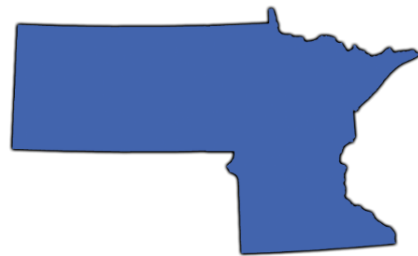


# Component Analysis

Presentation by:  
Technical Advisory Group

Presentation to:  
Fargo-Moorhead Area Flood Diversion Task Force

November 29, 2017



# Technical Advisory Group (TAG)

- Held two public meetings on Nov. 14 & Nov. 28
  - Meetings were well attended by Task Force members
- Defined criteria to evaluate alternatives and components
- Screened alternatives and components for further evaluation
- All information shown is for the 1-percent annual chance (100-year flood event)

# **TAG Key Criteria (not in particular order)**

- A. Satisfy Task Force Charter
- B. Meet Laws and Ordinances
- C. Minimize Residual Risk
- D. Reduce Floodplain Impacts
- E. Reduce Environmental Effects
- F. Limit Impacts to Structures
- G. Resilience/Robustness of Design
- H. Cost and Engineering Feasibility
- I. Upstream and Downstream Impacts
- J. Impacts at the U.S./Canadian Border

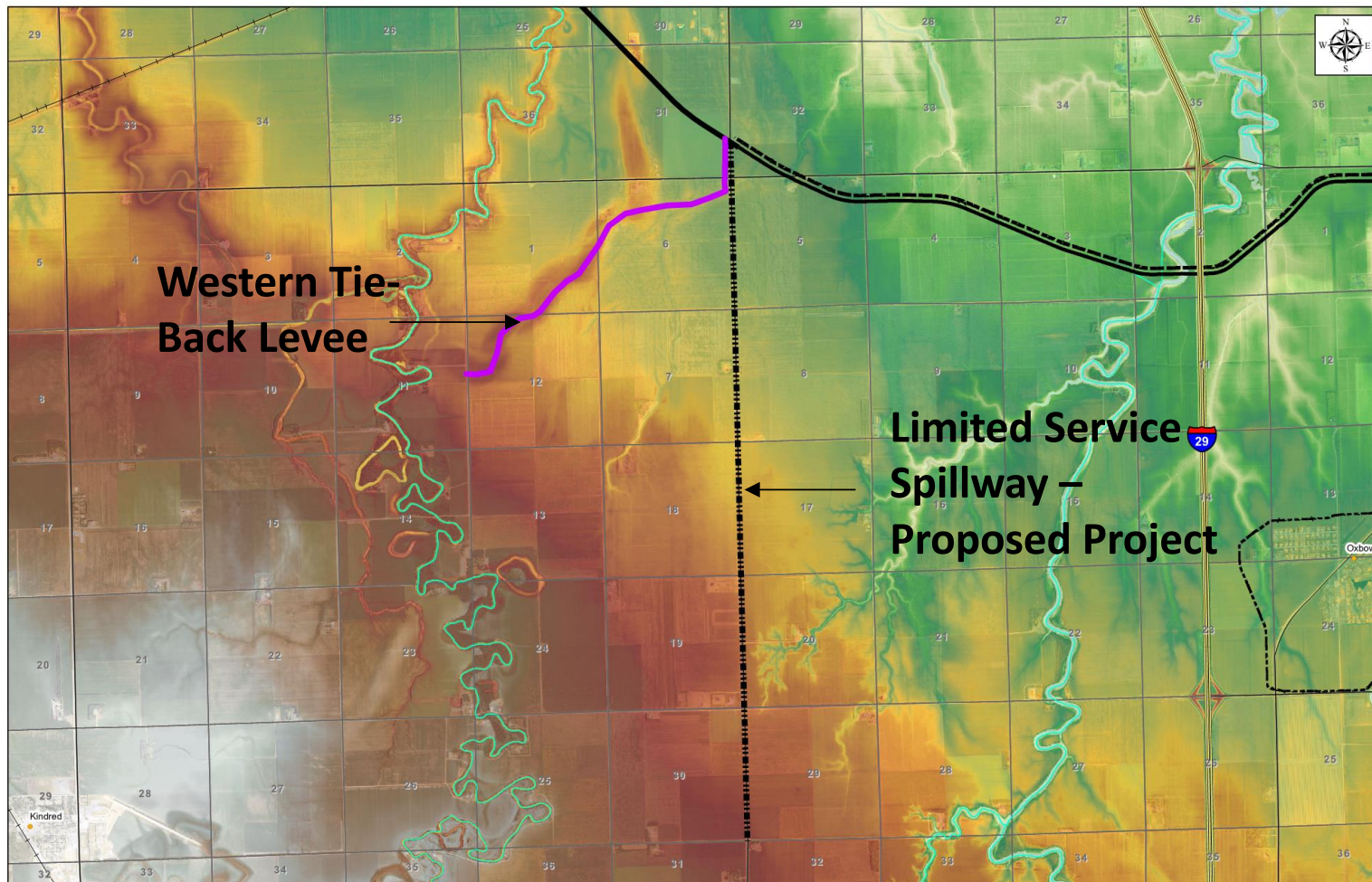
# Components

1. Additional Flows Through Town
  - a) RS 35 feet
  - b) RS 37 feet
  - c) RS 38 feet
  - d) RS 39 feet
2. Levees Only
3. Change Location of Dam
  - a) North of Wild Rice River (NWRR)
  - b) Northern Alignment Alternative
  - c) Modified Storage Area 1
4. Northern Storage Option
5. Increased Downstream Impacts (6 inches)
6. Wild Rice River Only Diversion



# Western Tie Back Levee as a Component

- Included as part of Alternatives 1, 3, 4, and 5
- Alternatives 2 and 6 do not include a WTBL



# Consideration of Distributed Storage

- Basin-wide retention efforts can increase the overall level of flood protection for communities
- Distributed storage can be a component for 100-year protection for Fargo-Moorhead only if projects are completed and operational
- Support for retention should continue as a long-term strategy to increase protection above the 100-year

