# Flood Protection and Ecosystem Restoration in an Urban Environment: The Dallas Floodway Extension, Dallas, TX

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Innovative solutions for a safer, better world

# What we want is to integrate functionality with infrastructure.



Definition of USACE **Ecosystem Restoration**? "Ecosystem restoration is the process of assisting in the recovery of ecosystems that have been **degraded**, **damaged**, **or destroyed** and focuses on establishing the ecological processes necessary to make terrestrial and aquatic ecosystems **sustainable**, **resilient**, **and healthy** under *current and future conditions*."

#### Focus?

"The focus of the Corps ecosystem restoration program is on **water-related ecosystem projects**, including restoration of wetland, riparian and aquatic systems."

## Major Challenges to Aquatic Ecosystem Restoration in an Urban Environment

Aside from reliable funding sources to forming partnerships that work

>Hydrology - we need water, but not too much!

Compatible floral associations that promotes desirable vegetation in an urbanized floodplains that provide the sustainable ecosystem goods and services we desire

>O&M – operations and maintenance

## Overcoming Challenges\* to Aquatic Ecosystem Restoration in an Urban Environment

Defining project goals - include realistic objectives and performance measures that work with the hydrology of the project

Involving ALL the stakeholders throughout planning, implementation, and monitoring

Adaptive Management - this approach incorporates flexibility into project management and provides an avenue to accomplish those realistic goals and objectives; QA/QC during monitoring

\*Lessons Learned

### **Overview - The Dallas Floodway Extention**

- Component of the Dallas Floodway Project located within the Trinity River Basin in North Texas
- General Investigation authorized in 1965 by Section 301 of the Rivers and Harbor Act authorized; modified by Section(s) 351/356 of Water Resources Development Act(s) of 1996/1999; construction began 2001
- > Amended to include environmental & recreational components
- Sponsor: City of Dallas, Texas; Fort Worth District requested assistance from Engineer Research and Development Center

#### Focus areas: Flood protection, Ecosystem Restoration, Recreation

#### **The Dallas Floodway Extention**

Purpose: provide overbank flowage capacity for Trinity River flood waters, ensuring reduced flood risk to the City of Dallas



Dallas County, TX Pop.: 1.714 million (1984)\*

Image: GE 1984

Trinity River: 710 mi. 4 forks 18K mi<sup>2</sup> Trinity Bay

\*US Census Bureau



Dallas, TX Pop.: 1.318 million (2016)\*

Dallas County, TX Pop.: 2.618 million (2017 est.)\*

Image: GE 2016

\*US Census Bureau



# The Dallas Floodway Extention Project Components

 $\geq$  Flood control – levees = ~3.7 miles

 Contiguous chain of constructed emergent wetlands with adjacent grasslands (~271 acres); replace woody with herbaceous plants
 9 wetland cells; ~6-20 ac. each

- ~123 ac. emergent wetlands; ~45 ac. open water; ~102 ac. grasslands
- Wetlands provide quality habitat during periods of no-flow 95% of the time

Recreation

> Tie-ins to existing/proposed trails (keeps stakeholders engaged)

#### **Dallas Floodway**

1950s

Trinity River channelized

Mowed regularly to deter woody vegetation; turf grass dominated vegetation

\*Image credit: Jon Loxley, COE-SWF





# Trinity River during an overbanking event /

#### **Design and Function - Wetlands**

1-ft shelf

**3-ft shelf** 

7-ft channel

 $\succ$  What does an aquatic plant want? > Design a system conducive to wetland plant growth Contours promote variety in structure/ food availability 1-ft shelf --- mixed grassland & wetland plants - moist soil > 3-ft shelf --- wetland & aquatic plants > 7-ft channel --- open water (& flood conveyance)

US Army Corps of Engineers • Engineer Research and Development Center

Depth profile & planting zones

### Hydrology - Wetlands

Vary water level to attract migratory birds (moist soil management)
 Fall & winter pools (full) for waterfowl (Central Flyway)
 Spring & summer pools (1 foot or more lower) for plants



