementation of Alternative 2 would result in less than significant impacts to human health and the environment associated with hazardous materials and wastes. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.10.3.4 Cumulative Impacts

<u>Design Anticipating Potential Trinity Parkway Construction</u>

The implementation of the Proposed Action would result in less than significant impacts to human health and the environment in terms of potential exposure to hazardous materials and wastes. Agencies and contractors implementing these identified projects would adhere to applicable regulations regarding the use, storage, and transportation of hazardous materials and disposal of hazardous wastes, resulting in limited potential for exposure and the limited possibility of hazardous material and waste releases into the environment.

Per FHWA policies, any sites with known environmental conditions within the right-of-way of the Trinity Parkway would be acquired by the North Texas Transit Authority (NTTA) and secured in accordance with applicable state and federal laws to minimize the risk of a contaminant release to the environment.

An increase in trucking of hazardous freight along the Floodway would occur with implementation of the Trinity Parkway. The transportation of hazardous materials on the Trinity Parkway would be controlled by ordinances adopted by the City of Dallas and TxDOT. Any accidental hazardous release would be addressed in accordance with applicable federal, state, and local regulations (FHWA 2014). Therefore, implementation of Alternative 2 in combination with the past, present, and reasonably foreseeable projects would result in less than significant cumulative impacts to human health and the environment associated with hazardous materials and waste.

Design Without Potential Trinity Parkway Construction Anticipated

Without construction of the Trinity Parkway, any potential hazardous materials investigation and remediation within the footprint of one of the identified projects and/or the Dallas Floodway Project would be the responsibility of others, whereas under the design anticipating Trinity Parkway construction some hazardous material investigation and potential remediation would occur as part of the potential Trinity Parkway project. Assuming project proponents adhere to applicable regulations regarding the use, storage, transportation, and disposal of hazardous materials and wastes, less than significant cumulative impacts to human health and the environment associated with exposure to hazardous materials and wastes would occur with the implementation of the Proposed Action and identified cumulative projects. Therefore, implementation of the design without Trinity Parkway construction anticipated in combination with the cumulative projects would result in less than significant cumulative impacts to human health and the environment associated with hazardous materials and wastes.

4.11 SAFETY

4.11.1 Approach to Analysis

The CDC and the TREIS ROD both set specific parameters for the management of floodwaters within the Floodway. These parameters are limited to flood control within the Floodway and do not extend to the interior drainage area. For the purpose of this analysis, any activity with the potential to impact the flow of flood waters within the Floodway is considered to be an impact, either adverse or beneficial, to public safety. If that activity also exceeds the TREIS ROD criteria and/or the CDC review criteria, the impact is considered to be both significant and adverse. For additional information about the TREIS ROD criteria and the CDC process, refer to Section 3.3.

The USACE Risk Assessment includes thresholds for societally tolerable risk. For additional information regarding the development and establishment of these thresholds, refer to the Risk Assessment in Appendix C of the USACE Feasibility Report (USACE 2014).

4.11.2 Alternative 1: Future Without-Project Condition

4.11.2.1 Interior Drainage System

The Future Without-Project Condition includes the completion of two substantial interior drainage projects: the Baker Pumping Plant Improvements and the Able Pumping Plant improvements. Previously, the Baker Pumping Plant drainage area included 104 structures subject to flooding during a 100-year storm event; with the completion of the Baker Pumping Plant improvements (expected 2014/2015), the number of potentially affected structures would be reduced to 4. Similarly, the Able Pumping Plant drainage area includes over 200 properties at flood risk. The proposed Able drainage improvements would substantially decrease the number of at-risk buildings in the Able Pumping Plant drainage area.

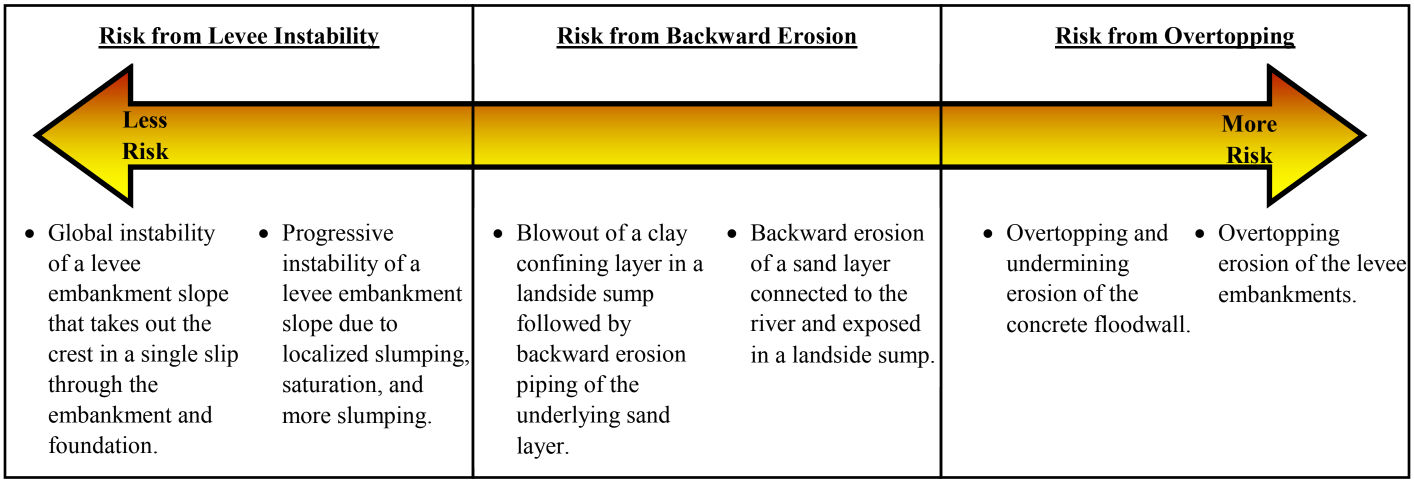


Figure 4.11-1 Level of Risk Posed by Various Potential Levee Failure Scenarios

Although improvements to the Baker and Able pumping plants would reduce the number of potentially affected structures within the ROI, there would be a potential increase in the risk to persons and property from stormwater flooding within the ROI under the Future Without-Project Condition. The reason for this would be two-fold. First, the Future Without-Project Condition would not include improvements to other components of the East West Levee Interior Drainage Systems (EWLIDS), and thus the conditions within those drainage basins would continue to deteriorate. Second, the ROI includes 10,237 acres of undeveloped lands. As that land is developed, the stormwater risk would increase with increased runoff and with continued deterioration of stormwater management facilities. If infill development occurs within the potentially affected flood zones over the next several decades, the risk for loss of life and damage from an SPF event or 100-year flood event would increase.

4.11.2.2 Riverine Flood Risk

The population of Texas is growing at twice the national rate (U.S. Census Bureau 2010), and the City of Dallas is one of the country's fastest growing cities (U.S. Census Bureau 2008, 2010). Over the next 50 years, there is a chance of major flooding events occurring in Dallas. At the current levels of build out in the City of Dallas, based on 2008 geographic information system data, nearly 15,000 properties would potentially be affected by flooding associated with the current (2007) SPF event.

While the City of Dallas would continue to perform Operation and Maintenance (O&M) actions on the Dallas Floodway Levee System, current O&M actions would be insufficient to keep up with changes in watershed hydrology, floodplain encroachments, and land use, which would change the potential magnitude of flood events in 2065. Thus, under the Future Without-Project Condition, the number of structures potentially subject to river flooding from the SPF event would increase.

The USACE Risk Assessment concluded that an SPF (or greater) flood that would overtop the East Levee embankment, West Levee embankment, and the floodwall on the East Levee would pose unacceptable risk using Societal Tolerable Risk Guidelines for life safety from USACE ER 1110-2-1156. Risks for all other failure modes considered (i.e., failure related to levee instability or backward erosion) would likely be tolerable. The Risk Assessment notes that while models predict that risk from failure due to backward erosion may be tolerable, that prediction may be modified as the erosion potential of levee soils is better understood. The Risk Assessment ranked different potential levee failures in terms of risk mode as shown in Figure 4.11-1 (USACE 2012).

The Risk Assessment determined that the estimated probabilities of the levee failure scenarios are low. The levee soils' resistance to erosion and the unlikelihood of frequent or long-lasting flooding in the SPF magnitude, lessens the likelihood of breach associated with overtopping; the long seepage path and lack of continuous, large-grained sandy layers under the levees likely precludes failure associated with backward erosion; and failure associated with levee instability requires the simultaneous occurrence of multiple, unlikely levee stress and slide events (USACE 2012). As analyzed in the Risk Assessment, the probability of an event is only part of risk. The Risk Assessment determined that life safety risks for overtopping under the existing levee conditions of the East and West Levee systems exceed Tolerable Risk Guidelines (USACE 2012).

Under the Future Without-Project Condition, several planned or proposed projects would strengthen the overall regional linkages within the Study Area by implementing designs to alleviate traffic congestion and improve access and linkages across the ROI. Implementation of these transportation-centric future projects would facilitate shorter response times by some emergency services providers to a major flood event, thereby beneficially impacting this aspect of their ability to respond to the affected area(s).

4.11.2.3 Emergency Response

Emergency response would be challenged by a major flood event, even with the regular updates to applicable emergency response plans and maintenance of existing communications protocols. Six of the 11 Dallas Fire-Rescue stations in the Study Area are located within the predicted extent of the current (2007) SPF event, thus the ability of the City of Dallas to provide rescue services or respond to medical emergencies would be reduced significantly. Similarly, the City of Dallas' medical district is within the predicted 2007 SPF inundation area, which could result in three of the four hospitals in the Study Area being inaccessible by ground vehicles during such an event. Lastly, of the 63 police beats in the Study Area, 39 would be directly impacted by an SPF event. This stress to all aspects of emergency response indicates that the Future Without-Project Condition would result in an adverse impact on the public safety of the City of Dallas. The City of Dallas would continue to implement the flood warning system described in their Emergency Action Plan for the Trinity River Federal Levee System.

4.11.3 Alternative 2: Proposed Action

4.11.3.1 Design Anticipating Potential Trinity Parkway Construction

As discussed in Section 4.3 the results of flood elevation and conveyance modeling showed that the comprehensive plans for the BVP with the Trinity Parkway would not meet the TREIS ROD criteria in terms of valley storage and water surface rise; however, the potential negative impacts are considered to be insignificant. While additional design refinement efforts may be able to reduce the valley storage losses noted and/or reduce the water surface rises for the flood event within the Dallas Floodway on the Trinity River Mainstem, meeting the TREIS ROD criteria on every point would likely not be achievable for such a large and complex combination of projects.

BVP Study FRM Elements

For all BVP Study FRM elements, the primary safety concern during the construction phase of project implementation would be related to the personnel and equipment working on construction projects within the Floodway. Flash flooding occurs within the City of Dallas, and personnel within the Floodway would be at risk of injury if flash flooding were to occur during construction. Similarly, the addition of large equipment, and disruption of the current system could impact river flood flow during the construction period. For example, during the AT&SF Railroad Bridge modification element, positioning additional equipment and material adjacent to the wooden trestle could exacerbate the blocking of river water at flood stage.

To minimize these potential construction safety risks, the construction contractor would closely monitor weather reports not only at the construction site itself, but also throughout the Upper Trinity River watershed. If significant rain events are predicted within the watershed, the contractor would be required to remove all equipment from the Floodway to the developed side of the levee to the greatest extent practicable. Construction would not occur during rain events, and construction personnel would be required to maintain frequent communication with the City of Dallas Flood Control Division to assess the safety of operating within the Floodway.

Operationally, implementation of Alternative 2 would improve the FRM elements within the Study Area, thereby reducing the potential flood-related safety impacts to persons within the Study Area. The following element-based discussion focuses on the operational impacts to public safety.

Levee Raise Modification and Flattening

The completion of the levee modifications would provide the developed sides of the levees with FRM for a 277,000 cfs river flood event. In addition, the flattening of the levees would improve the ease of maintenance; mowing and other maintenance equipment would be able to operate more safely on a shallower levee slope. The shallower levee slope would also reduce stress on the river-side levee integrity, and thus reduce the risks of levee slides and slumps.

AT&SF Railroad Bridge Modifications

The AT&SF Railroad Bridge modifications would allow for river floodwaters to leave the Floodway more rapidly than they leave now. This change would improve the discharge and thus flood management capability of the Floodway overall. The ability of flood waters to leave the ROI more rapidly, however, would not meet the requirements of the TREIS ROD criteria to maintain the pre-existing SPF flood elevation within the Study Area, and may pose a risk to downstream areas of the Trinity River that are unable to handle the increased rate of conveyance. When implemented in concert with the other parts of the Proposed Action, however, the overall flood conveyance would be maintained as other project elements and features act to slow flood water conveyance.

The AT&SF Railroad Bridge modifications would also eliminate a major point of "capture" within the Floodway that previously resulted in an accumulation of large debris being trapped by the wood trestle and exacerbated the effect of constraining flood flow. Thus, removal of the wood trestle would not only improve flow based on the trestle constriction alone, but also on this potential accumulation impact of Floodway debris. In addition, the removal of the embankments would enable flood waters to leave the ROI with relatively unobstructed flow in this area.

Nonstructural Improvements

Nonstructural improvements would focus on improved prediction and communication with the public in the event of a flood. Mobilization rate improvement measures would make the City of Dallas more responsive to the needs of an at-risk population. With improved transportation networks, at-risk members of the public would be able to evacuate a flood zone more efficiently, and the increased use of public transportation would allow the improvements to reach a broader segment of the population. Those without cars would be able to evacuate via the increased availability of public transportation options. Expanding the network of shelters and identified safe zones would also improve public safety by establishing a series of centralized areas for providing care and support to evacuated individuals.

BVP Study Ecosystem and Recreation Features

For all BVP Study Ecosystem and Recreation features, as with the BVP Study FRM elements, the primary construction safety concern would be the personnel and equipment working within the Floodway. To minimize these potential construction safety risks, the construction contractor would closely monitor weather reports throughout the Upper Trinity River watershed. If significant rain events are predicted within the watershed, the contractor(s) would be required remove all equipment from the Floodway to the developed sides of the levees to the greatest extent practicable. Construction would not occur during rain events, and construction personnel are expected to have frequent communication with the City of Dallas Flood Control Division to assess the safety of operating within the Floodway.

The following feature-based discussion focuses on the operational impacts to public safety. Recreational amenities would be closed when there is risk of flooding above bankfull level within the Floodway. Under Alternative 2, a total of 13 motorized vehicle access points to the Floodway are planned; 10 of these access points are planned as restricted for emergency access and use. These access points would allow for rapid response to provide emergency services throughout the Floodway, and help to address safety for all proposed features.

Lakes

The lakes created within the Floodway would constitute an attractive recreational feature likely to increase use of the Floodway by area residents and tourists. As such, the need for emergency services within the Floodway would also increase.

The lakes also represent an increase in valley storage within the Floodway, thus allowing larger floods to be contained within the Floodway without overtopping. There is some concern as to how close the three proposed lakes are to the levees. The USACE concluded in a risk assessment that placement of the proposed lakes detailed in the BVP Study will not impact the levee system because the excavation will not advance deep enough to penetrate the basal sand lenses that could cause seepage issues. The clay liner of the lakes would also prevent lake water from permeating the sands that are the source of under-seepage potential.

River Modification

The proposed river modifications within the Floodway would constitute an attractive recreational feature likely to increase use of the Floodway by area residents and tourists. As such, the need for emergency services within the Floodway would also increase. The river modifications also represent an increase in roughness of the river, that is, river bottom components that have the potential to slow or otherwise interrupt water movement. The proposed meanders and riffle/pond flows would slow channel conveyance through the Floodway.

The river modification would be designed to minimize the potential for levee underseepage. The existing cutoff walls the city has constructed on the East Levee currently prevent underseepage through the East Levee. These cutoff walls would be extended downstream to approximately Continental Avenue to mitigate for the increase in risk due to the river modification.

Wetlands

The proposed wetlands and associated amenities within the Floodway would constitute an attractive recreational feature likely to increase use of the Floodway by area residents and tourists. As such, the need for emergency services within the Floodway would also increase.

The new wetlands would also represent an increase roughness of the river, as meanders and riffle/pond flows would slow channel conveyance through the Floodway. At the same time, the proposed wetlands may increase valley storage within the Floodway, thus allowing larger floods to be contained within the Floodway without overtopping.

Increasing habitat within the Floodway may attract higher intensity usage by birds. Bird flights naturally occur along the river corridor at altitudes of less than a few hundred feet. Aircraft on approach and takeoff to and from Love Field do not cross the Floodway at such low altitudes, so the localized movement of birds up and down the river would not contribute to an increased risk of bird strikes. Furthermore, while the wetlands within the Floodway may provide habitat for increased usage by birds, the majority of the high quality habitat would be created at the eastern (southern) end of the Study Area. This area is nearly 5 miles from Dallas Love Field, and thus the likelihood of strike risk increasing from the habitat would be low. At this distance from the airfield, most planes are flying at more than a 10,000-foot elevation, which is higher than the majority of wetland birds fly.

Athletic Facilities

The proposed athletic fields within the Floodway would constitute an attractive recreational feature likely to increase use of the Floodway by area residents and tourists. As such, the need for emergency services within the Floodway would also increase.

General Features

The general features of the BVP Study include substantial infrastructure devoted to the safety of amenity users and deterrence of criminal activity. Alarm, video and lighting systems would all be incorporated in park design. All parking areas would include video monitoring, lighting, and emergency call boxes. Video cameras would also be located in other designated strategic areas. Emergency call boxes would be an integral part of providing emergency assistance to park patrons and an overall sense of safety and security. The call boxes would be installed in all access points, parking lots, and major park features. Call boxes along the primary and secondary trails would be spaced to industry standards.

Signage would be an important component in security design. Effective signage supports surveillance, detection, assessment and other security functions by creating a psychological deterrent and potentially deterring casual wrongdoers. Security and informational signage would be installed at all access points, parking lots and other strategic locations.

The Dallas Police Department would allocate a full-time security force, or a separate Trinity Lakes Area security force could be established to patrol the park. Access by appropriately equipped emergency vehicles, police, Emergency Medical Services, or fire, to service the park, would be facilitated by removable bollards installed at all managed access points. This access management strategy would allow emergency vehicles to access the park while denying access to private motorists. All levee access ramps would be able to accommodate the size and weight of Emergency Medical Service vehicles and police cars; fire trucks would use public motorized access points. Park roads and main paved trails would allow for emergency vehicle access, circulation, and egress.

Interior Drainage Outfall Modifications

The maintenance of the interior drainage outfalls would continue to be vital to prevent accumulation of debris, siltation, and/or erosion in and around outfalls. As discussed earlier, siltation can decrease the ability of the Floodway to store floodwaters, while erosion threatens levee stability. The city would be required to conduct on-going operation and maintenance to prevent future debris accumulation, erosions, and siltation.

IDP Improvements

Construction of IDP improvements would occur on the developed side of the levees. All IDP improvements proposed for locations adjacent to existing pump stations would move forward without interrupting the operation of the existing pump stations, and thus construction would not interfere with the functioning of existing public safety elements. The primary safety risk associated with construction would be general construction site safety of the workers, which would be required by contract agreements to be managed in accordance with OSHA regulations and through implementation of industry standard best practices, such as conduct of safety meetings and use of appropriate safety equipment on site.

During the project construction, the construction contractor would be responsible for the preparation and submittal of a Flood EAP to the USACE and Trinity River Flood Control District for their approval. The Flood EAP would be implemented in the event of imminent flooding during construction and would address actions to be implemented during above normal river stages for the duration of the construction activities. Continuity of FRM that at a minimum matches current protection levels would be maintained throughout the IDP construction period. This may be accomplished through phased construction/demolition, use of temporary additional control measures, or other measures deemed suitable by the City of Dallas and the USACE.

Implementation of Alternative 2 would remedy any remaining deficiencies related to interior drainage features identified in the 2007 USACE inspection report. Furthermore, proposed improvements would be implemented in accordance with Technical Letter No. 1110-2-571 by increasing grass growth for erosion control, removing any large trees that might become damaged by construction, and selecting species to moderate the erosive potential of water.

Interior drainage improvements would substantially reduce the number of structures potentially affected by a 100-year, 24 hour storm event. Table 4.11-1 compares the number of potentially affected and potentially flooded structures under current conditions with those predicted under Alternative 2.

Table 4.11-1. Potentially Affected Structures Under Existing Conditions and Alternative 2 (Proposed Action) for the 100-year, 24-hour Storm Event[a]

Drainage Area	*Existing Conditions*		*Predicted Conditions*	
	Potentially Affected Structures	*Potentially Flooded Structures*	*Potentially Affected Structures*	*Potentially Flooded Structures*
Hampton[b]	493	102	unknown	53
Eagle Ford	34	0	10	0
Delta	141	14	51	7
Charlie	47	6	40	6
Total	**222[c]**	**122**	**101**	**66**

Notes: [a] Table only displays those drainages with improvements proposed under Alternative 2.

[b] Predicted inundation extents for the Alternative 2 condition are not available for the Hampton Drainage area at this time. The Potentially Flooded Structures are estimated as those with a finished floor elevation lower than the proposed new flood elevation within the current inundation extents. However, it is likely that fewer than 53 structures would flood, as future flood events would not have as great an extent as that used here.

[c] Total for affected structures does not include the Hampton Drainage Area, as the future conditions are not known.

Sources: City of Dallas 2006, 2009.

As shown in Table 4.11-1, implementation of Alternative 2 would result in a 45% reduction of potentially affected structures in the West Levee Interior Drainage System, and a 54% reduction in potentially flooded structures in the East Levee Interior Drainage System. As used in the table, “Drainage Area” refers to the area drained by each pumping plant. The Hampton Drainage Area includes the Records Crossing and Nobles Branch sumps; the Eagle Ford Drainage Area includes the Eagle Ford Sump; the Delta Drainage Area includes the Trinity Portland, Westmoreland-Hampton, and Frances Street sumps; and the Charlie Drainage Area includes the Charlie and Corinth Street sumps. For more detail regarding pumping plant drainage, refer to Section 3.13.

Risk Assessment

The 2012 USACE Risk Assessment was updated in the “Study of the Impact on Risk of the Proposed Balanced Vision Plan and Trinity Parkway; Trinity River Corridor, Dallas Floodway” (refer to Appendix C of the 2014 USACE Feasibility Report). This analysis considered the risk to life safety as it would exist with the BVP Study features constructed. Although life safety and economic risks would be reduced with the BVP Study features, residual risk would remain once construction is complete. In the unlikely event that the East and West Levees were to overtop or experience a breach, the areas behind the levees would experience significant economic damages to property and the potential for loss of life. Total risk is reduced with the BVP features but not below the recommended tolerable risk guidelines.

4.11.3.2 Design Without Potential Trinity Parkway Construction Anticipated

<u>BVP Study Ecosystem and Recreation Features</u>

The design variations differ primarily in the alignment of the BVP Study Ecosystem and Recreation features. The design without potential Trinity Parkway construction anticipated would result in a difference in the number of bicycle and pedestrian paths, athletic fields, and meadows, and the amount of landscaping. The change in BVP Study features would result in nearly identical impacts between the two design variations. Therefore, the discussion of impacts presented in Section 4.11.3 is also valid for the design without potential Trinity Parkway construction anticipated.

4.11.3.3 Summary

Under the Proposed Action, construction would not occur during rain events, and construction personnel would be required to maintain frequent communication with the City of Dallas Flood Control Division to assess the safety of operating within the Floodway. There would be a related increase in access points and safety-related services under Alternative 2 within the Floodway. The proposed wetland areas would not result in an increase in bird/wildlife aircraft strike hazard potential to aircraft flying in and out of Dallas Love Field. Operationally, implementation of Alternative 2 would improve FRM elements and IDP improvements within the Study Area, thereby reducing the potential flood-related safety impacts to persons within the Study Area. Therefore, implementation of Alternative 2 would result in beneficial impacts to safety. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.11.3.4 Cumulative Impacts

The Future Without-Project Condition includes the completion of two substantial interior drainage projects: the Baker Pumping Plant Improvements and the Able Pumping Plant improvements, which combined reduce potentially flooded structures from 235 to 4. Combined with the interior drainage improvements proposed under the Proposed Action, the total potentially flooded structures in the EWLIDS would decrease by 78%.

Despite these improvements, the risk to persons and property from stormwater flooding within the ROI would potential increase under the Proposed Action from the potential development of vacant lands noted in Section 3.1.2.5. As infill development occurs within the potentially affected flood zones over the next several decades, the risk for loss of life and damage from an SPF event or 100-year flood event would increase; however, development restrictions would be employed to preclude construction in the potential inundation area to minimize risk.

Emergency response would be challenged by a major flood event, even with the regular updates to applicable emergency response plans, maintenance of existing communications protocols, and implementation of Alternative 2 (the Proposed Action). However, the conditions would be improved such that the challenges would be less substantial than under existing conditions. The six Dallas Fire-Rescue stations in the ROI located within the predicted extent of the 2007 SPF event would no longer be threatened by such a flood and would be able to better assist in emergency response. Similarly, the City of Dallas' medical district is located within the predicted 2007 SPF inundation area, and would have reduced flood risk with the implementation of Alternative 2. Lastly, as with Dallas Fire-Rescue stations, the 39 police beats within the ROI that are located within the current predicted inundation area of an SPF event would have reduced flood risk and remain accessible to participate in emergency response.

Several planned and proposed projects would strengthen the overall regional linkages within Study Area by implementing designs to alleviate traffic congestion and improve access and linkages across the ROI. Implementation of these transportation-centric future projects would facilitate quicker response times by emergency services within and outside of the ROI to a major flood event, thereby increasing their ability to respond to the affected area(s). The Trinity Parkway in particular would contribute to the overall benefit to public safety in the ROI. The anticipated improvement results from reduction in peak, weekday, weekend, and holiday local and non-local auto traffic on existing area roads, as well as facilitation of a reduction in response time for police, fire protection, and medical services. NTTA policies permit the toll-free use of toll lanes by emergency vehicles in emergencies (FHWA 2014).

Implementation of either design variation of the Proposed Action (Alternative 2) contributes to a beneficial impact to public safety that would be supported by improvements to the EWLIDS and the transportation network proposed by other projects. By decreasing the inundation risk from both the SPF and the 100-year, 24-hour storm event, while also improving vehicular connectivity, the ROI would be significantly benefitted. Therefore, implementation of Alternative 2 in combination with the past, present, and reasonably foreseeable projects would result in beneficial cumulative impacts to safety.

4.12 TRANSPORTATION

4.12.1 Approach to Analysis

The following process was used to analyze potential impacts to the transportation network:

- Proposed construction activities and land uses were evaluated to identify their traffic generation characteristics (i.e., construction traffic, traffic resulting from the operation of the various project components, or both);
- The number and type of trips associated with each project element was estimated using published traffic generation rates, or reasonably conservative estimates where published rates were not available;
- Construction and operation traffic was assigned to the projected future transportation network in accordance with likely origins, destinations, and travel routes;

- The effect of project traffic on Level of Service (LOS) on freeways and Trinity Parkway was identified. For the purpose of this analysis, a substantial traffic effect would occur if traffic from the Proposed Action would cause LOS ratings to decrease to D, E, or F;
- Recommendations for managing weekend operation traffic on internal streets were identified; and
- SCMs were identified to avoid, minimize or mitigate project traffic effects.

The following designations were used to describe the level of project impacts:

- *Potentially significant impact*: A potentially significant effect would occur if traffic from the Proposed Action causes LOS rating to drop to D, E or F. For segments already characterized by LOS F under baseline conditions, a significant effect would occur if the project increases traffic by 2% or more, as compared to the baseline.
- *Less than significant impact*: A less than significant effect would occur if the Proposed Action appreciably increases traffic volumes, but does not cause a decline in LOS rating to D, E, or F. Alternatively, for segments experiencing LOS F conditions, a less than significant impact would occur if the Proposed Action increases traffic by less than 2%, as compared to the baseline.
- *No impact*: When the Proposed Action does not add any recurring daily traffic to a given street or freeway, no impact would occur.

4.12.2 Alternative 1: Future Without-Project Condition

Because *Mobility 2035* has examined long-term transportation needs and improvements, this EIS uses those projections; however, the projections are for the year 2035, not 2065 as used for most other resource areas. Table 4.12-1 presents year 2013 and 2035 baseline (i.e., Future Without-Project Condition) volumes on major freeway and tollway facilities in the Study Area. As shown in Table 4.12-1, all freeway and tollway segments in the ROI would experience congested LOS E or F conditions in the Future Without-Project Condition. The Future Without-Project Condition would improve transit and non-motorized accessibility through the construction of various passenger rail and pedestrian trail improvements (refer to Section 2.7).

Table 4.12-1. Comparison of 2013 Freeway Traffic Volumes and LOS to Future Without-Project Condition (Year 2035)

Roadways	*2013 ADT*	*2013 LOS*	*2035 ADT*[1]	*2035 LOS*
IH-35E				
North of SH-183	139,000	D-F	173,900	D-F
SH-183 to Dallas North Tollway	303,000	F	316,700	F
Dallas North Tollway to IH-30	319,000	D-F	337,300	D-F
South of IH-30	234,000	F	314,900	F
IH-30				
West of IH-35E	165,000	F	217,400	DE
East of IH-35E	249,000	F	225,500	D-F
East of IH-45	250,000	F	272,600	F
SH-183				
West of IH-35E	194,000	D-F	319,400	F
US-75				
North of Spur 366	279,000	F	310,500	F
Trinity Parkway				
SH-183 to Spur 366	Not yet built.		126,700	A-E
Spur 366 to IH-45			121,800	D-F

Notes: [1] Baseline condition (refer to Section 3.12.2). ADT = average daily traffic.
Source: FHWA 2014.

Based on a review of data presented in Table 4.12-2, and considering the past, present, and reasonably foreseeable future projects described in Section 2.7, all 11 bridges with low beam elevations below the current SPF elevation would continue to have their low beam elevation below the SPF elevation. Public access to the Floodway would remain limited, while maintenance crew access would remain the same. Table 4.12-2 summarizes the anticipated impacts to transportation features under the Future Without-Project Condition.

Table 4.12-2. Summary of Anticipated Impacts to Transportation Features within the ROI under the Future Without-Project Condition

Features	*Existing Conditions*	*Change under the Future Without-Project Condition*
Vehicular Traffic	Substantial congestion on major freeway facilities	Increased traffic volumes due to projected regional growth
Public Transportation	Local and regional access with numerous bus stops and rail stations	Enhanced transit accessibility
Pedestrian and Bicycle Paths	Numerous paths totaling hundreds of miles	Enhanced pedestrian and bicycle accessibility
Vehicular Bridges with Low Beam Elevations Below SPF Elevation	Eleven	No change
Maintenance Access	Via levee top and levee toe roads	No change
Floodway Parking	One parking lot (Crow Lake Park)	One additional parking lot

As noted in Section 2.7, reasonably foreseeable future improvement projects are proposed at the Baker Pumping Plant and Able Pumping Plant. These improvements are expected to reduce the extent of the 100-year flood inundation area, and therefore the number of roadways subject to flooding. However, for roadways that continue to be located within the inundation area, the volume of traffic on these facilities would increase due to projected regional population growth. Under existing conditions, over 1.13 million vehicle trips throughout the City of Dallas would have been affected during a significant stormwater flood event. Population growth projections for the City of Dallas Metropolitan Area by the NCTCOG indicate a population increase of 45% from 2010 to 2035 (NCTCOG 2013), and population growth is expected to increase demand on freeways, surface streets, and transit facilities and services. Based on the freeway average daily traffic (ADT) change from 2013 to 2035, it is estimated that an increase of 9% in ADT would be possible for roads subject to flooding. This would increase the potential affected vehicle trips from a 100-year, 24-hour stormwater flood event from 1.13 million to 1.24 million. As presented in Table 4.12-3, the majority of roads currently subject to stormwater flooding would continue to be subject to stormwater flooding.

Table 4.12-3. Summary of Anticipated Impacts to Major Roads in the East and West Levee Interior Drainage Systems under the Future Without-Project Condition

Basin	*Existing Conditions*	*Change under the Future Without-Project Condition*
Hampton	45 roads subject to stormwater flooding	No change
Baker[1]	38 roads subject to stormwater flooding	Improvement
Able [2]	34 roads subject to stormwater flooding	Improvement
Eagle Ford	14 roads subject to stormwater flooding	No change
Delta	30 roads subject to stormwater flooding	No change
Pavaho	40 roads subject to stormwater flooding	No change
Charlie	21 roads subject to stormwater flooding	No change

Notes: [1] As described in Section 2.7, the City of Dallas and the USACE are planning to implement improvements to the Baker Pumping Plant.
[2] As described in Section 2.7, the City of Dallas and the USACE are planning to implement improvements to the Able Pumping Plant.

Under the Future Without-Project Condition, existing traffic volumes on major freeway facilities would increase by the year 2035, and flood events would continue to have the potential to affect local and regional transportation, resulting in short- to mid-term negative impacts to transportation. Public transit, pedestrian and bicycle accessibility, and Floodway parking would improve under the Future Without-Project Condition.

4.12.3 Alternative 2: Proposed Action

4.12.3.1 Design Anticipating Potential Trinity Parkway Construction

BVP Study FRM Elements

Under the Proposed Action, the FRM elements are not expected to result in a substantial and recurring increase in operational traffic. Although operation of the improvements would be expected to require on-going maintenance, such as vegetation removal, minor repairs, and related activities, such activities are not expected to result in a regular, daily increase in traffic. Accordingly, the primary traffic impact associated with the FRM would be from construction activities.

Construction

Construction of the FRM elements would involve the use of various types of heavy equipment and machinery, including excavators, bulldozers, compactors, cranes, trucks, and backhoes. Accordingly, delivery of heavy equipment and materials would not result in a regular daily traffic increase within the ROI. However, construction activities would involve trips by dump trucks (to transport excess fill material) and by construction workers (to operate earthmoving equipment). Because the borrow pits are located within the Floodway, the majority of fill material haul trips to and from the levees are expected to be confined to the Floodway, and would not traverse the street network. However, it may be necessary in some instances to transport fill material via public streets.

The levee raise component of the FRM elements would involve the excavation of approximately 620,000 cubic yards of fill material during a single calendar year (i.e., 2015). Because of the number of trucks that would be needed to transport excavated material within a single construction year, this phase of the FRM elements would have the highest construction-related traffic generation. The number of front-end loaders, and the number of dump trucks required to serve each loader, was estimated using a process developed by faculty at the University of Maryland (2003). Inputs to the process include the loader quantity of excavation, bucket capacity, dump truck capacity, and the haul time for trips between the construction site and disposal areas. The number of trips per truck was estimated based on the following assumptions:

- One one-way morning trip from the point of origin to the construction site in the Floodway;
- Two round trips between the construction site and the fill material disposal area;
- One one-way trip from the construction site to the fill material disposal area; and
- One one-way afternoon trip from the fill material disposal area to the point of origin.

Based on the preceding discussion, each truck was assumed to make a total of seven trips per day. The total number of employee and dump truck trips is presented in Table 4.12-4.

Table 4.12-4. BVP Study FRM Construction Traffic Generation

Traffic Generator	*Number of Vehicles*	*Weekdays*		
		Daily Trip Rate	*Passenger Car Equivalence* [1]	*Daily Passenger Car Equivalent Trips*
Dump Trucks [2]	200 trucks	7 / truck	1.5	2,100
Construction Workers [3]	25 workers	2 / worker	1.0	50
Total Traffic Generation				**2,150**

Notes: [1] This factor was applied to trucks and other heavy vehicles to reflect their disproportionate effect on capacity due to their relatively large size and sluggish performance (Transportation Research Board [TRB] 2010).
[2] Estimated based on loader and dump truck capacity and operations (University of Maryland 2003).
[3] Estimated based on the number of construction equipment required for each construction activity.

The construction-related traffic associated with the FRM elements would be temporary and localized. The total volume presented in Table 4.12-4 is conservative, because it includes all dump truck trips, including those that would operate exclusively within the Floodway. Even if all dump truck and employee trips associated with the FRM elements were to use the roadway network, the construction traffic generation would be lower than that of the BVP Study Ecosystem and Recreation features (refer to Table 4.12-5 and the accompanying discussion on the following pages). With implementation of SCMs (refer to Chapter 7), the BVP Study Ecosystem and Recreation features would not result in any significant traffic impact during construction. Because the FRM elements would involve a lower traffic generation and would be subject to the same SCMs, this project component would likewise not result in any significant traffic impact during construction.

Operation

The FRM elements would not result in a daily increase in traffic within the ROI. As discussed above in the introductory paragraph of this section, operation traffic would be limited to routine and infrequent maintenance activities, such as vegetation removal, minor repairs, and related activities, consistent with on-going maintenance activities. Therefore, no traffic-related impact would occur. Implementation of the FRM elements would reduce SPF elevations at all active road and rail crossings of the Floodway, and would therefore result in a beneficial impact with respect to local and regional access during major storm events.

<u>BVP Study Ecosystem and Recreation Features</u>

This portion of the design anticipating potential Trinity Parkway construction would involve both construction and operation related traffic. Furthermore, when compared to other elements of this design variation, the BVP Study Ecosystem and Recreation features would have a substantially higher level of construction-related traffic generation.

Construction

The BVP Study Ecosystem and Recreation features would involve the construction of numerous improvements (i.e., lakes, wetlands, trails, parking lots, internal streets, athletic fields, and other components) over the course of several years. The most intensive improvements, in terms of the number of construction workers and the number of dump trucks, would be the lake construction, which would occur over a 4-year period (i.e., 2022-2026), with the most intensive activity projected for the year 2022. This portion of the design anticipating potential Trinity Parkway construction would require extensive excavation and disposal of excess fill material, resulting in a large number of dump truck trips and employee trips. However, as noted in Sections 2.2.1.1, *Levee Height Modification*, and 2.3, *Anticipated*

Project Implementation Timeline, the lakes[5] would be partially excavated before this phase of project implementation by the FRM elements and by the potential Trinity Parkway project.

Construction traffic for the BVP Study Ecosystem and Recreation features was estimated using the methods described above (i.e., the number of front-end loaders and the number of dump trucks per loader was estimated using procedures from the University of Maryland [2003]). The key difference between the FRM elements and the BVP Study Ecosystem and Recreation features is the estimate of the net excavation quantity. For the BVP Study Ecosystem and Recreation features, the net excavation quantity accounted for the preceding excavation associated with the FRM elements and the potential Trinity Parkway, as borrow pit locations for both construction activities would overlap portions of the proposed lakes[6]. The traffic generation associated with lake construction is presented in Table 4.12-5.