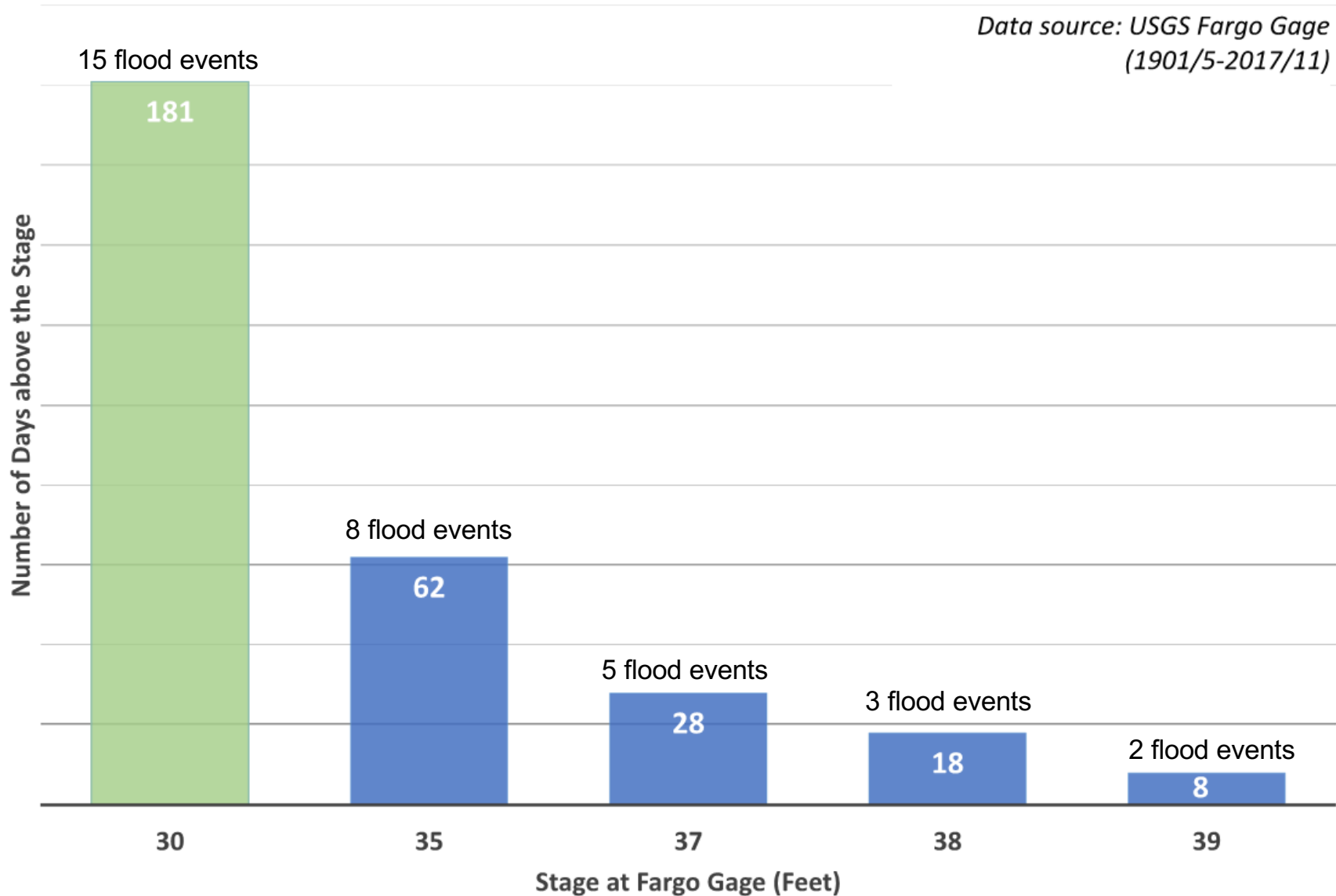
# Components

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# Components #1a-1d: Additional Flows Through Town

- Additional flows through town reduces the frequency of staging area operation and size of the inundation area
- Additional flows through town requires additional In Town measures be implemented
- Original project (2011) had River Stage (RS) 30' through town in a 100-year flood
- Proposed project design (2013) has RS 35' through town in a 100-year flood
- Additional analysis considered up to RS 39'

# Components #1a-1d: Additional Flows Through Town Histogram and Frequency Curve



# Component #1a-1d: Additional Flows Through Town

	<b>Proposed 35' (baseline)</b>	<b>35' w/WTBL (1a)</b>	<b>36'</b>	<b>37' (1b)</b>	<b>38' (1c)</b>	<b>39' (1d)</b>
Return Frequency /Discharge (cfs)	13 year / 16,400 cfs	13 year / 16,400 cfs	N/A	21 year / 20,200 cfs	28 year / 22,200 cfs	39 year / 24,500 cfs
Staging Area Elevation at Dam	921.66	921.54	N/A	920.87	920.64	920.51
Total Upstream Impacted Area (acres)	35,456	36,364	N/A	33,208	32,136	31,519
Newly Impacted Upstream Area (acres)	18,720	19,463	N/A	16,875	16,015	15,493
Residential/Total Structures Impacted Upstream	69 / 636	70 / 638	N/A	65 / 578	60 / 548	59 / 533
Residential/Total Unprotected Structures within FDRA	29 / 155	29 / 55	N/A	101 / 374	156 / 534	257 / 763
Residual Floodplain Through the Protected Area (acres)	21,051	21,068	N/A	26,736	31,209	35,239
Cost (Construction and Acquisitions – FM Only)	Ongoing	Ongoing	N/A	\$150M/130 Homes	\$330M/208 Homes	\$400M/326 Homes

