Mouse River Enhanced Flood Protection Project — Phases MI-2 and MI-3
Project Summary Report

Prepared for the Souris River Joint Board

BARR

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October 14, 2016

Col. Sam Calkins
Commander and District Engineer
St. Paul District, US Army Corps of Engineers
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St. Paul, MN 55101-1678

The Souris River Joint Water Resource Board, North Dakota (SRJB) requests US Army Corps of Engineers (USACE) approval under U.S.C. 408 for modifications to the Souris River, Minot Flood Control System as part of the Mouse River Enhanced Flood Protection Project (MREFPP).

The USACE flood control project at the City of Minot was authorized over several years in three separate Congressional actions:

- Flood Control Act of 1965 (P.L. 89-298)
- USACE Chief of Engineers in House Document 286, 87th Congress, 2d Session
- USACE Chief of Engineers in House Document 321, 91st Congress, 2d Session

Our proposed levee realignment and other repairs and modifications require review and approval by the USACE before we can proceed with construction. Section 33 U.S.C. 408 authorizes the Secretary of the Army to approve alterations or modifications to USACE authorized local flood control projects. The Secretary of the Army has delegated the approval authority to the Chief of Engineers. A Section 214 Memorandum of Agreement between the USACE and SRJB was executed on December 17, 2014 to provide funding and expedite the Section 408 review.

Attached is a Project Summary Report (PSR) of our requested modifications along with the required supporting engineering and environmental documentation conducted by Barr Engineering for Phases MI-2 and MI-3 of the MREFPP under contract to the Souris River Joint Board (SRJB). Houston Engineering is currently developing Phase MI-1. The North Dakota State Water Commission along with the SRJB and City of Minot has provided funding support for this project and will be providing funding assistance through construction. The primary features of the proposed modification include: new levee alignments, an interior drainage pump station and gatewells, stop log road closure structure, overbank excavation, levee and bank erosion protection, and municipal infrastructure modifications. The proposed modifications resolve issues related to FEMA levee certification and issues identified by USACE periodic project inspections.

An Environmental Impact Statement (EIS) for the proposed MREFPP is being conducted to comply with NEPA regulations (33 CFR Part 230). The EIS includes an analysis of impacts associated with Phases MI-2 and MI-3 of the proposed Project as well as the other Project segments from Burlington to downstream of Minot. The draft EIS is anticipated to be completed and released for public review in late October or early November 2016.

The SRJB contracted the services of HDR Engineering, Inc., to conduct a Type II Safety Assurance Review of the Section 408 proposal of the designer of record, Barr Engineering. The IEPR report is included in our submitted documents.

We request an expedited review of our final package so that construction of the project modifications can begin. The constructions season in North Dakota is short and an expedited approval will assist in starting the construction of critical project features in the summer of 2017.

Sincerely,

David Ashley, Chairman
Souris River Joint Board

Project Summary Report (PSR)
Mouse River Enhanced Flood Protection Project – Phases MI-2 and MI-3

October 2016

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Appendix A USACE Section 408 Review Request and Authorization Request Checklist

Executive Summary

This project summary report (PSR), in conjunction with the basis of design report (BDR) *(*reference [1]), contains information related to the design of the Mouse River Enhanced Flood Protection Project (MREFPP)—Phases MI-2 and MI-3 (aka, MREFPP Phase 2 and 3), located in Minot, North Dakota. The Mouse River is referred to as the Souris River in Canada and in U.S. federal descriptions. The state of North Dakota, however, has adopted Mouse River as the official name, and the waterbody will be referred to in this report as the Mouse River.

The MREFPP (Project) is part of a basin-wide effort by the Souris River Joint Board (SJRB) to address water issues within the Mouse River valley. In the immediate aftermath of the record flood of 2011, the SRJB and the North Dakota State Water Commission (NDSWC) focused their attention on developing a flood risk-reduction plan that could protect developed areas from a flood of similar magnitude. The planning objectives were to protect as many homes as possible, minimize the Project footprint, and minimize impacts to unprotected features. Following significant technical analysis, stakeholder and community input, and environmental considerations, the *Preliminary Engineering Report* (reference [2]) was published in February 2012 and adopted by SRJB and Minot.

This report summarizes the design basis for Phases 2 and 3 of the Project. Phase 1 (aka, Phase MI-1 being designed by others), referred to as Fourth Avenue Levee System, is on the north side of the river, generally between the Broadway and Third Street NE bridges. Phase 2, referred to as the Napa Valley Levee System, is on the north side of the river and extends from the Highway 83 Bypass on the west to Sixteenth Street SW on the east. Phase 3, referred to as the Forest Road Levee System, has features on both the north and south sides of the river. Features on the north side of the river extend east from Sixteenth Street SW to the Canadian Pacific Rail embankment. On the south side of the river, the features extend east from the Water Treatment Plant (WTP) to the Moose Park Pump Station.

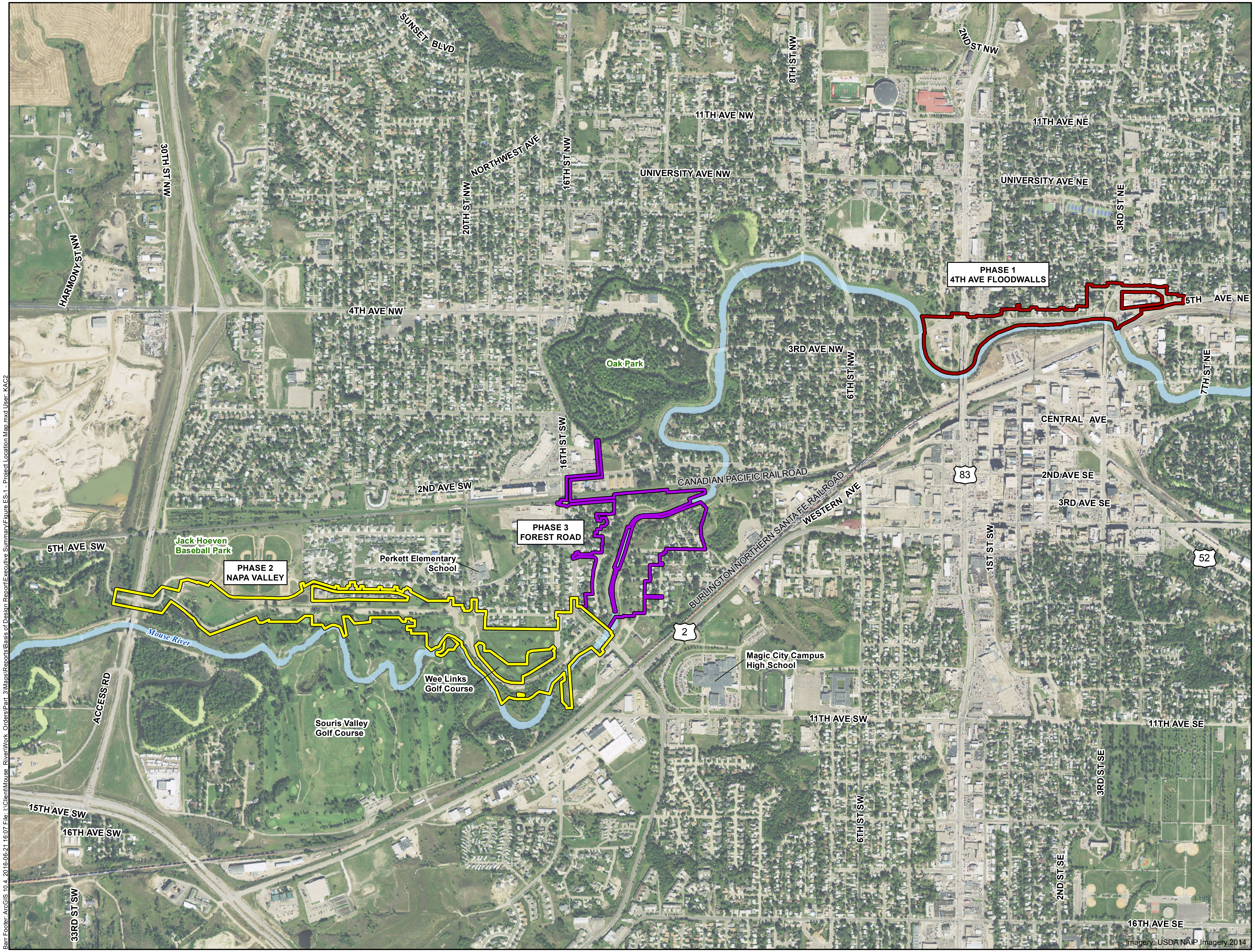
Phases 2 and 3 of the Project are being designed in conjunction with Phase 1. Figure ES-1 identifies the locations of Phases 1, 2, and 3. Major design features associated with Phases 2 and 3 are listed below.

- Approximately 10,530 feet of new levee
- Three gatewell control structures
- Levee ramps for access, maintenance, and inspections
- A new 45,000 gpm Perkett Ditch Pump Station with interior drainage improvements
- Tie-back levees at Wee Links Golf Course, Canadian Pacific Railroad, and Moose Park, providing these areas with the existing level of flood risk reduction
- A stoplog road closure with floodwall sections at Sixteenth Street SW
- Overbank excavation adjacent to the Mouse River channel from the Sixteenth Street SW bridge to the proposed Maple Diversion (future MREFPP phase)

- Bank and levee erosion protection
- Water main, force main, and storm sewer upgrades for pipe networks crossing under the levee within the Project right-of-way
- Municipal infrastructure modifications and improvements, including sanitary sewer, water main, storm sewer, and street reconstruction
- Wee Links and Souris Valley Golf Course modifications and improvements including tee, fairway, and green re-construction
- City greenway features including bike trail system and open space

Also included in planned system improvements are corrective measures and work items identified during the US Army Corps of Engineers (USACE) 2014 routine inspection:

- Unwanted vegetation growth
- Insufficient vegetation establishment
- Closure structure corrections
- Encroachments
- Erosion/bank caving
- Corrections to culverts and discharge piping



Barr Footer: ArcGIS 10.4, 2016-06-21 16:07 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Basis of Design Report\Executive Summary\Figure ES-1 - Project Location Map.mxd User: KAC2

Project Phases

- Phase 1
- Phase 2
- Phase 3

0 600 1,200 2,400

Feet

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Figure ES-1

PROJECT LOCATION MAP

Basis of Design Report
Mouse River Enhanced Flood Protection Project -
Phase 2 and 3
Minot, North Dakota

Pertinent Data

Original Project Authorization and Purpose

The Project for local flood risk-management improvements on the Souris (Mouse) River at Minot, North Dakota, was developed by the USACE over several years in three separate Congressional actions:

- Flood Control Act of 1965 (P.L. 89-298)
- USACE Chief of Engineers in House Document 286, 87th Congress, 2d Session
- USACE Chief of Engineers in House Document 321, 91st Congress, 2d Session

Project Purpose

The purpose of the Project is to meet the following goals:

- Reduce the risk of property damage and loss of life in the most densely populated reach of the river due to floods that approach the size of the 2011 flood (i.e., 27,400 cubic feet per second (cfs)), regardless of where the precipitation occurs in the Souris River Basin.
- Keep critical elements of the public transportation system operating during and after a flood similar to the 2011 flood in size.
- Design and construct a flood risk-reduction system for a 27,400 cfs flood event that meets current USACE standards and the Federal Emergency Management Agency (FEMA) requirements for accreditation.

Type of Project—Phases 2 and 3

This is a local flood risk-management project consisting of levees, interior drainage facilities, a pump station, seepage control, interceptor ditches, a road closure structure, overbank excavation, and bank/levee erosion protection.

Hydrology and Hydraulics

Drainage area	31,200 square miles
Existing flood risk reduction capacity	5,000 cfs
Phase 2 & 3 design flood flow	27,400 cfs
Channel capacity (discharge at which river banks overflow)	1,150 cfs

Principal Items of Work

Levee

Existing Levee Alignment

North side of Mouse River	9,485 feet
South side of Mouse River	2,645 feet

New Levee Alignment

Type	Compacted levee fill

Length	
North side of Mouse River	8,930 feet
South side of Mouse River	1,600 feet
Side slopes	3H:1V
Maximum height	23.3 feet
Average height	14.4 feet
Top crest width	10 feet
Stage Uncertainty	1.4 - 2.2 feet
Settlement Overbuild	10.5 - 14.0 inches
Superiority Overbuild	1.0 - 3.1 feet
Ramps	
Number of access ramps	17
Seepage Correction	
Collection trench	7,450 feet
Number of Relief Wells	6
Levee and Bank Erosion Protection	
Natural (bioengineered) streambank	1,600 feet
Turf reinforcement mat	21,000 square yards
Riprap	44,000 square yards
Closure Structures	
Sixteenth Street SW road closure	377 feet
Interior Drainage Facilities	
Pump Station	
Capacity of station	45,000 gpm
Number of pumps	3
Ponding	
Centennial Forest (storage volume) (independent project)	27 acre-feet at 1,555.85
Interceptor Ditches and Gatewells	
Interceptor ditches	
Length	2,840 feet
Side slopes	4H:1V
Gatewells	
Number of gatewells	3
Outlet size	
Perkett Ditch Gatewell	8- x 8-foot box
Wee Links Gatewell	18-inch pipe
Bark Park Gatewell	60-inch pipe

USACE Inspection Work Items Corrected (# of deficiencies)	
Unwanted Vegetation Growth	8
Insufficient Vegetation Establishment	2
Closure Structure Corrections	4
Encroachments	5
Bank Erosion Repair	3
General infrastructure	8
Property Acquisition (Phase 2 and 3)	
Existing levee right-of-way (from USACE drawings)	85.83 acres
Existing easement in project area to be vacated	53.51 acres
New permanent easement in project area	89.25 acres
Net permanent easement in project area	+35.74 acres
Temporary construction easement in project area	37.28 acres
Project Cost Share	
Federal share	0 percent
Local share	100 percent

1.0 Request for Permission

The Souris River Joint Board (SJRB) is requesting that the U.S. Army Corps of Engineers (USACE) allow the proposed modifications to the flood control system in Minot, North Dakota. Please contact David Ashley (SRJB) at 701-837-8737 or Engineer Jason Westbrock (Barr Engineering Co.) at 701-255-5472 with questions regarding the attached documentation. Appendix A includes the formal USACE Section 408 Review Request form and Authorization Request Checklist.

The proposed modifications to the existing flood risk-management projects along the Mouse River are described in the following sections.

