II. VISION

component: 1

Flood Protection

A balanced vision for flood protection throughout the Dallas – Fort Worth Metroplex must include efforts to manage growth's impacts on the watershed region-wide along with investments to minimize the impacts of flooding on specific neighborhoods and business areas. Without proper planning, upstream development will continue to undermine Dallas' efforts to utilize the Dallas Floodway for a mix of uses. At the same time, the Dallas Floodway Extension Project, the Elm Fork Flood Protection Project and modest levee raises within the Dallas Floodway are critical to providing a short term structural solution to flood protection. Fortunately, the parkway, lakes, recreation, and natural habitats can all be constructed within the Dallas Floodway without negative impacts to required flood conveyance. The goal of bringing residents and development closer to the Trinity Corridor can also be accomplished without diminishing the long term effectiveness of Dallas' flood protection system.

Event on the embankments of the flood prone Ohio River along the Louisville Waterfront.

The Baker Pump Station on the east Levee.

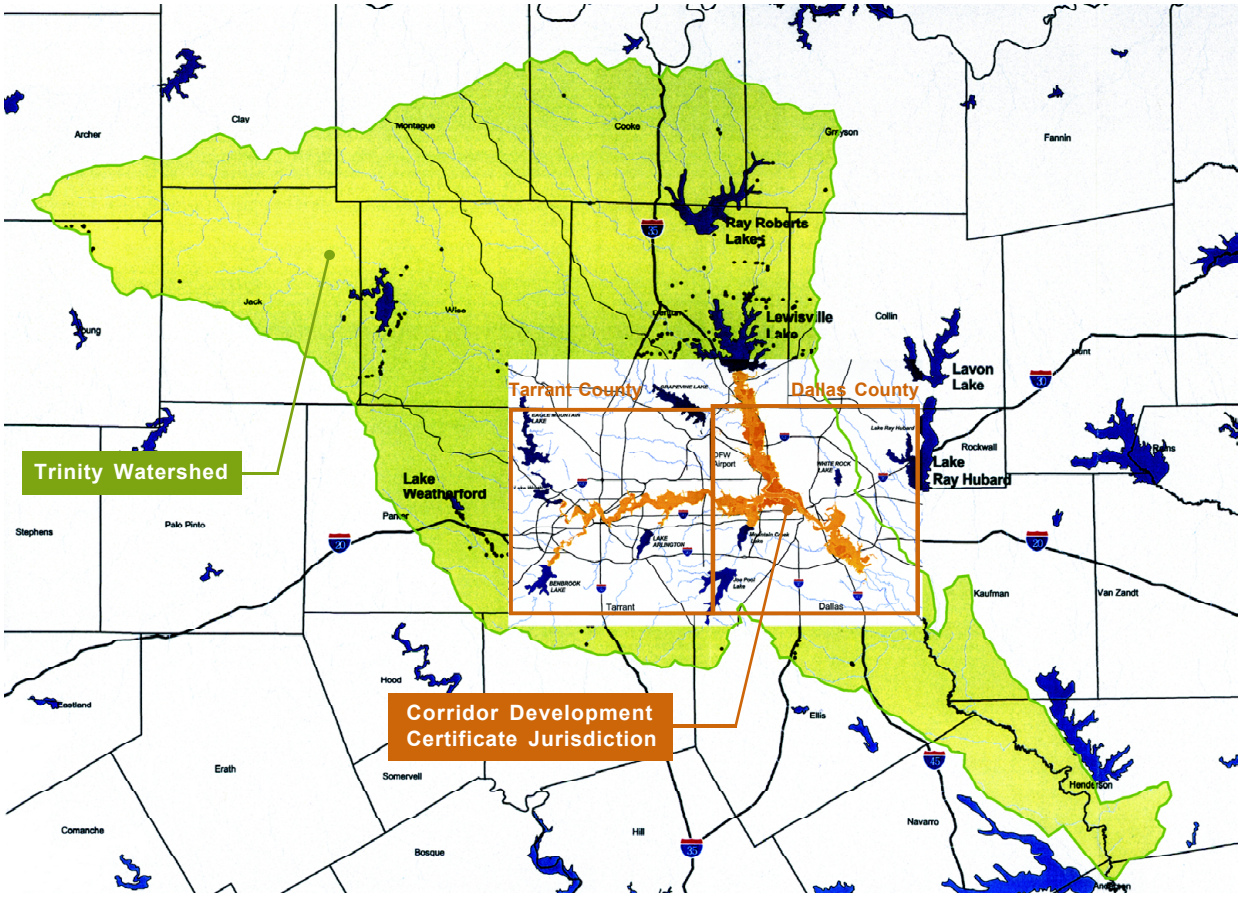
Flood Protection Strategies

Flood protection can be provided through structural means – such as floodway levees – or through non-structural 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 flood protection to the adjacent properties. The levee system is the most visible of the floodway components, and the levee systems are designed to provide protection from the design storm. Other components of the floodway include storm water pump stations, sumps for storing storm water, and outfall structures for pumped and gravity flow. For the Dallas Floodway the design storm is referred to as the Standard Project Flood (SPF), which is a storm that has a probability of occurring one time in approximately 800 years.

The actual design process for levees is complex, and many variables are considered including the height of the design flood, the velocity of the water in the floodway, the type of soil available for levee construction, the characteristics of the soils the levees rest on, possible seepage patterns under and through the levees, the types of structures penetrating the levees, the type and depth of structures

Postcard view of the Flood of 1990: Dallas as it can be.



The Corridor Development Certificate process protects less than 2% of the Upper Trinity Watershed.

below the levees, etc. All of these factors are evaluated and incorporated into the details of the levee design, resulting in a levee structure that is safe and stable.