## Hydrology - Wetlands

Weir gate control

Weir box

Wetlands hold water during non-flood periods
 RELIABLE WATER = sustain wetland plant communities

#### Three water sources

- Precipitation --- unpredictable
- > Overbanking --- unpredictable
- Pumping --- managed, reuse from Dallas' Waste Water Treatment Plant
  - Gravity fed through the wetland cells

## Hydrology - Challenges

 Too little water to wetlands
 Pump malfunction; weir gate vandalism
 Delays in repairs – sometimes for months
 Water loss during the wrong time of the year, i.e. mid-summer

➤ Too much water

 Stormwater/overbanking
 13 of the top 120 historic crests since 1908 occurred early in the project





## Hydrology – Overcoming Challenges

Include species that can tolerate adverse conditions; diversity is key
 Promote desirable volunteer annuals (fac, facw, facu)
 Choose hardy perennial species able to tolerate drought or prolonged inundation; tuber producers and/or rhizomatic species
 Go with what works! Use reference wetland plant associations!

Monitor closely the effects of water level manipulations on vegetation, what worked last year may not work this year



### **Compatible Flora Association – Wetlands/Grassland**

- Herbaceous vegetation required for flood conveyance (grassland/emergent wetland)
- "Dig it" & they will come Not recommended
  Some volunteer species are good, some are bad; depends on the seed bank
- Assisted succession for plant establishment
  Manage volunteer species
  Combine with aquatic & wetland plantings
  Ensures beneficial species are present
  Manage undesirable (pre-emption)



# **Compatible Flora Association – Challenges**

Urban floodplain hydrology promotes disturbance = succession

- Propagule source
  - Hard to find aquatic/wetland plants in the numbers needed that are the species desired and regionally appropriate
  - Seeds are scarce for aquatic/wetland plants
  - Seeds/plants for grasses and forbs
    - > Found commercially; germplasms avail.
    - Regionally appropriate?

> Herbivory

Thanks USACE for bringing dinner





#### Flora Association – Overcoming Challenges

- Containerized perennial plants are more robust; withstand adverse conditions, can be planted at any time even when dormant
  Grow your own to ensure species/biotype desired; stay within your ecoregion/watershed to get desired genetics
  Quarantined from exotics, i.e. zebra mussels
- Supplement commercial seed mixes with regionally harvested seed (stakeholders)
   Interseeding and re-seeding may be required; especially in areas managed for invasive species



## Flora Association – Overcoming Challenges

- Herbivory implement strategies to protect establishing plants (especially aquatic species); established plants usually outgrow herbivore populations
- Implement vegetation management strategies that promote desirable vegetation
  - IPM Integrated Pest Management (mowing, chemical, mechanical, biocontrol) for invasive species
  - i.e. Biocontrol/chemical control/drawdown alligatorweed
    Identify problematic species in baseline vegetation surveys; identify sources and target those for management

# Submersed aquatic vegetation establishment in exclosures

Photo credit: Aaron Schad

#### Submersed aquatic vegetation recruitment

Photo credit: Aaron Schad

#### 2"x4" mesh, 12 ga. PVC coated, welded wire 3-4' wide x 6-10' long (3-4' tall x 2-3' dia.) mesh overla 2-mesh overlap c rings (6 minimum) ancho anchors (2 pieces, 3/8" d) rebar, 1/3 ben Winter plantings **Emergent vegetation**

#### https://www.swf.usace.army.mil/Missions/Water-Sustainment/Dallas-Floodway-Extension/



#### **Dallas Floodway Extension Project**

#### **Project Overview**

The Dallas Floodway Extension (DFE) Project is located in Dallas, Texas, along the Trinity River beginning where the Dallas Floodway ends (at the abandoned Atchison, Topeka and Santa Fe trestle) and extending downstream to the area where IH-20 and Dowdy Ferry Road intersect. It is a complex project in cooperation and partnership with multiple units of local, state and federal government. It addresses a number of regional concerns, although reducing flood risk for the citizens of Dallas remains the cornerstone of this multi-faceted effort.