1.1 Project Authorization

The existing flood risk-management projects along the Mouse River (the Souris River Basin Project) were developed by the USACE over several years in three separate Congressional actions:

- Flood Control Act of 1965 (P.L. 89-298)
- USACE Chief of Engineers in House Document 286, 87th Congress, 2d Session
- USACE Chief of Engineers in House Document 321, 91st Congress, 2d Session

1.2 Prior Reports and Studies

Efforts to address flooding problems in Minot started in the 1930s and have resulted in the implementation of several flood risk-reduction projects. A brief summary of key past studies and resulting projects follows.

- **1930:** A USACE report recommended a study of flood control alternatives including reservoir storage near Foxholm, North Dakota, and a floodway through Minot.
- **1935:** A follow-up to the 1930 report conducted by the USACE concluded that neither reservoir storage nor local protection provided sufficient benefits to permit federal participation in flood risk-reduction projects.
- **1957:** Additional studies were recommended in a USACE examination of the Mouse River in the vicinity of Minot.
- **1965:** The Flood Control Act (Public Law [P.L.] 89-298) authorized channel modifications and enlargement at Minot.
- **1969:** The USACE issued a report and draft environmental impact statement (EIS) which included a recommendation for early construction of the channel modifications and enlargement at Minot.

- **1970:** Senate (June 25) and House (July 14) Public Works Committee resolutions authorized the channel modifications and enlargement features at Minot, as recommended in the 1969 USACE report.
- **1971–1979:** Channel enlargements within Minot were designed for 5,000 cfs flow.

1.3 Purpose/Need for Modification

The Mouse River has a history of flooding, including the record-breaking flood of 2011. The 2011 flood overwhelmed most levees and flood-fighting efforts along the entire reach of the Mouse River through North Dakota, causing extensive damage to homes, businesses, public facilities, infrastructure, and rural areas. Over 4,700 commercial, public, and residential structures in Ward and McHenry counties sustained an estimated $690 million in damages.

In the immediate aftermath of the 2011 flood, the Souris River Joint Board (SRJB) and the North Dakota State Water Commission (NDSWC) focused their attention on developing a flood risk-reduction plan that could protect developed areas from a flood of similar magnitude. A team led by Barr Engineering Co. (Barr) was selected by the NDSWC to develop plans for flood risk-reduction features that could accommodate flows up to 27,400 cfs. The primary objectives were to protect as many homes as possible, minimize the Project footprint, and minimize impacts to unprotected features. Significant stakeholder involvement was solicited to identify Project constraints/requirements which include, but are not limited to:

- Minimizing property acquisitions.
- Minimizing impacts to the Northwest Area Water Supply (NAWS) water pipeline.
- Incorporating 3 feet of additional flood risk management feature height to allow for uncertainty and superiority.
- Maintaining functionality of critical transportation routes during a flood.
- Limiting observed (2011) increases to water surface elevations at the WTP.
- Maintaining key community resources.

The resulting *Preliminary Engineering Report* (reference [2]) was completed on February 29, 2012, adopted by Minot through City Council action in April 2012, and adopted by the SRJB in December 2013. It serves as the master plan for the Mouse River Enhance Flood Protection Project (MREFPP or Project), which is sponsored by the SRJB and will be executed in multiple phases. Phases 1, 2, and 3 of the Project are shown in Figure 1-1. This design report will focus on the design elements of Phases 2 and 3 (Figure 1-2) and provide a broad assessment of the Project's hydraulics.

The SRJB is pursuing other measures to reduce the risk of flooding in the rural reaches of the valley based on the *Rural Flood Risk-Reduction Alternatives Evaluation* (reference [3]), completed by the Barr

Engineering team in May 2013. These methods include implementation of the structure acquisition, relocation or ring dike (StARR) program, and advocating for changes in reservoir operations.

The MREFPP would be constructed over a period of more than 25 years depending on availability of SRJB's funding. Implementation would involve constructing over 20 segments in various communities and neighborhoods from Burlington through Minot. The initial construction consists of designing and constructing three segments within Minot: Fourth Avenue NE (Phase 1), Napa Valley (Phase 2), and Forest Road (Phase 3). It is anticipated that these segments would be designed and permitted in 2015 and 2016 with construction beginning in 2017. The next phases of the Project would include the construction of the Maple Avenue High-Flow Diversion, Tierrecita Vallejo, and a tieback levee. The initial three phases along with these three later segments provide flood risk reduction to a portion of the Project area, independent of any other significant flood fighting actions, and is considered the first portion of the Project that can be permitted under Section 404. Additional information on the various construction stages is provided in the Environmental Impact Statement (EIS).

1.4 Description of Proposed Phase 2 and 3 Modification

Phases 2 and 3 of the Project will provide flood risk-reduction within the Napa Valley and Forest Road areas, in the western upstream portion of Minot.

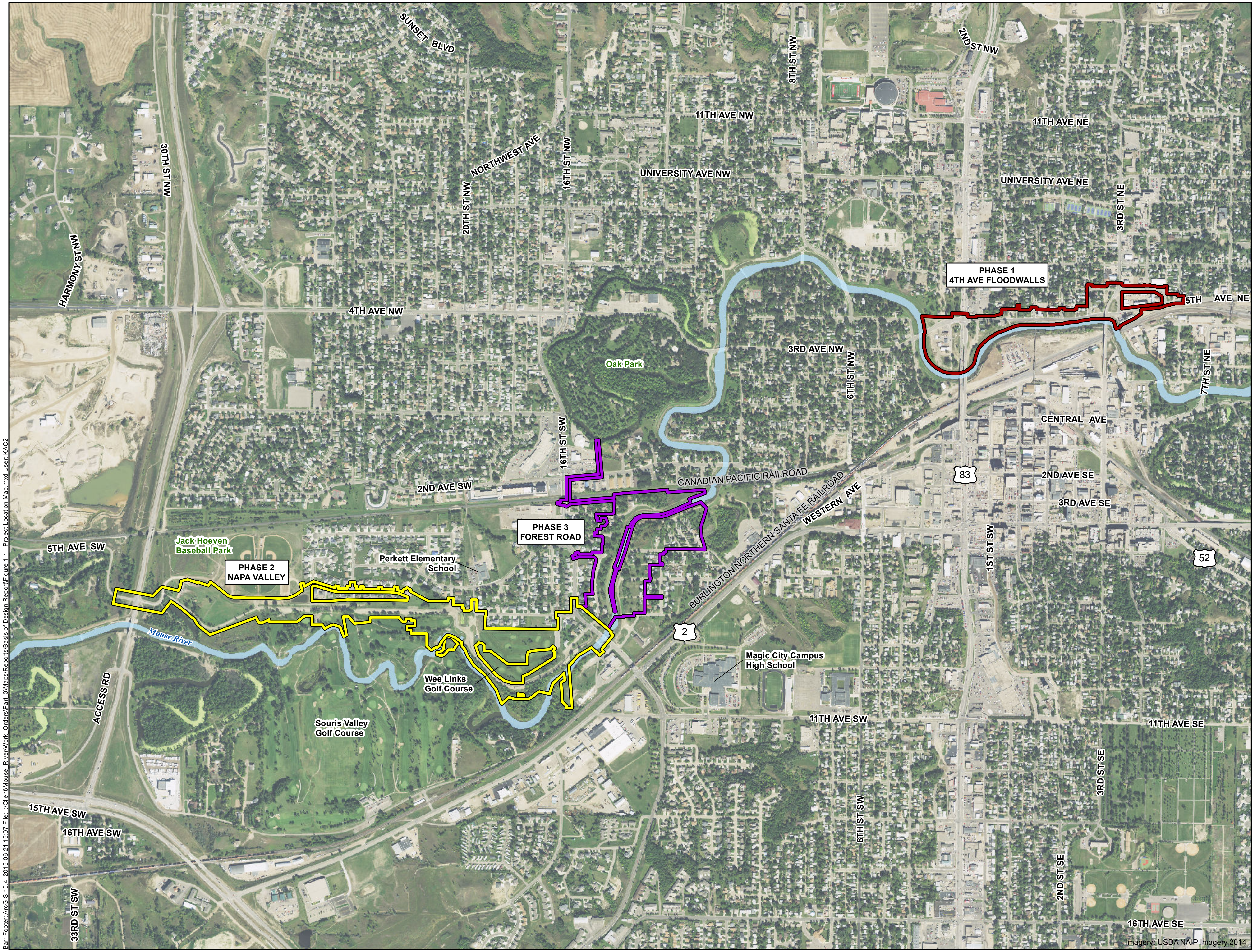
Significant modifications to the existing levee system are required to (1) accommodate the increase in design flow from 5,000 to 27,400 cfs, (2) generally follow USACE design criteria to obtain USACE Section 408 permission, and (3) obtain future Federal Emergency Management Agency (FEMA) accreditation for the flood risk-management system. These modifications generally consist of:

- New levee alignments on the north side of the Mouse River extending from approximately the Highway 83 Bypass to the Canadian Pacific Railroad (Station -0+60A to Station 88+70A) and on the south side of the river from the WTP to the future Maple Diversion (Station 0+00B to Station 16+00B).
- Gatewell control structure within the proposed levee at Station 5+60A to convey runoff to the Mouse River from drainage along Highway 83 Bypass and remnant oxbow.
- Levee ramps for access, maintenance, and inspection at locations identified in the construction drawings.
- The Perkett Ditch Pump Station and gatewell control structure at approximately Station 47+00A.
- A stoplog road closure at Sixteenth Street SW with floodwall sections at Station 65+71A.
- A Northwest Area Water Supply (NAWS) transmission line and water main upgrades for crossings within the USACE right-of-way near Sixteenth Street SW.
- Overbank excavation adjacent to the Mouse River channel from the Sixteenth Street SW bridge to the future Maple Avenue High Flow Diversion.

- A tie-back levee connecting the proposed and existing levees to maintain the level of risk management at Moose Park (Station 0+00D to Station 5+87D).
- Bank erosion protection for the Mouse River channel and flood risk-management features at various locations.
- Sanitary, water main, force main, and storm sewer upgrades for pipe crossings under the levee within the USACE right-of-way at various locations.
- Municipal infrastructure modifications and improvements including sanitary sewer, water main, storm sewer, and street reconstruction.
- Wee Links and Souris Valley Golf Course modifications and improvements including tee, fairway, and green reconstruction.
- A gatewell control structure within the existing levee near Station 0+00K to convey runoff from the Wee Links Golf Course to the Mouse River.
- A tie-back levee to provide the Wee Links Golf Course with the existing level of flood risk management from Station 0+00C to Station 4+03C.
- City greenway including bike trail system and open space.

Below is a summary of corrective measures and work items identified during the USACE's 2014 routine inspection. These work items are included in the planned system improvements within Phases 2 and 3.

- Unwanted vegetation growth
- Insufficient vegetation establishment
- Closure structure corrections
- Encroachments
- Erosion/bank caving
- Corrections to culverts or discharge piping



Project Phases
- Phase 1
- Phase 2
- Phase 3

0 600 1,200 2,400
Feet

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Figure 1-1

PROJECT LOCATION MAP

Basis of Design Report
Mouse River Enhanced Flood Protection Project -
Phase 2 and 3
Minot, North Dakota

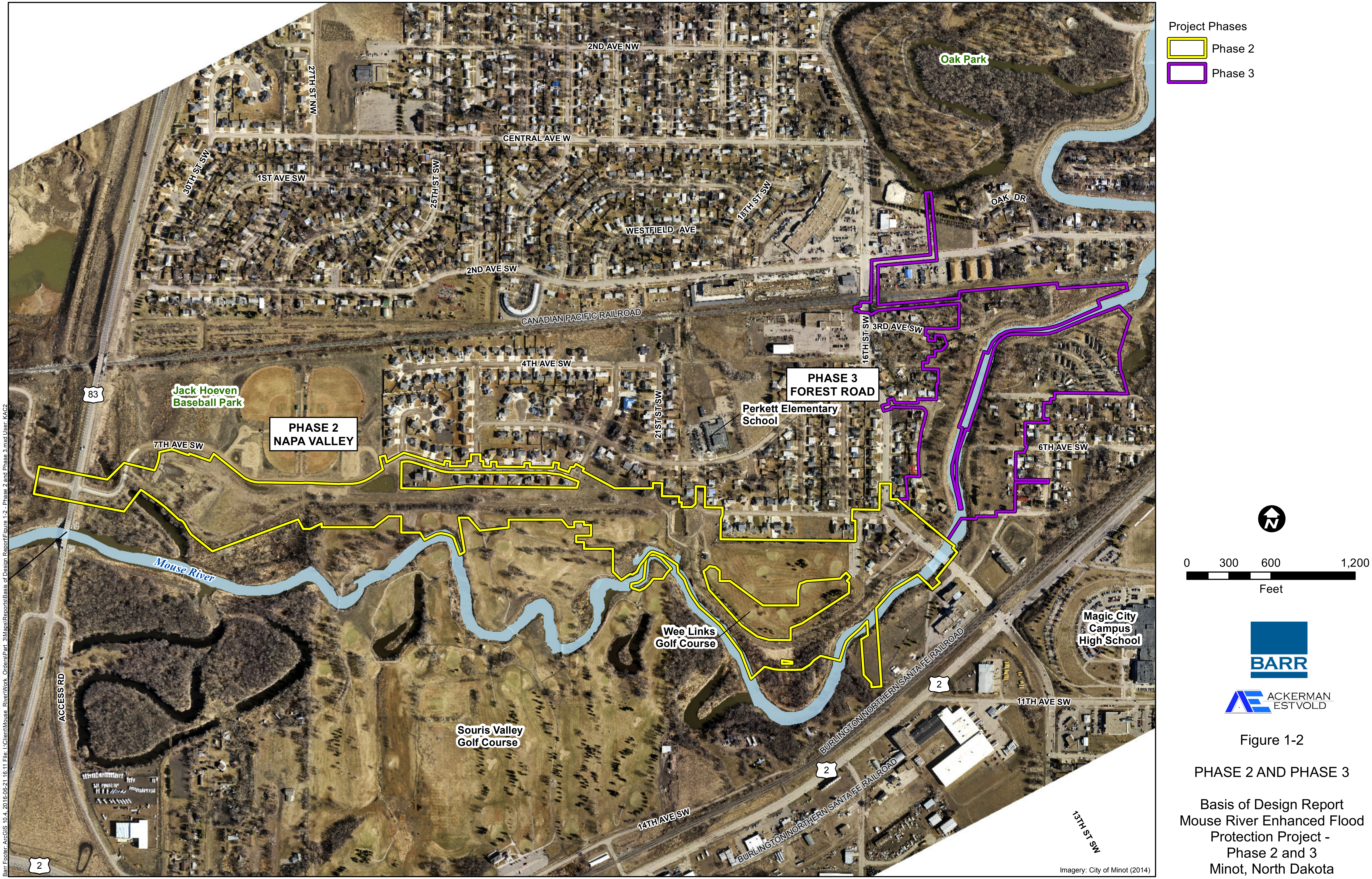


Figure 1-2

PHASE 2 AND PHASE 3

Basis of Design Report
Mouse River Enhanced Flood Protection Project -
Phase 2 and 3
Minot, North Dakota

2.0 Technical Analysis and Adequacy of Design

The USACE St. Paul District performed an agency technical review (ATR) for Phase 2 and 3. A concurrent review was completed by an independent external peer review (IEPR) panel. The set of plans and reports included in this Section 408 application reflects revisions made in response to ATR and IEPR comments.

