



**US Army Corps
of Engineers®**
St. Paul District

Appendix E: Civil-Site

Fargo Moorhead Metropolitan Area
Flood Risk Management Project

**Oxbow, Hickson, Bakke Ring Levee Phase
WP-43B**

Engineering and Design Phase

P2#

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Appendix E: Civil-Site

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Appendix E: Civil-Site

E.1 GENERAL

Civil design for this project will include clearing and grubbing, utility removals, layout of levee, drainage ditches, access roads, and general grading. This section summarizes the proposed layout, method of analyses, and support for preparation of the plans, specifications, and cost estimate.

E.2 DEMOLITION

Demolition by the levee contractor will include clearing and grubbing mature trees. Underground utilities abandoned in place will need to be removed by the levee contractor. See Section E.7 for additional discussion on demolition of utilities. Demolition of homes/buildings is not anticipated in WP-43B, as the alignment avoids these conflicts.

E.3 LEVEES

E.3.1 Levee Design

The OHB Ring Levee will have a 10' top width, and will have a 6" thick aggregate road for inspection and maintenance purposes. The aggregate road will have a 2% cross slope towards the outside of the levee to shed precipitation. The inside levee slope will be 4H: 1V while the outside levee slope will be 4H:1V with the exception of the NE segment between Main Street and CR81 which will have an outside levee slope of 5H:1V to satisfy the wind/wave run-up criteria. Interior and exterior ditches and culverts were designed by HMG and were incorporated into the WP-43B design by the COE. The levee slopes will have 6" of topsoil and seed for erosion protection.

During preparation of this submittal package, the Project Sponsors directed the design teams to evaluate a project design that would protect the OHB communities to a 100-year FEMA certifiable level utilizing the hydrology currently being used on the project. The 100-year FEMA certifiable level of protection will be referred to as the "basic" design.

The basic design levee will have a 10 foot wide road on top of the levee for maintenance and inspection. This road will have a 2% crown and .50 feet of aggregate base course. Similar to the full height levee, the basic levee inside slope will be 4H: 1V while the outside levee slope will be 4H:1V with the exception of the NE segment between Main Street and CR81 which will have an outside levee slope of 5H:1V to satisfy the wind/wave run-up criteria. Interior and exterior ditches and culverts were designed by HMG and were incorporated into the WP-43B design by the COE. The levee slopes will have 6" of topsoil and seed for erosion protection.

E.3.2 Levee Construction Grade and Final Design Grade

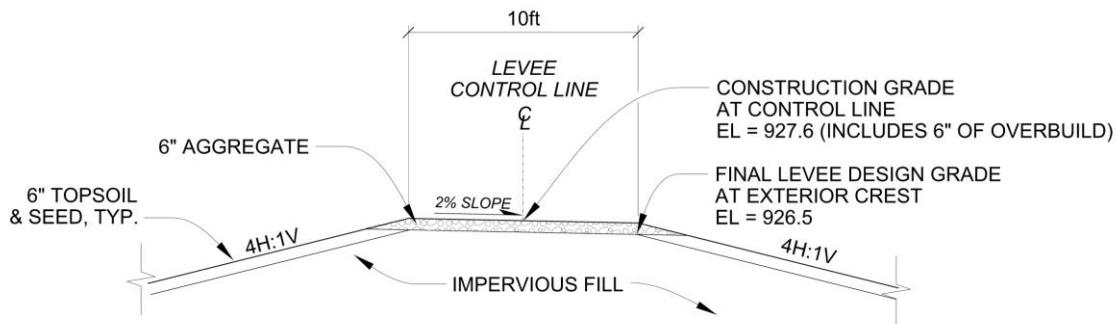


Figure 1 – Levee Design Elevations

The construction grade shown on the construction plan set is defined as the control line top of aggregate elevation taking into account the final levee design grade, the top of levee cross slope, aggregate road thickness, and overbuild to account for future settlement. Figure 1 shows these grades and they are discussed below.

- The final levee design grade is 926.5. This elevation is at the top exterior crest of the impervious fill. Overbuild will be added to this as defined below.
- The top of levee cross slope is 2% therefore the control line elevation top of impervious fill is 0.1' higher than the final levee design elevation.
- The aggregate road thickness is 0.5'.

Overbuild to account for future settlement is assumed to be 6" (with the exception of a few short segments where overbuild will be 8"). This will be added to the final levee design grade to define the control line construction grade.

