Draft Programmatic Environmental Impact Statement
Mouse River Enhanced Flood Protection Project

Ward County, North Dakota

November 2016

US Army Corps of Engineers ®

Prepared by:
U.S. Army Corps of Engineers
St. Paul District
180 Fifth Street East, Suite 700
St. Paul, MN 55101-1678

Cover Sheet
Draft Programmatic Environmental Impact Statement

Mouse River Enhanced Flood Protection Plan

LEAD AGENCY: U.S. Army Corps of Engineers, Mississippi Valley Division, St. Paul District (CEMVP)

ABSTRACT: The Draft Programmatic Environmental Impact Statement (DEIS) documents the analysis of requested actions to alter existing U.S. Army Corps of Engineers flood risk reduction projects in Ward County, North Dakota. The DEIS identifies effects associated with the initial phases of a project aimed to reduce flood risk up to the 2011 flood-of-record for the Souris (Mouse) River Basin from Burlington through Minot, North Dakota. The DEIS also generally evaluates the effects that are anticipated for remaining features following initial project implementation.

Privacy Notice: Persons submitting comments are advised that all comments received will be available to the public, to include the possibility of posting on a publicly accessible website. Commenters are requested not to include personal privacy information, such as home addresses, or home phone numbers, in their comments unless they do not object to such information being made available to the public.

Comments: Please direct inquiries on this Draft Programmatic Environmental Impact Statement (DEIS) to the U.S. Army Corps of Engineers, St. Paul District, Attention: Elliott Stefanik, 180 Fifth Street East, Suite 700, St. Paul, MN 55101-1678. Email Elliott.L.Stefanik@usace.army.mil; Telephone (651) 290-5260; Fax (651) 290-5805. **The official closing date for receipt of comments will be December 22, 2016**

Draft Programmatic Environmental Impact Statement
Mouse River Enhanced Flood Protection Project

November 2016

Contents

Executive Summary ES-1

Proposed Project ES-1

USACE Involvement ES-1

NEPA Compliance ES-2

Federal Coordination ES-2

Requester's Preferred Alternative and Other Alternatives ES-3

Summary of Effects ES-4

1.0 Introduction 1

1.1 Purpose and Need for the Project 2

1.2 Project Location 3

1.3 History of Flooding 5

1.4 Existing Flood Control Projects 7

1.5 Permits, Approvals, and Regulatory Requirements 9

1.6 Agency and Public Scoping 12

2.0 Alternatives 14

2.1 Requester's Preferred Alternative 14

2.2 Other Alternatives Considered 51

3.0 Affected Environment 89

3.1 Geology, Soils, and Groundwater 89

3.2 Surface Waters 93

3.3 Biological Resources 105

3.4 Land Use and Infrastructure 112

3.5 Potential Contaminated Sites 129

3.6 Socioeconomics 141

3.7 Recreation 156

3.8 Aesthetics and Visual Resources 162

3.9 Historic and Cultural Resources 163

3.10 Air and Noise Quality 173

4.0 Environmental Consequences 176

4.1 Geology, Soils, and Groundwater 176
4.2 Surface Waters 178
4.3 Biological Resources 192
4.4 Land Use and Infrastructure 197
4.5 Contaminated Sites 212
4.6 Socioeconomics 215
4.7 Recreation 225
4.8 Aesthetics and Visual Resources 229
4.9 Historic and Cultural Resources 234
4.10 Air Quality and Noise 237
4.11 Human Health and Safety 243
4.12 Cumulative Effects 244
4.13 Interim Impacts 251
5.0 Agency and Public Involvement 270
5.1 Agency Coordination 270
5.2 Public Involvement 272
6.0 Major Findings and Conclusions 274
6.1 Requester's Preferred Alternative and Other Alternatives 274
6.2 Geology, Soils, and Groundwater 274
6.3 Surface Waters 274
6.4 Biological Resources 275
6.5 Land Use and Infrastructure 275
6.6 Contaminated Sites 276
6.7 Socioeconomics 277
6.8 Recreation 277
6.9 Aesthetics and Visual Resources 278
6.10 Historic and Cultural Resources 278
6.11 Air Quality and Noise 279
6.12 Health and Safety 279
6.13 Cumulative Impacts 279
6.14 Interim Impacts 280
7.0 List of Reviewers and Preparers 281
8.0 References 284

List of Tables

Table 1-1 Floods Greater than 5,000 cubic feet per second (cfs), Souris River above Minot 5
Table 1-2 Local, State, and Federal Permits, Approvals and Reviews Needed for the Project 11
Table 2-1 Bridges to be Reconstructed or Modified 15
Table 2-2 Alternatives Evaluated for Operational Modifications of Existing Dams 54
Table 2-3 Alternatives Evaluated for Structural Modifications of Existing Dams 56
Table 2-4 Alternatives Evaluated for Construction of New Storage 58
Table 2-5 Major Upstream Diversion Alternatives 60
Table 2-6 Local Site Diversion Alternatives 63
Table 2-7 Ramstad Lincoln Neighborhood Alternatives 67
Table 2-8 Twenty-Seventh Street High-Flow Diversion Alternatives 71
Table 2-9 Kings Court Channel Realignment Alternatives 75
Table 2-10 Burdick Channel Realignment Alternatives 79
Table 3-1 Soil Units in the Impact Area 92
Table 3-2 Overview of Souris River Dams in North Dakota 97
Table 3-3 Fish Species Known to Occur in the Burlington-Sawyer Reach of Souris River between 1960 and 2009, with Last Documented Occurrences 107
Table 3-4 Major Roadways in the Project Area 118
Table 3-5 Roadway Bridges in the Project Area 121
Table 3-6 Non-Municipal Utility Providers 124
Table 3-7 Population 141
Table 3-8 Age and Gender Distribution, 2013 142
Table 3-9 Employment by Industry, 2013 144
Table 3-10 Housing Characteristics, 2013 145
Table 3-11 Minority Population Composition of North Dakota, Ward County, Burlington, Minot, and the Region of Interest (ROI) 150
Table 3-12 Minority Population Composition of North Dakota, Ward County, Burlington, Minot, and Census Block Groups in the ROI 151
Table 3-13 Racial Composition of the Population in Minot: Change from 2000 to 2010 153
Table 3-14 Poverty and Income Characteristics (2009-2013) of North Dakota, Ward County, Burlington, Minot, and the Region of Interest (ROI) 154
Table 3-15 Percentage of Individuals Below the Poverty Threshold and Median Household Income in the State of North Dakota, Ward County, Burlington, Minot, and Census Block Groups Traversed by the Project 156
Table 3-16 Minot Parks and Open Space in the Project Area 159
Table 3-17 Recreational Facilities Funded by the Federal Land and Water Conservation Fund in the Vicinity of the Project 161
Table 3-18 Class I Cultural Resource Survey – Prehistoric Archaeological Sites within Class I Study Area 165

Table 3-19 Class I Cultural Resource Survey – Historic Archaeological Sites within Class I Study Area 165
Table 3-20 Class I Cultural Resource Survey – Standing Structures/Historic Architectural Sites within Class I Study Area 166
Table 3-21 Class III Standing Structures Survey – Historic Structures within Phases 1-3 APE 170
Table 3-22 Limiting Noise Levels for Zoning Districts 175
Table 4-1 Inundation of Prime Farmland under the No-Action and Preferred Alternatives 178
Table 4-2 Accessible/Non-Accessible Primary Routes at 10,000 and 27,400 CFS 211
Table 4-3 Potentially Contaminated Sites That Could Be Flooded Under Various Flood Scenarios 214
Table 4-4 Protected and Inundated Parcels in 27,400 cfs Flood Event 217
Table 4-5 Property Buyouts for Phases 1, 2, and 3 of the Requester's Preferred Alternative 220
Table 4-6 Property Buyouts for Other Phases of Construction Stage 1.5 of the Requester's Preferred Alternative 222
Table 4-7 Number of Inundated Parcels: No-Action Alternative under Three Flow Conditions (5,000 cfs, 10,000 cfs, 27,400 cfs) 224
Table 4-8 Inundation of Recreational Facilities 229
Table 4-9 Typical Noise Levels of Construction Equipment 240
Table 4-10 Typical Noise Levels 241
Table 4-11 Sensitive Receptors within about 1,000 feet of Phases 1, 2, and 3 242
Table 4-12 Construction Stage Definitions 253
Table 4-13 No-Action Alternative: Interim Project Inundation Area and Depth Impacts Maps 260
Table 4-14 No-Action Alternative: Summary of Inundation Changes for Structures 261
Table 4-15 Previously or Previously Listed, Recommended Eligible or Potentially Eligible Properties 267

List of Figures

Figure 1-1 Project Location 4
Figure 1-2 Mouse (Souris) River 6
Figure 2-1 Project Phases of Construction Stage 1.5 16
Figure 2-2 Conceptual Layout of Tierrecita Vallejo 21
Figure 2-3 Detailed Layout of Phases 2 and 3 24
Figure 2-4 Conceptual Layout of Maple Ave High-Flow Diversion 27
Figure 2-5 Detailed Layout of Phase 1 30
Figure 2-6 Conceptual Layout of Tieback Levee 31
Figure 2-7 Perkett Ditch Pump Station 37
Figure 2-8 Broadway Pump Station 38
Figure 2-9 Locations of Potential Borrow Areas 41
Figure 2-10 Typical Levee Cross Section 43
Figure 2-11 Typical Floodwall Cross Section 43
Figure 2-12 Typical High-Flow Diversion Cross Section 44
Figure 2-13 Typical Channel Realignment Cross Section 45
Figure 2-14 Typical Overbank Excavation Cross Section 45
Figure 2-15 Exploration Trench Type I and Type III 46
Figure 2-16 Typical Schematic of Seepage Collection System 48
Figure 2-17 Upstream Flood Storage Alternatives 53
Figure 2-18 Major Upstream Diversions 61
Figure 2-19 Local Site Diversions 65
Figure 2-20 Ramstad Lincoln Neighborhood Alternatives 70
Figure 2-21 27th Street High-Flow Diversion Alternatives 72
Figure 2-22 Kings Court Channel Realignment Alternatives 76
Figure 2-23 Burdick Channel Realignment Alternatives 80
Figure 3-1 Schematic of Project Area for Environmental Analysis 91
Figure 3-2 Wellhead Protection Areas 95
Figure 3-3 Overview of Souris River, Major Tributaries, and Dams 96
Figure 3-4 Souris River Impaired Waters 100
Figure 3-5 Delineated Wetlands 104
Figure 3-6 Zoning Jurisdiction 114
Figure 3-7 Minot Growth Areas 117
Figure 3-8 Aviation Facilities 125
Figure 3-9 Minot Wastewater Treatment Plant 128
Figure 3-10 HTRW Site Observation Summary: Phases 2 and 3 131
Figure 3-11 Historic Businesses: Phase 1 134
Figure 3-12 Current Key Businesses: Phase 1 135
Figure 3-13 Known Environmental Sites: Phase 1 136
Figure 3-14 Phase II HTRW Assessment Area 137

Figure 3-15 Known Environmental Sites within One Mile of Project 139
Figure 3-16 Known Environmental Sites in Construction Stage 1.5 Impact Area 140
Figure 3-17 Environmental Justice Analysis Area 149
Figure 3-18 Low Income Populations in Project Area 155
Figure 3-19 Class III Archaeological and Standing Structures Surveys Phase 1 167
Figure 3-20 Class III Archaeological and Standing Structures Surveys Phases 2 and 3 168
Figure 4-1 Phase 1 OHWM Impacts 184
Figure 4-2 Phases 2 and 3 OHWM Impacts 185
Figure 4-3 Phases 2 and 3 Wetland Impacts 186
Figure 4-4 Tierrecita Vallejo OHWM Impacts 187
Figure 4-5 Tierrecita Vallejo Wetland Impacts 188
Figure 4-6 Maple Avenue High-Flow Diversion OHWM Impacts 189
Figure 4-7 Maple Avenue High-Flow Diversion Wetland Impacts 190
Figure 4-8 Phase 1 Roadway Modifications 204
Figure 4-9 Phases 2 and 3 Roadway Modifications 206
Figure 4-10 Construction Stage 1 Project Segments 255
Figure 4-11 Construction Stage 1.5 Project Segments 256
Figure 4-12 Construction Stage 2 Project Segments 257
Figure 4-13 Construction Stage 3 Project Segments 258
Figure 4-14 Construction Stage 4 Project Segments 259
Figure 4-15 Net Inundation Area Changes Relative to No-Action Alternative 263
Figure 4-16 Net Inundation Area Impacts 264
Figure 4-17 Cultural Resources Interim Impacts Construction Stage 1.5 100-Year Flood Event 268
Figure 4-18 Cultural Resources Interim Impacts Construction Stage 1.5 2011 Flood Event 269

List of Maps

Map 2-1	Proposed Project Features
Map 2-2	No-Action Alternative Inundation
Map 2-3	Existing Flood Risk-Reduction Features
Map 3-1	Soil Units
Map 3-2	Prime Farmland
Map 3-3	Floodplain and NWI Overview Map
Map 3-4	Land Cover
Map 3-5	Land Use Zones
Map 3-6	Transportation Overview
Map 3-7	Bridges in the Project Area
Map 3-8	Emergency Services Location
Map 3-9	Recreational Resources in Project Area

List of Appendices

Appendix A	Scoping Document - Mouse River Enhanced Flood Protection Plan Environmental Impact Statement
Appendix B	No-Action Alternative 2
Appendix C	Wetlands, Waters, and Biological Inventory Report
Appendix D	HTRW Assessment Report - Napa Valley and Forest Road Project Segments
Appendix E	HTRW Assessment Report Fourth Avenue
Appendix F	Hazardous, Toxic, and Radioactive Waste Field Investigation Phase 1- 4th Avenue Floodwall, Minot North Dakota Memo
Appendix G	Class I Cultural Resources Survey, Mouse River Enhanced Flood Protection Project, Burlington to Minot, Ward County, North Dakota*
Appendix H	Class III Archaeological Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, Minot Ward County, North Dakota*
Appendix I	Class III Standing Structures Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, 2nd Avenue SW Stormwater Pool, Minot, Ward County, North Dakota*
Appendix J	Programmatic Agreement between the U.S. Army Corps of Engineers, St. Paul District, the North Dakota State Historic Preservation Officer, and the Souris River Joint Water Resource Board Regarding the Mouse River Enhanced Flood Protection Project, Renville, Ward, McHenry, and Bottineau Counties, North Dakota
Appendix K	Interim Project Inundation Area and Depth Impacts Maps

**Historic and Archaeological artifacts or sites and associated locational data are protected under North Dakota Century Code 55-02-07. Access to, or release of, information from files that contain sensitive information, such as information included in this report, may be provided upon request from the director of the North Dakota state historical society.*

Acronyms, Abbreviations and Units

ACM	asbestos-containing material
ADT	Average Daily Traffic
APE	areas of potential effect
ARFF	Minot International Airport
BCC	Birds of Conservation Concern
BFE	Base Flood Elevations
BFEs	base flood elevations
Bgs	below ground surface
BMPs	best management practices
BNSF	Burlington Northern Santa Fe
CAA	Clean Air Act
CBDG-DR	Community Block Development Grant Disaster Recovery
CDBG-DR	Community Development Block Grant Disaster Recovery
CEMVP	U.S. Army Corps of Engineers, Mississippi Valley Division, St. Paul District
CEQ	Council on Environmental Quality
CEQ	Council on Environmental Quality
CERCLA	Compensation and Liability Information System
CFR	Code of Federal Regulations
Cfs	cubic feet per second
CH_4	methane
CLOMR	Conditional Letter of Map Revision
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-e	CO_2 equivalents
CWA	Clean Water Act
CWCS	Comprehensive Wildlife Conservation Strategy
dB	decibels
dBA	A-weighted decibel scale
DEIS	Draft Programmatic Environmental Impact Statement
DNPL	Delisted National Priorities List
DR	Departmental Regulation
DRO	diesel range organics
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FBFM	Flood Boundary and Floodway Map
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIRMs	Flood Insurance Rate Maps

FIS	Flood Insurance Study
FPPA	Farmland Protection Policy Act
GHGs	Greenhouse gases
Gpm	gallons per minute
GRO	gasoline range organics
Hazmat	Hazardous Materials
HIG	Historical Information Gatherers Inc.
Hp	horsepower
HTRW	Hazardous, Toxic, and Radioactive Waste
HUD	Department of Housing and Urban Development
IJC	International Joint Commission
IPaC	Information Planning and Conservation decision support system
ISRB	International Souris River Board
LEDPA	least environmentally damaging practicable alternative
LOI	Letters of Intent
LOMR	Letter of Map Revisions
LPP	Locally Preferred Plan
LTCR	Long-term Community Recovery
LUST	leaking storage tanks
LWCF	Land and Water Conservation Fund
MBTA	Migratory Bird Treaty Act
MDU	Montana-Dakota Utilities Company
MOA	Memorandum of Agreement
MOT	Minot International Airport
MREFPP	Mouse River Enhanced Flood Protection Project
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAWS	Northwest Area Water Supply
ND SHPO	North Dakota State Historic Preservation Office
NDAAQS	North Dakota ambient air quality standards
NDDES	North Dakota Department of Emergency Services
NDDH	North Dakota Department of Health
NDDOT	North Dakota Department of Transportation
NDGF	North Dakota Game and Fish
NDNH	North Dakota Natural Heritage
NDPDES	North Dakota Pollutant Discharge Elimination System
NDRC	National Disaster Resilience Competition
NDSWC	North Dakota State Water Commission
NED	National Economic Development
NEPA	National Environmental Policy Act
NFRAP	No Further Remedial Action Planned Sites

NHIS	Natural Heritage Inventory Species of Concern and Significant Ecological Communities
NHPA	National Historic Preservation Act
NLCD 2011	National Land Cover Database 2011
NLRRCRAG	No Longer Regulated Resource Conservation and Recovery Act (RCRA) Generator Facility
NO_2	nitrogen dioxide
NOI	Notice of Intent
NPS	National Park Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
O&M	Operations and Maintenance
O_3	ozone
OHWL	Ordinary High Water Level
OHWM	ordinary high water mark
OPC	opinion of probable cost
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
Pb	lead
PEMA	Palustrine emergent wetlands that are temporarily flooded
PEMC	seasonally flooded
PEMF	semi-permanently flooded
PER	Preliminary Engineering Report
PFO	Palustrine forested
PHASP	Project Health and Safety Plans
PL	Public Law
$PM_{\#}$	particulate matter
Project	Mouse River Enhanced Flood Protection Project
PSD	Prevention of Significant Deterioration
R2UBH	riverine with unconsolidated bottom
RCRA	Resource Conservation and Recovery Act
Requester	Souris River Joint Water Resource Board
ROC	Regions of Comparison
ROI	Region of Interest
RSA	regional service area
SFHA	Special Flood Hazard Areas
SFHAs	Special Flood Hazard Areas
SGCN	species of greatest conservation need
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SoCP	100 Species of Conservation Priority
SPWLF	Special Waste Landfills

SRJB	Souris River Joint Water Resource Board
SRT	Souris River Telephone
StARR	Structure Acquisition, Relocation, or Ring Dike
STIP	Statewide Transportation Improvement Plan
SVOCs	semi-volatile organic compounds
SWG	State Wildlife Grants
SWIF	System Wide Improvement Framework
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile Organic Compounds
VOCs	volatile organic compounds
WCWRD	Ward County Water Resource District
WTP	water treatment plant

Executive Summary

Proposed Project

There has been a history of flooding along the Souris River (also referred to as the Mouse River) in north-central North Dakota. In 2011 the flood of record occurred in the Souris River Basin, causing hundreds-of-millions of dollars in damages to homes, businesses, public facilities, and infrastructure along the entire length of the Souris River.

The Souris River Joint Water Resource Board (SRJB; the "requester") is pursuing a plan to reduce future flood risks throughout the U.S. portions of the Souris River Basin by constructing a series of new levees, floodwalls, and other flood risk reduction features. This plan has become known locally as the Mouse River Enhanced Flood Protection Project (MREFPP). The MREFPP would be constructed and permitted in a number of stages over a period of more than 25 years, depending on available funding. Each permitted stage would be able to provide interim flood risk reduction for flows of at least 10,000 cubic feet per second (cfs). Ultimately, at completion of construction, the MREFPP would provide flood risk reduction to 27,400 cfs (flows equivalent to those experienced during the 2011 flood).

USACE Involvement

The construction of the MREFPP would require alterations to a number of U.S. Army Corps of Engineers (USACE) flood risk reduction projects, collectively referred to as the Souris River Basin Project. Alterations to these projects requires permission from USACE by way of Section 14 of the Rivers and Harbors Act of 1899 (33 United States Code (USC) 408, hereinafter referred to as Section 408). Permission to alter projects is subject to USACE review of detailed designs and may be granted to the requester if the proposed alteration does not impair the usefulness of the USACE project, which includes retaining the project's authorized purpose, and is not injurious to the public interest. Detailed design has been completed for three segments: Fourth Avenue NE (Phase 1), Napa Valley (Phase 2), and Forest Road (Phase 3). Together, these three phases are Construction Stage 1 of the MREFPP. Permission to make alterations to the Souris River Basin Project is being sought from the USACE for actions associated with the construction of Stage 1.

In addition, the MREFPP would require fill to be placed in aquatic areas that are Waters of the United States, which requires a Section 404 permit from the USACE as regulated by Section 404 of the Clean Water Act (33 Code of Federal Regulations (CFR) 323). A Section 404 permit would only be issued for a combination of features which can provide independent utility (i.e., can be constructed and can function independently without substantial emergency actions). Construction of the next three phases (the Maple Avenue High-Flow Diversion, Tierrecita Vallejo, and the tieback levee) would be capable of providing independent utility for flood risk reduction to flows of 10,000 cfs (the 100-year flood event). These three phases, along with Stage 1, make up Construction Stage 1.5. A Section 404 permit for placing fill in Waters of the United States is being pursued for Construction Stage 1.5.

Flood risk reduction features, alignments, and phasing of the MREFPP after Stage 1.5 are more conceptual in nature, but are also described in this document. These plans are preliminary, and may change based on future evaluations, funding, and prioritization of critical needs for flood risk reduction.

NEPA Compliance

This document is an environmental compliance document, required by the National Environmental Policy Act (NEPA) for Federal actions, such as USACE Section 408 permissions and Section 404 permitting. The document evaluates the potential impacts of alternative actions that meet the Requester's purpose and need and also ensures that this information is available to public officials and citizens prior to making decisions and taking action. General impacts associated with construction and operation of the MREFPP from Burlington through Minot as well as site-specific impacts associated with features purposed for construction through Stage 1.5 are described in this document.

The proposed actions have the potential to result in significant effects to the human environment, resulting in the preparation of an Environmental Impact Statement (EIS). Due to the size and complexity of the project, the EIS was prepared as a programmatic document, meaning its scope is large enough to account for phases being proposed for construction in the near-term as well as the more distant the future. This approach allows for a more holistic evaluation of impacts and may reduce the number and breadth of subsequent NEPA documents needed to address impacts in the future. Site-specific and resource-specific issues for subsequent phases of the Project will be reviewed and evaluated as detailed plans and official proposals are submitted for approval. If impacts associated with the subsequent phases have changed appreciably from what is described in the programmatic EIS, additional NEPA documents may be required.

Federal Coordination

In compliance with the Fish and Wildlife Coordination Act (16 USC 661-667e), continued correspondence has occurred with the USFWS and other federal and state agencies with natural resource interests to evaluate impacts to fish and wildlife.

The Dakota skipper and the northern long-eared bat are two federally-listed (threatened) species with potential habitat in the project area. Preventative measures would be taken to avoid any effects to the northern long-eared bat. Options to avoid impacts to the Dakota skipper are currently being evaluated. Informal Section 7 consultation has been initiated with the U.S. Fish and Wildlife Service (USFWS) in accordance with the Endangered Species Act of 1973.

Section 106 of the National Historic Preservation Act, requires federal agencies to take into account the effects of their undertakings on historic properties. Because of the size of this project, a Programmatic Agreement (per 36 CFR 800.14(b)) will be negotiated between the USACE, the North Dakota State Historic Preservation Office (ND SHPO), and the SRJB to cover effects that cannot be fully determined in advance of the EIS.

The Federal Emergency Management Agency (FEMA) is responsible for reviewing potential impacts in the regulatory floodplain. The proposed MREFPP is intended to remove areas from the regulatory floodplain and thereby eliminate flood insurance requirements for properties in those areas. Preliminary results of studies currently underway suggest that the 100-year floodplain may be updated from the current discharge rate of 5,000 cfs to 10,000 cfs. If accepted by FEMA, this modification would considerably expand the existing 100-year floodplain. FEMA must comment on projects that create changes to the regulatory floodplain by issuing a Conditional Letter of Map Revision (CLOMR). After the completion of construction, a Letter of Map Revisions (LOMR) would be issued to officially revise the Flood Insurance Rate Map (FIRM) or Flood Boundary and Floodway Map (FBFM), and sometimes the Flood Insurance Study (FIS) report.

These and other required federal, state and local permits and approvals are discussed in detail in Section 1.5.

Requester's Preferred Alternative and Other Alternatives

Several alternatives were considered by the requester when developing plans for the MREFPP, including upstream flood storage, major upstream diversion channels, local site diversion channels, high-flow bypasses, channel modifications, floodproofing, relocations/buyouts, and additional floodplain regulations.

The plan being proposed by the requester includes approximately 18.9 miles of new levees, 2.7 miles of new floodwalls, 2 channel realignments totaling 1.6 miles, 2 high-flow bypass diversions, 21 transportation closure structures, the reconstruction of modification of 6 bridges, and 121 acres of overbank excavation. This plan is referred to as the "Requester's Preferred Alternative" in this EIS.

Alternatives other than the Requester's Preferred Alternative were eliminated for one or more of the following reasons: ineffectiveness at flows up to 27,400 cfs, political infeasibility, engineering infeasibility, significant social or environmental impacts, and cost. The Requester's Preferred Alternative was selected after several years of studies and consultations with stakeholders.

For purposes of USACE's Section 404 permit and Section 408 permission decisions, the Requester's Preferred Alternative was evaluated with respect to the No-Action Alternative. The No-Action Alternative includes the existing federal levee system with additional flood fighting to flows of 10,000 cfs. Flood fighting to this level has been successful in the past and is the most likely scenario to take place under the current management of the system. However, flood fighting can be an intensive endeavor, carries a high level of risk and uncertainty, and is not a favorable course of action for the community.

In the occurrence of an unexpected, extreme weather event causing flood waters to rise rapidly, it is possible that there would not be enough time for emergency flood fighting. Flood waters would circumvent many of the discontinuous levees throughout the project area with flows in excess of 5,000 cfs. The effects of flooding under this no-action scenario (No-Action Alternative 2) and the interim effects of flooding during the construction of various stages of the Requesters Preferred Alternative were also

evaluated. The probability of this scenario is low and the impacts of this analysis are confined to Appendix B.

Summary of Effects

Geology, Soils, and Groundwater

The Requester's Preferred Alternative would not affect geologic or groundwater resources. Construction could temporarily affect soils in the impact area, including approximately 300 acres of prime farmland, by increasing the potential for erosion, compaction, loss of productivity, and contamination from leaking equipment. Best management practices would be used to mitigate these effects and reduce the likelihood of impacts to be minor and temporary in nature.

The No-Action Alternative would not directly affect geologic, soil, or groundwater resources.

Surface Waters

The Requester's Preferred Alternative would temporarily affect the Souris River through localized physical disturbances attributed to construction activities such as vegetation clearing, grading, excavation, and soil stockpiling. These impacts would be minimized by using appropriate erosion control measures. Project features including 121 acres of overbank excavation and over 7,500 linear feet of riprap placement would require that work be done below the Souris River's ordinary high water mark, resulting in permanent impacts to the river. Other permanent effects include the realignment of the river channel in select areas, which would alter the course of the river or create cutoff channels.

The Requester's Preferred Alternative is expected to temporarily affect up to 26 acres of wetlands by causing sedimentation and ground disturbances, and to permanently affect up to 41 acres of wetlands where project features are constructed directly in wetland areas. Unavoidable wetland impacts would seek permitting and be mitigated as appropriate. In addition, the proposed setback levees and overbank excavation would result in a larger floodplain with increase connectivity to floodwaters. Some of these areas may eventually develop wetland characteristics.

The No-Action Alternative would not directly affect surface waters. The Souris River Channel would remain unchanged, occasionally overtopping the existing levee system.

The No-Action Alternative could temporarily affect wetlands if flood fighting measures include placement of fill in wetland areas. Any fill associated with flood fighting measures would be removed after the high water receded.

Biological Resources

There are six federally endangered, threatened, or candidate species known to occur in Ward County. Of these, there may be potential habitat in the project area for two threatened species; the Dakota skipper and northern long-eared bat. Avoidance measures during construction of the Requester's Preferred Alternative would prevent any adverse effects to the northern long-eared bat. Dakota skipper habitat was identified in an area being evaluated as a source for fill material that would be used in construction. If the

site is used during construction it may result in an adverse effect to the species. Other locations are currently being evaluated as a source of suitable fill material.

The Requester's Preferred Alternative would both temporarily and permanently affect vegetation communities in the project area by removing existing vegetation, including up to 65 acres of land with forests or moderate tree cover. Indirect impacts from changes to vegetation would include the alteration of hydrology, changes to nutrient and sediment deposition within existing vegetation communities, and changes in the spread and abundance of non-native plant species. The type and magnitude of indirect impacts on vegetation communities would vary widely with location, and may result in both positive and negative changes depending on the current composition of the vegetation community and its existing ecological function. Overall, however, the construction activities would likely result in a negative impact due to an increase in non-native plants and/or noxious weeds.

Features of the Requester's Preferred Alternative constructed within the Souris River channel, floodplain, or floodway could alter existing aquatic habitats of fish and other organisms through placement of riprap. These changes would not preclude fish and other aquatic organisms from using the river, but may adversely change the habitat for some species.

Small amounts of general wildlife habitat along the Souris River could be lost, but would not include any unique or specialized wildlife habitats. The Requester's Preferred Alternative would not be expected to affect any state-listed species, state Species of Conservation Priority, or federal Birds of Conservation Concern.

Under the No-Action Alternative, biological resources would continue to function as they do currently and have little to no effect on fish and wildlife. Fish and wildlife would be periodically displaced during flood events while plant communities would change to various extents following prolonged inundation.

Land Use

The Requester's Preferred Alternative, by converting land for flood risk reduction, could have temporary negative effects and permanent benefits to existing agricultural, commercial, industrial, residential, and recreational land use. The Requester's Preferred Alternative would also create substantial permanent benefits by allowing for the sustained use of land in the project area, and by creating a greenway along the river with ecological benefits and recreational opportunities.

The No-Action Alternative would not change zoning, land use, and development within the project area. The reoccurrence of high intensity flooding would make current land use in various locations of the project area unsustainable. Residents and businesses would eventually move out of flood prone areas and agricultural lands would experience adverse effects to productivity.

Infrastructure

The Requester's Preferred Alternative would significantly improve the flood risk-reduction infrastructure in the project area and would permanently and significantly benefit the roadway network, allowing transportation of essential goods, services, and facilitating emergency response during flood events.

Temporary transportation disruptions would occur during construction, but could be mitigated with proper signage, detours, and rerouting. The Requester's Preferred Alternative would also substantially benefit both public and private utilities by providing greater flood resilience, upgraded stormwater management, and improved infrastructure.

Under the No-Action Alternative, infrastructure in areas that have experienced flooding in the past would continue to be at risk. A flood event over 10,000 cfs would substantially and adversely affect infrastructure in the project area. Long-term disruptions and destruction of infrastructure from higher-intensity floods would result in adverse effects that could be felt regionally.

Contaminated Sites

A limited Phase II investigation in the Fourth Avenue NE segment revealed diesel range organic concentrations that exceeded state guidelines. The Requester's Preferred Alternative would require that groundwater pumped out for temporary dewatering during construction be discharged to the Souris River; however, based on surface water quality standards, the discharged water would not affect the river's water quality. The results were discussed with staff at the North Dakota Department of Health Surface Water Division, who did not have any concerns with the discharge of this water to the Souris River. No additional hazardous waste issues were identified for Phases 1, 2, or 3 of the Requester's Preferred Alternative.

The No-Action Alternative would not directly affect potentially contaminated sites. Some sites would be temporarily affected during flooding. The inundation of storage tanks and septic systems could potentially cause them to overflow, which could contaminate soil, groundwater, and surface waters. Flooding of contaminated sites is not expected to result in permanent adverse effects to any resources in the project area.

Socioeconomics

The acquisition of approximately 900 properties would be required to construct all phases of the Project. However, the Requester's Preferred Alternative would ultimately decrease the flood risk for nearly 4,700 parcels currently located within the flood inundation area, and would reduce the potential need to relocate businesses and homes. It would directly, permanently, and substantially increase the value of properties in the newly protected areas. This would stimulate local business activity and would support long-term business expansion. The Requester's Preferred Alternative would also support recovery strategies for rebuilding flood-affected areas and would ultimately benefit community cohesion within the project area. Construction of the Requester's Preferred Alternative would create jobs for each phase of construction, which would in turn create additional indirect and induced jobs.

The No-Action Alternative would not be expected to generate additional jobs or business activities in areas affected by the 2011 flood. Continued flooding could cause damage to properties, lead to loss of communities, and cause permanent relocation of residents and businesses.

Demographic analysis indicates that the communities impacted by the project are not composed of disproportionately minority or low-income communities, so no environmental justice impacts are

expected. While there are some pockets of low-income areas, these areas would not be affected disproportionate to other demographic classes.

Recreation

The Requester's Preferred Alternative would permanently enhance existing recreational features, create new recreational opportunities, and significantly contribute to the development of a planned greenway corridor. Constructing and maintaining the Requester's Preferred Alternative would temporarily disrupt access to some recreational resources, but these negative effects could be mitigated through coordination with the community.

The No-Action Alternative would not directly result in adverse effects to recreational facilities. Recreational use of levees, the river corridor, parks, fishing locations, and other recreational features would continue as established, with usage periodically disrupted by flooding.

Aesthetics and Visual Resources

The Requester's Preferred Alternative would enhance the aesthetic value in some areas while decreasing it in others. Developing a greenway that would connect with parks, picnic sites, and fishing sites would permanently improve visual aesthetics by enhancing the viewing experience of adjoining neighborhoods, hikers, and general recreational users. Constructing the Requester's Preferred Alternative would permanently decrease the aesthetic value for a limited number of properties that currently have pleasing views of the river or greenspaces that would be replaced with flood risk reduction features such as a levee or floodwall.

The No-Action Alternative would not directly affect aesthetics and visual resources. During flood events, temporary adverse visual and aesthetic effects would occur, as they do now, with standing water, debris, and sedimentation deposits.

Historic and Cultural Resources

A Class I Cultural Resources Survey was conducted to identify all known archaeological sites and historical structures that could be affected by the Requester's Preferred Plan, although the Class I did not consider historic structures within Minot. In addition, some Class III Archaeological Surveys were conducted to provide further detail on Stage 1 of the Requester's Preferred Alternative. Detailed investigations could not be completed for the entire project in advance of the EIS and a Programmatic Agreement will be negotiated between the USACE and the North Dakota State Historic Preservation Office (ND SHPO) to cover potential impacts to cultural resources and historic structures that have not yet been identified.

Stage 1 of the Requester's Preferred Alternative would have a direct effect on two historic structures recommended eligible for the National Register of Historic Places (NRHP); Home Sweet Home (32WD507) and the Minot Mill (32WD652). Stage 1.5 would require the replacement of the Soo Line-Canadian Pacific railroad bridge. The Soo Line-Canadian Pacific Railroad is potentially eligible for inclusion in the NRHP and proposed bridge replacement would need to follow the stipulations outline within the Programmatic Agreement.

The No-Action Alternative would not have a direct affect to historic and cultural resources. Six historic structures and two archaeological sites are located within one mile of the Requester's Preferred Alternative and would remain vulnerable to flood impacts.

Air Quality and Noise

The Requester's Preferred Alternative could temporarily affect air quality and noise in the project area by temporarily increasing daytime noise levels or air emissions from construction equipment and vehicles. Overall, the Requester's Preferred Alternative would have only minor adverse effects on air quality and noise in the project area.

The No-Action Alternative would not directly affect air quality or noise levels. Flooding could result in temporarily elevated noise levels and air emissions in localized areas where flood fighting and cleanup efforts occur.

Health and Safety

The Requester's Preferred Alternative would benefit human health in the long term. Many health hazards occur after floods and during clean-up activities, including compromising the structural integrity of roads, bridges, houses, and other structures in the damaged areas; dispersing sewage and pathogens into residential areas; and creating unhealthy conditions (like mold) in inundated structures. Reducing flood risk to the communities along the Souris River would reduce the potential for loss of life or injuries during flood events and would minimize the many health hazards that result from the flooding of developed areas.

With the No-Action Alternative the health and safety hazards associated with flood events would continue to occur during large flood events.

Cumulative Impacts

Impacts of the Requester's Preferred Alternative would contribute incrementally to the cumulative effects on various resources when added to the impacts of other past, present, and reasonably foreseeable future actions.

The primary cumulative effects resulting from the Requester's Preferred Alternative would include residence displacement and traffic modifications. The Requester's Preferred Alternative and other future flood risk reduction projects would add to the number of properties bought out or removed. Benefits would be provided by long-term protection to properties within flood-prone areas. Cumulatively, the Requester's Preferred Alternative and the other identified flood risk reduction projects provide the long-term beneficial effect of stabilizing property values and protecting against future flood damage.

The Requester's Preferred Alternative and others not related to flood control, such as infrastructure projects, would contribute to cumulative effects on traffic in the vicinity of the project. The long-term cumulative effect of these projects would, however, be beneficial, because these projects would improve traffic flow along those specific routes once construction is completed.

The Requester's Preferred Alternative and a wide variety of projects, primarily related to development and land conversion, contribute additional cumulative effects on wetlands and other natural resources. The contribution of the Requester's Preferred Alternative to cumulative effects on natural resources includes the realignment of the Souris River and the loss of up to 26 acres of wetland. Unavoidable impacts to these aquatic resource impacts would be mitigated as required.

The Requester's Preferred Alternative also contributes to cumulative effects to a lesser extent for air quality, health and safety, recreation, cultural resources, and contaminated sites.

Interim Impacts

The construction sequencing for the Requester's Preferred Alternative was chosen to remove large numbers of properties from the regulatory floodplain as soon as possible, while minimizing increases in flood risk to other properties in the floodplain. Interim increases in flood risk and intensity could occur, however, while the Requester's Preferred Alternative is partially constructed. Interim impacts for the Requester's Preferred Alternative were evaluated at four interim stages of project construction. Interim impacts were assessed using flows of 5,000 cfs, 10,000 cfs, and 27,400 cfs.

Interim impacts include increases in flood depth and changes in the locations of inundated properties. Interim changes in flood depth tend to occur in areas that are adjacent to newly constructed project segments – as available storage in the floodplain is removed, floodwaters are pushed into other areas. Inundation area reductions would generally occur where project features prevent inundation. Inundation area increases would generally occur upstream of or adjacent to constrictions created by the Requester's Preferred Alternative. The area of reduced inundation tends to be larger than that of increased inundation, especially for larger floods.

The Requester's Preferred Alternative would have little impact on the 5,000 cfs flood profile as waters would be contained within existing federal levees. Increases in inundation area and depth at 5,000 cfs would generally be at overbank excavation areas that make the channel slightly wider.

For the 10,000 cfs flood event, there would be a net increase in the total area inundated in Minot, as compared to the No-Action Alternative. This is in large part because much of the Requester's Preferred Alternative alignment is set further back from the banks of the river than that of the existing federal project. There is the potential for inundation depths to increase by greater than 0.1 feet for up to 100 structures during construction of the Requester's Preferred Alternative.

For the 27,400 cfs flood event, the total area flooded would tend to decrease with the implementation of each construction stage. The largest reduction in inundation area would come after Construction Stage 2 when the area north of the river would have a complete levee system. The most significant interim impacts would also come after Construction Stage 2, when higher flood elevations could be expected for areas south of the river and east of downtown Minot. After the completion of Stage 2, more than 700 structures would be expected to see an increase of greater than 0.5 feet. The majority of these increases in flood depths would no longer be realized after the completion of Stage 3. At the completion of all

construction stages, the Requester's Preferred Alternative would prevent more than 5,500 structures from being inundated at flows of 27,400 cfs.

Interim impacts to historic properties were also evaluated through Construction Stage 1.5. Flows of 10,000 cfs would increase flood depths by more than 0.5 feet after the construction of Stage 1.5 for portions of two historic districts; the northeast sector of the Minot Commercial Historic District and most of the Eastwood Park Historic District. Flows of 27,400 cfs would also increase the depth of inundation by more than 0.5 feet in the entire Minot Industrial Historic District and a small area in the northwest corner of the Minot Commercial Historic District with the construction of Stage 1.5.

1.0 Introduction

The U.S. Army Corps of Engineers (USACE) has prepared this programmatic Environmental Impact Statement (EIS) to analyze the effects of a flood risk-reduction project along the Souris River (referred to as the Mouse River in North Dakota) from Burlington, North Dakota through Minot, North Dakota. Locally this project has been referred to as the Mouse River Enhanced Flood Protection Project (Project). The Project requester is the Souris River Joint Water Resource Board (SRJB), which is comprised of representatives from Minot and the four counties that lie within the Souris Basin: Bottineau, McHenry, Renville, and Ward counties. The primary purpose of the SRJB is to address water management issues within the Basin.

The SRJB submitted a letter to the USACE initiating the process for obtaining approval under Section 14 of the Rivers and Harbors Act of 1899 (33 United States Code (USC) 408, hereinafter referred to as Section 408) to allow alterations to existing USACE projects in the Souris River Basin. USACE can issue Section 408 permission to alter a USACE project if it is determined that modifications are not injurious to the public interest and will not impair the usefulness of the project.

The proposed alterations and modifications would further reduce the risks of future flood events for communities along the river, including Minot. The SRJB and the USACE entered into a Memorandum of Agreement (MOA) for the Section 408 evaluation of the Project which established a framework for the acceptance and expenditure of funds provided by the SRJB to expedite the evaluation of the SRJB's request to make the proposed alterations to the USACE projects.

The requester's proposed Project would also involve placement of fill material in waters of the United States which is regulated by Section 404 of the Clean Water Act (33 Code of Federal Regulations (CFR) 323). A permit would be required from the USACE for any activities involving placement of fill in wetlands and waterbodies that are classified as waters of the U.S.

As part of the Section 408 and Section 404 processes, the USACE must comply with the National Environmental Policy Act of 1969, as amended (NEPA). This EIS was prepared in accordance with NEPA and the USACE regulations for implementing NEPA (Appendix B of 33 CFR 325 and Engineering Circular 1165-2-216). The St. Paul District of the USACE is the lead federal agency responsible for preparing the EIS with the Omaha District of the USACE providing regulatory and technical assistance.

This EIS evaluates general impacts associated with constructing and operating a flood risk-reduction project in the Souris River Basin that fulfill the Requester's purpose and need (Section 1.1). A more extensive impact assessment of the Requester's Preferred Alternative was conducted in areas where detailed design information is available. The purpose of the EIS is to identify the range of potential impacts that would result from the construction of the Project and ensure that this information is available to public officials and citizens prior to making decisions and taking action. Site-specific and resource-specific issues for subsequent phases of the Project will be reviewed and evaluated as detailed plans and official proposals are submitted for approval. Supplemental NEPA documents may be required as project plans evolve and appreciable changes to impacts are identified.

1.1 Purpose and Need for the Project

A record-breaking flood in 2011 caused extensive damage to homes, businesses, public facilities, and infrastructure along the entire length of the Souris River in North Dakota. As a result of this flood, the SRJB, in conjunction with the North Dakota State Water Commission (NDSWC), commissioned a study (Preliminary Engineering Report (PER)) to develop and evaluate alternatives to reduce the risk of damages from river flows comparable to those of the 2011 flood, including development of alignments for new levees, floodwalls, and other flood risk-reduction measures. The PER focused on the developed areas of the valley in an effort to provide homeowners with flood-damaged properties the information they needed to make personal decisions about rebuilding their flooded homes. The proposed Project represents the initial phases of a multi-phase process to implement the enhanced flood risk-reduction plan in the more highly populated portions (i.e., from Burlington through Minot) of the Souris River Valley.

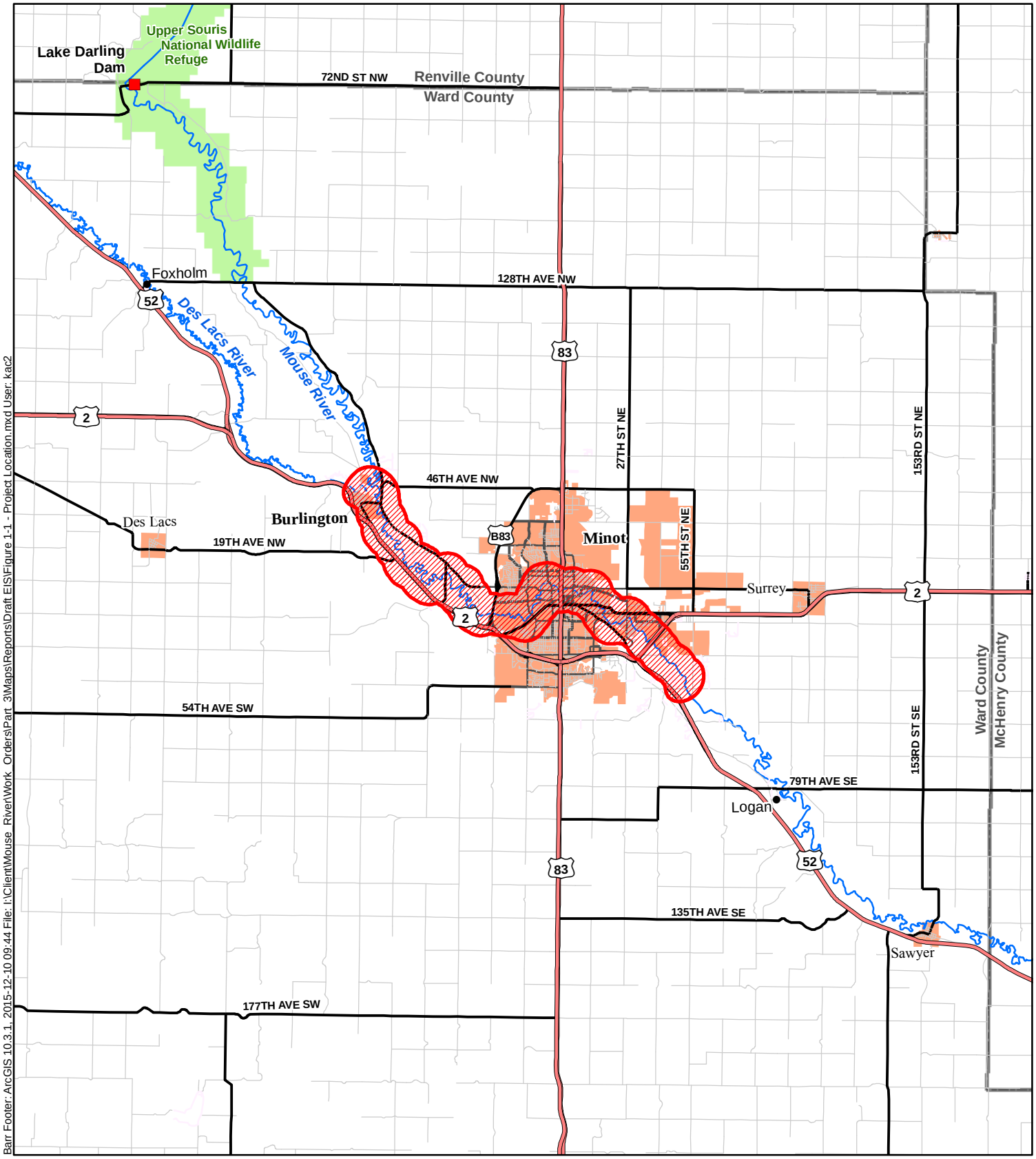
The purpose of the proposed Project is to meet the following goals established by the project requester:

- 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.
- Remove as many structures as possible from the Federal Emergency Management Agency (FEMA) preliminary regulatory floodplain (10,000 cfs flood) and provide a higher level of flood protection along the most densely populated reaches of the river through implementation of interim flood risk reduction measures (i.e., incremental project phases) that will be consistent and compatible with the proposed Project.
- Provide protection to FEMAs preliminary regulatory floodplain (10,000 cfs flood) or other measurable protection levels with each incremental project phase.
- Keep critical elements of the public transportation system operating during and after a flood event that approach the size of the 2011 flood.
- Design and construct a flood risk-reduction system for a 27,400 cfs design flood event that is consistent with current USACE standards and the Federal Emergency Management Agency (FEMA) requirements for accreditation.

The need for action arises from reoccurring flooding in the project area, beyond the limits of what can be contained by the existing Souris River Basin Project. Flooding has resulted in significant property damage, the displacement of thousands of residents, interference with transportation systems and emergency services, disruption to regional commerce, and resulted in total losses of more than $1 billion. Numerous residents along the river have expressed their interest in additional flood risk-reduction measures to protect them from floods of this magnitude and to avoid additional costs of flood insurance.

1.2 Project Location

The proposed Project is located along the Souris River in Ward County, North Dakota, from upstream of Burlington to downstream of Minot, as shown on Figure 1-1. The Souris River is known by two names. In Canada and by United States federal agencies such as the U.S. Geological Survey (USGS), USACE, U.S. Fish and Wildlife Service (USFWS), and FEMA it is referred to as the Souris River. The portion of the Souris River located in North Dakota is referred to by state agencies, and in state maps and documents, as the Mouse River. This document generally refers to the river as the Souris River.



Barr Footer: ArcGIS 10.3.1, 2015-12-10 09:44 File: I:\Client\Mouse River\Work Orders\Part 3\Maps\Reports\Draft EIS\Figure 1-1 - Project Location.mxd User: kac2

Project Area
National Wildlife Refuges
County Boundary
Municipalities

0 2 4 8
Miles

Figure 1-1

PROJECT LOCATION
Mouse River Enhanced Flood Protection Project

The Souris River has its headwaters in Saskatchewan, Canada. It flows southeasterly into North Dakota near Sherwood, continues southeast through the cities of Burlington, Minot, Sawyer, and Velva, then turns back north and re-enters Canada in the province of Manitoba. Eventually it flows into the Assiniboine River near Brandon—which joins the Red River of the North at Winnipeg. Within North Dakota, as shown in Figure 1-2, the Souris River first flows through Renville County, with the Lake Darling Dam and the Upper Souris National Wildlife Refuge as key features, then through Ward County where a major tributary, the Des Lacs River, joins it at Burlington. It continues on through the cities of Minot and Sawyer, then passes into McHenry County and through Velva. Flowing generally northward, it passes through Bottineau County and the J. Clark Salyer National Wildlife Refuge and flows back into Canada near Westhope.

The project area for the initial phases of the Project has been narrowed from the areas included in the initial study and planning (reference [1]). The project area includes a short reach of the Des Lacs River, from Park Road to the confluence with the Souris River, and the Souris River from the confluence to just south of the Thirty-Seventh Avenue SE bridge (downstream of Minot). This reach is mostly hydraulically independent from upstream and downstream river reaches and includes those Project components (e.g., levees, floodwalls, road raises/realignments, channel bypasses) that are anticipated to be constructed over the next 25 years or more.

1.3 History of Flooding

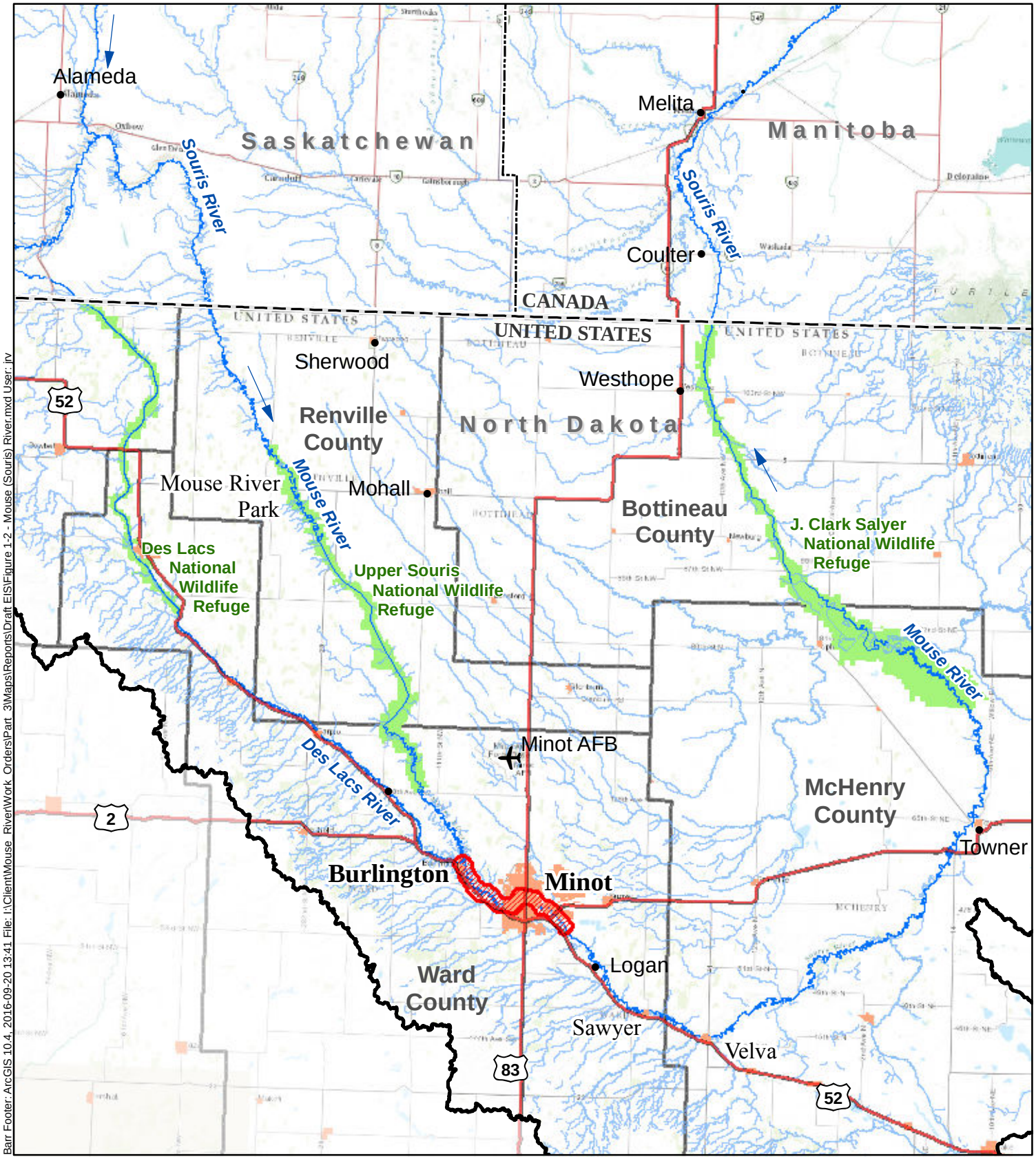
The Souris River has a history of flooding, including the record-breaking flood in June 2011. The current 100-year (1-percent annual chance) flood peak flow in Minot is 5,000 cfs, yet floods surpassing that flow have occurred six times since 1904 (Table 1-1). During the June 2011 flood event, runoff from heavy rains in the upstream portions of the watershed in Saskatchewan exceeded the storage capacity of upstream reservoirs, already full from attenuating the April snowmelt runoff and several spring rains. The inflow was essentially passed downstream, resulting in flood flows along the Souris River. A peak flow of 26,900 cfs was recorded at the USGS gage upstream of Minot and flows in Minot were estimated at 27,400 cfs.

Table 1-1 Floods Greater than 5,000 cubic feet per second (cfs), Souris River above Minot

USGS Gage 05117500 (data from USGS - 1903 to 2011)(1) (2)		
Year	Date	Peak Streamflow (cfs)
2011	June 25	26,900
1904	April 20	12,000
1976	April 17	9,350
1969	April 19	6,020
1979	May 09	5,960
1975	May 13	5,700

(1) Based on historic newspaper accounts, and as summarized in USGS reports, a flood in 1882 occurred in Minot that was about 3 feet higher than the 1904 flood and may have been comparable to the 2011 flood.

(2) Prior to 1934 the USGS gage data was taken at Minot. After 1934 the USGS gage data has been taken at the present gage location above Minot (USGS Gage 05117500).



Barr Footer: ArcGIS 10.4, 2016-09-20 13:41 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 1-2 - Mouse (Souris) River.mxd User: jrv

Project Area
Mouse/Souris River Watershed
Provincial/State Boundaries
National Wildlife Refuges
County Boundary
Flow Direction

0 6 12 24
Miles

Figure 1-2

MOUSE (SOURIS) RIVER
Mouse River Enhanced Flood Protection Project

The 2011 flood overwhelmed most levees and flood fighting efforts along the entire reach of the Souris River through North Dakota, causing extensive damage to homes, businesses, public facilities, infrastructure, and rural areas. The flood caused more than $690 million of damage to about 4,700 commercial, public, and residential structures in Ward and McHenry counties, and approximately 11,000 people were displaced from their homes.

1.4 Existing Flood Control Projects

To reduce the level of flood risk for developed areas along the Souris River, numerous federal flood control projects have been constructed in the Souris River Valley over the last 40 years. These projects generally consist of upstream flood storage reservoirs, levees, channel modifications, and pump stations.

The existing flood risk-reduction projects along the Souris River were developed by the USACE as the Souris River Basin Project. The Souris River Basin Project was developed over several years in three separate congressional actions and was implemented in three phases. The first phase was a channel modification project in Minot. The second phase was a levee project in Velva. The third phase involved multiple features, including flood storage in Alameda and Rafferty Dams in Saskatchewan; construction of a gated spillway and flood storage at Lake Darling Dam; levees at Sawyer, Renville County Park (Mouse River Park), and six housing subdivisions between Burlington and Minot; structural and nonstructural measures for rural residents along the Souris River; modification of USFWS structures in the Upper Souris and J. Clark Salyer National Wildlife Refuges; and development of a flood warning system.

Existing flood risk-reduction features in the reach of the Souris River from Burlington to the upstream side of Minot were federally designed and constructed by the USACE based on the project authorized by the 1986 Water Resources Development Act (Public Law [P.L.] 99-662) and Section 105 of the fiscal year 1988 Continuing Appropriations Act (P.L. 100-202). These existing features are located in Burlington (Johnson's Addition) as well as in several downstream communities, including, Brooks' Addition, Talbott's, Country Club Acres, Robinwood Estates, Kings Court, Rostad's Addition, and Tierrecita Vallejo. The project features in Burlington are operated and maintained by Burlington; the remaining project features are operated and maintained by the SRJB.

The existing flood risk-reduction features within Minot were federally designed and constructed by the USACE based on the project authorized by Section 201 of the Flood Control Act of 1965 (P.L. 89-298) and modified based on recommendations by the USACE Chief of Engineers in House Document 286, 87th Congress, 2nd Session, and House Document 321, 91st Congress, 2nd Session. The project is operated and maintained by Minot as the local sponsor. The project features consist primarily of channel modifications, channel cutoffs, and levees, and are part of an authorized federal project that extends from Burlington to Logan, which includes flood control storage behind the Burlington Dam. Channel modifications were designed to accommodate flows up to 5,000 cfs. In addition, several stretches of levee were also constructed. These levees, along with emergency flood fighting, can typically provide flood risk reduction to 10,000 cfs.

There are eight federal levee systems along the Souris River in the river reach extending from Burlington through Minot (Map 2-3). These levee systems are listed below.

- Johnson Addition (Burlington)
- Brooks' Addition
- Robinwood Estates/Country Club Acres
- Talbott's Nursery
- Kings Court
- Rostad's Addition (Del Nor Drive)
- Tierrecita Vallejo
- Minot Left Bank
- Minot Right Bank

For the Ward County levee systems upstream of Minot, the SRJB is the project sponsor. Operations and maintenance responsibilities have been subrogated to the Ward County Water Resource District (WCWRD). For the Minot levee systems, the WCWRD is the sponsor and operations and maintenance responsibilities have been subrogated to Minot.

In November 2013, the USACE notified the project sponsors that, based on its periodic and routine inspections, they would give the Minot and Ward County federal levee systems an "unacceptable" rating because the condition of the levee systems did not meet current USACE levee safety standards. Unacceptable deficiencies identified during the inspections included: unwanted vegetation growth; encroachments (e.g., shed, fence, garage addition, irrigation system, etc.); sod cover loss; slope stability problems; erosion/bank caving; cracking; obstruction of culvert inlets/outlets; erosion areas; and revetments other than riprap (Reference [2]). Federal levee systems operated and maintained by a non-federal sponsor, including the Ward County and Minot systems, are required to maintain "acceptable" or "minimally acceptable" ratings to remain eligible for rehabilitation assistance under Public Law (PL) 84-99. As part of PL 84-99, Flood Control and Coastal Emergencies, an "unacceptable" inspection rating is grounds for the USACE to assign the levee systems an "inactive" status, making the levee sponsor ineligible for federal rehabilitation assistance following a flood or natural disaster.

The USACE developed the System Wide Improvement Framework (SWIF) process to allow non-federal sponsors to remain temporarily eligible for PL 84-99 while a plan for addressing deficiencies is developed. A SWIF provides an opportunity to transition levee systems to USACE standards over time. By implementing a SWIF, sponsors are allowed to prioritize deficiencies and reduce system-wide risk.

In order to prevent a lapse in rehabilitation assistance under PL 84-99, the sponsors submitted requests to the USACE in March 2014 for a conditional extension to afford time to develop and implement a SWIF. Two separate SWIF requests were submitted in the form of SWIF Letters of Intent (LOI), in which the project sponsors outlined actions taken to date, along with planned future actions, to implement the system-wide levee improvements. The requests were accepted by the USACE on July 31, 2014.

A combined SWIF is being developed for the eight federal levee systems between Burlington and Minot. The primary component of the SWIF is a plan for addressing the deficiencies identified in the USACE inspections. The plan will include a risk-based prioritization list of deficiencies, schedule and funding commitments, interim risk-reduction measures, and interim maintenance standards. These deficiencies will be addressed during construction of the project.

1.5 Permits, Approvals, and Regulatory Requirements

The proposed Project requires approvals and permits from the USACE. 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 must be approved by the Chief of Engineers include degradations, raisings, and realignments of levee systems. The potential impacts of these changes, including system impacts, must be evaluated in accordance with USACE regulations and policy. Section 408 permission to alter a USACE project can only be granted if it is determined that modifications are not injurious to the public interest and will not impair the usefulness of the project.

Construction of the proposed Project would require the filling or excavating of wetlands and work within the Souris River. The USACE has the authority to permit the placement of fill in waters of the United States under Section 404 of the Clean Water Act (CWA; 33 USC 1344). As part of this permitting process, aquatic resource impacts must be avoided or minimized to the extent practicable, and compensatory mitigation must be provided for any unavoidable impacts. The Section 404 permit and the Section 408 permission constitute federal actions and must therefore comply with the regulatory requirements of NEPA. This EIS is meant to fulfill the NEPA requirements for both the Section 404 permitting and Section 408 permissions.

The Project could potentially effect the federally-listed Dakota skipper. However, options to avoid impacts to the Dakota skipper are currently being evaluated. If impacts cannot be avoided, Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) will be required in accordance with the Endangered Species Act of 1973.

In compliance with the Fish and Wildlife Coordination Act (16 USC 661-667e), there has been correspondence with USFWS and other federal and state agencies with natural resource interests to evaluate impacts to fish and wildlife.

Section 106 of the National Historic Preservation Act requires that federal agencies take into account the effects of their undertakings or permitting on historic properties. Because of the size of this project, a Programmatic Agreement (per 36 CFR 800.14(b)) is being developed between the USACE and the North Dakota State Historic Preservation Office (ND SHPO) to cover effects that cannot be fully determined in advance of the undertaking and non-Federal parties being delegated major responsibilities.

FEMA is responsible for reviewing potential Project impacts in the regulatory floodplain, which is defined as the flood elevation corresponding to the one-percent annual chance flood. The proposed Project features are intended to remove areas from the regulatory floodplain and thereby eliminate flood

insurance requirements for properties in those areas. The regulatory floodplain is defined on Flood Insurance Rate Maps (FIRMs). Projects that make physical changes within the regulatory floodplain that affect the hydraulic or hydrologic characteristics of a flooding source, including changes to the Base Flood Elevations (BFE), Special Flood Hazard Areas (SFHA), or the regulatory floodway, require review and approval by FEMA.

A Conditional Letter of Map Revision (CLOMR) is FEMA's comment on a proposed project that would, upon construction, affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective BFEs, or the SFHA. The CLOMR indicates whether the project, if built as proposed, would be recognized by FEMA. The CLOMR process reviews the technical engineering data to determine that approved engineering methods, required by 44 CFR Section 65.10, were applied and that the project is in compliance with the local government ordinance and FEMA standards.

Once a project has been completed, the community must request a revision to the FIRM to reflect the project. FEMA uses a Letter of Map Revision (LOMR) to modify published FIRMs. "As-built" certification and other data must be submitted to support the revision request. The LOMR revises the FIRM, may revise the Flood Insurance Study report, and when appropriate, includes a description of the modifications. The LOMR process assures that the as-constructed project also meets the requirements of 44 CFR Section 65.10 and that the project is in compliance with local government ordinances and FEMA's standards. This includes FEMA levee system accreditation, which allows the levee system to be shown on a FIRM as reducing risk from the one-percent annual chance flood, or one hundred year event. The LOMR and CLOMR processes are initiated through an application to FEMA from the local sponsor for the Project.

In addition to the federal permits and approvals discussed above, SRJB would be required to obtain other permits and approvals from state and local agencies. Table 1-2 lists the major federal, state, and local permits, approvals, and consultations for the Project.

Table 1-2 Local, State, and Federal Permits, Approvals and Reviews Needed for the Project

Agency	Permit/Requirement	Rationale
Federal Permits/Approvals/Reviews		
U.S. Army Corps of Engineers	National Environmental Policy Act Compliance	For projects in which there is a federal action. Federal actions for this project include Section 404 permits and Section 408 permissions.
U.S. Army Corps of Engineers	Section 404 Permit	For placement of dredged or fill material in jurisdictional wetlands or other waters
U.S. Army Corps of Engineers	Section 408 Permission	For modifications to existing USACE projects
U.S. Fish and Wildlife Service	Section 7 Consultation	For compliance with the Endangered Species Act where there are effects to federally listed species
U.S. Fish and Wildlife Service	Fish and Wildlife Coordination Act Compliance	For protection and conservation of fish and wildlife resources
Federal Emergency Management Agency	Conditional Letter of Map Revision	For projects that affect the regulatory floodway
State Permits/Approvals/Reviews		
State Historical Society of North Dakota	Section 106 Concurrence	For compliance with the National Historic Preservation Act
North Dakota State Water Commission	Sovereign Lands Permit	For placement of fill below the ordinary high water mark of traditionally navigable waters
North Dakota Game & Fish Department	Fish and Wildlife Coordination Act Compliance	For protection and conservation of fish and wildlife resources
North Dakota State Water Commission	Construction Permit	For construction of levees or other water resource facilities with a diverting capacity greater than 50 acre-feet of water
North Dakota Department of Health	Section 401 Water Quality Certification	For compliance with state water quality standards
North Dakota Department of Health	Construction General Permit NDPDES	For projects that disturb more than one acre of land
North Dakota Department of Health	Asbestos Notification of Demolition and Renovation	For demolition or renovation of existing facilities
North Dakota Department of Transportation	Driveway Permit, project review and approval	For new or modified driveway access to state highways; for activities that affect state roads or bridges

Agency	Permit/Requirement	Rationale
Local Permits/Approvals		
City of Minot – Engineering Department	Non-building Floodplain Development Permit	For construction within the regulatory floodplain
City of Minot – Engineering Department	Project approval	For project activities that affect city streets, traffic signals, and utilities
City of Minot – Planning and Zoning Department	Project approval	For project activities that affect city park and recreational facilities
Minot Park District	Project approval	For project activities that affect city park and recreational facilities
Canadian Pacific Railway	Permission to work in railroad rights-of-way	For project activities that take place in railroad rights-of-way

1.6 Agency and Public Scoping

As part of the environmental review process, the USACE initiated scoping of the Project to obtain comments from regulatory agencies and the public. On October 1, 2014, January 29, 2015, and May 27, 2015 USACE conducted consultation meetings with local, state, and federal agencies to provide an overview of the proposed actions, gather feedback, and gage the severity of potential impacts. For a similar purpose, public meetings were held in Burlington on April 8, 2015, and in Minot on April 9, 2015. Based on the discussions and comments received at these meetings it was determined that significant impacts to the human environment would result from the Project and that an EIS would be required to fulfill the requirements of the NEPA. The USACE published a Notice of Intent (NOI) to prepare a programmatic EIS for the proposed Project from Burlington through Minot in the Federal Register (Vol. 80, 137) on July 17, 2015.

After publishing the NOI, the USACE held an additional public scoping meeting in Minot on August 19, 2015. In addition, the SRJB has also hosted a number of neighborhood meetings. They included meetings on November 9, 2015, and June 30, 2015 to update residents on the project status and the design of the flood risk-reduction features in the vicinity of Fourth Avenue NE, and for the Napa Valley and Forest Road portions of the project, respectively. The SRJB has also held other public meetings and solicited comments and questions dating back to 2011.

A Scoping Document was prepared to summarize information gathered during project scoping so that it could be used to inform the planning and evaluation of the Project as it moves forward. A secondary purpose of the document was to inform interested parties of the issues that were raised through scoping and to identify how those issues could be addressed. A copy of the Scoping Document is included in Appendix A.

Numerous written and verbal comments were submitted in response to the proposed Project. Comments were categorized into seven areas along with generalized questions and responses in the Scoping

Document. Issues identified during scoping were taken into consideration and discussed as part of the preparation of this EIS.

2.0 Alternatives

Actions and features that could be used to reduce the risk of flooding were identified in the planning of the Project. Actions and features that could meet the requester's purpose and need were then combined to form various alternatives. Ultimately the general concept of the Requester's Preferred Alternative was determined to be the only alternative that could meet the purpose and need of the Requester. Therefore, the Requester's Preferred Alternative and the No-Action Alternative were explored more comprehensively than other alternative actions in this document.

2.1 Requester's Preferred Alternative

The Requester's Preferred Alternative would consist of new levees, floodwalls, high-flow bypasses, channel re-alignments, river closure structures, transportation closure structures, interior pump stations, overbank excavation, new bridges, and bridge modifications (Map 2-1). In the project area, it is estimated that 18.9 miles of new levees and 2.7 miles of new floodwalls would be constructed along the river corridor. Twenty-one transportation closure structures (14 roadway and 7 railroad) would be installed to allow traffic to regularly pass through the line of protection during non-flood periods. The Requester's Preferred Alternative would require an additional 26 stormwater pump stations (16 new and 10 replacement stations) and associated ponding areas to manage the surface water runoff from the interior drainage systems.

Construction of the Requester's Preferred Alternative would include the acquisition and removal of approximately 500 homes and businesses in locations within the area flooded in 2011. To date, approximately 110 of these homes and businesses have been purchased (and many removed) using federal, state, and local funds.

In addition, six bridges would be reconstructed or modified to meet the design flow criteria and keep critical bridges open during flood events. A total of about 121 acres of overbank excavation would be included under these bridges as well as in other select areas to increase hydraulic capacity within the floodplain of the river. Other ancillary activities to facilitate implementation of the Requester's Preferred Alternative would include re-aligning utilities (e.g., sanitary sewers, storm sewers, and watermains) and re-aligning and raising road segments. The bridge projects and associated road raises are being evaluated as part of this EIS but would be designed and built by the jurisdictional authority identified in Table 2-1.

Table 2-1 Bridges to be Reconstructed or Modified

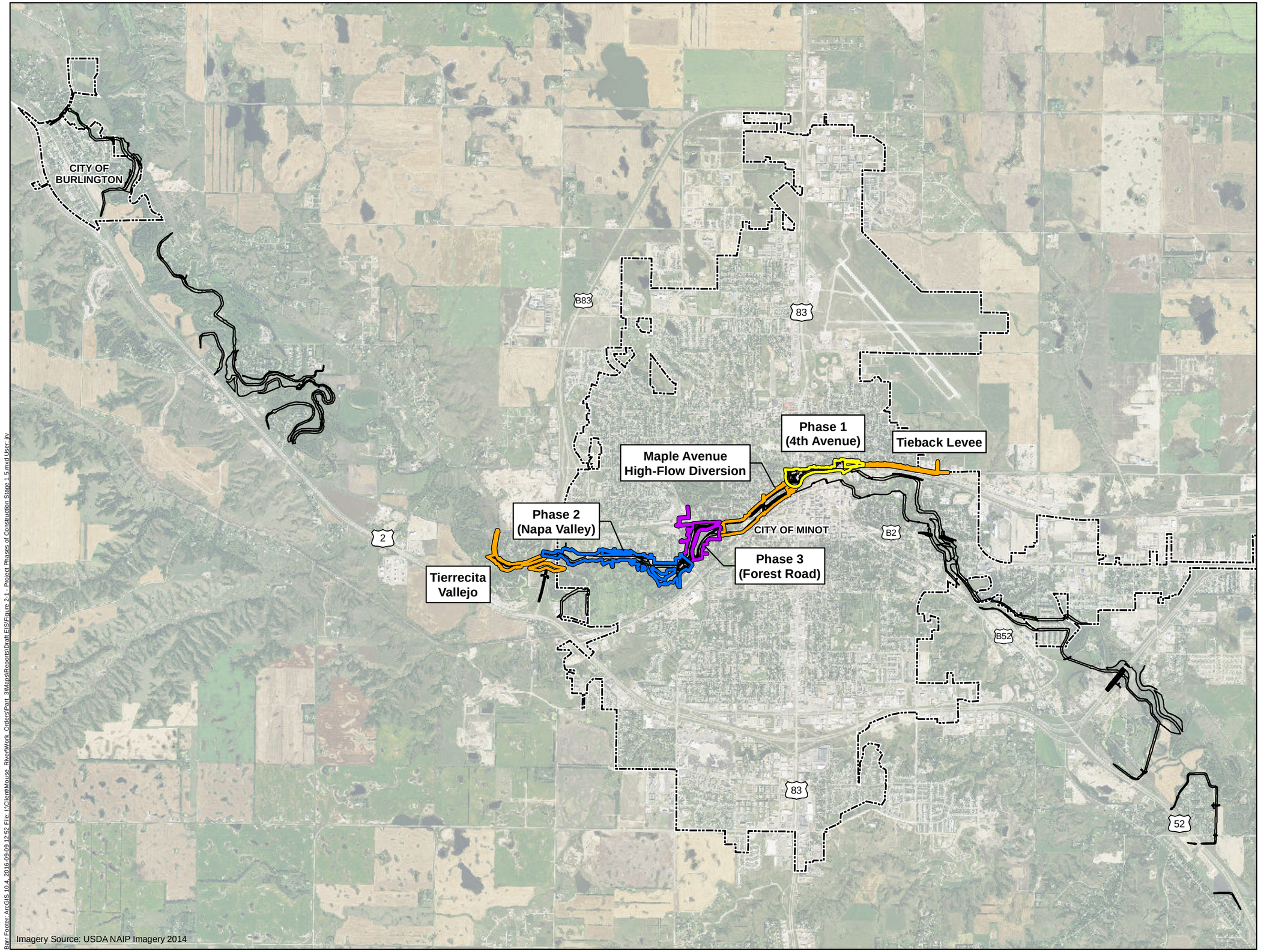
Bridge Name	Jurisdictional Authority
Colton Avenue Bridge (CR 10)	Ward County
U.S. Highway 83 Bypass Bridge	NDDOT
Canadian Pacific Railroad Bridge	Canadian Pacific Railroad
Burdick Expressway (U.S. 2 Bypass)	NDDOT
Twenty-Seventh Street Bridge	City of Minot
U.S. 2 Highway Bridge	NDDOT

Source: Reference [3]

The new flood risk-reduction features would accommodate flows up to 27,400 cfs (the estimated flow in Minot during the 2011 flood). The average height of flood protection in the Requester's Preferred Alternative would range from 9 to 14 feet along various stretches, with a maximum height of 27 feet at the community of Tierrecita Vallejo (reference [1]).

The opinion of probable cost (OPC) range for the Requester's Preferred Alternative is $589 million to $1,031 million based on feasibility-level design alternatives, alignments, quantities, and unit prices. The OPC point estimate within the estimated accuracy range is $763 million, based on the current level of project definition. This cost estimate does not consider the likelihood of cost escalation over the period of implementation and will change with further design.

The Requester's Preferred Alternative would be constructed over a period of more than 25 years depending on availability of SRJB's funding. Implementation of the Requester's Preferred Alternative would involve constructing over 20 segments in various communities and neighborhoods from Burlington through Minot. The initial construction of the Requester's Preferred Alternative would consist 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 early 2017 with construction beginning later in the year. 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 comprise Construction Stage 1.5. Construction Stage 1.5 provides 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 Section 4.13.1. The locations of all phases included in Construction Stage 1.5 are shown on Figure 2-1. Phasing for construction of the other segments of the Requester's Preferred Alternative would be determined based on funding and a prioritization of critical needs for flood risk reduction in each reach of the river.



Phase 1 (4th Avenue)
Phase 2 (Napa Valley)
Phase 3 (Forest Road)
Other Phases
Project Footprint
Municipalities

0 2,000 4,000 8,000
Feet

Figure 2-1

PROJECT PHASES OF CONSTRUCTION STAGE 1.5
Mouse River Enhanced Flood Protection Project

Barr Foster: ArcGIS 10.4, 2016-09-09 12:52 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-1 - Project Phases of Construction Stage 1.5.mxd User: jrv

There are also three other proposed projects related to Stage 1.5 that the USACE has determined to have independent utility (i.e., can be constructed and can function independently absent of the Requester's Preferred Alternative)(letter dated December 3, 2015 from Michael Bart of the USACE to Dave Ashley and Chuck Barney of the SRJB). Since they were determined to function independently, each may be pursued independently. These projects include:

1. Constructing the Centennial Forest Stormwater Pond and maintaining the Perkett Ditch.
2. Relocating the utilities extending from the Minot Water Treatment Plant to the other side of the Souris River.
3. Redirecting runoff from the Upper Tierrecita Vallejo Watershed directly to the Souris River.

The design of these projects would be compatible with future construction activities and would improve surface water management in select areas. Environmental analyses of these projects are also included in this EIS to evaluate cumulative effects.

The sections below describe the major components of the Requester's Preferred Alternative from upstream end of the project to downstream of Minot. The general layout of project features are displayed in Map 2-1.

2.1.1 Burlington

Burlington is the most upstream community in the project area, located at the confluence of the Mouse and Des Lacs Rivers. The major flood risk-reduction components in this community for the Requester's Preferred Alternative would consist of building about 1.7 miles of new levees and floodwalls, replacing the Colton Avenue bridge, and moving Old Settler's Park Road.

The new levee would start on the northwestern end of the alignment at the existing Canadian Pacific Railway embankment near Old Settler's Park Road. To minimize impacts to the community and avoid the Del Lacs River, the levee would transition to a floodwall and extend along the current location of Old Settler's Park Road. Old Settler's Park Road would be shifted south, away from the floodwall, to maintain clear zone requirements. The floodwall alignment then shifts to the north to avoid impacts to the Peace Lutheran Church cemetery. A closure structure is planned where the alignment crosses Old Settler's Park Road. The levee would continue around Burlington and tie into the railroad embankment.

The Colton Avenue bridge in Burlington would be modified to meet the design flow hydraulic criteria and keep the bridge open during flood events. The existing two-lane, 122-foot-long bridge would be removed and replaced with a 225-foot-long bridge of similar width, located along the same alignment. The bridge would be raised approximately 9 feet, which would require raising the roadway approaches. Overbank excavation, under and immediately adjacent to the new bridge, would provide additional flow conveyance under the bridge.

2.1.2 Vardon Golf Course and Surrounding Developments

New flood risk-reduction features at the Vardon Golf Course and the surrounding communities of Brooks Addition, Country Club Acres, Robinwood, and Talbott's, would consist of approximately 2.6 miles of new levees, two interior pump stations, pond storage, and rerouting of an existing ditch system east of the Dakota Boys and Girls Ranch.

The levee on the northern side of the river would begin in Brooks Addition near the intersection of County Highway 15 and Seventy-Fifth Street NW. The levee alignment extends downstream towards the Vardon Golf Course between Seventy-Fifth Street NW and the Souris River. The levee alignment at the Country Club was established to minimize possible impacts to the functionality of the golf course. It is anticipated that the existing golf course clubhouse would be relocated by the owner. South of the Country Club, the levee would follow the existing levee alignment through the community of Robinwood. At the southernmost end of Robinwood, the levee alignment has been offset north of the existing levee to achieve the required hydraulic capacity. The levee would then extend northeast and ultimately tie into higher ground on the east side of Robinwood near the Dakota Boys and Girls Ranch.

The existing ditch, extending from County Road 15 along Nineteenth Avenue NW and behind homes fronting Sixty-Fourth Street NW, would be realigned to the east of the Dakota Boys and Girls Ranch. Realignment is required to avoid significant pumping requirements and internal drainage issues associated with existing runoff from this ditch. A levee would be located along the Souris River to reduce the flooding risk to the Talbott's community. Upgrades in this area would consist of raising the existing levee system. Both ends of the alignment would tie into existing high ground on the western side of the community, near U.S. Highway 2. An interior pump station and pond storage area would be constructed within the community.

2.1.3 Kings Court

The Kings Court community is almost entirely surrounded by the Souris River. The Kings Court neighborhood did not flood in 2011 as a result of successful flood fighting efforts. However, features that would be constructed as part of the Requester's Preferred Alternative downstream of Kings Court would result in a stage increase likely to overwhelm efforts in a similar flood. The Requester's Preferred Alternative in this community would consist of about 0.9 mile of new levees, construction of gatewells at existing channel crossings, and the realignment of 1.3 miles of existing river channel.

The new levee would begin on the western side of Kings Court. The alignment then proceeds easterly and crosses the existing Souris River channel. The levee would wrap around Kings Court, again crossing the existing river channel, before connecting to high ground east of U.S. Highway 2. Control structures, such as gatewells, would be constructed to allow river flow and circulation through the original channel alignment. Gatewells would be closed during significant flood events to direct flow through the channel realignment.

The 1.3-mile-long channel realignment would be constructed outside of the Kings Court community and would be similar in overall length to the existing river channel. The constructed channel would begin

approximately 1,500 feet upstream of the levee/river crossing. The alignment follows an existing oxbow and meanders before reconnecting to the river downstream.

2.1.4 Tierrecita Vallejo

The Tierrecita Vallejo community is west of Minot on the northern side of the Souris River near U.S. Highway 83. The new flood risk-reduction features in this community would consist of about 0.7 mile of levee, a railroad closure structure with a small length of floodwall, an internal pump station, new ponding areas, and overbank excavation. It is anticipated that this segment would be constructed as part of Construction Stage 1.5 of the Requester's Preferred Alternative.

The levee would begin at the hillside north of the existing Canadian Pacific Railway, extending south towards the western side of the community. A closure structure with floodwall transition sections would be constructed at the railroad's intersection with the flood protection alignment. The closure structure would allow for normal railroad operation and protection of the community during flood events. The levee would extend southward from the railroad, on the western side of the community, before turning and extending to the east and connecting to high ground near the U.S. Highway 83 Bypass. Figure 2-2 shows a conceptual layout of this segment.

2.1.5 Minot

The Minot reach of the Requester's Preferred Alternative is bounded by the U.S. Highway 83 Bypass to the west and U.S. Highway 2 to the east. The Souris River bisects this community, meandering through the heart of the city. Due to the complexity of the flood risk-reduction system within the city, the Requester's Preferred Alternative has been divided into 12 segments in Minot, starting with the Napa Valley segment near the U.S. Highway 83 Bypass and ending at the Keller segment near U.S. Highway 2. The flood risk-reduction measures to be constructed in each segment of Minot are discussed in later sections.

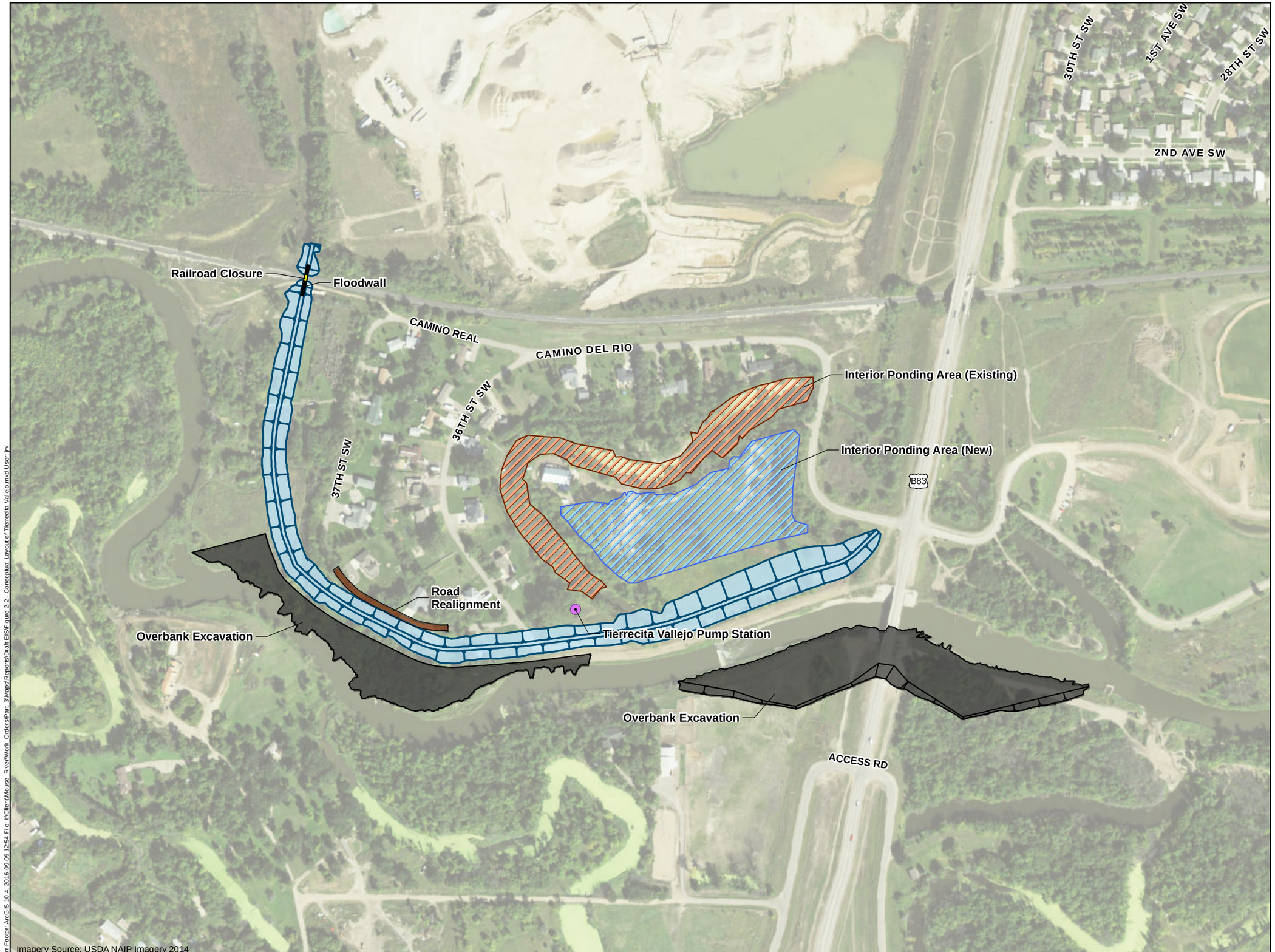
The major components of the Requester's Preferred Alternative in Minot would include the following:

- Approximately 9.2 miles of new levee
- Approximately 2.1 miles of new floodwalls
- Two high-flow diversion channels
- Twelve road closures and four railroad closures
- Five existing bridges would be reconstructed or modified
- Fifteen new or replaced pump stations and associated ponding areas
- Approximately 29 acres of overbank excavation

2.1.5.1 Napa Valley

In the Napa Valley segment, the primary flood risk-reduction measure would be a new levee, constructed from U.S. Highway 83 Bypass, across the Souris Valley Golf Course and the Wee Links Golf Course to

Sixteenth Street SW. As mentioned in Section 2.1, a stormwater pond would be constructed in the Centennial Forest to store and treat runoff before discharging to the Perkett Ditch and pump station.



Levee Footprint
Floodwall Alignment
Transportation Closure
Road Modifications
Overbank Excavation
Interior Ponding Areas (New)
Interior Ponding Areas (Existing)
Existing Pump Station (Replacement)

0 175 350 700
Feet

Figure 2-2

CONCEPTUAL LAYOUT OF TIERRECITA VALLEJO
Mouse River Enhanced Flood Protection Project

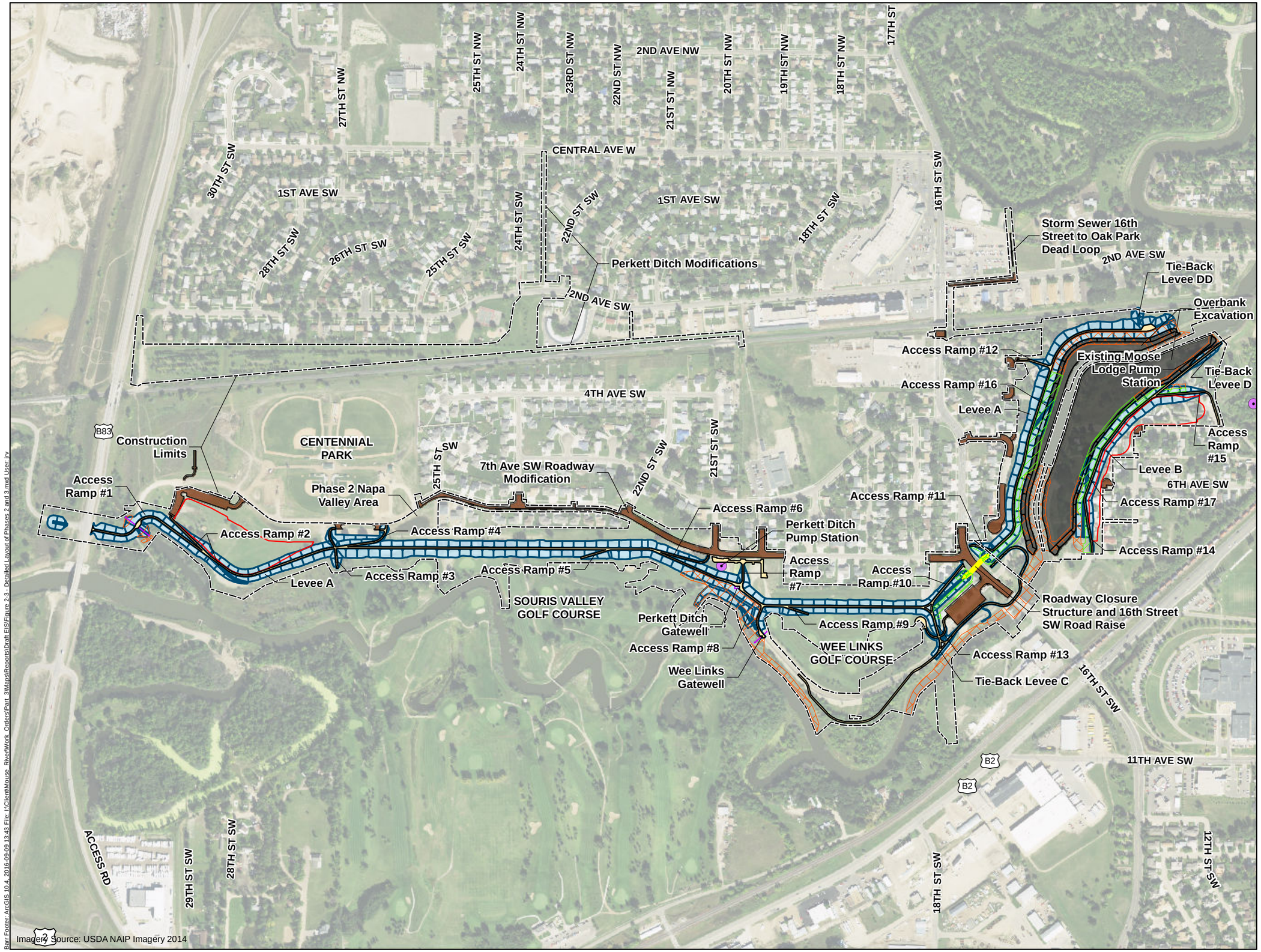
Barr Footer: ArcGIS 10.4, 2016-09-09 12:54 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-2_Conceptual Layout of Tierrecita Vallejo.mxd User: FV

The Napa Valley segment would be constructed during Phase 2 of the Requester's Preferred Alternative and has therefore been advanced for design and permitting. The detailed layout of this segment is shown on Figure 2-3. The Basis of Design Report (reference [4]) provides detailed information related to the design of the flood risk-reduction features in this segment. The report provides supporting design information and engineering analysis and methods for the major design features in this segment, including:

- New levee alignment—north of the Souris River extending (upstream to downstream) from U.S. Highway 83 Bypass to Sixteenth Street SW.
- Gatewell control structure near U.S. Highway 83 Bypass.
- Levee ramps for access, maintenance, and inspections at locations identified in the construction drawings.
- Perkett Ditch Pump Station and gatewell control structure.
- Stop log road closure, with floodwall sections on the upstream and downstream ends, at Sixteenth Street SW.
- Northwest Area Water Supply (NAWS) transmission line and watermain upgrades for crossings within the USACE right-of-way near Sixteenth Street SW.
- Bank erosion protection for the Souris River channel and flood risk-reduction features at various locations.
- Watermain, 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, watermain, storm sewer, and street reconstruction.
- Wee Links and Souris Valley Golf Course modifications and improvements including tee, fairway, and green reconstruction.
- Wee Links Golf Course Pump Station
- Gatewell control structure within the existing levee on the west side of the Wee Links Golf Course to convey runoff to the Souris River from the golf course.
- Tie-back levee to provide the Wee Links Golf Course with the existing level of flood risk reduction.
- City greenway implementation including features such as bike/hike trail system and open space (e.g., parks, natural areas).
- Corrective measures for work items identified during the USACE's 2014 routine inspection.

2.1.5.2 Leites Brekke

At the Leites Brekke segment, a levee would be constructed on three sides of the housing development and connected to an access road and higher ground on the southern edge of the development. A new internal pump station and ponding areas would be constructed in this segment.



0 300 600 1,200
Feet

Figure 2-3

DETAILED LAYOUT OF PHASES 2 AND 3
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 13:43 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-3 - Detailed Layout of Phases 2 and 3.mxd User: trv

2.1.5.3 Forest Road

With the Requester's Preferred Alternative, levees would be constructed on both sides of the river, and the areas between the levees and the river channel would be excavated in the Forest Road segment. On the northern side of the river the levee alignment extends from Sixteenth Street SW to the Canadian Pacific Railroad tracks. On the southern side the levee alignment extends from a floodwall on the wastewater treatment facility property to north of Fifth Avenue SW.

The Forest Road segment would be constructed during Phase 3 of the Requester's Preferred Alternative and has therefore been advanced for design and permitting. The detailed layout of this segment is shown on Figure 2-3 along with the Napa Valley segment. The Basis of Design Report (reference [4]) provides detailed information related to the design of the flood risk-reduction features in this segment. The report provides supporting design information and engineering analysis and methods for major design features in this segment, including:

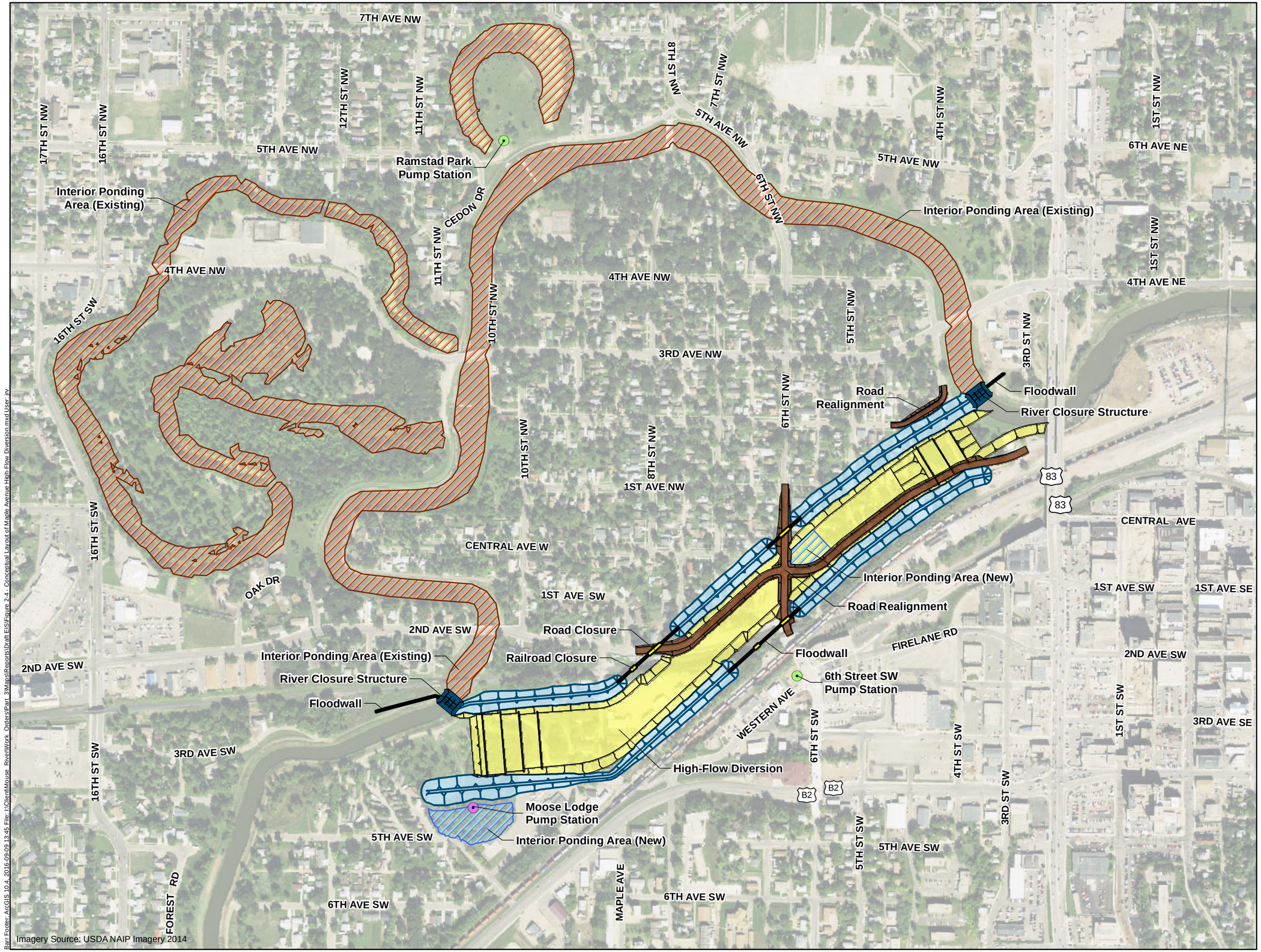
- A new levee north of the Souris River extending (upstream to downstream) from approximately Sixteenth Street SW to the Canadian Pacific Railroad and south of the Souris River extending (upstream to downstream) from the water treatment plant (WTP) to the future Maple Avenue Diversion.
- Levee ramps for access, maintenance, and inspections at locations identified in the construction drawings.
- Northwest Area Water Supply (NAWS) transmission line and watermain upgrades for crossing within the USACE right-of-way near Sixteenth Street SW.
- Overbank excavation adjacent to the Souris River channel from the Sixteenth Street SW Bridge to the future Maple Avenue Diversion.
- Tie-back levee connecting the proposed and existing levees to maintain the level of risk management on the south side of the river.
- Tie-back levee connecting the proposed levee to the existing railroad embankment to maintain the level of risk management on the north side of the river.
- Bank erosion protection for the Souris River channel and flood risk-reduction features at various locations.
- Watermain, 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, watermain, storm sewer, and street reconstruction.
- City greenway implementation including features such as bike/hike trail system and open space (e.g., parks, natural areas).

- Corrective measures for work items identified during the USACE's 2014 routine inspection.

2.1.5.4 Maple Avenue High-Flow Diversion

A high-flow bypass, referred to as the Maple Avenue High-Flow Diversion, would be constructed between Fifth Avenue SW and Broadway Avenue with the Requester's Preferred Alternative. The Maple Avenue High-Flow Diversion would cross under the Canadian Pacific Railway and run parallel to the Burlington Northern Santa Fe Railway. A levee would be located on both sides of the channel, aligned to minimize impacts to existing residences. An inlet weir would be installed at the beginning of the Maple bypass. This weir structure would allow flows up to 3,000 cfs (an approximately 15-year flood) to continue down the existing river channel. Flows over 3,000 cfs would discharge into and flow through the bypass channel. An outlet weir would be installed at the end of the bypass to restrict backwater flow into the diversion channel. River control structures would be installed in the existing river channel upstream of each of these weirs to prevent floodwaters from entering the bypassed segment of the river during high-flow events. It is anticipated that this diversion would be constructed during Construction Stage 1.5 of the Requester's Preferred Alternative.

The bypass channel alignment crosses several roads and the Canadian Pacific Railway. The railway would cross over the diversion channel on a new bridge designed to accommodate design flows. Two roads, Second Avenue SW and Sixth Street NW, would be reconstructed inside the bypass channel using no bridges. Road closures would be installed at each of these road crossings. Other roads along the channel alignment (e.g., Fifth Street SW, Seventh Street SW, Central Avenue W, and First Avenue W) would be terminated at the bypass levee. Figure 2-4 shows a conceptual layout of the Maple Avenue High-Flow Diversion.



Barr Footer: ArcGIS 10.4, 2016-09-09 13:45 File: I:\Client\Mouse_RiverWork_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-4_Conceptual Layout of Maple Avenue High-Flow Diversion.mxd User: jlv

- Levee Footprint
- Floodwall Alignment
- Transportation Closure
- High Flow Diversion
- River Closure Structure
- Road Modifications
- Interior Ponding Areas (New)
- Interior Ponding Areas (Existing)
- Existing Pump Station (Replacement)
- Approximate Pump Station (Existing)

0 250 500 1,000
Feet

Figure 2-4

CONCEPTUAL LAYOUT OF MAPLE AVENUE HIGH-FLOW DIVERSION
Mouse River Enhanced Flood Protection Project

2.1.5.5 Fourth Avenue NE

A floodwall and levee would be constructed along Fourth Avenue NE on the northern side of the river from Broadway Avenue to Third Street NE as part of the Requester's Preferred Alternative. Road closures would be needed for the floodwall crossings of Fourth Avenue NE. A floodwall was selected in this area to minimize impacts to Fourth Avenue NE and adjacent homes.

The Fourth Avenue NE segment would be the first segment (Phase 1) to be constructed and has therefore been advanced for design and permitting. The detailed layout of this segment is shown on Figure 2-5. The Basis of Design Report (reference [5]) provides detailed information related to the design of the flood risk-reduction features in this segment. The report provides supporting design information and engineering analysis and methods for major design features in this segment, including:

- New flood protection alignment—north of the Souris River extending (upstream to downstream) along the Souris River from the 3rd Avenue bridge west of Broadway to east of 3rd Street NE.
- Broadway Pump Station and discharge chamber control structures.
- Stop-log removable closure for walking path and maintenance access near Broadway.
- Overbank excavation adjacent to the Souris River channel near Broadway.
- Tie-back levee on the West end of the project west of the Broadway Pump Station and on the East end of the project directly south of the proposed Railway Avenue.
- Bank and slope stabilization for the Souris River channel and flood risk-reduction features at various locations within the proposed project.
- Watermain and storm sewer upgrades for pipe crossings through the line of protection within the USACE right-of-way at various locations.
- Municipal infrastructure modifications and improvements to accommodate the Project, including sanitary sewer, watermain, storm sewer, and street reconstruction.
- Franchise utility relocation.
- City greenway implementation including features such as bike/hike trail system and open space (e.g., parks, natural areas).
- Two tie-back levees, one west of the Broadway Pump Station, and one on the East end of the Project directly south of the proposed Railway Avenue.

2.1.5.6 Tieback Levee

An approximately 0.79-mile-long tieback levee would be constructed east of the Fourth Avenue NE floodwall to provide interim flood protection up to flows of 10,000 cfs for northern portions of Minot. This levee alignment starts at the eastern end of the 4th Avenue NE floodwall, runs easterly along the north side of the railroad tracks, and ties into high ground just east of the intersection of Thirteenth Street NE

and Fifth Avenue NE. To accommodate the levee, portions of Fifth Avenue NE would be re-aligned. It is anticipated that this tieback levee would be constructed as part of Construction Stage 1.5 of the Requester's Preferred Alternative. Figure 2-6 shows the conceptual layout of the tieback levee.

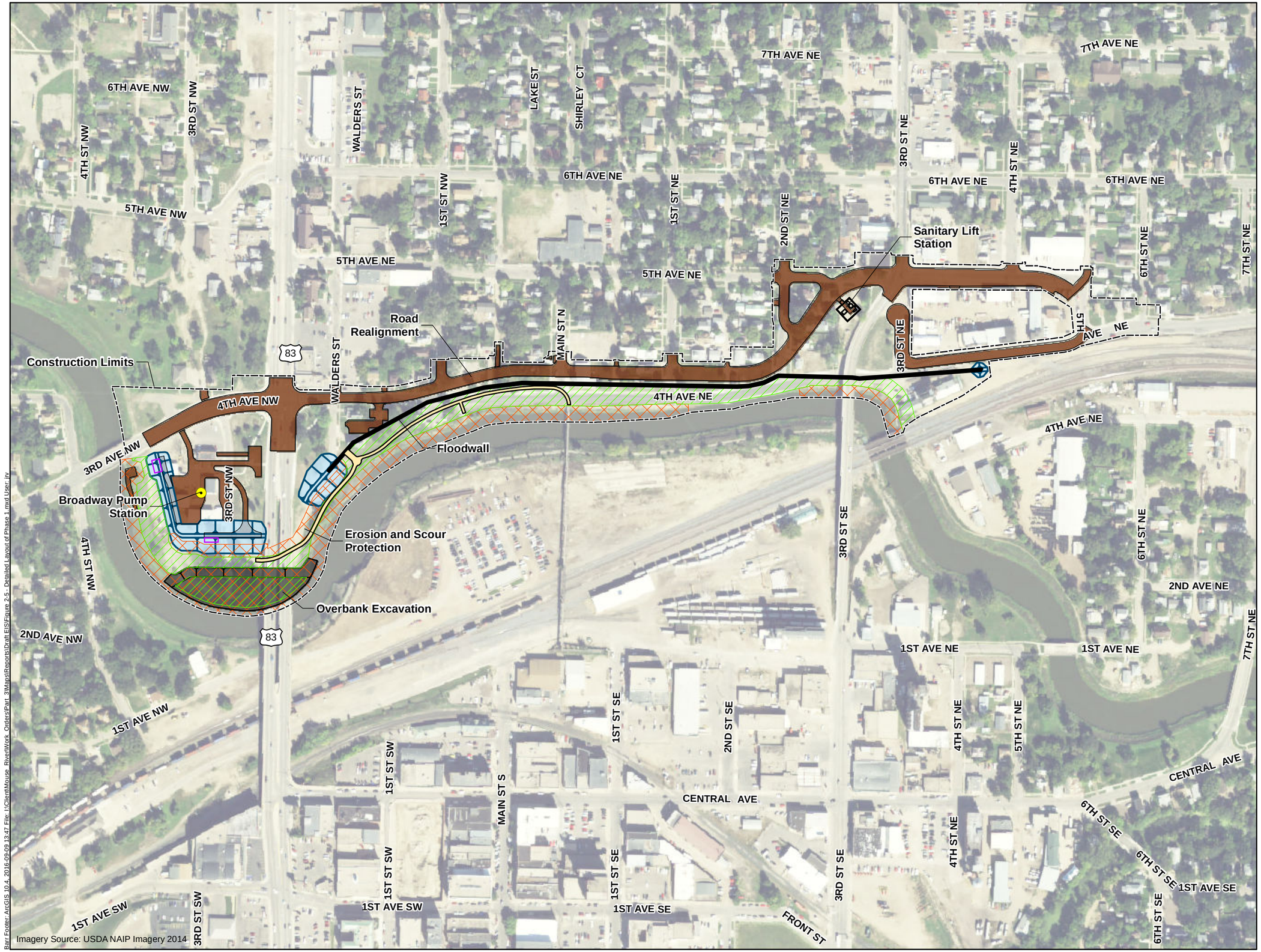
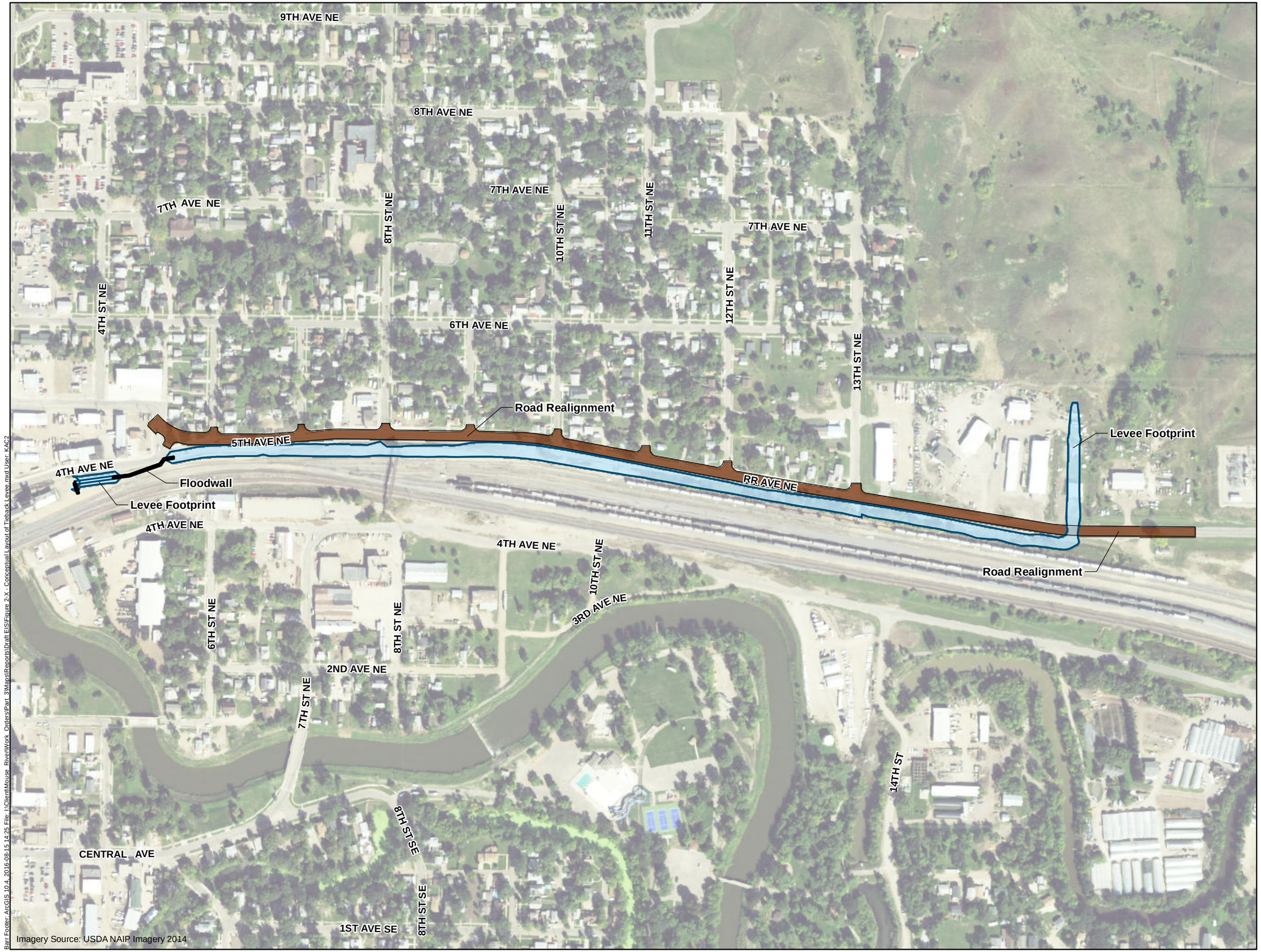


Figure 2-5

DETAILED LAYOUT OF PHASE 1
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 13:47 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-5 - Detailed Layout of Phase 1.mxd User: jxv



Levee Footprint

Floodwall Alignment

Road Modifications

0 175 350 700

Feet

Figure 2-6

CONCEPTUAL LAYOUT OF TIEBACK LEVEE
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-08-15 14:25 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-X_Conceptual Layout of Tieback Levee.mxd User: KAC2

2.1.5.7 Downtown Floodwalls

A floodwall would be constructed parallel to the Burlington Northern Santa Fe Railway on the southern side of the river from Broadway Avenue to Third Street NE. A railroad closure would be needed for the crossing of the railroad tracks. A floodwall was selected in this area to minimize impacts on the railroad and its operation facilities.

2.1.5.8 Rodeo Road

A combination of levees and floodwalls would be used in the Rodeo Road segment from Third Street NE to Fourth Avenue NE. A railroad closure would be needed for the crossing of the Burlington Northern Santa Fe Railroad and a road closure for the crossing of Seventh Street NE. A portion of Fourth Avenue NE would be re-aligned along the top of the levee.

2.1.5.9 Roosevelt Park

A combination of levees and floodwalls would be used in the vicinity of the Roosevelt Park and Zoo. On the southern side of the river, a floodwall would be aligned to maintain Central Avenue as a through street and allow access to the Roosevelt Park and Zoo. The floodwall would be constructed to protect the existing pool and bathhouse facility buildings at the park, leaving the skate park on the river side of the flood protection feature. The floodwall would transition to a levee, and the alignment would continue through the park, located as close to the river channel as possible, to maintain continuity of the park's open space. The levee would transition back to floodwall again as the alignment approaches the East Burdick Expressway. On the northern side of the river, a levee would extend from Fourth Avenue NE to the Burdick Expressway bridge.

2.1.5.10 Valker Road

Flood risk-reduction measures for the Valker Road segment would include new levees on both sides of the river, overbank excavation, and an approximately 0.3 mile channel re-alignment located directly west of Eighteenth Street to minimize impacts on this roadway. Road closures would be needed at the Eighth Avenue SE bridge, which would remain in place and not be modified. The Burdick Expressway bridge would be modified to keep the bridge open during flood events.

2.1.5.11 Twenty-Seventh Street SE High-Flow Diversion

Another high-flow diversion would be constructed along the existing railroad and grain elevator property for flood protection between Souris Court and downstream of Twenty-Seventh Street SE. Similar to the Maple Avenue High-Flow Diversion discussed in Section 2.1.5.4, a levee would be located on both sides of the channel and inlet and outlet weirs would be installed at the upstream and downstream ends of the channel, respectively, to allow flows higher than 3,000 cfs to discharge into the bypass channel. River control structures would also be needed upstream of the weirs to prevent floodwaters from entering the bypassed segment of the river during high-flow events. A new bridge would be constructed across the bypass channel at Twenty-Seventh Street SE to accommodate required channel flow capacity and keep Twenty-Seventh Street SE open to traffic during flood events.

2.1.5.12 Keller

A new levee would be constructed south of the river in the Keller segment from the Twenty-Seventh Street Diversion to U.S. Highway 2, where it would connect with the modified embankment of the highway. A road ramp over the levee would be needed to provide access to properties between the levee and the river. The U.S. Highway 2 bridge would be modified to keep the bridge open during flood events.

2.1.5.13 Bridge Modifications in the Minot Area

As part of the Requester's Preferred Alternative in the Minot area, three existing bridges would be modified:

- U.S. Highway 83 Bypass bridge—U.S. Highway 83 marks the upstream section of the Minot reach. The bridge would be lengthened from a 220-foot span to approximately 350 feet. The bridge would also be raised approximately 3.5 feet. The modifications are required to develop increased flow area under the bridge and keep this critical transportation route open during the design flood event. The roadway approach south of the bridge would be raised to 1 foot above the design water surface elevation to maintain transportation access. Modifications would include overbank excavation in the area under the bridge and immediately adjacent to it.