The major assumptions that have driven the design of this project are as follows:

- The proposed levee modifications must increase the level of flood risk reduction for Minot.
- The modifications must generally follow USACE guidelines and standards for design and construction.
- When constructed at the proposed elevation, the levee will meet FEMA accreditation criteria.

2.1 Geotechnical Analysis

Geotechnical documentation is included in Section 2 and Appendix B of the BDR (reference [1]). The geotechnical evaluations are intended to comply with the recommendations provided in EM 1110-2-1913: *Design and Construction of Levees* (reference [4]).

2.1.1 Soil Investigations

A total of 55 soil investigations consisting of both soil borings and in-situ (CPT and DMT) testing were performed to identify soil conditions along the project alignment. The soil borings were generally located along the proposed cross-section locations, spaced approximately every 600-800 feet along the alignment. Laboratory testing on selected soil samples from the borings were performed and results were used to determine unit weight, strength, compressibility, and permeability characteristics of each soil type.

2.1.2 Slope-Stability and Seepage Analysis

Seepage and slope-stability analysis was performed for locations along the proposed levees to make sure the design is consistent with the factors of safety criteria in EM 1110-2-1913 (reference [4]). The factors of safety were determined to evaluate stability of the levee system including levee side slopes, levee setback from river channel slopes, rapid drawdown scenarios, and piping/heave at the landside toe.

Results indicated that the recommended factors of safety were met by the proposed 3:1 levee sideslopes and levee location with the inclusion of a partially penetrating pressure-relief seepage-collection trench to achieve the necessary factor of safety against heave. In addition, six relief wells are included in the design to help relieve pressure where the levee alignment crosses the old oxbow channel near the Highway 83 Bypass.

2.1.3 Construction Materials

The earthwork specification required that levee fill materials have a liquid limit less than 50 percent, plasticity index less than 30 percent, and be classified as CL (lean clay) by ASTM D2487: *Standard Practice* *for Classification of Soils for Engineering Purposes* (reference [5]). This material is available from the upper 10 to 30 feet of the identified potential borrow sources.

2.1.4 Settlement

Evaluation of the in-situ and laboratory consolidation testing indicates that most of the levee alignment will have settlement less than 9 inches, but isolated locations on the north and south levee alignments could have up to 10.5 inches and 14 inches, respectively. Levee overbuild, using the higher magnitude estimated settlement, was incorporated into the design heights of the levees.

In areas where structures will be placed within the levee footprint, pre-consolidation using wick drains and surcharge piles were design to maintain an acceptable level of settlement while eliminating the need for deep foundations.

2.2 Hydrologic and Hydraulic Analysis

The hydrologic and hydraulic analysis is documented in Section 3.0 and Appendix C of the BDR. The purpose of hydrologic and hydraulic analysis is to:

- Establish existing hydraulic conditions.
- Establish design flood elevations for Project features.
- Help quantify Project impacts.
- Help evaluate risk and uncertainty associated with interim hydraulic conditions during Project implementation.

Hydraulic interdependencies among Project segments require that the hydrologic and hydraulic analysis include the entire Project area—not just the Napa Valley and Forest Road segments designed in Phases 2 and 3. The hydrologic and hydraulic modeling builds on previous modeling efforts for the *Preliminary Engineering Report* (reference [2]) and the *MREFPP Hydrologic and Hydraulic Modeling Report* (reference [6]).

2.2.1 Hydrologic Analysis

During the hydrologic analysis, inflow hydrographs for the hydraulic models were developed from rainfall-runoff modeling, observed flow data, and synthetic hydrographs.

Inflow hydrographs from HEC-HMS rainfall-runoff modeling were developed for the 2009, 2010, and 2011 historic flood events because they are representative of the range and types of flooding that occur in the Mouse River Valley. These events were also recent enough to have robust precipitation data sets that facilitated model calibration.

Unregulated and regulated flow data sets were developed using HEC-ResSim modeling of observed flow data from the USGS gaging stations for the entire period of record. From these data sets, synthetic balanced hydrographs and coincidental hydrographs were developed for the 10-, 25-, 50-, 75-, 100-, 200-, and 500-year return periods to simulate intermediate flood peaks and hydrographs not represented by the three historic events. The peak flow rates for the various return periods were based on FEMA's interim hydrology report for Ward County, North Dakota (reference [7]). A balanced hydrograph is a synthetic hydrograph that has equal exceedance probability for a variety of durations. Coincidental hydrographs define lateral inflows between gaging stations that result in a balanced hydrograph at the downstream gaging station.

2.2.2 Hydraulic Analysis

As part of the hydraulic analysis, existing and proposed conditions models were developed in HEC-RAS to simulate the Mouse River Valley from Lake Darling to Verendrye and a portion of the Des Lacs River from Foxholm to Burlington. The model was calibrated using the 2010 and 2011 flood events and validated with the 2009 event using stage and discharge data collected at gaging stations and observed high-water marks.

The calibrated and validated model was used to create two baseline models for evaluating Project impacts. These models allow evaluation of conditions with and without flood fights and are useful for understanding Project impacts at different flow rates.

- **Baseline 1** represents existing conditions with no emergency flood fight. This allows for the comparison of hydraulic differences between with-Project scenarios and no action.
- **Baseline 2** represents existing conditions with a successful 10,000 cfs flood fight, filling in gaps and low points along existing federally constructed levees. This allows for the comparison of hydraulic differences between with-Project scenarios and a flood-fight scenario similar to early June 2011.

Future conditions hydraulic models were developed to evaluate benefits and impacts for interim and full Project conditions. The with-Project hydraulic modeling simulates the flood risk-reduction elements for Burlington through Velva. The sequence for Project buildout was broken into five construction stages. Figure 2-1 is a schematic showing how the hydraulic models were developed and compared.

2.2.3 Hydraulic Design

The design flood for the Project is the 2011 flood hydrograph, which had a USGS estimated peak discharge of 27,400 at the Broadway bridge in Minot. Design flood elevations combined with uncertainty estimates and overbuild requirements were used to establish top elevations for levees, floodwalls, closure structures, geotechnical slope-stability, and seepage analysis.

The flood risk-reduction planning of this Project considered three types of uncertainty: (1) hydrologic uncertainty, (2) natural hydraulic uncertainty or variability in the estimated rating curves, and (3) model hydraulic uncertainty arising from the use of a hydraulic model. The hydrologic uncertainty was estimated by performing a discharge-probability analysis on 76 years of unregulated flows at the USGS gage above Minot simulated by a calibrated HEC-ResSim hydrologic model. Natural and hydraulic uncertainty was evaluated following methods outlined in USACE EM 1110-2-1619 (reference [8]).

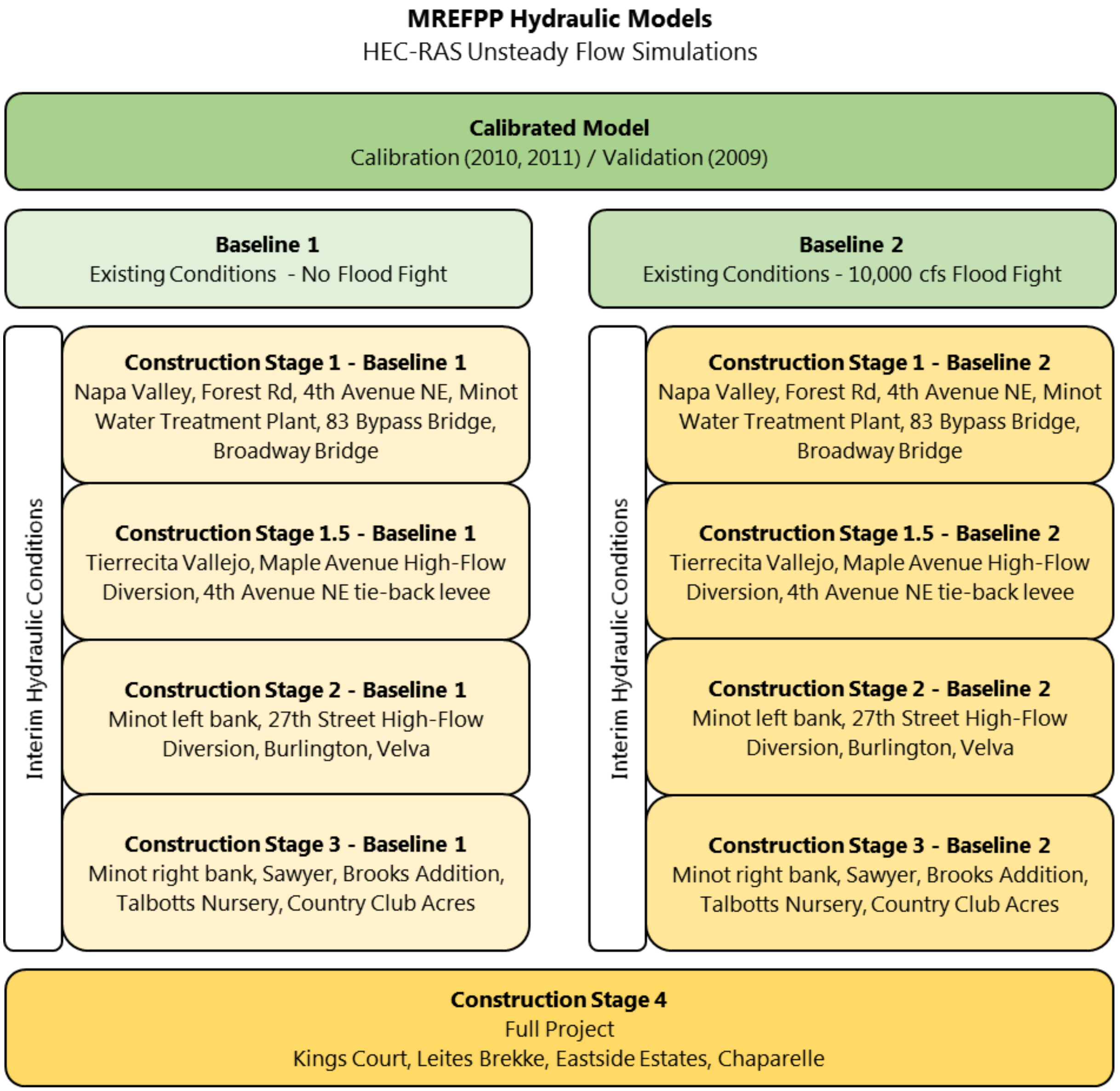


Figure 2-1 Hydraulic Model Development Schematic

2.2.4 Hydraulic Impacts Analysis

Hydraulic impacts from the Project on the regulatory floodway, flood profiles, flood hydrographs, inundation areas, structures and parcels, inundation depths at key bridges, depth duration frequency, and risk and uncertainty are evaluated and discussed in Section 3.0 and Appendix C of the BDR (reference [1]). Impacts from Construction Stages 1 through 4 were analyzed.

The Napa Valley and Forest Road project segments are Phases 2 and 3, respectively, of Construction Stage 1. These project segments would have some impact on both the effective regulatory floodway and FEMA's preliminary floodway. Because the preliminary floodway is larger, the Phase 2 and 3 impacts would be greater than for the effective regulatory floodway. Therefore, the local sponsor is coordinating closely with FEMA to develop a conditional letter of Map Revisions (CLOMR).

The risk and uncertainty analysis was used to evaluate how the Project would affect the risk of overtopping of existing and future levee segments after each construction stage. For existing conditions, the median and expected (average) annual probability of overtopping ranges between 0 and 1.5 percent. Over a 30-year period, the probability of overtopping ranges between 0 and 45 percent. After Construction Stage 1 is implemented, the annual exceedance probabilities increase slightly at some locations. However, the increase is less than 0.5 percent and the overall annual exceedance probabilities are less than 1.5 percent. At full Project buildout, the annual exceedance probability at all index stations is 0 percent.

Table 2-1 shows the percent chance of overtopping over a 30 year period for select locations near the Phase 1 floodwall, and Phase 2 and 3 levees. The table shows how the risk of overtopping is reduced for the Phase 1, 2, and 3 Project segments. Upstream of the Napa Valley reach (Phase 2), the percent chance of overtopping the existing Tierrecita Vallejo levee is not significantly changed by Construction Stage 1. Downstream of the 4th Avenue reach (Phase 1), the percent chance of overtopping near Burdick Expressway is not significantly changed by Construction Stage 1.

Table 2-1 Percent chance of levee overtopping over 30 years

Location	River Bank	HEC-RAS Model River Station (feet)	Existing Conditions	Construction Stage 1	Construction Stage 4
Tierrecita Vallejo 800 feet upstream of US 83 Bypass bridge	Left	1209143	30.6%	30.2%	0.1%
Napa Valley - Minot 700 feet downstream of US 83 Bypass bridge	Left	1207555	8.2%	0.1%	0.1%
Napa Valley - Minot 600 feet upstream of 16th Street bridge	Left	1199897	0.2%	0.1%	0.1%
Forest Road - Minot 1100 feet downstream of 16th Street bridge	Right	1198052	0.1%	0.1%	0.1%
Forest Road - Minot 1400 feet downstream of 16th Street bridge	Left	1197741	2.2%	0.1%	0.1%
4th Avenue - Minot 10 feet upstream of Broadway bridge	Left	1188485	19.6%	0.1%	0.1%
Burdick Expressway - Minot 500 feet downstream of Burdick Expressway bridge	Right	1178669	28.7%	28.9%	0.1%

2.3 Interior Drainage Analysis

The interior drainage analysis documentation for Phases 2 and 3 is included in Section 4.0 and Appendix D of the *MREFPP—Phase 2 and 3 Basis of Design Report—100% Design (BDR) (*reference [1]). The analysis was performed to determine the required pump station capacity, size gatewells, and design other interior drainage system modifications. It was completed following the methodology described in USACE EM 1110-2-1413 *Hydrologic Analysis of Interior Areas Engineering and Design* (reference [9]), to verify that the 1-percent annual chance coincident peak inundation levels behind the levee were developed with the following design considerations:

- Meeting the minimum requirements of U.S. Code of Federal Regulations 44 CFR §65.10(b) (6): *Mapping of Areas Protected by Levee Systems* (reference [10]).
- Accommodating criteria set forth in the Minot *Storm Water Design Standards Manual* (reference [11]) and the *Minot Standard Details* (reference [12]).
- Incorporating results of the river hydraulic analysis (Section 3.0, reference [1]) and levee design features (Section 6.0, reference [1]).
- Sizing the interceptor swales associated with drainage along the levees to convey the 1-percent annual design storm to a storm sewer system inlet.

