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Appendix N: Engineering Considerations

Fargo Moorhead Metropolitan Area
Flood Risk Management Project

Reach 4 Diversion Channel and Rush River Inlet/Drop Structure

Engineering and Design Phase

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N.1 INTRODUCTION

As depicted in **Figure 1**, Reach 4 includes the Diversion Channel beginning upstream of Reach 3 at Station 350+00 and continues upstream to Station 521+00, at 30th Street SE. In addition, there is a Reach 4 drainage structure located at approximately station 492+20, vertical grade control structures at the bridge and associated ditching to carry the local drainage. The County Road 32 Bridge and the Rush River Structure are included in Reach 4, although the bridge will be designed and constructed by the project sponsor and the Rush River Structure will be designed by the St Louis District. The Rush River Inlet/Drop Structure is located in the downstream (north) portion of the diversion channel and generally between the Maple River and Interstate Highway 29 (I-29). County Road 32 (28th Street SE) currently crosses the Reach 4 alignment adjacent to the Rush River Inlet/ Drop Structure. According to the most recent version of the Non-Federal Sponsor's transportation design, a single bridge will carry the traffic from this road across the diversion. The design and construction of this bridge is a local sponsor responsibility.

Major work items include the following:

- Diversion Channel with Sinuous Low-Flow Channel
- Reach 4 Inlet Structure
- Excavated Material Berms and Levees
- County Road 32 Bridge
- Rush River Structure
- Vegetation

