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St. Paul District

NW Diversion Channel Alignment Summary Appendix E

Fargo Moorhead Metropolitan Area
Flood Risk Management Project

Supplemental Environmental
Assessment Document

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JPA-NW Diversion Channel Alignment Summary
July 31, 2018

A Technical Advisory Group (TAG) was created as an advisory group to the Fargo-Moorhead Area Flood Diversion Governor's Task Force to assess components and alternatives as well as to provide technical guidance to the Task Force. After the conclusion of the Task Force, the TAG continued to meet to refine, explore and study alternatives, including alignments not studied by the Task Force. During the Task Force meetings, a representative from the Richland-Wilkin Joint Powers Authority (JPA) brought forward an alignment concept that modifies the diversion channel alignment between the Maple River and the outlet. This alignment was also brought forward at the TAG meetings by Charlie Anderson, the JPA technical representative for the TAG, and Houston-Moore Group (HMG) was requested to model the alignment. In general, the alignment turns east just south of the proposed Maple River Aqueduct; crosses the Sheyenne River at grade just north of the city of West Fargo; crosses Interstate 29 just south of the city of Harwood; and enters the Red River near the confluence with the Sheyenne River. The alignment has been referred to as the JPA-NW (northwest) alignment and is shown in the below Figure.

Prior to the TAG discussion of the JPA-NW alignment, the JPA technical representatives had performed preliminary modeling of the alignment using the unsteady HEC-RAS model developed for the Project. The Phase 8.1 CLOMR unsteady HEC-RAS model was used for the modeling. During TAG meetings, HMG was requested to complete further modeling of the alignment using the Phase 8.1 CLOMR unsteady HEC-RAS model. For this analysis, the JPA-NW alignment was modeled in combination with Option 7A/10D (now referred to as Plan B).

The alignment that was provided by the JPA is the orange line in the attached Figure. HMG, in consultation with the TAG, refined the alignment for hydraulic modeling purposes during the TAG coordination. The modeled alignment is the tan shaded alignment on the Figure. Additionally, a number of design details needed to be added by HMG (in consultation with the TAG) to accurately model the JPA-NW alignment. These include:

- Due to the proposed at-grade crossing of the diversion channel at the Sheyenne River, an in-line weir was added in the diversion channel just east of the Sheyenne River to keep normal Sheyenne River flows in the Sheyenne River vs routing into the diversion channel. The top of the weir was set at approximately the 2-year flood level.
- To accommodate the at-grade crossing of the Sheyenne River the slope of the diversion channel was decreased from the proposed project slope of 0.02% to a slope of 0.01% from the downstream Sheyenne River crossing to the Sheyenne River Aqueduct, located near Horace, ND. The slope downstream from the downstream Sheyenne River crossing was increased from 0.02% to 0.027%.
- Due to the flatter diversion channel slope and to match the proposed project diversion channel water surface profile, so positive drainage is maintained for land outside of the flood risk management area, the diversion channel bottom width was increased from 210 feet to 400 feet from near the Maple River to the outlet and from 300 feet to 600 feet from near the Maple River to the Sheyenne River Aqueduct.

- Per Charlie Anderson, the JPA TAG representative, excavation in the right (Minnesota) side overbank of the Red River was added for approximately 2 miles to add conveyance to reduce the tailwater effect in the flood risk management area that results from the diversion channel outlet being moved further south. Without this overbank excavation, flooding associated with the tailwater effect would reduce the stage reduction benefits in the northern end of the flood damage reduction area for the JPA-NW alignment. With the Pre-Task Force diversion channel alignment, which would not change with Plan B, this backwater is kept north of the Harwood area.

