East Grand Forks, MN
Grand Forks, ND
Local Flood Damage Reduction Project

Presentation
for the

2005 Infrastructure Conference
HH&C CoP Sessions

by

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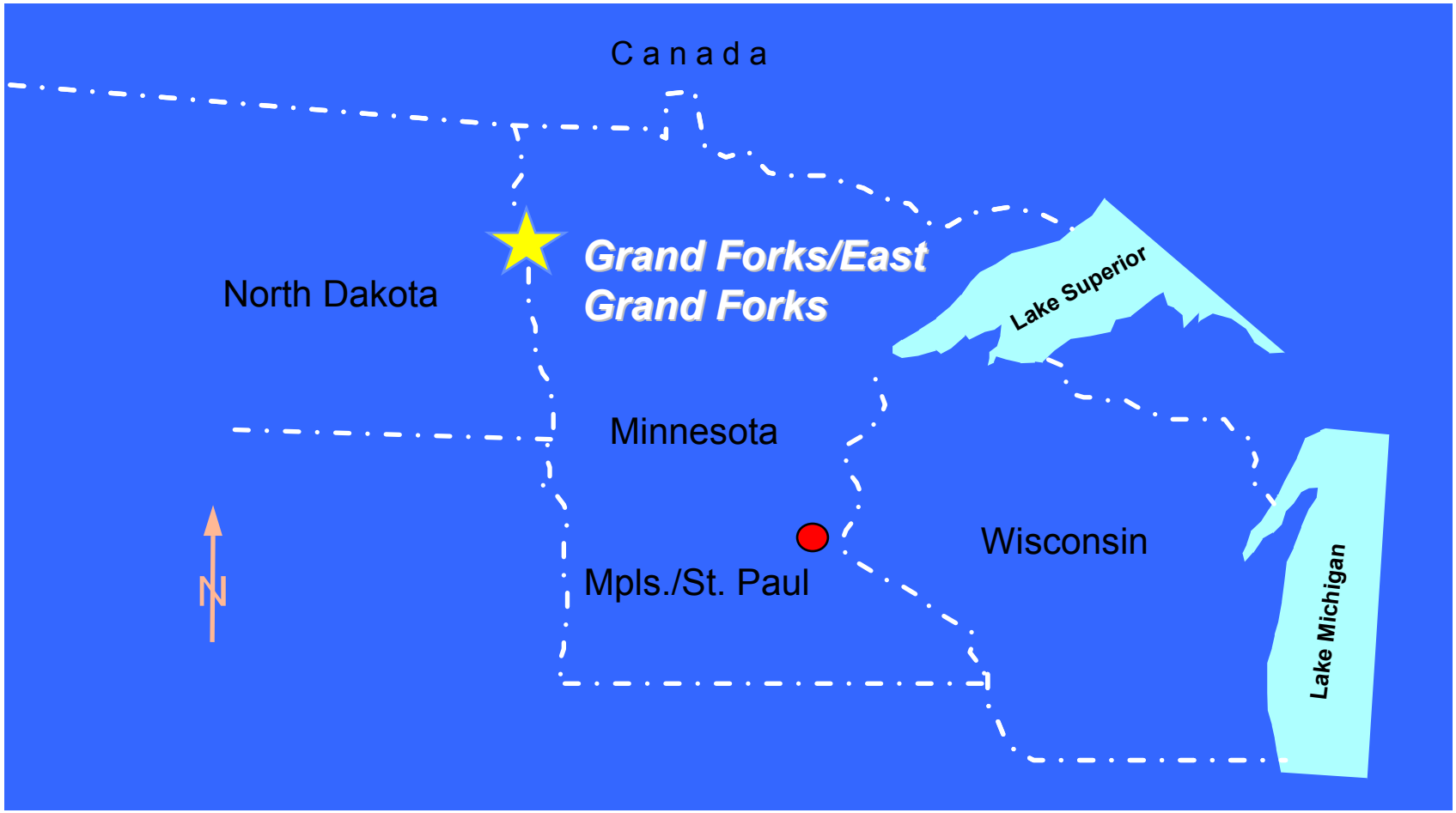
Presentation Summary

- ✓ Project Location & Background
- ✓ Top-of-Levee Design
- ✓ Superiority Profile Complications
- ✓ Interior Flood Control Analysis
- ✓ Pump, Control & Generator Supply Contracts
- ✓ 15 Construction Contracts
- ✓ East Grand Forks “Removable” Floodwall
- ✓ Stepped Dam converted to Rock Rapids
- ✓ RR Closure Sill Installation
- ✓ Construction Using GPS
- ✓ Ice Bridge used to haul Borrow
- ✓ Design Team & Construction Office Issues