The long-term stability of the levee system is dependent on proper operation and maintenance of the levees and the other components of the 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. Additionally, levees have periodic slides on their sides that require repair, and levees will settle some over time; therefore, the levees must be raised to their original levels. When properly designed, operated, and maintained levees will provide a safe and stable flood protection system.

Preserving existing valley flood storage: the “sump” at Cedars West.

Non-structural strategies are also important to protect people and property from flood damages. Non-structural approaches focus on retaining the natural floodplain as an area for flood waters to inundate during times of high water flow. This may mean that floodplain areas are not used for residential development or commercial development with high occupancy or value. It may also mean that development occurs with provisions for on-site floodwater retention or detention, so the buildings and pavement in a new project do not increase the level of runoff from the property to the rest of the watershed.

Flood Protection in Dallas

Flooding of the Trinity River has been a serious issue since the establishment of the City of Dallas along its banks. After the severe flooding of 1908, planning started on controlling the floodwaters by constructing levees to protect adjacent land. Early levees were built in 1932, and were raised to their current height of approximately 30 ft. in 1960. These levees ended just past the Corinth St. Viaduct, leaving

neighborhoods without flood protection. In 1965, Congress approved a plan submitted by the U.S. Army Corps of Engineers (USACE) to provide this protection, however, citizens of Dallas voted down a cost-sharing bond proposition to implement this plan with the USACE in 1975. After major flooding occurred in 1989 and 1990, the City of Dallas expressed renewed interest in the USACE's earlier plan for flood protection. The USACE thus began a reevaluation of this plan, known as the Dallas Floodway Extension Project.

Flood protection is an important concern for Dallas neighborhoods and business areas that are currently within the floodplain, many of which are in the Southern Sector of the city. It is also an important concern for areas behind levees that do not now provide adequate levels of flood protection. Since failure of the levees would result in catastrophic damages to adjacent property, it is essential that the levees be designed and maintained in a manner that guarantees their integrity and stability.