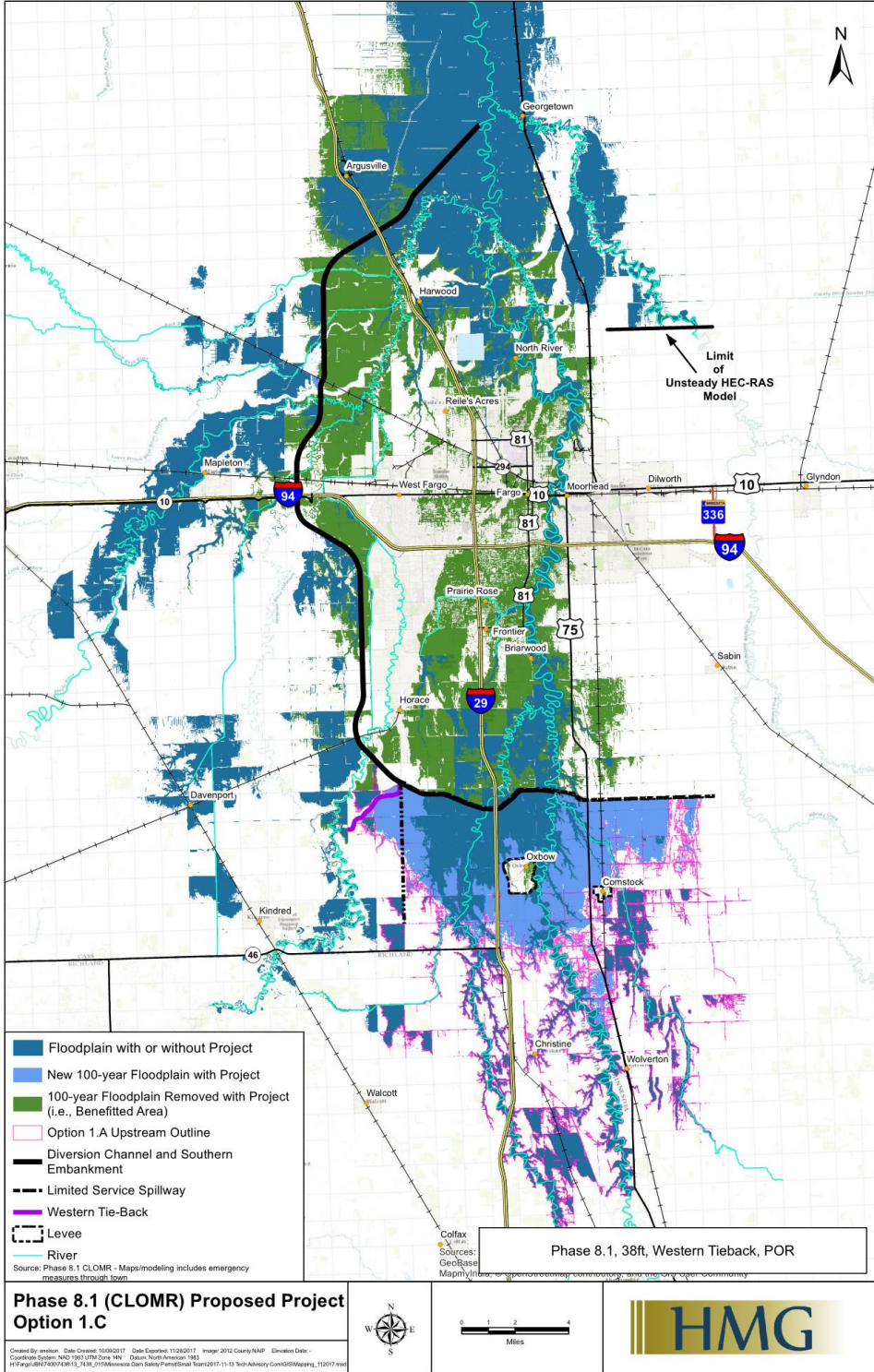








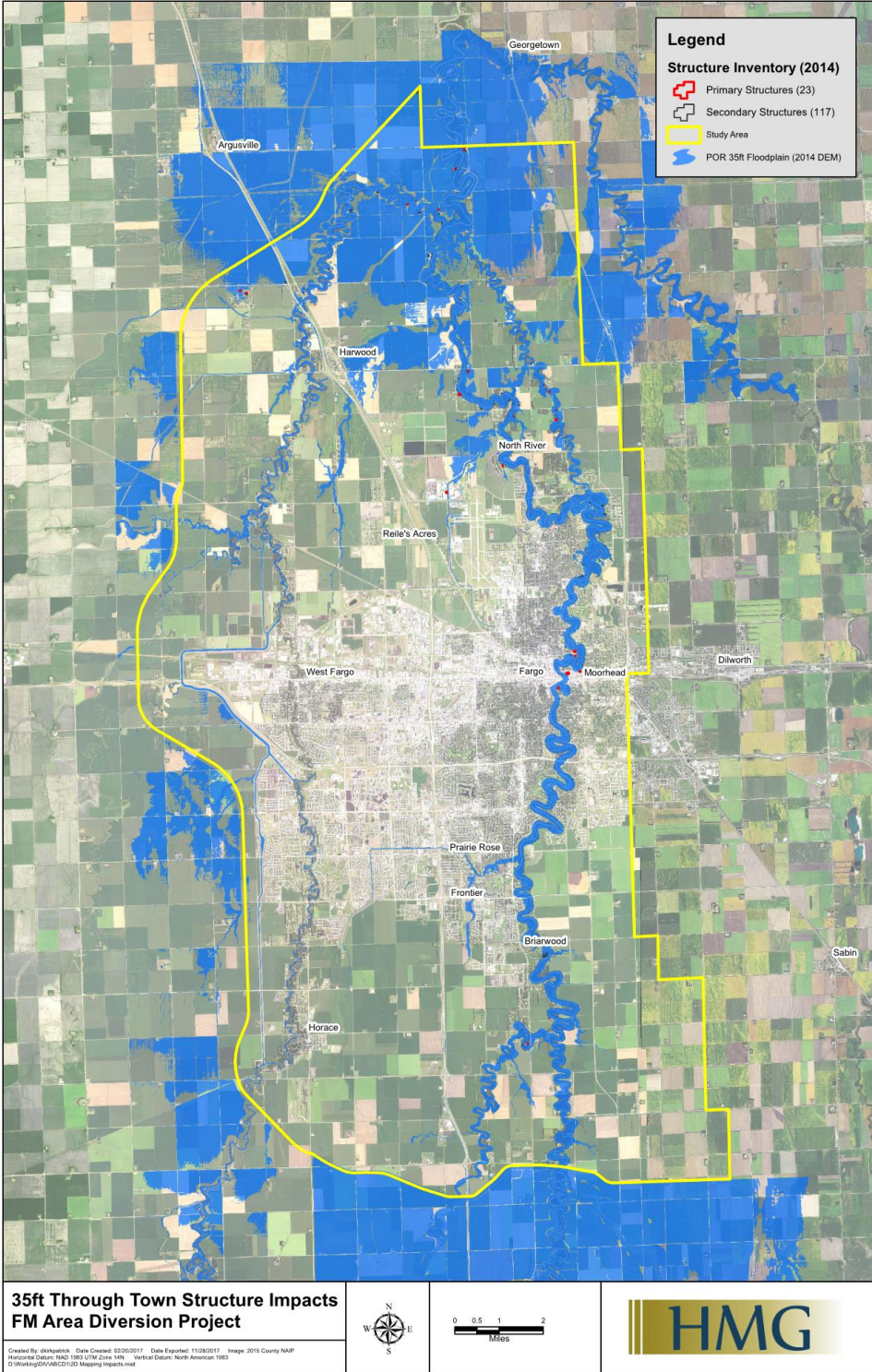
# Component #1c (RS 38')