The control line construction grade = $926.5' + 0.5' + 0.1' + 0.5' = 927.6'$

The construction grades shown on the construction plan set for the basic design is defined as the control line top of aggregate elevation taking into account the final levee design grade, aggregate road thickness, and overbuild to account for future settlement. These grades are discussed below.

- The final levee basic design grade at Sta B 0+00 is 921.5 and transitions linearly to a grade of 919.0 at Sta B 73+00. This elevation is at the control line or centerline on top of the impervious fill. Overbuild will be added to this as defined below.
- The aggregate road thickness is 0.5'.
- Overbuild to account for future settlement of the basic design is assumed to be 5" This will be added to the final levee basic design grade to define the control line construction grade.

The control line construction grade for the basic design at Sta B 0+00 is = $921.5' + 0.5' + 0.42' = 922.42'$. The control line construction grade for the basic design at Sta B 73+00 is = $919.0' + 0.5' + 0.42' = 919.92'$.

E.3.3 Levee Overflow Section

A small section of the OHB ring levee, Sta. B31+00 to Sta. B 54+00 will be constructed with an exterior crest elevation of 925.5. During a flood event large enough to potentially overtop the proposed levee this overflow section will allow flood water to enter the protected area in a controlled manner, which would potentially prevent an uncontrolled breach of the levee elsewhere along the alignment. As with the design top elevation of the levee, the weir crest elevation does not include required overbuild or aggregate base course. Details of this analysis are included in the Hydraulic and Hydrology Appendix C.1.

E.4 ACCESS ROADS AND TURNOUTS

EM 1110-2-1913 defines some design considerations for permanent project access roads as well as maintenance roads and turnouts. The maintenance road, turnouts and access roads are similar in design as the typical section for Cass County Roads: 6" gravel over compacted fill.

E.4.1 Project Access Roads

The design criteria used for the design of the access roads are summarized below:

Main Street Access Road

- 24' wide with 6" thick ND Class 13 gravel surface
- Grade of ramp should be no steeper than 1:7.
- Design Speed of vertical curves 25 mph minimum
- Side slopes should not be less than 1:4 to allow grass cutting equipment to operate.

51st Street Access Road

- 24' wide with 6" thick ND Class 13 gravel surface
- Grade of ramp should be no steeper than 1:8.
- Design Speed of vertical curves 20 mph minimum
- Side slopes should not be less than 1:4 to allow grass cutting equipment to operate.

E.4.2 Vegetation Free Zone (VFZ) Access

The location and design of access over the ditches to the VFZ will be provided in future submittals.

E.4.3 Turnouts

As defined in EM 110-2-1913, turnouts should be used to provide a means for the passing of two motor vehicles on a one way access road on the levee. Turnouts should be designed at intervals of approximately 2500 ft, if there are no ramps within the reach. Turnouts shall be 24 ft wide and approximately 100 ft in length (including transitions). Turnouts in WP-43B are located at the following stations:

- Station B 26+50
- Station B 82+30

E.5 SNOW FENCE

Because of the possibility for extreme snow events in the area, a 9 foot tall snow fence will be used from Sta. OBA 15+61.72 to OBB 32+78.27 and from Sta. OBC 11+51.18 to STA 0+10.75. The snow fence will be placed 20 feet from the daylight point of the outside ditch, (upwind from the levee). It was also recommended that the bench between the inside toe of the levee and the inside drainage ditch be increased to at least 30 feet wide where snow fence is to be installed. This will allow for more snow storage adjacent the interior toe of the levee while keeping the inside ditch clear of drifts. A guidance memo was developed for the snow fence, Fargo-Moorhead Metro Flood Risk Management Project - Oxbow, Hickson, Bakke (OHB) Ring Levee - GM-004 Snow Fence, and is included in Appendix M.

E.6 LOCAL DRAINAGE

Local drainage was designed by the local sponsor for incorporation into the WP-43B construction documents. The local drainage design includes culverts as well as drainage ditches that run parallel along the outside and inside of the OHB ring levee. The outside ditches will convey local runoff from adjacent properties, as well as the levees, to either existing field swales or existing road ditches. The inside ditches are designed to convey water to interior ponds and pump station. A minimum 20ft wide buffer will be provided between the toe of the levee and ditches. The outside and inside ditches are shown in the construction plans.