The drainage area upstream of Phase 2 and 3 is divided into six major watersheds (Figure 2-2): Tierrecita Vallejo, Perkett Ditch, Arrowhead, Forest Road/Sixteenth Street, Odds, and Moose Park.

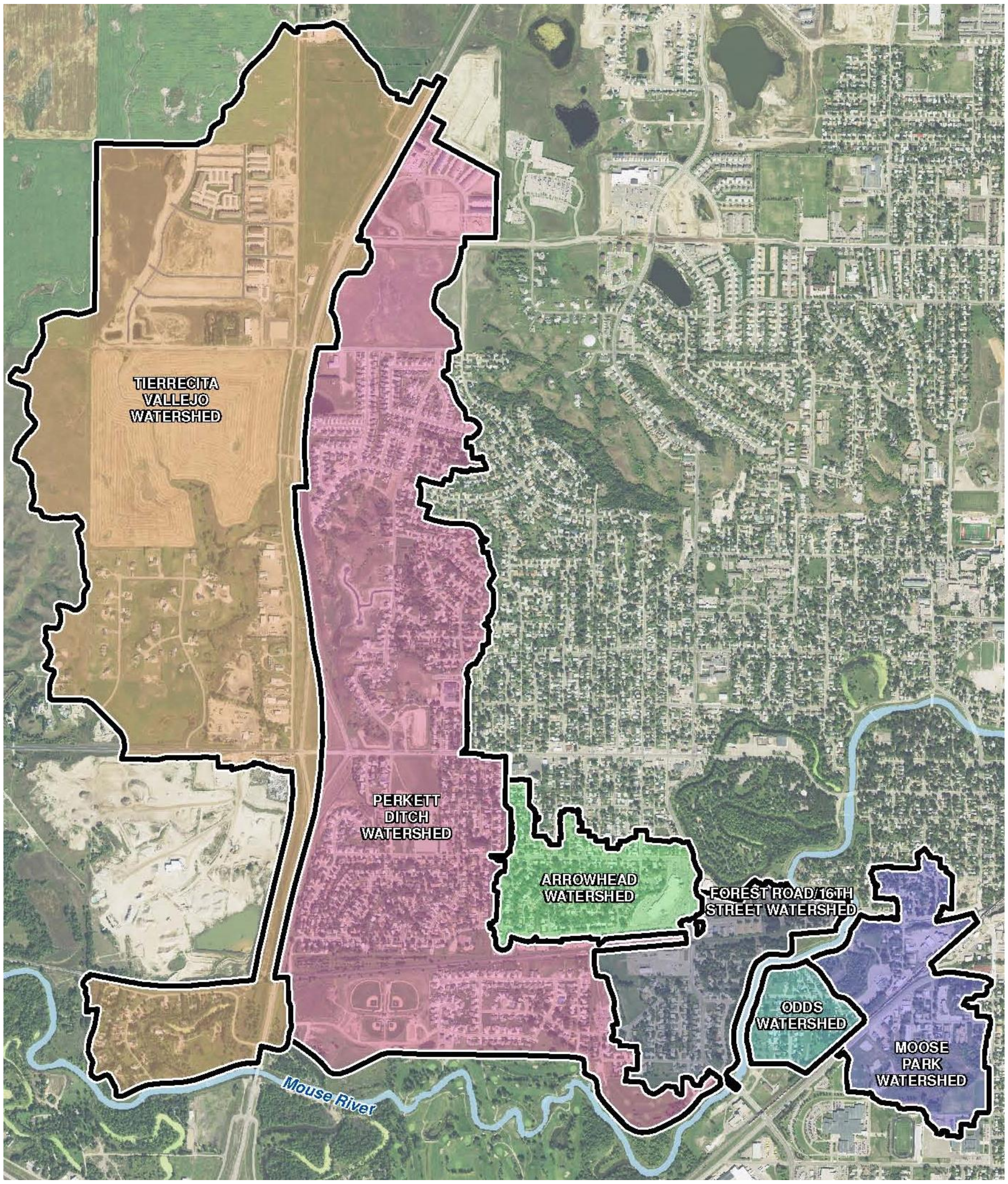


Figure 2-2 Phase 2 and 3 Project Location and Major Watershed Divides

2.3.1 Coincidental Frequency Analysis

A coincidental frequency analysis is a probabilistic method that can be used to perform a flood analysis of interior areas next to the levee system. This means that the probabilities of the river being at a given flood stage and a storm over the interior drainage area are combined to determine the likelihood of those events occurring simultaneously. In general, the analysis comprised three steps:

1. Develop a stage-duration function for the exterior area (Mouse River) based on historical gage data. Split the duration curve into several blocks based on hydraulic points of concern and obtain the average stage (elevation) for each block.

2. Simulate a series of hypothetical storm events over the interior drainage area for the average stage (elevation) of each block developed in Step 1.

3. Develop a weighted (coincident) probability function using the total probability theorem for each interior location of interest.

The coincident frequency analysis was used to determine the 1-percent annual chance flood elevations for the interior drainage system. The coincident 1-percent annual chance inundation areas within the interior drainage system were delineated. The interior drainage modifications, discussed in the following section, are intended to minimize the potential for the coincident 1-percent annual chance flood elevation from inundating existing structures in areas affected by the levee system modifications.

2.3.2 Interior Drainage System Proposed Modifications

Using coincident frequency analysis techniques, the interior drainage features were optimized to meet the minimum requirements of 44 CFR §65.10 (reference [10]) and the Minot *Storm Water Design Standards Manual* (reference [11]), while minimizing the size of the required pump station. Proposed major modifications to the interior drainage system include the following features.

- Construct an offline stormwater detention basin in Centennial Forest (aka. Centennial Forest Pond).
- Replace the existing Perkett Ditch Pump Station with a new 45,000 GPM capacity station.
- Convey runoff from the Wee Links Golf Course directly to the river through a new gatewell and provide emergency pumping capability.
- Increase select storm sewer capacity in the Perkett Ditch, Arrowhead, Forest Road, and Opps subwatersheds.
- Provide additional inlet capacity to the storm sewer system.
- Clean out and regrade sections of Perkett Ditch to provide positive drainage through the system.

2.4 Civil Design

2.4.1 Civil Design Features

Civil design was generally focused on Phase 2 and 3 elements related to alignment and definition of feature geometry, vertical profiles, utility design, and corridor requirements. USACE standards and guidelines were used for design development. Specific elements include the following:

- Erosion control
- Demolition and corridor preparation
- Horizontal and vertical levee alignments

- Cased utility penetrations and alignments within the proposed USACE right-of-way
- Levee ramps for access, service, or crossings
- Perkett Ditch Pump Station layout including access, grading, and general siting
- Box culvert modifications including extended alignment, maintenance ramp access, and approach pipe for the Perkett Ditch Pump Station
- Alignment of floodwalls and road closure structure
- Drainage control including seepage collection, interceptor ditches, culverts, and gatewells
- Slope erosion protection for levees, structures, and river bank areas
- Overbank excavation for increased channel capacity
- Borrow site, earthwork balance, and disposal options
- Municipal infrastructure modifications including sanitary sewer, water main, storm sewer, and street
- Traffic control during construction
- Franchise utilities including electric, gas, cable, telephone, and other private services
- Recreational facilities including bike/pedestrian trails, golf courses, and park areas
- Correction of USACE inspection items from the November 2014 routine inspection
- Site restoration and landscaping

2.4.2 Design Considerations

Civil design for Phase 2 and 3 levee systems was driven by location, elevation, and alignment considerations, as outlined below.

- Following USACE Engineering Manuals (reference [13]
- Accommodating the *Minot Front and Center Downtown and Neighborhood Plans* (reference [14]) and incorporating plan elements from concept drawings of the Souris Valley Golf Course, Wee Links Golf Course, and Centennial Park
- Reviewing and implementing the *Preliminary Engineering Report* (reference [2])
- Reviewing the 100-percent design of the Minot Water Treatment Plant Flood Hazard Mitigation Project (reference [15])

- Considering the Highway 83 bypass bridge project draft design by the North Dakota Department of Transportation
- Incorporating river hydraulic analysis and interior drainage features
- Considering geotechnical subsurface investigation and modeling results
- Limiting, to the extent possible, property acquisitions beyond those proposed in the *Preliminary Engineering Report* (reference [2])
- Integrating deficiencies (left bank and right bank) identified in the 2014 USACE inspection report (reference [16]) along the Phase 2 and 3 corridor
- Minimizing environmental, social, and economic impacts of the project

2.5 Structural Design

Structural design follows USACE engineering regulations (ERs), engineering manuals (EMs), engineering technical letters (TLs), and engineering circulars (ECs). Design of non-hydraulic structures, such as the pump station superstructure, is based on the North Dakota State Building Codes (reference [17]) and amendments, ASCE/SEI 7-10: *Minimum Design Loads for Buildings and Other Structures* (reference [18]) as well as other applicable local, state, and federal design criteria and codes.

2.5.1 Perkett Ditch Pump Station, Gatewell, and Trashrack Structure

Interior drainage structures consist of the new Perkett Ditch Pump Station, gatewell, and trashrack shown in Figure 2-3. The new pump station will be located west of the existing Perkett Pump Station.

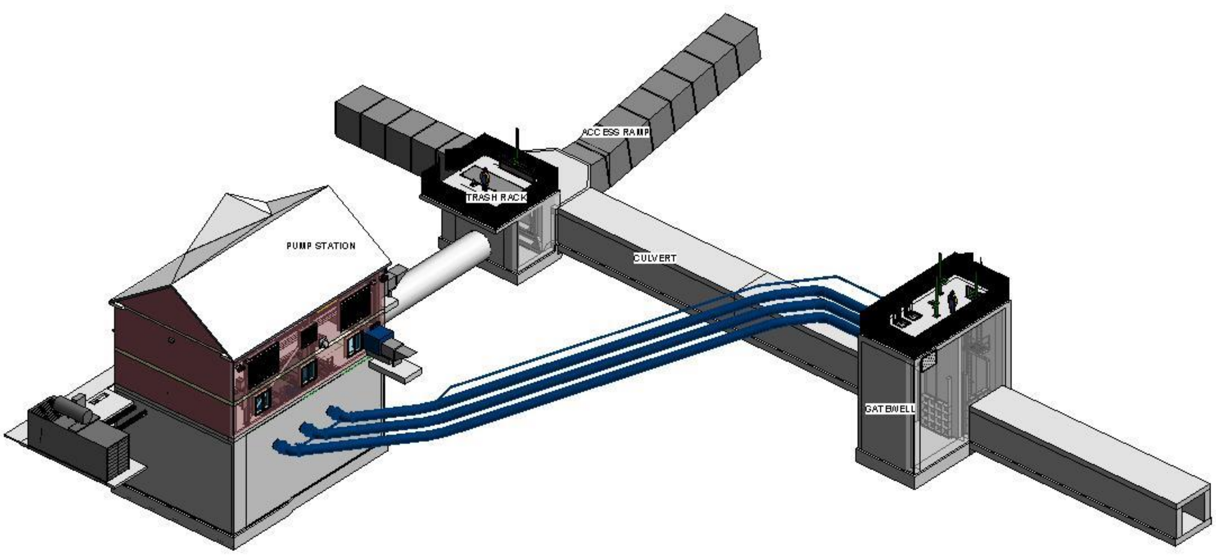


Figure 2-3 Perkett Ditch Pump Station, Gatewell, and Trashrack

The trashrack structure will divert the interior stormwater from the gravity discharge line to the pump station. The pump station will house three 15,000 gpm (45,000 gpm total) capacity submersible centrifugal pumps. During a flood event, water will be pumped from the pump station to the discharge chamber and will flow through the outlet culvert into the Mouse River.

The Perkett Ditch Gatewell will be a two-chamber structure. The east chamber will provide a path for gravity flows during non-flood events, while the west discharge chamber will be utilized during flood events. Sluice gates will be installed on both ends of the culvert inside the gatewell to provide redundancy.

2.5.2 Bark Park and Wee Links Gatewells

The Bark Park and Wee Links Gatewells will be single-cell, cast-in-place, reinforced-concrete structures that allow water passage via stormwater pipe. Gates at the inlet and outlet will be provided for redundancy

2.5.3 Road Closure Structures and Concrete Floodwalls

The Sixteenth Street Closure Structure will be a removable aluminum stoplog closure with adjacent reinforced concrete floodwalls that tie into the levee shown in Figure 2-4. The top of the flood wall will be set at the same elevation as the final levee grade (post-settlement) and will match the top of the closure structure.

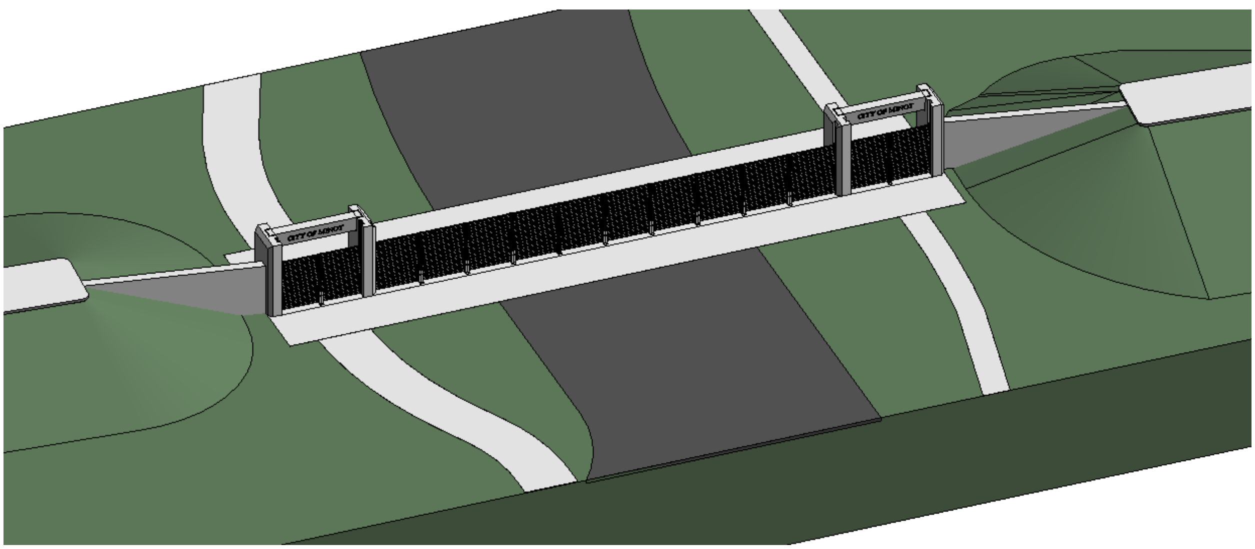


Figure 2-4 16th Street Road Closure Structure

To provide resiliency at the connection point between the floodwall and levee, the floodwall will be extended 5 feet into the levee and a sheetpile will be provided, extending an additional 20 feet beyond the end of the floodwall. The levee-floodwall transition will be armored with high-performance turf reinforcement mat.