Table 4.12-5. BVP Study Ecosystem and Recreation Construction Traffic Generation, Design Anticipating Potential Trinity Parkway Construction

Traffic Generator	*Number of Vehicles*	*Weekdays*		
		Daily Trip Rate	*Passenger Car Equivalence* [1]	*Daily Passenger Car Equivalent Trips*
Dump Trucks [2]	400 trucks	7 / truck	1.5	4,200
Construction Workers [3]	320 workers	2 / worker	1.0	640
Total Traffic Generation				**4,840**

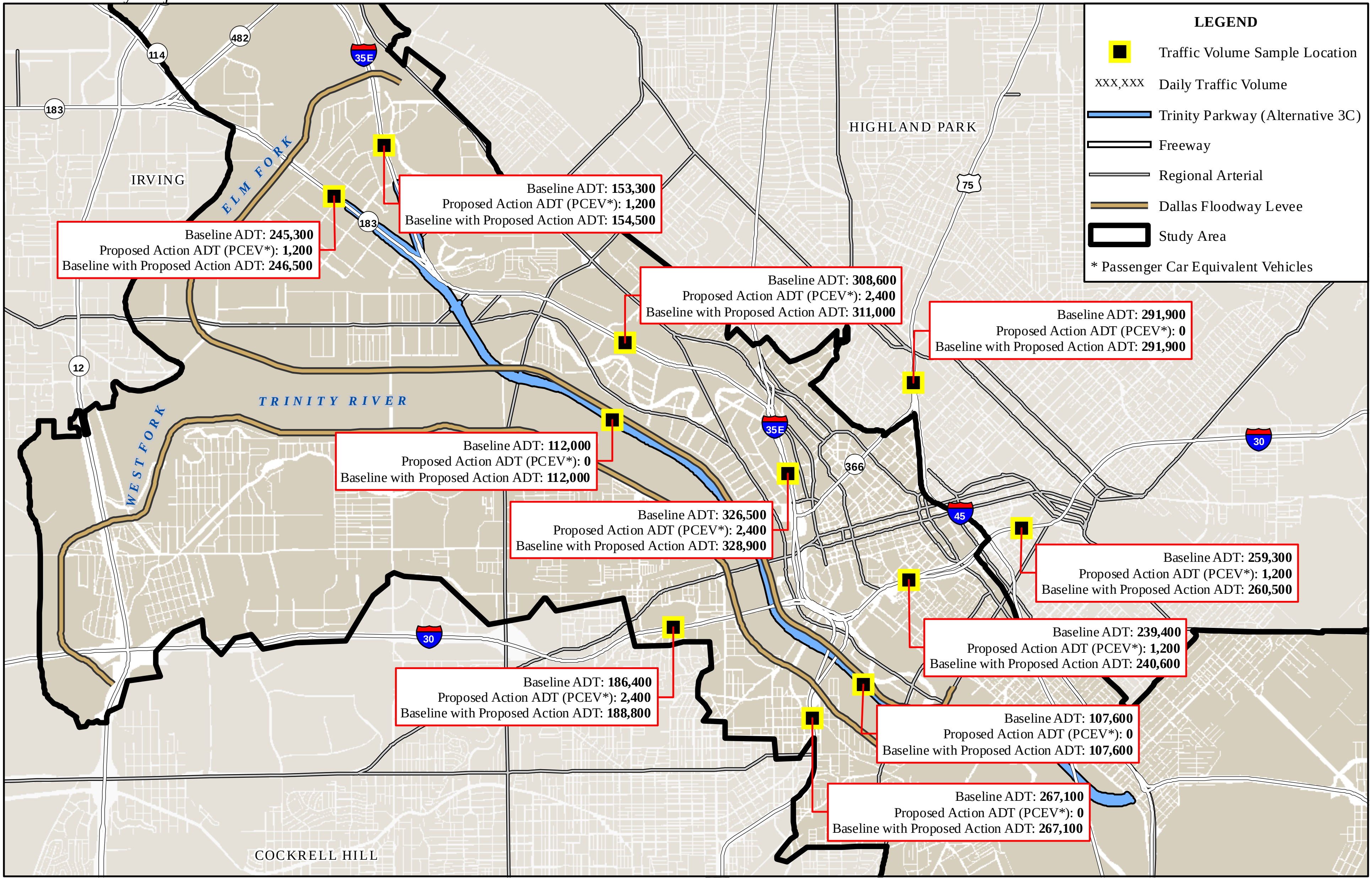
Notes: [1] This factor was applied to trucks and other heavy vehicles to reflect their disproportionate effect on capacity due to their relatively large size and sluggish performance (TRB 2010).
[2] Estimated based on loader and dump truck capacity and operations (University of Maryland 2003).
[3] Estimated based on the number of construction equipment required for each construction activity.

Baseline year 2022 conditions were estimated assuming a straight line of traffic growth for each freeway segment between years 2013 and 2035. The distribution of dump truck traffic to the freeway network was estimated based on likely travel routes from construction sites within the Proposed Action footprint to landfills in the region. For the purpose of this analysis, it was assumed that the McComma's Bluff, Arlington Sanitary Landfill, Camelot Landfill, and other landfills in the surrounding area would be able to accept excess fill material from the Proposed Action. Figure 4.12-1 presents daily traffic volumes for the year 2022 baseline, project construction activities, and the year 2022 baseline with the construction traffic associated with this design variation. Table 4.12-6 presents the temporary impact of construction-related traffic on major freeways and the potential Trinity Parkway[7] under year 2022 conditions. As shown in Table 4.12-6, there would be no significant traffic effect on any key freeway or tollway facility in the ROI.

[5] Trinity Parkway borrow pit areas that overlap the proposed lake locations are identified as grasslands in the impact analysis in Section 4.5.

[6] See Figure 2-1 for the FRM borrow pit locations. Trinity Parkway borrow pit locations were provided by Halff Associates (2013).

7 This analysis scenario assumes that the potential Trinity Parkway would be open to traffic by the year 2022; however, in accordance with Chapter 4 of the BVP Study (City of Dallas 2003), restrictions would be placed on trucks to discourage them from using the potential Trinity Parkway within the Floodway.



0 0.5 1 2 Kilometers

0 0.5 1 2 Miles

Figure 4.12-1
Year 2022 Traffic Volumes, Design Anticipating Potential Trinity Parkway Construction, Project Construction

N S

GIS Sources: City of Dallas 2008a; NCTCOG 2008, 2012, 2013

Table 4.12-6. BVP Study Ecosystem and Recreation Construction Freeway Segment Analysis, Design Anticipating Potential Trinity Parkway Construction

Roadways	*Year 2022 Baseline*		*Year 2022 with Proposed Action*			
	ADT	*LOS*	*ADT*	*LOS*	*ADT Increase (%)*	*Significant Impact?*
IH-35E						
North of SH-183	153,300	D-F	154,500	D-F	0.78%	No
SH-183 to Dallas North Tollway	308,600	F	311,000	F	0.78%	No
Dallas North Tollway to IH-30	326,500	D-F	328,900	D-F	0.74%	No
South of IH-30	267,100	F	267,100	F	0.00%	No
IH-30						
West of IH-35E	186,400	F	188,800	F	1.29%	No
East of IH-35E	239,400	F	240,600	F	0.50%	No
East of IH-45	259,300	F	260,400	F	0.46%	No
SH-183						
West of IH-35E	245,300	D-F	246,500	D-F	0.49%	No
US-75						
North of Spur 366	291,900	F	291,900	F	0.00%	No
Trinity Parkway						
SH-183 to Spur 366	112,000	A-E	112,000	A-E	0.00%	No
Spur 366 to IH-45	107,600	DE	107,600	DE	0.00%	No

Source: FHWA 2014.

Operation

The BVP Study Ecosystem and Recreation features would offer a broad range of both active and passive recreational opportunities. Users of the recreational facilities and amenities would create a substantial and recurring daily traffic increase on roadways approaching the Floodway, and on internal streets that provide access to and from the facilities. The Proposed Action would provide 1,900 parking spaces within the Floodway to accommodate these users, and various transit, pedestrian, and highway improvements would be provided to facilitate access.

In order to estimate the operation-related traffic of the BVP Study Ecosystem and Recreation features, various data sources were consulted, including the Programming and Capacities Study contained in the *Trinity River Corridor Design Guidelines* (City of Dallas 2009), the 9th Edition of the Institute of Transportation Engineers' (ITE) *Trip Generation Manual* (ITE 2012), and the *Whittier Narrows Dam Basin Recreation Area Environmental Impact Report* (Watershed Conservation Authority 2010). Table 4.12-7 presents the trip generation rates and traffic generation estimates of the BVP Study Ecosystem and Recreation features. As shown in this table, these features are expected to generate approximately 2,969 daily weekday trips and 7,477 daily weekend trips. This trip generation assumes typical usage of the proposed amphitheaters. The traffic and parking implications of concerts or other special events at these facilities, or elsewhere in the Floodway, are discussed below.

Table 4.12-7. BVP Study Ecosystem and Recreation Features Traffic Generation, Design Anticipating Potential Trinity Parkway Construction

Figure Number(s) [1]	*Land Use*	*Intensity* [2]		*Weekdays*				*Weekends*			
				Daily Trip Rate [2]			*Daily Trips*	*Daily Trip Rate* [2]			*Daily Trips*
D-2	Confluence Boat Launch [3]	15	spaces	2.00	/	spaces	30	4.00	/	spaces	60
D-4	Flex Space [4]	35.0	acre	2.28	/	acre	80	12.14	/	acre	425
D-6, D-8, D-10 and D-12	West Dallas Lake [4]	122.8	acre	2.28	/	acre	280	12.14	/	acre	1,491
D-9 through D-12	West Dallas Amphitheater [8]	150	attendees	0.36	/	attendees	55	0.36	/	attendees	55
Various	Pedestrian Trail [5]	28.9	mile	25.33	/	mile	733	38.00	/	mile	1,099
D-12 and D-14	Flex Space [4]	25.0	acre	2.28	/	acre	57	12.14	/	acre	304
D-14, D-16 and D-18	West Dallas Recreation Fields [6]	17	field(s)	71.33	/	field(s)	1,213	117.43	/	field(s)	1,996
D-21	Flex Space [4]	17.8	acre	2.28	/	acre	40	12.14	/	acre	215
D-23 through D-26	Urban Lake [4]	84.2	acre	2.28	/	acre	192	12.14	/	acre	1,022
D-26 through 1-30	Natural Lake [4]	49.5	acre	2.28	/	acre	113	12.14	/	acre	600
D-26	Skate Park [7]	1.0	acre	90.38	/	acre	90	97.60	/	acre	98
D-26	Central Island Amphitheater [8]	100	attendees	0.36	/	attendees	36	0.36	/	attendees	36
Various D Figures	Equestrian Trial [9]	8.0	mile	6.33	/	mile	51	9.50	/	mile	76
				Total Traffic Generation			**2,969**				**7,477**

Notes:
[1] Refer to listed figures in Appendix D for the location of BVP Study features listed in this table. Certain amenities (such as pedestrian trails) are presented in the majority of these figures.
[2] Trip generation rates were taken from ITE Trip Generation Manual, 9th Edition (ITE 2012) and other sources, as indicated in the notes below.
[3] Trip rates for boating uses obtained from Whittier Narrows Dam Basin Recreation Area Environmental Impact Report (Watershed Conservation Authority 2010).
[4] Trip rates taken from County Park land use designation contained in land use code 412 of the Institute of Transportation Engineers Trip Generation Manual, 9th Edition (ITE 2012).
[5] Developed based on Loop Trails land use designation (Watershed Conservation Authority 2010). Encompasses all pedestrian trails.
[6] ITE trip rate for land use code 488, Soccer Complex (ITE 2012).
[7] ITE trip rate for land use code 435, Multipurpose Recreational Facility (ITE 2012).
[8] Developed based upon traffic analysis for Allentown Arena and Mixed-Use Development (Allentown Economic Development Corp. 2011). Average of 100 attendees assumed.
[9] Trip rates based upon Watershed Conservation Authority (2010), but adjusted to reflect an anticipated lower concentration of equestrian activity, as compared to pedestrian use.

Weekday daily trips were assigned to freeway segments and portions of the potential Trinity Parkway in accordance with likely travel routes from estimated trip origins to parking facilities provided within the Floodway. The trip origins were identified based upon a review of U.S. Census Bureau Census County Division data for the 2010 decennial Census and aerial photography of the ROI. Operations related traffic associated with this design variation was added to baseline year 2035 volumes in Table 4.12-1 to determine the total traffic volumes of freeways and segments of the potential Trinity Parkway projected to occur under year 2035 baseline plus Proposed Action condition. Figure 4.12-2 depicts daily traffic volumes for the year 2035 baseline, project operation, and the year 2035 baseline with the addition of traffic associated with the design anticipating potential Trinity Parkway construction.

The Proposed Action would accommodate existing special events that currently take place in the Floodway, plus additional special events that would be scheduled to use the proposed amphitheaters and other venues. Parking for large events at the West Dallas Amphitheater would be accommodated by a 42-acre turf parking area, which has a capacity of 4,500 vehicles, and is located adjacent to the amphitheater. Additional parking demand may be accommodated using parking facilities outside of the West Levee that are currently used for existing special events, such as All Out Trinity. Also, 69,000 off-street parking spaces are available on weekday evenings and weekends in downtown Dallas (Dallas Morning News 2013). Special event organizers would follow the existing City of Dallas Parks and Recreation Department Special Event Permit Application process, including the inclusion of proposed road closures, traffic control, and a parking plan. A traffic and parking management SCM is provided in Chapter 7 (see SCM PD-29) to minimize the traffic effects when concerts or other major special events are scheduled within the Floodway.

Table 4.12-8 presents the results of freeway and the potential Trinity Parkway segment analysis under year 2035 conditions. As indicated in Table 4.12-8, the BVP Study Ecosystem and Recreation features would not result in a significant impact on major freeways in the ROI or on the potential Trinity Parkway.

Table 4.12-8. BVP Study Ecosystem and Recreation Features Operation Freeway Segment Analysis, Design Anticipating Potential Trinity Parkway Construction

Roadways	*Year 2035 Baseline*		*Year 2035 with Proposed Action*			
	ADT	*LOS*	*ADT*	*LOS*	*ADT Increase (%)*	*Significant Impact?*
IH-35E						
North of SH-183	173,900	D-F	174,000	D-F	0.06%	No
SH-183 to Dallas North Tollway	316,700	F	317,000	F	0.09%	No
Dallas North Tollway to IH-30	337,300	D-F	338,000	D-F	0.21%	No
South of IH-30	314,900	F	315,000	F	0.03%	No
IH-30						
West of IH-35E	217,400	DE	218,000	DE	0.28%	No
East of IH-35E	225,500	D-F	226,000	D-F	0.22%	No
East of IH-45	272,600	F	273,000	F	0.15%	No
SH-183						
West of IH-35E	319,400	F	320,000	F	0.19%	No
US-75						
North of Spur 366	310,500	F	311,000	F	0.16%	No
Trinity Parkway						
SH-183 to Spur 366	126,700	A-E	127,000	A-E	0.24%	No
Spur 366 to IH-45	121,800	D-F	122,000	D-F	0.16%	No

Source: FHWA 2014.

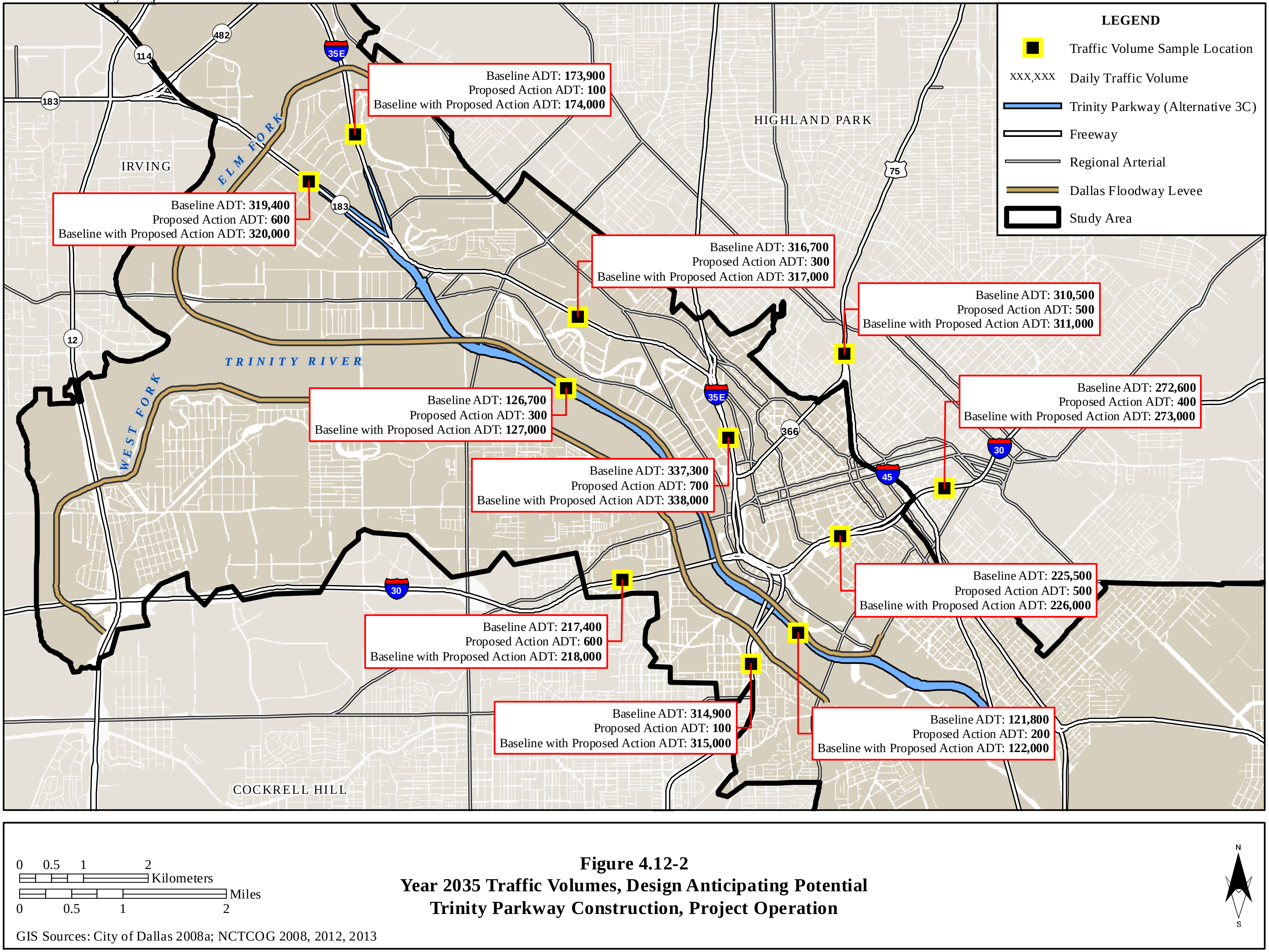


Figure 4.12-2
Year 2035 Traffic Volumes, Design Anticipating Potential Trinity Parkway Construction, Project Operation

GIS Sources: City of Dallas 2008a; NCTCOG 2008, 2012, 2013

IDP Improvements

Construction

The IDP improvements would involve a temporary increase in traffic due to construction activities, including the delivery of construction equipment and materials and construction worker commuting. Construction traffic impacts would be temporary and are expected to be localized. Also, construction-related traffic impacts may arise from temporary lane closures and possible traffic stoppages to accommodate construction traffic movement. A Traffic Control Plan would be required to minimize the effects of IDP improvement construction on traffic.

Operation

Operational traffic associated with the Proposed Action would involve infrequent routine maintenance activities (e.g., electrical system repairs, heating, ventilation and air conditioning repairs). Although there may be an incremental increase in maintenance required for newly-constructed or refurbished facilities, any associated traffic increase would be relatively minor, and would not be expected to recur on a daily basis during commuting periods.

Upon completion of the proposed IDP improvements, the expanded pumping plants would be better equipped to manage stormwater in their respective basins. As a result, the roads identified as being potentially subject to flooding would have a reduced risk of flooding-related closure.

4.12.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential impacts to transportation from implementation of the proposed FRM elements and IDP improvements would be the same as presented under the design anticipating potential Trinity Parkway construction, as there would be no change in these components. Therefore, refer to the sections titled "BVP Study FRM Elements" and "IDP Improvements" within Section 4.12.3.1 for a discussion of impacts to transportation associated with implementation of those elements and improvements. The following section presents the potential impacts to transportation from implementation of the BVP Study Ecosystem and Recreation features as designed without anticipating construction of the potential Trinity Parkway. As described below, construction of the BVP Study Ecosystem and Recreation features would involve a substantial increase in truck traffic, as compared to the design that does anticipate the potential Trinity Parkway being constructed.

BVP Study Ecosystem and Recreation Features

This design variation assumes that the potential Trinity Parkway would not be constructed. Accordingly, because partial excavation of lakes for the potential Trinity Parkway would not occur prior to the Ecosystem and Recreation features, the excavation requirements of the proposed BVP Study Ecosystem and Recreation features under this design variation would be substantially higher than those associated with the design anticipating potential Trinity Parkway construction, resulting in more construction trips. While some of the excess cut material would be rough graded into the Floodway, this analysis assumes a "worst case" scenario whereby all excess cut material would be transported out of the Floodway to an appropriate landfill or disposal facility. Also under this design variation, there would be a relatively minor reallocation of land uses within the Floodway, which would result in a negligible change relative to the design anticipating potential Trinity Parkway construction.

Construction

Construction traffic generation is presented in Table 4.12-9. As shown Table 4.12-9, the number of trucks potentially required to haul fill material would be more than twice the number that would be required for the design anticipating potential Trinity Parkway construction.

Table 4.12-9. BVP Study Ecosystem and Recreation Features Construction Traffic Generation, Design Without Potential Trinity Parkway Construction Anticipated

Traffic Generator	*Number of Vehicles*	*Weekdays*		
		Daily Trip Rate	*Passenger Car Equivalence* [1]	*Daily Passenger Car Equivalent Trips*
Dump Trucks [2]	900 trucks	7 / truck	1.5	9,450
Construction Workers [3]	390 workers	2 / worker	1.0	780
			Total Traffic Generation	**10,230**

Notes: [1] This factor was applied to trucks and other heavy vehicles to reflect their disproportionate effect on capacity due to their relatively large size and sluggish performance (TRB 2010).
[2] Estimated based on loader and dump truck capacity and operations (University of Maryland 2003).
[3] Estimated based on the number of construction equipment required for each construction activity.

Year 2022 baseline volumes were estimated using the process described above for the design anticipating potential Trinity Parkway construction. However, because the potential Trinity Parkway would not be constructed under this design variation, baseline volumes were adjusted to account for the diversion of traffic to other routes. Refer to Figure 4.12-3 for ADT volumes for the year 2022 baseline, project construction-related traffic, and the year 2022 baseline with construction traffic associated with the design without potential Trinity Parkway construction anticipated. Table 4.12-10 presents the findings of freeway segment analysis of this design variation. As shown in Table 4.12-10, construction activities would result in significant temporary impacts on one segment of IH-35E and one segment of IH-30. Although SCMs would minimize project construction traffic impacts, it would not reduce the volume of project construction traffic on freeways.

Table 4.12-10. BVP Study Ecosystem and Recreation Features Construction Freeway Segment Analysis, Design Without Potential Trinity Parkway Construction Anticipated

Roadways	*Year 2022 Baseline*		*Year 2022 with Proposed Action*			
	ADT	*LOS*	*ADT*	*LOS*	*ADT Increase (%)*	*Significant Impact?*
IH-35E						
North of SH-183	122,300	D-F	124,900	D-F	2.13%	Yes
SH-183 to Dallas North Tollway	348,800	F	353,900	F	1.46%	No
Dallas North Tollway to IH-30	341,200	D-F	346,300	D-F	1.49%	No
South of IH-30	259,500	F	259,500	F	0.00%	No
IH-30						
West of IH-35E	184,300	F	189,400	F	2.77%	Yes
East of IH-35E	251,500	F	254,100	F	1.03%	No
East of IH-45	253,500	F	256,100	F	1.03%	No
SH-183						
West of IH-35E	168,500	D-F	171,100	D-F	1.54%	No
US-75						
North of Spur 366	284,800	F	284,800	F	0.00%	No

Source: FHWA 2014.

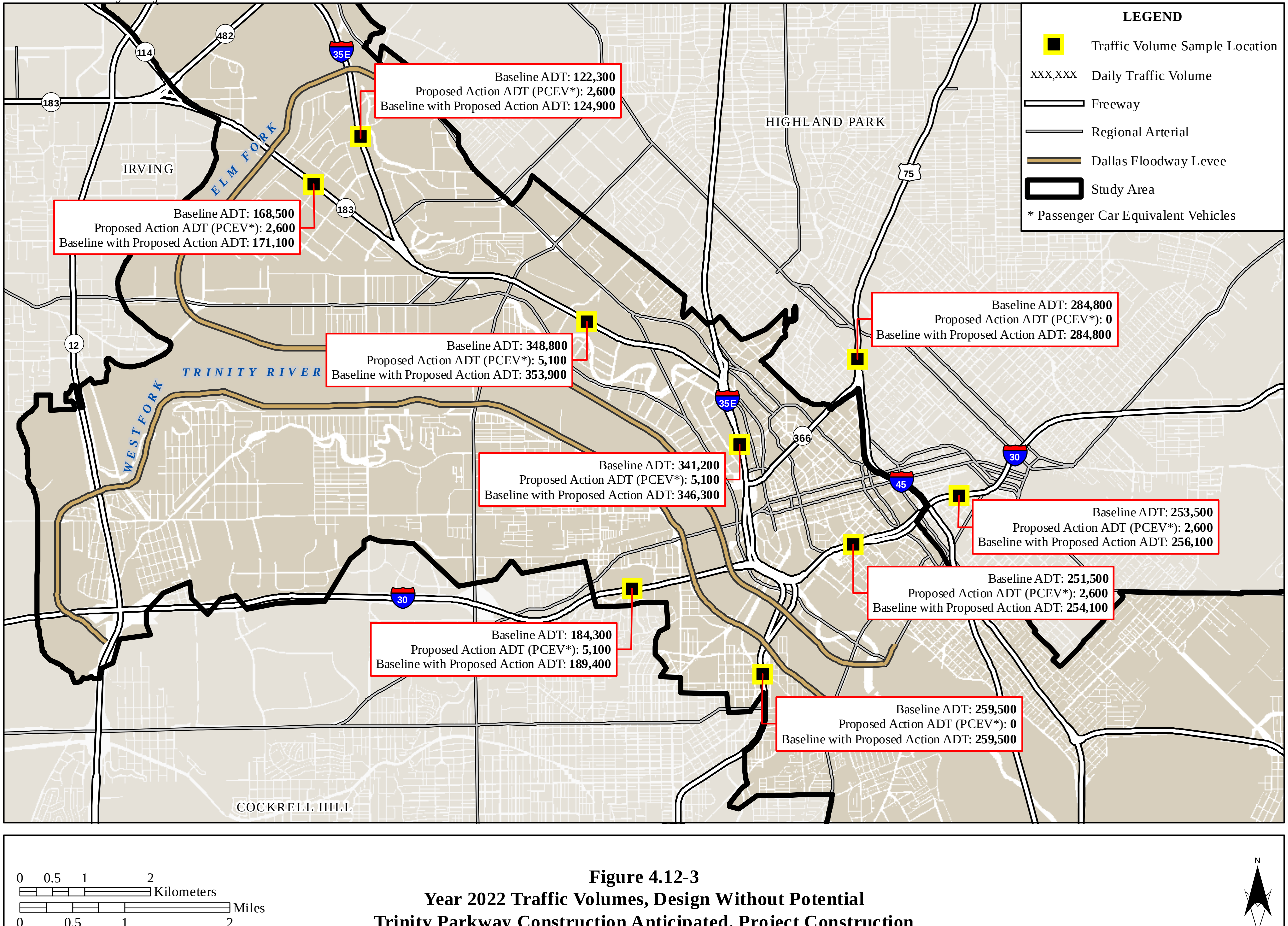


Figure 4.12-3
Year 2022 Traffic Volumes, Design Without Potential
Trinity Parkway Construction Anticipated, Project Construction

GIS Sources: City of Dallas 2008a; NCTCOG 2008, 2012, 2013; FHWA 2009

Operation

Table 4.12-11 presents the weekday and weekend traffic generation of the BVP Study Ecosystem and Recreation features under the design without potential Trinity Parkway construction anticipated. This design variation would result in a relatively minor increase in traffic generation (i.e., 30 additional weekday trips, and 122 additional weekend trips), as compared to the design anticipating potential Trinity Parkway construction. The Proposed Action's traffic assignment was estimated using the same procedures described above in Section 4.12.3.1. Figure 4.12-4 shows ADT volumes for the year 2035 baseline, Proposed Action operation-related traffic, and the year 2035 baseline plus Proposed Action operation-related traffic.

Table 4.12-11. BVP Study Ecosystem and Recreation Features Traffic Generation, Design Without Potential Trinity Parkway Construction Anticipated

Figure Number(s) [1]	*Land Use*	*Intensity* [2]		*Weekdays*				*Weekends*			
				Daily Trip Rate [2]			*Daily Trips*	*Daily Trip Rate* [2]			*Daily Trips*
E-2	Confluence Boat Launch [3]	15	spaces	2.00	/	spaces	30	4.00	/	spaces	60
E-4	Flex Space [4]	35.0	acre	2.28	/	acre	80	12.14	/	acre	425
E-6, E-8, E-10 and E-12	West Dallas Lake [4]	122.4	acre	2.28	/	acre	279	12.14	/	acre	1,486
E-9 through E-12	West Dallas Amphitheater [8]	150	attendees	0.36	/	attendees	55	0.36	/	attendees	55
Various	Pedestrian Trail [5]	28.5	mile	25.33	/	mile	721	38.00	/	mile	1,082
E-12 and E-14	Flex Space [4]	25.0	acre	2.28	/	acre	57	12.14	/	acre	304
E-14, E-16 and E-18	West Dallas Recreation Fields [6]	17	field(s)	71.33	/	field(s)	1,213	117.43	/	field(s)	1,996
E-21	Flex Space [4]	28.1	acre	2.28	/	acre	64	12.14	/	acre	341
E-23 through E-26	Urban Lake [4]	84.2	acre	2.28	/	acre	192	12.14	/	acre	1,022
E-26 through E-30	Natural Lake [4]	49.5	acre	2.28	/	acre	113	12.14	/	acre	600
E-26	Skate Park [7]	1.0	acre	90.38	/	acre	90	97.60	/	acre	98
E-26	Central Island Amphitheater [8]	100	attendees	0.36	/	attendees	36	0.36	/	attendees	36
E-28	Natural Lake Amphitheater [8]	50	attendees	0.36	/	attendees	18	0.36	/	attendees	18
Various E Figures	Equestrian Trial [9]	8.0	mile	6.33	/	mile	51	9.50	/	mile	76
				Total Traffic Generation			**2,999**				**7,599**

Notes:

[1] Refer to listed figures in Appendix E for the location of BVP Study features listed in this table. Certain amenities (such as pedestrian trails) are presented in the majority of these figures.

[2] Trip generation rates were taken from ITE Trip Generation Manual, 9th Edition (ITE 2012) and other sources, as indicated in the notes below.

[3] Trip rates for boating uses obtained from Whittier Narrows Dam Basin Recreation Area Environmental Impact Report (Watershed Conservation Authority 2010).

[4] Trip rates taken from County Park land use designation contained in land use code 412 of the Institute of Transportation Engineers Trip Generation Manual, 9th Edition (ITE 2012).

[5] Developed based on Loop Trails land use designation (Watershed Conservation Authority 2010). Encompasses all pedestrian trails.

[6] ITE trip rate for land use code 488, Soccer Complex (ITE 2012).

[7] ITE trip rate for land use code 435, Multipurpose Recreational Facility (ITE 2012).

[8] Developed based upon traffic analysis for Allentown Arena and Mixed-Use Development (Allentown Economic Development Corp. 2011). Average of 100 attendees assumed.

[9] Trip rates based upon Watershed Conservation Authority (2010), but adjusted to reflect an anticipated lower concentration of equestrian activity, as compared to pedestrian use.

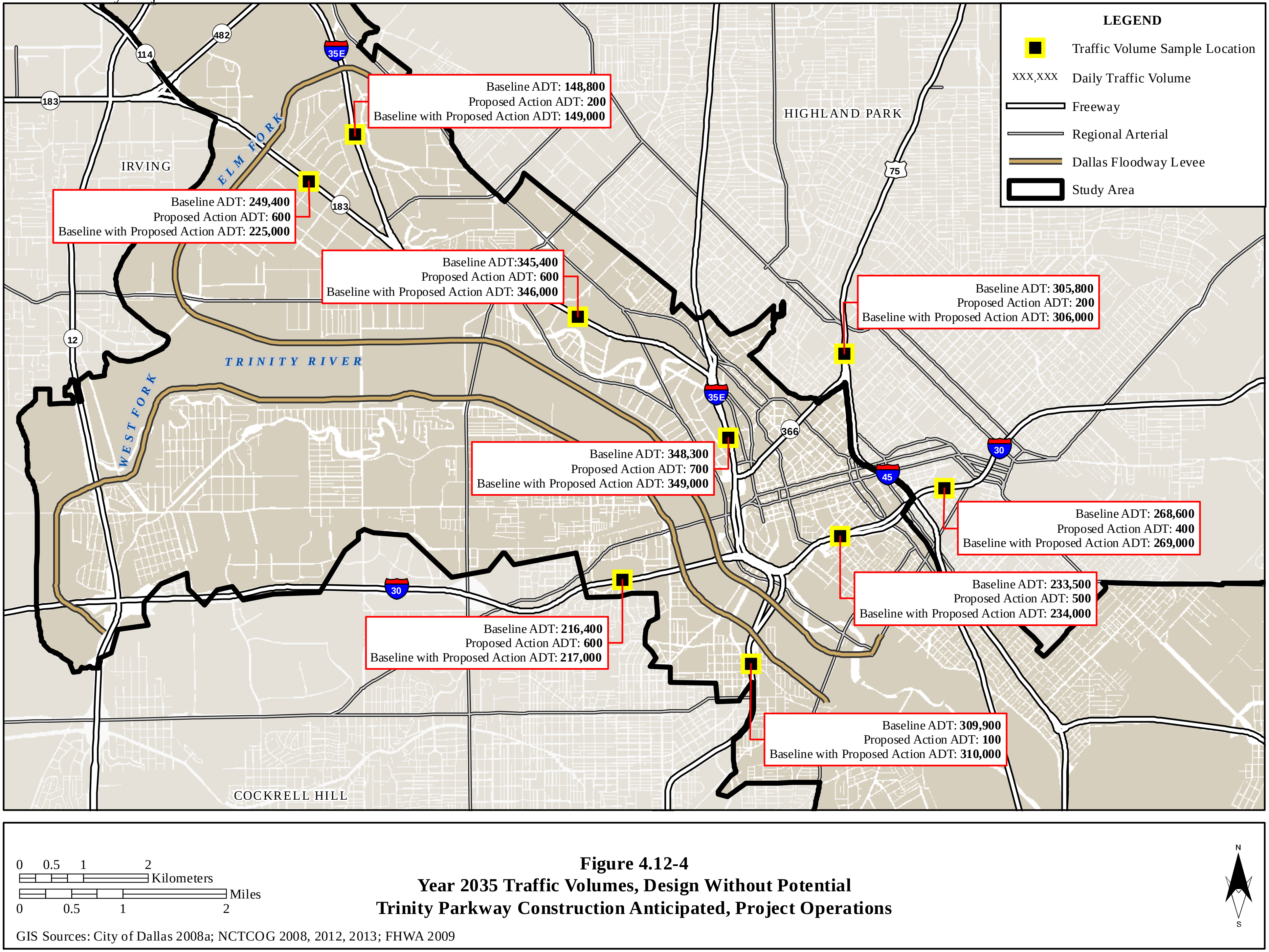


Figure 4.12-4
Year 2035 Traffic Volumes, Design Without Potential Trinity Parkway Construction Anticipated, Project Operations

GIS Sources: City of Dallas 2008a; NCTCOG 2008, 2012, 2013; FHWA 2009

Table 4.12-12 presents the results of freeway analysis. As shown in Table 4.12-12, no significant traffic effect on key ROI freeway segments would occur.

Table 4.12-12. BVP Study Ecosystem and Recreation Features Operation Freeway Segment Analysis, Design Without Potential Trinity Parkway Construction Anticipated

Roadways	*Year 2035 Baseline*		*Year 2035 with Proposed Action*			
	ADT	*LOS*	*ADT*	*LOS*	*ADT Increase (%)*	*Significant Impact?*
IH-35E						
North of SH-183	148,800	D-F	149,000	D-F	0.13%	No
SH-183 to Dallas North Tollway	345,400	F	346,000	F	0.17%	No
Dallas North Tollway to IH-30	348,300	D-F	349,000	D-F	0.20%	No
South of IH-30	309,900	F	310,000	F	0.03%	No
IH-30						
West of IH-35E	216,400	DE	217,000	DE	0.28%	No
East of IH-35E	233,500	D-F	234,000	D-F	0.21%	No
East of IH-45	268,600	F	269,000	F	0.15%	No
SH-183						
West of IH-35E	249,400	F	250,000	F	0.24%	No
US-75						
North of Spur 366	305,800	F	306,000	F	0.07%	No

Source: FHWA 2014.

4.12.3.3 Summary

Under either Proposed Action design variation, neither the FRM elements nor the IDP improvements would result in any significant impact to transportation during either construction or operation. For both design variations, these project components would reduce the risk of flooding-related closure on roadways in the ROI, resulting in a beneficial effect to transportation. With respect to the BVP Study Ecosystem and Recreation features, the two design variations would involve a similar amount of traffic generation during operations, and neither design variation would result in a significant impact to transportation during the operation of the Proposed Action. These conclusions assume the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

For the design anticipating potential Trinity Parkway construction, construction of the BVP Study Ecosystem and Recreation features would potentially require extensive excavation and disposal of excess fill material, if the excess cut material could not be used within the Floodway. While this would result in large number of dump truck trips during construction, this design variation would not result in any significant impacts on freeways or the potential Trinity Parkway. However, the design without potential Trinity Parkway construction anticipated would involve more than twice as many dump trucks to haul excess fill material. As a result, this design variation would result in a significant impact on one segment of IH-35E and on one segment of IH-30. These conclusions assume the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.12.3.4 Cumulative Impacts

Design Anticipating Potential Trinity Parkway Construction

The cumulative traffic implications of past, present, and reasonably foreseeable future projects are included in the year 2013 and year 2035 forecast traffic data developed by NCTCOG as part of *Mobility 2035*. This is because NCTCOG's year 2035 travel demand forecast was developed based on long-range population and employment projections in the North Central Texas region, and incorporates planned transportation improvements. Cumulative traffic conditions are summarized in Table 4.12-13. As shown in Table 4.12-13, traffic from cumulative growth, taken in combination with traffic associated with implementation of the design anticipating potential Trinity Parkway construction, would result in significant adverse impacts to all freeway segments in the ROI, except for IH-30, to the east of IH-35E.

Table 4.12-13. Cumulative Impacts, Design Anticipating Potential Trinity Parkway Construction

Roadways	*Year 2013*		*Cumulative Conditions (Year 2035)*				*Proposed Action Contribution*	
	ADT	*LOS*	*ADT*	*LOS*	*ADT Increase (%)*	*Significant Impact?*	*ADT*	*ADT Increase (%)*
IH-35E								
North of SH-183	139,000	D-F	174,000	D-F	25.18%	Yes	100	0.06%
SH-183 to Dallas North Tollway	303,000	F	317,000	F	4.62%	Yes	300	0.09%
Dallas North Tollway to IH-30	319,000	D-F	338,000	D-F	5.96%	Yes	700	0.21%
South of IH-30	234,000	F	315,000	F	34.62%	Yes	100	0.03%
IH-30								
West of IH-35E	165,000	F	218,000	DE	32.12%	Yes	600	0.28%
East of IH-35E	249,000	F	226,000	D-F	-9.24%	No	500	0.22%
East of IH-45	250,000	F	273,000	F	9.20%	Yes	400	0.15%
SH-183								
West of IH-35E	194,000	D-F	320,000	F	64.95%	Yes	600	0.19%
US-75								
North of Spur 366	279,000	F	311,000	F	11.47%	Yes	500	0.16%

Source: FHWA 2014.