During a series of TAG meetings, a list of pros and cons for the JPA-NW diversion channel alignment (along with other alignments that were analyzed) was developed when compared with Plan B (which includes the Pre-Task Force project diversion alignment). The below summarizes information developed by the TAG including pros and cons and the potential environmental benefits and impacts associated with the JPA-NW diversion channel alignment:

Pros:

- The JPA-NW Alignment is 1.5 miles shorter which will decrease cost.
- Eliminates the need for the Maple River Aqueduct structure.
- Eliminates the Rush and Lower Rush River channel abandonments.
- The JPA-NW Alignment, when combined with the Plan B dam/southern embankment alignment, reduces the additional flooded acreage by 535 acres in Richland and Wilkin Counties when compared to Plan B as modeled by the TAG.
- The JPA-NW Alignment, when combined with the Plan B dam/southern embankment alignment, results in 3,531 fewer acres being impacted (The sum of ND and MN Total Acres and Footprint (Line E) on the Difference Table below, 1% ACE, POR hydrology).

Cons:

- There are 1381 structures ((579 primary (homes and businesses) and 802 non-primary)) located between the Pre-Task Force / Plan B diversion channel alignment and the JPA-NW alignment that will be unprotected. This includes a population of approximately 1,500 people.
- 52 residential structures, 10 farmsteads, and 3 businesses will be added to the diversion channel footprint with the JPA-NW alignment shift.
- Stream stability concerns due to the at-grade crossing of the Sheyenne River and backup of water into the diversion channel from the Sheyenne River.
- Overbank excavation is included along the Red River downstream from the Diversion outlet to reduce tailwater effects in the protected area due to the diversion channel outlet being located further south. Overbank excavation involves excavating the Red River, generally above the ordinary high water mark, so it can convey more flow. Increasing channel conveyance through over-excavation of rivers or channelization was opposed by natural resource agencies during preparation of the USACE Feasibility Study.
- The flatter grade of the diversion channel as part of the JPA-NW alignment would result in a shallower but wider diversion channel, which will likely increase cost, including the need for significantly longer bridges.
- Requires the reconstruction of Cass County Drain 40/45.

- May adversely impact overland flooding south of Harwood, ND. The potential for impact has not been determined.
- May impact local drainage from the west and the height of the embedded levee along the diversion channel may need to increase due to a higher water surface profile along the diversion channel in some areas.
- Additional cost estimated to be $112M for Land and Construction.

Potential Environmental Benefits with JPA-NW Alignment:

- JPA-NW alignment eliminates the need for the Maple River Aqueduct, which reduces potential cold weather impacts. (It should be noted that the design for the Maple River Aqueduct addresses cold weather concerns.)
- Elimination of the Maple, Rush, and Lower Rush River crossings reduces potential impacts to fish passage and mortality. (It should be noted that the Pre-Task Force diversion channel design includes fish passage at the Maple and Rush rivers.)
- Impacts from the Rush and Lower Rush Rivers being cut off are eliminated. (It should be noted that the Pre-Task Force diversion channel design includes a meandering low flow channel to mitigate these cut offs.)

Potential Environmental Impacts with JPA-NW Alignment:

- At-grade crossing for the Sheyenne River has the potential for stream stability impacts along the Sheyenne River due to the flow interaction of the diversion channel and the Sheyenne River.
- The at-grade crossing for the Sheyenne River will result in water backing up in the diversion channel, all the way to the Sheyenne River Aqueduct. This will increase the potential for bank sloughing and sedimentation in the diversion channel and an increase in O&M costs.
- Overbank excavation downstream from the diversion channel outlet may have negative effects on the stability of the riverbanks along the Red River that would need to be designed to avoid impacts.
- Reduces the diversion channel length by approximately 1.5 miles but requires the diversion channel to be considerably wider for much of the diversion channel length. Given this, it is anticipated that wetland impacts will likely increase.
- May require additional/changed wetland mitigation because the diversion channel will have more water in it for longer periods of time.
- Overbank excavation feature may increase wetland impacts to higher functioning wetlands unless it is designed to avoid impacts.
- Includes an at-grade crossing at the north Sheyenne River crossing, which could create ice buildup due to the complicated nature of the crossing and mixing of flow from the diversion channel and Sheyenne River. Design would need to account for this.
- Would have more impacts to floodplain forest at the northern Sheyenne River crossing and the overbank excavation feature downstream from the diversion channel outlet.
- At-Grade crossing of the Sheyenne River may increase potential impacts to fish passage and mortality.