2.5.4 Wee Links Irrigation Pump Station

The existing Wee Links Irrigation Pump Station built in 2001 supplies water to the golf course irrigation system and will be displaced by the new levee alignment.

The new Wee Links Irrigation Pump Station will be on the interior of the new levee, directly north of the existing pump station and near the Perkett Ditch Pump Station. It consists of slab-on-grade, wood-framed walls supported by reinforced-concrete walls with strip footings set below the frost depth.

2.6 Mechanical Design

Mechanical components of the project include the pumps and associated piping and valves at the Perkett Ditch Pump Station and Wee Links Irrigation Pump Station. During river flooding, the Perkett Ditch Pump Station serves as part of the interior drainage system. The Wee Links Irrigation Pump Station is designed to provide irrigation water to the Wee Links Golf Course, either from the river or the city's water distribution system.

The pumps and associated mechanical components of the Perkett Ditch Pump Station and gatewells have been designed in accordance with the applicable USACE EMs and the Hydraulic Institute standards for pump intake design. The heating, ventilation, and plumbing components of the two pump stations have been designed in accordance with USACE EMs and applicable building codes and standards. The pumps and associated mechanical components for the Wee Links Irrigation Pump Station will be salvaged from the existing station and installed in the new station.

2.6.1 Perkett Ditch Pump Station

During non-flooding river conditions, surface runoff will drain through the proposed levee via a single gravity drain. When the river reaches approximately elevation 1,549.2 at the Broadway bridge, a sluice gate in the Perkett Ditch Gatewell will close the gravity drain. Surface runoff will then be collected through the interior drainage system and pumped over the proposed levee to the river through the Perkett Ditch Pump Station up to a rate of approximately 45,000 gpm.

The pump station intake consists of a trashrack that prevents large solids from reaching the pump station and a 48-foot-long, 6-foot-diameter RCP. The trashrack will be housed in an underground vault and has a manually operated trash rake for managing debris that collects on the screen.

The pump station has a trench-type wetwell that houses three submersible pumps, each with the nominal design capacity of 15,000 gpm. The pump station was design in accordance with Hydraulics Institute standards. The pumps will be operated using variable frequency drives (VFDs) to modulate discharge rate based on incoming flow rates; they will be staged to operate in parallel as the flow rate to the pump station increases.

Each pump discharges through a dedicated 24-inch ductile-iron pipe (DIP) that terminates at the Perkett Ditch Gatewell with a flap gate installed above the design flood level. Check valves will be installed in each pump discharge pipe in a valve chamber located adjacent to the pump station wetwell. After discharging to the gatewell, pumped interior drainage is conveyed to the river by gravity through the gatewell and downstream box culvert.

A small submersible pump with 300 gpm capacity provides drainage for low-flow conditions and pump station dewatering. It will be installed in a small sump below the valve chamber adjacent to the wetwell and discharge to the gatewell through 4-inch DIP.

Electrically operated sluice gates will be installed in the trashrack vault, the pump station, and the gatewell. The gates in the trashrack vault and the pump station will be used to isolate those structures from the gravity drainage system during non-flood periods. The gates in the gatewell will be used to isolate the interior drainage system from gravity outfall at the river during flooding. The gates in the trashrack vault and the gatewell will be heated to facilitate operation during freezing conditions.

The Perkett Ditch Pump Station is provided with heating and ventilation to maintain a heated, dry environment for housing the pumps and associated equipment and for operator safety and comfort.

2.6.2 Wee Links Irrigation Pump Station

The Wee Links Irrigation Pump Station will replace the existing irrigation pump station and storage building that will be demolished during levee construction. The existing irrigation pumping equipment and controls will be salvaged and relocated to the new station on the interior of the levee. The mechanical components of the new pump station will also include restroom facilities, heating, and ventilation.

The river intake for the irrigation pump will be relocated near the Perkett Ditch gravity outfall. A 12 inch buried pipe will be installed from the new river intake to the pump station. It will cross under the new levee in a casing, along with a 4-inch irrigation-supply pipe that connects the pumps to the Wee Links irrigation system. Isolation valves will be provided for the pipes at both ends of the casing, and an intake screen with an air-burst cleaning system will be installed at the river end of the pipe. A 1-inch air-supply line from a pump station compressor will be installed alongside the intake pipe to the screen.

2.7 Electrical Design

The electrical design of Phases 2 and 3 of the Project is based on the latest National Electrical Code and other codes and regulations, including USACE EMs.

2.7.1 Electrical Power Distribution

The electrical design comprises multiple pump motors operating in a multi-stage approach, depending on the stormwater demand. The pumps will be driven by VFDs to modulate pump speed and enable the pump(s) to match instantaneous stormwater flow while maintaining water velocity at 1 fps or lower.

The electrical mains will be based on three main 250-horsepower (hp) pumps, a 10 hp dewatering pump, and auxiliary lighting, heating, and ventilation loads. The anticipated electrical service switchgear and motor control center (MCC) lineup is rated 1,200 Amps at 480 Volts (V), three-phase.

The normal power supply to the station will be 277/480V three-phase, provided by franchise utility Xcel Energy.

The possibility of a hazard-area rating in accord with National Electrical Code (NEC) Chapter 5 was examined by the governing code official, who determined this did not apply (communicated via memo from the Minot Inspection Department dated December 16, 2015).

The utility electric service will be backed up by an onsite engine generator sized to power the design capacity pump station load. The recommended fuel source is diesel in a sub-unit double-walled tank to maximize fuel source availability (natural gas may not be available in emergency situations). The generator will be an outdoor unit housed in a weatherproof enclosure. It will be sized sufficiently to support the three main pumps (plus station general loads).

The main pump station switchboard should include an automatic transfer switch to sense loss of utility power, automatically start the generator, and transfer the load. When the utility source returns, the transfer switch will automatically return to utility power.

2.7.2 Control System

The pump station controls will consist of field instruments such as a wetwell-level transducer and a control panel with programmable logic controller (PLC). The control panel cover will have a touch-screen human/machine interface (HMI). System control logic will reside in the PLC.

Once initiated manually, the pump station will operate automatically until the flood condition has passed, allowing it to be deactivated. The wetwell level will be measured by a submersible level transducer, which provides a 4-20 mA level-proportional signal to the PLC. The PLC will include logic for starting and stopping pump(s) based on wetwell level and speed control for the VFD-driven pump(s). A pump alternator algorithm will be implemented in the PLC to alternate the pumps, equalizing pump wear over time. Additional pumps will be brought online after the capacity of the first pump is exceeded—failing to maintain flow below the maximum level. A float-switch backup-level sensing system will be used if the level transducer or PLC fail.

Due to the underground depth of the wetwell, freezing of the level transducer should not be a concern.

The PLC will monitor all analog and digital inputs and generate an alarm for pre-determined parameters. The alarms will interface with Minot's data acquisition (SCADA) system by connecting the PLC to a Minot WiFi panel next to the control panel.

The HMI will provide local display of system status (including alarms) via screen-view on the front of the control panel. Graphic screens will be built to depict the operation of the pump station, including wetwell level, pump status, and other aspects of the pump station operation.

2.7.3 Gatewells

The electrical facilities at the Perkett Ditch Gatewell and Bark Park Gatewell will be fairly minor. There will be an electrical outlet to power a handheld drill or similar device. Circuiting to the loads will be sufficiently oversized to minimize voltage drop. A pole-mounted lighting fixture will illuminate the Perkett Ditch Gatewell area. Gate actuators will be installed and each gate will be equipped with an electrical heating system to prevent them from freezing into position. Electrical loads at the trashrack structure will also be minor; these loads consist of gate operators and an electrical heating system for gates.

2.7.4 Wee Links Irrigation Pump Station

The Wee Links Irrigation Pump Station will have 480V three-phase, four-wire electric service originating from the same utility transformer feeding the Perkett Ditch Pump Station. It will, however, have a separate utility meter. A 200 Amp service panelboard will be sufficient to feed all the loads within the building, including the irrigation well pumps. A 30 kVA transformer will step voltage down to 120/208V three-phase, four-wire to provide power for general building use.

The existing Wee Links Irrigation Pump Station has a security system and closed-circuit television camera that will be salvaged and relocated to the new building.

2.8 Architectural Design

Phase 2 and 3 of the Project includes two structures: the Perkett Ditch Pump Station and the Wee Links Irrigation Pump Station. The architectural design of these structures are based on International Building Code 2012 [reference [19]], as well as codes mentioned in Section 7.0, 8.0, and 9.0 of the BDR (reference [1]).

2.8.1 Architectural Features

2.8.1.1 Perkett Ditch Pump Station

The Perkett Ditch Pump Station consists of a pump room that houses all components for the pump and electrical equipment. The building's exterior which consists of curved and square residential-style windows will be reflective of the neighborhood's typical style. Three large mechanical louvers will be placed on the south exterior of the building to avoid the sight lines of adjacent homes.

2.8.2 Wee Links Irrigation Pump Station

The Wee Links Irrigation Pump Station is 26 by 34 feet and consists of three separate spaces: a storage room, pump room, and rest room. The pump room comprises 205 square feet. The storage room is approximately 515 square feet and is used to store ATVs and other miscellaneous equipment throughout the winter months. The facility also has an accessible restroom that is approximately 45 square feet.

The Wee Links Irrigation Pump Station exterior includes brick wainscot, residential-style siding and windows to reflect the neighborhood's style and match the Perkett Pump Station. Door and overhead door styles will also compliment the Perkett Pump Station.

3.0 Operation and Maintenance Requirements

An addendum to the original Operations and Maintenance (O&M) Manual will be completed following construction of Phases 2 and 3 of the Project. The manual will summarize the procedures required for operation, maintenance, repair, rehabilitation, and replacement of Project features and will contain the latest approved flood risk-reduction regulations, maps, drawings, tables, and references. The content of the manual is anticipated to include:

- Section 1.0 General Information
- Section 2.0 Ordinary Inspections, Maintenance, and Operations
- Section 3.0 Inspections, Tests, and Operations during an Impending Flood
- Section 4.0 Operations during Floods
- Section 5.0 Post-Flood: Inspections, Tests, and Operations
- Section 6.0 Post-Flood Report
- Section 7.0 Repair, Replacement, and Rehabilitation

An addendum to the O&M manual is anticipated to be in future Appendix P of the BDR (reference [1]) and will be part of the project *Construction Documentation Report,* which will be submitted to the U.S. Army Corps of Engineers (USACE), Federal Emergency Management Agency (FEMA), and Project sponsor upon completion of Phases 2 and 3.

4.0 Real Estate Analysis

This section describes the real estate requirements for construction and final right-of-way for modifications to Phases 2 and 3 of the Project.

4.1 Parcel Acquisitions

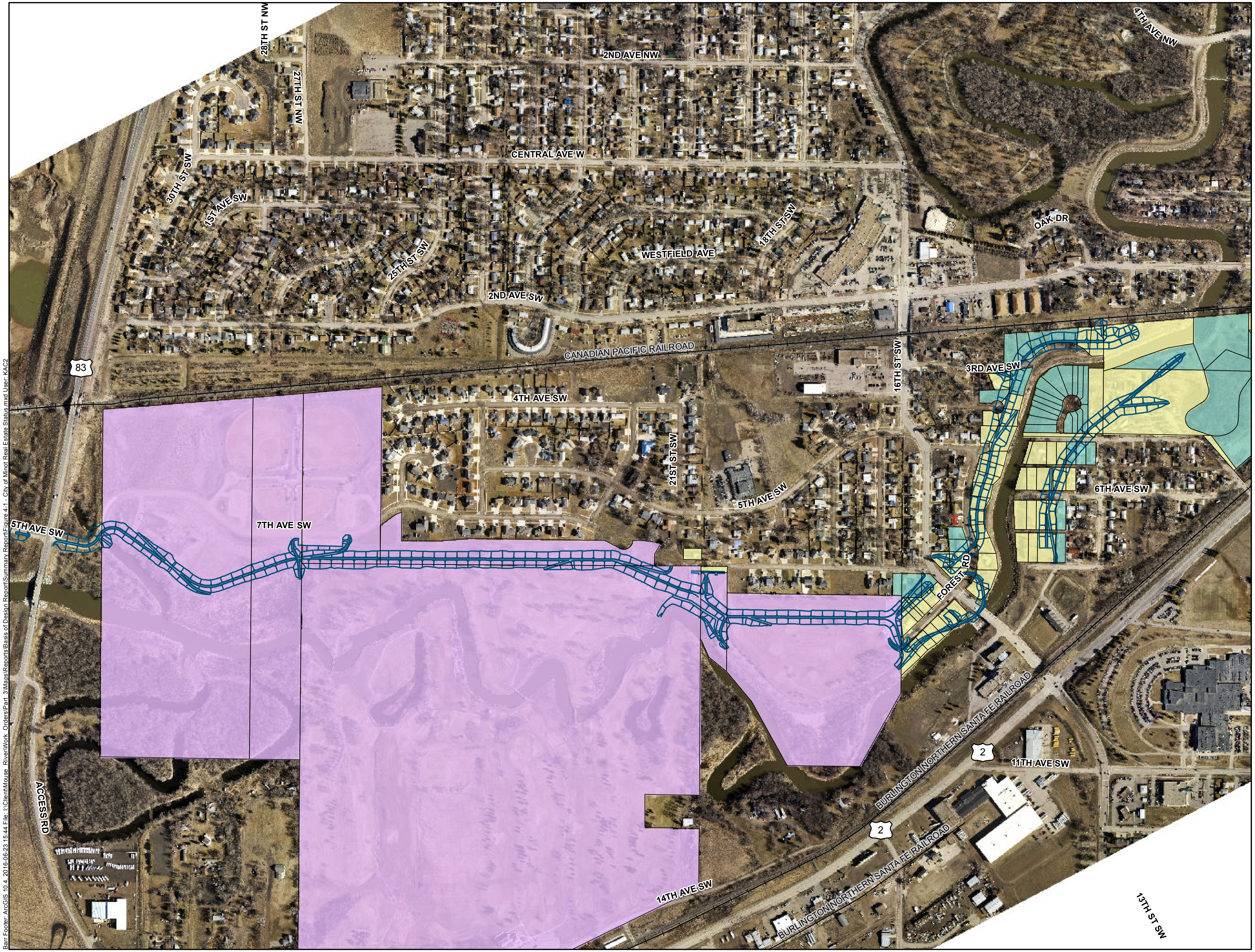
The process of acquiring property needed to establish right-of-way for construction, operation, and maintenance of the flood risk-management system is currently in progress. Figure 4-1 shows the status of parcel buyouts and anticipated acquisitions as of May 2016.