For example, failure of the Dallas Floodway during the Standard Project Flood (SPF) is estimated to result in $8 billion in damages and the inundation over 10,000 structures. Numerous residences, schools and churches in West Dallas and Oak Cliff would be inundated. The medical district would have its first floor underwater and significant sections of downtown would be flooded as well. More serious would be the impacts as a result of flooding of the Central Wastewater Treatment Plant. Levees, equipment and electrical controls would be damaged and require extensive rehabilitation and repair. Lack of this treatment capacity would significantly impact the region's economy. The process of bringing this plant back on-line would take months and cost millions of dollars. By analyzing and designing these flood protection measures with an eye towards regional safety, the benefits far outweigh the costs of implementation.

Levees in the Flood Protection Plan

Extending the Dallas Floodway and raising levee heights within the Dallas Floodway are essential for protection of Downtown and Dallas neighborhoods.

1. The Dallas Floodway Extension

The Dallas Floodway Extension (DFE) component of the Trinity River Corridor Project will build levees along the Cadillac Heights

Landforms can be used to manage or "fine tune" floodway performance by slowing or redirecting flows.

neighborhood and the Lamar Industrial area. The levees will protect these areas from the Standard Project Flood event. The Central Wastewater Treatment Plant levee will also have improved flood protection from its current 140-year flood protection to 500-year flood protection. The existing Rochester Park levee will be improved from the 110-year flood protection to the Standard Project Flood protection level.

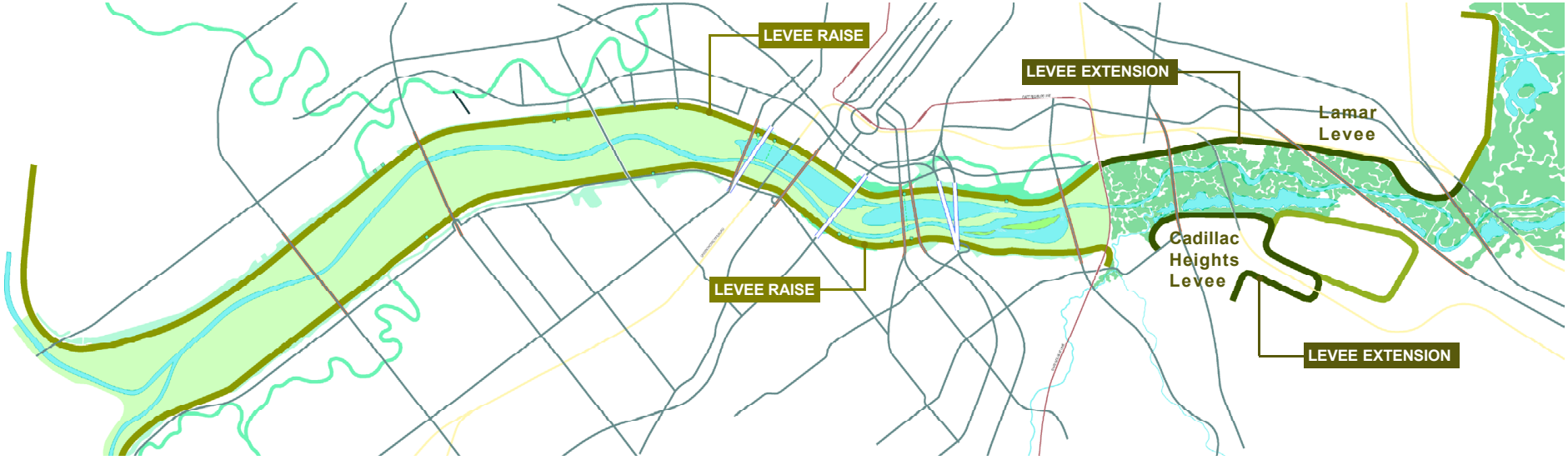
2. Elm Fork Flood Protection Project

The residents and businesses along the Elm Fork of the Trinity River have been impacted by flooding, both from the rising waters of the Elm Fork of the Trinity River, and from the lack of proper interior drainage of the creeks that flow through the area. The City of Dallas has studied the problems in this area with the help of a consultant, who developed the Elm Fork Floodplain Management Study. The recommendations for flood protection improvements from this study include by-pass swales, creek channel improvements, a small levee, and stormwater culvert replacements. Besides locating problem drainage areas and recommending solutions, this study also looked at potential recreational opportunities, including a premier soccer complex, trails and a dog park along the Elm Fork of the Trinity River. After the study is formally adopted by the Dallas City Council, the City of Dallas will begin implementation of those recommendations.