  Coordination is ongoing with the North Dakota Department of Transportation (NDDOT) regarding the U.S. Highway 83 Bypass bridge. Construction is currently planned to be performed by NDDOT starting in 2018.

- Burdick Expressway bridge—U.S. Highway B2 and the Burdick Expressway bridge were identified as critical transportation routes through Minot in the event of a flood. Based on required design flows and hydraulic modeling requirements, modifications to this bridge structure are essential. Bridge modifications would include realignment to the south to allow for traffic flow on the existing bridge during construction, increased span length, bridge deck raise, and adjusted roadway approaches. The bridge would be lengthened from a 200-foot span to approximately 395 feet. The bridge would also be raised approximately 10 feet. Channel excavation would be performed around the new structure in conjunction with the bridge modifications. Levee alignments would tie into the bridge abutments.

- U.S. Highway 2 bridge—U.S. Highway 2 marks the downstream end of the Minot reach. As part of the Requester's Preferred Alternative, a second set of bridges would be added to increase the overall total span length to approximately 380 feet from the existing total of 180 feet. The modifications are required to develop increased flow area under the bridge to keep this critical transportation route open during the design flood event. The roadway approach south of the bridge would be raised to 1 foot above the design water surface elevation to maintain transportation access. Modifications would include overbank excavation in the area under the bridge and immediately adjacent to it.

2.1.6 Apple Grove

Apple Grove is east of U.S. Highway 2, downstream of the Minot reach. The flood risk-reduction measures for this community would consist of about 1.3 miles of new levee, a railroad closure structure, a roadway up-and-over ramp, an interior pump station, and ponding storage. The levee alignment begins at the modified embankment of the U.S. Highway 2 bridge located north of Apple Grove. It extends around the community, generally following the Souris River, then turns south to avoid an existing section of remnant oxbow. The alignment continues until it intersects the Canadian Pacific railroad grade and terminates into high ground north of U.S. Highway 52. A railroad closure structure would be provided at the railroad grade intersection. A ramp would be provided to maintain access to the road crossing located just north of the railroad. About 28 acres of overbank excavation on the northern and southern river banks in the vicinity of the modified U.S. Highway 2 bridge would increase hydraulic capacity through the bridge reach, while reducing channel and overbank velocities during the design flood.

2.1.7 River Oaks

Flood risk-reduction measures for the River Oaks community would include a new 0.3-mile-long floodwall and an internal pump station. Approximately 9 acres of overbank excavation would be conducted on the northern river bank, just downstream of the end of the floodwall.

2.1.8 Eastside Estates

Eastside Estates is east of U.S. Highway 2 between U.S. Highway 52 and the Souris River. Flood risk-reduction measures would include about 1.2 miles of new levee on three sides of the community, a roadway up-and-over ramp, road and railroad closures, and an interior pump station. The levee alignment starts at U.S. Highway 52 and proceeds north between Puppy Dog Coulee and the community. It continues south and crosses U.S. Highway 52, connecting to high ground.

The levee alignment crosses the Canadian Pacific Railroad at two locations. A railroad closure structure would be required at the eastern crossing. The western crossing does not require a closure structure but would require a seepage cutoff. A road closure structure would be provided at the levee crossing of Thirty-Seventh Avenue SE and a ramp would be provided at the intersection of Thirty-Third Avenue SE and Fiftieth Street SE.

2.1.9 Chaparelle

Chaparelle is along U.S. Highway 52 and is the most downstream community in the project area. Flood risk-reduction measures in this community include about 1,600 feet of new levee, a minor road re-alignment, and a new pump station to manage internal drainage.

2.1.10 Additional Features of the **Requester's Preferred Alternative**

In addition to the flood risk-reduction structures discussed in the previous sections, other structures and features would be needed for constructing and operating the Requester's Preferred Alternative, including:

- Ponding areas, interceptor ditches, and pump stations to manage internal drainage.

- Gatewells to control stormwater.
- Utility modifications and relocations to facilitate construction of the levees and floodwalls.
- Roadway modifications to maintain access to properties and to accommodate the levees and related closure structures.
- Levee access ramps for service roads, golf course crossings, or trails.
- Borrow sites to obtain soils needed for construction of the levees.
- Disposal areas to manage excess soils and debris left over from construction activities.
- Demolition of any remaining structures within the construction right-of-way.
- Seepage control systems to intercept seepage during flooding and provide geotechnical stability.
- Levee and river bank erosion protection.
- Overbank excavation of the existing river channel to increase the cross-sectional area and capacity of river flow during flood events while minimizing the increase in upstream water surface levels.
- Staging areas to store construction equipment and materials.

Details for most of these structures and features would be further refined during the design process of each phase. Additional information on the pump stations and potential borrow sites is provided in the following sections.

Pump Stations

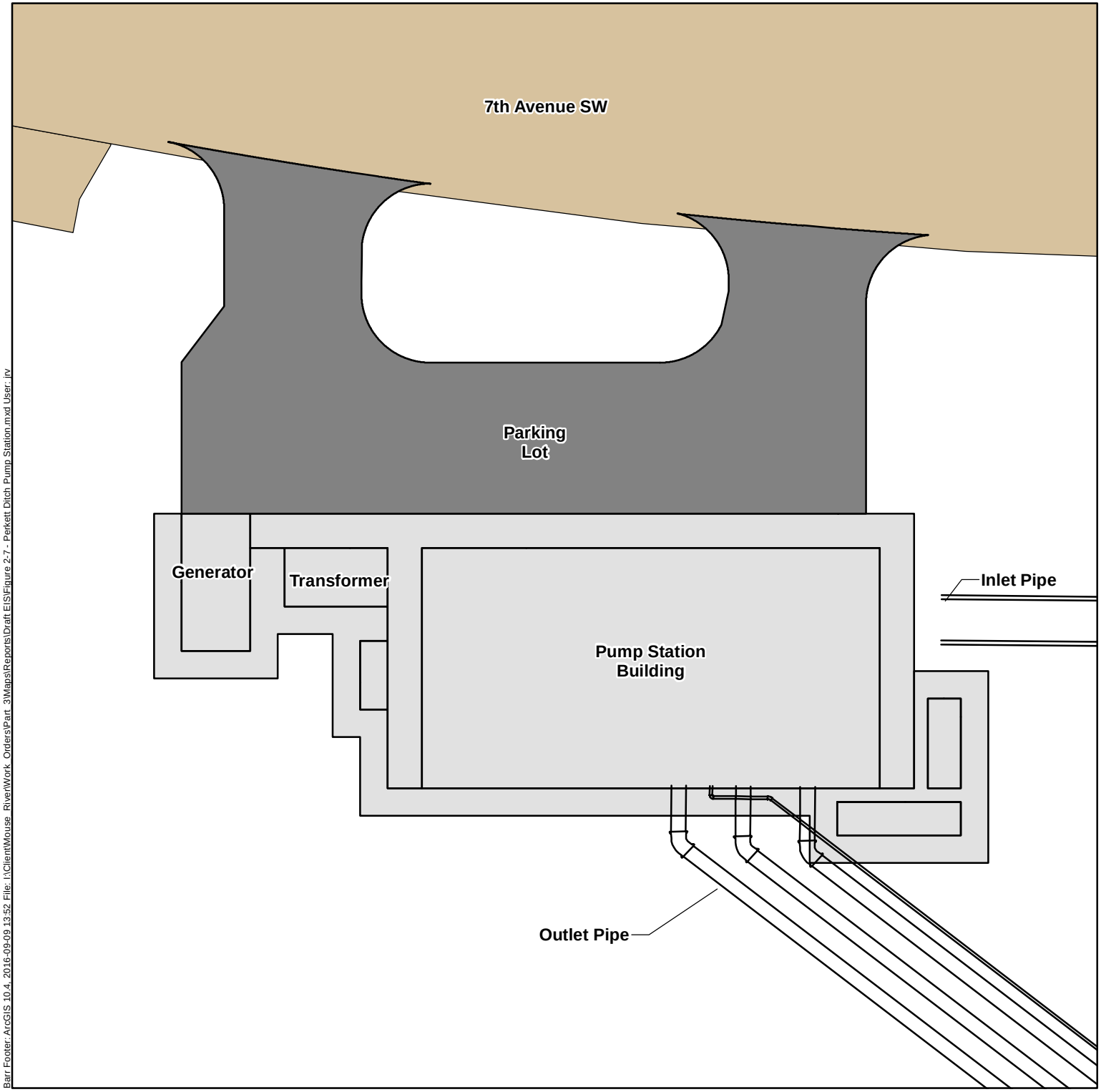
Pump stations would be needed to pump stormwater runoff ponded on the landside side of the levees to the river during periods of river flooding. Interceptor ditches and storm sewers would be used to route stormwater from upstream ponding areas to the pump stations. The locations of existing and proposed pump stations are shown on Map 2-1. A total of 26 new pump stations would be constructed for the Requester's Preferred Alternative.

The pump stations would be designed in accordance with EM 1110-2-1413 (Engineering and Design, Hydrological Analysis of Interior Areas), EM 1110-2-3102 (General Principles of Pumping Station Design), and EM 1110-2-3104 (Structural and Architectural Design of Pumping Stations). The design of each station would be dependent on site-specific conditions and the volume of stormwater that would have to be to be managed at each location. The pump stations would generally consist of a cast-in-place, reinforced-concrete trench-well submersible station with a heated building above the pumps for maintenance and pump storage. The exterior finish of the building would be designed to complement the surrounding neighborhood. The pump stations would have multiple pumps (minimum of two pumps) with a total maximum pumping capacity ranging from 2,000 gallons per minute (gpm) to 360,000 gpm. A permanent generator would be installed at each station to provide backup power during power outages.

For Phases 1 through 3 two new pump stations would be installed: Perkett Ditch Pump Station and Broadway Pump Station. The Perkett Ditch Pump Station would replace an existing station located along a levee in Phase 2. The location of this pump station is shown on Figure 2-3 and the detailed site plan is shown on Figure 2-7. A box culvert would route stormwater from an upstream pond northwest of the pump station (i.e., Centennial Forest Pond) to a flow-splitter structure. An 84-inch-diameter reinforced-concrete pipe would then carry the water from the flow splitter to the pump station. The pump station would pump interior stormwater to the Souris River via a discharge piping gatewell structure. The station would have three 250 horsepower (hp) submersible pumps with an approximate maximum pumping capacity of 45,000 gpm.

The Broadway Pump Station would be a new permanent pump station devoted to discharging interior runoff from the Fourth Avenue NE watershed into the Souris River during times of intermediate tailwater, when the Maple Avenue Diversion is not yet in operation. The Maple Avenue Diversion would be completed as part of Construction Stage 1.5 of the Requester's Preferred Alternative. In the time between completing the Broadway Pump Station and completing the Maple Avenue Diversion, the Broadway Pump Station would operate as the sole means of conveyance from the Fourth Avenue NE watershed for both intermediate and high tailwater conditions. The location of this pump station is shown on Figure 2-5 and the detailed site plan is shown on Figure 2-8. A box culvert would route water via a 60-inch trunk sewer in Third Street NE near the eastern extent of the Phase 1 limits and would convey storm runoff to a new outfall at the Broadway Pump Station.

An additional pump station is planned for the Maple Avenue High-Flow Diversion segment as part of Construction Stage 1.5. This pump station would provide relief to the Broadway Pump Station and would be designed similar to the pump stations described above. Additional details on the pump station would be provided during the design phase of this segment.



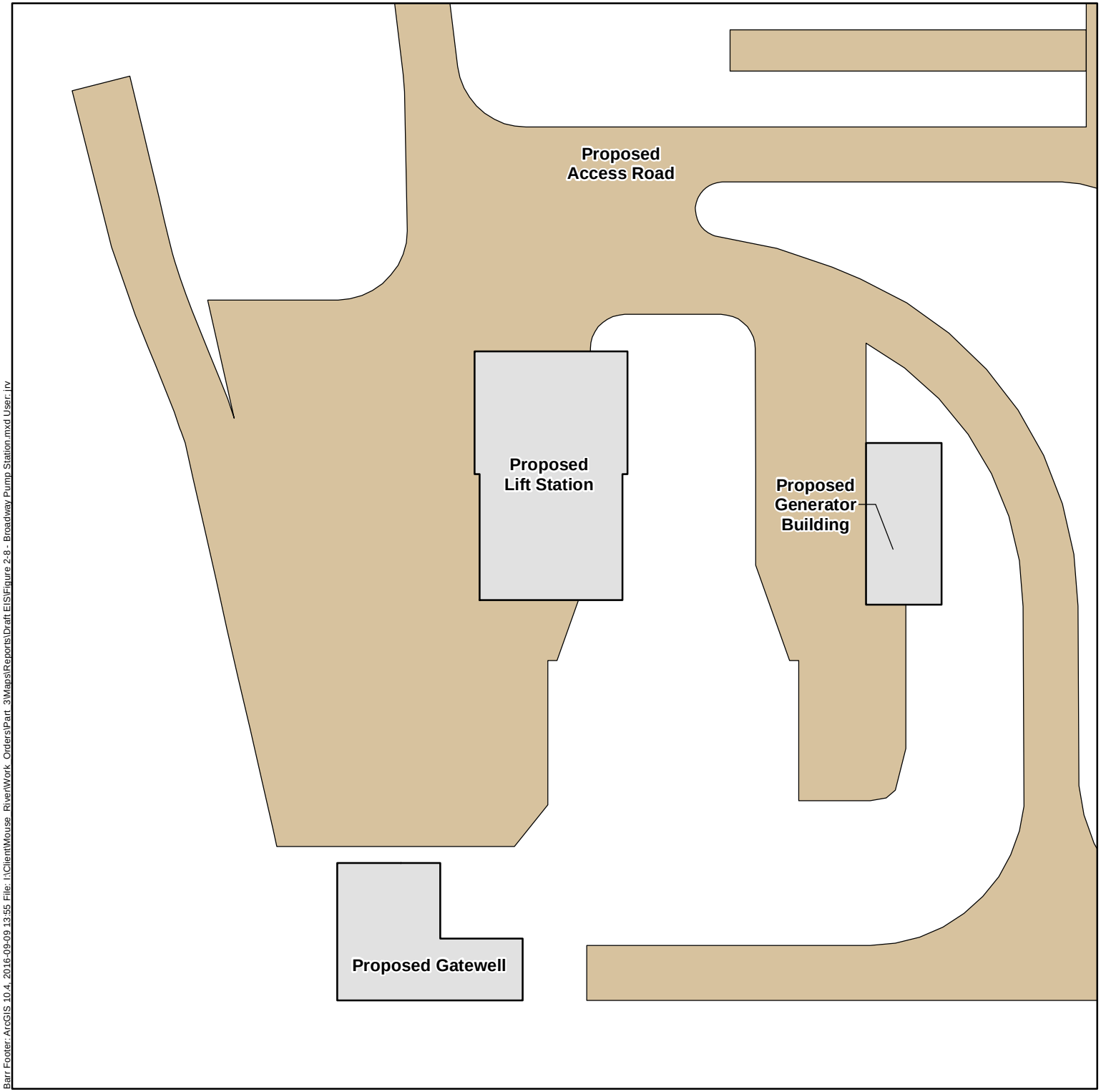
Perkett Ditch Pump Station

0 10 20 40
Feet

Figure 2-7

PERKETT DITCH PUMP STATION
Mouse River Enhanced Flood Protection Project

Bar: Footer: ArcGIS 10.4, 2016-09-09 13:52 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-7 - Perkett Ditch Pump Station.mxd User: jrv



Broadway Pump Station

0 20 40 80
Feet

Figure 2-8

BROADWAY PUMP STATION
Mouse River Enhanced Flood Protection Project

Bar Footer: ArcGIS 10.4, 2016-09-09 13:55 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-8 - Broadway Pump Station.mxd User: jrv

Borrow Areas

Borrow areas are locations that would be used to obtain fill to build features, such as levees. Potential borrow sources generally consist of existing pits, but some new sources are likely to be considered. A detailed subsurface investigation program consisting of test pits, soil borings, and lab testing would be required to characterize and quantify available materials. In addition, environmental and cultural resource studies would be conducted, as needed, along with research on any easements or land purchases required to secure the use of the site(s).

The selection of borrow areas would be completed in compliance with Chapter 4 of EM 1110-2-1913. The overlying objective for selecting a borrow source is to identify impermeable fill for levee construction and aggregate materials for pipe bedding, road construction, and other potential needs. The primary selection criteria that would be used to identify, screen, and select borrow source locations are provided below:

- Suitable material - The borrow location must contain a sufficient quantity of impermeable soils meeting the requirements for levee construction. If the material is at an offsite borrow source, the source must be able to provide at least 100,000 cubic yards of suitable material. Additionally, the material must be readily obtainable without requiring significant construction and excavation activities. Suitable material must also be located above the water table or be obtainable at or near the material's optimum moisture content. Drying the material prior to placing and compacting it in the levee is not recommended.

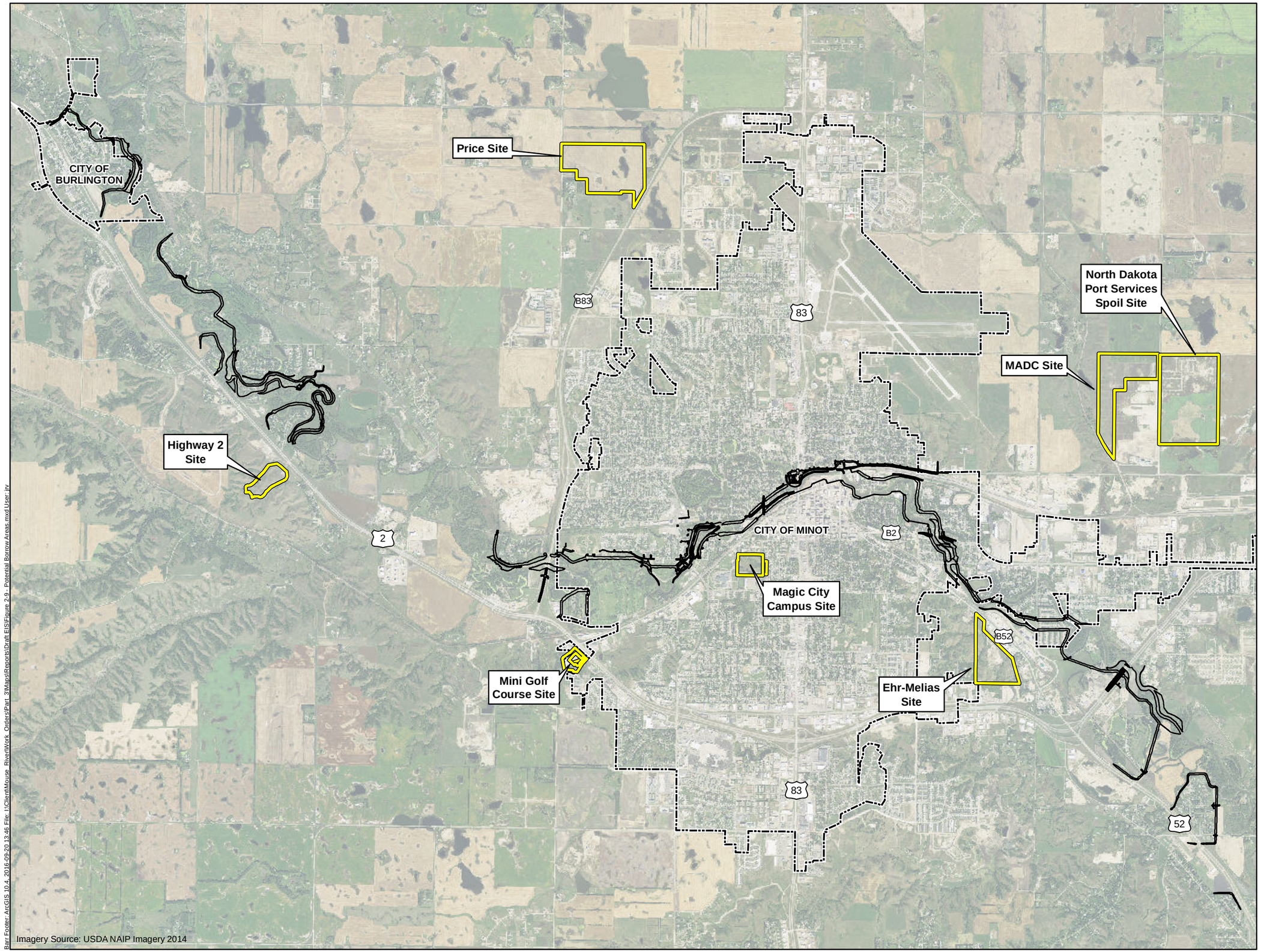
- Material proximity - The location of the borrow material must not create adverse impacts to the levee or surrounding structures and Requester's Preferred Alternative features. Preference would be given to borrow locations near the levee. If suitable, material from existing levees would be used first. Alternate offsite locations would be identified in the construction documents. Preference would be given to sites that fit the other suitability criteria, are in close proximity to the levee sections, and have haul truck accessibility.

- Property ownership - Stakeholders who own and manage borrow areas, including Minot and the SRJB, would receive preference in selecting borrow material. Secondary preference would be given to cooperative landowners who would provide access to the material with minimal stipulations on its use. A property-access and material-use agreement would be completed with the landowner prior to any borrow operations.

- Environmental and cultural resource constraints - A desktop environmental and cultural analysis would be completed prior to the selection of borrow locations. Additional field investigations would be carried out as needed. Borrow source areas would be selected and laid out to minimize environmental and cultural resource impacts to the extent practicable.

- Restoration requirements - Another criteria for selection of a borrow source includes the amount of restoration that would be needed. Sites requiring primarily replacement of topsoil and re-establishment of vegetation after material removal would be given more consideration, while sites requiring construction or restoration of structures would be given less consideration.

As part of the PER (reference [1]), a desktop review of available topographic, soil, and geological maps, aerial photographs, historical boring logs and well data, and information on existing engineering projects was conducted to identify potential borrow sites. Seven potential sites have been identified in the project area as shown on Figure 2-9. Additional studies (e.g., biological surveys, wetland surveys, cultural resources investigations, geotechnical investigations) are being conducted at several of these sites to evaluate site-specific impacts and suitability of the borrow material. The survey results will be used to select a borrow site that will provide suitable levee soils and will minimize impacts on environmental and cultural resources.



Potential Borrow Site Parcels

Project Footprint

Municipalities

0 2,000 4,000 8,000

Feet

Figure 2-9

LOCATIONS OF POTENTIAL BORROW AREAS
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-20 13:46 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-9 - Potential Borrow Areas.mxd User: jrv

2.1.11 Design, Construction, and Operations

The Requester's Preferred Alternative would be designed, constructed, and operated in accordance with current USACE standards for federal flood risk-reduction projects and in accordance with the methods and references cited in USACE engineering manuals, technical letters, regulations, and other documents. The Requester's Preferred Alternative would be primarily constructed within the right-of-way of the existing federal project. Additional right-of-way would be obtained where needed through purchase of easements, Minot's voluntary buy-out program, or in some situations, condemnation. The proposed right-of-way would create a corridor which would have a minimum width of the levee, floodwall, and embankment (including all appurtenant structures), plus 15 feet on each side measured from the outer edges of the outermost critical structure. Temporary easements to facilitate construction activities, borrow sites, and staging areas would also be obtained where needed.

For Phases 1 through 3, the staging areas would be located along the construction corridors and within the construction limits shown on Figure 2-3 and Figure 2-6. For other segments in Construction Stage 1.5, the staging areas would be located within the construction limits or within acquisition areas along the construction corridor.

2.1.11.1 **Requester's Preferred Alternative** Feature Designs

The typical designs of the larger features (i.e., levees, floodwalls, high flow diversions, realigned channels, and overbank excavations) of the Requester's Preferred Alternative are described in the following sections. Additional design and specifications for Phases 1 through 3 are also provided in the Basis of Design Reports (reference [4]; HEI 2015).

Levees

The typical levee for the Requester's Preferred Alternative would have side slopes of 3 horizontal to 1 vertical (3H:1V) with a minimum top width of 12 feet. The average levee height through the developed portions of Minot would be about 14.4 feet, including a minimum 3 feet of freeboard for the design flood event. The typical levee layout also includes a 30-foot-wide clear zone beyond the landslide toe of the levee for seepage control measures, inspection, and maintenance access. The typical levee cross section is shown in Figure 2-10.

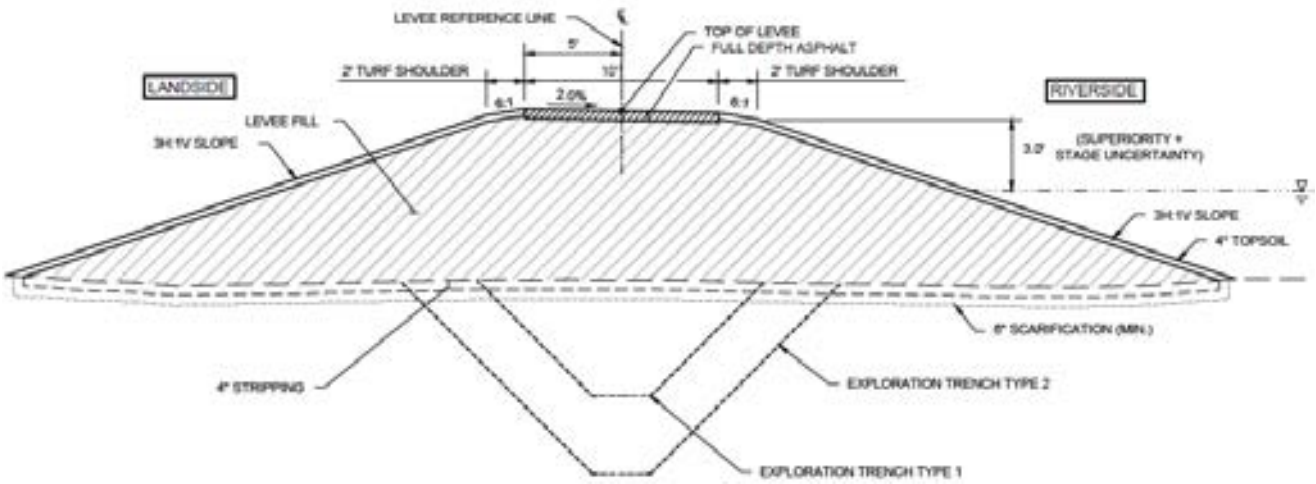


Figure 2-10 Typical Levee Cross Section

Floodwalls

Floodwalls consist of vertical wall sections to confine flood flows. The typical flood wall for the Requester's Preferred Alternative would consist of a reinforced concrete inverted-T cantilever wall section as shown on Figure 2-11. Similar to the levee, the typical floodwall layout would also include a clear zone beyond the landslide toe of the floodwall for seepage control measures, inspection, and maintenance access. Because of their more complex design, higher stresses on structural members, limitations on temporary raises during emergency flood fighting, and higher construction costs, floodwalls have generally been sited only where adequate space was not available to construct levees.

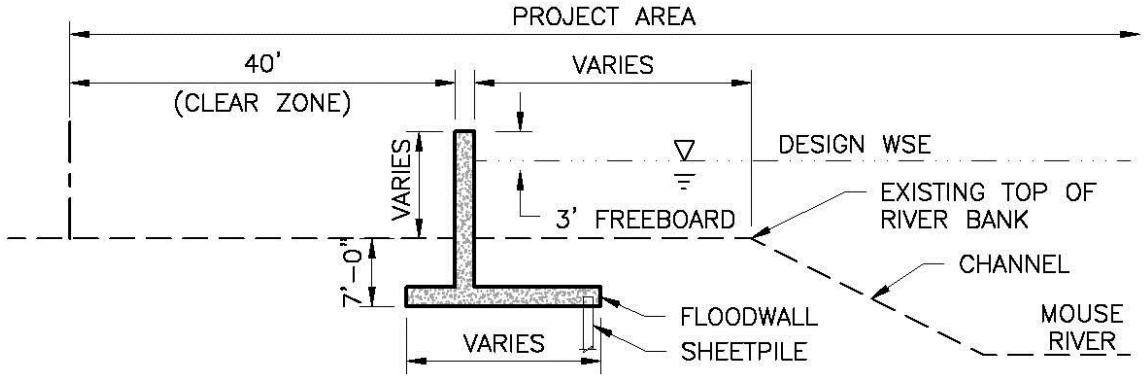


Figure 2-11 Typical Floodwall Cross Section

High-Flow Diversion Channels

High-flow diversions are new channels set above the existing river channel to convey flood flows and bypass a portion of the existing channel. Two high-flow diversions are included in the Requester's Preferred Alternative to reduce the number of residential properties affected by construction. The two locations are in Minot and are referred to as the Maple Avenue Diversion and the Twenty-Seventh Street SE Diversion. Water would only flow through these diversions during flows that exceed 3,000 cfs. As such, the diversion channel bottom would be at a higher elevation than the existing river channel bank.

Control structures would be located at the upstream (inlet) and downstream (outlet) ends of each diversion. Flows below 3,000 cfs would flow through the existing river channel. River closure structures would be constructed in the existing river channel upstream and downstream of each of the high-flow diversion channels. During normal flows the closure structure would be open, allowing water to continue through the original river channel. When a flood event occurs the structures would be closed and all river flows would be diverted into the high-flow diversion channel. The bottom width and elevation of the high-flow diversion channel would vary based on required channel capacity and use of channel space in non-flood conditions. A typical high-flow diversion cross section is provided in Figure 2-12.

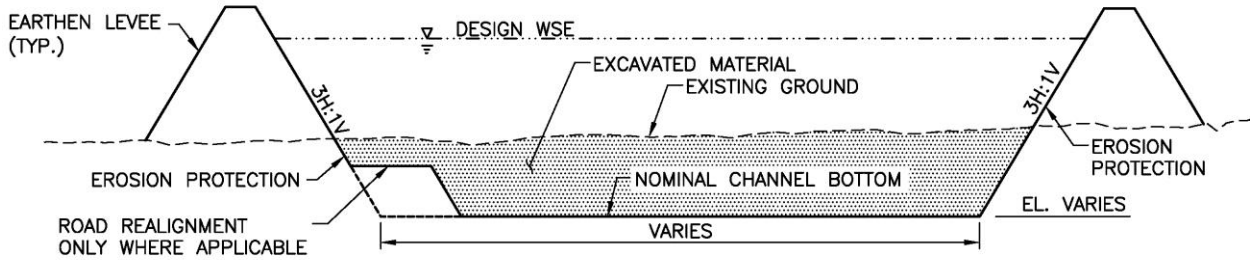


Figure 2-12 Typical High-Flow Diversion Cross Section

Realigned Channels

Potential realignment channels have been proposed for the Kings Court and Valker Road segments. These realignments have been designed to be about as long as the original channel. At each of these locations the existing channel would be closed off with a levee, and flows would be managed through the dead loop with a gatewell system. The gatewells would be open to allow river flows through the dead loops during non-flood conditions, and the gatewells would be closed during flood events. A new channel alignment would be excavated to convey all river flows up to the design flow event. The bottom elevation of the channel would vary based on channel capacity during the design flood event and the acceptable design water surface elevation. Geometry for channel realignments would closely mimic the existing channel geometry in proximity to the realignment. The slope on the sides of the channel excavation would range from 4–5H:1V.

Channel realignment corridors were designed be similar to levee corridors where flood protection measures are located on each side of the realignment. In areas where flood protection is not immediately adjacent, the channel realignment would be treated in a manner similar to other typical river corridors. A typical channel realignment cross section is shown in Figure 2-13.

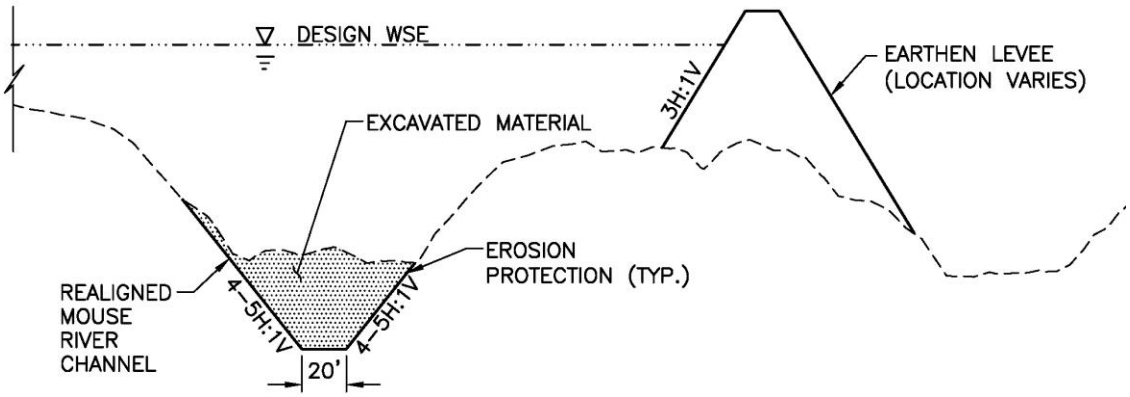


Figure 2-13 Typical Channel Realignment Cross Section

Overbank Excavation

Overbank excavations would be used to increase the cross section capacity for water flow during flood events to minimize the increase in upstream water surface levels. Overbank excavations would be primarily within Minot, in areas where space is restricted. To minimize impacts to the existing river and wetlands the bottom elevation of the excavated section would typically be at the delineated Ordinary High Water Level (OHWL) or above the 2-year flood event water surface elevation (approximately 1,150 cfs river flow). The slope on the side of the excavation would be 3H:1V and would typically extend from the bank of the existing channel to a constructed feature as shown on Figure 2-14. Topsoil and erosion protection materials could be placed in the excavation areas as part of the restoration procedures.

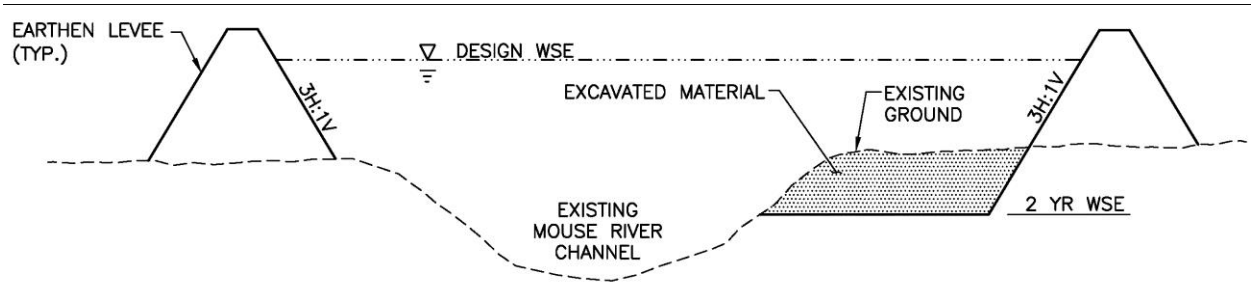


Figure 2-14 Typical Overbank Excavation Cross Section

2.1.11.2 Construction Activities

Construction activities would include demolishing and removing remaining structures, streets, and utilities; excavating exploration trenches to search for unknown utility penetrations; removing vegetation and unsuitable soils; constructing levees; and restoring the site. Temporary and permanent erosion control measures would be implemented during the construction process to minimize surface runoff and the deposit of sediment in the river and nearby wetlands. Each of these construction activities is generally described in the following sections.

Structure Demolition

Houses, sheds, and garages within the new levee right-of-way would be completely removed, along with basements, foundations, drain tiles, and bedding aggregate. Appurtenant items would be removed in similar fashion, including sidewalks and private utilities (including water, sanitary sewer, and all other underground utilities). The excavations would be backfilled with impervious material and compacted in a series of lifts. The removed material would be transported offsite for disposal at a licensed landfill.

Exploration Trench

Prior to constructing levees or closure structures, an exploration trench of 6-foot depth (Type I) or 10-foot depth within demolished structure footprints (Type II) (Figure 2-15) would be excavated to verify that the corridor is clear of unknown utility penetrations according to Section 7-2 of reference [6]. Backfill would only be placed after careful inspection of the excavated trench to ensure that seepage channels or undesirable materials are not present.

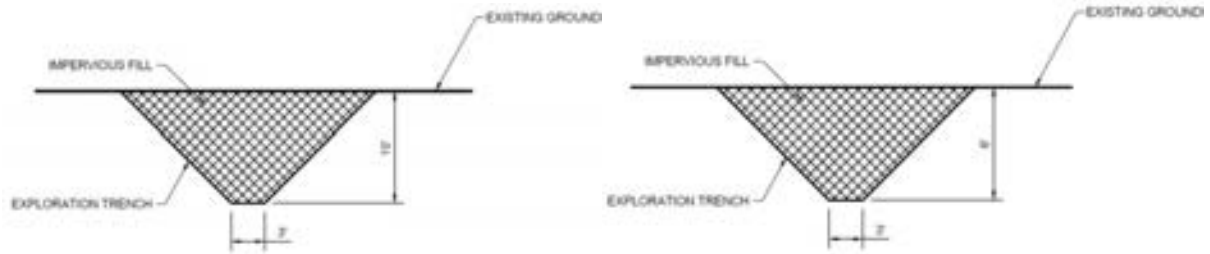


Figure 2-15 Exploration Trench Type I and Type III

Vegetation Removal

Clearing and grubbing would be conducted within the levee corridors, including removal of all vegetation, roots, stumps, etc. A vegetation-free zone would be developed with a minimum width that encompasses the levee, floodwall, or embankment dam, including all critical appurtenant structures, plus 15 feet on each side from the outer edge of the outermost critical structure. Non-compliant vegetation would be removed to reduce the risk of compromising the levee integrity in these areas. Areas where trees and shrubs infringe upon this zone would be identified prior to construction. Unwanted vegetation within the vegetation free zone would be removed during the flood protection system upgrades. This would include removing both trees and shrubs above grade and removing roots greater than ½ inch in diameter in the required root-free zone.

Street and Utility Demolition

Exiting streets and utilities would be removed within the new levee right-of-way. Roadway pavements and base aggregates would be removed down to the subsoils of low permeability. Public and private utilities existing under the street would be removed or abandoned. The removed material would be transported offsite for disposal at a licensed landfill.

Levee Construction

Existing topsoil would be removed from the levee footprints and stockpiled for re-use during reclamation. Wetland and other unsuitable soils would be removed entirely from the levee footprints and replaced with

acceptable compacted impervious fill. The levees would be constructed with impervious material, placed in specified lifts, and compacted according to project specifications. The material for the levees would be obtained primarily from designated borrow sites. Any excess material such as unsuitable soils and construction debris would be disposed of at a licensed landfill or other approved disposal area.

Levee and River Bank Erosion Protection

Design for protection against levee and river bank slope erosion resulting from high velocities, shear stresses, and scour during flood events would be completed in accordance with the Project Design Guidelines, EM 1110-2-1601 (reference [7]), and FHW0A's HEC-11, *Design of Riprap Revetment* (reference [8]). The main focus of erosion protection design is to protect the levee system. Designs would include an evaluation of river geometry, soil conditions, scour potential, and consideration of multiple flood events including the 2010 peak flow event (1,100 cfs), the preliminary flow being identified as the 100-year (1-percent annual chance) flood event (10,000 cfs), and the 2011 flood event (27,400 cfs).

Levee erosion protection would typically be designed considering total stream velocity, which is defined as the average velocity of flow in the total cross-section. Bank erosion protection would be designed considering modeled channel velocity.

Erosion protection at structures and outlets would be required to prevent erosion from concentrated flows. Tie-back levees and existing levees to remain in place would be reviewed for protection against potential overtopping.

Erosion protection design would explore alternative methods, when possible, that would meet both erosion protection needs and levee design requirements. Potential alternatives include riprap, articulated concrete block, turf-reinforced mats, and natural bioengineering methods. Selection of the appropriate erosion protection method would be dependent on several factors, including river geometry, proximity of levee to the river, depth, and velocity. The goal would be to balance erosion protection requirements with aesthetic and environmental considerations.

Launchable riprap would be used in select areas for both bank and toe scour protection. Launchable riprap is a technique for rock placement that provides protection against the undermining of bank armoring. The riprap is designed to migrate downslope in the event of scouring. In some areas this may result in a slight increase in riprap footprint.

Seepage Control

A seepage collection system is anticipated to be installed along the levee landside toe to intercept seepage during flooding and provide geotechnical stability. Seepage collection would typically involve a trench system with the following features:

- Shallow Filter Trench—The upper portion of the seepage collection trench would be a trapezoidal granular filter trench. The trench would be backfilled with fine aggregate and courser aggregate material would be placed around a collection pipe.

- Collection Pipe—A perforated, smooth-walled collection pipe would be centered horizontally in the trapezoidal shallow filter trench to route seepage water to storm sewer facilities. This pipe would typically be connected directly to a storm sewer manhole. Pipe size would be based on slope, proposed pipe material (perforated, smooth walled) and anticipated seepage flow beneath the levee.

- Deep Relief Trench—The lower portion of the seepage collection trench would be a vertical granular relief trench that extends down from the shallow relief trench and connects directly to underlying high-permeability sand/gravel layer at a depth of approximately 15 to 20 feet.

The seepage collection system would be designed and constructed in accordance with EM 1110-2-1913 (reference [6]). Figure 2-16 shows a typical seepage collection trench at landside toe of the levee system. Depending on soils and geotechnical analysis, seepage cut-off systems such as driven sheet pile or slurry wall may be necessary in specific locations.

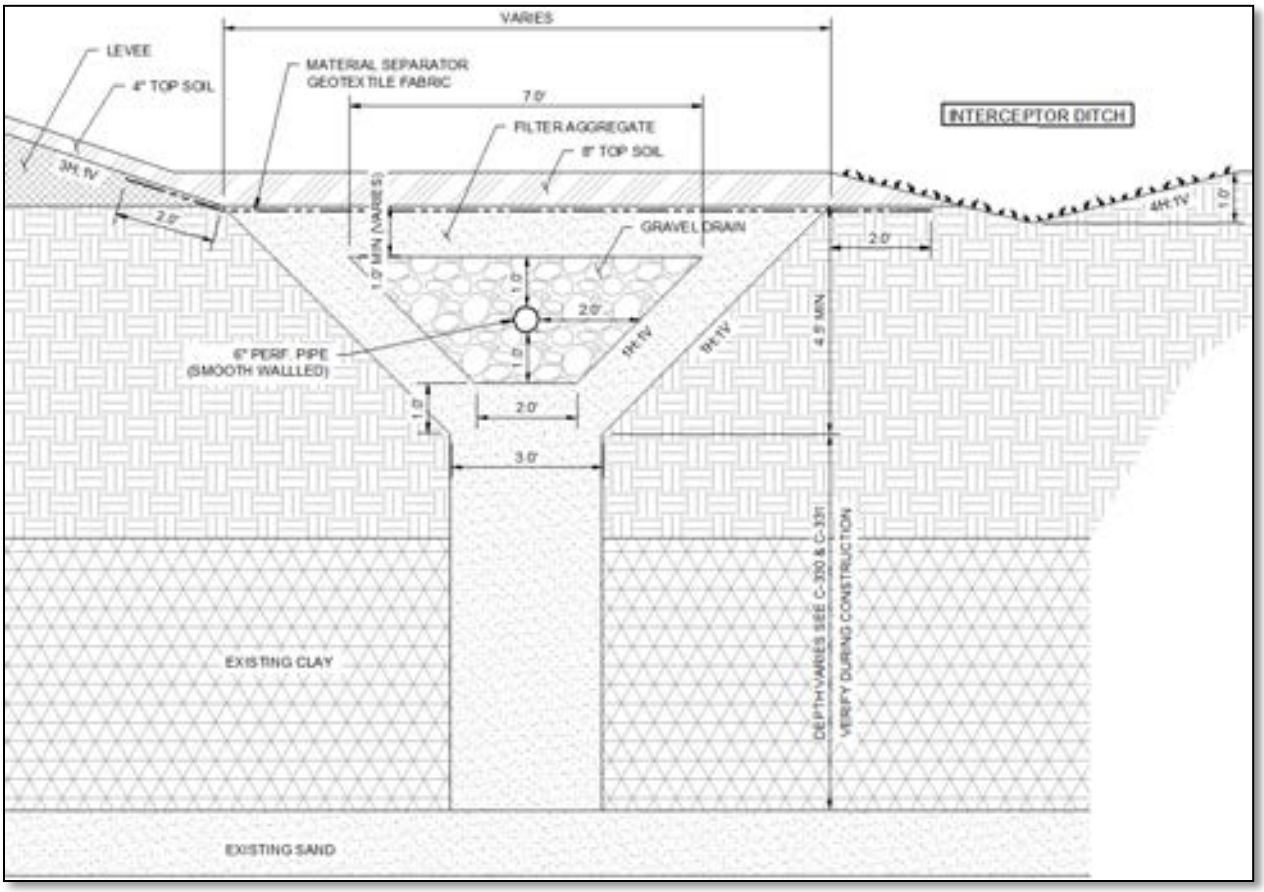


Figure 2-16 Typical Schematic of Seepage Collection System

Site Restoration

Areas disturbed by construction activities would be revegetated to prevent erosion and sedimentation, stabilize the levee and associated appurtenances, and restore a natural and aesthetic appearance.

Revegetation of the restored areas would be conducted using a variety of methods based on site-specific conditions. General methods and applicable locations for restoration measures include the following:

- Topsoil and sod—Minot right-of-way, critical infrastructure green space.
- Topsoil, hydraulic soil stabilizer, and seeding—open space areas, levee slopes, and all general disturbed areas.
- Topsoil with erosion control blanket and seeding—critical slope areas typically 3H:1V or steeper, concentrated stormwater flow areas, slopes immediately adjacent to wetlands or other environmentally sensitive areas.
- Topsoil with TRF and seeding—slopes around critical infrastructure such as closures, headwalls, or areas receiving concentrated stormwater flow.
- Revegetation with native seed mixes and tree plantings – open space areas.

Erosion Control Measures

Erosion control measures would be installed by the contractor prior to starting construction. As part of the construction documents, a Stormwater Pollution Prevention Plan (SWPPP) would be developed to comply with North Dakota Pollutant Discharge Elimination System (NDPDES) permit requirements. In accordance with local, state, and federal requirements, and best management practices, the SWPPP would outline the design, implementation, management, and maintenance of facilities, to reduce the amount of sediment and other pollutants in stormwater discharges associated with land-disturbing activities.

Temporary measures used to control erosion and sedimentation during construction may include one or more of the following:

- Rock construction entrance
- Sediment pond
- Silt fence
- Erosion-control blanket
- Inlet siltation protection
- Concrete washout
- Floating silt curtain
- Rock filter levee
- Temporary and Permanent Vegetation
- Dewatering controls

Temporary and permanent erosion-control measures would be specified on the construction drawings for each phase of the project. During the construction process, the contractor would inspect and monitor the installed erosion-control measures to verify they are functioning properly and providing adequate functionality for construction phasing and scheduling. Any damaged or malfunctioning structures would be fixed or replaced. It is anticipated that the contractor may also need to modify the erosion-control measures as work proceeds, based on site-specific conditions and, if needed, install additional structures to meet the requirements of the SWPPP. Any modifications to recommended erosion-control measures would be documented by the contractor and included in any required contractor submittals or work plans.

Utility River Crossings

Some municipal utilities would have to be modified as levees are constructed, interior drainage is improved, and roadways are modified. Affected utilities would include sanitary sewers, watermains, forcemains, and storm sewers. Utilities that cross under the Souris River channel would typically be installed using open cut trench methods. These methods would include:

- A steel sheet pile cofferdam system would be installed to facilitate open trench excavation. In order to allow continued river flow during construction, the cofferdam would be limited in length to approximately half of the river channel width at a time. The corridor width of the cofferdam system would be reduced as much as possible to minimize temporary impacts on the river and adjacent wetlands.
- After the cofferdam system is completed, the area within the cofferdam would be dewatered by pumping water to a sediment basin located in an adjacent upland area in accordance with requirements specified in the SWPPP.
- Once the area is dewatered, a trench would be excavated and the utilities would be installed within the trench. Excavated material would be contained within the cofferdam system. Any wetland soils excavated during construction would be stockpiled and replaced after construction has been completed.
- The river bed would be restored to pre-existing conditions and the cofferdam system would be removed to allow normal flow in the river channel.

2.1.11.3 Operation and Maintenance

An addendum to the original Operations and Maintenance (O&M) Manual for the specific projects would be completed as part of the Requester's Preferred Alternative. The manual would summarize the procedures required for operating, maintaining, repairing, rehabilitating, and replacing Project features and would include the latest approved flood risk-reduction regulations, maps, drawings, tables, and references. The manual would likely include the following sections:

- 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

The addendum to the O&M manual would be part of the project's *Construction Documentation Report,* which would be reviewed and approved by the USACE, FEMA, and the project sponsor upon completion of the Requester's Preferred Alternative.

2.2 Other Alternatives Considered

In the evolution of this project, several sets of alternative plans have been developed and evaluated by the requester with the goal of minimizing adverse impacts to the environment, local interests, and industry. This section summarizes alternatives considered, including macro-scale alternatives that were more conceptual in nature and micro-scale alternatives with more detailed analysis.

This analysis addresses alternatives for reducing flood risks from the Burlington through Minot stretch of the Project. The alternatives were evaluated in terms of their effectiveness in meeting Project purpose and need, as specified in Section 1.1.

Alternative plans that could meet these Project goals are described in this section. Social, environmental, political, and economic constraints were used to evaluate larger conceptual Project alternatives and screen out those that they felt were not viable from further analysis.

The generalized concept of the Requester's Preferred Alternative was determined to be a viable option for meeting the Project's purpose and need. Different alternative alignments and features were also analyzed in more detail for smaller segments of the Requester's Preferred Alternative in Section 2.2.3. These smaller-scale design alternatives face fewer broad social, political, and economic limitations, but would have substantial, prohibitive, local impacts.

It should be noted that all future phases of construction would be subject to targeted alternatives analysis and impact assessment under NEPA. Also, proposed actions would need to be determined to be the least environmentally damaging practicable alternative (LEDPA) to receive a Section 404 permit for the placement of fill in any Waters of the United States.

2.2.1 Upstream Flood Storage Alternatives

The four upstream dams (Rafferty Dam, Boundary Dam, Alameda Dam, and Lake Darling Dam [Figure 2-17]) are multiple purpose reservoir projects, operating for both flood storage and for water supply and conservation purposes. The drawdown of the pool levels and the flood operation of these dams are governed by an international agreement between the United States and Canada. The United

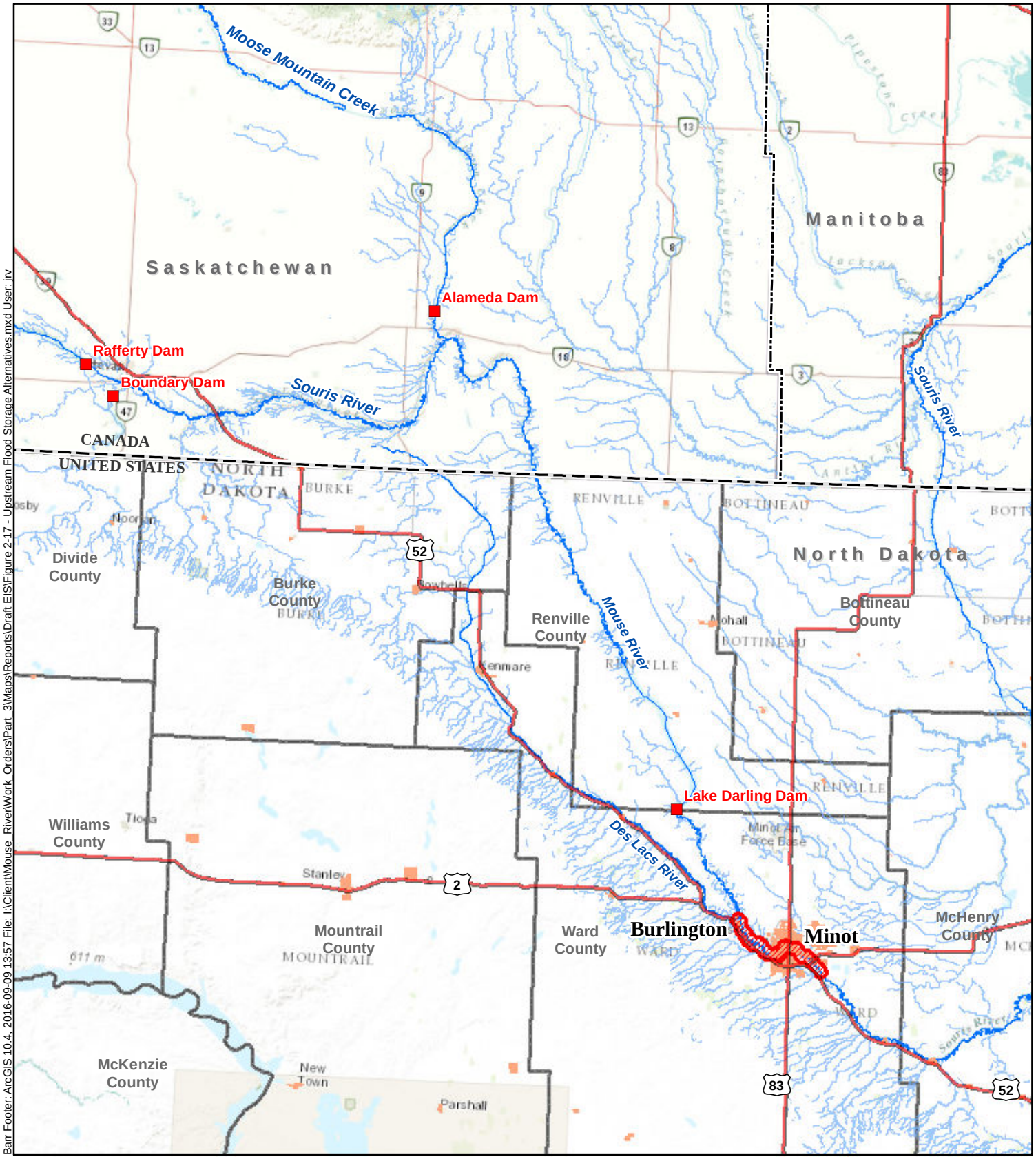
States and Canada have worked jointly to develop a water control plan that specifies procedures for operating all four dams during flood and non-flood conditions, consistent with the objectives of providing water supply and controlling flooding.

The Rafferty, Alameda, and Boundary dams are owned and operated by the Saskatchewan Water Security Agency. The Rafferty and Alameda dams are part of the Rafferty-Alameda Project that was developed between 1988 and 1995 to provide cooling water for the Shand Power Station near Estevan, reduce flood risk for residents downstream in Saskatchewan and North Dakota, and provide a reliable water source for municipal, domestic, irrigation and recreational use in the Saskatchewan portion of the Souris River Basin. The Boundary Dam was built in 1957 on Long Creek, a tributary of the Souris River, to provide cooling water for the Boundary Dam Generating Station. A channel links the Boundary Dam and the Rafferty Dam, allowing water to flow between the two reservoirs.

The Lake Darling Dam is within the Upper Souris National Wildlife Refuge and is owned and primarily operated by the USFWS, in accord with the water control plan developed by international agreement (the USACE takes over operation of the dam during a 10-percent annual chance flood or larger). The primary purpose of the Lake Darling Dam and reservoir is to furnish a regulated supply of water to smaller wetlands downstream and especially to the larger wetlands on the J. Clark Salyer Refuge, 110 miles downstream. The reservoir is designed to hold a two-year supply of water to safeguard wetlands downstream against the threat of drought.

The Lake Darling Dam, however, is operated in coordination with the upstream Rafferty-Alameda Project and plays an integral role in flood control within the Souris River Basin. During flood conditions, USFWS coordinates with USACE to manage releases to mitigate downstream flood risk, as specified in the international water control plan. The Lake Darling Dam was modified as part of the USACE Souris River flood risk-reduction project in the 1990s to provide additional storage and operational control of flooding. At this time the dam has a maximum flood pool level of elevation 1601. Flood pool levels as high as elevation 1620 were evaluated as part of the USACE Souris River Project, but the higher flood pool levels were not selected due to the substantial adverse impacts associated with habitat loss relative to the fairly modest degree of additional flood protection provided (reference [9]). The 1601 elevation in combination with the flood storage in the Rafferty-Alameda Project was selected as the preferred alternative for the USACE Souris River Project.

Although these existing dams are operated to reduce flooding in the downstream areas, they were only partially able to reduce the peak flood flow for the June 2011 flood of record. Additional upstream flood storage would be needed to meet the Project's need. This additional flood storage could be acquired by implementing either a major structural approach or a non-structural approach at one or more of the existing dams. Alternately, upstream flood storage capacity could be increased by constructing an entirely new storage basin. Each of these approaches is discussed in the following sections.



Barr Footer: ArcGIS 10.4, 2016-09-09 13:57 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-17 - Upstream Flood Storage Alternatives.mxd User: jrv

Project Area
Upstream Dam
Provincial/State Boundaries
County Boundary

0 7.5 15 30
Miles

Figure 2-17

UPSTREAM FLOOD STORAGE ALTERNATIVES
Mouse River Enhanced Flood Protection Project

2.2.1.1 Operational Modifications of Existing Dams

Non-structural alternatives for creating additional upstream flood storage to meet the Project needs, including protection to 27,400 cfs, would involve modifying the operating plans of the Rafferty, Boundary, Alameda, or Lake Darling Dam. This could be done in one of two ways:

1. Drawing down the reservoir pool levels further in the spring prior to runoff - a significant part of the flood storage capacity at these four dams comes from drawing down the pool level over the winter in anticipation of storing the spring runoff from snowmelt and coincidental rainfall. Additional storage could be gained by further drawing down the pool levels during the winter months.

2. Increasing the reservoir releases during flood events - strategically targeting higher levels of discharge during non-major flood events could create extra storage capacity in these reservoirs so that the flood storage could be more effectively used to reduce the peak flows from larger, infrequent events such as the 2011 flood of record.

Operational modification alternatives and their advantages and disadvantages are summarized in Table 2-2 and discussed further below.

Table 2-2 Alternatives Evaluated for Operational Modifications of Existing Dams

Location	Alternative	Effectiveness	Cost	Socio-Economic/Political Considerations	Natural Resource Considerations
Rafferty Dam, Boundary Dam, Alameda Dam, & Lake Darling	Further draw-down prior to spring runoff	Minimal effectiveness for the flood of record, but may reduce peak flows downstream during flood events of lower magnitude; only effective for runoff events upstream of the dams	Less than $100,000	Requires extensive international negotiations; restricted by existing reservoir purposes	May impact adequacy of water levels to support downstream refuge habitat objectives
	Increasing reservoir releases during flood events below 5,000 cfs			Requires extensive international negotiations; restricted by existing reservoir purposes; may cause increased downstream flood impacts during non-major flood events or when runoff occurs downstream of the dams	May impact adequacy of water levels to support downstream refuge habitat objectives

The potential benefits of additional spring drawdown or increased reservoir releases during non-major flood events would include reduced peak flows and reduced frequency and risk of major flood events in downstream areas. Operational modifications have the further benefit of being a relatively low cost

option. A significant drawback, however, is that if the flood runoff comes from a part of the drainage basin that is not controlled by the dams, the additional storage might not effectively reduce peak flows and could, in some situations, increase peak flows. The likely effectiveness of a spring drawdown is further limited by the possibility that the extra flood storage could already be filled to capacity when additional flooding occurs.

The effectiveness of a spring drawdown is also limited by the need to ensure that the reservoir pool will refill to the designated levels so that other project purposes, particularly supplying water in Canada, can be met. In addition, adequate water levels are critical in maintaining the natural resource conservation and habitat creation objectives of these dams can be attained, especially the Lake Darling Dam.

Alternatives involving the release of larger flows from the dams during flood events face significant challenges as they could result in additional undesired flood damages downstream. One of the current key factors in determining dam releases during a flood is to keep the target flow of the Souris River at Minot at or below 5,000 cfs, which is the design flow for the existing USACE flood risk-reduction projects from Burlington through Sawyer. At flows higher than 5,000 cfs, potential damages could occur in the developed areas downstream of Burlington. To achieve any higher levels of discharge during a flood so that the flood storage could be more effectively used to reduce the peak flows from larger floods, additional local measures from Burlington through Sawyer and on other reaches of the river in both the U.S. and Canada would be required.

Most importantly, effectively addressing the Project objectives through operational modifications at the existing dams would require challenging and time-consuming renegotiation of the existing international agreement. Changes to the water supply and habitat/wildlife objectives of the Souris River Basin would require significant compromises by many US and Canadian agencies.

Modifying dam operations would only be effective in reducing risks of floods from rainfall events upstream of the dams; as such, these alternatives do not meet the current Project objectives. Because of the political challenges and ineffectiveness to meet the Requester's desired objectives, these alternatives have not been carried forward for further evaluation as part of this EIS.

The International Souris River Board is currently preparing a Plan of Study to review upstream dam operations for flood conditions. In addition, the USACE is conducting a feasibility study to assess the Souris River Basin's flood risk reduction features. These studies could potentially lead to recommended modification of the basin's dam operations and to the reservoirs, levees, and channels. Any changes in operations would be taken into consideration when planning and designing future Project phases that have not yet been constructed.

2.2.1.2 Structural Modifications of Existing Dams

Additional upstream flood storage could be established by making structural modifications to the existing Rafferty, Alameda, or Lake Darling dams to increase their storage capacity. Additional flood storage at the Alameda and Rafferty dams would require major modifications to raise the dam embankments, as well as

modifications to the spillway and operating gates. Constructing additional storage at the Lake Darling Dam would involve raising dam embankments.

Structural modification alternatives and their advantages and disadvantages are summarized in Table 2-3 and discussed further below.

Table 2-3 Alternatives Evaluated for Structural Modifications of Existing Dams

<table>
<tr><th>Location</th><th>Alternative</th><th>Effectiveness</th><th>Cost</th><th>Socio-Economic/Political Considerations</th><th>Natural Resource Considerations</th></tr>
<tr><td>Rafferty Dam</td><td>Raise dam embankments, modify spillway and operating gates</td><td rowspan="3">Minimal effectiveness for the flood of record, but may reduce peak flows downstream during flood events of lower magnitude; only effective for runoff events upstream of the dams; minor reduction of impacts for 2011 flood levels</td><td rowspan="3">$200-700 million (reference [10])</td><td rowspan="2">Land acquisition/displacement concerns, international coordination considerations</td><td rowspan="2">Habitat loss</td></tr>
<tr><td>Alameda Dam</td><td>Raise dam embankments, modify spillway and operating gates</td></tr>
<tr><td>Lake Darling Dam</td><td>Raise dam embankments</td><td>Land acquisition/displacement concerns, recurring agricultural losses</td><td>Habitat loss, conflicts with USFWS refuge goals</td></tr>
</table>

In general, the ability of the alternatives identified in Table 2-3 to effectively meet the Project need correlates with the magnitude of additional storage capacity constructed. In order to achieve the desired levels of flood risk reduction, major modifications would be needed. These modifications would result in large capital expenditures, would require significant amounts of land, and would present potentially substantial social and political challenges.

The potential benefits of structural modifications to these existing dams would be to reduce both localized peak flows as well as the frequency and risk of major flood events in the downstream areas. A significant drawback in terms of overall effectiveness, however, is that if the flood runoff comes from a part of the drainage basin that is not controlled by the dams, the additional storage might not be effective in reducing system-wide peak flows.

Constructing additional flood storage at the Alameda and Rafferty dams presents a number of cost, resource-impact, and political challenges. Because the structural modification alternatives would require major construction to modify the existing dam infrastructure, these projects would most likely be very

expensive. Constructing additional flood storage would require acquisition of additional lands to be periodically flooded by the larger reservoir pool, causing environmental and social impacts when current land uses (habitat, housing, etc.) are displaced.

Most importantly, the Alameda and Rafferty structural modification alternatives would require coordination, cooperation, and funding agreements between the U.S. and Canada. As a result, a modification project would have to meet both Canadian and U.S. interests and meet both countries' federal standards for economic justification. Because the majority of the benefits of the additional flood storage would accrue to areas within the U.S., the project would not likely meet Canadian standards for economic justification.

Constructing additional flood storage at the Lake Darling Dam would present a number of similar cost and resource-impact challenges, as discussed in a 2012 design charrette conducted by the USACE. Like the structural modification alternatives for the Alameda and Rafferty dams, major modification of the existing Lake Darling Dam infrastructure would likely cost hundreds of millions of dollars. As noted in Section 2.2.1, the existing Lake Darling Dam was modified as part of the USACE Souris River flood risk-reduction project in the 1990s to provide additional storage and operational control of floods and was to be operated in coordination with the upstream Rafferty and Alameda projects. The existing maximum flood pool level was chosen after extensive planning efforts, and a number of alternatives were considered in the environmental review process (USACE, 1985). Adverse environmental and social impacts, large land-acquisition requirements, and compatibility issues with the existing USFWS refuge management plans were deemed prohibitive at higher flood pool levels.

Due to the significant challenges identified above, none of the structural modification alternatives are presently considered viable and these alternatives have not been evaluated further in this EIS. However, these alternatives may be reconsidered in close collaboration with Canadian partners for viability in future Project phases.

2.2.1.3 Construction of New Storage

Additional flood storage capacity could be provided by constructing new dams upstream in Canada or in the U.S. In Canada, new storage could be constructed along the Souris River or Moose Mountain Creek. New storage in the U.S. could be constructed along the Souris River or the Des Lacs River upstream of Burlington.

New storage alternatives and their advantages and disadvantages are summarized in Table 2-4 and discussed further below.

Table 2-4 Alternatives Evaluated for Construction of New Storage

Location	Alternative	Effectiveness	Cost	Socio-Economic/Political Considerations	Natural Resource Considerations
Canada: Souris River or Moose Mountain Creek	Construct new dams on Souris River or Moose Mountain Creek	Reduced peak flows; reduced frequency and risk of major flood events in the downstream areas	$200-300 million	Land acquisition/ displacement concerns, international coordination considerations	Habitat loss
United States: Souris River	Construct dam at Burlington, Baker Bridge, or Confluence sites			Land acquisition/ displacement concerns; ongoing public opposition	Habitat loss, conflicts with USFWS refuge management plans
United States: Des Lacs River	Construct dam upstream of Burlington	Control over very small part of the total upstream watershed	$30-40 million (reference [10])	Land acquisition/ displacement concerns	Habitat loss

In general, the alternatives identified in Table 2-4 could potentially meet the Project need, but similar to the case with structural modifications at existing dams, would require large capital expenditures and the acquisition of large tracts of land, and would present potentially insurmountable social and political challenges.

Potential new dams in Canada on the Souris River or Moose Mountain Creek would present the same challenges as structural modifications to Alameda or Rafferty dams, except that the new sites could be more costly, have greater adverse environmental and social impacts, and require greater land acquisitions. Furthermore, construction of new storage capacity in Canada would require coordination, cooperation, and funding agreements between the U.S. and Canada.

As with operational or structural modifications at any of the existing Canadian dams, construction of a new dam would be governed by an international treaty. As a result, any new dam project would have to meet both Canadian and U.S. interests and comply with both countries' federal standards for economic justification. Because the majority of benefits of the additional flood storage would accrue to areas within the U.S., a new dam project would not likely meet Canadian standards for economic justification.

Similarly, flood storage at new dams in the United States could be quite costly, have greater adverse environmental and social impacts, and require greater land acquisitions than structural modification of existing dams. Furthermore, new dam alternatives in the U.S. were previously evaluated and were determined to be unsuitable due to cost and political and social challenges (USACE, 1985). The Baker

Bridge and the Burlington and Confluence dams on the Souris River were all previously evaluated as part of USACE's EISs for the Burlington Dam and the Lake Darling flood control project.

The Baker Bridge site was reviewed and dismissed due to the limitations on the total volume of water that could be accommodated at this site and the unacceptable impacts to USFWS refuge lands. The Confluence site was dismissed due to high costs and the significant highway and railroad relocations that would have been required. The Burlington site was recommended by USACE and authorized by Congress as a single-purpose flood storage site to be combined with other downstream project features that would provide flood risk reduction for the Souris River Valley. Due to the extreme controversy surrounding the Burlington Dam, however, Congress directed the USACE to stop design and de-authorized the project, recommending in its place flood storage in the Lake Darling, Rafferty, and Alameda dams. This recommendation was ultimately implemented.

New dam sites on the Des Lacs River could also be considered for flood storage, although challenges exist similar to those at the sites on the Souris River. A major drawback is that the Des Lacs River is a tributary to the Souris River and only controls a relatively small part of the total upstream watershed. The contribution of the Des Lacs to the June 2011 flood peak was not significant, and additional storage on the Des Lacs would not have reduced the 2011 flood peak. That being the case, it is not a viable option for meeting the Project objectives.

Due to the significant challenges identified above, none of the new dam construction alternatives have been evaluated further in this EIS.

2.2.2 Diversion Channel Alternatives

Diversions of flood flows upstream of flood-prone areas can be an effective way to reduce the risk of flood damages. There are two basic concepts of diversions that would meet the project need for the Souris River Valley:

- Diversions from upstream of Lake Darling that would reduce flood flows along the entire U.S. reach of the Souris River.
- Local site diversions that would reduce flood flows and levels along specific reaches of the river.

Several potential diversion channel alternatives following these two basic concepts have been identified and are discussed further below.

2.2.2.1 Major Upstream Diversions

Creating a major upstream diversion channel to meet the Project need would involve diverting high flows from the Souris River starting from a location between the Lake Darling dam and the Canadian border. Flows would then be diverted easterly to re-enter the Souris River downstream of Minot, likely somewhere between Towner and the Canadian border. The two locations where such a diversion could be accomplished are immediately south of the Canadian border (49th Parallel alternative) and at the Lake Darling Dam Reservoir (Lake Darling alternative), as shown in Figure 2-18.

Both major upstream diversion alternatives would provide flood-reduction benefits to the majority of damage-prone locations along the Souris River in the U.S. but would be high cost projects with sizeable adverse social and environmental impacts. These two alternatives and their advantages and disadvantages are summarized in Table 2-5 and discussed further below.

Table 2-5 Major Upstream Diversion Alternatives

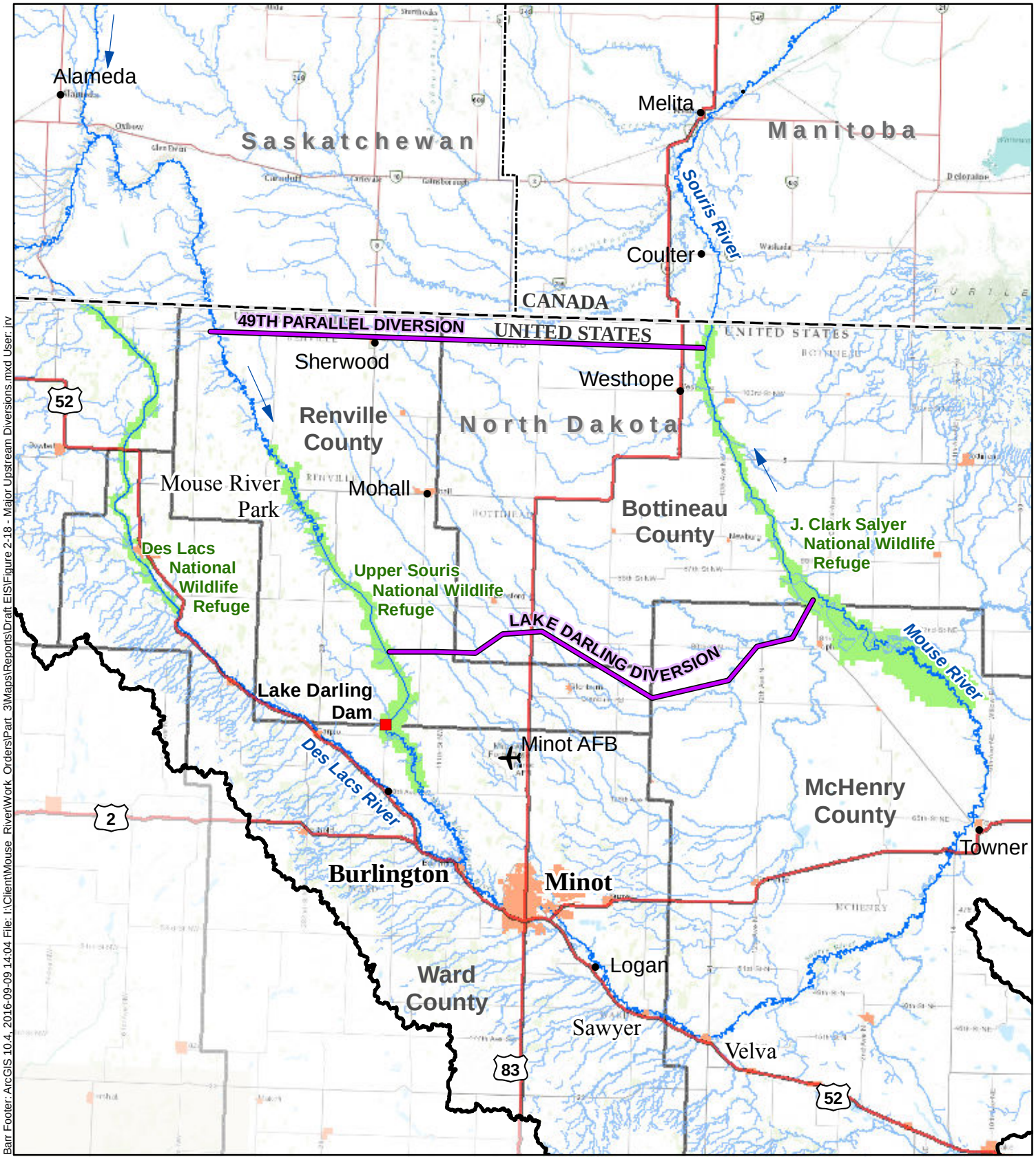
Location	Alternative	Effectiveness	Cost	Socio-Economic/Political Considerations	Natural Resource Considerations
Immediately south of and parallel to the Canadian border	49th Parallel Diversion	Diversion designed to pass up to 22,400 cfs, which would help Minot with keep peak flows at or below 5,000 cfs for floods originating on the upper Souris River	$2-8 billion	Large land requirements, high cost for excavation	Habitat loss, surface and groundwater impacts along alignment
Lake Darling Reservoir, Spring Coulee, Deep Creek, and Souris River in Bottineau County	Lake Darling Diversion		$3-8 billion (reference [10])	Large land requirements, high cost for excavation and pump operation	Habitat loss, surface and groundwater impacts along alignment, conflicts with USFWS refuge management plans

49th Parallel Diversion

The 49th Parallel Diversion alternative would divert Souris River high flows by way of a diversion channel located just south of and parallel to the Canadian border. The diversion channel would begin near Sherwood and terminate near Westhope, thereby diverting high flows upstream of Souris River Park and downstream of J. Clark Salyer NWR.

Several diversion plans using the 49th Parallel alternative alignment have been studied in the past (also referred to as Sherwood to Westhope Diversion and Boundary Diversion). The Burlington Dam EIS considered this diversion, but found it economically infeasible due to the extent and cost of required excavation. Because of its environmental, social, and economic disadvantages, the 49th Parallel Diversion alternative was not given further consideration in the Burlington Dam EIS.

Previous studies indicate that a 49th Parallel Diversion was designed to pass up to 22,400 cfs and would help Minot with keeping peak flows at or below 5,000 cfs for floods originating on the upper Souris River. In order to accommodate this, a diversion channel would require a top width of about 516 feet and an average bottom width of 60 feet. The channel would parallel the Canadian border for a distance of about 45 miles. (USACE, 1985).



Barr Footer: ArcGIS 10.4, 2016-09-09 14:04 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-18 - Major Upstream Diversions.mxd User: jrv

Major Upstream Diversions
Mouse/Souris River Watershed
Provincial/State Boundaries
National Wildlife Refuges
County Boundary
Flow Direction

0 6 12 24
Miles

Figure 2-18

MAJOR UPSTREAM DIVERSIONS
Mouse River Enhanced Flood Protection Project

Although the diversion would protect Minot, the channel inlet would cause other undesirable flooding impacts, including backwater effects and flooding in Saskatchewan, as well as increased peak flows in the lower end of the J. Clark Salyer NWR and in Manitoba. Furthermore, the diversion channel would affect normal surface and groundwater flow-patterns.

Constructing the 49th Parallel Diversion channel would also require about 2,800 acres of land. Disposing of the excavated material would require a strip 1,200 feet wide along the entire channel length on one side, resulting in an area of 6,500 acres of land. Disturbed lands would primarily include agricultural and prairie areas, and numerous roadways and farm operations would be affected as well.

Due to the significant challenges identified above, the 49th Parallel Diversion alternative is not considered viable and this alternative has not been evaluated further in this EIS.

Lake Darling Diversion

The Lake Darling Diversion alternative would involve constructing a pump station and diversion channel at the Lake Darling Reservoir. Flows would be diverted east to discharge into Spring Coulee, which would in turn discharge into Deep Creek before eventually returning to the Souris River in Bottineau County. Conveying flow through both Spring Coulee and Deep Creek would require the construction of new, larger channels as these waterways currently do not have the capacity required to convey 22,400 cfs. In addition, pumping 22,400 cfs would require construction of a pump station larger than the presently largest pump station in the world, which was constructed by the USACE in New Orleans at a cost of $500 million to convey 19,000 cfs of flow.

In order to accommodate 22,400 cfs, the Lake Darling Diversion channel requires the same cross section as the 49th Parallel alternative; a top width of about 516 feet and an average bottom width of 60 feet. The Lake Darling alternative would be approximately 44 miles long, requiring 2,750 acres of land. Disposing of the excavated material would likewise require a strip 1,200 feet wide along the entire channel length on one side, resulting in an area of 3,400 acres of disturbed land.

Significant land requirements, excavation and disposal of excavation material, groundwater impacts along the alignment, and increased peak flows in the lower end of the J. Clark Salyer NWR and in Manitoba would also accompany this diversion channel alternative.

The Lake Darling Diversion would face many of the same challenges raised by a diversion along the 49th Parallel. A Lake Darling Diversion was determined to be economically infeasible due to the costs of excavation and ongoing electricity requirements for pump operation. Due to these significant challenges the Lake Darling Diversion alternative is not considered viable and this alternative has not been evaluated further in this EIS.

2.2.2.2 Local Site Diversions

Four local site diversions have been considered in previous studies as options to reduce flood risks within targeted areas of the Burlington through Minot reach of the Souris River (USACE, 1977; USACE 1985). Local site diversion alternatives would involve constructing high-flow diversion channels located close to

certain flood-prone areas targeted for flood risk reduction. The four locations considered for local site diversions include a diversion channel on the north side of Minot (Minot North alternative), a diversion channel on the south side of Minot (Minot South alternative), a tunnel beneath Minot (Minot Tunnel), and diversion of Des Lacs River high flows via a tunnel to the Burlington Dam (Des Lacs Tunnel), as shown in Figure 2-19.

While local site diversion alternatives would provide effective flood protection to specific targeted areas, these diversions would have to be combined with other alternatives to meet the Project's need to reduce risks for the entire study reach. In general, these local site diversions raise challenges similar to those of major upstream diversions (high costs, large land requirements, significant excavation/disposal requirements, etc.), but on a smaller scale. The local site diversion alternatives and their advantages and disadvantages are summarized in Table 2-6 and discussed further below.

Table 2-6 Local Site Diversion Alternatives

<table>
<tr><th>Alternative</th><th>Effectiveness</th><th>Cost</th><th>Socio-Economic / Political Considerations</th><th>Natural Resource Considerations</th></tr>
<tr><td>Minot North</td><td>Reduced flood damage risks from Burlington through most of Minot; would not reduce risks along the Souris River downstream of Twenty-Seventh Street SE</td><td rowspan="2">$3-4 billion</td><td rowspan="2">Significant land acquisition requirement and relocations</td><td rowspan="2">Habitat loss, surface and groundwater impacts along alignment</td></tr>
<tr><td>Minot South</td><td rowspan="2">Reduced flood damage risks through Minot; would not reduce risks along the Souris River upstream or downstream of Minot</td></tr>
<tr><td>Minot Tunnel</td><td>Greater than $5 billion</td><td>Significant infrastructure requirement</td><td>Unfavorable geologic conditions, groundwater impacts along alignment</td></tr>
<tr><td>Des Lacs Tunnel</td><td colspan="4">Not viable without additional dam storage near Burlington</td></tr>
</table>

Minot North

The USACE Burlington Dam study considered diverting high flows from just upstream of Burlington through a diversion channel that extended to the east and discharged into Livingston Coulee on the north side of Minot. Flows would then re-enter the Souris River just upstream of Twenty-Seventh Street SE in Minot (Figure 2-19).

While the Minot North alternative could reduce flood damage risks from Burlington through most of Minot, it would not reduce risks along the Souris River downstream of Twenty-Seventh Street SE. This alternative would need to be combined with levee and floodwall projects in downstream communities to meet the Project need.

Because the diversion channel route would extend across the upland areas, issues similar to those of other diversion channel routes through the upland areas would exist, including extensive excavation and disposal of excavation material, groundwater impacts along the alignment, environmental and social impacts, large land requirements through highly developed and developable areas, and high cost. A diversion channel large enough to accommodate flows similar to those of the 2011 flood would require excavating a 14.4-mile-long channel more than 200 feet deep through upland, creating a large ravine that would be between 0.3 mile and 0.7 mile wide, with excavation quantities in the range of 230-330 million cubic yards of soil. Initial cost estimates are in the $3 to 4 billion range. Due to these challenges the Minot North Diversion alternative is not considered viable and this alternative has not been evaluated further in this EIS.

Minot South

The USACE Burlington Dam study considered diverting high flows from just upstream of Minot through a diversion channel around the south side of the city and re-entering the Souris River downstream of the city (Figure 2-19).

While this alternative could reduce flood damage risks through Minot, it would not reduce risks along the Souris River upstream or downstream of Minot. This alternative would need to be combined with levee and floodwall projects in communities outside of Minot to meet the Project need.

Similar to the case with the Minot North Diversion channel, the Minot South route would require extensive excavation, the disposal of excavation material, groundwater impacts, environmental and social impacts, large land requirements, and high cost. Minot South Diversion channel large enough to accommodate flows similar to those of the 2011 flood would require cutting a 10.5-mile-long channel more than 200 feet deep through high ground, creating a large ravine that would be between 0.3 mile and 0.7 mile wide, with excavation quantities in the range of 230-330 million cubic yards of soil. Initial cost estimates are in the $3 to 4 billion range. Due to these challenges the Minot South Diversion alternative is not considered viable and this alternative has not been evaluated further in this EIS.

Local Site Diversions

Municipalities

County Boundary

0 6,500 13,000 26,000

Feet

Figure 2-19

LOCAL SITE DIVERSIONS
Mouse River Enhanced Flood Protection Project

Bar Footer: ArcGIS 10.4, 2016-09-09 14:05 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-19 - Local Site Diversions.mxd User: jrv

Minot Tunnel

The USACE Burlington Dam EIS studied a Minot Tunnel on the south side of the Souris River. The Minot Tunnel would include a 2.2-mile long, 31-foot or more diameter diversion tunnel beneath Minot with a capacity of 9,000 cfs. Combined with the 5,000 cfs capacity channel enlargement project through Minot, the Minot Tunnel could provide Minot protection to 14,000 cfs. The amount of land that would be lost due to channel enlargement excavation was estimated to be about 212 acres. Additional lands would be affected by disposal of the excavated channel and tunnel materials. The major adverse impacts attributed to this alternative were associated with the disposal of excavated material, downstream channel modifications, an impoundment area immediately upstream of Minot, and local cost sharing requirements. This alternative was determined to be not economically feasible, to have notable adverse impacts, and to not have local support. It was not pursued further in the USACE Burlington Dam EIS.

In order to accommodate flows similar to those of the 2011 flood of record, it is estimated that two 36-foot diameter circular concrete tunnels would be required. Figure 2-19 shows an approximate alignment for a Minot Tunnel capable of addressing the Project purpose. An initial assessment of the tunnel project's feasibility indicates that the soft soil material in the project area would make tunnel construction extremely challenging, if not infeasible. Project costs for somewhat shorter and less challenging tunnel projects have been identified in the $3 to 5 billion range. The Minot Tunnel would be bigger and longer, with more challenging construction conditions. Costs in excess of $5 billion would be anticipated.

Furthermore, the downstream Souris River channel would need to be enlarged to prevent backwater effects in Minot. Downstream channel enlargement was estimated to require a channel bottom width of 105 feet.

Due to these challenges, the Minot Tunnel alternative is not considered viable, and this alternative has not been evaluated further in this EIS.

Des Lacs Tunnel

As part of the USACE Burlington Dam Project, a diversion of high flows from the Des Lacs River via a tunnel into the proposed flood pool of the Burlington Dam was evaluated. The Des Lacs River is a tributary to the Souris River at Burlington. As such, diverting the flood flows from the Des Lacs River into the Burlington dam flood pool could achieve greater control of the tributary's upstream drainage area. This alternative, however, could only meet the Project need in conjunction with a major dam for flood storage on the Souris River at the Burlington Dam site. Due to the challenges associated with the upstream flood storage at Burlington that would be required to make the Des Lacs Tunnel alternative a viable option for meeting the Project need, this alternative has not been evaluated further in this EIS.

2.2.3 Design Alternatives

Within the project area a number of design alternatives have been considered in select areas to meet the Project need while minimizing costs and impacts. Two basic design alternative concepts were considered in this alternatives analysis:

1. High-flow bypasses

2. Channel modifications/realignments

Several potential design alternatives following these two basic concepts have been identified and are discussed further below.

2.2.3.1 High-Flow Bypasses

High-flow bypasses cut flow off from river loop sections during major flood events and could be used as a component of a levee and floodwall system to divert flood flows, reducing flood risk to certain areas. Because high-flow bypasses are designed to only be used during high flows, normal river flows stay in the existing river channel. This approach can reduce the need for modification to the existing river corridor and adjacent land, thereby reducing project impacts and costs. Preliminary engineering studies have determined that these types of diversions would be applicable in only a few locations which are discussed further below.

Ramstad/Lincoln Neighborhood Design Alternatives

Three alternatives were considered for the Ramstad/Lincoln neighborhood of Minot to provide enhanced flood risk reduction for the design flow of 27,400 cfs. These alternatives include two high-flow bypasses (Lincoln High-Flow Bypass alternative and Maple Avenue High-Flow Bypass alternative) and one alignment alternative (Ramstad Alignment) as shown on Figure 2-20. More detailed information on these alternatives is in Appendix I of the Preliminary Engineering Report (reference [1]).

While each alternative provides a comparable level of flood risk reduction, the two bypass alternatives result in a smaller project footprint, less extensive levees, fewer pump stations, fewer closure structures, and fewer residential properties affected, as compared to the Ramstad Alignment. These alternatives and their advantages and disadvantages are summarized in Table 2-7 and discussed further below.

Table 2-7 Ramstad Lincoln Neighborhood Alternatives

Alternative	Effectiveness	Cost	Engineering Considerations	Properties Impacted	Dwellings Impacted(2)	River Channel Impacted (feet)	Wetlands Impacted (acres)
Lincoln Bypass	Meets Project purpose(1)	$125 million	Moderate	168	129	200	2.33
Maple Ave Bypass (Requester's Preferred Alt.)		$110 million		132	82	200	1.27
Ramstad Alignment		$130 million		264	173	0	18.50

(1) Indicates an alternatives ability to meet the Project purpose in conjunction with other flood risk reduction features
(2) Impacted dwellings include single family residences and mobile homes.

Lincoln High-Flow Bypass

The Lincoln High-Flow Bypass alternative would consist of a high-flow bypass and flanking levees along the north side of the existing Canadian Pacific and Burlington Northern Santa Fe railroad embankments from the area near Tenth Street SW and Second Avenue SW, extending east to the Broadway bridge. Two river-closure structures would be located on the Souris River: one near the intersection of Tenth Street SW and Second Avenue SW, and one just upstream of the Broadway bridge.

Maple Avenue High-**Flow Bypass (Requester's Preferred Alternative)**

The Maple Avenue High-Flow Bypass alternative is included as part of the Requester's Preferred Alternative. This alternative would consist of a high-flow bypass and flanking levees starting along the south side of the existing Canadian Pacific Railroad embankment near Second Avenue SW, extending through Moose Park and the old Magic City Lumber property, crossing the Canadian Pacific tracks west of the Sixth Street SW underpass, then following the same alignment as the Lincoln High-Flow Bypass, extending east to the Broadway bridge. Two river-closure structures would be located on the Souris River: one just upstream of the existing Canadian Pacific railroad bridge near Second Avenue SW, and one just upstream of the Broadway bridge.

Ramstad Alignment (Existing River Alignment with No Diversion)

The Ramstad Alignment would consist of flood risk-reduction features along the existing river channel between Second Avenue SW and the Broadway bridge. The Ramstad Alignment configuration consists primarily of levees, floodwalls, and channel modifications set farther back from the river than the existing flood control system to accommodate the design flow of 27,400 cfs with three feet of freeboard. This alternative would require the most road closure structures, and there is insufficient space to construct the levee without land acquisition and impacts to historic structures.

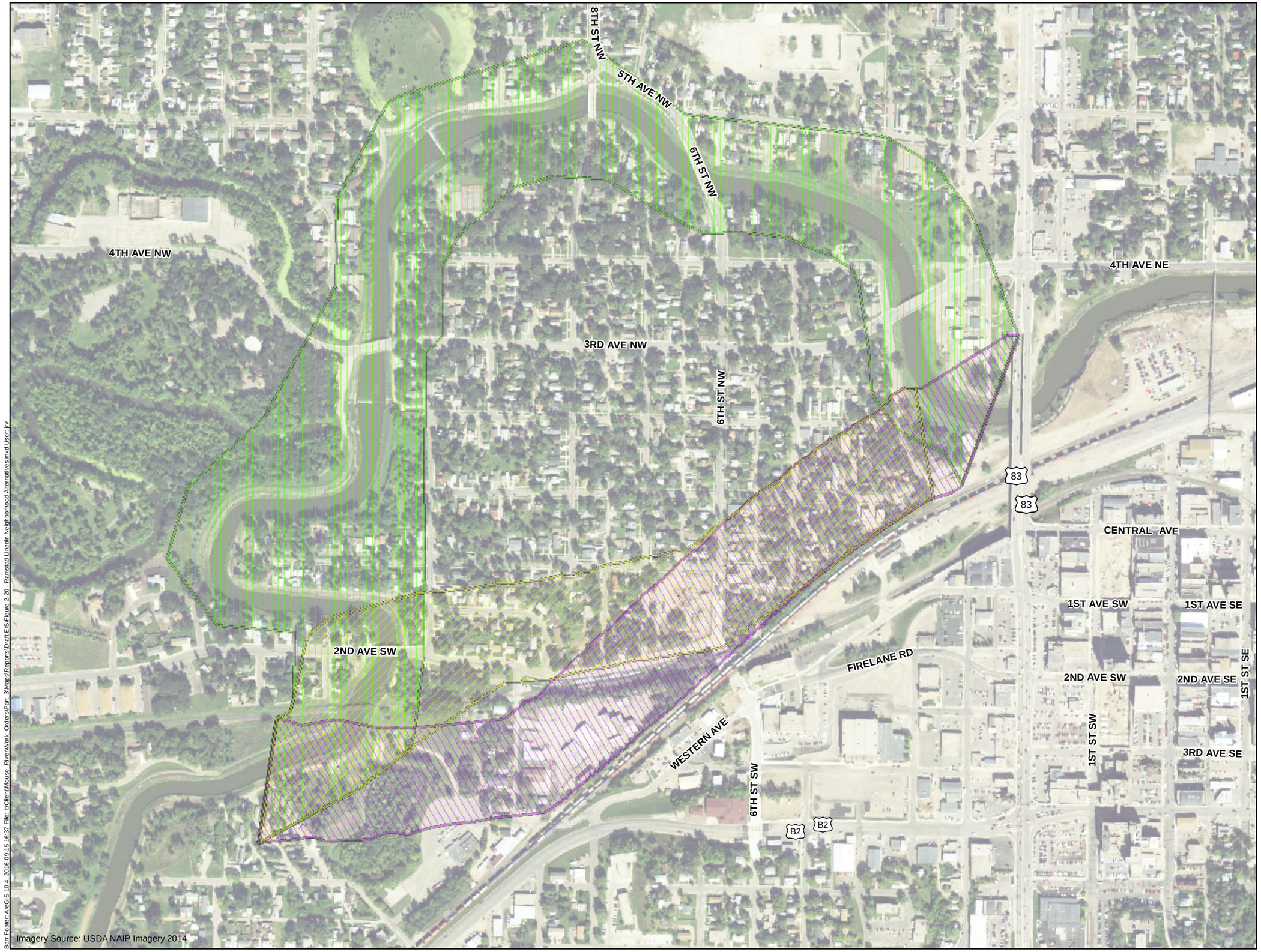
Comparison of Ramstad Lincoln Neighborhood Alternatives

Either the Lincoln or Maple Avenue bypass could be used for high-flow conditions only. During normal flow conditions, Souris River flows would be conveyed through the river closure structures within the existing main river channel, potentially allowing the bypass channels to be used for recreational purposes in non-flood times. During periods of flooding, the existing river channel and levee system could remain in place and provide protection up to 5,000 cfs. As water levels rise above a predetermined level (e.g., above 3,000 cfs), however, the river closure structures would be engaged and all flow would be diverted through the high-flow bypass channel.

The Lincoln and the Maple Avenue bypass alignments both result in a smaller project footprint, less extensive levees, fewer pump stations, fewer closure structures, and fewer residential properties to be acquired within the Project footprint as compared to the Ramstad Alignment. The two diversions were sized and designed to result in upstream water surface levels that are essentially the same as those estimated for the Ramstad Alignment.

At a public meeting on January 31, 2012, the Minot City Council selected the Maple Avenue High-Flow Bypass as the preferred alignment for the Project due to overall lower impacts to properties in the area as

well as lower wetland impacts. This feature is now incorporated as part of the Requester's Preferred Alternative.



Maple Avenue High-Flow Diversion

Lincoln High-Flow Diversion

Ramstad Alignment

0 225 450 900

Feet

Figure 2-20

RAMSTAD LINCOLN NEIGHBORHOOD ALTERNATIVES
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4 2016-09-15 16:37 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-20 - Ramstad Lincoln Neighborhood Alternatives.mxd User: jrv

Twenty-Seventh Street High-Flow Diversion Alternatives

Three configuration alternatives were considered for a high-flow diversion at Twenty-Seventh Street SE to provide enhanced flood risk reduction for the design river flow of 27,400 cfs. The Twenty-Seventh Street SE High-Flow Bypass would divert flood flows near the west end of El Rio Drive and Twenty-Fifth Street SE along a channel constructed north of the Canadian Pacific Rail line and CHS/Sun Prairie Grain property, eventually extending east across Twenty-Seventh Street SE to reconnect with the existing Souris River channel, as shown on Figure 2-21. River-closure structures would be located on the Souris River south of Souris Court and south of Thirty-First Street SE.

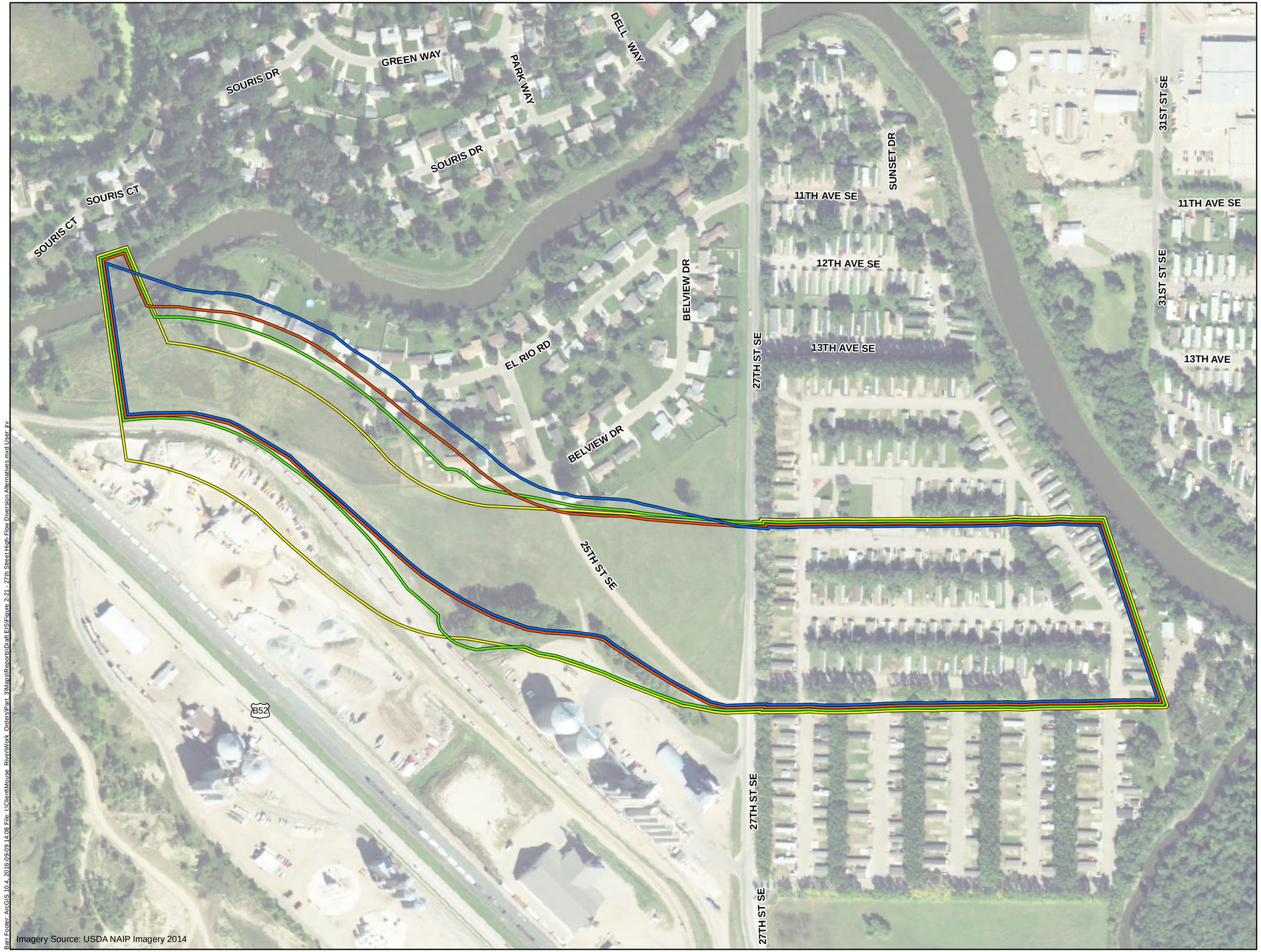
During normal flow conditions, Souris River flows would be conveyed through the river closure structures within the existing main river channel. The current river channel and levee system would remain intact and continue to provide protection. As water levels continue to rise, both closure structures would shut off flows to the existing river channel and divert all flows to the high-flow bypass channel.

Several configuration alternatives were considered for the Twenty-Seventh Street SE High-Flow Diversion. Configuration A was chosen for inclusion in the design of the Requester's Preferred Alternative as it results in the smallest increase in upstream flood levels and the lowest amount of impacts to wetlands. These alternatives and their advantages and disadvantages are summarized in Table 2-8 and discussed further below. More detailed information on these alternatives is in Appendix I of the Preliminary Engineering Report (reference [1]).

Table 2-8 Twenty-Seventh Street High-Flow Diversion Alternatives

Alternative	Effectiveness	Cost	Engineering Considerations	Properties Impacted	Dwellings Impacted(1)	River Channel Impacted (feet)	Wetlands Impacted (acres)
Configuration A (Requester's Preferred Alt.)	Meets Project purpose(2)	$84 million	Moderate	33	99	200	0.06
Configuration B		$82 million	Moderate	28	96	200	0.10
Configuration C		$139 million	Complex	24	94	200	0.10
Southward Shift		$134 million	Complex	22	94	200	0.10

(1) Impacted dwellings include single family residences and mobile homes.
(2) Indicates an alternatives ability to meet the Project purpose in conjunction with other flood risk reduction features



Configuration A
Configuration B
Configuration C
Southward Shift

0 150 300 600
Feet

Figure 2-21

27th STREET HIGH-FLOW DIVERSION ALTERNATIVES
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 14:08 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-21_27th Street High-Flow Diversion Alternatives.mxd User: jrv

Configuration A – (300-Foot-Wide Channel with Levees – **Requester's Preferred Alternative)**

Configuration A for the Twenty-Seventh Street Diversion would consist of a 300-foot wide (top width) channel with levees along both sides of the entire bypass channel. This configuration would provide the smallest increase in upstream flood levels but would have the largest footprint and therefore have the largest direct impact to residential property.

Configuration A was the selected alignment for the Requester's Preferred Alternative at the Twenty-Seventh Street High-Flow Diversion as it results in the least increase in upstream flood levels. Though Configuration B results in a slightly higher increase in upstream flood levels compared to Configuration A, it would require fewer property impacts. During the final design of the Twenty-Seventh Street High-Flow Diversion, further evaluation of Configurations A and B should be conducted to identify opportunities that minimize adverse impacts.

Configuration B (230-Foot-Wide Channel with Levees)

Configuration B is similar to Configuration A, but it is narrower. Configuration B would consist of a 230-foot wide (top width) channel with levees along both sides of the entire bypass channel. The alignment represents the narrowest levee alignment and would have fewer direct property impacts than Configuration A.; however, due to the constricted channel, Configuration B would result in upstream flood levels one to two feet higher than that of Configuration A.

Configuration C (230-Foot-Wide Channel with Floodwalls)

Configuration C represents the narrowest feasible configuration. The 230-foot wide channel is similar to that in plan B while the narrow footprint occupied by the floodwall allows for reduced impacts to adjacent residential and commercial properties. The narrow alignment, however, would result in a slight increase in upstream flood levels and increased construction cost in comparison to Configuration A.

Configuration C's floodwall would run along both sides of the bypass channel, extend from the bypass entrance to approximately Twenty-Seventh Street SE. Levees line both sides of the channel for the remaining alignment. The floodwall configuration on the north side of the channel would consist of a reinforced concrete T-wall. The floodwall configuration on the south side of the channel adjacent to the railroad and railroad spur would consist of a cantilevered sheet pile wall to minimize the excavation and construction footprint of the retaining wall, allowing the wall to be located closer to the rail spur than a T-wall could be. The cantilever floodwall design would require a very stiff combination wall section to minimize the wall deflection and impacts to the adjacent rail spur but would result in a more expensive wall section.

Southward Shift

A shift of the entire diversion alignment to the south to avoid any residential impact was also considered. This shift would, however, affect the CHS/Sun Prairie property and require relocation of a railroad segment. Discussions with CHS/Sun Prairie indicate that this alternative would result in the business being unable to operate at this site. Acquisition, relocation, and site preparation costs for CHS/Sun Prairie to

operate in a new location are expected to be $50 million or more. This configuration was not considered further at this stage due to the substantially higher associated cost.

2.2.3.2 Channel Modifications/Realignments

Channel modifications are generally considered as a way to increase the flow conveyance of a river. Modifications to achieve this can include either making the channel larger by increasing the width or depth or by making the channel shorter through channel straightening or cutting off portions of the channel. The existing USACE's flood risk-reduction project through Minot was primarily a channel modification/enlargement project. Although this type of modification can be effective in lowering water surface levels for the more frequent flood events, it typically has sizeable adverse environmental impacts. A channel modification option that would enlarge the Souris River through the entire stretch of the project area, to the degree that it could handle the 2011 flood flows, would not be considered a viable option due to the extremely high cost and the significant adverse environmental impacts. Minor channel modifications, however, where evaluated in two specific locations, Kings Court and the Burdick Segment. These smaller scale realignments were evaluated in preliminary engineering studies to identify the impacts and gage the practicality of their use

Kings Court

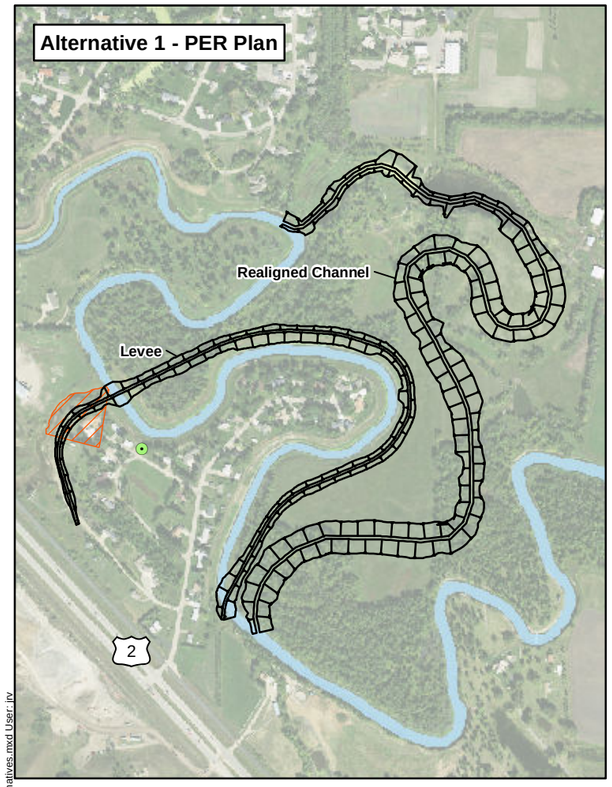
Several channel realignment alternatives considered in the vicinity of the Kings Court subdivision are shown on Figure 2-22. During public meetings, Kings Court residents expressed a strong desire to not lose any subdivision properties. The PER identified a preferred alternative for Kings Court that would realign the existing Souris River channel and construct a new levee on the opposite side of the existing river channel (Barr 2012).

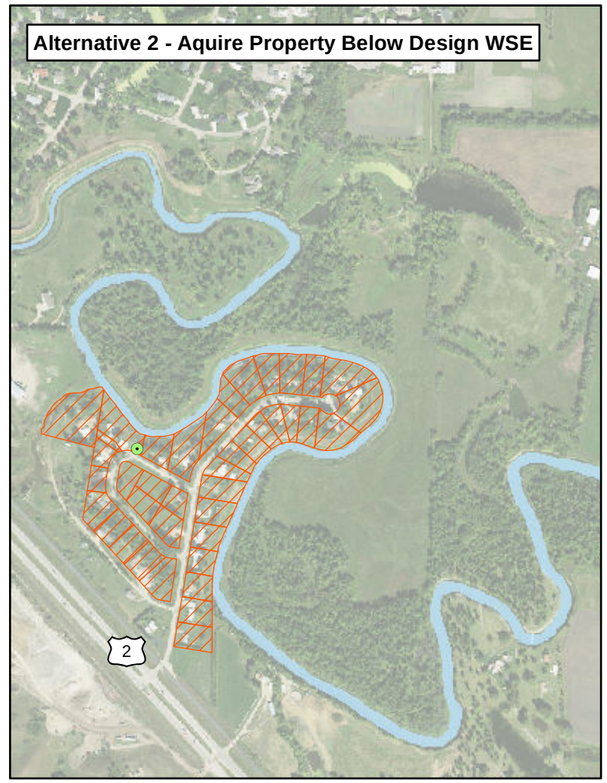
These alternatives and their advantages and disadvantages are summarized in Table 2-9 and discussed further below. . Further detail is provided in reference [11].

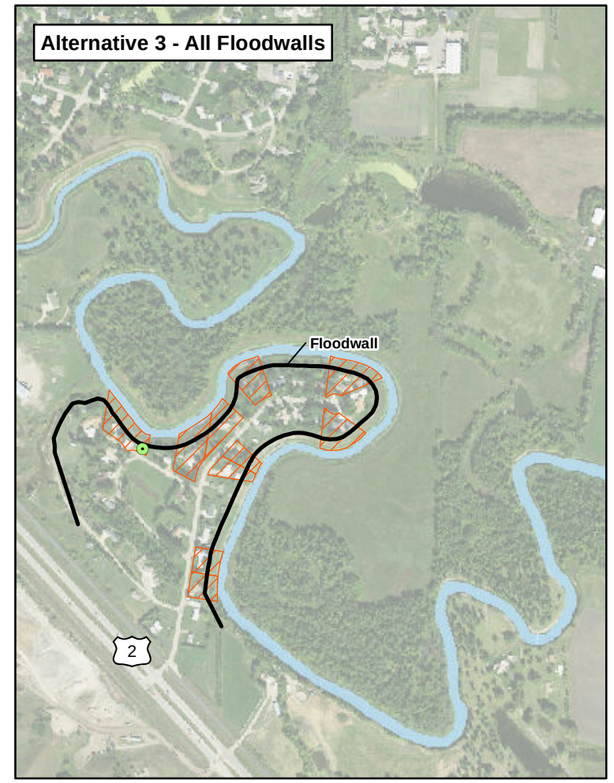
Table 2-9 Kings Court Channel Realignment Alternatives

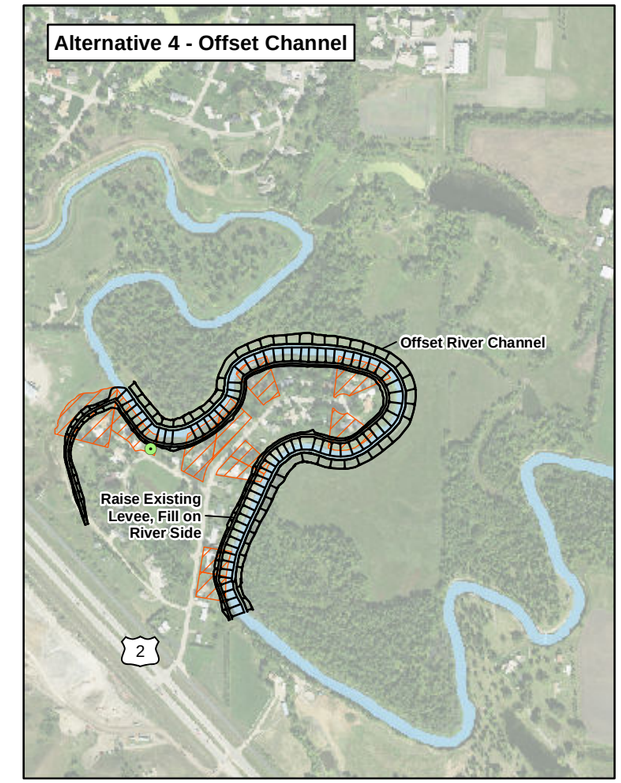
Alternative	Effectiveness	Cost	Engineering Considerations	Properties Impacted	Dwellings Impacted(1)	River Channel Impacted (feet)	Wetlands Impacted (acres)
Alternative 1 (Requester's Preferred Alt.)	Meets Project purpose (2)	$9.1 million	Complex	1	1	6,650	1.0
Alternative 2		$9.8 million	Easy	40	34	0	0
Alternative 3		$20.8 million	Moderate	10	10	0	0
Alternative 4		$11.5 million	Complex	11	11	4,000	5.8
Alternative 5		$8.9 million	Moderate	26	25	0	0
Alternative 6		$10.3 million	Moderate	26	25	0	0
Alternative 7		$16.4 million	Complex	2	2	100	0.6

(1) Impacted dwellings include single family residences and mobile homes.
(2) Indicates an alternatives ability to meet the Project purpose in conjunction with other flood risk reduction features

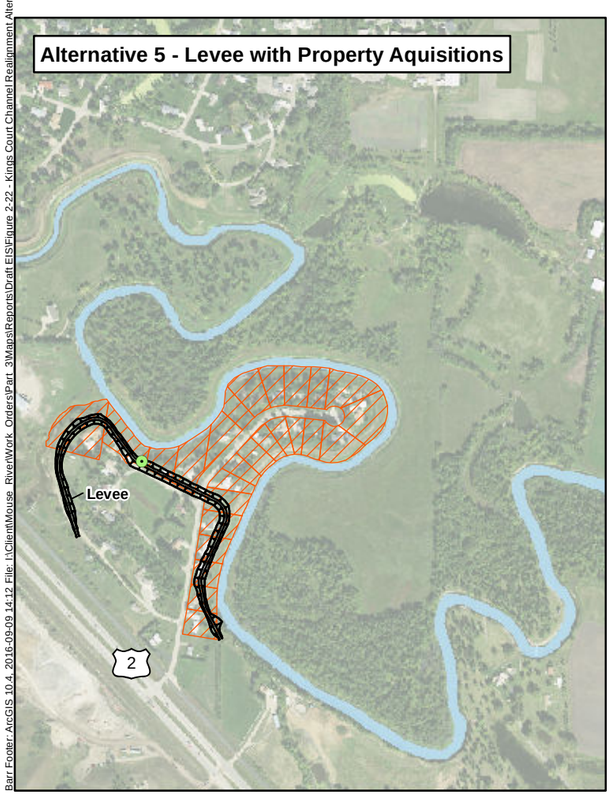


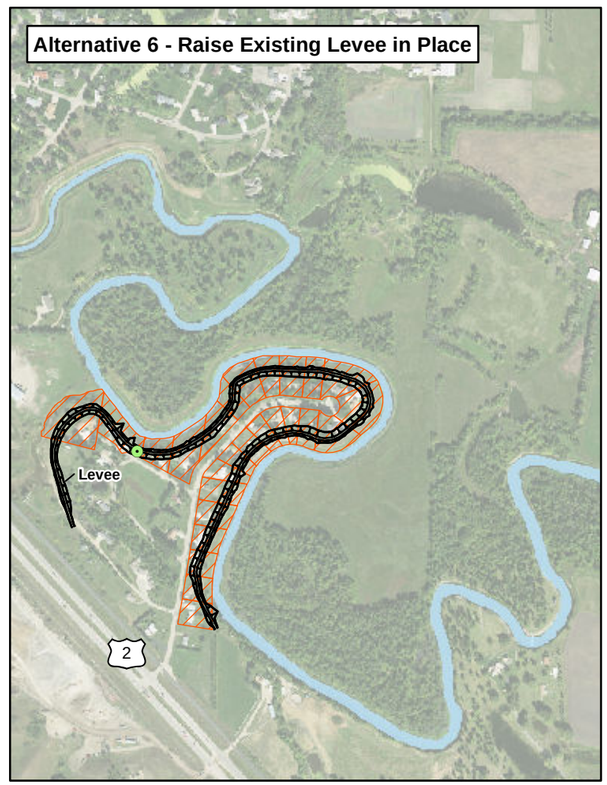


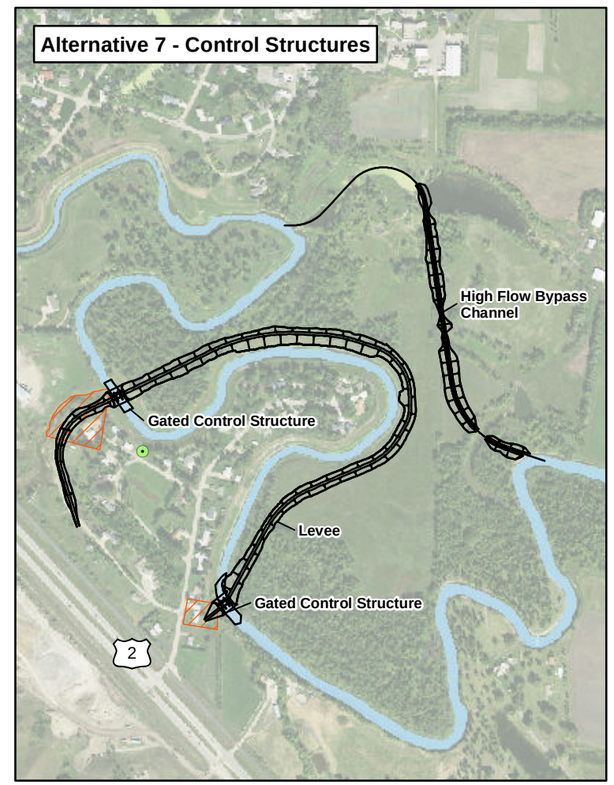




Imagery Source: USDA NAIP Imagery 2014







Flood Control Features

Acquired Property

Approximate Pump Station (Existing)

Mouse River

0 450 900 1,800

Feet

Figure 2-22

KINGS COURT CHANNEL REALIGNMENT ALTERNATIVES
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 14:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-22 - Kings Court Channel Realignment Alternatives.mxd User: jpv

Kings Court Alternative 1 – **PER Plan (Requester's Preferred Alternative)**

Alternative 1 would include realigning approximately 6,650 feet of the Souris River channel northeast of Kings Court. The new channel constructed in Alternative 1 was designed to be approximately 6,650 feet long, maintaining the original channel length through this area. The new channel would also be constructed to approximately the same cross-sectional dimensions as the existing river channel.

