BUREAU OF RECLAMATION

Final Environmental Impact Statement

Eastern North Dakota Alternate Water Supply Project

Volume 1: Chapters 1-6

McClusky Canal, Garrison Diversion Unit, North Dakota

Missouri Basin Region
Dakotas Area Office
Bismarck, North Dakota

Estimated lead agency costs for preparing this EIS:

$2,004,000

U.S. Department of the Interior

November 2020

Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Eastern North Dakota Alternate Water Supply Project
Final Environmental Impact Statement

Proposed action:	The Department of the Interior, Bureau of Reclamation, proposes to fund and construct the Eastern North Dakota Alternate Water Supply Project. This is a bulk water supply project, which would deliver an alternate water supply to the State of North Dakota's Red River Valley Water Supply Project.
Lead agency:	Bureau of Reclamation, Missouri Basin Region
Responsible official:	U.S. Department of the Interior, Secretary of the Interior
Cooperating agencies:	Federal: U.S. Army Corps of Engineers U.S. Environmental Protection Agency State: North Dakota Game and Fish North Dakota State Water Commission Quasi-State and Local: Garrison Diversion Conservancy District

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Comment period:	The comment period begins with the Federal Register Notice of Availability and extends for 30 days after that date.

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Acronyms and Abbreviations

A

ac-ft	acre-feet
AIS	aquatic invasive species

B

BEA	Bureau of Economic Analysis
BKD	bacterial kidney disease
BMP	best management practice
Biota WTP	Biota water treatment plant

C

Canal	McClusky Canal
CCV	channel catfish virus
cfs	cubic feet per second
CNDWSP	Central North Dakota Water Supply Project
Corps	U.S. Army Corps of Engineers

D

DKAO	Reclamation's Dakotas Area Office
DWRA	Dakota Water Resources Act of 2000

E

EA	Environmental Assessment
EIS	Environmental Impact Statement
ENDAWS	Eastern North Dakota Alternate Water Supply
EPA	U.S. Environmental Protection Agency
ERM	enteric redmouth disease

F

Federal RRVWSP	Federal Red River Valley Water Supply Project
FONSI	Finding of No Significant Impact
ft msl	feet above mean sea level

G

Garrison Diversion	Garrison Diversion Conservancy District
GDU	Garrison Diversion Unit

H

HBB	Hudson Bay Basin

I

IHNV	infectious hematopoietic necrosis virus
IMPLAN	IMpact analysis for PLANing
IPNV	infectious pancreatic necrosis virus
ISAV	infectious salmon anemia virus

M

MAF	million acre-feet
Master Manual	Missouri River Mainstem Reservoir System Master Water Control Manual (Corps 2018)
MEL	Mitigation Enhancement Ledger
MGD	million gallons per day
Missouri River System	Missouri River Mainstem Reservoir System
MM	mile marker
MOU	Memorandum of Understanding
MRB	Missouri River Basin
MR&I	Municipal, Rural, and Industrial

N

NDGF	North Dakota Game and Fish Department
NDSHPO	North Dakota State Historic Preservation Office
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act
NP2017	No Project Year 2017
NP2075	No Project Year 2075
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory

O

O&M	operation and maintenance
OM&R	operation, maintenance, and replacement

P

PAB	palustrine aquatic bed
PEM	palustrine emergent
PLOTS	Private Land Open to Sportsmen
Project	Eastern North Dakota Alternate Water Supply
PFO	palustrine forested

R

Reclamation	Bureau of Reclamation
ResSim Model	HEC-ResSim model
RIV	Riverine
ROD	Record of Decision
ROW	Right-of-Way

S

SDWA	Safe Drinking Water Act
Simulation Report	Missouri River Mainstem HEC-ResSim Modeling for ENDAWS EIS: Final, Mainstem Missouri River Reservoir Simulation Scenarios Technical Report (Corps 2020)
SVCV	Spring viremia of carp virus
State RRVWSP	State-led Red River Valley Water Supply Project
System	Missouri River Mainstem Reservoir System

T

TSC	Reclamation's Technical Service Center
Transbasin Effects Analysis	Transbasin Effects Analysis Technical Report