The USACE is also investigating this area in their Upper Trinity River Feasibility Study (UTRFS) to determine federal interest in a flood reduction project. While a large-scale project doesn't seem to be federally justified at this point, there may be an opportunity for the USACE to participate in some aspects identified in the Elm Fork Floodplain Management Plan.

3. Levee Improvements in the Dallas Floodway

Although the DFE Project will restore the SPF level of protection, it does not provide a "freeboard", that is, an additional area between the surface of the standard project flood and the top of the levee. Therefore, this plan



Levee extensions and levee raises in the Dallas Floodway.

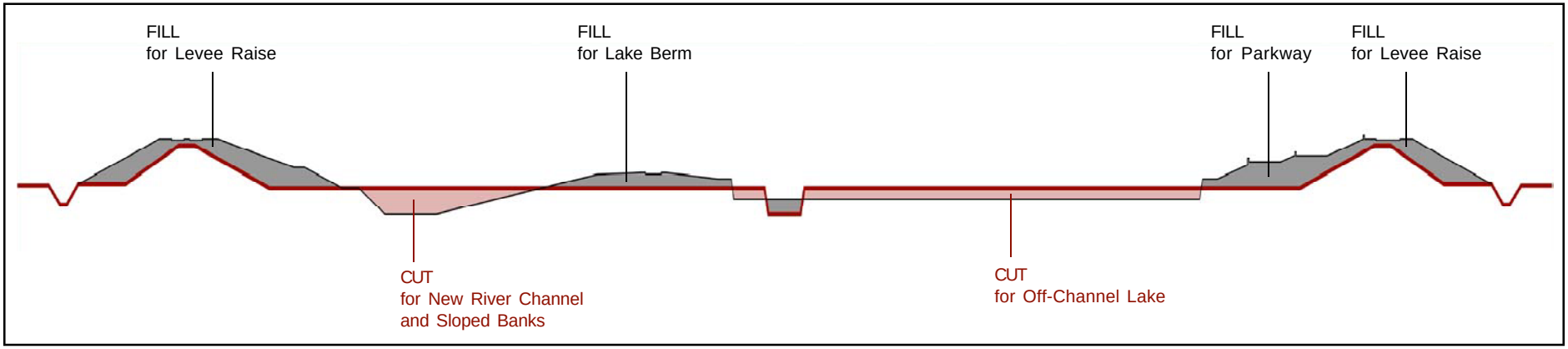
proposes that the existing levees be raised by as much as two feet to provide freeboard and that the riverside slope of the levees be flattened to reduce the likelihood of slope failure. The maximum raise will occur at the downstream end of the existing levees, near the DART rail line, and the raise will gradually diminish in height going upstream. The levee raise will also serve to provide additional stabilization of the levees, as the slopes will also have compacted fill placed on them. The fill for the levee raise will come from a portion of the excavation for the proposed lakes and river meanders in the floodway.

A Balance of Cut-and-Fill within the Dallas Floodway

First and foremost the Dallas Floodway is a flood control facility, designed to protect the health and safety of Dallas citizens as well as significant economic assets within the City. As such, any improvements to the floodway must maintain flood protection levels as established by the US Army Corps of Engineers. The proposed combination of roadways, lakes and river meandering within the Dallas Floodway has been designed to maintain the current flow characteristics of the Dallas Floodway. The excavation necessary to recreate meanders in the Trinity River, combined with excavation for several lakes is approximately the same (4.6 million cubic yards) as the quantity of soil needed to raise the parkway and the levees. The "balance" of cut and fill reduces the cost of exporting or importing soil into the corridor. This general balance also ensures that the flow characteristics of the floodway are maintained.