The potential Trinity Parkway project is not expected to cause a substantial and recurring increase in traffic generation during operations. Instead, the potential tollway would accommodate existing and forecasted future traffic that is already accounted for in existing traffic counts and future traffic growth projections. Construction and operation of the potential Trinity Parkway would result in the diversion of traffic from current routes this potential new facility. As a result, traffic would increase on some arterials and freeways, and would decrease at other locations (FHWA 2014). From a regional perspective, the potential Trinity Parkway would increase transportation capacity, and the diversion of traffic would result in a net reduction in traffic on other arterials and freeways within the ROI. As a result, the potential Trinity Parkway's cumulative traffic impact would be less than significant.

Design without Potential Trinity Parkway Construction Anticipated

As shown in columns 6 and 7 of Table 4.12-14, the design without potential Trinity Parkway construction anticipated, in combination with the past, present, and reasonably foreseeable projects, would result in cumulative significant adverse impacts to all freeway segments, except for IH-30, to the east of IH-35E.

Table 4.12-14. Cumulative Impacts, Design Without Potential Trinity Parkway Construction Anticipated

Roadways	*Year 2013*		*Cumulative Conditions (Year 2035)*				*Proposed Action Contribution*	
	ADT	*LOS*	*ADT*	*LOS*	*ADT Increase (%)*	*Significant Impact?*	*ADT*	*ADT Increase (%)*
IH-35E								
North of SH-183	139,000	D-F	149,000	D-F	7.19%	Yes	200	0.13%
SH-183 to Dallas North Tollway	303,000	F	346,000	F	14.19%	Yes	600	0.17%
Dallas North Tollway to IH-30	319,000	D-F	349,000	D-F	9.40%	Yes	700	0.20%
South of IH-30	234,000	F	310,000	F	32.48%	Yes	100	0.03%
IH-30								
West of IH-35E	165,000	F	217,000	DE	31.52%	Yes	600	0.28%
East of IH-35E	249,000	F	234,000	D-F	-6.02%	No	500	0.21%
East of IH-45	250,000	F	269,000	F	7.60%	Yes	400	0.15%
SH-183								
West of IH-35E	194,000	D-F	250,000	F	28.87%	Yes	600	0.24%
US-75								
North of Spur 366	279,000	F	306,000	F	9.68%	Yes	200	0.07%

Source: FHWA 2014.

4.13 UTILITIES

4.13.1 Approach to Analysis

The following designations were used to describe the level of project impacts:

- *Potentially significant impact*: Significant adverse impacts to utilities would occur if implementation of any of the proposed projects would result in the use of a substantial proportion of the remaining utility system capacity, reach or exceed the current capacity of the utility system, or require development of facilities and utility sources beyond those existing or currently planned.
- *Less than significant impact*: There would be no significant or unmitigable impacts on the utility system from the implementation of a proposed project (e.g., relocation of utilities).
- *Beneficial impact*: Beneficial impacts to utilities would occur if a proposed project results in increases in utility capacity or a reduction in potential flood extent.
- *No impact*: The project would have no impact to utilities.

4.13.2 Alternative 1: Future Without-Project Condition

Overall, utility demand would increase with the predicted increase in population in the Study Area. It can be reasonably anticipated that area utility providers would plan and implement additional utility upgrade/improvement projects to increase capacity to meet the anticipated increase in utility demands associated with future population growth.

In addition, several Future Without-Project Condition projects would result in improvements to overall utility service. The proposed Beckley Avenue Improvements project would include a major new drainage system and upgrades to water and wastewater mains. The proposed EF2 Wastewater Interceptor Line project would increase the capacity of wastewater conveyance throughout the Study Area. Moreover, several identified Future Without-Project Condition projects would incorporate water conservation and water reuse strategies, and would thus be consistent with water supply planning efforts initiated by DWU, thereby resulting in a likely increased efficiency of water use and beneficial impacts to water supply. Water planning strategies include water conservation, contract for return flows, and additional direct reuse. The existing unacceptable encroachments to the Dallas Floodway Levee System would remain, unless addressed as part of future projects.

The majority of the Future Without-Project Condition projects would likely result in the temporary or permanent relocation of utilities. During construction, there would likely be short-term, pre-approved, scheduled, and controlled utility service interruptions; however, upon completion of construction these temporary service interruptions would cease.

Under the Future Without-Project Condition, the existing threat of stormwater flooding due to inadequate interior drainage capacity would remain for those areas served by the Hampton, Charlie, Delta, and Eagle Ford Drainage Basins. Stormwater flooding risks would remain, as the identified Future Without-Project Condition projects would not alleviate all existing risk factors.

4.13.3 Alternative 2: Proposed Action

4.13.3.1 Design Anticipating Potential Trinity Parkway Construction

Prior to implementation of Alternative 2, construction managers would be required to ensure that proposed construction activities would not physically impact existing infrastructure (e.g., buried pipes, power lines) by contacting utilities providers to locate utilities infrastructure and by identifying utility crossings.

BVP Study FRM Elements

Levee Raise and Flattening

Several underground utility lines exist in proximity to the proposed borrow pits. These include two fiber optic cables, a water main, and a telecommunication line (Figure 4.13-1). Relocation and adjustment of these utilities would be planned as part of the proposed BVP Study features and would be completed prior to borrow activities. As the levee improvements would involve construction activities on the surface of levees, no underground utilities are anticipated to be impacted. When proposed construction would occur near overhead electrical transmission lines, low clearance and work platforms would be utilized to avoid damage to electrical lines and maximize worker safety. Also, when the levee flattening and improvements would occur near bridge crossing locations, utility location investigations would be undertaken as utilities are often suspended underneath bridges.

Proposed levee improvements would not result in an increase in demand for utility services.

AT&SF Railroad Bridge Modifications

Multiple overhead electrical transmission lines cross the AT&SF Railroad Bridge on the northwestern side of the Floodway (refer to Figure 3.13-15). Moreover, an overhead electrical line crosses directly over the Santa Fe Trestle Trail embankment. Low-clearance equipment and/or lower work platforms would be utilized as necessary to avoid low clearances from utility lines. The existing utility lines would remain. No underground utilities are known to occur in the area; however, verification would be required prior to construction.

Figure 4.13-1
Proposed Borrow Pits and Existing Utilities

LEGEND

Proposed FRM Elements

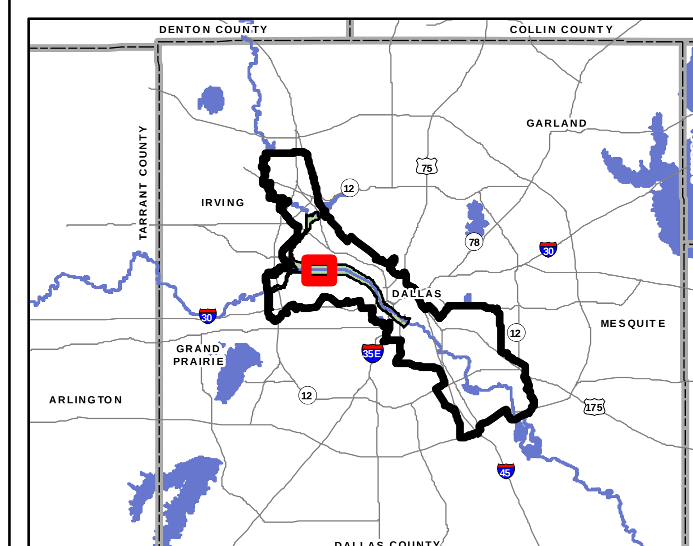
- Borrow Pit

Utility Lines

- Abandoned Oil and Gas
- Communication
- Electrical
- Natural Gas
- Petroleum
- Sewer
- Water
- Dallas Floodway Levee Crest
- Exterior Light
- Power Pole
- Transmission Tower

Key

CRI&P	Chicago, Rock Island and Pacific Railroad
Ex.	Existing
HP	High Pressure
IH	Interstate Highway
IP	Intermediate Pressure
KV	Kilovolt
OH	Overhead
SH	State Highway
SFB	Suspended From Bridge
UG	Underground
WW	Wastewater



0 100 200 Meters

0 250 500 Feet

GIS Sources: City of Dallas 2008a; NCTCOG 2008; USACE 2011, 2013a

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Proposed AT&SF Railroad Bridge and Santa Fe Trestle Trail modifications would not result in an increase in demand for utility services.

Nonstructural Flood Control Improvements

Nonstructural actions associated with the implementation of Alternative 2 are largely focused on emergency response and public safety during an emergency. No impacts to utilities are anticipated as a result of implementing these nonstructural actions.

BVP Study Ecosystem and Recreation Features

Construction

Based on the findings of a Trinity River Utility Adjustment and Relocation study (City of Dallas 2008), several utilities within the Floodway are proposed for adjustment or relocation due to the proposed implementation of the BVP Study features. These include the relocation of four underground water mains, 13 underground and/or aerial franchise utilities and the removal of five miscellaneous pipelines (Table 4.13-1; Figures 4.13-2 and 4.13-3). The utility relocations would be designed and constructed in advance of other project improvements by each respective franchise utility company to minimize the potential for utility service interruptions. Table 4.13-1 lists currently known utilities that would need to be relocated as part of the BVP Study features; as design progresses it is likely that additional utilities would need to be relocated.

Table 4.13-1. Utility Relocations and Adjustments from the Implementation of the BVP Study Features

Utility Responsibility	*Utility Description*	*Location*
City of Dallas	Approximately 4,800 LF of 24-inch water main	South of the Corinth Street Viaduct
City of Dallas	Approximately 2,900 LF of 24-inch water main	South of the Houston Street Viaduct
City of Dallas	Approximately 3,200 LF of 36-inch water main	Approximately 2,400 feet east of the Hampton Road/Inwood Road Bridge
City of Dallas	Approximately 4,100 LF of 48-inch water main	East of the Westmoreland Road/ Mockingbird Lane Bridge
City of Dallas	Removal of miscellaneous water main pipelines	Various locations
Atmos Energy	Approximately 2,000 LF of 16-inch intermediate pressure gas main	North of the Houston Street Viaduct
Atmos Energy	Approximately 1,400 LF of 30-inch high pressure gas main	Approximately 900 feet south of the future Sylvan Avenue Bridge
United Gas	Remove approximately 2,800 LF of abandoned gas main	Crossing the Trinity River Floodway between the Union Pacific Railroad Bridge and north of the Continental Avenue Viaduct
Oncor Electric Delivery	Approximately 2,100 LF of underground electric	South of the Houston Street Viaduct
Oncor Electric Delivery	Approximately 1,800 LF of underground electric	North of the Commerce Street Viaduct
Oncor Electric Delivery	Up to ten 138 kV aerial transmission towers and 4,000 LF of transmission lines	North of Continental Avenue Viaduct
AT&T	Approximately 2,700 LF of underground telecommunications	South of the IH-30/Tom Landry Highway Bridge
AT&T	Approximately 1,400 LF of underground telecommunications	East of the Westmoreland Road/Mockingbird Lane Bridge

Utility Responsibility	*Utility Description*	*Location*
AT&T	Approximately 3,000 LF of underground fiber optics	Crossing the Trinity River Floodway between the Sylvan Avenue Bridge and Continental Viaduct
Verizon	Approximately 1,700 LF of underground fiber optics	Approximately 200 feet south of the Union Pacific Railroad Bridge
Level 3	Approximately 700 LF of underground fiber optics	East of the Hampton Road/Inwood Road Bridge
Level 3	Approximately 1,400 LF of underground fiber optics	West of the Westmoreland Road/ Mockingbird Lane Bridge
Time Warner	Approximately 1,400 LF of underground fiber optics	East of the Westmoreland Road/ Mockingbird Lane Bridge
Magellan Pipeline Company	Approximately 2,100 LF of underground jet fuel pipeline	Approximately 1,900 feet west of the Westmoreland Road/Mockingbird Lane Bridge
Chevron	Approximately 1,700 LF of abandoned 8-inch underground oil pipeline	Approximately 4,200 feet west of the Westmoreland Road/Mockingbird Lane Bridge

Note: LF = linear feet.
Source: City of Dallas 2008.

The implementation of the BVP Study Ecosystem and Recreation features would require the rearrangement of multiple utilities and involve possible temporary service disruptions. Advanced notice would be given to those users that would be affected by service disruptions. Of note, design specifications would be developed and implemented to avoid and minimize any impact from construction or relocation activities to the operation of the four underground water mains that cross the Trinity River. To minimize service disruptions, the City of Dallas would require that shut-down for tie-ins to the existing water mains would occur only during the coldest months (i.e., between October 1 and April 1).

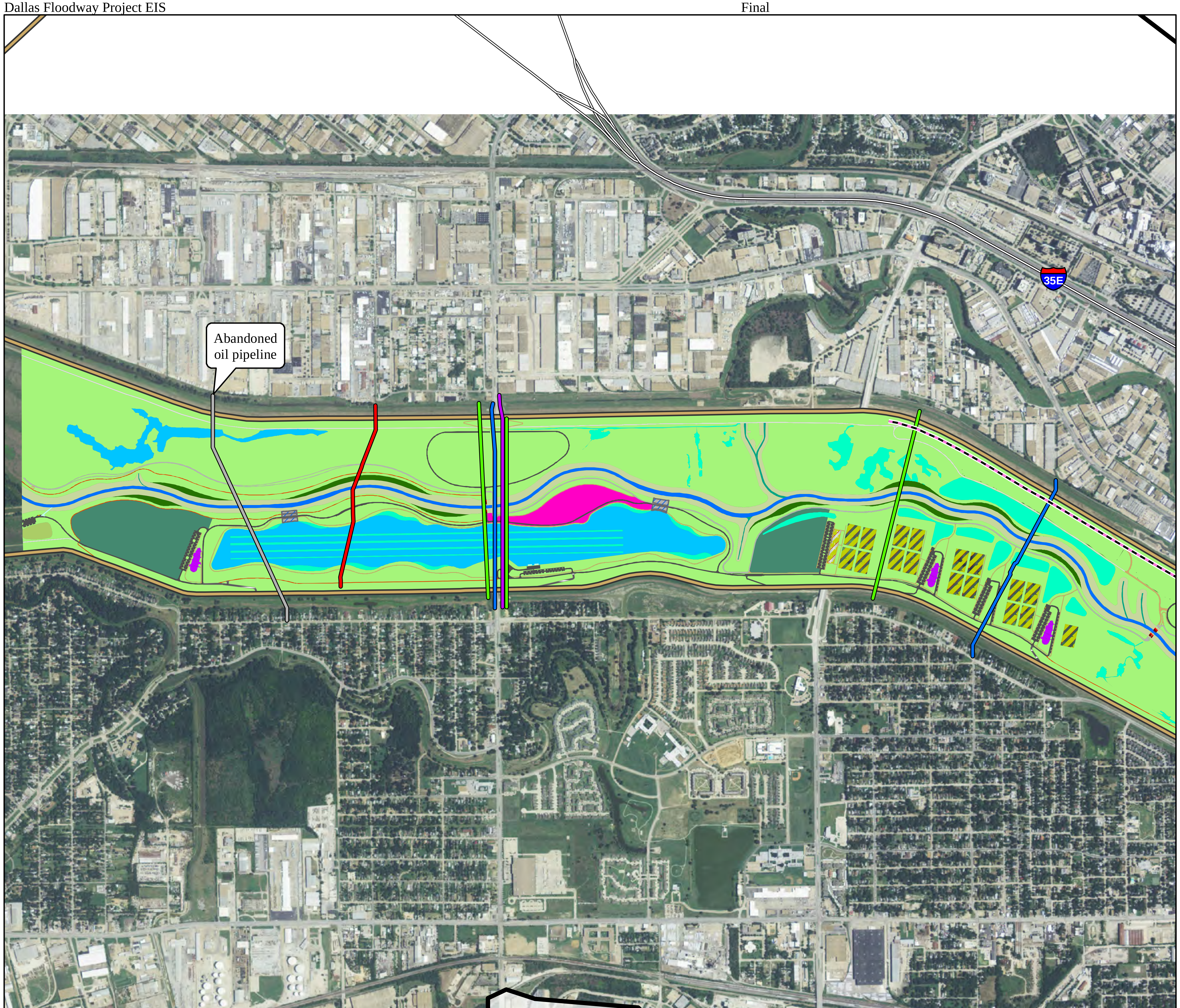
Operation

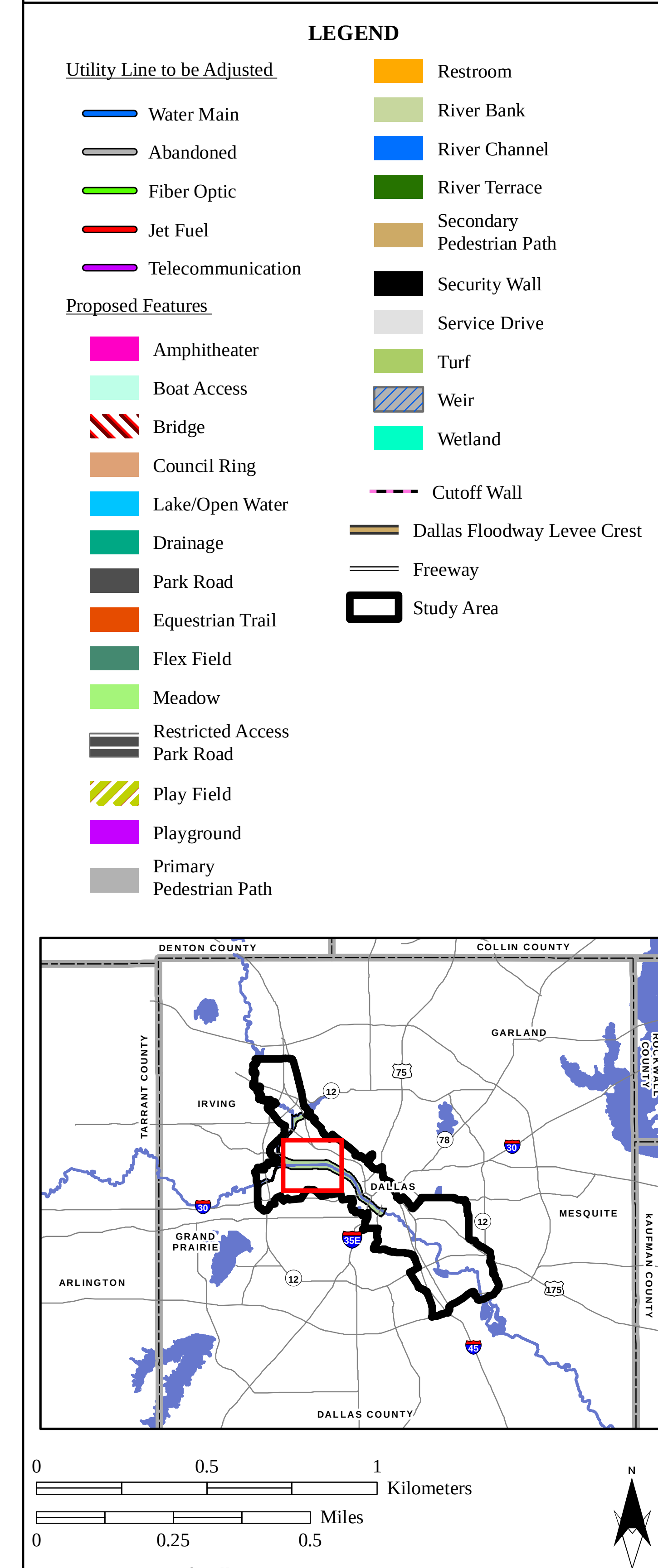
The operation of the BVP Study Ecosystem and Recreation features would require utilities within the Floodway to provide capacity to serve the proposed features and visitors. Anticipated utility requirements include wastewater, potable water, and electricity for facilities such as restrooms, drinking fountains, bridge and trail lighting, sound systems, etc. The intent as explained by the City of Dallas is to the have a concessionaire provide amenities such as toilets and wash stations for your hands; this approach is successfully used at other large events in and around the City, such as the Byron Nelson Championship.

Electricity

Electricity consumption associated with the operations of the BVP Study features would include lighting for bridges, trails, amphitheaters, promenade, and recreational fields. To minimize the potential project-related increase in demand on the electricity grid, a goal of the design is to render the daily use of the BVP Study features a carbon-neutral operation. Photovoltaic (PV) panels installed along the floodwall and atop mobile restrooms would add to the overall use of renewable energy and reduce dependence on the existing electric grid. PV is also proposed on the park's shade structures, powering their nighttime lighting. Solar-powered high-efficiency light-emitting diode trail lighting is under consideration as well (City of Dallas 2009).

Figure 4.13-2
Utility Adjustment Locations and BVP Study Features: Upper Floodway





GIS Sources: City of Dallas 2008a, 2008c; NCTCOG 2008; USACE 2011

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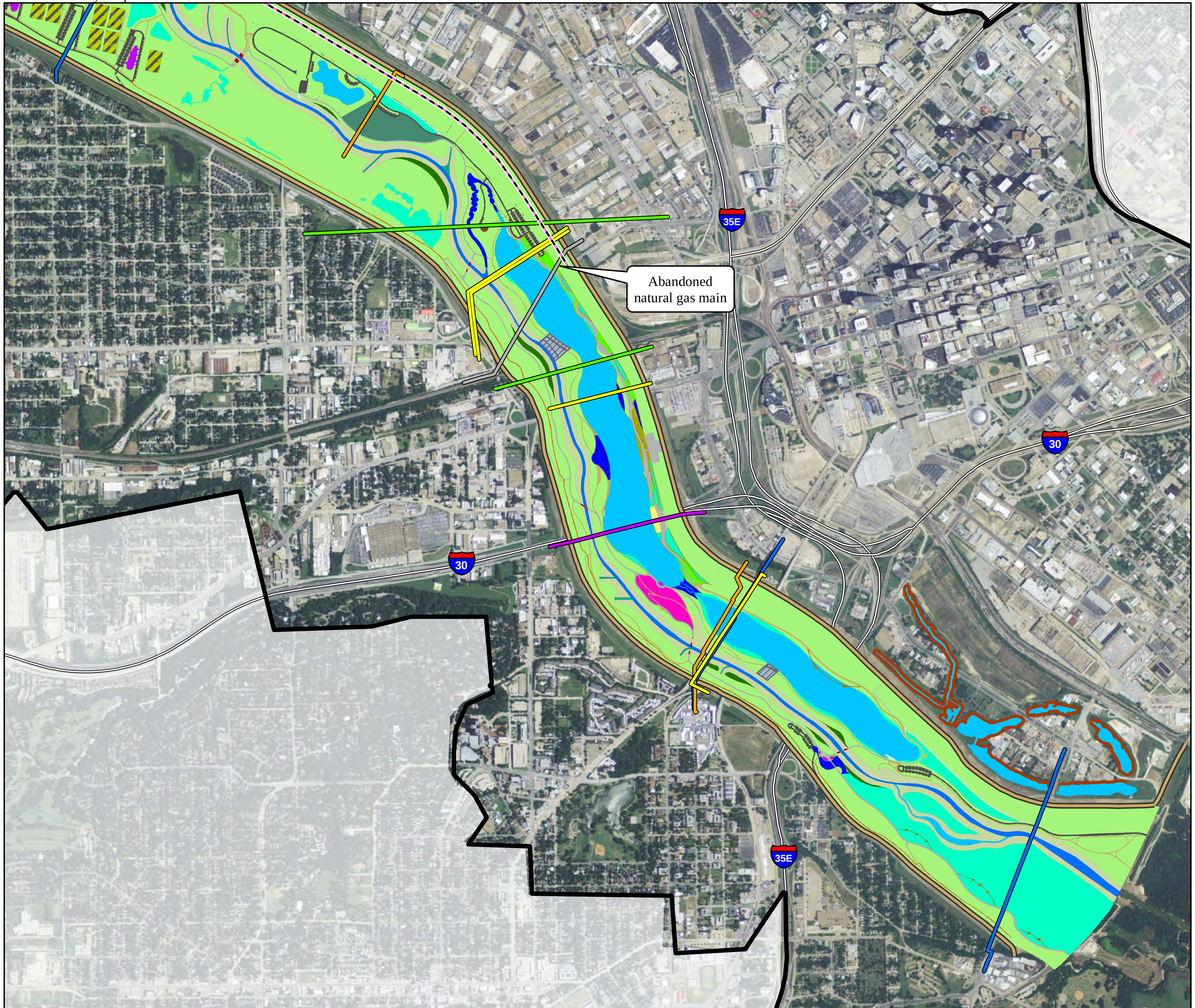
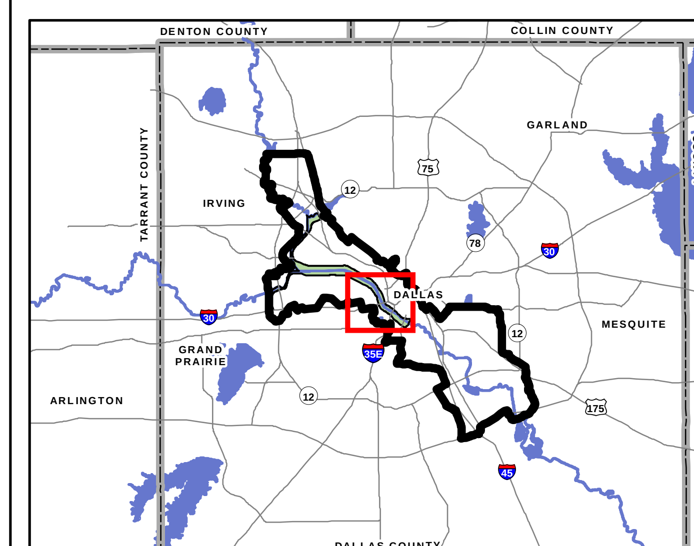


Figure 4.13-3
Utility Adjustment Locations and BVP Study Features: Lower Floodway

LEGEND

Utility Line to be Adjusted
- Electrical
- Natural Gas
- Water Main
- Abandoned
- Fiber Optic
- Telecommunication

Proposed Features
- Amphitheater
- Bench/Curb/Steps/Wall
- Boardwalk
- Boat Access
- Bridge
- Water Feature
- Council Ring
- Lake/Open Water
- Drainage
- Elevated Access
- Park Road
- Equestrian Trail
- Flex Field
- Meadow
- Restricted Access Park Road
- Pavillion
- Planter
- Play Field
- Playground
- Primary Pedestrian Path
- Restroom
- River Bank
- River Channel
- River Terrace
- Secondary Pedestrian Path
- Security Wall
- Service Drive
- Skate Park
- Urban Forest
- Weir
- Wetland
- Cutoff Wall
- Dallas Floodway Levee Crest
- Freeway



0 0.5 1 Kilometers

0 0.25 0.5 Miles

GIS Sources: City of Dallas 2008a, 2008c; NCTCOG 2008; USACE 2011

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Furthermore, to avoid impacts to the electrical system from flooding, permanent facilities within the Floodway would be designed to withstand inundation from floodwaters. Concessions would be trailer based and moved seasonally or in advance of predicted floods. With the inclusion of these project design guidelines, the total increase in consumption of electricity would be sufficiently low to support the conclusion that the impacts on the service area would be less than significant.

Potable Water

An important component of the BVP Study is the responsible management of fresh water. Among the ways the City of Dallas would conserve water is by using treated effluent - rather than fresh potable water - in its design of the water features and amenities associated with the BVP Study. The design specifications would include the re-use of treated wastewater in headwater wetlands, the lake system, and recreational field irrigation, as well as other water-recycling practices. The only potable water that would be consumed would be that used in restrooms and drinking water fountains. Although the BVP Study features would require consumption of potable water, the sustainability practices initiated by the Study would conserve water and not adversely impact the existing water supply.

Wastewater

Treated wastewater from the CWWTP would be pumped to the Natural Lake. On average, up to 60 MGD of treated effluent would be supplied to the lake. Wastewater would be produced from new facilities including restrooms and water fountains around the Floodway. There are 18 total proposed restroom facilities throughout the BVP Study Area, which would be connected to the sewer system. Prior to forecasted flood events, the restrooms would be disconnected to avoid structural loss and sewage spills. Wastewater treatment capacity for the City of Dallas is 260 MGD and average daily city-wide usage is approximately 144 MGD (City of Dallas 2013).

The additional wastewater from the proposed BVP Study facilities would be within the capacity of the existing plants and would not require additional wastewater utility construction.

Stormwater

To accommodate the proposed relocation of the river, the existing stormwater outfalls would need to be modified. The alterations of the outfalls would not affect stormwater conveyance efficiency or capacity, but rather change the water discharge locations.

The BVP Study would improve habitat quality by both constructing new wetlands and enhancing existing wetlands within the Dallas Floodway. The strategy for enhancement and construction includes raising the wetlands slightly above the base of the Floodway and/or providing FRM from low level inundation, debris and sediment via the use of berms. The floodway wetlands would be designed to provide a high flow channel for larger storm events that can be easily accessed for periodic maintenance. Benefits from the additional wetlands would derive from the pollutant removal capabilities inherent in the existing sump areas - screening of floatable material and settling of particulates. Some additional benefit would be derived from uptake of nutrients and additional biofiltering in the wetlands during low flow (non-storm) periods. This treatment would provide measurable benefits for the stormwater flows passing through these sump areas.

Proposed enhancements to the Able Sumps would improve stormwater storage and flow efficiencies, reducing stormwater flood risk in the area.

IDP Improvements

This section focuses on improvements to IDP stormwater conveyance. For a discussion of how these improvements relate to property damage and public safety, refer to Section 4.11.

Hampton Pump Station and Sump Improvements

Construction

The location of the proposed New Hampton Pump Station is adjacent to an industrial park with power and utility lines running just west of the proposed facility. Texas Utility (TXU) overhead power lines would continue to provide service to the Hampton Pumping Plant. Any existing utilities (fire hydrants, gas meters, etc.) that would conflict with the design would be relocated (Figure 4.13-4). Water lines would be extended from Security Drive and be provided by Dallas Water Utilities. Gas service to the site would not be needed. However, there is a 24-inch diameter underground gas main located between the pump station and the levee. This main may require relocation or lowering because of the 84-inch discharge pipes being placed above it (URS 2009a).

Operation

Alternative 2 would increase the pump capacity of the Hampton Pumping Plant by 550,000 gpm. Also, three, 60-inch culverts would be installed to facilitate stormwater flow between the Nobles Branch and Record Crossing Sumps. With the implementation of the proposed improvements, the Hampton Pumping Plant's predicted 100-year, 24-hour storm event elevations would be the same as the design elevation (405 feet), resulting in a substantial reduction in the potential flood extents. The increased pump capacity and sump improvements would increase stormwater conveyance to the Floodway. Increased utility demands generated by the New Hampton Pump Station would be met by area service providers.

Charlie Pump Station and Sump Improvements

Construction

The proposed New Charlie Pump Station would be built on undeveloped land, adjacent to the existing Charlie Pump Station, between Houston and Jefferson Streets. Approximately 430 feet of new, 8-inch diameter water line would be tied in to the existing 12-inch line and run along Brazos Street to provide water service to the new pump station. A new 2-inch line would branch-off from the eight-inch supply line to provide potable domestic water to the station. A fire hydrant would be installed on the eastern end of the 8-inch line for protection of the station. Sewer service for the station would be provided by installing a new section of gravity pipe that would connect the discharge from the pump station restroom to this existing line. Demolition of the Old Charlie Pump Station would occur after the New Charlie Pump Station has been activated.

The TXU overhead power lines that run along Levee Road would continue to provide service to the Charlie Pumping Plant. Power would be supplied to the site from two independent sources, ensuring continued operation during a power outage (URS 2009b). Any existing utilities (e.g., fire hydrants, gas meters, etc.) that would be in conflict with the design plan would be relocated (Figure 4.13-5). Of note, an existing 48-inch gravity sewer line runs at a depth of approximately 20 feet from the northwest to the southeast side of the proposed pump station site. The line would be re-routed around the facility by installing a new section of 54-inch reinforced concrete pipe and four structural manholes.

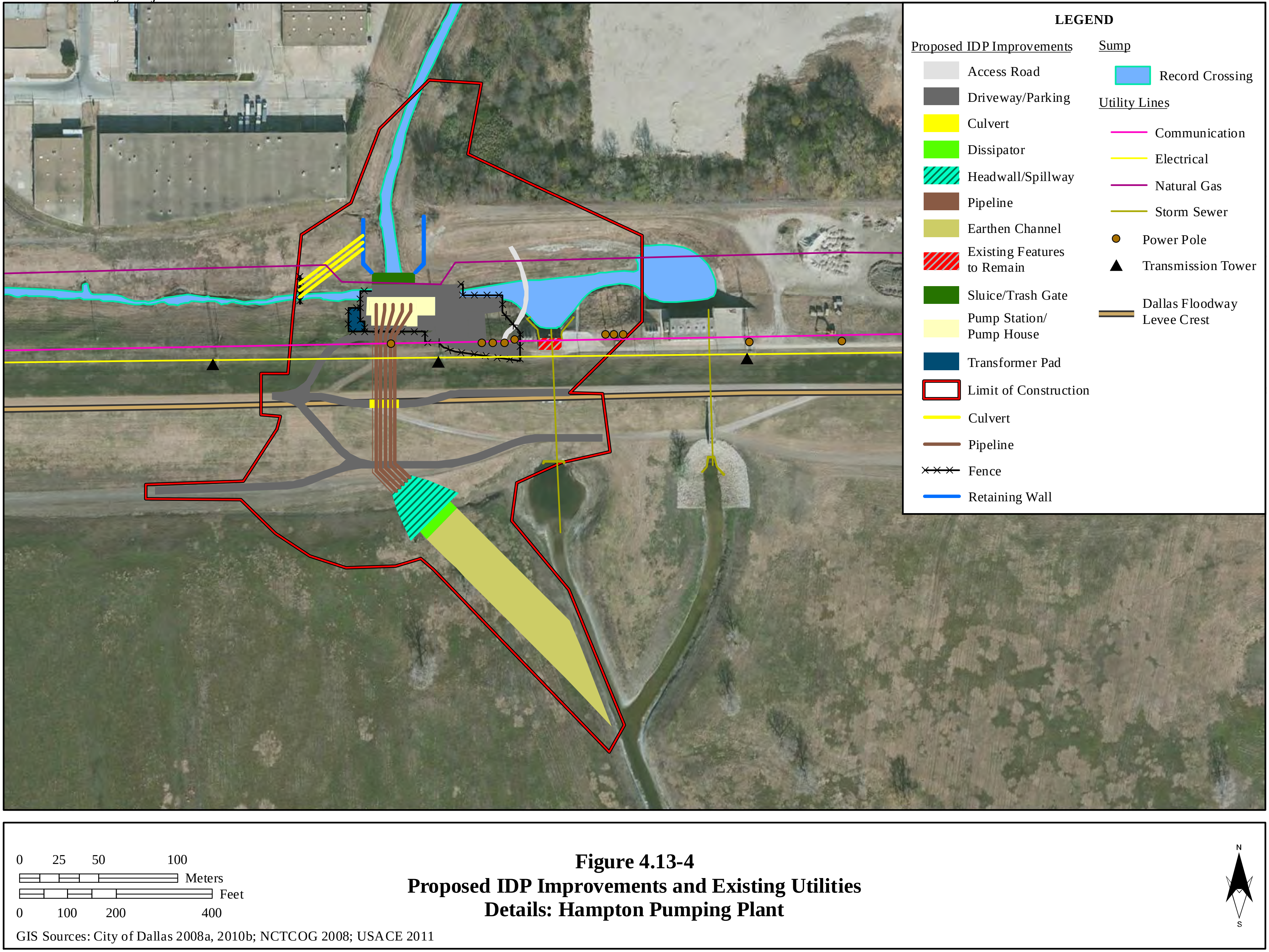

Figure 4.13-4
Proposed IDP Improvements and Existing Utilities
Details: Hampton Pumping Plant

GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2011

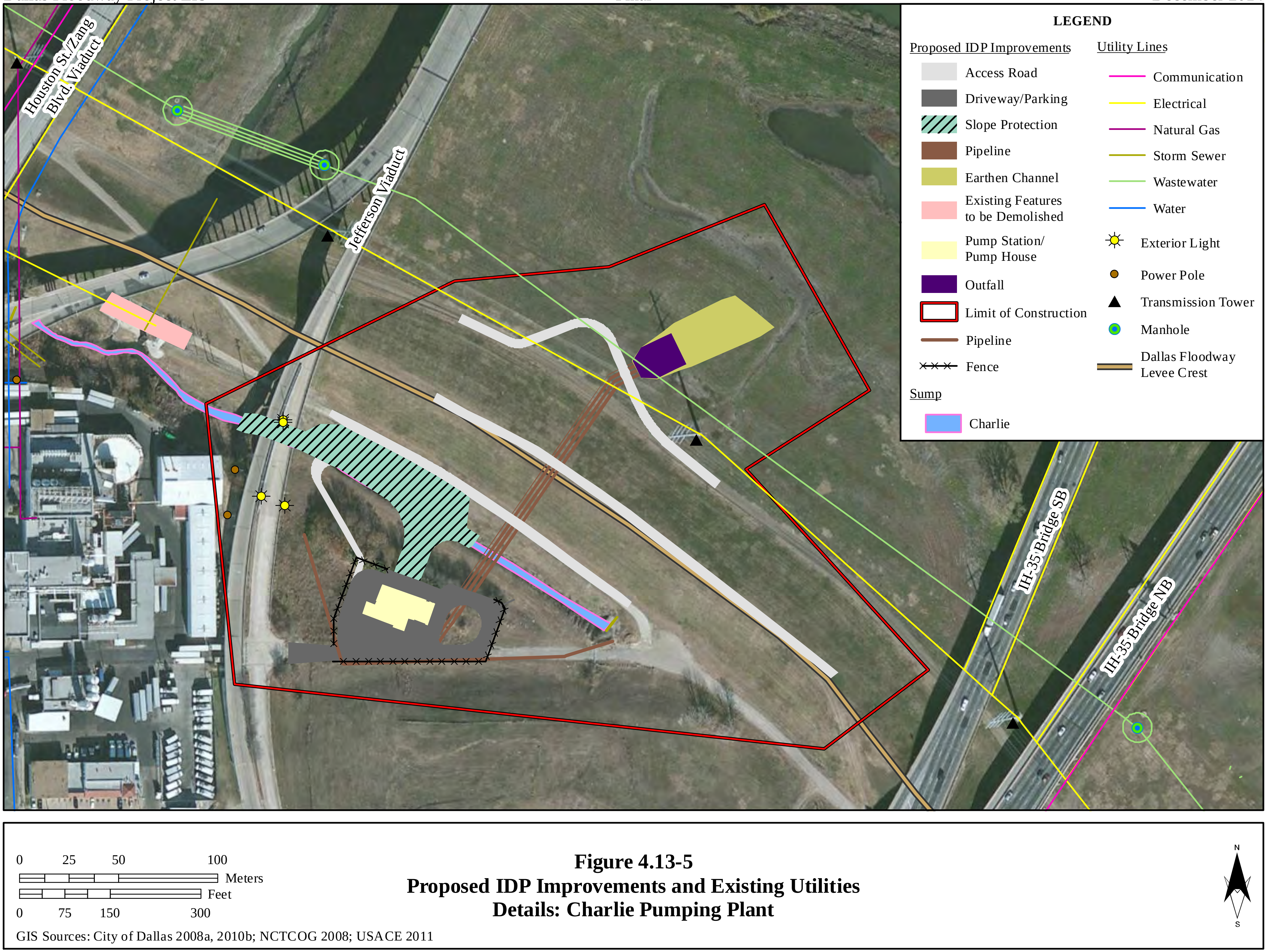

Figure 4.13-5
Proposed IDP Improvements and Existing Utilities
Details: Charlie Pumping Plant

GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2011

Operation

Alternative 2 would increase the pump capacity of the Charlie Pumping Plant by 145,000-gpm. The increased pump capacity would increase stormwater conveyance to the Floodway. A standby generator would be used in case of emergency. Increased utility demands generated by the New Charlie Pump Station would be met by area service providers.

