COMPLETED PROJECTS (SINCE 2009)

- Over 18 miles constructed
  - *47 miles of emergency levees constructed by the City in 2009

- Project Cost ≈ $120 million

- Reduces required sandbags by approximately 4.5 million

- 50% of the Comprehensive Plan Completed
ND LEVEE CONSTRUCTION PERMIT

- A Flowage Easement is required if a Project impounds water on land not owned by applicant.

- Impacts greater than 0.1 foot requires a property right.

0.1 ft = 1.2 inches
MITIGATION CONCEPT

24,500 cfs

4,500 cfs
OVERVIEW

- Study Area
- FEMA Floodplain
- Flood Protection to Date
- Hydraulic Modeling
- Impacts from Flood Protection
- Mitigation and Costs
STUDY AREA

- Red River
- Wild Rice River
- Drain 27
- Drain 53
- Rose Coulee
FEMA FLOODPLAIN

- Red River
- Wild Rice River
- Drain 27
- Drain 53
- Rose Coulee

- no human intervention
- no flood protection
- state of nature

Cass County FIS – Jan 2015
Clay County FIS – April 2012
TEMPORARY FLOOD PROTECTION
TEMPORARY FLOOD PROTECTION
COMPREHENSIVE FLOOD MITIGATION PLAN

MARCH 2012

Comprehensive Review of Potential Flood Mitigation Options

Completed by Houston Engineering in cooperation with Braun Intertec

[Map and Diagram]
COMPREHENSIVE PLAN

- Conceptual Design
  - Levees
  - Floodwalls
  - Property Acquisitions
  - Geotechnical Analysis

- ~50,000 foot plan
- Modeling Approach (Steady State)
ANALYZING HYDRAULICS IMPACTS

- HEC-RAS
  - Steady State (FEMA FIS)
  - Unsteady State (FM Diversion)
FEMA FLOODPLAIN MODEL

- Simple Approach
- Steady State
- Many Unknowns
- Many Assumptions
- Does not reflect reality
- Outdated Hydrology

Cass County FIS – Jan 2015
Clay County FIS – April 2012
FEMA FLOODPLAIN MODEL

- Simple Approach
- Steady State
- Many Unknowns
- Many Assumptions
- Does not reflect reality
- Outdated Hydrology

Cass County FIS – Jan 2015
Clay County FIS – April 2012
FEMA FLOODPLAIN MODEL

- Simple Approach
- Steady State
- Many Unknowns
- Many Assumptions
- Does not reflect reality
- Outdated Hydrology
  - H&H
  - 1979
  - FM Diversion
  - FEMA Future
  - Flood Risk

Cass County FIS – Jan 2015
Clay County FIS – April 2012
FLOOD CHARACTERISTICS

- Red River
- Wild Rice River
- Drain 27
- Drain 53
- Rose Coulee
FLOOD CHARACTERISTICS

- Reverse Flow: Rose Coulee Drain 27 Drain 53
FLOOD CHARACTERISTICS

- Large Events
- Breakout Flows
  - Overland Flow
  - Wild Rice River
  - County Road 16
MODEL SIMULATION

- New Model
- FM Diversion
  - Phase 8
  - Unsteady State
    - Full Hydrograph
    - Cross Sections
    - Storage Areas
- Complex
- More Realistic
- Flow Interaction
- Wild Rice River Breakout
- Reverse Flow
STUDY AREA

Identify flood impacts from floodplain removal
FLOOD IMPACTS

Flood Impacts

1. Volume Loss
   Area 1 = 3,100 ac-ft
   Area 2 = 100 ac-ft
   Area 3 = 1,000 ac-ft

2. Conveyance Loss
   Area 4 = 100 ac-ft
   Area 5 = 1,400 ac-ft
   Total = 6,400 ac-ft
IMPACTS – AREA 1

Impacts from Current Flood Protection

Area 1 = 3,100 ac-ft
IMPACTS – AREA 1

Impacts from Current Flood Protection

Area 1 = 3,100 ac-ft

Newman Outdoor Field x 1000 ft high
IMPACTS – AREAS 1 & 2

Impacts from Current Flood Protection

Area 1 = 3,100 ac-ft
Area 2 = 100 ac-ft
Total = 3,200 ac-ft
**IMPACTS – AREAS 1 - 3**

Impacts from Current Flood Protection

Area 1 = 3,100 ac-ft
Area 2 = 100 ac-ft
Area 3 = 1,000 ac-ft
Total = 4,200 ac-ft
Impacts from Current Flood Protection

Area 1 = 3,100 ac-ft
Area 2 = 100 ac-ft
Area 3 = 1,000 ac-ft
Total = 4,200 ac-ft

25,500,000 cu.ft. = 585 ac-ft

Photo by championshipsubdivision.com
IMPACTS – AREAS 1 - 4

Impacts from Current Flood Protection

Area 1 = 3,100 ac-ft
Area 2 = 100 ac-ft
Area 3 = 1,000 ac-ft
Area 4 = 800 ac-ft
Total = 5,000 ac-ft
IMPACTS – ALL AREAS (1 – 5)

Impacts from Current and Future Flood Protection

Area 1 = 3,100 ac-ft
Area 2 = 100 ac-ft
Area 3 = 1,000 ac-ft
Area 4 = 800 ac-ft
Area 5 = 1,400 ac-ft
Total = 6,400 ac-ft

40 ac. 160 ft
IMPACTS – ALL AREAS (1 – 5)

Impacts from Current and Future Flood Protection

Area 1 = 3,100 ac-ft
Area 2 = 100 ac-ft
Area 3 = 1,000 ac-ft
Area 4 = 800 ac-ft
Area 5 = 1,400 ac-ft
Total = 6,400 ac-ft

* Photo by championshipsubdivision.com

25,500,000 cu.ft. = 585 ac-ft
IMPACTS – ALL AREAS (1 – 5)

Newman Outdoor Field x 2100 ft high
CONVEYANCE LOSS
CONVEYANCE LOSS
CONVEYANCE LOSS

29,000 cfs
CONVEYANCE LOSS

Flow over entire width of floodplain

Total = 29,000 cfs

4,500 cfs

24,500 cfs
CONVEYANCE LOSS

Levee Construction
Forces flow between the levees
Results in a stage increase

29,000 cfs
CONVEYANCE LOSS

Levee Construction
Forces flow between the levees
Results in a stage increase

24,500 cfs
FLOOD MITIGATION

30,000,000 CY Excavation
15 Miles of levee
2000 Acres of Land

Estimated Construction = $150M
Estimated Land = $30M
Estimated Total = $180M
ANALYSIS UPDATE

▪ Analysis to Date
▪ Uses latest FM Diversion model
  ▪ Best Available
  ▪ Model was developed for the larger scale project
  ▪ Could be refined for this smaller scale project
▪ Plan to review model parameters
  ▪ Detailed modeling to better reflect the isolated project area
  ▪ Adjustments could result in 20-30% difference in results