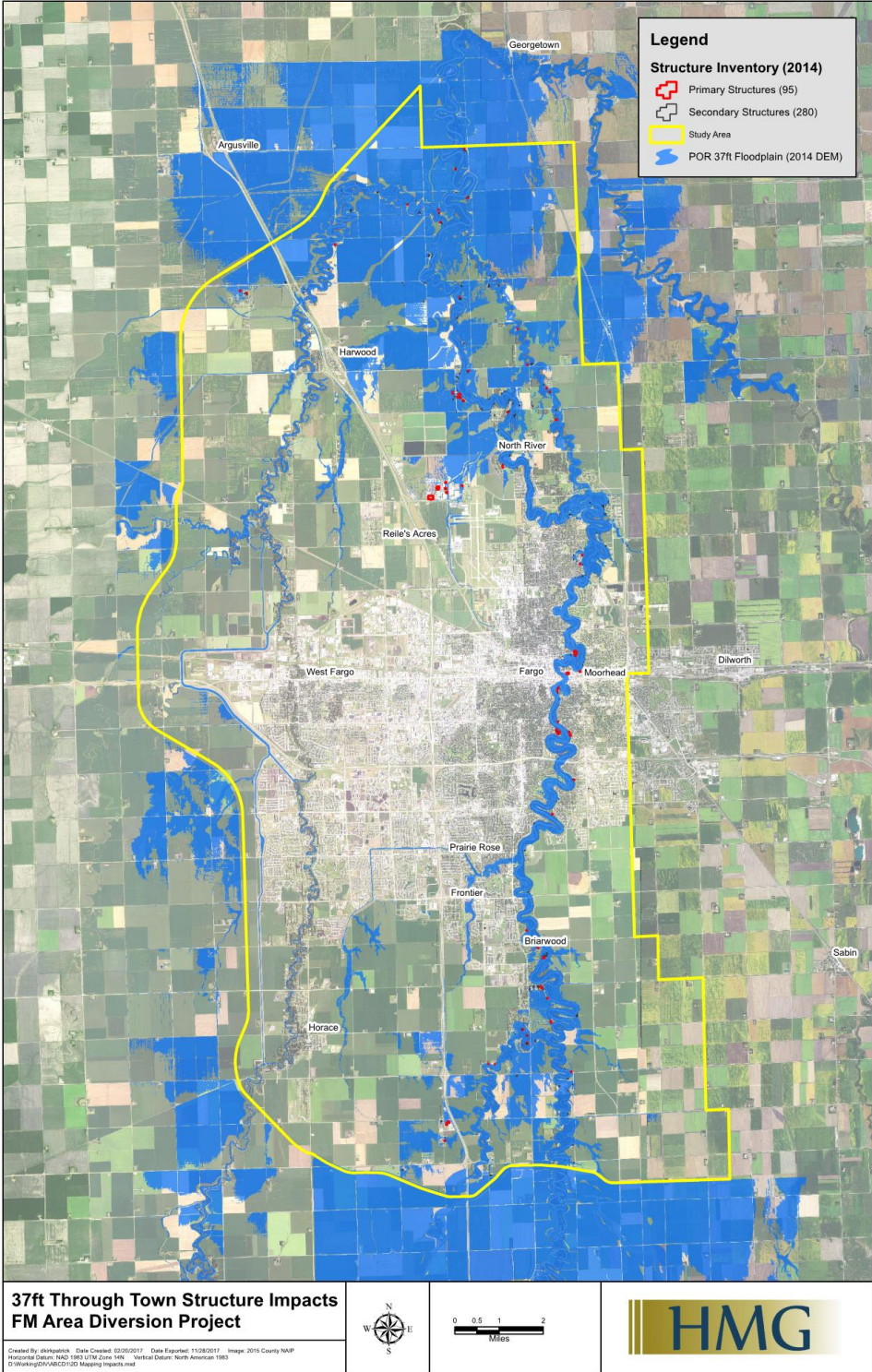


# Component #1a (RS 35')



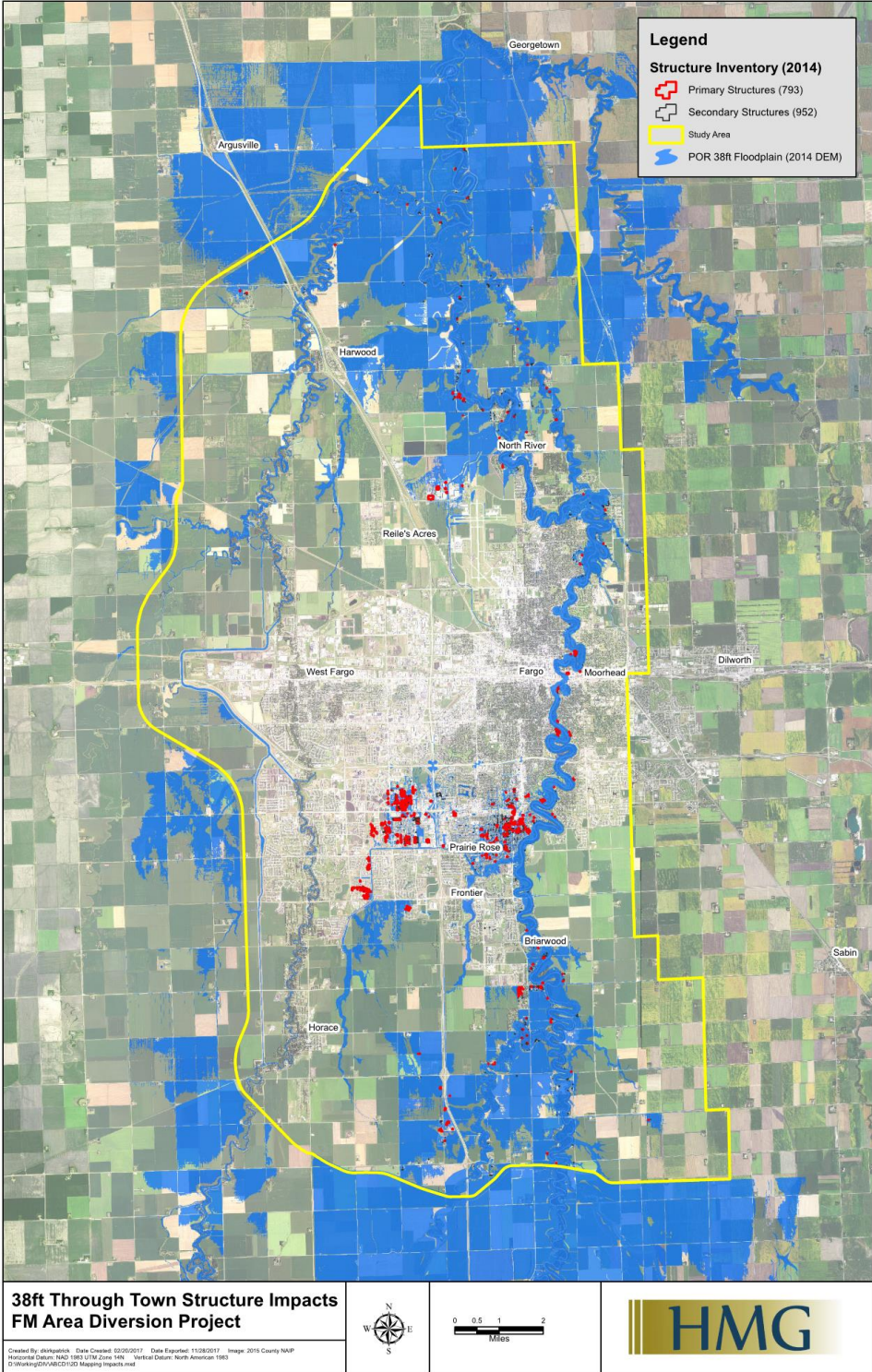


# Component #1b (RS 37')



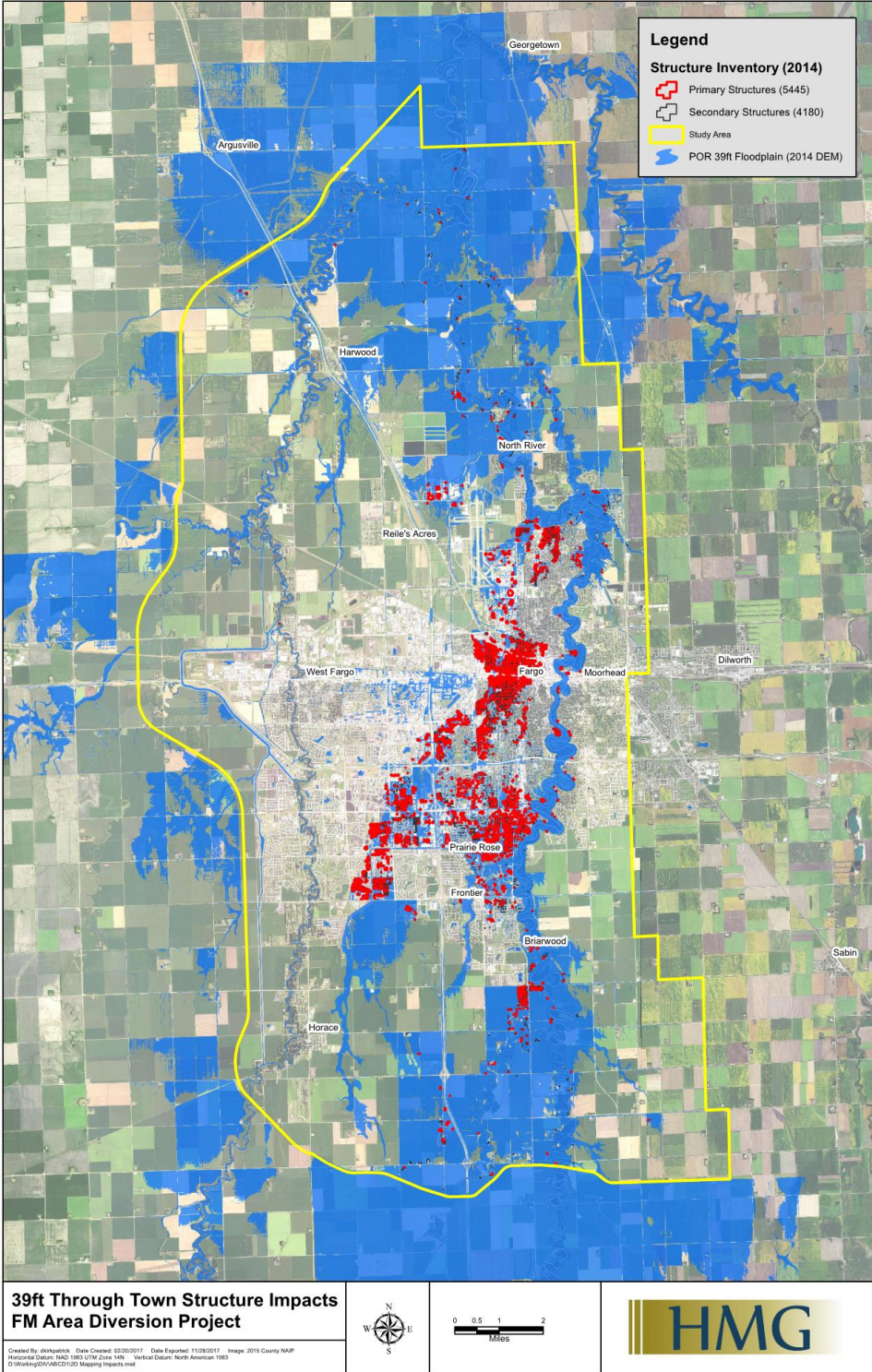


# Component #1c (RS 38')





# Component #1d (RS 39')



# Component #2: Levees Only

- Based on a preliminary analysis, a ring levee could achieve 100-year accredited (FEMA) protection
- Would utilize existing Horace to West Fargo and West Fargo Diversion projects on the west side
- Limited capacity through the Red River induces higher water levels upstream that requires mitigation and property rights
- Causes an induced upstream stage of 1.5 (on Red River) to 4 feet (near Horace) during the 100-year flood and 5.5 to 6.5 feet during the 500-year flood
- Levee/floodwall system would overtop at some point between the 100-year and 500-year flood

## Component #2: Levees Only

- 66.5 miles of levee/floodwall required (ND = 44 miles; MN = 22.5 miles)
- 64 Stormwater Lift Stations required (ND=38; MN=26)
- Grade raise required for I-29 and potential grade raises for U.S. Highway 75 and BNSF Railway through area with induced stage
- Grade Raises required through F-M for I-94, Main Avenue, and BNSF
- Grade Raise required for I-29 North of FM for levee crossing
- Existing WF and HWF Diversions may need to be modified or may offer a lesser level of protection