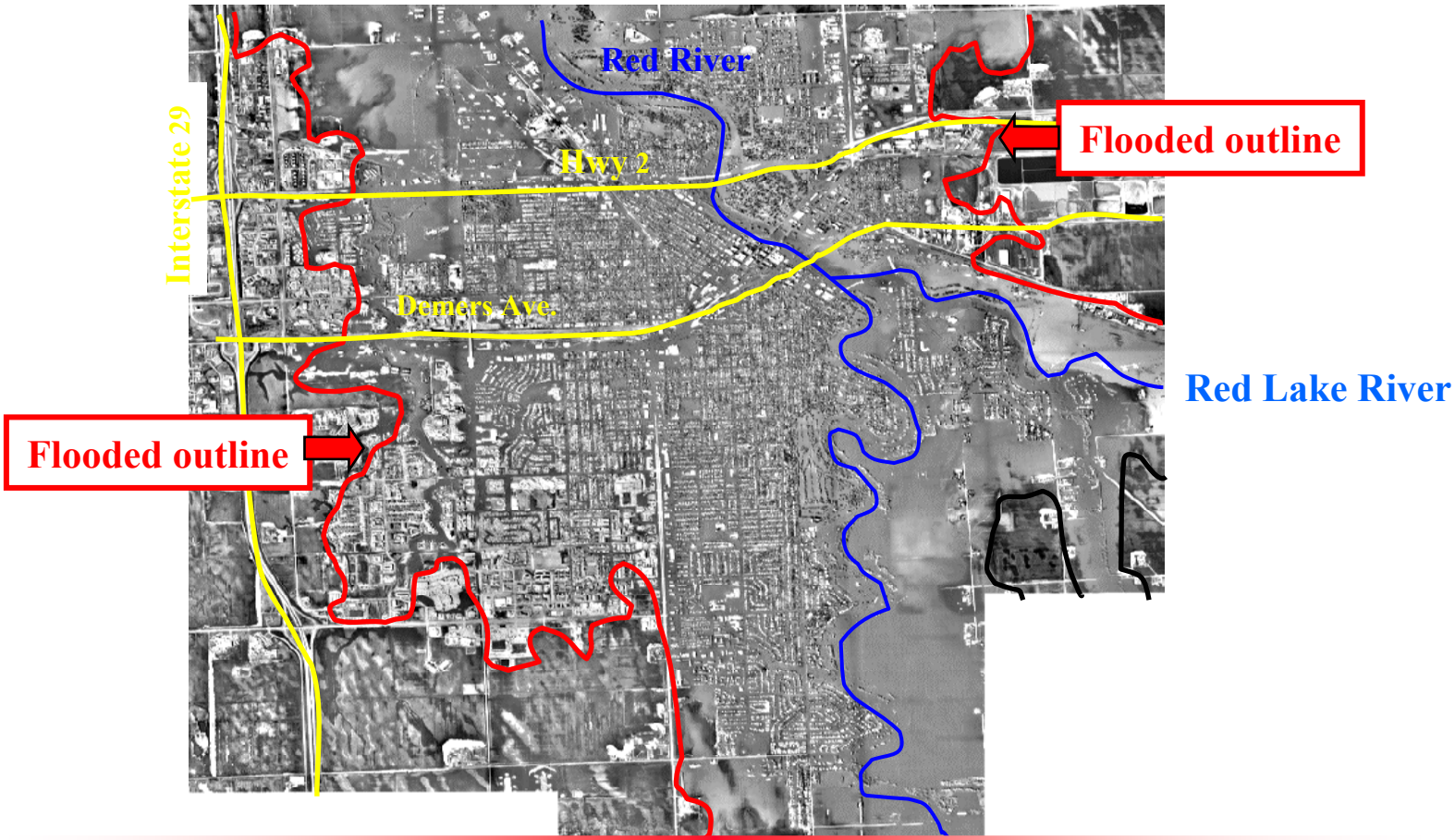
Project Location



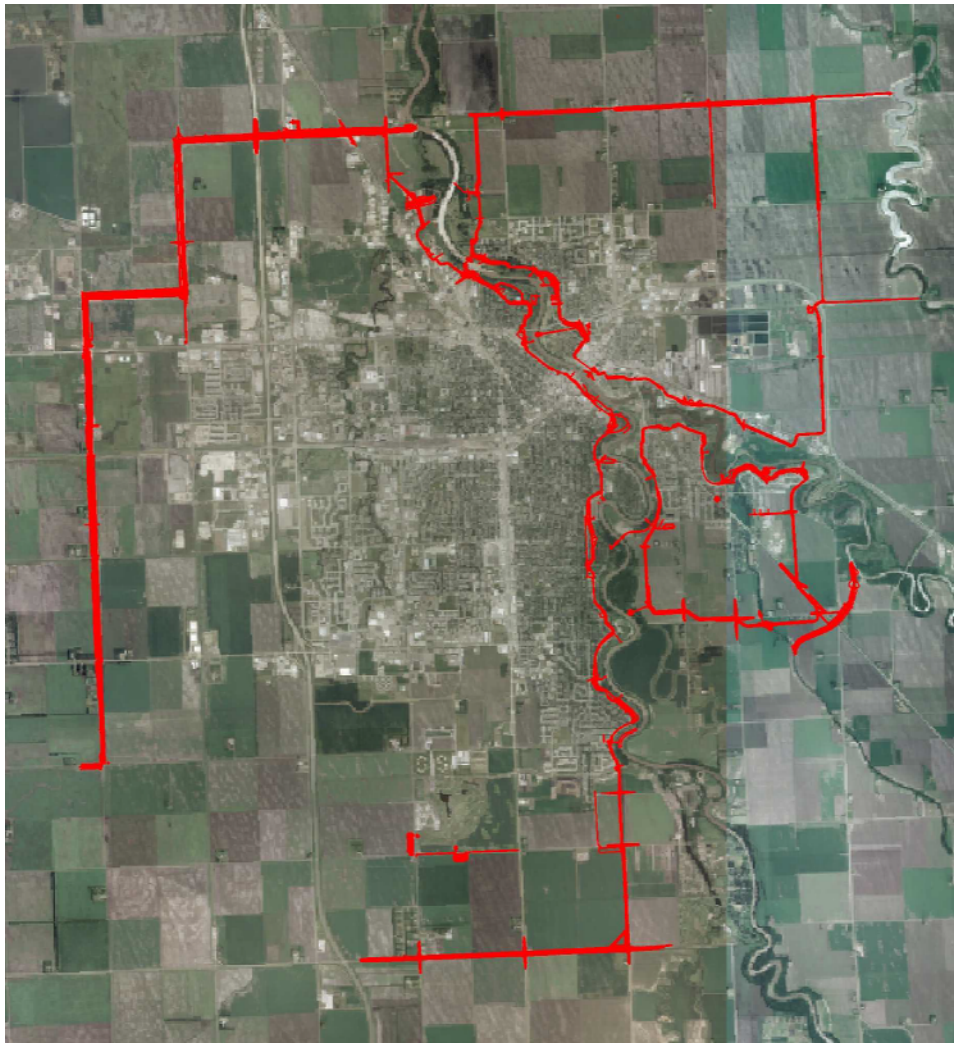
Project Background

- ✓ Both Cities have Long History of Significant Flooding
- ✓ Most Damaging was in April 1997 when Temporary Levees & Heroic Flood Fighting were not Successful
- ✓ General Reevaluation Report completed in Dec. 1998
- ✓ Plan consists of Levees, Floodwalls, Two Diversion Channels and Interior Flood Control Facilities
- ✓ Current Working Estimate is $410 Million
- ✓ Pre-Certification Package Submitted to FEMA in May 2005
- ✓ Substantially Complete in Dec. 2006 & Certified in Spring of 2007