The existing levee would be left in place. A new, taller levee would, however, be constructed on the opposite (i.e., northern and eastern) side of the Souris River channel to provide flood risk reduction up to the 2011 event. The levee would be designed to have three feet of freeboard above the design water surface elevation, reducing the risk of flooding for residents of the Kings Court neighborhood. The new levee would cross the existing Souris River channel in two locations creating a dead loop between the levee crossings. Flows through the dead loop would be managed using a gatewell system.

Gatewells on the upstream and downstream sides of the dead loop would provide minimal flow through the dead loops during non-flood conditions, preventing stagnant water. The gatewells would be closed during flood events. The area between the existing and new levees would function as an interior drainage and ponding area. Deficiencies on the existing levee (i.e., garages/sheds built partially on the levee, trees, etc.) would not be addressed as this levee would no longer be the line of protection. Alternative 1 is anticipated to cost $9.1 million, including construction, land acquisition, and easements.

Alternative 1 was selected as the Requester's Preferred Alternative for Kings Court. It requires the fewest residential relocations while also being one of the lower cost alternatives. Any alternative that does not minimize property loss is not expected to meet the objectives of the Project, nor gain support from Kings Court residents. Alternative 1 does, however, have more aquatic impacts than other alternatives evaluated along Kings Court with approximately 6,500 feet of impacted river channel and 1 acre of wetland impacts.

Kings Court Alternative 2 – Acquire Property below the Design Water Surface Elevation

Alternative 2 would include acquiring and removing all Kings Court properties that are located below the design water surface elevation. This alternative would require almost full acquisition of the Kings Court neighborhood, removal of all associated structures, and relocation of residents. Alternative 2 is anticipated to cost $9.8 million, including construction, land acquisition, and easements.

Kings Court Alternative 3 – All Floodwalls

Alternative 3 would include construction of approximately 5,030 feet of floodwall within the existing levee footprint. The top of the floodwall would be located four feet above the design water surface elevation to provide freeboard and overtop protection. It is assumed that this alternative would require the replacement of the gatewell adjacent to the existing pump station. Alternative 3 is anticipated to cost $20.8 million, including construction, land acquisition, and easements.

Kings Court Alternative 4 – Offset Channel

Alternative 4 would include raising approximately 850 linear feet of existing levee in place, fixing the landside toe such that the majority of the center line of the levee is shifted riverside. This results in the majority of the levee being constructed in the existing river channel. To mitigate filling of the river

channel, an offset channel would be constructed on the north and east sides of the new levee. The offset channel would approximately follow the existing channel alignment, maintaining channel length but shifted to a location further away from Kings Court homes. The new channel would be constructed to approximately the same cross-sectional dimensions as the existing river channel. This alternative would require that existing deficiencies be corrected. It is assumed that this alternative would require the replacement of the gatewell adjacent to the existing pump station. Alternative 4 is anticipated to cost $11.5 million, including construction, land acquisition, and easements.

Kings Court Alternative 5 – Levee with Property Acquisitions

Alternative 5 would include construction of approximately 1,800 linear feet of new levee across the southwest portion of Kings Court, raising approximately 850 linear feet of the existing Kings Court levee, and acquiring all properties on the riverside of the levee. It is assumed that this alternative would require the replacement of the gatewell adjacent to the existing pump station. Alternative 5 is anticipated to cost $8.9 million, including construction, land acquisition, and easements.

Kings Court Alternative 6 – Raise Existing Levee in Place

Alternative 6 would include raising approximately 5,000 linear feet of the existing Kings Court levee in place to provide flood protection for the design water surface elevation plus freeboard. The existing levee would be raised on the landside to prevent impacts to the existing river channel, and existing infringements on the levee (i.e., garages/sheds, trees, etc.) would need to be removed. It is assumed that this alternative would require the replacement of the gatewell adjacent to the existing pump station. Alternative 6 is anticipated to cost $10.3 million, including construction, land acquisition, and easements.

Kings Court Alternative 7 – Control Structures

Alternative 7 would include constructing control structures on the upstream and downstream ends of Kings Court and a high-flow bypass channel, approximately 1,850 linear feet, northeast of Kings Court. This alternative would connect with the river channel for flows less than a 2-year event. For flows less than a 2-year event, all flow would pass through the control structures. Under larger events, flows could be divided between the high-flow bypass channel and the control structures. As the flow increases, the gates would be operated to restrict flow into the leveed side of the system.

The existing Kings Court levee would be left in place, Approximately 4,000 linear feet of new levee, however, would be constructed on the opposite (i.e., north and east) side of the Souris River, and approximately 850 linear feet of existing levee would be raised to provide flood protection to the design water surface elevation plus freeboard based on the 2011 event. Deficiencies on the existing levee (i.e. garages/sheds built partially on the levee, trees, etc.) would not be addressed as this levee would no longer be the line of protection. The area between the existing and new levees could function as an interior drainage and ponding area. Alternative 7 is anticipated to cost $16.4 million, including construction, land acquisition, and easements.

Burdick Segment

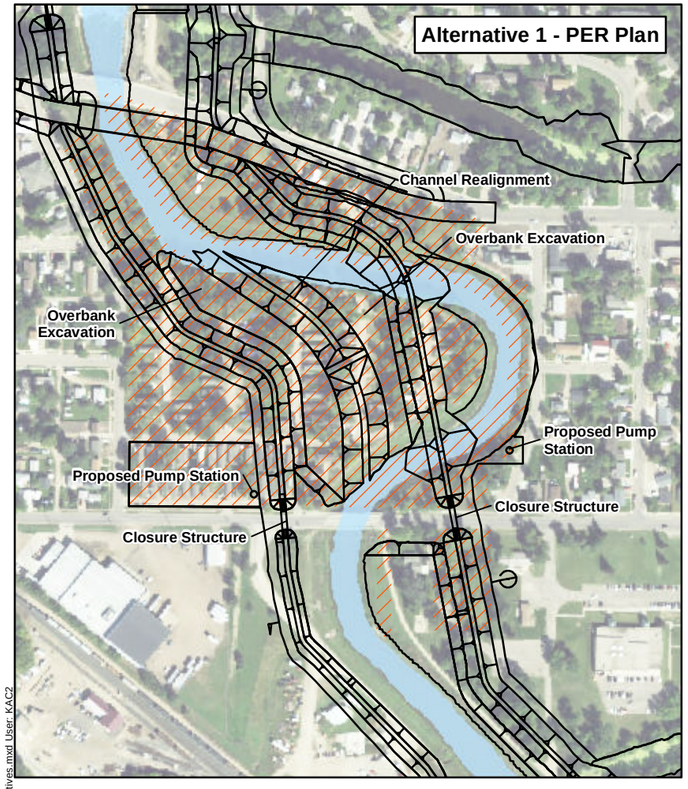
Several channel realignment alternatives considered between the Burdick Expressway and 8th Avenue SE (i.e., the Burdick Segment) are shown on Figure 2-23. A preferred alternative for the Burdick Segment was identified in the PER (Barr 2012) that would realign the existing Souris River channel and construct a new levee adjacent to the area.

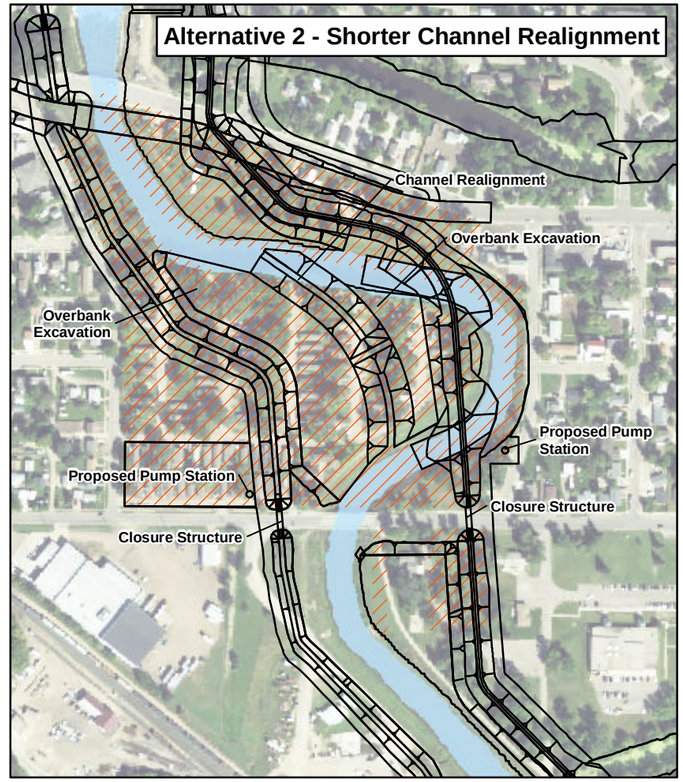
These alternatives and their advantages and disadvantages are summarized in Table 2-10 and discussed further below. Further detail is provided in a technical memorandum prepared by Barr Engineering Co (reference [12]).

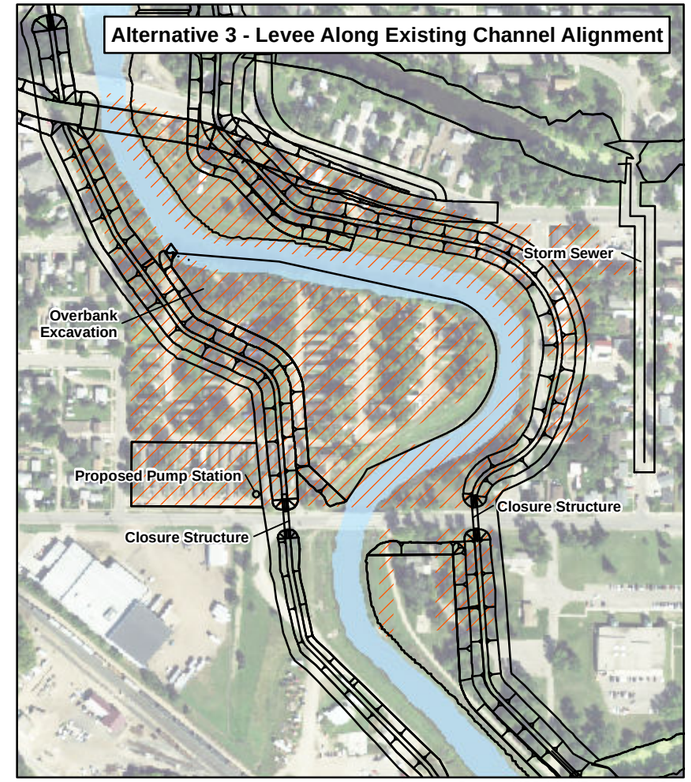
Table 2-10 Burdick Channel Realignment Alternatives

Alternative	Effectiveness	Cost	Engineering Considerations	Properties Impacted	Dwellings Impacted(1)	River Channel Impacted (feet)	Wetlands Impacted (acres)
Alternative 1 (Requester's Preferred Alt.)	Meets Project purpose(2)	$18.3 million	Moderate	12	116	1,610	1.2
Alternative 2		$17.6 million	Moderate	13	116	1,370	1.3
Alternative 3		$16.9 million	Easy	23	132	0	0
Alternative 4		$20.2 million	Easy	20	128	0	0
Alternative 5		$26.5 million	Complex	13	117	100	0

(1) Impacted dwellings include single family residences and mobile homes.
(2) Indicates an alternatives ability to meet the Project purpose in conjunction with other flood risk reduction features

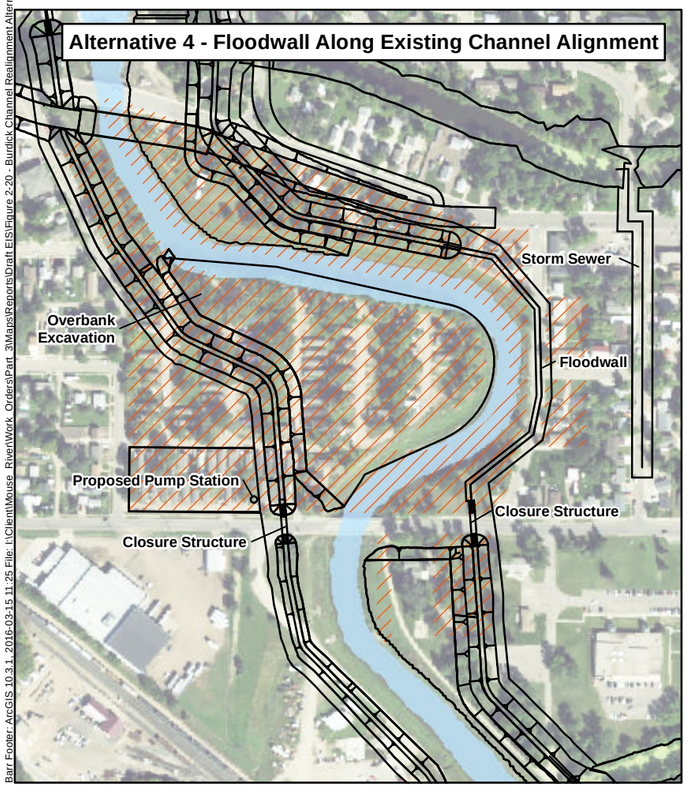


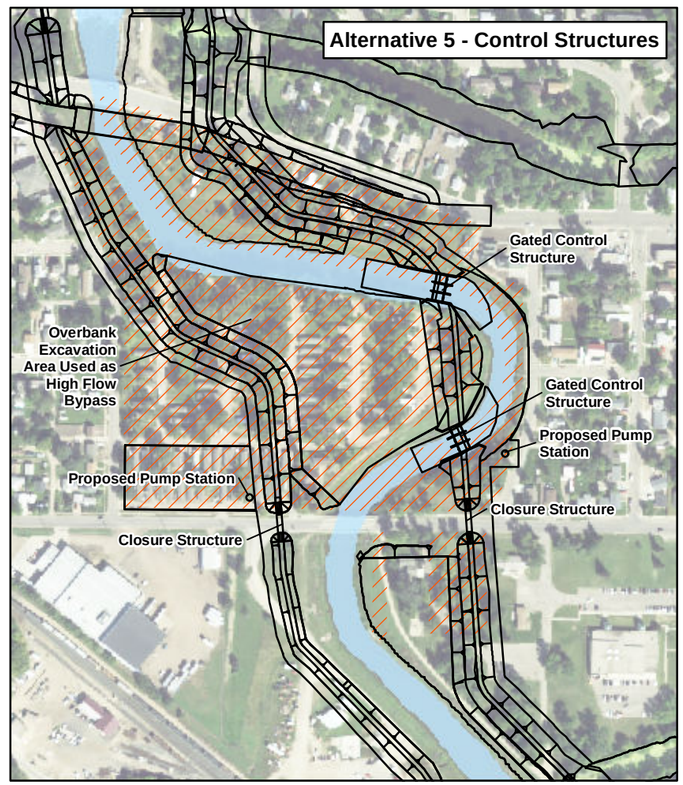




Flood Control Features
Acquired Property
Mouse River

Imagery Source: USDA NAIP Imagery 2014





0 225 450 900
Feet

Figure 2-23

BURDICK CHANNEL REALIGNMENT ALTERNATIVES
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.3.1, 2016-03-15 11:25 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 2-20_Burdick Channel Realignment Alternatives.mxd User: KAC2

Burdick Alternative 1 – **PER Plan (Requester's Preferred Alternative)**

Alternative 1 would include realigning approximately 1,610 feet of Souris River channel to the west. The new channel would be approximately 860 feet long. To keep the same streambed slope along the shorter realigned channel, a grade control structure (assumed for this alternatives analysis to be a boulder drop structure) would need to be constructed within the realigned channel. The new channel would be constructed to approximately the same cross sectional dimensions as the existing river channel. To provide additional flow capacity for flood events through this reach, approximately 110,000 cubic yards of overbank excavation would be included.

Approximately 1,670 feet of new levee would be constructed on the east side of the realigned Souris River channel to provide flood risk reduction up to the 2011 event. The east levee would cross the existing Souris River channel in two locations, creating a low-flow loop between the levee crossings. Flows through the existing channel loop would be managed using a gatewell system. Gatewells on the upstream and downstream sides of the existing channel loop would allow flow through the existing channel during non-flood conditions, minimizing ecological impacts and preventing water stagnation. The gatewells would be closed during flood events. The existing channel area would be used as a ponding area for interior drainage management with a new pump station. Alternative 1 is anticipated to cost $18.3 million, including construction, land acquisition, and easements.

Alternative 1 was selected as the Requester's Preferred Alternative for the Burdick Segment as it requires the fewest residential/commercial relocations.

Burdick Alternative 2 – Shorter Channel Realignment

Alternative 2 is very similar to Alternative 1 but would involve a shortened channel realignment. Alternative 2 would result in the realignment of 1,370 feet of existing channel into a 730 foot long channel. Again, a grade control structure would be needed to keep the same streambed slope along the shorter realigned channel. To provide additional flow capacity through this reach, approximately 133,000 cubic yards of overbank excavation would be included.

Approximately 1,750 feet of new levee would be constructed on the east side of the new Souris River channel to provide flood risk reduction based on the 2011 event. The east levee would cross the existing Souris River channel in two locations, creating a low-flow loop between the levee crossings. Flows through the existing channel loop would be managed using a gatewell system. Gatewells on the upstream and downstream sides of the existing channel loop would allow flow through the existing channel during non-flood conditions, minimizing ecological impacts and preventing water stagnation. The gatewells would be closed during flood events. The existing channel area would be used as a ponding area for interior drainage management with a new pump station. Alternative 2 is anticipated to cost $17.6 million, including construction, land acquisition, and easements.

Burdick Alternative 3 – Levee along Existing Channel Alignment

Alternative 3 would include construction of approximately 2,100 feet of new levee on the east side of the existing Souris River channel. The levee alignment along the east bank would approximately follow the

edge of the existing river, minimizing impacts within the channel. Approximately 178,000 cubic yards of overbank excavation would be included to increase flow capacity.

Rather than installing a new pump station at Eighteenth Street SE, for Alternative 3, approximately 970 feet of new storm sewer would be installed to convey interior drainage north to the Roosevelt Park dead loop. Alternative 3 is anticipated to cost $16.9 million, including construction, land acquisition, and easements.

Burdick Alternative 4 – Floodwall along Existing Channel Alignment

Alternative 4 includes construction of approximately 1,000 feet of levee and approximately 1,030 feet of floodwall on the east side of the river, adjacent to Eighteenth Street Southeast. Approximately 178,000 cubic yards of overbank excavation would be included to increase flow capacity through the reach. As with Alternative 3, approximately 970 feet of new storm sewer would be installed to convey interior drainage north to the Roosevelt Park dead loop. Alternative 4 is anticipated to cost $20.2 million, including construction, land acquisition, and easements.

Burdick Alternative 5 – Control Structures

Alternative 5 would include control structures on either side of the river bend and a high-flow bypass channel west of the existing Souris River channel. This alternative would remain connected to the river channel under most flow events. For flows less than a 2-year event, all flow would pass through the control structures. Under larger events, flows could be divided between the high-flow bypass channel and the control structures. As the flow increases, the gates would be operated to restrict flow into the leveed side of the flood risk-reduction system.

Approximately 1,550 feet of levee would be constructed on the east side of the river. The east levee alignment would cross the existing Souris River channel in two locations. The control structures would be installed at these locations. The high-flow bypass channel would be created by removing 166,000 cubic yards of material as overbank excavation between the levees. Alternative 5 would require that a new pump station be installed. Alternative 5 is anticipated to cost $26.5 million, including construction, land acquisition, and easements.

2.2.4 Other Alternatives

2.2.4.1 Floodproofing

Floodproofing can be used to modify structures that are in an area subject to flooding so that the property does not receive significant damage when flooded. Floodproofing modifications could include raising the first floor of homes above the design flood level; placing utilities such as the furnace, hot water heaters, and electrical panels above the design flood level; locating garages or other low damage type uses in the lower levels of buildings; and making structural modifications to prevent floodwaters from entering the building. The USACE National Non-structural Floodproofing Committee identifies a range of floodproofing measures that may be recommended for different flood depths, velocities, locations, and structure types (i.e., residential or commercial) (reference [13]). Based on the Committee's recommendations, the following floodproofing methods were considered in this evaluation:

- Single family residences would be floodproofed through structural elevation with compensation for basement loss.
- Mobile homes would be relocated outside of the 2011 inundation area;
- Commercial, industrial, and institutional structures would be floodproofed through floodwalls.

Floodproofing costs were assessed based on methodology in the USACE's 2011 Final Feasibility Report and EIS for the Fargo-Moorhead Metropolitan Area Flood Risk Management Project (reference [14]). Costs were adjusted to 2016 rates based on a general comparison of Engineering News Record's construction cost indices from 2011 to 2016. Floodproofing measures were considered for primary dwelling and commercial, industrial, and institutional structures within the footprint of the 2011 inundation area. The heights of floodproofing measures were assumed to be such that flood risk reduction to the structure would be at a level comparable to the levee associated with the Requester's Preferred Alternative.

Structural elevation of residences would require lifting the entire main floor of the primary dwelling to an elevation greater than the 2011 flood event. Assuming most residential main floors are approximately 2 feet above existing ground, this would result in roughly a 12-foot structural raise. The basement would be removed, though a storm shelter space would remain, and owners would be compensated for the loss of living space. Mobile homes would be relocated outside of the 2011 inundation area. Auxiliary outbuildings are assumed to remain at their existing elevation without any floodproofing measures.

Commercial, industrial, and institutional structures would be floodproofed through floodwalls approximately 14 feet tall (above existing ground elevation). This floodproofing method would consist of construction of a floodwall, extending to the footings of the building, to prevent floodwater from seeping under the floodwall. Structural elevation was not considered viable for non-residential structures due to the assumed size of the building footprints.

The estimated cost of the floodproofing methods described above is $738 million. It should be noted that costs associated with any subsequent infrastructure modifications (e.g., sanitary lift station, gas, etc.) are not included in the floodproofing cost estimate, but are expected to be required and would increase the actual cost of this alternative.

According to the USACE National Nonstructural Floodproofing Committee, floodproofing by the methods described above can pose several social concerns (reference [13]). Floodproofing would not protect public infrastructure or emergency services, leaving these systems susceptible to flood damage and potentially unavailable to the community during flood periods. With elevated structures, the risk remains that residents would stay in their homes despite evacuation recommendations, though they would likely not have access to infrastructure or services. Floodproofing would only protect primary dwellings or commercial/industrial/institutional buildings and would not protect property or outbuildings. The height of floodproofing methods needed to provide protection for this project would result in a severe disruption of community cohesion, with dwellings elevated by 12-feet and 14-foot floodwalls surrounding businesses. It is expected that the public would resist such measures and therefore was not chosen as the

Requester's Preferred Alternative. For these reasons, floodproofing has not been evaluated further in this EIS.

2.2.4.2 Relocation/Buyouts

Removing structures from flood-prone areas is one of the most effective means of reducing future structural flood damages and can be used effectively on a limited basis in conjunction with other options such as levees and floodwalls. When considering relocations and buyout options, most state and federal regulatory guidelines focus on the structures located within the 100-year floodplain. In the case of the Souris River, however, almost all of structures damaged by the 2011 flood were located outside of the 100-year floodplain, especially in Minot where the principal feature of the existing flood risk-reduction project was based on channel enlargements and not levees. A complete buyout and relocation of all structures from the area flooded in 2011 would involve more than 5,500 structures[1] and would cause an extreme disruption to the existing communities within the Souris River Valley. The estimated cost of buying out the structures and relocating mobile homes in the 2011 inundation area is $915 million, as based on methodology in the USACE's 2011 Final Feasibility Report and EIS for the Fargo-Moorhead Metropolitan Area Flood Risk Management Project (USACE, 2011). It should be noted that costs associated with any subsequent utility modification and/or abandonment are not included in the relocation/buyout cost estimate, but are expected to be required and would increase the actual cost of this alternative. Though the cost of this alternative is comparable to that of the Requester's Preferred Alterative, it is likely that this plan would be met with a high amount of public resistance, causing a number of social impacts. Therefore, a complete buyout and relocation of all structures in the area flooded in 2011 has not been further evaluated in this EIS.

2.2.4.3 Floodplain Regulations

As with other options such as floodproofing, relocations, and buyouts, floodplain regulations are generally applied to structures within the 100-year floodplain. Such regulations have been in effect in the Souris River Valley, governing the developments within the 100-year floodplain, but because the 2011 flood greatly exceeded the defined 100-year floodplain limits, it is unlikely that using regulations alone would reduce potential flood damages to the existing buildings that are currently in areas that were or could have been flooded in 2011.

Adopting floodplain regulations that use the 2011 flood as the base flood for regulating future development, however, could reduce potential damages to any new development from a potential future flood comparable in size to the 2011 flood. This option could supplement other alternatives.

---

[1] The City of Minot has already undertaken a voluntary buyout program. As such, some of these 5,500 structures have already been bought out, while others have been abandoned.

2.2.5 No-Action Alternative

The NEPA requires that alternative analysis include the evaluation of a no-action alternative. In instances where management measures, such as flood fighting, are likely to take place, no action should be evaluated as no change from the current management direction or level of management intensity. Flooding in the project area has often been anticipated based on snowpack, precipitation forecasts, and hydrological conditions, allowing for successful flood fighting to flows of approximately 10,000 cfs in Minot. Therefore, the primary no-action alternative evaluated in this EIS shall be based on a successful flood fight to 10,000 cfs and will be referred to as the No-Action Alternative.

Under the No-Action Alternative, any flows over 10,000 cfs will assume overtopping of the levees and flooding behind those areas. The effectiveness of the existing infrastructure provides the basis for assessing impacts resulting from the No-Action Alternative, which are presented in Section 4.0 of this EIS. Impacts associated with the Alternatives have been assessed under three flood flow conditions (5,000 cfs, 10,000 cfs, and 27,400 cfs). Map 2-2 illustrates the extent of inundation associated with the No-Action Alternative. Regardless of the past success to flood fight flows of 10,000 cfs, it should be noted that flood fighting can be an intensive endeavor, carries a high level of risk and uncertainty, and is not a favorable course of action for the community.

In addition to the No-Action Alternative, a second no-action scenario was evaluated. This scenario will be referred to as No-Action Alternative 2. No-Action Alternative 2 assumes that no emergency flood fighting would take place, allowing water to circumvent many of the discontinuous levees throughout the project area when flows exceed 5,000 cfs. This scenario could occur with an unexpected, extreme weather event, where flood waters rise rapidly and do not allow enough time for emergency flood fighting. Although flood fighting has been successful for the majority of properties during events under 10,000 cfs, a large rainfall over particular locations in the basin could result in a lack of response time and ultimately lead to flooding. Climate change predictions for the region include the increased likelihood of extreme weather, namely high-intensity rainfall (reference [15]). However, conditions that would result in No-Action Alternative 2 are still of low probability. Therefore the majority of results for No-Action Alternative 2 are provided in Appendix B with only brief mention later in the EIS.

2.2.5.1 Existing Infrastructure

As part of the Souris River Basin Project, the USACE took measures to reduce the risk of flood damages along the Souris River. This project included the construction of multiple flood risk-reduction features in six subdivisions between Burlington and the upstream side of Minot. Flood risk-reduction features for this project were federally designed and constructed by the USACE based on the project authorized by the 1986 Water Resources Development Act (Public Law [P.L.] 99-662) and Section 105 of the fiscal year 1988 Continuing Appropriations Act (P.L. 100-202). A separate phase of the Souris River Basin Project included a channel-modification project within Minot. These flood risk-reduction features were federally designed and constructed by the USACE based on the project authorized by the Flood Control Act of 1965 (P.L. 89-298) and modified based on recommendations by the USACE Chief of Engineers in House Document 286, 87th Congress, 2d Session, and House Document 321, 91st Congress, 2d Session. Collectively, the flood

risk-reduction features constructed during the two phases of the Souris River Basin Project are referred to as the existing federal project.

Many features built in these previously constructed projects were damaging to the Souris River channel, adjacent wetlands, and other aquatic and terrestrial resources. Further understanding of the environment and the beneficial services provided by natural processes since the construction of these projects have led to numerous environmental laws and federal guidance aimed to avoid impacts to these resources. While features constructed as part of the Souris River Basin Project are successful in providing the intended flood risk reduction, a number of the features described in the following sections would not likely be constructed if proposed today, due to environmental considerations.

Existing Flood Risk-Reduction: Burlington to Minot

Flood risk-reduction features were constructed in six subdivisions from Burlington to the upstream side of Minot as part of the Souris River Basin Project. These existing features are described in the Operations and Maintenance Manual for the Burlington to Minot project prepared by the USACE (November, 1981). The existing federal project features are located at Johnsons Addition (Burlington), Brooks Addition, Talbott's, Country Club Acres and Robinwood Estates, Kings Court and Rostads Addition, and Tierrecita Vallejo, as shown in Map 2-3. The existing federal project features in Burlington are operated and maintained by Burlington; the remaining project features are operated and maintained by the SRJB.

Existing flood risk-reduction features in Burlington, located at Johnsons Addition, include 4,800 feet of levee, five sections of adjacent channel modifications across 2,800 feet of river channel (including an approximately 400-foot long cut-off channel), an interior drainage system, a ponding area, a 2,000 gpm pumping station, and a sandbag/earthen closure structure. The Johnsons Addition pump station is on the south side of Colton Avenue, southwest of the intersection of Elm and Cheery Streets. The levee wraps around the northeast portion of town, beginning just southeast of the city park/ball fields and ending almost 600 feet from the CP Railway tracks near the border of wetland and agricultural lands. These flood risk-reduction features, which were completed in 1991, were designed for a flood flow of 5,000 cfs with 3 to 3.8 feet of freeboard.

The Brooks Addition segment consists of about 4,600 feet of levee, five sections of adjacent channel modifications across about 3,200 feet of river channel, one 2,000 gpm pumping station, and a ponding area. The project, which was completed in 1991, was designed for a flood flow of 5,000 cfs with 3 to 3.8 feet of freeboard.

The Talbott's segment consists of 2,600 feet of levee, three sections of adjacent channel modifications across 1,500 feet of river channel, one 2,000 gpm pumping station, and a ponding area. The Country Club Acres and Robinwood Estates stretch consists of about 8,400 feet of levee, three sections of adjacent channel modifications across 2,700 feet of river channel, one 2,000 gpm pumping station, and two connected ponding areas. The Kings Court and Rostads Addition project consists of 4,100 feet of levee, 4,000 feet of channel modifications adjacent to the levee, one 4,000 gpm pumping station, and a ponding area. All three of these projects, which were completed in 1993, were designed for a flood flow of 5,000 cfs with 3 to 3.8 feet of freeboard.

The Tierrecita Vallejo segment consists of 900 feet of levee, channel modifications on 600 feet of river channel, a ponding area, and a portable Crisafulli pump. An existing 1,800-foot long emergency levee on the west side of the development was also left in place without any upgrades. The project, which was completed in 1990, was designed for a flood flow of 5,000 cfs with 3 to 3.8 feet of freeboard.

Existing Flood Risk-Reduction: Minot

During a separate phase of the Souris River Basin Project, operated and maintained by Minot, channel modifications were developed within Minot. The project features consist primarily of channel modifications and channel cutoffs which are part of an authorized federal project that extends from Burlington to Logan, including flood-control storage in the Burlington Dam. The project features in Minot were constructed separately from and prior to any of the other components of the authorized project. The existing federal project in Minot extends from the U.S. Highway 83 Bypass on the west (upstream) to the U.S. Highway 2 Bypass on the east (downstream). These existing features are detailed in the Operations and Maintenance Manual for the existing federal project, prepared by the USACE (November, 1981).

The existing federal project was designed to accommodate flows up to 5,000 cfs with freeboard. This was estimated at the time to be the 100-year (1-percent annual chance) flood peak discharge with the implementation of upstream reservoir storage in the authorized plan. The existing Minot project features are shown in Map 2-3 and include the following:

- *Channel excavation*: Almost the entire Souris River reach through Minot was modified, Excavation was done on one side of the channel, providing a channel bottom width from 35 to 40 feet, with 3:1 side slopes. The channel excavation extends from approximately Twenty-First Street SW on the west (upstream) to the U.S. Highway 2 Bypass on the east (downstream).

- *Channel cutoffs*: There are nine channel cutoffs in Minot with channel bottoms from 35- to 40-feet wide. Several of the more prominent channel cutoffs are in the Roosevelt Park, Eastwood Park, and Oak Park areas.

- *Channel control structures*: Channel control structures are located within the cutoff channels to maintain channel grade in the river or to divert normal stream flows around the original cutoff channel loops. Four of the control structures are comprised of reinforced concrete and are located in the cutoff channels at Roosevelt Park, Eighth Street SE, Ramstad Park, and Oak Park.

- *Levees*: Levees were constructed adjacent to the channel wherever natural ground provided less than two feet of freeboard above the 100-year (1-percent annual chance) flood elevation. Levees were constructed to have a top elevation set three feet above the design water surface. The longest reach of levee is on the west side of Minot from about Twenty-First Street SW to the U.S. Highway 83 Bypass. Several other smaller and shorter sections of levee exist through the city.

- *Ponding areas*: Seven areas have been acquired for use as temporary ponding areas.

- *Pumping stations*: There are six pumping stations located in Minot to handle the interior drainage due to storm sewer system modifications or channel cutoffs, as required by the channel modifications or the levees.

2.2.5.2 Flood fighting

Emergency flood-fighting activities are currently executed in the Souris River Basin depending on snowpack, hydrological conditions, and anticipated forecasts. While the extent and magnitude of these actions are dependent on the timing and severity of the forecasted conditions, certain actions are most likely to occur. For instance, in the Burlington through Minot area there are discontinuous levees that, when connected during flood fighting efforts, provide flood risk reduction to flows of 10,000 cfs. Emergency flood fighting actions to connect these levees can be considered likely management measures expected to be implemented during high flow conditions.

3.0 Affected Environment

This section provides information on the existing resources and condition of the environment in the project area as they relate to the existing social, economic, cultural and environmental settings surrounding the project.

In this EIS, several specific terms are used to describe the affected area around the project. These terms are defined below and shown on the schematic in Figure 3-1.

- *Project footprint* is the specific area covered by Project features.
- *Impact area* is the construction limits for phases that have undergone advanced design (Phases 1, 2, and 3), and is the Project footprint plus 50 feet for subsequent phases to account for uncertainties in the final design and temporary workspaces.
- *Project area* is the broad, nonspecific area in the vicinity of the Project. The Project footprint and the impact area would both be within the project area.

3.1 Geology, Soils, and Groundwater

3.1.1 Geology

The Project is on the floodplains of the Souris River Valley and the Des Lacs River Valley, which were carved into late Wisconsin age glacial drift during the draining of Glacial Lake Regina, in Saskatchewan. Near the northern extent of the project area, the Souris River and Des Lacs River Valleys come together to form the Souris River Valley. The side slopes of these river valleys slope steeply downward to the river bottom and are deeply incised by perennial drainage streams (reference [16]).

Floodplain alluvial deposits, generally mapped across the extent of the Souris River Valley floodplain, consist of fluvial channel and overbank sands, gravels, silts, and clays (reference [17], reference [18]). The alluvial deposits are typically 50 to 100 feet thick (reference [19]). Beneath the alluvial deposits lies glacial drift, including outwash deposits that are important local aquifers, as described in Section 3.1.3. At the margins of the floodplain, colluvial fan deposits of sandy and silty clay originate from the mouths of coulees and ravines (reference [17]). River terrace deposits, generally less than 20 feet thick, are used as sources of construction aggregate material (reference [16]).

A total of approximately 250 feet of unconsolidated deposits overlie bedrock in the Souris River Valley near central Minot (reference [18]). Bedrock underlying the Souris River Valley in the Minot area is the Fort Union Group, a Paleocene sedimentary unit with alternating beds of silt, sand, clay, lignite, shale, and sandstone (reference [19]). Thin lignite beds outcrop in the Souris River Valley and Des Lacs River Valley northwest of Minot, but not in the project area. Minot is at the eastern edge of the Williston Basin, although Ward County is only a minor producer of oil and gas. The core North Dakota petroleum production areas are to the west of the Minot area.

Seismic risk is very low. The Project is in an area rated <1 on the 2014 USGS Seismic-Hazard Map (reference [20]).

P:\Mpls\34 ND\34511010\WorkFiles\Task 2 - EIS\Schematic of Project Areas for Environmental Analysis,CDR RLG 02-29-16

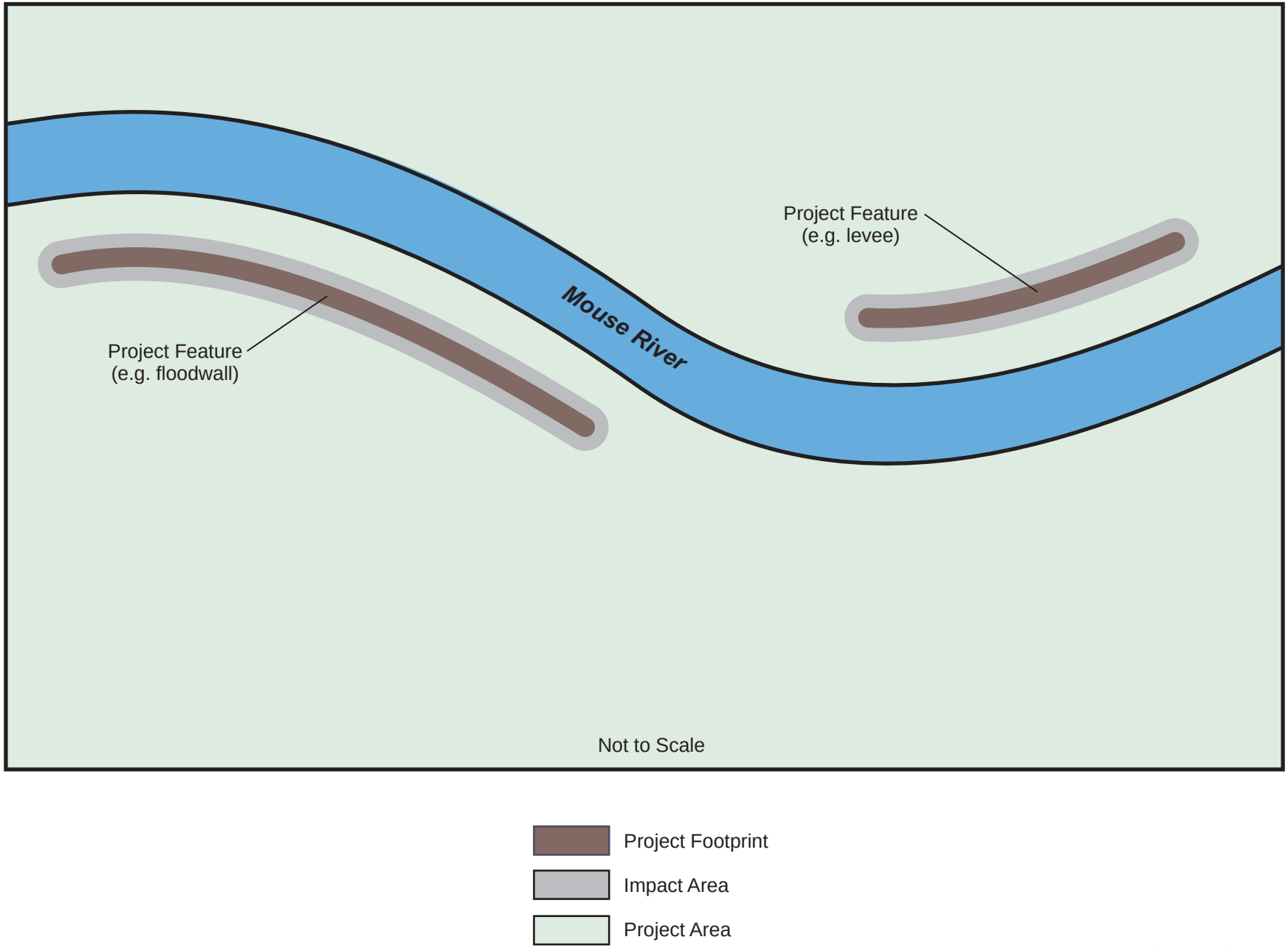


Figure 3-1

SCHEMATIC OF PROJECT AREAS

FOR ENVIRONMENTAL ANALYSIS

3.1.2 Soils

Soil units within the impact area are listed in Table 3-1. Over 60 percent of the soils are classified as Velva series, which consist of deep, level, well-drained soils that formed in stratified loamy alluvium on river bottoms. Velva series soils make fair topsoil, are not suitable to supply sand and gravel, give only fair performance as road fill because they are subject to frost heaving, and can exhibit poor stability if used in embankments (reference [21]). Approximately 28 percent of soils are classified as urban land, primarily loamy udifluvents. Map 3-1 shows the distribution of these soil units. Soils in the impact area generally have low to moderate susceptibility to sheet and rill erosion (Erosion Factors shown in Table 3-1).

Table 3-1 Soil Units in the Impact Area

Map Unit Symbol	Soil Name	Percent Slope	Erosion Factor Kf(1)	Prime Farmland	Acres	Percent(2)
F576A	Velva loam, moist, occasionally flooded	0 to 2	0.32	Yes	288.9	34.7
F577A	Velva, moist-Fluvaquents, channeled fine sandy loams, frequently flooded	0 to 2	0.17	No	185.8	22.3
F578A	Velva fine sandy loam, moist, wooded, frequently flooded	0 to 2	-(3)	No	26.0	3.1
F645B	Urban land-Udifluvents loamy complex	0 to 6	-(3)	No	233.0	27.9
F639F	Orthents-Aquents-Urban Land, highway complex	0 to 35	0.28	No	15.9	1.9
F643B	Urban land-Udorthents loamy complex	0 to 6	-(3)	No	2.8	0.3
F527A & F55A	Ludden silty clay, very poorly drained, frequently flooded	0 to 1	0.24	No	24.1	2.9
F596A & F596B	Darnen loam	0 to 6	0.24	Yes	15.1	1.8
F147D & F147F	Buse-Barnes-Darnen loams	9 to 35	0.20	No	3.4	0.4
F272E	Sioux-Arvilla-Renshaw complex	9 to 25	0.15	No	2.7	0.3
F562A	La Prairie-Fluvaquents, channeled complex, frequently flooded	0 to 2	0.24	No	2.1	0.3
F680D	Barnes-Sioux complex	6 to 15	0.24	No	1.6	0.2

1 Erosion Factors indicate susceptibility of a soil to sheet and rill erosion by water. Kf indicates the erodibility of material less than 2 millimeters in size. Values of K range from 0.02 to 0.69. Higher values indicate greater susceptibility. Data from the U.S. Department of Agriculture Web Soil Survey http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.
2 Do not add to 100 percent because portions of the impact area are water.
3 No erosion factor listed by the U.S. Department of Agriculture Web Soil Survey

The Farmland Protection Policy Act (FPPA), USDA regulation implementing the FPPA (7 CFR Part 658), and USDA Departmental Regulation (DR) No. 9500-3, Land Use Policy, provide protection for prime and important farmland and prime rangeland and forestland. Map 3-2 shows prime farmland, unique

farmland, and farmland of statewide importance in the project area. The impact area contains approximately 300 acres of prime farmland.

3.1.3 Groundwater

Groundwater resources in the project area consist of unconsolidated sand and gravel aquifers. Four aquifers have been delineated in the area: Souris Valley aquifer system, Northwest Buried-Channel aquifer, North Hill aquifer, and Sundre aquifer. The Souris Valley aquifer system, which occurs along the entire length of the Souris River in Ward County, consists of multiple water bearing units with varying degrees of hydrologic connection, including the Minot aquifer and the Burlington aquifer (reference [19]).

The Souris Valley aquifer system underlies the project area and is the source of public water supplies for several communities in the region. Burlington draws its public water supply from the Burlington aquifer. Big Dipper Housing, approximately 2 miles downstream of Burlington, operates a community water system with a well in the Souris Valley aquifer. Minot obtains its public water supplies from the Minot and Sundre aquifers. Portions of the Project are located within wellhead protection areas established by the North Dakota Department of Health (NDDH) to protect the Souris Valley aquifer, including the Burlington and Minot aquifers (Figure 3-2).

The Minot aquifer is overlain by 50 to 100 feet of low permeability silts and clays. The aquifer varies in thickness from 50 feet to more than 200 feet, and is present over an area approximately 0.5- to 1-mile wide by 6- to 7-miles long. Recharge to the Minot aquifer comes from infiltration of precipitation, inflow from adjacent aquifers (the Northwest buried-channel aquifer and the lower Souris aquifer), and seepage from the Souris River (reference [19]). Before development, the Minot aquifer was under artesian pressure (i.e., the aquifer water level elevation was higher than the Souris River water surface elevation). Pumping from city wells drew the water level down approximately 70 feet by the 1960s. Water levels have since recovered somewhat, but are still below their original levels (reference [19]).

The Burlington aquifer, located near the confluence of the Souris River and the Des Lacs River, extends approximately 3 miles upriver to the north and 1.5 miles downriver toward Minot. It is poorly connected to the Minot aquifer (reference [22]). Lithologic logs of the Burlington municipal wells show the aquifer is 30 to 45 feet thick, and overlain by approximately 70 feet of clay (reference [23]).

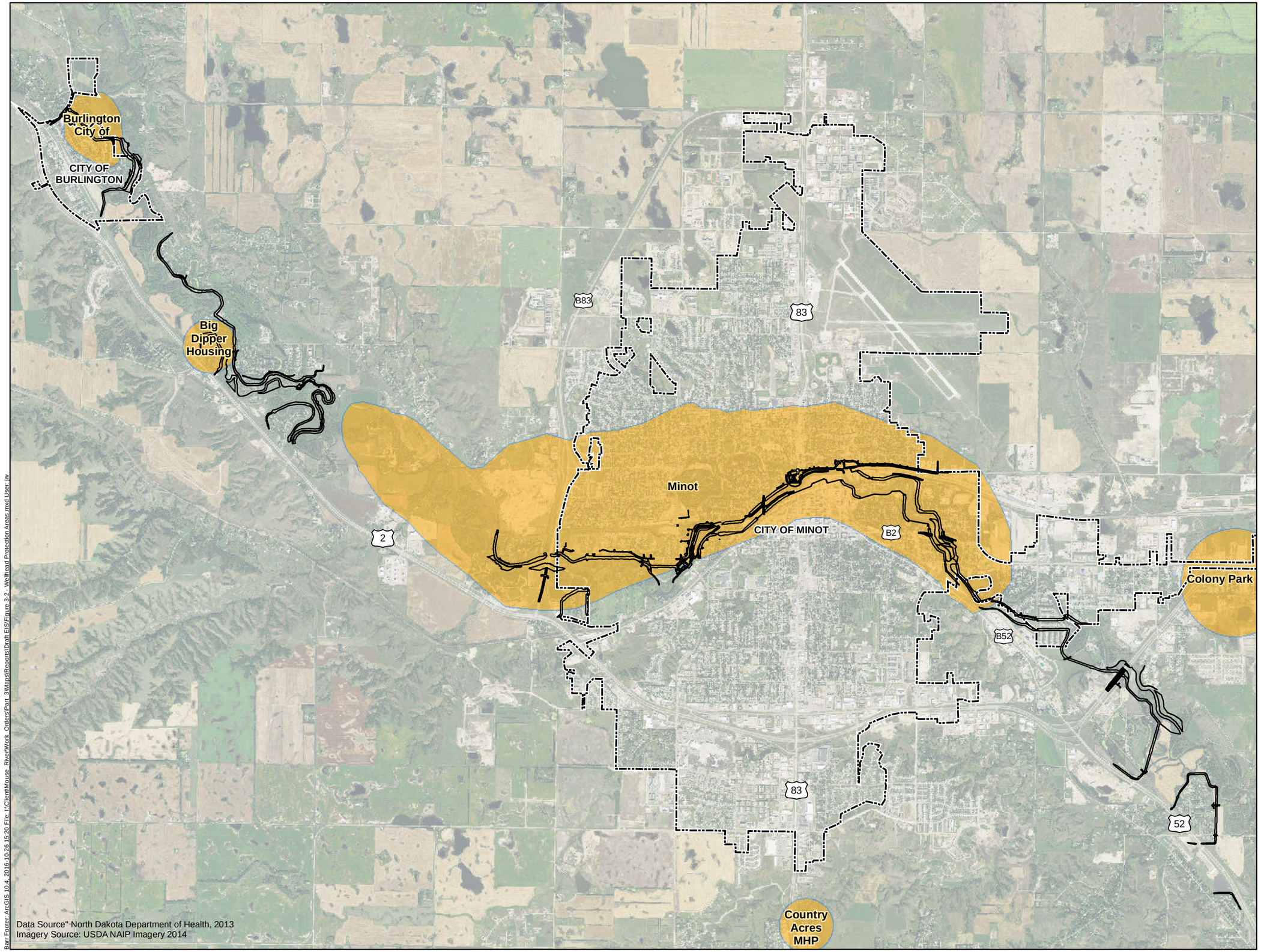
3.2 Surface Waters

3.2.1 Souris (Mouse) River

The primary water resource in the project area is the Mouse (Souris) River. The 435-mile long Souris River originates in Saskatchewan, where it then flows to the southeast, across the Canadian border and into North Dakota. Downstream (east) of Minot the Souris River turns to the northeast and flows back into Canada in the Province of Manitoba. The Souris River has a large and complex watershed, with an approximately 8,000 square-mile drainage area in North Dakota. The river is more than 300 miles long in North Dakota and it passes through 11 dams and under more than 90 bridges. Major tributaries in North Dakota include the Des Lacs River, Wintering River, Deep River, and Willow Creek (Figure 3-3). Major

tributaries in Canada include Long Creek, Moose Mountain Creek, Antler River, Gainsborough Creek, Graham Creek, Jackson Creek, and Pipestone Creek.

In North Dakota, the upstream portion of the Souris River channel is narrow and steep and is confined within a narrow floodplain. Channelization of the river increases as it approaches Burlington and Minot. Through Minot, the Souris River is highly channelized and straightened as a result of the previous flood control projects discussed in Section 2.2.5.1. From Sawyer to upstream of Towner, the Souris River channel is relatively deep and exhibits more natural meandering. Downstream of Towner, the Souris River enters the plain of Glacial Lake Souris where it becomes a wide, slower-moving channel with less steep banks. Average annual normal flows in Minot are approximately 37 cubic feet per second, with upstream impoundments creating slower flows.



Wellhead/Source Water Protection Area

Project Footprint

Municipalities

0 2,000 4,000 8,000

Feet

Figure 3-2

WELLHEAD PROTECTION AREAS
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:20 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-2_Wellhead Protection Areas.mxd User: rjv

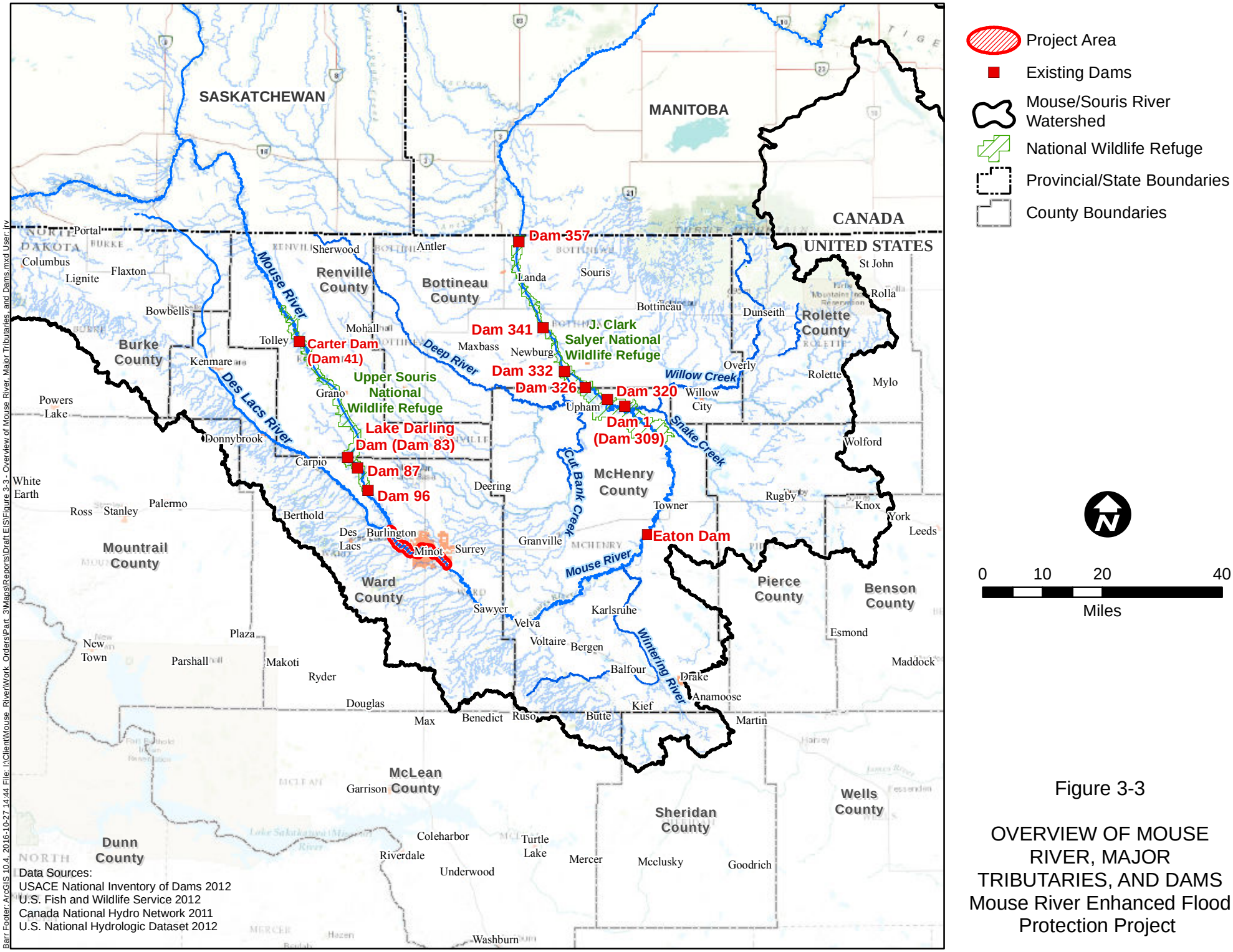


Figure 3-3

OVERVIEW OF MOUSE RIVER, MAJOR TRIBUTARIES, AND DAMS
Mouse River Enhanced Flood Protection Project

Bar Footer: ArcGIS 10.4, 2016-10-27 14:44 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-3 - Overview of Mouse River, Major Tributaries, and Dams.mxd User: jrv

Souris River flows are highly influenced by its 11 dams, which are critical elements in flood management across the river's floodplain. As described in Table 3-2, many of these dams were constructed to create habitat for waterfowl and other aquatic species and were not originally constructed to impound water for flood management purposes; however, the reservoirs have incidentally been able to provide some additional storage during periods of high flows. As shown by the comparison of low- and high-flow conditions in Table 3-2, several of the dams have the capacity to double the volume of water in their reservoirs during periods of high flow.

Table 3-2 Overview of Souris River Dams in North Dakota

Structure Name	General Description	Low-Flow Surface Area (ac) & Volume (ac-ft)	High-Flow Surface Area (ac) & Volume (ac-ft)
Carter Dam (Dam 41)	Carter Dam is upstream of the Lake Darling reservoir and is part of the USFWS Upper Souris National Wildlife Refuge. It is operated by the USFWS.	204 ac 1,417 ac-ft	641 ac 2,664 ac-ft
Lake Darling Dam (Dam 83)	Lake Darling Dam was constructed to create Lake Darling. The dam's reservoir is used to maintain pool elevations in the J. Clark Salyer Wildlife Refuge (JCSNWR), located downstream. It also provides flood storage to mitigate flood risk for downstream properties. During low flows, the Lake Darling Dam is operated by the USFWS. It is operated by the USACE during flood conditions.	9,900 ac 108,894 ac-ft	12,900 ac 158,600 ac-ft
Dam 87	Dam 87 is operated by the USFWS to aid with wetland management in the Upper Souris National Wildlife Refuge and is not intended for flood risk reduction.	177ac 670 ac-ft	382 ac 1,371 ac-ft
Dam 96	Dam 96 is operated by the USFWS to aid with wetland management in the Upper Souris National Wildlife Refuge and is not intended for flood risk reduction.	837 ac 2,560 ac-ft	1,076 ac 3,420 ac-ft
Eaton Dam	The Eaton Dam was constructed as part of an irrigation project that diverts water into a series of diked farm fields with flow-control structures. Eaton Dam is operated seasonally for irrigation; as such, it does not maintain a permanent pool and is not intended for storage.	Dam does not provide storage	
Dam 1	Dam 1 is a rock masonry dam that diverts water into a managed storage area; it does not provide storage itself. Gated culverts allow water to enter and leave the storage area.	Dam does not provide storage	
Dam 320	Dam 320 is the furthest upstream of the series of JCSNWR dams. It was constructed to create a conservation area for waterfowl and aquatic species.	365 ac 513 ac-ft	4,203 ac 10,167 ac-ft

Structure Name	General Description	Low-Flow Surface Area (ac) & Volume (ac-ft)	High-Flow Surface Area (ac) & Volume (ac-ft)
Dam 326	Dam 326 is a JCSNWR dam constructed to create a conservation area for waterfowl and aquatic species.	2,104 ac 2,186 ac-ft	5,994 ac 26,382 ac-ft
Dam 332	Dam 332 is a JCSNWR dam constructed to create a conservation area for waterfowl and aquatic species.	225 ac 460 ac-ft	4,259 ac 10,378 ac-ft
Dam 341	Dam 341 is a JCSNWR dam constructed to create a conservation area for waterfowl and aquatic species.	1,003 ac 1,847 ac-ft	3,225 ac 12,238 ac-ft
Dam 357	Dam 357 is the furthest downstream Souris River dam in North Dakota, located a little over a mile south of the Canadian border. It was constructed to extend the JCSNWR north, with the intent of providing habitat for waterfowl and aquatic species.	348 ac 467 ac-ft	5,775 ac 35,744 ac-ft

3.2.1.1 Water Quality Classification

North Dakota Century Code (33-16-02.1) establishes a system for classifying waters of the state, specifies existing and beneficial uses of these waters, and provides water quality standards to protect the beneficial uses. Under this code, the Souris River is classified as a Class IA water. Class IA waters are intended to be suitable for the propagation or protection of fish and other aquatic biota and for swimming, boating, and other water recreation. Water quality in Class IA waters is intended to be suitable for irrigation, livestock watering, and wildlife, without harmful effects. With treatment, including softening, Class IA waters are intended to be suitable for municipal or domestic use.

3.2.1.2 Impairment Status

Under Section 303(d) of the Clean Water Act (CWA), states are required to monitor and assess their waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide (33 U.S.C. 1313(d)). Waters that do not meet their designated uses because of water quality standard violations are listed as impaired. States are required to develop a list of impaired waters that require total maximum daily load (TMDL) studies and are to submit an updated list of impaired waters to the EPA every two years. In North Dakota, the NDDH monitors and assesses waters to determine if they meet water quality standards for designated uses and lists waters as impaired that do not meet their designated uses.

Based on the 2014 reporting year, the NDDH has listed portions of the Souris River as impaired or threatened (Figure 3-4). Waters listed as impaired have water quality conditions that do not support at least one designated use of the water. Waters listed as threatened have water quality conditions that currently support all uses, but appear to be declining. The reach of the Souris River from the North Dakota/Saskatchewan Border downstream to Lake Darling is listed as threatened or impairment, with the

stressors being low dissolved oxygen and sedimentation/siltation and the affected designated uses being for fish and other biota (reference [24]). A TMDL has been completed for dissolved oxygen, but a TMDL has not yet been developed for sedimentation/siltation. The reach of the Souris River from Lake Darling downstream to its confluence with the Des Lacs River is listed as impaired for benthic macroinvertebrate bioassessments, with the affected designated uses being for fish and other aquatic biota (reference [24]). A TMDL has not yet been completed for this impairment. Both of these reaches are located upstream of the Project. The river reach that includes the proposed Project is not listed as impaired or threatened but does lie downstream of the aforementioned areas.

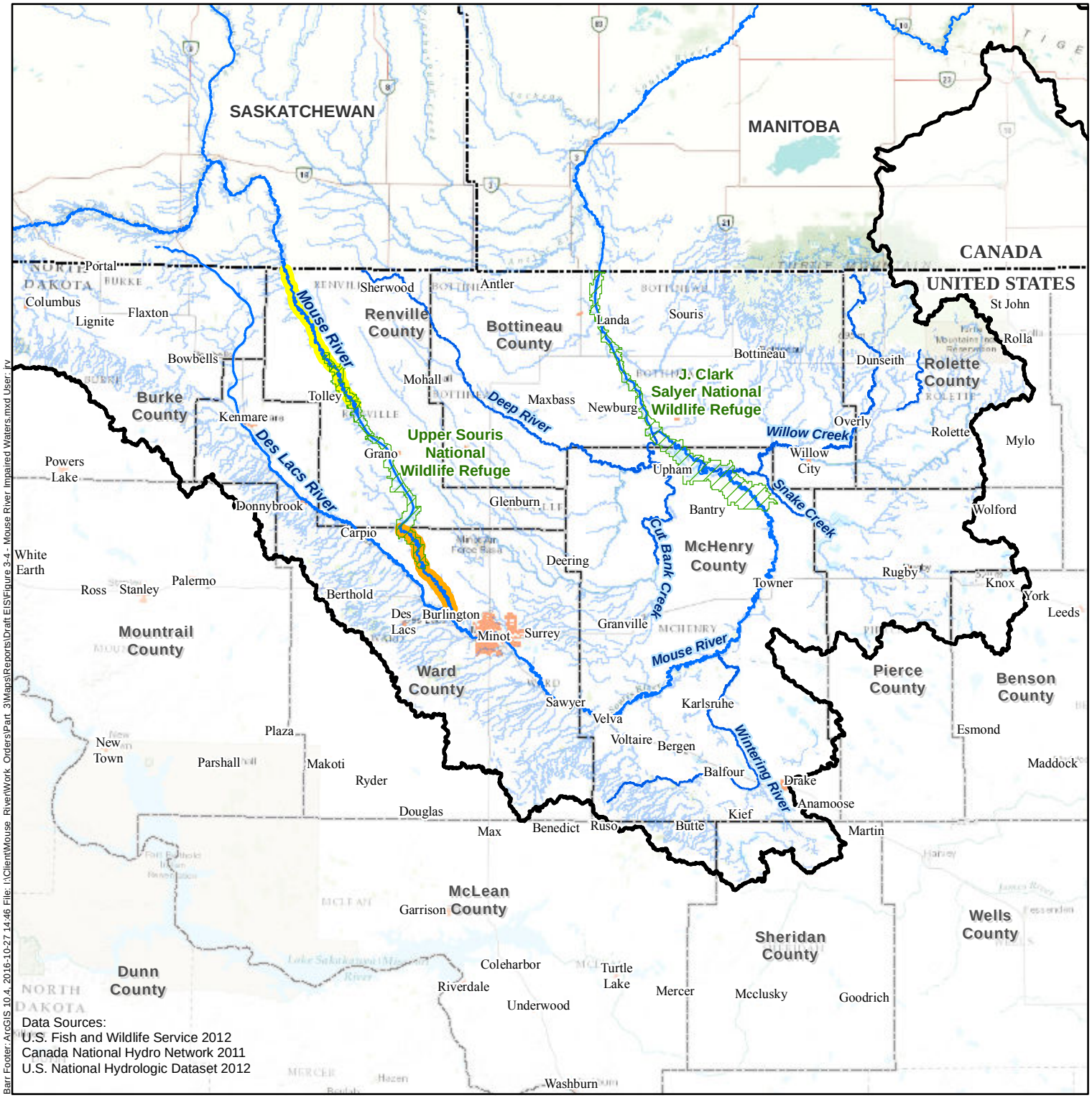


Figure 3-4

MOUSE RIVER IMPAIRED WATERS
Mouse River Enhanced Flood Protection Project

Bar Footer: ArcGIS 10.4, 2016-10-27 14:46 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-4 - Mouse River Impaired Waters.mxd User: jrv

3.2.2 Floodplain

Floodplains are flat or nearly flat land adjacent to a river or stream that experiences occasional or periodic flooding. Floodplains include the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which includes areas covered by the flood, but which do not experience a strong current. Floodplains function to prevent flood damage by detaining debris, sediment, water, and ice.

FEMA delineates floodplains and determines flood risks in areas susceptible to flooding. The base flood that FEMA uses, known as the 100-year (1-percent annual chance) flood, has a one-percent chance of occurring during a given year. Executive Order 11988, Floodplain Management, requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with occupying and modifying floodplains and to avoid supporting direct or indirect floodplain development wherever there is a practicable alternative. According to current FEMA floodplain designations, portions of the project area fall within the regulatory floodway, as well as 100-year and 500-year floodplains of the Souris River (Map 3-3).

Executive Order 13690 created new flood risk-reduction standards to apply to federal actions in light of the potential impact of climate change on flooding. Federal agencies must expand floodplain management from the current base flood level to a higher vertical elevation and corresponding floodplain to address current and future flood risk. Under Executive Order 13690, federal agencies have the flexibility to select one of three approaches to establish the flood elevation and hazard area under potential climate change impacts:

- Use data and methods informed by best-available, actionable climate science.
- Build 2 feet above the 100-year (1-percent annual chance) flood elevation for standard projects and 3 feet above for critical buildings, such as hospitals.
- Build to the 500-year (0.2-percent annual chance) flood elevation or the elevation and flood hazard area that result from using any other method identified in an update to the Federal Flood Risk Management Standard.

Studies are underway to update the Souris River 100-year floodplain using the first option. As part of the detailed Flood Insurance Study (FIS), updates to the floodplain and floodway boundaries are being assessed along a portion of the Souris River (reference [25]). Preliminary study recommendations suggest modifying the 100-year floodplain to be based on a discharge rate of 10,000 cfs, twice the discharge rate of 5,000 cfs which is the basis for the current 100-year effective floodplain (reference [26]). If accepted by FEMA, this modification would considerably expand the existing 100-year floodplain. The SRJB will coordinate with FEMA to ensure permitting requirements are met for an expanded 100-year floodplain.

A flow of 10,000 cfs will be the assumed 100-year flood event in this EIS. Though results are only preliminary, they appear to be the best available assessment of flood frequency at this time.

3.2.2.1 Hydrology and Hydraulics

A hydrologic and hydraulic study was conducted to evaluate existing conditions in support of floodplain management alternatives for the Souris River Valley (reference [27]). Hydrologic models are used to estimate the amount of water generated during a flood and where that floodwater comes from. Hydraulic models are used to simulate the extent of flooding. Hydraulic model results provide water surface elevations that can be used to map inundated areas for a particular flood event. For this project, hydraulic models were used to predict how flooding occurs under existing conditions and to evaluate what could be expected to occur under proposed conditions.

Flood condition models were developed for several different flood flow scenarios, including 5,000 cfs, 10,000 cfs, and 27,400 cfs [(2)]. From preliminary floodplain study results, the 5,000 cfs scenario represents a 50-year flood event and the 10,000 cfs scenario represents a 100-year flood event, meaning a floods of these magnitudes have a two-percent chance and a one-percent chance of occurring in a given year, respectively. The 27,400 cfs scenario represents modeled conditions from the flood of 2011, also known as the "flood of record" as it was the most substantial flood ever recorded. Inundation maps were developed to show which areas of the Souris River Valley could be expected to flood under each of these three flood scenarios. As shown in Map 2-2, the 27,400 cfs scenario results in a much larger inundation area than the other two modeled flood events.

3.2.3 Wetlands

Wetlands are defined in the 1977 Executive Order 11990, Protection of Wetlands, and in Section 404 of the CWA, as those areas that are inundated by surface or ground water frequently enough to support, under normal circumstances, a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Three parameters that define a wetland, as outlined in the 1987 Corps of Engineers Wetlands Delineation Manual (reference [28]) and the 2010 Great Plains regional supplement, are hydric soils, hydrophytic vegetation, and hydrology.

Wetlands are an important natural resource serving many functions, such as providing habitat for wildlife, storing floodwaters, recharging ground water, and improving water quality. Executive Order 11990 encourages federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance their natural and beneficial values. To meet these objectives, the order encourages federal agencies to consider alternatives to wetland impacts and to minimize potential wetland impacts if an activity affecting a wetland cannot be avoided.

The Project is in a part of the upper Great Plains known as the Prairie Pothole Region. As glaciers from the last ice age began to recede, millions of small depressional wetlands, known as potholes, were created. As

---

[(2)] Models simulating flows of 14,000 and 20,000 cfs were created as part of project development; however, the results were not appreciably different than the 10,000 cfs and 27,400 cfs events. Therefore, these model results were not carried forward in the EIS.

humans settled and developed the area, it is estimated that more than half of the wetlands within the Prairie Pothole Region were drained to accommodate agricultural practices (reference [29]).

Wetlands in the project area were first identified during a desktop review of U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps (Map 3-3). The NWI classifies wetlands into different types according to the USFWS's Cowardin Classification System (reference [30]). Wetlands within the project area are primarily associated with the Souris River channel itself and former oxbow areas, as well as small, isolated pothole wetlands (Map 3-3).

The most prevalent Cowardin wetland types within the project area are riverine with unconsolidated bottom (R2UBH), Palustrine emergent wetlands that are temporarily flooded (PEMA), semi-permanently flooded (PEMF), or seasonally flooded (PEMC), and Palustrine forested (PFO). However, the NWI tends to be outdated and does not always accurately reflect wetland presence, type, or size on the landscape. As such, the desktop review incorporated topography and aerial imagery sources to modify NWI polygons to more accurately depict current conditions.

It is estimated that 37.0 acres of wetlands lie within the Project footprint or adjacent to the construction limits of Construction Stage 1.5. Wetlands in Phases 1, 2, and 3 of the Project were field delineated in May through July, 2015 (Appendix C). No wetlands were identified in the Phase 1 or Phase 3 areas. In the Phase 2 area, seven wetlands, totaling 2.6 acres were delineated within or intersecting the construction limits, as shown on Figure 3-5. Delineated wetlands ranged in size from less than 0.1 to 1.5 acres and were primarily classified as PEMA, PEMC, or PEMF with some areas also classified as PFO. For the remaining portions of Stage 1.5 (Tierrecita Vallejo, the Maple High-Flow Diversion, and the tieback levee) NWI maps revealed three wetlands totaling 11.8 acres. Additional field delineations will be required in these areas to confirm these numbers.

Future construction activities are anticipated beyond the three currently planned phases described above, including levees, floodwalls, and road improvements. Field verification was performed where these proposed features overlap with wetlands identified in the desktop review. During the field verification, the presence of wetland vegetation and hydrology was noted, but a detailed wetland delineation was not completed. Thirty-one basin and oxbow wetlands, collectively totaling about 99 acres, were identified during the field verification effort (reference [31]). Impacts to wetlands associated with future Project phases would require additional field wetland delineations for design and permitting.

Field Delineated Wetlands*

Wetlands (National Wetlands Inventory)

Project Footprint

* Wetland delineation by Houston Engineering Inc May through July, 2015

0 300 600 1,200

Feet

Figure 3-5

DELINEATED WETLANDS
Mouse River Enhanced Flood Protection Project

Barr Foster ArcGIS 10.4, 2016-10-28 06:57 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-5_Delineated Wetlands.mxd User: rjv

3.3 Biological Resources

3.3.1 Vegetation

Prior to European settlement, native plant communities within the project area were dominated by drift prairie, a mixed grass community transitional between tallgrass prairie to the east and shortgrass prairie further west. The USEPA Level III Ecoregion mapping shows the project area is within the Northern Glaciated Plains. It is further divided into the USEPA Level IV Ecoregions Northern Black Prairie, north of Souris River, and Drift Plains, south of the river.

There are no undisturbed native plant communities remaining within the project area. Urbanized corridors and developed riparian areas, along with the presence of existing flood risk-reduction features built from 1971 to 1993, including levees and flow control structures, have resulted in a disturbed non-continuous river corridor throughout the project area. Much of the river corridor from Burlington through Minot is dominated by non-native species. Other land in the project area has been committed to crop and pasture land.

Within the urbanized, developed parts of the project area, the existing vegetation is dominated by artificial cover types, specifically maintained lawns, and golf courses. Plant species typically found in developed and disturbed urbanized environments are the primary inhabitants. These include non-native grasses and non-native or naturalized herbaceous species and shrubs.

Non-native and invasive species are aggressive competitors with native plant species. When native species cover is reduced, wildlife diversity typically decreases, because many wildlife species are adapted to habitats comprised of native plant species. As a result, areas characterized by non-native and invasive species vegetative cover are typically less diverse, both in plant and wildlife species. In addition, infestations of some non-native invasive species can result in serious economic impacts, including reduced crop yields and injury to livestock. Two such species, leafy spurge (*Euphorbia esula*) and Canada thistle (*Cirsium arvense*) occur regularly in stretches along Souris River between Burlington and Minot [reference [32]]. Both are on the North Dakota Noxious Weeds list [reference [33]].

Small-to-medium size stands of trees can be found scattered along the Souris River. These stands are typically dominated by cottonwood (*Populus deltoides*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), and box elder (*Acer negundo*). A tree inventory conducted as part of the biological studies for the proposed Project found that the vast majority (about 86 percent) of the trees in the surveyed areas are green ash (reference [31]). Green ash and box elder are common tree species that are generally not regarded as high-quality, desirable species. Nevertheless, these species and other trees present along the Souris River provide habitat for nesting birds, insects and small mammals, and in some places can cast shade on Souris River, which improves fish habitat.

Seasonal, temporary, and riparian wetlands are also present along the river. The vegetation that makes up these wetland communities is described above in Section 3.2.3.

3.3.2 Fish and Wildlife

The Souris River is classified under the North Dakota Water Quality Standards as Class 1A (33-16-02.1-09), by NDDH. This classification indicates water quality that supports propagation or protection of resident fish species. North Dakota Natural Heritage (NDNH) database records, U.S. Fish and Wildlife Service (USFWS) records, and North Dakota Game and Fish (NDGF) records show that no federally listed aquatic resident species have been identified in the Souris River reach that passes through the project area. NDGF capture records identify 24 fish species in the Souris River, two of which, the trout perch (*Percopsis omiscomaycus*) and pearl dace (*Margariscus margarita*), are identified by NDGF as species of conservation priority.

Fish surveys conducted on seven occasions dating back to 1960 revealed that the reach of the Souris River between Burlington and Sawyer has historically been used by eighteen species of fish, including popular game fish such as northern pike, walleye, and yellow perch. The most recent fish survey data (2008-2009) for the Burlington-Sawyer reach, however, indicate only seven species were collected from this part of the Souris River. These seven species include three species of cyprinids (minnows), three bottom-dwelling species (bullheads and suckers), and yellow perch. The 2008-2009 surveys found no pike, walleye, or other game fish. Recent anecdotal evidence, however, suggests that walleye are present in the Souris River in Minot, as well as upstream. A complete list of the eighteen fish species known to have historically occurred in the Souris River between Burlington and Sawyer, along with the last documented occurrence of each species, is provided in Table 3-3.

Table 3-3 Fish Species Known to Occur in the Burlington-Sawyer Reach of Souris River between 1960 and 2009, with Last Documented Occurrences

Species Common Name	Species Scientific Name	Last Documented
Black Bullhead	*Ameiurus melas*	2009
Blacknose dace	*Rhinichthys atratulus*	1975
Brassy minnow	*Hybognathus hakinsoni*	1975
Brook stickleback	*Culaea inconstans*	1997
Blackside darter	*Percina maculata*	1998
Common shiner	*Luxilus comutus*	2008
Creek chub	*Semotilus atromaculatus*	1998
Emerald shiner	*Notropis atherinoides*	1975
Fathead minnow	*Pimephales promelas*	2009
Johnny darter	*Ethestoma nigrum*	2009
Longnose dace	*Rhinichthys cataractae*	1998
Northern pike	*Esox lucius*	1997
Sand shiner	*Notropis stramineus*	2008
Tadpole madtom	*Noturus gyrinus*	2008
Trout perch	*Percopsis omiscomaycus*	1997
Walleye	*Sander vitreus*	1997
White sucker	*Catostomus commersonii*	2009
Yellow perch	*Perca flavescens*	1997

The Upper Souris National Wildlife Refuge (NWR), located upstream of the study area; the J. Clark Salyer NWR, located downstream; and the nearby Wintering River NWR and Cottonwood Lake NWR attract migratory waterfowl. The NWRs are also important migratory stopover points for neotropical bird species, which are migratory species where the majority of the individuals breed north of the Tropic of Cancer (23° North latitude) and winter south of that latitude. There are approximately 200 bird species that meet this definition, primarily songbirds, but also shorebirds, raptors and a few waterfowl. A USFWS Information Planning and Conservation decision support system (IPaC) search conducted on September 2, 2016 for the project area plus a one-mile buffer listed 22 USFWS Birds of Conservation Concern (BCC) that may migrate through the area. BCCs are migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973. The BCC species identified in the IPaC search of the project area, as well as other neotropical migratory bird species, likely utilize the nearby NWRs, and some may also nest in the project area.

Wildlife species inhabiting the project area are those species that are well-habituated to human presence and are able to use the artificial or degraded vegetation communities that typify the area. These include small to medium mammals (e.g., squirrels, fox, and deer), perching birds, common raptors, and common insect species.

Bridges in the project area are typically used as nesting locations by several species of birds, primarily cliff swallows, barn swallows, and rock pigeons. An inventory of bridges in the project area was conducted in summer 2015 to determine the number of bridges used by birds for nesting, the species of birds that use the bridges, and the estimated number of nests present (Appendix C). The inventory identified 29 bridges within the project area. Of these, 12 bridges, or about 41 percent of the bridges in the project area, had no birds or nests present. Nine bridges hosted only cliff swallow nests, and five bridges hosted only rock pigeon nests. Three bridges hosted both cliff swallow and rock pigeon nests. No barn swallows were observed, and no barn swallow nests were present at any bridge. The number of nests present ranged from 60 to 500 for cliff swallows, with an average of 216 cliff swallow nests at bridges where the species was present. The number of rock pigeon nests was more difficult to determine. There were no rock pigeon nest counts at six of the eight locations where rock pigeons, or rock pigeons and swallows were observed. Where rock pigeon nests were also counted; the number of nests ranged from 10 to 40.

3.3.3 National Wildlife Refuges

There are five NWRs within 50 miles of the project area. These are Upper Souris NWR, 14 miles northwest of Minot and upstream of the project area; Des Lacs NWR, 36 miles northwest of Burlington and upstream of the project area; J. Clark Salyer NWR, 39 miles northeast of Minot and downstream of the project area; Wintering River NWR 31 miles southeast of Minot; and Cottonwood Lake NWR 43 miles south of Minot.

Upper Souris River NWR is a 39,092-acre refuge in the Souris River Valley, extending approximately 35 miles along the Souris River. It includes the 9,600-acre impoundment Lake Darling, which is managed as a regulated supply of water to marshes within the Refuge and downstream, especially for the J. Clark Salyer NWR 110 miles downstream.

The Des Lacs NWR is made up of more than 19,500 acres along 34 miles of the Des Lacs River. The Des Lacs NWR extends from approximately 6.5 miles south of Kenmare, ND to the Canadian border. This refuge is a mix of natural lakes and managed wetlands that provide ideal habitat for migrating and nesting waterfowl and marsh birds.

At 58,700 acres, J. Clark Salyer NWR is the largest NWR in North Dakota, extending southward 45 miles from the Canadian border along the Souris River. The Refuge is in the lakebed of glacial Lake Souris. The rolling topography and diverse habitats on the Refuge are a result of glacial processes. Most of the Refuge is river valley wetland. The southern part of the Refuge has wooded river bottoms, floodplain meadows, and native prairie sandhills.

The Wintering River and Cottonwood Lake NWRs are both easement refuges where USFWS has acquired the rights to regulate water levels and control hunting. The land on which these refuges are located remains under private ownership and control.

All five of these NWRs provide important resting, forage and cover habitat for migratory birds and other wildlife. They are also important components of the Central Flyway used by migrating waterfowl and other birds.

3.3.4 Threatened and Endangered Species

Under Section 7 of the Endangered Species Act (ESA) of 1973, Federal agencies are required to ensure that agency actions are not likely to jeopardize the continued existence of any listed species or result in the destruction of adverse modification of critical habitat. 16 U.S.C. § 1536(a)(2). Listed species include endangered and threatened species. According to the USFWS, an endangered species is one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species is one that is likely to become endangered in the foreseeable future. A candidate species is a plant or animal on which the USFWS has sufficient information to propose it as threatened or endangered under the ESA, but which they have not yet proposed because other listing activities take precedence. While candidate species are not legally protected under the ESA, it is consistent with the intent of the ESA to consider that these species have significant value and merit protection.

The September 2, 2016 IPaC search identified six federally endangered, threatened, or candidate species known to occur in Ward County. These include:

- Gray wolf (*Canis lupus*), an endangered mammal
- Whooping crane (*Grus americana*), an endangered bird
- Dakota skipper (*Hesperia dacotae*), a threatened insect
- Northern long-eared bat (*Myotis septentrionalis*), a threatened mammal
- Piping plover (*Charadrius melodus*), a threatened bird
- Rufa red knot (*Calidris canutus rufa*), a threatened bird

The USFWS has designated critical habitat for gray wolf, whooping crane, Dakota skipper and piping plover. However, there is no designated critical habitat for gray wolf or whooping crane in North Dakota. There are designated critical habitat units for the piping plover and the Dakota skipper in North Dakota, but they are outside of the project area. No critical habitat has been designated or proposed for Northern long-eared bat or Rufa red knot.

3.3.4.1 Federally-listed Species Life History Summaries

Gray Wolf

The gray wolf is the largest wild canine species in North America. Gray wolves are most abundant throughout northern Canada, Alaska, and the forested areas of Northern Michigan, Minnesota, and Wisconsin and have been re-introduced to Yellowstone National Park in Wyoming. Historically, its preferred habitat includes biomes such as boreal forest, temperate deciduous forest, and temperate grasslands. Gray wolves live in packs of up to 21 members, although some individuals will roam alone.

While the gray wolf is not common in North Dakota, occasionally individual wolves pass through the state. There are no documented occurrences of gray wolf, however, in the project area. USFWS has designated critical habitat for gray wolf, but not in North Dakota.

Whooping Crane

The whooping crane is the tallest bird in North America. In the United States, this species is found throughout the Midwest and Rocky Mountains regions from North Dakota south to Texas and west into Colorado. Whooping cranes migrate through North Dakota along a band running from the south central to the northwestern parts of the state. They use shallow, seasonally and semi-permanently flooded Palustrine (marshy) wetlands for roosting and various cropland and emergent wetlands for feeding. During migration, whooping cranes are often recorded in riverine habitats. Currently there are three wild populations of whooping cranes in the United States, yielding a total population of about 383. Of these three populations, only one is self-sustaining. None of these populations occurs within the project area. USFWS has designated critical habitat for whooping crane, but not in North Dakota.

Dakota Skipper

The Dakota skipper is a northern prairie butterfly species. Most of the native prairie habitat throughout the species' historical range has been lost and converted to agriculture. As a result, the Dakota skipper is now a rare and localized species, dependent upon high-quality native prairie remnants in Minnesota and the Dakotas.

The USFWS has designated critical habitat for Dakota skipper but there are no designated critical habitat units in Ward County. Throughout the project area there are potentially suitable habitats for Dakota skipper. However, the North Dakota Natural Heritage Inventory Species of Concern and Significant Ecological Communities database (NHIS database), has only one confirmed Dakota skipper sighting in the vicinity of the Project. Based on the NHIS database, consulted September 2, 2016, a Dakota skipper occurrence was documented in 1991 in an approximately 42-acre area west of Burlington.

Vegetative surveys and butterfly habitat evaluations of the borrow sites, revealed potential habitat for the Dakota skipper at the Highway 2 site (reference [34]). Survey results from other potential borrow sites indicate that these sites do not contain suitable habitat for the Dakota skipper. A vegetation survey was not conducted at the Price site, however, as this site has been cultivated and is not expected to contain native prairie vegetation or suitable habitat. The results of these surveys are being discussed with the USFWS. Appropriate actions will be taken through Section 7 consultation, if it is determined that there will be an impact to the Dakota skipper.

Northern Long-eared Bat

The northern long-eared bat is a medium-sized bat that hibernates in caves and mines in the winter, and in the summer roosts singly or in colonies under the bark or in cracks and crevices of trees. The northern long-eared bat is relatively widespread. It is listed as a threatened species, however, because populations of the species in the eastern and central United States are being sharply reduced by a fungal pathogen that causes white-nose syndrome. The pathogen causes the bat to come out of hibernation prematurely.

In the eastern United States, northern long-eared bat populations have been reduced by more than 90 percent. The project area is within the range of the northern long-eared bat, although the project area lies outside of the USFWS' current estimate of the spread of white-nose syndrome. In addition, there are no known hibernacula or occupied roost trees within 0.25 mile of the project area, and there are no documented occurrences of northern long-eared bats in the project area. USFWS determined in April 2016 that designation of critical habitat is not prudent at this time [reference [35]].

Piping Plover

The piping plover is a small migratory shorebird. Historically, piping plovers could be found throughout the Atlantic Coast, Northern Great Plains, and the Great Lakes. Drastically reduced, sparse populations presently occur throughout this historic range. However, piping plover is known to occur in Ward County, and there are ten USFWS-designated piping plover critical habitat units in the county, approximately 19 to 26 miles southwest of the project [reference [36]}. Additional designated critical habitat units for piping plover are scattered throughout North Dakota, and along the Missouri River in western North Dakota. Piping plover critical habitat includes reservoir reaches on the Missouri River system composed of sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with water bodies.

Rufa Red Knot

The rufa red knot is a small-medium shorebird that migrates long distances between summer and wintering grounds. Rufa red knots travel more than 9,300 miles each way between Tierra del Fuego in the winter and above the Arctic Circle for summer breeding. The long migration routes require regular stopover points, referred to as staging areas, for feeding. Rufa red knots return regularly every year to these staging areas, among which are the North Atlantic seaboard horseshoe crab breeding grounds, specifically on the Delaware Bay and the Cape May Peninsula, where the birds feed on the crab eggs. Commercial fisheries in these areas, however, have significantly reduced the production of horseshoe crab eggs, which has been a major factor in the decline of the species and has prevented the red rufa from being able to maintain viable population levels. There are no documented occurrences of rufa red knot in the project area. Potential suitable staging areas for the species in and near the project area are relatively small and do not provide food or shelter opportunities preferred by rufa red knots. USFWS has not designated critical habitat for rufa red knot.

3.3.4.2 Species of Conservation Priority

In 2001, the USFWS began awarding State Wildlife Grants (SWG) for the development and implementation of programs for the benefit of wildlife and their habitat, including species that are not hunted or fished. States interested in qualifying for SWG funds were required to develop a Comprehensive Wildlife Conservation Strategy (CWCS) that identified species of greatest conservation need (SGCN) that occur in the state, and the habitats needed to conserve them. In 2005, the North Dakota Game and Fish Department (NDGFD) published an updated version of the North Dakota CWCS that identified 100 Species of Conservation Priority (SoCP, the NDGFD term for SGCN) (reference [37]). Federal funding for the SWG program has since been eliminated; however, North Dakota and the other states continue to maintain their CWCS and species lists.

The 100 SoCP in North Dakota include 45 birds, 2 amphibians, 9 reptiles, 15 mammals, 22 fish, and 7 freshwater mussels. The most current information on the distribution and relative abundance of SoCP species is found in Appendix A of the 2005 CWCS (reference [37]). It is likely that many of the SoCP bird species are occasionally present in the project area. However, it is unlikely that SoCP species in general are regular inhabitants of the project area. This is because SoCP species typically do not use the developed and artificial cover types and habitats in the project area. These species are also generally at a competitive disadvantage with more common, introduced species that use the project area.

Many of the SoCP species are likely found in one or more of the four NWRs within 50 miles of the project area, especially the SoCP waterfowl and shorebird species. Of the federally-species known to occur in Ward County, the gray wolf, whooping crane, piping plover and Sprague's pipit are also SoCP species.

3.4 Land Use and Infrastructure

Land use and infrastructure in the project area are strongly influenced by the aggressive pace of growth Minot has experienced in recent years. Between 2000 and 2014, Minot's population increased approximately 30 percent (reference [38]), due largely to the expansion of the petroleum industry tapping the Bakken shale formation during that period. Population growth has resulted in a growing demand for housing and infrastructure (e.g., water, sewer, and transportation systems). Damage to housing and infrastructure from the 2011 flood events has exacerbated the imbalance between supply and demand, and the area currently faces economic-based development challenges along with flood disaster recovery.

3.4.1 Land Use

Land use in the project area was assessed by reviewing local zoning ordinances and relevant comprehensive land use and natural resource plans; federal, state, and local agency websites; aerial photography; and a variety of GIS mapping sources including the Multi-Resolution Land Characteristics Consortium, National Land Cover Database 2011 (NLCD 2011). Minot's Land Use Plan and 2012 Comprehensive Plan provide an overview of existing and planned land use in Minot.

3.4.1.1 Historical Context

Historically, North Dakota was covered with flat and rolling prairies. As people began to settle in the state and as railroads were developed, much of the prairie land was converted to agricultural use and towns like Minot and Burlington grew up along the railroads to facilitate transportation of goods and people. The land use within the project area was influenced by Minot's historical development as a transportation and shipping hub since the late 1800s. This region was developed during the time when the railroad was expanding into the Midwest and natural resources were discovered in this area. Burlington, established in 1883, was the first county seat for Ward County, which was at the time the center for lignite mining. Burlington is recognized as the site of the first framed building in the territory (reference [39]). An influx of settlers came to the Burlington/Minot area during the 1880s, in part due to the expansion of railroad to the area. The present day Great Northern Railroad is the successor to the Manitoba Railroad, which reached Minot in 1886. Minot was established in 1887 and by 1888 had replaced Burlington as the county seat. Minot experienced a significant population boom from the late 1880s through 1911 (reference [40]).

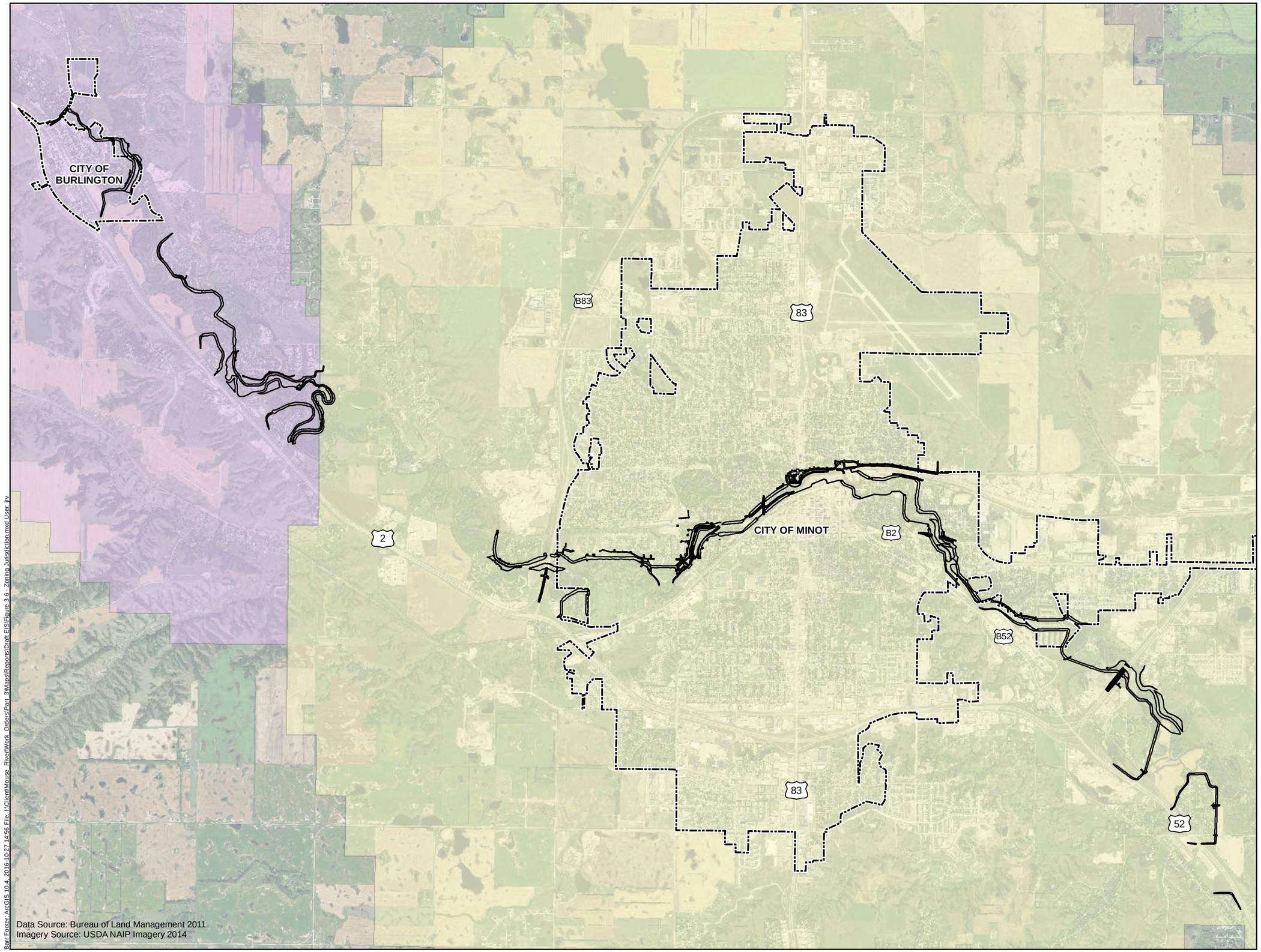
In the 1950's, the area experienced significant development, including the Minot Air Force base to the north. Also around this time the Garrison Dam was built on the Missouri River south of Minot.

3.4.1.2 Current Land Use

Land cover reflects the general types of land use within the area. The NLCD2011 mapping results showing the land cover in the project area are provided in Map 3-4. Zoning reflects land-use restrictions, limitations, rights, and privileges assigned by municipalities. At present, Burlington and Minot each govern zoning and land use within their corporate city limits and an extraterritorial zoning boundary (Figure 3-6). Zoning maps for the cities are provided in Map 3-5. The project area between the corporate city limits of Burlington and Minot, consisting of rural residential communities within Harrison Township, is covered under the cities' extraterritorial zoning. The project area downstream of Minot is within Minot's extraterritorial zoning boundary.

Burlington is a small residential community located in the Souris River Valley, south of the confluence of the Mouse and Des Lacs Rivers. The Burlington segment of the project extends along the eastern/northeastern outskirts of the city. Within and directly adjacent to the project boundary are residential properties, a cemetery, Old Settlers Park, and the Canadian Pacific Railway. Land cover of the project area near Burlington is predominately low-intensity developed area, with some open space, pasture/hay, and cultivated crop areas. Other land cover includes developed areas, woody and emergent herbaceous wetlands associated with areas directly adjacent to Souris River, and old oxbows associated with the river channel. Burlington recently adopted city zoning. Previously Burlington zoning was governed by Ward County under Ward County Zoning District 6 (reference [41], the *Ward County Zoning Districts* map). Project features in the Burlington segment are in, or adjacent to, areas zoned residential and agricultural, as shown on Map 3-5.

Between the city limits of Burlington and Minot, the project area is generally less developed. The Vardon Golf Club is in this portion of the project area. North of this community, on the opposite side of the railroad is an aggregate mine. Land cover in this area is predominantly open developed area, hay/pasture, cultivated crops, and wetlands, with occasional areas of low- and medium-intensity development. Project features within Burlington's and Minot's extraterritorial zoning boundaries are in areas that are zoned agricultural and residential.



City of Minot Extraterritorial Zoning

City of Burlington Extraterritorial Zoning

Project Footprint

Municipalities

0 2,000 4,000 8,000

Feet

Figure 3-6

ZONING JURISDICTION
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 14:56 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-6_Zoning Jurisdiction.mxd User: RV

Within Minot, the project area is predominantly developed land, although in the western portions of Minot, significant areas of undeveloped open space are present, along with low-intensity residential areas. Jack Hoeven Park and the Wee Links Golf Course are also in this area. The project area in central Minot is more densely developed and populated and includes commercial and industrial uses. The Roosevelt Park and Zoo, in east-central Minot, is a public zone area used for outdoor recreation and leisure. Towards the eastern limits of Minot, land use in the project area is low- to medium-density residential and manufactured home neighborhoods along with light- to heavy-industrial, and commercial areas.

The project area downstream of the Minot city limits is largely less densely developed communities that have a more rural character, with adjacent agricultural lands and wetland areas. Land use is generally zoned single-family residential and agricultural, with minor areas zoned for general commercial uses.

3.4.1.3 Future Land Use and Flood Recovery Planning

Minot's Comprehensive Plan (reference [42]) recognizes that the city has experienced significant new development due to the oil boom in western North Dakota, agriculture and railroad-related business, flood recovery and reconstruction, the Minot Air Force Base, Minot State University, and Minot's continued role as a regional center for western North Dakota and eastern Montana. These aspects are discussed in more detail in Section 3.6. The Comprehensive Plan has identified "Growth Areas" with a logical pattern of land uses to allow compact, orderly, rational growth to occur, creating desirable new neighborhoods (Figure 3-7). The Growth Areas identified in Figure 3-7 show areas where growth is expected to occur in the future. Note that the "phases" listed on the figure are from the Comprehensive Plan and are not associated with the phases developed for the Requester's Preferred Alternative. These Growth Areas have been planned to address future scenarios ranging from explosive growth (phase 5) to slow growth (phase1) (reference [42]).

The proposed flood risk reduction Project is compatible with Minot's future planning efforts. Minot's land use planning integrates greenway connections and compact development in the city. The 2012 Comprehensive Plan recognizes the need for rational and responsible growth and development that offers a well-planned community and preservation of quality of life. Important considerations are made for coordinated land use and transportation plans; encouragement of new and continued, balanced growth of commercial/industrial development; and maintenance of downtown Minot as a focal point. Minot's land use plan identifies the entire Souris River reach within the city, as conceptual greenway connections. Designating greenway connections involves protecting and enhancing drainage corridors; providing amenities; connecting major destinations with biking/walking routes; providing active living choices; connecting wildlife habitat; and enhancing existing streets. Much of Construction Stage 1.5 is located within the downtown area, which is considered a growth area with its own potential for development and redevelopment.

Burlington has not developed a comprehensive city plan, but the Project plans have been closely coordinated with city officials to ensure that they are compatible with any future plans they may have.

Much effort and support has been invested in recovering from the effects of the June 2011 flood. The Federal government provided assistance to affected areas and communities (including housing,

infrastructure, and economic recovery), as well as recovery planning, which included developing flood risk reduction measures. A long-term Mouse River Basin Recovery Strategy was developed by the North Dakota Department of Commerce: the *State of North Dakota Action Plan for Disaster Recovery, Utilizing Supplemental CDBG Disaster Recovery Funding from the Department of Housing and Urban Development Appropriations Act, 2013 (Public Law, 113-2), through the U.S. Department of Housing and Urban Development (Federal Register Docket Nos, FR-5696-N-01, FR-5710-N-01 and FR-5696-N-03* (August 2013).

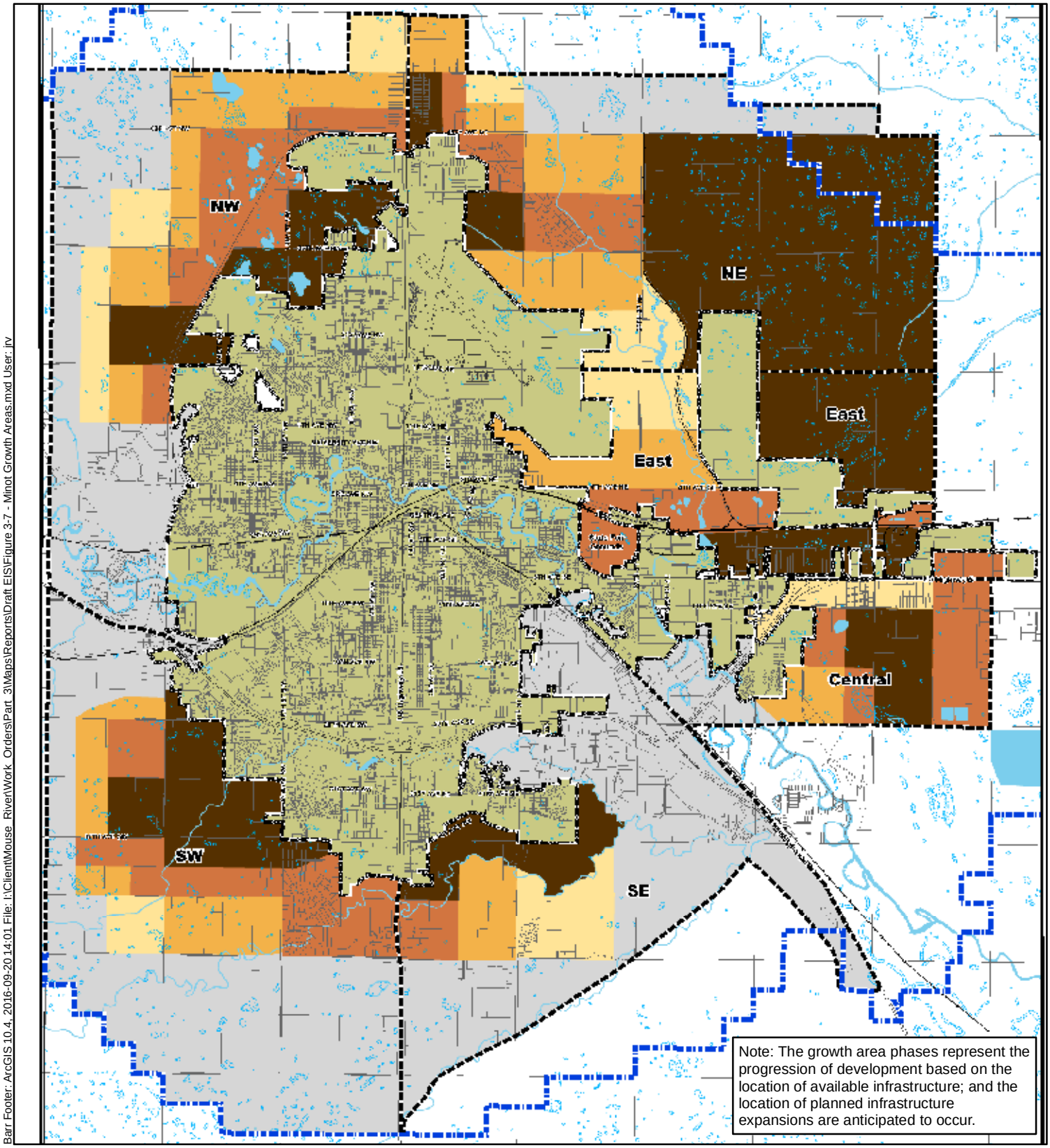
At the invitation of local and state partners, FEMA deployed a specialized team of planners to facilitate long-term community planning in the Souris River Basin. Given the magnitude of the 2011 flooding, FEMA's team included the Emergency Support Function #14, also known as Long-term Community Recovery (LTCR), to assist with planning for the long-term recovery of the Souris River Basin. FEMA and North Dakota Department of Emergency Services (NDDES) determined that state and federal disaster recovery programs would adequately address the needs of all but one jurisdiction – Ward County. Given the effects of the flood on the cities of Burlington and Minot, their proximity, and their similar recovery issues, the team indicated that Ward County communities would benefit from developing a long-term recovery plan with coordinated efforts on recovery issues that would affect both jurisdictions, especially those related to flood control and housing. The top long-term recovery priorities identified include:

- Developing affordable housing.
- Creating a Souris River Valley Greenway with recreational amenities.
- Conducting a transportation study for the region.

As part of the long-term recovery planning, the *Mouse River Basin Enhanced Flood Protection Plan, Preliminary Engineering Report* (reference [1]) was developed and released February 29, 2012. The proposed Project is a continuation of these long-term planning efforts for a portion of the area affected by the June 2011 flood.

Minot completed a disaster recovery plan, which supports the development of the Project. Related to the state disaster recovery action plan, the Minot disaster recovery action plan (reference [43]) recommends short-term recovery (e.g., acquiring and demolishing hazardous structures; removing debris; repairing basic infrastructure; rehabilitating and reconstructing homes, businesses, and schools; and ensuring adequate and operational emergency service), along with flood control planned and implemented on a regional basis as one of the highest priorities for long-term recovery.

In addition to local city and disaster recovery planning in the project area, the Project has also been incorporated into and is compatible with the North Dakota State Water Commission plans. The *North Dakota 2015 State Water Management Plan* identifies Mouse River flood control as a high priority water development project. This state plan identifies the MREFPP, as designed, to provide flood relief to Souris River Valley residents in both urban and rural settings. Flood control efforts by MREFPP consist of the features of the proposed Project, as well as other efforts outside of the project area, in Renville, McHenry, and Bottineau Counties (reference [44]).



Barr Footer: ArcGIS 10.4, 2016-09-20 14:01 File: I:\ClientMouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-7 - Minot Growth Areas.mxd User: jrv

Source: reference[27]

- 2-Mile Jurisdictional Boundary
- Growth Area Boundaries
- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- City of Minot (2011)
- Railroad
- Airport
- Streams
- Open Water
- Wetland

0 3,000 6,000 12,000
Feet

Figure 3-7

MINOT GROWTH AREAS
Mouse River Enhanced Flood Protection Project

3.4.2 Infrastructure

Infrastructure provides the basic physical and organizational structures needed for the operation of a functional society. It includes roadways, railways, transit systems, airports, utilities, water delivery and internal drainage systems, along with emergency services. Types and density of infrastructure present vary throughout the project area, ranging from extensive urban infrastructure within Minot to the more minimal infrastructure in the rural residential areas outside the city limits of Burlington and Minot.

3.4.2.1 Existing Flood Risk-reduction Infrastructure

Flood risk-reduction infrastructure in the project area includes multiple flood risk-reduction features, in six subdivisions between Burlington and the upstream side of Minot, constructed by USACE as part of the Souris River Basin Project, as well as channel modification features constructed under a previous phase of the Souris River Basin Project. Existing flood risk-reduction features in the project area are described in Section 1.4.

3.4.2.2 Transportation

Roadways

As shown in Map 3-6**,** Minot is at the intersection of three major arterial roadways (U.S. Highway 83, U.S. Highway 2, and U.S. Highway 52). These transportation routes are the primary roadway corridors for long trips and are essential for commerce to and through the region and the state (reference [3]). Also shown in Map 3-6 are minor arterial and collector (urban and rural) roadways. The minor arterial and collector roadways serve the sub-region (i.e., Burlington and Minot), providing connections to principal arterial roadways, activity centers, business/retail, schools, hospitals, and neighborhoods.

Table 3-4 provides a detailed summary of features and functions of the roadway networks identified on Map 3-6.

Table 3-4 Major Roadways in the Project Area

Roadway Name	Functional Classification	No. of Lanes	Average Daily Traffic (ADT)(1)
U.S. Highway 2 (County 17 and 55th Street NE)	Principle Arterial Expressway	4	10,600 – 19,710
U.S. Highway 2/ Burdick Expressway (U.S. Highway 2 eastward to 13th Street SE)	Principal Arterial	4-5(2)	5,280 – 7,620
U.S. Highway 52	Principal Arterial	3	8,000 – 8,490
U.S. Highway 83 (S. and N. Broadway)	Principal Arterial	4-5(3)	11,700 – 29,440
U.S. Highway 83 Bypass	Principal Arterial	2	6,630 – 10,610
Railway Avenue	Minor Arterial	2	NA
University Avenue W	Minor Arterial	2/3	N/A
2nd Avenue SW	Minor Arterial/Collector	2	NA

Roadway Name	Functional Classification	No. of Lanes	Average Daily Traffic (ADT)(1)
3rd Street SE	Minor Arterial	3/4	4,470 – 8,455
3rd/4th Avenue NW	Minor Arterial	2/4	4,495
8th Street NW	Minor Arterial/Collector	2/3	NA
8th Avenue SE	Minor Arterial	2	NA
11th Avenue SW	Minor Arterial/Collector	2/3	NA
13th Street SE	Minor Arterial	2/3	NA
16th Street NW	Minor Arterial/Collector	2, 4, 5	11,130(4)
16th Street SW	Minor Arterial	4	14,365 – 15,780(5)
20th Avenue SW	Minor Arterial	3/4	NA
20th Avenue SE	Minor Arterial	4/5	NA
21st Avenue NW	Minor Arterial	2/4	3,090 – 3,400
27th Street SE	Minor Arterial	2/3	NA
31st Avenue SW	Minor Arterial	3	NA
31st Avenue SE	Minor Arterial	2	NA
37th Avenue SW	Minor Arterial	5	2,370 – 7,845
37th Avenue SE	Minor Arterial	3	NA
Central Avenue	Collector	2	NA
Hiawatha Street (SE)	Collector	2	NA
Northwest Avenue	Collector	2	NA
Sunset Blvd (NW)	Collector	2	NA
1st Avenue SE	Collector	2	NA
1st Street SW	Collector	2	NA
1st Street SE	Collector	2	NA
2nd/3rd Street SE	Collector	2	NA
3rd Avenue SE	Collector	2	NA
4th Avenue NE	Collector	2	NA
6th Street SW	Collector	2	NA
7th Street NE	Collector	2	NA
16th Avenue SE/SW	Collector	2/3	NA
11th Avenue NW	Collector	2	NA
11th Avenue SE	Collector	2	NA
20th Avenue SE	Collector	2	NA

Roadway Name	Functional Classification	No. of Lanes	Average Daily Traffic (ADT)(1)
20th Street NW	Collector	2	NA
27th Street SE	Collector	2	NA
31st Street SE	Collector	2	NA
55th Street NE/SE	Collector	2	1,610 – 3,115
County Road 10 (Colton Avenue-Burlington)	Collector	2	NA
County Road 12	Collector	2/3	3,115
County Road 14	Collector	2	NA
County Road 15	Collector	2	NA
County Road 17	Collector	2	NA
County Road 19 (S)	Collector	2	NA

Table sourced from reference [3]

(1) Range of current ADT (>5,000) was obtained from Minot, North Dakota 2035 Transportation Plan (Final January 2015).
(2) U.S. Highway 2 Bypass is five lanes running west to east, transitioning to four-lanes on the east side of U.S. Highway 83, then becoming five lanes in east Minot prior to rejoining U.S. Highway 2.
(3) U.S. Highway 83 in north Minot is four-lane divided transitioning into five lanes through the heart of Minot, then south of U.S. Highway 2 becoming four-lane divided.
(4) Segment located between Eleventh Avenue NW and Second Avenue SW
(5) Segment located between Second Avenue SW and Thirty-First Avenue SW

Roadway Bridges

Bridges over the Souris River are integral to transport in the region as they provide connections and continuity for the overall transportation network regionally and locally. Numerous bridges are located within the project area (Map 3-7). Table 3-5 provides an overview of roadway bridges in the project area. Roadway bridges that would be directly affected by the Project include the following:

- Colton Avenue bridge (Burlington)
- U.S. Highway 83 Bypass bridge (Minot)
- Burdick Expressway bridge (Minot)
- Twenty-Seventh Street bridge (Minot)
- U.S. Highway 2 bridge (Minot)

Table 3-5 Roadway Bridges in the Project Area

Bridge Name	Bridge No. – (Map 3-7)	Bridge Location	No. of Lanes	Approx. Length (feet)
Colton Avenue Bridge(1)	1	Burlington	2	122
U.S. Highway 83 Bypass Bridge(1)	2	Minot (far west)	2	220
16th Street SW Bridge	3	Minot (west)	4	140
2nd Avenue SW	4	Minot (west/central)	4	150
4th Avenue NW	5	Minot (west/central)	4	165
5th Avenue NW	6	Minot (west/central)	3	300
3rd Avenue NW/4th Avenue NW	7	Minot (central)	4	220
U.S. Highway 83/ Broadway Bridge	8	Minot (central)	4	>200
3rd Street NE	9	Minot (central)	2	>200
7th Street NE	10	Minot (central)	2	175
Burdick Expressway Bridge (U.S. Highway 2 Bypass Bridge)(1)	11	Minot (central)	4	200
8th Avenue SE	12	Minot (east/central)	2	165
27th Street Bridge(1)	13	Minot (east/central)	2	185
U.S. Highway 2 Bridge(1)	14	Minot (east)	4	180

Table sourced from reference [3]
(1) Roadway bridges that would be modified as part of the proposed Project

The U.S. Highway 83/Broadway Bridge is scheduled to be replaced. This effort is considered to have independent utility from the proposed flood risk reduction project. It is being planned and evaluated as a separate action by the North Dakota Department of Transportation (NDDOT) in cooperation with the Federal Highway Administration and City of Minot. Detailed engineering design, construction documentation, and environmental review and permitting are expected to be completed by fall 2016 with construction anticipated during the 2017 and 2018 construction season. The bridge replacement is being evaluated by NDDOT/FHWA separately for NEPA compliance.

Railways

The Burlington Northern Santa Fe (BNSF) Railway and the Canadian Pacific Railway are Class I commercial rail lines carrying main line freight operations through the project area. The location of the railways in relation to the Project are shown on Map 3-6. BNSF also has AMTRAK passenger service operating on its tracks in the project area. The AMTRAK station, located in downtown Minot, is served by the "Empire

Builder," which has become increasingly popular, as reflected in its growing number of riders during the 2010 to 2014 oil boom (reference [3]).

BNSF has major yard operations in Minot, operating two mainline tracks through the city and the switching yard is in eastern Minot, along U.S. Highway 2, in the industrial portion of the city. Trains are routed on the multiple BNSF lines that come into Minot from the southeast, east, north, and west. BNSF operates about 30 trains per day through Minot. BNSF freight traffic is primarily comprised of intermodal and grain freight, drilling supplies for the western North Dakota oil fields, and oil shipments to refineries in the southern United States. In addition to freight traffic, AMTRAK operates two trains per day on the BNSF track—one east bound and one west bound. A portion of the mainline tracks and the yards are susceptible to inundation during larger flood events. As a result of the 2011 flood event, BNSF temporarily discontinued service on mainline tracks and at the AMTRAK depot, and they suffered damage to their support facilities. BNSF has expressed a desire to raise their track and bridge to prevent mainline service interruption during major flood events.

Canadian Pacific Railway operates a mainline through the Souris River Valley, running diagonally from north central North Dakota, through Minot, to the extreme southeastern corner of the state. This is the primary connection from their system in Saskatchewan and Alberta to the central United States. Canadian Pacific has multiple siding locations and spur lines that service rail users. Canadian Pacific Railway currently operates about 16 trains per day through the Souris River Valley. A single track of the Canadian Pacific Railway passes through the project area near the intersection of First Avenue SW and Second Avenue SW in Minot. As a result of the 2011 flood, Canadian Pacific also temporarily discontinued service on tracks and suffered damage to support facilities. A Canadian Pacific Railway bridge located in the Maple Avenue High-Flow Diversion segment would require reconstruction to be compatible with flows from the diversion.

Public Transit

There are two public transit systems (Minot City Transit and Souris Basin Transportation) in the project area. Jefferson Lines also provides regional bus service.

Public transit plays an important role in Minot's overall transportation network. It serves Minot by providing an alternate means of transportation, reducing traffic, and supporting community members who do not have access to personal vehicles. Minot City Transit operates nine fixed bus routes, which operate daily Monday through Saturday. The Minot City Transit public transportation system in the project area is centralized in Minot.

Souris Basin Transportation is a non-profit corporation providing rural public transit service within Minot and the surrounding seven county area. Souris Basin Transportation offers service for on-demand trips and scheduled routes. This bus service operates along 14 routes, providing transit service to the general public, with focus on the elderly and special-needs individuals.

Jefferson Lines provides commercial bus service to and from Minot. This intercity service provides connections to cities along U.S. Highway 2 throughout North Dakota.

Airports and Airstrips

Two aviation facilities are located in the Minot region: the Minot International Airport and Minot Air Force Base (Figure 3-8). The Minot International Airport is located at the northern edge of Minot – it serves Minot and the surrounding communities. The Minot Air Force Base is about 10 miles north and would not be affected by the Project.