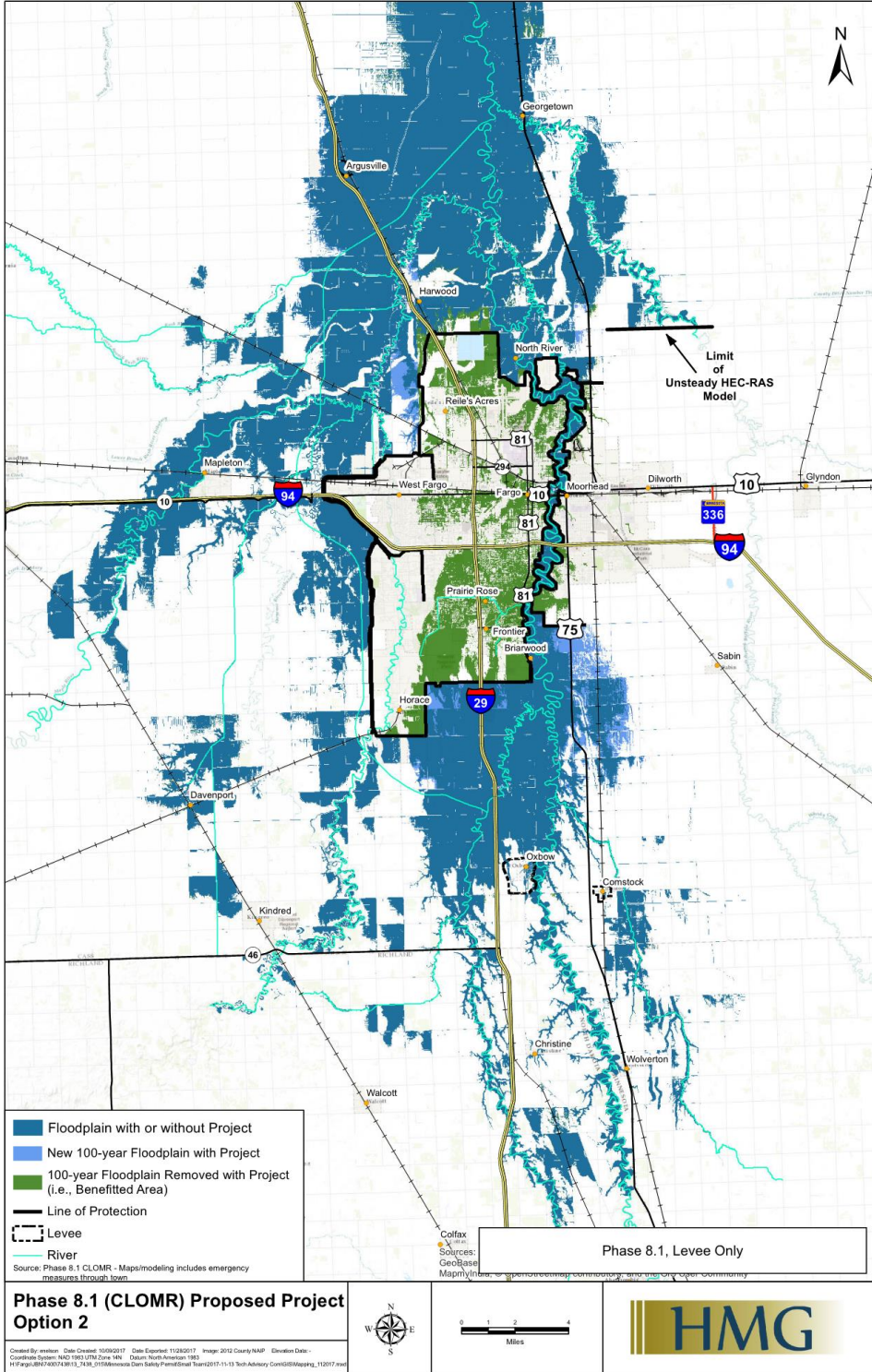


# Component #2: Levees Only

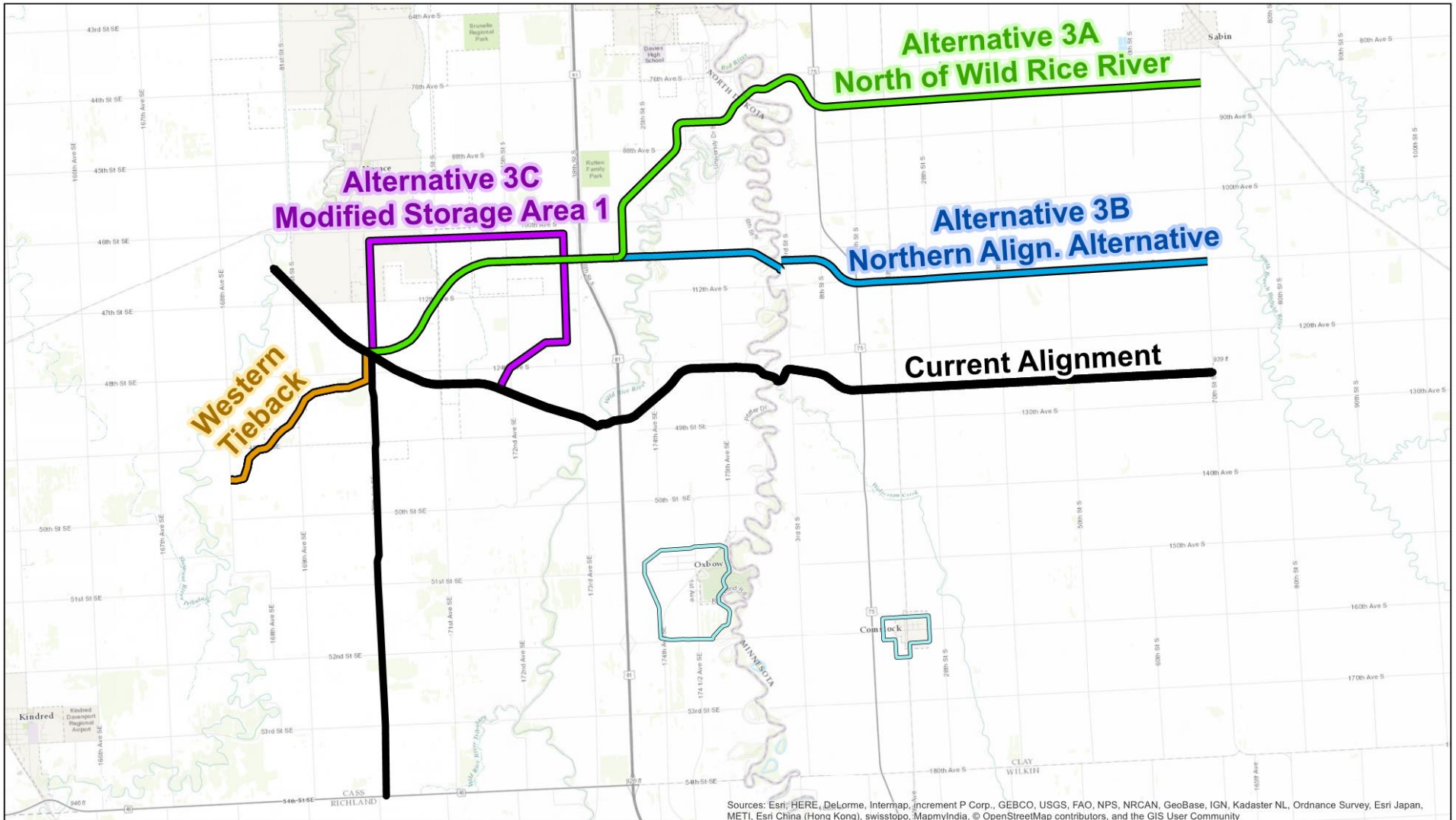
	Proposed 35' (baseline)	Levee Only Alternative (2)
Protected Area Floodplain Removed(acres)	58,137	16,197
Total Upstream Impacted Area (acres)	35,456	22,348
Newly Impacted Upstream Area (acres)	18,720	3,776
Residential/Total Structures Impacted Upstream	69 / 636	259 / 796
Unprotected Structures (Residential/Total) within the FDRA for Proposed Project	23/140	1,071 / 2,686
Residential and Commercial Structure Acquisitions for Construction (ND/MN)	14/3	831 / 673
Cost	\$2.2 Billion	*\$1.1 Billion (ND) / \$800 Million (MN)

***\*\$1.9 Billion total excluding upstream mitigation/property rights that may be required.***

# Component #2 – Levees Only



# Components #3a-3c: Dam Alignments (RS 35')



Sources: Esri; HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

## TASK FORCE ALTERNATIVES MAP FM AREA DIVERSION PROJECT

Created By: HRV Date Created: 11/27/17 Date Saved: 11/28/17 Date Exported: 11/28/17  
 Plotted By: Kyle Wolk Parcel Date: N/A Aerial Image: N/A Elevation Data: N/A  
 Reference Datum: NAD 1983 StatePlane North Dakota South FIPS 3302 Feet Vertical Datum: NAVD83  
 T:\Projects\17700\17739\ACWP\Task\_Force\_Alternatives\_Map\_Labels\_2017\_11\_27.mxd



### Legend

- Current Diversion Alignment
- Western Tieback
- Levee
- Alternative 3A – North of Wild Rice River
- Alternative 3B – Northern Alignment Alternative
- Alternative 3C – Modified Storage Area 1



# Component #3a-3c: Dam Alignments (RS 35')

	Proposed (baseline)	Proposed WTBL	3a (NWRR)	3b (NAA)	3c (SA1)
Newly Impacted Upstream Area –ND/MN (acres)	7,088 / 11,631	8,194 / 11,270	2,336 / 10,410	4,860 / 9,429	6,956 / 9,001
Newly Impacted Upstream Area –Richland/Wilkin (acres)	1,124 / 1,391	1,053 / 1,283	74 / 29	270 / 118	613 / 640
Area Protected (acres)	58,137	58,119	48,359	52,031	54,972
Residential Structures Impacted - Richland	3	3	0	1	2
Residential Structures Impacted - Wilkin	5	5	0	2	2
Residential Structures Impacted - Cass	41	42	151	90	49
Residential Structures Impacted - Clay	20	20	45	24	17