East Grand Forks & Grand Forks Flood of 1997

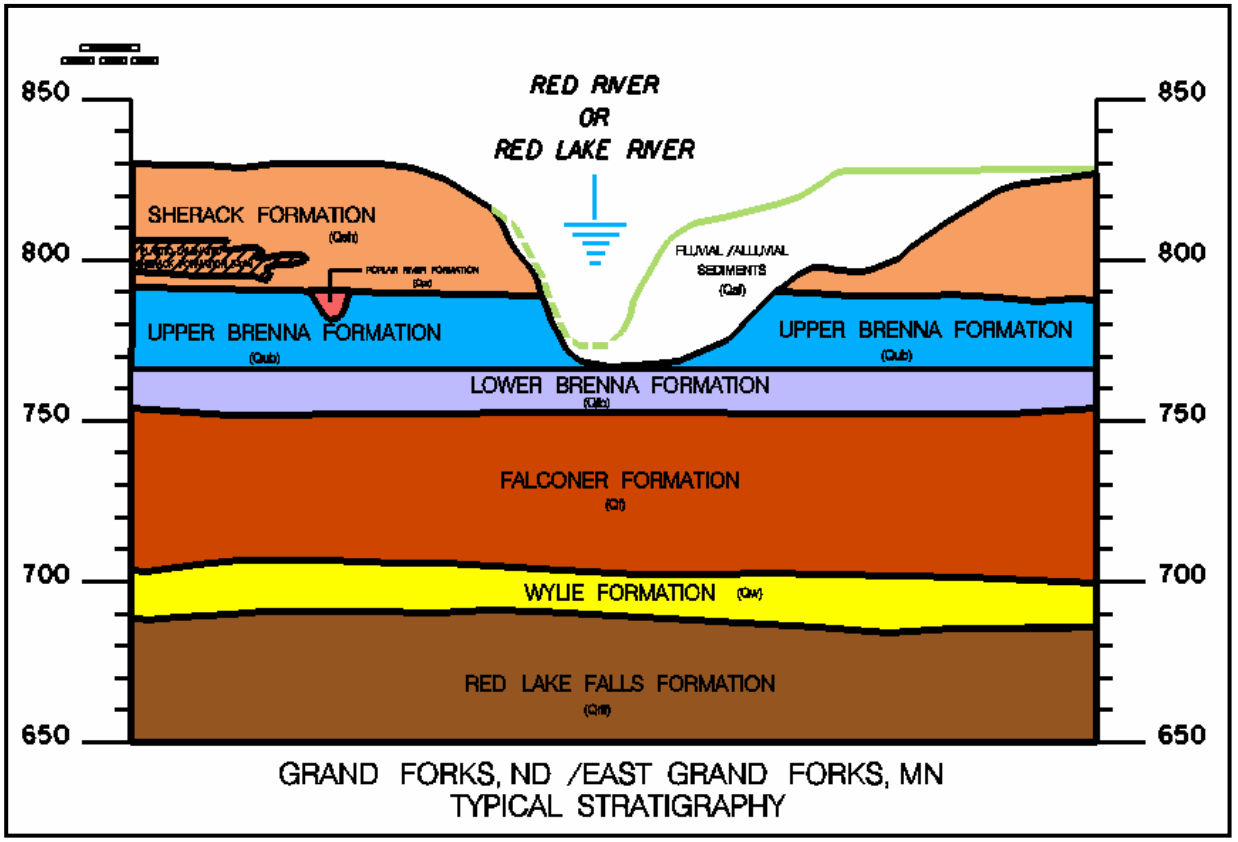


Project Overview



Top-of-Levee Design

Iterative Process based on Hydraulic Analysis & Geotechnical Slope Stability Analysis



Levee Overbuild for Settlement

Settlement Range:

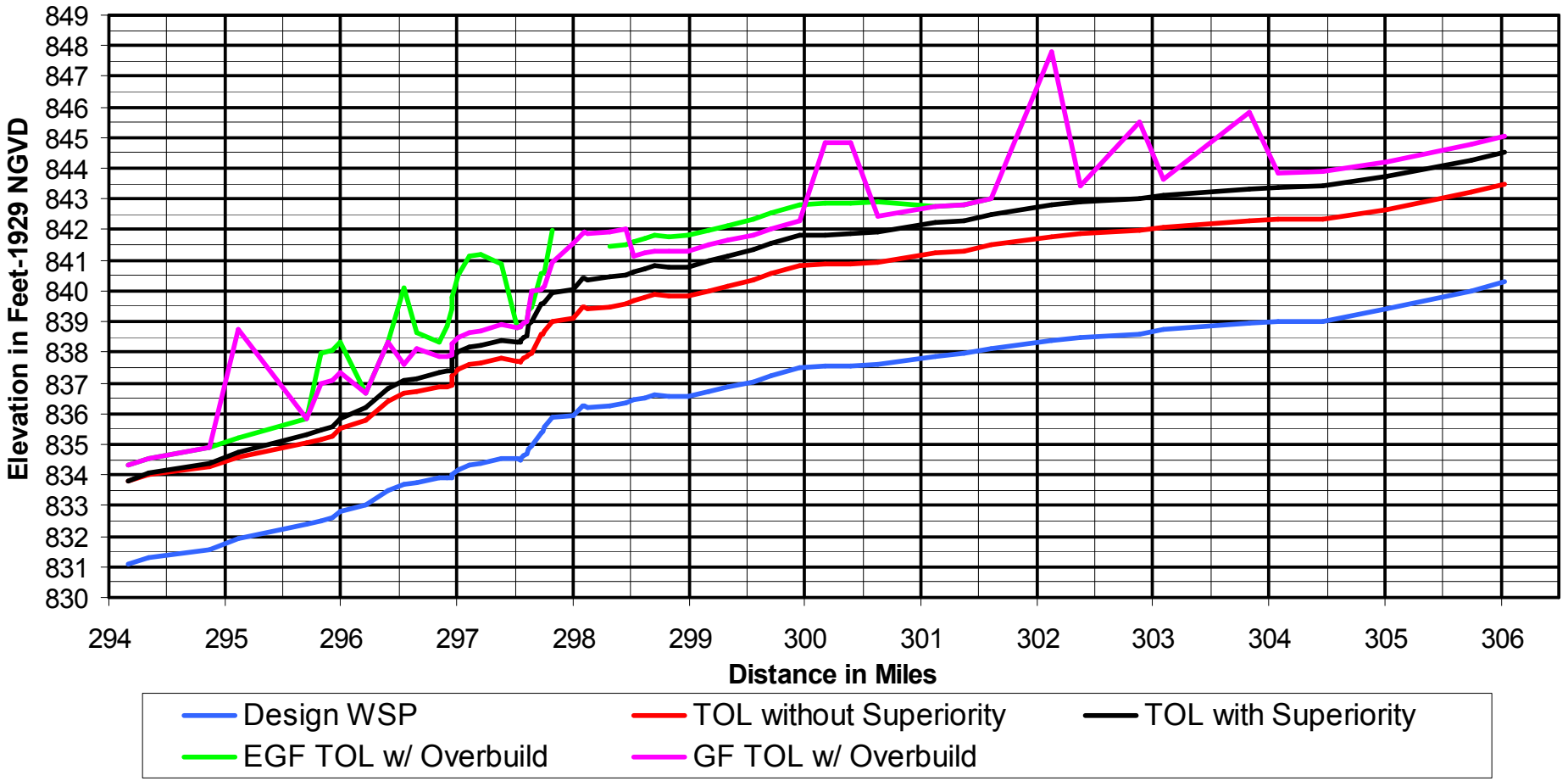
- ✓ Minimum of 6 inches for a 5’ to 10’ high levee
- ✓ Maximum of 60 inches for a 35’ high levee