With the implementation of the proposed improvements, the Charlie Pumping Plant's predicted 100-year, 24-hour storm event elevations would be the same as the design elevation (402.5 feet), resulting in a substantial reduction in the potential flood extents. The increased pump capacity and sump improvements would increase stormwater conveyance to the Floodway.

Delta Pump Station and Sump Improvements

Construction

The proposed Delta Pump Station would be located on the West Levee adjacent to the existing Delta Pump Station, along Canada Drive. An increase in electrical supply would be required because of the increased size of the pump. The TXU overhead power lines that run along Levee Road would provide this increase in service demand to the Delta Pumping Plant (Figure 4.13-6). Any existing utilities (fire hydrants, gas meters, etc.) that would be in conflict with the design plan would be relocated.

Operation

Alternative 2 would increase the pump capacity of the Delta Pumping Plant by 166,000 gpm. The increased pump capacity would increase stormwater conveyance to the Floodway. A standby generator would be installed for use in case of emergency. Increased utility demands generated by the New Delta Pump Station would be met by existing area service providers.

With the implementation of the proposed improvements, the Delta Pumping Plant's predicted 100-year, 24-hour storm event water levels would be the same as the design elevation (406.9 feet), resulting in a substantial reduction in the potential flood extents.

Trinity-Portland Pumping Plant and Sump Improvements

Construction

The proposed Trinity-Portland Pump Station would be located on the West Levee between Mexicana Road and Canada Drive. Water and sewer are available. The TXU overhead power lines that run along Levee Road would continue to provide service to the Trinity-Portland Pumping Plant (Figure 4.13-7). No utilities are anticipated to be relocated.

Operation

As there is currently no pumping plant located in the Trinity-Portland Basin, the construction of the new Trinity-Portland Pumping Plant would increase pumping capacity to 225,000 gpm. The increased pump capacity and installation of the proposed gated conduit structure between Trinity-Portland and Eagle Ford sumps would allow for selective exchange of flow between these two sumps and would increase stormwater conveyance to the Floodway. A standby generator would be used in case of emergency. Increased utility demands generated by the Trinity-Portland Pumping Plant would be met by area service providers.

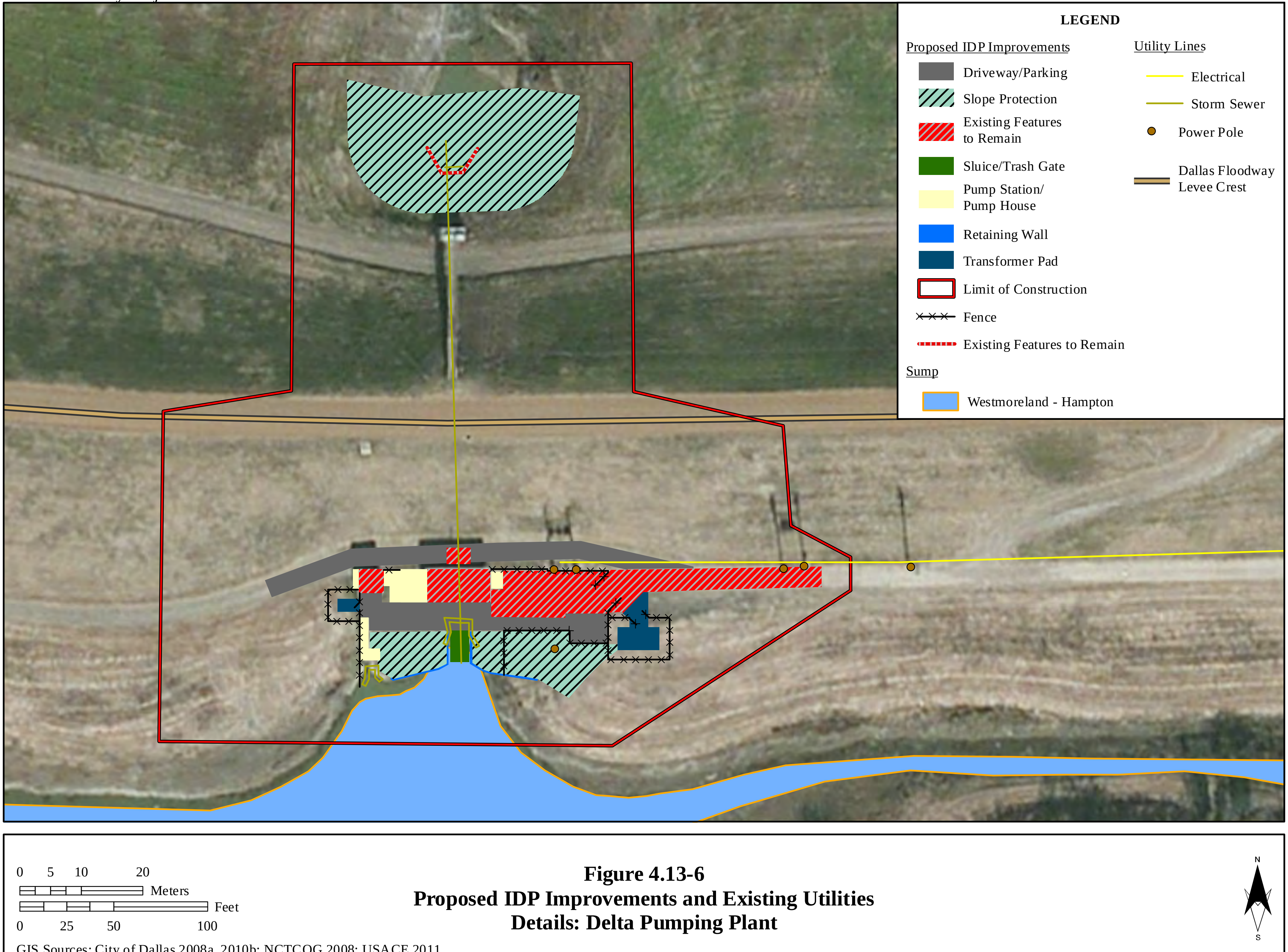

Figure 4.13-6
Proposed IDP Improvements and Existing Utilities
Details: Delta Pumping Plant

GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2011

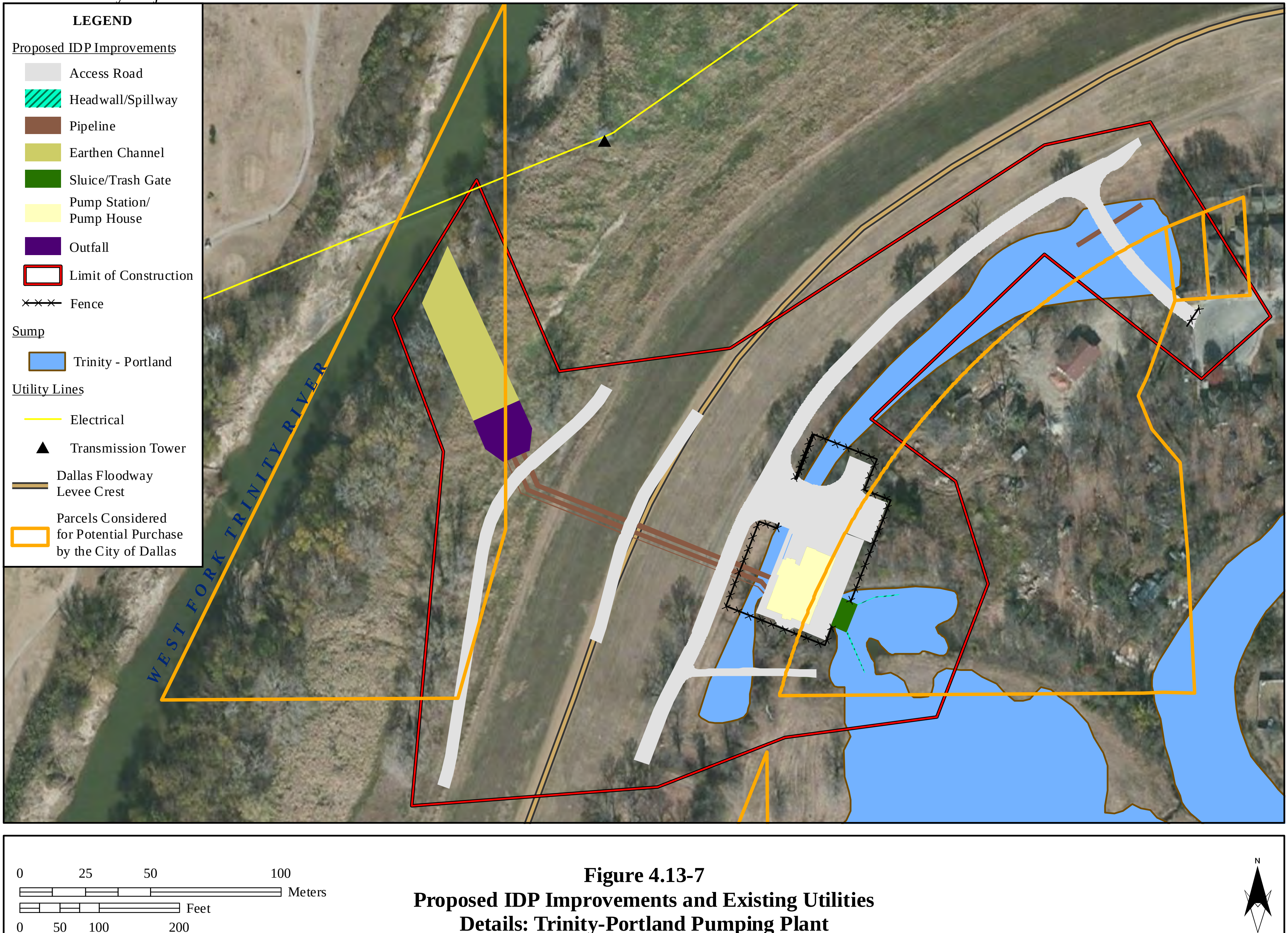

Figure 4.13-7
Proposed IDP Improvements and Existing Utilities
Details: Trinity-Portland Pumping Plant

GIS Sources: City of Dallas 2008a, 2010b; NCTCOG 2008; USACE 2011

With the implementation of Alternative 2, the Trinity-Portland Pumping Plant's predicted 100-year, 24-hour storm event water levels would be the same as the design elevation (411.5 feet), resulting in a substantial reduction in the potential flood extents.

4.13.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential impacts to utilities from implementation of the proposed FRM elements and IDP improvements would be the same under both design variations, as there would be no change in these components. Therefore, refer to Sections 4.13.3 for a discussion of impacts to utilities associated with implementation of the FRM elements and IDP improvements, respectively.

<u>BVP Study Ecosystem and Recreation Features</u>

The construction of the BVP Study Ecosystem and Recreation features under the design without potential Trinity Parkway construction anticipated would involve the same utility relocations that are described in Section 4.13.3; however, because the potential Trinity Parkway is assumed to not be constructed, all utility relocations would be the responsibility of the BVP Study project proponent, whereas under the design anticipating potential Trinity Parkway construction, some relocations would occur during construction of the potential Trinity Parkway and would be the responsibility of the FHWA. Under both design variations, advanced notice would be given to those customers that would be affected by service disruptions. Operational impacts would be the same under both design variations.

4.13.3.3 Summary

Prior to implementation of the Proposed Action, construction managers would be required to ensure that proposed construction activities would not physically impact existing infrastructure (e.g., buried pipes, power lines) by contacting utility providers to locate utilities infrastructure and identifying utility crossings. Any impacts to utility services during construction would be temporary and communicated to customers ahead of the temporary outage. Impacts to utilities under the design anticipating potential Trinity Parkway construction would be slightly greater, but not substantially different, during the construction phase as compared to design anticipating potential Trinity Parkway construction because more utilities would be temporarily affected to create the proposed BVP Study lakes. The proposed operations associated with the BVP Study features would result in an increase in utility demand; however, this increase is anticipated to be met by local and regional utility providers and BVP Study features (e.g., PV panels). The proposed IDP improvements would substantially increase the level of stormwater conveyance. Therefore, implementation of Alternative 2 would result in beneficial impacts to utilities. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.13.3.4 Cumulative Impacts

Implementation of Alternative 2 would result in beneficial impacts to utilities by improving stormwater conveyance. Several past, present, and reasonably foreseeable projects would also result in improvements to overall utility service. The proposed Beckley Avenue Improvements project would include a major new drainage system and upgrades to water and wastewater mains. The proposed EF2 Wastewater Interceptor Line project would increase the capacity of wastewater conveyance throughout the Study Area. Also, the Able and Baker Pumping Plant Improvements are anticipated to reduce the stormwater flood risk in the Able and the Oak Lawn Basin, respectively. All past, present, and reasonably foreseeable projects would be implemented following coordination with regional utility providers to minimize the potential for impacts to utilities.

The various build alternatives of the potential Trinity Parkway project would impact electrical, communications, water, sanitary sewer, natural gas, and storm drainage utilities. Specifically, construction of the potential Trinity Parkway within the Floodway would relocate at least two potable water lines, two natural gas lines, and five overhead electrical transmission lines. These relocations may result in temporary, localized utility disturbance; the NTTA is currently coordinating with the Public Utilities Commission to maximize efficiencies and minimize service interruptions (FHWA 2014). Relocations would be required to comply with FHWA regulations 23 CFR Part 645. Operations of the potential Trinity Parkway would require electricity for lighting and toll collection activities.

Under the design without potential Trinity Parkway construction anticipated, the project proponents do not anticipate the potential Trinity Parkway being constructed. Without the Trinity Parkway construction, substantially more utility relocations (potentially at least 8 potable water lines, between 1 and 3 sewer lines, 1 natural gas line, 6 electrical transmission lines, and an electrical substation) and associated temporary, localized interruptions would occur (FHWA 2014).

Potential temporary, localized interruptions in utility service may result from implementation of Alternative 2 and from several other past, present, and reasonably foreseeable projects. These interruptions are not anticipated to be long lasting, to impact large sections of the Study Area, or to repeatedly impact smaller sections of the Study Area. Implementation of Alternative 2 would require coordination with the Public Utilities Commission and other activities in the region to minimize impacts to individuals from service interruptions. Because of the localized, temporary nature of the potential service interruptions, implementation of Alternative 2 in combination with the past, present, and reasonably foreseeable projects would result in less than significant cumulative impacts to water, sewer, electrical, gas, and communications utilities.

Operationally, because the proponents for Alternative 2 and all identified past, present, and reasonably foreseeable projects requiring utility connection and/or relocation coordination with the Public Utilities Commission, the power requirements of Alternative 2 cumulatively with other projects are not anticipated to significantly impact the regional power supply or other utility services. The future needs are anticipated to be within existing and future service distribution/collection capacities and capabilities (U.S. Energy Information Administration 2013).

In conjunction with Alternative 2, past, present, and reasonably foreseeable projects would further reduce the extent of flooding in the communities alongside the levees from a 100-year, 24-hour storm event. Alternative 2 contributes significantly to this reduction as well, and thus there would be a significant, beneficial impact to stormwater conveyance. As the cumulative benefits to stormwater conveyance are significant and long term, they are expected to outweigh the inconvenience of temporary, localized interruptions in service. Therefore, implementation of Alternative 2 in combination with the past, present, and reasonably foreseeable projects would result in beneficial cumulative impacts to utilities.

4.14 AIR QUALITY

4.14.1 Approach to Analysis

Emissions projected to occur as a result of implementing the Proposed Action were evaluated to determine potential impacts to regional air quality. Potential air quality impacts would include: (1) increasing ambient air pollution concentrations above the National Ambient Air Quality Standards (NAAQS), (2) contributing to an existing violation of the NAAQS, (3) interfering with, or delaying timely attainment of the NAAQS, (4) impairing visibility within federally-mandated Prevention of Significant Deterioration (PSD) Class I areas, or (5) resulting in the potential for any new stationary source to be considered a major source of emissions.

The closest PSD Class I area to Dallas, Texas is the Wichita Mountains Wilderness Area in Oklahoma, a distance of approximately 175 miles. Therefore, there are no PSD Class I areas within regulatory proximity of the Study Area and this impact threshold was not carried forward in the analysis.

On March 24, 2010, the USEPA revised the General Conformity regulations. These rules implement Clean Air Act (CAA) provisions prohibiting federal agencies from taking actions that may cause or contribute to violations of the NAAQS. A formal conformity determination is required for federal actions occurring in nonattainment or maintenance areas when the total direct and indirect stationary and mobile source emissions of nonattainment pollutants or their precursors exceed *de minimis* thresholds. As discussed in Section 3.14.3.1, the applicable criteria pollutant *de minimis* levels are 50 tons/year for volatile organic compounds (VOCs) and oxides of nitrogen (NO_x); VOCs and NO_x are precursors to the formation of ozone (O_3). The Study Area is in attainment of the NAAQS for all other criteria pollutants (*de minimis* thresholds are only applicable for nonattainment pollutants).

4.14.2 Alternative 1: Future Without-Project Condition

Under the Future Without-Project Condition, many large-scale transportation, planning, and recreation enhancement projects would likely occur within the Study Area between existing conditions and the year 2065, resulting in impacts to regional air quality. Many of the identified future projects would require the use of heavy construction equipment and vehicles, which would result in a temporary increase in mobile source emissions (most notably VOCs and NO_x, particulate matter less than 2.5 microns in diameter [$PM_{2.5}$], and particulate matter less than 10 microns in diameter [PM_{10}]) to the region. The proposed future construction projects would likely require a conformity applicability analysis and demonstration of compliance with the Texas State Implementation Plan (SIP), where applicable.

Following construction, an overall reduction in mobile source emissions would be expected to occur as the majority of the Future Without-Project Condition projects are designed to improve traffic and circulation, promote pedestrian and bicycle use, and enhance recreational opportunities, all of which could result in a reduction in vehicle trips and lengths and beneficial impacts to air quality. None of the identified future projects would result in significant new sources of stationary emissions. Thus, under the Future Without-Project Condition there would likely be a reduction in mobile emissions and beneficial impacts to air quality within the Air Quality Control Region (AQCR).

Under the Future Without-Project Condition, the TCEQ would continue to implement the strategies outlined in the December 2011 Dallas-Fort Worth SIP revision for demonstrating attainment of the federal O_3 standard (TCEQ 2011). With implementation of TCEQ's SIP strategies, technologically driven reductions in vehicle and equipment emissions, a promotion of mass transit, and implementation of the reasonably foreseeable projects that enhance recreational opportunities and improve traffic and circulation, air quality within the AQCR over the next several decades would likely improve. Specifically, the overall trend of a reduction in NO_x emissions as captured in Table 4.14-1 would likely continue. VOC emissions would likely stabilize if not decrease.

Table 4.14-1. Estimated Change in Emissions in the Dallas-Fort Worth O_3 Non-Attainment Area (tons per day) under the Future Without-Project Condition

Criteria Pollutant	*2006 Baseline Emissions*	*2012 Emissions*	*Future Without Project Condition*
VOC	505	522	Stabilize
NO_x	519	370	Decrease

Source: TCEQ 2011.

4.14.3 Alternative 2: Proposed Action

4.14.3.1 Design Anticipating Potential Trinity Parkway Construction

Overview

This air quality analysis considers the environmental consequences resulting from implementation of the elements as summarized in Table 2-1. The Proposed Action consists of implementing the BVP Study FRM elements and Ecosystem and Recreation features, and IDP improvements within the Trinity River Corridor in Dallas, Texas.

Assessing potential impacts requires an evaluation of the emissions generated as a result of implementing the design anticipating potential Trinity Parkway construction, and assessing if these emissions would either increase ambient air pollution concentrations above the NAAQS, contribute to an existing violation of the NAAQS, interfere or delay attainment of the NAAQS, or result in the construction of a new major stationary source. To assess if emissions could contribute to an existing violation or otherwise interfere with attainment of the NAAQS for O_3, NO_x and VOC emissions were estimated using industry standards, and then compared to the General Conformity Rule (GCR) *de minimis* thresholds. The applicable GCR *de minimis* levels are 50 tons/year for VOCs and NO_x; VOCs and NO_x are precursors to the formation of O_3.

Because this design variation would primarily generate air emissions as a result of construction activities, the air quality analysis has been quantitatively evaluated. Detailed estimated emissions calculations resulting from all project activities, and construction scenarios and schedule assumptions are presented in Appendix N, *Air Quality Emissions Estimates*. These assumptions take into account the anticipated project implementation timeline discussed in Section 2.3.2.3. It was assumed that construction planning and design would commence in March 2015, and all construction activities would be completed in September 2029. It was also assumed that larger elements in the FRM and IDP would be constructed first, before implementing many of the "surface" BVP Study features.

For the purpose of analyzing air quality impacts, emissions are presented per year of construction implementation and many of the FRM elements, BVP Study features, and IDP improvements were assumed to overlap within a given implementation year. Table 4.14-2 presents the estimated VOC and NO_x emissions, by year, that were estimated to occur from construction activities associated with this design variation. The emissions were then compared to the GCR thresholds to assess conformity applicability. For the remaining pollutants, the annual emissions were compared to the latest published compilation (2008) of Dallas County emissions to provide a frame of reference as to the percent contribution that this design variation's emissions would represent during the year with the greatest estimated emissions (Table 4.14-3).

Table 4.14-2. Annual Summary of Estimated VOC and NO_x Emissions from Proposed Action and Comparison to GCR *de minimis* Thresholds, Design Anticipating Potential Trinity Parkway Construction

Year	*Estimated Emissions (in tons per year)*	
	VOCs	*NO_x*
2016	1.51	13.08
2017	25.84	**202.54**
2018	20.85	**166.57**
2019	48.84	**445.80**
2020	45.55	**390.87**
2021	41.93	**368.78**
2022	38.35	**341.86**
2023	32.48	**301.82**
2024	33.87	**323.21**
2025	18.91	**151.30**
2026	35.19	**310.79**
2027	36.04	**342.61**
2028	4.36	34.03
2029	1.45	11.55
de minimis Thresholds	50	50
Exceeds *de minimis* Thresholds?	No	Yes

Note: Bolded values represent years where exceedances of the GCR thresholds would occur.

Table 4.14-3. Annual Summary of Estimated CO, SO_2, PM_{10}, and $PM_{2.5}$ Emissions from Proposed Action and Comparison to 2008 Dallas County Emissions, Design Anticipating Potential Trinity Parkway Construction

Year	*Estimated Emissions (in tons per year)*			
	CO	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
2016	6.13	0.02	5.24	1.46
2017	115.80	.34	38.07	13.19
2018	95.97	0.27	26.91	9.91
2019	196.71	0.58	41.19	19.55
2020	**190.35**	**0.56**	**44.35**	**19.54**
2021	172.65	0.05	35.84	16.88
2022	157.11	0.47	32.66	15.39
2023	130.46	0.38	21.68	11.72
2024	134.60	0.39	21.36	12.01
2025	84.77	0.23	21.64	8.45
2026	146.03	0.43	24.06	12.94
2027	142.09	0.41	20.36	12.31
2028	20.13	0.05	3.36	1.66
2029	7.15	0.02	1.39	0.62
[1]2008 Dallas County emissions	2,595,454	1,068	45,007	9,207
% of county emissions (2020)	0.007%	0.047%	0.128%	0.218%

Note: Bolded values represent year with largest quantity of emissions.
Source: [1] USEPA 2013.

Estimated emissions associated with this design variation would exceed *de minimis* thresholds for NO_x (50 tons per year) for the 2017 through 2027 construction years. Based on the preliminary project assumptions, NO_x emission estimates for the proposed project elements under this design variation would require a determination of conformity. This may be achieved by:

- Documenting that the emissions from the action are identified and accounted for in the SIP;
- Obtaining a statement from the TCEQ that the emissions from the action along with all other emissions in the area do not exceed the budget for those emissions in the SIP;
- Having the Dallas – Fort Worth Metropolitan Planning Organization provide a statement that the emissions are included in transportation plan modeling;
- Having the state agree to include the emissions in the SIP; or
- Mitigating or offsetting the increase in emissions.

Implementation of the Proposed Action design anticipating potential Trinity Parkway construction would result in temporary increases in criteria pollutant emissions associated with construction activities. A comparison of the annual emissions to the 2008 Dallas County emission inventory demonstrates that in the year when the greatest quantity of emissions would be generated (2020), the emissions would represent less than one-third of 1% of the county emissions in 2008 for $PM_{2.5}$ and less than that for the remaining pollutants. Vehicle emissions generated by proposed construction activities would be temporary; no long-term increases in mobile or stationary source emissions would occur in the region.

Fugitive dust (i.e., PM_{10} and $PM_{2.5}$) would increase as a result of surface disturbances associated with construction activities and would temporarily impact local air quality. However, fugitive dust generated by proposed construction activities would be temporary; no long-term increases in fugitive dust would occur following the completion of construction activities. In addition, increases in PM_{10} and $PM_{2.5}$ would be moderated through implementation of the SCMs identified in Chapter 7, thereby limiting the total quantity of fugitive dust emitted during project implementation.

<u>BVP Study FRM Elements</u>

Construction

Air quality impacts would occur from the use of equipment during construction activities, other project-related vehicles, and worker commuting trips. Detailed emission calculations from implementation of the FRM elements are presented in Appendix N. Included in Appendix N is a detailed assumed construction schedule that outlines the estimated construction duration and schedule for the FRM elements. This construction scenario was based on industry standards and data provided by the USACE. The following assumptions were made regarding the construction activities associated with implementing the FRM elements:

The levee raise and levee construction and relocation activities would occur between May 2017 and December 2019 and would include the following elements:

- West levee raise
- West fork levee raise
- East levee raise
- Elm fork levee raise
- AT&SF Railroad Bridge modification
- Removal and replacement of roads
- Rip-Rap removal and replacement

Operation

Operational emissions associated with the FRM elements are not anticipated to increase substantially. Minor maintenance activities may occur; however, emissions associated with these activities would be similar to existing conditions.

<u>BVP Study Ecosystem and Recreation Features</u>

Construction

The following assumptions were made regarding the construction activities associated with implementing the BVP Study features:

- Lakes (West Dallas Lake, Urban Lake, and Natural Lake) construction would occur from December 2022 through February 2026 and would include the following elements:
  - Wetlands
  - Trails
  - Parking
  - Lighting
  - Boat launches and facilities
  - Water features
  - Amphitheaters
- River modification would occur from May 2018 through March 2027, and would include the following elements:
  - Relocation
  - River terraces
  - Boat/canoe launches
  - Oxbow Lake
  - Channel modifications
  - Bridge Pier modifications
  - Utility relocations
- Wetlands construction would occur from January 2019 through December 2021, and would include the following elements:
  - Marshlands
  - Corinth Wetlands
- Athletic facilities construction would occur from 2022 through 2024.
- General feature construction would occur from 2019 through 2024, and would include the following:
  - Parking
  - Lighting
  - Vehicular access and roads
  - Trails
  - Restrooms
  - Sidewalks and boardwalks
  - Stairs
  - Wetland garden
  - Forested Ponds
  - Observation decks/blinds
  - Pedestrian bridges

- Interior Drainage Connections would occur from 2016 through 2018, and would include the following elements:
    - Interior drainage outfall modifications
    - Able Pumping Plant sump ponds and enhancements

Operation

With implementation of the BVP Study features, additional people would be expected to visit and recreate in the area compared with baseline conditions. Operational emissions associated with the influx of visitors would primarily consist of mobile emissions from vehicle use. However, it is reasonably assumed that the majority of mobile source emissions currently occur within the region, and no substantial increases in operational emissions would occur within the Metropolitan Dallas-Fort Worth AQCR. As the attractiveness of the BVP increases through feature completion, there would be a potential for a slight increase in out of region visitors, resulting in a negligible increase in regional mobile emissions. Ongoing maintenance activities would occur, particularly with respect to maintaining the Natural and Urban Lakes; however, emissions associated with these activities would not be considered substantial.

<u>IDP Improvements</u>

East Levee Projects

Construction

Air quality impacts would occur from the use of equipment during demolition and construction activities, other project-related vehicles, and worker commuting trips. Emissions calculations from implementation of the East Levee projects are presented in Appendix N. Using industry standards and data provided by USACE, the following assumptions were made regarding the construction activities associated with implementing the East Levee Projects:

- The Hampton Pump Station improvements would occur between February 2020 and September 2021.
- The Nobles Branch sump improvements would occur between September 2021 and October 2021.

Operation

Operational emissions associated with the East Levee projects are not anticipated to increase substantially. Minor maintenance activities and use of emergency backup generators may occur; however, emissions associated with these activities would be similar to existing conditions.

West Levee Projects

Construction

Air quality impacts would occur from the use of equipment during construction activities, other project-related vehicles, and worker commuting trips. Emissions calculations from implementation of the West Levee projects are presented in Appendix N, Tables 5-7. Using industry standards, the following assumptions were made regarding the construction activities associated with implementing the West Levee Projects:

- Construction of the New Charlie Pump Station would occur between December 2017 and April 2018.
- Rehabilitation of the Delta Pump Station would occur between March 2019 and May 2019.
- Construction of the New Delta Pump Station would occur between March 2019 and May 2019.

- Construction of culvert improvements at the Eagle Ford Sump would occur between March 2016 and March 2017.
- Construction of the Trinity-Portland Pump Station would occur between May 2019 and July 2020.

Operation

Operational emissions associated with the West Levee projects are not expected to increase substantially. Minor maintenance activities and use of emergency backup generators may occur; however, emissions associated with these activities would be similar to existing conditions.

4.14.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential air quality impacts associated with implementation of the proposed FRM elements and IDP improvements would be the same as presented under the design anticipating potential Trinity Parkway construction, as there would be no change in these components. Therefore, refer to the sections titled "BVP Study FRM Elements" and "IDP Improvements" within Section 4.14.3.1 for a discussion of air quality impacts caused by the implementation of those elements and improvements. The following section presents the potential impacts to air quality caused by the implementation of the BVP Study Ecosystem and Recreation features as designed without anticipating construction of the potential Trinity Parkway. These features are slightly different from those presented under the design that does anticipate the Trinity Parkway being constructed.

BVP Study Ecosystem and Recreation

This Proposed Action design variation assumes that the potential Trinity Parkway would not be constructed. Accordingly, because partial excavation of lakes for the potential Trinity Parkway would not occur prior to the BVP, the excavation requirements of this design variation would be substantially higher than those associated with the Proposed Action design anticipating potential Trinity Parkway construction. As described in Section 4.12.3.2, this analysis assumes a worst case scenario whereby all excess cut material would be transported out of the Floodway.

Construction

Because this design variation would primarily generate air emissions as a result of construction activities, the air quality analysis has been quantitatively evaluated. The anticipated project implementation timeline would be the same as for the Proposed Action design anticipating potential Trinity Parkway construction, and construction assumptions and impacts would be similar to those described under that design variation. Detailed estimated emissions calculations resulting from all project activities, and construction scenario and schedule assumptions are presented in Appendix N. Additional excavation equipment and haul truck trips would be required under this design variation because all excavation needed for construction of the lakes would be completed under the BVP. In addition, all vehicular access points would be completed under the BVP as part of this design variation. As shown in Table 4.14-4, estimated emissions would therefore be slightly higher during the 2017, 2022, and 2023 construction years than those identified under the Proposed Action design anticipating potential Trinity Parkway construction.

Table 4.14-4. Annual Summary of Estimated VOC and NO_x Emissions from Implementation of Proposed Action and Comparison to GCR *de minimis* Thresholds, Design Without Potential Trinity Parkway Construction Anticipated

Year	*Estimated Emissions (in tons per year)*	
	VOCs	*NO_x*
2016	1.51	13.08
2017	25.93	**204.22**
2018	20.96	**168.81**
2019	48.84	**445.80**
2020	45.55	**390.87**
2021	41.93	**368.78**
2022	49.78	**435.41**
2023	39.31	**357.75**
2024	31.69	**306.25**
2025	6.84	**55.35**
2026	34.31	**307.61**
2027	36.04	**342.61**
2028	4.36	34.03
2029	1.45	11.55
de minimis Thresholds	50	50
Exceeds *de minimis* Thresholds?	Yes	Yes

Note: Bolded values represent years where exceedances of the GCR thresholds would occur.

The estimated VOC and NO_x air quality emissions, by year, were estimated to occur from construction activities associated with this design variation. The emissions were then compared to the GCR thresholds to assess conformity applicability. For the remaining pollutants, the annual emissions were compared to the latest published compilation (2008) of Dallas County emissions to provide a frame of reference as to the percent contribution that this design variation's emissions would represent during the year with the greatest estimated emissions (Table 4.14-5).

Table 4.14-5. Annual Summary of Estimated CO, SO_2, PM_{10} and $PM_{2.5}$ Emissions from Implementation of Proposed Action and Comparison to 2008 Dallas County Emissions, Design Without Potential Trinity Parkway Construction Anticipated

Year	*Estimated Emissions (in tons per year)*			
	CO	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
2016	6.13	0.02	5.24	1.46
2017	116.24	0.35	48.08	14.96
2018	96.55	0.29	40.26	12.27
2019	196.71	0.58	41.19	19.55
2020	190.35	0.56	44.35	19.54
2021	172.65	0.05	35.84	16.88
2022	**210.92**	**0.63**	**67.69**	**24.49**
2023	166.05	0.49	49.94	18.45
2024	123.77	0.36	22.57	11.83
2025	30.76	0.085	6.90	2.90
2026	140.26	0.41	26.48	13.14
2027	142.09	0.41	20.36	12.31
2028	20.13	0.05	3.36	1.66
2029	7.15	0.02	1.39	0.62
[1]2008 Dallas County emissions	2,595,454	1,068	45,007	9,207
% of county emissions (2020)	0.009%	0.057%	0.019%	0.299%

Note: Bolded values represent year with largest quantity of emissions.
Source: [1] USEPA 2013.

Similar to the design anticipating potential Trinity Parkway construction, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated would exceed de minimis thresholds for NO_x (50 tons per year) during the same construction implementation years described in the preceding section.

Operation

The operational impacts of this design variation would be similar to those described for the design anticipating potential Trinity Parkway construction described in the preceding section.

4.14.3.3 Summary

Implementation of the both design variation would result in temporary increases in criteria pollutant emissions associated with construction activities. Estimated NO_x emissions generated by construction activities would exceed GCR *de minimis* thresholds for NO_x; however, TCEQ has concurred with the USACE (refer to Appendix A) that the total estimated NO_x emissions would be well within the emissions threshold for the 2007 Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Reasonable Further Progress SIP, as demonstrated in the Conformity Analysis prepared by the USACE (refer to Appendix N) (TCEQ 2014). The estimated construction emissions for the design without potential Trinity Parkway construction anticipated would be only slightly greater during the peak construction years (2017, 2022, and 2023) than those estimated for the design anticipating potential Trinity Parkway construction.

Thus, while implementation of both Proposed Action design variations would result in significant adverse impacts to air quality, the impacts would be addressed and moderated to the extent possible. No substantial long-term increase in mobile or stationary source emissions in the ROI would occur. Implementation of both Proposed Action designs variation would result in significant adverse impacts to air quality during construction and less than significant impacts to air quality during operation. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.14.3.4 Cumulative Impacts

<u>Design Anticipating Potential Trinity Parkway Construction</u>

Construction

The ROI considered in this air quality cumulative analysis includes areas adjacent to the Study Area and potentially the entire Metropolitan Dallas-Fort Worth AQCR. Cumulative impacts resulting from this design variation, in conjunction with impacts from other projects discussed in Section 2.7, would potentially occur during proposed construction activities.

As discussed above, proposed construction activities under this design variation would produce emissions that would exceed applicable GCR significance thresholds for NO_x during multiple years of project implementation. Any concurrent emissions-generating action that occurs in the region would potentially further contribute to ambient air quality impacts.

As a result of the significant air quality impacts identified, a conformity determination would be prepared prior to project implementation to demonstrate that the net increase in NO_x would conform to the SIP. An impact analysis would determine whether or not emissions from this design variation and combined projects implemented during the same construction period would adversely impact the regions requirements to attain compliance with the O_3 standard or increase ambient air pollution concentrations above the NAAQS for any of the other criteria pollutants. The combination of proposed and future project emissions of O_3 would be minimized through the USEPA and TCEQ enforcement of federal and state regulations, which would insure that despite the increase in O_3 emissions, compliance with the O_3 standard and SIP is not prevented and the maintenance of air quality standards for all other criteria pollutants is not jeopardized.

The combination of proposed and future project emissions of carbon monoxide (CO), sulfur dioxide (SO_2), PM_{10}, and $PM_{2.5}$ would be unlikely to contribute to an exceedance of an ambient air quality standard based on air quality levels that are measured today, as none of these pollutants are currently trending towards nonattainment. In addition, projected impacts associated with the potential Trinity Parkway project, which is considered a substantial regional reasonably foreseeable project, determined that concentrations of criteria pollutants are not expected to exceed ambient air quality standards at any time.

Operation

Operational emissions are not expected to increase substantially and would be similar to baseline conditions. There are no identified past, present, and reasonably foreseeable projects (refer to Section 2.7) that suggest that operational impacts would result in significant air quality impacts. The combination of proposed operations and future project operational emissions would not be expected to significantly increase.

Summary

Implementation of this design variation in combination with the identified past, present, and reasonably foreseeable projects would result in significant adverse impacts to air quality during construction and less than significant impacts to air quality during operation.

<u>Design Without Potential Trinity Parkway Construction Anticipated</u>

Implementation of the Proposed Action design without potential Trinity Parkway construction anticipated would result in similar cumulative impacts as described in the preceding section, with the exception that cumulative impacts to air quality would be greater than those associated with the design anticipating potential Trinity Parkway construction. The proposed construction activities under this design variation would produce emissions that would exceed applicable GCR significance thresholds for NO_x during multiple years of project implementation. Any concurrent emissions-generating action that occurs in the region would potentially further contribute to ambient air quality impacts.