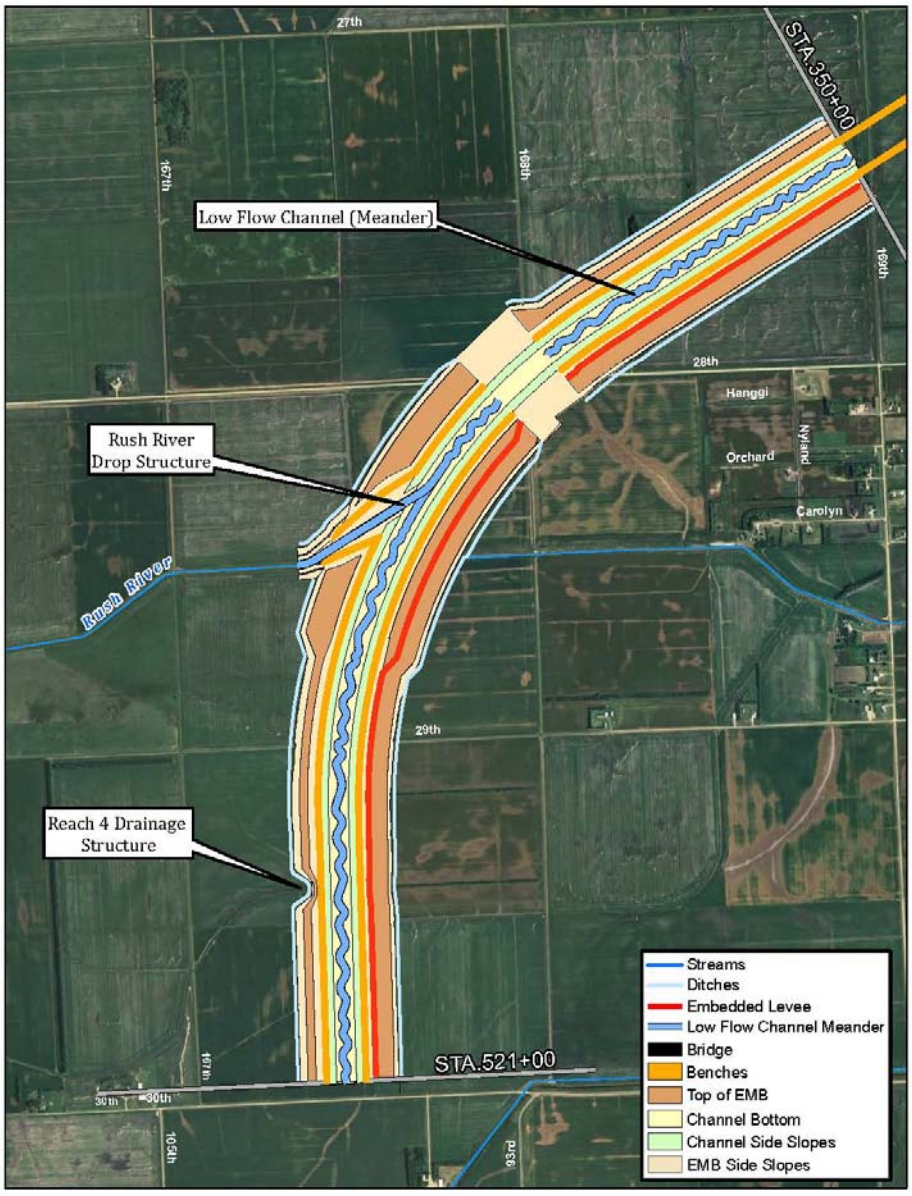

Figure 1: Reach 4 Overall Layout

N.2 HYDRAULICS

N.2.1 Reach 4 Drainage Structure

The Reach 4 Drainage Structure has been sized to pass the computed 100 year peak discharge of 520 cfs from the lateral drain located at approximately station 492+20 of the project. The structure will be a triple pipe structure. It will have 72 inch diameter concrete pipes with flap gates to prevent backflow and a cast in place headwall. The cast in place headwall allows for a larger trash screen that will reduce the potential for flooding from blocked inlets. The outlet structure will be an impact energy dissipater design developed by the U. S. Bureau of Reclamation. The design was slightly modified to accommodate the flap gates. The EMB on the west side of the diversion channel is not being designed to function as a

levee and therefore a positive closure (slide gate) at this structure is not warranted. The drainage structure will discharge into a shallow trapezoidal channel, lined with riprap that will contain the flows from the drainage structure to the low-flow channel during low water periods in the diversion channel.

N.2.2 Rush River Inlet Structure

The Rush River inlet structure was designed to pass the computed 500 year Rush River discharge of 3,490 cfs into the diversion channel with no additional flow in the diversion channel from other sources. This condition represents the worst case scenario during construction of the diversion. The inlet was designed as a rock ramp fish passage that allows passage for a wide range of discharges. Upstream of the rock ramp, rock dikes will be constructed to increase the upstream 100 year water surface elevation for the with project condition in an attempt to match the existing 100 year water surface elevation. It is not possible to match the existing 100 year elevation, even with these structures dramatically constricting the channel. A shear analysis was performed for the existing channel upstream of the project footprint that indicated that for all but the 100 year and rarer events should pass without additional erosion.

The Rush River inlet structure serves two main hydraulic purposes. The first goal is to safely convey flood flows from the Rush River to the diversion channel. The second is to provide adequate opportunity for fish passage from the diversion channel to the Rush River, for a wide range of flow conditions. In order to provide the best opportunity for fish passage, a number of design aspects of the structure have been altered from typical Red River Basin fish passage structures. Since this passage will be on a newly constructed channel rather than an existing river channel, further modifications can be made to improve the chance for fish passage. A list of these modifications and engineering considerations for construction are as follows:

1) The overall slope of the outlet, at 2%, is flatter than the slopes of most fish passages.

2) The vertical drop between each boulder weir, and therefore each pool elevation, is 0.6 ft. While some fish passages utilize drops of 0.8-1.0 ft or higher, a smaller drop should allow for greater chance for passage of a wider variety of species at a minimal additional cost. For this project, it is not desirable for adjacent pools to have greater than 0.6 ft of difference between them.

3) Boulders along each weir should be placed under the supervision of a hydraulic engineer or similar technical advisor. The boulders should be adjusted so that they provide adequate gaps for passage while maintaining the designed pool elevations.

4) Placement of irregularly shaped boulders should ensure that the top elevation of the boulders align and follow the boulder-weir profiles as specified in the plans.

5) Pools should also be shaped under the supervision of a hydraulic engineer or similar technical advisor. Riprap should be shaped to maximize pool depths while still ensuring that the minimum riprap thickness is met throughout the pool.

6) Riprap should be built up on either side of each boulder-weir to help embed the boulder and reduce the chance for boulder movement from ice and debris.

7) While all boulders will be required to meet the specifications for size and shape, those that minimally meet the requirements (smaller boulders) should be placed toward the ends of the boulder-weirs. Larger, heavier boulders should be placed toward the center of the boulder-weir to better resist impacts from ice and debris down the center of the channel.