Superiority Profile for Overtopping at the Least Critical Location was Complicated by the Settlement Overbuild

Gravity Outlet Profiles were Adjusted to Accommodate the Settlement

Top-of-Levee with Overbuild

EGF & GF Top-of-Levee with Overbuild



Interior Flood Control Analysis

Gravity Outlets:

- ✓ Economic Optimization Analysis performed for Several Outlets
- ✓ Results were Inconclusive
- ✓ Outlets were Sized for the 4% (25-Year) Event with No Surcharge & No Damages for the 1% (100-Year) Event

Pump Stations:

- ✓ All were Sized based on Economic Optimization Analysis
- ✓ Included Analysis of Alternatives to Reduce the Number of Pump Stations via Interceptor Sewers.

Pump Stations

- ✓ Standard Pump Sizes of 3,000; 6,000 and 15,000 gpm were Selected based on Results of IFC Analyses
- ✓ Standard Pump Station Configurations were Developed & used throughout the Project
- ✓ Generators were included in All Pump Stations & were Sized to Power 1 of 2 or 2 of 3 Pumps
- ✓ Pumps, Pump Controls & Generators were Purchased under a Supply Contract
- ✓ Generators were also Sized to Power an Adjacent Sanitary Lift Station in two locations

Pump Stations

East Grand Forks – 11 Pump Stations

- ✓ Includes retrofit of an existing Station
- ✓ Smallest Station Capacity is 6,000 gpm
- ✓ Largest Station Capacity is 18,000 gpm

Grand Forks – 12 Pump Stations

- ✓ Includes one Station with a Capacity of 116,000 gpm that does not use the standard pumps and station configuration
- ✓ Smallest Station Capacity is 6,000 gpm
- ✓ Largest Station Capacity using standard pumps sizes is 60,000 gpm

Pump Stations

Pump Stations

Pump Stations

Pump Stations

Construction Contracts

Plans & Specs - EGF & GF

- ✓ Old Railroad (Pedestrian) Bridge Removal – In-house
- ✓ Riverside Dam – In-house
- ✓ Pedestrian Bridges – Ayres Associates

Plans & Specs – East Grand Forks

- ✓ Phase 1 - Short, Elliot, Hendrickson, Inc.
- ✓ Phase 2 - Short, Elliot, Hendrickson, Inc.
- ✓ Phase 3 - In-house
- ✓ Phase 4 – In-house
- ✓ Heartsville Coulee Diversion - Short, Elliot, Hendrickson, Inc.

Plans & Specs – Grand Forks

- ✓ English Coulee Diversion – HDR, Inc.
- ✓ English Coulee Pump Station – Ayres Associates
- ✓ Phase 1 – Stanley Consultants
- ✓ Phase 2 – Stanley Consultants
- ✓ Phase 3 – Stanley Consultants
- ✓ Phase 4 – Stanley Consultants
- ✓ 55th Street Pump Station – In-house

EGF "Removable" Floodwall

City of EGF received an Economic Development Administration grant that was used for "Removable" Floodwall

Removable Floodwall is a proprietary system from "Flood Control America"

Designed and Constructed before Corps FCP started Construction (with some Corps Input)

Floodwall is 880' long including three full height road closures (two 80' long and one 60' long)

Floodwall begrudgingly accept by St. Paul District

Floodwall Portion has a 4' high Parapet Wall at about the 1% (100-Year) Flood Elevation

Modifications required to include in FCP include changing pedestals to a grade beam and extending the footing ~6' riverward