Two additional factors influence the flow characteristics of the floodway and are worth mentioning. Since excavation within the floodway is primarily located in the middle of the floodway, and fill within the floodway is primarily located at the edge to support the parkway, ability of the floodway to maintain flood conveyance is essentially preserved. An important change to the characteristics of flood flows is that the creation of lakes within the floodway creates a "smoother" surface for flood waters (compared to the vegetation that currently exists), which actually increases the ability of the floodway to carry flood events downstream.

While improving the ability of flood flows to move through the floodway would seem to be a benefit, increasing flood capacity has negative downstream impacts which the U.S. Army Corps of Engineers will not allow. As a result, features such as berms and trees must actually be introduced into the floodway to slow flood



"No Net Change": management of flood conveyance by balancing cut-and-fill within the floodway.

velocity so that there is no net increase or decrease in flood conveyance. This opportunity to add features to the floodway is integral to the landscape concept calling for varied terrain, wetlands and increased tree cover. Further studies will be necessary to determine the exact level of tree planting and contouring that will be possible within the floodway to offset the lakes. Floodway conveyance is expected to limit tree plantings to no more than ten percent of the floodway area; planting of meadows, grasslands, wetlands and similar habitat will not be constrained by the needs of floodwater conveyance.

Chain of Wetlands for Flood Conveyance

An important portion of the flood protection realized from the DFE project comes from the construction of the chain of wetlands in the Great Trinity Forest. The need for the floodwater conveyance provided by the wetlands actually comes from the thick growth of trees that currently slows the flow of water during heavy rain and flood events. The DFE Project will create a 3½-mile long chain of wetlands through the Great Trinity Forest. These narrow, shallow pools of water would be interconnected, and would serve two purposes. They provide a secondary path for the floodwaters to flow through the growth of the Great Trinity Forest more quickly, which reduces flood levels upstream in the downtown area and restores the protection of the existing levees to the standard project flood level. They also serve as diverse habitats for the native wildlife. The City of Dallas is in the process of acquiring land for these wetlands. USACE has completed its design of the lower chain of wetlands, and could begin construction by Spring 2004.

To some, removal of trees for a chain of wetlands has been viewed as diminishing the value of the Great Trinity Forest. The 170 acres of forest removed for wetlands, however, represents less than 2% of the Great Trinity Forest. By comparison, nearly five times as much land will be purchased as part of the environmental mitigation plan.

Furthermore, the wetland cells have been carefully located to minimize their effect on the most important parts of the Great Trinity Forest. The species to be removed for the wetland cells represent neither the most aesthetically pleasing stands within the forest nor the most biologically diverse. The areas of most diversity have been found along the edges of the forest, in grasslands, and along the edges of the Trinity River and White Rock Creek. The chain of wetlands would create a significant length of new edge condition around its perimeter. The most aesthetically pleasing stands of trees, dominated by Elms, are located in areas of the Great Trinity Forest not affected by the wetland cells. The 230 acres of trees slated for removal, are predominantly composed of dense stand of Ash, Mulberry, and Swamp Privet, specifically the types of trees most susceptible to long term drought, tornados and disease. These stands also tend to collect the most

The structural approach to flood protection focuses on the levees.
A view of the levee top today; an amazing place to be were it part of the public realm.