N.3 GEOTECHNICAL

N.3.1 Impervious Embankment Materials

The excavation of the diversion channel will be made through different types of materials. These materials have not been differentiated in the bid package for measurement and payment; all materials are lumped together. It is anticipated that various methods of excavation will be used/required because the materials differ in properties.

N.3.1.1 Topsoil

Topsoil is anticipated to be 1 to 2 feet thick within Reach 4. Stripping of the topsoil and organics is only required beneath the embedded levee prism and any roadway subgrade. The topsoil should be readily distinguishable as it will be black compared to the gray or dark gray material beneath it.

The project will require more topsoil than is available in locations where stripping is required. The Contractor will need to strip additional areas to obtain the necessary quantity of topsoil for the project. The Contractor is responsible for determining the location and quantity to strip and stockpile. (See Specification Section 31 00 00.00 13 Paragraph 2.2.4 Topsoil)

N.3.1.2 Excavation

The materials required to be excavated vary in quality with depth. The upper-most material will be either Alluvium or Sherack, and will be able to support the construction equipment the best. This material will meet the requirements of impervious fill and will be used to construct the embedded levee and roadway subgrade. It should also be used for any impervious structural backfill. The moisture content will increase with depth, especially below the groundwater table.

Below the upper layer, Oxidized Brenna and Brenna will be encountered. These materials will have the highest liquid limit and will provide the least support to construction equipment. These materials will also be located below the groundwater table, so the moisture contents will be high.

N.3.1.3 Muck Excavation

The diversion channel crosses existing drains and low areas where “muck” materials may be located. The muck material shall be removed prior to placement of any type of fill. The COR shall observe the conditions of the surface prior to allowing the Contractor to place any fill.

N.3.1.4 Groundwater and Seepage

Due to the impervious nature of the soils, dewatering of the site prior to excavation is not required as groundwater flow into the excavation will be minimal. A slope will need to be maintained in the excavation to allow precipitation to drain to a low area. Depending on amount of precipitation, this low area may need to be pumped out.

N.3.1.5 Wells

There could be abandoned wells encountered within the excavation area. These wells were to be abandoned by the Local Sponsor per applicable state well codes and regulations. This means the well casing was filled with a lean cement or bentonite grout. The Local Sponsor will be required to excavate and expose the well casing 3 feet below final grade and cut it off. The excavated area needs to be backfilled with impervious fill material. If it appears that the well was not properly abandoned or sealed, the Geotechnical and Geology Section shall be contacted.

N.3.1.6 Foundations and Other Underground Tanks

The Local Sponsor is responsible for the demolition of structures within the grading limits. House foundations and underground tanks will be removed and temporarily backfilled to prevent a hazard. The temporary backfill will be placed without any control. The Contractor is required to remove the temporary backfill and recompact it. If the temporary backfill falls within the slope of the diversion channel or beneath the EMB, the fill shall be reconstructed to 85% maximum dry density of the Standard Proctor. If the temporary fill falls beneath the embedded levee, the fill shall be reconstructed to 90% dry density of the Standard Proctor. (See Specifications Section 31 00 00.00 13 Paragraph 3.13.3 Temporary Fill Locations.)

N.3.1.7 Rebound

The excavation of the channel will reduce the stresses in the underlying materials, allowing them to expand. The result is that the excavated surface will rebound. Due to the impervious nature of the soils, the rebound will occur over time. It is anticipated that some rebound will occur during the construction period and the rest will take years, maybe even decades. It will be important to monitor the grade of the diversion channel as it nears the final grade lines. It is not recommended to allow a long delay to occur between final grading of the excavation and the placement of the topsoil. The quantity surveys should be completed soon after each grading operation.

N.3.2 Placement of Excavated Materials

The Contractor will need to plan the excavation such that the materials required for topsoil, the embedded levee, and the road subgrade is obtained from the upper portion of the excavation where Alluvium and Sherack are located. The majority of the excavated materials will be placed as random fill within the excavated material berms.

N.3.2.1 Embedded Levee

The Contractor is required to construct an embedded levee within the right bank excavated material berm. The embedded levee prism is similar to the standard Corps levee used within the Red River Valley, consisting of 1V:3H slopes and a 10 foot top width. The impervious fill used to construct it should come from the upper portion of the diversion excavation where Alluvium and Sherack are located. The material only needs to be semi-compacted, meaning a minimum compaction of 90% of the Standard Proctor with a maximum lift thickness of 12 inches. There is no moisture requirement, but if the material is too wet, the Contractor may have a hard time working with the material and achieving required compaction.