As a result of the significant air quality impacts identified, a conformity determination would be prepared prior to project implementation to demonstrate that the net increase in NO_x and VOCs would conform to the SIP. An impact analysis would determine whether or not emissions from this design variation and combined projects implemented during the same construction period would adversely impact the region requirements to attain compliance with the O_3 standard or increase ambient air pollution concentrations above the NAAQS for any of the other criteria pollutants. The combination of proposed and future project emissions of O_3 would be minimized through the USEPA and TCEQ enforcement of federal and state regulations, which would insure that despite the increase in O_3 emissions, compliance with the O_3 standard and SIP is not prevented and the maintenance of air quality standards for all other criteria pollutants would not be jeopardized.

The combination of proposed and future project emissions of CO, SO_2, PM_{10} and $PM_{2.5}$ under this design variation would be unlikely to contribute to an exceedance of an ambient air quality standard based on air quality levels that are measured today, as none of these pollutants are currently trending towards nonattainment. Therefore, implementation of the Proposed Action design without potential Trinity Parkway construction anticipated, in combination with the identified past, present, and reasonably foreseeable projects, would result in significant adverse impacts to air quality during construction and less than significant impacts to air quality during operation.

4.15 NOISE

4.15.1 Approach to Analysis

The following process was used to analyze potential impacts to the noise environment:

- Likely sources of construction and operational noise were identified and evaluated;
- The location, distance, and ambient noise conditions of sensitive noise receptors closest to the Proposed Action were determined;
- Potentially significant effects based upon the significance thresholds described below were identified; and
- SCMs were developed to avoid, minimize or mitigate project noise effects.

The following impact designations have been used to characterize the level of project impacts relative to noise:

- *Significant impact*: For construction, a temporary significant noise impact would occur if construction activities were to take place during nights, early mornings, and Sundays. For operations, a significant effect would occur if the Proposed Action were to cause a permanent and continuous increase of 10 A-weighted decibels (dBA)[8] or more above the existing worst-hour ambient noise level.
- *Less than significant impact*: For construction, a less than significant temporary impact would occur if construction activities were to avoid nights, early mornings, and Sundays. For operations, a less than significant impact would occur if a proposed action were to cause a relatively minor permanent and continuous increase in ambient noise levels at sensitive noise receptors in the project vicinity, defined as an increase of less than 10 dBA above the existing worst-hour noise level.
- *No impact*: No discernible change in ambient noise levels at sensitive noise receptors in the project vicinity.

4.15.2 Alternative 1: Future Without-Project Condition

Under the Future Without-Project Condition, several past, present, and reasonably foreseeable projects would involve roadway flattening and other improvements that could shift vehicular traffic closer to sensitive noise receptors. Examples include the Beckley Avenue improvements, various bridge projects (such as the Hampton Road Bridge, the Sylvan Avenue Bridge, and the Loop 12 Bridge), the Horseshoe Project, and Riverfront Boulevard. Also, other present and reasonably foreseeable projects may result in temporary and localized noise impacts due to construction activities, including construction worker traffic and the operation of construction equipment. Operations- and construction-related noise impacts from these projects would be minimized through compliance with applicable regulations, including Section 4(b) of the *Noise Control Act (NCA) of 1972* and *Dallas City Code: Volume II, Chapter 30*.

[8] This threshold is based on the relative impact criterion established by TxDOT (2011).

In addition, projected traffic increases on existing transportation networks may also contribute toward an increase in traffic noise within the ROI[9]. However, in instances where there is no line of sight between a sensitive receptor and construction activities, when no construction or operations traffic would be added to adjacent roadways, and when proposed improvements would not shift traffic closer to sensitive receptors, no impact would occur. Based on the above information, noise levels are expected to increase at 10 of the 20 sample sites under the Future Without-Project Condition, as shown in Table 4.15-1.

Table 4.15-1. Estimated Noise Levels under Existing Conditions and Future Without-Project Condition

Sample Site/ Location	*Existing Conditions max dBA (equivalent sound levels)*	*Change Under Future Without-Project Condition*
1 (Adjacent to Dallas Floodway)	77.0	Increase
2 (Trinity-Portland Sump)	67.0	NC
3 (Trinity-Portland Sump)	58.0	NC
4 (Trinity-Portland Sump)	67.0	NC
5a (Frances Street Sump)	83.1	NC
5b (Westmoreland-Hampton Sump)	83.1	NC
6 (Westmoreland-Hampton Sump)	73.7	Increase
7 (Pavaho Sump)	75.1	NC
8 (Charlie Sump)	65.0	Increase
9 (Able Sump)	73.1	Increase
10 (Able Sump)	75.4	Increase
11 (Able Sump)	66.0	NC
16 (Able Sump)	80.6	Increase
12 (Hampton-Oak Lawn Sump)	65.6	Increase
13 (Record Crossing Sump)	80.0	Increase
14 (Record Crossing Sump)	60.4	NC
15 (Record Crossing Sump)	81.8	Increase
17 (Record Crossing Sump)	87.1	Increase
18 (Record Crossing Sump)	82.8	NC
19 (Nobles Branch Sump)	80.0	NC

Note: NC = no change.

4.15.3 Alternative 2: Proposed Action

4.15.3.1 Design Anticipating Potential Trinity Parkway Construction

BVP Study FRM Elements

The AT&SF Railroad Bridge modifications are located primarily within the Floodway are therefore not near any sensitive noise receptors. Most of the components situated near or beyond the levees do not have a line of sight to nearby sensitive noise receptors. Similarly, the borrow pits would be located within the Floodway, and would be shielded from sensitive noise receptors by the levees. Accordingly, the analysis of the noise impacts of the FRM elements focuses on the levee raise and levee flattening improvements.

[9] The magnitude of the noise impact depends on both the increase in traffic volumes and associated traffic congestion. Specifically, increased traffic volumes generally result in increased traffic noise. However, to the extent that increased congestion reduces vehicle speed, traffic noise would also be reduced (TxDOT 2011).

Construction

Construction of the FRM elements would require the use of various types of construction equipment and machinery (e.g., excavators, bulldozers, compactors, cranes, trucks) over a period of several years. As discussed above, much of the construction work would take place in areas that are relatively far away, or shielded, from sensitive noise receptors. However, when construction takes place on top of or on the developed side of the levees, surrounding land uses would be exposed to temporary noise impacts. This is particularly true for the proposed FRM activities on the West Levee, which would be close to multiple sensitive noise receptors along Canada Drive and Mexicana Road.

FHWA (2006) has developed a model that estimates construction related noise that uses a database consisting of a wide range of construction equipment and vehicles and their associated noise levels. In order to estimate construction noise levels, a hypothetical construction scenario consisting of the following equipment was input into the FHWA model. The list below presents the equipment used for the model, as well as their respective noise levels as reported by FHWA.

- Backhoe (maximum noise level: 80.0 dBA[10])
- Compactor (maximum noise level: 80.0 dBA)
- Dozer (maximum noise level: 85.0 dBA)
- Dump truck (maximum noise level: 84.0 dBA)
- Excavator (maximum noise level: 85.0 dBA)
- Front end loader (maximum noise level: 80.0 dBA)
- Tractor (maximum noise level: 84.0 dBA)

Based on the above list, the model estimates that the combined construction noise level would to be 85.5 dBA[11] at 50 feet from the noise source. Ambient noise at Sample Sites adjacent to sensitive receptors located near the FRM elements on the West Levee ranges from 58 dBA (Sample Site 3) to 83.1 dBA (Sample Site 5b). Sensitive receptors having a direct line of sight to construction activities on the crest of the West Levee may experience a temporary noise increase of 10 dBA or more during construction. The extent of this noise effect varies based on ambient noise levels. For receptors near Sample Site 3, construction noise would be 10 dBA higher than ambient noise 400 feet away from the construction site. Construction noise would have no effect at receptors near Sample Site 5b, since construction noise is not substantially louder than ambient noise. (It should be noted that this discussion is concerned with outside noise levels only, and does not consider the additional attenuation offered within the structure when the windows are closed.) Chapter 7 contains measures to reduce the noise effects of the FRM elements. These measures include compliance with Section 4(b) of the NCA of 1972 and the City of Dallas noise ordinance (i.e., Dallas City Code: Volume II, Chapter 30). Compliance with the City of Dallas noise ordinance would require construction activities to take place between the hours of 7:00 a.m. and 7:00 p.m. on weekdays and between 8:00 a.m. and 7:00 p.m. on Saturdays and legal holidays[12]. Accordingly, although the FRM elements would result in temporary and localized noise increases during construction,

[10] Estimates for the maximum noise associated with each piece of construction equipment obtained from FHWA construction noise model (2006).

[11] Analysis of construction noise typically considers noise levels from the two or three loudest pieces of equipment (Caltrans 2009).

[12] Defined in the ordinance as New Year's Day (January 1), Memorial Day (observed date), Fourth of July (July 4), Labor Day (observed date), Thanksgiving Day (observed date), and Christmas Day (December 25).

these increases would not occur during early mornings, nights, or on Sundays. Therefore, construction impacts would be less than significant.

Operation

The FRM elements would not introduce any substantial recurring, or permanent sources of operational noise. While routine maintenance activities would involve occasional use of maintenance equipment and light-duty trucks, such activities are consistent with on-going maintenance activities, would be limited in scope, and would therefore not be expected to result in substantial noise increases.

BVP Study Ecosystem and Recreation Features

Construction

Construction activities associated with the proposed BVP Study features would include, but would not be limited to, delivery of construction equipment and materials; operation of heavy construction equipment for various construction activities (including excavation, earth moving, and grading); import and export of soil; and construction worker trips to and from the various construction sites. Construction of the projects that comprise the BVP Study features are expected to take place over a period of years, resulting in temporary and localized construction noise at various locations as construction progresses. Construction would occur within the Floodway and on top of, and adjacent to, the levees. Sensitive noise receptors (mostly residential land uses, others could include churches, hotels, parks and schools) are located proximate to the proposed BVP Study features, primarily along the western and southern sides of the Floodway.

Construction activities are expected to result in a noise level of 85.5 dBA at 50 feet from the noise source. One residence located at the intersection of Mexicana Road and Canada Drive is situated within 50 feet of the proposed trail connection near the West Dallas Lake. At this distance, construction noise would be more than 10 dBA higher than the ambient noise of 67 dBA, and would be temporary. However, as discussed in Chapter 7, SCMs have been identified to reduce project noise effects. As would be the case for the FRM elements, these measures would reduce noise levels to below the significance threshold.

Operation

The Proposed Action would construct a number of recreational enhancements within, and adjacent to, the Floodway, resulting in an overall increase in ambient noise levels within the Floodway. For the most part, the various recreational enhancements would encourage outdoor activities (e.g., walking, picnicking, bird observation, etc.) that would not in themselves constitute substantial new sources of noise. The BVP Study features include new roadways to provide vehicular access to the recreational facilities. Traffic on these roadways would introduce a new source of noise to the ROI. The majority of new access roads would be located within the Floodway; noise from traffic within the Floodway would be attenuated by the levees, which would act as a noise barrier between the roads and residential areas to the south and west of the Floodway. However, these residences would be directly exposed to traffic noise as vehicles approach and pass over the levees en route to the Floodway. The volume of traffic accessing the recreational areas would be distributed to various roads approaching the vehicular access points, and would be concentrated during weekends, when demand for recreational facilities is highest (ITE 2012). During weekends, travel demand on freeways and regional arterials associated with work commuting trips would be substantially lower than on weekdays (TRB 2010). Accordingly, ambient noise levels associated with traffic would be lower on weekends than on weekdays.

The Proposed Action design anticipating potential Trinity Parkway construction would also involve the construction of two amphitheaters within the Floodway. The West Dallas Amphitheater would be located along the north side of the West Dallas Lake, to the west of the Westmoreland Road bridge across the Floodway. The stage would face to the north and west, and the venue would have a maximum capacity of 25,000 people. A concert in the amphitheater could generate noise levels as high as 110 dBA (Caltrans 2012). Ambient noise at the nearest noise measurement (i.e., Sample Site 13) is 80 dBA. The nearest sensitive receptor (a church) is located approximately 3,500 feet to the north and west of the West Dallas Amphitheater stage. Assuming that the 110 dBA noise level is measured roughly 50 feet from the stage, and a noise attenuation of 6 dBA per doubling of distance, concert noise would approach ambient levels at a distance of 1,600 feet[13]. Given that the sensitive receptor is more than twice that distance from the West Dallas Amphitheater, no significant noise impact would occur, given the significance criteria described in Section 4.15.1. For this reason, and because the West Dallas Amphitheater would not be a permanent and continuous source of noise, the impact would be less than significant.

The Central Island Amphitheater would be located along the western bank of the Urban Lake, to the south of the IH-30 bridge across the Floodway. The Central Island Amphitheater would accommodate up to 100 people on a typical weekend and could accommodate up to 2,500 people under peak conditions. The stage would be located on a small island within the Urban Lake, and seating areas would be provided within a sloped area extending inland from the Urban Lake's western bank (City of Dallas 2009b). Although nearby uses are generally commercial and industrial, some residential land uses, including mid-rise developments, are situated opposite the Central Island Amphitheater stage, beyond the levee. The nearest residential uses, located along Greenbriar Lane, are approximately 1,500 feet from the Central Island Amphitheater stage. Based on the assumptions described above, unobstructed noise levels at the residences would be approximately 80 dBA, or 15 dBA higher than the nearest existing noise measurement (i.e., Sample Site 8). However, noise is further attenuated by shielding, such as vegetation, buildings and noise walls. Although the levees were not specifically built for noise abatement, they would provide some measure of shielding between activities within the Floodway and nearby sensitive noise receptors. Assuming that the levee would offer noise level reduction of 6 dBA or more, then the noise level increase associated with concerts would be below the significance threshold of 10 dBA above ambient conditions. Therefore, the noise impact of the Central Island Amphitheater would be less than significant.

In addition to existing residences, new receptors would be introduced by the BVP Study features. Specifically, new pedestrian and equestrian trails would be constructed near the amphitheaters, and within the levees. Therefore, users of these facilities would not be shielded from noise emanating from the amphitheaters by the levees. However, as discussed above, noise from concerts or events at the amphitheaters would be infrequent, and would not constitute a permanent and continuous source of noise. In addition, trail users are expected to be mobile; if they did not care for the amphitheater noise, they would continue moving through the area, thus minimizing their exposure to noise.

<u>IDP Improvements</u>

The IDP improvements would necessitate the delivery of equipment and materials for the construction or demolition; construction activities including excavation, earth moving, grading and the removal of

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[13] This analysis does not account for the noise attenuation provided by the East Levee, which lies between the stage and the receptor.

resulting debris; and trips to and from the various sites by contracted workers. The effects would be localized to the various sites, within and adjacent to the Floodway and levees. Sensitive noise receptors (mostly residential land uses; also including parks, schools, hotels and churches) are located on all sides of the IDP Study Area, but those closest to the proposed improvements lie along the southwestern border of the Floodway.

Construction

As would be the case for the FRM elements and BVP Study Ecosystem and Recreation features, construction noise associated with the IDP improvements are expected to result in a noise level of 85.5 dBA at 50 feet from the noise source, and would be temporary in nature. However, as discussed in Chapter 7, measures have been identified to reduce the Proposed Action's noise impact to below the significance threshold.

Operation

After construction, operational noise at most locations would be consistent with existing noise levels. Noise generating activities are assumed to include occasional service to the pump stations and supply delivery. Routine maintenance of the proposed improvements would not increase noise levels.

Additional noise may result from the operation of trash screens at new or improved pump stations. Trash screen operation at the new Trinity-Portland Pumping Station would create a new source of noise. As noted in Section 3.15, attenuation of this noise level would occur at a rate of 6 dBA per doubling of distance. As noted above, the nearest sensitive noise receptor is 400 feet from the pump station. Given this relationship, the noise level at the nearest sensitive receptor would be 62.0 dBA, or 4 dBA higher than the ambient level. This noise level would be less than 10 dBA higher than ambient noise, and would not be considered significant.

4.15.3.2 Design Without Potential Trinity Parkway Construction Anticipated

The potential noise impacts arising from implementation of the proposed FRM elements and IDP improvements would be the same as presented under the design anticipating the construction of the potential Trinity Parkway, as there would be no change in these components. Therefore, refer to the sections titled "BVP Study FRM Elements" and "IDP Improvements" within Section 4.15.3.1 for a discussion of noise impacts associated with implementation of those elements and improvements. The following section presents the potential noise impacts caused by implementation of the BVP Study Ecosystem and Recreation features as designed without anticipating construction of the potential Trinity Parkway. These features are slightly different from those presented under the design that does anticipate the potential Trinity Parkway being constructed.

<u>BVP Study Ecosystem and Recreation Features</u>

Under this design variation, the proposed lakes would not be partially excavated by the potential Trinity Parkway project. As a result, the number of dump trucks required to transport excess fill material would increase relative to the Proposed Action design anticipating potential Trinity Parkway construction (refer to Section 4.12), resulting in an incremental increase in construction noise from truck traffic. The Proposed Action design without potential Trinity Parkway construction anticipated would involve a relatively minor reallocation of land uses within the Floodway, the majority of which would not introduce noise sources different from those described in Section 4.15.3.1. However, under this design variation, a third amphitheater (i.e., the Natural Lake Amphitheater) would be constructed along the north side of the Natural Lake, to the east of the IH-35E bridge crossings of the Floodway. This amphitheater would be substantially smaller than both the West Dallas Amphitheater and the Central Island Amphitheater. The Natural Lake Amphitheater's stage would face to the north, and seating areas would be provided within a sloped area extending inland from the Natural Lake. Ambient noise at the nearest noise measurement (i.e., Sample Site 10) is 75.4 dBA. Based on the significance criteria described above, a significant impact could occur if a sensitive receptor were to experience a noise level of 85.4 dBA or more. Based on the concert noise level and propagation assumptions described above, and discounting the noise attenuation provided by the East Levee, a sensitive receptor within 3,200 feet of the stage could experience a significant noise impact. However, land uses located to the north of the Natural Lake Amphitheater are predominantly industrial and commercial, and no sensitive receptors are located within 3,200 feet of the stage. Therefore, operational impacts under this design variation would be less than significant.

4.15.3.3 Summary

Under both design variations, construction would include the use of various types of construction equipment and machinery (e.g., excavators, bulldozers, compactors, cranes, trucks, etc.) over a period of several years. The majority of proposed construction activities would occur in areas that are relatively far away or shielded from identified sensitive noise receptors. Construction noise would be temporary, localized, and subject to the City of Dallas noise ordinance. While the Proposed Action design without potential Trinity Parkway construction anticipated would involve a higher level of construction noise due to the greater number of trucks needed to haul excess fill, this incremental is not expected to result in any significant noise impacts. Therefore, the construction noise impact would be less than significant for both design variations.

Both design variations would involve the construction of a number of recreational enhancements within and adjacent to the Floodway, resulting in an overall increase in ambient noise levels within the Floodway. The design without potential Trinity Parkway construction anticipated would involve an additional amphitheater, but operational noise is not expected to be substantially higher than for the design anticipating potential Trinity Parkway construction. As discussed in Sections 4.15.3.1 and 4.15.3.2, noise increases from the operation of the BVP Study Ecosystem and Recreation features would be less than significant for both design variations. Operational noise associated with FRM and IDP activities would be relatively minor, temporary, and consistent with existing noise levels associated with on-going operations. Therefore, implementation of either design variation would result in less than significant impacts to the noise environment. This conclusion assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

4.15.3.4 Cumulative Impacts

<u>Design Anticipating Potential Trinity Parkway Construction</u>

As discussed in Section 2.7, there are multiple past, present and reasonably foreseeable future projects within the overall Study Area. Among the reasonably foreseeable future projects, the potential Trinity Parkway would be a notable source of new traffic noise in the ROI, particularly within the Floodway.

When considering all past, present, and reasonably foreseeable projects except for the potential Trinity Parkway, construction-related cumulative noise impacts would be less than significant, provided that all projects comply with applicable regulations (specifically, Section 4(b) of the NCA of 1972 and Dallas City Code: Volume II, Chapter 30). As described above, this design variation's operational impacts due to traffic and amphitheater noise would be less than significant at existing sensitive noise receptors located primarily along the south side of the West Levee, and at new sensitive noise receptors created within the Floodway by the BVP Study features. A cumulative noise increase near sensitive receptors would occur at

Sample Site 6. This increase is due to the widening of the Hampton Road Bridge, which shifted traffic closer to sensitive receptors. The BVP Study would provide public vehicular access to the Floodway at this location. While this design variation would contribute to an incremental increase in noise due to traffic, the cumulative impact would be less than significant for the following reasons:

1. Assuming that the Hampton Road Bridge project shifted traffic 20 feet closer to the nearest sensitive receptor (located 180 feet to the west), the bridge project would result in a net noise increase of less than 1 dBA[14].
2. Traffic from this design variation would access the Floodway from a total of 7 alternative access "gateways." Weekday daily traffic coming into the Floodway would be 2,969 ADT. The existing ADT on Canada Drive to the west of Hampton Road is 3,300 ADT (refer to Table 3.12-5). A doubling of ADT would increase noise by 3 dBA (TxDOT 2011). If 100% of all project traffic were to use the Hampton Road access point (and 0% were to use the remaining 6 access points), then project traffic would increase traffic noise by less than 3 dBA. This increase, taken together with the increase described above, would be less than the significance threshold of 10 dBA. Accordingly, no significant cumulative impact would occur.

Therefore, implementation of this design variation in combination with the past, present, and reasonably foreseeable projects would result in less than significant impacts to the noise environment.

Traffic noise from the potential Trinity Parkway project would increase noise levels at some locations within the Dallas Floodway. As compared to existing conditions, noise levels would increase by between 1 dBA and 9 dBA, depending on the location. No net increase in noise is projected near the Hampton Road Bridge project described above (FHWA 2014). Because traffic noise from the potential Trinity Parkway project, when taken in combination with noise from this design variation and other past, present, and reasonably-foreseeable future projects, would not increase noise levels by more than 10 dBA above ambient levels, the potential Trinity Parkway project would not result in a significant cumulative noise impact.

<u>Design Without Potential Trinity Parkway Construction Anticipated</u>

The cumulative impacts of this design variation would be the same as those described for the design anticipating potential Trinity Parkway construction, except the additive noise impacts from the potential Trinity Parkway project would not occur. Therefore, implementation of this design variation in combination with the past, present, and reasonably foreseeable projects would result in less than significant impacts to the noise environment.

[14] That is, based on cylindrical spreading from a line source: dBA_2 = 73.7 dBA + 10log10(200/180) = 74.1 dBA.

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CHAPTER 5
SUMMARY AND COMPARISON OF ALTERNATIVES

This chapter of the Dallas Floodway Project Environmental Impact Statement (EIS) presents a summary and comparison of the potential impacts to environmental resources from implementation of the Proposed Action (Alternative 2), as compared to the Future Without-Project Condition (Alternative 1). Chapter 3 provided a baseline for impact analysis by presenting an overview of the existing conditions for each resource area. Chapter 4 discussed the impacts of the Proposed Action, as well as probable future conditions under each alternative (including taking no action as presented under Alternative 1, Future Without-Project Conditions) in light of the other projects planned in and around the Study Area. The preceding discussion of impacts included several categories where the impacts were similar for the design variations developed for the Proposed Action. If the design variations would have distinct impacts, then those differences have been clearly identified.

5.1 SUMMARY OF IMPACTS

Table 5-1 presents a summary of the anticipated impacts to each resource area from implementation of either design variation of the Proposed Action. Impacts are summarized by themselves ("discrete") as well as in combination with the identified past, present, and reasonably foreseeable projects ("cumulative"). As shown in Table 5-1 and as noted in the resource-specific impact analysis, some resource areas have different construction and operational impacts, whereas other resource areas have one impact period presented (i.e., construction and operation as indicated by "both"). Impact summaries assumes the incorporation of minimization, avoidance, and/or mitigation measures as detailed in Chapter 7.

Table 5-1. Summary of Impacts from Implementation of the Proposed Action

Resource Area	*Impact Period*	*Impacts from Design Anticipating Parkway Construction*		*Impacts from Design Not Anticipating Parkway Construction*	
		Discrete	*Cumulative*	*Discrete*	*Cumulative*
Land Use	Both	+	+	+	○
Geology and Soils	Construction	○	○	○	○
	Operation	+	+	+	+
Hydrology and Hydraulics	Both	○	○	○	○
Water Resources	Construction	▲	▲	▲	▲
	Operation	+	+	+	+
Biological Resources	Construction	▲	▲	▲	▲
	Operation	+	+	+	+
Cultural Resources	Both	▲	▲	▲	▲
Recreational Resources	Construction	○	○	○	○
	Operation	+	+	+	+
Visual Resources	Construction	○	○	○	○
	Operation	+	○	+	+
Socioeconomics	Both	+	+	+	+
Hazardous Materials and Wastes	Both	○	○	○	○
Safety	Both	+	+	+	+
Transportation	Construction	○	▲	▲	▲
	Operation	○	▲	○	▲

Resource Area	*Impact Period*	*Impacts from Design Anticipating Parkway Construction*		*Impacts from Design Not Anticipating Parkway Construction*	
		Discrete	*Cumulative*	*Discrete*	*Cumulative*
Utilities	Construction	○	○	○	○
	Operation	+	+	+	+
Air Quality	Construction	▲	▲	▲	▲
	Operation	○	○	○	○
Noise	Both	○	○	○	○

Impact Summary Key: + = Beneficial impacts ○ = Less than significant impacts ▲ = Significant adverse impacts
Note: Refer to Chapter 6 for the analysis of impacts relative to floodplain management, climate change, and environmental justice.

5.2 COMPARISON OF ALTERNATIVES

Table 5-2 presents a summary of the features, construction period, and area of disturbance associated with the Proposed Action. The proposed design variations do differ in the features to be implemented, as the design that does not anticipate the construction of the Parkway includes more trails and other features as compared to the design that does anticipate the construction of the Parkway. Overall, the designs would have similar construction schedules. Both designs would disturb the same amount of land, as both designs assume impacts to the entirety of the Floodway.

Table 5-2. Comparison of Proposed Action Design Variation Key Components

Elements	*Design Anticipating Parkway Construction*	*Design Not Anticipating Parkway Construction*
Features	• Improved Flood Risk Management (FRM). • Extensive ecosystem and recreational improvements within the Floodway, including 2 amphitheaters, 38 miles of trails, 20 miles of roads (partially restricted), and 78 acres of “flexible” field space. • Improvements to interior drainage.	• Improved FRM. • Extensive ecosystem and recreational improvements within the Floodway, including 3 amphitheaters, 41 miles of trails, 23 miles of roads (partially restricted), and 88 acres of “flexible” field space. • Improvements to interior drainage.
Construction Implementation	• Construction planned 2015-2030. • Construction schedule coordinated with construction schedule of the potential Trinity Parkway project.	• Construction planned 2015-2030.
Disturbance	• 2,413 acres	• 2,413 acres

As shown in Table 5-2, the elements between the proposed design variations are very similar, and thus so are the environmental impacts of the alternatives.

Table 5-3 summarizes the key impacts to each resource area from implementation of either design variation and highlights the differences in impacts between the two designs. In addition, the anticipated Future Without-Project Condition (Alternative 1) for each resource area is summarized. For an analysis of impacts associated with floodplain management, climate change, and environmental justice, refer to Chapter 6.

Overall, impacts from the implementation of either Proposed Action design variation are largely similar. In fact, land use, hazardous materials and wastes, cultural resources, and safety impacts would be the same under both designs. Several resources would have slightly greater beneficial impacts under the design anticipating the Trinity Parkway construction than the design that does not anticipate Parkway construction. The design that does not anticipate Parkway construction would not be able to take advantage of construction efficiencies afforded by the implementation of the potential Trinity Parkway project. Without the excavation of the lakes from the construction of the potential Trinity Parkway project, greater impacts would occur due to increased traffic, emissions, and hauling of materials. Thus, the Proposed Action design that does not anticipate Trinity Parkway construction in the Floodway would result in greater impacts to geology and soils, transportation, air quality, and noise compared to the design that does anticipate Parkway construction. At the same time, the design that does not anticipate Parkway construction allowing for slightly more space for Balanced Vision Plan (BVP) Study features. This would result in slightly more recreational facilities and wetlands, increasing the beneficial impacts to water quality, biological resources, recreational resources, and visual resources under the design that does not anticipate the Parkway.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Land Use	• Current land use patterns within the Study Area would generally remain the same. • Inconsistent with Trinity River Corridor Comprehensive Land Use Plan (TRCCLUP).	• Consistency with TRCCLUP.	• Consistency with TRCCLUP.	No substantial difference.
Geology and Soils	• Levee slides and erosion would continue to occur. • Current maintenance activities would continue.	• Construction-related impacts to soils. • Maximized re-use of excavated fill where possible. • Reduction in erosion of levees. • Excavation of lakes takes advantage of borrow pits from other project.	• Construction-related impacts to soils. • Maximized re-use of excavated fill where possible. • Reduction in erosion of levees. • Excavation of lakes could require off-site disposal of excess fill.	Substantially more fill excavated and potentially disposed of under the design that does not anticipate Parkway construction than design that does.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Hydrology and Hydraulics	• Increased peak flows within the Dallas Floodway. • Overtopping of the levees could occur at several locations during Standard Project Flood (SPF) events. • No change to floodplain inundation map extent.	• SPF FRM achieved. • Water surface elevation increase in excess of that authorized by the Trinity River EIS (TREIS) Record of Decision (ROD). • Valley storage loss in excess of that authorized by TREIS ROD for the 100-year flood event or the SPF event.	• SPF FRM achieved. • Water surface elevation increase in excess of that authorized by the TREIS ROD. • Valley storage loss in excess of that authorized by TREIS ROD for the 100-year flood event or the SPF event.	Both alternatives exceed TREIS ROD criteria; the design that anticipates the construction of the Trinity Parkway exceeds criteria less than the design that does not anticipate Parkway construction.
Water Resources	• Increase in urbanization in the Upper Trinity River watershed could increase stormwater pollution.	• Short-term negative impacts from construction runoff to jurisdictional wetlands and other waters of the U.S. • Predicted net functional gain from Modified Dallas Floodway Project (MDFP) of 6,115 linear feet for the Trinity River and 28.68 acres for wetlands. • Negative impacts would result in a total loss of 20.81 acres of jurisdictional other waters of the U.S. and 58.31 acres of jurisdictional wetlands. The City of Dallas would be required to purchase credits from an approved mitigation bank at the appropriate ratio.	• Short-term negative impacts from construction runoff to jurisdictional wetlands and other waters of the U.S. • Predicted net functional gain from MDFP of 6,115 linear feet for the Trinity River and 6.10 acres for wetlands. • Negative impacts would result in a total loss of 26.72 acres of jurisdictional other waters of the U.S. and 82.41 acres of jurisdictional wetlands. The City of Dallas would be required to purchase credits from an approved mitigation bank at the appropriate ratio.	There would be an overall greater net functional gain via implementation of the MDFP for the design anticipating Parkway construction as compared to the design without the Parkway anticipated. The City of Dallas would need to purchase more credits if the design that does not anticipate Parkway construction is implemented than they would for the design that does not anticipate the Parkway construction to offset the greater impacts to wetlands and other open waters. This summary assumes that if the design anticipating the Trinity Parkway construction is implemented, it would be constructed after the Parkway is complete.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Biological Resources	• Increase in acreage for emergent wetland (1 acre). • Decrease in acreage for bottomland hardwood (-25 acres), grassland (-118 acres), aquatic riverine (-10 acres), and open water (-5 acres). • Increase in habitat units (HUs) for bottomland hardwood (1 HU). • Decrease in HUs for emergent wetland (-3 HUs), grassland (-82 HUs), aquatic riverine (-13 HUs), and open water (-14 HUs).	• Increase in acreage for bottomland hardwood (143 acres), aquatic riverine (86 acres), and open water (258 acres). • Decrease in acreage for emergent wetland (-103 acres) and grassland (691 acres). • Increase in HUs for bottomland hardwood (75 HUs), emergent wetland (21 HUs), aquatic riverine (99 HUs), and open water (197 HUs). • Decrease in HUs for grassland (-213 HUs). • ROI total increase in HUs (179; 50 HUs for cumulative).	• Increase in acreage for bottomland hardwood (142 acres), aquatic riverine (86 acres), and open water (258 acres). • Decrease in acreage for emergent wetland (-101 acres) and grassland (652 acres). • Increase in HUs for bottomland hardwood (74 HUs), emergent wetland (22 HUs), aquatic riverine (99 HUs), and open water (197 HUs). • Decrease in HUs for grassland (-235 HUs). • ROI total increase in HUs (158; 91 HUs for cumulative).	• The design that anticipates the construction of the Trinity Parkway directly generates 21 more HUs than would the design that does not anticipate Parkway construction, primarily in the grassland habitat. • Cumulatively, the design that does not anticipate construction of the Trinity Parkway generates more HUs than does the design anticipating Parkway construction. This is because the designs consider the future condition that both includes and does not include the Parkway construction within the Floodway.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Cultural Resources	• The Dallas Floodway would continue to deteriorate from age, wear, and erosion. • No impacts to known archaeological resources.	• Impacts to historic structures, including the East and West Levees and Atchison, Topeka, and Santa Fe (AT&SF) Railroad Bridge. • Coordination with the Texas Historical Commission (THC) required to minimize/mitigate impacts. The City of Dallas will be responsible for this coordination if any sites are designated as a State Antiquities Landmark.	• Impacts to historic structures, including the East and West Levees and AT&SF Railroad Bridge. • Coordination with the THC required to minimize/mitigate impacts. The City of Dallas will be responsible for this coordination if any sites are designated as a State Antiquities Landmark.	No substantial difference.
Recreational Resources	• Past, present, and reasonably foreseeable projects would contribute to an increase in recreation facilities, aquatic resources and access, trail networks, and recreation acreage. • Increased amenities would remain insufficient for population demand.	• Development of 38 miles of trails, 20 miles of roads, 78 acres of flex fields. • Development of 260 acres of lake surface for aquatic recreation. • Interior Drainage Plan (IDP) improvements would reduce the flood risk to existing and proposed recreation areas.	• Development of 41 miles of trails, 23 miles of roads, 88 acres of flex fields. • Development of 260 acres of lake surface for aquatic recreation. • IDP improvements would reduce the flood risk to existing and proposed recreation areas.	• The design that does not anticipate Parkway construction proposes 3 more miles of trails, 3 more miles of road surface, and 10 acres more of flex fields than does the design that anticipates the construction of the Parkway. • The design that does not anticipate Parkway construction proposes four more Gateways than does the design that anticipates the construction of the Parkway.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Visual Resources	• Consistent with the overall existing visual environment of the Dallas Floodway. • Vividness, intactness, and unity would likely remain moderately high.	• Construction would result in negative, short-term impacts to visual resources within the Floodway. • Overall beneficial impacts to visual resources.	• Construction would result in negative, short-term impacts to visual resources within the Floodway. • Overall beneficial impacts to visual resources.	No substantial difference associated with Proposed Action. Difference between designs results from the presence/absence of a reasonably foreseeable future project (i.e., the Trinity Parkway).
Socioeconomics	• Increase in both temporary construction jobs and permanent jobs, due to multiple large-scale past, present, and reasonably foreseeable projects. • Increases in economic development Study Area are anticipated.	• Implementation would create jobs and increase economic output within the Region of Influence (ROI). • The increase in visitors and income from project features would result in more money spent in the local economy, generating jobs and income for Dallas residents as well as tax revenues for local governments and the State of Texas.	• Implementation would create jobs and increase economic output within the ROI. • The increase in visitors and income from project features would result in more money spent in the local economy, generating jobs and income for Dallas residents as well as tax revenues for local governments and the State of Texas.	No substantial difference.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Hazardous Materials and Wastes	• Several past, present, and reasonably foreseeable projects have the potential to come in contact or disturb existing hazardous sites. • Hazardous materials and wastes would continue to be used, generated, and disposed of in much the same manner as they are currently used, generated, and disposed.	• No impact to sites with known environmental conditions. • Before construction/ demolition, structures would be surveyed for asbestos/lead-based paint, and handle any found materials accordingly. • All hazardous materials and wastes would be used, stored, and disposed of in accordance with all applicable local, state, and federal regulations.	• No impact to sites with known environmental conditions. • Before construction/ demolition, structures would be surveyed for asbestos/lead-based paint, and handle any found materials accordingly. • All hazardous materials and wastes would be used, stored, and disposed of in accordance with all applicable local, state, and federal regulations.	No substantial difference.
Safety	• Current Operation and Maintenance actions would continue to be challenged by major storm events. • Continued impaired ability for rescue services/medical emergency response. • The number of structures potentially subject to river flooding from the SPF event would increase. • Risk of loss of life in the Study Area from overtopping of the levees is above societally tolerable levels.	• Implementation would provide SPF risk management outside of the Floodway. • IDP improvements reduce the number of potentially affected or flooded structures by at least 51%. • Increase in access points and safety-related services within the Floodway. • Risk of loss of life in the Study Area from overtopping of the levee with or without associated levee breach significantly reduced from existing conditions.	• Implementation would provide SPF risk management outside of the Floodway. • IDP improvements reduce the number of potentially affected or flooded structures by at least 51%. • Increase in access points and safety-related services within the Floodway. • Risk of loss of life in the Study Area from overtopping of the levee with or without associated levee breach significantly reduced from existing conditions.	No substantial difference.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Transportation	• Existing traffic volumes on major freeway facilities is projected to increase by the year 2035.	• Substantial traffic increase in and out of the Floodway during construction. • Users of recreational facilities and amenities would create a substantial and recurring daily traffic increase. • Roads would have a reduced risk of flooding-related closure.	• Substantial traffic increase in and out of the Floodway during construction. Traffic would primarily impact three segments of IH-35E, two segments of IH-30, and one segment of SH-183. • Users of recreational facilities and amenities would create a substantial and recurring daily traffic increase. • Roads would have a reduced risk of flooding-related closure.	• Construction of the design that does not anticipate construction of the Trinity Parkway would result in a greater increase in construction traffic generation as compared to the design that does anticipate the construction of the Parkway. • No difference in operational impacts.
Utilities	• Overall utility demand is expected to increase. • Utilities would be upgraded/improved to meet anticipated population growth. • The existing insufficient storm water drainage would persist.	• Implementation would require utility relocation with associated temporary localized service outages. • Proposed operations of BVP Study features would result in an increase in utility demand to be met by local and regional utility providers and BVP Study features. • IDP improvements would substantially increase the level of storm water conveyance.	• Implementation would require utility relocation with associated temporary localized service outages. • Proposed operations of BVP Study features would result in an increase in utility demand to be met by local and regional utility providers and BVP Study features. • IDP improvements would substantially increase the level of storm water conveyance.	• Potential construction efficiencies associated with coordinating the Trinity Parkway with the implementation of the Proposed Action would result in fewer utility relocations under the design anticipating Parkway construction as compared to the design without the Parkway construction anticipated. • No difference in operational impacts.