Minot International Airport (MOT) is a public airport located approximately two miles northeast of downtown Minot. The airport includes a passenger terminal, a general aviation terminal building, three aprons, two lighted runways, and a number of hangers, offices, and other support buildings and equipment. Access to the Minot International Airport is primarily by Airport Road, a two-lane roadway leading to the air carrier terminal area from North Broadway at the Twentieth Avenue NW intersection. Nineteenth Avenue NW also serves as access between North Broadway and Airport Road.

3.4.2.3 Private Utilities

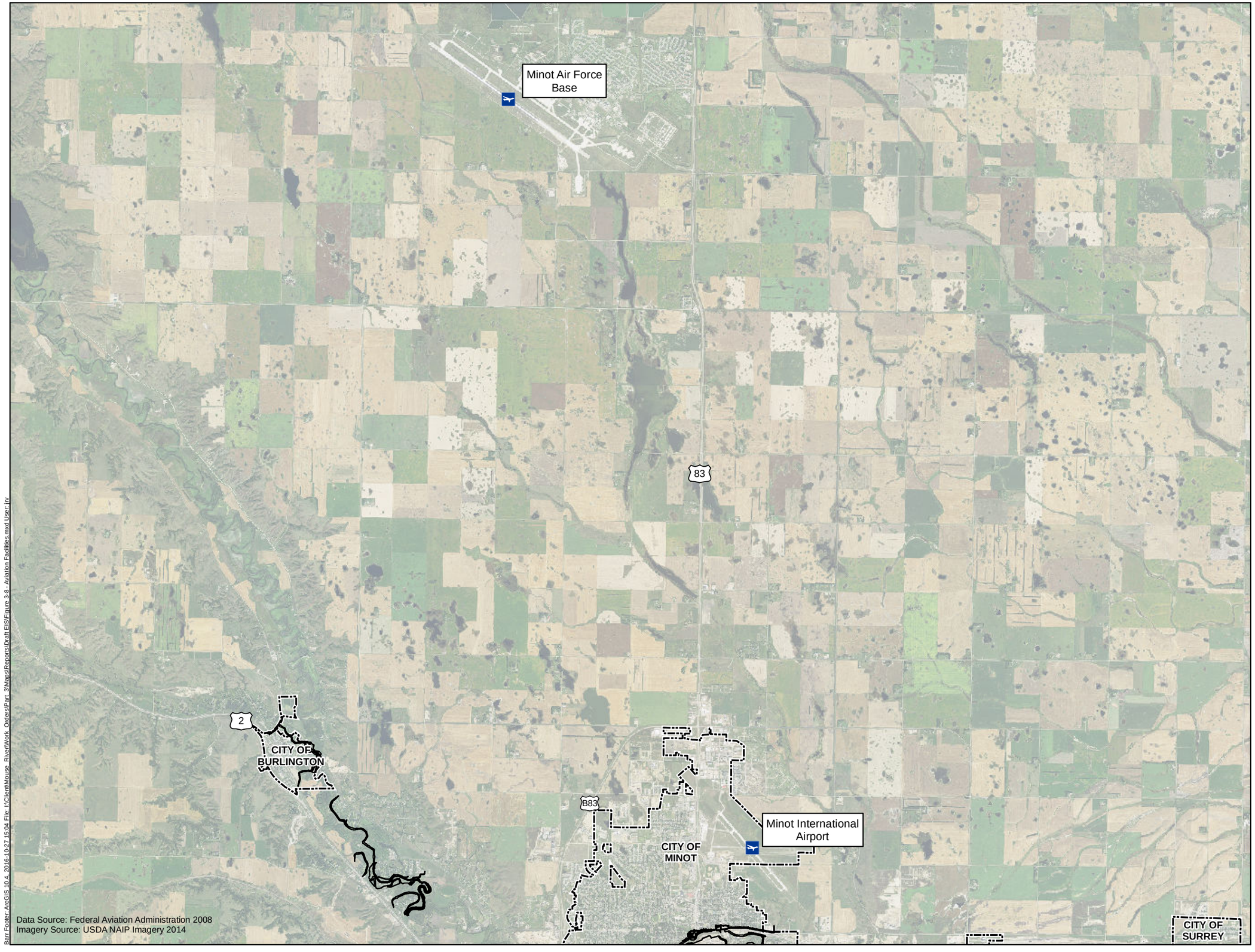
Private, non-municipal utility companies serving the communities in the project area are listed in Table 3-6. Private utilities are commonly referred to as franchise utilities because these companies have contractual permission to place their utilities in the public rights-of-way, with various local exceptions. Generally, franchise agreements between local governments and utility companies require that the utility company be responsible for relocating any utilities that conflict with the location of public improvements.

The Montana-Dakota Utilities Company (MDU) is the natural gas provider in the project area, providing service to both Burlington and Minot. Within Minot, underground gas mains and service pipelines are commonly run adjacent to and within the impact area. Natural gas service distribution stations are also scattered throughout Minot near the project area.

Xcel Energy, the Verendrye Electric Cooperative, and Otter Tail Power are the primary electric providers in the project area, providing service to both Burlington and Minot. Infrastructure within and adjacent to the impact area includes overhead transmission and distribution lines, distribution switches, underground transformers and distribution lines, and street lights.

Table 3-6 Non-Municipal Utility Providers

Utility Company	Service Type
Xcel Energy	Electric
Verendrye Electric Cooperative	Electric
Otter Tail Power	Electric
Montana Dakota Utilities	Natural Gas, Electric
Souris River Telecommunications	Telecommunications
Midcontinent Communications	Telecommunications
Reservation Telephone Cooperative	Telecommunications
North Prairie Rural Water District	Rural Water
Upper Souris Water Users District	Rural Water
Northwest Area Water Supply	Regional Water Supply
Enbridge	Crude Oil Transmission
Minot Air Force Base	Missile Communications



Airport Location
Project Footprint
Municipalities

0 3,500 7,000 14,000
Feet

Figure 3-8

AVIATION FACILITIES
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:04 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-8 - Aviation Facilities.mxd User: jrv

3.4.2.4 Public Water Distribution Systems

Burlington and Minot each operate public water distribution systems. Both municipal systems are connected to the Northwest Area Water Supply (NAWS) system. The NAWS system is designed to supply drinking water from Lake Sakakawea, on the Missouri River, to Burlington, Minot, and other North Dakota communities. The system is only partially completed, however, and as of 2015 Minot was supplying water to the NAWS system, rather than receiving water. Eventually, the NAWS system will serve Minot.

Burlington's municipal water supply is provided primarily by the NAWS system. The city also owns two water supply wells (one of which is currently out of service) and a water treatment facility, which are used as a redundant water supply and as a supplemental supply during periods of high demand.

Minot operates a municipal water system with wells that draw groundwater from the Minot Aquifer and the Sundre Aquifer. Groundwater from the Minot and Sundre aquifers is being withdrawn at an unsustainable rate. Minot is currently supplying water to the NAWS system and the North Prairie Rural Water District system. Since 2008, Minot has been providing water from the city's groundwater wells to Berthold, Deering, Kenmare, Mohall, Burlington, and the North Central Rural Water Consortium. This interim water supply, as the NAWS project infrastructure is being completed, is provided by Minot through temporary water service contracts that are scheduled to expire in 2018 (reference [42]).

The Minot Water Treatment Plant is in the western portion of Minot, adjacent to the Forest Road segment of the Project and north of the BNSF Railway and U.S. Highway 2 business loop (Figure 3-9). Water is treated and then distributed through high-service pumps to the water distribution system, which includes trunk mains, booster stations, and water storage reservoirs that provide the water supply and pressure to the system. Water distribution in Minot is currently divided between three pressure zones: North, South, and Valley. A flood risk-reduction project, separate from the Requester's Preferred Alternative, is currently underway to protect the Minot Water Treatment Plant from flooding.

The rural communities between Burlington and Minot receive potable water from the North Prairie Rural Water District and the West River Water and Sewer District. Rural communities downstream of Minot are supplied with potable water by the North Prairie Rural Water District.

3.4.2.5 Sanitary Sewer Systems

Burlington operates a municipal sanitary sewer system, with the treatment facility located north of the city between the Des Lacs and Souris Rivers. In the rural communities between Burlington and Minot, sewage treatment systems consist of privately owned and managed septic systems and drain fields.

Minot also operates a municipal sanitary sewer system. Sanitary sewer system facilities that serve Minot include the Treatment Facility, Valley Forcemains and Lift Stations, and the Puppy Dog Sewer System which is currently undergoing expansion and enhancement with USACE funding (these actions are independent of those being evaluated in this EIS). A critical component of Minot's sanitary sewer system is the Puppy Dog Lift Station which is just east of the Eastside Estates phase of the proposed Project. This lift station serves a majority of south Minot and is intended to serve substantial future development in the city. The Minot Wastewater Treatment Plant, located southeast of Minot, consists of aeration ponds with

mechanical aerators for primary treatment, a series of facultative lagoon ponds for secondary treatment, and an artificially constructed (discharging) wetland system for tertiary treatment.

Rural communities downstream of Minot are provided with sanitary sewer services through an agreement with the Ward County Water Resources District and Minot. Although Minot's sanitary sewer infrastructure exists in this area, sanitary sewer service in the far downstream extents of the project area consists of privately owned septic systems and drain fields.

3.4.2.6 Storm Sewer System

Minot maintains and operates a storm sewer system within the city. Minot's storm sewer system consists of underground pipes, manholes, lift stations, and other associated infrastructure. Portions of this infrastructure are located in the Project impact area, particularly in central Minot. There is currently no storm sewer infrastructure within the impact area downstream of the Minot city limits.

Burlington does not have a complete storm sewer system. Some shallow ditches located adjacent to the city streets direct runoff into dead loops along the Souris River.

3.4.2.7 Emergency Services

Emergency services are provided throughout the project area and are critical in times of flooding and other natural disasters. Locations of law enforcement departments, fire departments, medical emergency response services, and hospitals within the project area are shown in Map 3-8.

Law Enforcement

Both cities in the project area have their own police departments. The Burlington Police Department, which is headquartered in the western portion of town on Wallace Street East, has a chief and two accompanying police officers. Minot, as County Seat of Ward County, has its city police department, as well as the offices of the Ward County Sheriff's Department and other state and federal law enforcement agencies, including the North Dakota Highway Patrol and U.S. Marshals Service, District of North Dakota. The Minot Police Department, which is headquartered in City Hall off Second Avenue SW, less than 300 feet south of Phase 3 of the Requester's Preferred Alternative, is a full service law enforcement agency, with 24/7 response and patrol.

Water Treatment Plant Levee Footprint

Water Treatment Plant Floodwall Alignment

Project Footprint

0 150 300 600

Feet

Figure 3-9

MINOT WASTEWATER TREATMENT PLANT
Mouse River Enhanced Flood Protection Project

Barr Foster-ArcGIS 10.4, 2016-10-27 14:16 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-9 - Minot Wastewater Treatment Plant.mxd User: jrv

Fire Services

Burlington has a volunteer fire department currently with 25 firefighters and 8 junior firefighters. The department has nine pieces of apparatus: three wildland trucks, two tenders, two engines, one command vehicle, and one rescue truck (reference [45]). The Burlington Fire Station is in central Burlington, southwest of the confluence of the Des Lacs and Souris Rivers.

The Minot Fire Department has three fire stations with Headquarters Station in south-central Minot, Station #2 near the downtown area, and Station #3 adjacent to the Minot International Airport. As Minot has grown, the city has identified an immediate need for an additional fire station in northwestern Minot. During the June 2011 flooding, northern portions of Minot were cut off from fire station access by flooded roads.

The Minot Fire Department employs approximately 50 individuals in three Battalions. The fire department provides services with full-time fire/rescue, medical, ARFF (Minot International Airport), and Hazardous Materials (Hazmat) protection. According to the *City of Minot 2012 Comprehensive Plan*, the rescue squad also protects a radius of 40 miles with Emergency Medical Services, auto extrication, high angle rescue, water/ice rescue with PADI trained divers, and confined space rescue.

Emergency Medical Response

Both Burlington and Minot have medical emergency response services, though services in Minot are more comprehensive, as the nearest hospitals and trauma center in the project area are located in Minot. Burlington has a group of 15 state-certified First Responders that respond to medical emergencies awaiting ambulance transport to a medical facility (reference [45]). In the project area there are two hospitals (Trinity Hospital and Saint Joseph's) and the Trinity Medical Center, which is a+- Level II Trauma Center, all located in downtown Minot (Map 3-8). The Trinity Medical Center operates the Trinity Medical Center Heliport. Trinity Medical has discussed the possibility of moving its main facility to new buildings in southwest Minot. If this move were to occur, the heliport would also relocate to the new location. Minot's medical facilities serve not only local residents, but also the entire north-central North Dakota region.

3.5 Potential Contaminated Sites

A Hazardous, Toxic, and Radioactive Waste (HTRW) assessment was conducted for the project area in general conformance with *ER 1156-2-132 U.S. Army Corps of Engineers Water Resources Policies and Authorities, Hazardous, Toxic and Radioactive Waste Guidance for Civil Works Projects* (reference [46]). The overall HTRW assessment area includes the sites of the planned flood risk-reduction features and a buffer of approximately 50 feet around each feature. The purpose of this assessment was to identify potentially contaminated sites that could be affected by construction or operation of the Project or that could affect construction procedures.

The approach to the HTRW assessment was commensurate with the current level of project definition. Two levels of assessment, with varying intensity, were carried out along the length of the Project. Phase I HTRW assessments, which involves the real estate holdings and potential or existing environmental contamination liabilities, were conducted for the three segments of the Project that have advanced into

the design phase, including the Fourth Avenue NE segment (Phase 1), Napa Valley segment (Phase 2), and the Forest Road segment (Phase 3). Findings from the Phase I assessment identified an industrial area in the Fourth Avenue NE segment so a more detailed Phase II investigation involving soil, air, and groundwater samples was conducted. A general, desktop HTRW assessment was performed for the rest of the Project segments. A full HTRW assessment will be for these segments prior to construction.

As flood risk-reduction features of the Project continue to be refined, more detailed assessments may be conducted in the current HTRW assessment area, or if necessary, the HTRW assessment area may be expanded during future environmental reviews of the Project. The following sections summarize the detailed HTRW assessments that were completed for the initial three segments, and presents the general HTRW assessment for the other segments of the Project.

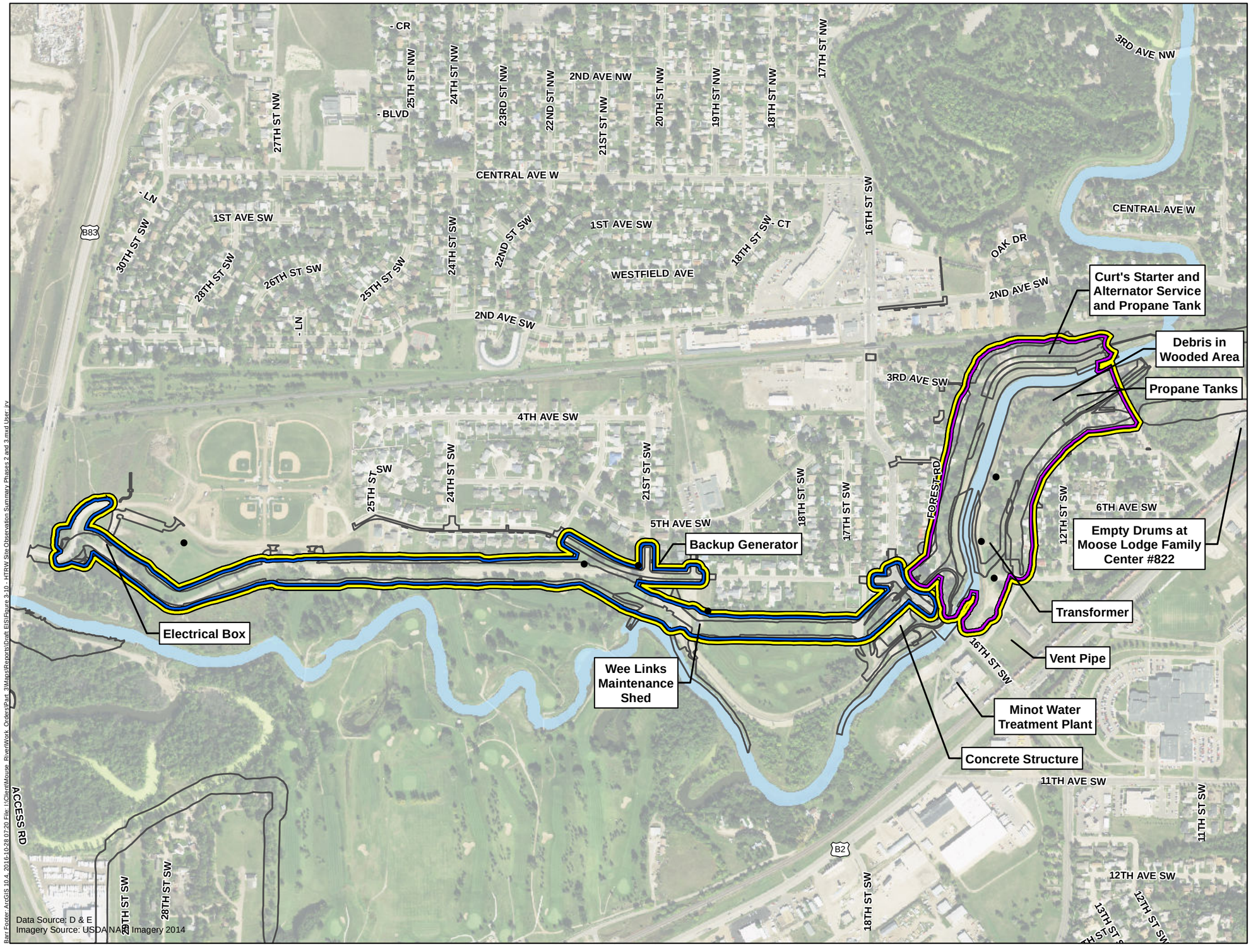
3.5.1 Napa Valley and Forest Road Segments (Phases 2 and 3)

The HTRW assessments for the Napa Valley and Forest Road segments, due to their proximity, were combined into a single report (Appendix D). A review of historic aerial photographs, topographic maps, fire insurance maps, and reverse city directories for the HTRW assessment area indicates that historical land use along the proposed levees and floodwalls was primarily agricultural until 1953, when homes started being built. More recently, many of the homes and buildings have been vacated and demolished as the result of the flood of 2011. The Wee Links Golf course was constructed in 2003 and the Jack Hoeven Park and the Dakota Bark Park were opened in 2009. Current land use in the area of the Napa Valley and Forest Road segments is shown on Map 3-5.

A search of regulatory database records covering the HTRW assessment area and adjoining areas was conducted to identify known environmental sites that could be affected by the Project. Interviews were also conducted with city staff knowledgeable about the area. The regulatory database search and the interviews did not identify any sites of concern within the HTRW assessment area.

A geotechnical drilling investigation along the proposed alignments of the levees and floodwalls was conducted from February through April 2015, which included several borehole locations within the HTRW assessment area. Drilling observations indicate the presence of sand and clay fill, from depths of 2 to 16 feet below ground surface (bgs). No debris was encountered, with the exception of plastic in one boring. No odors, discoloration, or free product were observed during the investigation (Barr 2015c).

A site inspection of the HTRW assessment area was completed in March 2015 from public rights-of-way. No buildings or residences were entered and inspected. There are approximately 60 buildings located within the assessment area. No evidence of contaminated materials was identified at any of these buildings. Due to the age of the structures, however, it is possible that hazardous building materials (such as asbestos-containing material (ACM) and lead-based paint) could have been used during construction. Also, older buildings such as these could have had heating oil storage, wells, septic systems, or other contaminant-related concerns. Buildings, equipment, and debris identified during the site inspection that could contain potentially contaminated substances or be potential indicators of contamination are shown on Figure 3-10.



HTRW Phase 2 (Napa Valley) Assessment Area

HTRW Phase 3 (Forest Road) Assessment Area

Project Footprint

Storm Sewer / Manhole

HTRW - Hazardous, Toxic and Radioactive Waste

0 300 600 1,200

Feet

Figure 3-10

HTRW SITE OBSERVATION SUMMARY: PHASES 2 AND 3
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 07:20 File: I:\Client\Mouse River\Work Orders\Part 3\Maps\Reports\Draft EIS\Figure 3-10 - HTRW Site Observation Summary Phases 2 and 3.mxd User: jrv

3.5.2 Fourth Avenue NE Segment (Phase 1)

3.5.2.1 Phase I Assessment

A Phase I HTRW assessment was conducted for the Fourth Avenue NE segment (Appendix E). A review of historic aerial photographs, topographic maps, fire insurance maps, and reverse city directories of the Fourth Avenue NE HTRW assessment area indicates that land use along the floodwall and road realignment was primarily residential by 1913. Past commercial/industrial properties included the Minot Flour Mill, a feed and stable building/Cox Emerson Lumber/Bond Lumber Company, and Great Northern Lumber Company. Other historic land uses are as follows:

- Between 1913 and 1918, Standard Oil was operating on the east side of the assessment area and had an oil warehouse, a lubricating tank house, a building for filling wagon tanks, a barrel filling shed, and kerosene tanks. A dry cleaner, creamery, and the Minot Water Treatment Plant were operating north of the assessment area in 1918 (Figure 3-11).
- By 1926, additional residential development had occurred north of Fourth Avenue NE. Other land uses were the same as in 1918; the creamery, however, had been converted to a filling station, and the lumber company also had a filling station.
- Between 1969 and 1979, the Souris River was realigned west of the assessment area. The U.S. Highway 83 bridge and several buildings were demolished in the process of realigning the river.

Current land use in the assessment area is a mix of vacant land, residential, commercial, and industrial. Industrial and commercial uses include the Home Sweet Home gift shop; Giscon concrete pumping service; Souris Valley Feed and Seed grain elevator; Souris River Design, Taxi 9000; and Helm's & Mork's Storage, which consists of a furniture store, a small used car sale lot, and a portable heater storage area. There are also a large vacant church and the bridges for U.S. Highway 83 and Third Street SE (Figure 3-12).

A search of regulatory database records covering the assessment area and adjoining areas was conducted to identify known environmental sites that could be affected by the Project. Three sites were identified in the assessment area: Werner Oil Company, North Dakota Concrete Products, and Porter Brothers Salvage Yard (Figure 3-13). Werner Oil Company and Porter Brothers have registered storage tanks, likely for petroleum storage. North Dakota Concrete Products is listed as a leaking storage tank site, with site cleanup completed in 1989.

Interviews were also conducted with city staff knowledgeable about the area. The interviews did not identify any sites of concern for the HTRW assessment area beyond the sites identified in the regulatory records. Site inspections were completed in March and May 2015, from public rights-of-way. No buildings were entered and inspected.

Notable items in the surrounding area to the north were a generator in Lowe's Printing yard, two pad-mounted electrical boxes in good condition in the city park, three pole-mounted transformers in good condition, and a 55-gallon drum, large plastic liquids container, lawn mowing equipment, and heavy equipment near a shop behind Philotechnics Ltd. No stained ground was observed.

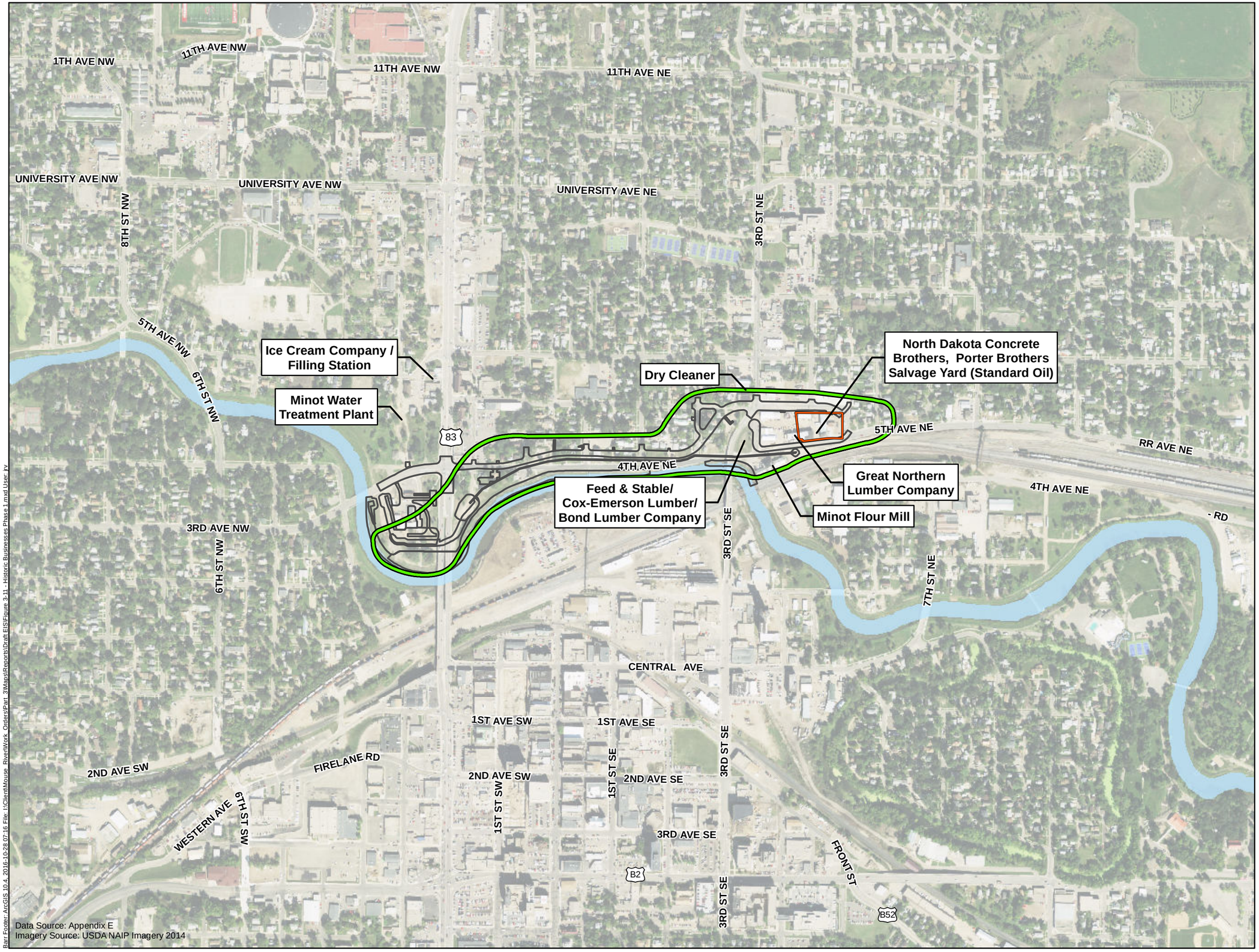
In January 2015, Braun Intertec conducted a geotechnical investigation in the HTRW assessment area, and fill was observed in all borings ranging in depth up to 15 feet below ground surface (bgs). Debris, including asphalt, brick, glass, wood, and concrete, was present in about 25 percent of the borings.

3.5.2.2 Phase II Assessment

Based on the results of the Phase I HTRW assessment of this segment, it was determined that a limited Phase II investigation was needed in the vicinity of some industrial properties (Werner Oil Company, North Dakota Concrete Products, and Porter Brothers Salvage Yard) located in the eastern portion of the Fourth Avenue NE segment (Figure 3-14). The purpose of the investigation was to evaluate soil and groundwater conditions at these properties to determine if contaminants are present. The investigation consisted of placing six borings in the investigation area and collecting soil and groundwater samples from the boreholes. These samples were analyzed for gasoline range organics (GRO), diesel range organics (DRO), semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs), and Resource Conservation and Recovery Act (RCRA) metals.

A summary of the Phase II investigations, including analytical results of the soil and groundwater samples, can be found in Appendix E. The soil analytical results were compared to Environmental Protection Agency's (EPA) Industrial Carcinogenic and Non-Carcinogenic values and NDDH Guidelines for the Assessment and Cleanup of Saltwater Releases – Soil Cleanup Standards. The analytical groundwater results were compared to EPA Secondary Drinking Water Regulations, NDDH Guidelines for the Assessment and Cleanup of Saltwater Releases – Groundwater Cleanup Standards, EPA Maximum Contaminant Levels, and North Dakota surface water standards (North Dakota Water Quality Criteria – Human Health Values, and North Dakota Maximum Limits for Substances in or Characteristics of Class 1 Streams – Chronic).

The analytical results of the soil and groundwater samples did not identify significant contaminant concerns at these industrial properties, so no further HTRW assessments were conducted. It was concluded that construction activities in this industrial area would not be of markedly higher risk for release of HTRW solutes or materials.



HTRW Assessment Area

Project Footprint

Standard Oil Company

HTRW - Hazardous, Toxic and Radioactive Waste

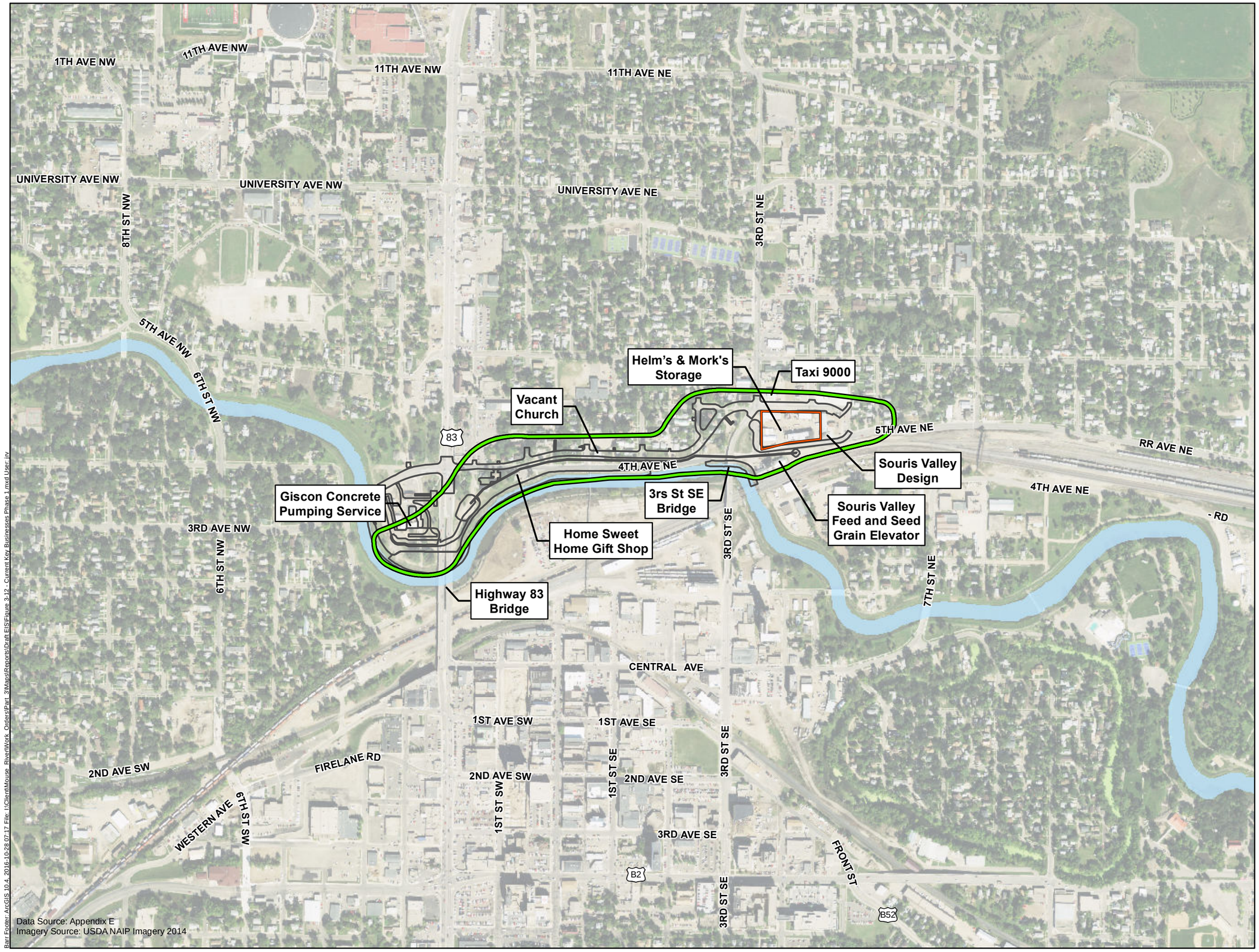
0 300 600 1,200

Feet

Figure 3-11

HISTORIC BUSINESSES: PHASE 1
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 07:16 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-11_Historic Businesses Phase 1.mxd User: jrv



HTRW Assessment Area

Project Footprint

Helm's & Mork Storage

HTRW - Hazardous, Toxic and Radioactive Waste

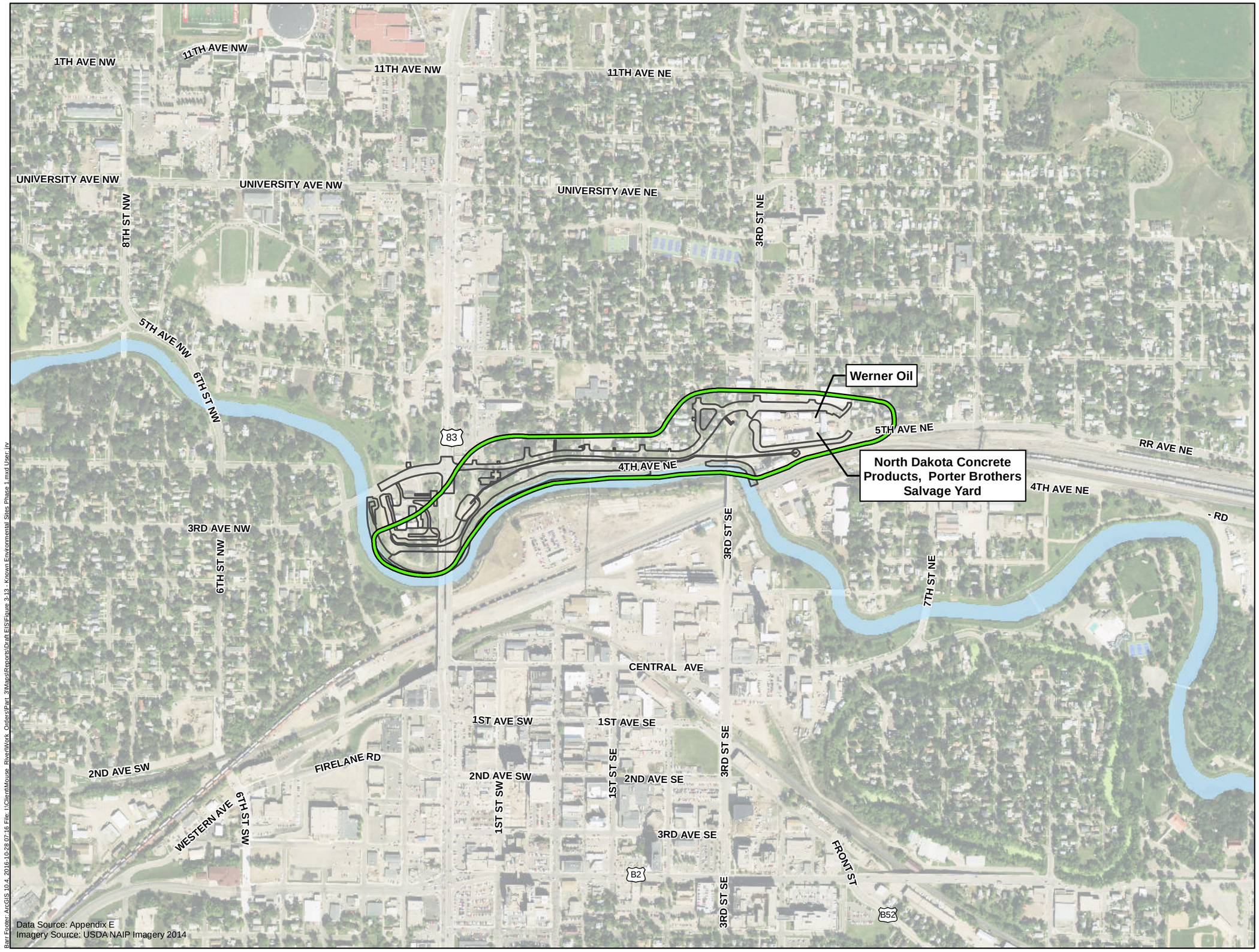
0 300 600 1,200

Feet

Figure 3-12

CURRENT KEY BUSINESSES: PHASE 1
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 07:17 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-12_Current Key Businesses Phase 1.mxd User: rv



HTRW Assessment Area

Project Footprint

HTRW - Hazardous, Toxic and Radioactive Waste

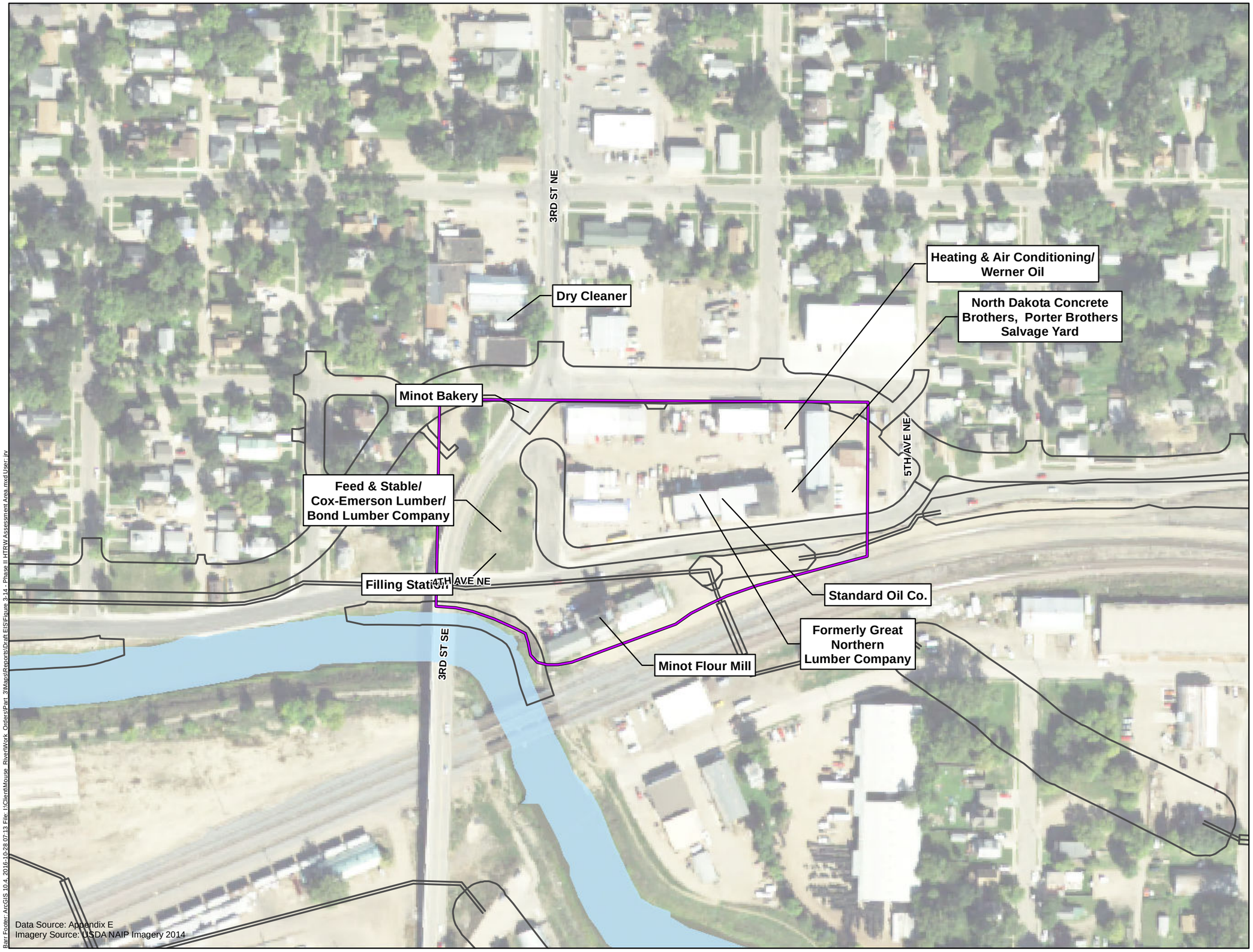
0 300 600 1,200

Feet

Figure 3-13

KNOWN ENVIRONMENTAL SITES: PHASE 1
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 07:16 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-13_Known Environmental Sites Phase 1.mxd User: jrv



Phase II HTRW Investigation Area

Project Footprint

* All locations are approximate

HTRW - Hazardous, Toxic and Radioactive Waste

0 75 150 300
Feet

Figure 3-14

PHASE II HTRW ASSESSMENT AREA
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 07:13 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-14 - Phase II HTRW Assessment Area.mxd User: jv

3.5.3 HTRW Assessment of Other Phases of Construction Stage 1.5

Inactive underground storage tanks have been identified along the Maple Avenue High-Flow Diversion and the tieback levee through desktop analysis and review of environmental regulatory reports. The storage tank along the Maple Avenue High-Flow Diversion is located at the Magic City Lumber, Inc. site while the one near the tieback levee is located at as the Main Electric Construction, Inc. (Figure 3-16). Additional HTRW assessments will be conducted prior to construction in these areas, as appropriate.

3.5.4 HTRW Assessment for Other Segments

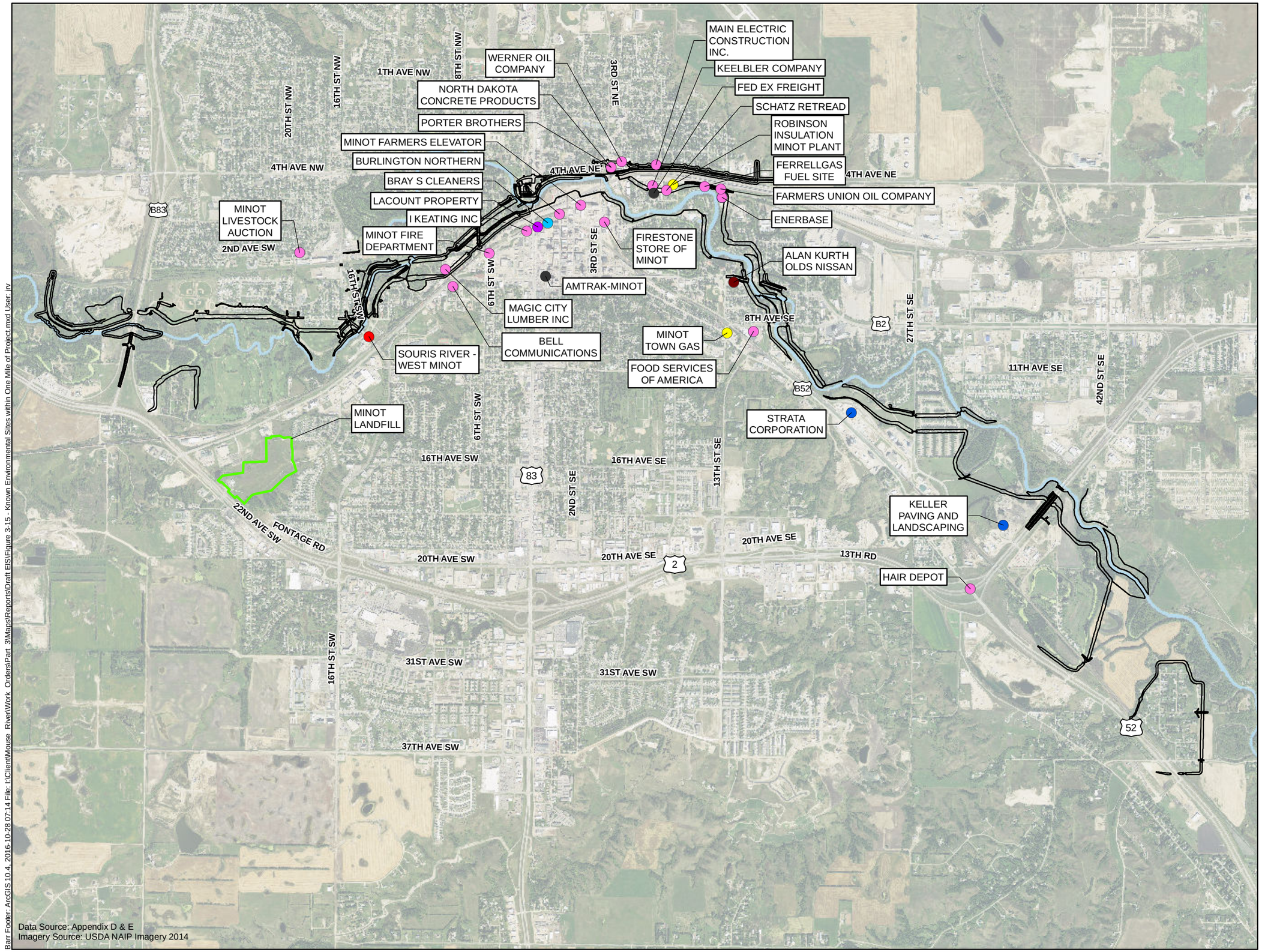
Because it is possible that site conditions and land use will change over the duration of the Project, a full HTRW assessment was not completed at this time. Instead, a general HTRW assessment was conducted based on a desktop study and review of available environmental regulatory reports.

Land use in the project area upstream of Minot is a mix of low-to medium-intensity developed areas in Burlington and other small communities in Harrison Township, amidst the rural agricultural land and wetland areas directly adjacent to the Souris River channel. Likewise, downstream from Minot, the project area is characterized by less densely developed communities that have a more rural character with adjacent agricultural lands and wetland areas. Section 3.4.1 provides additional detail on current and historical land use in the project area.

A search of regulatory database records covering the remainder of the Project segments and adjoining areas was conducted to identify any known environmental sites that could be affected by the Project. Historical Information Gatherers Inc.'s (HIG) regulatory report was obtained and reviewed to identify known environmental sites within 500 feet of the assessment area. A wider search area of one mile beyond this assessment area was used to review HIG's databases associated with more significant environmental sites, including sites listed in the Superfund, Comprehensive Environmental Response, Compensation and Liability Information System (CERCLA), and No Further Remedial Action Planned Sites (NFRAP).

Thirty sites were identified in the regulatory reports within the assessment area, including three CERCLA sites, one NFRAP site, one Delisted National Priorities List (DNPL) site, one No Longer Regulated Resource Conservation and Recovery Act (RCRA) Generator Facility (NLRRCRAG), 19 storage tanks, two Special Waste Landfills (SPWLF), and three leaking storage tanks (LUST). All of the identified sites are concentrated in the Minot area as shown on Figure 3-15.

Seven properties with storage tank listings were identified within the impact area; many with multiple above or below-ground storage tanks. Tanks are listed as active and inactive Fed-Ex Freight is listed as a SPWLF but no additional information was provided.



HTRW Locations (Approximate)

- CERCLIS
- CERCLIS, NFRAP
- NLRRCRAG
- RST, LRST
- UST
- SPWLF
- UAST
- UST, LUST
- Project Footprint

HTRW - Hazardous, Toxic and Radioactive Waste

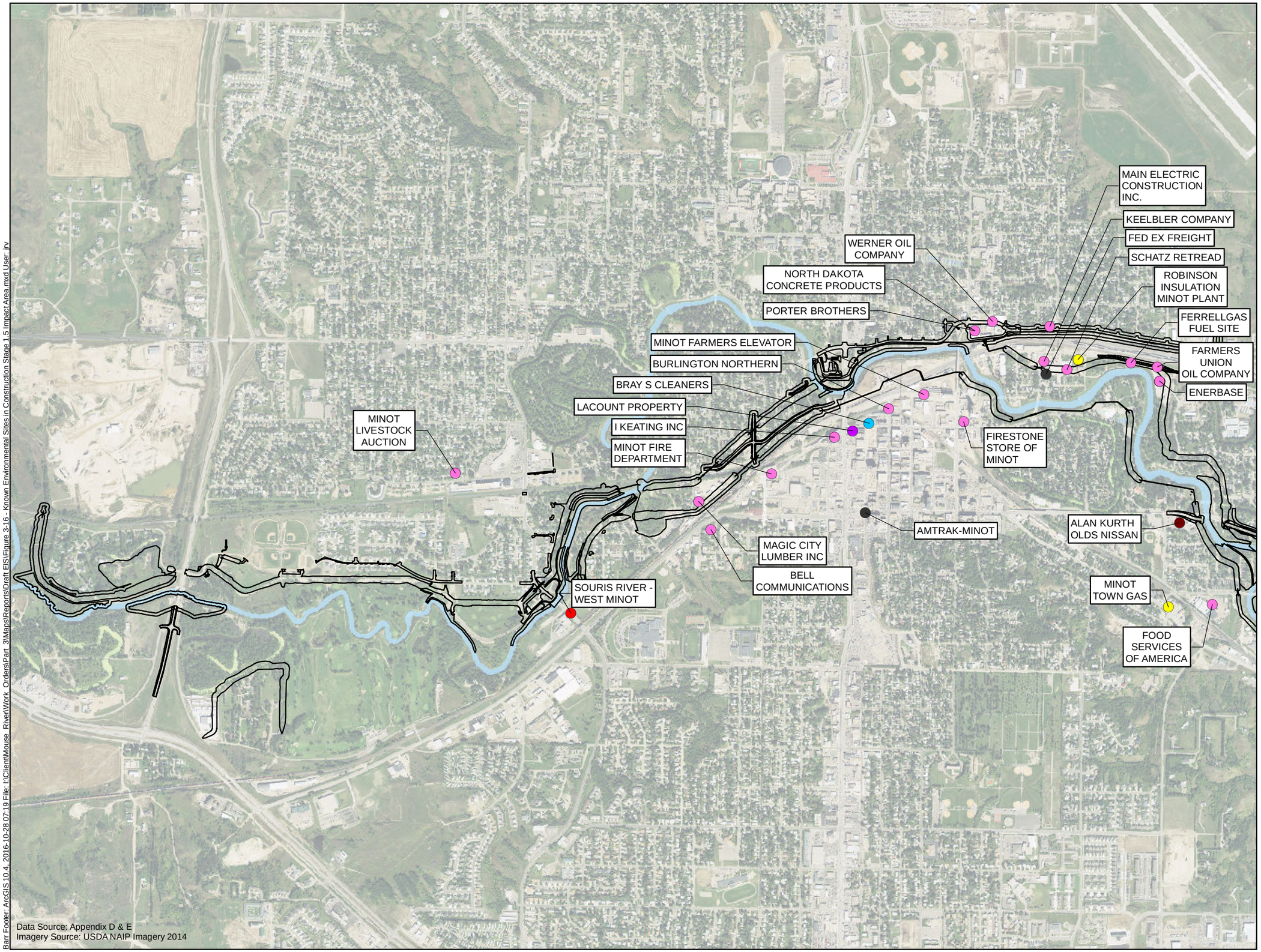
0 1,250 2,500 5,000
Feet

Data Source: Appendix D & E
Imagery Source: USDA NAIP Imagery 2014

Barr Footer: ArcGIS 10.4, 2016-10-28 07:14 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-15 - Known Environmental Sites within One Mile of Project.mxd User: jrv

Figure 3-15

KNOWN ENVIRONMENTAL SITES WITHIN ONE MILE OF PROJECT
Mouse River Enhanced Flood Protection Project



HTRW Locations (Approximate)

- CERCLIS
- CERCLIS, NFRAP
- NLRRCRAG
- RST, LRST
- UST
- SPWLF
- UAST
- UST, LUST
- Project Footprint

HTRW - Hazardous, Toxic and Radioactive Waste

0 750 1,500 3,000
Feet

Figure 3-16

KNOWN ENVIRONMENTAL SITES IN CONSTRUCTION STAGE 1.5 IMPACT AREA
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 07:19 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-16 - Known Environmental Sites in Construction Stage 1.5 Impact Area.mxd User: jrv

3.6 Socioeconomics

3.6.1 Population

Minot is the fourth largest city in North Dakota and the county seat for Ward County. Minot serves as a hub for the local project area, as well as a trade center for northwestern North Dakota and southern portions of Canadian provinces of Manitoba and Saskatchewan. Minot Air Force Base and its approximate 7,500 on-base personnel also contribute to the city's economy [reference [47]]. In January 2016, The North Dakota Department of Commerce – Census Office, published the 2016 population projections for the state (reference [48]). The projections were made using high, expected, and low rates of migration between 2015 and 2040. All three scenarios assume in-migration will exceed out-migration for the next several years. The report presents population data for the Economic Planning Region 2, which includes Minot. Based on most recent projections, under the expected migration scenario, population in the Minot region is expected to grow but at a decreasing rate over time (15% growth between 2010-2015 to 3% growth between 2035-2040) (reference [48]).

Table 3-7 presents population characteristics for the communities in the project area. According to the 2013 population estimate, Minot represents 67 percent of the total population for Ward County, while Burlington accounts for about 2 percent of the total population in the county. The total population of Ward County has grown about 9 percent since 2000. Minot has experienced rapid growth with a 17 percent population increase from 2000 to 2013. Burlington, however, has seen little change in population since 2000 (1.2 percent population growth).

Table 3-7 Population

Population	Burlington	Minot	Township of Burlington	Township of Harrison	Township of Nedrose	Ward County	North Dakota
Population (2013)(1)	1,109	42,870	333	1,828	1,858	64,008	689,781
Population (2000)	1,096	36,567	356	1,402	2,149	58,795	642,200
Population Change (2000-2013)	13	6,303	-23	426	-291	5,213	47,581
Population Percent Change (2000-2013)	1.20%	17.20 %	-6.50%	30.40%	-13.50%	8.90%	7.40%

Notes:
Table sourced from reference [49]
The data in this table are calculated by ACS using annual surveys conducted during 2009-2013 and are representative of average characteristics during this period (U.S. Department of Commerce. 2013. Census Bureau, American Community Survey Office, Washington, D.C.; U.S. Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington, D.C.).

Median age is fairly consistent across the communities in the project area; median ages are slightly higher outside Burlington and Minot. Table 3-8 shows the age and gender distribution of the populations in the project area.

Table 3-8 Age and Gender Distribution, 2013

	Burlington	Minot	Township of Burlington	Township of Harrison	Township of Nedrose	Ward County	North Dakota
Total Population	1,109	42,870	333	1,828	1,858	64,008	689,781
Total Female	514	21,436	180	807	883	31,080	339,834
Total Male	595	21,434	153	1,021	975	32,928	349,947
MEDIAN AGE							
Median Age (2013[(1)])	31.3	32.6	34.5	46.2	45.9	31.9	36.4
Median Age (2000)	30.8	35	40.1	39	35.3	32.4	36.2
Median Age % Change	1.60%	-6.90%	-14.00%	18.50%	30%	-1.50%	0.60%

Notes:
Table sourced from reference [49]
The data in this table are calculated by ACS using annual surveys conducted during 2009-2013 and are representative of average characteristics during this period (U.S. Department of Commerce. 2013. Census Bureau, American Community Survey Office, Washington, D.C., Department of Commerce. 2000. Census Bureau, Systems Support Division, Washington D.C.).

3.6.2 Employment and Industry

The economy of the project area is based primarily on government, manufacturing, retail trade, and service (education, health, hospitality) sectors. Economic activity in the project area is centered in Minot for a number of reasons:

- Minot is an important service center for the region, which meets health care needs and provides service and shopping needs of a trade area extending into eastern Montana and Canada.
- The Minot Air Force Base is an economic engine for Minot and Ward County resulting in demand for goods, services, housing, and tertiary business that support the base.
- Oilfield development in North Dakota caused an economic boom in Minot, and unemployment rates are low, both locally and state wide.

As the major regional economic center, Minot is home to a number of the region's major employers. The Minot Air Force Base is the largest employer in the Minot area with 7,500 employees, followed by Trinity Health (2,790 employees). Of the top 14 employers, three are government related, three provide social service assistance, two provide medical/health care services, and two are in hospitality. The primary industries in the project area are education, health care and social assistance, retail trade, and construction (Table 3-9).

Between 2010 and 2014, as workers for the petroleum industry and associated support service industries flocked to the area, there was an increase in demand for housing, goods, and services. In late 2014 North

Dakota's oil production fell considerably with a crash in oil prices. However, local costs and unemployment have remained relatively stable due to the emphasis the State of North Dakota has placed on diversification and value-added industry. This has enabled North Dakota's present day economy to be more diversified, increasing the state's ability to navigate the economic ebb and flows associated with its key economic drivers; agriculture and energy [reference [50]].

Table 3-9 Employment by Industry, 2013

	Burlington	Minot	Township of Burlington	Township of Harrison	Township of Nedrose	County Subdivision Region(1)	Ward County	North Dakota
Civilian employed population >16 years (persons)	640	23,315	201	1,194	1,092	26,442	33,103	371,612
Agriculture, forestry, fishing & hunting, and mining	2.8%	6.1%	10.9%	5.8%	**10.7%**	6.3%	7.4%	**8.9%**
Construction(2)	**18%**	**9.2%**	**16.9%**	**10.3%**	9.9%	**9.5%**	**9.2%**	7.4%
Manufacturing	2.3%	3.3%	0%	7.2%	4.6%	3.4%	3.7%	7.1%
Wholesale trade	5.3%	4.2%	6.5%	2.3%	1.7%	4.0%	4.1%	3.2%
Retail trade(2)	**16.6%**	**15.5%**	5.5%	**12.5%**	**18.1%**	**15.4%**	**14.7%**	**12.1%**
Transportation, warehousing & utilities	5.2%	4.9%	0%	8.1%	4.5%	5.0%	5%	5.4%
Information	1.3%	1.7%	3.5%	0%	0%	1.6%	1.5%	1.5%
Finance and insurance & real estate	6.1%	6.2%	7%	2.0%	2.4%	5.8%	5.6%	5.8%
Professional, scientific, management, administration, & waste management	5.6%	6.1%	**13.9%**	6.2%	5.5%	6.2%	6.1%	6.4%
Education, health care, & social assistance(2)	**21.1%**	**23%**	**19.4%**	**33.1%**	**22.9%**	**23.4%**	**22.8%**	**25.0%**
Arts, entertainment, recreation, accommodation, & food service	6.6%	10%	4%	3.3%	8.3%	**9.5%**	**9.1%**	7.8%
Other services, except public administration	3%	4.80%	7.50%	6%	6.10%	4.9%	4.80%	4.50%
Public administration	6.30%	5.10%	5%	3.20%	5.20%	5.0%	6%	4.90%

Notes:
Table sourced from reference [49]
The data in this table are calculated by ACS using annual surveys conducted during 2009-2013 and are representative of average characteristics during this period (U.S. Department of Commerce. 2013. Census Bureau, American Community Survey Office, Washington, D.C.).
The top three industries in each jurisdiction are indicated in **bold text**.
(1) County Subdivision Region includes the cities of Burlington and Minot, and the townships of Burlington, Harrison, and Nedrose.
(2) Primary industries throughout the project area

3.6.3 Housing Characteristics

3.6.3.1 General Characteristics

Housing units in the project area and their average rate of occupancy and vacancy from 2009 to 2013 are summarized in Table 3-10. The cities of Minot and Burlington both had lower vacant-housing rates than Ward County or the state of North Dakota during that time.

Table 3-10 Housing Characteristics, 2013

	Burlington	Minot	Township of Burlington	Township of Harrison	Township of Nedrose	County Subdivision Region(1)	Ward County	North Dakota
Total Housing Units	416	19,868	129	743	860	22,016	27,966	324,712
Occupied (%)	92.1%	90.6%	87.6%	89.4%	87.9%	90.5%	90.0%	88.5%
Vacant (%)	7.9%	9.4%	12.4%	10.6%	12.1%	9.5%	10.0%	11.5%

Notes:
Table sourced from reference [49]
The data in this table are calculated using annual surveys conducted during 2009-2013 and are representative of average characteristics during this period (U.S. Department of Commerce. 2013. Census Bureau, American Community Survey, Washington, D.C.).
(1) County Subdivision Region includes the cities of Burlington and Minot, and the townships of Burlington, Harrison, and Nedrose.

In the early 2010s, there was a rapid expansion of oil field facilities in North Dakota, including in the Minot area. As a result, there was an increased demand for additional housing to accommodate oil industry workers who relocated to the Minot area. During peak production of oil during this timeframe, the population growth in the Minot area pressured housing availability and affordability as housing demands outstripped supply. Development of new housing was limited by a number of factors, which included:

- Increasing land prices, especially for agricultural or vacant land, driven by growth in the oil sector in the Minot area.
- High demand for existing water and wastewater systems are struggling to meet current demands, and this infrastructure is limited in its capacity to serve new, denser development.
- Increased construction costs.

The 2011 flood, which destroyed or severely damaged thousands of existing homes, further exacerbated the situation. Thousands of homes in Minot sustained extensive damage during the flooding and many of these were damaged beyond repair. The most severe flood damage occurred in the heart of Minot, the most densely populated area with much of the oldest and most affordable housing (reference [47].

Post-flood disaster response efforts included an assessment of the state of housing in Minot, to affirm that post-flood recovery actions consider fair and affordable housing within the flooded area [47]. The

assessment found an ongoing need for additional housing units that are affordable for low and moderate income households, large families, persons with disabilities, the elderly, and those with special needs. Minot is focused on recovery of neighborhoods that were affected by the 2011 flood, to repair, replace, and augment available housing stock [51].

The construction of numerous housing developments followed to account for the housing needs. Since oil prices began to fall, the demand for owner occupied and rental housing has decreased substantially. However, Minot is expected to continue to grow as the major economic center for north-central North Dakota. The growth of this city has played a key role in the rise of the median home value in North Dakota, which has gone up 4.3% since April 2015, and is forecasted to rise another 2.7% in the next year [reference [52].

3.6.3.2 Relocations and Buyouts

Since the 2011 Souris River flood, Minot has been actively buying properties located within the flood inundation area, using U.S. Department of Housing and Urban Development (HUD) and local funding. Minot was incorporated into HUD's Community Block Development Grant Disaster Recovery (CBDG-DR) program for the 2011 disasters. Under this program, Minot received two CDBG-DR funding allocations: B-12-MT-38-0001; and B-13-MS-38-0001. Home and business buyouts through HUD's CDBG-DR program are voluntary, and are separate from the Requester's Preferred Alternative.

The first allocation was approved in 2012 and enabled Minot to acquire flood damaged properties near the Souris River, subject to the willingness of owners and the availability of funding. These acquisitions typically involved acquiring the lots, all structures, and mineral rights, and removing all existing structures.

The second allocation was approved in 2013 and enabled Minot to buy properties located within the flood inundation area, including single and multi-family residences, mobile homes and pads, and religious and commercial establishments. Once the purchases were completed, all existing structures were removed with the intent that the parcels would remain as open space or be used for flood risk reduction purposes.

The SRJB is currently finalizing the Rural StARR (Structure Acquisition, Relocation, or Ring Dike) Program (Draft January 1, 2015). This program will provide funding from various sources for the purchase and demolition, relocation, or ring diking of structures in certain areas of the Souris River basin. This program would be voluntary, and interested parties were to have completed right-of-entry forms by May 2015. Relocation assistance benefits will be provided under the North Dakota Century Code Chapter 54-01.1: Relocation Assistance or the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act). Home and business buyouts through the Rural StARR Program are separate from the Requester's Preferred Alternative.

3.6.4 Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income in developing, implementing, and enforcing environmental laws, regulations, and policies [53]. The purpose of this section is to identify and describe the minority and low-income populations within the project area.

3.6.4.1 Regulatory Responsibilities

An evaluation of environmental justice impacts is mandated by Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994). This Executive Order directs federal agencies to identify and address, as appropriate, disproportionately high and adverse health or environmental effects of its programs, policies, and activities on minority and low-income populations. The effects of an action can be considered disproportionately high and adverse if the percentage of total impacts imposed on a specific group is greater than the percentage of the total population in a given area represented by that group. For this analysis, a community of concern is defined by either race or ethnicity (i.e., minority) or by low income.

The Council on Environmental Quality (CEQ) and U.S. Environmental Protection Agency (EPA) developed guidance documents to provide EPA and other federal agencies with a process for identifying communities of concern and addressing potential impacts to them. According to these guidance documents, the CEQ's *Environmental Justice: Guidance Under the National Environmental Policy Act* (1997, reference [54]) and the EPA's *Final Guidance For Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (1998, reference [55]), the basic components of an environmental justice assessment should include:

- A demographic assessment of the affected community to identify minority and low-income populations that may be present.
- An integrated assessment to determine whether any adverse impacts would disproportionately affect minority and low-income populations.

3.6.4.2 Environmental Justice Assessment Process

The geographic area for this environmental justice analysis consists of the 14 census block groups intersected by the Project. These census block groups are considered representative of the general population in the project area and provide the best approximation of the area within which potential disproportionate adverse impacts from the Project could occur. The region covered by these selected census block groups is referred to as the Region of Interest (ROI). Demographic and poverty data for the ROI are compared with data for Burlington, Minot, Ward County, and North Dakota. These larger areas are referred to as the Regions of Comparison (ROC). Figure 3-17 shows the location of the census block groups in relation to the Project.

EPA guidance specifies two measures to determine whether there is a minority or low-income community in the Project impact area that must be considered in the scope of the EIS (reference [55]).

- Minorities or low-income persons make up more than 50 percent of the population of the impact area.
- The minority or low-income population percentage in the impact area is "*meaningfully greater*" than the minority or low-income population in the general population. For this assessment, a 10 percentage-point threshold was used to measure whether the percentage of a low-income

population or minority group in an ROI census block group was "*meaningfully greater*" than in the ROC.

3.6.4.3 Environmental Justice Assessment for the Region of Interest

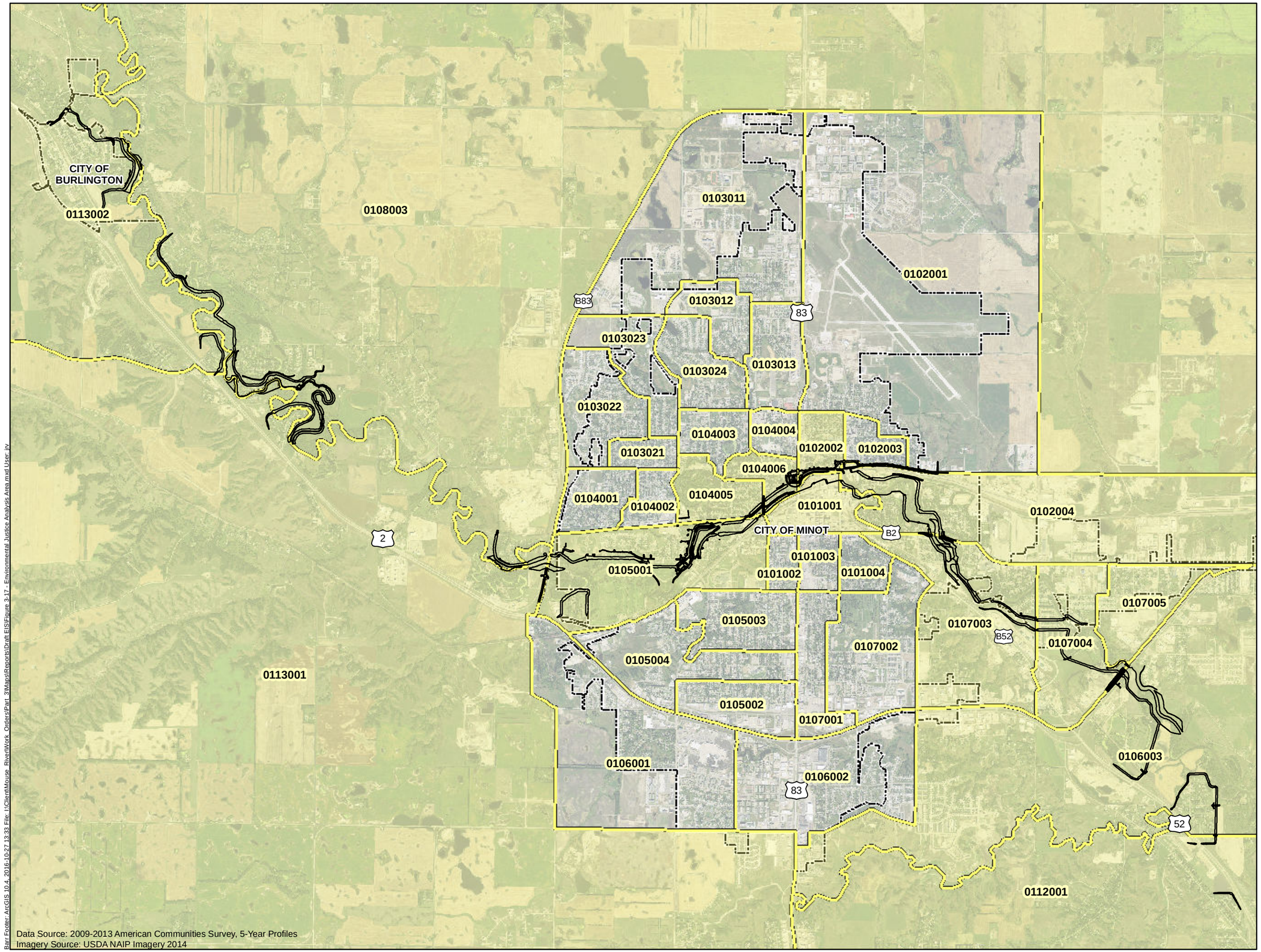
Minority Populations

Minority populations in the ROI, as well as in Burlington, Minot, Ward County, and North Dakota are provided in Table 3-11. Minority population information for the fourteen geographic census block groups of the ROI are presented in Table 3-12.

The ROI as a whole has a lower minority population than the ROC areas (Table 3-11). The total minority population is 3.9 percent of the ROI as a whole, lower than in Minot by 5.3 percentage points, in Ward County by 6.1 percentage points, and in North Dakota by 6.5 percentage points

Within the ROI, total minority population percentages of the three census block groups with the largest minority populations (12.8 percent, 10.9 percent, and 9.7 percent) are similar to the total minority population percentages of Minot, Ward County, and North Dakota (9.2 percent, 10 percent, and 10.4 percent respectively). These three census block groups, identified in Table 3-12 with italicized and bolded text, are located in central Minot and just east of downtown Minot. The total minority population in the remainder of the individual census block groups in the ROI varies from 0.6 percent to 7.1 percent.

Overall, demographic data indicate that the distribution of minority populations in the project area does not meet the thresholds which require the EIS to assess the potentially disproportionate impacts to minority communities from the Project. In the ROI as a whole, and in all individual census blocks, the minority population is less than 50 percent of the population. Also, none of the minority population percentages, nor the total minority population percentage, in the ROI are "meaningfully greater" than the minority population percentages in the ROC areas.



US Census Block Groups

US Census Blocks with Project Features

Project Footprint

Municipalities

0 2,000 4,000 8,000

Feet

Figure 3-17

ENVIRONMENTAL JUSTICE ANALYSIS AREA
Mouse River Enhanced Flood Protection Project

Data Source: 2009-2013 American Communities Survey, 5-Year Profiles
Imagery Source: USDA NAIP Imagery 2014

Barr Foster: ArcGIS 10.4, 2016-10-27 13:33 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-17 - Environmental Justice Analysis Area.mxd User: jtv

Table 3-11 Minority Population Composition of North Dakota, Ward County, Burlington, Minot, and the Region of Interest (ROI)

			Racial Minority Populations (%)						Ethnic Minority (%)[3]
Area	Total Population (number of persons)[2]	White %	Black or African American	American Indian & Alaskan Native	Asian	Native Hawaiian & Other Pacific Islander	Some Other Race	Total Racial Minority (%)	Hispanic or Latino Ethnicity
North Dakota	723857	89.6%	1.8%	5.4%	1.2%	0.1%	1.9%	10.4%	2.9%
Ward County	67998	89.9%	3.6%	2.4%	1.2%	0.2%	2.6%	10.0%	4.8%
Burlington	1051	94.2%	0.1%	2.7%	0.2%	0.0%	2.1%	5.1%	2.1%
Minot	46321	90.2%	2.3%	3.2%	0.9%	0.1%	2.7%	9.2%	2.7%
ROI[1]	17,462	94.1%	1.6%	1.8%	0.4%	0.0%	0.1%	3.9%	1.8%

Notes:
Data Source: 2009-2013 American Community Survey 5-Year Profiles
Persons may opt to identify with more than one racial minority, therefore, the sum of all racial categories in the table may equal more than 100%.

(1) The Region of Interest (ROI) represents the geographic area in which the project may exert some influence. It is an aggregate of census block group data of the census blocks that the Project transects (census block groups traversed by the project are shown in Table 3-12). The ROI is calculated by dividing the total population for a minority in the block groups by the total population of the block groups.

(2) Total Racial Minority populations and White populations may not add up to 100 percent as not all racial minority populations were included in this analyses. Racial minority populations that were excluded were the smaller sub-classifications such as those of two of more races.

(3) The Hispanic or Latino ethnicity is not included in the total racial minority population percentages as it can be claimed by a person of any race. The Hispanic or Latino ethnicity is therefore included separately and reflects an ethnic minority.

Table 3-12 Minority Population Composition of North Dakota, Ward County, Burlington, Minot, and Census Block Groups in the ROI

Jurisdiction	Census Block Group Identifier	Total Population (number of persons)[2]	White %	Racial Minority Populations (%)						Ethnic Minority (%)[3]
				Black or African American	American Indian & Alaskan Native	Asian	Native Hawaiian & Other Pacific Islander	Some Other Race	Total Racial Minority (%)	Hispanic or Latino Ethnicity
North Dakota	NA	723,857	89.6%	1.8%	5.4%	1.2%	0.1%	1.9%	10.4%	2.9%
Ward County	NA	67,998	89.9%	3.6%	2.4%	1.2%	0.2%	2.6%	10.0%	4.8%
Burlington	NA	1,051	94.2%	0.1%	2.7%	0.2%	0.0%	2.1%	5.1%	2.1%
Minot	NA	46,321	90.2%	2.3%	3.2%	0.9%	0.1%	2.7%	9.2%	2.7%
ROI[1]	381010106003	1,492	96.2%	1.1%	0.5%	0.0%	0.0%	0.0%	1.6%	0.0%
ROI[1]	381010104005	710	93.9%	0.0%	6.1%	0.0%	0.0%	0.0%	6.1%	0.0%
ROI[1]	381010104006	590	92.9%	7.1%	0.0%	0.0%	0.0%	0.0%	7.1%	2.7%
ROI[1]	381010105001	1,517	94.7%	2.0%	3.2%	0.0%	0.0%	0.0%	5.3%	2.4%
ROI[1]	**381010107003**	**1,081**	**77.4%**	**6.7%**	**0.0%**	**3.1%**	**0.0%**	**0.0%**	**9.7%**	**0.0%**
ROI[1]	381010107004	1,408	94.5%	0.3%	0.0%	0.0%	0.0%	0.5%	0.8%	0.5%
ROI[1]	381010102004	1,091	99.4%	0.0%	0.6%	0.0%	0.0%	0.0%	0.6%	1.4%
ROI[1]	**381010101001**	**939**	**86.0%**	**5.8%**	**1.5%**	**2.2%**	**0.0%**	**1.4%**	**10.9%**	**3.3%**
ROI[1]	381010102002	1,082	97.6%	0.0%	2.3%	0.0%	0.0%	0.0%	2.3%	2.1%
ROI[1]	**381010107005**	**884**	**87.2%**	**5.3%**	**7.5%**	**0.0%**	**0.0%**	**0.0%**	**12.8%**	**7.7%**
ROI[1]	381010108003	1,809	99.1%	0.0%	0.5%	0.0%	0.0%	0.1%	0.6%	0.8%

Jurisdiction	Census Block Group Identifier	Total Population (number of persons)(2)	White %	Racial Minority Populations (%)						Ethnic Minority (%)(3)
				Black or African American	American Indian & Alaskan Native	Asian	Native Hawaiian & Other Pacific Islander	Some Other Race	Total Racial Minority (%)	Hispanic or Latino Ethnicity
ROI(1)	381010112001	1,760	96.4%	0.0%	1.9%	0.0%	0.0%	0.0%	1.9%	1.0%
ROI(1)	381010113002	1,859	93.4%	0.2%	3.2%	0.6%	0.0%	0.1%	4.1%	3.7%
ROI(1)	381010113001	1,240	98.8%	0.0%	0.4%	0.8%	0.0%	0.0%	1.2%	1.1%

Notes:

Data Source: 2009-2013 American Community Survey 5-Year Profiles

Persons may opt to identify with more than one racial minority, therefore, the sum of all racial categories in the table may equal more than 100%.

(1) The Region of Interest (ROI) represents the geographic area in which the project may exert some influence. ROI for this environmental justice analysis includes census block groups traversed by the project.

(2) Total Racial Minority populations and White populations may not add up to 100 percent as not all racial minority populations were included in this analysis. Racial minority populations that were excluded were the smaller sub-classifications such as those of two or more races.

(3) The Hispanic or Latino ethnicity is not included in the total racial minority population percentages as it can be claimed by a person of any race. The Hispanic or Latino ethnicity is therefore included separately and reflects an ethnic minority.

The racial composition of the population in Minot is changing (reference [51]), and the environmental justice assessment considered the possible effects of these changes. As Minot's population increased between 2000 and 2010, (from 36,567 to 40,888, a 12 percent increase) the black population grew the most, increasing by 92 percent, followed by the Asian population (62 percent) (Table 3-13). It is anticipated that the increase in non-white residents and those of Hispanic ethnicity is driven by the Minot Air Force Base and the petroleum industry in the Bakken shale region, which are drawing people to this area from across the United States (reference [51]). Despite the large percent increases in minority populations during this period, racial minorities remain a small percentage of the total population.

Table 3-13 Racial Composition of the Population in Minot: Change from 2000 to 2010

Race	Population in 2000	Population in 2010	Percent change within racial class from 2000-2010
White	93.18%	90.20%	8.24%
Black	1.34%	2.30%	92.00%
American Indian	2.76%	3.20%	29.60%
Asian	0.62%	0.90%	62.10%
Native Hawaiian/Pacific Islander	0.07%	0.10%	57.70%
Other	0.49%	0.60%	36.90%
Multiracial	1.54%	2.70%	49.00%
Total	100.00%	100.00%	-
Hispanic/Latino	1.47%	2.70%	51.30%

Data Source: reference [51] p. 3-6

Low-Income Populations

Low-income populations (defined as individuals living in households below the poverty threshold) in the ROI, as well as in Burlington, Minot, Ward County, and North Dakota are provided in Table 3-14. The U.S. Census uses a set of income thresholds that vary by family size and composition to determine who is in poverty (reference [54], reference [55]). If the total household income falls below the relevant poverty threshold, then all members of the household are counted as "below the poverty level."

Table 3-14 Poverty and Income Characteristics (2009-2013) of North Dakota, Ward County, Burlington, Minot, and the Region of Interest (ROI)

Jurisdiction	Total Population (number of persons)	% Below Poverty Threshold	Median Household Income
State of North Dakota	723,857	11.9%	$53,741
Ward County	67,998	9.1%	$56,580
Burlington	1,051	4.1%	$63,487
Minot	46,321	10.3%	$53,524
ROI(1)	17,462	5.2%	$54,017

Data Source: 2009-2013 American Community Survey 5-Year Profiles

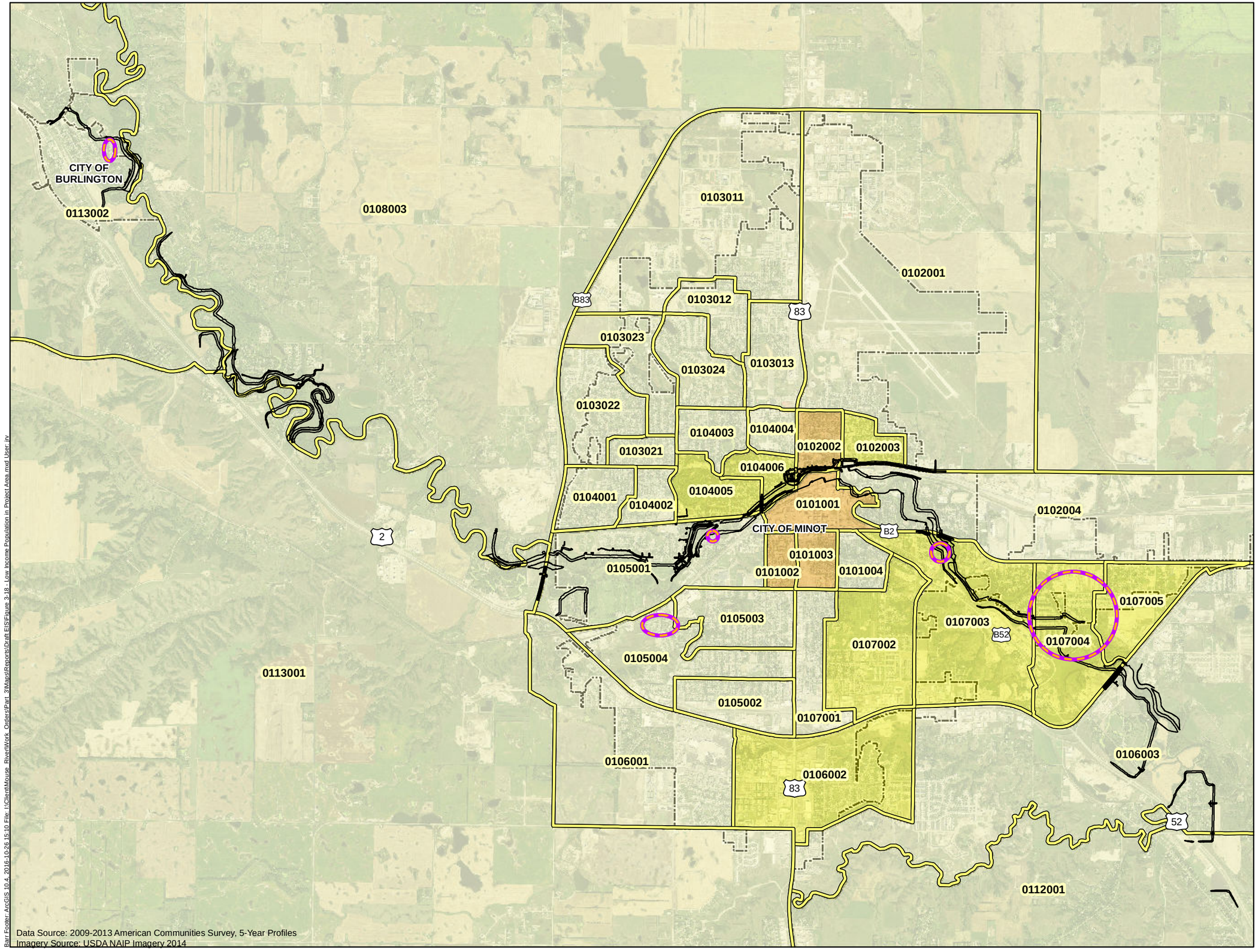
(1) The Region of Interest (ROI) represents the geographic area in which the project may exert some influence. ROI for this environmental justice analysis includes the census block groups traversed by the project.

With the exception of Burlington, the ROI as a whole has a smaller low-income population than the ROC areas (Table 3-14). The median household income in the ROI is comparable to that of Minot and North Dakota.

Figure 3-18 provides an overview of low-income populations within the ROI census block groups. Within the ROI, the low-income population percentages of the three census block groups with the largest low-income populations (9.3 percent, 10.2 percent, and 13.1 percent) are similar to the low-income population percentages of Minot, Ward County, and North Dakota (10.3 percent, 9.1 percent, and 11.9 percent, respectively). These three census block groups, identified in Table 3-15 with italicized and bolded text, are located in central and east-central Minot.

Residential areas in central and east-central Minot are more densely populated, and housing stock is typically older and priced lower than outlying, more recent developed residential areas in the Minot area. However, areas (i.e., Census Blocks) representing low to medium, low-income population percentages are not necessarily indicative or representative of actual low-income populations. For example, it is possible pockets of low-income populations are located in large Census Blocks where the majority of the population or households is not below the poverty threshold.

The level of demographic analysis data indicate that the distribution of low-income populations in the project area does not meet the thresholds which would require the EIS to assess potential, disproportionate impacts of the Project on low-income communities. In the ROI as a whole, and in all individual census blocks, the low-income population is less than 50 percent of the population. Also, the low-income population percentages are not "meaningfully greater" than the low-income population percentages in the ROC areas. Overall, the analysis concludes that there are low-income (and minority) populations present throughout the project area, and flood protection benefits of the project would reach all segments of the population.



Data Source: 2009-2013 American Communities Survey, 5-Year Profiles
Imagery Source: USDA NAIP Imagery 2014

Barr Footer: ArcGIS 10.4, 2016-10-26 15:10 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-18_Low Income Population in Project Area.mxd User: jrv

US Census Block Groups
Project Footprint
Municipalities

Percentage Below Poverty Threshold

0 - 4.9%
5 - 9.9%
>10%

Pockets of Potential Low Income Populations

0 2,000 4,000 8,000
Feet

Figure 3-18

LOW-INCOME POPULATIONS IN PROJECT AREA
Mouse River Enhanced Flood Protection Project

Table 3-15 Percentage of Individuals Below the Poverty Threshold and Median Household Income in the State of North Dakota, Ward County, Burlington, Minot, and Census Block Groups Traversed by the Project

Jurisdiction	Census Block Group Identifier	Total Population (number of persons)	% Below Poverty Threshold	Median Household Income
State of North Dakota	NA	723,857	11.9%	$53,741
Ward County	NA	67,998	9.1%	$56,580
Burlington	NA	1,051	4.1%	$63,487
Minot	NA	46,321	10.3%	$53,524
ROI(1)	381010106003	1,492	3.9%	$58,750
ROI(1)	381010104005	710	5.1%	$44,712
ROI(1)	381010104006	590	6.3%	$41,714
ROI(1)	381010105001	1,517	3.2%	$74,444
ROI(1)	***381010107003***	***1,081***	***9.3%***	***$54,605***
ROI(1)	381010107004	1,408	7.7%	$35,305
ROI(1)	381010102004	1,091	3.1%	$57,009
ROI(1)	***381010101001***	***939***	***13.1%***	***$23,073***
ROI(1)	***381010102002***	***1,082***	***10.2%***	***$34,227***
ROI(1)	381010107005	884	6.3%	$30,500
ROI(1)	381010108003	1,809	0.1%	$75,781
ROI(1)	381010112001	1,760	1.4%	$75,703
ROI(1)	381010113002	1,859	1.0%	$76,042
ROI(1)	381010113001	1,240	2.7%	$74,375

Data Source: 2009-2013 American Community Survey 5-Year Profiles

(1) The Region of Interest (ROI) represents the geographic area in which the Project may exert some influence. ROI for this environmental justice analysis includes the census block groups traversed by the Project.

3.7 Recreation

Recreation is an important consideration to the communities throughout the project area. According to the North Dakota State Parks and Recreation Department's *State Comprehensive Outdoor Recreation Plan*, 72 percent of North Dakota households throughout Ward, Burke, Renville, Bottineau, Mountrail, and McHenry counties are interested in going to a park, natural area, or green space to play on a playground, enjoy nature, or relax, and 66 percent are interested in picnicking (reference [56]). Minot and the Minot Park District seek to preserve and promote a park system that meets the needs of all, and recognize that community facilities such as parks, trails, and open space are integral components of Minot's community character (reference [42]).

The 2011 floods damaged parks and other recreational facilities within Minot; many of these parks, however, also provide some flood attenuation by providing flood storage during high water events. The Minot Comprehensive Plan views parks as a major component of future flood protection, through developing a continuous greenway that would be a linear network of open spaces and natural areas compatible with the main purpose of flood control.

Recreational opportunities in the project area include sport fishing in the Souris River and the use of recreational facilities such as parks, trails, and golf courses along the river. Recreational facilities and features in the project area are shown in Map 3-9. Designated recreational areas, especially parks, are mostly located within Minot, and recreational access to the Souris River is primarily limited to these parks and public fishing piers. Seasonal sport fishing at channel flow-control features, which concentrate fish by blocking their movement, is the primary recreational activity on the river. Although the fishery is affected by variable flow regimes (due to weather and upstream reservoir operation) and regularly occurring periods of minimal flow and low dissolved oxygen, natural resource field surveys documented considerable use of the river by sport fisherman. There are no state or federal parks, recreational areas, nature preserves/areas, or scenic byways in the immediate project area. National wildlife refuges are located upstream and downstream of the project area, as discussed in Section 3.3.3.

Recreational features near Burlington include Old Settlers Park, a city sports complex, and portions of two trail systems. Old Settlers Park, located northwest of Burlington on the northern side of the Des Lacs River, has a campground, picnic areas, and a variety of recreational amenities (e.g., playground, baseball diamonds, volleyball court, etc.), and provides access to the Des Lacs River for fishing. The Old Settlers Association Historic Monument, dedicated to the first settlers in this area, is also located in the park. The Burlington sports complex was built in 1991 and is south of the Souris River channel and just south of River Road. The complex includes picnic areas and various recreational amenities (e.g., playground, baseball diamond, volleyball court) (reference [57]). There are two trails within the city; an approximate 0.27-mile multi-use trail along Johnson Street in south/southwest Burlington and portions of a regional snowmobile trail system that goes north out of the city and east towards Minot (Map 3-9). There is also a small playground located near the Burlington City Hall and a playground with tennis courts near the Burlington-Des Lacs Elementary School.

Downstream of Burlington and upstream of Minot, the predominant recreational feature is the Vardon Golf Club. The original golf course (Minot Country Club) was built in 1928 and included a golf course, clubhouse, and swimming pool. It was severely damaged in the 2011 flood. After the flood, the owners of the Minot Country Club built a new course and club house on a site located outside the floodplain in southeastern Minot (reference [58]). The original Minot County Club was restored and reopened in August 2013 as the Vardon Golf Club.

Designated recreational areas in the project area in Minot include several parks and golf courses with various recreational amenities and trail systems. Table 3-16 lists the parks, designated open space, and other recreation facilities in Minot in the vicinity of the Project, and summarizes their amenities. Parks located within or near the proposed flood risk-reduction features are listed in bold on Table 3-16. Map 3-9 shows the locations of Minot recreational facilities. Trails in the vicinity of Minot, but outside of

the project footprint include a portion of a regional snowmobile trail system and the Minot Base Trail located in east-central Minot leading up to the Minot AFB.

One of the larger recreational features in the immediate vicinity of the Project is the Roosevelt Park and Zoo. Roosevelt Park is within the bends of the Souris River and is adjacent to an existing interior ponding area north of East Burdick Expressway and south of Fourth Avenue NE. The trail/sidewalk system within the park is approximately 1.4 miles long, and the park also provides water access for fishing. The Roosevelt Park Zoo has a variety of mammals, birds, reptiles, amphibians, and invertebrates, along with other amenities.

The Souris Valley Golf Course and the Wee Links Golf Course are facilities of the Minot Park District. The Souris Valley Golf Course is an 18-hole par 72 course. The Wee Links Golf Course is a 9-hole course specifically designed for young golfers. These courses are located within the Napa Valley segment of the proposed Project.

Table 3-16 Minot Parks and Open Space in the Project Area

Name/Location	Acres	Amenity															
		Baseball field(s)	Basketball Court(s)	Golf Course	Dog Park	Hockey Rink	Ice Skating	Horseshoe Court(s)	Skate Park	Parking	Pavilion/Picnic Shelter	Picnic Area/Grills	Play Structure	Tennis Court(s)	Trails	Volleyball Court(s)	Water Access/ Fishing
Neighborhood Parks																	
Green Valley	1.5		X					X		X	X	X	X	X			
Hammond Park	4.4		X								X		X	X			
Leech Park	4.0		X							X	X		X	X			
Moose Park	4.5							X		X	X	X	X			X	
Riverside Park	7.4		X							X	X	X	X				X
Community Parks																	
Oak Park	90.0									X	X	X	X		X	X	
Roosevelt Park	85.0								X	X	X		X	X	X		X
Roosevelt Park Zoo	20.0									X					X		
School Community Playfield/Athletic Complex																	
Jack Hoeven Baseball Park	21.0	X								X							
Corbett Field	7.0	X				X	X			X							
Open Space Park																	
Via View Park	5.2									X							
Nubbin Park	7.4							X								X	

Name/Location	Acres	Amenity															
		Baseball field(s)	Basketball Court(s)	Golf Course	Dog Park	Hockey Rink	Ice Skating	Horseshoe Court(s)	Skate Park	Parking	Pavilion/Picnic Shelter	Picnic Area/Grills	Play Structure	Tennis Court(s)	Trails	Volleyball Court(s)	Water Access/ Fishing
Special Use Facility																	
Souris Valley Golf Course	169.0			X						X							
Wee Links Golf Course	17.0			X						X							
Dakota Bark Park	3.0				X												

reference [42]

Several recreational facilities, mostly in Minot, have received federal funds for their development or maintenance. The U.S. Department of the Interior, National Park Service has issued grant money through the Land and Water Conservation Fund (LWCF) to support the development or maintenance of parks and recreational facilities within Ward County. Table 3-17 lists federally funded recreational features in the project area. Those in the Project impact area are listed in bold. Several of these LWCF grant-funded parks and recreational amenities in Minot were damaged during the 2011 flooding event. These facilities were repaired to pre-flood conditions using local and private grant funds.

Table 3-17 Recreational Facilities Funded by the Federal Land and Water Conservation Fund in the Vicinity of the Project

Grant ID & Element	Grant Element Title	City	Funding Amount	Year Approved/ Expiration
38-01160	Ward County Playground Improvement (Old Settlers Park)	Burlington	NA	NA
38-00798	Burlington Tennis Court	Burlington	$6,500	1979/1984
38-00009	**Souris Valley Golf Course**	Minot	$104,772	1966/1967
38-00311	**Minot Golf Course Improvement**	Minot	$12,348	1972/1973
38-00951	Minot Golf Course Facility	Minot	$75,000	1983/1984
38-00393	Minot School Park	Minot	NA	NA
38-00124	Minot – Oak Park South Hill Acquisition	Minot	$23,875	1968/1968
38-00877	Minot Oak Park Pool	Minot	$74,000	1981/1986
38-00332	Minot Longfellow Hockey Rink	Minot	NA	NA
38-00207	Minot Roosevelt Park Swimming Pool	Minot	$119,947	1971/1972
38-00314	Minot Roosevelt Tenniplay	Minot	$5,428	1972/1973
38-00628	**Minot Roosevelt Park Footbridge**	Minot	$65,300	1977/1979
38-00422	Minot Green Valley Park	Minot	$9,700	1973/1976
38-00895	Minot Softball Complex	Minot	$189,500	1981/1986
38-00451	Minot Recreation Developments (River Drive Park and Via View Park improvements)	Minot	$19,505	1973/1976
38-00629	Minot Parks Improvement (Roosevelt Park, Spring Lake Park, Polaris Park, 24th Street Park, Oak Park)	Minot	$15,347	1977/1979
38-01130	Minot Fitness Trail	Minot	$16,245	1995/1999
38-01184	**Minot Parks Playground Improvement** (Leach Park, Oak Park, River Side Park, **Roosevelt Park**, Green Valley Park)	Minot	NA	NA

3.8 Aesthetics and Visual Resources

The aesthetic and visual resources of a landscape are defined as the existing natural and built features visible to the public which affect the visual quality and character of an area. This section discusses the existing aesthetic and visual resources visible from areas where the Project is likely to be within view, referred to as the "viewshed." The size of the Project viewshed varies based on location: Project segments in open and agricultural areas would have a more expansive viewshed, as they are free of visual obstructions. Conversely, Project features in urban and residential areas may have a smaller viewshed, due to the presence of visual obstructions from trees and buildings.

In order to gauge how the aesthetics of the landscape could be affected by the Project, it is valuable to first assess the character of the existing landscape. A landscape's character is largely influenced by topography, vegetation, and water resources. The Project is within the Northern Black Prairie and Drift Plains of the Northern Glaciated Plains eco-region. This area of the Northern Glaciated Plains is characterized by subtle undulating topography, with wetland areas interspersed among vegetated forested areas. Many of the viewsheds of the western and eastern segments of the Project consist of agricultural fields, primarily row crops, grasslands, pastures, and hay fields. Views in the agricultural areas of the Project are generally unimpeded, because of a lack of visual obstructions and the subtle rolling topography. The Souris River is the central defining visual resource in the landscape of the project area. The aesthetics of the river corridor have been previously altered by flood control projects (i.e., the existing federal projects), including river channel re-alignments, channel cutoffs, and the addition of levees, pump stations, and ponding areas to the viewshed.

The visual character of a landscape is also largely influenced by the presence of the built environment, such as residential, commercial, and municipal buildings, transportation infrastructure, and industrial features. The built environment transitions from a more rural area that is sparsely populated near Burlington to more urbanized areas in Minot. In the Burlington area, the Souris River passes primarily through residential areas visually characterized by one- and two-story homes with large lots and mature trees. The Minot area is more urbanized, consisting of low-, medium-, and high-density areas of single- and multi-family homes.

In general, neighborhoods zoned for single-family homes located near the Project footprint are visually characterized by homes less than 35 feet tall, with large, mature trees scattered over large lots. Resident viewsheds are limited by the presence of trees and neighboring homes and buildings. Neighborhoods zoned for multi-family homes allow for a variety of housing types, including single-family dwellings and multi-family stacked dwellings. These neighborhoods are generally higher-density than neighborhoods zoned for single-family homes. Views in these neighborhoods are again limited due to the presence of view-obstructing homes, multi-story buildings, and trees.

Some manufactured home parks are also present within the project area and within the viewshed on the eastern side of Minot. Manufactured home neighborhoods are visually characterized by single-family detached or attached manufactured homes which do not exceed a height of 35 feet. Due to the low height of these dwellings and the presence of open space, viewsheds in these neighborhoods are not

typically limited by the build structures, but rather by tall trees bordering the perimeter of the neighborhoods.

The visual character of the project area is also influenced by Minot's downtown civic area and parks. The civic area of downtown Minot is of visual significance for the historic and architectural presence of its public facilities, including the Minot Public Library, Minot City Hall, and the Minot Police Department. The aesthetics of the Project footprint and the associated viewshed within this area are urban and dense, comprised of taller buildings, shopping/commercial businesses, and multi-family housing with sparse vegetation. The prominence of these buildings restricts views in this civic area. The Project also goes through Roosevelt Park, the largest park in Minot, visually characterized by the presence of large, old trees scattered throughout grassy open spaces. Other parks such as the Jack Hoeven Park and public baseball fields are also located within the viewshed of the Project.

3.9 Historic and Cultural Resources

It is not within the scope of this EIS to provide detailed overview of the cultural setting specific to the study area. For detail concerning the historic contexts of the area see Historic Preservation, National Register Historic Contexts or publications by the State Historical Society of North Dakota. Cultural resources include historic properties such as districts, sites, buildings, structures and objects that may be included in, or eligible for inclusion in the National Register; artifacts and materials related to historic properties, significant events and people; historic records; and the lifeways, traditions and ceremonies of communities. A historic property is any prehistoric or historic site, structure, building, object, or district included in, or eligible for inclusion in the National Register of Historic Places (NRHP).

Four surveys have been performed to identify cultural resources in the project area. Listed below and attached as Appendix G, Appendix H, and Appendix I, are reports documenting the findings of the surveys.

- *Class I Cultural Resources Survey, Mouse River Enhanced Flood Protection Project, Burlington to Minot, Ward County, North Dakota*
- *Class III Archaeological Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, Minot Ward County, North Dakota*
- *Class III Standing Structure Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, 2nd Avenue SE Stormwater Pool, Minot, Ward County, North Dakota*
- *Class III Cultural Resources Investigation of Mouse River Enhanced Flood Protection Plan Borrow Site, Ward County, North Dakota*

The study area for the Class I Cultural Resources Survey encompassed the entire Project footprint with an additional 1 mile buffer from Burlington through Minot except for historic structures within the City of Minot. The Class III Archaeological and Standing Structure surveys narrowed down this study area to the

areas of potential effect (APE) associated with Stage 1 (Phases 1 through 3) and the Highway 2 borrow area. Cultural resource surveys at other potential borrow areas have not been conducted at this time.

3.9.1 Class I Cultural Resources Survey

The Class I Cultural Resources Survey was conducted to identify all known archaeological sites and historical structures that could be affected by the Project [59]. Sites within the study area were identified using records at the North Dakota State Historic Preservation Office (SHPO). The Class I background research was conducted in May 2015 in accordance with guidelines outlined by SHPO. Using the methodology noted below, historic structures are addressed in the Class III Standing Structure Survey discussed in Section 3.9.3.

Since the 2011 flood, Minot has been actively acquiring and redeveloping housing infrastructure through the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR) Program. As this effort is a federal action, it is also subject to NEPA and compliance under Section 106 of the National Historic Preservation Act (NHPA). That effort and this EIS for the Souris River Enhanced Flood Protection Project are being evaluated through separate NEPA documents. In order to avoid duplicating surveys, the Class I survey did not evaluate historic structures within Minot because a survey of standing structures was already underway within Minot for the City's HUD CDBG-DR program.

The Class I Cultural Resources Survey methodology was as follows:

- Search existing records for known archaeological sites and historic structures in the study area.
- Identify sites that might be eligible for the NRHP, so they can be considered and investigated to inform the planning processes.
- Design a Class III Cultural Resources Survey methodology, where appropriate.

The following subsections identify and summarize known archaeological sites and historic structures and features identified in the Class I Cultural Resources Survey as having potential NRHP eligibility. The Class I survey report recommended that a Class III Cultural Resources Survey be prepared where there will be ground-disturbing activities that could affect features potentially eligible for the NRHP. The Class III archaeological and standing structure surveys are summarized in Section 3.9.2 and Section 3.9.3.

3.9.1.1 Prehistoric Archaeology

The Class I survey identified four archaeological sites within the study area (Table 3-18, reference [59]). The four archaeological sites (32WD24, 32WD58, 32WD59, 32WD130) were inventoried from 1982-1992. During the initial documentation (1982, 1989, and 1992) of the sites, subsurface testing was recommended to discern eligibility for the NRHP. The archaeological sites listed in Table 3-18 are not within the APE for Stage 1. Future phases of the Project are covered under stipulations within the Programmatic Agreement between the USACE and ND SHPO.

Table 3-18 Class I Cultural Resource Survey – Prehistoric Archaeological Sites within Class I Study Area

Site	Date Recorded & Description	NRHP Eligibility
32WD24	1982: Charcoal scar and faunal remains from eroding terrace.	Potentially eligible
32WD58	1989: Lithics, debris, faunal bone fragments. No subsurface testing at time of 1989 recordation.	Potentially eligible
32WD59	1989: Cultural material scatter, including lithics, bison, or bovid bone. No subsurface testing at time of 1989 recordation.	Potentially eligible
32WD130	1992: Stone circles and rock features. No subsurface testing at time of 1992 recordation.	Potentially eligible

Data source: reference [59]

3.9.1.2 Historic Archaeology

The former Soo Line Railroad corridor (present day Canadian Pacific Railroad), which extends through the project area, is recommended as potentially eligible for the NRHP (Table 3-19) because of the significance of railroads in North Dakota and the American West. Segments of the former Soo Line corridor are adjacent to the APE.

Table 3-19 Class I Cultural Resource Survey – Historic Archaeological Sites within Class I Study Area

Site	Location	Date Recorded & Description	NRHP Eligibility	Status/ Recommendation
32WD1631	Soo Line-Canadian Pacific Railroad	2010 - Soo Line Railroad	Check Statewide Context	Recommended Eligible

Data Source: reference [59].

3.9.1.3 Standing Structure/Historic Architectural History

The Class I survey identified four standing structures in the project area that are potentially eligible for the NHRP (Table 3-20). Site 32WD34 is an historic farmstead, and sites 32WD1613, 32WD1615, and 32WD1841 are bridges.

Table 3-20 Class I Cultural Resource Survey – Standing Structures/Historic Architectural Sites within Class I Study Area

Site	Date Recorded & Description	NRHP Eligibility	Status/ Recommendation
32WD34	1982: Vellejo Farm	N/A	Possibly Eligible/ Recommend revisit site
32WD1613	2001: Bridge	NRHP	Statewide Context: Recommended eligible
32WD1615	2001: Bridge	NRHP	Statewide Context: Recommended eligible
32WD1841	2014: Steel bridge	N/A	Further investigation needed/ Avoidance recommended

Data Source: reference [59]

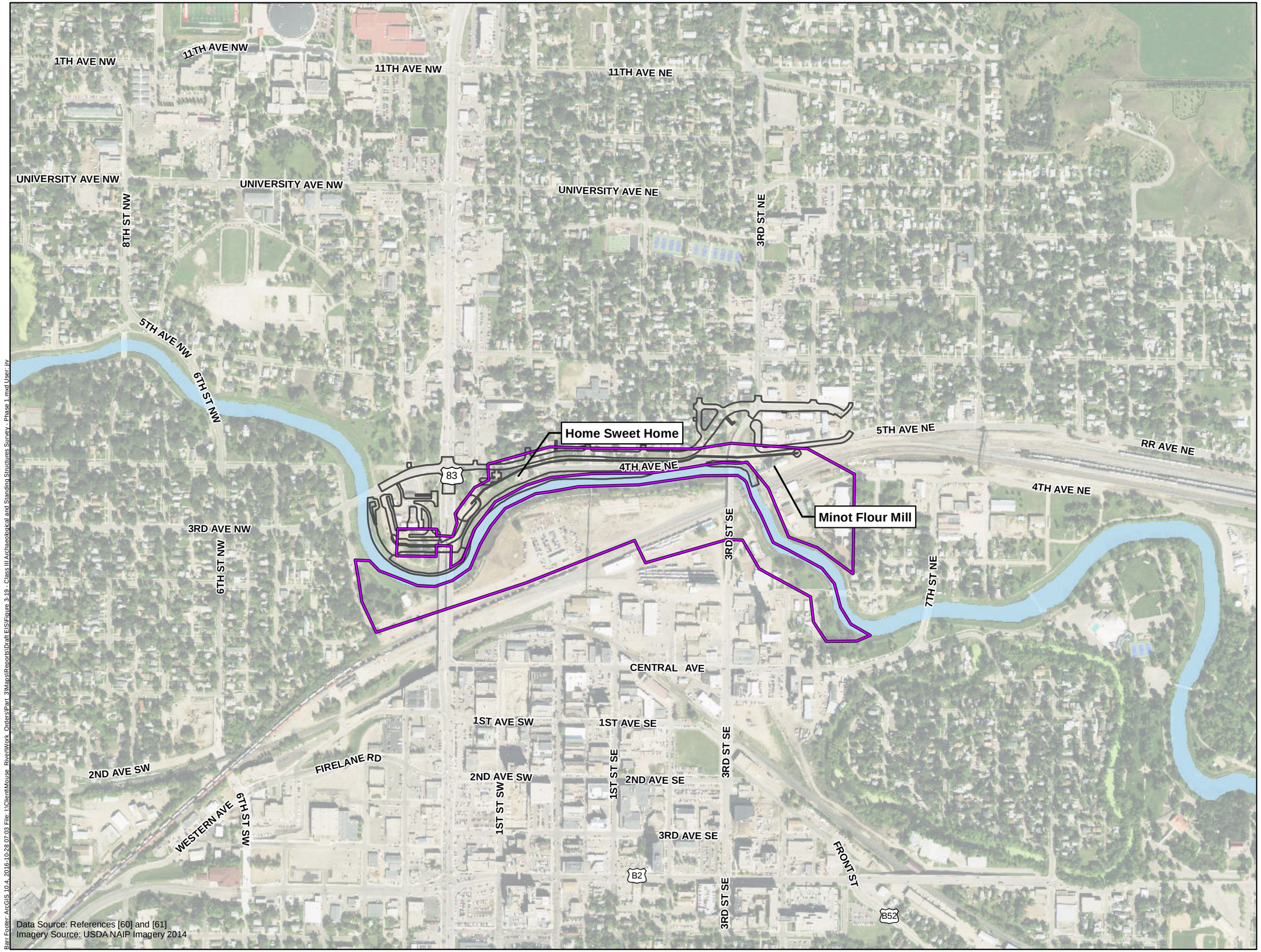
3.9.2 Class III Archaeological Survey – Phases 1 through 3

A Class III Archaeological Survey for Stage 1 of the Project was conducted in May, 2015, to determine the presence of archaeological sites, historical sites, or buried soils that have the potential to contain archaeological materials (reference [60]). The Class I Cultural Resources Survey noted that there were no previously identified archaeological or historic sites within the Class III survey areas. All of Stage 1 was surveyed by foot. Stage 1 surveys were separated into three phases and the extent of the APEs for the Class III Archaeological Survey are shown on Figure 3-19 and Figure 3-20.

The Class III Archaeological Survey methodology was as follows:

- Visual inspection of the survey area and a significant buffer for above ground indicators and landscape features that might indicate earthworks, burial mounds, cemeteries, foundations or other cultural resources.
- Where visibility was adequate (>30 percent of ground surface visible), pedestrian survey of the APE to locate artifacts, features, architectural remains, or other evidence of human occupation or utilization, using parallel transects not more than 30 meters apart.
- Manual three-quarter-inch soil cores were taken to confirm that the pedestrian survey was adequate (i.e., no buried soils likely to contain archaeological materials were present.)
- Soils within the APE had been stripped by erosion or construction of earlier flood risk-reduction features and were not intact; no subsurface testing was deemed necessary.

The Class III Archaeological Survey of Stage 1 did not identify archaeological or historical sites and did not detect intact soils likely to contain archaeological materials. Survey results for the separate phases is provided below.



Class III Archaeological and Standing Structures Survey Areas

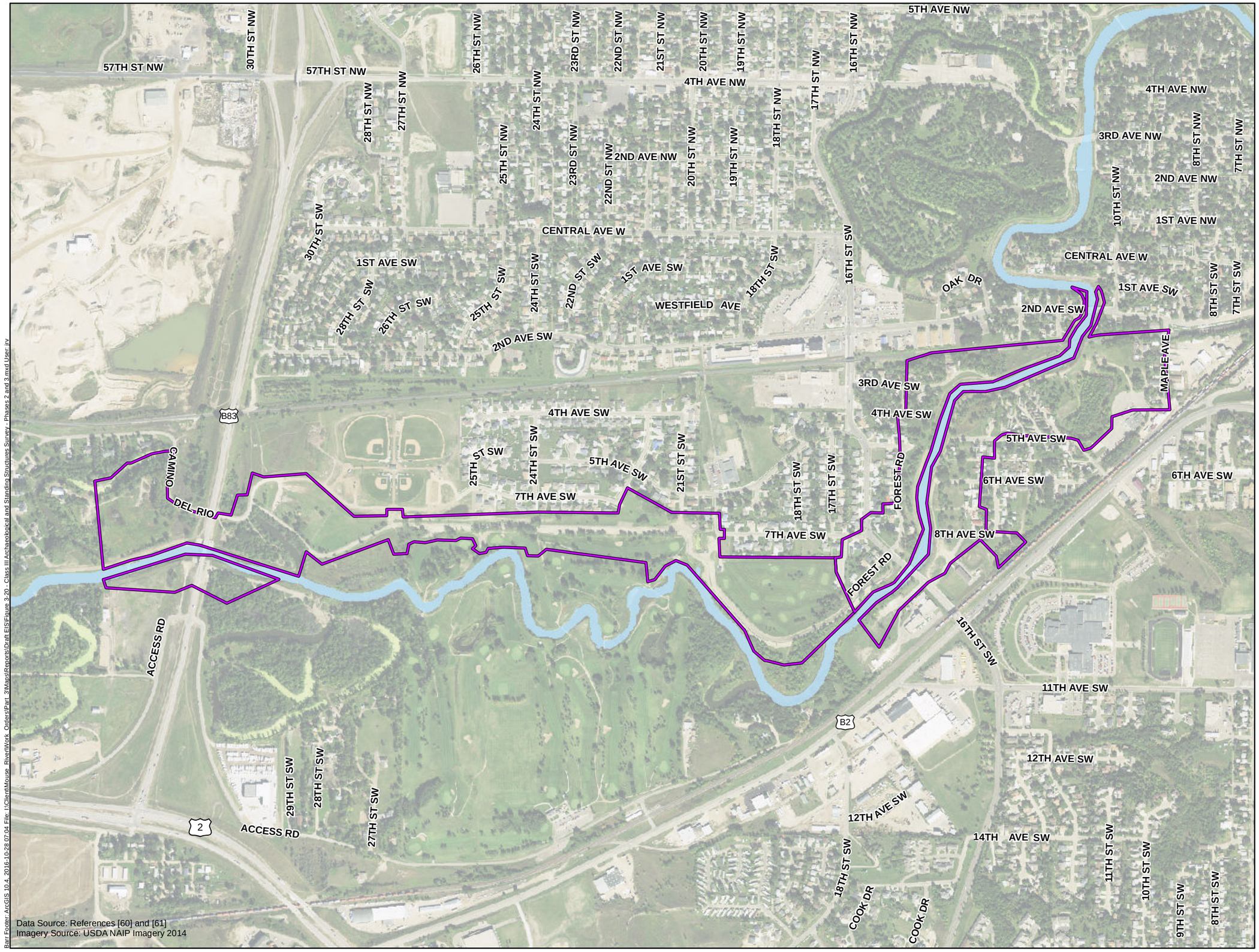
Project Footprint

0 300 600 1,200
Feet

Figure 3-19

CLASS III ARCHAEOLOGICAL AND STANDING STRUCTURES SURVEYS
PHASE 1
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 07:03 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-19_Class III Archaeological and Standing Structures Survey_Phase 1.mxd User: jrv



Data Source: References [60] and [61]
Imagery Source: USDA NAIP Imagery 2014

Barr Footer: ArcGIS 10.4, 2016-10-28 07:04 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 3-20 - Class III Archaeological and Standing Structures Survey - Phases 2 and 3.mxd User: rrv

Class III Archaeological and Standing Structures Survey Areas

Project Footprint

0 400 800 1,600
Feet

Figure 3-20

CLASS III ARCHAEOLOGICAL AND STANDING STRUCTURES SURVEYS
PHASES 2 AND 3
Mouse River Enhanced Flood Protection Project

3.9.2.1 Phase 1 – Fourth Avenue NE

The survey for Phase 1 of the Project was conducted from the line of the proposed floodwall and levee segments on the northern and southern sides of the Souris River to the banks of the Souris River. Soil probes indicated that soils within the survey area had been substantially stripped by fluvial erosion or construction of the existing levees. The survey did not identify any archaeological or historical sites, and detected no intact soils likely to contain archaeological materials. No additional archaeological survey is recommended for Phase 1.

3.9.2.2 Phase 2 – Napa Valley

The Phase 2 APE is primarily developed golf courses that have been extensively landscaped. An existing levee runs through the area. The pedestrian survey was conducted from the line of the proposed levee on the northern side of the Souris River to the bank of the Souris River. A pedestrian survey was also conducted on a floodplain terrace south of the Souris River. Soil probes in the area indicated that soils within the survey area for this Project phase had been substantially stripped by fluvial erosion or construction of the existing levee line. The survey did not identify archaeological or historical sites, and detected no intact soils likely to contain archaeological materials.

Within the Phase 2 APE, the area near Second Avenue SW had been previously cultivated and is now planted with trees. This wooded field adjacent to Second Avenue SW and the railroad line would be used as a stormwater pond. Soil probes in this survey area indicated a minimal potential for buried archaeological deposits. No further archaeological survey is recommended for any of the areas associated with Phase 2 of the Project.

3.9.2.3 Phase 3 - Forest Road

The Phase 3 cultural resources survey was conducted from the line of the proposed levees on the northern and southern sides of the Souris River to the banks of the Souris River. The APE also included a proposed section of floodwall and two ponding areas. The results of soil probing indicated that soils within the APE had been substantially stripped by fluvial erosion or construction of the existing levees. The survey did not identify archaeological or historical sites, and detected no intact soils likely to contain archaeological materials. No further archaeological survey is recommended for the Phase 3.

3.9.3 Class III Standing Structures Survey – Stage 1

A Class III Standing Structures Survey for Stage 1 was conducted in May, 2015 [61]. The survey was limited to identifying standing structures within the survey areas that were eligible or potentially eligible for the NRHP. Stage 1 surveys were separated into three phases. The APEs for the Class III Standing Structure Survey are shown on Figure 3-19 and Figure 3-20.