N.3.2.2 Road Subgrade

The 36 inches of subgrade below any aggregate of road surfacing shall be compacted to 95% of the Standard Proctor and at a moisture content within 3 percentage points above and 2 percentage points below optimum moisture content, in lifts not exceeding 9 inches. There is a large portion of the road subgrade that will be on top of the EMB fill material, which is only placed at a minimum density of 85% of Standard Proctor. The Contractor may need to start compacting the EMB to a higher density below the road subgrade in order to have a stiffer foundation that the road subgrade can be compacted against to obtain a minimum density of 95% of Standard Proctor.

N.3.2.3 Excavated Material Berms

All the remaining excavated material that is not used as topsoil, levee, or road subgrade material will be placed within the EMBs as random fill. The random fill can be placed in lifts up to 18 inches thick and the minimum compaction is 85% of the Standard Proctor. The excavated material berms (EMBs) are offset 50 feet from the top of the diversion channel. Based on the geotechnical analyses, the maximum shoulder height of the EMBs range from 13 to 20 ft. The variation depends on local soil conditions. The EMBs have been taken into consideration when analyzing the stability of the diversion channel slopes. Grading guidelines and maximum grading extents have been developed to ensure that the layout of the EMB meets geotechnical design criteria. The grading guidelines and maximum grading extents due to geotechnical criteria are documented in Appendices D1 and D2. Embedded levees will be constructed at 1V:3H slopes and will have more stringent material and compaction requirements than the surrounding EMBs.

N.3.2.4 Topsoil

The placement of the topsoil requires the subgrade to first be deep disked and then incorporated into the subsoil (See Specification Section 32 92 19.01 13, 3.2 Site Preparation). This requirement will preclude the Contractor from placing topsoil during winter operations.

N.3.2.5 Swell / Shrink

It is expected that the excavated material will swell within the EMB. The EMBs have been designed to accommodate a net increase in volume of 15% of the plan excavation quantity. The actual amount of swell will depend on the method of operations the Contractor uses for excavation and how much the material is compacted by the equipment traffic. The excavated material will have a greater swell factor during winter operations.

N.3.3 Winter Operations

The team recognized that excavation of the diversion channel during winter conditions may be advantageous to the Contractor. In the specification, this is referred to as Winter Operations. It is defined as when the frost thickness is 3 inches or more. The intent is to allow the Contractor more time and flexibility to excavate the channel. Also, a frozen subgrade may facilitate operations at the base of the channel. With winter operations, there are a few unique constraints which are discussed below. The Contractor is required to provide a winter operations plans for review and approval. The plan shall detail how the earthwork operations will be done.

(Reference Specification Section 31 00 00.00 13 Paragraph 3.7 Winter Operations.)

N.3.3.1 Placement of Excavated Materials

The integrity of the inward one half of the EMB nearest the diversion channel shall be maintained. This is important as the slopes on the EMB will be seen as part of the project and sloughing and differential settlement of this slope may lead to unwarranted deficiencies being documented during inspections. To minimize this, the specifications require that the inward one half of the EMB consist only of unfrozen material placed on unfrozen subgrade. If the subgrade becomes frozen, it shall be removed to expose unfrozen subgrade.

The integrity of the outward one half is not as critical to the project performance and will not be subject to the same level of scrutiny during inspections. This allows the placement of materials to be relaxed. In the outward one half, the frozen subgrade must be scarified prior to placement of unfrozen materials. This will help the lifts bond together and help minimize potential shear surfaces.

When dealing with frost and frozen materials, it is important to minimize the potential for large voids within the EMB as this will lead to differential settlement. To reduce this potential but still provide some flexibility to the Contractor, the specifications indicate the excavated materials containing frost, chucks of frozen materials measuring less than 8 inches can be placed within the outward third of the EMB in 18 inch lifts. If the material excavated contains chunks of frozen material greater than 8 inches or is completely frozen, this material needs to be temporarily stockpiled and reworked once it has thawed out.

N.3.3.2 Snow Removal

The Contractor will be required to keep the snow cleared from the work area. Snow shall not be incorporated into any portion of the EMB.