EGF "Removable" Floodwall

Parapet Wall with Intermediate Columns

EGF "Removable" Floodwall

Floodwall Portion with some Stop Logs Installed

EGF "Removable" Floodwall

Demers Avenue, 80' Wide, 14' High Closure

EGF "Removable" Floodwall

Flood Control America Stop Log

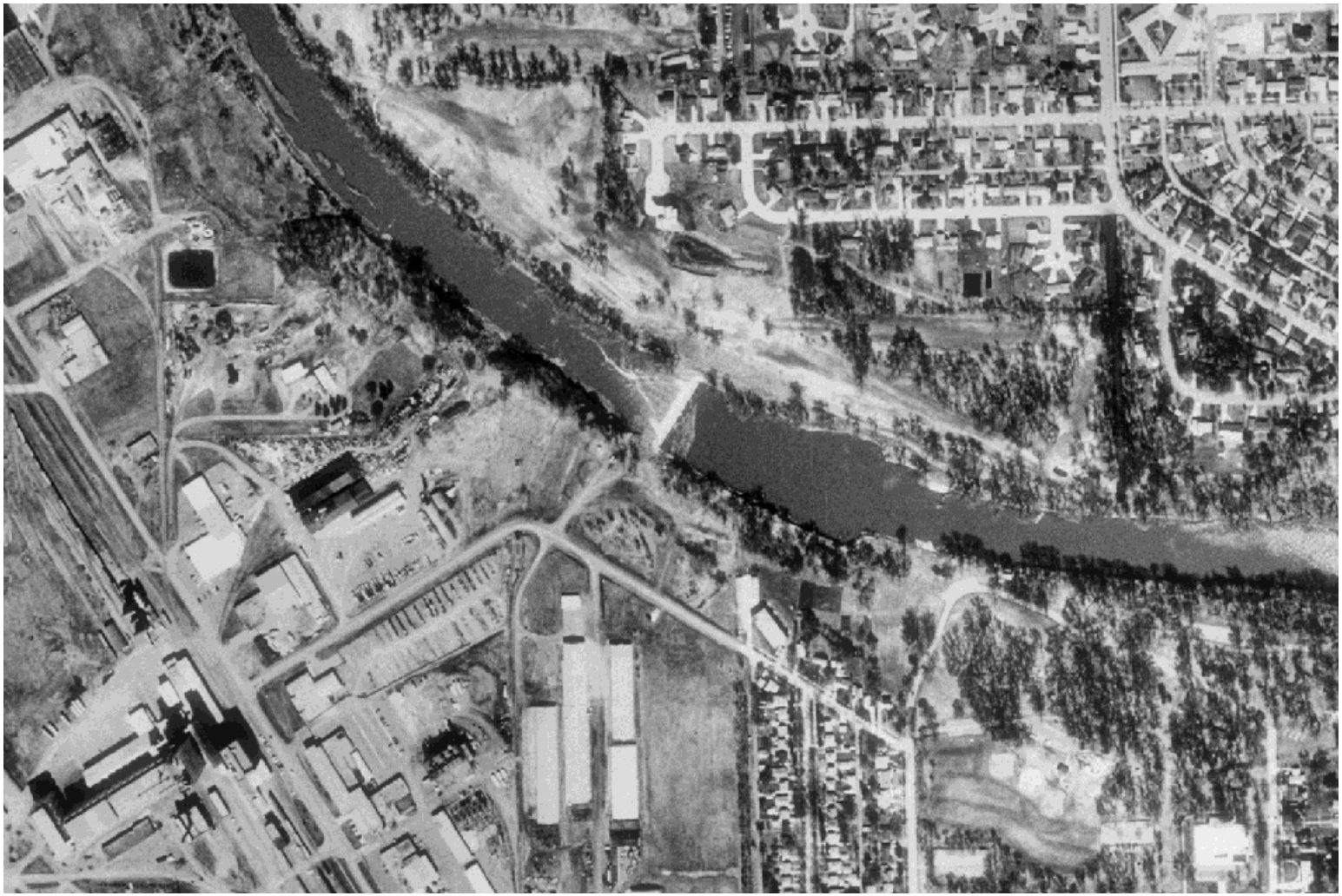
EGF "Removable" Floodwall

Footing Modifications to Include in FCP

EGF "Removable" Floodwall

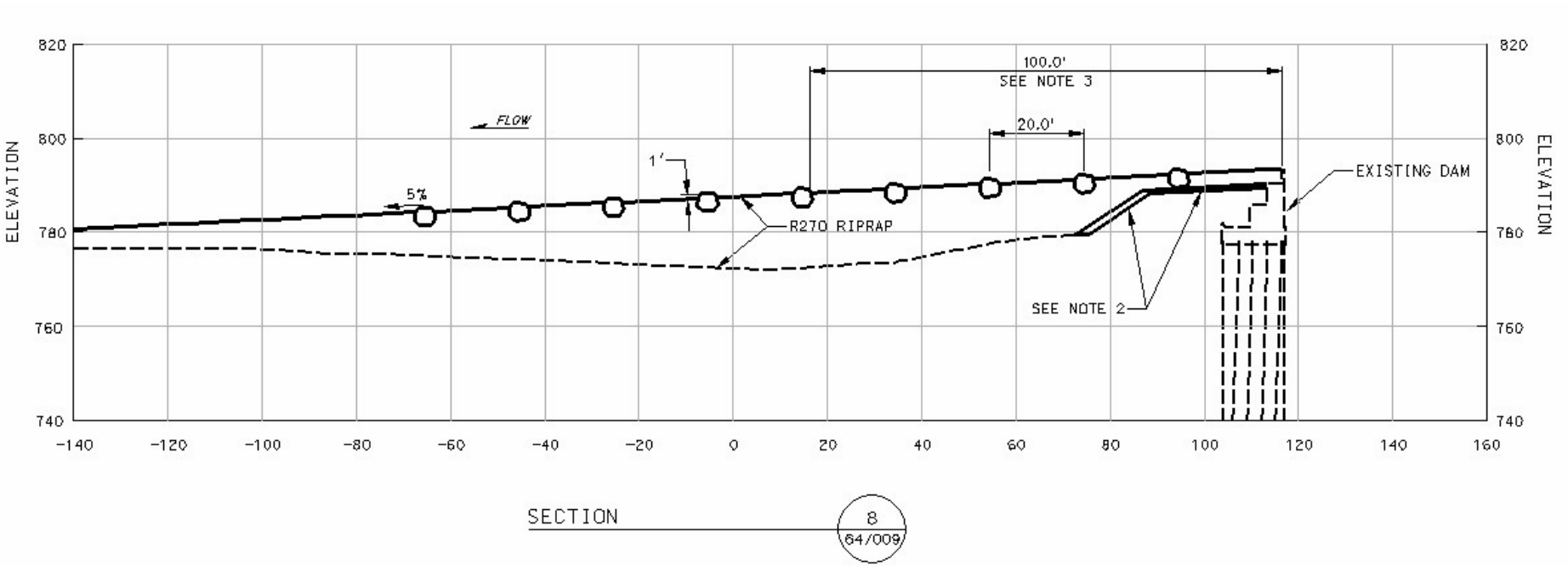
Pedestal Modifications to Include in FCP