U

USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UV	ultraviolet

V

VHSV	viral hemorrhagic septicemia virus

W

WTP	water treatment plant

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Executive Summary

ES.1 Introduction

Garrison Diversion Conservancy District (Garrison Diversion), on behalf of the State of North Dakota, has requested a contract for an additional 145 cubic feet per second (cfs) of water from the Bureau of Reclamation's (Reclamation) McClusky Canal (Canal) as an alternate water source for a State-led municipal rural and industrial water supply project known as the Red River Valley Water Supply Project (State RRVWSP). The State RRVWSP is currently being developed as a water supply project, with an intake on the Missouri River, to meet the future water needs of central and eastern North Dakota; a portion of which is within the Hudson Bay Basin (HBB). The proposed project Reclamation is evaluating as an alternate bulk water supply to the State RRVWSP is being referred to as the Eastern North Dakota Alternate Water Supply (ENDAWS) Project. Garrison Diversion estimates that using the proposed alternate water source could save millions of dollars in costs for construction and annual operations and maintenance; including decreased energy costs for pumping.

This request for an additional 145 cfs of water is in addition to a previous request by Garrison Diversion for 20 cfs of water from the Canal that was to be delivered to the State RRVWSP for use in the Missouri River basin (MRB). The previous request is referred to as the Central North Dakota Water Supply Project (CNDWSP) and was analyzed by Reclamation in an Environmental Assessment. A Finding of No Significant Impacts was signed in 2018.

This request necessitates that Reclamation analyze its actions and potential impacts of these actions to comply with the National Environmental Policy Act (NEPA) and other applicable laws. Reclamation initiated the NEPA process by publishing a Notice of Intent to prepare this environmental impact statement (EIS) in the Federal Register on November 13, 2019. Reclamation sought public comment and involvement during the planning and preparation of this EIS by (1) hosting public scoping meetings, (2) communication and consultation with a variety of Federal, State and local agencies, Native American tribes and interest groups, and (3) establishing a project website to share information with the pubic. A cooperating agency team was also established to assist Reclamation in the preparation of this Draft EIS. Cooperating agency members include federal and state agencies with jurisdiction or special expertise.

ES.2 Background

The Garrison Diversion Unit (GDU) Principal Supply Works was authorized by the 1965 Garrison Diversion Unit Act to deliver Missouri River water throughout North Dakota. In 1944, the U.S. Congress passed the Flood Control Act (of which the Missouri-Basin Pick Sloan Act is a part), which authorized construction of dams on the Missouri River and its tributaries. The GDU was authorized in 1965, and construction began in 1967. The GDU project was designed to divert Missouri River water to central and eastern North Dakota for irrigation, municipal and industrial water supply, fish and wildlife conservation and development, recreation, flood control, and other project purposes. Most of the currently authorized principal supply works have been completed

(Snake Creek Pumping Plant, McClusky Canal, and New Rockford Canal). The connecting link between the two canals, which would have been Lonetree Reservoir, has since been deauthorized.

The GDU project was reauthorized in 1986, which resulted in a reduced emphasis on irrigation and an increased emphasis on meeting the municipal, rural and industrial (MR&I) water needs throughout North Dakota. The 1986 Reformulation Act, which amended the 1965 Act, authorized a Sheyenne River water supply and release feature, and a water treatment plant capable of delivering 100 cfs of water to eastern North Dakota. The GDU Project was never fully completed, nor delivered water to the HBB, limiting intended benefits to North Dakota.

In 2007, Reclamation completed an environmental impact statement (EIS) evaluating the Federal Red River Valley Water Supply Project (Federal RRVWSP), which would have provided Missouri River water to eastern North Dakota communities located in the HBB. The preferred alternative was controversial for several reasons; therefore, a Record of Decision (ROD) was never signed by the Secretary of the Interior. As a result, the State is pursuing its own State RRVWSP project with state and local funding. The State RRVWSP is being designed to meet the future water needs of central and eastern North Dakota through the year 2075.

ES.3 Setting

Reclamation has determined that the geographic scope for the Project includes the following counties in North Dakota: Burleigh, Sheridan, and Wells (Figure ES-1). The geographic scope of the resource analysis is limited to areas that could be impacted by the alternatives being evaluated. Some resource analyses such as aquatic invasive species, socioeconomics, and Missouri River depletions extend beyond this geographic scope as described in Chapter 3 of this EIS.