N.3.3.3 Final Grading

Final grading of the diversion channel excavation needs to be completed when conditions allow. If the thickness of the frozen rough graded channel is close to the thickness that is required to be removed to obtain the final grade, there is concern that the final grade will not be smooth and level. Also, if the final grade is established during the winter, the spring melt, runoff, and rain may disturb the final grade enough that regrading is required prior to placement of topsoil. Coordination between the Contractor and the Corps is recommended regarding the timing of final grading and final surveys.

N.3.4 Materials

N.3.4.1 Select Granular Fill

The select granular fill is used beneath the Reach 4 local drainage structure to reduce the frost heave potential. This select granular fill needs to be clean material (less that 5 percent passing the No. 200 sieve). Materials that are dirtier will increase the frost heave potential. It is very important to have the gradation tests completed prior to delivery of the material to the site to make sure it meets the specifications, and have gradations completed on the materials after it has been placed.

N.3.4.2 Riprap and Bedding

Erosion is a major concern for the diversion channel, and a significant amount of stone protection is required as part of the project. Most areas of stone protection consist of riprap underlain by bedding and permanent erosion control geotextile. Stone protection can consist of either field stone or quarried stone, but not both. All stone is subject to gradation testing prior to and during placement.

N.3.5 Instrumentation

As part of the project design, nested vibratory wire piezometer clusters were installed throughout Reach 4. The locations of these instruments are indicated on the plan sheets. These instruments are located outside the grading limits but still within the work limits. The Contractor shall be made aware of these locations and shall take precautions so as not to damage them.

N.3.6 Hazardous, Toxic, and Radioactive Wastes

A Phase I Environmental Site Assessment (ESA) was completed on a previous North Dakota Diversion alignment during the feasibility study in 2010. A supplemental ESA was completed along the current alignment in 2012. Based on site visits during the supplemental ESA, one site was noted in Reach 4 that consisted of a barn with asphalt shingles, a water well, and 3 grain silos. The interview notes stated that there was no known above or underground storage, there were grain bins at one time, but not anymore, and the area is all farmland except for a few trees in the middle. These are common to small agriculture farms and rural residential settings and if handled properly will not be a risk. The Phase 1 ESA also recommended that all structures be inspected for “potential asbestos containing materials prior to demolition. A limited Phase ll ESA was also recommended. The Contractor shall make the Corps aware of any HTRW that is encountered and dispose of it properly.

N.4 STRUCTURAL

The Reach 4 inlet to the diversion channel will be triple 72-inch-diameter reinforced concrete pipes (RCPs) between an upstream headwall structure and a downstream impact stilling basin. Energy dissipation will be provided by the impact stilling basin which extends the width of the pipes. A flap gate will be installed on each pipe to reduce the effect that flood waters in the diversion channel could have on the water levels in the county drain. Reach 4 drop structure enters the diversion under the left EMB at station 492+20.

N.4.1 Reach 4 Inlet Headwall Structure

The inlet headwall structure has three 72” reinforced concrete pipes that should be cast into the headwall. There is a requirement for the geotextile fabric to be placed on the soil side of the wall at the joints so that material is not moved through the joints.

N.4.2 Reach 4 Triple RCP Lines

Voids beneath the pipes should be filled with flowable concrete fill. The choice for the flowable fill is because the contractor will not be able to compact and use pipe bedding to avoid seepage paths

through the embankment. There is a 40' drainage blanket on either end of the pipe that needs to be select granular fill not flowable concrete around the pipe, see S-100 in the plan set.

N.4.3 Reach 4 Outlet Impact Basin

The outlet impact basin has a pipe box on the upstream end which needs to be connected to the impact basin and have the pipes cast into. The rebar must tie each slab together, but the contractor can pour the slabs individually.

There is a key on the downstream end of the impact basin which has the only purpose of keeping the structure from being undermined and loosing the select granular fill that is required to keep the structure from heaving. The key needs to extend 1' past the select granular fill.

N.4.4 Reach 4 Concrete Construction

N.4.4.1 Materials and Testing

The specifications identify sources that are capable of producing aggregates of quality acceptable for this project. Any other sources must be approved in accordance with the specification requirements. All concrete components and admixtures must comply with the specified requirements.