The Class III Standing Structures Survey methodology was as follows:

- Identify all historic structures in existing SHPO records.

- Identify all historic structures in existing SHPO records designated as eligible or potentially eligible for the NRHP.
- Conduct 100-percent visual inspection survey of all structures to confirm that potentially eligible structures had been identified.

Four structures within the APE have been identified as eligible for the NRHP (**Error! Reference source not ound.**).

Table 3-21 Class III Standing Structures Survey – Historic Structures within Phases 1-3 APE

Site	Name	Location	Location relevant to project	NRHP Eligibility
32WD507	Home Sweet Home	103 Fourth Avenue NW, Minot	Within Phase 1 footprint	Eligible
32WD652	Minot Mill	400 Third Street NE, Minot	Within Phase 1 footprint	Eligible as a contributing element to the NRHP Minot Mill District
32WD681	20th century residence	25 Fifth Avenue NE, Minot	Adjacent to (north of) Phase 1	Not Eligible
32WD1631	Soo Line-Canadian Pacific Railroad	Linear corridor following current railway	Adjacent to Phase 2 and Phase 1 (west to east)	Eligible

Data Source: reference [61]:

At the same time as this Class III survey, a comprehensive architectural study of several neighborhoods in the project area in Minot was underway as part of the HUD CDBG-DR program under the MOA between Minot and the North Dakota SHPO.

3.9.3.1 Phase 1 – Fourth Avenue NE

The Phase 1 Class III Standing Structure Survey was conducted from the line of the proposed floodwall and levee segments on the northern and southern sides of the Souris River to the banks of the Souris River. The record search for the northern side of the Souris River included all structures within and immediately beyond the boundaries of the APE, and all structures between Fifth Avenue NE and the Souris River and Sixth Street NE. The record search for the southern side of the Souris River consisted of a scattering of industrial buildings immediately adjacent to the Burlington Northern Santa Fe Railroad tracks, and everything recorded between the Souris River, Third Street NE, Central Avenue E, and Seventh Street N.

Home Sweet Home (32WD507)

Home Sweet Home is within the Phase 1 Project footprint. This site consists of a two-and-a-half-story house built on or before 1907 with a façade of stucco, brick, and horizontal wood siding. The gambrel roof is covered in asphalt shingles, with a gable dormer on the northern elevation. Ornamental towers are on the eastern elevation.

Although the inventory of standing structures initially identified Home Sweet as "not eligible," in further consultation with SHPO it was confirmed that Home Sweet Home was eligible for NRHP.

Minot Mill (32WD652)

The Minot Mill is within the Phase 1 Project footprint. Last documented in 1985, the Minot Mill consists of a central four-story building, flanked by one-story warehouse extensions on the eastern and western sides of the central building. The Minot Mill has been identified as a contributing element of the NRHP Minot Industrial District. Although the structure has been heavily modified since the 1986 creation of the NRHP Minot Industrial District, it may still retain integrity sufficient to be a contributing element to that district.

25 Fifth Street NE (32WD681)

The 25 Fifth Street NE site is recorded as a one-story T-frame house with a cross gable roof, built between 1905 and 1907. The T-frame house is outside the Project footprint and is part of the extended APE. Additionally, the house has been heavily modified and no longer has structural integrity sufficient for NRHP eligibility. No further investigation or mitigation efforts are recommended.

Soo Line-Canadian Pacific Railroad (32WD1631)

The Soo Line-Canadian Pacific Railroad (32WD1631) was previously discussed in Section 3.9.1.2. Modifications to the existing railroad corridor are not anticipated to occur as part of Phase 1 of the Project.

3.9.3.2 Phase 2 – Napa Valley

The Phase 2 APE is primarily developed golf courses that have been extensively landscaped. An existing levee runs through the area. The pedestrian survey was conducted from the line of the proposed levee on the northern side of the Souris River to the bank of the Souris River. Some proposed retention ponds and a small area of levee on the southern side of the river were also surveyed. The record search and 100-percent visual inspection survey identified one site that might be eligible for the NRHP: site 32WD1631, the Soo Line-Canadian Pacific Railroad.

Soo Line-Canadian Pacific Railroad (32WD1631)

The Soo Line-Canadian Pacific Railroad (32WD1631) was previously discussed in Section 3.9.1.2. Modifications to the existing railroad corridor are not anticipated to occur as part of Phase 2 of the Project.

3.9.3.3 Phase 3 – Forest Road

The Phase 3 survey was conducted from the line of the proposed levees on the northern and southern sides of the Souris River to the banks of the Souris River. The APE also includes a proposed section of floodwall and two retention pond areas. The record search and 100-percent visual inspection survey identified no structures eligible for the NRHP. No additional survey is recommended.

3.9.4 Class III Archaeological Survey – Highway 2 Borrow Site

In March 2016, a Class III cultural resource investigation was conducted at a potential borrow site (i.e., Highway 2 borrow site) for the proposed Project. The fieldwork involved a pedestrian survey of the approximately 32 acre site. No cultural resources or historic properties were identified during field investigations of the site. Likewise, no trace could be found of one site lead (32WDX0115) previously recorded in the area (reference [62]).

3.9.5 Native Tribes

The USACE is responsible for consultation with federally recognized tribes that have historical and cultural associations within the project area. In accordance with 36 CFR 800.3(f)(2) of the Advisory Council on Historic Preservation's regulation implementing Section 106 of the National Historic Preservation Act of 1966, as amended, the USACE sent consultation letters on March 9, 2016 to tribes notifying them of the Project and seeking interest as a consulting party for Section 106 purposes. These consultation letters were sent to the tribes listed below.

- Cheyenne River Sioux Tribe (SD)
- Chippewa Cree Cultural Resources (MT)
- Crow Creek Sioux Tribe (SD)
- Crow Nation (MT)
- Fort Peck Tribes (MT)
- Northern Cheyenne Nation (MT)
- Oglala Sioux Tribe (SD)
- Rosebud Sioux Tribe (SD)
- Santee Sioux Nation (NE)
- Sisseton-Wahpeton Oyate (SD)
- Spirit Lake Sioux Nation (ND)
- Standing Rock Sioux Tribe (ND)
- Three Affiliated Tribes (ND)
- Turtle Mountain Band of Chippewa (ND)
- Yankton Sioux Tribe (SD)

3.10 Air and Noise Quality

3.10.1 Air Quality

3.10.1.1 Criteria Pollutants

The Clean Air Act (CAA) of 1970 (42 United States Code [USC] 7401 et seq.), as amended in 1977 and 1990, is the primary federal statute governing ambient air pollution. The CAA designates standards for the following criteria pollutants that have been determined to affect human health and the environment: particulate matter (PM10 and PM2.5), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), and ozone (O_3). Volatile Organic Compounds (VOC) and NO_2 are precursors to O_3, which is not an emitted source but is formed by these pollutants in the atmosphere (40 CFR Part 50).

The USEPA has developed National Ambient Air Quality Standards (NAAQS) for these criteria pollutants to protect public health and welfare. When a designated air quality area or airshed exceeds a NAAQS, that area may be designated as a "nonattainment" area. Areas with levels of pollutants below the health-based standard are designated as "attainment" areas. To determine whether an area meets the NAAQS, air monitoring networks have been established and are used to measure ambient air quality and determine attainment status.

The NDDH Air Quality Division regulates air quality throughout the state, except for on Indian reservations. North Dakota has promulgated ambient air quality standards (NDAAQS) in addition to the NAAQS. These standards include hydrogen sulfide and SO_2; for all other pollutants, the NAAQS are equivalent or more stringent than the NDAAQS. Both the NAAQS and NDAAQS apply to the Project.

NDDH's most recent Annual Air Quality Monitoring Summary indicates that no sulfur dioxide, nitrogen dioxide, ozone or particulate matter exceeds either the state or federal ambient air quality standards measured at any state operated ambient air monitoring sites. North Dakota is one of 13 states that are in attainment for all criteria pollutants (reference [63]). Because of North Dakota's attainment status and because primary emissions associated with the Project would be from non-major sources, it is not anticipated that any air-quality permits or authorizations would be required from the NDDH Air Quality Division.

New projects within attainment or unclassified areas must conform to limits defined under the Prevention of Significant Deterioration (PSD) Program. For actions resulting in emissions that exceed a threshold (250 tons per year or more of any air contaminant regulated under North Dakota Century Code Chapter 23-25), PSD requirements provide maximum allowable increases in pollutant concentrations for areas that are already in compliance with the NAAQS.

3.10.1.2 Greenhouse Gases

Climate change refers to any significant change in measures of climate lasting for an extended period of time. Greenhouse gases (GHGs) are gaseous emissions that trap heat in the atmosphere. These emissions occur from natural processes but are exacerbated by human activities. The most common GHGs emitted from human activities include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) (reference [64]). On December 18, 2014, the Council on Environmental Quality (CEQ) issued revised draft

guidelines "to provide federal agencies direction on when and how to consider the effects of GHG emissions and climate change in their evaluation of all proposed federal actions in accordance with the National Environmental Policy Act (NEPA) and CEQ Regulations implementing NEPA" (reference [65]). These revised draft guidelines are intended to describe requirements for controlling GHGs under the terms of NEPA and the CEQ regulations. CEQ's revised draft guidelines indicate that NEPA requires both documentation of the proposed Project's potential impacts on GHG emissions and an assessment of how climate change would affect the proposed Project (reference [65]). Climate-related impacts are occurring across regions of the country and across many sectors of our economy. Many state and local governments are already preparing for the impacts of climate change through "adaptation," which is planning for the changes that are expected to occur (reference [66]).

On the federal level, USEPA and other agencies have implemented various programs to encourage the reduction of GHG emissions. On June 2, 2014, USEPA proposed draft rules under Section 111(d) of the CAA to cut carbon emissions from existing fossil fuel-fired power plants. The draft rules are commonly referred to as "the Clean Power Plan." The Clean Power Plan would establish goals for reducing carbon emissions, but the states would determine the means of achieving the standards: "EPA's guidelines provide flexibility and encourage states to look across their whole electric system to identify strategies to include in their plans that reduce carbon pollution from fossil fuel-fired power plants" (reference [67]).

3.10.1.3 Climate

The High Plains Regional Climate Center provides data and climate-trend assessments for the Great Plains region of the United States, including data over a 116-year period (1895-2011). Based on this data the Great Plains region shows an average temperature warming trend relative to the baseline of the 1901-1960 average. The warming trend shows an average of a 0.2°F increase in temperature per decade for the Great Plains Region. By comparison, the warming trend in North Dakota specifically is an annual average temperature increase of 0.26°F per decade, which is higher than the trend for the Great Plains Region, as well as the greatest annual average increase in the nation.

Annual precipitation for the entire Great Plains region was greater than the 1895-2011 average during the 1990s, less than the average during the early 2000s, and greater than average during the last few years on record. Over this period, observations indicate an upward trend in the number of extreme precipitation events for the region (reference [68]). Climate models project a warming in the High Plains region of about 4°F by 2050 and 8°F or more by 2090. With regard to precipitation, models show general drying in summer and autumn, with wetter conditions in winter. Spring is also projected to be wetter in the northern part of the region (reference [69]).

One key climate change consideration for the proposed project is the potential impact of climate change on flooding. As part of a national policy on resilience and risk reduction consistent with President Obama's Climate Action Plan, the National Security Council staff has coordinated an interagency effort to create a new flood risk-reduction standard for federally funded projects.

As a result, in January 2011, President Obama issued Executive Order 13690, which requires that agencies expand management from the current base flood level to a higher vertical elevation and corresponding

horizontal floodplain to address current and future flood risk and ensure that projects funded with taxpayer dollars last as long as intended. For example, the floodplain may be established using science that considers climate information and projections and that uses the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science.

Alternatively, the executive order allows that the agencies address flood risk-reduction goals by building 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. Climate change considerations addressed in defining the floodplain and analyzing the effectiveness of the proposed Project are discussed further in Section 3.2.2.

3.10.2 Noise

Noise is generally defined as unwanted sound and is commonly measured in units of decibels (dB) on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more "weight." The A-weighted decibel scale (dBA) is used to emphasize the range of sound frequencies that are most audible to the human ear. The human range of hearing extends from approximately 0 dBA to 140 dBA, and the human ear can usually detect the difference when a sound changes by 3 dBA, while a 5 dBA change in sound is clearly noticeable to the human ear. Decibels are on a logarithmic scale, thus an increase in dBA of 10 is perceived as a doubling of the noise level.

Minot has adopted an ordinance that limits noise levels within the city limits. Minot's code of ordinances (Ch. 23 article VI Sec 23-108) sets noise level limits for three different use classifications: residential, commercial, and industrial. Table 3-22 identifies these use classification as well as the corresponding zoning districts and summarizes daytime and nighttime noise standards for each.

Table 3-22 Limiting Noise Levels for Zoning Districts

	Zoning District		
	Residential (R1, R2, R3, R4, PD-MH)	Commercial (C1, C2, C3, C4)	Industrial (M1, M2)
Maximum number of decibels permitted from 7:00 a.m. until 11:00 p.m., daily	55	65	80
Maximum number of decibels permitted from 11:00 p.m. until 7:00 a.m. of the following day	50	60	75

Minot has identified a number of activities that are exempt from these noise standards, including noises of safety signals, warning devices, and emergency relief valves, any construction or maintenance activities, and any other noise resulting from activities of a temporary duration permitted by law and for which a special permit (Ch. 23 article VI Sec 23-108(g)) has been granted by the City.

4.0 Environmental Consequences

This chapter describes the potential environmental and social consequences of the Requester's Preferred Alternative and the No-Action Alternative. Consequences generally fall into two categories – consequences related to constructing and operating flood risk-reduction features, and consequences related to flooding. Alternatives were evaluated for flood-related effects at three flood discharges: 5,000 cfs, 10,000 cfs, and 27,400 cfs. The Requester's Preferred Alternative consists of alignments and features as described in Section 2.1. The No-Action Alternative assumes a successful flood fight to 10,000 cfs in conjunction with the existing federal project. Further detail on the No-Action Alternative can be found in Section 2.2.5.

Mitigation measures used to avoid, minimize, or offset adverse impacts of the Requester's Preferred Alternative are discussed in many of the following sections. Specific permit conditions would require certain mitigation actions. In addition, the requester has identified a number of mitigation measures that would be pursued outside of permitting requirements. Both required and voluntary mitigation actions are described in the following sections. Permit conditions have not yet been identified and therefore cannot be differentiated from voluntary measures with complete certainty.

4.1 Geology, Soils, and Groundwater

4.1.1 Requester's Preferred Alternative

4.1.1.1 General Effects and Mitigation Measures

Geology

No significant geological resources are located in the impact area; therefore, the Requester's Preferred Alternative would not adversely affect geological resources.

Soils

Construction of the flood risk-reduction features would disturb up to approximately 250 acres of urban soils and 550 acres of other soil types (Table 3-1), including 300 acres that are classified as prime farmland (described in Section 4.1.1.2). The Requester's Preferred Alternative could adversely affect soils in the impact area in several ways, including increasing the potential for erosion, compaction, loss of productivity, and through contamination from leaking construction equipment. The most serious potential impacts would be temporary and could include soil erosion and loss of soil productivity through soil compaction and mixing productive topsoil with less productive subsoil. Any of these effects could interfere with crop production or impair revegetation within the impact area. The potential loss of soil productivity due to compaction or mixing of soil horizons would be greatest in cultivated agricultural fields and greenspace in the impact area.

Construction of the flood risk-reduction features would require the use of heavy equipment, which could de-stabilize the soil surface and increase erosion potential. A soil's susceptibility to erosion varies and is a function of characteristics such as soil texture and structure, topography, surface roughness, amount of vegetative cover, and climate. Erosion may also be influenced by the length of time the soils are left bare

during construction. Erosion from water occurs primarily on loose soils on moderate to steep slopes, particularly during high intensity storm events. The flat topography of the floodplain makes the soils in the impact area less susceptible to erosion. The potential for erosion is greatly reduced once construction is completed and permanent erosion controls, such as vegetation and rip rap, are established.

Appropriate best management practices (BMPs) would be used to minimize soil erosion in disturbed areas. These areas would be identified in the Project's Stormwater Pollution Prevention Plan (SWPPP). These BMPs would consist of both temporary and permanent erosion control measures, including, but not limited to, minimizing the duration of soil disturbance, and installing measures such as silt fences, erosion control blankets, temporary sedimentation basins, and reestablishing contours and vegetative cover by seeding and mulching or by hydromulching as soon as practicable following construction.

Heavy construction vehicles moving off existing roadways could compact the soil. The degree of compaction would depend on the moisture content and texture of the soil. Compaction damages soil structure and reduces pore space, which impedes the movement of air and water to plant roots, resulting in loss of soil productivity and lower growth rates. Soil compaction would be most severe where high ground weight equipment operates on wet soils with high clay content.

Measures to avoid or minimize soil compaction include avoiding construction or the use of high ground weight equipment during wet weather, segregating topsoil from the construction areas, and doing subsurface plowing following construction. If topsoil or subsoil were severely compacted, as determined by testing, a deep tillage device could be used to de-compact the soil.

The mixing of soil horizons during construction could also lower soil productivity by diluting the productive topsoil with the less productive subsoil. The mixing of soil horizons can be avoided or minimized by separating stripped topsoil and excavated subsoil, and returning subsoil and topsoil to their original horizons during backfilling.

Overall, the Requester's Preferred Alternative would have a minor and temporary adverse effect on soils in the project area.

Groundwater

Temporary dewatering activities during construction (lasting 1 to 9 months per construction phase) would withdraw water from the water table aquifer. Groundwater withdrawn for dewatering would be discharged to storm sewers or to the Souris River via temporary sediment basins. Given the hydraulic separation between the water table aquifer and the deeper resource aquifers (Souris Valley aquifer system), no effects to groundwater resources would be expected.

4.1.1.2 Potential Effects on Specific Unique and Sensitive Resources

The Requester's Preferred Alternative would require the disturbance, and permanent conversion of, 300 acres of prime farmland to construct Project features. Farmland is under cultivation within the impact area in three primary Project segment locations: near Talbot's, Apple Grove, and Eastside Estates. Elsewhere, land within the impact area classified as prime farmland is currently developed for non-agricultural uses.

Construction of the Requester's Preferred Alternative could adversely affect prime farmland in the impact area in several ways, including increasing the potential for erosion, compaction, loss of productivity, contamination from leaking equipment, and disturbance to farming activities and schedules. A discussion of these potential impacts and mitigation measures is provided in Section 4.1.1.1.

With the Requester's Preferred Alternative, approximately 1,440 acres of prime farmland would be inundated under the flood scenario of 27,400 cfs. Inundation of prime farmland is not expected to cause permanent adverse effects, but could cause temporary adverse effects such as crop damage and disruption of farming activities.

Because prime farmland is widespread in the project area (the prime farmland within the impact area represents less than 0.1% of the prime farmland in Ward County), the overall adverse effect to prime farmland in the project area would be minor.

4.1.1.3 Site-Specific Effects for Construction Stage 1.5

Construction and operation of the Requester's Preferred Alternative is not expected to have a significant impact on specific geology, soil, or groundwater resources in the Construction Stage 1.5 impact areas. Likewise, the impact to prime farmland would be minor.

4.1.2 No-Action Alternative

The No-Action Alternative would inundate more acres of prime farmland than the Requester's Preferred Alternative under all three flow conditions evaluated. The No-Action Alternative would have varying effects to productivity increasing with the frequency and intensity of flooding. The acres of prime farmland that would be flooded or disrupted under each alternative are shown in Table 4-1.

Table 4-1 Inundation of Prime Farmland under the No-Action and Preferred Alternatives

	Inundation Area (acres)		
	5,000 cfs	10,000 cfs	27,400 cfs
Requester's Preferred Alternative(1)	387	962	1,436
No-Action Alternative	408	1,298	2,280

(1) In addition, 300 acres of prime farmland would be directly impacted by the Requester's Preferred Alternative.

4.2 Surface Waters

4.2.1 **Requester's Preferred Alternative**

4.2.1.1 General Impacts and Mitigation Measures

Constructing, operating, and maintaining the Requester's Preferred Alternative would result in temporary and permanent impacts on surface water resources, as described below.

Souris River

The Requester's Preferred Alternative would have temporary impacts to water resources including localized physical disturbance caused by construction equipment during site preparation, such as vegetation clearing, grading, excavation, and soil stockpiling. These activities would increase the potential for soil erosion and subsequent sedimentation of surface waters. The presence of exposed topsoil or disturbed vegetation during construction could also increase sediment runoff from stormwater, which could affect turbidity and dissolved oxygen levels in receiving waters, such as the Souris River. However, the Requester's Preferred Alternative is not anticipated to alter impairment status or existing impoundment functions along the Souris River.

Erosion control measures would be installed by the contractor prior to the start of construction, as identified by the Project's SWPPP. The SWPPP would use BMPs to reduce the potential for and quantity of sediment and other pollutants reaching surface waters. Temporary erosion control measures used along the Souris River could include, but would not be limited to, one or more of the following: rock construction entrance, sediment ponds, silt fence, erosion-control blanket, inlet siltation protection, concrete washout, floating silt curtain, or rock filter levee.

Permanent, indirect effects on surface waters could include removal of riparian or shoreline forest areas adjacent to the Souris River. In addition to riparian habitat changes, this vegetation clearing could increase light penetration to the Souris River, potentially resulting in localized increases in water temperatures and changes to the river's aquatic communities.

Construction of the Project would also result in permanent impacts to the Souris River, as several Project features would require work to be done below the river's ordinary high water mark (OHWM). The river would be widened in some locations through overbank excavation, and the river's banks would be stabilized in several locations through the use of riprap both above and below the OHWM. Near the Kings Court subdivision and downstream of East Burdick Expressway, proposed channel realignments, would alter the course of the river or create areas that are cut off from the main Souris River channel (known as cutoff channels). Cutoff channels and former oxbows can store water during periods of high flow. Because they do not convey flow, however, these features tend to become stagnant pools with poor water quality once high flows recede. Realigned channels can be designed using natural channel design concepts to provide some functions similar to natural channels; however, they take time to develop and are not likely to provide all comparable functions.

Placement of fill below the OHWM and channel realignment activities would require a USACE Section 404 Permit. Under Section 404, a project can be permitted if it meets the requirements of the 404(b)(1) Guidelines. The Guidelines specifically require that impacts to the aquatic ecosystem be avoided and minimized to the maximum extent practicable prior to mitigating for unavoidable impacts. Mitigation is project specific and varies greatly depending on the aquatic ecosystem being impacted. Currently the USACE does not have a standard for mitigating channel loss in North Dakota. Generally unavoidable channel impacts are mitigated by providing a new channel in a similar configuration and, at a minimum, the length of the impacted channel. Mitigation requirements will be addressed for each permitted phase after all avoidance and minimization measures are implemented.

Floodplain

The Requester's Preferred Alternative would involve constructing flood risk-reduction features within the Souris River's floodplain and floodway. These activities would require a Non-Building Floodplain Development Permit from the Burlington, Minot, or Ward County floodplain administrator, as appropriate. Activities to modify the floodway would require authorization from the local floodplain administrator, as well as the North Dakota State Water Commission.

One objective of the Requester's Preferred Alternative is to remove areas from the regulatory floodplain, thus eliminating flood insurance requirements for properties in those areas. These actions would have to be reviewed and approved by FEMA. A Conditional Letter of Map Revision (CLOMR) serves as FEMA's comment on a proposed Project that would, upon construction, result in the modification of the existing regulatory floodway, the effective base flood elevations (BFEs), or Special Flood Hazard Areas (SFHAs). A CLOMR indicates whether a project, if built as proposed, would be recognized by FEMA. Once a project has been completed, the community must request a revision to the effective Flood Insurance Rate Maps (FIRMs) to reflect the changes. A Letter of Map Revision (LOMR) is used by FEMA to modify published FIRMs.

As part of the floodplain permitting process, the Project sponsor would need to show that adverse flooding impacts caused by the construction of Project features would be mitigated. This is typically accomplished by providing additional storage elsewhere in the floodplain. In the case of the Requester's Preferred Alternative, additional floodplain storage would be accomplished through targeted areas of overbank excavation.

The Requester's Preferred Alternative would result in some downstream impacts during flows over 10,000 cfs, relative to the No-Action Alternative. Under the No-Action Alternative, flows over 10,000 cfs would overtop the existing levees and emergency flood risk reduction features. Construction of the Requester's Preferred Alternative would not allow water to overtop the levees, sending the full volume of flood water downstream. Downstream impacts from the Requester's Preferred Alternative would result in less than 0.5 feet of increased flood elevation and would likely be greatest for floods that peaks in the 12,000 cfs to 15,000 cfs range (reference [4]). These profile impacts would attenuate near Sawyer.

Hydraulic modeling indicates that the flood profile would increase upstream of Minot for the design flood event but that these increases would not extend past the Colton Avenue bridge in Burlington. Mitigation of upstream profile increases would be accomplished as part of the Project by replacing existing levee systems with new levees designed to accommodate the Project design flood profile.

Wetlands

The construction of flood risk-reduction features could temporarily or permanently affect wetlands. Permanent wetland impacts would generally be from construction in the location of an existing wetland, grading within a wetland to prepare a foundation, or reconstruction of a community amenity (such as a park or golf course). Based on preliminary estimates, the completed Project could permanently affect up to 26 acres of primarily freshwater emergent wetlands and temporarily affect up to 41 acres of predominantly riverine wetlands.

Temporary wetland impacts would primarily be from driving construction equipment through wetlands or from soil erosion and deposition during construction. Sedimentation and ground disturbance in wetlands can make them more susceptible to invasive plant species, such as reed canary grass, which could adversely affect wetland function by reducing vegetative biodiversity and altering wildlife habitat. Wetlands immediately adjacent to the Project impact area could potentially be affected by inadvertent spills or leaks of fuels or other hazardous substances from construction equipment. Actions identified above for impacts to surface waters would also be used to minimize erosion and sedimentation of wetlands. In addition, a spill plan would be required as part of the Project's SWPPP. The spill plan would identify measures to protect water resources from accidental releases of harmful substances and would include stipulations such as prohibiting vehicle refueling in wetlands or storing hazardous materials in wetlands.

A USACE Section 404 permit and associated NDDH Section 401 water quality certification would be required for impacts to wetlands. Under Section 404, a project can be permitted if it meets the requirements of the 404(b)(1) Guidelines. The Guidelines specifically require that impacts to the aquatic ecosystem be avoided and minimized to the maximum extent practicable prior to mitigating for unavoidable impacts. Mitigation is project specific and varies greatly depending on the aquatic ecosystem being impacted and the permanence of the impact. Mitigation can be required for any unavoidable impact. Generally, mitigation for wetlands in North Dakota is regional service area (RSA) based and at ratios established by a Federal and state team and published in the *North Dakota Mitigation Banking Guidance Document*. The RSAs and wetland mitigation ratios contained in the document are typically applied to all compensatory mitigation plans. Mitigation requirements will be addressed for each permitted phase after all avoidance and minimization measures are implemented.

4.2.1.2 Site-Specific Impacts for Construction Stage 1.5

Phase 1- Fourth Avenue NE

Phase 1 would include construction of a floodwall and levee within the Souris River floodplain. Overbank excavation beneath the Broadway bridge would also be completed as part of Phase 1, and associated armoring of the channel would extend below the OHWM, resulting in 2,905 linear feet (2.2 acres) of permanent impact as shown in Figure 4-1. Impacts would be managed and mitigated as described in Section 4.2.1.1. Site-specific impacts to wetlands are not anticipated for Phase 1 project elements.

Phase 2 - Napa Valley

Phase 2 would include construction of levees, road grade raises, and reconfiguration of the Souris Valley and Wee Links Golf Courses within the Souris River floodplain. Riprap would be placed along the banks of the river and beneath the Sixteenth Street SW bridge to minimize potential for erosion and scour. Some of this riprap would be placed below the OHWM of the Souris River. Riprap placement in Phase 2 is expected to result in approximately 3.0 acres of permanent impact below the OHWM, as shown in Figure 4-2. The need for riprap has been minimized through using it in conjunction with other erosion protection methods (e.g., turf-reinforced mats) and natural bioengineering practices for streambank stabilization, as well as proposing riprap primarily in areas that are highly susceptible to erosion due to channel velocities

and other stream factors. A mitigation plan for the effects of placing fill below the OHWM is currently being prepared in coordination with the USACE and will be finalized as part of project 404 permitting.

In addition, Phase 2 would require modification to utilities located beneath the Souris River channel in two locations. Utility modifications would be completed using cofferdams to contain the river's flow while open trenches are dug to access the utility. Utility modifications would temporarily affect approximately 0.4 acre below the OHWM, as shown in Figure 4-2. Reconfiguring the Souris Valley Golf Course would also temporarily affect about 0.3 acre below the OHWM and about 0.1 acre of wetlands beyond the footprint of the levee. In total, bank stabilization activities associated with Phase 2 would impact 3,145 linear feet below the OHWM, with 825 linear feet due to bioengineering bank stabilization and 2,320 linear feet due to riprap placement.

Constructing the Phase 2 levees would permanently affect wetlands. Phase 2 project features would permanently affect approximately 0.7 acre of primarily palustrine emergent or palustrine forested wetland, as shown in Figure 4-3. Approximately 0.24 acre of temporary wetland impact are expected with respect to levee construction and grading. A mitigation plan for permanent wetland impacts is currently being prepared in coordination with the USACE and will be finalized as part of project permitting.

Phase 3 - Forest Road

Phase 3 would include construction of levees on both sides of the channel within the Souris River floodplain. The areas between the levees and the channel would be excavated to provide additional capacity during flood events and would be lined with riprap to minimize the potential for riverbank erosion. Some of this riprap would be placed below the OHWM of the Souris River. Riprap placement would permanently affect approximately 2.1 acres below the OHWM, as shown in Figure 4-2. As discussed in the previous section, the need for riprap has been minimized by using natural designs, where able, and placement in areas highly susceptible to erosion. In addition, Phase 3 would require modification to utilities running beneath the Souris River channel in one location. Utility modifications would be completed using cofferdams to contain the river's flow while open trenches are dug to access the utility. Utility modifications are expected to temporarily affect approximately 0.1 acre of area below the OHWM, as shown in Figure 4-2. In total, bank stabilization activities associated with Phase 3 would impact 2,595 linear feet below the OHWM, with 670 linear feet due to bioengineering and 1,925 linear feet due to riprap placement.

Because there are no wetlands in the immediate vicinity of Phase 3, this phase would not affect wetlands.

Other Phases of Construction Stage 1.5

Based on conceptual plans of the three other phases in Construction Stage 1.5, construction of the Tierrecita Vallejo segment and Maple Avenue High-Flow Diversion would result in impacts to the Souris River and adjacent wetlands. The tieback levee is not anticipated to affect any wetlands or waterbodies.

Construction of the levee and excavation of the overbank areas in the Tierrecita Vallejo segment would result in approximately a 1.2 acres of permanent impact below the OHWM of the river (Figure 4-4). Of this, 325 linear feet is due to bank stabilization using riprap. In addition, these flood risk reduction

features would temporarily affect approximately 0.35 acre of wetlands and permanently affect another approximately 0.45 acre of wetlands (Figure 4-5). The Maple Avenue High-Flow Diversion would permanently affect approximately 1.0 acre below the OHWM (Figure 4-6) and approximately 1.9 acres of wetland (Figure 4-7).

Ordinary High Water Mark

Approximate Permanent Impacts Below OHWM

Impact Area

Project Footprint

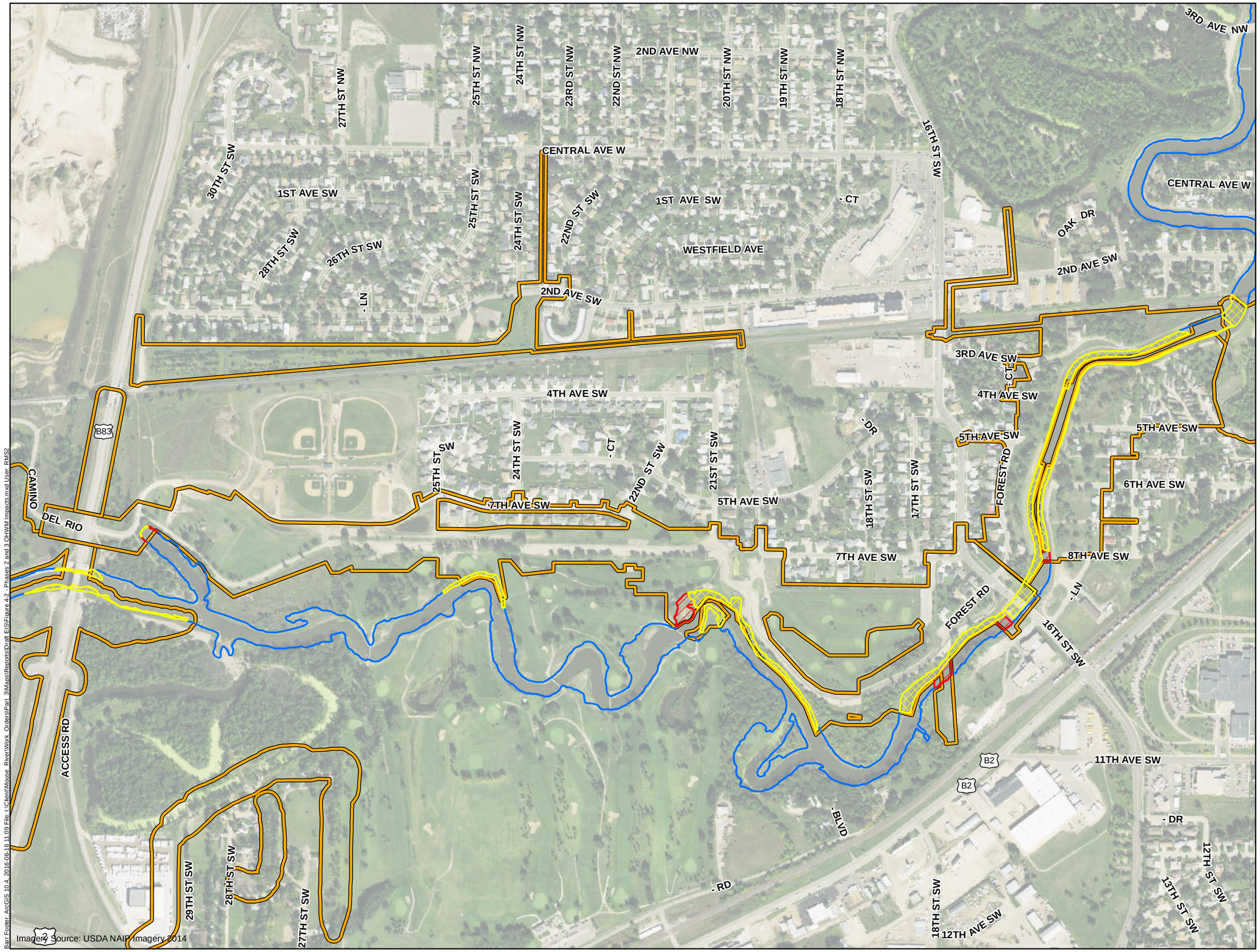
0 150 300 600

Feet

Figure 4-1

PHASE 1 OHWM IMPACTS
Mouse River Enhanced Flood Protection Project

Barr Foster; ArcGIS 10.4, 2016-06-16 10:26 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-1_Phase 1 OHWM Impacts.mxd User: kac2



Ordinary High Water Mark

Approximate Permanent Impacts Below OHWM

Approximate Temporary Impacts Below OHWM

Impact Area

Project Footprint

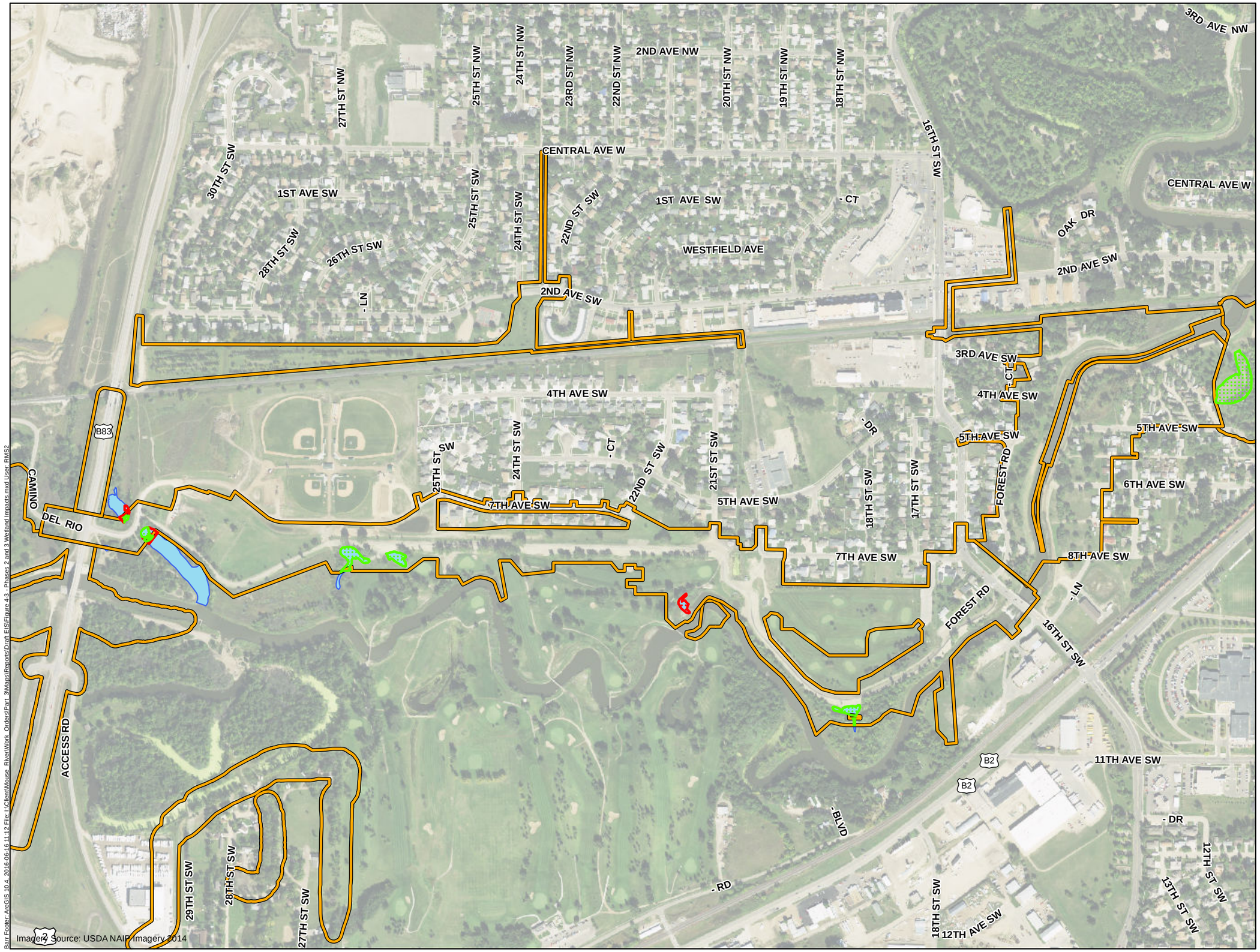
0 300 600 1,200

Feet

Figure 4-2

PHASES 2 AND 3 OHWM IMPACTS
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-06-16 11:09 File: U:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft_EIS\Figure 4-2_Phases 2 and 3 OHWM Impacts.mxd User: RMS2



Permanent Wetland Impacts

Temporary Wetland Impacts

Field Delineated Wetlands

Impact Area

Project Footprint

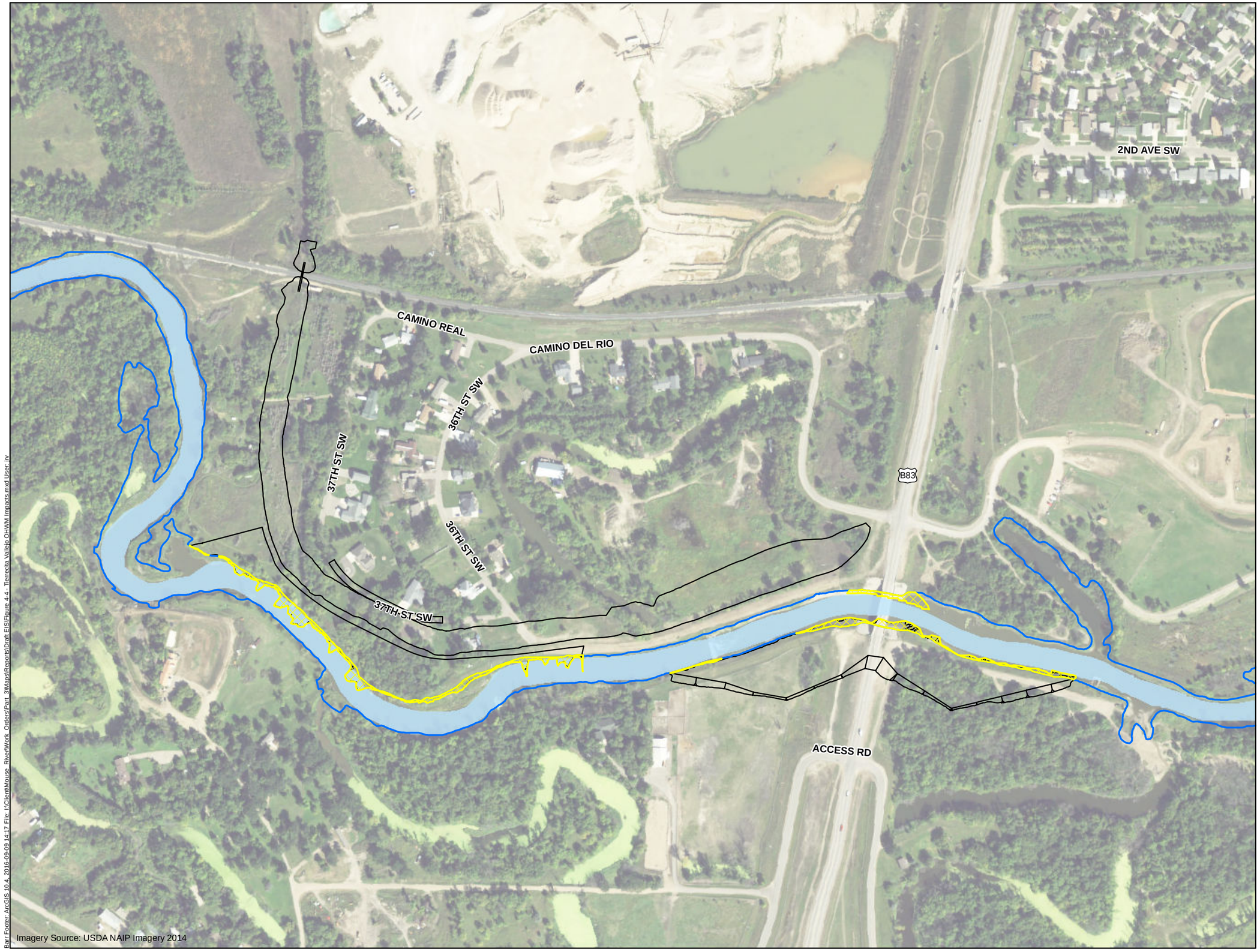
0 300 600 1,200

Feet

Figure 4-3

PHASES 2AND 3 WETLAND IMPACTS
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-06-13 11:12 File: U:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft_EIS\Figure 4-3_Phases 2 and 3 Wetland Impacts.mxd User: RMS2



Ordinary High Water Mark

Approximate Permanent Impacts Below OHWM

Project Footprint

0 175 350 700

Feet

Figure 4-4

TIERRECITA VALLEJO
OHWM IMPACTS
Mouse River Enhanced Flood Protection Project

Barr Foster: ArcGIS 10.4, 2016-09-09 14:17 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-4 - Tierrecita Vallejo OHWM Impacts.mxd User: jpv

Permanent Wetland Impacts

Temporary Wetland Impacts

Field Delineated Wetlands

Field Verified Wetlands

Project Footprint

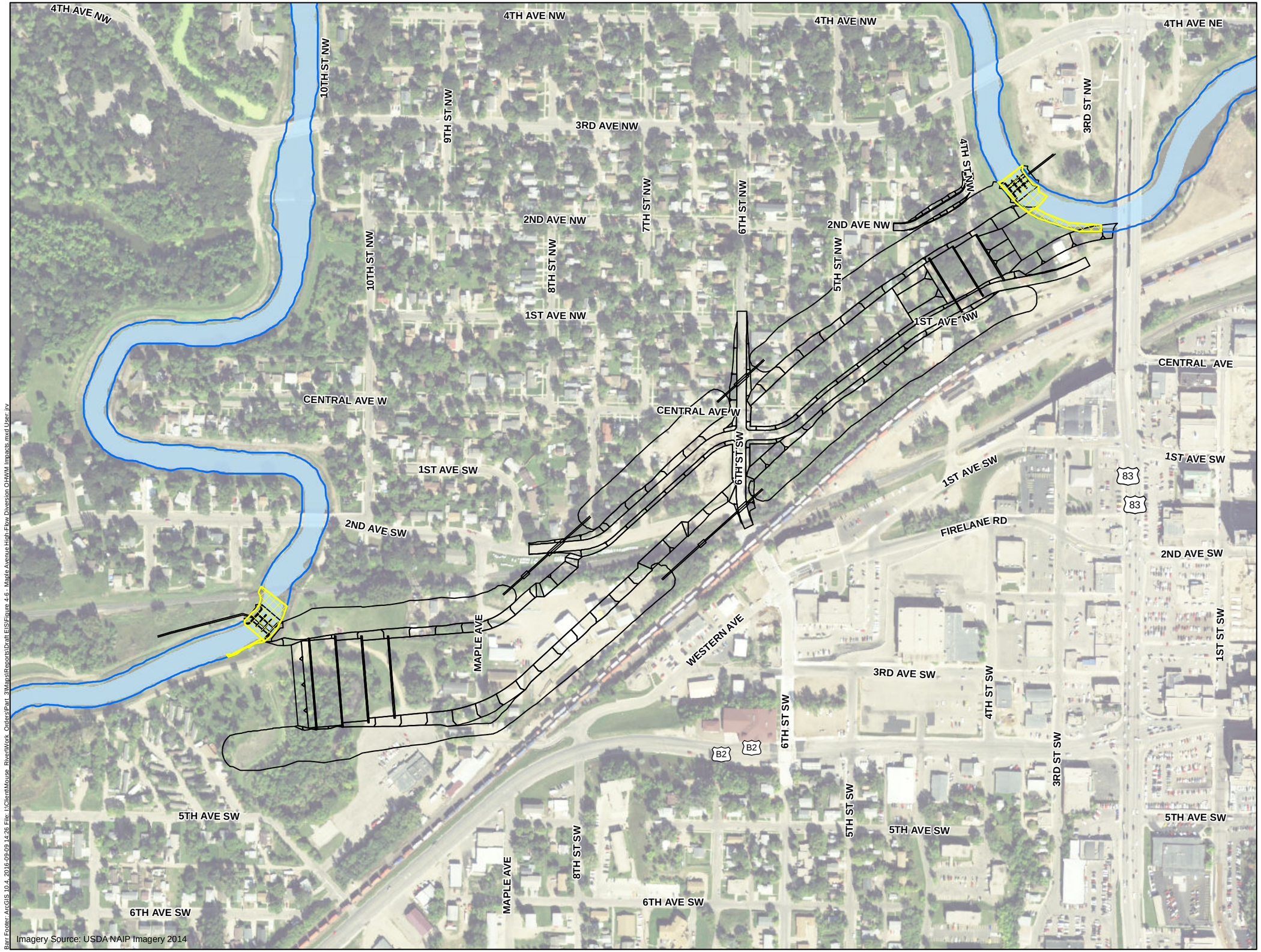
0 175 350 700

Feet

Figure 4-5

TIERRECITA VALLEJO
WETLAND IMPACTS
Mouse River Enhanced Flood
Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 14:18 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-4 - Tierrecita Vallejo Wetland Impacts.mxd User: jrv



Ordinary High Water Mark

Approximate Permanent Impacts Below OHWM

Project Footprint

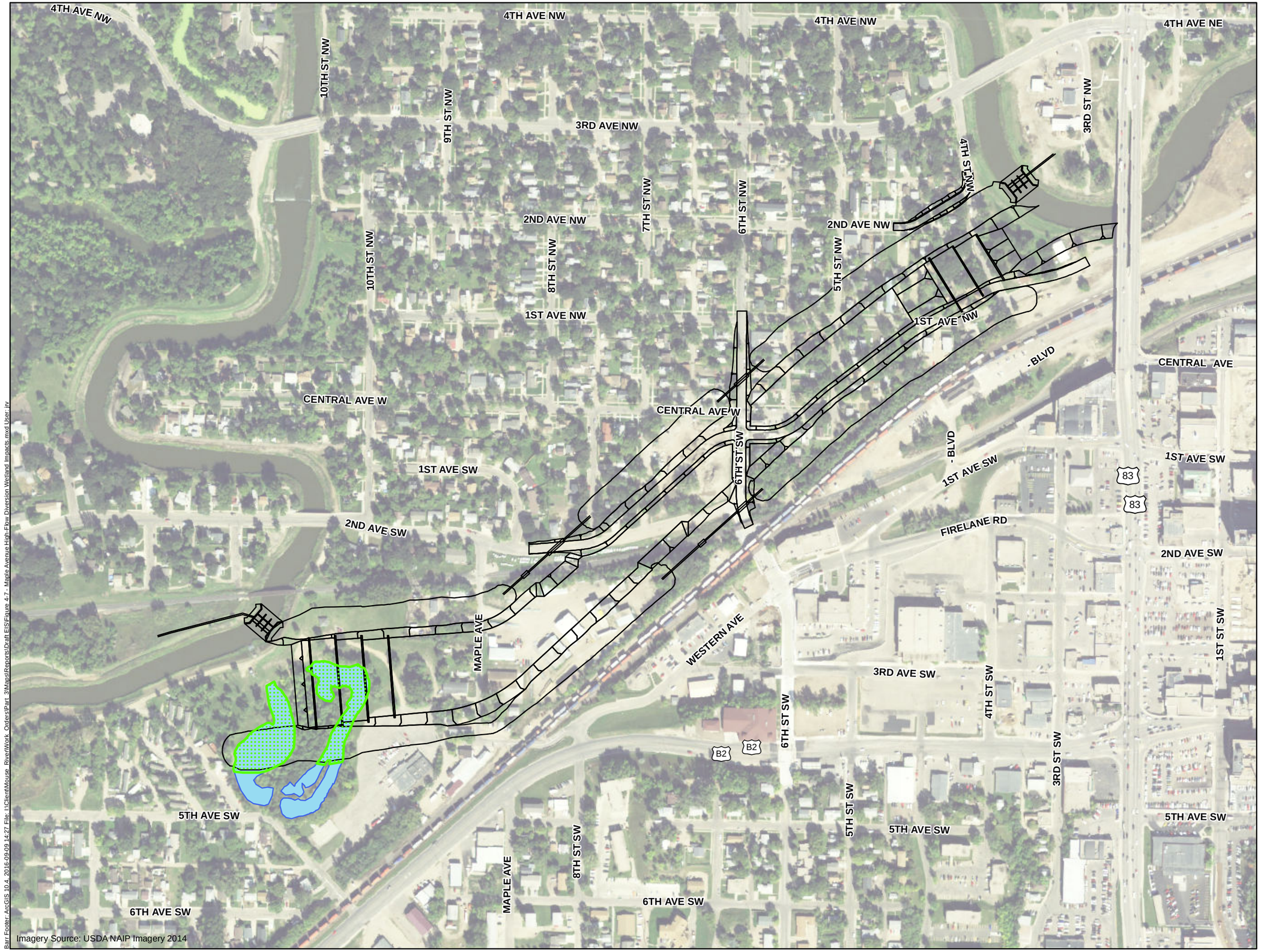
0 175 350 700

Feet

Figure 4-6

MAPLE AVENUE HIGH-FLOW DIVERSION OHWM IMPACTS
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 14:26, File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-6 - Maple Avenue High-Flow Diversion OHWM Impacts.mxd User: jrx



Permanent Wetland Impacts

Field Delineated Wetlands

Project Footprint

0 175 350 700

Feet

Figure 4-7

MAPLE AVENUE HIGH-FLOW DIVERSION WETLAND IMPACTS

Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 14:27 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-7 - Maple Avenue High-Flow Diversion Wetland Impacts.mxd User: jrv

4.2.2 No-Action Alternative

Under the No-Action Alternative, surface water resources would continue to function as they have historically during large flood events. Flows less than 10,000 cfs would generally be confined within the existing levees. Some flood-fighting measures would be necessary to close gaps and raise low spots in the existing levees where the top elevations are lower than the 10,000 cfs inundation profile.

4.2.2.1 Souris River

Flood fighting efforts to 10,000 cfs would minimize property damage behind existing levees. With the No-Action Alternative, the Souris River would begin overtopping some existing levee systems at flows between 10,000 cfs and 15,000 cfs, causing flood-related damages to public infrastructure and private properties behind the levees.

Preventing flooding behind the existing levees could cause water surface elevations to increase up to 0.5 feet both upstream and downstream of areas included in the flood fight. Increases in water surface elevation depend on the magnitude of a given flood and would most likely occur for flood events that peak in the 8,000 cfs to 10,000 cfs range.

The No-Action Alternative would continue to cause riverbank erosion during large flood events, but not to any levels that would be expected to alter the impairment status or existing impoundment functions along the Souris River.

4.2.2.2 Floodplain

Floodplain areas would remain unchanged under the No-Action Alternative. Minot and neighboring communities successfully fought floods to 10,000 cfs during the early stages of the 2011 flood. The flood fight to 10,000 cfs would consist primarily of filling in low spots in the existing levee system. These emergency measures would be outside of the effective regulatory floodplain.

Much of the area that was inundated during the 2011 flood are anticipated to be in the new regulatory floodplain, requiring thousands of property owners to purchase flood insurance. Once the new regulatory floodplain is made effective, some of locations where temporary fill is currently placed during a flood fight would be in the new floodplain and floodway.

4.2.2.3 Wetlands

The No-Action Alternative could result in direct but temporary impacts to wetlands if flood fighting measures require placement of fill (i.e., sand bags, temporary levees, etc.) directly in wetland areas. During flood events greater than 10,000 cfs, wetlands outside the existing levees would become inundated. Wetlands that are inundated with either more water or for longer duration than usual may be vulnerable to seasonal vegetation die-off or transition to different wetland plant community types.

4.3 Biological Resources

4.3.1 Requester's Preferred Alternative

4.3.1.1 General Impacts and Mitigation Measures

Constructing, operating, and maintaining the Requester's Preferred Alternative could temporarily and permanently affect biological resources, as described below.

Vegetation

The Requester's Preferred Alternative would both temporarily and permanently affect plant communities in the project area. These effects would be both adverse and beneficial.

Removing existing plant communities for clearing, grading, excavating, or constructing Project features would permanently and adversely affect vegetation. Details of construction-related vegetation removal are provided in Section 2.1.11.2. While plant communities are generally low quality throughout the project area, construction would result in the loss of up to 65 acres of land with desirable forest or moderate tree cover, including deciduous, coniferous, and mixed forest communities. These trees provide habitat for nesting birds, insects, and small mammals. In addition, trees near the Souris River can provide shade over the river, reducing water temperatures and improving fish habitat. Mitigation could be required for the loss of forested areas.

Loss of marginal plant communities would be partially offset by the potential expansion and recovery of native plant communities elsewhere within the project area. Site restoration and revegetation is discussed in Section 2.1.11.2. As noted in Section 4.2.1.1, vegetation clearing under the Requester's Preferred Alternative could also change the composition of Souris River aquatic plant communities, due to both increased light penetration and subsequent localized increases in water temperatures. In general, this would reduce the quality of habitat for fish and other aquatic species.

In addition, indirect permanent adverse impacts could result from the potential alteration of hydrology and nutrient and sediment deposition within existing plant communities. The Requester's Preferred Alternative's alteration of the existing seasonal flood regime could potentially change the frequency and location of flooding in plant communities along the project area. This in turn could potentially alter the current patterns of sedimentation and supply of nutrients to plant communities along the project area, which could lead to long-term change in the species composition.

Finally, the Requester's Preferred Alternative would result in permanent adverse effects that indirectly promote the spread of non-native species. Similar to effects resulting from hydrology and nutrient/sediment deposition, the Requester's Preferred Alternative's alteration of the existing seasonal flood regime could influence the spread and abundance of non-native plant species. This type of permanent effect would be adverse if it resulted in the establishment of non-native species in areas where they currently do not exist, or are present in low-percent coverage. Non-native species can be aggressive competitors with native plant species, reducing or eliminating native species cover. Native plant communities have evolved over tens of thousands of years, and typically comprise many different species. Native wildlife species have evolved with the native plant communities, and are adapted to the habitats

they provide. Therefore, when native plant species are reduced or eliminated from the vegetative cover, there is not only a decline in plant diversity, but also a reduction in the number of wildlife species present.

Ten non-native invasive species are aggressive to the point of being listed by the North Dakota Department of Agriculture as "noxious weeds." Under state law, noxious weeds must be controlled [reference [33]]. Four of the listed noxious weed species occur along Souris River from Burlington into Minot [reference [32]]. The two most prevalent noxious weeds along Souris River between Burlington and Minot are leafy spurge (*Euphorbia elusa*) and Canada thistle (*Cirsium arvense*). Both of these species are known to reduce crop yields and can also injure or, in the case of leafy spurge, poison livestock. Two other listed noxious weeds mapped along Souris River are absinthe wormwood (*Artemisia absinthium*) and Dalmatian toadflax (*Linaria genistifolia*).

Overall, impacts related to the spread of non-native plant species would likely be minor and would not differ significantly from the current spread of non-native plant species within the existing project area.

Temporary adverse impacts to vegetation from the Requester's Preferred Alternative could also be caused by additional clearing and grading required outside of the permanent project features for construction of temporary workspaces, soil stockpiling, and contactor and equipment yards. In addition to these effects of clearing, this temporary construction could potentially cause soil erosion and sedimentation of surface waters and adjacent riparian areas. These temporary construction impacts could, however, be avoided or minimized by using BMPs, as discussed in Section 4.1.1.1.

Fish and Wildlife

The Requester's Preferred Alternative would require that Project features be constructed within the Souris River floodplain or floodway. These changes could result in alterations to natural elements that currently provide fish habitat such as dominant vegetation, light penetration, and current velocities. However, these changes are not expected to be significant, nor would they alter the in-stream aquatic environment in a manner that would preclude fish and other aquatic organisms from using the river. The current distribution and abundance of fish species and other aquatic organisms in the Souris River would not be notably altered. The channel grade control structures located throughout the river, where fish tend to congregate, would not be affected by the Project but alterations could be considered for future mitigation.

Utilities would be relocated across the river, requiring in-stream construction using cofferdams. This would result in temporary indirect adverse effects on fish and other aquatic organisms, due to temporary re-suspension of sediment and minor alteration of flow patterns. For fish species, these impacts are unlikely to result in any meaningful loss of fish. For smaller, less mobile aquatic organisms (e.g., macroinvertebrates), individuals could potentially be lost. The magnitude of the loss is, however, expected to be minor, and would not significantly alter the size and distribution of macroinvertebrates or other smaller aquatic organism populations.

The Project would require extensive placement of erosion and scour protection measures (e.g., riprap). In some stretches, the river channel would be almost completely lined with riprap. While the placement of

riprap has been shown to have both beneficial and detrimental impacts to aquatic habitat, it is likely to have an overall adverse effect on the presence of fish and aquatic organisms.

Riprap directly affects habitat by altering the character of the substrate and riparian/aquatic associations (reference [70]). Overall, riprap reduces habitat for breeding, spawning, nesting, and feeding for most fish species. Riprap is less effective than natural cover for most fish species to escape or hide from predators, and can also provide shelter for predators waiting for prey. The placement of riprap during construction would cover substrate and the associated benthic organisms such as native mussels and other invertebrates. However, riprap would quickly be colonized by aquatic invertebrates after completion of rock placement. The placement of the fill would displace fish currently in the areas. However, fish would quickly return following placement.

Riprap can, however, have a beneficial effect on certain species that favor spaces between rock surfaces, such as smaller fish (minnows, etc.) and macroinvertebrates (reference [70]). The effect of riprap as shelter is therefore variable. At a larger scale (e.g., stream reaches) riprap can have positive effects by creating preferred habitat for some species, but can have negative effects by eliminating natural habitats and vegetated banks favored by other species (reference [70], reference [71]). Where riprap is placed over large areas of the river channel and banks, there would be a permanent adverse effect on aquatic habitat. In addition, banks lined with riprap typically do not support the types of vegetation communities found along natural banks. As a result, riprap banks provide reduced habitat for plant and wildlife species that prefer riparian and streambank habitats. Riprap also impedes the movement of wildlife that frequently move between terrestrial and aquatic habitats; examples include turtles, waterfowl, muskrats, etc.

Overbank excavation to provide additional storage in the floodplain could also have adverse impacts to fish by providing more areas for them to become stranded during high water. Fish can become stranded when they move into flooded areas outside of the main stream channel during flood events, and are left with insufficient water depth to return to the channel as the flood waters recede. Incidences of fish stranding would be related to the periodicity and magnitude of flood events. Incidence of fish stranding would not, however, be expected to result in significant declines in fish populations.

There would be minor, temporary losses of wildlife habitat expected with the construction of the Requester's Preferred Alternative. It is anticipated that wildlife would use adjacent similar habitats during the construction of the Project and that many species would quickly recolonize the area of impact soon after Project completion.

Endangered and Threatened Species

There are six federally endangered, threatened, or candidate species known to occur in Ward County. Of these, there may be potential habitat in the project area for the Dakota skipper and northern long-eared bat. However, preventative measures would be taken to avoid any direct impacts and there would be no likely effect on either species.

The Dakota skipper is a species of butterfly known to occur in various patches of native grasslands throughout the project area. Sites with moderate to high quality native vegetation will be avoided during construction and during the acquisition of borrow material to prevent any adverse effects to the species.

The presence of the northern long-eared bat has not been confirmed in the project area. However, it is possible that they may use some of the mature trees in the project area during the summer months. To avoid any harm to the bat, tree clearing will be limited to the winter months, when they are hibernating in caves or mines.

The Requester's Preferred Alternative may affect two federally-listed species, the Dakota skipper, and northern long-eared bat. There is no designated critical habitat present within the project area for either federally-listed species. Potential habitat for the Dakota Skipper is present at the Highway 2 borrow site and in the surrounding area. Trees within the project area may provide habitat for northern long-eared bat. Informal consultation with the USFWS for these species is currently ongoing.

4.3.1.2 Potential Impacts on Specific Unique and Sensitive Resources

National Wildlife Refuges

There are five NWRs within 50 miles of the project area, including the Upper Souris NWR, the Des Lacs NWR, the J. Clark Salyer NWR, the Wintering River NWR, and the Cottonwood Lake NWR (Section 3.3.3). The Upper Souris NWR and Des Lacs NWR are located far enough upstream of the Project that they would not be unaffected by Project features. The J. Clark Salyer NWR is approximately 70 river miles downstream of the project area. Changes to the flood profile caused by the Requester's Preferred Alternative attenuate well before the J. Clark Salyer NWR. The Wintering River and Cottonwood Lake NWRs would be unaffected by the Requester's Preferred Alternative because there are no direct or indirect hydrologic connections between the Souris River and these NWRs.

Nesting Birds

Migratory birds, as well as their nests and eggs are protected under the Migratory Bird Treaty Act (MBTA) of 1918. Under the MBTA, it is illegal to remove an active, occupied bird nest. Construction of the Project could potentially affect use of trees, shrubs, or ground vegetation in the project area by nesting birds. During construction, it is anticipated that nesting birds would temporarily avoid using any otherwise preferred nest sites within the active construction area. It is expected that nesting birds would resume use of preferred nest sites within the project area once construction was completed. Permitting for the Project would likely include conditions to avoid or minimize disturbance of bird nests, including fall and winter tree clearing, and/or bird nest surveys prior to clearing. Overall, there may be minor, temporary adverse effects resulting from construction-related clearing.

There would also be potential effects on nesting birds that use bridges in the project area, specifically cliff swallows and rock pigeons (Section 3.3.2). During construction of the Requester's Preferred Alternative, nesting birds might be less likely to congregate and nest at bridge sites close to active construction. The magnitude of this effect would vary between bridge structures. As noted in Section 3.3.2, use of the bridge structures as nest sites in the Project area varies widely by location and species. Moreover, it is

expected that cliff swallows and rock pigeons would go back to using bridge structures within the project area once construction was completed. Some of the bridges would, however, be modified as part of future phases of the Project. These modifications would also result in the temporary abandonment of the bridge nesting sites. Potential permanent loss of a bridge or bridges as nesting sites could also occur if the modifications result in unfavorable conditions.

4.3.1.3 Site-Specific Impacts for Construction Stage 1.5

Phase 1-3 (Fourth Avenue NE, Napa Valley, and Forest Road)

The Requester's Preferred Alternative is not expected to affect specific biological resources in the Fourth Avenue NE (Phase 1), Napa Valley (Phase 2), or Forest Road (Phase 3) areas because there is relatively little native vegetation and limited fish and wildlife habitat in these areas. As discussed above, the dominance of non-native and or invasive vegetation in the project area supports a less-diverse assortment of plant and wildlife species, most of which are common and habituated to urbanized or developed habitats. As a result, further development of the project area would have little impact on the existing biological resources.

Other Phases of Construction Stage 1.5

The other phases of Construction Stage 1.5 are also not expected to significantly affect specific biological resources because there is relatively little native vegetation and limited fish and wildlife habitat in these areas.

Construction of the levee for Tierrecita Vallejo segment would result in minor impacts on fish habitat within the river. The Maple Avenue High-Flow Diversion would affect fish habitat in the river during construction and operation of the river closure structures. This diversion would only be used when flows exceed 3,000 cfs (an approximately 15-year flood). During flows less than 3,000 cfs, the river would flow through the main channel and continue to provide habitat for fish and other aquatic organisms. During flood flows, the river channel would be temporarily closed off. Fish and other aquatic organisms may experience restricted movement during these closures, but such occurrences would be infrequent and of limited duration.

4.3.2 No-Action Alternative

Potential impacts to vegetation, fish, and wildlife would be the same as those under the Requester's Preferred Alternative for flood scenarios of 5,000 cfs and 27,400 cfs. Emergency flood fighting efforts for flows over 5,000 cfs could result in the placement of sandbags or fill material in wetland or upland vegetation communities, resulting in temporary disturbance to these areas.

4.3.2.1 General Impacts

Vegetation

High-water events would continue to have mostly minor impacts on vegetation communities. Effects would include potential loss of trees and shrubs due to high flow velocity or prolonged inundation. Depending on the timing and duration of high-water events, there would also be potential disruption in

seasonal reproductive cycles (*e.g.*, flowering or seed production). These impacts would be temporary, as the majority of the plant community types in the project area have adapted in some degree to periodic flooding and episodic inundation. The magnitude of the impacts to vegetation under the No-Action Alternative would be expected to increase along a gradient between the 10,000 cfs flow condition and the 27,400 cfs flow condition.

Fish and Wildlife

Under the No-Action Alternative, wildlife species in the project area would be periodically displaced during high water events, and fish species would temporarily relocate to slower backwaters off of the main channel. Periodic high water events and their resulting effects on fish and wildlife are naturally occurring and not necessarily adverse impacts, For instance, certain fish species respond favorably to flooding as spawning and forage conditions are improved with the inundation of the floodplain. The magnitude and duration of the impacts under the No-Action Alternative would be expected to increase between the 10,000 cfs flow condition and the 27,400 cfs flow condition. Fish stranding under the No-Action Alternative would be larger under the 27,400 cfs flow conditions than under the 5,000 cfs or 10,000 cfs flow conditions as fish could stray further from the river channel. However, foraging and spawning opportunities could be improved.

4.4 Land Use and Infrastructure

4.4.1 **Requester's Preferred Alternative**

4.4.1.1 General Impacts and Mitigation Measures

The following discussions of general impacts and mitigation measures apply to all phases of the Requester's Preferred Alternative and are therefore not repeated in the "Site Specific Impacts" subsections, unless there are more prominent unique resources or features that have been determined to be sensitive or significant.

Existing/Potential Land Use

Constructing, operating, and maintaining the Requester's Preferred Alternative could both positively and negatively affect existing and potential land use, as discussed below.

Construction of the proposed flood risk-reduction features would affect agricultural, commercial, industrial, residential, and recreational land use by permanently converting those lands into use for flood risk-reduction. FEMA is presently in the process of designating a new 100-year floodplain, and the new floodplain designation would also affect the existing land use classifications in the project area.

The land directly adjacent to the Souris River channel, within the footprint of the Requester's Preferred Alternative, is designated as future greenway and is a flood risk-reduction strategy designed to create a community asset (reference [72] and reference [73]). The greenway would provide opportunities to connect new open space and provide recreational amenities and opportunities for Minot (reference [42]) and the rest of the region.

Construction operations, temporary work easements, and staging of equipment would temporarily affect land use to a small extent and would result in temporary detours and disruption to regular use and access to residential-, recreational-, commercial-, or industrial-use properties. After construction has been completed, land uses would generally be restored to pre-project conditions.

The Requester's Preferred Alternative would sustain and encourage use of land in the project area by providing significant future flood risk reduction. Economic benefits of the Requester's Preferred Alternative are discussed in Section 4.6.1.

Infrastructure

Flood Risk-reduction Infrastructure

The Requester's Preferred Alternative would modify the existing flood risk-reduction features along the river and significantly improve the flood risk-reduction infrastructure in the project area. New levees, floodwalls, high-flow bypasses, channel realignments, river and transportation closure structures, pump stations, and overbank excavations would be constructed from Burlington to downstream of Minot. Many of these features would be constructed within the rights-of-way of existing flood risk-reductions structures, while others will be constructed in new areas. Section 2.0 describes major components of the Requester's Preferred Alternative for each of the segments within the project area.

Transportation

A significant goal of the Requester's Preferred Alternative is to provide an operable and reliable transportation system during and after a flood event similar to the 2011 flood.

Construction of the Requester's Preferred Alternative would temporarily disrupt traffic patterns, connectivity, and accessibility to destinations within the project area. Closures of transportation routes would also affect traffic flow on neighboring streets. These temporary adverse effects would be minor if mitigated with proper signage, detours, and rerouting, as described below in the Mitigation Measures.

Roadways

The Requester's Preferred Alternative would permanently and significantly benefit the roadway network in the project area. It would protect and enhance a network of principal arterial corridors (U.S. Highways 2, 52, and 83, and their bypasses) that would allow transportation of essential goods and services and facilitate emergency response during flood events. Permanent adverse impacts to transportation would be minor, and primarily limited to localized areas where streets would be realigned to accommodate the flood risk-reduction features.

Bridges

Proposed bridge modifications would include horizontal and vertical realignments, roadway approaches, and channel alterations. Four bridges (Colton Avenue bridge, U.S. Highway 83 Bypass bridge, Burdick Expressway bridge, and U.S. Highway 2 bridge) would be modified so they could remain open during the 27,400 cfs flood event. Site-specific review of future phases would provide more detailed discussions on the effects of bridge modifications.

Railways

The Requester's Preferred Alternative would protect significant portions of the Burlington Northern Santa Fe and Canadian Pacific Railway tracks and operations during flood events, by installing railroad closure structures where levees or floodwalls cross the railroad tracks. When in operation, these structures would interrupt through-service rail activities, but physically would remain mostly intact. Sections of both railways would remain outside the Requester's Preferred Alternative line of protection and would continue to be subject to flooding. The railroads would have to approve any flood risk-reduction features sited on railroad property or rights-of-way.

Public Transit Systems

Construction of the Requester's Preferred Alternative could temporarily disrupt public transit systems. Effects on these transportation resources would minor and limited to the duration of each construction phase.

Airports

The Requester's Preferred Alternative would not directly affect the Minot International Airport or Minot Air Force Base. People, goods, and services, could continue to travel to and from the airports during flood events via the enhanced transportation network

Utilities

The Requester's Preferred Alternative would significantly benefit both public and private utilities by providing greater flood resilience, upgraded stormwater management, and improved infrastructure.

The Requester's Preferred Alternative would temporarily disrupt the services of both public and private utilities, particularly during relocation of utilities that penetrate the levee. These adverse impacts would be minor and could be mitigated through careful planning. Affected utilities on specific parcels and the corresponding relocations and modifications to this infrastructure would be identified during final design of each phase. Upgraded utilities would be located and constructed to minimize the risk of pipe leaking or rupture, trench settlement, and other failures, which could negatively affect the line of protection. In addition, landside valves would be placed on all lines crossing the levees to provide isolation from the riverside in the event of a line failure (reference [74]).

Private Utilities

The Requester's Preferred Alternative would affect existing private utility infrastructure (e.g., gas, electricity, and telecommunication services). Relocations and abandonment of gas lines and other utility infrastructure would be required. As more detailed design is developed, the requester has indicated that specific mitigation measures would be developed in coordination with affected private utilities.

Water Supply

The Requester's Preferred Alternative would temporarily affect water distribution. Project improvements would include reconstructing or relocating the affected portions of the water distribution system and realigning adjacent portions to maintain adequate circulation and water quality (reference [27]).

The Requester's Preferred Alternative would affect portions of the existing 36-inch diameter NAWS line that conveys potable water from the Minot Water Treatment Plant to the west. Effects of the Requester's Preferred Alternative on the NAWS line would be minimized to the extent practicable. Sections of the NAWS line that would be affected include:

- The transmission line crossing of the Souris River on the western side of the U.S. Highway 83 Bypass;
- Vicinity of the Perkett Pump Station;
- The transmission line crossing beneath the levee in the vicinity of the Wee Links Golf Course; and
- The transmission line crossing of the Souris River on the northeast side of Sixteenth Street Southwest.

The 48-inch diameter Sundre raw water line in Minot would be impacted by the Requester's Preferred Alternative at the following locations:

- Minot Water Treatment Plant;
- Maple Diversion alignment;
- Broadway Avenue; and
- Along Fourth Avenue N from Broadway to 3rd Street NE.

Sanitary Sewer Systems

The Requester's Preferred Alternative would temporarily affect sanitary sewer collection lines and force mains in the project area. Flood risk reduction improvements would consist of reconstructing the affected portions of the sanitary sewer system, decommissioning gravity sanitary sewers within the Requester's Preferred Alternative footprint, and constructing lift stations and force mains that convey wastewater across the Souris River corridor to wastewater treatment facilities. Associated isolation valves would be placed on the landside of all force main river crossings.

Storm Sewer Systems

Proposed improvements to storm sewer systems would vary throughout the project area and would be discussed under site specific reviews. Improvements to stormwater pipes and storage areas would correspond with roadway realignments and modifications and would accommodate other flood risk-reduction features.

Emergency Services

The Requester's Preferred Alternative would indirectly and permanently benefit emergency services in the project area by improving the transportation network so that major transportation corridors could remain open during flood events similar to the 2011 flood.

Constructing the Requester's Preferred Alternative would temporarily disrupt existing roadways, which could cause delays in emergency services. With mitigation, however, these temporary adverse effects would be minor.

Mitigation Measures

Mitigation of Temporary Construction Impacts

Mitigation measures to offset the potential effects of the Requester's Preferred Alternative on land use, and infrastructure, in the project area could be implemented both during and after the construction phase.

Implementing the Requester's Preferred Alternative in phases would help confine temporary construction impacts to smaller areas across the extent of the Project. During the different phases of Project construction, site-specific mitigation measures would be used.

During construction, contractors could work with public authorities, railways, utilities, and emergency services to coordinate temporary curtailment of services, and could notify them and others of such restrictions in advance. Access to transportation services, driveways, and private roads should be kept open as much as possible, and adequate parking for construction vehicles should be provided. Once construction has been completed, damaged roadways would be repaired.

Compatibility with Land Use Plans

The requester has indicated that any mitigation measures would be compatible with land use plans and would be consistent with the short- and long-term goals of the jurisdictions involved. Such plans include:

- City of Minot's 2012 Comprehensive Plan (reference [42]).
- City of Minot's Community Development Block Grant Disaster Recovery Action Plan (reference [43]).
- State of North Dakota Action Plan for Disaster Recovery (reference [75].
- North Dakota 2015 State Water Management Plan (reference [44]).
- The Uniform Relocation Assistance and Real Property Acquisition Act of 1970 (Uniform Act or URA) (42 U.S.C. § 61 (2015)).

In accordance with the URA, the Requester's Preferred Alternative must ensure that adequate time, funding and staffing are available for acquiring real property and for fulfilling other responsibilities under the Uniform Act. The Requester's Preferred Alternative is consistent with the objectives of the URA, which include providing uniform, fair, and equitable treatment to persons whose real property is acquired.

4.4.1.2 Unique and Sensitive Land Use and Infrastructure

The Requester's Preferred Alternative is not expected to affect any specific unique or sensitive land use or infrastructure features aside from recreational facilities (discussed in Section 4.7) and prime farmland (discussed in Section 4.1).

4.4.1.3 Site-Specific Impacts for Construction Stage 1.5

The following subsections describe unique site-specific impacts to land use and infrastructure that would be associated with Phases 1 through 3 of the Requester's Preferred Alternative.

Phase 1 – Fourth Avenue NE

Existing/Potential Land Use

The existing land use in the Phase 1 area consists of commercial, medium-density residential and open space (Map 3-5). The Phase 1 footprint of the new levee and floodwall would directly affect portions of these land uses and change them to flood risk-reduction land use.

Infrastructure

Flood Risk-reduction Infrastructure

New flood risk-reduction features for Phase 1, described in Section 2.1.5.5, would significantly improve the flood risk-reduction infrastructure in this area.

Transportation

Phase 1 would modify existing streets to accommodate the flood risk-reduction improvements and maintain access to properties within the affected area. Road closures for floodwall crossings would be located on Fourth Avenue SW. Phase 1 roadway modifications are shown on Figure 4-8.

Phase 1 would permanently benefit this area by protecting transportation systems, public and private utilities, and emergency services in this area under flood conditions up to 27,400 cfs. The adverse effects of Phase 1 transportation disruptions would be minor.

Utilities

Phase 1 would replace all public and private utilities along Fourth Avenue from Walders Street to East of Third Street. Phase 1 would affect private utilities as follows:

- Montana-Dakota Utilities - relocations and abandonment of several gas lines, extension of a gas line across North Broadway south of Fourth Avenue NW, addition of a gas line parallel to Third Street NE on the western side starting at the intersection of Fourth Avenue NE going south under the Souris River continuing to Third Avenue NE
- Midcontinent Communications - changes to the network
- Souris River Telephone - crossings of two lines

- Xcel Energy - Removals, modifications, and relocations of primary underground electric lines, overhead power lines, and underground electric service lines

Phase 1 would permanently benefit utilities by protecting them from future flooding under flood conditions up to 27,400 cfs. Construction of Phase 1, however, would create temporary disruptions to the existing utility infrastructure in the project area.

Water Supply

The Requester's Preferred Alternative would replace or relocate a significant portion of the watermain within the Phase 1 area, with approximately 2,285 feet of 16-inch PVC watermain being installed.

The new watermain would tie into existing watermain at the intersections of North Broadway and Fourth Avenue NW and Fourth Avenue NE and Third Street NE. Watermains that currently run on First Street NW, Main Street N, and First Street NE would be shortened to tie into the new alignment.

Phase 1 would permanently and substantially benefit the water supply within the affected area by improving the existing system and offering enhanced protection from future flood events. Construction of Phase 1, however, could temporarily disrupt the water supply in the project area.

Figure 4-8

PHASE 1 ROADWAY MODIFICATIONS
Mouse River Enhanced Flood Protection Project

Barr Foster; ArcGIS 10.4, 2016-09-09 14:29 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-8 - Phase 1 Roadway Modifications.mxd User: jrv

Phase 2 - Napa Valley

Existing/Potential Land Use

The existing land use in the Phase 2 area is low- and medium-density residential and recreational (i.e., parks/open space and golf courses) (Map 3-5). The levee alignment currently extends across the Phase 2 area, along the Souris River. The Requester's Preferred Alternative would convert land currently designated for recreational (or public) and single-family land uses to flood risk-reduction uses.

Construction activities would temporarily restrict recreational land use in this area. Direct and indirect effects, and the associated mitigation opportunities, are discussed in more detail in Section 4.7.

Phase 2 would substantially and permanently benefit future land use in the area. Such land use changes would be compatible with current and potential land uses, and would protect and enhance land use in this area.

Infrastructure

Flood Risk-reduction Infrastructure

New flood risk-reduction features for Phase 2, described in Section 2.1.5.1, would significantly improve the flood risk-reduction infrastructure in this area.

Transportation

Phase 2 would modify existing roadways to accommodate the levee alignment and maintain access to properties within the affected area, as shown on Figure 4-9. Phase 2 would provide significant, permanent benefits by protecting and improving the transportation systems in this area. Phase 2 would also, however, temporarily disrupt the transportation network in the project area. The adverse effects of disrupting transportation in this area would be minor.

Construction Limits

Road Modifications and Parking Areas

0 300 600 1,200

Feet

Figure 4-9

PHASES 2 AND 3 ROADWAY MODIFICATIONS
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-23 10:05 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-9 - Phases 2 and 3 Roadway Modifications.mxd User: jlo

Utilities

Phase 2 would replace or remove utility infrastructure of several private utilities:

- Souris River Telephone (SRT);
- Montana-Dakota Utilities (MDU);
- Xcel Energy; and
- Midcontinent Communications.

Private utilities serving residential properties in the levee footprint would be removed prior to levee construction. One overhead river crossing would be removed, and another overhead line would be moved and raised to meet the USACE levee crossing requirements.

Phase 2 would permanently benefit utilities by protecting them from future flooding under flood conditions up to 27,400 cfs. Construction of Phase 2, however, would create temporary disruption to the existing utility infrastructure in the project area.

Water Supply

The Requester's Preferred Alternative would reconstruct all water and sanitary sewer lines crossing the proposed levees, with the exception of the existing Northwestern Area Water Supply (NAWS) line, for which modifications would be limited to "in-place" casing and installation of isolation valves. Water and sanitary sewer lines that would be located beneath the proposed levees have been designed to meet USACE standards.

Phase 2 flood risk-reduction improvements would significantly benefit the water supply within the affected area by improving the existing system and offering enhanced protection from future flood events.

Phase 3 - Forest Road

Existing/Potential Land Use

The existing land use in the Phase 3 area is low-density residential (Map 3-5). The Requester's Preferred Alternative would convert some of this land to flood risk-reduction uses, but would substantially and permanently benefit future land use in the area. This area is already subject to development consistent with the existing federal project. Such land use changes would be compatible with current and potential land uses.

Infrastructure

Flood Risk-reduction Infrastructure

New flood risk-reduction features for Phase 3, described in Section 2.1.5.3, would significantly improve the flood risk-reduction infrastructure in this area.

Transportation

Phase 3 would modify existing roadways to accommodate the levee alignment and maintain access to properties within the affected area, as shown on Figure 4-9. Phase 3 would provide significant, permanent benefits by protecting and improving the transportation systems in this area. Phase 3 would also, however, temporarily disrupt the transportation network in the project area, but the adverse effects of disrupting transportation in this area would be minor.

Utilities

Phase 3 would replace or remove some of the public and private utilities in the area, affecting the same private utilities affected by Phase 2. One Xcel Energy overhead transmission line river crossing would be removed, and another overhead line would be moved and raised to meet the USACE levee crossing requirements. Multiple utilities are buried along the shoulder of the Highway 83 Bypass. Utilities crossing under the levee are designed based on USACE EM 1110-2-1913. Discussions are ongoing with the Project requester and private utilities that would be affected by the Phase 3 flood risk-reduction improvements. The Basis of Design Report (reference [4]) provides information regarding modification, relocation, removal, and general mitigation of these utilities.

Phase 3 would permanently benefit utilities by protecting them from future flooding under flood conditions up to 27,400 cfs. Construction of Phase 3, however, would create temporary disruption to the existing utility infrastructure in the project area.

Water Supply

All water and sanitary sewer lines crossing the proposed levees would be reconstructed – with the exception of the existing NAWS line, as described in the Phase 2 site-specific impacts, above.

Other Phases of Construction Stage 1.5

Potential site-specific impacts to land use and infrastructure for the other three phases of Construction Stage 1.5 are based on conceptual plans for the Tierrecita Vallejo, Maple Avenue High-Flow Diversion, and the Tieback Levee phases. The following review is limited and based on the degree of detail available at this time for these segments.

Existing/Potential Land Use

The existing land uses in the areas of the Tierrecita Vallejo, Maple Avenue High-Flow Diversion, and Tieback Levee phases are agricultural, residential, light industrial, and commercial (Map 3-5). The Requester's Preferred Alternative would substantially and permanently benefit future land use in the area. The other three phases of Construction Stage 1.5 would impact land use directly within the Project footprint and would convert some of this land outside of the existing federal project to flood risk-

reduction uses, though the existing land use pattern in adjacent areas are not expected to change. This area is already subject to development consistent with the existing federal project. Such land use changes would be compatible with current and potential land uses.

Infrastructure

Flood Risk-Reduction Infrastructure

New flood risk-reduction features for the other three phases of Construction Stage 1.5, described in Section 2.1.4, Section 2.1.5.4, and Section 2.1.5.6, would significantly improve the flood risk-reduction infrastructure in these areas. Once constructed, these phases would tie in with Phases 1-3 and provide a continuous line of flood protection to the Tierrecita Vallejo community in western Minot through east-central Minot.

Transportation

The other three phases of Construction Stage 1.5, described below, would modify existing roadways to accommodate the new flood risk-reduction features and maintain access to properties within the affected areas. These phases would provide significant, permanent benefits by protecting and improving the transportation systems in these areas. They would temporarily disrupt and permanently alter the transportation network in the project area, however, the effects would generally be minor.

Tierrecita Vallejo

A closure structure would intersect the Canadian Pacific Railway at the levee tie-in locations along the western side of this community (Figure 2-2). This would impede through-service rail activities when in operation during flood conditions greater than 3,000 cfs. When in operation, the railroad closure structure would protect the Canadian Pacific Railway east of the structure; portions of the railway west of the structure would continue to be subject to flooding.

Maple Avenue High-Flow Diversion

A new Canadian Pacific Railroad Bridge would be designed and constructed to accommodate increased flows (Figure 2-4). Second Avenue SW and Sixth Street NW would be reconstructed with roadway closure structures installed, and roadway terminations at Fifth Street SW, Seventh Street SW, Central Avenue W, and First Avenue W would be required to accommodate new flood risk-reduction features.

Tieback Levee

Fifth Avenue NE would be realigned and shifted slightly to the north to accommodate the levee footprint, which would tie into the eastern end of the Phase 1 floodwall and extend east near the intersection of Thirteenth Street NE and Fifth Avenue NE (Figure 2-5). The Tieback Levee would protect the transportation system in this area from floods up to 10,000 cfs, but would be overtopped during 27,400 cfs. Transportation impacts for larger flood flows would not be as

excessive as that during the 2011 event because of the other Project phases that would have already been implemented.

4.4.2 No-Action Alternative

The following subsections describe potential impacts to land use and infrastructure of the No-Action Alternative. Potential impacts under 5,000 cfs, 10,000 cfs, and 27,400 cfs flow conditions were considered. The No-Action Alternative, and the associated inundation areas for these flow conditions are described in Section 2.2.5.

4.4.2.1 Existing/Potential Land Use

In flood events greater than 10,000 cfs, floodwaters would overtop flood risk-reduction features, adversely affecting land use in the project area. Potential adverse effects range from minor to significant, increasing in severity with higher water levels. Under the No-Action Alternative, emergency flood risk-reduction actions would begin to take place when conditions appear to be favorable for flooding. Temporary land use limitations would result in the vicinity of these actions and would vary with the intensity and duration of flooding.

Flood events topping 10,000 cfs would substantially and adversely affect existing and potential land uses. Flood flows of 10,000 cfs would overtop existing flood risk-reduction elements, and residential, commercial, industrial, rural (agricultural) and open space would be inundated. In agricultural areas this could result in erosion and sedimentation which could disrupt seasonal cultivation and crop productivity. Within urban areas, a 10,000 cfs flood event could result in weeks to months of clean up and restoration.

A flood event of 27,400 cfs would significantly and adversely affect existing and potential land uses. Flood flows of 27,400 cfs would inundate, erode, and sediment agricultural and open space areas. Destruction and damage to agricultural equipment and ancillary structures could disrupt crop productivity. Within urban areas, the flooding of entire neighborhoods and large portions of the communities in the project area would occur. Many of these properties would become permanently unusable, or too costly to restore, resulting in permanent an unplanned land use changes. Clean up and recovery from such an event would take many months and possibly several years.

4.4.2.2 Infrastructure

The No-Action Alternative would provide flood risk-reduction for infrastructure for all flows up to 10,000 cfs. Flows in excess of 10,000 cfs would result in adverse impacts to residential, commercial, industrial, and recreational properties. Continual exposure to flooding could also adversely affect the structural integrity of roads and utilities over time.

Under the No-Action Alternative, a flood event of 27,400 cfs would significantly and adversely affect infrastructure in the affected area, especially in Burlington and in central and west-central Minot. This alternative would cause long-term disruptions and destruction of the infrastructure in the project area, resulting in widespread impacts that would be felt regionally and potentially statewide. Significant clean-up and repair efforts could last for months if not years.

With flows of 10,000 cfs and greater, public and private underground utilities would be submerged. Adverse effects to utilities could include degradation of structural integrity or backflow of floodwaters entering or accumulating through the systems. Services could be disrupted for an extended period, and subsequently restoring the affected areas could be costly.

Transportation

Under the No-Action Alternative, local, regional, and state governments and agencies would continue to monitor roadway and traffic circulation conditions, pursuing improvements throughout the project area as needed. Local roads and bridges near the Souris River would continue to experience localized flooding and closures during high water conditions.

Primary transportation routes would be accessible with flows up to 10,000 cfs and 27,400 cfs would result in adverse effects to transportation systems in the affected area. Transportation systems serving local and regional destinations would be inundated. Access disruptions could last from hours to months depending on location and the severity of the flood event. Clean-up and repair that could last months or even years. Alternative transportation routes could be used, but would take longer due to congestion and in many cases the use of less efficient routes. At flows of 10,000 cfs over half of the bridges along primary transportation would either have water over the bridge deck or at the approach. At flows of 27,400 all but one bridge, the U.S. Highway 83 Bypass Bridge, would be affected by water. See Table 4-2 for additional details.

Table 4-2 Accessible/Non-Accessible Primary Routes at 10,000 and 27,400 CFS

Bridge / Road name	Top of Bridge Deck (min)	Inundation Elevation	
		10k Elev.	27.4k Elev.
County Road 10 (Colton Avenue-Burlington)	1575.254	**1576.51**	**1580.914**
54th Street NW	1570.044	1567.691(1)	**1571.286**
U.S. Highway 83 Bypass Bridge	1572.40	1561.291	1565.667
16th Street SW	1561.19	1557.457	**1561.916**
2nd Avenue SW	1556.77	1556.62	**1559.158**
3rd Avenue NW/4th Avenue NW (West)	1554.29	**1555.466**	**1558.162**
5th Avenue NW/6th Street NW	1557.65	1554.648(1)	**1557.929**
3rd Avenue NW/4th Avenue NW (East)	1553.15	**1554.415**	**1557.877**
U.S. Highway 83/ Broadway Bridge	1560.42	1554.168(1)	1557.755(1)
3rd Street NE	1555.54	1553.935(1)	**1557.586**
7th Street NE	1554.67	1553.114	**1557.466**
Burdick Expressway Bridge (U.S. Highway 2 Bypass Bridge)	1551.64	**1551.962**	**1556.887**
8th Avenue SE	1552.79	1551.087	**1556.563**
27th Street Bridge	1552.27	1549.14	**1554.551**

U.S. Highway 2 Bridge	1563.81	1548.01	1553.427(1)

Elevations where bridge decks would be inundated are bolded.
(1) Top of bridge deck is not inundated but roadway approach to bridge is inundated

Adverse effects on transportation systems could lead to increased response times for police, fire, and emergency medical response services and inability to readily access all neighborhoods and communities.

4.5 Contaminated Sites

4.5.1 Requester's Preferred Alternative

4.5.1.1 General Impacts and Mitigation Measures

Based on the results of the HTRW assessments discussed in Section 3.5, there are numerous sites in the project area that contain hazardous materials and petroleum products or have environmental concerns. Potential impacts associated with these existing sites include construction impacts resulting from disturbance of contaminated soil or groundwater, impacts associated with demolition of buildings containing hazardous building materials, and excavation of debris in fill soil.

Impacts from hazardous materials and petroleum products could result from construction-related activities in areas where contaminated soil or groundwater occur. These impacts could include exposure of construction workers or nearby residents to hazardous substances that are encountered during construction activities. Also, contaminants could inadvertently be spread to other areas as the result of moving contaminated soils during excavation activities or pumping contaminated groundwater during dewatering activities.

A Contingency Plan has been developed by the Requester to guide actions in the event that unanticipated environmental conditions are encountered during construction of the Requester's Preferred Alternative. Contingent conditions that could be encountered include uncovering an unknown underground storage tank, a water well or vent pipe, debris, containers, contaminated soils, or contaminated water that accumulates in an excavation. The requester has indicated that these and other unexpected conditions would be addressed according to the procedures described in the Contingency Plan. Should an unexpected condition be encountered, work would immediately stop, and an environmental professional would be contacted to inspect, assess, and manage the situation in accordance with the Contingency Plan, which is provided in the HTRW assessment reports (Appendix D and Appendix E).

Due to the age of the buildings present in the project area, it is possible that hazardous building materials (such as asbestos-containing material (ACM) and lead-based paint) could have been used during construction. Also, older buildings could have had heating oil storage, wells, septic systems, or other items that could pose environmental concerns. Although the HTRW for Phases 1, 2, and 3 did not involve building walkthroughs or interviews with owners, an inventory of such items should be conducted in the future at buildings to be demolished and any identified environmental concern should be addressed/abated/sealed/etc. prior to demolition in accordance with applicable local, state, and federal requirements.

Debris is present in some areas of shallow fill soil, including glass, brick, and asphalt fragments. If the Requester's Preferred Alternative involves excavation into these areas, then the excavated materials may require further evaluation to determine whether the type and extent of the debris represents a concern for reuse of the soil in project construction, and/or for potential export to off-site locations. If significant amounts of debris are encountered in excavation areas, then it might be necessary to segregate the excavated debris material and transport it to a landfill. Excavation of debris areas should be monitored by an environmental professional to verify that the debris is consistent with the type of materials observed during the geotechnical investigations (glass, brick, asphalt) and that no hazardous materials are present.

The proposed flood risk-reduction measures could result in inundation of some properties that were not previously impacted, specifically south of the intersection of U.S. Highway 83 and Fourth Avenue NE. Inundation of any tanks or septic systems on these properties could cause them to overflow or leak, spreading the contents throughout the environment, and potentially contaminating soil, groundwater, and surface water.

4.5.1.2 Site-Specific Impacts for Construction Stage 1.5

Phase 1(Fourth Avenue NE), Phase 2 (Napa Valley), and Phase 3 (Forest Road)

Several properties within the Fourth Avenue NE area that use or have used hazardous substances or petroleum products are located near the proposed flood risk-reduction features. The results of the Phase II investigation indicated that these properties do not pose a contamination risk during construction of the proposed features. Several of these properties (Werner Oil Company, North Dakota Concrete Products, and Porter Brothers Salvage Yard) have historically been inundated during previous flood events; however the Requester's Preferred Alternative would protect these properties up to a 27,400 cfs flood event.

The Requester's Preferred Alternative is not expected to impact specific contaminated sites in the Napa Valley or Forest Road segments. If contaminated soils or groundwater are encountered during construction activities, then the Contingency Plan would be followed to ensure proper management of the contaminated material.

Other Phases of Construction Stage 1.5

Potential site-specific impacts for the other phases of Construction Stage 1.5 are based on the desktop HTRW assessment described in Section 3.5.3, and the locations of environmental sites shown on Figure 3-16.

No environmental sites were identified in the Tierrecita Vallejo impact area. The Maple Avenue High-Flow Diversion impact area includes an underground storage tank at Magic City Lumber, Inc., and the tieback levee impact area includes an underground storage tank at Main Electric Construction Inc. Phase I HTRW assessments (and if needed, Phase II HTRW assessments) would be completed prior to final design and construction of these segments of the Requester's Preferred Alternative. If these underground tanks are located within the construction limits of the Project features, they would be removed prior to construction. If construction occurs near these sites, soils and groundwater removed during construction

activities would be monitored for signs of contamination. If contaminated soils or groundwater are encountered during construction activities, then the Contingency Plan would be followed to ensure proper management of the contaminated material.

4.5.2 No-Action Alternative

4.5.2.1 General Impacts

River flows greater than 10,000 cfs could result in the inundation of potentially contaminated sites and the dispersion of contaminants from these sites. Sites with storage tanks and septic systems could be inundated, causing them to overflow, spreading the contents throughout the environment, and potentially contaminating soil, groundwater, and surface waters. Known potentially contaminated sites that could be flooded at various flood scenarios are shown in Table 4-3.

Table 4-3 Potentially Contaminated Sites That Could Be Flooded Under Various Flood Scenarios

	5,000 cfs (50-Year) Impact	Over 10,000 cfs (100-Year) Impact	27,400 cfs (2011 Flood) Impact
Alan Kurth Olds Nissan			X
Enerbase			X
Farmers Union Oil Company			X
Fed Ex			X
Ferrellgas Fuel			X
Firestone Store Of Minot			X
Keelbler Company			X
Keller Paving and Landscaping		X	X
Magic City Lumber Inc			X
Main Electric Construction Inc.			X
Minot Farmers Elevator		X	X
Minot Fire Department			X
Porter Brothers			X
Robinson Insulation Minot Plant			X
Schatz Retread			X
Souris River - West Minot			X
Werner Oil Company			X

4.5.2.2 Site-Specific Impacts

Phase 1-3 (Fourth Avenue NE, Napa Valley, and Forest Road)

Several properties within the Fourth Avenue NE area currently use or have historically used hazardous substances or petroleum products. No impacts from contaminants would be expected with flows under 10,000 cfs along the Fourth Avenue segment.

The No-Action Alternative would not affect any contaminated sites in the Napa Valley or Forest Road areas.

Other Phases of Construction Stage 1.5

Several properties within the other phases of Construction Stage 1.5 area currently use or have historically used hazardous substances or petroleum products. No impacts from contaminants would be expected with flows under 5,000 cfs. Flows in excess of 10,000 cfs would inundate two properties known to use hazardous substances or petroleum products; Keller Paving and Landscaping and Minot Farmers Elevator. Several properties with potential for contaminated sites would be inundated with flows of 27,400 cfs. If these properties were inundated, hazardous substances and petroleum products may be released into the environment, potentially contaminating soil, groundwater, and surface waters.

4.6 Socioeconomics

4.6.1 Requester's Preferred Alternative

4.6.1.1 General Impacts

Constructing, operating, and maintaining the Requester's Preferred Alternative could cause businesses and homes to be relocated and could affect property values, tax revenue, regional growth, employment, business activity, community cohesion, community growth and development, and environmental justice. Nearly 4,700 parcels would benefit from flood risk reduction at flows of 27,400 cfs with construction of the Requester's Preferred Alternative (Table 4-4).

Relocations and Buyouts of Businesses and Homes

Since the 2011 Souris River flood, Minot has been actively buying properties located within the flood inundation area, using federal, state, and local funding sources. The Requester's Preferred Alternative would require the acquisition of additional properties. It is estimated that a total of approximately 900 parcels would be required to be bought out to complete construction for all phases of the Project. If any owners of properties within the footprint of the Requester's Preferred Alternative do not wish to sell, eminent domain proceedings could be initiated. As designs for the various phases are finalized, additional properties could fall within the footprint and would require acquisition for the project to move forward.

The Requester's Preferred Alternative would increase flood risk reduction for nearly 4,700 parcels currently located within the flood inundation area and would reduce the potential need to relocate future businesses and homes from the protected area.

Property Values

The Requester's Preferred Alternative would permanently and substantially increase the value of properties as flood risk reduction features were build and became operable. Not only would property values increase, but owners of protected parcels would also benefit from not having to acquire flood insurance and from having fewer restrictions on improvements that could be made.

Owners of existing developments or developable parcels in the immediate vicinity of the protected area would also benefit from increased accessibility and decreased disruption in the event of a flood.

Business Activity

Constructing, operating, and maintaining the Requester's Preferred Alternative would stimulate local business activity by increasing direct, indirect, and induced expenditures. In the long term, the increased flood protection provided by the Requester's Preferred Alternative would support business expansion and would attract new businesses to the area.

Table 4-4 Protected and Inundated Parcels in 27,400 cfs Flood Event

	Number of Parcels[1] Affected by a 27,400 cfs Flood Event								
Jurisdiction	Inundated under **No-Action** Alternative			Inundated Despite Requester's Preferred Alternative			Protected[2] by Requester's Preferred Alternative		
	Parcels without Structures	Parcels with Structures	Total Parcels	Parcels without Structures	Parcels with Structures	Total Parcels	Parcels without Structures	Parcels with Structures	Total Parcels
Burlington	95	140	235	19	4	23	76	136	212
Burlington Township	71	66	137	47	34	81	24	32	56
Harrison Township	193	230	423	127	67	194	66	163	229
Minot	1,016	3,605	4,621	360	264	624	656	3,341	3,997
Nedrose Township	158	154	312	95	33	128	63	121	184
Sundre Township	23	15	38	19	8	27	4	7	11
Total	**1,556**	**4,210**	**5,766**	**667**	**410**	**1,077**	**889**	**3,800**	**4,689**

Parcel data source: Ward County, ND Parcels. 2015. Available at: http://gis.wardnd.opendata.arcgis.com/datasets

(1) Parcels are tax parcels, which may or may not include a built structure

(2) Protected parcels would flood under the No-Action Alternative but not flood with the Requester's Preferred Alternative

Employment

Constructing the Requester's Preferred Alternative would create temporary jobs during each phase of construction and for future operating and maintenance activities. Unemployment rates for construction workers in the affected area were low during the oil boom, however with the slowdown in the oil industry, construction jobs could primarily be filled from local labor pools. Some construction workers might be recruited from communities outside the area.

Constructing the Requester's Preferred Alternative would also indirectly create and induce temporary job growth. Indirect jobs are the jobs created in related support industries, resulting from economic activity that could be generated by the project. Induced jobs are jobs created due to the increased household spending of workers who are employed for construction of the Project. Indirect jobs would primarily be filled by local labor, although, as with direct jobs, the surrounding region might also benefit from the creation of indirect and induced jobs not filled by the local labor pool.

Regional Growth

Minot is an important service center for the region, meeting the health care, service, and shopping needs of western North Dakota, eastern Montana, Canada, and the Minot Airforce Base. By reducing flood risk, the Requester's Preferred Alternative would enhance Minot's capacity to function as a stable regional hub, resulting in permanent, beneficial impacts to regional growth. As noted above, workers relocating to the area would increase population in the short-term and would temporarily benefit regional growth.

Tax Revenue

The total estimated cost of the project would be over $800 million, which would result in additional revenues for both local and state economies. Expenditures on goods and services directly linked to constructing and implementing the Requester's Preferred Alternative would temporarily increase state and local tax revenues. Anticipated increases in direct spending would generate additional indirect, induced and "value-added" spending—including increased spending on wages, rents, and interest—which would result in higher total output spending.

The Requester's Preferred Alternative would also permanently increase tax revenues by better protecting public and private investments, like infrastructure and homes, and by expanding developable land within the affected area. By preserving property values for developed and developable areas located outside of the designated floodplain, the Requester's Preferred Alternative would allow for the redevelopment of properties and encourage the expansion of additional businesses and industry within the affected area.

Community Cohesion (Sense of Unity)

Past floods have significantly disrupted community cohesion in the affected area. Residential and business buyouts have been, or are being, initiated in order to remove substantially damaged structures, and such buyouts directly affect neighborhoods with lost residences and businesses. Several people commented on the hardships caused from moving out of their homes and leaving neighborhoods which many have lived in for most of their lives.

The Requester's Preferred Alternative would, however, provide substantial and permanent benefits to community cohesion in protected areas and the community as a whole. With increased stability and security, residents and businesses would be less likely to relocate, and would increase the level of commitment to the community, leading to greater involvement with community issues and needs.

The acquisition of a number of properties would also be required to construct the Requester's Preferred Alternative. The majority of properties have or will be bought out voluntarily, but a number of others would be acquired through eminent domain. Property owners that are forcefully ordered to give up ownership are likely to be disgruntled which could cause potential unrest and adverse effects to community cohesion.

Community Growth and Development

Following the 2011 flood, the Souris Basin Regional Recovery Strategy was developed as a framework for identifying short- and long-term community vision and strategies for rebuilding flood-affected areas of Minot, Burlington, and Ward County. Community members involved in developing the Souris Basin Recovery Strategy identified permanent housing policy initiatives, affordable housing zones, mortgage and rental assistance programs, and subsidized housing as top recovery priorities.

The Requester's Preferred Alternative would support these housing priorities by protecting public and private investments—residences, businesses, infrastructure, and recreational resources—in the affected area. This increased protection would support existing community uses and would encourage future growth and development within the affected area and the region. This would provide a path towards more sustainable and resilient communities, and would benefit long-term community growth and development within the affected area.

Environmental Justice

The project would reduce flood impacts to existing residential, commercial, and industrial development in the project area. While there are pockets of low-income and minority populations within the project area, implemented flood protection benefits of the project would reach all population groups, and would not result in a disproportionate adverse impacts. There could be some impacts to low-income populations as a result of construction access to sites; however, these impacts would not be disproportionate to other social classes (see Section 3.6.4 for details).

4.6.1.2 Mitigation Measures

As a means to avoid, minimize, or mitigate potential effects of the Requester's Preferred Alternative on socioeconomic resources within the project area, the following strategies are recommended:

- Coordinate with agency, local-government, residential, and business stakeholders to provide both structural and non-structural approaches for minimizing unavoidable impacts.
- Incorporate features—such as increased wildlife habitat, aesthetic character, and recreational access to the Souris River—that will increase property values.

- Incorporate ideas from local communities on how to mitigate the effects of flood risk-reduction projects during recovery.
- Leverage the planned phased-construction approach to lessen the severity of disturbances, and develop phase-specific best management practices to reduce impacts on residential, commercial, and industrial properties.

4.6.1.3 Potential Impacts on Specific Unique and Sensitive Resources

The Requester's Preferred Alternative would not affect any specific unique or sensitive socioeconomic circumstances.

4.6.1.4 Site-Specific Impacts for Construction Stage 1.5

Socioeconomic effects of Construction Stage 1.5 would include property buyouts, increased employment, and economic benefits of construction spending.

Phases 1, 2, and 3

Property buyouts as of May 2016 are summarized in Table 4-5. In general most of the properties acquired (to date) through the CDBG program were parcels with structures present prior to the flood. Very few parcels were vacant at the time of the flood. Most residential properties appear to include a typical single family residential property configuration (residence and garage). These buyouts create temporary disruptions for the individual property owners, but ultimately provide the permanent benefit of relocation to properties not at risk for flooding.

Table 4-5 Property Buyouts for Phases 1, 2, and 3 of the **Requester's Preferred Alternative**

	Phase 1	Phase 2	Phase 3
Residential Properties			
Acquired	18	15	42
Pending acquisitions	7	4	30
Total residential buyouts	25	19	72
Commercial and Industrial Properties			
Acquired	19	0	0
Pending acquisitions	10	0	0
Total commercial and industrial buyouts	29	0	0
Other (zoned agricultural or public))			
Acquired	0	1	1
Pending acquisitions	2	6	0
Total other buyouts	2	7	1

Increased employment associated with Phases 1, 2, and 3 would benefit the local communities both directly and indirectly. Construction of Phase 1 would create approximately 1,100 to 1,900 direct, indirect, and induced jobs. Construction of Phases 2 and 3 would create approximately 800 to 1,100 similar jobs. It is anticipated that the vast majority of these jobs would be hired locally. The non-local hires would include personnel highly qualified in mechanical, electrical, and instrumentation work and control tradesmen and other workers to provide an adequate labor force to meet the Project needs.

Construction of the three phases would also benefit the local and state economies by generating revenues for local and state governments and for local businesses. These revenues would be generated by the approximately $63.2 million costs to construct Phase 1 and the approximately $43.3 million costs for constructing Phases 2 and 3. The majority of these revenues would be collected from payroll taxes and sales taxes on materials purchased during construction as well as direct expenditures at local businesses.

Other Phases of Construction Stage 1.5

Development of the other three phases of Construction Stage 1.5 would also result in property buyouts in areas that would be used for construction of new flood risk reduction features. Property buyouts for the Maple Avenue High-Flow Diversion are currently ongoing. Buyout numbers as of May 2016 are summarized in Table 4-6. Property buyout requirements for the tieback levee and the Tierrecita Vallejo segments are not yet known. A preliminary estimate for the tieback levee and Tierrecita Vallejo are provided in Table 4-6. Only one of the 15 parcels anticipated for buyout in the Tierrecita Vallejo area contains a house.

Table 4-6 **Property Buyouts for Other Phases of Construction Stage 1.5 of the Requester's** Preferred Alternative

	Maple Avenue High-Flow Diversion	Tieback Levee	Tierrecita Vallejo
Residential Properties			
Acquired	83	0	0
Pending acquisitions	19	0	0
Total residential buyouts	102	7	15
Commercial and Industrial Properties			
Acquired	4	0	0
Pending acquisitions	6	0	0
Total commercial and industrial buyouts	10	1	0
Other (zoned agricultural or public))			
Acquired	0	0	0
Pending acquisitions	3	0	0
Total other buyouts	3	0	0

It is anticipated that employment and other economic benefits of the Tierrecita Vallejo segment and the tieback levee would be similar to those described for Phases 1, 2, and 3. Because the estimated construction costs of the Maple Avenue High-flow Diversion are the highest ($104 million), it is anticipated that construction of this phase of the Project would provide the highest number of jobs and the greatest economic benefit to the region.

4.6.2 No-Action Alternative

Under the No-Action Alternative, a flood event up to 10,000 cfs would generate minimal socioeconomic impacts. Existing flood risk-reduction elements, when combined with emergency flood fighting, are generally able to contain flood flows up to 10,000 cfs. However, a limited number of parcels would still be inundated (Table 4-7).

Under the No-Action Alternative, flood events under 10,000 cfs would generally be contained. Events greater than 10,000 cfs would overtop existing flood risk-reduction features, and portions of Burlington, Harrison Township, Minot, and a small portion of Nedrose and Sundre Townships would be inundated. This would cause damage to homes, businesses, and public infrastructure, and lead to substantial and adverse effects to individuals, communities, and local economic activity.

A flood event of 27,400 cfs would result in significant adverse socioeconomic effects, with damages similar to those from the flood of 2011. Flooding would inundate a large number of parcels (Table 4-7),

temporarily or permanently affecting communities and businesses. Damages to some properties could be permanent, as the cost of clean-up might be prohibitive. This could result in permanent loss of homes and businesses in the inundated area, leading to loss of community and permanent relocation of residents and businesses.

Table 4-7 Number of Inundated Parcels: No-Action Alternative under Three Flow Conditions (5,000 cfs, 10,000 cfs, 27,400 cfs)

	5,000 cfs			10,000 cfs			27,400 cfs		
Community	**Parcels Without Structures**	**Parcels With Structures**	**Total Parcels**	**Parcels Without Structures**	**Parcels With Structures**	**Total Parcels**	**Parcels Without Structures**	**Parcels With Structures**	**Total Parcels**
City of Burlington	14	9	23	28	13	41	94	140	234
Burlington Township	44	32	76	43	32	75	71	66	137
Harrison Township	106	86	192	115	102	217	196	229	425
City of Minot	218	143	361	286	227	513	1,034	3,648	4,682
Nedrose Township	98	65	163	115	90	205	158	154	312
Sundre Township	13	9	22	14	16	30	23	15	38
Total	**493**	**344**	**837**	**601**	**480**	**1,081**	**1,576**	**4,252**	**5,828**

4.7 Recreation

This section evaluates the potential effects of the proposed alternatives on recreational resources and opportunities in the project area, and site-specific impacts within Phases 1 through 3. Recreational resources and opportunities within the project area, as described in Section 3.7**,** include sport fishing, canoeing, kayaking, and the use of designated facilities such as parks, trails, and golf courses.

4.7.1 Requester's Preferred Alternative

4.7.1.1 General Impacts and Mitigation Measures

Permanent benefits of the Requester's Preferred Alternative on recreational opportunities and recreational areas within the project area would include providing more connections to use of local parks and trails systems, and the establishment of the Mouse River Valley greenway system.

Adverse effects could include temporary disruption during construction and permanent loss of designated recreational lands for flood risk-reduction use.

General Impacts

Constructing, operating, and maintaining the Requester's Preferred Alternative would affect the accessibility, usefulness, and layout of recreational resources within the impact area. The degree of impact depends largely upon the proximity of the existing recreational resource to the Project's footprint. The Requester's Preferred Alternative would reallocate portions of land currently used for recreation to temporary construction uses and permanent flood risk-reduction features. This change in land use could result in either total loss or reconfiguration of open or recreational features. These changes could require permanent modification to recreational access points, amenity layout, or reconstruction of existing recreational features.

Constructing the proposed features within and adjacent to the Souris River corridor would temporarily disrupt access to parks, trails, golf courses, and fishing locations. Increased noise and dust could detract from outdoor activities, like running, golf, and baseball. Increased noise could also temporarily displace wildlife, thereby interfering with bird watching, fishing, and nature walks. Future operation and maintenance activities could temporarily disrupt recreational facilities and opportunities, although these adverse effects are anticipated to be temporary and minor.

The features of the Requester's Preferred Alternative, such as channel realignments, overbank excavations, and to a certain extent, high-flow diversion channels, would affect the flow path of the Souris River. These changes could modify fish movement and fish concentration areas. Effects on recreational sport fishing opportunities are anticipated to be minimal. However, channel grade control structures, where fish tend to congregate, may be subject to modification or removal for future mitigation purposes.

The Requester's Preferred Alternative would permanently enhance existing recreational features and would create new recreational opportunities. The Requester's Preferred Alternative would also significantly contribute to the development of the future greenway corridor described in the Souris Basin Regional Recovery Strategy (December 2011) and the 2012 Comprehensive Plan for Minot (reference [73] and reference [42]). This greenway, which would incorporate flood risk-reduction features with recreational opportunities, is part of long-term flood disaster recovery planning in the 2011 flood-affected region. The greenway would feature an interconnected biking/walking path system that would eventually stretch the length of the city. The greenway would connect open spaces along the Souris River, including several city parks and existing natural areas along the river. Amenities in the green way would include interpretive signage, a dog park, restrooms, tree plantings, and park benches.

The Requester's Preferred Alternative would also reduce inundation of recreational facilities (Table 4-8)

Mitigation Measures

As a means to avoid, minimize, or mitigate potential effects on recreational resources and opportunities within the impact area, the requester has proposed the following actions:

- Coordinate with agency, local-government, and recreation stakeholders to provide structural and non-structural approaches to minimizing unavoidable impacts and recreational access to the Souris River.
- Incorporate recreational amenities into final designs, to the extent practicable, which would bring additional benefits the area.
- Coordinate maintenance activities to limit disturbances, where possible, to times when recreational facilities are less used.

4.7.1.2 Potential Impacts on Specific Unique and Sensitive Recreational Resources

The Land and Water Conservation Fund (LWCF), funded by the National Park Service (NPS), has issued grant funds for developing or maintaining a number of recreational facilities in the vicinity of the Requester's Preferred Alternative (listed in Section 3.7). Recreational facilities that receive funding from the LWCF must be retained and used in perpetuity solely for outdoor recreation. Many of the LWCF-funded recreational facilities in the project area were affected by the 2011 floods and have been restored. Use of these LWCF-funded recreational facilities for other than their designated purpose must be approved by the NPS. The Requester's Preferred Alternative would not change the use of LWCF-funded recreational facilities.

4.7.1.3 Site-Specific Impacts for Construction Stage 1.5

Features constructed as part of Stage 1.5 would be part of the permanent future flood control efforts that would protect recreational and other community resources adjacent to the project area. These phases of the Requester's Preferred Alternative provide increased connections to Minot's park and trails system and encourage the use of this system throughout Minot. Phase-specific best management practices, construction operations, and other detailed information would be developed as part of the designs.