- Increased potential for cultural resource impacts due to overbank excavation feature downstream from the diversion channel for the JPA-NW alignment. Increased potential for cultural sites near the confluence of the Sheyenne and Red River, which is the proposed outlet for the JPA-NW alignment.

Comparison tables for Plan B vs. Plan B/JPA-NW Alignment were also developed during the TAG coordination and are summarized below:

TAG Modeling Comparison – Plan B vs. Plan B/JPA-NW Alignment

Plan B

	Impacted Lands	ND	MN	Splits	Richland	Wilkin
A	Staging Area Total Acres	22,585	5,420	81% ND / 19% MN	2,783	1,407
B	Staging Area Additional Acres (newly inundated)	7,751	3,286	70% ND / 30% MN	596	385
C	Diversion Channel Footprint	6,800	0	100% ND	0	0
D	Southern Embankment Footprint	1,100	420	72% ND / 28% MN	0	0
E	**Total Acres & Footprint**	**30,485***	**5,840***	**84% ND / 16% MN**	**2,783***	**1,407***
F	Total Impacted Residential Structures in the Staging Area	60	11	85% ND / 15% MN	2	2
G	Newly Impacted Staging Area Residential Structures	44	8	85% ND / 15% MN	2	0
H	Protected Acres	41,187	9,456	81% ND / 19% MN	-	-

*Total acreage is sum of rows A+C+D.

** Results are based on modeling performed during TAG meetings and used the Phase 8.1-CLOMR unsteady HEC-RAS model.

Plan B/JPA-NW

	Impacted Lands	ND	MN	Splits	Richland	Wilkin
A	Staging Area Total Acres	18,509	4,265	81% ND / 19% MN	1,224	728
B	Staging Area Additional Acres (newly inundated)	5,146	2,644	66% ND / 34% MN	228	218
C	Diversion Channel Footprint	8,500	0	100% ND	0	0
D	Southern Embankment Footprint	1,100	420	72% ND / 28% MN	0	0
E	**Total Acres & Footprint**	**28,109***	**4,685***	**86% ND / 14% MN**	**1,224***	**728***
F	Total Impacted Residential Structures in the Staging Area	51	7	88% ND / 12% MN	1	0
G	Newly Impacted Staging Area Residential Structures	35	6	85% ND / 15% MN	1	0

H	Protected Acres	39,263	9,069	81% ND / 19% MN	-	-

*Total acreage is sum of rows A+C+D.