The government determines when concrete will be sampled for testing. The minimum frequency for obtaining test samples and testing procedures are identified in the specifications and must be complied with. The Contractor's personnel are responsible for casting, protecting and delivering concrete cylinders and determining slump and air content. The Contractor personnel conducting the testing must be certified as a Concrete Field testing Technician, Grade I. Minimum concrete strength requirements, maximum Water-Cementitious Materials (W/CM) ratios and allowable slump and air content ranges are indicated in the specifications for the different types of concrete elements

N.4.4.2 Tolerance

The specifications identify the acceptable tolerance for completed concrete elements. All formwork must be checked for dimensional accuracy prior to casting concrete to minimize the potential for exceeding these specified tolerances. Minimum reinforcement cover requirements are identified in the drawings and should be verified during formwork inspections.

N.4.4.3 Batching and Transporting of Concrete

Proper batching of concrete is essential to producing a uniform, consistent and compliant concrete mixture. The specification requirements for batch plant equipment and operations must be complied with. The ability to determine the moisture content of fine aggregates and to adjust the mixture accordingly is an important requirement. The specifications also identify minimum requirements for testing concrete aggregates during the time concrete is being produced.

Concrete transported in a truck-mixer must be discharged from the truck-mixer within 1-1/2 hours after introduction of the cement to the aggregates. Concrete transported in non-agitating equipment must be placed within 30 minutes of its introduction into the equipment.

N.4.4.4 Placing of Concrete

The specifications identify measures and procedures for the preparation of surfaces that are to receive concrete prior to placement that must be complied with. The temperature of the concrete mix must not exceed 90 degrees F at the time of placement. To minimize the potential for segregation of the mix, concrete shall be deposited as close as possible to its final position in the forms and there shall be no vertical drop greater than 5 feet. Concrete must be consolidated in horizontal layers not to exceed 2 feet in thickness with approved consolidation equipment and methods. Concrete shall be produced, delivered and placed at a rate that keeps the concrete plastic and avoids cold joints while the concrete is being placed.

Hot-Weather and Cold-Weather concrete placing requires special methods and procedures, which are identified in the specifications.

N.4.4.5 Finishing and Curing of Concrete

Surface finish requirements for the various concrete elements are indicated in the specifications. The specifications also indicate special finishing methods and procedures are required during hot weather conditions.

The acceptable methods for curing and required duration of curing concrete are identified in the specifications. Proper curing of concrete is an important step in reducing cracks and ensuring efficient hydration of the cementitious materials.

N.5 CIVIL

N.5.1 Existing Conditions

Existing topographic data utilized for the design and drawings is from Aerial Light Detection and Ranging (LIDAR) and ground survey campaigns performed in May 2011 by Merrick and Company through contract with the local sponsors. Detailed ground and hydrographic survey campaigns were performed between October 2011 and March 2012 by the St. Paul District Corps of Engineers survey crew and Anderson Engineering of MN in order to enhance the accuracy of the surface models. The coordinate system and projection of the existing condition data is NAD83 (2007), North Dakota State Plane Coordinate System, South Zone (U.S. Survey Feet). The elevation datum of the existing condition data is NAVD88 (U.S. Survey Feet).

N.5.2 Existing Utilities

All utility relocations will be performed prior to construction. Utility relocation plans will be provided to the contractor as a plan reference document.

The following table lists identified utilities within the construction limits of Reach 4:

Utilities Reach 4

UTILITY	CROSSING STATION	DESCRIPTION
ELECTRIC		
Western Area Power Administration	Overhead line crosses Reach 4 center line at Station 505+80.	115 kV OHE Line crosses the control line in a NW-SE vector and changes direction to run north-south (parallel along the west edge of the diversion).

N.5.3 Care and Diversion of Water

N.5.3.1 Construction Phasing

The construction phasing for Reach 4 will be designed to meet compliance with the NPDES Permit NDR10-0000.

The following construction phasing was considered during the design of Reach 4 – Volume 2.

1. The left bank permanent drainage ditch should be completed prior to backfilling the County Road 32 temporary left drainage ditch (by others) in order to maintain local drainage at all times.

2. The portion of the project that is north of the existing Rush River side berm, including the Rush River realignment, drop structure and downstream diversion channel, is to be completed prior to making the connection with the existing Rush River channel. The Rush River flows are to remain in the existing channel and the existing side berm top elevations are to remain undisturbed prior to establishing the connection with the Rush River realignment in order to maintain local drainage and protection at all times throughout the construction of the project.