Phase 1- Fourth Avenue NE

At present, recreational opportunities within Phase 1 are limited (Map 3-9). The Phase 1 footprint is within a future regional greenway system which could result in significant benefits by providing more recreational opportunities through increased access and connections with trails, parks, and river activities.

Parks, open spaces, sidewalks, and trails are located within the Phase 1 footprint. Construction of Phase 1, with heavy equipment traffic, noise, and dust, could temporarily limit access to the Victoria Pedestrian bridge, connecting sidewalks, and the trail system.

Phase 2 - Napa Valley

Two parks, two golf courses, and part of the Minot trail system are located within the Phase 2 footprint (Map 3-9**)**.

Phase 2 construction, which would increase heavy equipment traffic, dust, and noise, would temporarily affect these recreational resources and could lead to short-term closures and access restrictions. Temporary mitigation measures would include dust control and roadway or trail detours.

More significantly, both golf courses would have to be modified, and the trail segment would be removed. Both golf courses, however, would be improved, and a new trail segment would be built and would provide more connections to Minot's parks and trails system which would encourage use of other parks and trails.

In addition, the Dakota Bark Park would be expanded by about 20,000 square feet. New parking would also be added as well as access to the regional greenway and the Minot parks and trail system.

Phase 3 - Forest Road

Phase 3 flood risk-reduction improvements could affect a small portion of the Minot park and trail system, which is adjacent to the Phase 3 footprint (Map 3-9). Phase 3 levee construction would include establishing trails on top of the newly constructed levees. The trails would connect with the existing Minot park and trail system. This system along the river corridor is proposed to be integrated into the regional greenway corridor.

Phase 3 construction activities could disrupt or cause temporary use restrictions to one trail segment and adjacent recreational facilities. Phase 3 flood risk-reduction improvements would provide significant benefits to recreational opportunities in the area by providing new trails and connections to Minot's parks and trails system and by future incorporation into the greenway in this area along the Souris River corridor.

Other Phases of Construction Stage 1.5

There are no specific recreational facilities located within the Tierrecita Vallejo or Tieback Levee impact areas. Construction of the Maple Avenue High-Flow Diversion could affect Moose Park and a portion of Minot's trail system. Measures to mitigate impacts on this park and trail system would be developed during the detailed design process.

4.7.2 No-Action Alternative

Flood event under 10,000 cfs would affect recreational facilities within and adjacent to the current 100-year floodplain (Table 4-7).

Flood events over 10,000 cfs would inundate and damage recreational facilities and infrastructure in portions of Burlington, Harrison Township, Minot, Nedrose Township, and a small portion of Sundre Township. Uses of existing recreational facilities would be restricted until flood waters receded and cleanup and restoration were completed.

A flood event of 27,400 cfs would significantly damage existing facilities and infrastructure, erode soil, and uproot vegetation. Recreational facilities and trails would be unusable until cleaned up and restored, and some recreational facilities might never be fully restored to their former condition. This would permanently reduce the quality and quantity of recreational opportunities within the affected area.

Table 4-8 Inundation of Recreational Facilities

Location Name	5,000 cfs		10,000 cfs		27,400 cfs	
	No-Action Alt.	Requester's Preferred Alt.	No-Action Alt.	Requester's Preferred Alt.	No-Action Alt.	Requester's Preferred Alt.
Burlington City Park	X	X	X	X	X	X
Corbett Field and Rink					X	
Dakota Bark Park					X	
Green Valley Park					X	
Hammond Park					X	
Jack Hoeven Baseball Park					X	
Leech Park					X	
Moose Park	X	X	X	X	X	X
North Dakota State Fairgrounds / Nodak Speedway / Dacotah Flat Track					X	
Nubbin Park	X		X		X	
Oak Park	X		X		X	
Old Settlers Park	X	X	X	X	X	X
Riverside Park	X		X		X	
Roosevelt Park / Zoo	X	X	X	X	X	X
Roughrider Campground	X	X	X	X	X	X
Souris Valley Golf Course	X	X	X	X	X	X
Vardon Golf Club	X	X	X	X	X	X
Via-View Park					X	
Wee Links Golf Course	X	X	X	X	X	X
Total Locations Inundated:	**11**	**8**	**11**	**8**	**19**	**8**

4.8 Aesthetics and Visual Resources

This section evaluates the potential effects of the Requester's Preferred Alternative and the No-Action Alternative on the aesthetic values and visual resources in the project area. Both positive and negative effects were considered to be noteworthy if an alternative would:

- Change views of the Souris River corridor within existing trails, parks, open space, recreational facilities, or residences.
- Change landmarks or other defining features.

- Obstruct public views or viewshed corridors.
- Create development that is not balanced with the surrounding visual setting, and contrasts with the rural topography (agricultural fields interspersed with wetland and forested areas), Souris River corridor, or urban settings (residential, parks, open space, or recreational facilities).

4.8.1 Requester's Preferred Alternative

4.8.1.1 General Impacts and Mitigation Measures

The following general impacts and mitigation measures would apply to all phases of the Requester's Preferred Alternative and are therefore not repeated under the "Site Specific Impacts" subsection, unless there are more prominent aesthetic values and visual resources that have been determined as sensitive or significant.

General impacts to the landscape's existing aesthetic value and visual resources from constructing, operating, and maintaining the Requester's Preferred Alternative would include changes in vegetative cover, topography, water resources, and built structures. The scale of impact is partially based on the degree to which the landscape is temporarily or permanently changed. Viewer perceptions would also influence the significance of effects on aesthetics and visual resources—two viewers could perceive the same changes quite differently.

Changes to the landscape cannot be quantified, and there is no threshold at which all individuals will agree a change is substantial. How a viewer perceives aesthetic value is primarily influenced by two common factors: visual sensitivity and viewer exposure. Visual sensitivity varies by the individual, and reflects the viewer's degree of interest and level of concern for the aesthetics of the landscape, and their sensitivity to potential impacts. Viewer sensitivity is likely to be highest in residential areas near flood risk-reduction features, as these viewers have the most frequent viewing opportunities and the highest degree of concern.

Viewer exposure, however, varies by location, and refers to the number of viewers who frequent a landscape location and how long they stay on each visit. Therefore, changes to the existing aesthetic value of an area that many people visit, like areas surrounding the Minot Riverwalk, could have a greater effect. Aesthetic impacts also depend upon viewing distance. Viewers located near flood risk-reduction features would feel the greatest effect, although in areas with unimpeded views, like agricultural fields, effects could be experienced from a greater distance.

Construction activities under the Requester's Preferred Alternative would temporarily affect both the visual character of the landscape and viewing distance within the impact area. The Requester's Preferred Alternative would require construction of numerous structural features, including levees, floodwalls, high-flow diversion channels, channel realignment, and overbank excavations. Temporary adverse effects would include visual changes to the existing landscape caused by construction yards, staging areas, landscape grading changes, removal of vegetation, changes in the character and type of post-project vegetation, increased construction traffic and the presence of equipment, materials, fences and other elements during construction.

The presence of heavy vehicles on widened or unpaved roads could also increase amounts of visible dust, which could affect air clarity and view distances. Increased light sources such as headlights of construction vehicles, and nighttime construction site lighting, if needed, could also affect visual aesthetics. These temporary adverse effects would be reduced by using best management practices during construction.

Constructing new structural features of the Requester's Preferred Alternative would permanently affect the existing landscape. Levees are already present in many locations, however the Requester's Preferred Alternative will build them higher. The total height of levees would vary from a minimum in areas where the Requester's Preferred Alternative features tie-in to high ground, to a maximum of approximately 27 feet above grade elevation. Concrete floodwalls would typically vary in height from 5 to 15 feet, and both levees and floodwalls could affect view distance and views of the Souris River corridor, resulting in minor to substantial adverse effects by reducing the aesthetic quality of the viewshed.

Earth moving, stockpiling of materials, and physical changes to the channel alignments could visually change the project area, as could the addition of riprap and erosion control features. These new features would create additional openings within the viewshed and affect view distance. The view of excavated features would also be influenced by the presence of other flood risk-reduction features such as floodwalls or levees which could reduce the viewshed from neighborhoods, or enhance view distance from the top of a levee.

The Requester's Preferred Alternative would also, however, enhance the aesthetic value of the project area, by developing a greenway that would provide connections to parks, picnic areas, and fishing sites. The greenway and connections would improve visual aesthetics by enhancing the viewing experience of adjoining neighborhoods, hikers, and general recreational users, and would increase access to the Souris River corridor.

In summary, constructing and operating the Requester's Preferred Alternative, along with implementing temporary work easements and staging equipment, would have substantial permanent and temporary effect on visual resources within the affected area. The severity of impacts would largely depend on the type of flood risk-reduction feature being constructed and on the contrast between the feature and the existing landscape. The severity of impacts would also depend on the visibility of the aesthetic changes, the viewer exposure, and the visual sensitivity of viewers.

Strategies to avoid, minimize, or mitigate the Requester's Preferred Alternative's potential effects on aesthetics and visual resources could include:

- Stabilizing banks where possible to allow vegetation to be established on slopes of levees, thereby minimizing visual contrast with the surrounding areas. Managed vegetation could also be used for erosion control purposes, depending on channel use and desired aesthetics.
- Incorporating vegetation within the vicinity of constructed levees and floodwalls to reduce visual contrast and replace vegetative visual resources removed during construction.

- Limiting straight line elements where possible and incorporating the curving nature of the Souris River into structural design.
- Avoiding project elements where possible that would block views, particularly along parks and open space, recreation trails, and residential areas.
- Installing vegetated ground cover on the levees, landscaping on the landside of the levees and aesthetically designed floodwalls.
- Designing riprap features, used as the primary erosion control method for the Requester's Preferred Alternative, to increase the natural aesthetic appeal.
- Designing Requester's Preferred Alternative features to consider public use, recreation, and aesthetic elements. Already incorporated into the design is the Mouse River Valley greenway with recreational amenities.

4.8.1.2 Potential Impacts on Specific Unique and Sensitive Resources

Unique aesthetic and visual resources—including scenic vistas, cultural landscapes, and wilderness areas—are assets that characterize a landscape's visual appearance. No specific unique aesthetic or visual resources are located in the project area, so none would be affected by the Requester's Preferred Alternative.

4.8.1.3 Site-Specific Impacts for Construction Stage 1.5

The Requester's Preferred Alternative would have various adverse and beneficial effects to aesthetics and visual resources. Project features would impede views in some areas, as the average height of levees throughout developed portions of Minot would be approximately 14 feet. However, features would also allow accessibility to pleasing sights along trails and green spaces. The following subsections discuss the visual and aesthetic effects of constructing and operating specific phases of flood risk-reduction features for the Requester's Preferred Alternative through Stage 1.5. General impacts and mitigation measures discussed in Section 4.8.1.1 apply to these phases.

Phase 1- Fourth Avenue NE

Flood risk reduction features for Phase 1 would include a levee, two floodwalls, and two removable road closure structures. Residents, walkers, and bikers on the landside of the levee and floodwalls would be affected, as direct views of the Souris River corridor would be replaced by a view of the built features.

Flood risk reduction features would be integrated with recreational amenities along the Souris River, facilitating the implementation of the greenway in the city (as described in Section 4.7.)

Phase 2 - Napa Valley

Flood risk reduction features for Phase 2 would include a road raise, levees, road realignments, a temporary road closure structure, and a stormwater pump station. Residents, walkers, and bikers on the

landside of the levee would be affected, as direct views of the Souris River corridor would be replaced by a view of the built features.

Phase 3 - Forest Road

Flood risk reduction features for Phase 3 would consist of levees, bank stabilizations, overbank excavation, and roadway modifications. Residential properties in the Phase 3 footprint and directly adjacent to the east and west sides of the river have been or would be removed prior to construction of Phase 3. Adjacent residential properties on the landside of the Phase 3 levees would be aesthetically affected, as these properties would now border levees and the expanded river corridor instead of other residential properties.

Implementing the flood risk-reduction improvements, like increasing levee height and performing overbank excavation, would cause residences on both sides of the Souris River corridor to be removed, and would increase the amount of visual open space. The height of the levees would determine view distances of the expanded corridor, although the overbank excavation would increase the width of the river corridor and provide a longer view from the increased open space.

Other Phases of Construction Stage 1.5

Flood risk reduction features for the Tierrecita Vallejo segment would include a levee, overbank excavation, and a stormwater pump station. The levee in this segment could reach a height of 27 feet, thus affecting the local residences direct views of the Souris River corridor.

Flood risk reduction features for the Maple Avenue High-Flow Diversion would include a diversion channel, levees, roadway modifications, and a new railroad bridge. The residences within the footprint of these flood risk reduction features would be removed and replaced with these features. The existing landscape in this area would be drastically changed resulting in substantial visual effects to nearby residences as well as people traveling through this area on the modified roadways.

Flood risk reduction features for the Tieback Levee would include a levee and a modified roadway. The residences on the landward side of the levee would likely have obstructed views of the railroad and river corridors.

4.8.2 No-Action Alternative

Aesthetics and visual resources would be adversely effected by any flooding in the project area. Even with flows contained by the No-Action Alternative, residents, walkers, and bikers with a view of the river could experience minor aesthetic impacts as the river would be at a higher stage than normal and trash and debris left after floodwaters subside could also create an unappealing visual.

At flows over 10,000 cfs flood risk-reduction features would be overtopped, inundating portions of Burlington, Harrison Township, Minot, Nedrose Township, and a small portion of Sundre Township. Effects would be most pronounced in residential areas near the Souris River corridor, as adjacent residences would have the highest viewer sensitivity and the highest risk of becoming inundated. In agricultural

portions of the affected area, aesthetic impacts would be experienced at greater distances, due to the lack of visual obstructions.

Flooding would cover public and private land and infrastructure with standing water, altering existing views. As waters recede, debris, sedimentation, and damaged vegetation and infrastructure would be revealed. Cleanup and restoration efforts could require an increased presence of construction or debris removal services, causing temporary displeasing sights. Viewsheds and landscapes would be restored within days to weeks.

Under the No-Action Alternative, a flood event of 27,400 cfs would significantly damage existing aesthetic and visual resources. Flood waters would expand in all directions from the existing Souris River corridor, and would inundate private and public land and infrastructure. During the flood of 2011, land was inundated with two to fifteen feet of water, with water covering some homes all the way to the eaves.

As flood waters recede, they would reveal the destruction as described previously. Cleanup and restoration activities in some areas could take months, and some natural and structural landmarks could be permanently damaged. Damaged structures could be an eyesore if not demolished.

4.9 Historic and Cultural Resources

This section evaluates the potential effects of the Requester's Preferred Alternative and alternatives on historic and cultural resources in the project area. Impacts are considered to be substantial if they alter, directly or indirectly, any of the characteristics of a cultural resource that would qualify that resource for the NRHP so that the integrity of the cultural resource location, design, setting, materials, workmanship, feeling, or association is diminished.

4.9.1 Requester's Preferred Alternative

4.9.1.1 General Impacts and Mitigation Measures

The following general impacts and mitigation measures apply to all phases of the Requester's Preferred Alternative. A Programmatic Agreement (per 36 CFR 800.14(b)) will be established between the USACE and the ND SHPO to cover effects that cannot be fully determined in advance of the undertaking and non-Federal parties being delegated major responsibilities (Appendix J).

The Class I Cultural Resources Survey identified all known archaeological sites and historic structures within a one-mile study area of the Requester's Preferred Alternative except historic structures within the City of Minot. They include:

- Four previously identified archaeological sites Table 3-18, Section 3.9.1.1
- The Soo Line Railroad corridor (present day Canadian Pacific Railroad) (32WD1631), Table 3-19, Section 3.9.1.2
- Four standing structures Table 3-20, Section 3.9.1.3

Since the 2011 flood, Minot has been actively acquiring and redeveloping housing infrastructure through the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR) Program. Through this program, all proposed activities are subject to Federal review and will comply with HUD CDBG-DR regulations, policies, and procedures. The Requester's Preferred Alternative is also subject to Federal review and will comply with the USACE regulations. Both efforts are subject to NEPA compliance under Section 106 of the National Historic Preservation Act, and are being evaluated separately.

The two efforts overlap in specific locations where flood-damaged properties were acquired through the HUD CDBG-DR and construction related to the Requester's Preferred Alternative would occur. The acquisition of structures in Minot for HUD has proceeded under a memorandum of agreement (MOA) between Minot and the North Dakota State Historic Preservation Office (SHPO) and stipulates all proposed activities comply with HUD CDBG-DR regulations, policies and procedures. The Requester's Preferred Alternative would proceed under a Programmatic Agreement between the USACE and SHPO.

4.9.1.2 Site-Specific Impacts for Construction Stage 1.5

A Class I Cultural Resources survey was conducted for the entire study area, including all segments that are part of Stage 1.5 of the Requester's Preferred Alternative. In addition, a Class III Archaeological Survey and Class III Standing Structure Survey was completed for the Stage 1 of the Requester's Preferred Alternative and the Highway 2 borrow site. The Class III surveys narrowed the scope to an area of potential effect (APE).

Four historic structures and the Soo Line Railway are located within Stage 1.5, and are identified as potentially eligible for inclusion on the National Register of Historic Places (NRHP). The APE for areas not covered by the Class III surveys completed for the first three phases will be determined during design and permitting of these phases and would proceed under a Programmatic Agreement being developed between the USACE and SHPO.

Phase 1- Fourth Avenue NE

The Class III Archaeological Survey identified no archaeological or historic sites within the Phase 1 area, and detected no intact soils likely to contain archaeological materials. No additional archaeological survey is recommended.

The Class III Standing Structures Survey identified four structures within the Phase 1 APE as eligible for the NRHP (Table 3-21, Section 3.9.3.1). They include:

- Home Sweet Home (32WD507)
- Minot Mill (32WD652)
- 25 5th Street NE (32WD681)
- Soo Line Railroad (32WD1631)

A finding of No Properties Affected is recommended for two of the structures (32WD681 and 32WD1631). The structure at 25th Street NE, an early 20th century residence, has been modified and is no longer eligible for the NRHP. The Soo Line - Canadian Pacific Railroad is within the APE but would not be affected by flood risk-reduction features associated with Phase 1.

Home Sweet Home (32WD507) and Minot Mill (32WD652) would be directly affected. Home Sweet Home is an early 20th century residence located within the Phase 1 levee footprint. This property is eligible for NRHP, and should be avoided or relocated to a similar suitable location near the river (reference [76]). Stipulations for this property are identified in the MOA between Minot and the North Dakota SHPO.

The Minot Mill has been identified as a contributing element of the NRHP Minot Industrial District. As the structure cannot be avoided and would be razed, it is recommended that mitigation measures would include a revised inventory form, and medium and small format photography done to appropriate architectural documentation standards. In addition, due to the historic significance of the structure, it is recommended that a reevaluation of the Minot Industrial Historic District and revision of the NRHP nomination would be conducted in cooperation with SHPO. As stipulated within the PA, structures determined eligible for the NRHP will follow procedures described in 36 CFR Sections 800.5 through 800.7 to assess adverse effects (Appendix J).

Phase 2 - Napa Valley

The Class III Archaeological Survey identified no archaeological or historical sites within the Phase 2 area, and detected no intact soils likely to contain archaeological materials. No additional archaeological survey is recommended.

The Class III Standing Structures Survey identified one site, 32WD1631 (Soo Line-Canadian Pacific Railroad) within the Napa Valley segment that could be eligible for the NRHP. Site 32WD1631 is within the APE but would not be affected and a Finding of No Properties Affected is recommended.

The Requester's Preferred Alternative is not expected to affect historic and cultural resources in the Phase 2 area.

Phase 3 - Forest Road

The Class III Archaeological Survey identified no archaeological or historical sites within the Phase 3 area, and detected no intact soils likely to contain archaeological materials. No additional archaeological survey is recommended.

The Class III Standing Structures Survey identified no structures eligible for the NRHP, and no additional survey is recommended.

The Requester's Preferred Alternative would not affect historic architectural values or prehistoric and historic archaeological values, because no specific historic and cultural resources have been identified in the Phase 3 area.

Borrow Sites

A number of borrow sites are being evaluated for their suitability as potential sources of fill material for construction of the Requester's Preferred Alternative. A Class III Archaeological Survey was completed for the Highway 2 borrow site and resulted in no trace of cultural resources or historic properties, including one site that had previously been recorded in the area. No additional archaeological surveys are recommended for this site.

Other potential borrow sites would be covered by stipulations within the Programmatic Agreement between the USACE and the ND SHPO, if the initial studies determine they are suitable and the requester chooses to pursue them further.

Other Phases of Construction Stage 1.5

The results of the Class I Cultural Resources Survey indicates that there are no known archaeological sites or historic structures located within the impact areas of the later three phases of Construction Stage 1.5. The Soo Line Railway (now known as the Canadian Pacific Railroad), which has been designated as potentially eligible for listing on the NRHP, runs through the proposed location of the Maple Avenue High-Flow Diversion. Construction of this diversion would require replacement of the railroad bridge crossing the diversion channel. A Class III cultural resources investigation will be required to assess potential impacts of the diversion on this historic railway as well as other historic structures in the area. Class III cultural resources investigations may also be required for the Tierrecita Vallejo segment and the Tieback Levee to assess potential impacts of the new flood risk reduction features on archaeological sites and historic structures.

4.9.2 No-Action Alternative

Existing flood risk-reduction elements would be overtopped at flood flows greater than 10,000 cfs for the No-Action Alternative. Cultural and historic resources would be inundated to various extents depending on their location and the intensity of the flood event.

4.10 Air Quality and Noise

4.10.1 **Requester's Preferred Alternative**

4.10.1.1 General Impacts and Mitigation Measures

Air Quality

Constructing and operating the Requester's Preferred Alternative would result in direct and indirect emissions of criteria air pollutants and greenhouse gases (GHGs). These emissions would result in minor, primarily localized impacts.

Criteria Pollutants

Construction activities would temporarily increase air emissions as a result of the combustion of fossil fuels in construction equipment and vehicles, and from the fugitive dust emissions associated with ground disturbance. Typical construction equipment (e.g., backhoes, compactors, compressors, concrete mixers,

dozers, front loaders, generators, graders, excavators, backhoes, rollers, scrapers) and equipment carrying materials and personnel would be used during construction. Equipment and material deliveries, the removal of waste, and worker activities would produce indirect emissions on paved and unpaved roads.

The Requester's Preferred Alternative would be constructed over several years. Over this period, construction impacts would be concentrated in different locations as construction progresses. These impacts would be localized and temporary. Because specific scheduling and construction documentation has not yet been developed, total emissions of criteria pollutants from construction cannot currently be quantified accurately. Initial estimates, however, indicate that construction emissions would be well below Prevention of Significant Deterioration (PSD) emission rates.

Because of North Dakota's attainment status and because primary emissions associated with the Requester's Preferred Alternative would be from non-major sources, it is likely that no air quality permits or authorizations would be required from the NDDH, Air Quality Division, for the Project.

Construction emissions can be minimized by using BMPs, including:

- Minimizing idling of construction vehicles.
- Using existing power sources (e.g., grid-supplied power) or clean fuel generators rather than diesel-powered generators.
- Ensuring that construction equipment is properly tuned and maintained prior to and during on-site operation.
- Developing a project-specific dust-control plan, which could include the following additional BMPs:
    - Restricting traffic to predetermined routes.
    - Maintaining as much natural vegetation as practicable.
    - Phasing of construction to reduce the area of land disturbed at any one time.
    - Using temporary mulching, or temporary vegetative cover, to reduce the need for dust control.
    - Using mechanical sweepers on paved surfaces where necessary to prevent dirt buildup, which can create dust.
    - Periodically moistening exposed soil surfaces to control dust.

Direct emissions of criteria pollutants from operating the Requester's Preferred Alternative are anticipated to be minimal, and would come from minor amounts of gasoline and diesel combustion used to power maintenance vehicles. The pump stations would be operated during floods, to pump stormwater runoff

from the landside of the levees to the river. The pumps would, however, be electrically powered and would therefore not result in direct emissions of criteria pollutants.

Climate Change and GHG Emissions

Construction activities for all phases of the Requester's Preferred Alternative would result in similar temporary increases in GHG emissions, from the combustion of fossil fuels used to power equipment and vehicles, as described above. Combustion of fossil fuels would emit CO2, CH4, and N2O. Because specific construction schedules and plans have not yet been developed, total emissions of GHGs from constructing the Requester's Preferred Alternative cannot currently be quantified accurately. Initial estimates, however, indicate that emissions would be less than 6,000 metric tons of CO_2 equivalents (CO_2-e) for Phases 1 through 3. This amount is equivalent to approximately 0.01% of North Dakota's statewide GHG emissions of 56.6 million metric tons of CO_2-e in 2013. Emissions data is not available at the local or regional level. However, the increased construction activity resulting from the Project would increase emissions more appreciably at these scales.

As with criteria pollutant emissions, direct emissions of GHGs from operation of the Requester's Preferred Alternative are anticipated to be minimal, limited to emissions from minor amounts of gasoline and diesel combustion used to power maintenance vehicles. As mentioned above, the pump stations would be operated only during floods, and the pumps would be electrically powered, thus resulting in no direct emissions of GHGs. Due to the very small (less than 1,000 hp) total power needs associated with operating the Requester's Preferred Alternative, indirect GHG emissions are also anticipated to be minimal. As noted in Section 3.10, North Dakota is currently developing a plan to reduce carbon pollution from fossil fuel-fired power plants in compliance with EPA's recently finalized Clean Power Plan rule. These measures would aid in further reducing the very small indirect GHG footprint associated with operating the Requester's Preferred Alternative.

At present, climate modeling is not advanced enough to evaluate the potential climate effects of GHGs from an individual project. As noted in Section 3.10, however, the potential impacts of climate change on the viability and effectiveness of the Requester's Preferred Alternative are an important consideration, especially given the relationship between climate change and changes in flooding.

The design of the Requester's Preferred Alternative addresses climate-related changes in flooding, by going above and beyond what would be required of a federally funded project by Executive Order 13690. Executive Order 13690 allows flood risk reduction projects to address uncertainty with climate change by building projects two feet above the 100-year (1-percent annual chance) flood elevation for standard projects, and three feet above for critical buildings like hospitals and evacuation centers. The design height of levees for the Requester's Preferred Alternative is at least three feet above the flood of record, which is about ten feet higher than the current 100-year (1-percent annual chance) flood elevation, exceeding the current recommendations for mitigation of climate-related changes in flooding.

Noise

During construction of the Requester's Preferred Alternative, temporary, localized noise from heavy equipment and increased vehicle traffic would occur in the project area during daytime hours and would

be concentrated in different locations as construction progresses across the Requester's Preferred Alternative footprint. Because specific construction schedules and plans have not yet been developed, the effect of noise on specific receptors cannot currently be quantified explicitly. Typical noise levels from heavy duty equipment commonly used for construction (at 50 feet from the source) are summarized in Table 4-9. Typical noise levels of common activities are summarized in Table 4-10 for comparison. The noise level at 50 feet away from the construction equipment would be similar to a noisy urban area or the noise level at 100 feet away from a gas-powered land mower.

Construction noise could also affect residences in the project area when temporary construction sites or access roads are located in the immediate vicinity of receptors. Impacts, however, are anticipated to be minor, localized, and temporary. Construction noise would occur during daytime hours and is exempt from the Minot noise ordinance. It would be intermittent, and levels would decrease by approximately 6 dBA with each doubling of distance from a point source. Residences immediately adjacent to the construction area could experience noise levels up to 88 dBA.

Table 4-9 Typical Noise Levels of Construction Equipment

Equipment Type	Maximum Noise Level (Lmax, dBA)	Utilization Factor	Estimated Noise Level (dBA) at 50 feet
Pickup Truck	55	0.4	51
Crew Cab	55	0.4	51
Compressor Trailer	80	0.4	76
Crane	85	0.16	77
Backhoe/Frontend loader	80	0.4	76
Auger Truck	85	0.2	78
Water Truck	84	0.4	80
Dump Truck	84	0.4	80
Concrete Truck	85	0.4	81
Fork Lift	86	0.4	82
Vibratory Pile Driver	95	0.2	88

Sources: Federal Highway Administration (reference [77]
Notes: Noise emission levels and utilization factors are based on FHWA guidelines.

Table 4-10 Typical Noise Levels

Common Outdoor Activities	Noise Level dBA	Common Indoor Activities
	--110--	Rock Band
Jet Fly0over at 300 m (1000 ft)		
	--100--	
Gas Lawn Mower a 1 m (3 ft)		
	--90--	
Diesel Truck at 15 m (50 ft) at 80 km/hr (50 mph)		Food Blender at 1 m (3 ft)
	--80--	Garbage Disposal at 1 m (3 ft)
Noisy Urban Area, Daytime		
Gas Lawn Mower, 30 m (100 ft)	--70--	Vacuum Cleaner at 3 m (10 ft)
Commercial Area		Normal Speech at 1 m (3 ft)
Heavy Traffic at 90 m (300 ft)		
	--60--	
Quiet Urban Daytime		Large Business Office
	--50--	Dishwasher Next Room
Quiet Urban Nighttime		
Quiet Suburban Nighttime	--40--	Theater, Large Conference Room (Background)
	--30--	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (Background)
	--20--	Broadcast/Recording Studio
	--10--	
Lowest Threshold of Human Hearing	--0--	Lowest Threshold of Human Hearing

Note: Recreated from Technical Noise Supplement, (TeNS) A Technical Supplement to the Traffic Noise Analysis Protocol. California Department of Transportation, October 1998. "Table N-2136.2 Typical Noise Levels".

4.10.1.2 Potential Impacts on Specific Unique and Sensitive Resources

Numerous schools, churches, nursing homes, and hospitals—which are particularly sensitive to noise and air-quality impacts—are located in the project area. Table 4-11 provides a list of those sensitive receptors located within about 1,000 feet of the impact areas for Phases 1, 2 and 3.

Potential impacts to the nearest sensitive receptors would vary as the Project advances. When construction equipment is operating at the nearest points, noise levels could be as high as 75 dBA. Levels this high would be limited, however, as construction activity would not continually occur at maximum levels near any given receptor. Many of the nearest sensitive receptors are churches, and the most sensitive times for these receptors are unlikely to correspond to the hours of peak construction activity. Intervening homes, vegetation, and other structures would further mitigate noise levels potentially reaching sensitive receptors.

Given the temporary duration and progressive movement of construction activity, the Requester's Preferred Alternative is not expected to result in any prolonged adverse air quality or noise effects for any specific unique or sensitive receptors.

Table 4-11 Sensitive Receptors within about 1,000 feet of Phases 1, 2, and 3

Project Phase	Sensitive Receptor	Minimum Distance to Construction Limits (feet)	Peak Projected Construction Noise Levels (dBA)
1	Congregational United Church	225	75
1	McKinley Elementary School	305	72
1	First Lutheran Church	425	69
1	Old Soo Depot Transportation Museum	555	67
1	West Pedestrian Footbridge (Historic)	865	63
1	Trinity Homes	880	63
1	Erik Ramstad Middle School	935	63
1	Roosevelt Elementary School	1060	61
1	First Baptist Church	1075	61
2	Perkett Elementary School	250	74
2	First Church of the Nazarene	490	68
2	St. John the Apostle Catholic Church	900	63
2	Magic City Campus High School	1140	61
2	St. Mark's Lutheran Church	1260	60
3	Eagles Wings Community Fellowship	225	75
3	Magic City Campus High School	990	62
3	Perkett Elementary School	1115	61

Notes: Noise levels based on minimum distance and maximum noise source from Table 4-9 (Pile Driver = 88 dBA @ 50 feet).

4.10.1.3 Site-Specific Impacts for Construction Stage 1.5

Air quality and noise impacts from all phases of Construction Stage 1.5 would be the same as the general impacts and mitigation measures described in Section 4.10.1.1. No site-specific effects would occur. Residences and sensitive receptors in the vicinity of these three phases could experience minor, temporary increases in air emissions (e.g., dust) and noise levels during construction of these phases.

4.10.2 No-Action Alternative

4.10.2.1 Air Quality

Under the No-Action Alternative there would be no change from existing air quality conditions described in Section 3.10.

4.10.2.2 Noise

Under the No-Action Alternative there would be no change from existing noise conditions described in Section 3.10, except during flood fighting efforts when noise levels could be higher in localized areas to construct temporary flood risk-reduction features.

4.11 Human Health and Safety

4.11.1 **Requester's Preferred Alternative**

4.11.1.1 Human Health

Construction of the Requester's Preferred Alternative could temporarily affect human health. Construction-related impacts that could affect the health of construction workers and nearby residents include noise, vibrations, exhaust fumes, and dust, which are discussed in Section 4.10.1. Excavations could uncover contaminated soils or groundwater that would need to be remediated, as discussed in Section 4.5.1. Demolition of existing structures could disturb hazardous materials, such as asbestos. Temporary impacts would be mitigated through best practices for managing health hazards associated with demolition, heavy construction, and working in potentially contaminated sites.

The Requester's Preferred Alternative would have long-term benefits for human health. Many health hazards occur after floods and during clean-up activities, including compromising the structural integrity of roads, bridges, houses, and other structures in the damaged areas; dispersing sewage and pathogens into residential areas; and creating unhealthy conditions (e.g., mold) in structures inundated by flood waters. Reducing flood risk to the communities along the Souris River would reduce the potential for loss of life or injuries during flood events and would minimize the many health hazards that result from flooding of developed areas. In addition to reducing flood risks, the Requester's Preferred Alternative would create park and recreational features along the river, which would make it easier for people in the community to maintain active and healthy lifestyles.

4.11.1.2 Safety

Construction of the Requester's Preferred Alternative could temporarily affect human safety. Construction activities would involve the use of heavy equipment to move, place and transport materials to and from the site and would involve the demolition of existing structures. The requester has indicated that temporary impacts to safety would be mitigated through best practices for ensuring safe construction zones and travel routes to and from the site. Contractors for the Project would be required to develop Project Health and Safety Plans (PHASP) which would specify safety procedures and programs to be implemented for the safety and health of all persons and properties. The Contractor's PHASP would, at a minimum, meet the regulatory requirements set forth by the Occupational Safety and Health Administration (OSHA), specifically those set forth in the Code of Federal Regulations (CFR) at 29 CFR

Parts 1910 and 1926, in particular 1910.120 (Hazardous Waste Operations and Emergency Response), and would comply with all other appropriate state and federal safety regulations.

4.11.2 No-Action Alternative

4.11.2.1 Human Health

The No-Action Alternative would have adverse impacts on human health during flood events and from the resulting unhealthy conditions that are created in the flood-damaged areas. Residents in flood-prone areas would be required to follow emergency health precautions to protect their health during and after flood events.

4.11.2.2 Safety

The No-Action Alternative would have temporary adverse effects on human safety during floods, when flood waters, the evacuation process, and flood fighting efforts would expose residents and workers to unsafe conditions along the flooded river. The flood fighting associated with the No-Action Alternative can be an intensive endeavor, carries a high level of risk and uncertainty, and has a higher potential for failure than permanent flood risk reduction structures. There would be continual risks of loss of lives or injuries during flood events under the No-Action Alternative, as in 2011 when two elderly residents in Burlington died as a result of complications from flooding (reference [78]).

4.12 Cumulative Effects

4.12.1 Regulatory framework and overview

The Council on Environmental Quality's (CEQ) regulations (40 CFR §§1500 - 1508) implementing the provisions of the National Environmental Policy Act (NEPA) of 1969 define cumulative effects as:

> *"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR §1508.7)."*

Cumulative effects are defined in the context of the action, alternatives, and effects, and are evaluated along with the Project's direct and indirect effects. The range of alternatives considered includes the no-action alternative as a baseline against which the cumulative effects on the environment are evaluated.

Analyzing cumulative effects requires identifying the environmentally relevant area, and the past, present and future actions in that area that would contribute incrementally to the overall effect. The environmentally relevant area is determined by both location and time. Future actions are those that are reasonably likely to occur. A future project is only considered in this analysis if there is sufficient information on the project to understand what its incremental contribution to cumulative effects might be.

There have been numerous federal flood control projects in the Souris River Valley over the last 40 years, including upstream flood storage reservoirs, levees, channel modifications, and pump stations. For the purposes of the cumulative effects assessment, these projects are considered part of the existing

landscape and affected environment. They are described in detail in Section 1.4 and include existing flood risk-reduction projects along the Souris River that were developed by the USACE as the Souris River Basin Project.

4.12.2 Spatially and Temporally Relevant Projects

Some projects not related to the historical flood control efforts in the region could contribute to cumulative effects in one or more resource areas. These projects are divided into two categories: projects related to flood control and other relevant projects.

4.12.2.1 Projects Related to Flood Risk Reduction and Cleanup

Past Projects

1970s-1990s: The Souris River Basin Project – The USACE constructed a series of flood risk reduction projects under three separate congressional actions that are referred to collectively as the Souris River Basin Project. These projects generally consist of upstream flood storage reservoirs, levees, modifications to the Souris River channel, and pump stations. A detailed description of these projects can be found in Section 1.4.

2011-2013: North Dakota Housing Rehabilitation and Citizen Retention Grant program – In 2011, the North Dakota legislature authorized the Housing Rehabilitation and Citizen Retention Grant program and appropriated $10 million to help North Dakota homeowners cover the costs of repairing flood-damaged homes. The North Dakota Office of the Adjutant General awarded nearly $8 million in 2012 to help residents in Minot and Ward County repair flood-damaged homes and to help cover the costs of demolishing homes destroyed by the flood. The fund has also supported flood recovery efforts by Minot, other flood-affected counties, and the Spirit Lake Nation.

In 2013, the legislature approved a plan to provide an additional $1.19 million in remaining program funds to further assist residents in Minot and Ward County. About 600 households in Minot and Ward County have received assistance through the Housing Rehabilitation and Citizen Retention Grant program.

2012-2016: HUD Acquisition/Buyout Program – In 2012, Minot began implementing an acquisition/buyout program within the areas of the city affected by the 2011 flood. The program is funded by the U.S. Department of Housing and Urban Development (HUD) Community Block Development Grant Disaster Recovery (CBDG-DR) program. Under this program, Minot received two CDBG-DR funding allocations (Section 4.6.1.1 includes details on the HUD CBDG-DR program). Home and business buyouts through HUD's CDBG-DR program are voluntary, and are separate from the Requester's Preferred Alternative.

The first allocation of ~$67.6M was approved in 2012, and enabled Minot to acquire properties, typically including the lot, all structures, and mineral rights. All existing structures were removed from the acquired properties as part of this effort. Under the first allocation, 83 homes were acquired. Nine were relocated and the remaining 74 were demolished.

The second allocation of ~$35.1M was approved in 2013, and involved buying properties located within the flood inundation area. Property buyouts included single- and multi-family residences, mobile homes and pads, and religious and commercial establishments. Under the second allocation, an additional 80 properties were acquired, all of which were slated for demolition. Demolition of properties began in 2013 and is estimated to be completed in 2016.

Present and Ongoing (Future) Projects

2014-Present: System-Wide Improvement Framework (SWIF) – In November 2013, the USACE notified SRJB and WCWRD that all levee systems from Burlington through Minot would be rated "Unacceptable." An "Unacceptable" rating is grounds for the USACE to assign the levee systems an "inactive" status, making the levee sponsor ineligible for federal rehabilitation assistance following a flood or natural disaster.

In order to prevent a lapse in rehabilitation assistance, the sponsors submitted requests to the USACE in March 2014 for a conditional extension while they develop and implement a System Wide Improvement Framework (SWIF). Two separate SWIF requests were submitted in the form of SWIF Letters of Intent, in which the project sponsors presented an outline of actions taken to date, along with planned future actions, to implement the system-wide improvements to the levee systems. Additional information on the SWIF is provided in Section 1.4.

After the 2011 historic flood event, the NDSWC commissioned a study on how to reduce the risk of flood damages within the Souris River Valley from a similar event in the future. This study resulted in development of the Requester's Preferred Alternative. The SWIF plan, portions of which are still under development, details the efforts associated with the Requester's Preferred Alternative and how it will support the overall solution to bring the levee systems to an "Acceptable" rating.

The SWIF is intended to fulfill two objectives. First, it provides the SWIF plan requirements and outlines the schedule and approach for the correction of USACE-identified deficiencies within the levee systems from Burlington through Minot. Second, the SWIF provides the framework for coordination between the remedial actions associated with the SWIF and the new construction activities associated with the Requester's Preferred Alternative.

2015-Present: Federal Emergency Management Agency (FEMA) Floodplain Remapping – Congress requires FEMA to remap floodplains where growth has taken place. Proposed revisions to the FEMA floodplain maps of the Souris River Valley were developed in 2015 and are currently under review by FEMA, with approval anticipated in 2016. Previous FEMA flood maps were drawn to show a 100-year (1-percent annual chance) flood event at 5,000 cfs. The proposed revisions to the floodplain maps would draw the new boundaries of the 100-year (1-percent annual chance) flood event at 10,000 cfs, adding about 3,200 properties to the regulatory floodplain. The proposed expansion of the regulatory floodplain would require additional homeowners in the hazard areas to buy flood insurance.

2015-2017: Northern Area Water Supply; Minot Water Treatment Plant – The Northern Area Water Supply (NAWS) project is a large-scale regional effort to deliver water from the Missouri River to

northwest North Dakota, including Minot. One component of the NAWS project that could potentially contribute to the cumulative effects in the project area is the proposed flood proofing of the Minot Water Treatment Plant (WTP). During the 2011 flood, the Minot WTP was inundated and the water supply contaminated with untreated river water. Because of the significant service this facility provides, Minot determined that flood proofing of the WTP was a first priority in the development of the MREFPP. All of the proposed upgrades to the Minot WTP would occur within the existing boundaries of the WTP and would not affect land use outside of those boundaries. Construction of the Water Treatment Plant Flood Protection Project began in September 2015 and is anticipated to be completed in 2017.

2016: National Disaster Resilience Competition (NDRC) Grant – The NDRC is a competitive grant program that will make $1 billion available to communities struck by natural disasters in recent years. Grants awarded through the competition promote risk assessment and planning and fund the implementation of innovative resilience projects to better prepare communities for future storms and other extreme events. Funding for the competition is from the Community Development Block Grant disaster recovery (CDBG-DR) appropriation provided by the Disaster Relief Appropriations Act, 2013 (PL 113-2) (reference [79], reference [80]).

In January 2016, Minot was awarded $74,340,770 in NDRC funding to support its integrated approach to addressing climate change and recent upstream development that has increased the risk of frequent flooding. The City is launching a set of three integrated projects that will reduce flood risk and improve water management, build affordable and resilient neighborhoods connected to transit and job centers, and foster economic resilience by creating Centers for Technical Education.

2012-Present: Review of the International Operating Plan for Souris River Basin Reservoirs - The sharing and management of water across the International Boundary between Canada and the United States was established in the Boundary Waters Treaty of 1909. The Treaty also established an International Joint Commission (IJC) to have jurisdiction over the use, obstruction or diversion of these waters. The International Souris River Board (ISRB) was later established by the IJC and given responsible for ensuring compliance with flow apportionment and low flow measures adopted by the two countries in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.

The flooding in 2011 resulted in requests to: 1)review the Operating Plan contained in Annex A to the 1989 International Agreement, 2)evaluate additional flood protection measures, above and beyond what is currently provided under the International Agreement, and 3)review the Operating Plan contained in Annex A of the Agreement. As a result, the ISRB established the 2012 Souris River Basin Task Force which developed a Plan of Study to conduct the review (reference [81]). The primary goal of the studies identified in this Plan of Study is to enable the IJC to present recommendations for the consideration of the Governments of Canada and the United States on alternatives to the operating rules contained in Annex A of the 1989 agreement to maximize the provision of flood control and water supply benefits in the Souris River basin. Alternatives evaluated may include raising of existing dams, changes to channel alignment and capacity, provision of flood control measures in and around vulnerable communities, etc.

2016-Present: Souris River Basin Feasibility Study – The USACE has initiated a Souris River Basin Feasibility Study at the request of the Souris River Joint Water Resource Board who is serving as the project sponsor. The feasibility study will identify ways to provide a flood risk management system to the residents in the United States portion of the Souris River Basin. The steps of the study will involve problem and opportunity identification, inventory, evaluation, screening alternatives, risk informed decision making, determining the National Economic Development (NED) plan, identification of a Locally Preferred Plan (LPP), designing and costing of the recommended plan, determining and disclosing the environmental effects of the recommended plan, and documentation of the economic feasibility of a recommended plan. The recommended plan may include, but is not limited to, the modification of existing features or construction of new features such as levees, floodwalls, diversion channels, non-structural flood-proofing, relocation of flood-prone structures, and flood storage, or no federal action.

4.12.2.2 Other Relevant Projects in the Area

Present and Ongoing (Future) Projects

2015-2017: Minot Downtown Infrastructure Improvements – A series of infrastructure improvements are underway in downtown Minot, in a project area generally bounded on the west by Broadway Street, on the south by Burdick Expressway, on the east by Third Street SE, and on the north by the BNSF Railway property and First Avenue NE. The improvements include constructing sanitary sewer mains and service lines; storm sewer mains and inlets; water mains and service lines; sidewalks with ADA-compliant pedestrian ramps; concrete streets with concrete curb and gutter; signage and street striping; street lighting; and streetscape components. Improvements will also include demolition of existing items; abandonment of existing sub-sidewalk vaults; traffic control; and erosion control. The infrastructure improvements are expected to be completed in 2017.

2016: U.S. Highway 83 Bypass/U.S. Highway 2 interchange improvement – In accord with the North Dakota Department of Transportation (NDDOT) Statewide Transportation Improvement Plan (STIP), the interchange of U.S. Highway 83 bypass and U.S. Highway 2 on the west side of Minot will be improved in fiscal year 2016. Improvements will include a new bridge deck overlay and reconstruction of on and off ramps. Construction of this project will result in temporary, localized traffic modifications until the work is completed.

2017-2019: U.S. Highway 83/Broadway Viaduct Structure Replacement – Also in accord with the NDDOT STIP, the viaduct structure at U.S. Highway 83 and Broadway will be rebuilt in fiscal years 2017-2019. Construction of this project will result in temporary, localized traffic modifications until the work is completed.

2016-2019: Minot Intersection Improvements and Turn Lane Additions – The NDDOT STIP also includes improvements at various local road intersections within Minot in fiscal years 2016-2019. Intersection improvements can typically include turn lane additions or turn radius adjustments, and may also include signal control changes. Construction of these projects will result in temporary, localized traffic modifications until the work is completed, however, the incremental contribution of the proposed

intersection improvements to cumulative effects in the area would vary depending on the distance of a particular intersection improvement from the Requester's Preferred Alternative.

2016: Other General Street and Infrastructure Improvements - Minot is currently accepting bids for other street and infrastructure improvements to be completed in 2016. These include sidewalk, curb and gutter replacements, street sealing and patching projects, and an extension of the Thirty-Sixth Avenue sanitary sewer line to Broadway Avenue.

Anticipated Future Parks and Trails - The 2012 Minot Comprehensive Plan assessed the existing availability of neighborhood parks, community parks, athletic facilities, special use parks and open space/greenway corridors within Minot. The Comprehensive Plan projects a need for an additional 360 to 635 acres of park lands by 2030, which is based on a desired ratio of 20 to 25 acres of park land per 1,000 people, and the projected 2030 Minot population of 55,000 people. To meet this anticipated demand, the Comprehensive Plan calls for an additional ten neighborhood parks, four community parks, additional ball fields, soccer fields, a golf course, an additional special use park, and additional open space/greenway acreage. The Comprehensive Plan also calls for an expansion of the existing trails system from the current 19.6 miles to 96.3 miles.

Anticipated New Housing Developments - In the early 2010s, there was a rapid expansion of oil field facilities in North Dakota, including in the Minot area. As a result, there was an increased demand for additional housing to accommodate oil industry workers who relocated to the Minot area. New housing was also needed to accommodate Minot residents displaced by the 2011 flood. With the sharp decline in oil prices in recent years, and the ensuing decrease in production in North Dakota oil, demand for housing is currently lower than during the initial influx of oil-related workers. Rental prices dropped in 2015 by as much as 20% in cities like Minot [reference [82]}. Nevertheless, the median home value in North Dakota has gone up 4.3% since April 2015, and is forecast to rise another 2.7% in the next year [reference [52]}. However, demand for housing for oil industry workers and others relocating to Minot is expected to increase when oil prices and production rise (Housing Predictor 2015).

4.12.3 Assessment of Cumulative Effects

The primary cumulative socioeconomic effects of the Requester's Preferred Alternative and the past, present, and future projects identified in Section 4.12.2 would include residence displacements, and temporary and recurring traffic modifications. Projects not related to flood control and cleanup would have little or no effect on property displacements. They would, however, affect traffic in the vicinity of the project.

The Requester's Preferred Alternative and the past, present, and future flood risk reduction and cleanup projects identified in Section 4.12.2.1 would contribute to adverse cumulative effects on property displacement by adding to the number of residential and commercial properties bought out or removed for flood risk reduction projects. This adverse cumulative effect would be offset, however, by the beneficial long-term cumulative effects of the Requester's Preferred Alternative in combination with the other projects. This is because the Requester's Preferred Alternative would provide long-term protection to

properties within potentially flood-prone areas, greatly reducing the likelihood for future flood-related property displacements and buyouts.

In addition, the HUD CBDG-DR, the NDRC Grant, and the North Dakota Housing Rehabilitation and Citizen Retention Grant programs would offset financial losses from flood damage and ensuing repairs and demolition, and reduce the number of properties exposed to potential future flood damages. Cumulatively and collectively, the Requester's Preferred Alternative and the other flood risk reduction projects identified in Section 4.12.2.1 would have the long-term beneficial effect of stabilizing property values and protecting properties from future flood damage.

The Requester's Preferred Alternative and all past, present, and future projects identified in Section 4.12.2.1 and Section 4.12.2.2 would affect traffic because all of these projects would require some degree of temporary or permanent traffic modification in the vicinity of the Project. Traffic modifications during construction would be temporary, but once construction has been completed, traffic flow would be improved and ultimately result in long-term and beneficial cumulative effects.

Overall, the Requester's Preferred Alternative and the past, present, and future projects identified in Section 4.12.2 would not result in significant adverse cumulative effects on property displacements and traffic. These projects would have a long-term beneficial cumulative effect on property displacements and traffic. This is because, as discussed above, effects during the construction and implementation stages would be temporary and would be outweighed by the long-term benefits.

A significant cumulative socioeconomic benefit of the Requester's Preferred Alternative and the past, present, and future projects identified in Section 4.12.2 would be to limit the number of homeowners required to purchase flood insurance as a result of the FEMA floodplain remapping. This effect would occur due to the various property buyout programs, and to the reduced inundation area created by the Requester's Preferred Alternative. Under the No-Action Alternative, the cumulative effect would be an increased number of homeowners required to purchase flood insurance as a result of the FEMA floodplain remapping.

In addition to impacts resulting from the Requester's Preferred Alternative, past, present, and future pressures from urbanization, development, and agricultural practices would likely continue to adversely affect wetlands. Wetlands that flow to Waters of the United States, such as the Souris River, fall under jurisdiction of the USACE and may require mitigation. Mitigation through the Ducks Unlimited North Dakota Aquatic Resource In-Lieu-Fee Program has become a frequently utilized mitigation option. Although the Program provides mitigation, it may not result in wetlands to be restored, enhanced or established in the immediate area, but within the larger Souris River Basin Regional Service Area.

With respect to wetlands not regulated by USACE, North Dakota does not currently have any regulatory agencies that require mitigation for impacts to those wetlands; it is likely that there would continue to be degradation and loss of these resources.

The Requester's Preferred Alternative and the past, present, and future flood control and cleanup projects identified in Section 4.12.2 have and will continue to impact biological resources, including native vegetation communities, wildlife and aquatic habitat and sensitive species. The project area is intensively urbanized. The landscape has undergone substantial land use changes, including urban expansion and alterations to riparian and aquatic habitat to provide flood risk reduction. For example, previous flood projects have included channel widening and straightening, which has significantly altered aquatic and riparian habitat and natural river processes. The requester's preferred alternative would include project features that contribute further to some of these habitat stressors. However, permit conditions and associated mitigation could help to off-set project-specific impacts.

The Requester's Preferred Alternative and other projects also generate cumulative effects on air quality, health and safety, recreation, cultural resources, and contaminated sites. However, the cumulative effect on these resources is expected to be relatively minor. This is because the project area is intensively urbanized and developed. Noise and dust impacts would be temporary and minor, and would be further mitigated through implementation of BMPs and constraints on hours of construction.

4.13 Interim Impacts

With the Requester's Preferred Alternative, flood risk reduction features would be built in phases over the next 25 or more years. As phases are constructed, portions of the project area would essentially be protected from floodwaters. However, excluding these areas from the floodplain may cause increases in the frequency, depth, and duration of flooding to areas where the Project has yet to be constructed. The increased flood risk would occur in specific locations throughout the area until all phases of the Project have been completed; these impacts will be referred to as interim impacts in the following section. Most interim impacts would not be appreciably different from what was described earlier in Section 4. However, changes in flood depth and area of inundation do have the potential to substantially alter the intensity of flood impacts on structures, which will be the focus of this section.

Interim impacts were evaluated for four construction stages (Stages 1, 1.5, 2, and 3). Construction stages are a combination of Project phases, that when combined, would provide independent flood risk reduction for a sizable portion of the project area.

Interim impacts for each construction stage are assessed relative to the No-Action Alternative, which assumes a successful flood fight up to 10,000 cfs. This assessment demonstrates how inundation areas and depths could change after the implementation of each construction stage.

4.13.1 Construction Stages

Design and construction of the Project would be in phases. These phases were grouped into construction stages, defined by the likely sequence of construction, as identified by the Project requester. The Project requester's rational for the construction sequencing was to minimize interim impacts from construction of Project phases. Table 4-12 shows the extent of construction included in each construction stage.

The initial impacts analysis evaluated three construction stages (1, 2, and 3). The construction of Stage 4 results in the completion of the Requester's Preferred Alternative. Therefore there are no interim impacts associated with Stage 4, rather only the permanent impacts of the Requester's Preferred Alternative, as disclosed throughout Section 4. A fifth construction stage between Stage 1 and Stage 2 was identified later in the analysis and is referred to as Stage 1.5. Stage 1.5 is also included in the interim impacts analysis.

4.13.1.1 Construction Stage 1

Construction Stage 1 refers to the conditions after completion of the Project phases currently authorized for design by the SRJB and being pursued for Section 408 permissions: Fourth Avenue NE (Phase 1), Napa Valley (Phase 2), and Forest Road (Phase 3). In addition, Stage 1 would include the independent levee-floodwall system for the Minot Water Treatment Plant. Areas included in Stage 1 are shown in Table 4-12 and in Figure 4-10.

With the exception of the Water Treatment Plant levee-floodwall system, the changes implemented during Construction Stage 1 would not remove areas from the regulatory floodplain. Flood risk-reduction features of the Napa Valley, Forest Road and Fourth Avenue NE phases would not tie into high ground, so additional flood fighting would be required to prevent flows over 5,000 cfs from flowing around the features.

4.13.1.2 Construction Stage 1.5

Construction Stage 1.5 was added as an intermediate construction stage after Construction Stages 1, 2, 3, and 4 had been analyzed. Construction Stage 1.5 refers to conditions after completion of Construction Stage 1, plus features along Tierrecita Vallejo; U.S. Highway 83 Bypass bridge replacement; Maple Avenue high-flow diversion; and the tie-back levee extending east from the Fourth Avenue NE floodwall along the north side of the railroad tracks. Areas included in Construction Stage 1.5 are shown in Table 4-12 and in Figure 4-11.

Features in Phases 1 through 3 would be designed to provide protection to 27,400 cfs. However, the tie-back levee would only be designed for the 10,000 cfs flood event with at least three feet of additional levee height above the 10,000 cfs water surface elevations. The tie-back levee was designed as a temporary feature that would be replaced by features that provide protection to 27,400 cfs later in the construction of the Project.

Upon completion of Stage 1.5, a substantial portion of NW Minot would be protected to flows of 10,000 cfs. This would allow for FEMA accreditation of the features, exclusion of the protected areas from the regulatory floodplain, and exemption of properties in this area from needing to purchase flood insurance. The tie-back levee would be overtopped during a 27,400 cfs event, but the inundation would not be as extensive or as deep as it was during the 2011 flood.

4.13.1.3 Construction Stage 2

Construction Stage 2 refers to the conditions after completion of Construction Stage 1.5, plus the construction of features in the following areas: Rodeo Road; North Roosevelt Park; Burdick bridge; North Valker Road; South Valker Road; Twenty-Seventh Street SE High-Flow Diversion; and Burlington. The areas included in Construction Stage 2 are shown in Table 4-12 and in Figure 4-12. This stage would complete all Project features on the left bank (north side) of the Souris River in Minot. Areas behind the left bank levee system would likely be eligible for accreditation by FEMA and removal from the regulatory floodplain.

4.13.1.4 Construction Stage 3

Construction Stage 3 refers to the conditions after completion of Construction Stage 2, plus the features and bridge modifications in the following areas: South Downtown Floodwalls, South Roosevelt Park; South Keller; U.S. Highway 2 bridge; Apple Grove Golf Course; Brooks Addition; Country Club; and Talbots. The locations of features for Construction Stage 3 are shown in Table 4-12 and in Figure 4-13. This stage would complete the remaining Project segments on the right bank (south side) of the Souris River in Minot as well as three of the four independent segments between Burlington and Minot.

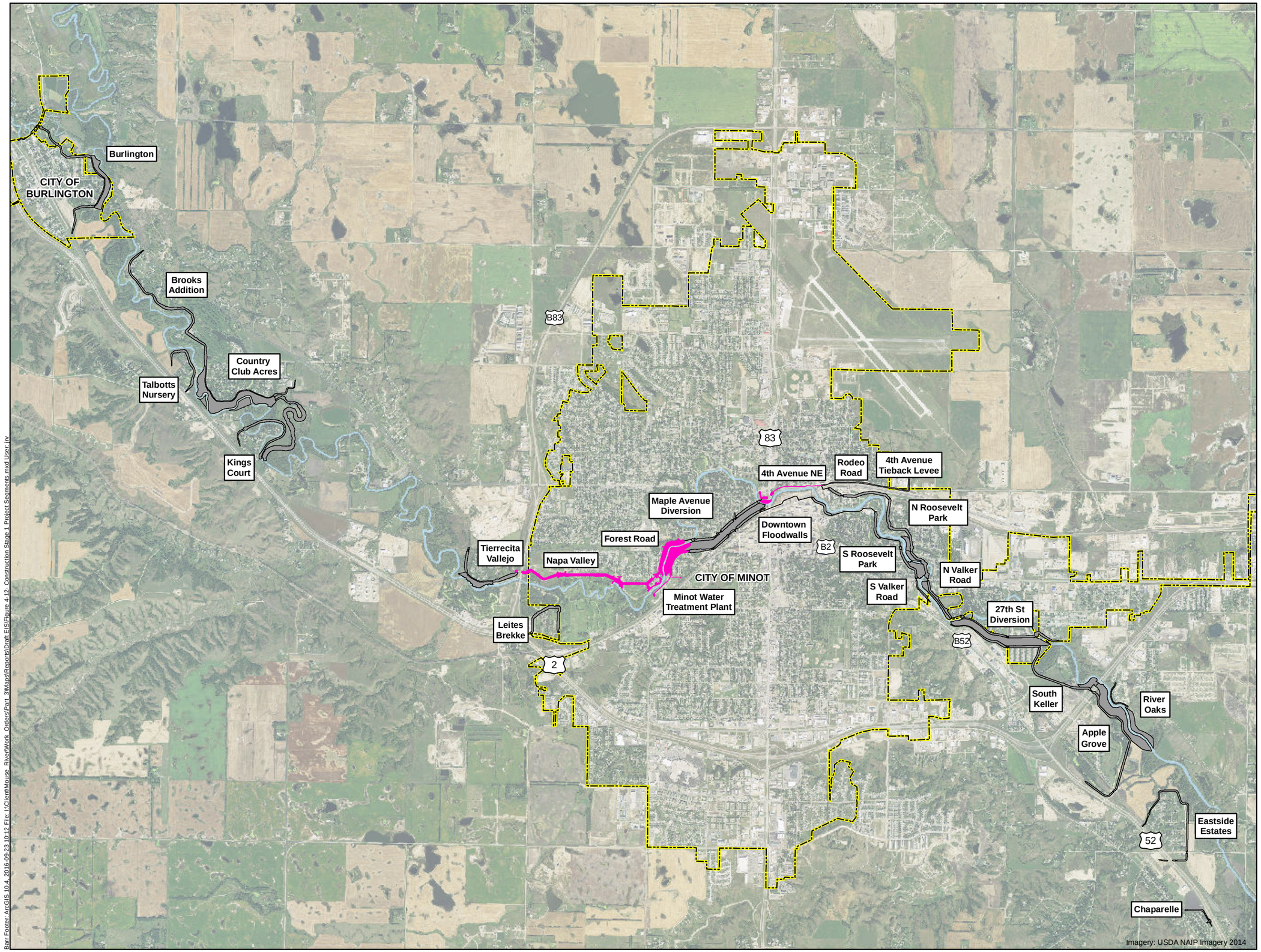
4.13.1.5 Construction Stage 4

Construction Stage 4 refers to the conditions after completion of the Requester's Preferred Alternative. The remaining areas requiring construction in Stage 4 would include Kings Court, Leites Brekke, Eastside Estates, Chaparelle, and a road raise for U.S. Highway 52 southeast of Minot. The portions of the Project included in Construction Stage 4 are shown in Table 4-12 and in Figure 4-14. Impacts from completing this stage are discussed in the previous environmental consequences sections where it is referred to as the Requester's Preferred Alternative.

Table 4-12 Construction Stage Definitions

Reach	Project Segments	Construction Stage 1	Construction Stage 1.5	Construction Stage 2	Construction Stage 3	Construction Stage 4
Upstream of Minot	Burlington			■	■	■
	Brooks Addition				■	■
	Country Club				■	■
	Talbotts				■	■
	Kings Court					■
	Tierrecita Vallejo		■	■	■	■

Reach	Project Segments	Construction Stage 1	Construction Stage 1.5	Construction Stage 2	Construction Stage 3	Construction Stage 4
Minot	U.S. Highway 83 Bypass Bridge	■	■	■	■	■
	Napa Valley	■	■	■	■	■
	Forest Road North	■	■	■	■	■
	Forest Road South	■	■	■	■	■
	Water Treatment Plant(1)	■	■	■	■	■
	Maple Avenue High-Flow Diversion		■	■	■	■
	Broadway Bridge			■	■	■
	4th Avenue NE	■	■	■	■	■
	Rodeo Road			■	■	■
	North Roosevelt Park			■	■	■
	Burdick Bridge			■	■	■
	South Valker Road			■	■	■
	North Valker Road			■	■	■
	27th Street SE High-Flow Diversion			■	■	■
	South Downtown Floodwalls				■	■
	South Roosevelt Park				■	■
	South Keller				■	■
	U.S. Highway 2 Bridge				■	■
	Apple Grove				■	■
	Leites Brekke					■
	Eastside Estates					■
	Chaparelle					■
	U.S. Highway 52 Road Raise, Minot					■



Current Construction Stage (1)

Future Construction Stages (1.5, 2, 3, 4)

Municipality

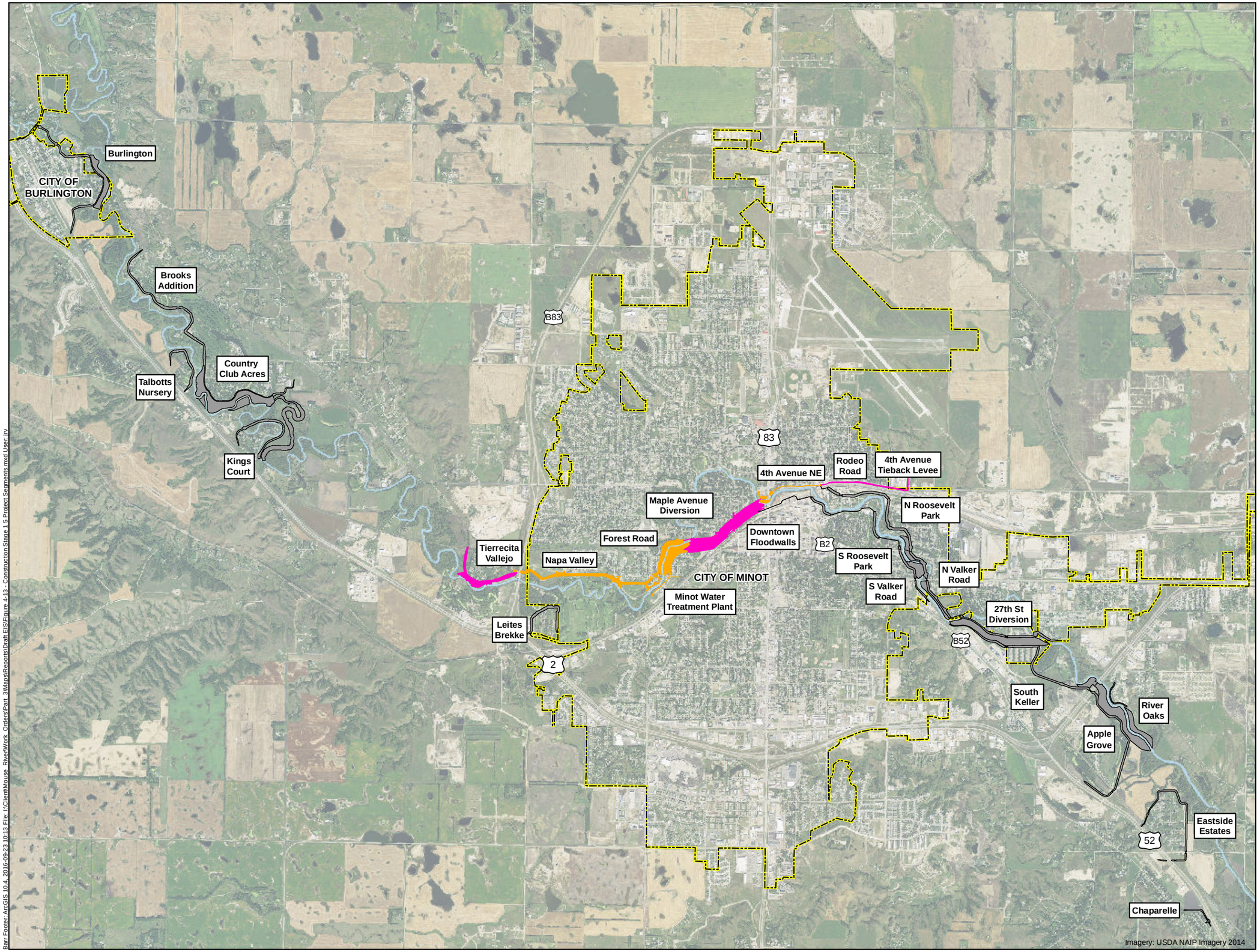
0 2,000 4,000 8,000

Feet

Figure 4-10

CONSTRUCTION STAGE 1
PROJECT SEGMENTS
Mouse River Enhanced Flood
Protection Project
Minot, North Dakota

Bar Footer: ArcGIS 10.4, 2016-09-23 10:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-12_Construction Stage 1 Project Segments.mxd User: jrv



Previous Construction Stage (1)

Current Construction Stage (1.5)

Future Construction Stages (2,3,4)

Municipality

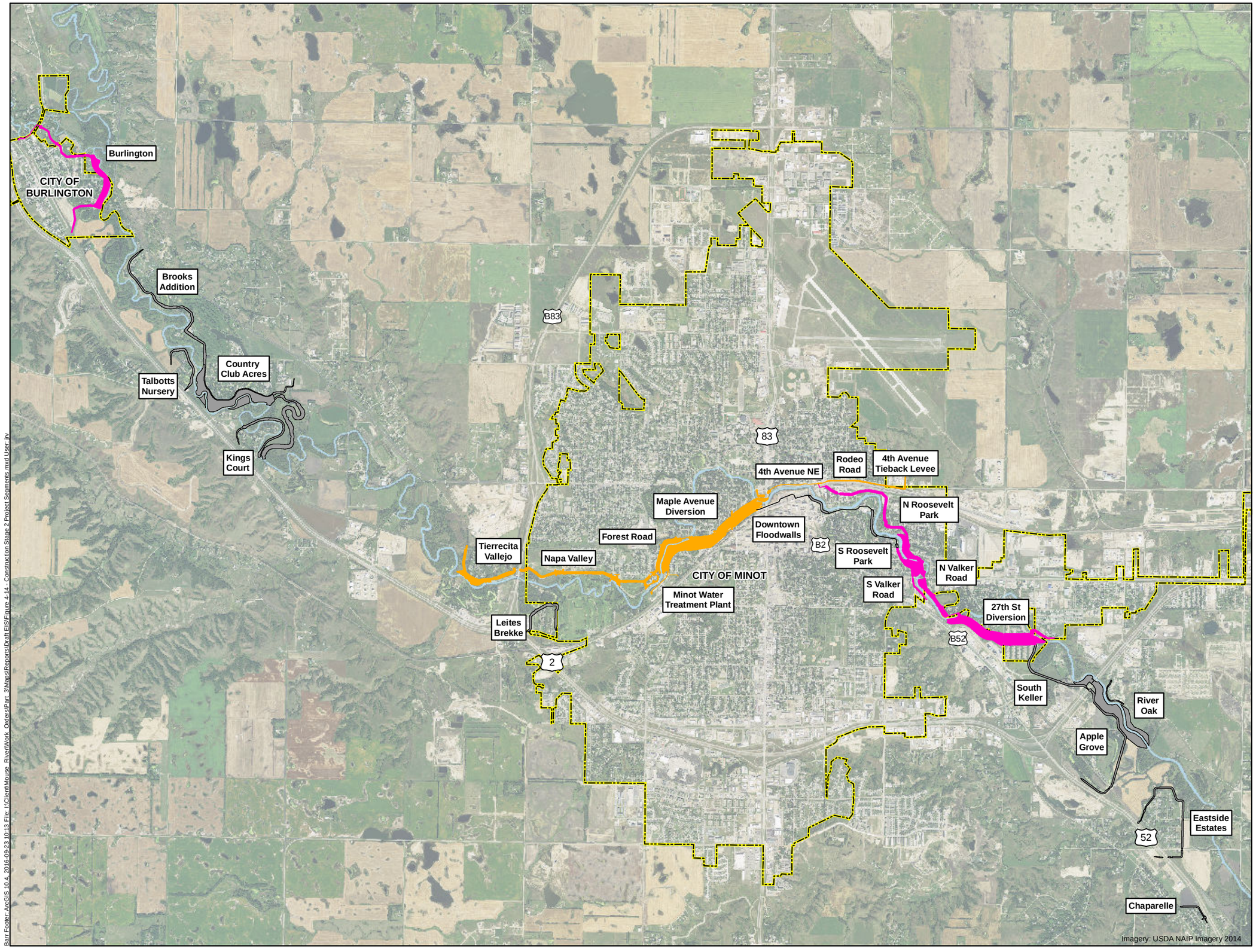
0 2,000 4,000 8,000

Feet

Figure 4-11

CONSTRUCTION STAGE 1.5
PROJECT SEGMENTS
Mouse River Enhanced Flood
Protection Project
Minot, North Dakota

Bar Footer: ArcGIS 10.4, 2016-09-23 10:13 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-13_Construction Stage 1.5 Project Segments.mxd User: jlv



Previous Construction Stages (1, 1.5)

Current Construction Stage (2)

Future Construction Stages (3,4)

Municipality

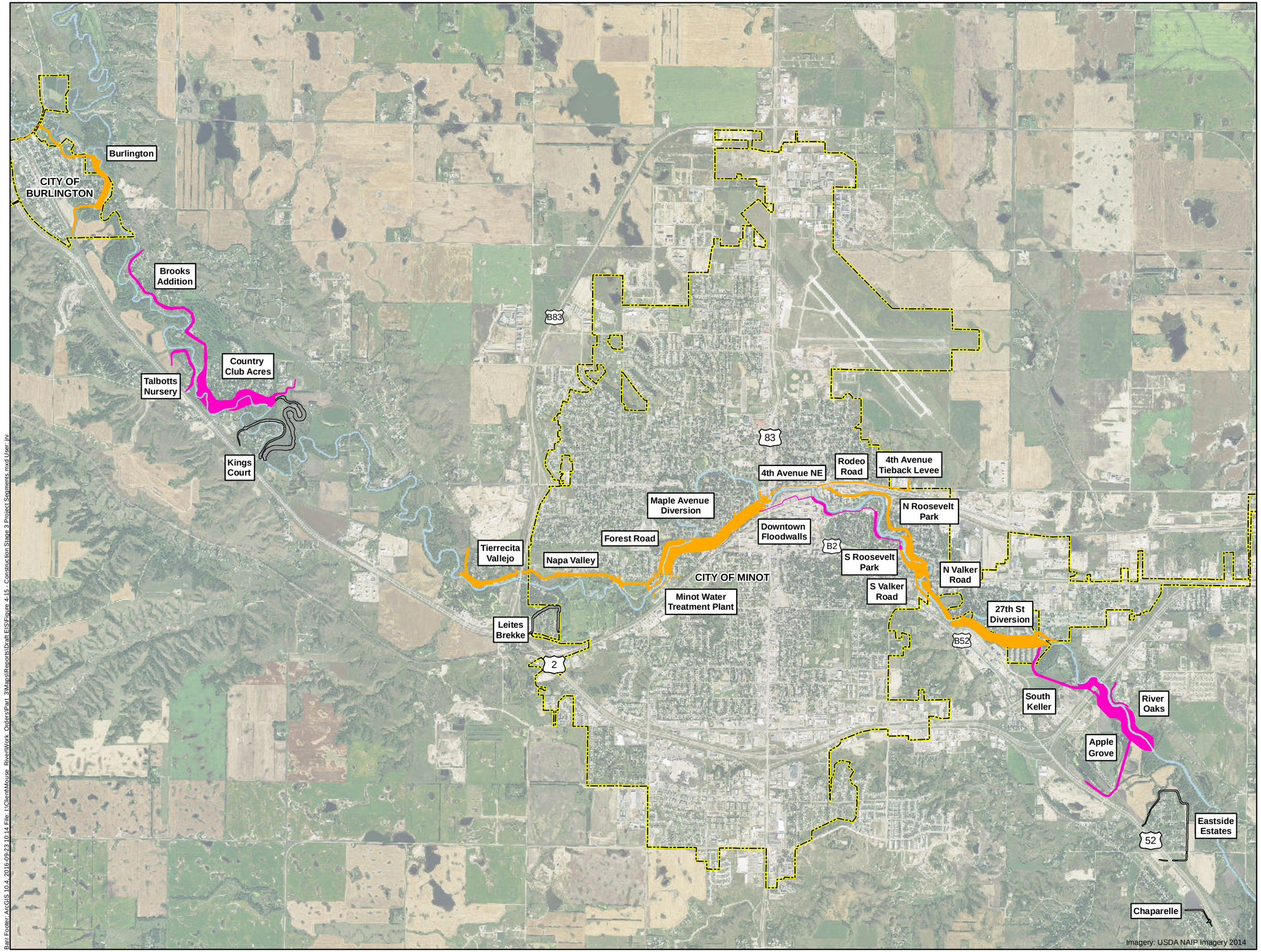
0 2,000 4,000 8,000

Feet

Figure 4-12

CONSTRUCTION STAGE 2
PROJECT SEGMENTS
Mouse River Enhanced Flood
Protection Project
Minot, North Dakota

Barr Foster: ArcGIS 10.4, 2016-09-23 10:13 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-14 - Construction Stage 2 Project Segments.mxd User: jrv



Previous Construction Stages (1, 1.5, 2)

Current Construction Stage (3)

Future Construction Stage (4)

Municipality

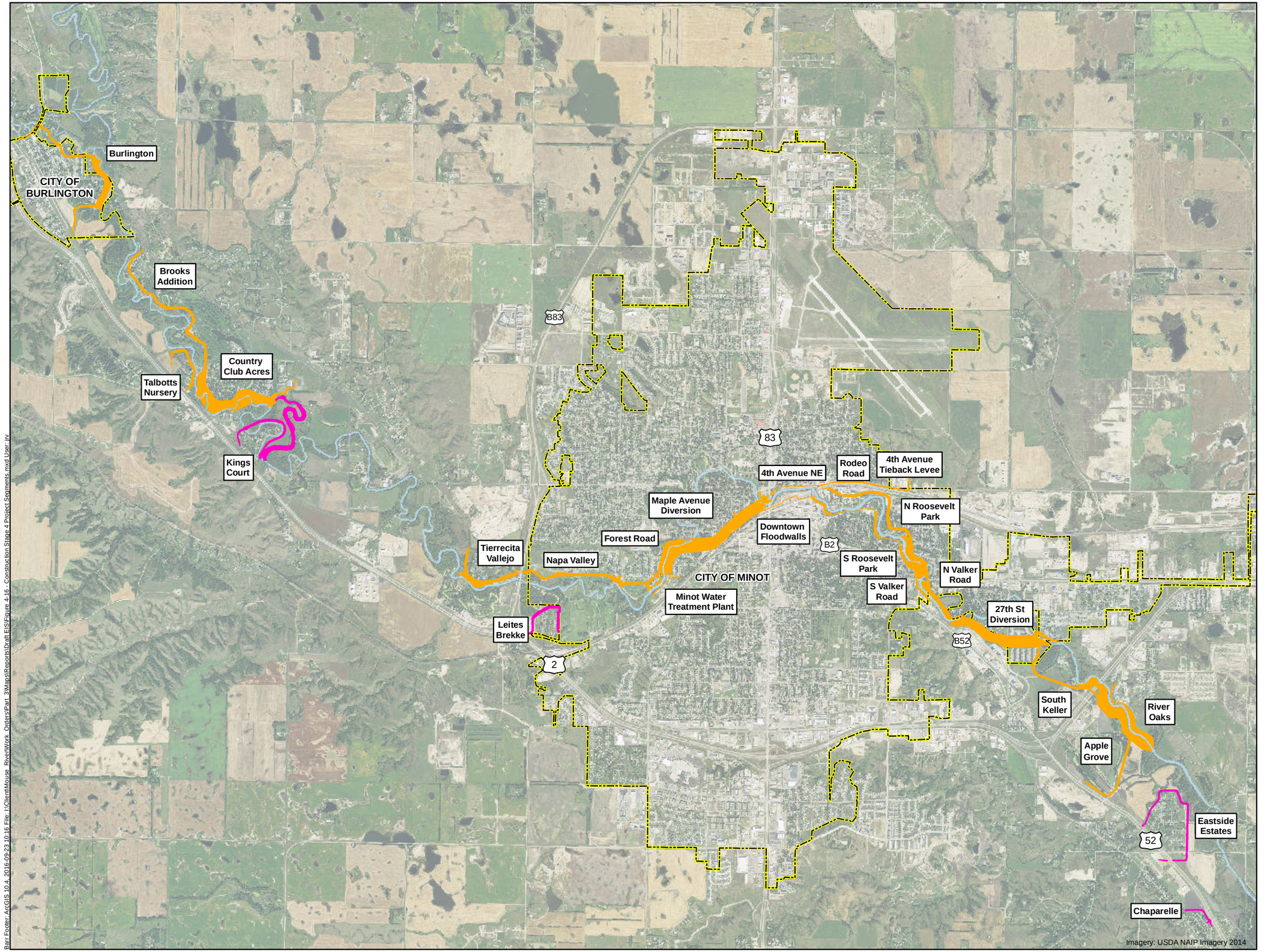
0 2,000 4,000 8,000

Feet

Figure 4-13

CONSTRUCTION STAGE 3
PROJECT SEGMENTS
Mouse River Enhanced Flood
Protection Project
Minot, North Dakota

Barr Footer: ArcGIS 10.4, 2016-09-23 10:14 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-15_Construction Stage 3 Project Segments.mxd User: jrv



Previous Construction Stages (1,1.5, 2, 3)

Current Construction Stage (4)

Municipality

0 2,000 4,000 8,000

Feet

Figure 4-14

CONSTRUCTION STAGE 4
PROJECT SEGMENTS
Mouse River Enhanced Flood
Protection Project
Minot, North Dakota

Barr Footer: ArcGIS 10.4, 2016-09-23 10:16 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-16 - Construction Stage 4 Project Segments.mxd User: jrv

4.13.2 Flood Events

Interim impacts were evaluated for the 5,000 cfs, 10,000 cfs and 27,400 cfs flood events. The 5,000 cfs flood event was selected because it is level to which the existing Souris River Basin Project provides protection without intervention, it is the FEMA effective 100-year (1-percent annual chance) flood flow for Ward County, and also because it is the maximum target discharge through Minot that governs releases from Lake Darling Dam and Canadian reservoirs during a flood fight. The 10,000 cfs event was selected because it is FEMA's proposed 100-year flood flow for Ward County as well as being the approximate flow to which the existing discontinuous levees can provide protection by filling the gaps. The 27,400 cfs flood event was selected because it is the flood of record and the design flood for the Requester's Preferred Alternative.

Models simulating flows of 14,000 and 20,000 cfs were also created as part of project development; however, the interim impacts at these flows were not appreciably different than the 10,000 cfs and 27,400 cfs events. Therefore, these model results are not presented in the EIS. Analysis of other flow rates are provided in the Basis of Design Report [reference [4]].

4.13.3 Interim Impacts to Flood Depth and Area of Inundation

The Requester's Preferred Alternative would progressively block off areas of the floodplain from inundation. Properties in these areas would have a reduced flood risk, but would also tend to increase the depth of flooding in other areas. Higher flooding would also cause waters to flow into areas that wouldn't flood under existing conditions. Inundation depth changes are shown in a series of maps provided in Appendix K. Table 4-13 list the six sets of inundation maps showing changes in depth with the Requester's Preferred Alternative in respect to the No-Action Alternative.

Table 4-13 No-Action Alternative: Interim Project Inundation Area and Depth Impacts Maps

Construction Stages	5,000 cfs	10,000 cfs	27,400 cfs
1	Map 5k Stage1	Map 10k Stage1	Map 27k Stage1
1.5	Map 5k Stage1.5	Map 10k Stage1.5	Map 27k Stage1.5
2	Map 5k Stage2	Map 10k Stage2	Map 27k Stage2
3	Map 5k Stage3	Map 10k Stage3	Map 27k Stage3
4	Map 5k Stage4	Map 10k Stage4	Map 27k Stage4

See Appendix K for maps

A series of maps, found in Appendix K, display the areas inundated and the areas that would be taken out of the floodplain and converted to dry land for each construction stage at 5,000 cfs, 10,000 cfs, and 27,400 cfs. Locations that would no longer be inundated, areas that would be inundated with water depths expected to be less than 0.1 feet, locations where the inundation depth increases by 0.1 feet to 0.5 feet, and locations where the inundation depth increases by more than 0.5 feet are represented on the maps. Table 4-14 summarizes the approximate number of structures that are located within each of these areas. The tables show how there would be few structures affected by the Project at 5,000 cfs.

Table 4-14 provides an order of magnitude estimate of the number of structures that would be affected by the Project after each construction stage. Structure counts were developed using LiDAR survey and aerial imagery. Counted structures include homes, businesses, garages, sheds, barns, and other outbuildings. The approximate number of affected structures are presented as a range because the number of structures in the project area changes regularly; there are on-going buyouts and the demolition of properties. The structure counts exclude structures that are located within the Project footprint and would need to be purchased prior to construction. There is also uncertainty associated with when a given structure would be flooded. The analysis assumes that the first floor elevation of structures is LiDAR based elevation at the centroid of the structure.

Table 4-14 No-Action Alternative: Summary of Inundation Changes for Structures

Inundation Changes by Peak Flood Flow (1)	Approximate number of structures inundated during construction of the Project				
5,000 cfs	**Construction Stage 1**	**Construction Stage 1.5**	**Construction Stage 2**	**Construction Stage 3**	**Construction Stage 4**
Less than 0.1 feet(2)	20 to 40	0 to 20	20 to 40	10 to 30	10 to 30
0.1 to 0.5 feet	0	0	0	0	0 to 10
More than 0.5 feet	0	0 to 10	0	0	0
No Longer Inundated	0	10 to 30	0	0 to 20	0 to 20
10,000 cfs	**Construction Stage 1**	**Construction Stage 1.5**	**Construction Stage 2**	**Construction Stage 3**	**Construction Stage 4**
Less than 0.1 feet(2)	140 to 160	50 to 70	40 to 60	50 to 70	30 to 50
0.1 to 0.5 feet	0 to 10	60 to 80	70 to 90	20 to 40	20 to 40
More than 0.5 feet	0 to 10	0 to 10	0 to 10	20 to 40	0 to 20
No Longer Inundated	0 to 10	20 to 40	20 to 40	40 to 60	80 to 100
27,400 cfs	**Construction Stage 1**	**Construction Stage 1.5**	**Construction Stage 2**	**Construction Stage 3**	**Construction Stage 4**
Less than 0.1 feet(2)	4440 to 4540	4910 to 5010	590 to 610	220 to 240	50 to 70
0.1 to 0.5 feet	920 to 940	60 to 80	60 to 80	70 to 90	60 to 80
More than 0.5 feet	120 to 140	50 to 70	700 to 720	50 to 70	50 to 70
No Longer Inundated	110 to 130	560 to 580	4280 to 4380	5240 to 5340	5430 to 5530

(1) Maps in Appendix K show the areas that correspond to the four different inundation change categories in this table.
(2) Flood elevation changes of less than 0.1 feet includes areas where the flood elevation decreases.

Interim impacts due to changes in inundation area and depth were also quantified. This portion of the interim impacts analysis calculated the number of acres that would be inundated for a given flood event in addition to the area that would no longer be inundated.

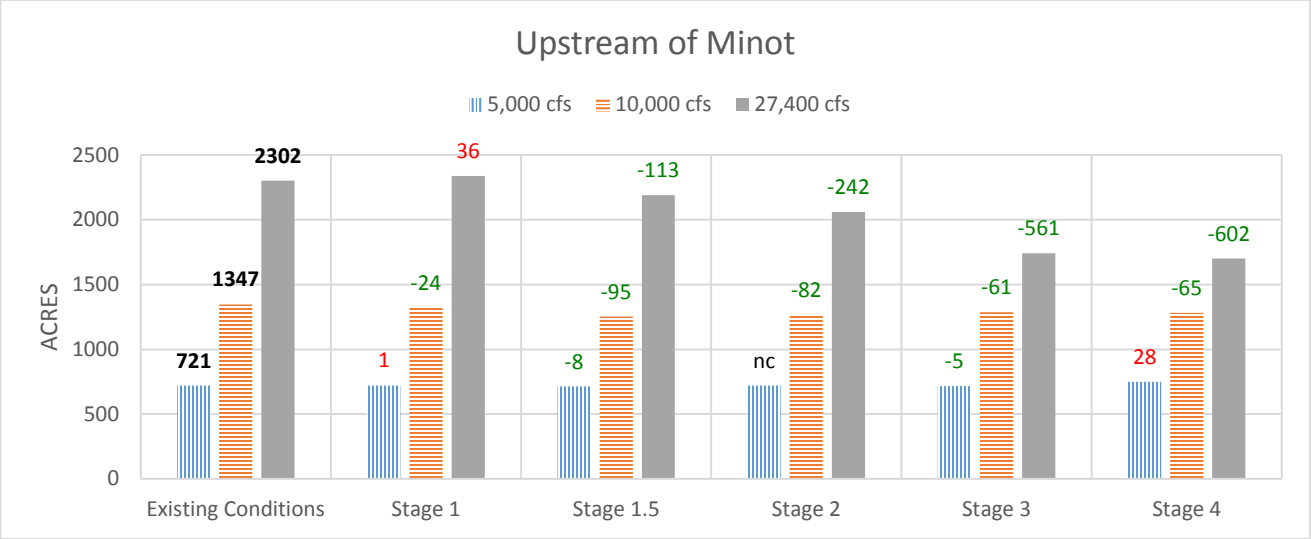
Inundation area changes were calculated for three geographic areas: Upstream of Minot, Minot, and downstream of Minot. Upstream of Minot is defined as areas upstream of the U.S. Highway 83 Bypass bridge to immediately upstream of the confluence of the Mouse and Des Lacs Rivers. Minot is defined as the area between the U.S. Highway 83 Bypass bridge and the U.S. Highway 2 bridge. Downstream of Minot is defined as the area between the U.S. Highway 2 bridge and just downstream of the Thirty-Seventh Avenue SE bridge.

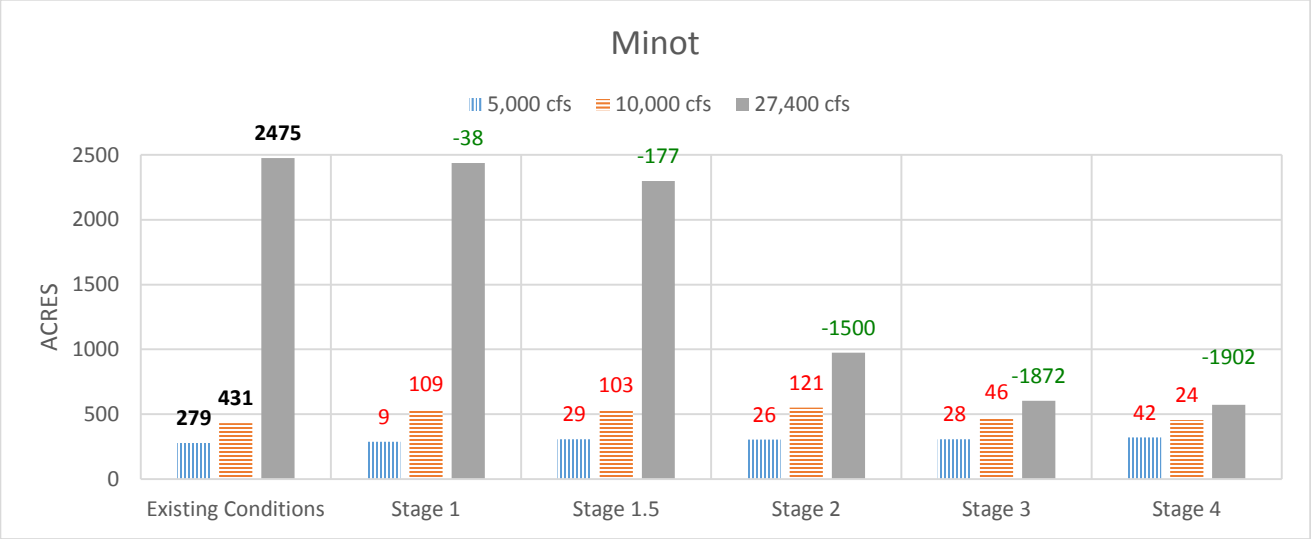
4.13.3.1 Impacts Upstream of Minot

There would be little change to the depth or area of inundation at 5,000 cfs upstream of Minot for any of the construction stages. This is because the Requester's Preferred Alternative levees and floodwalls would be constructed such that they would not restrict the 5,000 cfs flood event any more than the existing federal levees. The few inundation depth and area changes at 5,000 cfs would be associated with overbank excavation along the proposed levees and channel modifications near Kings Court.

There would be a net reduction in the inundation area at 10,000 cfs upstream of Minot between certain construction stages (Figure 4-15 and Figure 4-16). However, some areas upstream of Minot would be at an increased risk of flooding during interim stages that coincide with major flood events (Appendix K). While floods of this magnitude are unlikely (e.g., potentially a 100-year flood or greater), it's important to realize some areas could see a greater risk of flooding under such conditions during interim construction. Hydraulic modeling suggests some areas could see an increase in water elevations of up to a half-foot or more for floods at or above 10,000 cfs. Areas with the greatest risk are immediately upstream of the City of Minot, approximately between the U.S. Highway 83 bridge and King's Court. However, some areas just downstream of Burlington also could see an increased risk for flooding under later construction stages during the most significant floods. Please reference Appendix K for the locations upstream of Minot that may be at increased flooding risk.

n.c.: no change from existing conditions
5: inundation area increases by 5 acres compared to existing condition
-5: inundation area decreases by 5 acres compared to existing conditions





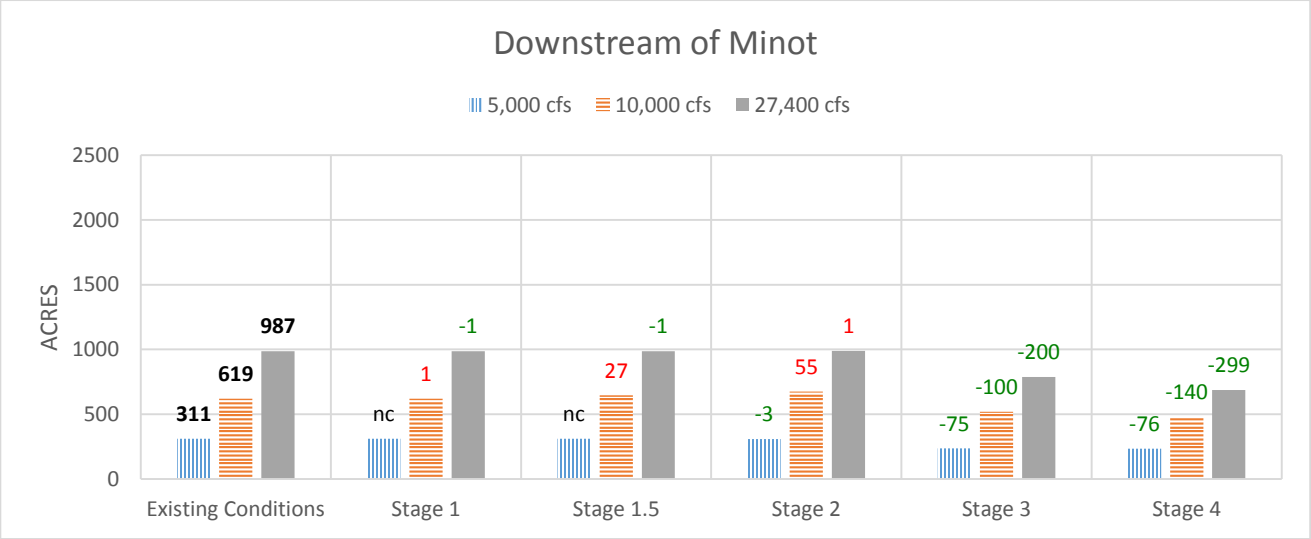
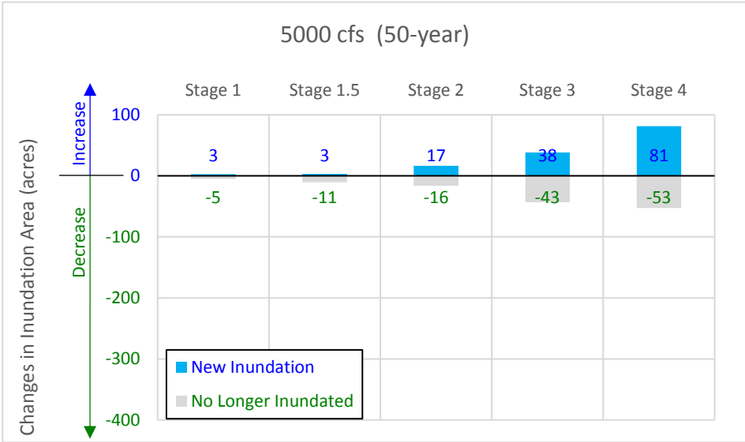


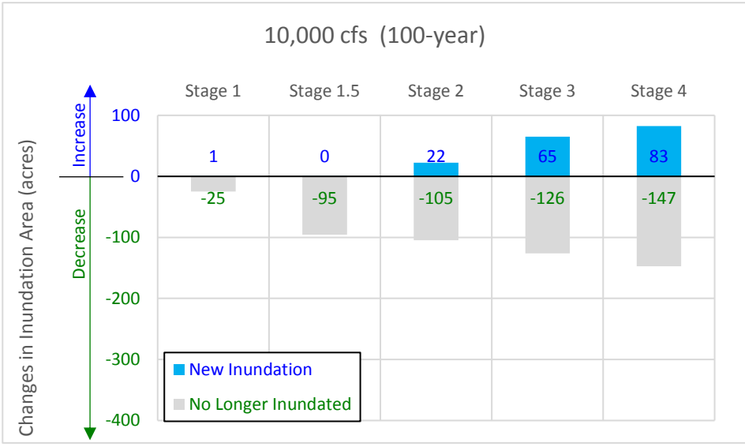
Figure 4-15 Net Inundation Area Changes Relative to No Action Alternative

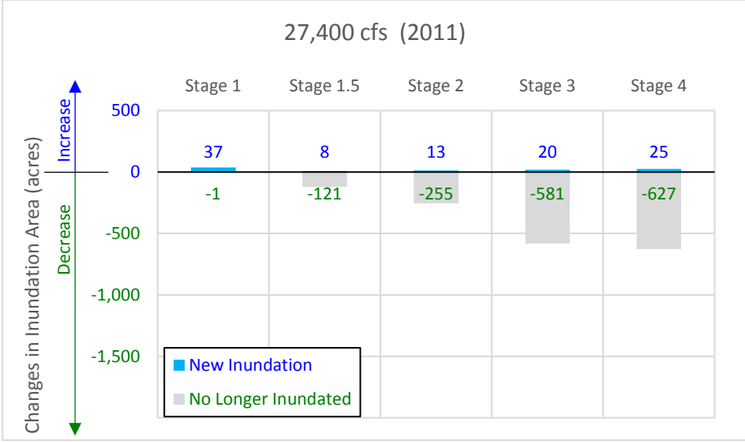
Inundation Area Changes - All Construction Stages

50-year, 100-year, 2011

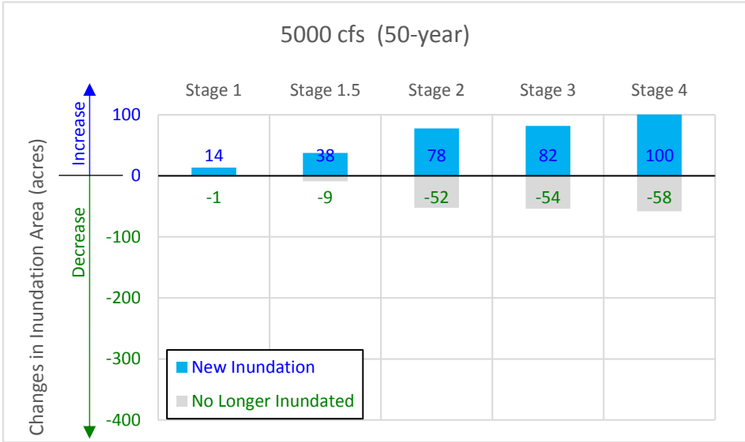
Upstream of Minot

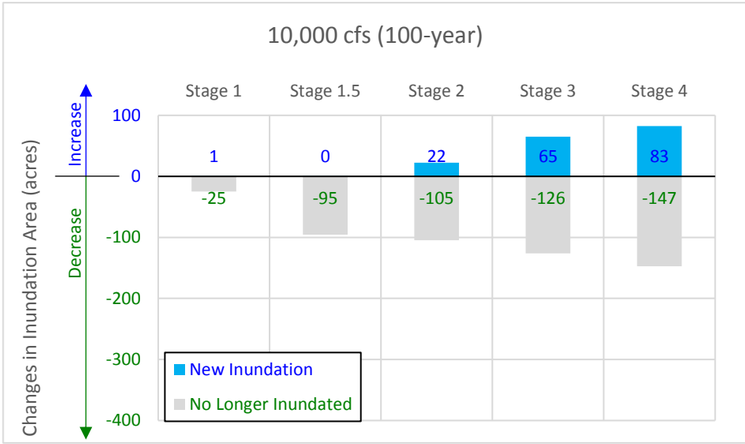


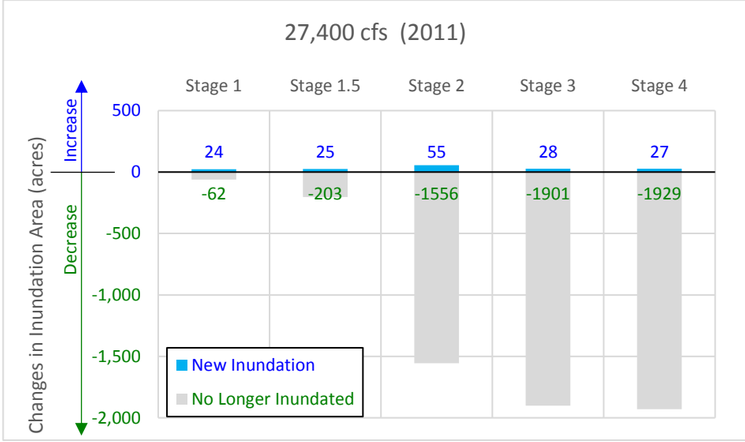




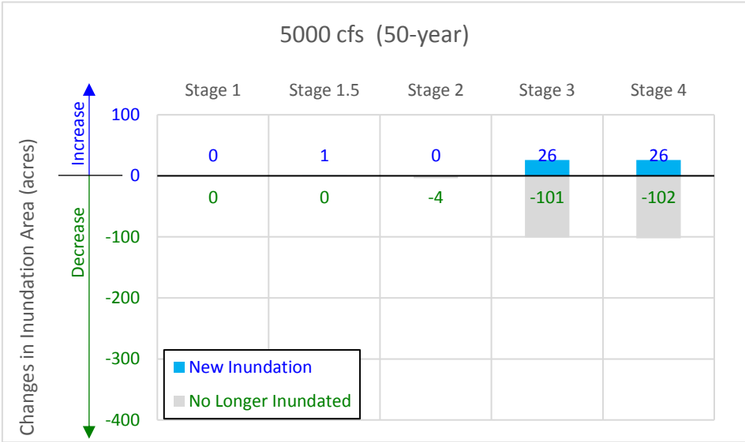
Minot

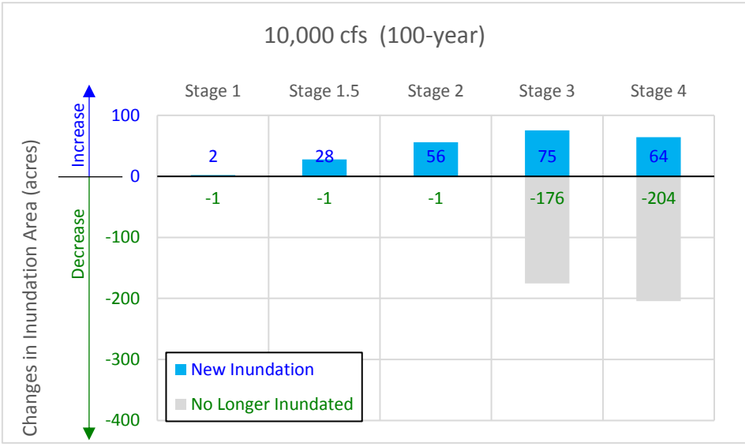






Downstream of Minot





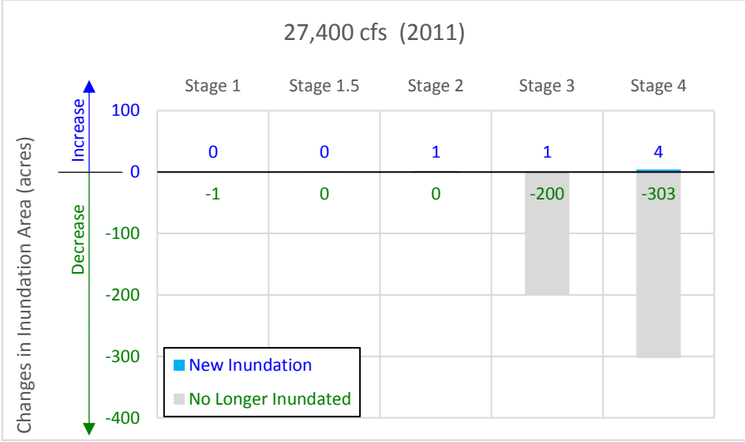


Figure 4-16 Net Inundation Area Impacts

4.13.3.2 Impacts in Minot

The total inundation area at 5,000 cfs within Minot changes little for the different interim construction stages. This is because flow is generally contained within the channel, and the levees and floodwalls for the Requester's Preferred Alternative would not restrict the 5,000 cfs flood event any more than the existing federal levees. The locations that are inundated would change in some areas primarily due to overbank excavation along proposed levees and channel modifications at Burdick Expressway.

The total inundation area at 10,000 cfs in Minot is roughly 430 acres for the No-Action Alternative (Figure 4-16). Successive construction stages would move levees further back from their existing locations resulting in an increase in acres of inundation.

Interim impacts become much more pronounced with major flood events above 10,000 cfs. The inundation area at 27,400 cfs in Minot would be slightly reduced after Construction Stages 1 and 1.5, and significantly reduced after Construction Stages 2 and 3 (Figure 4-16). The reductions in the inundation area would come as the Requester's Preferred Alternative completes independent levee systems. The Requester's Preferred Alternative would greatly restrict the available conveyance area for the 27,400 cfs flood which would increase the flood profile. While floods of this magnitude are unlikely, it's important to realize some areas could see a greater risk of flooding under such conditions during interim construction. Hydraulic modeling suggests some areas could see an increase in water elevations of up to 0.5-foot or more for floods of 27,400 cfs. Areas with the greatest risk are around the Souris Valley Golf Course, the neighborhood on the east side of the 2nd Avenue bridge, and the area south of the river near Roosevelt Park. However, interim flood risks would change greatly with construction stage (Appendix K).

4.13.3.3 Impacts Downstream of Minot

The inundation area at 5,000 cfs downstream of Minot would not be affected by Construction Stages 1, 1.5, and 2 because these stages would be constructed upstream. Construction Stages 3 and 4 would construct flood risk-reduction features downstream of the U.S. Highway 2 bridge. Some of the developments protected by Stages 3 and 4 do not have federal project levees, are more flood prone than the rest of the project area, and would otherwise flood at flows between 5,000 and 10,000 cfs.

The inundation area at 10,000 cfs downstream of Minot would increase after Construction Stages 1.5, 2, and 3 (Figure 4-16). The newly inundated areas are caused by an increase in the peak flow downstream of Minot for the 10,000 cfs event because temporary flood storage in the floodplain in Minot would be reduced. Construction Stages 3 and 4 would place flood risk-reduction features downstream of the U.S. Highway 2 bridge and would remove some areas from the 10,000 cfs floodplain. However, it's important to realize that some areas downstream of Minot would be at an increased risk of flooding during the construction process if a flood of this magnitude occurs. The location of elevated flood risk is dependent on flood size and the stage of Project construction (Appendix K). For example, the area of Apple Grove could see an elevated flood risk until the construction of Stage 3 which would protect much of this area. Eastside Estates could see an elevated risk until the construction of Stage 4. Additionally, under current tentative plans, not every structure downstream of Minot would be protected by Project features. Please

reference Appendix K for the locations downstream of Minot that may be at increased flooding risk between various construction stages.

4.13.4 Interim Impacts on Historic Structures

Interim impacts following completion of Construction Stage 1.5 (which includes Phases 1, 2 and 3 and Maple Avenue High-Flow Diversion, Tierrecita Vallejo, and the Tieback Levee) were evaluated to determine if changes in flood depth would impact previously identified historic structures within the survey areas or APE. Figure 4-17 and Figure 4-18 show identified historic districts and historic structures surveyed through the City of Minot CDBG-DR Program and identified historic structures surveyed through the Class III standing structure report for Phases 1, 2, and 3. The evaluation looked at the 100 year flood event (10,000 cfs) and 2011 flood event (27,400 cfs) for Construction Stage 1.5 as compared to the No-Action Alternative. In addition to areas identified as being no longer flooded, Figure 4-17 and Figure 4-18 depict flood depth categories ranging from flood elevation changes of less than 0.1-foot to flood elevation increases greater than 0.5-feet.

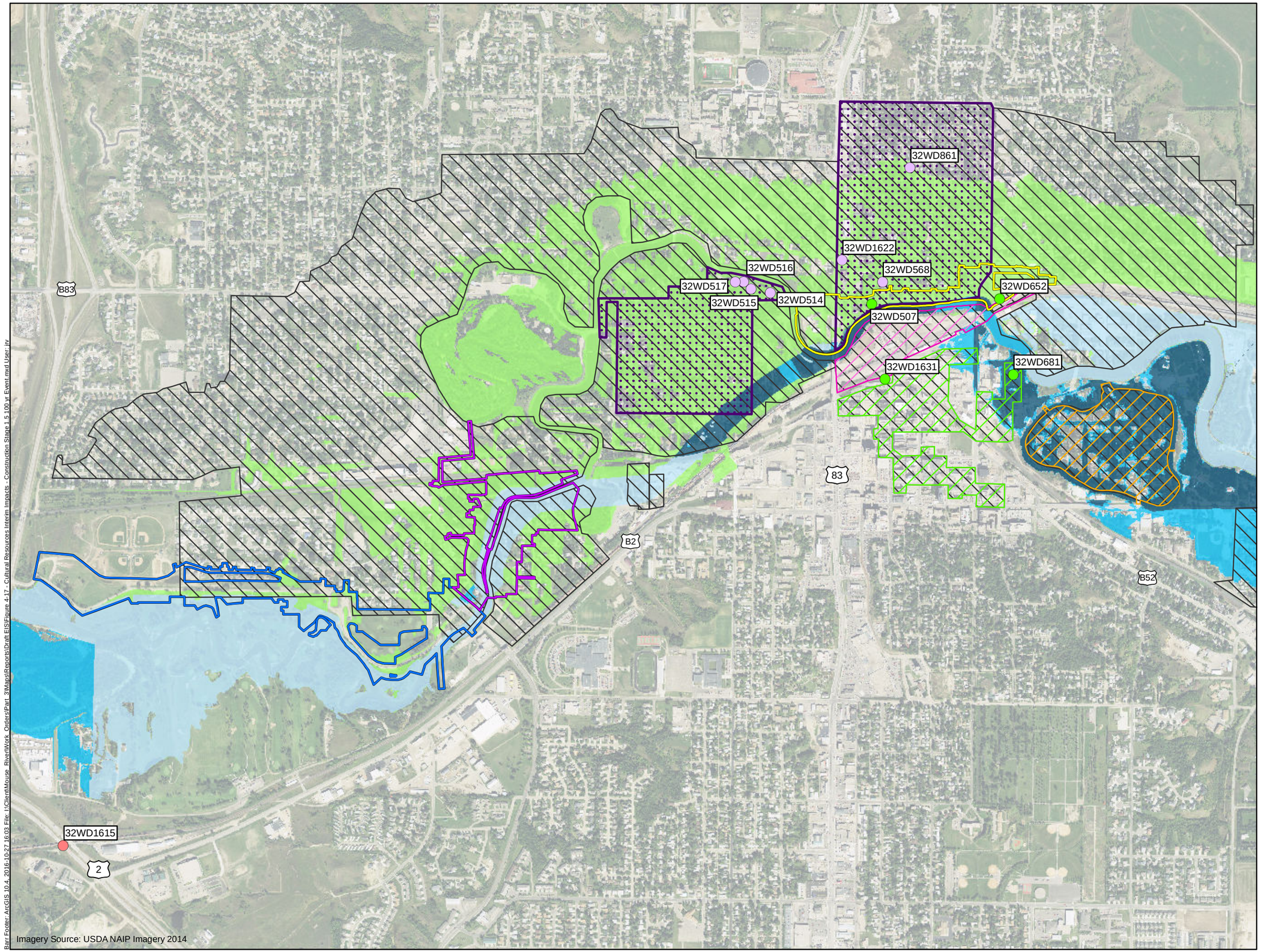
Eleven historic structures (Table 4-15) and three historic districts (Eastwood Park Historic District, Minot Industrial Historic District, and the Minot Commercial Historic District) were identified within Construction Stage 1.5. Potential interim impacts associated with a 100 year flood event for Construction Stage 1.5 (Figure 4-17) indicate the eleven historic structures and the Minot Industrial Historic District are located in areas that would no longer flood or are outside the limits of a flood event of this magnitude. The northeast sector of the Minot Commercial Historic District and most of the Eastwood Park Historic District would experience flood elevation increases greater than 0.5 feet.

Potential interim impacts associated with a 2011 flood event at Construction Stage 1.5 (Figure 4-18) indicate that eleven historic structures and Eastwood Park Historic District are located in areas that would experience less than a 0.1-foot flood increase or are outside the limits of a flood event of this magnitude. The entire Minot Industrial Historic District and a small portion of the northwest corner of the Minot Commercial Historic District would experience flood inundation levels greater than 0.5-foot increase. The remaining area of the Minot Commercial District is outside the limits of a flood event of this magnitude.

Table 4-15 Previously or Previously Listed, Recommended Eligible or Potentially Eligible Properties

SITS No.	Address	Feature	NRHP Status
32WD568	414 1st St. NW	Dwelling, Single Unit	Recommended Individually Eligible
32WD507	103 4th Ave. NW	Dwelling, Single Unit	Recommended Individually Eligible
32WD514	422 4th Ave. NW	Dwelling, Single Unit	Recommended Individually Eligible
32WD515	426 4th Ave. NW	Dwelling, Single Unit	Listed
32WD516	504 4th Ave. NW	Dwelling, Single Unit	Recommended Individually Eligible
32WD517	510 4th Ave. NW	Dwelling, Single Unit	Listed
32WD1622	120 5th Ave. NW	Church Complex and Cemetery	Recommended Eligible
32WD861	812 Main St. N	Church, Catholic	Recommended Individually Eligible
32WD652	400 3rd St. NE	Minot Mill	Recommended Individually Eligible
32WD681	25 5th St. NE	Dwelling, Single Unit	Listed
32WD1631	Varies	Soo Line Railroad	Recommended Individually Eligible

Data based on City of Minot CDBG-DR Program and MREFPP Cultural Resources Inventories



Construction Phase 1

Construction Phase 2

Construction Phase 3

City of Minot CDBG - DR Program Cultural Resources Study Areas

MREFPP Cultural Resources Class I (Structures)

MREFPP Cultural Resources Class III (Structures)

CDBG HUD Disaster Recovery Program

Eastwood Park Historic District

Minot Industrial Historic District

Minot Commercial Historic District

Previous SHPO Cultural Resources Survey Areas

Interim Impacts (Construction Stage 1.5 - 100yr Flood Event)

Flood Elevation Change Less Than +0.1 Ft

Flood Elevation Increase Between 0.1 Feet and 0.5 Ft

Flood Elevation Increase Greater Than 0.5 Ft

Area No Longer Flooded

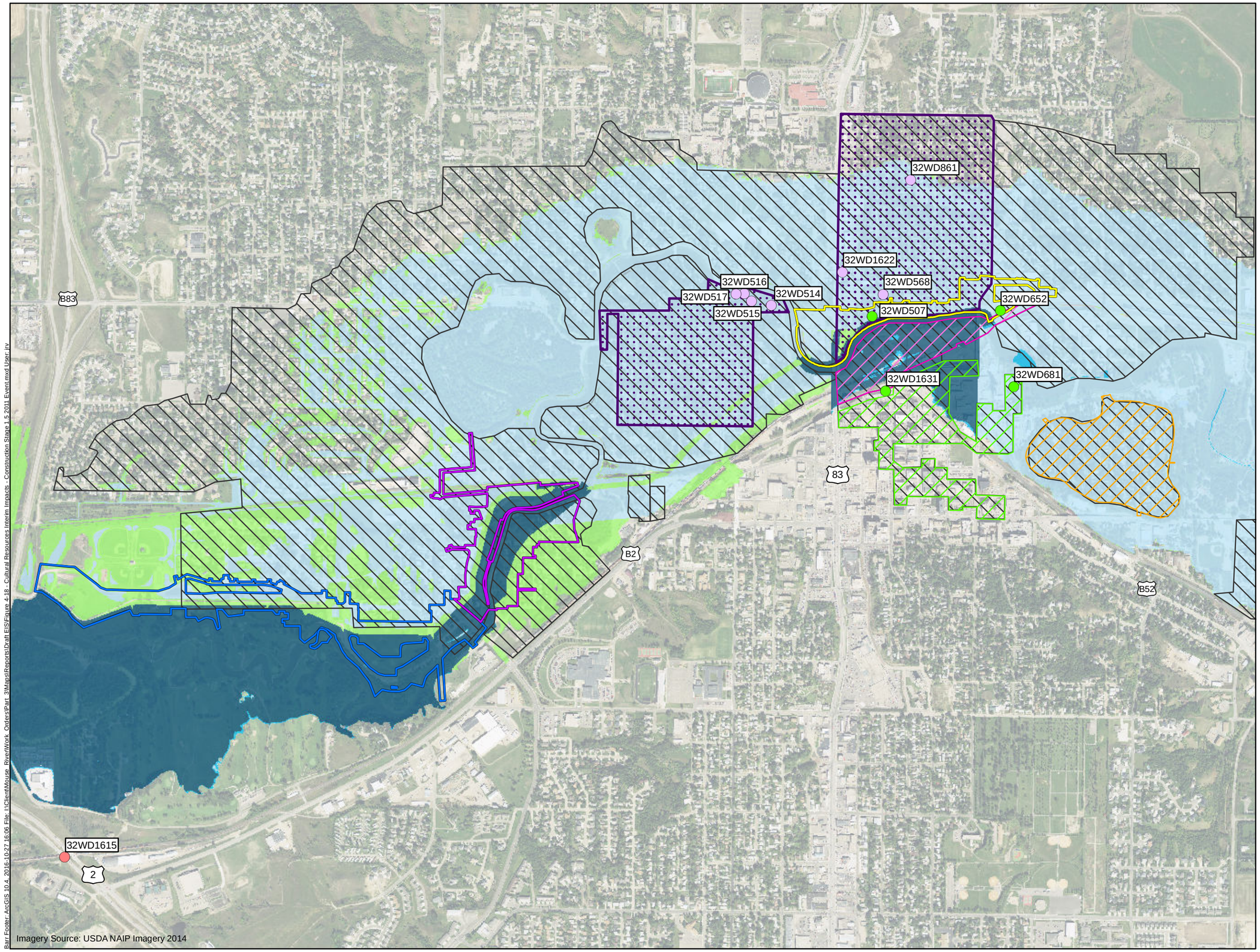
0 600 1,200 2,400

Feet

Figure 4-17

CULTURAL RESOURCES INTERIM IMPACTS CONSTRUCTION STAGE 1.5 100 YEAR FLOOD EVENT Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 16:03, File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-17_Cultural Resources Interim Impacts_Construction Stage 1.5 100 yr Event.mxd User: jrv



Construction Phase 1

Construction Phase 2

Construction Phase 3

City of Minot CDBG - DR Program Cultural Resources Study Areas

MREFPP Cultural Resources Class I (Structures)

MREFPP Cultural Resources Class III (Structures)

CDBG HUD Disaster Recovery Program

Eastwood Park Historic District

Minot Industrial Historic District

Minot Commercial Historic District

Previous SHPO Cultural Resources Survey Areas

Interim Impacts (Construction Stage 1.5 - 2011 Flood Event)

Flood Elevation Change Less Than +0.1 Feet

Flood Elevation Increase Between 0.1 Feet and 0.5 Feet

Flood Elevation Increase Greater Than 0.5 Feet

Area No Longer Flooded

0 600 1,200 2,400

Feet

Figure 4-18

CULTURAL RESOURCES
INTERIM IMPACTS
CONSTRUCTION STAGE 1.5
2011 FLOOD EVENT
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 16:06 File: I:\Client\Minot_RiverWork_Orders\Part_3\Maps\Reports\Draft EIS\Figure 4-18 - Cultural Resources Interim Impacts - Construction Stage 1.5 2011 Event.mxd User: jrv

5.0 Agency and Public Involvement

Agency coordination and public involvement have been ongoing throughout the development of the Project, as further described below.