Table 5-3. Summary and Comparison of Impacts for Alternatives 1 and 2

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action)*		
		Design Anticipating Parkway Construction	*Design Not Anticipating Parkway Construction*	*Notable Difference Between Proposed Designs*
Air Quality	• Many large-scale past, present, and reasonably foreseeable projects would likely occur within the Study Area between 2015 and 2065, resulting in impacts to regional air quality. • The Texas Commission on Environmental Quality would continue to implement the strategies outlined in the December 2011 Dallas-Fort Worth SIP revision for demonstrating attainment of the federal O_3 standard.	• Temporary, construction-based increases in criteria pollutant emissions associated with construction activities. • Annual NO_x emissions generated by construction activities would exceed *de minimis* thresholds. • No substantial long-term increase in mobile or stationary source emissions in the ROI would occur.	• Temporary, construction-based increases in criteria pollutant emissions associated with construction activities. • Annual NO_x emissions generated by construction activities would exceed *de minimis* thresholds. • No substantial long-term increase in mobile or stationary source emissions in the ROI would occur.	• Estimated construction emissions from implementing the design that does not anticipate the Trinity Parkway would be approximately 17% greater during the peak construction years than those estimated under the design that does anticipate Parkway construction. • No difference in operational impacts.
Noise	• Past, present, and reasonably foreseeable projects may shift vehicular traffic closer to sensitive noise receptors. • Increased construction and operation traffic noise.	• Construction noise would be temporary, localized, and subject to the City of Dallas noise ordinance. • Operational environment would result in an overall increase in ambient noise levels within the Floodway.	• Construction noise would be temporary, localized, and subject to the City of Dallas noise ordinance. • Operational environment would result in an overall increase in ambient noise levels within the Floodway.	No substantial difference.

CHAPTER 6
OTHER CONSIDERATIONS REQUIRED BY NEPA

This chapter of the Dallas Floodway Project Environmental Impact Statement (EIS) presents a discussion of other considerations required by the National Environmental Policy Act (NEPA). This EIS has been prepared in compliance with and in regard to the requirements of applicable laws, regulations, Executive Orders (EOs), and Memoranda of Agreement (MOA) pertaining to federal water resource projects. Table 6-1 and the following text provide information regarding the current compliance status of the Proposed Action with the applicable environmental laws, regulations, EOs, and MOA.

Before initiating construction, the project proponent would be required to ensure that project complies with the applicable environmental laws, orders, and agreements. Discussion to support the required compliance review is incorporated within the main body of this EIS and supporting appendices (specific references are provided in Table 6-1). Additional summary discussions to address climate change and environmental justice are included in Sections 6.6 and 6.7, respectively.

6.1 COMPLIANCE WITH SPECIFIC REQUIREMENTS

6.1.1 Proposed Action

This EIS has determined that implementation of the Proposed Action would not conflict with the objectives of other applicable plans, policies, and regulations, regardless of the design variation implemented. A summary of this compliance status is provided in Table 6-1. For more detail on regulatory considerations, refer to Appendix B.

6.1.2 Distinction between Federal Project and Non-Federal Project Element Compliance Requirements

Project elements proposed as part of the Modified Dallas Floodway Project (MDFP) have different compliance requirements than do project elements that would be completed without federal sponsorship. For example, elements of the Proposed Action that would be undertaken by the City of Dallas and that are not part of the Federally Recommended Plan would fall under the jurisdiction of state agencies. The non-federal project elements would be required to comply with state and local regulations and requirements (as well as some federal requirements), and the project proponent could be penalized for failure to comply. Elements of the Proposed Action undertaken by the United States Army Corps of Engineers (USACE) would be required to comply with federal laws and regulations.

Because project elements that are not part of the Federally Recommended Plan would still be within a USACE managed system, the project proponent would be required to satisfy Section 408 permitting process. Part of that process includes NEPA documentation and public comment; this EIS satisfies Section 408 NEPA requirements as well as the USACE's Regulatory Division Section 10/404 NEPA requirements. Before issuing a construction authorization, the USACE would evaluate the project proponents' construction proposal to ensure that all aspects would be consistent with the project as described and analyzed in this EIS. If the construction proposal substantially differs, then the project proponent would be required to prepare supplemental NEPA documentation and Section 408 analysis, or revise the construction proposal to fit within the project as described and analyzed in this EIS.

Table 6-1. Summary of Applicable Environmental Regulations and Regulatory Compliance Required with Implementation of the Proposed Action

Plans, Policies, and Controls	*Regulatory Authority*	*Compliance Status*	*EIS Section*
NEPA Council on Environmental Quality Regulations USACE Engineering Regulation 200-2-2	CEQ and USACE	This EIS has been prepared in accordance with NEPA, CEQ regulations implementing NEPA, and USACE NEPA procedures. Public participation and review have been conducted in compliance with NEPA.	Entire EIS
Clean Air Act (CAA)	USEPA and Texas Commission on Environmental Quality (TCEQ)	The air quality analysis in this EIS concluded that proposed emissions under the Proposed Action would temporarily exceed the annual *de minimis* threshold for oxides of nitrogen (NO_x). The USACE prepared a conformity analysis and the TCEQ has determined that emissions from the Proposed Action would not exceed the emissions budget specified in the most recent State Implementation Plan revision approved by the USEPA (refer to Appendix A and N).	3.14, 4.14, and Appendix N
Clean Water Act (CWA) and Safe Drinking Water Act	USEPA, USACE, and TCEQ	Permits under CWA Sections 401 and 404 would be required under the Proposed Action. • A Section 404(b)(1) Analysis of the Proposed Action has been included in the EIS (refer to Appendix L). The TCEQ has reviewed the Proposed Action and has issued a State Water Quality Certificate (Appendix A) for the federal MDFP. Prior to implementation of the non-federal elements, the City of Dallas would obtain water quality certification from the TCEQ. • Before construction, a stormwater pollution prevention plan (SWPPP) would be developed and a Notice of Intent would be submitted to TCEQ, followed by submittal of a Notice of Termination once the construction site has reached final stabilization. • Stormwater runoff during construction of infrastructure improvement aspects of the Proposed Action and on-going operational activities would be performed in compliance with the Texas Construction General Permit. The proposed demolition and construction activities would require preparation of a SWPPP and use of Best Management Practices to limit potential erosion and runoff. • Refer to 6.1.2 for a discussion of CWA permitting for federal and non-federal project elements.	3.4, 4.2, 4.4, 6.1.2, and Appendix L

Table 6-1. Summary of Applicable Environmental Regulations and Regulatory Compliance Required with Implementation of the Proposed Action

Plans, Policies, and Controls	*Regulatory Authority*	*Compliance Status*	*EIS Section*
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	USEPA	Contaminated soil or groundwater could be encountered during demolition or constructed-related activities under the Proposed Action; however, as required by CERCLA, a Health and Safety Plan and Soil Management Plan would be implemented.	3.10 and 4.10
Endangered Species Act	U.S. Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department	As stated in the Coordination Act Report (CAR), "due to the lack of suitable habitat and the urbanized character of the project area, it is unlikely that any federally listed threatened or endangered species would become established in any of the study area. … [A]dverse effects to federally listed species are not anticipated with implementation of any of the proposed alternatives." (USFWS 2014). Prior to construction, a review would be conducted to determine if new species or impact information is available which warrants further consideration.	3.5 and 4.5
EO 11988, *Floodplain Management*	Federal Emergency Management Agency	This EIS satisfies the requirements of EO 11988. An eight-step analysis as required under USACE implementing guidelines regarding EO 11988 is found in Section 6.5.2. As shown in that analysis, the Proposed Action would occur in the Floodway as there are no practicable alternatives that are outside of the Floodway. The Proposed Action would not increase flood risk or harm public safety. The Proposed Action would not trigger additional development within the floodplain. This EIS presents an analysis of the foreseeable impacts associated with the Proposed Action, and no additional alternatives have been developed in the course of analysis. No substantial change to flood elevation is predicted under either action alternative. The public notice requirements of this EO are satisfied in the course of the public notice and outreach completed prior to and during the release and review period of the Draft EIS.	3.3, 3.4, 4.3, and 6.5
EO 11990, *Protection of Wetlands*	USACE	The Proposed Action would initially impact lower quality wetlands, but would ultimately would increase the functional quality of wetlands within the Study Area.	3.4, 4.4, and 4.5
EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	USACE	This EIS considers disproportionate high and adverse effects on minority, low-income, and child populations. The majority of the residential population within the Study Area is more than 50% minority; substantial sections of the Study Area have populations of more than 50% that live in poverty. The population was active in the development of the Proposed Action, and the USACE and City of Dallas have proactively continued to engage and educate members of the public regarding the Proposed Action and its impacts.	3.9, 4.9, and 6.7

Table 6-1. Summary of Applicable Environmental Regulations and Regulatory Compliance Required with Implementation of the Proposed Action

Plans, Policies, and Controls	*Regulatory Authority*	*Compliance Status*	*EIS Section*
EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*	USACE	This EIS considers disproportionate high and adverse effects on minority, low-income, and child populations. Children make up nearly 25% of the Study Area population. The Proposed Action is not expected to disproportionately adversely impact children during construction or operation.	3.9 and 6.7
EO 13112, *Invasive Species*	USFWS	The TPWD control measures relating to invasive species are incorporated into the Proposed Action. The Proposed Action is not likely to cause or promote the introduction or spread of invasive species in the U.S.	3.5 and 4.5
EO 13175, *Consultation and Coordination With Indian Tribal Governments*	USACE	Coordination with Indian Tribal Governments has been undertaken by the USACE to determine if the Proposed Action would impact known Traditional Cultural Properties. The Caddo Tribe has been included in all governmental notifications. No tribal interest associated with the Proposed Action has been identified.	3.6 and Appendix A
EO 13186, *Responsibilities of Federal Agencies To Protect Migratory Birds*	USFWS	The Proposed Action would beneficially impact migratory birds by creating new and better wetland and aquatic habitats for stopover and foraging.	3.5 and 4.5
Fish and Wildlife Coordination Act	USFWS and USACE	The USFWS has prepared a Final Fish and Wildlife CAR (refer to Appendix M). The findings of the CAR conclude, “Both [design variations] would result gains to fish and wildlife resources and both would support the Dallas Floodway Project objectives of flood protection, habitat creation/restoration, and public recreation. … In summary, we believe the implementation of these recommended measures would serve to minimize the adverse impacts associated with the proposed project.”	3.5 and 4.5, Appendix M
Migratory Bird Treaty Act	USFWS and TPWD	The Proposed Action would beneficially impact migratory birds by creating new and better wetland and aquatic habitats for stopover and foraging.	3.5 and 4.5
National Historic Preservation Act		Section 405(a) of the 2010 Supplemental Disaster Relief and Summer Jobs Act (Public Law 111-212) states that the USACE is not required to make determinations under NHPA for the Dallas Floodway Project. USACE Implementation Guidance dated October 19, 2010 directed the Fort Worth District not to make a determination under the National Historic Preservation Act (NHPA) and instead to examine the Dallas Floodway Project as an engineering system with a discussion of the cultural resource’s significance without making explicit references to NHPA’s eligibility criteria.	3.6 and 4.6
Native American Graves Protection and Repatriation Act, 25 USC 3001 et seq.	USACE	This EIS analyzes the impact of the alternatives and coordinates with Native American Tribes as required. Because no Native American remains or funerary objects have been discovered within the Study Area, requirements of this act have been met.	3.6 and 4.6

Table 6-1. Summary of Applicable Environmental Regulations and Regulatory Compliance Required with Implementation of the Proposed Action

Plans, Policies, and Controls	*Regulatory Authority*	*Compliance Status*	*EIS Section*
Noise Control Act of 1972 and Quiet Communities Act of 1978	USACE	This EIS considers noise impacts consistently with these statutes. Noise impacts would occur during the construction of the Proposed Action. The special conservation measures identified in Section 7.2 would minimize the adverse impacts of noise, consistent with the requirements of these statutes.	3.15, 4.15, 7.2
Resource Conservation and Recovery Act	USEPA	The Proposed Action would not result in significant hazardous materials related impacts. Management protocols for hazardous substances that could potentially be discovered during construction would follow existing regulations and procedures for hazardous materials.	3.10 and 4.10
Rivers and Harbors Act	USACE	Section 10 compliance with the Rivers and Harbors Act is completed jointly with the CWA Section 404 permitting process.	3.4, 4.4, 6.1.2, and Appendix L
Texas Health and Safety Code, 13 Texas Administrative Code Part 22	USACE	The Proposed Action would be implemented in accordance with 13 Texas Administrative Code Part 22.	3.10
Trinity River EIS (TREIS) Record of Decision (ROD) and Local Corridor Development Certification	USACE	The Proposed Action does not satisfy ROD or Corridor Development Certificate criteria for the 100-year flood event. The USACE and City of Dallas would request a variance from the TREIS ROD requirements, with the demonstration of there being no impact to public safety.	3.3 and 4.3
U.S. Army MOA with FAA and Advisory Circular – Hazardous Wildlife Attractants on or Near Airports	USACE and Federal Aviation Administration (FAA)	The USACE and the City of Dallas have agreed to implement some of the FAA recommendations regarding the potential for the Proposed Action to create a potentially hazardous wildlife attractant to aircraft operations. Coordination will continue through the design and construction phases.	3.11 and 4.11
U.S. Army MOA with USEPA – The Determination of Mitigation under the CWA Section 404(b)(1) Guidelines	USACE and USEPA	This EIS has identified Alternative 2 as the least environmentally damaging practicable alternative.	7.1 and Appendix L

Non-federal projects involving discharge of dredged or fill materials into waters of the U.S. require CWA Section 404 approval by the USACE. Specifically, Section 404(b)(1) of the CWA stipulates that no discharge of dredged or fill material into waters of the U.S., which include wetlands, shall be permitted if there is a practicable alternative which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant environmental consequences. Furthermore, an alternative is considered practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. A Section 404(b)(1) Analysis has been prepared for the Proposed Action (refer to Appendix L).

6.2 UNAVOIDABLE ADVERSE IMPACTS AND CONSIDERATIONS THAT OFFSET THESE IMPACTS

Avoidance and minimization of adverse impacts to natural, cultural, and other environmental resources were integrated into the Proposed Action to the greatest extent possible and practicable. However, adverse impacts may not always be completely avoided and/or minimized. Special conservation measures (SCMs) and mitigation measures have been developed over the course of impact analysis. These measures are identified within the impact analysis for each resource, and in Chapter 7, *Recommended Plan and Resource Impact Minimization Actions*. As the NEPA process progressed, additional mitigation measures and management actions have been revised based on consultation with federal and state regulatory agencies and comments received from the public. The Final EIS has been updated to reflect these changes, including additional and revised mitigation measures. The ROD also notes any and all mitigation requirements. These mitigation measures would be funded, and efforts to ensure their successful completion or implementation are to be treated as compliance requirements. For the non-federal remaining Balance Vision Plan (BVP) Study features, the City of Dallas would submit a compensatory mitigation package that satisfies the requirement of 33 Code of Federal Regulations (CFR) 332 for the Section 10/404 permit.

6.3 RELATIONSHIPS BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Implementation of the Proposed Action would not result in impacts that would reduce environmental productivity, have long-term impacts on sustainability, decrease biodiversity, or narrow the range of long-term beneficial uses of the environment. As discussed in Chapter 4, the Proposed Action would result in both short- and long-term environmental impacts.

Short-term uses of the environment associated with the Proposed Action would include construction throughout the Floodway. Short-term effects from construction would include localized disruptions and higher noise levels in some areas. Trinity River water quality would likely be substantially degraded during the construction period. Project-related construction activities would temporarily increase air pollution emissions and noise in the immediate vicinity of the affected area(s). Depending upon their location, humans and animals could experience increased levels of noise from construction. As described in Section 4.15, noise levels could be as loud as 65.5 decibels. Noise from construction activities would be short-term and would not be expected to result in permanent damage or long-term changes in human experience, wildlife productivity, or habitat use.

Upon completion of construction, the productivity and use of the Floodway would improve. The Proposed Action aims to improve ecosystem health and diversity within the Floodway. Thus, it is anticipated that after the short-term adverse effects to the Floodway, the long-term productivity would be substantially enhanced.

6.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA requires that an environmental analysis include identification of "…any irreversible or irretrievable commitments of resources that would be involved if the Proposed Action is implemented." The term "resources" (both renewable and nonrenewable) means the natural and cultural resources committed to, or lost by, the action, as well as labor, funds, and materials committed to the action.

The permanent use and subsequent loss of non-renewable resources, such as oil, natural gas, and iron ore, are considered irreversible because non-renewable resources cannot be replenished by natural means. An action that causes a loss in the value of an affected resource, which cannot be restored (e.g., disturbance of a cultural site), is considered an irretrievable commitment of resources. Similarly, the consumption of a renewable resource that would be lost for a period of time is also considered an irretrievable commitment of resources. Renewable natural resources include water, lumber, and soil, all of which can be replenished by natural means within a reasonable timeframe.

The Proposed Action would involve irretrievable commitments of both non-renewable and renewable resources. Demolition, construction, and renovation activities would expend fuel, construction materials, and labor. The operation and maintenance of new and existing facilities required to implement the Proposed Action would require energy to light the amenities and fuel to operate landscaping and maintenance equipment.

Implementation of the Proposed Action would have an irreversible impact to grassland quality and quantity. The grasslands consist primarily of nonnative Bermuda grasses, which are mown and maintained within an urban environment. The value of these grasslands is not considered to be high due to their low value as wildlife habitat, and therefore impacts to this resource would not be mitigated. In addition, the Proposed Action would result in the creation of higher quality habitat within the Floodway.

6.5 FLOODPLAIN ACTIVITIES

EO 11988 requires federal agencies to avoid "to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." EO 11988 states that to accomplish this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities" for:

- Acquiring, managing, and disposing of federal lands and facilities;
- Providing federally undertaken, financed, or assisted construction and improvements; and
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

6.5.1 Regional Development

Activities and development within the Floodway falls under multiple plans, policies, and requirements. As discussed in Section 1.6, the City of Dallas participates in the National Flood Insurance Program, is subject to consideration under the 1988 Upper Trinity River EIS Record of Decision (ROD) criteria, has adopted the Trinity River Corridor Development Certificate (CDC) process, and enforces zoning regulations for development in the floodplain.

The Trinity River EIS (TREIS) ROD Hydrologic and Hydraulic (H&H) criteria were originally developed for the purpose of limiting potential increases in flood risk in the Trinity River Corridor due to floodplain developments and has been applied to the USACE Section 404 regulatory process. The criteria identified in the TREIS ROD are described and analyzed for the Proposed Action in Sections 3.3 and 4.3. For no-federal project features that would be implemented entirely by the City of Dallas, the CDC process applies. CDC criteria are nearly identical to the H&H criteria established in the TREIS ROD with the only difference being that the CDC include the project criterion “no increase in the 100-year flood water surface elevation and no significant increase in the Standard Project Flood water surface elevation.”

The City of Dallas’ BVP Study and the Trinity River Corridor Comprehensive Land Use Plan (TRCCLUP) jointly create a land use development regime that aims to revitalize the Floodway and surrounding developed regions. Implementation of these plans, currently in progress, involves maintaining most of the residential area while phasing out industrial use along the riverfront and replacing it with neighborhood-scale commercial and residential development. The City of Dallas zoning code has requirements for all construction and land use activities within the city limits, and is helping bring new development in line with the goals of the TRCCLUP. Current zoning within the Floodway is agricultural or public use.

As described in Section 1.6, the USACE evaluated the Dallas Floodway levees and Interior Drainage Systems (IDS) in Periodic Inspection No. 9 (USACE 2009), and the system as a whole was given an “unacceptable” rating. Based the review, the USACE withdrew its letter of support for certification provided to the Federal Emergency Management Act (FEMA). In response, the City of Dallas prepared a Maintenance and Deficiency Correction Period (MDCP) plan that identified 198 items. The City of Dallas has addressed all MDCP items and expects to have the levee system repaired and certified prior to FEMA completing the revised maps. If FEMA accepts the City’s certification package, FEMA could accredit the Dallas Floodway Levee System and its Flood Insurance Rate Maps would again show the levees provide “protection” from the 1% Annual Exceedance Probability (AEP), or 100-year event. FEMA is also remapping the floodplain on the interior side of the levee system because the IDS currently does not provide the 100-year level of flood risk. The City of Dallas expects to have the IDS improved to 100-year levels prior to the remapping.

6.5.2 EO 11988 Eight Step Analysis

To assist in complying with EO 11988, the USACE has issued guidance (USACE Engineering Regulation [ER] 1165-2-26), as it pertains to planning, design, and construction of USACE projects. The Water Resources Council Floodplain Management Guidelines for implementation of EO 11988, as referenced in USACE ER 1165-2-26, requires an eight-step process that agencies should carry out as part of their decision-making on projects that have potential impacts to, or are sited within, the floodplain.

The eight steps reflect the decision-making process required in Section 2(a) of EO 11988. In order to demonstrate the Proposed Action complies with EO 11988 and to address related public safety concerns, the following documentation is provided. The existing floodplain management activities, including National Flood Insurance Program related actions and requirements are described. This is followed by a response to the eight-step process.

1. *Determine if the proposed action is in the base floodplain.*

   Yes, the Proposed Action lies within the base floodplain.

The 1% AEP riverine floodplain in the project area is contained within the larger Dallas Floodway Levee System. The 1% AEP interior drainage floodplain is located on the developed side of the levee system. The proposed Flood Risk Management (FRM) elements would be improvements to the existing Dallas Floodway Project and IDS. The intended effects of the proposed FRM elements are to reduce both economic damages and life safety risk associated with riverine flooding. The intended effects of the proposed Interior Drainage Plan (IDP) improvements is to reduce flooding within the 1% AEP floodplain on the developed side of the levee to reduce both economic damages and life safety risk associated with interior flooding. The BVP Study ecosystem restoration and recreation enhancements are located within the Floodway. The BVP Study ecosystem restoration activities are within the base floodplain and include features that would improve the existing condition of the Trinity River riverine ecosystem and associated wetlands in the Floodway. The BVP Study recreation enhancements would create a desirable destination for active recreation, festivities, or nature observation in the Floodway.

2. *If the action is in the base floodplain, identify and evaluate practicable alternatives to the action or to location of the action in base floodplain.*

Alternatives have been evaluated and not carried forward as they were either not practicable or did not meet the goals of the Proposed Action.

The Proposed Action has multiple components including FRM, ecosystem restoration and recreation enhancements. Practicable alternatives for FRM elements actions are described first, followed by ecosystem restoration and recreation enhancements, respectively, and lastly, IDP improvements.

FRM Elements

Riverine and interior drainage flood risks are addressed by the Proposed Action. The proposed riverine FRM plan is located within the base floodplain and includes modifications to existing features of the Dallas Floodway Project. A flood risk analysis (as described in the USACE Feasibility Report [USACE 2014]) concluded the existing levee system could overtop during a flooding event, overtop and breach, or breach prior to overtopping due to seepage through the foundation of the levee system. The levee system evaluation followed the “Principals and Guidelines for Water and Related Land Resources,” dated March 1983, including an evaluation of contributions to National Economic Development (NED) and reducing potential life-safety risk. The NED analysis was only performed on the measures that address riverine flood risk. Plan formulation and screening of plans described in the USACE’s Feasibility Report, Chapter 3, Sections 3.1 through 3.4 (USACE 2014) is the basis for concluding there are no practicable alternatives to locating the proposed FRM plan in the base floodplain. The main Federal objective of reducing flood risk cannot be achieved by alternatives outside the floodplain. All structural alternatives considered were located in the base floodplain.

Practicable nonstructural alternatives like flood proofing, structure relocation, permanent evacuation, and instrumentation were considered. Flood proofing, structure relocation and permanent evacuation were removed from consideration because they were not viable for broad application across the Study Area, or were not economically viable. Other nonstructural measures including instrumentation and Emergency Action Plan (EAP) improvements are part of the Proposed Action.

BVP Study Ecosystem and Recreation Features

As developed in the BVP Study, the City of Dallas aims to revitalize the Trinity River as a great natural resource in order to create a unique public domain and achieve a model of environmental stewardship. The BVP Study ecosystem and recreation features are located in the Dallas Floodway and are part of the City’s overall vision for the Trinity River Corridor. Environmental restoration of the Trinity River is site specific and requires actions in the floodplain. The actions are intended to be beneficial to the ecosystem in nature.

The City of Dallas proposes land- and water-based recreation to be intertwined with the FRM and ecosystem features. The City of Dallas' recreation need is broader than being targeted in the Dallas Floodway and land and water-based recreation can be accommodated at other locations (refer to Section 3.7 for a discussion of recreation need). Even with the recreation component of the Proposed Action being located elsewhere, the desire to locate recreational facilities in the Dallas Floodway would continue to exist.

IDP Improvements

A number of potential alternatives were evaluated to determine the identified recommended improvements to the City's IDS. The alternatives are described in the City's Interior Levee Drainage Study – East Levee Phase I Report, Dallas, Texas; and West Levee Phase II Report (City of Dallas 2006 and 2009). The goal of the IDP improvements is to reduce computed peak sump elevations for the 100-year, 24-hour event. Recent local severe rainfall events resulting in widespread stormwater flooding and property damage have demonstrated that improvements are needed to the IDS to reduce the risk of interior flooding.

The City's IDP studies (City of Dallas 2006, 2009) considered decreasing the magnitude or altering the timing of the inflow to the sump, increasing the discharge from the sump, or increasing the storage capacity of the sump at each of the major pumping plants (including pump stations and associated sumps). A large amount of stormwater detention would be required to decrease the magnitude or alter timing of inflow; these are not considered feasible, as the region is highly developed. Increasing storage capacity had its limitations due to high property values in the surrounding area to the sumps. Areas that were identified as feasible for expansion ultimately would have little effect on storage capacity.

None of the potential alternatives considered would eliminate the need for additional pump stations. The screening of alternatives described in the City's IDP reports is the basis for concluding there are no practicable alternatives to locating the proposed interior drainage improvements in the base floodplain. The IDS improvements did not require evaluation in accordance with the "Principals and Guidelines for Water and Related Land Resources," dated March 1983, due to the language contained in Section 5141 of the Water Resources Development Act (WRDA) of 2007.

3. *State whether the proposed action would induce development in the base floodplain.*

The Proposed Action would not induce development in the base floodplain.

The Proposed Action would occur in a highly urbanized area near downtown Dallas, Texas. Urban development would remain on the protected side of the Dallas Floodway Levee System as it exists today and would not enter the base floodplain because of the Proposed Action. The City of Dallas has developed land use plans that aim to revitalize the Trinity River Corridor and riverfront regions; however, any additional development within the Floodway would be counter to the long range TRCCLUP. The changes to the existing urban development would remain on the protected side of the Dallas Floodway Levee System as it exists today, and revitalization of these areas could happen with or without the Proposed Action. Interior drainage system components are considered public utilities under the City of Dallas zoning code. The proposed IDP projects would not change this land use designation and would not induce development in the base floodplain. Some undeveloped areas outside of the Floodway are expected to become developed over time; however, such development is being observed currently, and could continue with or without the Proposed Action.

4. *Identify the impacts in the base floodplain of the proposed action and any induced development.*

   Impacts within the base floodplain are presented in Chapter 4.

Impacts to the base floodplain are described for the Proposed Action. Impacts are described in terms of the 1988 TREIS ROD criteria and the Trinity River CDC process. The alternatives were evaluated whether they meet the ROD criteria in terms of valley storage and water surface rise. The alternatives did not meet the ROD criteria; however, the potential negative impacts are insignificant and a variance to the ROD is recommended.

Criteria for the CDC, a local requirement, are nearly identical to the H&H criteria established in the 1988 TREIS ROD. The City of Dallas would conduct the necessary CDC permit actions. As project designs move toward a higher level of detail in the final design stages, continual H&H analysis will be performed to ensure the highest reasonable level of compliance with the 1988 ROD criteria, and CDC criteria as appropriate.

Impacts to fish and wildlife, cultural resources, recreation, and other floodplain resources are considered in this EIS. Avoidance and minimization to existing floodplain resources has been considered in the development of the Proposed Action. Most of the expected losses or impacts to existing floodplain resources are expected to be compensated by the benefits provided by the Proposed Action. Mitigation requirements for the Proposed Action are described in Section 7.2.

5. *Describe measures available to minimize adverse impacts on the natural and beneficial floodplain values.*

   Avoidance and minimization efforts for all resources are described in Section 7.2.

Implementation of the Proposed Action would incorporate SCMs designed to prevent, avoid, and/or minimize adverse impacts to resources. Mitigation measures are proposed in some cases to counter impacts that cannot be sufficiently avoided or minimized by an SCM. Mitigation requirements are described in Section 7.2.

The ecosystem restoration features are intended to preserve and improve natural floodplain values. Alternative 2 provides greater habitat functions and values over existing conditions, especially for the aquatic habitats of greatest concern, i.e., wetlands, bottomland hardwoods, and aquatic riverine. For these reasons, separable mitigation features are not recommended.

6. *Describe the effect of the above topics on any reevaluation of alternatives and on the final plan selection*

   A re-evaluation of alternatives was not required because of considering the topics listed above.

There are no remaining unmitigated adverse effects on natural and beneficial floodplain due to implementation of the Proposed Action.

7. *Finding and Explanation*

EO 11988 requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The Proposed Action does not support direct or indirect floodplain development within the base floodplain. The City of Dallas and USACE have lead public outreach efforts to local communities starting with the NEPA scoping meeting and throughout the study process. To date, there is no known public opposition to the Proposed Action. A public review of the Draft USACE Feasibility Report and this EIS was conducted and relevant public and agency comments were considered.

8. *Critical Actions*

The same results of the base floodplain apply considering the topics listed above to the 0.2% AEP (500-year event). This flood event, like the base floodplain, remains contained in the Floodway, and would not overtop the existing or proposed levee system improvements. A breach could occur prior to overtopping due to seepage through the foundation of the levee system; however, the probability of this occurrence is low. Chapter 2 of the USACE Feasibility Report discusses annualized failure probabilities by failure mode for the levee system. A breach due to internal erosion through the foundation of the levee system (PFM #7) has an estimate annualized probability of failure of 5.19E-06. This probability is estimated assuming water levels at a top of levee height. The 500-year event is approximately 4-5 feet below the top of levee (USACE 2014). The non-federal sponsor is seeking FEMA certification for National Flood Insurance Program purposes as a floodplain management choice. This allows for areas provided flood risk reduction to not have to be required to pay mandatory flood insurance, and thus no development restrictions are enforced. A potential project being pursued under Section 408, referred to as the Trinity Parkway, would be located within the 500-year floodplain. The Trinity Parkway would not be included in an evacuation route in riverine or interior drainage flooding events.

6.5.3 Additional Public Safety Considerations

Life safety and economic risks are reduced with the application of FRM and IDP components of the Proposed Action; however, residual risk remains once construction is complete. In the highly unlikely event that the East and West Levees were to overtop and experience a breach, the areas behind the levees would experience significant economic damages to property and the potential for loss of life. In the USACE Feasibility Report (USACE 2014), alternatives were evaluated based on their ability to contribute to economic development and reduce life safety risk. The residual risk is determined to be tolerable because there was no practicable way to reduce risk further.

Because the area is urbanized, consequences of a highly unlikely levee failure would remain high. Flood warning issuances vary among levee failure modes. For example, failure due to internal erosion of the foundation would have less time than the warning time for overtopping with a subsequent breach. Overtopping and subsequent breach has an estimated warning time of approximately 8 hours. The city has an existing in-depth EAP that identifies elderly populations over 65, special needs households, and other structures that should to be targeted for evacuation during flood events (refer to Sections 3.11 and 4.11 for the description of the EAP).

In the highly unlikely event of levee failure, the City of Dallas can anticipate to experience substantial loss of life and economic harm. Economic risk and risk of loss of life are quantitatively estimated in the 2012 USACE Risk Assessment (within USACE 2014).

Based on analyses included in the 2012 USACE Risk Assessment, implementation of the proposed FRM elements to contain the 277,000 cubic feet per second (cfs) flood event would reduce the risk of exceeding the levee compared to the Future Without-Project Condition by 44.5% on the East Levee and 28% on the West Levee.

6.6 CLIMATE CHANGE

The *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* issued by the CEQ on February 18, 2010 recommends incorporating impacts associated with climate change as part of the standard cumulative impact analysis of all NEPA documents. The draft guidance encourages agencies to determine which climate change impacts warrant consideration in their analyses based on both the Proposed Action's potential impact to climate changes and the potential impact a changing climate may have on implementation of the Proposed Action.

The USEPA developed a "State of Knowledge" website subsequent to the 2007 Intergovernmental Panel on Climate Change report. The USEPA affirms that while the contribution is uncertain, human activities are substantially increasing greenhouse gas (GHG) emissions, which, in turn, are contributing to a global warming trend (USEPA 2013). The U.S. Global Change Research Program (USGCRP) was established by President George H. Bush in 1989, and later mandated by congress as part of the Global Change Research Act of 1990. The USGCRP is a working group coordinating the efforts of 13 different federal agencies, including the U.S. Department of Agriculture, the Department of the Interior, the Department of Defense, and the Department of Energy. The USGCRP releases regular reports presenting the most current scientific consensus of predicted changes associated with global climate change; the 2009 report (USGCRP 2009) is the most recent complete report. In 2013, the USGCRP issued a draft update of the 2009 report, *Global Climate Change Impacts in the US*. These reports summarize the science of climate change and the impacts of climate change on the U.S., now and in the future, and are recommended by the CEQ 2010 draft guidance as the primary sources for framing climate change discussions.

While the 2009 and 2013 USGCRP reports acknowledge difficulty in specifying climate change impacts, there are several resource areas identified as being altered by climate change and human impacts. The report identifies fresh water in the U.S. as being stressed, and that climate change exacerbates that stress. Predictably, with increased pressure on water sources, the report predicts challenges to agriculture in the U.S., as water stress, weather extremes, pests and disease impede agricultural production. Extreme weather patterns have been linked to climate change, and the report predicts correlated increased risk to human health via heat and cold stress, as well as increase exposure risk to disease vectors (USGCRP 2009, 2013).

6.6.1 Regional Predictions

6.6.1.1 Existing Conditions

The USGCRP looks at potential impacts of climate change globally, nationally, regionally, and by resource (e.g., water resources, ecosystems, human health). The City of Dallas is within the Great Plains region of analysis. The Great Plains region has already seen evidence of climate change in the form of rising temperatures that are leading to increased demand for water and energy and impacts on agricultural practices. Over the last few decades, the Great Plains have seen fewer cold days and more hot days, as well as an overall increase in total precipitation. The decrease in the cold days has resulted in an overall shortening of the frost-free season by one to two weeks. Within this region, there was an increase in average temperatures 1.5°F from a 1960-1970 baseline to the year 2000 (USGCRP 2013).

Since 1991, the amount of rain falling in very heavy precipitation events in the Great Plains has increased by 21% from 1901-1960 (USGCRP 2013). From 1971-2011, the City of Dallas received an average of 34.9 inches of rainfall annually, an 8.4% increase over the annual rainfall average of the 40 previous years (1930-1970) (National Weather Service 2012).

In addition to more extreme rainfall, extreme heat events have also been increasing. Most of the increases of heat wave severity in the U.S. are likely due to human activity, with a detectable human influence in recent heat waves in the southern Great Plains (USGCRP 2013). In particular, in 2011, the State of Texas experienced a heat wave and drought. The growing season and summer were both the hottest and driest on record. Extreme heat events in Texas have also been occurring substantially more frequently. Using historical data, an extreme heat event that was predicted to have a 100-year recurrence (i.e., a 1% AEP) in 1964 would have only 5- to 6- year recurrence (i.e., a 20% to 17% AEP) in 2008 (Rupp et al. 2011).

6.6.1.2 Future Conditions

Predicted Temperature Changes

The USGCRP looks to two potential future conditions as part of its predictive modeling process. Under conditions of lower greenhouse gas emissions, the average temperature in the Great Plains region may increase as much as 4°F by 2020, 6°F by 2050, and 8°F by 2090 from averages observed in 2000. Under conditions of higher continuous greenhouse gas emissions, the potential increase is greater in the long-term, and may be as much as 13.5°F by 2090. Projected changes in long-term climate predict more frequent extreme events such as heat waves, droughts, and heavy rainfall (USGCRP 2013). These varying conditions shape the resource-level discussion presented here.

Extreme Weather Events

Despite the documented increase in precipitation since 1991, current simulations predict decreasing rainfall for the region into the future. As climate change continues to influence weather patterns, current modeling predicts that the average spring rainfall in the Dallas area may decrease between 5% (low emissions scenario) and 15% (high emissions scenario) by 2070-2090. At the same time, the precipitation that does fall is predicted to occur in more frequent heavy rainfall events, and thus the intensity of flooding is projected to increase. The increase in frequency of extreme heat events is also likely to continue; the temperatures observed during extreme events are projected to increase by 4°F to 15°F, depending on the emissions scenario used for predictive modeling (USGCRP 2013). This change in precipitation and heat would likely alter agricultural and ecosystem conditions.

The combined increased risk of drought and flooding may indicate a decrease in overall water quality for the Trinity River. Increased frequency and duration of droughts, and associated low water levels, increase nutrient concentrations and residence times in streams, have the potential to increase the likelihood of harmful algal blooms and low oxygen conditions.

Predicted Habitat Changes

As climate change is seen in increased temperatures and drier conditions in the Dallas area, aquatic, open water, and emergent wetland habitats are expected to convert to drier habitats, such as bottomland hardwoods and grasslands (USFWS 2014). By the year 2060, 1% of the emergent wetlands are expected to convert to grassland due to siltation and drier conditions from climate change; 5% of the aquatic riverine habitat is expected to be converted to bottomland hardwoods, primarily due to warmer and drier conditions from climate change; and 8% of open water is expected to convert to bottomland hardwoods (USFWS 2014). Meanwhile, grassland and plains birds could experience significant shifts and reductions in their ranges (USGCRP 2013).

As temperatures increase optimal zones for growing crops will shift. Pests that were historically unable to survive in cooler areas may spread northward. Milder winters and earlier springs also may encourage greater numbers of pest species. Rising carbon dioxide levels in the atmosphere may increase growth of both crop and weeds species. In some areas, water scarcity may reduce or even eliminate certain types of agricultural production. Similarly, changes in temperature and precipitation affect the composition and diversity of native animals and plants through altering their breeding patterns, water and food supply, and habitat availability. In a changing climate, populations of some pests such as red fire ants and rodents, better adapted to a warmer climate, are projected to increase (USGCRP 2013).

Predicted Changes to Energy Demands and Emissions

Changes in temperature are also correlated with changes in energy demands. Energy demands for the City of Dallas associated with heating needs are expected to decrease by between 27% (low emissions scenario) and 40% (high emissions scenario) by 2080-2099. However, the predicted temperature change anticipates more warm days, and therefore increased cooling demands. In Dallas, energy demands associated with cooling needs are expected to increase by between 28% (low emissions scenario), and 73% (high emissions scenario) by 2080-2099. At the same time, power sources may become less dependable. The portion of U.S. electric grid disturbances caused by weather-related phenomena has more than tripled from about 20% in the early 1990s to about 65% in recent years. The frequency of disturbance caused by extreme weather has increased tenfold since 1992 (USGCRP 2013).

The potential for increased risk of power loss, combined with increased temperatures has the potential to have substantial impacts on public health. Heat is the leading cause of weather-related deaths in the U.S. More than 3,400 deaths between 1999 and 2003 were reported as resulting from exposure to excessive heat. Analyses suggest that currently rare extreme heat waves will become much more common in the future. At the same time, the U.S. population is aging, and older people are more vulnerable to hot weather and heat waves. Diabetics are also at greater risk of heat-related death, and the prevalence of obesity and diabetes is increasing (USGCRP 2013).