4.2 Existing Property Information

To determine legal property boundaries, property surveys were completed through the Phase 2 and 3 areas. Property corners were recovered along the reach, and property lines and parcel boundaries were established by North Dakota professional land surveyors in accordance with generally accepted practice and state law.

Easements for the existing federal project were retraced by conducting deed research at the Ward County courthouse. In general, the recorded permanent easements for the existing federal project are smaller than the right-of-way indicated on the as-built plans. Temporary construction easements recorded are generally consistent with the right-of-way indicated on the as-built plans.

Existing levee right-of-way information was provided by the USACE in GIS format during development of the *Preliminary Engineering Report* (reference [2]). The alignment of this right-of-way was refined by recovering survey control points from the existing federal project and retracing the boundary using the coordinates listed within the as-built plans.



Acquired
Acquisition Pending
Partial Acquisition / Easement Pending
Levee Footprint

0 300 600 1,200
Feet

BARR
ACKERMAN ESTVOLD

Figure 4-1

CITY OF MINOT REAL ESTATE STATUS

Basis of Design Report
Mouse River Enhanced Flood Protection Project
Phase 2 and 3
Minot, North Dakota

Barr Footer: ArcGIS 10.4, 2016-06-23 15:44 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Basis of Design Report\Summary Report\Figure 4-1 - City of Minot Real Estate Status.mxd User: KAC2

Parcel and property information on the engineering drawings is shown in the project coordinate system. Parcel and property information on plats and legal drawings is shown in accordance with state law.

4.3 Project Right-of-Way

The proposed project right-of-way will create a corridor with a minimum width of levee, floodwall, and appurtenant structures, plus 15 feet on each side—measured from the outer edges of the outermost critical structure. The following features will be located within the proposed project right-of-way.

- **Levee:** Real estate surrounding the levee alignment to provide access for operation and maintenance of this feature.
- **River channel:** Real estate surrounding the river channel, slopes, and overbanks to provide access for operation and maintenance of these features.
- **Gatewells:** Real estate surrounding gatewells to provide access for operation and maintenance of these features.
- **Access road ramps:** Real estate surrounding roads which are required to access the levee for inspections or levee maintenance activities. *Access ramps solely intended to provide pedestrian access or access up and over the levee are not included in the project right of way.*
- **Interceptor/drainage ditches:** *Real estate surrounding ditches to accommodate surface runoff that is not related to seepage is not included in the project right of way.*
- **Seepage control features:** Real estate surrounding seepage control features to provide access for operation and maintenance. Seepage collection piping is connected to the storm sewer, which is typically within Minot right of way. *The storm sewer downstream of the seepage collection piping is not included in the project right of way.*
- **Closure structure:** Real estate surrounding the roadway closure structure to provide for access and maintenance of this feature.
- **Pump station structures:** Real estate surrounding the pump stations to provide for access and maintenance of this feature.

4.4 Municipal Right-of-Way

Several Minot streets and utilities, along with corresponding public rights-of-way, will be modified to accommodate the flood risk-management system. This includes both the addition (Seventh Avenue SW extension) and the reduction (Phase 3) of municipal right-of-way.

4.5 Permanent Utility Easements

As a part of the interior drainage modifications associated with this project, portions of storm sewer are being rerouted across private property. The acquisition of permanent utility easements in these areas to accommodate access and future maintenance and repairs is in progress.

4.6 Temporary Construction Easements

During construction, temporary construction easements are required to allow access to staging areas, borrow sites, transport of materials, and clearance for construction of structures. Temporary easements will be in effect until final acceptance of the work.

4.7 Real Estate Requirement Tabulation

The USACE Real Estate Division requires tabulation of real estate requirements for Phases 2 and 3 of the Project. Based on the current design configuration, the real estate requirements are presented in Table 4-1. Additional information can be found in the BDR (reference [1]) as part of the Real Estate Summary (Appendix I) and Real Estate Drawings (Appendix K). Further details will be developed in the remaining design tasks. Minor revisions may be made to the alignment of features but are not expected to substantively impact the real estate requirement. The Souris River Joint Board (SRJB) and Minot will acquire all necessary property in fee title and easements prior to construction.

Table 4-1 Real Estate Requirements for Phase 2 and 3

Real Estate Description	Estimated Area
Existing levee right-of-way (from USACE drawings)	85.83 acres
Existing easement in project area to be vacated	53.51 acres
New permanent easement in project area	89.25 acres
Net permanent easement in project area	+35.74 acres
Temporary construction easement in project area	37.28 acres

5.0 Residual Risk

As a result of the modifications, the Project will reduce the existing level of risk to life and property. The new levees will be an average of 6 to 8 feet higher than existing levees. Future phases and construction of any subsequent stages will need to create closed levee systems at the design elevations. The modifications will be constructed under the supervision of a competent project inspector, discipline engineer, or engineer of record—depending on the type of work performed. Additional oversight and periodic inspections will be performed by the U.S. Army Corp of Engineers (USACE), St. Paul District and potentially IEPR members.

5.1 Changes in Risk

The proposed modification will not generate new or increased flows. The new levees will create greater restriction of the floodplain at higher flood flows, which will increase some upstream flood elevations. While the new levees are not closed systems, they will make it more difficult for water to inundate areas behind the levees—reducing the flood risk for structures in those areas. The levee modifications have been designed and will be constructed according to USACE standards. Construction will occur during the summer months after the river has receded from spring flooding. The risk of levee failure caused by slope failure, seepage, or settlement is less likely for the modified levee than for the existing levee system.

5.2 Residual Risk

The term residual risk as applied to levee systems refers to the level of risk that remains after flood control measures have been implemented. The overall level of risk for the community will not change significantly with implementation of Phase 2 and 3 of the Project. Because the new levee segments will not be closed systems, areas behind them will potentially be flooded if adjacent existing levees overtop. The risk of flooding behind the new levees is lower; it will be harder for water to get behind them than to inundate those same areas under existing conditions. The new levees will also decrease flood risk by reducing the locations that will need to be addressed in an emergency flood fight. This will allow for more robust flood fighting in other areas along the river.

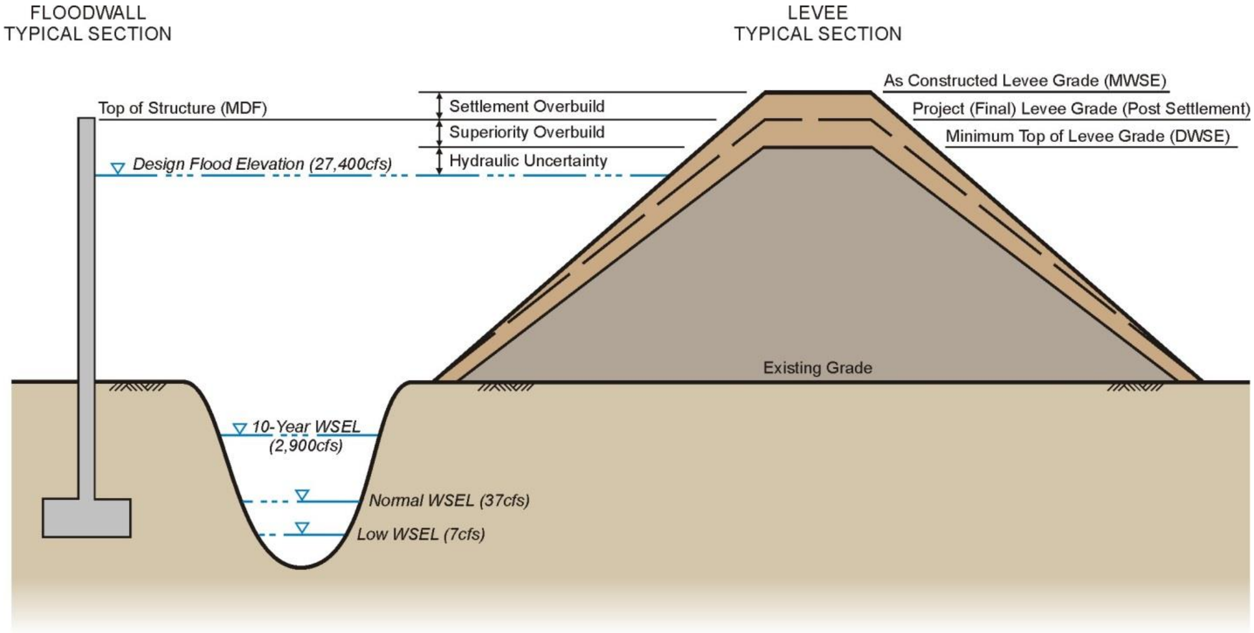
Top elevations for the levees, floodwalls, and closure have been designed to incorporates uncertainty, settlement overbuild and superiority. Once the other project segments are completed, the new system will have top of feature elevations above FEMA's preliminary 1-percent annual exceedance probability event (10,000 cfs).

5.3 Transfer of Risk

Construction of the Napa Valley and Forest Road levees will cause flood elevations for the Leites Brekke and Tierrecita Vallejo neighborhoods to increase on the order of 0.1 to 0.2 feet at 10,000 cfs flow rate. This will result in a slight increase in flood risk for these areas. The amount of risk transferred is small compared to the risk reduction achieved from constructing these new levee segments. Permitting restrictions will require the SRJB to obtain in addition, local property rights for an increase in flood levee of more than 0.1 feet for the 100-year event.

5.4 Feature Height Design Summary

Project features were designed to reduce the risk of flooding from an event similar to the 2011 flood of record by incorporating risk and uncertainty analysis and system superiority. Figure 5-1 illustrates key design terms and elevations for levees and floodwalls. These terms are discussed further below.



NOTES:
1. Not to Scale.
2. Design Water Surface Elevation (DWSE) = Minimum Top of Levee Grade.
3. Maximum Water Surface Elevation (MWSE) = As Constructed Levee Grade (Pre-Settlement).
4. Maximum Design Flood (MDF) = Top of Structure.

Figure 5-1 Design Elevations for Levees and Floodwalls

Terms for establishing design elevations for levees:

- **Design flood elevation** is the modeled water surface elevation for the 2011 flood hydrograph under with-Project conditions. The USGS measured a peak discharge of 27,400 cfs at Broadway bridge in Minot.
- **Hydraulic uncertainty** accounts for natural variability and model parameter uncertainty associated with the design flood elevation. Hydraulic uncertainty defines the additional feature height needed to provide 95-percent probability that the design flood will not exceed the minimum top-of-levee grade.
- **Design water surface elevation (DWSE)** is the minimum top-of-levee grade**.** The DWSE is defined as the design flood elevation plus hydraulic uncertainty.
- **Superiority overbuild** is material added to some portions of the levee so that overtopping occurs at a predetermined location. The overtopping location is typically at the downstream end of a levee system as it ties into high ground. Superiority overbuild varies by location.

- **Project (final) levee grade** is the minimum top-of-levee grade plus superiority overbuild. It is the anticipated finished grade of the levee system after long-term settlement.
- **Settlement overbuild** is additional material placed on top of the levee when it is initially constructed to allow for settlement of the levee top to the desired Project (final) grade.
- **As-constructed levee grade** is the Project (final) levee grade plus settlement overbuild. The construction drawings will instruct the contractor to build the levee to this elevation.
- **Maximum water surface elevation (MWSE)** is the top of the as-constructed levee grade.
- **Top of structure** is the as constructed top of a floodwall or closure structure.
- **10-year water surface elevation** (10-year WSEL) is the water surface elevation for the 10-percent annual exceedance probability flood event.
- **Normal water surface elevation** (normal WSEL) is the discharge with a 50-percent chance of daily exceedance.
- **Low water surface elevation** (low WSEL) is the discharge with a 75-percent chance of daily exceedance.

6.0 Administrative Record

A number of federal, state, and local permits and/or approvals will be required prior to the start of Phase 2 and 3 construction. Permits/approvals that may be required are summarized in Table 6-1; further information describing the rationale for each is included as Appendix H-1 of the BDR (reference [1]).

Table 6-1 Potentially Required Permits/Approvals

Agency	Permit/Approval	Estimated Issuance Timeline
Federal Permits/Approvals		
U.S. Army Corps of Engineers	Section 408 Permission	Q4 2016
U.S. Army Corps of Engineers	National Environmental Policy Act Compliance	Q4 2016
U.S. Army Corps of Engineers	Section 404 Permit	Q2 2017[1]
U.S. Fish and Wildlife Service	Section 7 Concurrence	Q2 2017[2]
U.S. Fish and Wildlife Service	Fish and Wildlife Coordination Act Compliance	Q2 2017[2]
Federal Emergency Management Agency	Conditional Letter of Map Revision	Q2 2017
U.S. Department of Agriculture	AD-1006 Farmland Conversion Impact Rating Form	Q3 2016
State Permits/Approvals		
State Historical Society of North Dakota	Section 106 Concurrence	Q2 2017[2]
North Dakota State Water Commission	Sovereign Lands Permit	Q3 2016
North Dakota State Water Commission	Construction Permit	Q3 2016
North Dakota Department of Health	Section 401 Water Quality Certification	Q2 2017
North Dakota Department of Health	Construction General Permit NDPDES	Q4 2016
North Dakota Department of Health	Asbestos Notification of Demolition and Renovation	Q4 2016
North Dakota Department of Transportation	Driveway Permit, project review and approval	Q4 2016
Local Permits/Approvals		
City of Minot – Engineering Department	Non-building Floodplain Development Permit	Q4 2016
City of Minot – Engineering Department	Project approval	Q4 2016
City of Minot – Planning and Zoning Department	Project approval	Q4 2016
Minot Park District	Project approval	Q4 2016
Canadian Pacific Railway	Permission to work in railroad rights-of-way	Q4 2016

1 Assumes permit applications are submitted after agency review of the Draft EIS (to be completed by late June 2016). Also assumes that permit cannot be issued until 30 days after the EIS Record of Decision has been issued.