5.1 Agency Coordination

Agency coordination on the Project has been ongoing since early 2012, when the PER was being developed. A Scoping Document was developed during the preparation of the EIS. The Scoping Document summarized comments received from both public agencies and other stakeholders during the Project definition and scoping process (Appendix A). Agency coordination that has taken place as part of the development of this EIS is summarized in the following sections.

5.1.1 Pre-application Permitting Meeting

A Section 404 pre-application meeting was held with the USACE and members of the requester's team on October 1, 2014, to review estimated impacts from Phases 1, 2, and 3 of the Requester's Preferred Alternative and to seek guidance on what the USACE would be looking for in a complete Section 404 permit package. Field surveys for wetlands or other waters, threatened and endangered species, nesting migratory birds, or cultural resources had not been completed at the time of this meeting. Instead, the survey approach for each of these resources was discussed.

The USACE advised that a clearly defined Project purpose and need would be important in the Section 404 permit application, as well as an evaluation of the Least Environmentally Damaging Practicable Alternative. The attendees reviewed potential mitigation measures, including those for wetlands in overbank excavation areas and for managing existing dead loops within Minot.

5.1.2 Cooperating Agencies

In accordance with 40 CFR 1501.6, the USACE contacted several state and federal agencies on April 3, 2015, to notify them of the April 8 and 9, 2015, public meetings for the Project and to seek interest as cooperating agencies for the EIS. The agencies contacted included the EPA, FEMA, USFWS, and NDGF. Both the EPA and USFWS expressed interest in serving as cooperating agencies for the Project, but noted staff availability would make full participation difficult. As such, no cooperating agreement was formalized between the USACE and another agency. However, the USACE did coordinate with both agencies on key issues where their expertise provided value in the development of this EIS. For example, EPA has been involved with review and preliminary comment on Environmental Justice considerations within the EIS. The USACE also coordinated with the USFWS about potential concerns associated with the Fish and Wildlife refuges found upstream and downstream of the Project, as well as potential Endangered Species Act issues associated with a borrow site under consideration for the Project."

5.1.3 Consultation Meetings

An agency consultation teleconference meeting was held on January 29, 2015, to provide agencies with Project status updates. Twenty-two people, representing 10 agencies and the requester's team, attended

the meeting. During this meeting, an overview of the Project and PER process was given, followed by a description of the consultant teaming arrangement for design, environmental review, and permitting. The group discussed the purpose and need for the Project, key potential environmental impacts, and federal actions/NEPA triggers.

Potential environmental impacts discussed included those on wetlands/waterbodies, floodplains, channel realignment and high-flow bypasses, flow velocities and bank erosion, contaminated soils/cleanup, cultural resources, recreation (including fisheries), and migratory birds. Indirect impacts, mitigation, and identification of borrow sources were also discussed. The Section 408 process and the need for a Section 404 permit were identified as the federal actions that trigger review under NEPA. The meeting concluded with a discussion of the environmental review process and tentative Project schedule.

An agency scoping meeting was held on May 27, 2015, in Bismarck, North Dakota. The purpose of this meeting was to solicit specific comments and concerns regarding the Project from resource agencies. Twenty-four people, representing 11 agencies and the requester's team, attended the meeting. In this meeting, the USACE recommended that the No-Action Alternative with flood fighting be added to the requester's ongoing analysis looking at the no flood fight conditions. In addition, FEMA reviewed their CLOMR requirements with the group. Channel realignment and the proposed high-flow bypasses were also discussed. Other agency concerns included downstream erosion as a result of changed velocities, threatened and endangered species, fish and wildlife habitats, low-income housing areas, downstream effects on agriculture/ranching, and cultural resources. During this meeting potential mitigation measures were also identified.

5.1.4 Alternatives Analysis Meeting

USACE staff met with members of the requester's team on October 27, 2015, to review alternatives considered in this EIS document. During this meeting, the group reached consensus on which alternatives should be considered and which alternatives should be studied in additional detail. The Purpose and Need Statement submitted by the Requester included flood risk reduction for an event similar to that experienced in 2011 regardless of where it should occur in the basin. It was determined that if the 2011 event occurred in particular locations in the basin that there would be no time to execute emergency flood fighting (though unlikely). Therefore, a No-Action Alternative with no flood fighting was also evaluated. Given the unlikelihood of a flood event with no flood fighting, this analysis is provided as an appendices to the main document (Appendix K).

5.1.5 Workgroup Meetings

The USACE developed agency workgroups for several key environmental resource topics, including fish and wildlife resources, cultural resources, environmental justice, floodplains, and wetlands. Agency workgroups corresponded as needed to share information or gain input when questions about a specific resource arose.

The fish and wildlife workgroup met on November 24, 2015, to discuss erosion protection methods incorporated into Phases 2 and 3 of the Requester's Preferred Alternative. During this meeting, an

overview of erosion protection design considerations (including modeling efforts, design guidelines, and velocity summaries) was provided, followed by design measures proposed to control erosion. Design elements discussed included levee and bank protection through use of traditional riprap, buried riprap, turf reinforced matting, natural bank protection, and launchable riprap.

The cultural resources workgroup met on December 22, 2015, to review the results of the cultural resource investigations and to discuss the development of a Programmatic Agreement (PA) between the USACE and SHPO to address the Project's cultural resources impacts. The use of the PA as a tool to cover effects that cannot be fully determined in advance of the undertaking and non-Federal parties being delegated major responsibilities.

The floodplain working group met on January 21, 2016, with representatives of the USACE, FEMA, and NDSWC. The purpose of this meeting was to discuss coordination of the Project and the regulatory programs related to the regulatory floodplain and floodway. Topics included a summary of hydrologic modeling; residual floodplain mapping; CLOMR/LOMR and other permitting requirements; and Section 408 coordination.

5.2 Public Involvement

5.2.1 Public Scoping Meetings

The Burlington Public Scoping Meeting took place April 8, 2015, at the Burlington-Des Lacs Elementary School, and was attended by nine members of the public and 17 requester and federal agency representatives. This meeting used an open-house format, followed by presentations from a requester representative and from USACE representatives. Following the presentations, questions and comments were taken from the public. Key public concerns included modifications to the Colton Avenue bridge, existing levee inspection and repair, keeping the public informed on Project progress, and the schedule for Project completion.

The Minot Public Scoping Meeting took place April 9, 2015, at the Minot Municipal Auditorium, and was attended by 41 members of the public and 20 requester and federal agency representatives. The meeting used an open-house format, followed by presentations from a requester representative and from USACE representatives. Following the presentations, members of the public were divided into small groups based on randomly assigned numbers. Each small group identified items of concern, with individual group members ranking which items were the most important to them. Results from each small group were then shared with the larger group. Each participant then ranked items from any of the small groups that were most important to them. The meeting concluded with the USACE summarizing the overall rankings, and questions and comments were taken from the public. Key public concerns included Souris River management, the Project's influence on flood insurance, cost-benefit analysis of Project alternatives, and the schedule for Project permitting and construction.

An additional Public Scoping Meeting took place August 19, 2015, at the Minot Municipal Auditorium, after the Notice of Intent was published in the Federal Register announcing that the USACE would be preparing an EIS for the Project. Forty-one members of the public and seven requester and federal agency

representatives were in attendance. This meeting used an open-house format, followed by presentations from a requester representative and from USACE representatives. Following the presentations, questions and comments were taken from the public. Key public concerns included changes in reservoir operations, the Project's influence on flood insurance, schedule for Project permitting and construction, and Project funding sources.

In addition, the SRJB held numerous public meetings during development of the PER and has solicited and responded to thousands of comments and questions dating back to 2011. Comments collected at these meetings were also considered during preparation of this EIS.

5.2.2 Neighborhood Meetings

On June 30, 2015, the SRJB and Minot hosted a neighborhood meeting for Napa Valley and Forest Road residents. The purpose of this meeting was to update residents on the status of the Project, especially on features proposed for those neighborhoods. The meeting was held at Perkett Elementary School and began with an open house to review planned features of the Requester's Preferred Alternative in the neighborhoods. Maps and an aerial fly-through video of the Requester's Preferred Alternative were displayed, and a formal presentation was given by the engineering team. The public was invited to ask questions after the presentation, and comment cards were available for those who wished to provide written comments. The majority of the comments focused on dam management, funding sources, residential buyouts, and flood insurance. Approximately 160 residents attended this meeting, along with SRJB members, Minot staff and representatives, and members of the engineering team.

On November 9, 2015, the SRJB and Minot hosted a neighborhood meeting for the Fourth Avenue Floodwall residents. The purpose of this meeting was to update residents on the status of the Project, especially on features proposed for that neighborhood. The meeting was held at the McKinley Elementary School Gymnasium and began with an open house. Maps and an aerial fly-through video of the Requester's Preferred Alternative were displayed, and a formal presentation was given by the engineering team. The public was invited to ask questions after the presentation, and comment cards were available for those who wished to provide written comments. The majority of the comments focused on roadway modifications, the purpose of the storm sewer lift station, and the floodwall's effect on pedestrian access to the nearby footbridge. Approximately 120 residents attended this meeting, along with SRJB members, Minot staff and representatives, and members of the engineering team.

6.0 Major Findings and Conclusions

This EIS has analyzed the effects of the Requester's Preferred Alternative on natural and cultural resources, land use and infrastructure, socioeconomics, recreation, aesthetics, and air and noise quality. In general, the construction activities of the Requester's Preferred Alternative would have some permanent adverse impacts and many temporary adverse effects to these resources. However, long-term permanent changes would substantially reduce or prevent numerous adverse effects brought about by flooding. This is true for both the Requester's Preferred Alternative alone and for the Requester's Preferred Alternative in conjunction with other past, present and foreseeable future projects in the area. This section presents these major findings.

6.1 Requester's Preferred Alternative and Other Alternatives

Several alternatives and combinations of alternatives were considered in developing the Requester's Preferred Alternative, including upstream flood storage, major upstream diversion channels, local site diversion channels, high-flow bypasses, channel modifications, floodproofing, relocations/buyouts, and additional floodplain regulations. Alternatives were eliminated for one or more of the following reasons: ineffectiveness at 27,400 cfs, political infeasibility, engineering infeasibility, significant environmental impacts, and cost. The Requester's Preferred Alternative was able to fulfil all criteria listed in the purpose and need for the Project and is being proposed for construction by the SRJB.

6.2 Geology, Soils, and Groundwater

The Requester's Preferred Alternative would not affect geologic or groundwater resources. Construction could temporarily adversely affect soils in the impact area, including prime farmland, in several ways, including increasing the potential for erosion, compaction, loss of productivity, and contamination from leaking equipment. BMPs, however, would be used to mitigate these effects. Overall, the Requester's Preferred Alternative would have a minor and temporary adverse effect on soils in the project area.

The No-Action Alternatives would result in no direct effects to geologic, soil, or groundwater resources. Soils would be temporarily affected by inundation, but the effects would not be permanent. Flooding could have temporary adverse effects on prime farmland, depending on the timing and severity of the flooding, such as diminished yields or loss of one season's crop. Flooding is not expected to permanently affect prime farmland.

6.3 Surface Waters

The Requester's Preferred Alternative would temporarily affect the Souris River because construction activities like vegetation clearing, grading, excavation, and soil stockpiling would cause localized physical disturbances. Project features like overbank excavation and riprap placement would require that work be done below the Souris River's OHWM, which would permanently affect the Souris River. Other permanent effects would include realigning the river channel in select areas, which would alter the course of the river or create cutoff channels. Permanent impacts to the river would be subject to permitting and mitigation as appropriate.

The Requester's Preferred Alternative is expected to temporarily affect wetlands by causing sedimentation and ground disturbances, and to permanently affect wetlands where project features are constructed directly in wetland areas. Unavoidable wetland impacts would seek permitting and mitigation as appropriate.

The No-Action Alternative would not directly affect surface waters. The Souris River channel would continue to overtop existing levee systems during large flood events. The No-Action Alternative could temporarily affect wetlands if flood fighting measures required placement of fill in wetland areas.

6.4 Biological Resources

There are six federally endangered, threatened, or candidate species known to occur in Ward County. Of these, there is potential habitat in the project area for the Dakota skipper and northern long-eared bat. Preventative measures would be taken to avoid any direct impacts to the northern long-eared bat. Options to avoid impacts to the Dakota skipper are currently being evaluated. Few, if any, of the 100 North Dakota Species of Conservation Priority are typically associated with the developed and artificial cover types that typify the project area.

The Requester's Preferred Alternative features constructed within the Souris River channel, floodplain, or floodway could permanently and temporarily alter existing fish habitat and passage through changes in flow, substrate, composition, and the direct elimination of habitat.

The Requester's Preferred Alternative would both temporarily and permanently affect plant communities in the project area. These effects would be both adverse and beneficial and would include removal of existing plant communities, including up to 65 acres of land with forest or moderate tree cover. Indirect impacts on vegetation would include alteration of hydrology, nutrient inputs and sediment deposition within existing vegetation communities, and changes in the spread and abundance of non-native plant species. The type and magnitude of indirect impacts on plant communities would vary widely with location. Impacts could be either improve or degrade plant communities depending on the existing composition ecological function, as many areas are of low quality or primarily non-native species.

Under the No-Action Alternative, high-water events would continue to affect vegetation communities and could potentially include loss of trees and shrubs due to high flow velocity or prolonged inundation. Wildlife species in the project area would be periodically displaced, and fish species would also temporarily relocate during high-flow events to slower backwaters. The No-Action Alternative would have little or no direct or indirect effect on federal- or state-listed species, or state Species of Conservation Priority, as these species are not known to occur in areas impacted by flooding.

6.5 Land Use and Infrastructure

6.5.1 Land Use

The Requester's Preferred Alternative, by converting land for flood risk reduction, could permanently affect existing agricultural, commercial, industrial, residential, and recreational land use. Construction, operations, temporary work easements, and staging of equipment would have minor, temporary, adverse

effects, particularly through detours and disrupted access to residential, recreational, commercial, or industrial properties. The Requester's Preferred Alternative would create substantial permanent benefits by sustaining and encouraging use of land in the project area, and by creating a greenway along the river that would be a community asset and provide recreational opportunities.

The No-Action Alternative would not change zoning, land use, and development within the project area. In flood events under 10,000 cfs, the existing project, along with emergency flood fighting, would keep most flood water contained. Flood events over 10,000 cfs would overtop levees, resulting clean up and restoration at residential, commercial, industrial, institutional, and recreational properties could last weeks or even months. In agricultural areas, flood events of this magnitude could result in erosion and sedimentation and could disrupt seasonal crop production. Flood impacts of an event of 27,400 cfs would significantly and adversely affect existing and potential land use. Impacts described for a 10,000 cfs would be further intensified with a flood of 27,400 cfs. Buildings, infrastructure, and agricultural land could become too costly to repair or unproductive resulting in the abandonment of the current land use.

6.5.2 Infrastructure

The Requester's Preferred Alternative would significantly improve the flood risk-reduction infrastructure in the project area. It would permanently and significantly benefit the roadway network, allowing transportation of essential goods and services and facilitating emergency response during flood events. Temporary transportation disruptions would occur during construction, but would be mitigated with proper signage, detours, and rerouting. The Requester's Preferred Alternative would also significantly benefit both public and private utilities by providing greater flood resilience, upgraded stormwater management, and improved infrastructure.

Under the No-Action Alternative, infrastructure in areas that have experienced flooding in the past would continue to suffer flood damage in the event of a flood. A flood event of 5,000 cfs would not affect infrastructure, because the existing federal project would protect areas from flows up to this level. Under the No-Action Alternative, emergency flood risk features and levees would be overtopped with flows over 10,000 cfs, and floods would disrupt access and services, damage infrastructure, and hamper subsequent clean-up and repair efforts. A flood event of 27,400 cfs would significantly and adversely affect infrastructure, especially in Burlington and in central and west-central Minot. Long-term disruptions and destruction of infrastructure would have regional and statewide effects.

6.6 Contaminated Sites

Based on the results of the Hazardous, Toxic, and Radioactive Waste (HTRW) assessment, numerous sites in the project area contain hazardous materials and petroleum products or have other environmental concerns. Potential impacts associated with these existing sites could be caused by with construction of the Requester's Preferred Alternative by disturbing contaminated soil or groundwater, demolishing buildings containing hazardous materials, and excavating debris in fill soil.

A limited Phase II investigation was conducted in the Fourth Avenue NE segment (Phase 1) to evaluate soil and groundwater conditions. Petroleum-related constituents exceeding the Guidelines for the Assessment

and Cleanup of Saltwater Releases – Groundwater Cleanup Standard would be pumped out for temporary dewatering during construction and discharged to the Souris River (reference [83]). The discharge would not exceed water quality standards but would add low levels of contaminants to the river.

The No-Action Alternative would not directly affect potentially contaminated sites. Some sites would be temporarily affected by inundation of storage tanks and septic systems, potentially causing them to overflow and spread the contents throughout the environment, which could contaminate soil, groundwater, and surface waters. Flooding is not expected to result in permanent adverse effects to potentially contaminated sites.

6.7 Socioeconomics

The Requester's Preferred Alternative would increase flood protection for nearly 4,700 parcels currently located within the flood inundation area, and would reduce the potential need to relocate future businesses and homes from the protected area. It would directly, permanently, and significantly increase the value of developed and undeveloped property in the newly protected areas. This would stimulate local business activity and would support long-term business expansion and increased employment in the region. The Requester's Preferred Alternative also supports recovery strategies for rebuilding flood-affected areas and would substantially and permanently benefit community cohesion within the project area. Constructing the Requester's Preferred Alternative would create jobs by requiring workers for each phase of construction, which would in turn create additional indirect and induced jobs.

Requester's Preferred Alternative would require the acquisition of properties for construction to take place. Properties that cannot be purchased voluntarily will likely be acquired through eminent domain. Property owners that are forcefully ordered to give up ownership are likely to be disgruntled which could potentially cause unrest and result in adverse effects to community cohesion. Currently, 183 of 293 properties have been acquired for the construction of Stage 1.5 of the Project. Local tension would be expected to increase as eminent domain becomes increasingly exercised on property owners reluctant to sell. A demographic analysis of the impacted communities indicates that the project would not encompass disproportionately minority or low-income communities; therefore, no environmental justice impacts are expected.

The No-Action Alternative would generate no additional sustainable jobs or business activities. During flood events areas adjacent to the Souris River would continue to suffer socioeconomic impacts associated with flooding. Under the No-Action Alternative approximately 1,100 parcels would be inundated for a flood event of 10,000 cfs. A flood event of 27,400 cfs could cause damages similar those from the flood of 2011, which included the inundation of approximately 5,800 parcels. Damages to some properties could be permanent, leading to loss of community and permanent relocation of residents and businesses.

6.8 Recreation

The Requester's Preferred Alternative would permanently enhance existing recreational features, create new recreational opportunities, and significantly contribute to the development of the planned greenway

corridor. Constructing and maintaining the Requester's Preferred Alternative would temporarily disrupt access to some recreational resources, but these negative effects could be mitigated through coordination with the community.

The No-Action Alternative would not likely have any permanent adverse effects to recreational facilities but could have a number of temporary adverse impacts. Recreational use of levees, the river corridor, parks, fishing locations, and other recreational features would continue as established, with usage periodically disrupted by flooding. Flood events over 10,000 cfs would damage existing recreational facilities, and usage would be restricted until flood waters receded and the sites were cleaned up and restored. A flood event of 27,400 cfs would significantly damage existing recreational facilities which would not be unusable until cleaned up and restored.

6.9 Aesthetics and Visual Resources

The Requester's Preferred Alternative would enhance the aesthetic value of the project area, by developing a greenway that would provide connections to parks, picnic sites, and fishing sites. The greenway and connections would permanently improve visual aesthetics by enhancing the viewing experience of adjoining neighborhoods, hikers, and general recreational users, and would increase access to the Souris River corridor. Constructing the Requester's Preferred Alternative would temporarily affect aesthetic and visual resources within the project area. The severity of impacts would largely depend on the type of flood risk-reduction feature being constructed and on the contrast between the feature and the existing landscape.

The No-Action Alternative would not directly affect aesthetics and visual resources. During flood events, temporary adverse visual and aesthetic effects would occur, with standing water, debris, sedimentation deposits, and damaged vegetation.

6.10 Historic and Cultural Resources

A Class I Cultural Resources Survey of previously identified archaeological and historical sites was completed for the areas within 1 mile of Project features, to gage the potential impact of the Project. The survey identified 4 archaeological sites, the Soo Line Railroad corridor, and 4 standing structures. Detailed investigations could not be completed for the entire project in advance of the EIS and a Programmatic Agreement will be developed between the USACE and the ND SHPO to cover potential impacts to cultural resources and historic structures that have not yet been identified.

A more intensive Class III Archaeological Survey and a Class III Standing Structure Survey was completed for the first three phases of the Requester's Preferred Alternative, revealing direct effects to two historic structures recommended eligible for the National Register of Historic Places (NRHP). Construction of features in Stage 1.5 would require the replacement of a railroad bridge on the Soo Line Railroad which is potentially eligible for listing on the NRHP.

The No-Action Alternative would not have any direct affect to historic and cultural resources. Eight historic structures, four archaeological sites, and others that have not yet been identified in the inundation area, would remain vulnerable to flood impacts.

6.11 Air Quality and Noise

The Requester's Preferred Alternative would temporarily affect air quality and noise in the project area, including for residences and sensitive receptors (schools, churches, etc.), by temporarily increasing daytime noise levels or air emissions from construction equipment and vehicles.

The No-Action Alternative would result in no direct effects on air quality and noise resources. Flooding could result in temporarily elevated noise levels and air emissions in localized areas if flood fighting and cleanup efforts occur.

6.12 Health and Safety

Noise, vibrations, exhaust fumes, and dust from constructing the Requester's Preferred Alternative could temporarily affect the health of construction workers and nearby residents. Construction activities involving the use of heavy equipment to move, place and transport materials would pose general safety risks associated with the use of heavy machinery. Contractors for the Project would be required to develop Project Health and Safety Plans which would specify safety procedures and programs to protect the safety and health of all persons and properties.

The Requester's Preferred Alternative would benefit human health in the long-term. Many health hazards occur after floods and during clean-up activities, including compromising the structural integrity of roads, bridges, houses, and other structures in the damaged areas; dispersing sewage and pathogens into residential areas; and creating unhealthy conditions (like mold) in inundated structures. Reducing flood risk to the communities along the Souris River would reduce the potential for loss of life or injuries during flood events and would minimize the many health hazards that result from the flooding of developed areas.

6.13 Cumulative Impacts

The primary cumulative effects resulting from the Requester's Preferred Alternative and the past, present, and future flood risk reduction projects would include residence displacements and traffic modifications. The Requester's Preferred Alternative and other future flood risk reduction projects would add to the number of properties bought out or removed. Cumulatively and collectively, the Requester's Preferred Alternative and the other identified past, present, and future flood risk reduction projects provide the long-term beneficial effect of stabilizing property values and protecting against future flood damage.

Projects not related to flood control would have little impact on property displacements, but would contribute to cumulative effects on traffic in the vicinity of the Project. The long-term cumulative effect of these projects would, however, be beneficial, because these projects would improve traffic flow along the specific routes where construction is proposed.

The Requester's Preferred Alternative and other projects contribute additional cumulative effects on wetlands and other natural resources. The Requester's Preferred Alternative's contribution to cumulative effects on natural resources includes the realignment of the Souris River and the loss of 26 acres of emergent wetland and 42 acres of riverine wetland. Wetland impacts would be mitigated.

The Requester's Preferred Alternative and other projects also generate cumulative effects on air quality, health and safety, recreation, cultural resources, and contaminated sites. However, the cumulative effect on these resources is expected to be relatively minor.

Under the No-Action Alternative, there would be no contribution to the cumulative effects generated by past, present and foreseeable future projects on natural, socioeconomic cultural and other resources.

6.14 Interim Impacts

For the 5,000 cfs flood event, the total area flooded would remain about the same for each of the three geographic areas evaluated (upstream, in-town, and downstream of Minot). The Requester's Preferred Alternative would have little impact on the 5,000 cfs flood profile. This is because the 5,000 cfs flood event is already contained within existing federal levees.

For the 10,000 cfs flood event, there would be a net increase in the total area inundated in Minot, in large part because in many locations the alignment of the Requester's Preferred Alternative is further back from the banks of the river than the existing federal project levees. There is the potential for inundation depths to increase by roughly 0.5 feet in some areas. These areas tend to have a low numbers of structures.

For the 27,400 cfs design flood event, the total area flooded would tend to decrease with the implementation of each construction stage. The biggest reduction in inundation area would come after Construction Stage 2 when the area north of the river would have a complete levee system. The most significant adverse impacts would also come after Construction Stage 2, when higher flood elevations could be expected for areas south of the river and east of downtown Minot.

The completion of Construction Stage 1.5 would prevent 11 historic structures and the Minot Industrial Historic District from being inundated with flows of 10,000 cfs. However, the northeast sector of the Minot Commercial Historic District and most of the Eastwood Park Historic District would experience flood elevation increases greater than 0.5 feet for this event.

An event with flows equal to the 27,400 cfs event, would experience increases greater than 0.5 feet in the entire Minot Industrial Historic District and a small area in the northwest corner of the Minot Commercial Historic District after construction of Stage 1.5.

7.0 List of Reviewers and Preparers

U.S. Army Corps of Engineer – St. Paul District

Ingvalson, Derek – Environmental Review Project Manager
B.S., Biology, University of Minnesota – Duluth, 2007

Hammer, Vanessa - Cultural Resources Manager
B.A., Anthropology, University of Minnesota – Twin Cities, 2011

Wallerstedt, Nathan – Project Engineer/Project Manager
B.S., Civil Engineering, University of Minnesota – Twin Cities, 2004

U.S. Army Corps of Engineers – Omaha District

Erhardt, Toni – Section 404 Permitting Project Manager
Regulatory Manager – 30 yrs experience

Barr Engineering Co.

Duncan, Randy - Project Lead, Project Description, Senior Review
M.S., Water Resources Management, University of Wisconsin - Madison, 1982
B.A., Biology, Luther College, 1978

Segroves, Louise – Alternatives, Socioeconomics, Air Quality
M.S., Geosciences, Penn State University, 2007
B.A., Economics, Geology, Carleton College, 2005

Pollak, Melisa - Geology, Soils and Groundwater
M.S., Science, Technology, and Environmental Policy, Univ. of Minnesota - Twin Cities, 2008
B.S., Geophysics, University of Minnesota - Twin Cities, 1983

Braun, Shanna – Surface Waters
M.S., Water Resources Science, University of Minnesota – Twin Cities, 2015
B.S., Natural Resources Management, North Dakota State University, 2004

Jones, Daniel – Biological Resources, Cumulative Impacts
M.S., Ecology and Evolution, University of Oregon, 1995
B.S., Botany and Plant Pathology, Michigan State University, 1982

Bohnenblust, Mandy – Contaminated Sites
M.S., Environmental Pollution Control, Penn State University, 2006
B.S., Biology, Truman State University, 2004

Kloss-Molina, Julie – Cultural Resources
M.S., Industrial Heritage, Michigan Technological University, 2002
B.A., Anthropology, University of Minnesota, 1999

Skoglund, Andrew – Noise
B.S., Engineering Science, Iowa State University, 2004

Waln, Joe – Hydraulics and Hydrology, Interim Impacts
M.Ed., Science, University of Notre Dame, 2001
B.S., Civil Engineering, University of Portland, 1999

Wild, Kelly – GIS, Graphics
M.S., Geographic Information Science, University of Minnesota – Twin Cities, 2011
B.S., Cartography/GIS and Geography, University of Wisconsin - Madison, 2008

Lee, Jeff – QA/QC Review
M.Ed., Secondary Education and Aquatic Ecology, University of Wisconsin - La Crosse, 1987
B.S., Biology, University of Wisconsin - La Crosse, 1977

Houston Engineering, Inc.

Lind, Katherine – Land Use and Infrastructure, Socioeconomics
B.S., Environmental Science and Policy Management, University of Minnesota-Twin Cities, 2012

Olm, Rachel – Recreation, Aesthetics and Visual Resources
M.S., Water Resources Science, University of Minnesota - Twin Cities, 2015
B.S., Environmental Studies and Biology, University of Minnesota - Morris, 2009

Lutz, Jeff – Senior Review and Editing
B.S., Geography, South Dakota State University, 1987

Kramka, Larry - QA/QC Review
Minnesota Executive Program, University of Minnesota - Carlson School of Management, 2010
B.S., Natural Resources and Environmental Studies, University of Minnesota, 1990

Trefoil Cultural and Environmental

Rothaus, Richard – Cultural and Historic Resources
Ph.D., History, The Ohio State University, 1993
M.A., Classics, Vanderbilt University, 1989
B.A., English and Classics, The Florida State University, 1985

The Holton Group

Holton, Rick – Technical Editor

Ph.D., English, Edinburgh University, 1979

M.A., English, University of Virginia, 1975

A.B., English, Harvard University, 1973

Advanced Professional Certificate in Business Administration, New York University Business School, 1982

8.0 References

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

[2] U.S. Army Corps of Engineers, *Periodic Inspection Report, Burlington to Minot Flood Risk Managment Project, Burlington to Minot, North Dakota, Periodic Inspection Report No. 1-Draft,* 2013.

[3] SRF Consulting Group, Inc., *City of Minot, ND 2035 Transportation Plan,* 2015.

[4] Barr Engineering Co.; Ackerman Estvold, *Mouse River Enhanced Flood Protection Project — Phases MI-2 and MI-3 Basis of Design Report — 100% Draft Design Submittal,* 2016.

[5] Houston Engineering Inc., *Mouse River Enhanced Flood Protection Project – Phase MI-1 – 4th Avenue NE, Basis of Design Report, Prepared for the Souris River Joint Board - 60% Design Submittal,* 2016.

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

[7] U.S. Army Corps of Engineers, *Hydraulic Design of Flood Control Channels Engineering Manual (EM 1110-2-1601),* 1991.

[8] *Hydraulic Engineering Circular No. 22, Third Edition (FHWA-NHI-10-009),* Federal Highway Administration, Revised August 2013.

[9] U.S. Army Corps of Engineers, *Final Feature Environmental Impact Statement Lake Darling Flood Control Project Souris River - Renville, Ward, McHenry, and Bottineau Counties, North Dakota,* 1985.

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

[11] Barr Engineering Co., *Comparative Analysis of King's Court Channel Realignment Alternatives - Project File Memorandum,* 2015.

[12] Barr Engineering Co., *Comparative Analysis of Burdick Segment Channel Realignment Alternatives - Project File Memorandum,* 2015.

[13] U.S. Army Corps of Engineers National Nonstructural/Flood Proofing Committee, *Flood Damange Reduction Measures,* 2010.

[14] U.S. Army Corps of Engineers, *Final Feasibility Report and Environmental Impact Statement: Fargo-Moorhead Metropolitan Area Flood Risk Managment-Appendix P (USACE-MVP-0000087980),* 2011.

[15] U.S. Army Corps of Engineers, *Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions - Souris-Red-Rainy Region 09,* 2015.

[16] A. E. Kehew, *Geology and Geotechnical Conditions of the Minot Area, North Dakota,* 1983.

[17] F. J. Anderson and L. A. Manz, *Geology of the Minot Area - Geological Investigations No. 46,* 2007.

[18] W. A. Pettyjohn, *Geohydrology of the Souris River Valley in the Vicinity of Minot, North Dakota,* 1967.

[19] S. W. Pusc, *Hydrogeology of the Minot Aquifer, Ward County, North Dakota,* North Dakota State Water Commission, 1994.

[20] U.S. Geological Survey, *Seismic-Hazard Maps for the Conterminous United States - Scientific Investigations Map 3325,* U.S. Department of the Interior, 2015.

[21] R. L. Howey, C. Farris, F. Glatt, F. Hauff, S. Lahlum, S. Larson, L. Neubauer and F. Wahl, *Soil Survey of Ward County, North Dakota,* United States Department of Agriculture - Soil Conservation Service in cooperation with North Dakota Agricultural Experimentation Station, 1974.

[22] W. A. Pettyjohn and R. D. Hutchinson, *Ground-water Resources of Renville and Ward Counties,* 1971.

[23] North Dakota State Water Commission, "Ground and Surface Water Data Query," [Online]. Available: http://www.swc.state.nd.us/4dlink2/4dcgi/WellSearchForm/Map%20and%20Data%20Resources. [Accessed 24 August 2015].

[24] U.S. Environmental Protection Agency, "2014 Waterbody Report for Souris River," 214. [Online]. Available: http://ofmpub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=&p_au_id=ND-09010008-001-S_00&p_cycle=2014&p_state=ND.

[25] Swenson, Hagen & Co., and Houston Engineering, Inc., *City of Minot Flood Insurance Study,* 2002.

[26] Houston Engineering Inc., *Interim Hydraulics Report for Ward County, ND, FY 2011 Risk Map Project, FEMA Case #07-08-0688S, FEMA Region VIII,* 2014.

[27] 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.

[28] 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.

[29] U.S. Environmental Protection Agency, "Prairie Potholes," 2012. [Online]. Available: http://water.epa.gov/type/wetlands/potholes.cfm. [Accessed 20 May 2015].

[30] L. V. C. F. G. R. L. Cowardin, "Classification of Wetlands and Deepwater Habitats of the United States," U.S. Fish and Wildlife Service, 1979.

[31] Houston Engineering Inc., *Wetlands, Waters, and Biological Inventory Report,* 2015.

[32] North Dakota Department of Agriculture, "North Dakota Weed Mapper," 2015. [Online]. Available: https://apps.nd.gov/ndda/mapping/. [Accessed 27 May 2016].

[33] North Dakota Department of Agriculture, "Noxious Weeds," 2016. [Online]. Available: https://www.nd.gov/ndda/program/noxious-weeds. [Accessed 7 May 2016].

[34] HDR, Inc., *Dakota Skipper Habitat Assessment Report - Mouse River Enhanced Flood Protection Project (MREFPP),* 2016.

[35] Federal Register, *Endangered and Threatened Wildlife and Plants; Determination That Designation of Critical Habitat Is Not Prudent for the Northern Long-Eared Bat (50 C.F.R. Part 17),* vol. 81, 2016, pp. 24707-24714.

[36] U.S. Fish and Wildlife Service , "Final Designation of Critical Habitat for Breeding Piping Plovers in North Dakota," 2016. [Online]. Available: https://www.fws.gov/northdakotafieldoffice/gis/ppcrithab/ND/ndcrithab.htm. [Accessed 14 June 2016].

[37] S. Hagen, P. Isakson and S. Dyke, *North Dakota Comprehensive Wildlife Conservation Strategy,* Bismarck: North Dakota Game and Fish Department, p. 454.

[38] U. S. Census Bureau, "Quick Facts - Minot city, North Dakota," [Online]. Available: http://quickfacts.census.gov/qfd/states/38/3853380.html. [Accessed March 2016].

[39] Burlington, ND, City of, "History," [Online]. Available: http://www.burlingtonnd.gov/index.asp?SEC=A61B00BA-2CB9-4696-8117-F2E957E185E2&Type=B_BASIC. [Accessed 14 May 2015].

[40] *North Dakota Year Book - Ward County,* pp. 240-244.

[41] Ward County Planning and Zoning Department, "Ward County Zoning Districts," [Online]. Available: http://www.wardnd.com/DocumentCenter/View/1022. [Accessed 16 July 2015].

[42] Stantec, *City of Minot 2012 Comprehensive Plan.*

[43] City of Minot, *Community Development Block Grant Disaster Recovery Action Plan,* Minot, ND, 2012.

[44] North Dakota State Water Commission, *2015 North Dakota State Water Management Plan,* 2015.

[45] Burlington, ND, City of, "Departments," [Online]. Available: http://www.burlingtonnd.gov/index.asp?SEC=032A2ACD-368C-49E7-89D7-1ECE36C048CC&Type=B_BASIC. [Accessed 27 August 2015].

[46] U.S. Army Corps of Engineers, *Water Resources Policies and Authorities, Hazardous, Toxic and Radioactive Waste Guidance for Civil Works Projects (ER 1165-2-132),* 1992.

[47] City of Minot, North Dakota, *Minot Affordable Housing Strategy: Affordable Housing Action Plan,* Vols. October 25, 2013, Prepared by CDM Smith, 2013.

[48] North Dakota Department of Commerce, *North Dakota Census Office Population Projections of the State, Regions and Counties 2016,* 2016.

[49] Headwaters Economics, "Economic Profile System - Human Dimensions Toolkit," 1 July 2015. [Online]. Available: http://headwaterseconomics.org/tools/economic-profile-system/about.

[50] J. Schramm, *Developing Dakota: State takes role in promoting economic growth,* Minot Daily News, 2016.

[51] City of Minot, North Dakota, *Analysis of Impediments to Fair Housing Choice for Minot, North Dakota,* Vols. July 29, 2013, Prepared by CDM Smith, 2013.

[52] Zillow, "North Dakota Home Prices & Values," 2016. [Online]. Available: http://www.zillow.com/nd/home-values/. [Accessed 16 June 2016].

[53] U.S. Environmental Protection Agency, "Environmental Justice," 10 06 2015. [Online]. Available: http://www.epa.gov/environmentaljustice/. [Accessed 05 07 2015].

[54] Council on Environmental Quality, Executive Office of the President, "Environmental Justice, Guidance Under the National Environmental Policy Act," 10 December 1997. [Online]. Available: http://www.epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf. [Accessed 27 February 2015].

[55] U.S. Environmental Protection Agency, "Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses," April 1998. [Online]. Available: http://www.epa.gov/environmentaljustice/resources/policy/ej_guidance_nepa_epa0498.pdf. [Accessed 7 July 2015].

[56] North Dakota Parks and Recreation Department, *2013-2017 North Dakota State Comprehensive Outdoor Recreation Plan.*

[57] Burlington, ND, City of, "Parks/Recreation/Golf/Sr. Center," 29 April 2013. [Online]. Available: http://www.burlingtonnd.gov/index.asp?SEC=1FA60552-13B4-4FCE-89DB-EFB163FA057D&Type=B_BASIC. [Accessed 21 May 2015].

[58] Minot Country Club, "Our Story," [Online]. Available: http://www.minotcountryclub.com/-our-story. [Accessed 26 May 2015].

[59] P. Richard Rothaus, *Class I Cultural Resources Survey, Mouse River Enhanced Flood Protection Project, Burlington to Minot, North Dakota,* Trefoil, August 9, 2015.

[60] P. a. J. M. Richard Rothaus, *Class III Archaeological Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, Minot, Ward County, North Dakota,* Trefoil, August 18, 2015.

[61] P. a. A. B. M. Richard Rothaus, *Class III Standing Structures Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, 2nd Ave SW Stormwater Pool, Minot, Ward County, North Dakota,* Trefoil, August 09, 2015.

[62] Ackerman-Estvold, *Class III Cultural Resources Investigation of Mouse River Enhanced Flood Protection Plan Borrow Site, Ward County, North Dakota,* 2016.

[63] North Dakota Department of Health, *North Dakota Air Quality Monitoring Data Summary 2013 Annual Report,* 2014.

[64] U.S. Environmental Protection Agency, "Overview of Greenhouse Gases," 7 May 2015. [Online]. Available: http://www.epa.gov/climatechange/ghgemissions/gases/fgases.html. [Accessed 20 May 2015].

[65] U.S. Council on Environmental Quality, "Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts," [Online]. Available: https://www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf. [Accessed 15 March 2015].

[66] U.S. Environmental Protection Agency, "Climate Change Impacts and Adapting to Change," [Online]. Available: http://epa.gov/climatechange/impacts-adaptation/index.html. [Accessed 20 May 2015].

[67] U.S. Environmental Protection Agency, "FACT SHEET: Clean Power Plan State Roles," 2015. [Online]. Available: http://www2.epa.gov/carbon-pollution-standards/fact-sheet-clean-power-plan-state-roles. [Accessed 5 February 2015].

[68] U.S. Department of Commerce National Oceanic and Atmospheric Administration, *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment Part 4. Climate of the U.S. Great Plains,* Washington, D.C., 2013.

[69] High Plains Regional Climate Center, *Climate Change on the Prairie: A Basic Guide to Climate Change in the High Plains Region - UPDATE,* 2013.

[70] Fischenich, J. Craig, *Effects of riprap on riverine and riparian ecosystems (REDC/EL TR-03-4),* Vicksburg, MS: U.S. Army Corps of Engineers, 2003.

[71] J. T. Quigley and D. J. Harper, Eds., *Streambank Protection with Rip-rap: An Evaluation of the Effects on Fish and Fish Habitat,* Vancouver, B.C.: Fisheries and Oceans Canada, 2004, p. 76.

[72] ND Department of Emergency Services, *2011 Flood Report: Response and Recovery,* NDDES Homeland Security State Radio, 2011.

[73] Souris Basin Planning Council, *Souris Basin Regional Recovery Strategy - Minot, Burlington and Ward County, North Dakota. Prepared with Assistance by FEMA,* 2011.

[74] North Dakota Department of Transportation, *North Dakota's Statewide Strategic Transportation Plan - TransAction III,* 2012.

[75] North Dakota Department of Commerce, *State of North Dakota Action Plan for Disaster Recovery,* 2013.

[76] State Historical Society of North Dakota, *ND SHPO REF: 14-7774 HUD CDBG Acquisition and Demolition, 103 4th Avenue NW, Minot, Ward County, North Dakota Letter to CDM Smith (on behalf of the City of Minot, ND),* 2015.

[77] Federal Highway Administration (FHWA), *FHWA Roadway Construction Noise Model User's Guide. FHWA-HEP-05-054,* 2006.

[78] U.S. Army Corps of Engineers, St. Paul District, *2011 Post-Flood Report for the Souris River Basin,* 2012.

[79] U.S. Department of Housing and Urban Development, "HUD Awards $1 Billion through National Disaster Resilience Competition," 21 January 2016. [Online]. Available: http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2016/HUDNo_16-006.

[80] U.S. Department of Housing and Urban Development, *National Disaster Resilience Competition.*

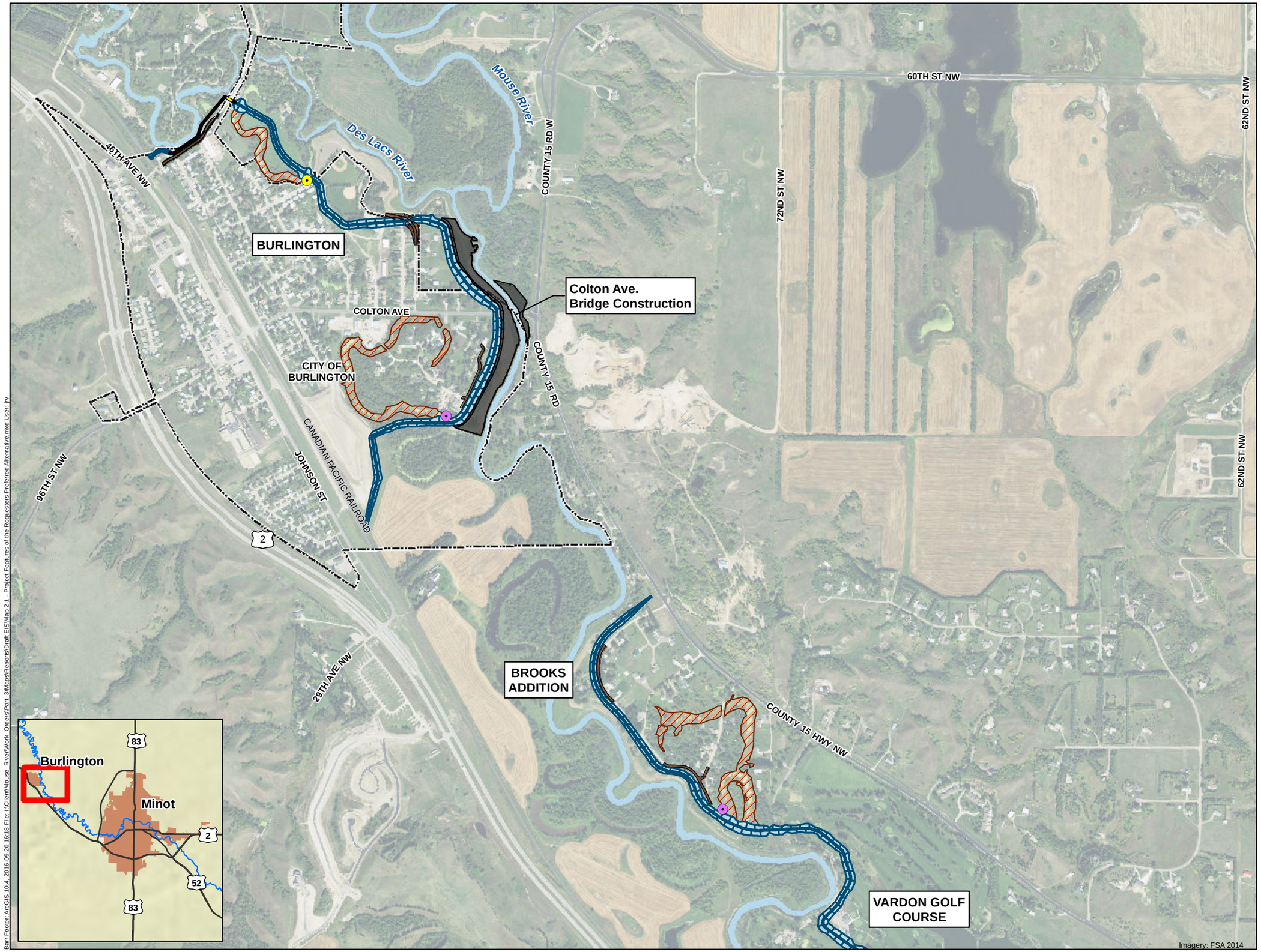
[81] 2012 Souris River Basin Task Force, *Plan of Study: For the Review of the Operating Plan Contained in Annex A of the 1989 International Agreement Between the Government of Canada and the Government of the United States of America,* 2013.

[82] Housing Predictor, "2015 North Dakota Real Estate and Housing Market Predictions," 2015. [Online]. Available: http://www.housingpredictor.com/2015-north-dakota-real-estate/. [Accessed 16 June 2016].

[83] North Dakota Department of Health, *Guidelines for the Assessment and Cleanup of Saltwater Releases,* 2014.

References available upon request.

Maps



Levee Footprint

Floodwall Alignment

Transportation Closure

Road Modifications and Parking Areas

Overbank Excavation

Interior Ponding Areas (Existing)

Approximate Proposed Pump Station (New)

Existing Pump Station (Replacement)

Municipalities

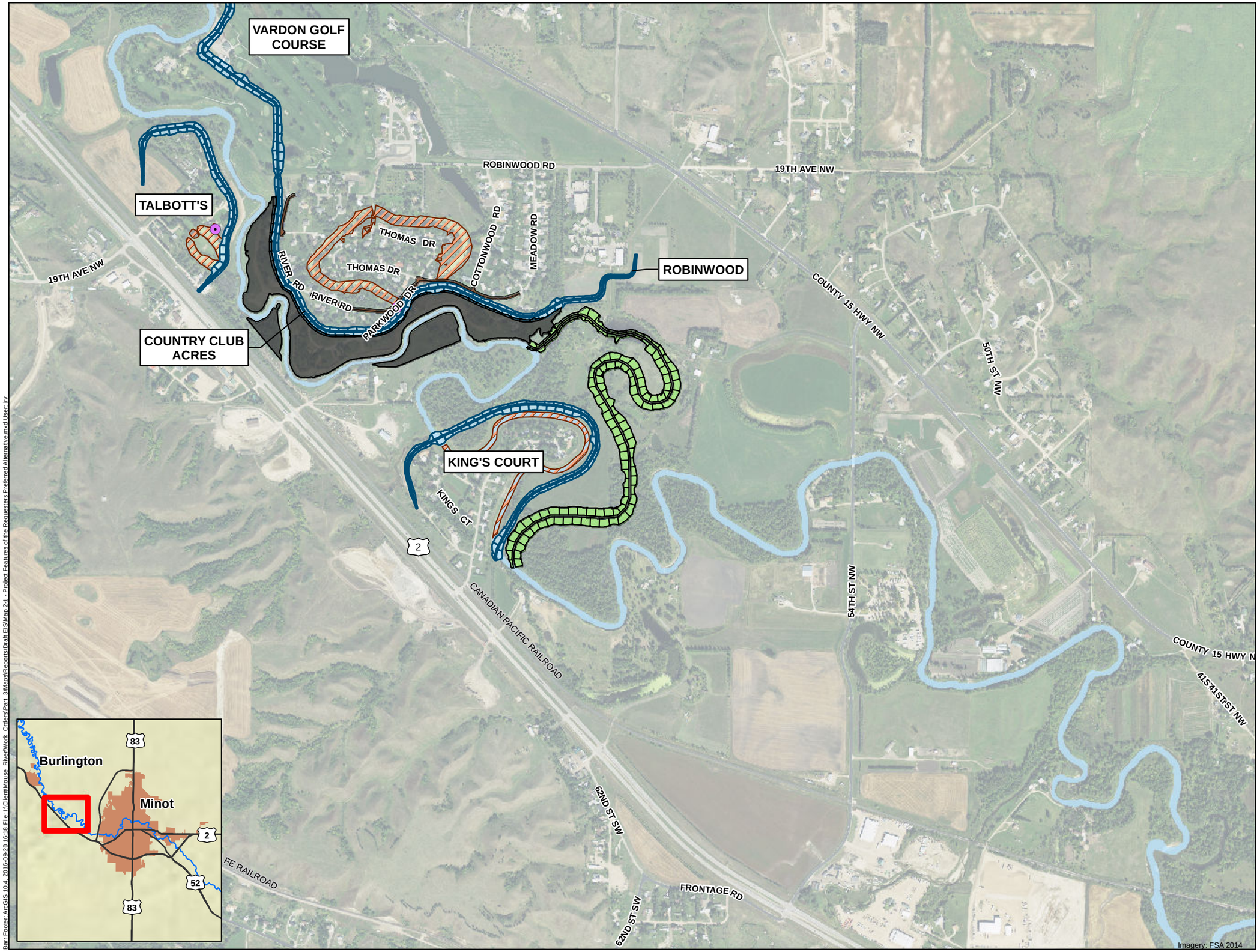
0 500 1,000 2,000

Feet

Map 2-1

PROJECT FEATURES OF THE REQUESTER'S PREFERRED ALTERNATIVE
Map (1 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-20 16:18 File: I:\Client\Mouse_RiverWork_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-1 - Project Features of the Requesters Preferred Alternative.mxd User: jkv



Levee Footprint

Road Modifications and Parking Areas

Overbank Excavation

Stream Realignment

Interior Ponding Areas (Existing)

Existing Pump Station (Replacement)

Approximate Pump Station (Existing)

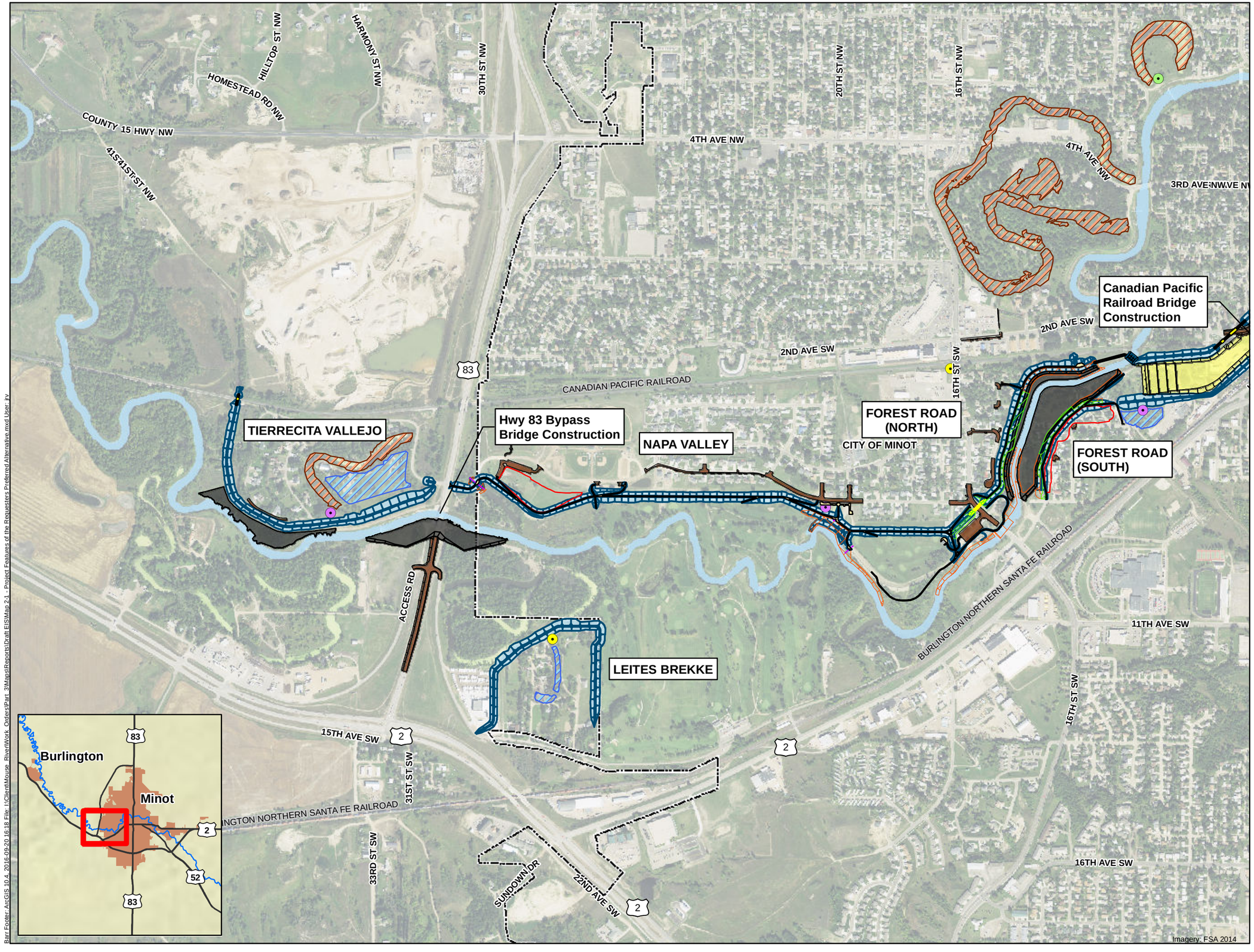
0 500 1,000 2,000

Feet

Map 2-1

PROJECT FEATURES OF THE REQUESTER'S PREFERRED ALTERNATIVE
Map (2 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-20 16:18 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-1 - Project Features of the Requesters Preferred Alternative.mxd User: jkv



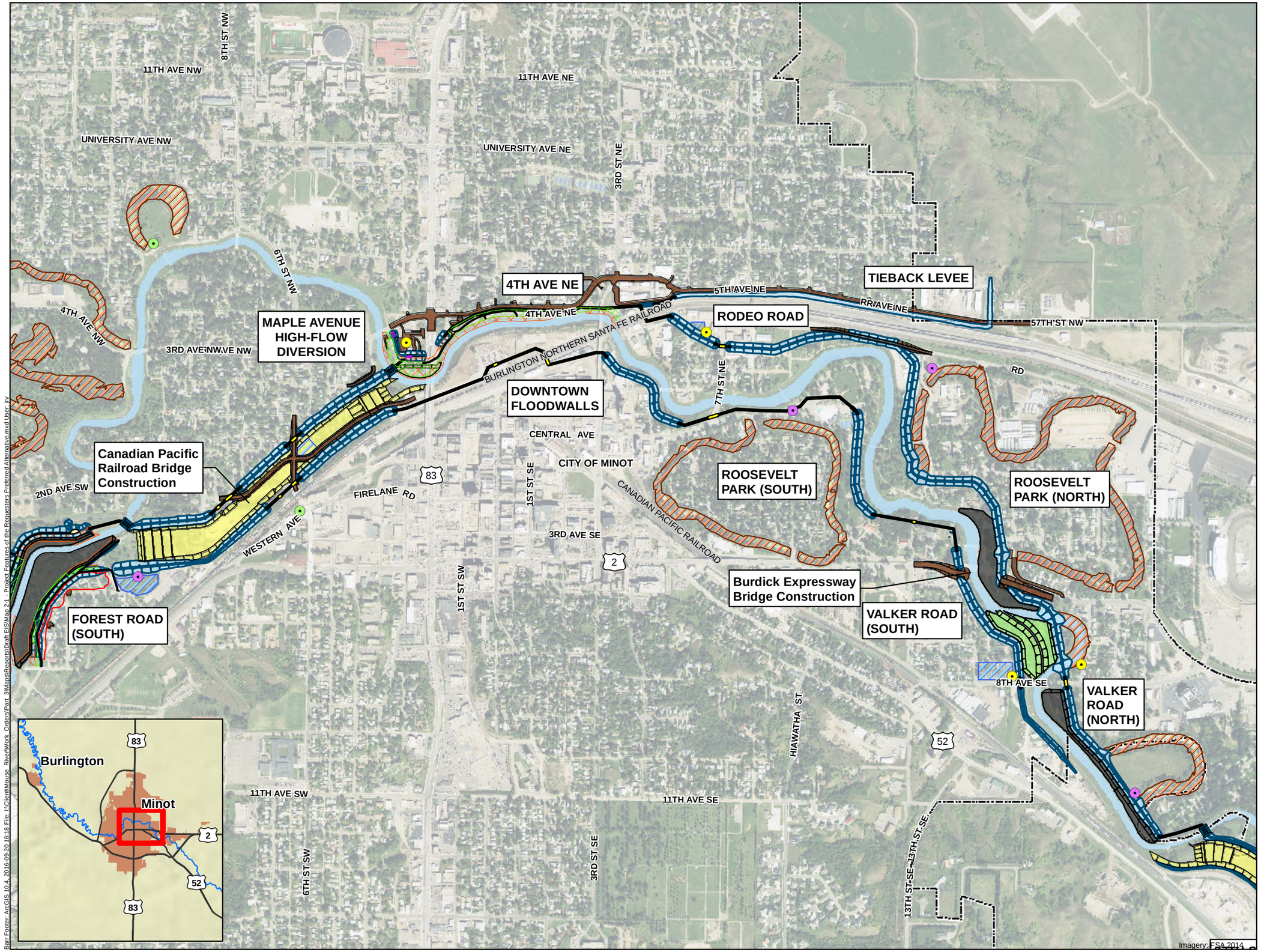
Levee Footprint
Floodwall Alignment
Transportation Closure
River Closure Structure
High Flow Diversion
Road Modifications and Parking Areas
Trails
Overburden Waste
Bank Stabilization Rip-Rap
Turf Reinforcement Mat
Overbank Excavation
Interior Ponding Areas (New)
Interior Ponding Areas (Existing)
Approximate Proposed Pump Station (New)
Existing Pump Station (Replacement)
Approximate Pump Station (Existing)
Gatewell
Municipalities

0 500 1,000 2,000
Feet

Map 2-1

PROJECT FEATURES OF THE REQUESTER'S PREFERRED ALTERNATIVE
Map (3 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-20 16:18, File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-1 - Project Features of the Requesters Preferred Alternative.mxd User: jcy



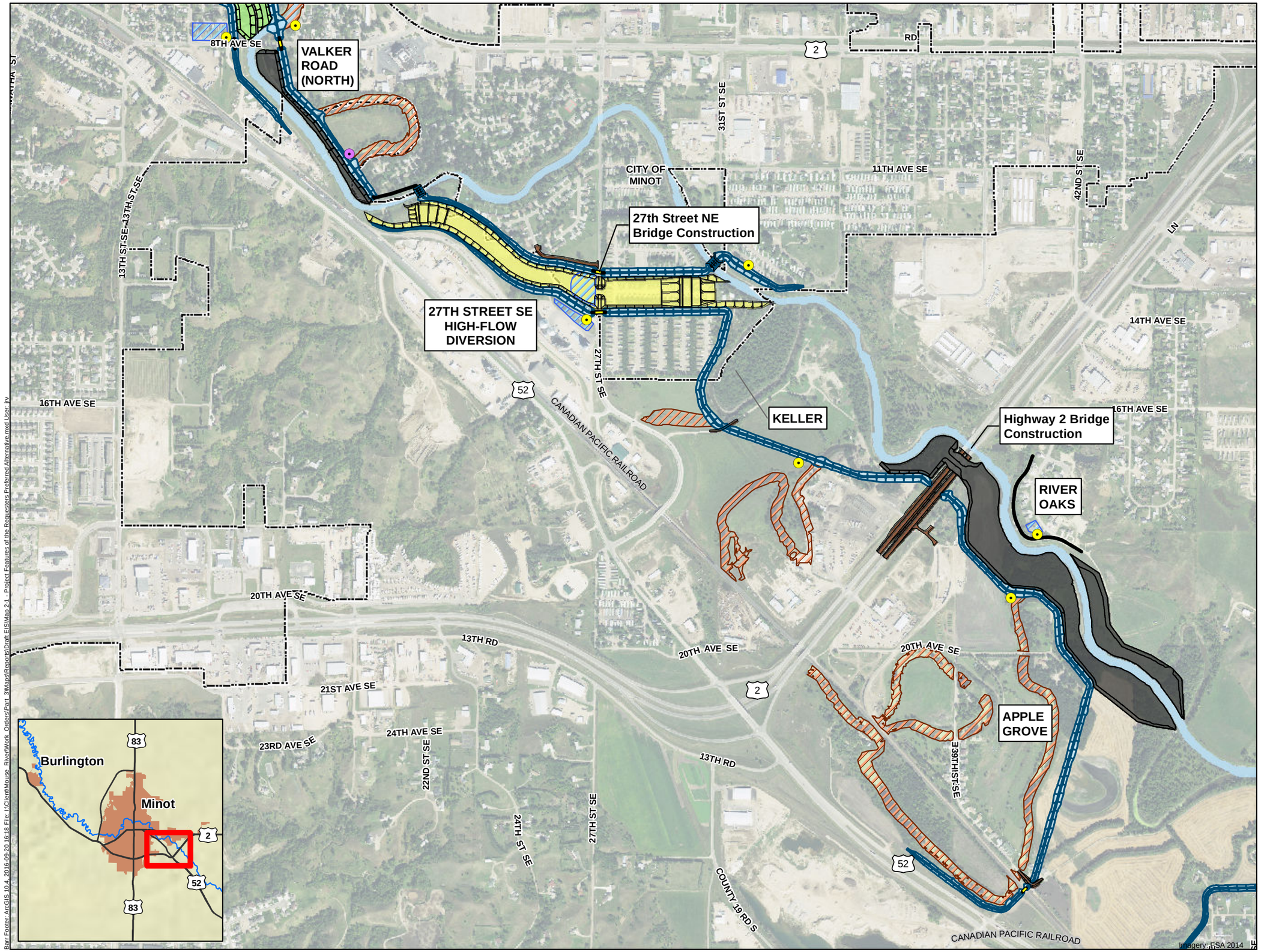
Levee Footprint
Floodwall Alignment
Transportation Closure
River Closure Structure
High Flow Diversion
Road Modifications and Parking Areas
Trails
Overburden Waste
Bank Stabilization Rip-Rap
Turf Reinforcement Mat
Overbank Excavation
Stream Realignment
Interior Ponding Areas (New)
Interior Ponding Areas (Existing)
Approximate Proposed Pump Station (New)
Existing Pump Station (Replacement)
Approximate Pump Station (Existing)
Gatewell
Municipalities

0 500 1,000 2,000
Feet

Map 2-1

PROJECT FEATURES OF THE REQUESTER'S PREFERRED ALTERNATIVE
Map (4 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-20 16:18 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-1_Project Features of the Requesters Preferred Alternative.mxd User: ky



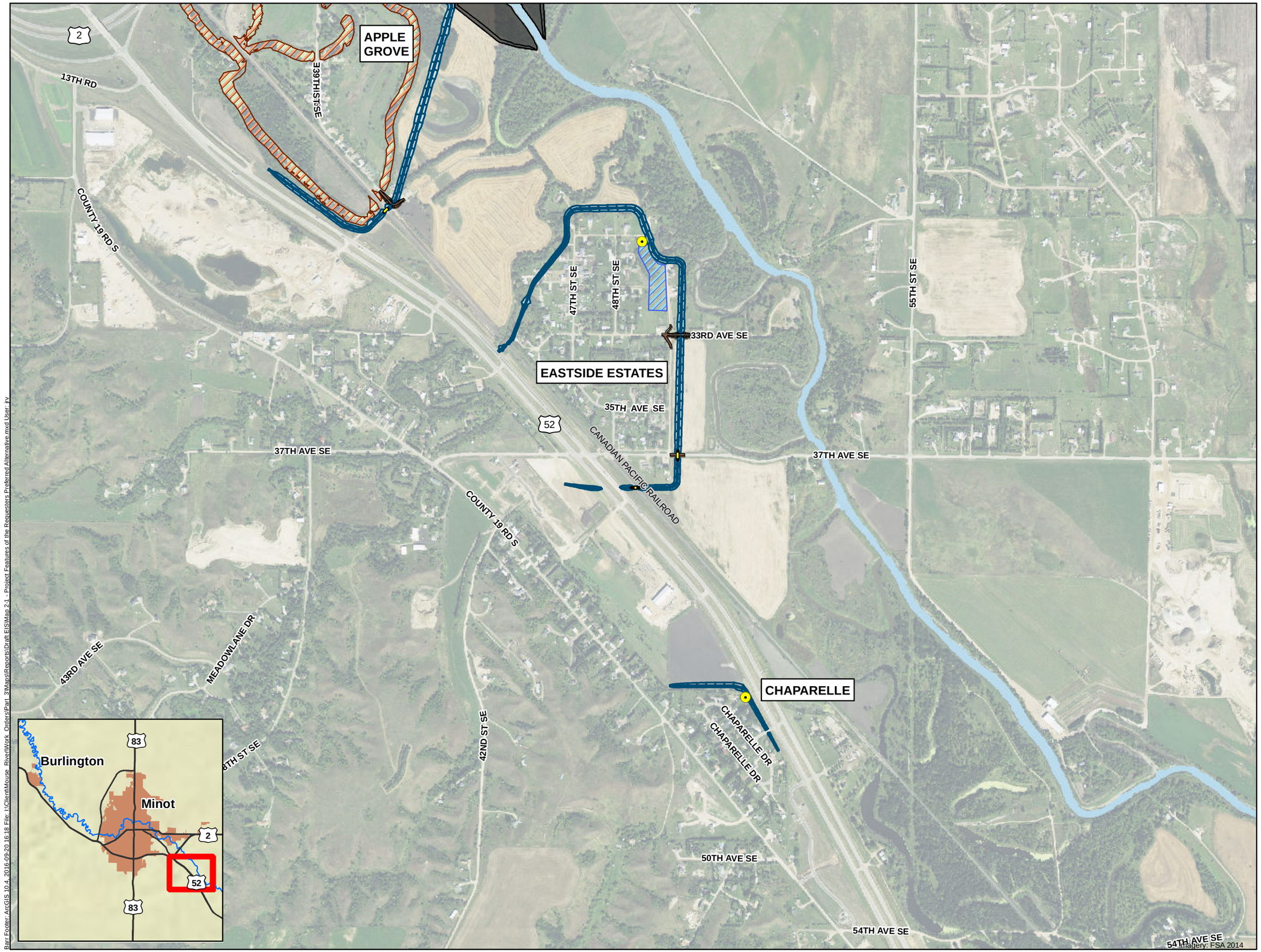
Levee Footprint
Floodwall Alignment
Transportation Closure
River Closure Structure
High Flow Diversion
Road Modifications and Parking Areas
Overbank Excavation
Stream Realignment
Interior Ponding Areas (New)
Interior Ponding Areas (Existing)
Approximate Proposed Pump Station (New)
Existing Pump Station (Replacement)
Municipalities

0 500 1,000 2,000
Feet

Map 2-1

PROJECT FEATURES OF THE REQUESTER'S PREFERRED ALTERNATIVE
Map (5 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-20 16:18 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-1_Project Features of the Requesters Preferred Alternative.mxd User: jrv



Levee Footprint

Floodwall Alignment

Transportation Closure

Road Modifications and Parking Areas

Overbank Excavation

Interior Ponding Areas (New)

Interior Ponding Areas (Existing)

Approximate Proposed Pump Station (New)

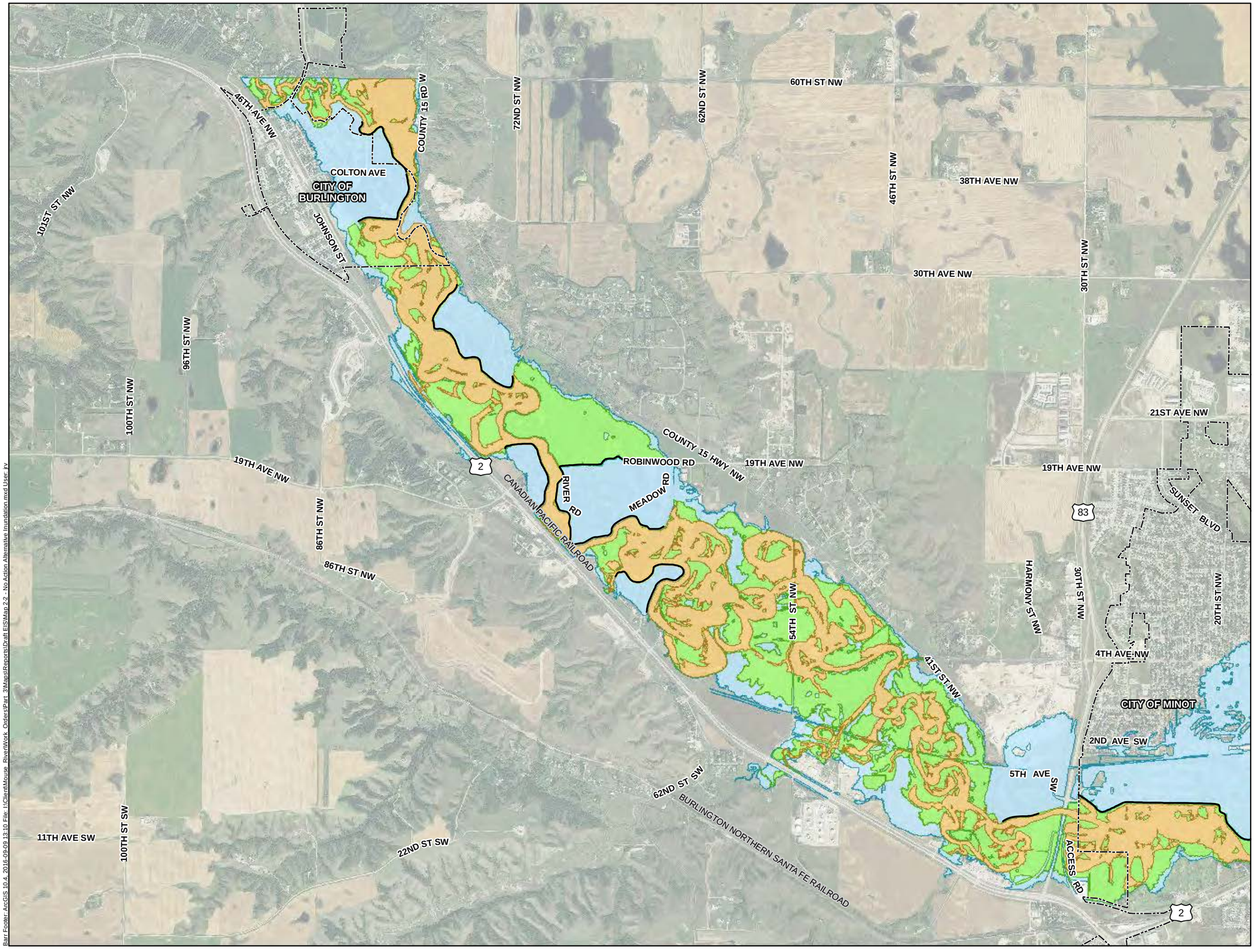
0 500 1,000 2,000

Feet

Map 2-1

PROJECT FEATURES OF THE REQUESTER'S PREFERRED ALTERNATIVE
Map (6 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-20 16:18 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-1 - Project Features of the Requesters Preferred Alternative.mxd User: jkv



Modeled Inundation Extents

- 5,000 cfs flow
- 10,000 cfs flow
- 27,400 cfs flow
- Existing Federal Flood Control Features
- Municipalities

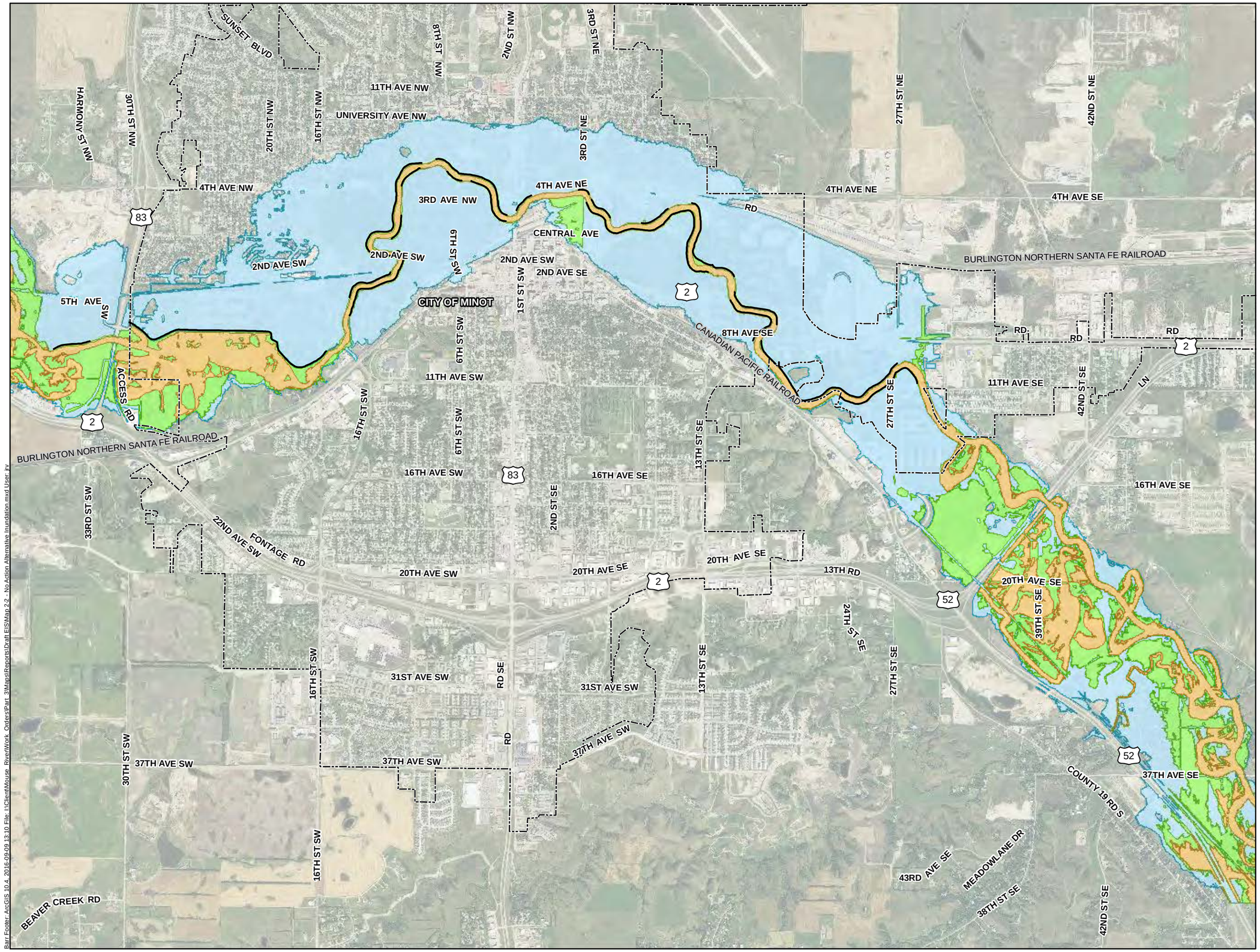
0 1,250 2,500 5,000

Feet

Map 2-2

NO ACTION ALTERNATIVE
INUNDATION
Map (1 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 13:10 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-2 - No Action Alternative Inundation.mxd User: jrv



Modeled Inundation Extents

- 5,000 cfs flow
- 10,000 cfs flow
- 27,400 cfs flow
- Existing Federal Flood Control Features
- Municipalities

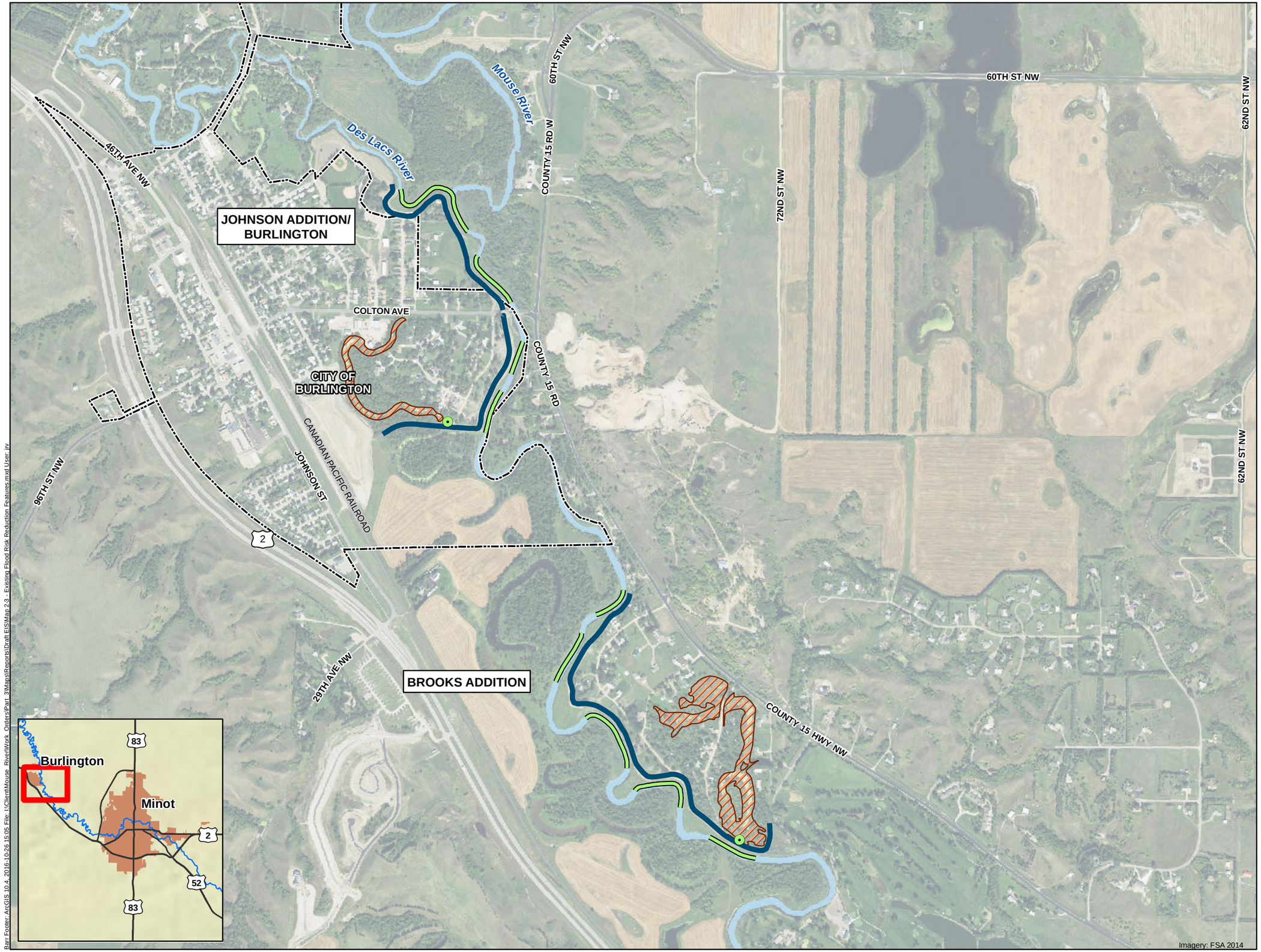
0 1,250 2,500 5,000

Feet

Map 2-2

NO ACTION ALTERNATIVE INUNDATION
Map (2 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-09-09 13:10 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-2_ No Action Alternative Inundation.mxd User: jrv



Levee Centerline

Channel Modifications

Ponding Areas

Pump Stations

Municipalities

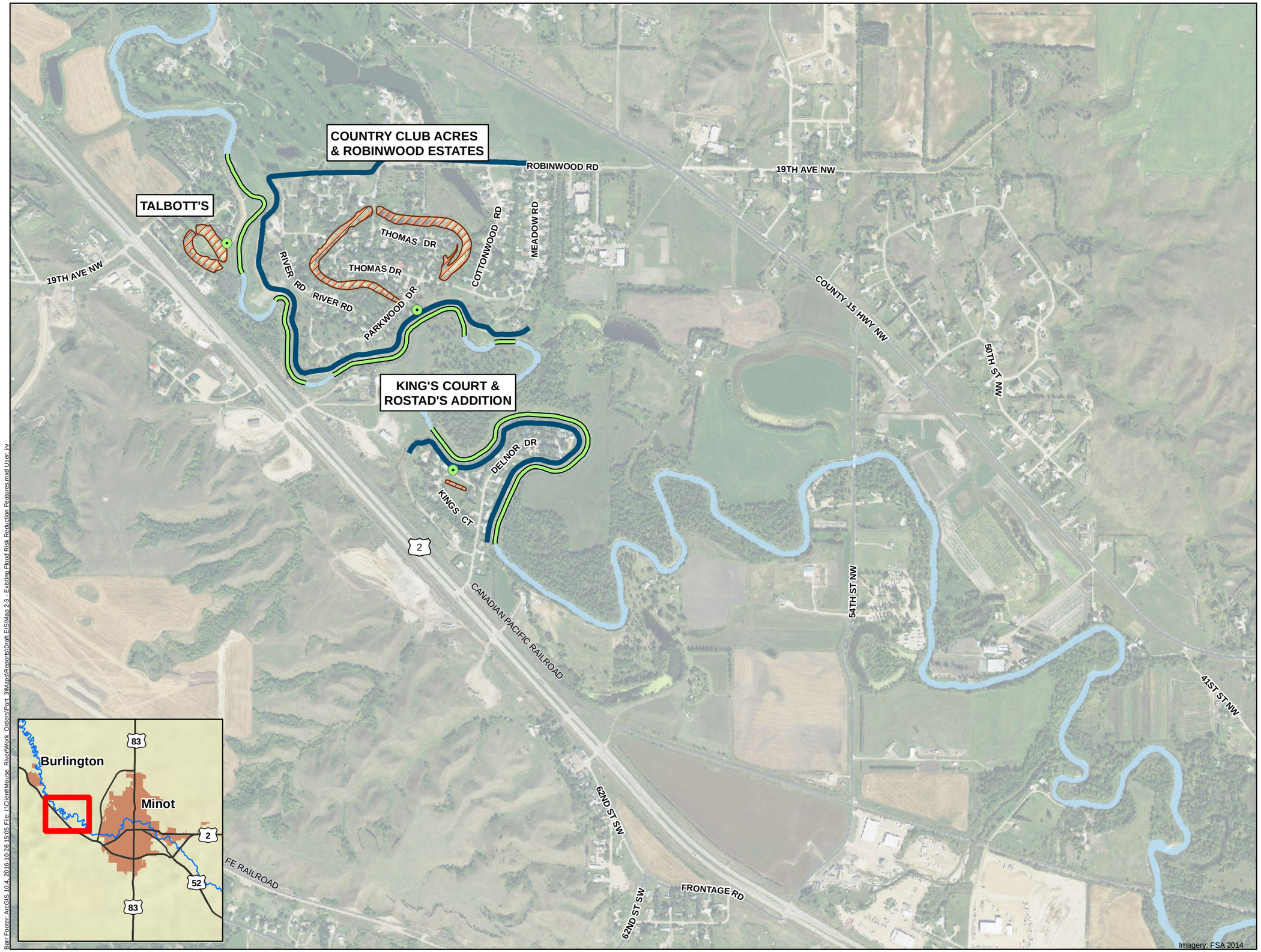
0 500 1,000 2,000

Feet

Map 2-3

EXISTING FLOOD RISK REDUCTION FEATURES
Map (1 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:05, File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-3_Existing Flood Risk Reduction Features.mxd User: jrv



Levee Centerline

Channel Modifications

Ponding Areas

Pump Stations

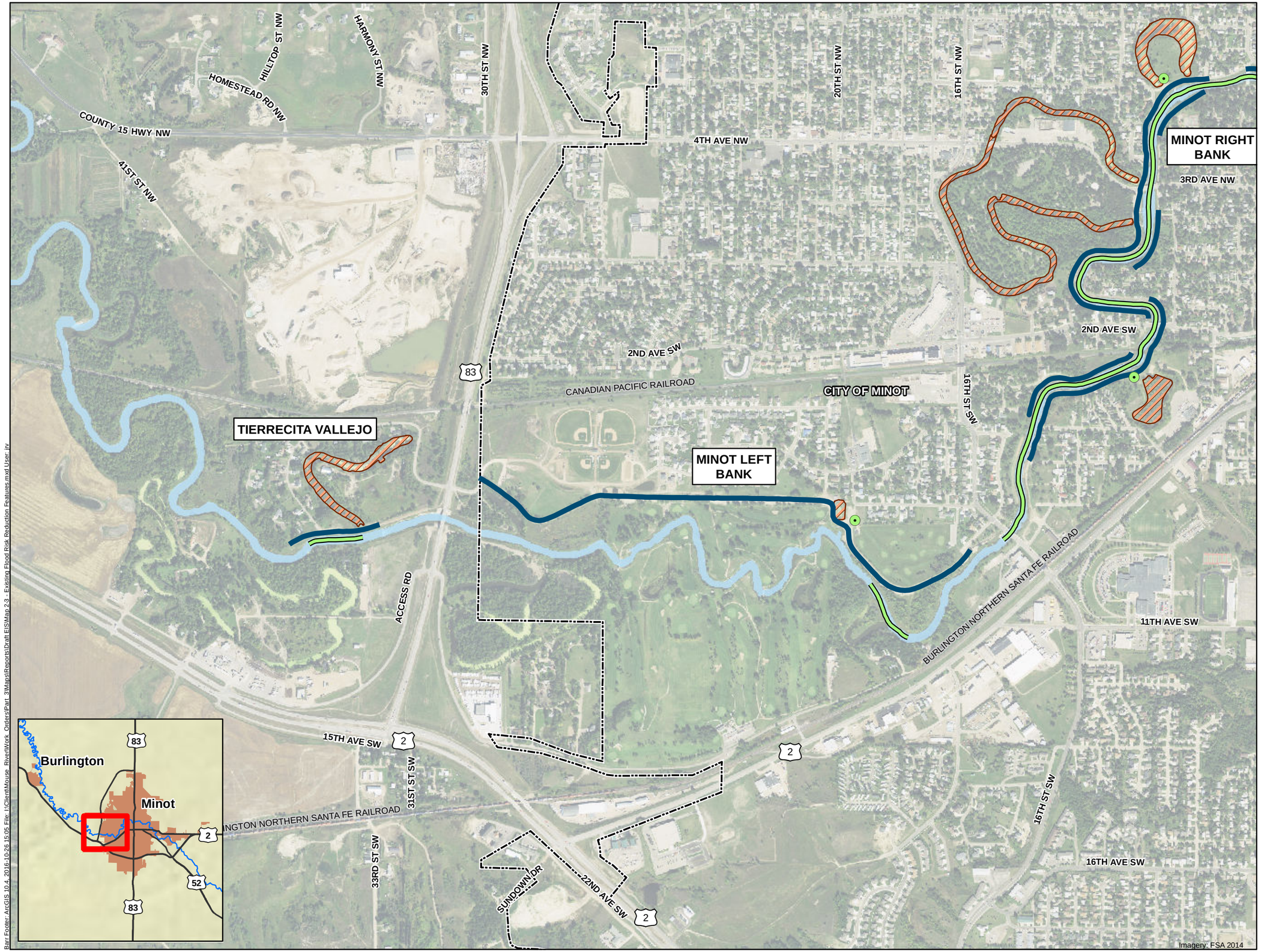
0 500 1,000 2,000

Feet

Map 2-3

EXISTING FLOOD RISK
REDUCTION FEATURES
Map (2 of 6)
Mouse River Enhanced Flood
Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:05, File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-3 - Existing Flood Risk Reduction Features.mxd User: jrv



Levee Centerline

Channel Modifications

Ponding Areas

Pump Stations

Municipalities

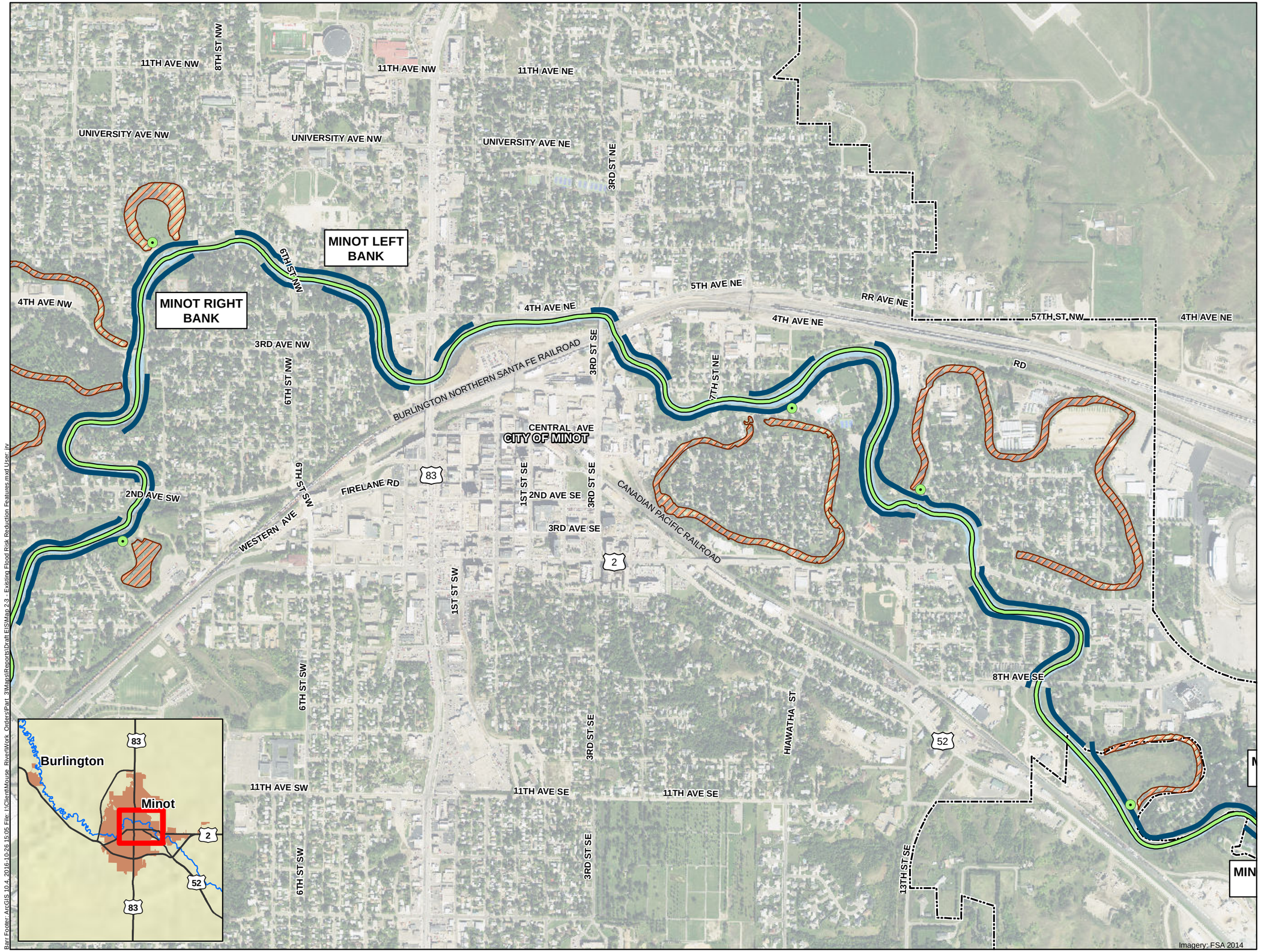
0 500 1,000 2,000

Feet

Map 2-3

EXISTING FLOOD RISK REDUCTION FEATURES
Map (3 of 6)
Mouse River Enhanced Flood Protection Project

Barr Foster: ArcGIS 10.4, 2016-10-26 15:05 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-3_ - Existing Flood Risk Reduction Features.mxd User: rv



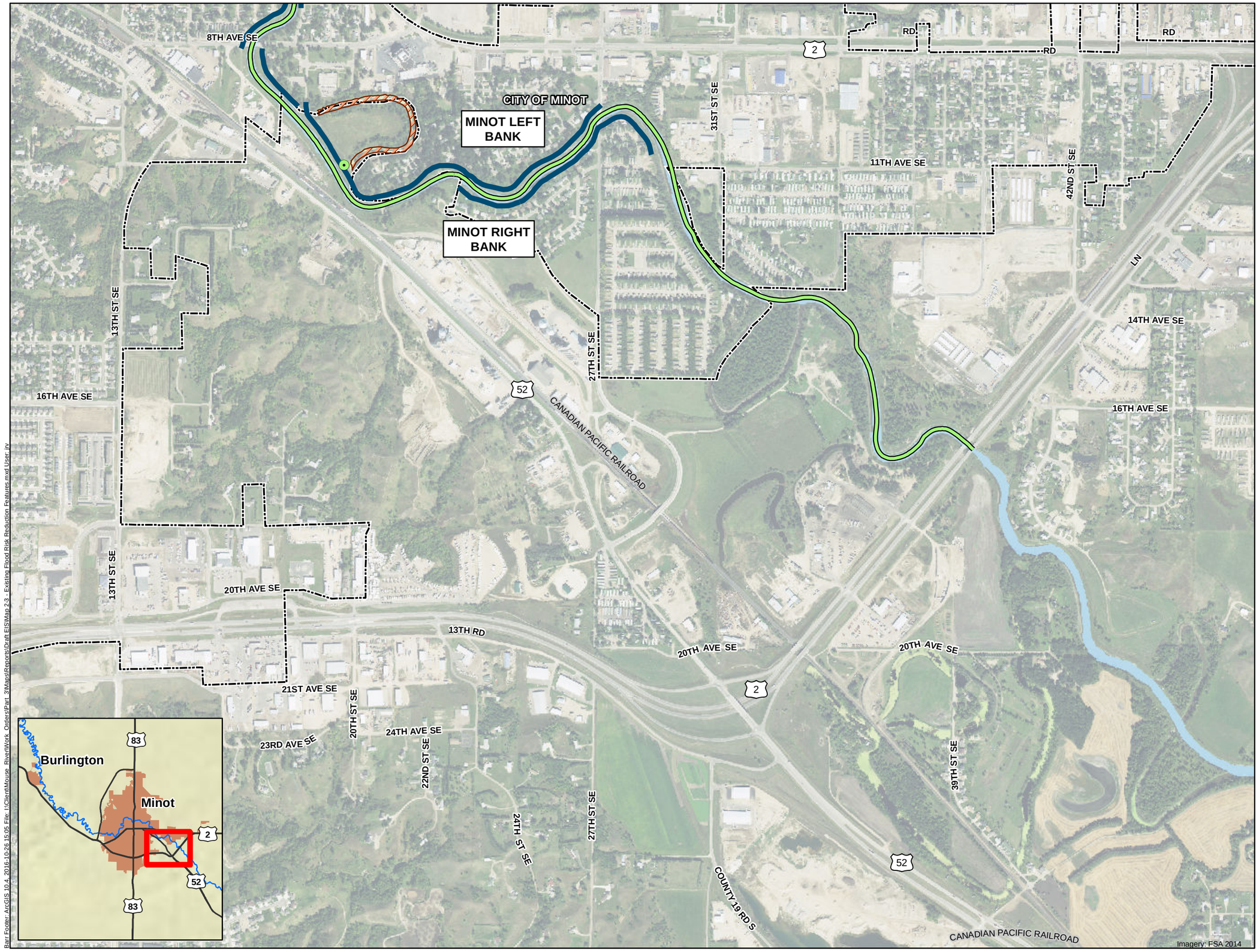
Levee Centerline
Channel Modifications
Ponding Areas
Pump Stations
Municipalities

0 500 1,000 2,000
Feet

Map 2-3

EXISTING FLOOD RISK REDUCTION FEATURES
Map (4 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:05 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-3_Existing Flood Risk Reduction Features.mxd User: jrv



Levee Centerline

Channel Modifications

Ponding Areas

Pump Stations

Municipalities

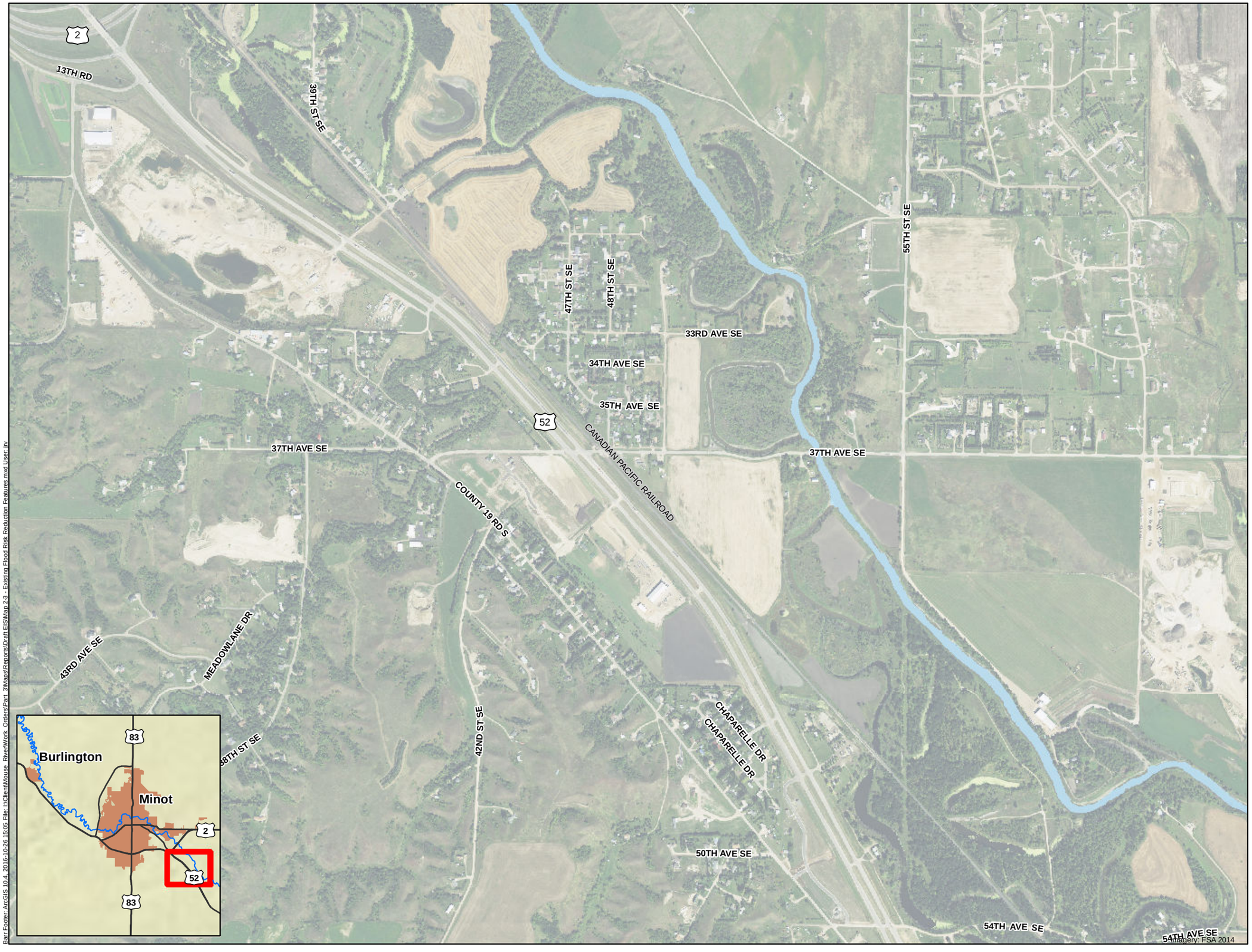
0 500 1,000 2,000

Feet

Map 2-3

EXISTING FLOOD RISK REDUCTION FEATURES
Map (5 of 6)
Mouse River Enhanced Flood Protection Project

Bar Footer: ArcGIS 10.4, 2016-10-28 15:05 File: I:\ClientMouse_RiverWork_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-3_Existing Flood Risk Reduction Features.mxd User: jrv

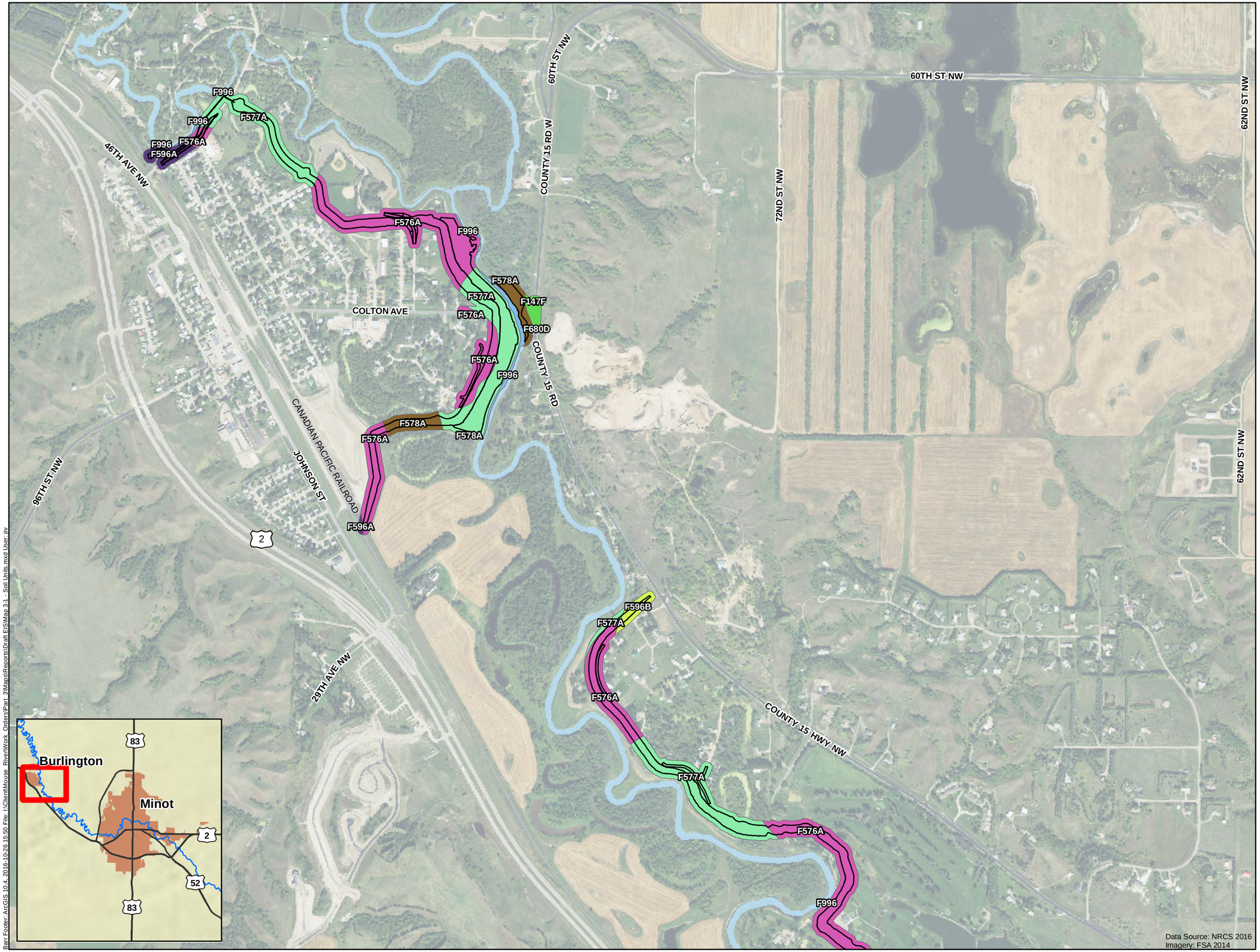


0 500 1,000 2,000
Feet

Map 2-3

EXISTING FLOOD RISK REDUCTION FEATURES
Map (6 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:05 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 2-3 - Existing Flood Risk Reduction Features.mxd User: jrv



Project Footprint

Map Unit Name

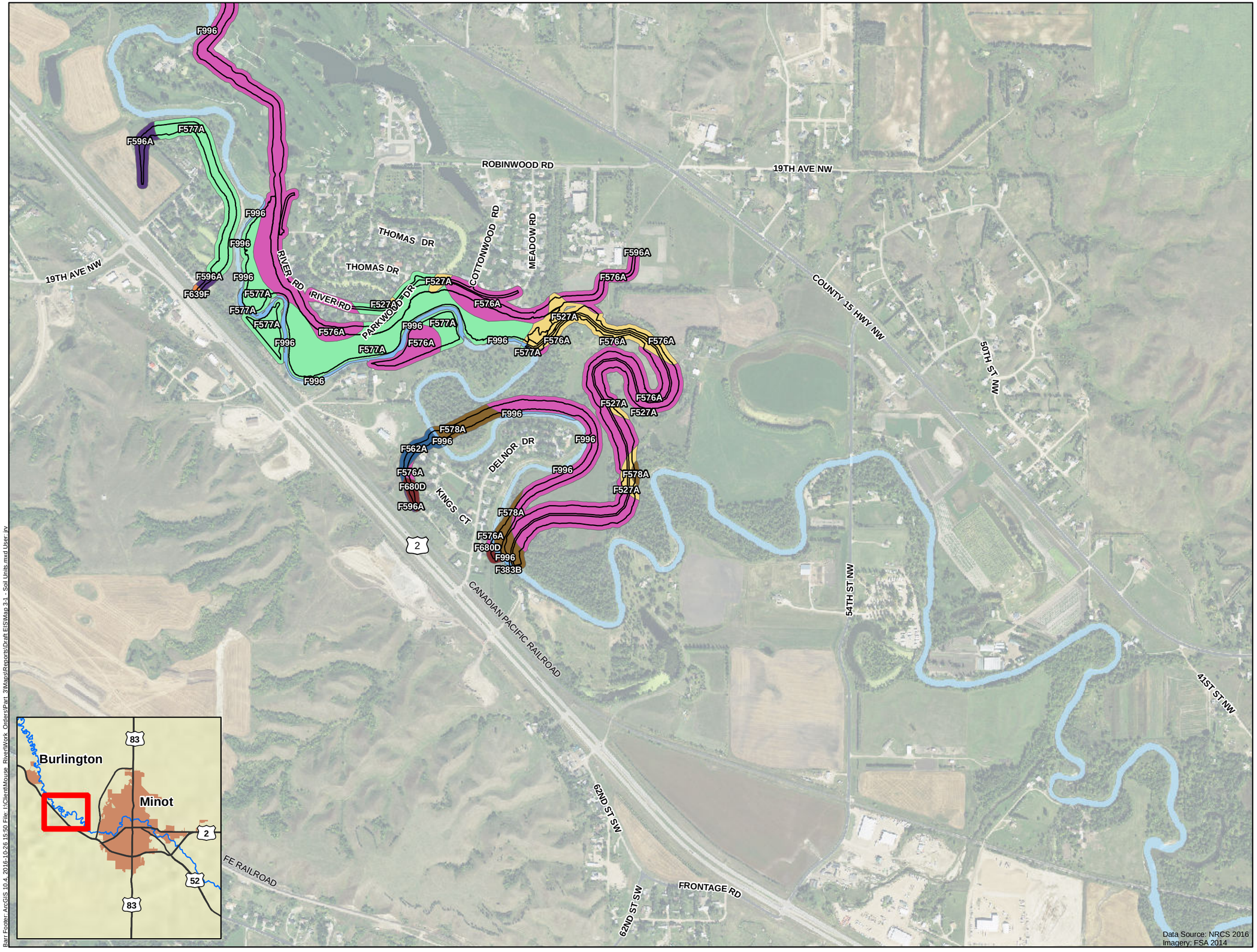
- F147F:Buse-Barnes-Darnen loams, 9 to 35 percent slopes
- F576A:Velva loam, moist, 0 to 2 percent slopes, occasionally flooded
- F577A:Velva, moist-Fluvaquents, channeled fine sandy loams, 0 to 2 percent slopes, frequently flooded
- F578A:Velva fine sandy loam, moist, wooded, 0 to 2 percent slopes, frequently flooded
- F596A:Darnen loam, 0 to 2 percent slopes
- F596B:Darnen loam, 2 to 6 percent slopes
- F680D:Barnes-Sioux complex, 6 to 15 percent slopes
- F996:Water

0 500 1,000 2,000
Feet

Map 3-1

SOIL UNITS
Map (1 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:50 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-1 - Soil Units.mxd User: jrv



Project Footprint

Map Unit Name

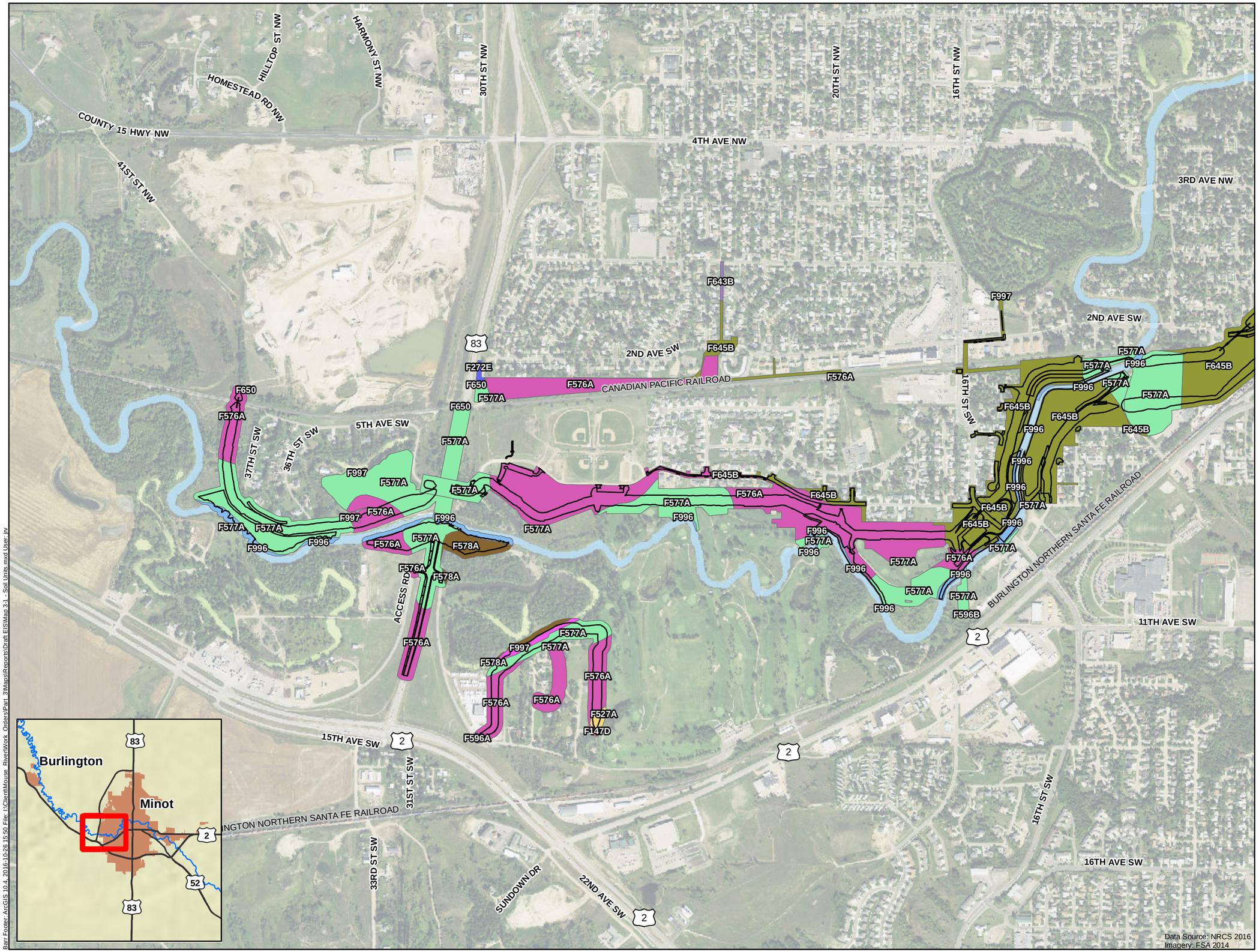
- F383B:Maddock-Hecla fine sandy loams, 0 to 6 percent slopes
- F527A:Ludden silty clay, very poorly drained, 0 to 1 percent slopes, frequently flooded
- F562A:La Prairie-Fluvaquents, channeled complex, 0 to 2 percent slopes, frequently flooded
- F576A:Velva loam, moist, 0 to 2 percent slopes, occasionally flooded
- F577A:Velva, moist-Fluvaquents, channeled fine sandy loams, 0 to 2 percent slopes, frequently flooded
- F578A:Velva fine sandy loam, moist, wooded, 0 to 2 percent slopes, frequently flooded
- F596A:Darnen loam, 0 to 2 percent slopes
- F639F:Orthents-Aquents-Urban Land, highway complex, 0 to 35 percent slopes
- F680D:Barnes-Sioux complex, 6 to 15 percent slopes
- F996:Water