ES.4 Proposed Federal Action

Garrison Diversion requests Reclamation consider issuing a contract for up to 165 cfs of water from GDU facilities, as an alternate water supply for the State RRVWSP. Reclamation proposes to provide federal cost share funding for the construction of the ENDAWS Project and the federal actions associated with this include:

- Construction of ENDAWS project features, which may include an intake and pump station located along the Canal, a biota water treatment plant, and a bulk transmission pipeline to deliver water to the main transmission pipeline of the State RRVWSP.
- Issuance of a water repayment contract for GDU facilities, and
- Issuance of permits to construct and maintain ENDAWS facilities on Reclamation rights-of-way.

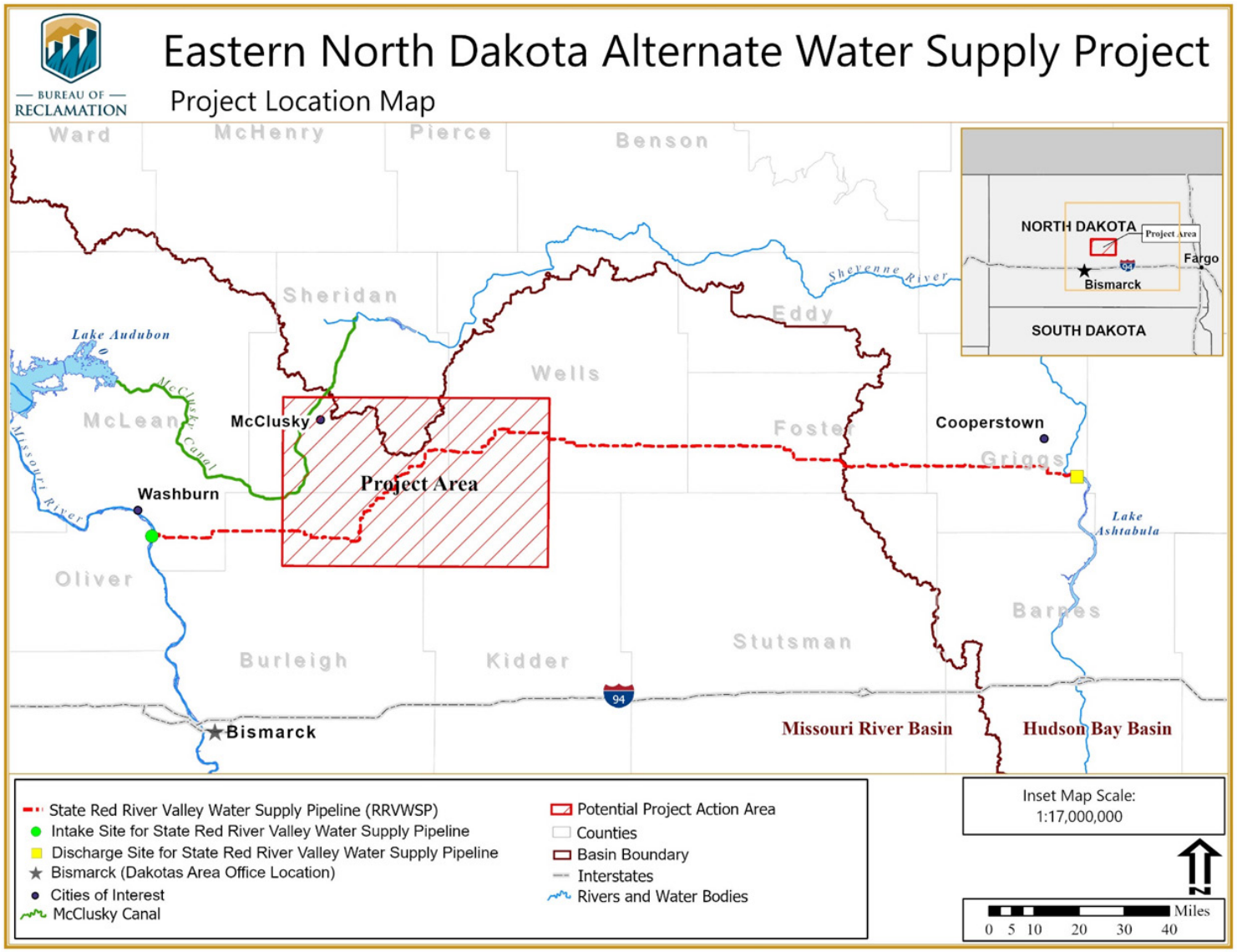

Figure ES-1: Action Alternative Study Areas

ES.5 Purpose of and Need for Action

The purpose of the Project is to respond to Garrison Diversion's request for a contract for up to 165 cfs of water from Reclamation's GDU to provide an alternate bulk water supply to the State RRVWSP. The need for Reclamation's proposed action is established by Reclamation's responsibility under Dakota Water Resources Act, which authorizes Reclamation to jointly, with the State of North Dakota, construct MR&I water resource development projects to serve areas throughout the State of North Dakota.

ES.6 Alternatives

The EIS examines the range of reasonable alternatives developed to meet the Project's purpose and need as well as a No Action alternative. A no action alternative is required to be considered under NEPA (40 CFR 1502.14[d]) as a basis for comparison of the alternatives. In addition to the No Action Alternative, five action alternatives have been evaluated in detail, considering potential environmental effects, as well as technical and economic considerations such as reliability and cost.

The action alternatives were developed to provide an alternate source of water to the State RRVWS Project for MR&I uses. The action alternatives are identified by the water source utilized, either the Canal, or the Missouri River, or a combination thereof.

Action alternatives that utilize the Canal to deliver Missouri River water into the HBB include a Biota water treatment plant (Biota WTP). The purpose of the Biota WTP is to treat the water prior to it being delivered into the HBB as a means of complying with the 1909 Boundary Waters Treaty between the United States and Canada. Compliance with this treaty is required as stated in Section 1(h) of Dakota Water Resources Act. The U.S. government has not developed water treatment standards, rules, or regulations specifically for use in reducing the risk of an introduction of an invasive species (biota) through interbasin water transfers.