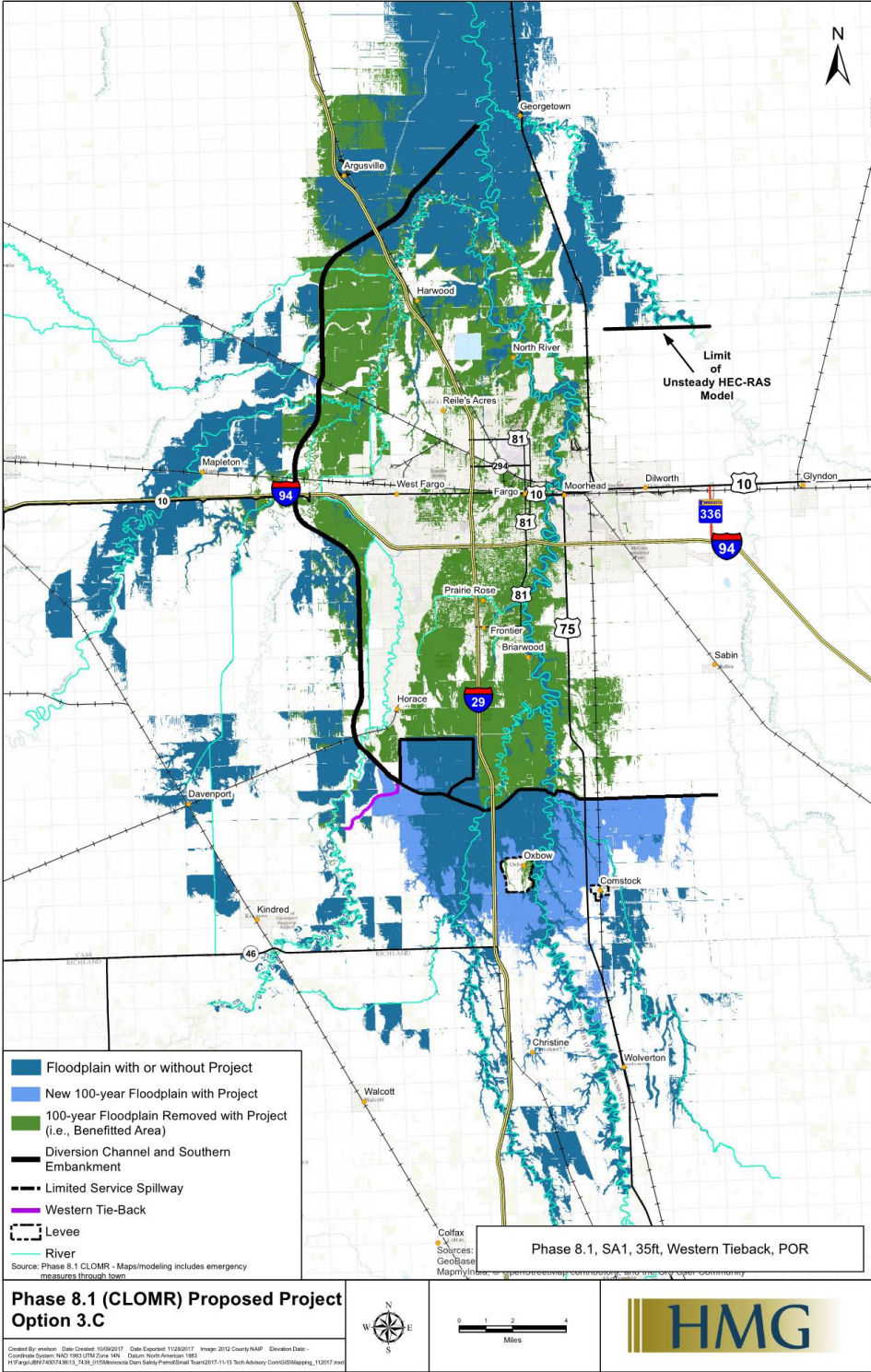






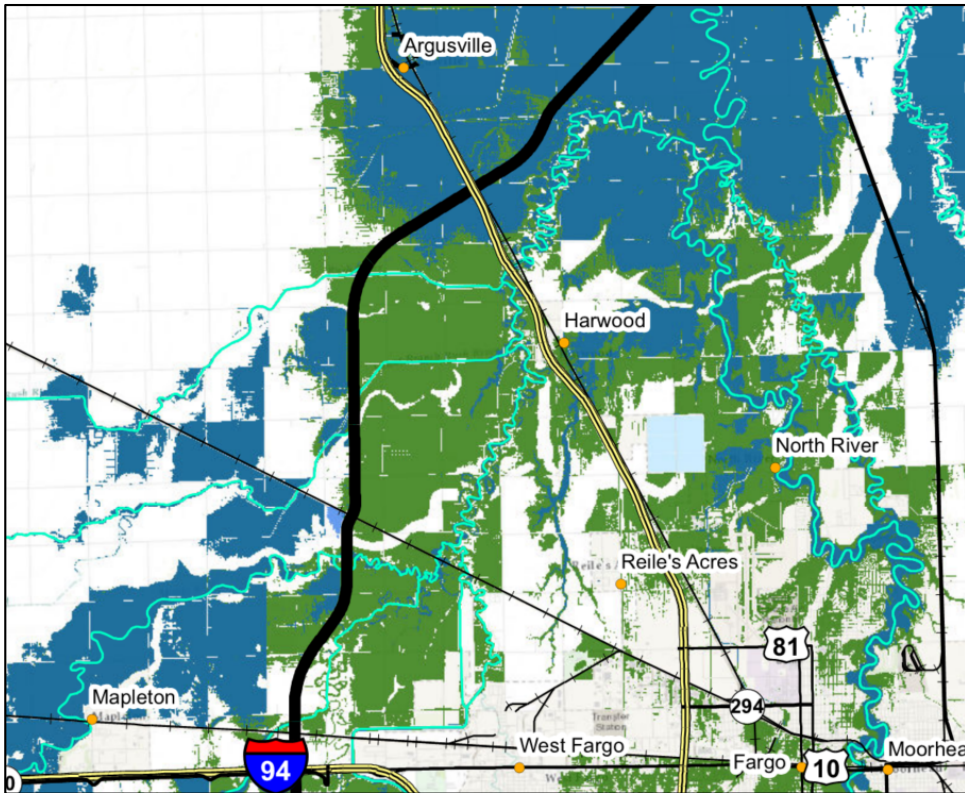


# Component #3c – Modified Storage Area 1

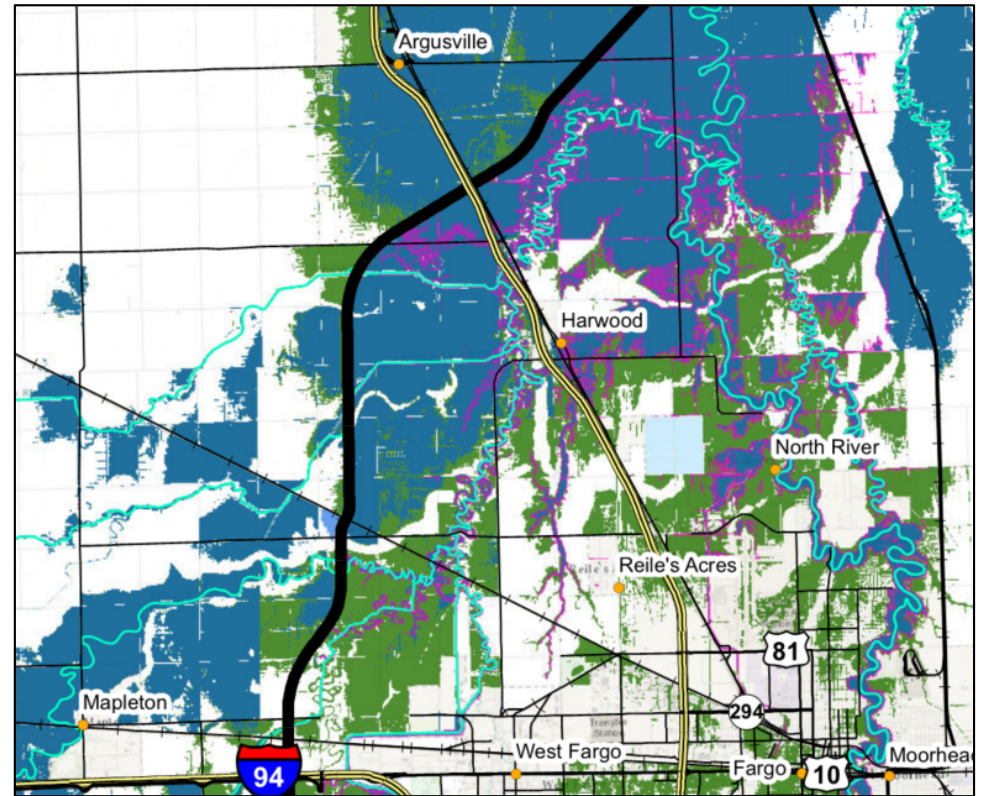


# Component #4: Northern Storage Option

- Evaluated passing additional water through the Maple and Sheyenne River Aqueduct to provide storage and retain existing floodplain in the NW area