3. Earthen barriers shall be maintained between the completed downstream reaches and the Volume 2 diversion channel excavation until temporary erosion control measures are established and permission to remove any barriers is granted by the Contracting Officer. Recommend construction phasing to establish final stabilization in compliance with applicable NPDES Permit NDR10-0000. Appendix 1-A. Erosion and Sediment Control Practices requires temporary sediment basins, or equivalent control where ten (10) or more acres of disturbed area drain to a common location prior to the runoff leaving the site or entering surface waters.

N.5.4 Vegetation Free Zone

The Vegetation Free Zone (VFZ) will comply with the requirements in ETL 1110-2-571, as well as the criteria set forth in project specific guidance documents such as the Memo For Record (MFR) FMM Vegetation Free Zone, and Dam vs Levee Criteria. The VFZ will be a minimum of 15’ from the toe of stand-alone levees and partially embedded levees. The Vegetation Management Zone (VMZ) will extend 15’ from the landside crown of the levees embedded within EMB’s.

N.5.5 As-Built Survey Considerations

Survey the constructed embedded levee top to develop an independent horizontal and vertical control line for the embedded levee. Survey the main channel toe to include on as-built documents for use on future maintenance.

N.6 CULTURAL RESOURCES

N.6.1 Archaeological

Reach 4 was surveyed for cultural resources in July 2010 (original Rush River crossing), June and October 2011 (diversion alignment), and May and October-November 2012 (revised diversion alignment). Only parcels along 167th Avenue plus two excavated material pile (EMP) areas and a construction staging area remain to be surveyed for cultural resources, which were done in the spring of 2013. Four archeological sites and two built-environment linear resources were recorded in the Reach 4 area.

Archeological site 32CS5177 is a historic cultural material scatter in Section 20, Township 141 North, Range 49 West. Prehistoric isolated find spots 32CSX369 and 32CSX383 are each single projectile points found in the SW¼ and SE¼ of Section 36, Township 141 North, Range 50 West. These three sites were recommended as not eligible to the National Register of Historic Places (Meier et al., 2013 draft, *The Fargo-Moorhead Flood Risk Management Project, Cass County, North Dakota, and Clay County, Minnesota: Results of Phase I Cultural Resources Investigations, 2012*, URS Corp., Denver, Colorado). Coordination with the North Dakota SHPO to confirm their non-eligibility is ongoing.

Prehistoric find spot site 32CSX384 (FM14-47-IF) consists of a Knife River flint biface and a mineralized bison bone fragment, also found in Section 36, Township 141 North, Range 50 West. Additional testing was recommended at this site location to determine its eligibility to the National Register (Tucker et al., 2012, *The Fargo-Moorhead Flood Risk Management Project, Cass County, North Dakota and Clay County, Minnesota: Results of Phase I Cultural Resources Investigations, 2010-2011*, URS Corp., Denver, Colorado). Phase II testing was conducted at this find spot in November 2012 and no additional artifacts were encountered. As a result, this find spot site is recommended as not eligible to the National Register (Jones et al., 2013 draft, *Phase II Evaluation of Archaeological Sites 32CS0201 & FM 14-47-IF, Reaches 1 and 4, of the Fargo-Moorhead Metro Flood Risk Management Diversion Channel Alignment, Cass County, North Dakota*, Great Lakes Archaeological Research Center, Milwaukee, Wisconsin). The draft Phase II testing report has been submitted to the North Dakota SHPO, who is expected to concur that this find spot site is not eligible to the National Register and no further cultural resources work at its location is necessary.

Finally, the channelized portion of the Rush River in Section 25, Township 141 North, Range 50 West, was recorded as Feature 2 (Rush River Drain No. 12), and a segment of drainage ditch in the center of Section 36, Township 141 North, Range 50 West, was recorded as Feature 2 South, of linear resource 32CS5113, historic flood control ditch channels. Tucker et al. (2012:219, Table 136) recommends these segments of channelized river and drainage ditch as

eligible to the National Register due to their association "with the historical events surrounding the significant flooding that has occurred in and around the area since it was settled" as the ditch was dug and the river channelized "to allow for settlement and continued use of the area, both for residential and agricultural purposes." The Corps of Engineers does not concur with these recommendations at this time. Coordination with the North Dakota SHPO regarding the National Register eligibility or non-eligibility of the drainage ditch segment and channelized segment of the Rush River is ongoing.

N.7 MECHANICAL AND ELECTRICAL

The only mechanical features within Reach 4 are the flap gates on the local drainage structure.

There are no electrical features within Reach 4.