In an effort to help minimize potential adverse impacts from climate change, the City of Dallas has a series of programs designed to minimize GHGs and favor more sustainable lifestyle choices. In 2006, the Mayor of Dallas signed the U.S. Mayors Climate Change Agreement, which is a commitment by the mayors around the country to reduce GHG emissions in their own cities and communities to 7% below 1990 levels by the year 2012 through improved efficiency in government fleets, improved transit systems, and other emissions reduction measures (Green Dallas 2008).

In 2010, the estimated GHG emissions from the City of Dallas operations were 402,560 metric tons (Green Dallas 2012). This amount is approximately 33% less than 1990 GHG emissions (Green Dallas 2012). The City of Dallas has already attained the 7% GHG emissions reduction for the period between 1990 and 2012. The main factors that may have helped Dallas obtain this goal are (1) the purchase of renewable energy sources (at 40%) for the City's electricity consumption, and (2) the energy efficiency improvements in the power generation sector (Green Dallas 2012).

6.6.2 Climate Change and the Dallas Floodway Project

This section evaluates the potential impacts of the Dallas Floodway Project on climate change and the potential impacts of climate change on the Dallas Floodway Project.

6.6.2.1 Impact of the Dallas Floodway Project on Climate Change

Impact of the Dallas Floodway Project on Climate Change Greenhouse Gas Contribution: Proposed Action Design Anticipating Construction of the Potential Trinity Parkway

The potential effects of proposed GHG emissions are by nature global and cumulative impacts, as individual sources of GHG emissions are not large enough to have an appreciable effect on climate change. Therefore, an appreciable impact on global climate change would only occur when proposed GHG emissions combine with GHG emissions from other man-made activities on a global scale. Currently, there are no formally adopted or published NEPA thresholds of significance for GHG emissions stemming from proposed actions. Formulating such thresholds is problematic, as it is difficult to determine what level of proposed emissions would substantially contribute to global climate change.

Nonetheless, the project emissions of the GHG compounds: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have been quantified to the extent feasible in Appendix N. GHG emissions are quantified in terms of "CO_2 equivalence" (CO_2e), that is the degree to which a compound may function as a GHG as compared to CO_2. The emissions from the year of greatest anticipated construction activity, 2020, have been compared to the 2012 U.S. GHG Emission Inventory (USEPA 2014). The estimated GHG emissions from the 2020 construction activities associated with the Proposed Action design anticipating construction of the potential Trinity Parkway represent less than one thousandth of 1% of the GHG emissions generated by the U.S. in 2012 (Table 6-2). GHG emissions for other construction years during the period of implementation of the Proposed Action design anticipating construction of the potential Trinity Parkway would be lower than for the year 2020.

Table 6-2. Comparison of 2020 Proposed Action (Design Anticipating Construction of the Potential Trinity Parkway) GHG Emissions to U.S. 2012 Greenhouse Gas Emissions

Alternative	*Metric Tons CO_2e per Year*	*Percent of U.S. 2012 GHG Emissions*
2020 Alternative 2 Construction (design anticipating construction of the potential Trinity Parkway)	48,305	0.0007
U.S. 2012 Total GHG Emissions	$6{,}501.5 \times 10^6$	

Note: CO_2e calculation for Alternative 2 (design anticipating construction of the potential Trinity Parkway) for year 2020 = 41,861+(21*2.84)+(310*20.59)* 0.9071847 = 48,305 metric tons.
Source: USEPA 2014.

Federal agencies are addressing and will continue to address emissions of GHGs on a national scale by reductions mandated in federal laws and EOs. As previously mentioned, the City of Dallas has already attained the federally mandated 7% GHG emissions reduction for the period between 1990 and 2012, and is proactively addressing GHG emissions within the region.

Impact of the Dallas Floodway Project on Climate Change Greenhouse Gas Contribution: Proposed Action Design without the Potential Trinity Parkway Construction Anticipated

As shown in Table 6-3, the estimated GHG emissions from the 2022 construction activities for the Proposed Action design without the potential Trinity Parkway construction anticipated represent less than one hundredth of 1% of the GHG emissions generated by the U.S. in 2012. GHG emissions for other construction years during the period of implementation of the Proposed Action design without the potential Trinity Parkway construction anticipated would be lower than for the year 2022.

Table 6-3. Comparison of 2022 Proposed Action (Design without the Potential Trinity Parkway Construction Anticipated) GHG Emissions to U.S. 2012 Greenhouse Gas Emissions

Alternative	*Metric Tons CO_2e per Year*	*Percent of U.S. 2012 GHG Emissions*
2022 Alternative 2 Construction (design without the potential Trinity Parkway construction anticipated)	55,637	0.0009
U.S. 2012 Total GHG Emissions	$6{,}501.5 \times 10^6$	

Note: CO_2e calculation for Alternative 2 (design without the potential Trinity Parkway construction anticipated) for year 2022 = 48,376+(21*3.16)+(310*23.21)* 0.9071847 = 55,637 metric tons.
Source: USEPA 2014.

6.6.2.2 Impact of Climate Change on the Dallas Floodway Project

The primary drivers of the Dallas Floodway Project are to increase FRM, enhance the ecosystem, and improve recreational amenities available in the City of Dallas. The improvements to the levee system are designed to contain the future predicted Standard Project Flood (SPF) of 277,000 cfs. Current predictions anticipate that the frequency and intensity of flooding in the southern Great Plains region, including Dallas, are expected to increase. If these projections are validated as more data come available, it is possible that the SPF elevations may be higher than currently anticipated, and additional FRM may be required. In addition, more frequent and intense flooding below the SPF may also substantially increase the operation and management cost to maintain the Floodway and proposed amenities between flood events. Climate change predictions do not currently provide sufficient granularity to design the FRM elements to completely address any increase in risk. Instead, the USACE and City of Dallas would monitor climate change predictions and adaptively manage FRM within the risk area as new data become available.

Climate change is also expected to increase drought frequency and severity in the southern Great Plains. As many of the ecosystem and recreation features proposed are aquatic in nature (e.g., the proposed lakes and extensive wetland construction), water scarcity may degrade the values of these amenities. The Urban and Natural Lakes complex is proposed to be supplied with wastewater from the Central Wastewater Treatment Plant, which treats wastewater from the City of Dallas. No major reduction programs in water usage have been proposed for the City of Dallas, and the population is expected to increase in the coming decades (refer to Section 3.9). Therefore, it is likely that this water supply would continue to be available. At the same time, those features that would be supported via groundwater, river flow, or precipitation may be harder to maintain.

The 2014 Planning Aid Report (USFWS 2014) considered climate change in estimating habitat changes into the future. As summarized in Sections 3.5 and 4.5, the predicted decrease in precipitation may result in a loss of emergent wetlands. Wetlands designated as mitigation wetlands may require additional maintenance and monitoring to continue to function as required. Other emergent wetlands in the Study Area may contract over time due to lack of water.

An additional effect of creating more aquatic habitat within the Study Area is the potential for increased pest and disease-vector habitat. The increased amount of habitat could exacerbate the predicted increased public health risk from vector-borne diseases such as West Nile Virus and various tick-born conditions that already frequent Texas. In addition, emergent diseases such as Dengue Hemorrhagic Fever may also pose a health risk compounded by increased habitat. Thus far, lifestyles (notably well-sealed buildings with air filtration systems) in Texas mitigate exposure to vector born disease (Reiter et al. 2003). The City of Dallas mosquito control program also functions to keep disease vector populations low. However, an anticipated result of the Proposed Action is to significantly increase the number of people participating in outdoor recreation, adjacent to newly constructed high quality habitat. Thus, it is possible that climate change will contribute to a public health risk; however, the public health risk would continue to be addressed by the City of Dallas.

6.7 ENVIRONMENTAL JUSTICE

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* was designed to focus Federal attention on the environmental and human health conditions in minority communities and low-income communities with the goal of achieving environmental justice. EO 12898 also promotes nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority communities and low-income communities access to public information on, and an opportunity for public participation in, matters relating to human health or the environment.

The following impact analysis for environmental justice is based on the combination of impact analyses from other resource areas covered in this EIS. Resource areas that were determined to potentially impact populations and/or communities include Recreational Resources, Visual Resources, Socioeconomics, Safety, Transportation, Utilities, Air Quality, and Noise. For a detailed discussion of the overall impacts to each resource area, refer to Chapter 4.

6.7.1 Proposed Action

The resource impacts to environmental justice (i.e., impacts potentially felt disproportionately by low-income, minority, and/or child populations) from implementation of the Proposed Action are summarized in Table 6-4. The environmental justice impacts of both Proposed Action design variations are virtually identical, and thus, Table 6-4 presents potential impacts from the Proposed Action implemented under either Proposed Action design. The design without potential Trinity Parkway construction anticipated, as compared to the design anticipating potential construction of Trinity Parkway, would create slightly more recreation features (refer to Table 4.7-6). These additional improvements would be minor and impacts related to environmental justice would be similar to those described for the Proposed Action design anticipating potential Parkway construction. In addition, under the design without potential construction of the Parkway, there would be slightly more construction activity than under the design with potential construction of the Parkway anticipated. As such, there would be a slightly higher level of construction-related impacts to environmental justice. Any differences would be minimal and thus the results presented under the Proposed Action apply to either design variation. SCMs, as identified in Chapter 7, would be implemented.

Table 6-4. Summary of Impacts to Low-income, Minority, and Child Populations

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action[1])*	
		Construction	*Operation*
Recreational Resources	• No additional recreational amenities proposed. • As population growth continues, the deficit of recreational amenities would be felt more acutely by environmental justice communities.	• Access to existing/proposed amenities would be locally temporarily disrupted. • Disruption would be preceded by public notification. • Disruption limited to no more than two years at each amenity. • Temporary, local adverse impacts to low-income, minority, and child populations by potentially restricting access to existing recreational resources.	• Significant increase in number and variety of recreational amenities throughout the Floodway. • Significant reduction in recreational shortfall within Study Area. • Improved access to Floodway and proposed amenities. • Reduced flood risk to existing amenities. • Improved access and recreational opportunities to Study Area residents. • Beneficial impacts to low-income, minority, and child populations.

Table 6-4. Summary of Impacts to Low-income, Minority, and Child Populations

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action[1])*	
		Construction	*Operation*
Visual Resources	• No change to visual resources.	• Temporary, local adverse impacts to low-income, minority, and child populations by disturbing the existing viewshed during construction.	• Development of the Floodway would enhance the landscape seen by the residential population of the Study Area. • Beneficial impacts to low-income, minority, and child populations.
Socioeconomics	• Existing patterns of gentrification would continue.	• An estimated 8,553 jobs created, $662,634,032 in labor income, and a $1,264,620,223 increase in economic activity. • Economic benefits would accrue primarily to businesses and higher-income individuals. • Residents of the Study Area would also benefit from economic growth (primarily through construction jobs). • While benefits would not be equally distributed, there would still be an economic benefit to low-income, minority, and child populations of the Study Area.	• Increased visitors for recreational amenities would increase money spent in local businesses. • Completion of the Proposed Action may increase the rate of the on-going gentrification within the Study Area. • Visitors attracted to the Floodway would generate jobs and income for Dallas residents. • Improvements in the local and regional economy would result in beneficial impacts to low-income, minority, and child populations.
Safety	• FRM would continue to diminish. • Flooding from inadequate interior drainage in the residential sections of the Study Area would persist.	• No impacts to low-income, minority, and child populations of the Study Area.	• Improved residential and emergency access to the Floodway. • Improvements to interior drainage would reduce flood elevation within the Study Area. • Nonstructural improvements that improve monitoring capabilities would provide better FRM and earlier warning to residents of the Study Area. • Improvements in the access, interior drainage, and FRM would result in beneficial impacts to low-income, minority, and child populations.

Table 6-4. Summary of Impacts to Low-income, Minority, and Child Populations

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action[1])*	
		Construction	*Operation*
Transportation	• Flood-related road closures would persist at current flood elevations.	• Additional truck traffic within the Study Area. • Adverse, but mitigated (see Chapter 7) impacts to low-income, minority, and child populations due to increased truck traffic on residential streets.	• Improved residential access to the Floodway. • Increased traffic through residential streets and highways that lead to Floodway access points. • Scheduled large events may utilize street parking, but would develop traffic and parking plans, as well as provide advance notice. • Reduced road closures due to increased FRM. • Improvements in the access and reduced street flooding would result in beneficial impacts to low-income, minority, and child populations.
Utilities	• No change to utility resources. • Stormwater management capacity would continue to be insufficient.	• Temporary, short-term outages of utility services. • Outage would be preceded by notice. • Outages would be limited to daytime hours. • Adverse, but mitigated (see Chapter 7) impacts to low-income, minority, and child populations due to these potential utility outages.	• Increased capacity for stormwater management within the IDS. • Price of utilities not expected to be affected by operation of the Proposed Action. • Improvements in stormwater management would result in beneficial impacts to low-income, minority, and child populations.
Air Quality	• No change to air quality.	• Increased, short-term, fugitive dust generation during construction. • Increased production of ozone precursors may contribute to more frequent air quality alert days. • Adverse, short-term, but mitigated (see Chapter 7) impacts to low-income, minority, and child populations due to fugitive dust and potential increase in frequency of air alert days.	• No change to air quality. • No impacts to low-income, minority, and child populations.

Table 6-4. Summary of Impacts to Low-income, Minority, and Child Populations

Resource Area	*Alternative 1 (Future Without-Project Condition)*	*Alternative 2 (Proposed Action[1])*	
		Construction	*Operation*
Noise	• No change to the noise environment.	• Temporary construction noise would be primarily located within the Floodway where the levees protect residential areas from the majority of the construction noise generated. • Localized, temporary noise impacts adjacent to residential areas associated with the interior drainage improvements. • Adverse, short-term, localized, mitigated (see Chapter 7) impacts to low-income, minority, and child populations.	• Infrequent, temporary noise may result from large events at the proposed amphitheaters. • Events would be within the Floodway; the majority of noise would be attenuated by the levees. • No adverse impacts to low-income, minority, and child populations.

Note: [1] Impacts to environmental justice populations are substantially the same between both design variations being considered for implementation of the Proposed Action. The impacts summarized here would be the same for either design variation.

6.7.1.1 Cumulative Project Environmental Justice Impacts

Large construction projects have been occurring within the Region of Influence (ROI) the past several years (refer to Section 2.7.2.1), with each of these projects having localized impacts on residents. From a cumulative perspective, impacts of construction activity in the ROI are not temporary; these impacts have been a constant condition. Impacts of construction on communities in the ROI are disproportionate in a cumulative context; no other area of Dallas has endured the impacts of multiple construction projects over recent years. In addition, the large infrastructure projects that have been constructed within the ROI (particularly the Hampton Bridge and the Margaret Hunt Hill Bridge) do not specifically benefit residents of the ROI; the benefits of these projects are enjoyed by all Dallas residents and visitors to Dallas. The Proposed Action design anticipating potential Trinity Parkway construction reinforces the trend that residents of the ROI must disproportionately endure the impacts of construction of projects that would not specifically benefit them.

Future projects in the ROI (refer to Section 2.7.2.2) would generate additional cumulative impacts, in terms of length of time and magnitude of impacts, that would be additive to the impacts associated with the Proposed Action design anticipating potential Trinity Parkway construction. In particular, the Trinity Parkway EIS identifies adverse impacts to environmental justice. Adverse impacts to environmental justice identified in the Trinity Parkway EIS include disproportionate effects on low-income and minority populations such as relocations and displacements, noise impacts, visual impacts, and transportation impacts. Displacements would be due to acquisition of property, increased traffic would be due to new access roads located in residential areas, with noise and visual impacts stemming from construction activities (Federal Highway Administration [FHWA] 2014).

6.7.2 Summary

There would be no adverse impacts to environmental justice populations related to socioeconomics, safety, or transportation with implementation of specified SCMs and mitigation measures. The implementation of SCMs and mitigation measures tends to benefit the public in general, and especially nearby residents. Therefore, it is anticipated that the SCMs and mitigations would generally benefit low-income and minority residents of the project area. Specific SCMs and mitigations that would improve outcomes for low-income and minority residents of the project area are identified in Sections 7.2.2 and Section 7.2.3, and in Table 7-1.

Impacts to environmental justice populations related to recreation, visual resources, utilities, air quality, and noise would be adverse during construction, in the near-term, but have either no adverse impact or a beneficial impact during operation and in the longer term. The “near-term” however is a fairly extensive period of time – at least 10 years – and adverse impacts over this period would not seem temporary to affected populations, especially to children who would be dealing with stresses (and other potential health issues associated with the project) for the bulk of their childhood.

While no residents would be displaced as a direct or indirect result of the either Proposed Action design, from a cumulative perspective, there would be potential for a continuation of gentrification in environmental justice population areas. The potential exists for amenities to improve through construction, and when construction is finished, for the ROI to become higher-income and less-minority via increasing rents that are out of the control of current low-income and minority residents of the ROI. Noting this potential, the BVP Study incorporates over two decades of past coordination with the public – with special attention paid to the low income and minority neighborhoods. Based on the extensive communication with the affected residential communities, the recreational amenities proposed directly reflect the requests of the communities. The USACE has similarly lead public outreach efforts to target these residential communities, and continues to receive public feedback.

6.7.3 Public Outreach

The BVP Study is the result of more than two decades of outreach and collaboration by the City of Dallas with the residential population of the Study Area, which is more than 50% minority for the majority of the Study Area. More recently, the USACE has engaged and educated residents of the Study Area regarding on-going and proposed Floodway projects. Table 6-5 summarizes notable public outreach efforts conducted by the USACE in 2013.

Table 6-5. Dallas Floodway USACE Public Outreach in 2013

Date	*Event*	*Population Targeted*	*Summary*
February 27	Scheduled presentation	General. The Trinity Trust membership includes all demographics of membership and volunteers.	The USACE Fort Worth District Commander joined with the Assistant Dallas City Manager to present a Dallas Floodway Project update including the FRM plan progress before a gathering of the Trinity Trust civic group in Dallas.
April 20	Earth Day Dallas, Fair Park	General. Located in a low-income neighborhood, but attended by over 50,000 north Texans.	Fort Worth District Dallas Earth Day booth provided updates on Dallas Floodway Project including the FRM plan progress at Fair Park in Dallas. Vast majority of the visitors were from the suburbs, with little interest in the project.
April 21	Oak Cliff Earth Day	Low income/minority.	For five days, the Fort Worth District Oak Cliff Earth Day informational booth provided updates on Dallas Floodway Project including the FRM plan progress at Lake Cliff Park in the heart of the project area. Significant attendance by low-income populations. Comments received referred to the Trinity Parkway; no comments associated with the Proposed Action received.

Table 6-5. Dallas Floodway USACE Public Outreach in 2013

Date	*Event*	*Population Targeted*	*Summary*
May 18	Trinity Wind Festival	Low income/minority.	Fort Worth District Trinity Wind Festival booth provided updates on Dallas Floodway Project, utilized water-driven Trinity Basin lakes/flood demonstration display. Presentation was mostly educational, explaining how the Floodway worked and future plans. Comments received referred to the Trinity Parkway; no comments associated with the Proposed Action received.
June 13	Oak Cliff Town Hall Meeting	Low income/minority.	The USACE Fort Worth District Commander and Assistant City Manager gave a brief, which included details of plans to develop the Dallas Floodway Project.
November 13	Oak Cliff Town Hall Meeting	Low income/minority.	The USACE Trinity Corridor Project Director and Assistant City Manager gave an update briefing, which included details of plans to develop the Dallas Floodway Project, including the FRM plan. About 100 attended. Emails collected to be used to notify people about future public meetings. The audience was very knowledgeable and engaged. Questions and comments focused on reasonably foreseeable future projects, not the Proposed Action.

As shown in the examples in Table 6-5, residential populations have been informed about on-going and proposed projects within the Floodway. Concerns voiced by the public in the course of outreach efforts have been targeted to specific proposed features within the Floodway (e.g., the Trinity Parkway or the Dallas Wave) that are unrelated to the Proposed Action analyzed in this EIS. In addition, between 2012 and 2014, the USACE conducted the following additional public outreach efforts:

- Nine mass mailings to stakeholders;
- Six joint City of Dallas-USACE presentations to public town halls and stakeholder groups;
- Four Dallas City Council or Council Committee project briefings; and,
- Five days of USACE project information booths at community events primarily located on event grounds between the levees (e.g., two events with the local Audubon Society).

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CHAPTER 7 RECOMMENDED PLAN AND RESOURCE IMPACT MINIMIZATION ACTIONS

7.1 PREFERRED ALTERNATIVE AND THE LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE

As discussed in Chapter 1, Section 5141 of the Water Resource Development Act (WRDA) of 2007, as amended, directs the U.S. Army Corps of Engineers (USACE) to review the City of Dallas Balanced Vision Plan (BVP) Study and Interior Drainage Plan (IDP), to determine if the project is "technically sound" and "environmentally acceptable." This Environmental Impact Statement (EIS) evaluates the environmental acceptability of the BVP Study and its associated features. The companion Feasibility Report prepared by the USACE (USACE 2014), evaluates the technical soundness of the project.

The 2004 BVP Study and subsequent design variations have been developed following over two decades of iterative and interactive community input, analysis, and evaluation, and recognize other activities proposed within the Study Area. No alternatives or substantial design variations were proposed or developed in the course of scoping or public review of this EIS. Finally, the 2007 WRDA authorization was limited to the 2004 BVP Study. Thus, there is only one action alternative (Alternative 2) analyzed in this EIS. Recognizing the on-going policy and funding challenges associated with the construction of the potential Trinity Parkway, the City of Dallas has developed preliminary variations of two different designs of the BVP Study recreation and ecosystem features. These two design variations are evaluated under Alternative 2 in this EIS. As determined in the USACE's Feasibility Study, the BVP Study and IDP improvements have been determined to have the potential to be technically sound following proper design and construction (USACE 2014).

In identifying a preferred alternative, the USACE reviewed trends in project planning and development in the City of Dallas. Specifically, at the time of this writing (December 2014), the potential Trinity Parkway project continues to undergo public and environmental review. Therefore, it remains uncertain if the potential Trinity Parkway project would be constructed within the Floodway as proposed by Alternative 3C of the Trinity Parkway EIS.

Implementation of the Proposed Action would result in the same impacts for the Flood Risk Management (FRM) elements and IDP improvements. The difference between the two BVP Study design variations being considered in Alternative 2 is driven by whether or not a reasonably foreseeable project (i.e., the potential Trinity Parkway project) would be constructed within the Floodway; the ultimate alignment of the potential Trinity Parkway project would be determined by a separate agency (i.e., Texas Department of Transportation [TxDOT]). Both Alternative 2 design variations would result in direct impacts (excavation and fill) to wetlands and other waters of the U.S. but would result in an overall increase in the acreage and functionality of wetlands and other waters of the U.S. within the Floodway. Impacts to the aquatic ecosystem and water quality would be avoided and minimized to the greatest extent possible through implementation of special conservation measures (SCMs) (refer to Section 7.2). As discussed in Section 4.3, the project has been designed so that impacts to the hydrology and hydraulics of the Trinity River would be less than significant. However, as summarized in Chapter 5, impacts to certain resource areas under the design that does not anticipate construction of the potential Trinity Parkway would be greater than would occur under the design that does anticipate the potential Trinity Parkway being constructed in the Floodway.

The USACE and the City of Dallas have tentatively identified Alternative 2, the Proposed Action, as the Preferred Alternative. The Preferred Alternative may be further developed and refined as the result of public and agency input obtained through the on-going public involvement process described in Section 1.7.2.

7.2 SPECIAL CONSERVATION AND MITIGATION MEASURES

Implementation of the Preferred Alternative would incorporate SCMs designed to prevent and/or minimize adverse impacts to resources. SCMs may be resource specific, or may be procedural and apply to several different resources. In addition, mitigation measures may also be applied to counter impact that cannot be sufficiently avoided or minimized by an SCM. For the non-federal BVP features, the City of Dallas would submit a compensatory mitigation package that satisfies the requirement of 33 Code of Federal Regulations (CFR) 332 for the Section 10/404 permit.

Planning efforts for USACE projects ensure that project-related adverse environmental impacts (i.e., impacts on fish and wildlife resources) have been avoided or minimized to the extent practicable, and that remaining unavoidable significant adverse impacts are compensated to the extent justified. As part of project development, implementation of the Preferred Alternative would include development of a mitigation plan, as required under Engineering Regulation 1105-2-100 (the USACE Planning Guidance Notebook) and Section 2036(a) of WRDA 2007, as amended. The mitigation plan would comply with the mitigation standards and policies of the regulatory programs administered by the USACE and would require the following specific mitigation plan components:

- monitoring until successful;
- criteria for determining ecological success;
- a description of available lands for mitigation and the basis for the determination of availability;
- the development of contingency plans (i.e., adaptive management);
- identification of the entity responsible for monitoring; and
- establishment of a consultation process with appropriate federal and state agencies in determining the success of mitigation.

Section 7.2.1 presents a description of each recommended SCM that would be incorporated with implementation of the Preferred Alternative; Section 7.2.2 presents proposed mitigation and monitoring measures. Subsequent resources will refer back to the measure by code if it applies as well. Section 7.2.3 presents a table (Table 7-1) summarizing which resource area impacts are being avoided, minimized, or mitigated by each of the presented measures.

7.2.1 Special Conservation Measures

SCMs are organized according to the stage of the project in which they would be implemented: planning and design phase (PD), pre-construction phase (PRE), construction phase (C), and the post-construction/operations phase (POST). Each measure is described in detail according to the first resource to which it applies.

7.2.1.1 Planning and Design Phase (PD)

PD-1 This EIS and associated reports evaluated 35% complete design plans. Further design should refine the current plans, and not significantly alter size, alignment, or the magnitude of potential impacts. If there are sizeable changes between the 35% design and future designs, additional analysis may be required for NEPA and regulatory compliance. This analysis may include the potential for additional public and agency review and comment. This SCM is applicable all resource areas and environmental justice.

PD-2 As project elements are designed and submitted for construction, the project sponsor shall ensure that the proposed project feature would be a single and complete project that is within the impacts discussed within this EIS (e.g., impacts to valley storage are no greater than those discussed in Section 4.3) and incorporates any ecosystem restoration requirements incurred. For example, the project sponsor may not propose to begin construction on a project feature that would impact wetlands without also including equal or greater wetland restoration/enhancement as part of the same proposal. A project sponsor may not defer restoration that may balance impacts to a later project element. This SCM is applicable to all resource areas and environmental justice.

PD-3 Before construction of any action within the Floodway, the proponent shall submit design plans to the USACE and the City of Dallas Planning Department for review, consistent with the currently applicable Dallas Development Guide (City of Dallas 2006). At the time of this EIS publication, these plans should include at least:

- Fill permit application form with letter of request and application fee;
- Vicinity map;
- Wetlands and waters as identified in the approved jurisdictional delineation;
- Acreage figures for the entire tract, the area located in the floodplain, and the area proposed to be filled, and description of proposed land use;
- Description of hydrologic and hydraulic analyses conducted, with copies of input and output, and a disk containing data files;
- Plots of water surface profiles and cross sections;
- Table of values for engineering criteria;
- Tree survey with inventory of trees of 6-inch or greater caliper;
- Landscape and erosion control plan;
- Grading plan; and
- Environmental Impact Study, if applicable.

The submittal of the design plans shall occur for each construction proposal, and the USACE would review the plans for consistency with the actions describe in the Preferred Alternative as described in Section 7.1. Supplemental environmental analysis may be required.

PD-4 Construction activities that abut residential land uses shall complete a residential adjacency review before moving forward with construction. This SCM is also applicable to environmental justice.

PD-5 As zoning codes frequently change, the design and construction contractors are responsible for engaging the City of Dallas Development Services to ensure consistency with all applicable land use code requirements.

PD-6 The design and construction of proposed retaining walls, embankment fills, cut slopes, and levees would have appropriate temporary and permanent erosion and/or scour control measures to minimize erosion potential and levee/channel slope instability.

PD-7 For each construction proposal, an Erosion Control Plan shall be prepared by the construction contractor. The Erosion Control Plan would include site-specific Best Management Practices (BMPs) to minimize erosion, sediment generation, and fugitive dust generation during construction. The City of Dallas would finalize each Erosion Control Plan upon final design approval of the proposed improvements, and submit the plan for USACE Regulatory review as part of the comprehensive Section 408 package review.

PD-8 For each construction proposal, a Soils Management Plan shall be prepared by the construction contractor. The Soils Management Plan would provide protocol for testing of soils prior to excavation and movement to/from the borrow sites. The Soils Management Plan would describe the testing to be completed, and include a decision matrix to aid in determining when soils are appropriate for reuse and when soils should be managed as waste. The Soils Management Plan would be complementary to the Contingency Action Plan (see PD-24).

PD-9 The final design of the river modification (including channel relocation, terraces, and riverbank treatments) shall satisfy all applicable standards for channel modifications within a designated Floodway. These may include, but are not limited to, requirements of the USACE, the City of Dallas, the Texas Commission on Environmental Quality (TCEQ), and the TxDOT. Final river terrace designs would be evaluated for stability and sustainability using geotechnical, hydraulic, and sediment transport analyses. Terrace vegetation would be established in a manner that does not compromise terrace function or stability.

PD-10 Any refinements to existing designs would maintain the geomorphic terrace elevations designed in relation to water surface elevations at effective flow frequencies, with stable slopes given local hydraulic, geotechnical, and vegetation conditions, and would provide adequate terrace drainage.

PD-11 Bank treatments shall be designed based on local hydraulic conditions, maximum shear stresses during high flows, local geotechnical conditions, proximity to other park features, and existing or proposed vegetation. Typical treatments shall be designed for river reaches with similar conditions and would extend the length of a given reach. Transitions between different bank treatments shall be designed to withstand hydraulic discontinuities and changes in shear stress. All bank treatments would be appropriately “keyed in” at the channel invert elevation and the top of bank elevation to prevent unraveling of the treatment. Materials and construction methods for all bank treatments shall be specified to ensure sustainability over the necessary design life for each treatment. Only native North Texas riparian species would be planted in riparian areas.

PD-12 To ensure that the enhanced/restored wetland would properly function, the design/construction plans and post project monitoring would include the following measures:

a. *Hydrology*: The wetland would be designed to achieve the minimum requirement to meet the hydrology criteria as defined in the 1987 Wetland Delineation Manual and the Great Plains Regional Supplement (USACE 2010b). This would be achieved through either (1) locating the wetland at an elevation where it would receive sufficient inundation/saturation from the Trinity River or (2) designing the wetland as a depressional basin that would receive stormwater runoff from surrounding areas, overbank flows from the Trinity River and drainage sumps, or water from other artificial sources (e.g., pumped from the created lakes or Trinity River).

b. *Vegetation*: The design would utilize a mixture of agency recommended native plants, as well as other native plants that are more common early successional species and easy to establish vegetative cover, to help ensure plant survival. The vegetation must meet hydrophytic vegetation criteria as well as TXRAM future conditions scores (refer to Appendix L).

c. *Soils*: The project design would include identification of soils that would be collected from wetland impact locations and then spread on the enhanced/restored areas. The soils must meet hydric soils criteria. By using soils from the impact sites, there would be the added benefit of an incredible seed source as well as organic material. The soils to be used for enhancement/restoration would be tested for nutrient, organics, and percolation and if they do not meet the minimum standards, additional organics/soil amendments/ripping would be added/completed until the standard is met.

PD-13 The final design of Floodway features would conform to all USACE regulations and guidelines for construction in the Floodway.

PD-14 The river channel relocation design shall have a geomorphically stable channel pattern and geometry that avoids encroaching within 200 feet of the toe of the levee. The channel pattern shall be offset from all sensitive floodplain park features by a distance sufficient to allow channel adjustments to occur without impacting park features over the life of the project. Where offset from park features is not possible, channel geometry shall be strengthened, using bioengineering approaches that incorporate native vegetation and other natural materials.

PD-15 Components of the Preferred Alternative shall be designed such that foundations and structural supports provide for adequate anchoring of design components during flood events.

PD-16 Trail and road bridges within the Floodway shall be designed so that they present as thin and unobtrusive profile as possible to minimize potential flood impacts.

PD-17 Shade structures and the Group Pavilion shall be designed so that no portion of the canopy structure would be below the 100-year flood extent.

PD-18 For the non-federal BVP Study elements, the City of Dallas shall initiate consultation with the Texas Parks and Wildlife Department (TPWD) early in the design process to discuss potential impacts to aquatic resources and specifically to state-listed mussels. If appropriate, the City of Dallas would prepare an Aquatic Resources Management Plan for any impact to state-listed species anticipated by a project feature.

PD-19 The final project design shall consider that periodic flooding of the entire Floodway can last for days or weeks at a time. Thus, features shall be designed to be able to sustain the force of powerful floodwaters, while also requiring minimum maintenance and cleanup after floodwaters recede. Design may incorporate the use of features that may be removed when a flood is anticipated, such as floating barges or trailer structures that could be removed within an 8-hour period. Site features such as benches, trashcans, and light poles shall be anchored in place and designed to withstand floodwaters. The final project design shall seek to create a landscape that minimizes flood-related maintenance and repair.

PD-20 Buoy and lane marking structures, such as floating wetlands in the lakes shall be designed to incorporate measures to hold the plant communities together during flood events. The anchorage cables shall have sufficient slack to allow the floating features to rise to a 10-year flood elevation and to remain affixed to the structure during larger flood events, keeping them in place underwater.

PD-21 The final design of the riparian zones shall meet USACE and City of Dallas requirements for Floodway vegetation.

PD-22 The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and U.S. Fish and Wildlife Service (USFWS) to create an Aquatic Resources Management Plan or similar plan.

PD-23 Restrooms within the Floodway shall consist of mobile or removable units that could be detached from water and sewer utilities and moved out of the Floodway before flood events.

PD-24 The construction contractor shall prepare a Contingency Action Plan for managing hazardous materials on the construction site that reflects the guidance of Army Regulation 200-1 and Engineering Regulation 1165- 2-132 before implementing the Preferred Alternative. The City of Dallas would finalize the Contingency Action Plan upon final design approval of the proposed improvements, and all hazardous material control measures would be field adjusted for site conditions.

PD-25 The project shall be required to limit the establishment and harmful effects of non-native/invasive species within the areas of ecosystem restoration/habitat enhancement. To that end, an Invasive Species Management Plan shall be prepared, submitted for review and approval to the USACE and the TPWD, and implemented. This plan shall conform to the requirements of the USACE Regulatory division, and shall include at minimum the following components:

a. A list of the non-native/invasive plant and animal species that may occur, along with practical methods for their detection and removal.
b. Monitoring protocols and provisions to ensure that non-native invasive plant and animal species are detected early and eradicated if possible, but in any case controlled to ensure that they do not become dominant to the exclusion of native species.
c. To ensure that the non-native/invasive species metric of TXRAM scores for the enhanced/restored wetlands is higher than the baseline condition, action shall be taken as necessary to ensure that the average total relative percent cover of non-native/invasive plant species in wetland communities remains below 10% (USACE 2010a).

PD-26 All planting plans shall be reviewed by USACE prior to approval for consistency with Technical Letter No. 1110-2-571, including a buffer of 15 feet at the levee toe for all tree/shrub planting. The buffer also extends vertically eight feet, such that an adjacent tree may not have a branch overhang less than 15 feet from the levee toe.

PD-27 Prior to construction and operational activities, a Draft Lighting Management Plan shall be drafted. The Final Lighting Management Plan would be approved by the USACE and the City of Dallas. Potential measures from the Lighting Management Plan, would include the following:

- Where lighting is not essential for safety or security, timers would be installed to switch lights off in the evening. Where applicable and not a threat to security, motion-detector switches may be installed.
- The size, type, and number of exterior lights would be minimized and would be restricted to low pressure sodium, to the extent practicable.
- Directing, shielding, or positioning the lighting of the facilities to the extent possible (without decreasing safety and security) to minimize lateral light spread and decrease uplighting.
- Light fixtures would be strategically located to minimize their physical impact on vegetation and wildlife. Light levels in these areas would strike a balance between a desired lighting aesthetic that supports the nighttime activities of the Corridor for visitors and the need to provide a benign environment for plants and wildlife.
- Corridor lighting would be set to respond dynamically to seasonal light levels and light duration.

PD-28 Passive recreation areas shall be sited above the 2-year flood elevation to reduce the frequency of maintenance.

PD-29 As part of the Special Event Permit Application process, the City of Dallas shall require the development and implementation of a Traffic and Parking Plan to accommodate concerts or other major special events scheduled within the Floodway. As appropriate, the plan shall identify travel routes between freeway facilities and parking areas and shall allocate appropriate personnel and equipment (e.g., changeable message signs, barricades, cones, etc.) to ensure efficient traffic flow before, during, and after the event. The Traffic and Parking Plan shall also incorporate measures to provide adequate parking supply and to facilitate traffic circulation within the parking area(s). This SCM is also applicable to environmental justice.

PD-30 For each construction proposal, the construction contractor shall prepare a Traffic Control Plan for managing traffic during construction. The City of Dallas would finalize the Traffic Control Plan upon final design approval of the proposed improvements. This SCM is also applicable to environmental justice.

PD-31 A Truck Traffic Management Plan shall be developed for the FRM elements and BVP Study Ecosystem and Recreation features to establish travel routes from freeways to construction sites. To the extent feasible, the travel routes shall use multilane arterials and shall avoid traversing residential areas. Also, to the extent feasible, the Truck Traffic Management Plan will shift truck trips to periods outside the peak commuting hours (typically 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. on weekdays). Construction scheduling shall consider phasing to minimize vehicle trips. This SCM is also applicable to environmental justice.

PD-32 If construction takes place after truck restrictions are implemented on IH-30 and IH-35E, the City of Dallas shall coordinate with TxDOT and North Central Texas Council of

Governments (NCTCOG) to either process a temporary waiver to accommodate the delivery of fill material to area landfills, or to identify alternative routes that avoid the routing of dump trucks to surface streets. This SCM is also applicable to environmental justice.

7.2.1.2 Pre-Construction Phase (PRE)

PRE-1 In defining the construction extents for each element, the construction contractor would minimize the amount of disturbed ground area at any given time, and minimize ground disturbing activities in proximity to residential areas and waters of the U.S. This SCM is also applicable to environmental justice.

PRE-2 The perimeter of all areas to be disturbed during construction activities shall be clearly demarcated using flagging or temporary construction fencing, and no disturbance outside the demarcated perimeter would be authorized. All access routes into and out of the proposed disturbance area shall be flagged, and no construction travel outside those boundaries shall be authorized. When available, areas already disturbed by past activities or those that would be used later in the construction period would be used for staging, parking, and equipment storage. This SCM is also applicable to environmental justice.

PRE-3 Erosion control measures and appropriate BMPs, as required and developed through the Stormwater Pollution Prevention Plan (SWPPP) and engineering designs and erosion control plan (refer to PD-7), would be implemented before, during, and after construction activities in accordance with the Texas Construction General Permit TXR150000.

