Assessment of Conceptual Nonstructural Alternative
Levee Setbacks along the Missouri River
(Lower L-575 / Upper L-550 and Lower L-550)

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Assessment Background

Historic Flooding along Missouri River
- long duration
- large discharges
- high stages
- high velocities
- levee breaches
- levee erosion
- excessive damages
- recurring damage locations

Conceptual Levee Setbacks
- alternative to repairs in-place
- risk based assessment
- flood risk considerations
  - reduced damages
  - sustainable
  - reliable
- enhanced environmental benefits
- reconnected floodplain
Levee System Authorization

Flood Control Act of 1944
Design discharges:
- 250,000 cfs at Omaha
- 295,000 cfs at Nebraska City

Freeboard: 2-feet
Minimum conveyance width: 3,000 feet

1952 Council Bluffs Levee Construction
# Levee System Constrictions

<table>
<thead>
<tr>
<th>Federal Levee System</th>
<th>Levee to Levee (feet)</th>
<th>Levee to Bluff (feet)</th>
<th>Width at Bridge (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-520</td>
<td></td>
<td>34,390</td>
<td></td>
</tr>
<tr>
<td>L-536</td>
<td></td>
<td>3,280</td>
<td></td>
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<tr>
<td>L-550</td>
<td>3,170</td>
<td>2,730</td>
<td>1,770</td>
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<tr>
<td>R-548</td>
<td>3,170</td>
<td></td>
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</tr>
<tr>
<td>R-562</td>
<td>3,780</td>
<td></td>
<td></td>
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<tr>
<td>L-575</td>
<td>3,780</td>
<td>3,140</td>
<td>1,090</td>
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<tr>
<td>R-573</td>
<td>4,960</td>
<td></td>
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<tr>
<td>L-594</td>
<td>4,090</td>
<td>2,780</td>
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<tr>
<td>Lake Waconda</td>
<td>4,091</td>
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<tr>
<td>L-601</td>
<td></td>
<td>3,010</td>
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<tr>
<td>L-611-614</td>
<td>2,910</td>
<td>2,390</td>
<td>1,260</td>
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<tr>
<td>R-613</td>
<td>2,950</td>
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<tr>
<td>R-616</td>
<td>2,910</td>
<td></td>
<td>2,500</td>
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<tr>
<td>L-624</td>
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<td>10,510</td>
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<td>L-627</td>
<td>2,760</td>
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<td>1,180</td>
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<tr>
<td>Omaha</td>
<td>3,000</td>
<td>2,890</td>
<td>1,180</td>
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</tbody>
</table>

Significant Pinch Points
Levee Setback Fundamentals

Levee Setbacks are a localized realignment using risk based levee design.

Levee Setbacks are not the complete removal of levee systems or the complete realignment of levee systems.
Levee Setback Fundamentals
(potential benefits associated with levee setback)

- Reduced flood stages
- Reduced flood velocities
- Potentially more favorable foundation soils
- Reduced O&M RRR
- Reconnected historic floodplain
Levee Setback Site Selection Process

- Hydraulic (conveyance/velocities/scour/deposition)
- Geotechnical (soils/seepage/slopes)
- Habitat (aerial photos/wetlands)
- Critical Facilities (live risk/economics)
Levee Setback Details for Lower L-550

Lower L-550 (Aspinwall Bend)
3.5 Miles of Levee Setback replacing
8.6 Miles of Existing Levee
Stage Reductions of up to 4feet
Hydraulic Constriction at RM 525 - 529
Benefits to: L-550, R-548, Cooper Nuclear
Upper L-550 (Nishnabotna Confluence)
7.3 Miles of Levee Setback replacing
8.6 Miles of Existing Levee
Stage Reductions of up to 2.7 feet
Hydraulic Constriction at RM 541 – 544
Historic Breach Grouping from RM 537-540
Frequent Overtopping at RM 541
Benefits to: L-550, L-575, R-562
Levee Setback Details for Lower L-575

Lower L-575 (Nish Confluence/Hamburg)
5.9 Miles of Levee Setback replacing
7.9 Miles of Existing Levee
Stage Reductions of up to 3 feet
Hydraulic Constriction RM 544-550
Benefits to: R-562, L-575, R-573, Nebraska City Coal Plant
Potential Environmental Attributes  L-550/L-575