Riverside Dam



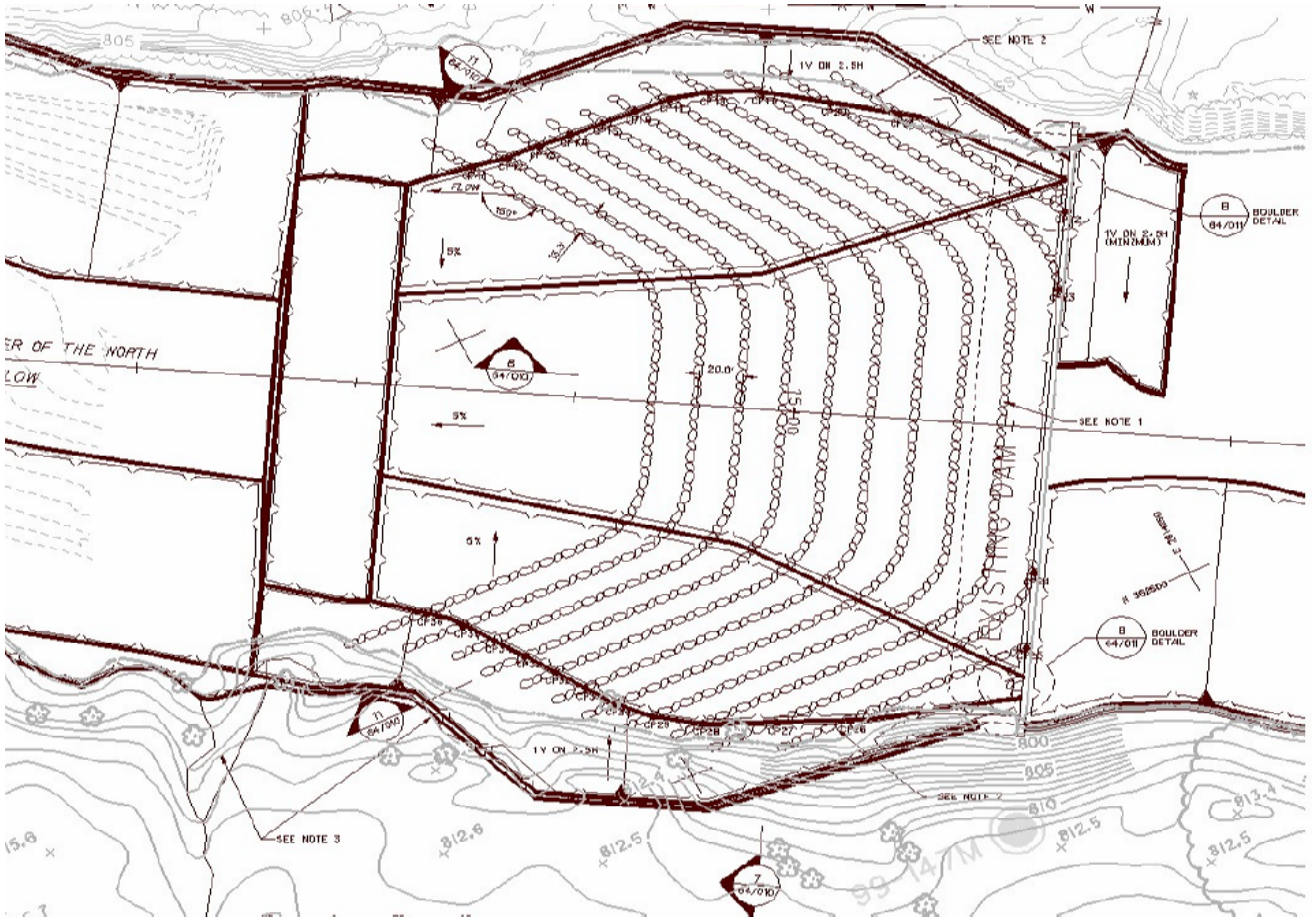
Riverside Dam

Riverside Dam



Section along Channel Centerline

Riverside Dam



Riverside Dam - Plan View of Rock Rapids Structure

Riverside Dam

Riverside Dam

Riverside Dam

Riverside Dam

Riverside Dam

Before

After

Railroad Closures

Three RR Closure Sills had to be completed in a single 24-hour track outage

24-hour outage included time for the RR to remove and replace the tracks

Contractor had 14 hours to excavate sites, drive sheetpile cutoffs, place rebar & forms, pour concrete, strip forms and backfill sites

Concrete mix included an accelerator additive, all test cylinders had strengths > 5,100 psi after 24 hours

Railroad Closures

Track & Tie Removal (by RR Crew)

Railroad Closures

Excavating Site

Railroad Closures

Driving Sheetpile Cutoff

Railroad Closures

Setting Rebar Mat

Railroad Closures

Pouring Concrete

Railroad Closures

Fit Test of Stoplog

Railroad Closures

Installing & Setting Ties & Tracks (by RR Crew)

Construction using GPS

- ✓ Subcontractor requested Corps' model files including the 3D models from Microstation InRoads
- ✓ Subcontractor loaded Microstation files into their software
- ✓ Computer in Bulldozer cab and GPS unit on each end of blade
- ✓ Monitor in cab can display either plan view or cross-section view
- ✓ In plan view, dozer is shown in respect to project centerline and footprint
- ✓ In cross-section view, dozer is shown in elevation in respect to design
- ✓ Cut or fill depths are indicated for each end of blade
- ✓ When cut or fill depths are within a few inches, dozer may be switched to automatic mode to grade to design elevations

Construction using GPS

GPS Units on Each End of Blade

Construction using GPS

GPS Base Station at the Subcontractor's Shop

Construction using GPS

Monitor in Cab showing Plan View

Construction using GPS

Monitor in Cab showing Cross-Section View