Additional culvert information can be found in the Draft Technical Memorandum for the Local Drainage Plan and is included in Appendix C.2. This memorandum is for information only. No review shall be done on this memorandum for this submittal.

E.7 UTILITY INFORMATION

Utility information, including surveyed locations, was obtained from Moore Engineering under contract with the local sponsor.

E.7.1 Existing Utilities

The following table lists identified utilities within the construction limits of WP-43B:

Table E-1: Utilities WP-43B

UTILITY	CROSSING STATION	DESCRIPTION
ELECTRIC		
Cass County Electric	Underground line crosses at Station B 58+80	Line runs east-west along north side of 51 st Street. Three Phase Underground.

UTILITY	CROSSING STATION	DESCRIPTION
Cass County Electric	Underground line crosses interior ditch at Station IBB 10+40	Line runs east-west crossing inside drainage ditch. Three Phase Underground.
COMMUNICATION		
MidContinent	Underground line crosses at Station B 5+00	Line runs north-south along the east side of Cass County Rd 81.
Sprint	Underground line crosses at Station B 3+40	Line runs North-South along the west side of Cass County Rd 81.
Century Link	underground lines cross at Station B 107+20	One pair copper line runs north-south along the west side of Main Avenue.
Century Link	Underground copper line crosses at Station B 58+50	One 100 pair copper line runs east-west along north side of 51 st Street.
Century Link	Underground copper line crosses at Station B 58+20	One 75 pair copper line runs east-west along south side of 51 st Street.

A complete overview of all existing utility information for Oxbow, Hickson, Bakke Ring Levee is included in WP-43E.

E.7.2 Utility Relocations

Utility relocations will comply with MFR-019 Oxbow, Hickson, Bakke Ring Levee Utility Relocation Requirements and local/state requirements. This MFR is included in Appendix M. All relocations will be performed prior to construction. Utility relocation plans are included in WP-43E and will be provided to the contractor as a plan reference document.

E.7.2.1 Overhead Electric

Overhead electrical lines will be relocated by the utility owner prior to project construction. Demolition of existing lines and poles will be the responsibility of the utility owner.

E.7.2.2 Underground Electric

Underground electrical lines will be relocated by the utility owner prior to project construction. Existing lines will be abandoned in place by the Utility Company and removed by the WP-43B Contractor. The removals are included in the WP-43B plans.

E.7.2.3 Buried Communication Lines

Buried Communication lines will be relocated by the utility owner prior to project construction. Existing lines will be abandoned in place by the Utility Company and removed by the WP-43B Contractor. The removals are included in the WP-43B plans.

E.7.2.4 Water Mains

There are no existing water mains within the grading limits of WP-43B.

E.8 VEGETATION FREE ZONE (VFZ)

The requirements for VFZ are outlined in the USACE Technical Letter ETL 1110-2-571. The VFZ will be a minimum of 15' from the toe of levee. The VFZ lines will not be shown in the WP-43B contract documents, but will be defined in the O&M documents provided to the local sponsor at project completion.

E.9 REAL ESTATE/WORK LIMITS/CONSTRUCTION

E.9.1 Easements

The VFZ for this project will be acquired in Fee Title. The inside and outside ditches will be outside of the VFZ, so additional Fee Title property acquisition will be required for the ditch footprint, as well as the area adjacent to the ditch to allow for maintenance. Temporary construction easements (Work Limits) may also need to be secured to allow for adequate space to construct the project. Work Limits are shown on the construction plans. Fee Title and Temporary Easement boundaries will be shown in the Right of Way drawings developed by Houston-Moore Group (HMG) and will not be included with WP-43B.

E.10 TECHNICAL GUIDELINES AND REFERENCES

<i>A Policy on Geometric Design of Highways and Streets</i> , Fifth Edition; American Association of State Highway and Transportation Officials (AASHTO); 2004.
<i>Guidelines for Geometric Design of Very Low-Volume Local Roads</i> , American Association of State Highway and Transportation Officials (AASHTO); 2001
USACE EM 1110-2-1913, Design and Construction of Levees
USACE EM 1110-2-2902, Conduits, Culverts and Pipes

USACE ETL 1110-2-571, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Damns and Appurtenant Structures
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USACE MVP MFR 019 Oxbow, Hickson, Bakke Ring Levee Utility Relocation Requirements
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