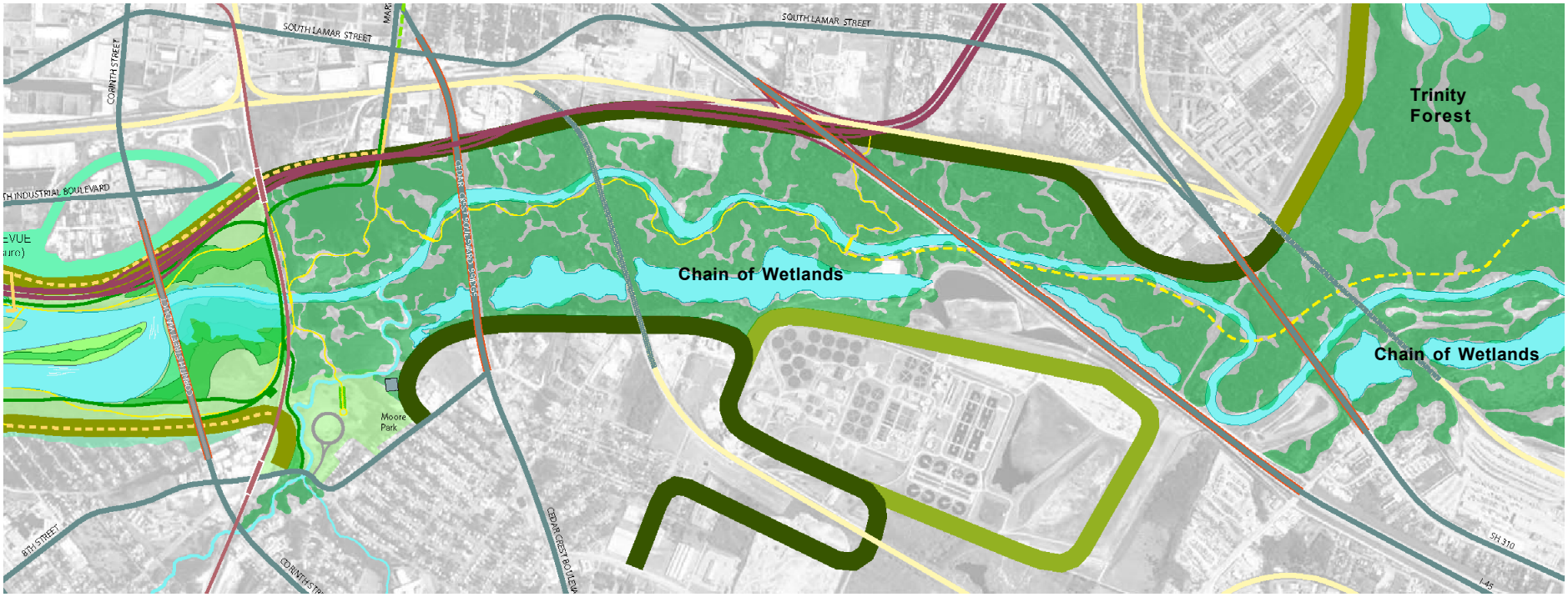
debris after frequent flooding events. Trees will also be removed in the areas of the Lamar and Cadillac Heights levees. The USACE authorized environmental mitigation area was developed in conjunction with the U.S. Fish and Wildlife Service and was concurred with by the Texas Parks and Wildlife Department. The Environmental Protection Agency's role was that of a reviewer for environmental compliance. The environmental mitigation plan calls for:

- Purchase of approximately 1,179 acres of land in the Great Trinity Forest.
- Planting of containerized trees, and tree and shrub seedlings.
- Construction of bird and squirrel boxes
- Development of a Forest Management Plan, which includes reforestation as well as prairie land restoration.

City staff has been working with the USACE to identify parcels of land that would serve the mitigation purpose. As of this writing, over 500 acres of land have already been purchased, and there are over 1,000 acres that are under survey or being appraised.

Other aspects of the DFE Project include:

- Realignment of the Trinity River at the IH-45 bridge to protect the pier structures.
- Recreational amenities including trails, gateway parks and pedestrian bridges to



The proposed chain of wetlands will add to the wetlands that already exist in the floodplain.

make the wetlands and Forest more accessible to visitors.

- Replacement of a portion of the ATSF (Railroad) Bridge with a new pedestrian facility that will reduce the current problem of debris collection on the existing piers.

Existing “volunteer” wetlands within the floodway.