Construction using GPS

Monitor in Cab showing Coordinates, Existing & Design Elevations, and GPS Status

Ice Bridge

- ✓ Subcontractor approached Corps regarding using an Ice Bridge to haul material across the Red Lake River.
- ✓ Ice bridge shortened haul route from 5 miles to ½ mile.
- ✓ Eliminated hauling through residential neighborhoods & by two schools.
- ✓ Eliminated Wear & Tear on Roads.
- ✓ Residents not Irritated by Traffic on Roads.
- ✓ MN DNR contacted for Permit Requirements.
- ✓ CRREL contacted for Technical Support.
- ✓ 22” of Clear, Sound Ice needed for 30-ton Trucks.
- ✓ To increase ice depth, subcontractor plowed snow from the area then flooded it & let it freeze.

Ice Bridge

- ✓ Ice was 18” thick at beginning of January.
- ✓ Ice was 40” thick on January 28th.
- ✓ Operators wore personal floatation devices and crampons and kept their truck windows open.
- ✓ Operators limited to 20 mph over the Ice Bridge.
- ✓ In just under a month, Subcontractor hauled & stockpiled more than 300,000 CY of Impervious Fill.
- ✓ Hauling would have taken three months without the Ice Bridge.
- ✓ Subcontractor kept detailed ice, weather and haul records that CRREL will use in studies re: Ice Bridges.
- ✓ Ice Bridge was deemed a success by Everyone.

Ice Bridge

Comparison of Routes

Ice Bridge

Plowing Snow from the Site

Ice Bridge

Flooding the Site to Increase Ice Thickness

Ice Bridge

Loading Borrow

Ice Bridge

Truck Crossing Ice Bridge

Ice Bridge

Stockpiling Borrow

Construction Office & Design Team Issues

Shop Drawings not Submitted according to Schedule

Numerous Design Changes made without Coordinating with Designers

Changes made to Interior Flood Control Facilities required Contract Modifications to Correct

- ✓ Street grades raised
- ✓ Curb Cuts to Drop Inlets Eliminated
- ✓ Drop Inlet Elevations Raised
- ✓ Toe Ditches Modified

EGF & GF
Local Flood Damage Reduction Project

Questions?

Comments?