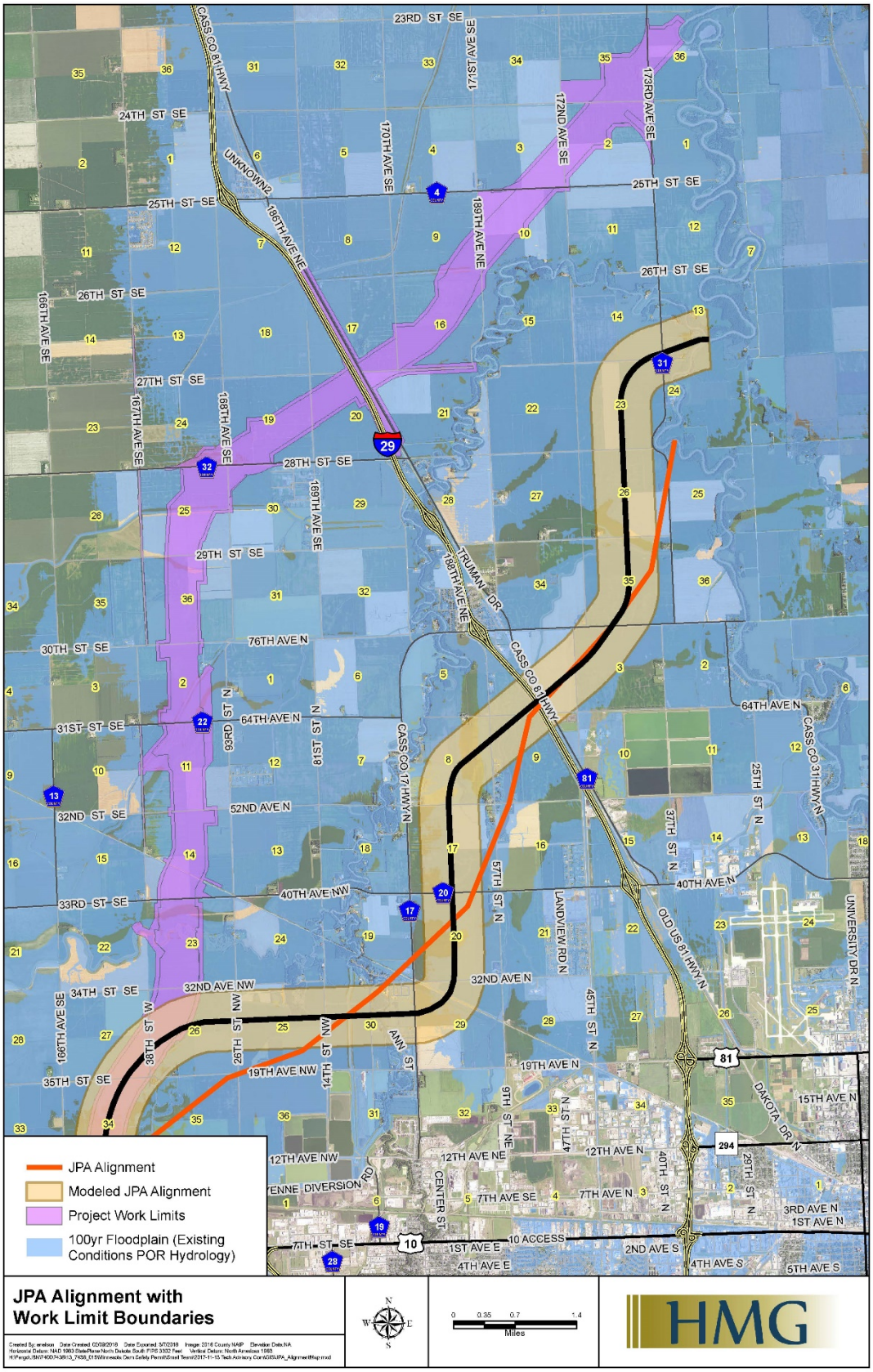
** Results are based on modeling performed during TAG meetings and used the Phase 8.1-CLOMR unsteady HEC-RAS model.

Difference Between Plan B and Plan B/JPA-NW

	Impacted Lands	**ND**	**MN**	**Splits**	**Richland**	**Wilkin**
A	Staging Area Total Acres	-4,076	-1,155	-	-1,559	-679
B	Staging Area Additional Acres (newly inundated)	-2,605	-642	-	-368	-167
C	Diversion Channel Footprint	+1,700	0	-	0	0
D	Southern Embankment Footprint	0	0	-	0	0
E	**Total Acres & Footprint**	**-2,376***	**-1,155***	**-**	**-1,559***	**-679***
F	Total Impacted Residential Structures in the Staging Area	-9	-4	-	-1	-2
G	Newly Impacted Staging Area Residential Structures	-1	-1	-	-1	0
H	Protected Acres	-867	-0	-	-	-

*Total acreage is sum of rows A+C+D.

** Results are based on modeling performed during TAG meetings and used the Phase 8.1-CLOMR unsteady HEC-RAS model.


JPA Alignment
Modeled JPA Alignment
Project Work Limits
100yr Floodplain (Existing Conditions POR Hydrology)
JPA Alignment with Work Limit Boundaries
Miles
HMG