2 Issued as part of Section 404 Permit approval.

7.0 Executive Order 11988 Considerations

Executive Order 11988, Floodplain Management (May 24, 1977), directs federal agencies to issue or amend existing regulations and procedures to ensure that the potential effects of any actions or procedures implemented are evaluated and that planning programs and budget requests reflect consideration of flood hazards and floodplain management. The purpose of this directive is "to avoid, to the extent possible, the long- and short-term adverse impact associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." The proposed Project will result in the levee moving back from the river; it does not include any development in the existing floodplain other than levee construction. The proposed impacts will not result in adverse floodplain impacts.

Related to resiliency, Executive Order 11988, as revised in 2015, provided agencies three approaches for increasing resiliency of projects in the floodplain:

- Use data and methods informed by best-available, actionable climate science;
- Build two feet above the 100-year (1%-annual-chance) flood elevation for standard projects, and three feet above for critical buildings like hospitals and evacuation centers; or
- Build to the 500-year (0.2%-annual-chance) flood elevation.

Currently the MREFPP is entirely funded with local resources. Still, the local sponsor has selected a design approach consistent with the intent of EO11988 to design to a higher standard than the 100-year plus one foot. The Project is designed to the flood of record, which is 27,400 cfs. This is 2.7 times the FEMA's preliminary 100-year flow rate of 10,000 cfs. The design profile is well above the FEMA 100-year flood profile plus three feet. In addition the top elevation of the flood risk reduction measures account for hydraulic uncertainty associated with the design profile. The Project improves resiliency in several other ways through:

- Creating closed systems that would have superior levee sections to control the location and manner of overtopping should a flood event larger than the flood of record occur.
- Structural resiliency for the floodwalls and road closure structures incorporated by the system superiority by providing designed overtopping at predetermined locations to reduce the risk of uncontrolled failures.
- Gatewells designed to be 2-feet above the top of levee to improve accessibility during a flood event.
- Potential modification of reservoir operations rules in the future to further reduce flood risk (e.g., allows for more rapid drawdown of reservoirs to free up flood storage).

- Raising key bridges to improve transportation connectivity during a major flood event. This would make it quicker and easier for emergency responders to get where they need to be during a flood.
- Addressing regional resilience through coordination with Fish and Wildlife Service regarding the operation of hydraulic structures in the wild life refuges to address flooding problems in rural areas.

8.0 Environmental Compliance

The alteration and modification of the existing levee system requires approval by the U.S. Army Corps of Engineers (USACE). Section 14 of the Rivers and Harbors Act of 1899 (33 United States Code [USC] 408, hereinafter referred to as Section 408) authorizes the Secretary of the Army to permit alterations and modifications to existing USACE projects in certain circumstances. The Secretary of the Army has delegated this approval authority to the Chief of Engineers of the USACE. The types of alterations and modifications under Section 408 that require approval by the Chief of Engineers include degradations, raisings, and realignments of levee systems. Nonfederal proposals to alter or modify an existing USACE project such as the Mouse River Enhanced Flood Protection Project (MREFPP or Project) must be evaluated as new construction of federal projects. The potential impacts of these changes, including system impacts, must be evaluated in accordance with USACE regulations and policy, including the regulatory requirements of the National Environmental Policy Act (NEPA).

Environmental surveys and inspections have been conducted in Phases 2 and 3 to collect data for environmental review and permitting, document existing conditions at the site, and assist in design and engineering. These surveys and inspections include wetland delineations, ordinary high water mark (OHWM) determination, biological studies, cultural resources investigations, and a review of potential hazardous, toxic, and radioactive waste (HTRW) sites in or near Phases 2 and 3. A pre-demolition inspection of any remaining structures to be removed from the Project footprint will be completed prior to demolition. These surveys and inspections are briefly described in the following sections.

8.1 Environmental Review

An environmental review of the proposed Project is being conducted to comply with NEPA regulations (33 CFR Part 230). The environmental review includes an analysis of impacts associated with Phases 2 and 3 of the proposed Project as well as the other Project segments from Burlington to downstream of Minot. The USACE determined that a programmatic environmental impact statement (EIS) is needed for the proposed Project. This programmatic EIS is being prepared in accordance with the guidelines specified in the Section 408 Submittal Package Guide as part of CECW-PB Memorandum titled *Clarification Guidance on the Policy and Procedural Guidance for the Approval of Modifications and Alterations of Corps of Engineers Projects* (reference [20]). The EIS evaluates resources listed in Section 122 of the Rivers and Harbors Act of 1970 and includes an analysis of Project alternatives and the direct, indirect, and cumulative impacts on natural and socioeconomic resources. A preliminary draft EIS was provided to the USACE on March 24, 2016. The USACE provided comments and a revised version of the draft EIS was resubmitted on June 17, 2016. The table of contents for this preliminary draft EIS is provided in the BDR (reference [1]).

As part of the environmental review process, the USACE initiated scoping of the EIS to obtain comments on the Project from regulatory agencies and the public. The first set of public meetings was held in Burlington on April 8, 2015 and in Minot on April 9, 2015. The USACE published a Notice of Intent (NOI) in the Federal Register (Vol. 80, 137) on July 17, 2015 indicating their intent to prepare a programmatic EIS for the MREFPP from Burlington through Minot. After the publication of this NOI, the USACE held an additional public scoping meeting in Minot on August 19, 2015. In addition to these public meetings, the

USACE hosted agency consultation meetings with local, state, and federal agencies on October 1, 2014, January 29, 2015, and May 27, 2015 to provide an overview of the Project and solicit comments from the regulatory agencies. The USACE prepared a scoping document to summarize the information gathered during Project scoping so that it can be used to inform planning and evaluation of the Project as it moves forward. The Project sponsor also held a neighborhood meeting on June 30, 2015 in Minot to update Napa Valley and Forest Road residents on the status of Phases 2 and 3 of the Project and provide another opportunity for questions and comments.

The USACE developed agency workgroups for several key environmental resource topics, including fish and wildlife resources, cultural resources, socioeconomics, floodplains, and mitigation. Agency workgroups corresponded as needed to share information or gain input when questions about a specific resource arose. To date, the following work groups have met to discuss various aspects of the Project: fish and wildlife group; cultural resources group; and floodplain group.

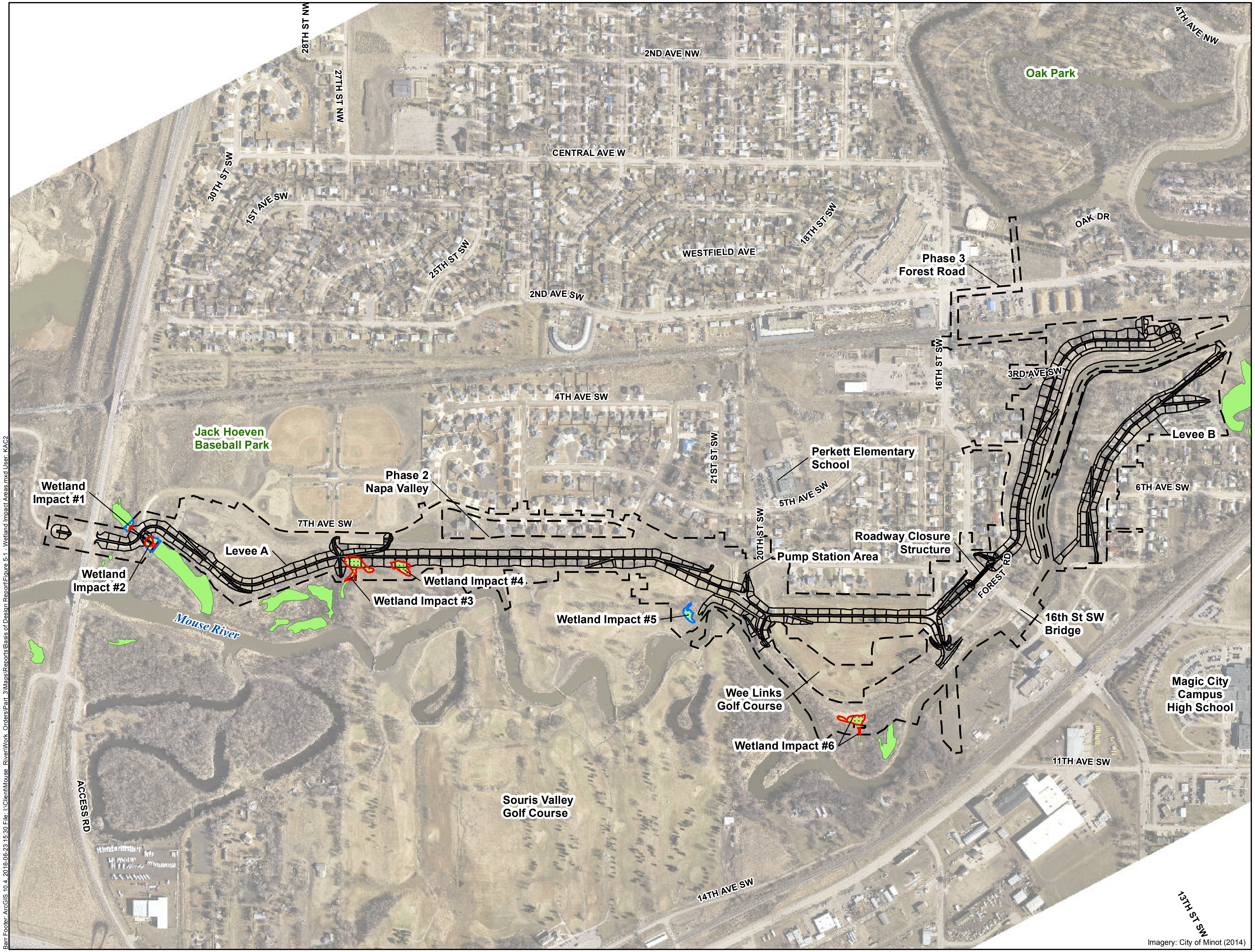
8.2 Wetland Delineations

Wetlands within the construction limits of Phases 2 and 3 of the Project were identified and delineated in the field in May through July 2015 in accordance with the procedures specified in the *Corps of Engineers Wetland Delineation Manual* (reference [21]) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0)* (reference [22]). Wetland boundaries were determined by completing USACE Wetland Determination Data forms for paired sample points and by observing vegetation and hydrology in the study areas. The sample points and wetland boundaries were documented using site photography and GIS positioning in conjunction with GPS point locations taken with a Trimble Geo 7x instrument. A summary of the wetland delineation results is provided in the Wetlands, Waters, and Biological Inventory section of the BDR (reference [1]).

Based on the delineation of wetlands in Phases 2 and 3, an estimate of wetland impacts within the construction limits was determined. As shown in Table 8-1, it is estimated that a total of 39,858 square feet (0.92 acre) of wetlands will be affected by construction of Phases 2 and 3, including 9,846 square feet (0.23 acre) of temporary impacts and 30,012 square feet (0.69 acre) of permanent impacts. The wetland impact areas are shown on Figure 8-1.

Table 8-1 Phase 2 and 3 Wetland Impact Estimates

Wetland Impact Area	Permanent Impact Area (Square Feet)	Temporary Impact Area (Square Feet)	Total Impact Area (Square Feet)
Wetland #1	340	1,904	2,244
Wetland #2	3,050	3,665	6,715
Wetland #3	12,305	0	12,305
Wetland #4	7,057	0	7,057
Wetland #5	0	4,277	4,277
Wetland #6	7,260	0	7,260
Total	**30,012**	**9,846**	**39,858**



- 100% Draft Construction Limits
- Wetland Boundaries
- Permanent Wetland Impacts
- Temporary Wetland Impacts

0 300 600 1,200
Feet

BARR

ACKERMAN ESTVOLD

Figure 8-1

WETLAND IMPACT AREA

Basis of Design Report
Mouse River Enhanced Flood
Protection Project -
Phase 2 and 3
Minot, North Dakota

8.3 Ordinary High Water Mark Determination (OHWM)

Other waters within the Project area include the Mouse River and its associated fluvial features (e.g., oxbows). As part of state and federal regulations, the OHWM is used to determine the jurisdictional boundaries of these waterbodies. Construction activities will be conducted below the OHWM of the Mouse River at several locations throughout Phases 2 and 3. These river impact areas are summarized in Table 8-2 . A total of approximately 253,338 square feet (5.82 acre) of the Mouse River will be affected below the OHWM, including 219,021 square feet (5.03 acre) of permanent impacts and 34,317 square feet (0.79 acre) of temporary impacts. Most of the permanent impacts are the result of erosion and scour protection that will be placed along the shoreline to prevent bank erosion. The temporary impacts are the result of installing utilities across the river using in-stream construction methods. The OHWM impact areas are shown on Figure 8-2.