Regional Flood Protection Efforts

A regional approach to flood protection must be continued to stabilize flood risk along the entire Trinity River. The (USACE) has limited permit authority in the floodplain to control extensive development and the cumulative impacts on the Trinity Corridor. Nine cities and two counties within the Trinity River Watershed in the metroplex together implement the Corridor Development Certificate (CDC) program with the North Central Texas Council of Governments (NCTCOG) providing coordination and technical assistance. This process assures similar regulations within cooperating cities and counties and allows affected communities to review and comment on their neighbors’ jurisdictions. This innovative and successful intergovernmental partnership has been effective, but is limited to a regulatory zone consisting of less than 2% of the Upper Trinity River watershed. Given the size of the watershed at 6,100 square miles - the size of New Jersey - and the rates of widespread development outside of the defined regulatory zone, the City of Dallas should advocate for more wide-reaching cooperation so the CDC process is used throughout the watershed. Failure to do so will mean continuing increases in flood elevations in the downstream areas of the region, including Dallas, and will cause Dallas citizens to face continuing pressure to increase levees or take other actions to maintain adequate flood protection.

Purchase and protection of valley flood storage areas is another effective strategy undertaken by communities to reduce the need for structural solutions to flood control. The Trinity River Corridor Project has undertaken just such a program downstream of the Dallas Floodway within the Great Trinity Forest by acquiring over a thousand acres of flood-prone bottomlands. Similar efforts, if undertaken in the watershed upstream of the Dallas Floodway, could have lasting environmental benefits and reduce the need for future levee raises.

Fact Sheet

DALLAS FLOODWAY FACTS

- Length of Dallas Floodway from confluence of Elm Fork and West Fork to DART bridge: ~7.2 miles
- Width of the Dallas Floodway at Commerce Street: ~1/3 mile (~1,900 ft)
- Stage elevation of banks of the river channel: 30 feet
- Stage elevation of existing levees: 61.38 feet (East levee at Commerce Street)
- Stage elevation of 100 year flood level: 51.23 feet (at Commerce Street)
- Number of times the river has exceeded the 100 year flood stage elevation since 1908: 0
- Number of days the river has exceeded stage elevation 37.65 feet (the height of the proposed lake protection berm) since 1960: 62 days
- Average number of days the proposed Urban Lake would be inundated per year (based on last 43 years): 1.4 days/year
- Representative flow of the Trinity River during dry periods: 800 cubic feet/second or approximately 500 million gallons/day
- Typical amount of water discharged by the Central Wastewater Treatment Plant: 150 million gallons/day
- Amount of water needed to supply the Trinity Lakes to compensate for evaporation and other losses: 4 million gallons/day

REGIONAL FLOOD CONTROL MECHANISMS

- Size of Upper Trinity River watershed: 6,100 square miles
- Size of the Regulatory Zone where a Corridor Development Certificate is required: 113 square miles

DALLAS FLOODWAY EXTENSION PROJECT

- Lamar Levee Extension (3.1 miles)

  Removes 417 acres of low lying lands (mostly occupied by industrial uses) from the 100-year flood plain
- Cadillac Heights Levee Extension (2.2 miles)

  Removes 205 acres of low lying lands (mostly composed of residential uses) from the 100-year flood plain
- Realignment of river channel at IH-45
- Chain of Wetlands replaces approximately 230 acres of bottomland hardwoods with wetlands. Year round water supply for wetlands is provided by the Central Wastewater Treatment Plant
- Mitigation includes purchasing 1,179 acres of forested low lying land including 926 acres of bottomland hardwood forest

DOWNTOWN LEVEE MODIFICATIONS

- Increase in levee height to provide up to an additional 2 feet of freeboard above the Standard Project Flood elevation
- Riverside slopes of levees will be reduced in steepness from current slopes of three in one(horizontal to vertical) to four in one. Reduced slopes will reduce risks from potential slope failures during flood events

TRINITY PARKWAY IMPACTS ON FLOOD CONVEYANCE

- Amount of soil needed to build parkway: 3.1 million cubic yards
- Amount of soil needed to increase levee freeboard by 2 feet: 1.5 million cubic yards
- Amount of soil available from lake excavations and river modifications: 4.6 million cubic yards