Component 1a



Component 4



# Component #4: Northern Storage Option

	<b>Proposed (baseline)</b>	<b>Proposed WTBL</b>	<b>Alt. 4</b>
Staging Area Elevation at Dam	921.66	921.54	921.01
Newly Impacted Upstream Area – ND/MN (total)	7,088 / 11,631	8,194 / 11,270	7,335 / 9,943
Newly Impacted Upstream Area – Richland/Wilkin (total)	1,124 / 1,391	1,053 / 1,283	837 / 957
Unprotected Structures (Residential/Total) within the FDRA for Proposed Project	3 / 14	3 / 14	31 / 140
Acres Protected	58,137	58,119	50,401
Total Residential Structures Impacted—Richland/Wilkin (total)	3 / 5	3 / 5	3 / 5
Total Residential Structures Impacted—Cass/Clay (total)	41 / 20	42 / 20	41 / 19
Cost	N/A	Similar	+\$190M



# **Components #5: Change Operation Plan to Allow up to 6 inches of Downstream Impacts**

- Could be applied to Alternatives 1a-1d, 3a-3c, 4
- Some measurable impact will extend beyond the U.S./Canadian border
- Mitigation may be required for existing downstream flood protection projects

# Component #5: Change Operation Plan to Allow up to 6 inches of Downstream Impacts

Reference Point	Proposed (baseline)	Proposed WTBL	Alt. 5
Drayton, ND Impact	+0.03'	+0.03'	+0.09'
Grand Forks, ND Gage Impact	+0.05'	+0.06'	+0.25'
Climax, MN Impact	-0.03'	-0.02'	+0.48'
Halstad, MN Impact	-0.05'	-0.04'	+0.17'
Hendrum, MN Impact	-0.12'	-0.11'	+0.22'
Perley, MN Impact	-0.05'	-0.05'	+0.11'
Staging Area Elevation at Dam	921.66	921.54	921.24

# **Component #6: Wild Rice River Diversion with Levees (no dam)**

- Divert the Wild Rice River only
- Includes levees through town
- No staging area or dam included
- Some measurable impact will extend beyond the U.S./Canadian border
- Mitigation may be required for existing downstream flood protection projects

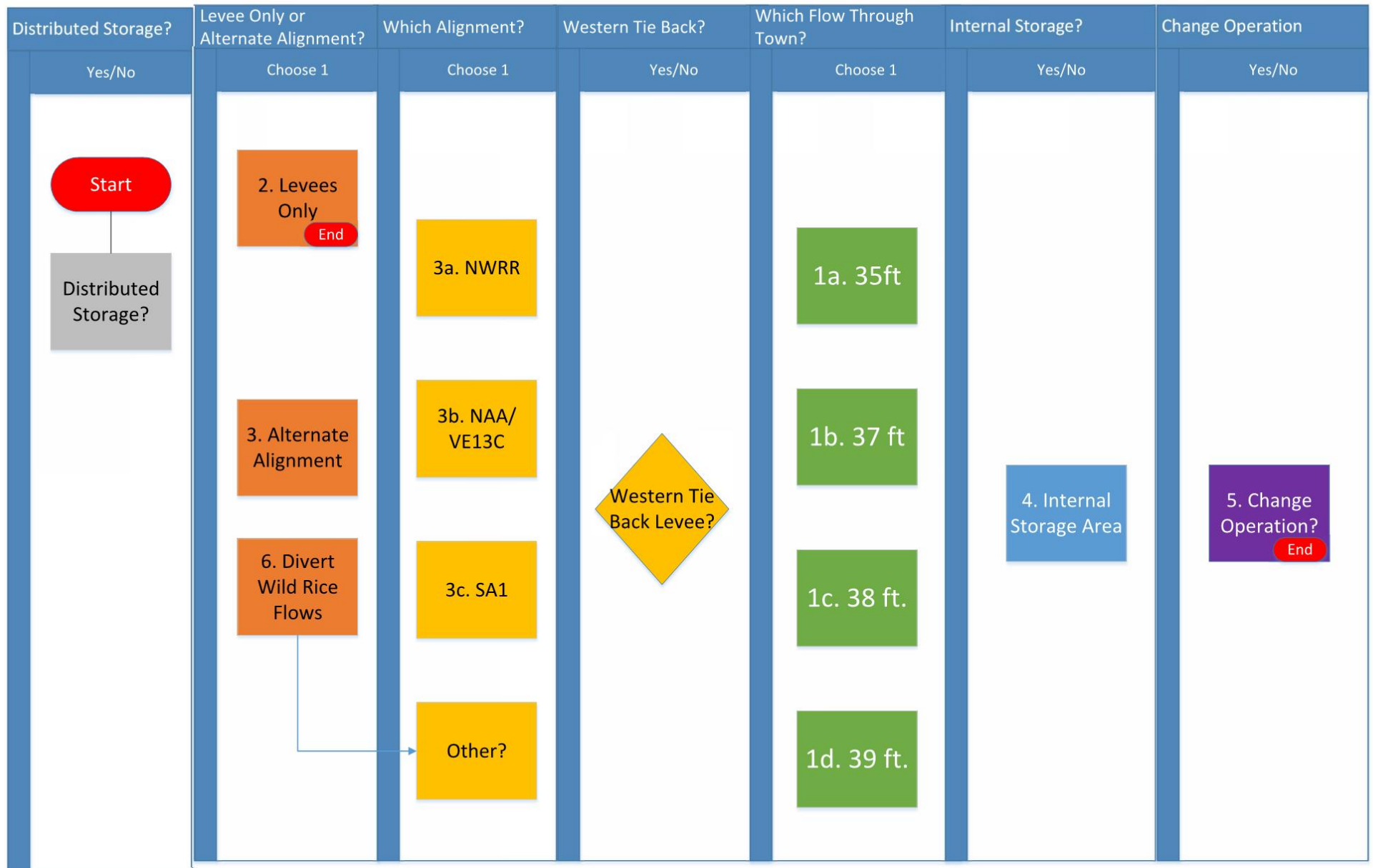
# Component #6: Wild Rice River Diversion with Levees (no dam)

Reference Point	Proposed (baseline)	Proposed WTBL	Alt. 6
Drayton, ND Impact	+0.03'	+0.03'	+0.39'
Grand Forks, ND Gage Impact	+0.05'	+0.06'	+1.07'
Climax, MN Impact	-0.03'	-0.02'	+1.82'
Halstad, MN Impact	-0.05'	-0.04'	+0.63'
Hendrum, MN Impact	-0.12'	-0.11'	+0.73'
Perley, MN Impact	-0.05'	-0.05'	+0.28'
Staging Area Elevation at Dam	921.66	921.54	N/A

# Consensus Items?

- Basin-wide Retention
  - Zoning (Development) Restrictions within the Protected Area
  - Western Tie-Back Levee
- 1) Additional Flows Through Town
    - a) RS 35 feet
    - b) RS 37 feet
    - c) RS 38 feet
    - d) RS 39 feet
  - 2) Levees Only
  - 3) Change Location of Dam
    - a) North of Wild Rice River (NWRR)
    - b) Northern Alignment Alternative
    - c) Modified Storage Area 1
    - d) Other
  - 4) Northern Storage Option
  - 5) Increased Downstream Impacts (6 inches)
  - 6) Wild Rice River Only Diversion

# Consensus Items?





**Questions/Next Steps?**