Table 8-2 Phase 2 and 3 River Impact Estimates

River Impact Area	Permanent Impact Area (Square Feet)	Temporary Impact Area (Square Feet)	Total Impact Area (Square Feet)
OHWM #1	346	407	753
OHWM #2	12,493	0	12,493
OHWM #3	0	13,438	13,438
OHWM #4	9,068	0	9,068
OHWM #5	44,978	0	44,978
OHWM #6	127,784	0	127,784
OHWM #7	0	11,000	11,000
OHWM #8	0	5,517	5,517
OHWM #9	0	3,955	3,955
OHWM #10	24,352	0	24,352
Total	**219,021**	**34,317**	**253,338**

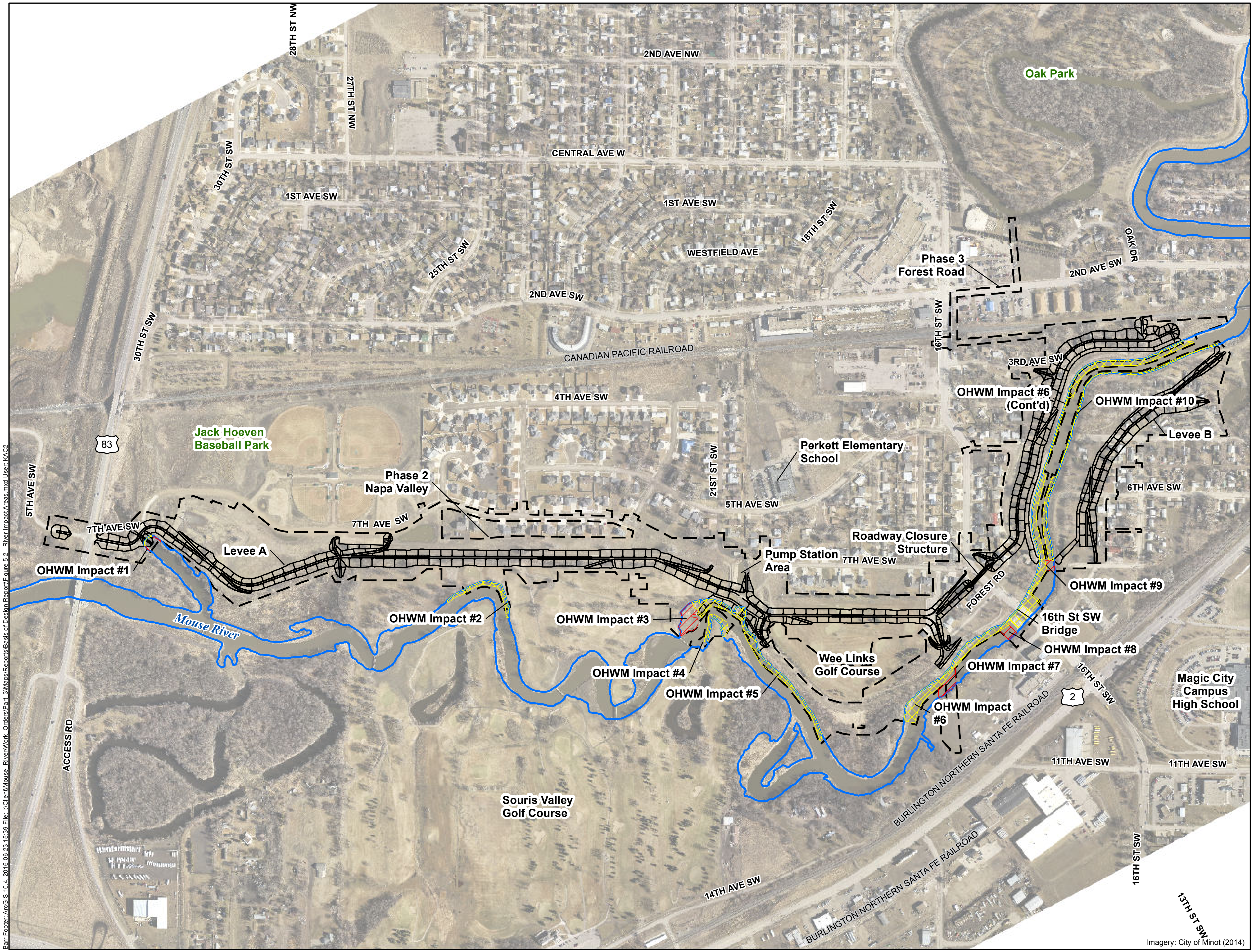


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Figure 8-2

RIVER IMPACT AREA

Basis of Design Report
Mouse River Enhanced Flood
Protection Project -
Phase 2 and 3
Minot, North Dakota

8.4 Biological Inventory

A biological inventory was conducted for Project segments. This included an evaluation of raptor nests (primarily bald eagles) in the Project area, bird use under bridges in the Project corridor, and an estimate of the number of trees within potential disturbance areas. These studies were conducted in late spring and early summer of 2015. A summary of the biological inventory is provided in Appendix O-2 of the BDR (reference [1]).

No eagle or other raptor nests were observed within the vicinity of Phases 2 and 3. Cliff swallow nests were observed under most bridges within the river reach of Phases 2 and 3. The Highway 83 bypass bridge, located on the western end of this reach, had the highest number of nests with approximately 450 swallow nests. For the Burlington through Minot reach, it was estimated that over 12,000 trees could be affected by constructing levees, floodwalls, and channel diversions and excavating overbank and ponding areas. The vast majority (about 86 percent) of these trees are green ash (*Fraxinus pennsylvanica*). There are a few scattered trees along the levee alignments and within a proposed ponding area that could be affected during Phase 2 and 3 construction activities.

8.5 Cultural Resources Investigation

An investigation was conducted to assess the cultural resources in the Phase 2 and 3 areas and to comply with Section 106 of the National Historic Preservation Act. The investigation included a Class I cultural resources inventory to search existing records for known archaeological sites and historic structures within the area of potential effect (APE) and a 1-mile buffer zone. No known archaeological sites or historic structures were identified within the Phase 2 or 3 Project areas (Appendix O-3, reference [1]). A Class III cultural resources survey (i.e., pedestrian field inspection) was conducted in areas that will be disturbed during construction of Phases 2 and 3. This survey identified no archaeological sites in the vicinity and detected no intact soils likely to contain archaeological materials (Appendix O-4, reference [1]). In addition, a Class III standing-structures survey was conducted to identify any historic structures in the vicinity. The results of this survey indicated that no historic structures will be affected by construction of Phases 2 and 3 (Appendix O-5, reference [1]).

8.6 Hazardous, Toxic, and Radioactive Waste Assessment

An HTRW assessment was conducted in general conformance with ER 1156-2-132: *HTRW Guidance for Civil Works Projects* (reference [23]). The purpose of the HTRW assessment was to identify issues and problems associated with waste in Phases 2 and 3 of the Project. The HTRW assessment focused on areas surrounding the new levee alignment and included a review of regulatory reports, historic aerial photographs, fire insurance maps, reverse city directories, and topographic maps; interviews with city staff; and a field inspection of the Project area to identify land-use practices and potential sources of contamination (reference [1]).

The following environmental risks were identified as having the potential to affect Phases 2 and 3 of the Project:

- Hazardous building materials may have been used during construction of the buildings and should be abated prior to demolition of any remaining buildings.
- No fuel oil tanks were observed during site reconnaissance; however, based on the age of the residences in the Project area, storage tanks may be encountered during demolition and will need to be removed and properly disposed.
- Hazardous materials may be present in a debris pile west of Odd's Mobile Home Park. This debris should be managed appropriately.

Based on the lack of regulatory sites within and adjacent to the proposed levee alignment and the lack of drums, storage tanks, or other potential sources of hazardous materials or petroleum products in or near Phase 2 and 3 areas, it was determined that no further HTRW investigations were needed. However, a contingency plan for unanticipated releases will be in place during construction to specify procedures for management and disposal of hazardous materials that may inadvertently be encountered (reference [1]).

8.7 Pre-Demolition Inspection

Inspections of any homes or structures remaining in the construction areas will be performed prior to demolition activities. Inspections will involve documenting asbestos and hazardous materials. Regulated waste within buildings will be documented in accordance with North Dakota requirements (North Dakota Department of Health [NDDH] Title 33 Article 20—Solid Waste; NDDH Title 33 Article 24—Hazardous Waste). A report will be prepared to document hazardous materials identified during onsite inspections and specify procedures for proper management and disposal of the materials.

9.0 References

[1] Barr Engineering Co., Ackerman-Estvold Engineering, "MREFPP, Phase 2 and 3 Basis of Design Report, 100% Design," July 2016.

[2] Barr Engineering Co., Ackerman-Estvold Engineering, Moore Engineering and CPS, Ltd, *Mouse River Enhanced Flood Protection Plan – Preliminary Engineering Report,* 2012.

[3] Barr Engineering Co., Ackerman-Estvold Engineering, Moore Engineering and CPS, Ltd, *Rural Flood Risk Reduction Alternatives Evaluation,* 2013.

[4] U.S. Army Corps of Engineers, *Design and Construction of Levees Engineering Manual EM 1110-2-1913,* 2000.

[5] ASTM International, *ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System),* ASTM International, 2011.

[6] Barr Engineering Co., Ackerman-Estvold Engineering, Moore Engineering and CPS, Ltd, *Hydrologic and Hydraulic Modeling Report - Mouse River Enhanced Flood Protection Plan, North Dakota State Water Commission,* 2013.

[7] Houston Engineering Inc., "Interim Hydrology Report for Ward County, North Dakota: Preliminary Ward County Flood Insurance Study, FY2011 Risk Map Project, FEMA Case #07-08-0688S," FEMA, Minot, 2013.

[8] U.S. Army Corps of Engineers, "Risk-Based Analysis for Flood Damage Reduction Studies Engineering Manual (EM 1110-2-1619)," Washington, D.C., 1996.

[9] U.S. Army Corps of Engineers, *Hydrologic Analysis of Interior Areas Engineering and Design Engineering Manual (EM 1110-2-1413),* Washington, D.C., 1987.

[10] U.S. Code of Federal Regulations, "Mapping of Areas Protected by Levee Systems".

[11] Swenson, Hagen & Co. in association with Houston Engineering, Inc., *City of Minot Storm Water Design Standards Manual,* 2002.

[12] City of Minot, North Dakota, "Standard Specifications Documents," CivicPlus Content Management System, 2013. [Online]. Available: http://www.minotnd.org/168/Standard-Specification-Documents. [Accessed 2016].

[13] Houston Engineering Inc.; Barr Engineering Co., *Mouse River Enhanced Flood Protection Project Design Guidelines,* Version 1 ed., 2016.

[14] Stantec, *Minot Front & Center - Downton & Neighborhood Plans,* 2014.

[15] Houston Engineering Inc., *Minot Water Treatment Plant Flood Hazard Mitigation Grant Program - 100% Design Submittal-Draft,* 2015.

[16] U.S. Army Corps of Engineers, *2014 Routine Inspection for the Minot Left Bank and Right Bank Levee Systems Letter from Michael J. Bart, Chief Engineering and Construction Division Levee Safety Officer to Tom Klein, Chairman, Ward County Water Board.*

[17] North Dakota Department of Commerce, *North Dakota State Building Code,* Bismarck, 2014.

[18] American Society of Civil Engineers, *ASCE Standard ASCE/SEI 7-10: Minimum Design Loads for Buildings and Other Structures,* Reston, Virginia: American Society of Civil Engineers, 2010.

[19] International Code Council, Inc., *2015 International Building Code,* 2015.

[20] U.S. Army Corps of Engineers, *Clarification Guidance on the Policy and Procedural Guidance for the Approval of Modifications and Alterations of Corps of Engineers Projects CECW-PB Memorandum,* 2008.

[21] U.S. Army Corps of Engineers, Environmental Laboratory, *Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS,* 1987.

[22] U.S. Army Corps of Engineers Research and Development Center, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0) (ERDC/EL TR-10-1),* Vicksburg, MS, 2010.

[23] U.S. Army Corps of Engineers, *Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Works Projects (ER 1165-2-132),* Washington, D.C., 1992.

Appendix A

USACE Section 408 Review Request and Authorization Request Checklist

USACE Section 408 Review Request

07/15/2016 *Date*	Souris River/Minot/Ward County JWRB *Segment/System/Sponsor Name*	Souris River Joint Board - David Ashley *Sponsor Point of Contact/Commissioner*
SRJB P.O. Box 5005 Minot, ND 58702 *Point of Contact Address*		XXX-XXX-XXXX *Point of Contact Phone Number*

Project Modification Location (Include PLSS, GPS Coordinates, Original Design Stationing, and River Mile):

See Project Summary Report (PSR) specifically Figures ES-1, Figure 1-1 and Figure 1-2 for Project Modification Location.

Project Modification Description (Include Dates of Construction):

See Project Summary Report (PSR) specifically the Executive Summary and Section 1.0 for Description of Proposed Modification for Phases MI-2 and MI-3 of the Mouse River Enhanced Flood Protection Project (MREFPP)

Anticipated Dates of Construction: Spring 2017 through Summer 2019

Purpose of Project Modification:

See Project Summary Report (PSR), Section 1.0 for Project Purpose/Need for Modification for Phases MI-2 and MI-3 of the Mouse River Enhanced Flood Protection Project (MREFPP)

Jason Westbrock *Engineer of Record (Please Print)*	XXXXXXX *PE State & License Number*	Barr Engineering Company *Engineering Firm (if Applicable)*
234 West Century Avenue Bismarck, ND 58503 *Engineer's Address*		701-255-5472 *Engineer's Phone Number*

DRAFT

Certification: I, Jason Westbrock, hereby certify that the proposed project modification was designed under my guidance, and it does not compromise the structural integrity of the Flood Risk Management System or adversely affect the designed level of protection.

Engineer's Signature	XX/XX/XXXX *Date*

Sponsor's Request: I, David Ashley, on behalf of the Flood Risk Management System, request that the United States Army Corps of Engineers review and approve the proposed project modification.

DRAFT

Sponsor/Commissioner's Signature	XX/XX/XXXX *Date*

USACE Section 408 Authorization Request Checklist			
All items listed below need to be included in the project modification submittal or indicated as not applicable. Items indicated as not applicable may need to be submitted if deemed necessary by the USACE review team. Additional information may also be required by the USACE. **All design drawings and calculations should be stamped by a professional engineer.**			
Item	Description	Included	N/A
Location Maps	**Required:** Detailed maps showing exact location of the modification in relationship to original baseline stationing, major roadways, distance from system, wetlands, and any other pertinent information.	✓	
Design Drawings	Design drawings including plan views, cross sections, dimensions, construction details, soil borings, and original as-built plans of areas to be potentially impacted.	✓	☐
Specification	Design specifications including type of material, construction methods, compaction requirements, safety measures, etc.	✓	☐
Real Estate Documents	Types of necessary real estate documents include Right of Way drawings, lease agreements, and easements. Include existing and proposed changes.	✓	☐
Flood Action Plan	**Required:** Provide detailed flood action and monitoring plans. Include temporary flood control measures, monitoring, notification procedures, access plans, and any other actions needed in a high water event.	To be included in O&M as part of project completion	
Geotechnical Evaluation	Design calculations and documents including: stability, seepage, erosion control, vegetation, material usage/borrow/waste/transport/hauling.	✓	☐
Structural Evaluation	Design calculations and documents including: bridges, piers, penetrations, diaphragm walls, structural components, gates, sheet piling, dams, and any other items or structures that may impact the system.	✓	☐
Hydraulic/Hydrologic Evaluation	Models, design calculations, and documents including: project flows, water surface profiles, and upstream and downstream impacts for all work within the floodplain, temporary construction purposes, and pump stations.	✓	☐
Electrical Evaluation	Design calculations and documents for all electrical components.	✓	☐
Mechanical Evaluation	Design calculations and documents including: motors, engines, discharge piping, intake piping, gates, pumps, and any other mechanical features.	✓	☐
O&M Requirements	Provide a document referencing changes to the Operation and Maintenance requirements for the project. Include maintenance activities, flood fight implications, and responsibilities.	Include as part of project completion documentation	
Additional Federal, State, & Local Laws	Provide all documentation relating to additional federal, state, and local laws and permits. (i.e. NEPA, Endangered Species Act, DNR, floodplain permits, FEMA "No Rise" certification, local building permits, NPDES, etc)	✓	☐
Additional Information	Provide any additional information: See attached Project Summary Report (PSR) and Basis of Design Report (BDR) for requested and additional information.	✓	☐
Note: It is recommended that project modifications be designed to USACE design standards. Standards may be found at the following address: http://www.publications.usace.army.mil/			