PRE-4 Staging areas shall be established for the storage of equipment and materials. Construction equipment shall be stored within a staging area at the end of each working day to minimize trip generation to and from the site. The removal of any trees or potential ground nesting areas shall comply with the Migratory Bird Treaty Act (MBTA). BMPs shall also be implemented to prevent soil erosion at the staging areas. This SCM is also applicable to environmental justice.

PRE-5 For each distinct project element, a Field Contact Representative shall be present during the beginning of the construction period to provide all construction personnel with an environmental education briefing that would include, but not be limited to, the following:

- information regarding sensitive species and habitats with the potential to occur in the area,
- impacts that may occur,
- conservation measures being implemented,
- construction worker responsibilities under the Endangered Species Act, and
- avoidance and reporting procedures.

PRE-6 If proposed construction activities occur during the avian breeding season (February 15 through August 31), construction activities shall comply with the MBTA to avoid impacts to nesting migratory birds within the region of influence. Specifically, a biologist shall check the proposed construction sites, including laydown areas, for nests (in trees, shrubs, and on the ground) before the construction phase has begun. If the biologist finds an active nest, construction workers would not directly or indirectly disturb the nest or adjacent areas until the biologist determines the nest is no longer active.

PRE-7 Archaeological testing shall be conducted prior to construction because presently unknown deeply buried deposits may exist. Should significant sites be discovered, mitigation would be required.

PRE-8 The construction contractor shall be required to survey for all pre-existing utilities in the area to avoid and/or minimize any temporary interruption of utility service(s). This SCM is also applicable to environmental justice.

PRE-9 Continuity of FRM that, at a minimum matches current protection levels would be maintained throughout the IDP construction period. This may be accomplished through phased construction/demolition, use of temporary additional control measures, or other measures deemed suitable by the City of Dallas and the USACE. This SCM is also applicable to environmental justice.

PRE-10 Truck operators shall certify their understanding and compliance with the Truck Traffic Management Plan prepared per PD-31 before they can participate in construction activities.

7.2.1.3 Construction Phase (C)

C-1 Before completing river-channel construction, the river banks shall be stabilized to ensure slope integrity. Meander bends shall be protected with bank treatments designed to prevent lateral migration and channel instability. In addition, where feasible, channel bank slopes shall be flattened to 4:1 on the insides of the meander bends and remain at 3:1 on the outsides of the meander bends.

C-2 If any potential contamination is encountered, work in the area would cease and the material would be tested in accordance with the Soil Management Plan. The soil samples would be screened for potentially hazardous contaminant concentrations that may exceed the $_{Tot}Soil_{Comb}$ Texas Risk Reduction Program Tier I Residential Protective Concentration Level standards.

C-3 All open storage piles and disturbed areas shall be stabilized by covering and/or applying water or chemical/organic dust palliative where appropriate at active and inactive sites during workdays, weekends, holidays, and windy conditions.

C-4 Wind fencing shall be installed at active construction sites. During windy conditions, grading operations shall be phased as appropriate to minimize dust. Water trucks for dust stabilization of surfaces under windy conditions may be used.

C-5 When hauling excavated or fill material and operating non-earthmoving equipment, operators shall prevent spillage and limit speeds to 15 miles per hour for non-earthmoving equipment and 10 miles per hour for earth-moving equipment.

C-6 After grading of the enhanced/restored wetlands is complete and before planting, the permittee would document that the site is ready (i.e., contains sufficient soils and hydrology) to support hydrophytic vegetation.

C-7 BMPs shall be implemented at staging areas to prevent the discharge of petroleum, oils, lubricants and other pollutants to the municipal storm drain system and/or adjoining land.

C-8 During construction, with respect to the handling, storage, and/or disposal of hazardous and/or regulated materials, contractors shall operate in accordance with USACE Safety and Health Requirements Manual 385-1-1: Safety and Health; AR-200-1: Environmental Protection and Enhancement; and the approved Contingency Action Plan prepared per PD-24.

C-9 To minimize potential impacts of exposure to or release of hazardous and regulated materials, all fuels, waste oils, and solvents shall be collected and stored in tanks or drums within a secondary containment system that consists of an impervious floor and bermed sidewalls capable of containing the volume of the largest container, plus 10%, stored therein.

C-10 Prior to entry into the construction site, all equipment shall be cleaned to prevent the import of non-native plant species. Also before entering the construction site, all equipment would be inspected to ensure that hydraulic fittings are tight, hydraulic hoses are in good condition, and to verify that there are no leaks of petroleum, oils, or lubricants.

C-11 All deep, narrow open pits that pose a threat to wildlife shall be covered at the end of each construction day so animals do not become trapped.

C-12 To minimize the potential for starting a fire, all smoking shall be restricted to areas clear of vegetation and all vehicles would be equipped with spark arrestors and fire extinguishers.

C-13 Solid waste receptacles shall be maintained at construction staging areas, and nonhazardous solid waste (trash and waste construction materials) shall be collected and deposited in on-site receptacles. Waste receptacle shall be secured containers to prevent birds or other scavengers from being attracted to the site.

C-14 Any construction equipment that comes in contact with floodway waters shall adopt the "Clean, Drain, and Dry" protocol to prevent zebra mussel larvae from spreading among Texas waters. This protocol requires that boat owners thoroughly clean, drain, and dry their boats after each and every put-in.

C-15 If human remains and/or objects subject to the Native American Graves Protection and Repatriation Act (25 United States Code [USC] §§ 3001 *et seq*.) or the Texas Health and Safety Code Chapter 711-715, are encountered during proposed construction activities, work would immediately stop, and the City of Dallas would immediately notify the USACE and Texas Historical Commission, and consult with appropriate federally recognized Tribe(s) to determine appropriate treatment measures in agreement with 36 CFR Part 800.13. If then determined necessary, a cultural resources monitor would be present during additional construction in the discovery area.

C-16 In the event that excavated material contains hazardous substances, a landfill or treatment facility that meets the relevant state and federal regulatory standards for waste treatment and disposal would be used.

C-17 The construction contractor shall closely monitor weather reports throughout the Upper Trinity River watershed. If significant rain events are predicted within the watershed, the contractor would remove all equipment from the Floodway to the developed sides of the levees to the greatest extent practicable. Construction shall not occur during rain events, and construction personnel shall have frequent communication with the City of Dallas Flood Control Division to assess the safety of operating within the Floodway.

C-18 As determined in the Traffic Control Plan prepared per PD-30, contractors shall be responsible for providing and maintaining all barricades, warning signs, flashing lights and traffic control devices in conformance with Part VI of the Texas Manual on Uniform Traffic Control Devices (TxDOT 2012). Closure of traffic lanes and sidewalks along any public roadway shall be restricted to the hours of 8:30 a.m. to 3:30 p.m. workdays to minimize the impact on traffic flows, unless otherwise approved by the City of Dallas. This SCM is also applicable to environmental justice.

C-19 Construction shall comply with Section 4(b) of the Noise Control Act of 1972 (42 USC Sections 4901-4918), which directs federal agencies to comply with applicable federal, state, and local noise requirements with respect to the control and abatement of environmental noise. Construction shall also comply with the City of Dallas noise ordinance (i.e., Dallas City Code: Volume II, Chapter 30) Section 30-2, item (8), limiting construction/demolition activities to between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday, and between the hours of 8:00 a.m. and 7:00 p.m. on Saturdays. The City of Dallas Director of Public Works may issue a written permit to exceed these hours for reasons determined to be necessary for the public health, safety, or welfare. This SCM is also applicable to environmental justice.

C-20 Operators shall limit idling of heavy equipment to less than five minutes and verify idling limits through unscheduled inspections.

C-21 Construction contractors shall maintain and tune engines per manufacturer's specifications to perform at U.S. Environmental Protection Agency (USEPA) certification levels, prevent tampering, and verify maintenance with unscheduled inspections to ensure these measures are followed.

C-22 If practicable, contractors shall use new, clean equipment meeting the most stringent of applicable federal or state standards. Contractors shall commit to the best available emissions control technology. Tier 4 engines should be used for project construction equipment to the maximum extent feasible. Lacking availability of non-road construction equipment that meets Tier 4 engine standards, the construction contractor shall commit to using USEPA-verified particulate traps, oxidation catalysts and other appropriate controls where suitable to reduce emissions of diesel particulate matter and other pollutants at the construction site; and consider alternative fuels and energy sources such as natural gas and electricity (plug-in or battery).

7.2.1.4 Post-Construction and Operations Phase (POST)

POST-1 All disturbed soils shall be immediately stabilized following the completion of work and be replanted with native species. Before approval of the final design, the contractor shall obtain City of Dallas approval of a soil layering plan, seed mixes, planting/seeding, and monitoring methods proposed for use in revegetation. Noxious and invasive vegetation would be controlled by hand weeding or herbicide application.

POST-2 During operations, spill response materials (e.g., absorbents, drain covers, mops, brooms, shovels, drum repair materials and tools, warning signs and tapes, and personal protective equipment) shall be readily available for use and during transport in the event of an accidental release.

POST-3 The City of Dallas shall make efforts to eradicate Johnson grass. The presence of these grasses impedes the ability of managers to inspect levee condition during high flow events and thus precludes accurate prediction of cracks, slumps, or slides on the levees.

POST-4 At each boat ramp and put-in, the City of Dallas shall post and maintain signage requiring boaters to adopt the “Clean, Drain, and Dry” protocol to prevent zebra mussel larvae from spreading among Texas waters. This protocol requires that boat owners shall thoroughly clean, drain, and dry their boats after each and every put-in.

POST-5 A traffic wayfinding system, consisting of street and freeway signage, shall be implemented to guide users of the BVP Study Ecosystem and Recreation features from freeways to internal streets within the Floodway. To the extent feasible, the wayfinding system shall route traffic away from residential streets and congested highways, and shall encourage transit, pedestrian, and bicycle access to the Floodway instead of passenger cars. This SCM is also applicable to environmental justice.

POST-6 All construction equipment and/or activities that produce waste oil and solvents would be recycled. All non-recyclable hazardous and regulated wastes would be collected, characterized, labeled, stored, transported, and disposed of in accordance with all applicable federal, state, and local regulations, including proper waste manifesting procedures.

POST-7 Once construction is complete, the contractor shall restore all items not specifically included in street reconstruction that are disturbed during installation of temporary traffic control, to original or better condition. This SCM is also applicable to environmental justice.

POST-8 A Health and Safety Plan identifying potential safety hazards and providing procedures to mitigate for these would be developed and procedures reviewed with all cleanup personnel prior to post-flood response/clean-up activities.

7.2.2 Mitigation and Monitoring Measures

Mitigation and monitoring to be implemented as part of the Preferred Alternative would include:

M-1 For the non-federal BVP features, the City of Dallas would submit a compensatory mitigation package that satisfies the requirement of 33 CFR 332 for the Section 10/404 permit.

M-2 Erosion, fugitive dust, and sedimentation controls identified in the Erosion Control Plan (refer to PD-7) would be monitored and maintained during construction and for 12 months thereafter to ensure site stabilization.

M-3 The construction contractor shall designate personnel to monitor dust control and to increase dust suppression measures (e.g., watering exposed soils), as necessary, to minimize the generation of dust.

M-4 The USACE and City of Dallas shall develop and implement a Wetland and Waters Enhancement/Restoration and Monitoring Plan. This plan would specify that unavoidable permanent impacts to sensitive habitats (i.e., aquatic riverine and emergent wetlands) would be compensated through enhancement/restoration of similar habitats. Overall performance standards for the project shall be established through this plan. Specifically, ecosystem restoration/habitat enhancement shall be required to adequately offset losses and alterations of existing aquatic and wetland habitats.

M-5 For any regulatory action, wetland success determinations associated with restored or created wetlands in the project area will be based upon the application of TXRAM as the site develops with comparison to predicted conditions. The period required for monitoring of wetland features can vary due to success being achieved earlier than predicted or take longer than 5 years. Regardless, the site will be monitored in compliance with 33 CFR 332.5 and 332.6. If success is achieved in less than 5 years additional monitoring can be waived These results would be incorporated into an Annual Monitoring Report using the USACE Fort Worth District's recommended form (see SCM M-8).

If success is not achieved in the 5 year period, monitoring will be extended. If degradation of the enhanced/restored or created wetland sites is discovered, and/or failure of projected function and acreage through the required monitoring, implementation of contingency actions will be required. These actions will be dependent upon the type of degradation and failure documented. It is further noted that the calculation of wetlands, via the conditional assessment method TXRAM, currently include a 15% chance of failure or contingency. Any degradation to wetlands found through monitoring as a result of the project would require additional mitigation. Mitigation credits would need to be purchased from a mitigation bank if adequate compensation is not provided.

M-6 The USACE and City of Dallas would coordinate with the TPWD, TCEQ, and USFWS to create an Aquatic Resources Management Plan or similar plan. Detailed planning to minimize impacts to mussel beds and other sensitive aquatic resources would be completed as project elements move forward with Section 408 review. The Plan may include measures such as minimizing disturbance to the existing river channel, leaving cut off segments of the river channel as mussel refugia, collecting and relocating mussels during dewatering of the river construction areas, and monitoring mussel population and community parameters after project completion.

M-7 A biological analysis would be conducted every 3 years using the same habitat evaluation technique to monitor and quantify habitat impacts resulting from future flood control or restoration projects. Such an analysis would provide data for adaptive management and for future habitat restoration planning projects (USFWS 2014).

M-8 As new/enhanced aquatic and wetland habitats are developed under the project design, wetland and stream assessment reach (WAAs and SARs, respectively) shall be established and evaluated using TXRAM methods (USACE 2010a) to provide objective metrics on whether the project is meeting the over-arching goal of adequately compensating for its impacts with net gains in aquatic resource acreage and/or functions. Individual WAAs and SARs shall be established during the first year following construction, and shall be reevaluated every two years subsequently, until the score is within two points of the previous evaluation and the site appears to be on a stable trajectory. Each WAA and SAR would be evaluated in this manner for a minimum of 5 years (first year plus two subsequent evaluations). The data shall be used in conjunction with the Annual Monitoring Report (see M-5) to identify which metrics indicate functional deficiencies, and how they can be improved. Such an analysis would provide data for adaptive management and for future habitat restoration planning projects (USFWS 2014).

M-9 The USACE and City of Dallas shall implement the Revegetation and Landscaping Plan for the BVP Study Ecosystem and Recreation features (see Plant List in Appendix H). In particular, the Revegetation and Landscaping Plan identifies the use of regionally native plants and landscaping practices and technologies that conserve water and prevent pollution and sets out recommendations for maintenance schedules. The project proponent would not be permitted to use non-native plant species, even if they are currently part of the BVP Study planting palette. Non-native species shall not be included in the implemented planting palettes of aquatic, wetland, and riverbank and terrace habitats.

M-10 When appropriate, the City of Dallas shall coordinate with Dallas Love Field to issue Notices to Airmen of wildlife/migratory birds in potential flightpaths.

M-11 Prior to modification of the AT&SF Railroad Bridge and demolition of the Old Hampton Pump Station and the Charlie Pump Station, Historic American Buildings Survey and Historic American Engineering Record Level II written documentation and high quality digital photography will be completed. In addition, mitigation for impacts under the BVP will include the distribution of 250 hard-bound copies of a revised version of the 2010 Intensive Engineering Inventory and Analysis of the Dallas Floodway, Dallas, Texas. The report will be revised to meet Public History standards. The hard-bound copies of this book will be distributed to all branches of the Dallas Public Library system. Mitigation of any previously unknown archaeological sites discovered during construction will be determined on a resource-specific basis.

M-12 Proper advanced notification of potential disruption to recreation areas shall be provided to the public. This mitigation is also applicable to environmental justice.

M-13 Scheduled power outages shall be during the day to avoid the risk of increased crime and degraded safety conditions that occur in the dark (e.g., personal injury and fire). Advanced notice of known utility shut-downs shall be given to those users who would be affected by unavoidable service disruptions. This mitigation is also applicable to environmental justice.

M-14 The City of Dallas shall develop and implement a Traffic Monitoring Plan to assess the adequacy of internal streets within the Floodway to efficiently accommodate weekend traffic demand. Traffic data collection and traffic operations observations shall be conducted at vehicular access points and key locations within the Floodway (i.e., internal street intersections and approaches to parking facilities). Recommendations to facilitate traffic flow (e.g., installation of permanent or temporary traffic control, channelization, pavement markings) shall be implemented to reduce traffic congestion and queuing. This mitigation is applicable to also environmental justice.

M-15 Potable water shut-down for tie-ins to the existing water mains would only occur between October 1 and April 1. This mitigation is also applicable to environmental justice.

M-16 The construction contractor would seek authorization from the City of Dallas and TCEQ to implement "flex hours," as appropriate, for construction activities during peak commuting hours in the summer months to minimize ozone-forming emissions. This may require a variance of the noise ordinance (refer to C-19). This mitigation is also applicable to environmental justice.

M-17 The berms separating lakes and the Trinity River, pump stations, bridges would be periodically inspected for erosion or other flaws. These critical elements need to be fixed immediately as they directly impact the functionality of the Dallas Floodway Levee System.

M-18 A Lake Management Plan would be developed to address water quality including nutrient loading and seasonal stratification. The recommended monitoring activities include sampling and analyses for water and sediment quality, quantitative surveys of sediment accumulation, fish and vegetation communities, and visual inspections of conditions in the lakes. Baseline monitoring is intended to provide sufficient information to track conditions in the lakes during the initial five years of operation and to refine the management activities as needed.

7.2.3 Special Conservation, Mitigation, and Monitoring Measures by Resource Area

The incorporation of SCMs and mitigation and monitoring into the Preferred Alternative would minimize adverse impacts to environmental resources. Table 7-1 identifies the resource areas to which each measure would apply. As depicted, several measures would apply to multiple resource areas.

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Table 7-1. Applicable SCMs and Mitigation and Monitoring by Environmental Resource Area

Measure Code	*Land Use*	*Geology & Soils*	*Hydrology & Hydraulics*	*Water Resources*	*Biological Resources*	*Cultural Resources*	*Recreational Resources*	*Visual Resources*	*Socioeconomics*	*Hazardous Materials & Wastes*	*Safety*	*Transportation*	*Utilities*	*Air Quality*	*Noise*	*Environmental Justice*	*Measure Code*
Special Conservation Measures: Planning and Design Phase																	
PD-1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	PD-1
PD-2	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	PD-2
PD-3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	PD-3
PD-4	•															•	PD-4
PD-5	•																PD-5
PD-6		•	•	•							•						PD-6
PD-7		•		•	•									•			PD-7
PD-8		•		•	•												PD-8
PD-9		•	•	•	•		•	•			•						PD-9
PD-10		•	•	•	•												PD-10
PD-11		•	•	•	•												PD-11
PD-12		•	•	•	•												PD-12
PD-13		•	•	•			•				•						PD-13
PD-14		•	•	•	•						•						PD-14
PD-15		•	•				•				•						PD-15
PD-16			•				•				•	•					PD-16
PD-17			•				•				•						PD-17
PD-18				•	•												PD-18
PD-19	•		•	•	•		•				•		•				PD-19
PD-20			•	•	•		•										PD-20
PD-21			•	•	•												PD-21
PD-22				•	•												PD-22
PD-23			•							•			•				PD-23
PD-24		•								•							PD-24
PD-25					•												PD-25
PD-26			•		•						•						PD-26
PD-27					•		•				•		•				PD-27
PD-28			•				•										PD-28
PD-29							•					•				•	PD-29
PD-30												•				•	PD-30
PD-31												•		•		•	PD-31
PD-32												•		•		•	PD-32
Special Conservation Measures: Pre-Construction Phase																	
PRE-1		•		•	•									•	•	•	PRE-1
PRE-2		•		•	•						•			•	•	•	PRE-2
PRE-3		•		•	•												PRE-3
PRE-4		•		•	•							•		•	•	•	PRE-4
PRE-5					•												PRE-5
PRE-6					•												PRE-6
PRE-7						•											PRE-7
PRE-8											•		•			•	PRE-8

Measure Code	*Land Use*	*Geology & Soils*	*Hydrology & Hydraulics*	*Water Resources*	*Biological Resources*	*Cultural Resources*	*Recreational Resources*	*Visual Resources*	*Socioeconomics*	*Hazardous Materials & Wastes*	*Safety*	*Transportation*	*Utilities*	*Air Quality*	*Noise*	*Environmental Justice*	*Measure Code*
PRE-9			•								•		•			•	PRE-9
PRE-10												•					PRE-10
Special Conservation Measures: Construction Phase																	
C-1		•	•	•	•												C-1
C-2		•								•	•						C-2
C-3		•												•			C-3
C-4		•												•			C-4
C-5		•												•			C-5
C-6			•	•	•												C-6
C-7				•	•					•	•						C-7
C-8				•	•					•	•						C-8
C-9				•	•					•	•						C-9
C-10					•					•							C-10
C-11					•						•						C-11
C-12					•					•	•						C-12
C-13					•					•							C-13
C-14					•		•										C-14
C-15						•											C-15
C-16		•		•	•					•	•						C-16
C-17			•	•						•	•						C-17
C-18											•	•			•	•	C-18
C-19											•	•			•	•	C-19
C-20												•		•			C-20
C-21												•		•			C-21
C-22												•		•			C-22
Special Conservation Measures: Post-Construction and Operations Phase																	
POST-1		•			•												POST-1
POST-2					•					•	•						POST-2
POST-3					•						•						POST-3
POST-4					•		•										POST-4
POST-5							•				•	•		•	•	•	POST-5
POST-6										•		•					POST-6
POST-7											•	•				•	POST-7
POST-8			•							•	•						POST-8
Mitigation and Monitoring Measures																	
M-1				•	•												M-1
M-2		•		•	•									•			M-2
M-3		•		•	•									•			M-3
M-4				•	•												M-4
M-5				•	•												M-5
M-6				•	•												M-6
M-7				•	•												M-7
M-8				•	•												M-8
M-9					•												M-9

Measure Code	*Land Use*	*Geology & Soils*	*Hydrology & Hydraulics*	*Water Resources*	*Biological Resources*	*Cultural Resources*	*Recreational Resources*	*Visual Resources*	*Socioeconomics*	*Hazardous Materials & Wastes*	*Safety*	*Transportation*	*Utilities*	*Air Quality*	*Noise*	*Environmental Justice*	*Measure Code*
M-10					•						•	•					M-10
M-11						•											M-11
M-12							•									•	M-12
M-13							•				•	•	•			•	M-13
M-14												•		•	•	•	M-14
M-15													•			•	M-15
M-16												•		•	•	•	M-16
M-17		•	•								•						M-17
M-18				•	•		•	•			•						M-18

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CHAPTER 11 GLOSSARY

100-year floodplain: the area adjoining a river, stream, or other watercourse that would be covered by water as a result of a 100-year storm event.

100-year storm event: the amount of rainfall within 24 hours that has a 1% annual exceedance probability within a specific area.

Alluvium: loose, unconsolidated soil or sediment, which has deposited by flowing water, as in a riverbed, floodplain, or delta.

Ambient Air Quality: air concentrations of specific pollutants (termed “criteria” pollutants) determined by the USEPA to be of concern to the health and welfare of the public.

Annual Exceedance Probability (AEP): the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a flood, which may be calculated to have a 1% chance to occur in any one year, is described as the 1% AEP.

Aquifers: an underground body of rock that contains groundwater.

Archaeological resources: locations where human activity measurably altered the earth or left deposits of physical remains (e.g., stone flakes, arrowheads, or bottles). Archaeological resources are either sites or isolates, and may be either prehistoric or historic in age. Isolates often contain only one or two artifacts, while sites are usually larger and contain more artifacts. These resources can include campsites, roads, trails, dumps, battlegrounds, mines, and other features.

Architectural resources: standing buildings, dams, canals, bridges, and other structures of historic or architectural significance.

Attainment, Nonattainment, and Maintenance Areas: if the air quality in a geographic area meets or does better than the National Ambient Air Quality Standards (NAAQS), it is called an attainment area; areas that don't meet the national standard are called nonattainment areas. Once a nonattainment area meets the standards and additional redesignation requirements, the USEPA will designate the area as a maintenance area.

Average Daily Traffic (ADT) volume: the number of vehicles crossing a given point on a roadway in both directions during a 24-hour period.

Bedrock: subterranean solid rock that lies beneath loose material (such as soil, sand, clay, or gravel).

Biofiltration: a pollution control technique that uses living material to capture and degrade pollutants.

Bioretention: the process in which contaminants and sedimentation are removed from stormwater runoff by plants and microbes.

Borrow area (or borrow pit): a surface area where material (usually soil, gravel or sand) excavated for use at another location.

Brownfield: an abandoned or underused industrial or commercial facility available for re-use, however such redevelopment may be complicated by real or perceived environmental contamination.

Channelization: man-made measures intended to alter the course, characteristics and/or flow of a river.

Channel bank armoring: protective covering, using rocks, vegetation or other materials, to protect stream banks from water erosion.

Channel bank armoring
Source: Lancaster Online

Cofferdam: a temporary enclosure built within a body of water that is pumped dry to create a dry work environment below the waterline.

Comprehensive analysis: a complete and multi-disciplinary assessment of existing conditions, direct and indirect environmental consequences, and project alternatives.

Conformity Determination: a Conformity Determination is the formal process and documentation required when the proposed emissions from a federal action in a nonattainment or maintenance area exceed *de minimis* thresholds and are not otherwise exempt from the General Conformity Rule requirements.

Cooperating Agency: an agency, other than the Lead Agency, that participates in the NEPA process for a proposed action because of jurisdiction by law or special expertise.

Criteria Pollutants: commonly found air pollutants Ozone (O_3), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Oxides (SO_x), Particulate Matter (PM_{10}, $PM_{2.5}$) and Lead (Pb) that can harm your health, the environment, and cause property damage. USEPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria for setting permissible levels. The set of limits based on human health is called primary standards. Another set of limits intended to prevent environmental and property damage is called secondary standards.

Cubic feet per second: a unit expressing the rate of discharge (or flow rate) of water. One cubic foot per second is equal to the discharge of water flowing at a velocity of one foot per second, through a rectangular opening that is one foot wide and one foot high.

Culvert: a tunnel accommodating the flow of water under a road or railroad.

Culvert
Source: American Concrete

Cumulative project: any past, present, or future project that could contribute toward cumulative effects on environmental resources, when taken in combination with a proposed action and other past, present, and reasonably foreseeable projects.

Cutoff Wall: a wall, constructed underground, designed to impede the flow of water.

Dallas Floodway (or "the Floodway"): a floodway that crosses the western and central portions of the City of Dallas, adjacent to the Trinity River and the West and Elm Forks of the Trinity River.

***de minimis* Threshold**: the General Conformity Rule establishes maximum emission levels in tons per year allowed based on the severity of an area's air quality problem. The exceedance of a *de minimis* threshold requires a Conformity Determination. 40 CFR 93 Section 153 lists these maximum *de minimi*s thresholds.

Direct Impacts (Socioeconomics): impacts associated with the construction projects themselves. Direct jobs include jobs building and/or constructing the proposed projects. Direct labor income is the incomes earned by workers who are building/construction the proposed projects. Direct economic output is associated with initial purchases of local construction materials and supplies.

East and West Levee Interior Drainage System (EWLIDS): a system of pumping plants, sumps, pressure sewers, and gravity sluices used to feed stormwater into the Dallas Floodway from areas located on the developed side of levees.

Economic Output Impact: total production and sales volume that would be generated in the region of influence as a result of construction activities. Economic output is generated by increases in personal expenditures.

Ecosystem: a biological community of interacting organisms and their surrounding physical environment.

Embankment: a wall of earth or stone built to hold back water (embankments are also used to support roadways and railroads).

Emergent wetland: a wetland dominated by herbaceous plants (plants without woody stems) adapted to grow in water.

Environmentally acceptable: a proposed action is environmentally acceptable if it has been determined to be acceptable through the application of the NEPA process and is documented in the Record of Decision.

Environmental Impact Statement (EIS): a document that is required under the NEPA for any major federal action, and/or when the environmental consequences of a proposed action may be significant. An EIS discloses both the positive and negative effects of a proposed action.

Environmental Justice Low-income Population Area: a census block group where 20% or more of the residents have incomes below the poverty line. For purposes of analysis, the populations of these areas are considered special status populations.

Environmental Justice Minority Population Area: a census block group where 50% or more of the residents have minority status. For purposes of analysis, the populations of these areas are considered special status populations.

Feasibility Study: a detailed investigation of engineering feasibility, cost effectiveness, and environmental consequences of alternative solutions to a water resources challenge.

Flex field: an open area or field that can be used for a variety of activities and sports.

Floodway: a channel of a river or other watercourse and adjacent land areas reserved in order to discharge a specified flood without increasing the water surface elevation above a designated height. Floodways provide levees and other facilities to manage the risk of flooding to adjacent properties.

Floodway encroachment: any object in a floodplain that could obstruct flood flows, such as fill material, bridges, above-ground utilities, buildings, or other structures.

Flood Risk Management (FRM): the USACE's program to minimize flood risk through the appropriate use and resiliency of structures such as levees and floodwalls. FRM also promotes alternatives when other approaches (e.g., land acquisition, flood proofing, etc.) reduce flood-related risks.

Flood Warning System: a system to advise residents of flooding to facilitate preparedness and evacuation.

Fluvial Geomorphology: the study of river forms and the processes that shape them. Fluvial geomorphology considers the geological setting, channel morphology, hydrology, hydraulics, sediment transport, and riparian and floodplain vegetation.

Fugitive Dust: particulate matter that becomes airborne and has the potential to adversely affect human health or the environment. The most common forms of particulate matter are known as PM_{10} (particulate matter with a diameter of 10 microns or less) and $PM_{2.5}$ (particulate matter with a diameter of 2.5 microns or less).

Future Without-Project Condition: this future condition describes environmental conditions in a given area assuming that a proposed action is not implemented. The Future Without-Project Condition is the baseline for measuring a proposed action's environmental effects.

General Conformity Rule: ensures that Federal actions comply with the NAAQS. In order to meet Clean Air Act requirement, a federal agency must demonstrate that every action that it undertakes, approves, permits or supports will conform to the appropriate state implementation plan. A federal action can be shown to "conform" by demonstrating there will be no increase in emission in the nonattainment or maintenance area from the federal action that could cause new violations of the standards and/or no increase in the frequency or severity of previous violations.

Geotextile: permeable fabric which, when used in association with soil, have the ability to separate, filter, reinforce, protect, or drain the soil.

Greenbelt: land use designation used in land use planning to retain areas of largely undeveloped, wild, or agricultural land surrounding or neighboring urban areas.

Greenhouse Gas (GHG): gases that trap heat in the atmosphere and contribute to global climate change (also known as the greenhouse effect) by absorbing infrared radiation. Many GHGs occur naturally in the atmosphere, such as carbon dioxide (CO_2), methane (CH_4), water vapor, and nitrous oxide (N_2O), while others are synthetic.

Hydraulics: the science that deals with the conveyance of liquids through pipes and channels.

Hydraulic Neutrality: A term often used to characterize "technical soundness" as it relates to the hydraulic performance of the Dallas Floodway. In this context, hydraulic neutrality indicates that the floodway's ability to convey the SPF and 100-year flood event would be minimally altered.

Hydrology: the science that deals with the properties, circulation and distribution of water on and under the surface of the earth. Hydrology is also concerned with water in the atmosphere, from the moment of precipitation until it returns to the atmosphere, or is discharged into the ocean.

Indirect Impacts (Socioeconomics): jobs, income, and economic output generated by the businesses that would supply construction materials and supplies. Indirect jobs include jobs at companies that supply construction materials/supplies or sell or rent construction equipment. Indirect jobs can extend to include jobs related to the manufacture of products used for construction (if the manufacture is within the region of influence [ROI]). Indirect labor income includes the income earned by people working indirect jobs. Indirect output includes the total sales volume related to the supply of goods and services to construction contractors.

Induced Impacts: impacts that result from the spending of wages and salaries of the direct and indirect employees on items such as food, housing, transportation, and medical services. This spending creates induced employment in nearly all sectors of the economy, especially service sectors.

Invasive species: introduced species that adversely affects the habitats and bioregions that they invade economically, environmentally and/or ecologically.

Inverse square law: an equation that describes how noise dissipates over a given distance from the noise source.

Jobs Impact: the number of jobs that would be created or sustained within the ROI as a result of construction activities.

Labor Income Impact: the income generated through the jobs that would be created or sustained within the ROI as a result of construction activities.

Lead Agency: a federal agency designated to supervise the preparation of the National Environmental Policy Act environmental analysis.

Levee: an elongated naturally occurring ridge, or artificially constructed fill or wall, which regulates water levels. It is usually earthen and often located parallel to, and both sides of the course of a river. Areas located outside of the levees are referred to as developed areas.

Level of Service (LOS): a measure of the relative level of congestion on streets, intersections and other highway facilities. LOS A indicates free-flowing conditions, while LOS F indicates heavily congested conditions.

Low Beam Elevation: the elevation of the lowest element of a bridge superstructure.

Low Beam Freeboard: the distance between the low beam elevation and the surface of the water beneath a bridge.

Main stem: the primary downstream segment of a river, which is fed by the river's upstream tributaries.

Major federal action: actions with effects that may be major and which are potentially subject to federal control and responsibility.

"Mixmaster": an important freeway-to-freeway interchange. The location at the junction of IH-35E and IH- 30, to the north and east of the Dallas Floodway is referred to as the Mixmaster.

Morphology: a description of the shapes of river channels and how they change over time.

National Ambient Air Quality Standards (NAAQS): The Clean Air Act required the USEPA to set NAAQS for wide-spread pollutants that were considered harmful to the public and environment. The USEPA has set NAAQS for the following principal pollutants, which are called "criteria" pollutants: Ozone (O_3), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Oxides (SO_x), Particulate Matter (PM_{10}, $PM_{2.5}$) and Lead (Pb).

National Economic Development (NED): a critical consideration in the assessment of alternative civil works projects by the U.S. Army Corps of Engineers. NED analysis directs the USACE to formulate, evaluate, and select alternative project plans based on their estimated net economic benefits (plan benefits less and plan costs) expressed in dollars.

National Environmental Policy Act (NEPA): a federal environmental law intended to help public officials make decisions based on an understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

Notice of Intent: a formal announcement of the intent of the Lead Agency to prepare an EIS.

Notional: an idea that is either speculative or theoretical. Notional exhibits are developed to help the reader visualize how an as yet undefined project element may look.

Outfall: a place where a river, drain, or sewer empties into the sea, a river, or a lake.

Passenger Car Equivalent Vehicles: a traffic volume that includes a factor that is applied to trucks to better represent their disproportionate effect on highway capacity.

Plasticity: A geologic process where a material undergoes a change under extremely high pressure and/or temperature. High plasticity soils (soils most similar to high quality pottery clay) turn into sticky mud when mixed with water. Soils with a high plasticity tend to be clay, those with a lower placidity tend to be silt, and those with a plasticity of 0 (non-plastic) tend to have little or no silt or clay.

Potentially affected structure: a structure that is wholly or partially within the extent of a specified storm event.

Potentially flooded structure: a potentially affected whose estimated finished floor elevation is below the predicted storm event water level.

Pressure sewer: means of collecting wastewater from multiple sources and delivering the wastewater to an existing collection sewer, and/or to a local or regional treatment facility. Pressure sewers are not dependent on gravity to move wastewater.

Promenade

Promenade: a paved public walkway, typically along a waterfront area.

Public Involvement: a systematic interdisciplinary approach to solicit input from the public on a proposed action, including public hearings and reasonable notices to the public.

Pump station: facilities including pumps and equipment for moving fluids from one place to another. In the Dallas Floodway, pump stations are used to convey water from sumps on the developed side of the levees into the Floodway.

Pump Station

Reasonably foreseeable: actions or impacts that are considered likely to occur based upon an assessment of data and trends.

Record of Decision (ROD): a written public record identifying and explaining the reasoning for the Lead Agency’s decision on the Proposed Action.

Recurrence Interval/Return Period: the probability that a given event (e.g., 100-year flood) will be equaled or exceeded in any given year.

Region of Influence (ROI): the geographic extent that is being evaluated for a particular environmental resource.

Regionally Significant Arterial (RSA): major surface streets (i.e., not freeways). RSAs identified by the North Central Texas Council of Governments are projected to accommodate approximately 20% of all vehicular traffic in the North Central Texas region by the year 2035.

Retaining wall: above-ground structures designed to prevent soil erosion.

Scoping Meeting: a public meeting where a Lead Agency (and other agencies as appropriate) describes a proposed action and solicits input from the public.

Section 408 Project: any project that modifies a federal levee system, above and beyond ordinary operation and maintenance that requires USACE approval under 33 United States Code Section 408.

Seepage: the slow escape of a liquid or gas through porous material or small holes.

Sensitive Noise Receptors: buildings or parks where quiet forms a basic element of their purpose; residences and buildings where people normally sleep (e.g., homes, hotels, hospitals), where nighttime noise is most annoying; and institutional land uses (e.g., schools, libraries, parks, churches) with primarily daytime and evening use.

Sluice: an artificial passage for water to flow through with a gate for controlling the flow.

Standard Project Flood (SPF): the volume of stream flow expected to result from the most severe combination of meteorological and hydrologic conditions that are reasonably characteristic of the geographic region involved, excluding extremely rare combinations.

State Implementation Plan (SIP): developed in order to improve air quality in designated nonattainment and maintenance areas. Through this plan, States propose their strategy for reducing criteria air pollutant emissions. Plans often incorporate different strategies, such as the use of a permit system to ensure that power plants, factories and other pollution sources meet State clean-up goals.

Sump: a low-lying basin that receives surface water runoff. Sumps are used in the Dallas Floodway EWLIDS to store stormwater on the developed side of the levees before it is pumped into the Dallas Floodway.

Sump

Superfund: common name for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, a United States federal law designed to clean up sites contaminated with hazardous substances.

Technically sound: this means that, at a minimum, a proposed action has been designed and implemented in accordance with USACE standards.

Traditional Cultural Properties (TCP): resources associated with the cultural practices and beliefs of a living community that link that community to its past and help maintain its cultural identity. These resources can encompass a variety of subjects including archaeological resources and architectural resources, as well as sacred areas or objects, sources of raw materials, and traditional hunting and gathering areas. TCPs are generally associated with Native American groups.

Trestle

Trestle: a framework consisting of beams used to support a flat surface, such as a roadway or railroad.

Tributary/Fork: a stream or river that flows into a mainstem (or parent) river or a lake.

Trip generation: an estimate of the number of new trips that would be added to the transportation network as the result of a proposed action.

U.S. Army Corps of Engineers (USACE): a U.S. federal agency under the Department of Defense and a major Army command with approximately 37,000 military and civilian personnel. The USACE is involved with numerous civil works projects, and is especially associated with dams, canals, and flood risk management.

Urbanization: the physical transformation of rural and undeveloped areas to provide permanent structures and infrastructure to accommodate an influx of population.

Valley Storage: the water volume that occupies a floodplain following a flood event. Valley storage is a measure of floodplain volume capacity.

Viaduct: a bridge composed of several small spans supported by arches, piers, or columns.

Watershed: an area or region that is drained by a river, river system, or other body of water.

Wetland

Water Resources Development Act (WRDA): legislation for authorizing water projects to be studied, planned, and developed by the USACE.

Wetland: a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem.

Weir: a low barrier across a river designed to alter its flow characteristics.

CHAPTER 12
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