The U.S. Army Corps of Engineers has oversight responsibility for all activities within the federally authorized Dallas Floodway System. The Corps' Fort Worth District is a lead actor in some of the projects, such as the Dallas Floodway Extension Project here. In other projects within the confines of the Dallas Floodway Extension Project listed below, the Corps plays a smaller supporting role.

This Corps project is focused on three of five inter-related components: flood protection, ecosystem restoration and recreation in partnership with the City of Dallas, which is the Dallas Floodway Extension's local sponsor.

The Corps also has some role, but not a lead role, in two other major components: transportation and community/economic development.

Public safety is the No. 1 priority in the Corps' Levee Safety Program. The DFE Project, now in the construction phase, is one of two adjacent Fort Worth District projects on the Trinity River designed to reduce flood risk for the citizens of Dallas. The other project, the Dallas Floodway Project, is in a Feasibility Study/Draft Environmental Impact Statement phase and is also in partnership with the City of Dallas, the non-federal sponsor. The Corps and the City of Dallas share the responsibility of public safety and both are committed to flood risk management. Each project has its own web section accessed from the Fort Worth District home page. The Corps also provides public access to a National Levee Database providing more information on Dallas levees.

#### Project Menu

Project Overview

Dallas Floodway Timeline (1908 - 2013)

Lower Chain of Wetlands Fact Sheet

Upper Chain of Wetlands Fact Sheet

Trinity River Corridor Project Update (11/13/2013)

Dallas City Council briefing (8-21-2013)

Corps-built ecosystem in urban Dallas attracts wildlife (2013)

Mitigation plantings in harsh North Texas climate challenge U.S. Army Corps of Engineers team (2013)

Trinity Bird Count birding report,



Map credit: Texas Water Development Board

#### **References/helpful links:**

Bailey, P. 2014. A Sustainable Design Manual: Engineering With Nature using Native Plant Communities. U.S. Army Corps of Engineers for EWN Program, Engineer Research and Development Center. <u>https://ewn.el.erdc.dren.mil/</u>

Dick, G. O., Smart, R. M. and Dodd, L. L. 2013. Propagation and establishment of native plants for vegetative restoration of aquatic ecosystems, <u>ERDC/ELTR-13-9</u>, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Institute for Water Resources, 2013. Benchmarks for incorporating adaptive management into water project designs, operational procedures, and planning strategies. Report I Federal Agency Inventory of Adaptive Management Practices and Policies. 2013-R-11. <u>https://www.iwr.usace.army.mil/</u>

McDonald T., Gann G. D., Jonson J., and Dixon K. W. 2016 International standards for the practice of ecological restoration – including principles and key concepts. Society for Ecological Restoration, Washington, D.C.

Society for Ecological Restoration International Science & Policy Working Group. 2004. The SER international primer on ecological restoration. www.ser.org & Tucson: Society for Ecological Restoration International.

Stankey, G.H, Clark, R.N., Bormann, B.T. 2005. Adaptive management of natural resources: theory, concepts, and management institutions. U.S. Department of Agriculture General Technical Report PNW-GTR-654. 76 pgs.

Stapanian, M. A., Lewis, T. E., Palmer, C. J., and M. M. Amos. 2016. Assessing accuracy and precision for field and laboratory data: a perspective in ecosystem restoration. Restoration Ecology 24:1, 18-26

Webb, M. A., r. A. Ott, Jr., C. C. Bonds, R. M. Smart, G. O. Dick, and L. L. Dodd. 2012. Propagation and establishment of native aquatic plants in reservoirs. Texas Parks and Wildlife Management Data Series No. 273. 61 pgs.

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