0 500 1,000 2,000
Feet

Map 3-1

SOIL UNITS
Map (2 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-28 15:50 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-1_Soil Units.mxd User: jro



Project Footprint

Map Unit Name

- F147D:Buse-Barnes-Darnen loams, 6 to 15 percent slopes
- F272E:Sioux-Arvilla-Renshaw complex, 9 to 25 percent slopes
- F527A:Ludden silty clay, very poorly drained, 0 to 1 percent slopes, frequently flooded
- F576A:Velva loam, moist, 0 to 2 percent slopes, occasionally flooded
- F577A:Velva, moist-Fluvaquents, channeled fine sandy loams, 0 to 2 percent slopes, frequently flooded
- F578A:Velva fine sandy loam, moist, wooded, 0 to 2 percent slopes, frequently flooded
- F596A:Darnen loam, 0 to 2 percent slopes
- F596B:Darnen loam, 2 to 6 percent slopes
- F643B:Urban land-Udorthents loamy complex, 0 to 6 percent slopes
- F645B:Urban land-Udifluvents loamy complex, 0 to 6 percent slopes
- F650:Pits, gravel and sand
- F996:Water
- F997:Water, intermittent

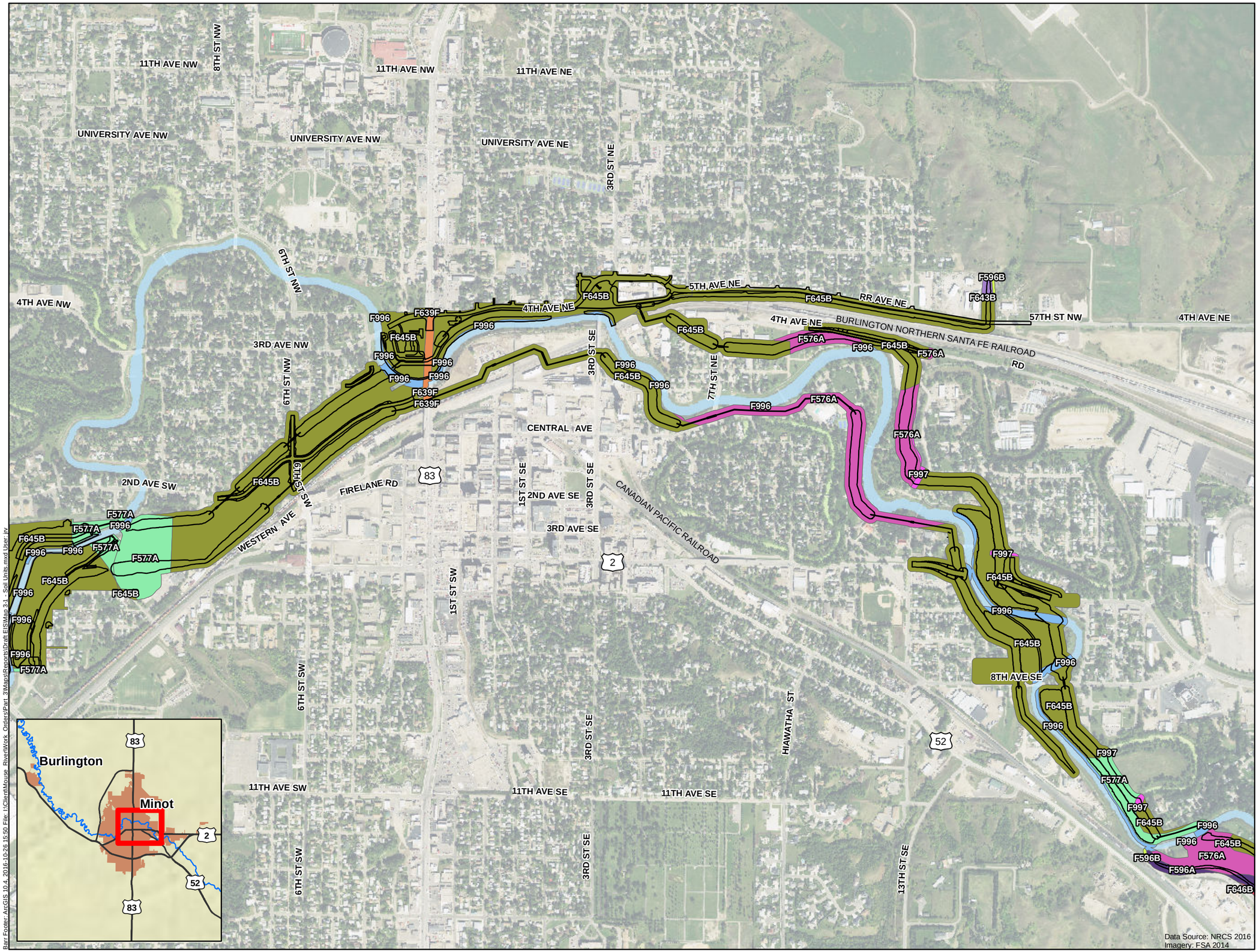
0 500 1,000 2,000

Feet

Map 3-1

SOIL UNITS
Map (3 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:50 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-1 - Soil Units.mxd User: jrv



Project Footprint

Map Unit Name

- F576A:Velva loam, moist, 0 to 2 percent slopes, occasionally flooded
- F577A:Velva, moist-Fluvaquents, channeled fine sandy loams, 0 to 2 percent slopes, frequently flooded
- F596A:Darnen loam, 0 to 2 percent slopes
- F596B:Darnen loam, 2 to 6 percent slopes
- F639F:Orthents-Aquents-Urban Land, highway complex, 0 to 35 percent slopes
- F643B:Urban land-Udorthents loamy complex, 0 to 6 percent slopes
- F645B:Urban land-Udifluvents loamy complex, 0 to 6 percent slopes
- F646B:Urban land, 0 to 6 percent slopes
- F996:Water
- F997:Water, intermittent

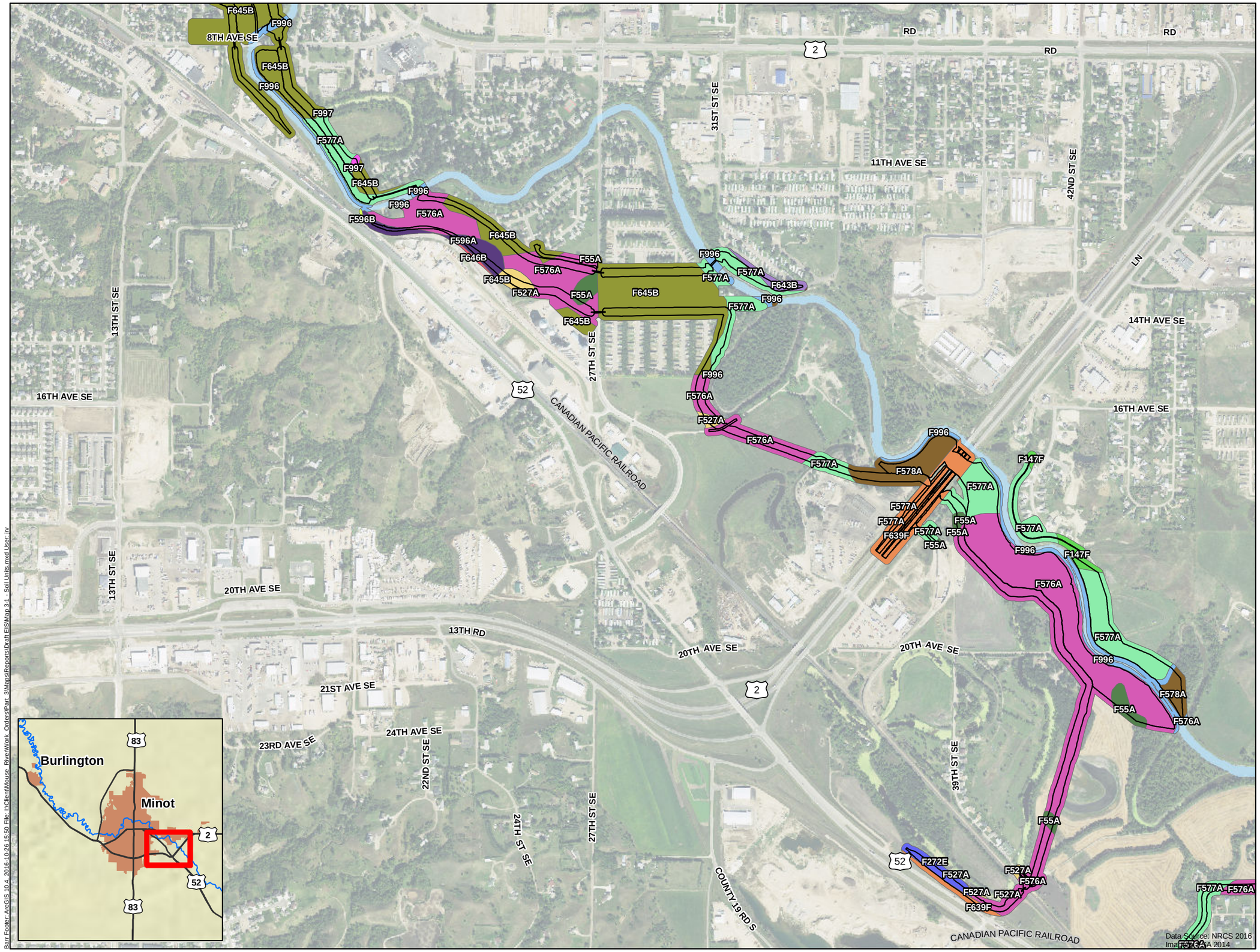
0 500 1,000 2,000

Feet

Map 3-1

SOIL UNITS
Map (4 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:50 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-1_Soil Units.mxd User: jpv



Project Footprint

Map Unit Name

- F147F:Buse-Barnes-Darnen loams, 9 to 35 percent slopes
- F272E:Sioux-Arvilla-Renshaw complex, 9 to 25 percent slopes
- F527A:Ludden silty clay, very poorly drained, 0 to 1 percent slopes, frequently flooded
- F55A:Ludden silty clay, 0 to 1 percent slopes, frequently flooded
- F576A:Velva loam, moist, 0 to 2 percent slopes, occasionally flooded
- F577A:Velva, moist-Fluvaquents, channeled fine sandy loams, 0 to 2 percent slopes, frequently flooded
- F578A:Velva fine sandy loam, moist, wooded, 0 to 2 percent slopes, frequently flooded
- F596A:Darnen loam, 0 to 2 percent slopes
- F596B:Darnen loam, 2 to 6 percent slopes
- F639F:Orthents-Aquents-Urban Land, highway complex, 0 to 35 percent slopes
- F643B:Urban land-Udorthents loamy complex, 0 to 6 percent slopes
- F645B:Urban land-Udifluvents loamy complex, 0 to 6 percent slopes
- F646B:Urban land, 0 to 6 percent slopes
- F680D:Barnes-Sioux complex, 6 to 15 percent slopes
- F996:Water
- F997:Water, intermittent

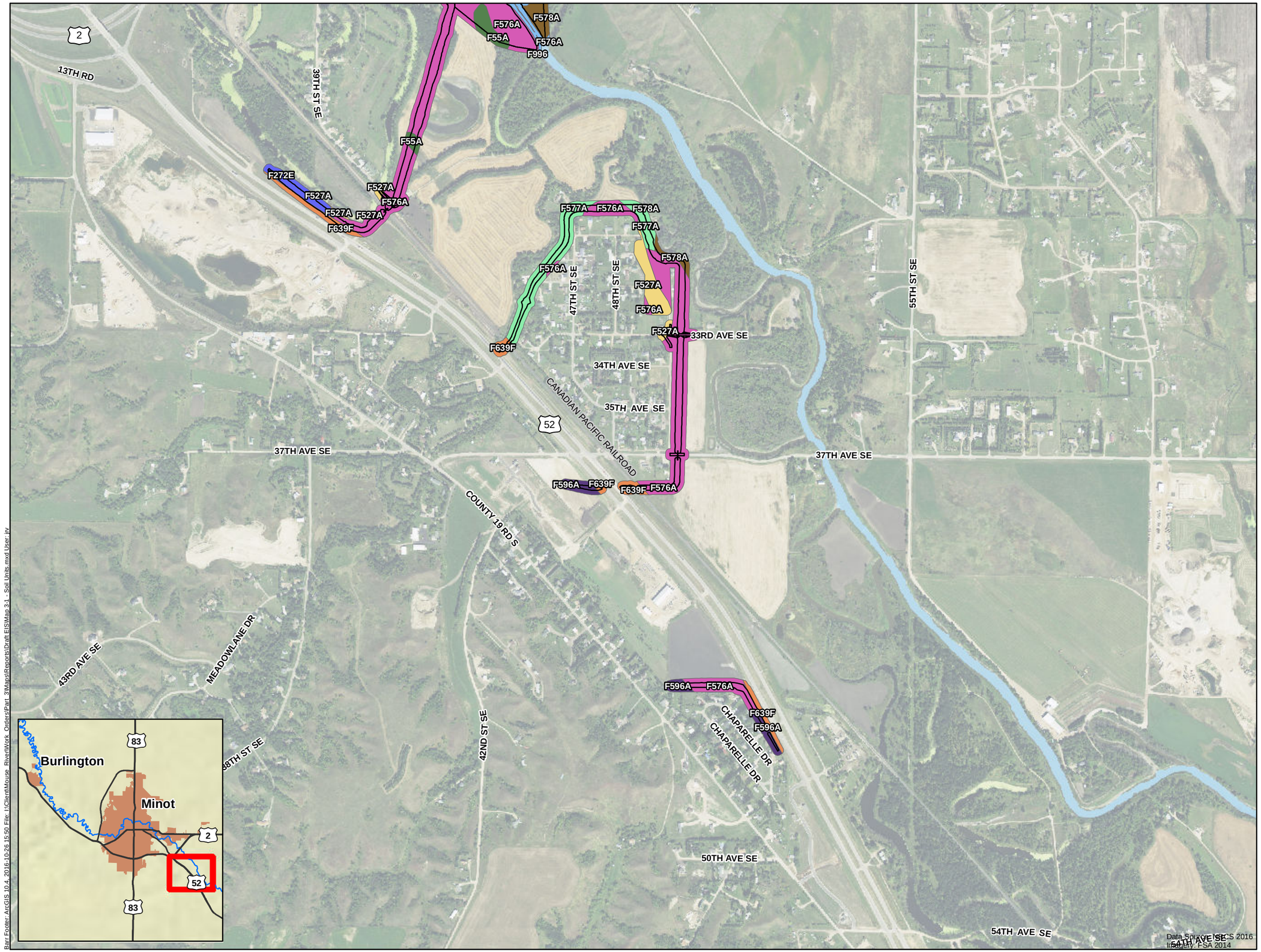
0 500 1,000 2,000

Feet

Map 3-1

SOIL UNITS
Map (5 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:50 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3.1_Soil Units.mxd User: jrv



Project Footprint

Map Unit Name

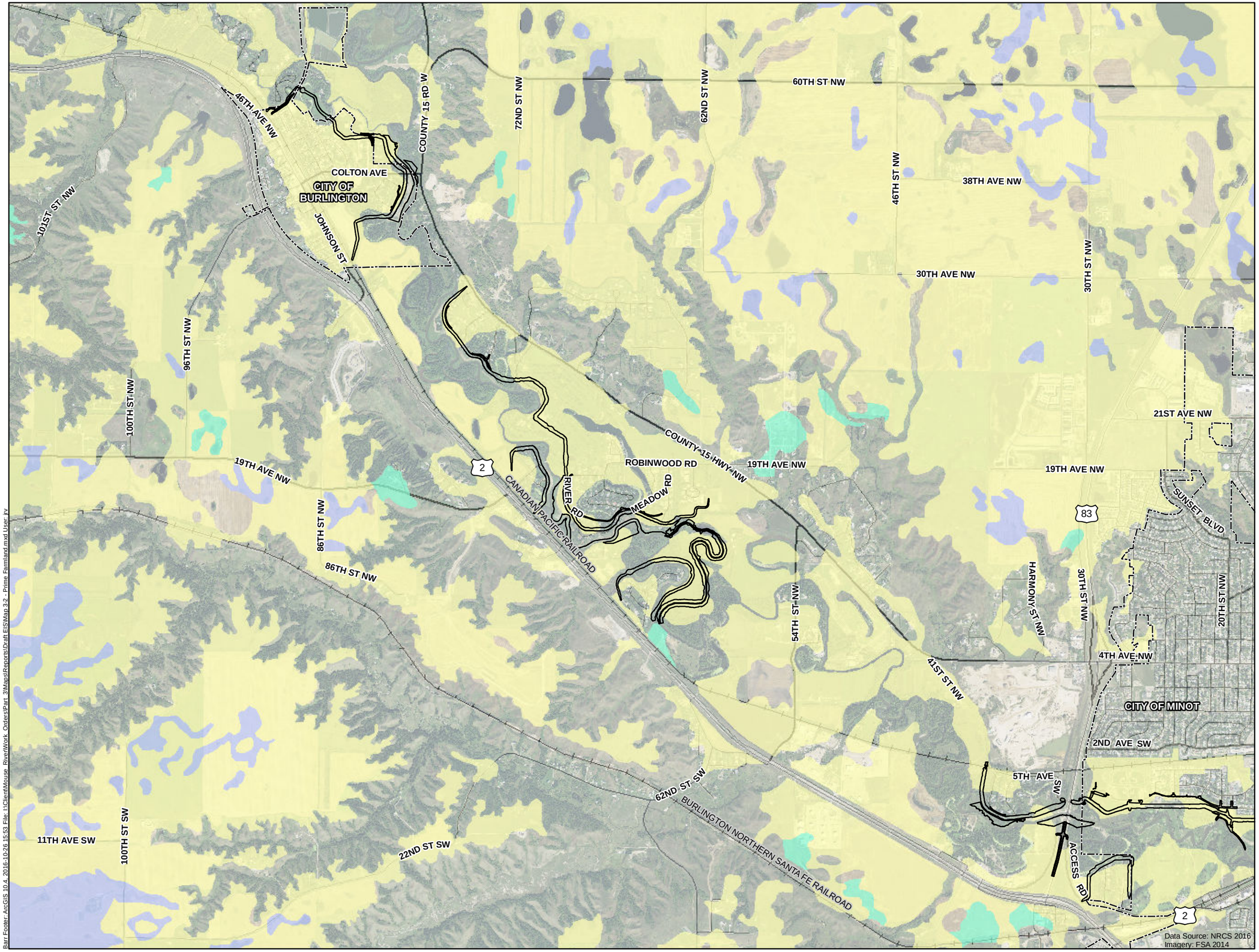
- F272E:Sioux-Arvilla-Renshaw complex, 9 to 25 percent slopes
- F527A:Ludden silty clay, very poorly drained, 0 to 1 percent slopes, frequently flooded
- F55A:Ludden silty clay, 0 to 1 percent slopes, frequently flooded
- F576A:Velva loam, moist, 0 to 2 percent slopes, occasionally flooded
- F577A:Velva, moist-Fluvaquents, channeled fine sandy loams, 0 to 2 percent slopes, frequently flooded
- F578A:Velva fine sandy loam, moist, wooded, 0 to 2 percent slopes, frequently flooded
- F596A:Darnen loam, 0 to 2 percent slopes
- F639F:Orthents-Aquents-Urban Land, highway complex, 0 to 35 percent slopes
- F996:Water

0 500 1,000 2,000
Feet

Map 3-1

SOIL UNITS
Map (6 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:50 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-1_Soil Units.mxd User: jrv



Farmland Classification (NRCS SSURGO Soils)

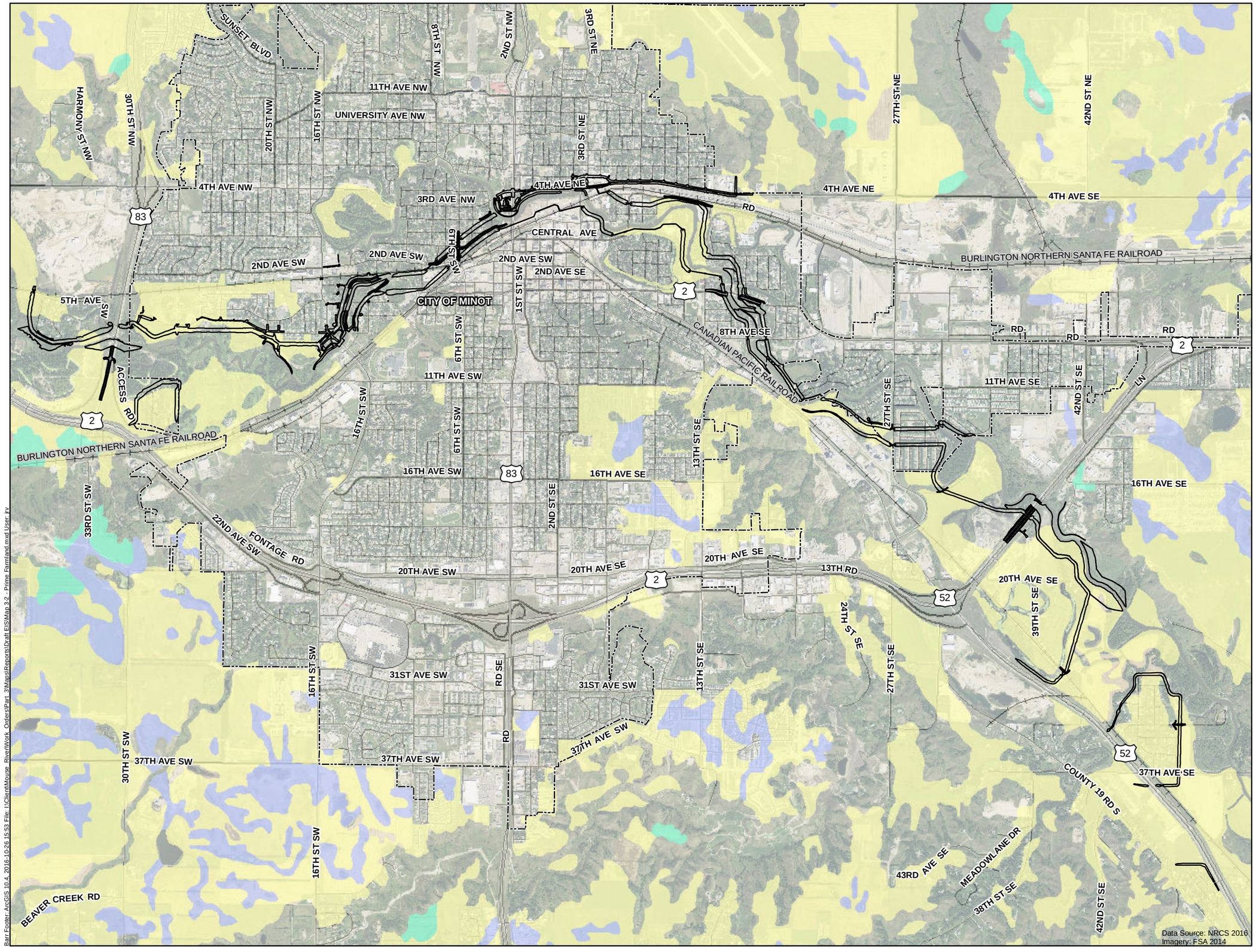
- Prime farmland
- Farmland of statewide importance
- Prime farmland if drained
- Project Footprint
- Municipalities

0 1,250 2,500 5,000
Feet

Map 3-2

PRIME FARMLAND
Map (1 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:53 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-2 - Prime Farmland.mxd User: FV



Farmland Classification (NRCS SSURGO Soils)

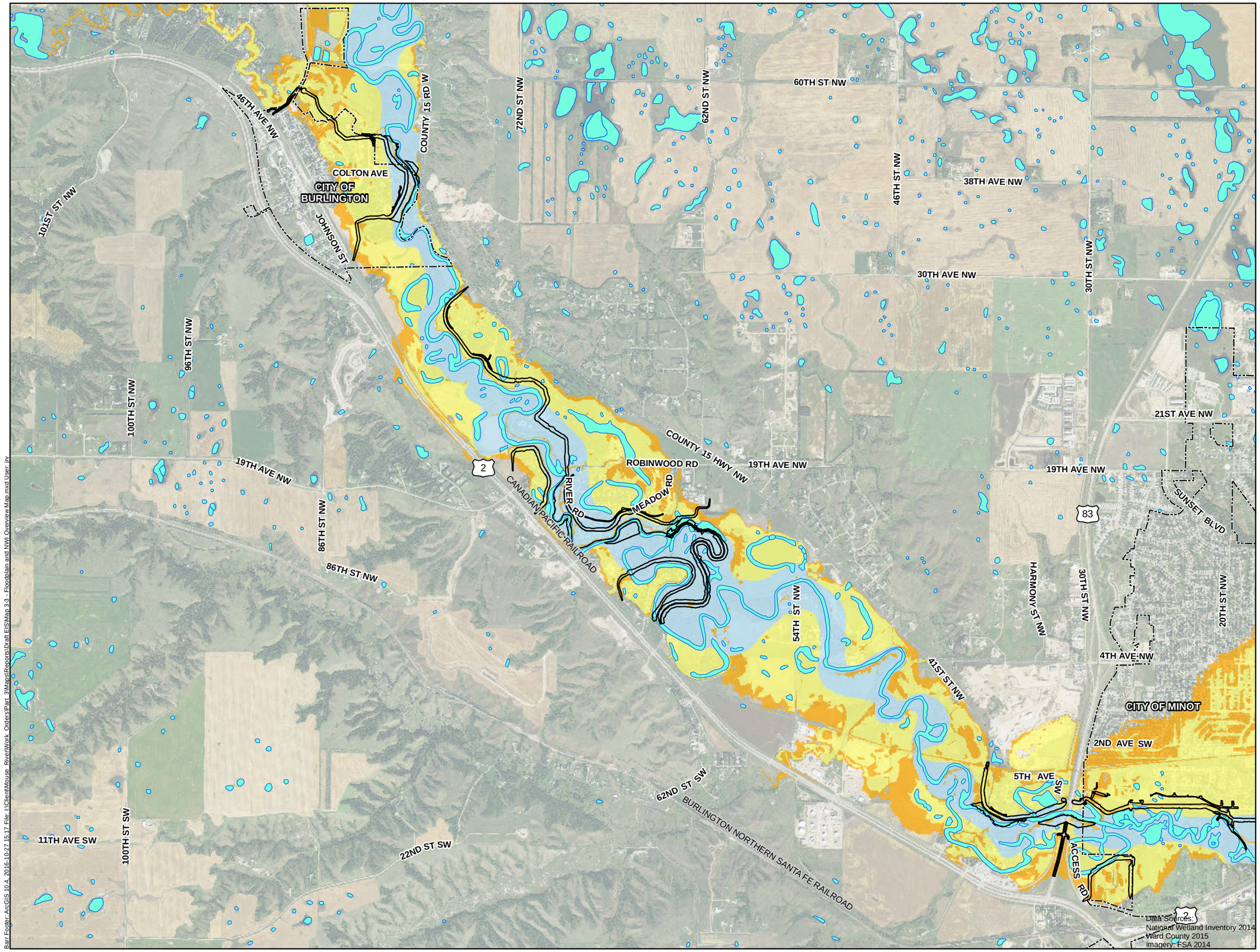
- Prime farmland
- Farmland of statewide importance
- Prime farmland if drained
- Project Footprint
- Municipalities

0 1,250 2,500 5,000
Feet

Map 3-2

PRIME FARMLAND
Map (2 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 15:53 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-2 - Prime Farmland.mxd User: fv



Wetlands (National Wetland Inventory)

Floodway

100-yr Floodplain

500-yr Floodplain

Project Footprint

Municipalities

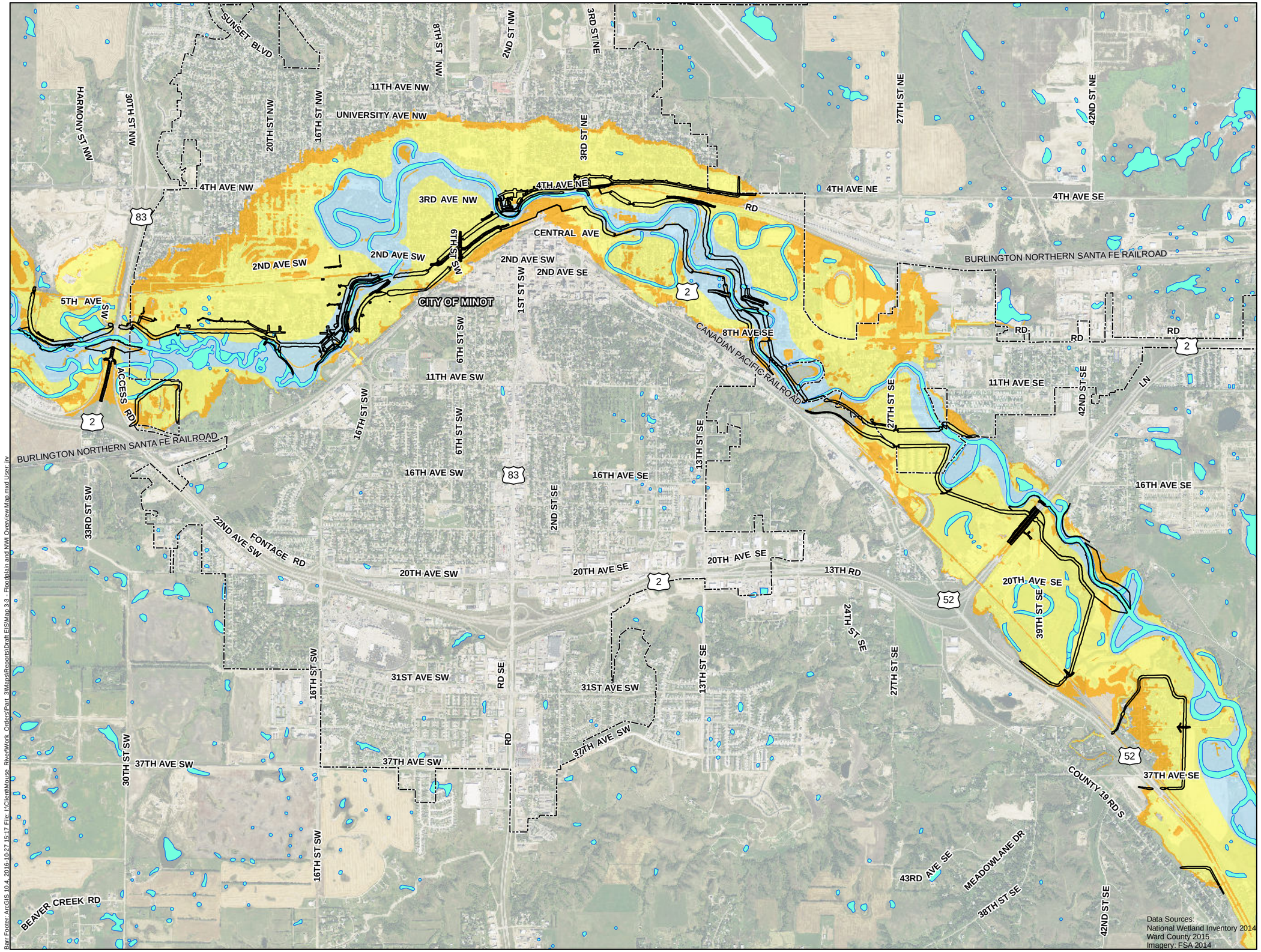
0 1,250 2,500 5,000

Feet

Map 3-3

FLOODPLAIN AND NWI OVERVIEW MAP
Map (1 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:17 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3.3_Floodplain and NWI Overview Map.mxd User: jrv



Wetlands (National Wetland Inventory)

Floodway

100-yr Floodplain

500-yr Floodplain

Project Footprint

Municipalities

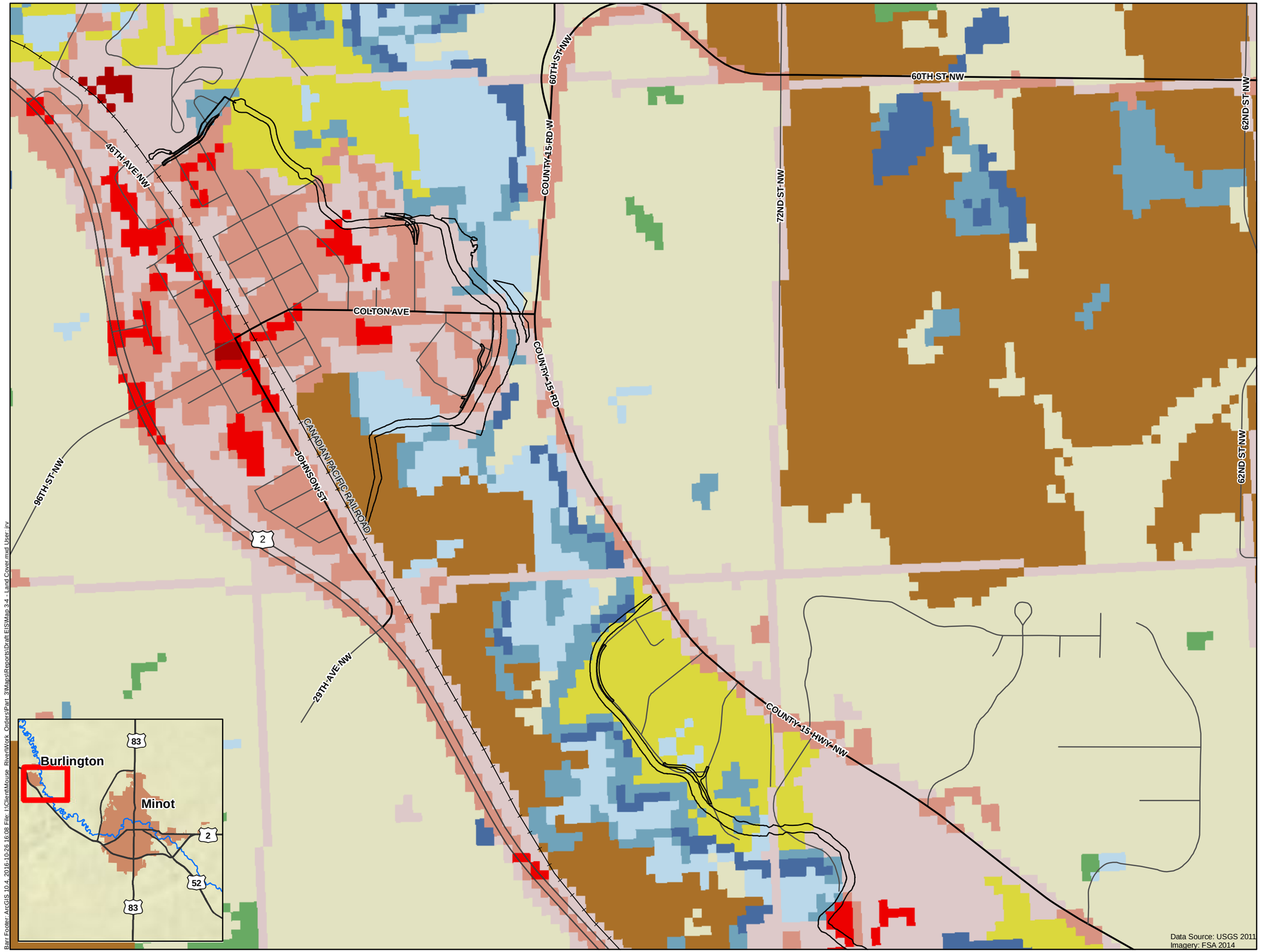
0 1,250 2,500 5,000

Feet

Map 3-3

FLOODPLAIN AND NWI OVERVIEW MAP
Map (2 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:17 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-3 - Floodplain and NWI Overview Map.mxd User: jlv



Project Footprint

Land Cover (USGS 2011)

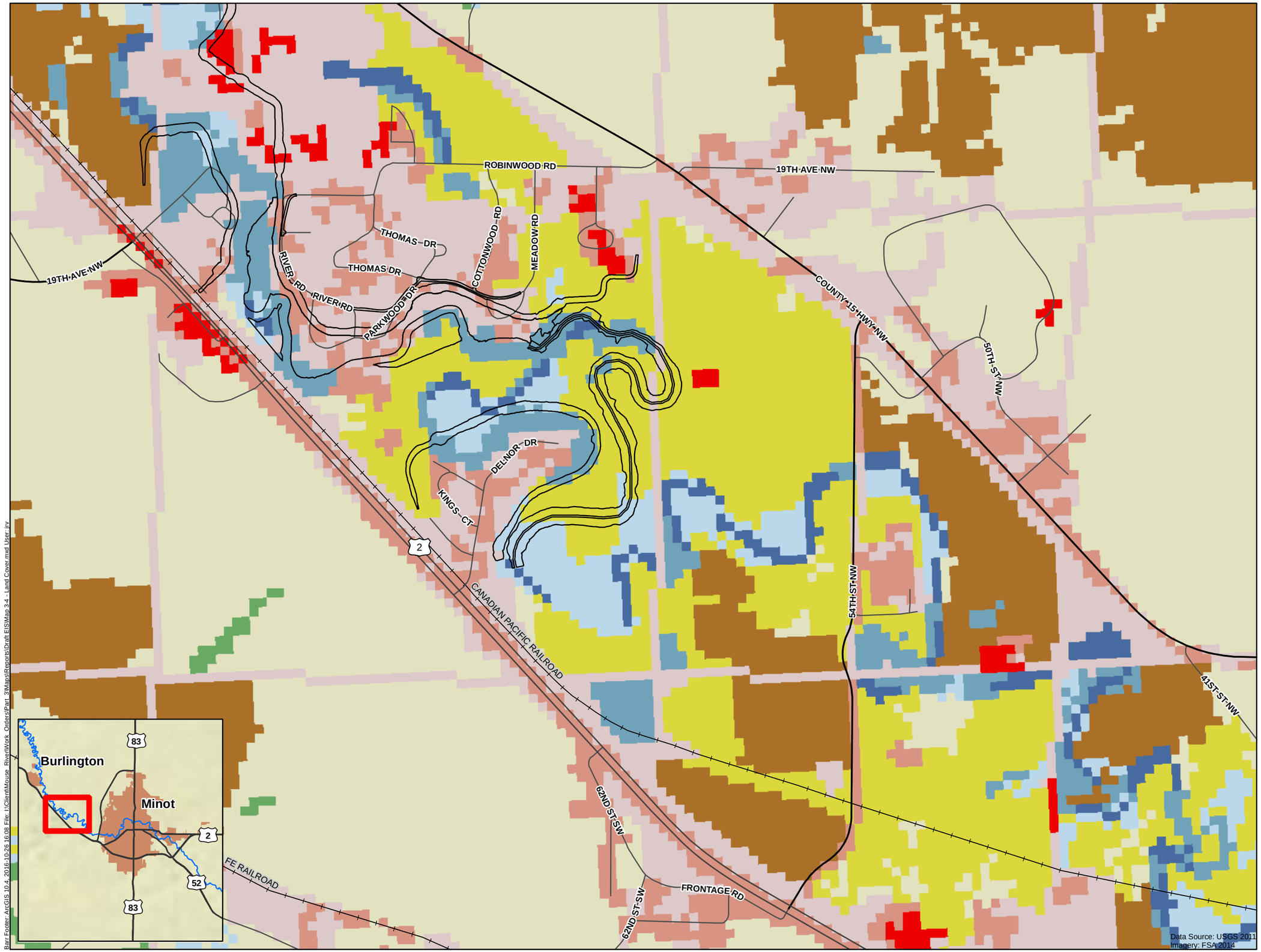
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Deciduous Forest
- Herbaceuous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceuous Wetlands

0 500 1,000 2,000
Feet

Map 3-4

LAND COVER
Map (1 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:08 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-4 - Land Cover.mxd User: jrv



Project Footprint

Land Cover (USGS 2011)

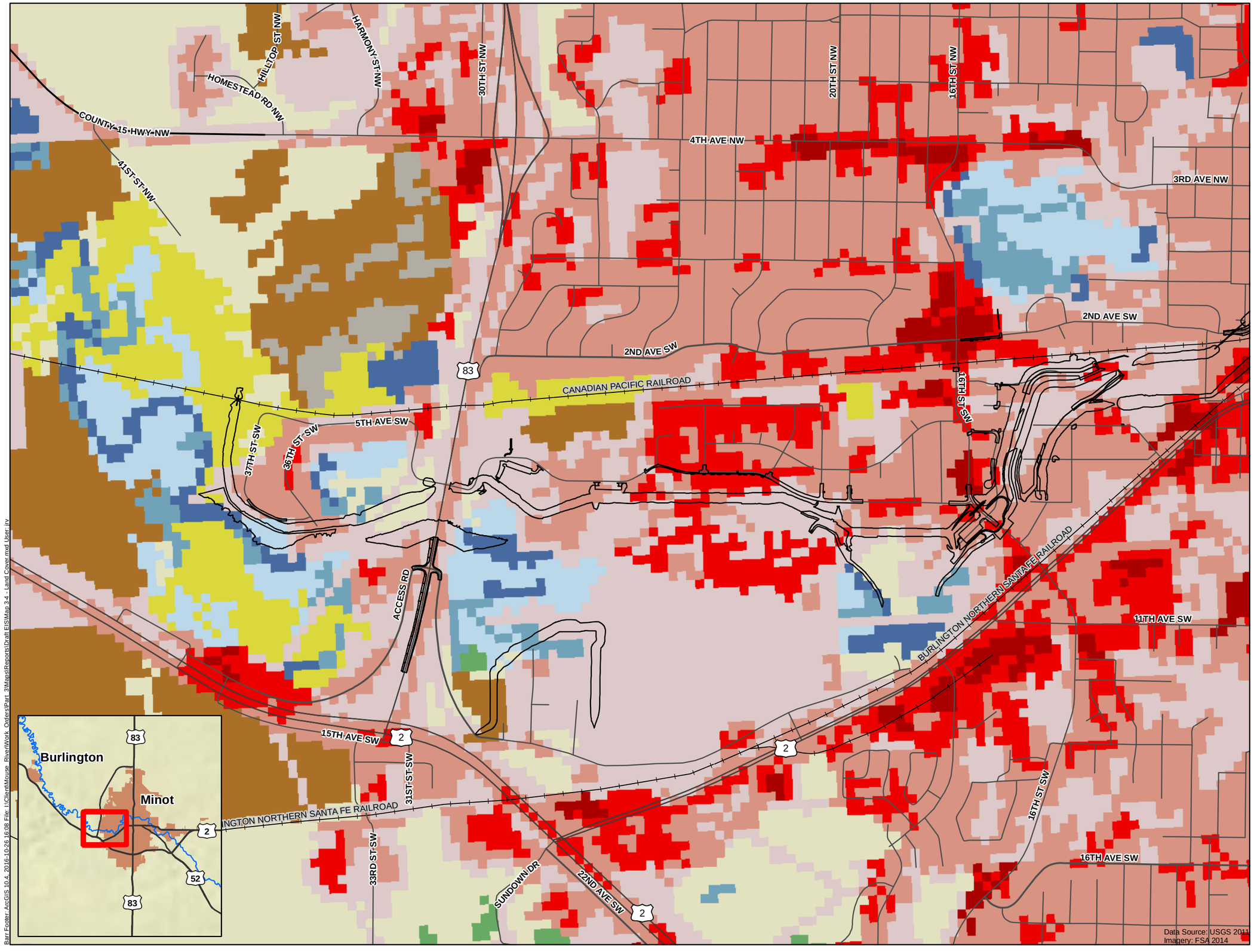
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Deciduous Forest
- Herbaceuous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceuous Wetlands

0 500 1,000 2,000
Feet

Map 3-4

LAND COVER
Map (2 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:08 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-4 - Land Cover.mxd User: jrv



Project Footprint

Land Cover (USGS 2011)

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Herbaceuous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceuous Wetlands

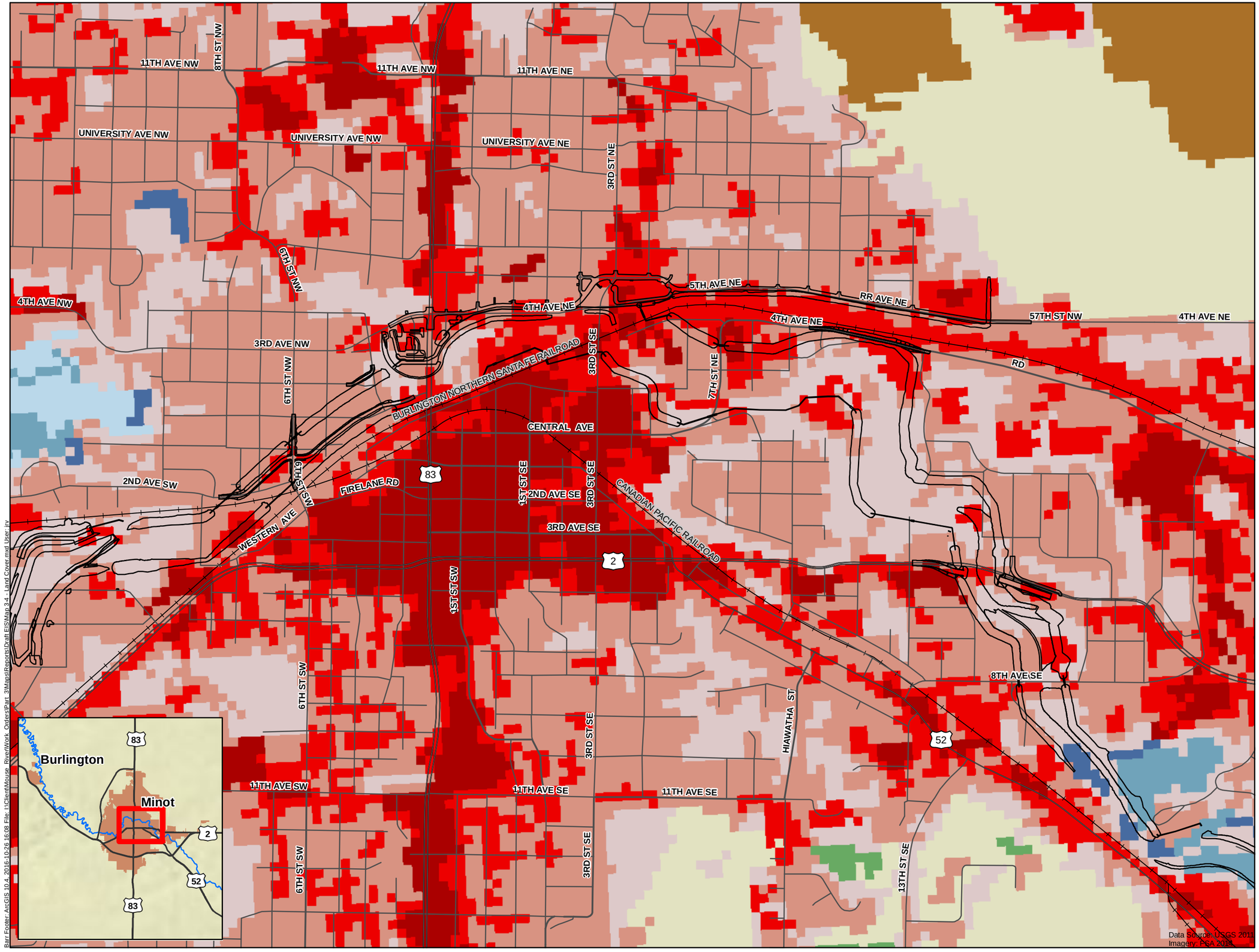
0 500 1,000 2,000

Feet

Map 3-4

LAND COVER
Map (3 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:08 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-4 - Land Cover.mxd User: jrv



Project Footprint

Land Cover (USGS 2011)

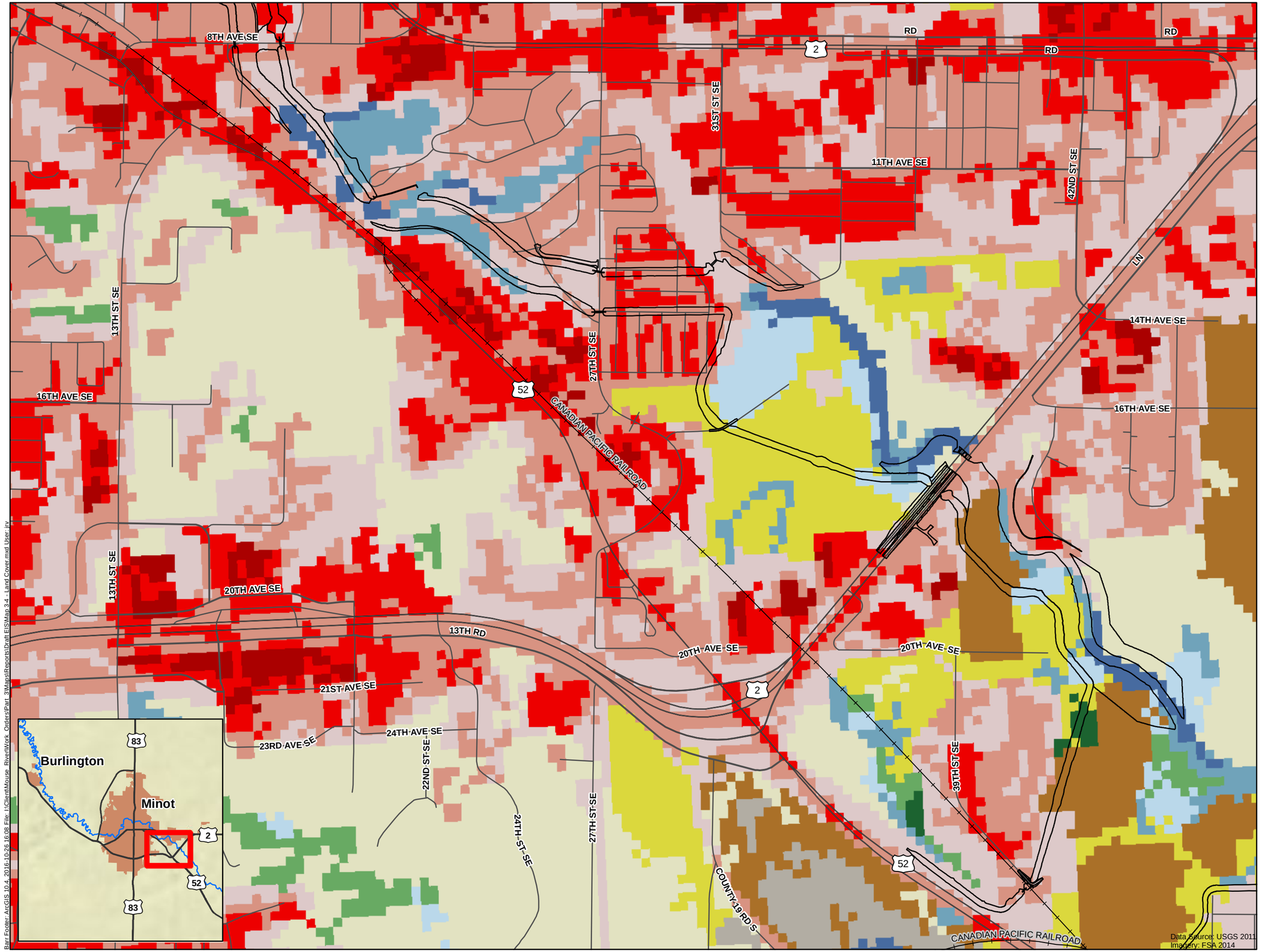
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Deciduous Forest
- Herbaceuous
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceuous Wetlands

0 500 1,000 2,000
Feet

Map 3-4

LAND COVER
Map (4 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:08 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3.4 - Land Cover.mxd User: jrv



Project Footprint

Land Cover (USGS 2011)

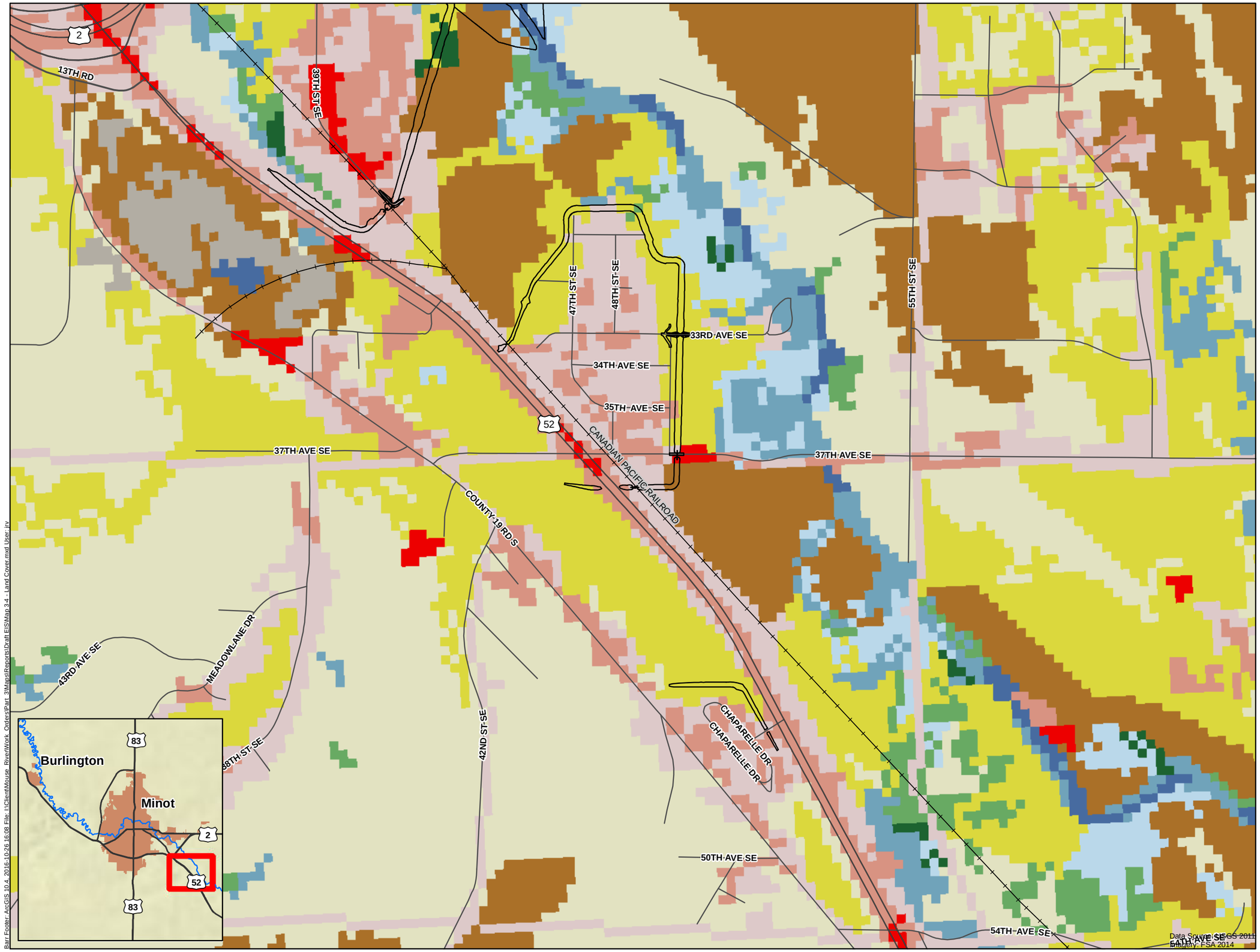
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Herbaceuous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceuous Wetlands

0 500 1,000 2,000
Feet

Map 3-4

LAND COVER
Map (5 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:08 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-4 - Land Cover.mxd User: jxy



Project Footprint

Land Cover (USGS 2011)

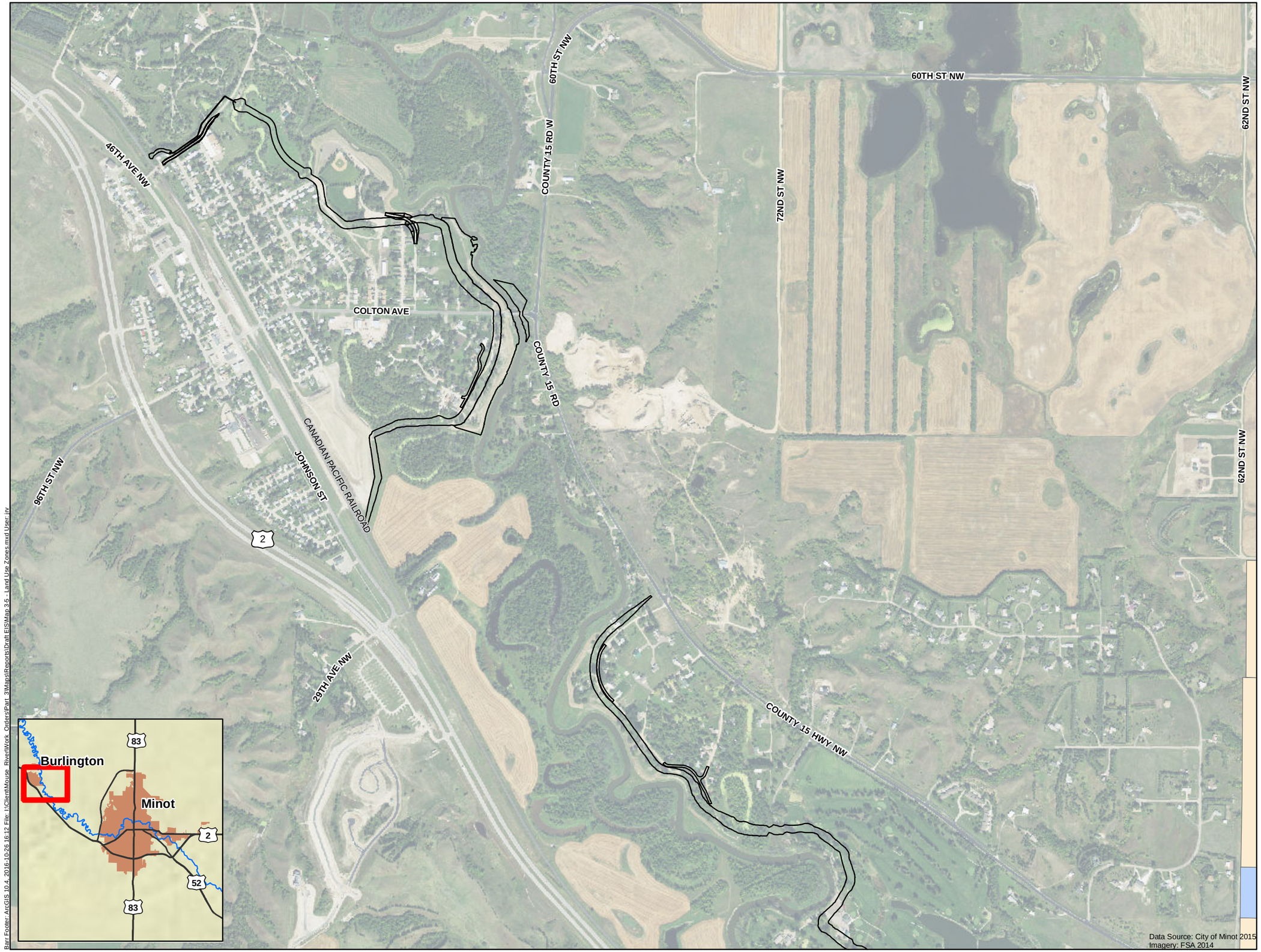
- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Herbaceuous
- Hay/Pasture
- Cultivated Crops
- Woody Wetlands
- Emergent Herbaceuous Wetlands

0 500 1,000 2,000
Feet

Map 3-4

LAND COVER
Map (6 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:08 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-4 - Land Cover.mxd User: rrv



Project Footprint

Zoning

Agriculture / Residence District

Agriculture District

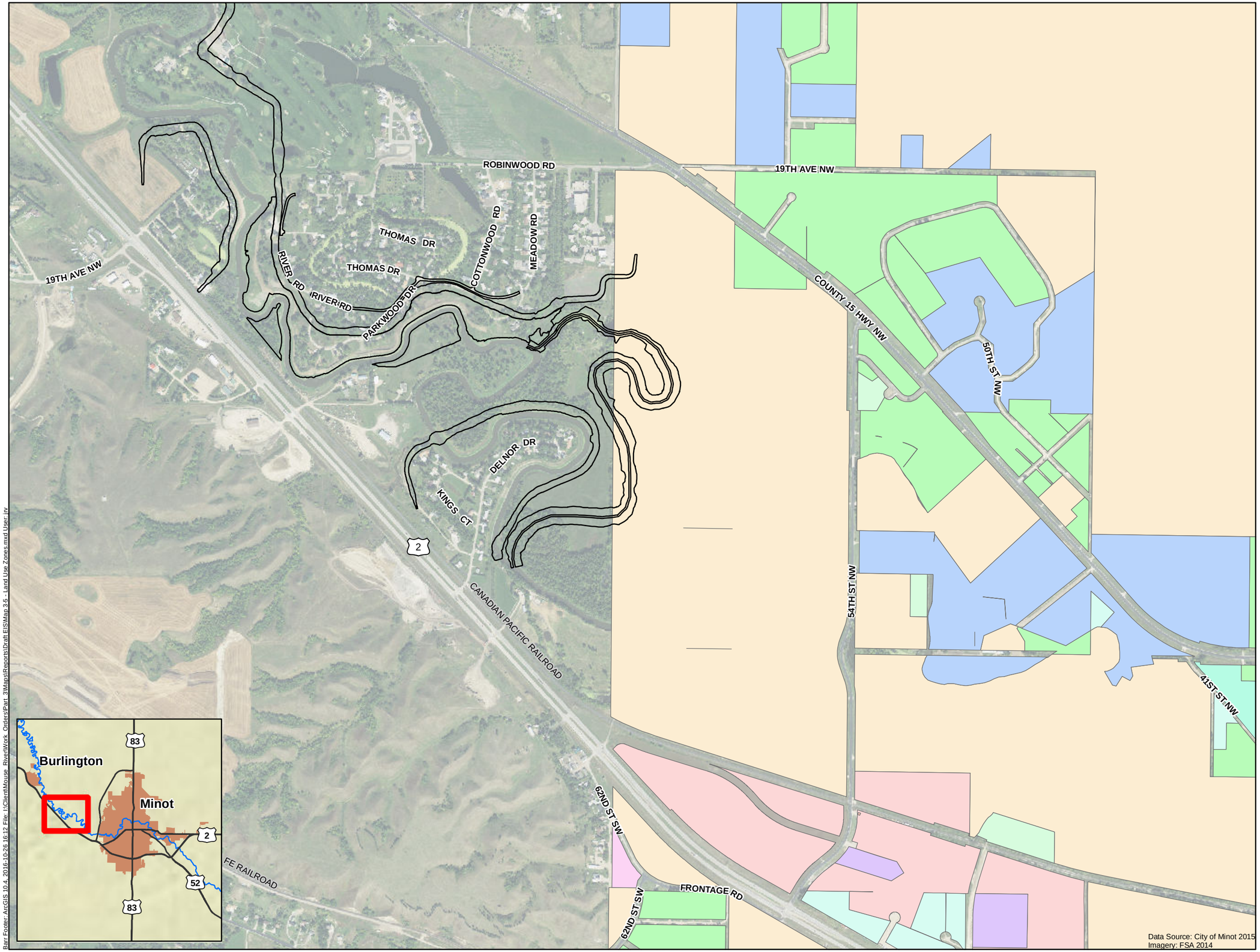
0 500 1,000 2,000

Feet

Map 3-5

LAND USE ZONES
Map (1 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-5 - Land Use Zones.mxd User: jrv



Project Footprint

Zoning

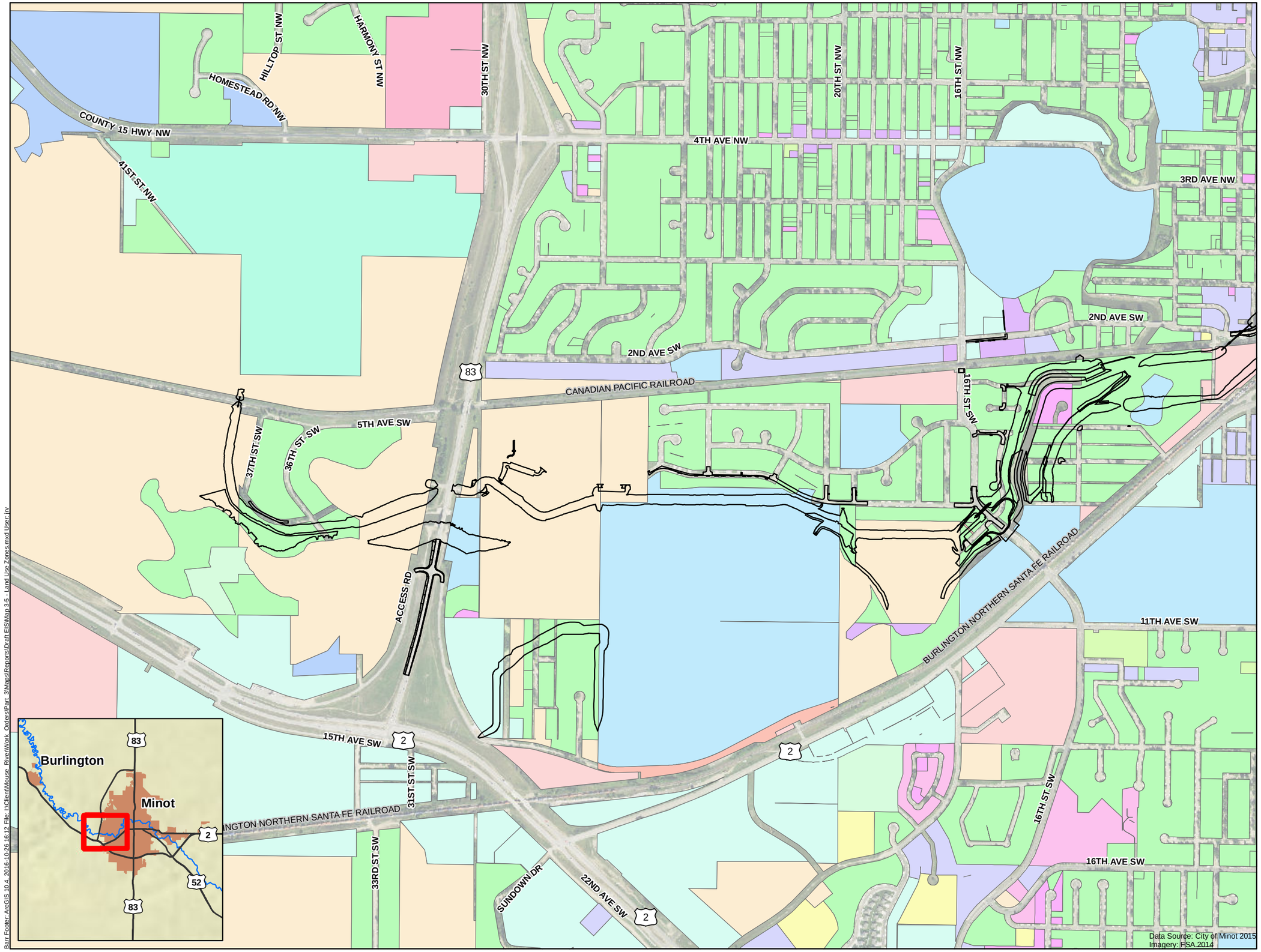
- Agriculture / Residence District
- Agriculture District
- General Commercial District
- Interim Use
- Light Industrial / Agriculture District
- Light Industrial District
- Manufacture Home District
- None Provided
- Single Family Residence District
- Special use

0 500 1,000 2,000
Feet

Map 3-5

LAND USE ZONES
Map (2 of 6)
Mouse River Enhanced Flood Protection Project

Barr Foster: ArcGIS 10.4, 2016-10-26 16:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-5_-_Land Use Zones.mxd User: rjv



Project Footprint

Zoning

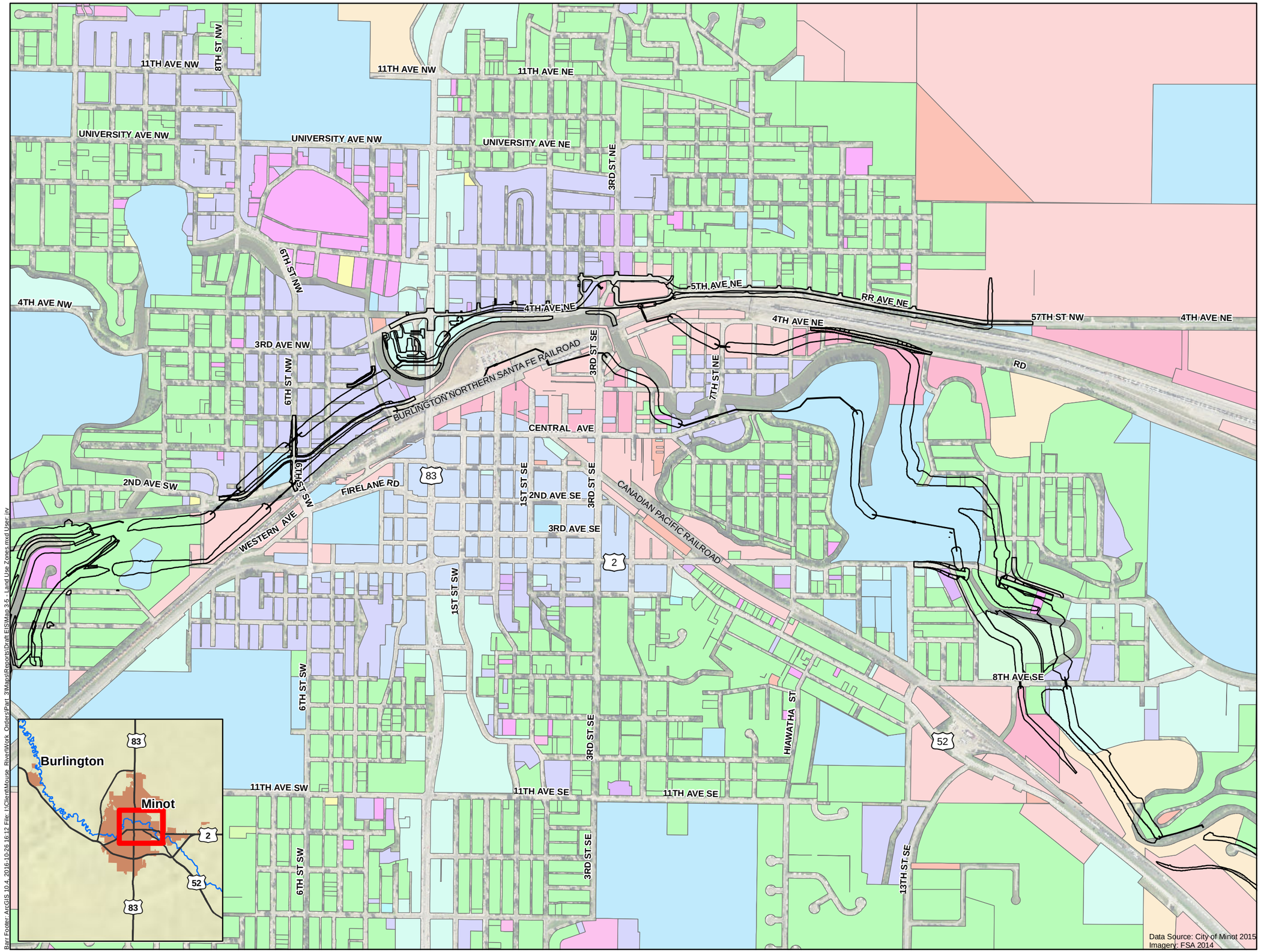
- Agriculture / Residence District
- Agriculture District
- General Commercial District
- Heavy Industrial District
- Light Industrial / Agriculture District
- Light Industrial District
- Limited Commercial District
- Manufacture Home District
- Medium Density Residence District
- Multiple Residence District
- None Provided
- Planned (Commercial)
- Planned (Residential)
- Public Zone
- Single Family Residence District
- Townhouse
- Two-Family Residence District

0 500 1,000 2,000
Feet

Map 3-5

LAND USE ZONES
Map (3 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-5 - Land Use Zones.mxd User: rrv



Project Footprint

Zoning

- Agriculture District
- Central Business District
- General Commercial District
- Heavy Industrial District
- Light Industrial District
- Limited Commercial District
- Manufacture Home District
- Medium Density Residence District
- Multiple Residence District
- None Provided
- Office
- Planned (Commercial)
- Planned (Residential)
- Public Zone
- Single Family Residence District
- Townhouse
- Two-Family Residence District

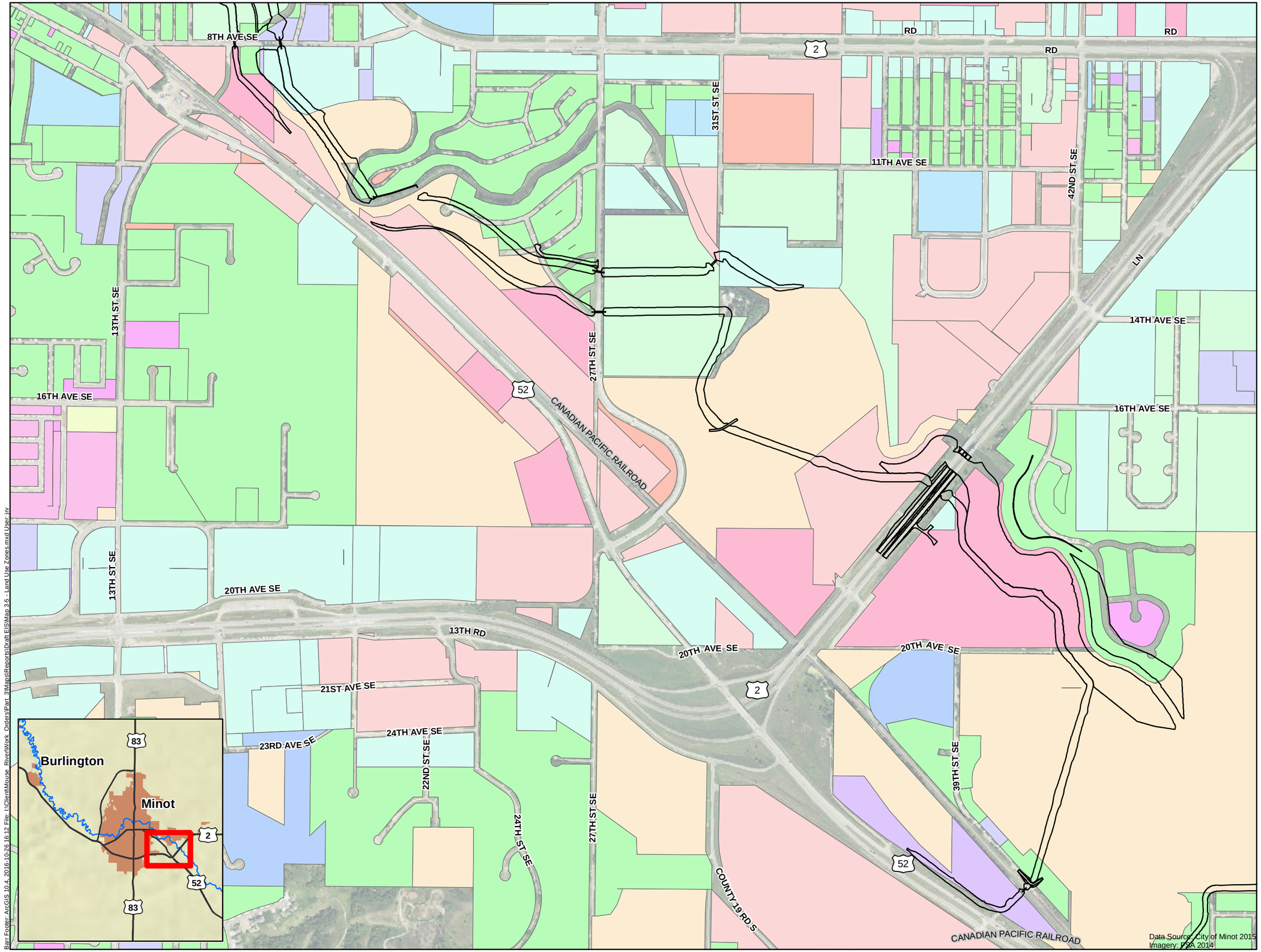
0 500 1,000 2,000

Feet

Map 3-5

LAND USE ZONES
Map (4 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-5 - Land Use Zones.mxd User: jrv



Project Footprint

Zoning

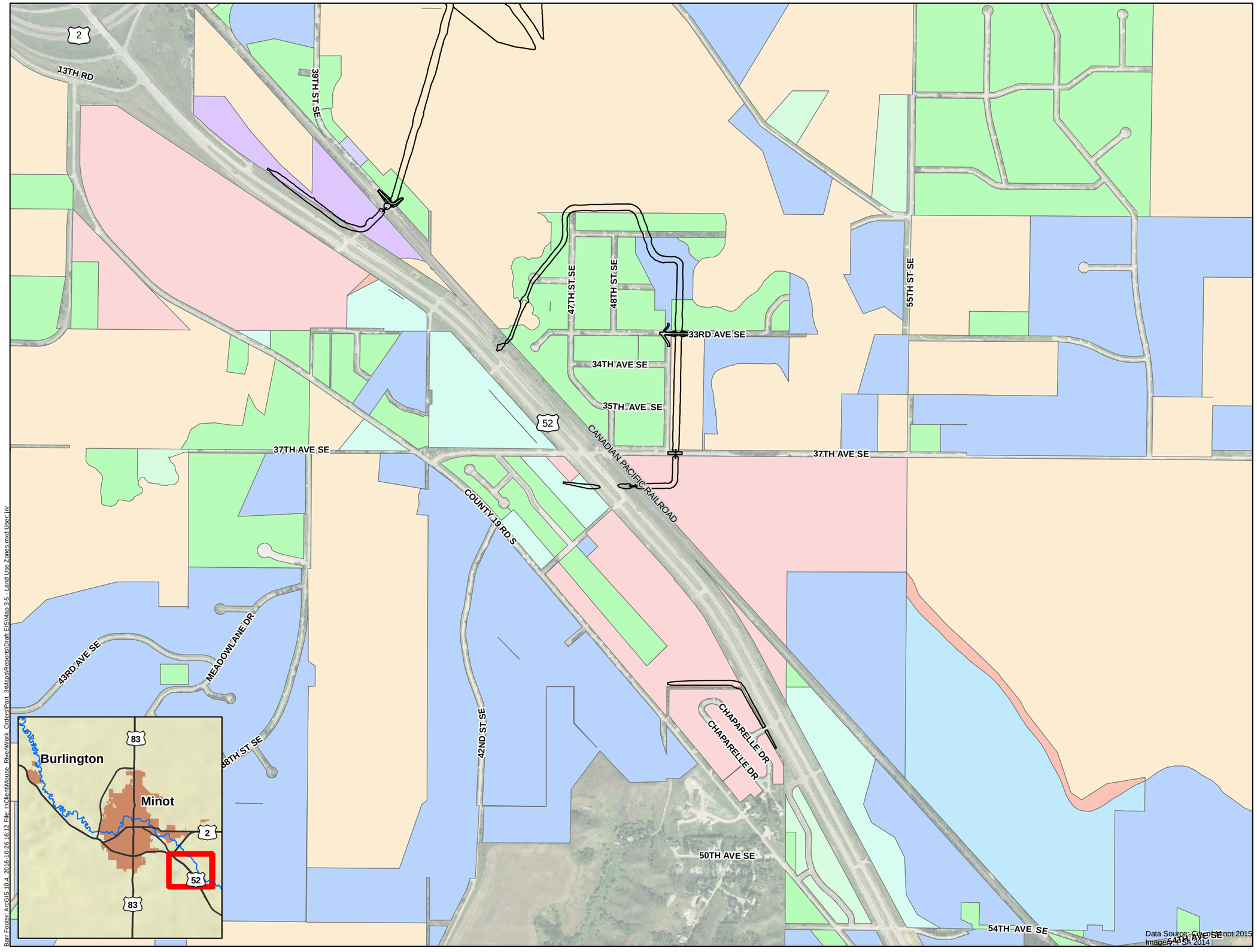
- Agriculture / Residence District
- Agriculture District
- General Commercial District
- Heavy Industrial District
- Light Industrial District
- Limited Commercial District
- Manufacture Home District
- Medium Density Residence District
- Multiple Residence District
- None Provided
- Planned (Residential)
- Public Zone
- Single Family Residence District
- Special use
- Two-Family Residence District

0 500 1,000 2,000
Feet

Map 3-5

LAND USE ZONES
Map (5 of 6)
Mouse River Enhanced Flood Protection Project

Barr Foster: ArcGIS 10.4, 2016-10-26 16:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-5 - Land Use Zones.mxd User: jpv



Project Footprint

Zoning

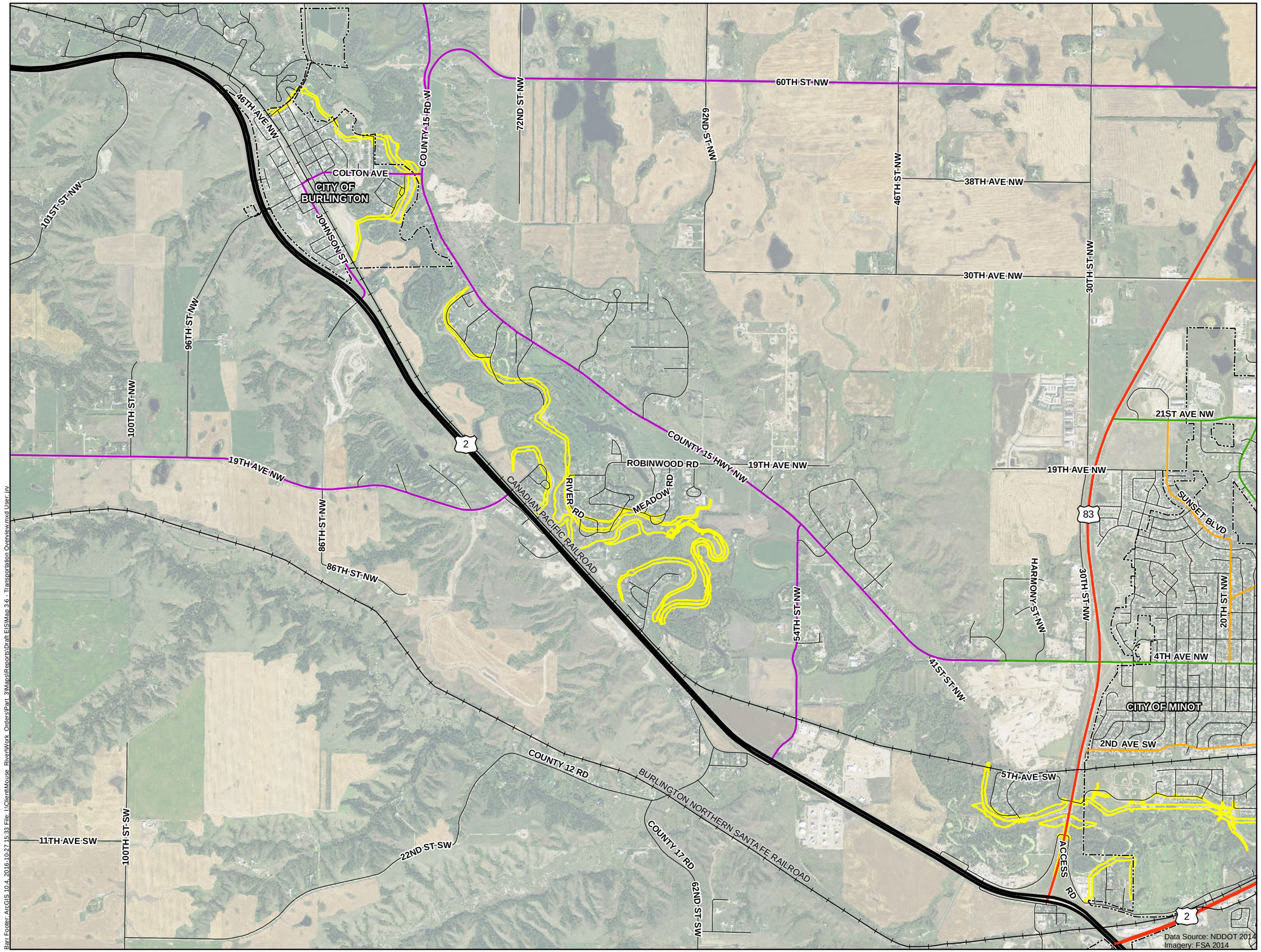
- Agriculture / Residence District
- Agriculture District
- General Commercial District
- Light Industrial District
- Manufacture Home District
- Multiple Residence District
- None Provided
- Public Zone
- Single Family Residence District
- Special use

0 500 1,000 2,000
Feet

Map 3-5

LAND USE ZONES
Map (6 of 6)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-26 16:12 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-5 - Land Use Zones.mxd User: jrv



Principal Arterial - Expressway

Principal Arterial - Other

Major Collector

Minor Arterial

Collector

Local

Railroads

Project Footprint

Municipalities

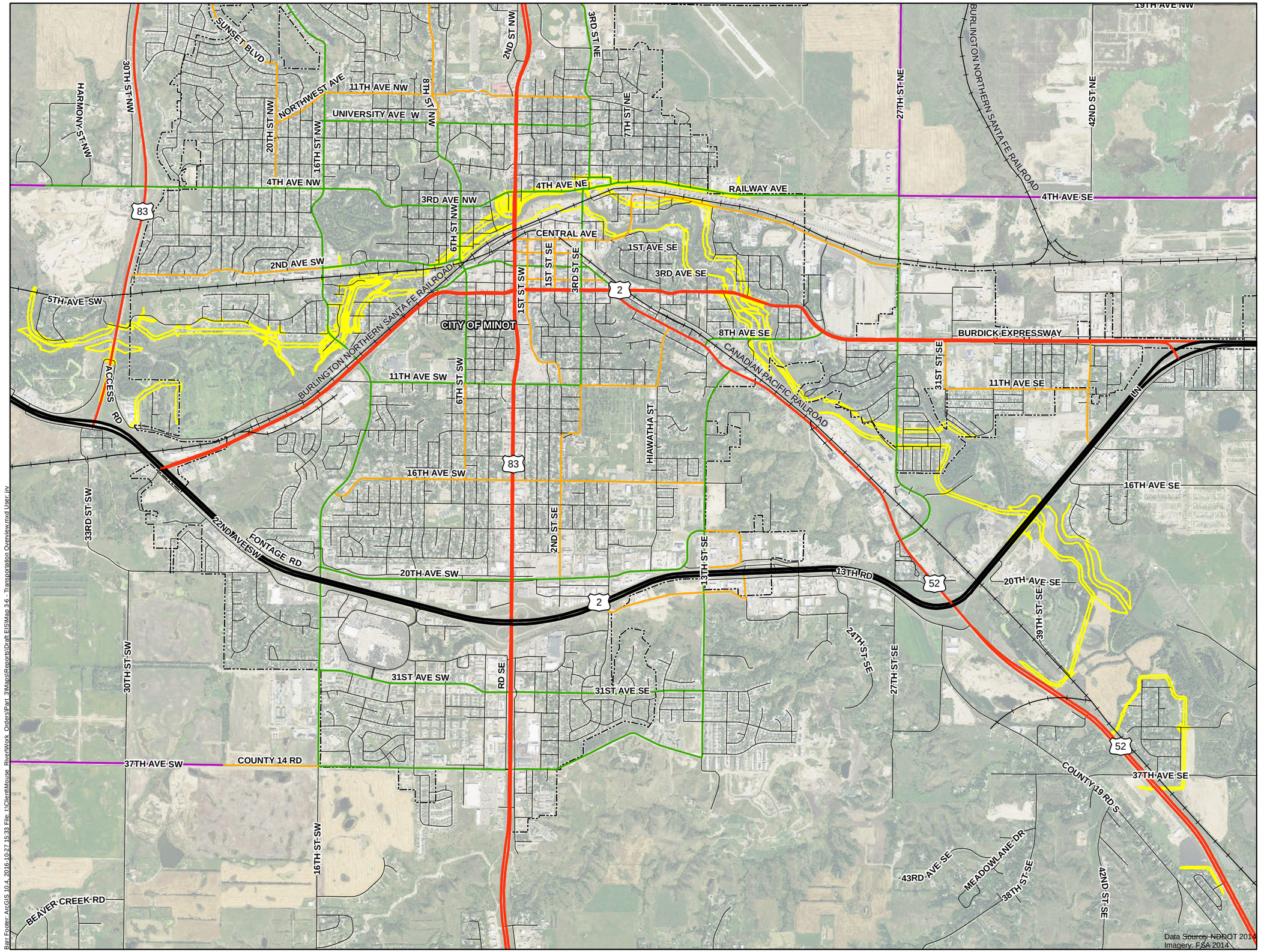
0 1,250 2,500 5,000

Feet

Map 3-6

TRANSPORTATION OVERVIEW
Map (1 of 2)
Mouse River Enhanced Flood Protection Project

Barr Foster: ArcGIS 10.4, 2016-10-27 15:33 File: I:\ClientMouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-6_Transportation Overview.mxd User: jrv



Principal Arterial - Expressway

Principal Arterial - Other

Major Collector

Minor Arterial

Collector

Local

Railroads

Project Footprint

Municipalities

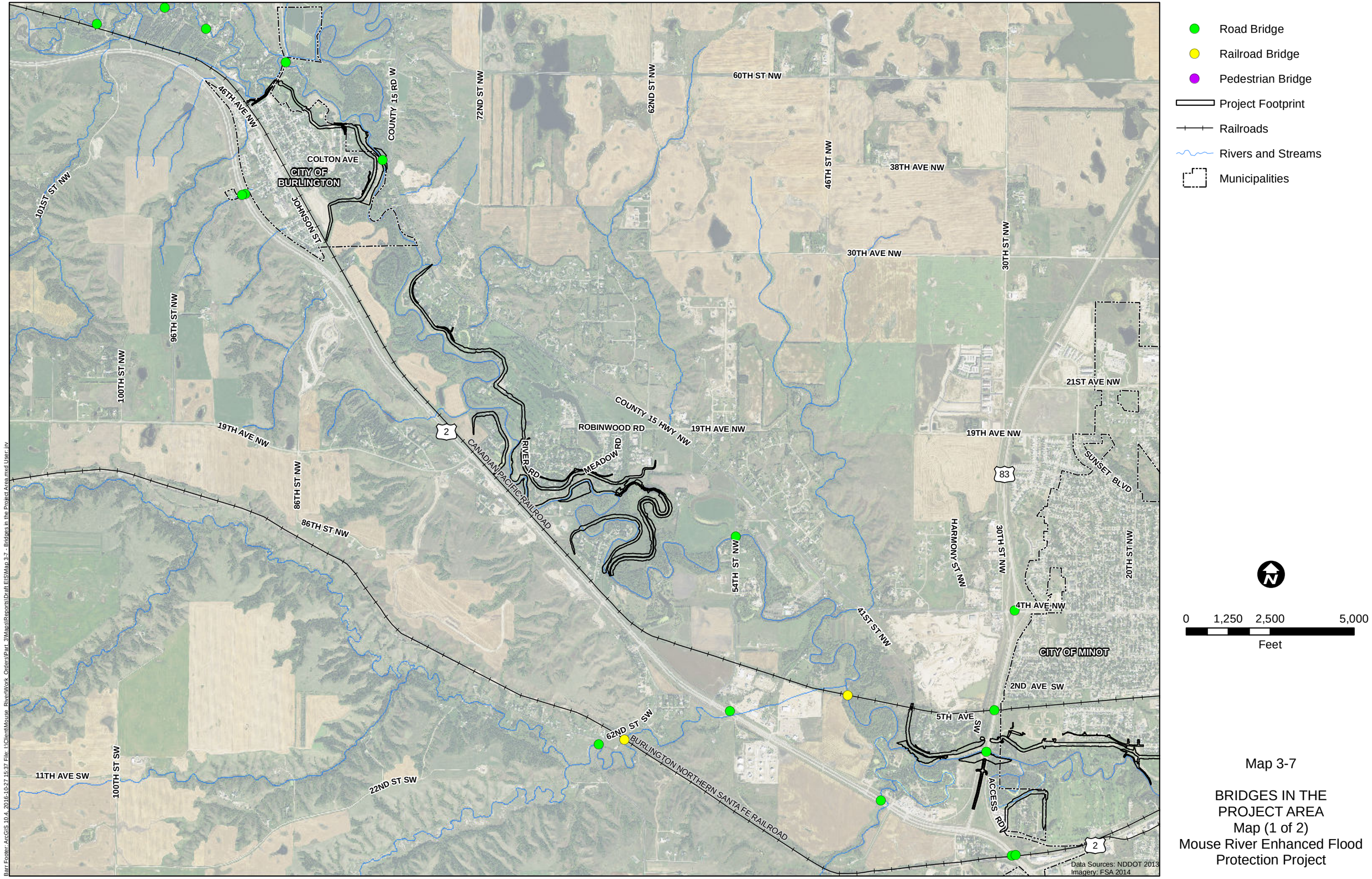
0 1,250 2,500 5,000

Feet

Map 3-6

TRANSPORTATION OVERVIEW
Map (2 of 2)
Mouse River Enhanced Flood Protection Project

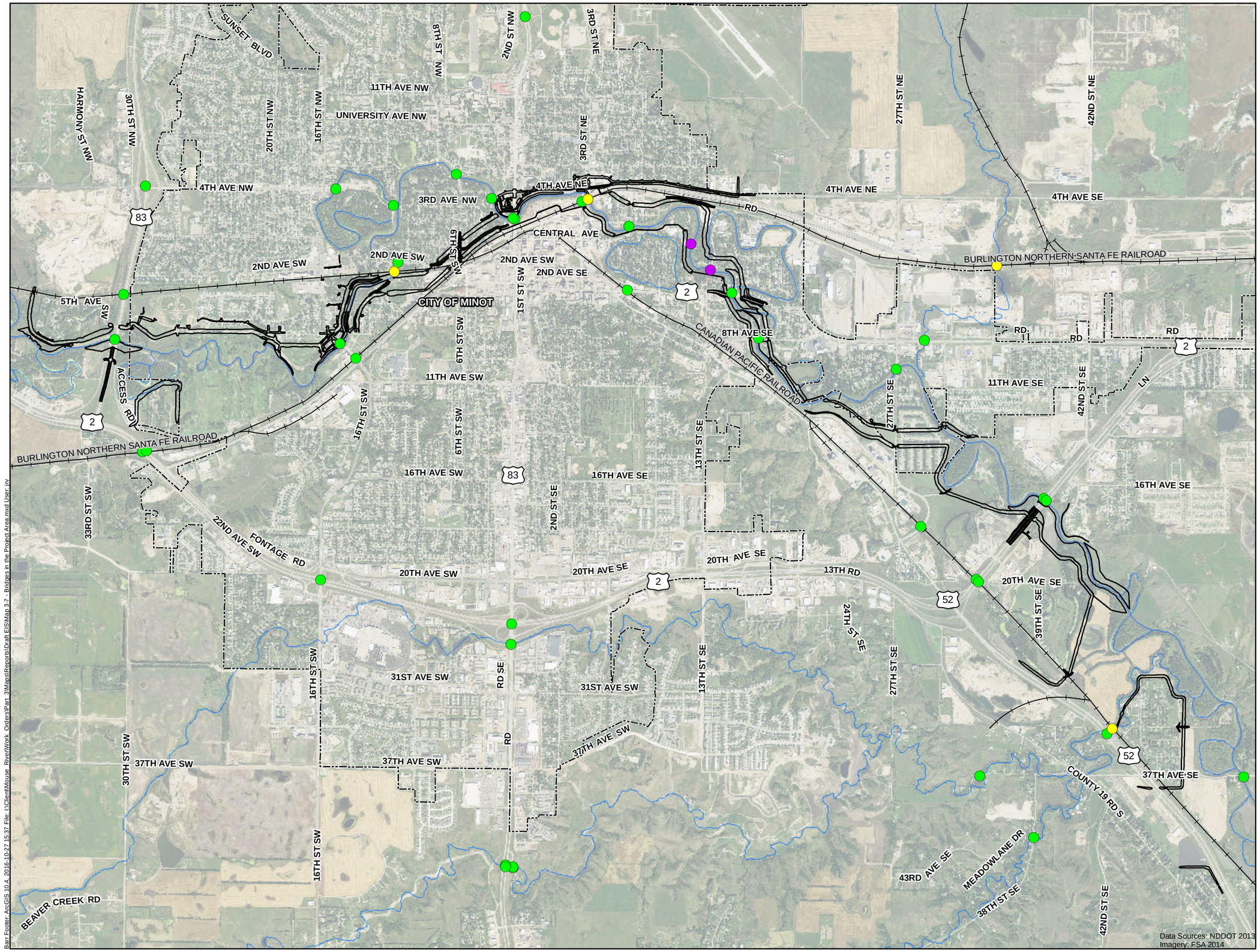
Barr Footer: ArcGIS 10.4, 2016-10-27 15:33 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-6_Transportation Overview.mxd User: rrv



Map 3-7

BRIDGES IN THE PROJECT AREA
Map (1 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:37 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-7 - Bridges in the Project Area.mxd User: jrv



Road Bridge

Railroad Bridge

Pedestrian Bridge

Project Footprint

Railroads

Rivers and Streams

Municipalities

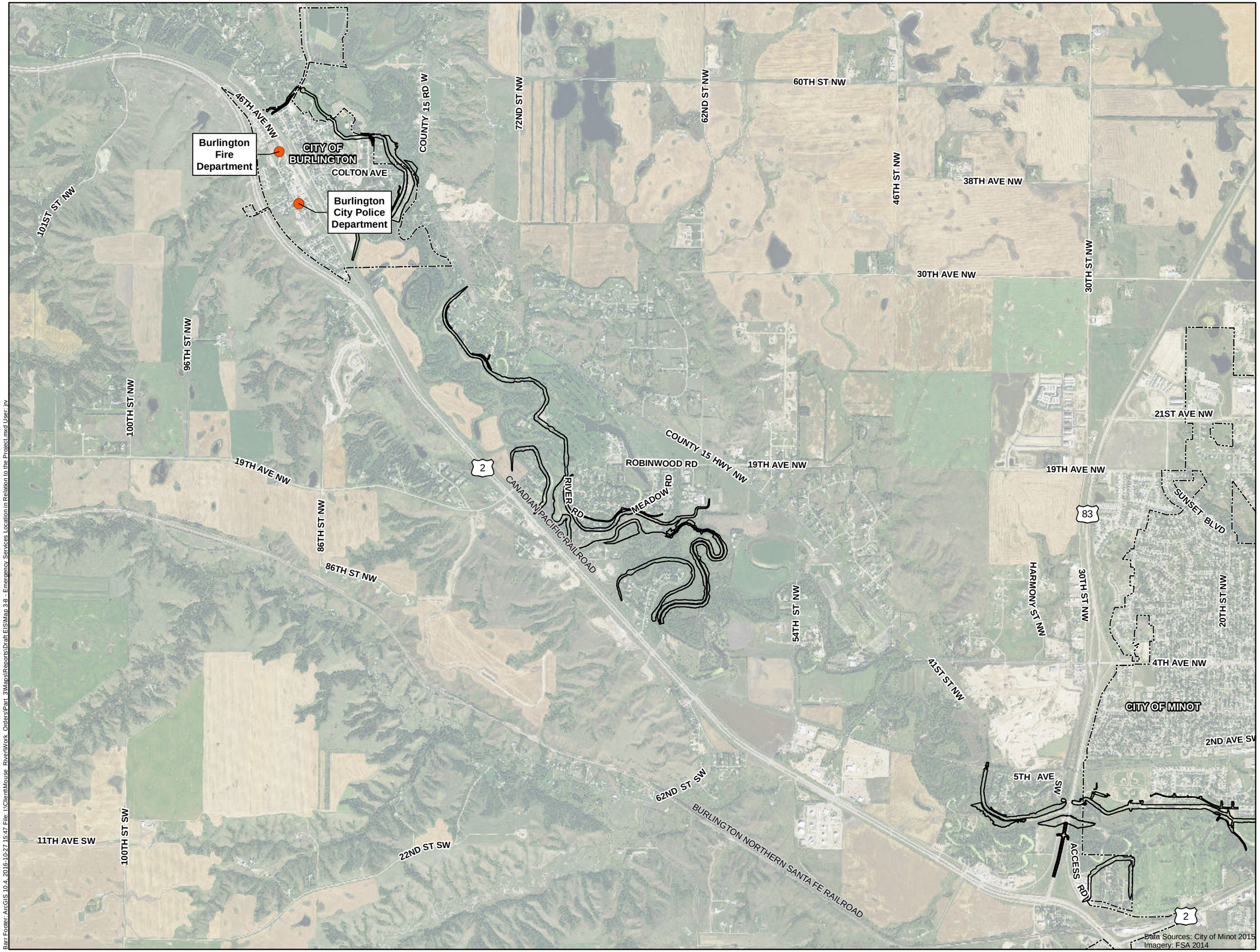
0 1,250 2,500 5,000

Feet

Map 3-7

BRIDGES IN THE PROJECT AREA
Map (2 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:37 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-7 - Bridges in the Project Area.mxd User: rv



Emergency Services

Project Footprint

Municipalities

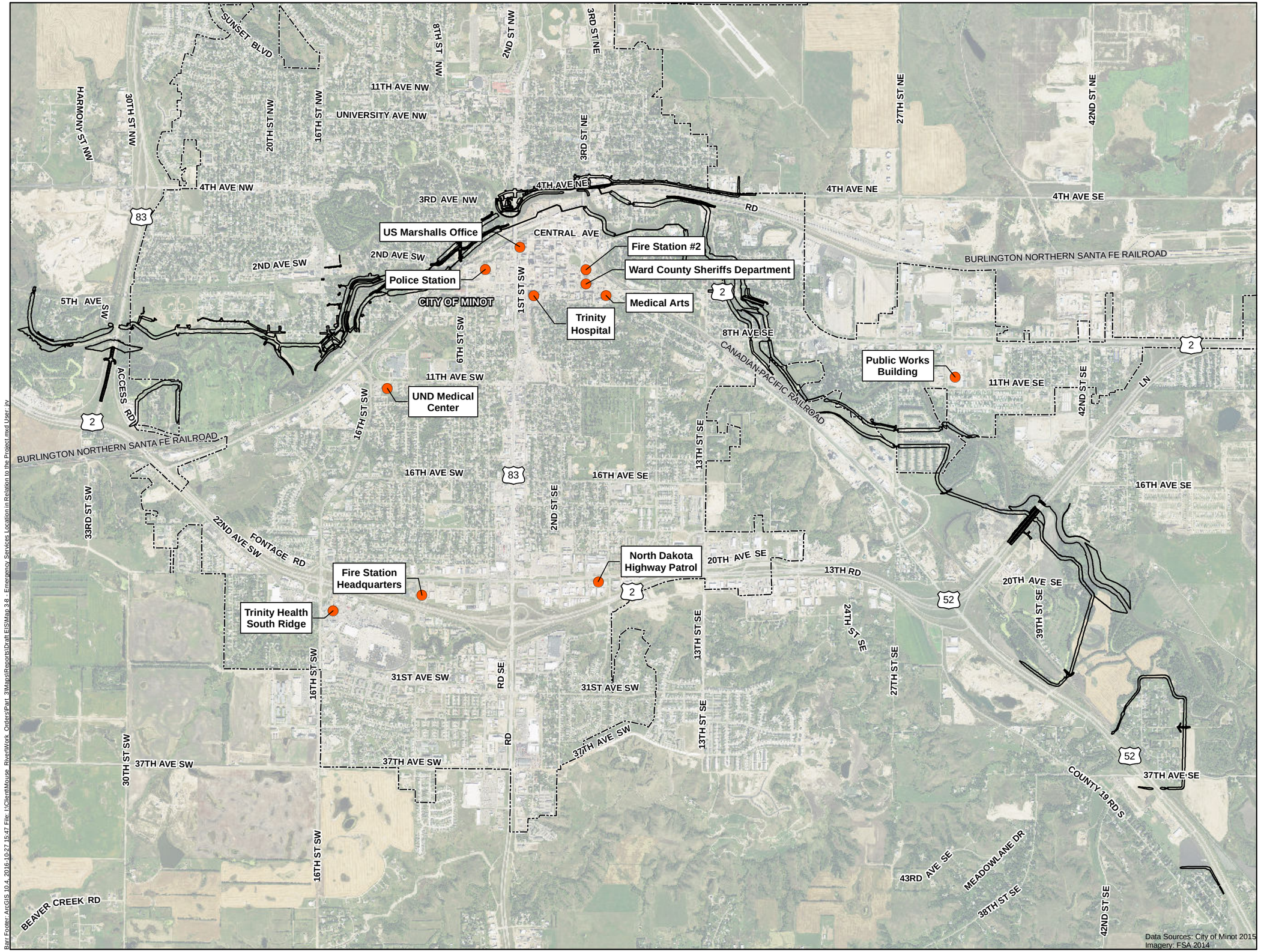
0 1,250 2,500 5,000

Feet

Map 3-8

EMERGENCY SERVICES
IN PROJECT AREA
Map (1 of 2)
Mouse River Enhanced Flood
Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:47 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-8_Emergency Services Location in Relation to the Project.mxd User: jrv



Emergency Services

Project Footprint

Municipalities

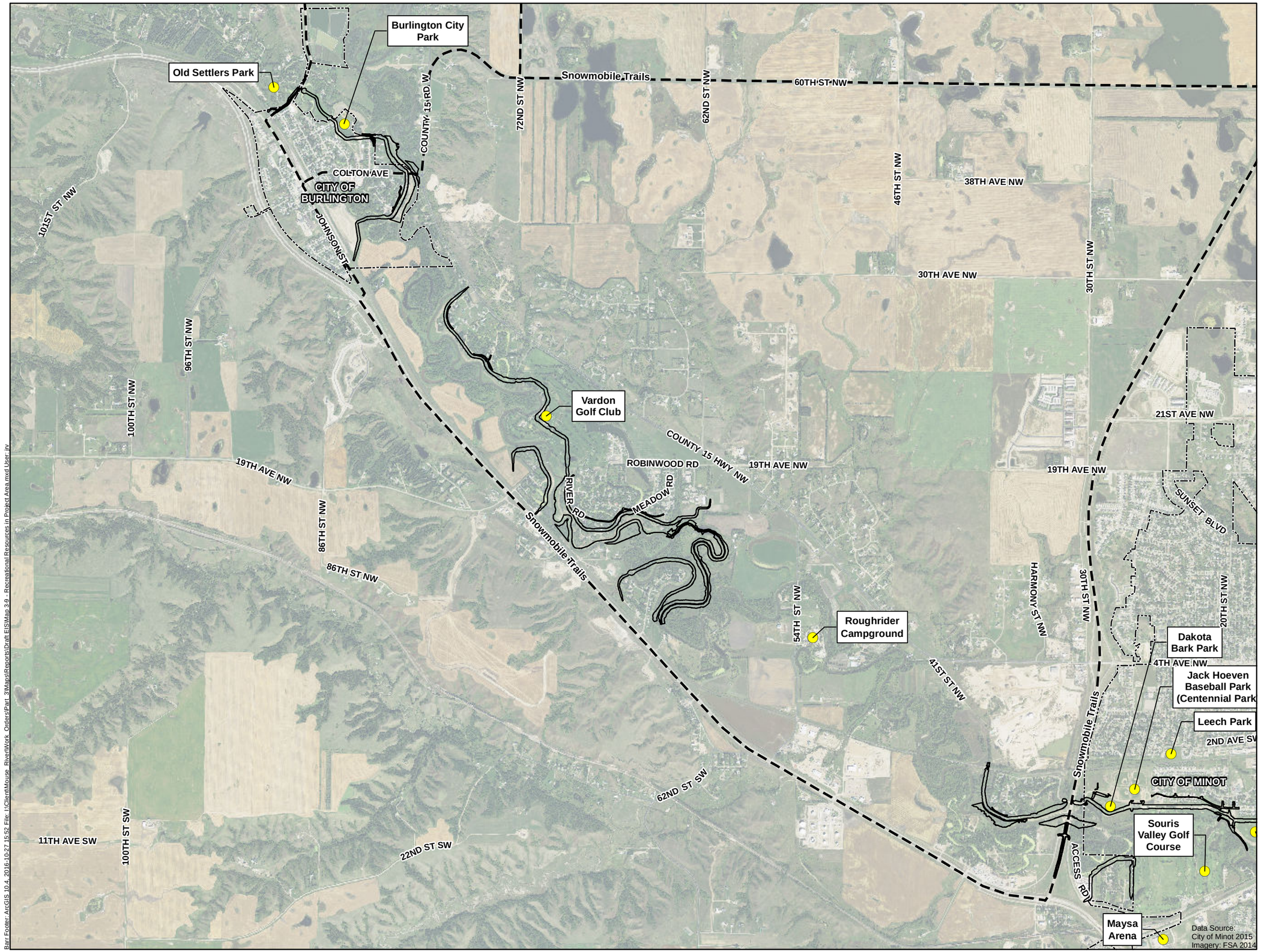
0 1,250 2,500 5,000

Feet

Map 3-8

EMERGENCY SERVICES
IN PROJECT AREA
Map (2 of 2)
Mouse River Enhanced Flood
Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:47 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-8 - Emergency Services Location in Relation to the Project.mxd User: jrv



Recreational Location

Trails

Project Footprint

Municipalities

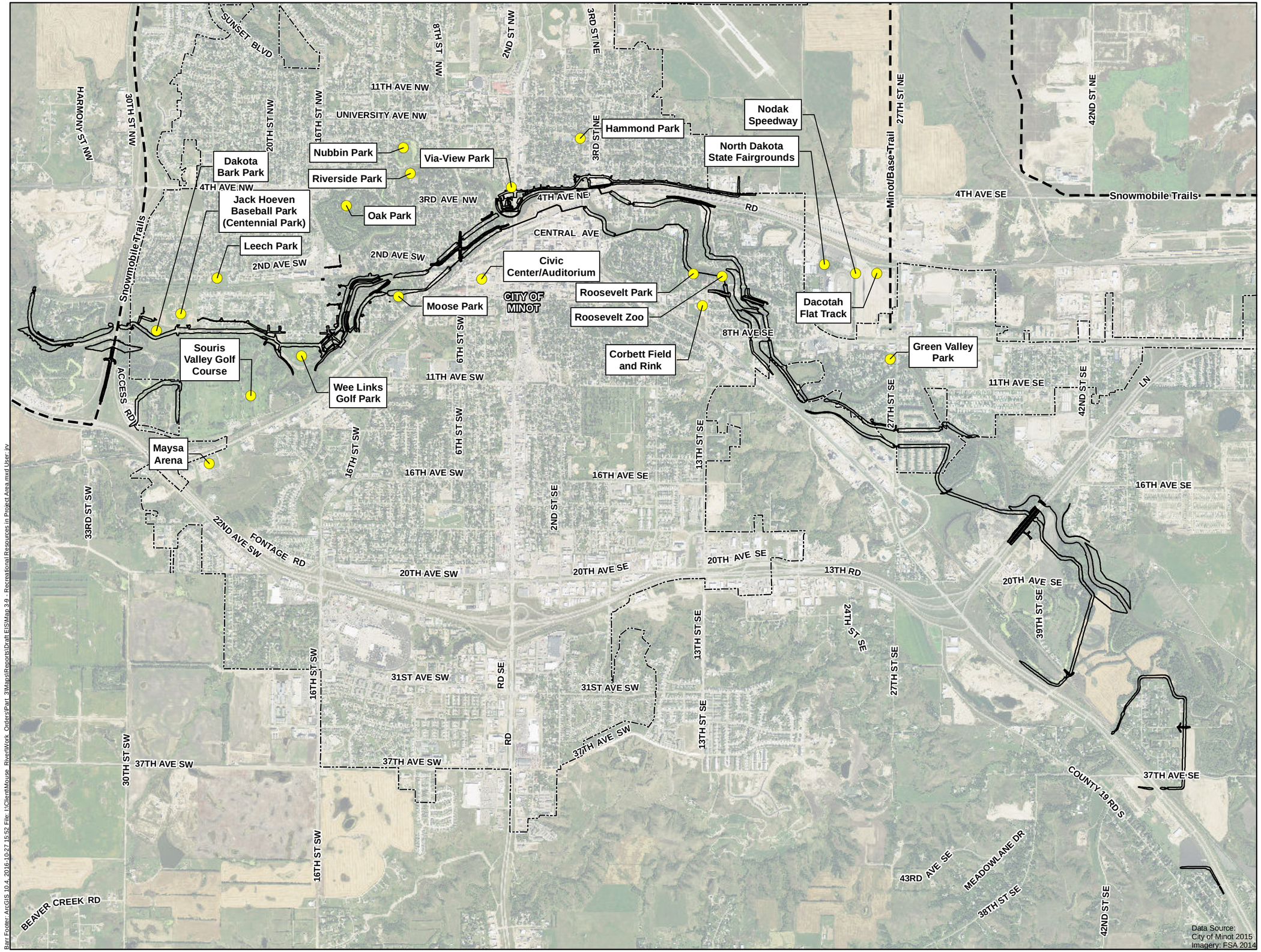
0 1,250 2,500 5,000

Feet

Map 3-9

RECREATIONAL RESOURCES IN PROJECT AREA
Map (1 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:52 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-9_Recreational Resources in Project Area.mxd User: jrv



Map 3-9

RECREATIONAL RESOURCES IN PROJECT AREA
Map (2 of 2)
Mouse River Enhanced Flood Protection Project

Barr Footer: ArcGIS 10.4, 2016-10-27 15:52 File: I:\Client\Mouse_River\Work_Orders\Part_3\Maps\Reports\Draft EIS\Map 3-9 - Recreational Resources in Project Area.mxd User: jrv

Appendices

Appendix A

Scoping Document - Mouse River Enhanced Flood Protection Plan Environmental Impact Statement

Appendix B

No-Action Alternative 2

Appendix C

Wetlands, Waters, and Biological Inventory Report

Appendix D

HTRW Assessment Report - Napa Valley and Forest Road Project Segments

Appendix E

HTRW Assessment Report Fourth Avenue

Appendix F

Hazardous, Toxic, and Radioactive Waste Field Investigation Phase 1-4th Avenue Floodwall, Minot North Dakota Memo

Appendix G

Class I Cultural Resources Survey, Mouse River Enhanced Flood Protection Project, Burlington to Minot, Ward County, North Dakota

**Historic and Archaeological artifacts or sites and associated locational data are protected under North Dakota Century Code 55-02-07. Access to, or release of, information from files that contain sensitive information, such as information included in this report, may be provided upon request from the director of the North Dakota state historical society.*

Appendix H

Class III Archaeological Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, Minot Ward County, North Dakota

**Historic and Archaeological artifacts or sites and associated locational data are protected under North Dakota Century Code 55-02-07. Access to, or release of, information from files that contain sensitive information, such as information included in this report, may be provided upon request from the director of the North Dakota state historical society.*

Appendix I

Class III Standing Structures Survey, Mouse River Enhanced Flood Protection Project, Forest Road Levee, 4th Avenue NE Floodwall, Napa Valley Levee, 2nd Avenue SW Stormwater Pool, Minot, Ward County, North Dakota

**Historic and Archaeological artifacts or sites and associated locational data are protected under North Dakota Century Code 55-02-07. Access to, or release of, information from files that contain sensitive information, such as information included in this report, may be provided upon request from the director of the North Dakota state historical society.*

Appendix J

Programmatic Agreement between the U.S. Army Corps of Engineers, St. Paul District, the North Dakota State Historic Preservation Officer, and the Souris River Joint Water Resource Board Regarding the Mouse River Enhanced Flood Protection Project, Renville, Ward, McHenry, and Bottineau Counties, North Dakota

Appendix K

Interim Project Inundation Area and Depth Impacts Maps

5,000 cfs - No Action Alternative
10,000 cfs - No Action Alternative
27,400 cfs - No Action Alternative

5,000 cfs - No Action Alternative

10,000 cfs - No Action Alternative

27,400 cfs - No Action Alternative