11.75 square miles of new floodplain connectivity

Improved inundation depth and duration frequency

Positive habitat potential

Potential to enhance habitat thru use of levee setback borrow areas

Data indicate that on low elevation areas along the Missouri River, adult and juvenile pallid sturgeon have been found to utilize submerged floodplains for feeding (Integrated Science, February 2012)
### BCR Summary for Conceptual Levee Setback Alternatives

<table>
<thead>
<tr>
<th></th>
<th>Fix In-Place Alternative (from PIRs)</th>
<th>Setback Alternative with Original Level of Protection</th>
<th>Setback Alternative with Original Levee Height</th>
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</thead>
<tbody>
<tr>
<td><strong>L-550 Level of Protection</strong></td>
<td>20 years</td>
<td>20 years</td>
<td>28 years</td>
</tr>
<tr>
<td><strong>L-575 Level of Protection</strong></td>
<td>30 years</td>
<td>30 years</td>
<td>30 yrs upper L-575 56 yrs lower L575</td>
</tr>
<tr>
<td><strong>System Protected Area</strong></td>
<td>72.9 sq miles</td>
<td>64.6 sq miles</td>
<td>64.6 sq miles</td>
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</table>

**Traditional BCR computations:**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Total Cost</td>
<td>$166.8M</td>
<td>$193.8M</td>
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<tr>
<td>Annual Cost</td>
<td>$10.7M</td>
<td>$12.7M</td>
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<tr>
<td>Annual Benefit</td>
<td>$33.3M</td>
<td>$32.1M</td>
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<tr>
<td>BCR</td>
<td>3.11</td>
<td>2.52</td>
</tr>
</tbody>
</table>

**BCR computations including R,R&R benefit:**

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</thead>
<tbody>
<tr>
<td>Annual Cost</td>
<td>$10.7M</td>
<td>$12.7M</td>
</tr>
<tr>
<td>Annual Benefit (including R,R&amp;R)</td>
<td>$33.3M</td>
<td>$32.5M</td>
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<tr>
<td>Annual R,R&amp;R Cost-Savings</td>
<td>$0.0M</td>
<td>$0.4M</td>
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<tr>
<td>BCR</td>
<td>3.11</td>
<td>2.55</td>
</tr>
</tbody>
</table>

**Other Benefits Associated with Setback Alternatives:**

- Critical Facilities – $2.4M Cooper Nuclear, $4.4M Neb City Coal, Transportation
- System Benefits – Increased Level of Protection on adjacent systems
- Reduced O&M R&R on adjacent systems
- Less Frequency of Emergency Operations and flood-related activities
- 6,471 acres of potential habitat

Levee setbacks would be a more expensive construction effort than repair in-place.

All levee setback options result in a positive benefit-cost ratio and would be worth consideration of federal investment.

Reduced RR&R costs increases BCR.
Constraints of taking Concepts to Reality

Time and Costs
- Construction costs are likely higher than repairing levees
- Development of setback plan thru construction takes longer than repairs

Authorities
- The PL 84-99 program relies on sponsor for real estate
- Levee repairs generally require little or no real estate

Benefit to Cost Quantification
- Current methodology inhibits innovation
- Quantify O&M RRR, habitat, adjacent Systems, critical facilities
- Frequency of damages to levee system (recurring damages)

Societal Concerns
- Unfamiliar processes
- “Not on my Land” initial responses
L575 Levee Setback Final Layout
L575 Levee Setback Construction Completed in 2013
Goals/Issues to Address
Missouri River erosion in Upper Hamburg Bend Chute, which encroached on the toe of the Federal levee
Reconstruction and protection of the levee toe required

RSM Integrated Solution
To prevent further damage to levee, a rock revetment was added at the failure point
40,000 tons of riprap placed to create fill area, dredge backfill. Also dredge to create seepage berm
Initial dredging from point bar, additional dredging done to create backwater for shallow water habitat

BLUF: Dredging of backwater for shallow water habitat provides fill for repair at less cost as other sources while supporting habitat creation for the MRRP
• Hamburg Bend Chute Levee Repair
Questions / Comments