Projects transferring water from the MRB to the HBB is a longstanding concern voiced by opponents to the development of the GDU. For MR&I projects involving an interbasin transfer of water, Reclamation has responded to these concerns by treating the water prior to it entering the HBB. Reclamation evaluated biota water treatment options to determine the adequate level of treatment for aquatic invasive species to comply with the boundary waters treaty. Chapter 2 describes the alternatives and the Biota WTP options in detail and concludes with a description of the preferred alternative.

Appendix A and Appendix B include the appraisal level engineering design reports for the alternative development and the development of the Biota WTP options, respectively. Both appendices also include appraisal level cost estimates which are based on 2019 dollars.

ES.6.1 Alternative A – No Action

The No Action Alternative is based on the environmental analyses and conclusions of the previously completed NEPA compliance documents for the Central North Dakota Water Supply Project (CNDWSP), and the proposed action selected in the FONSI (Reclamation 2018). As stated in the

Council on Environmental Quality Regulations [Section 1502.14(d)], a no action alternative is to be considered as part of the NEPA process. Additional guidance from the Council of Environmental Quality is provided in the document, NEPA's *Forty Most-Asked Questions*. This guidance states that the no action alternative can be defined as a continuing action of the current management direction. Therefore, Reclamation has defined the No Action alternative to include the CNDWSP, which would provide 20 cfs of water from the Canal to the State RRVWSP. This alternative includes an intake into the Canal and a six-mile pipeline connection between the Canal and the State RRVWSP. The 20 cfs of water taken from the Canal can only be supplied to users within the Missouri River Basin.

ES.6.2 Alternative B – State RRVWSP

This alternative would be constructed by the State of North Dakota utilizing only the Missouri River as the sole source of water to provide 165 cfs for the RRVWSP. Reclamation would not construct the CNDWSP or issue any contract for water use out of the Canal. Under this alternative the State of North Dakota would continue with their plans to construct the State RRVWSP without any federal involvement by Reclamation.

ES.6.3 Alternative C – McClusky Canal Only North

This alternative would include the construction of features to provide 165 cfs from the Canal through a buried pipeline along a northern route where it terminates at the connection with the main transmission pipeline of the State RRVWSP. Features would include an intake on the canal, pump station, Biota WTP, and pipelines. Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

ES.6.4 Alternative D – McClusky Canal Only South

This alternative would include the construction of features to provide 165 cfs from the McClusky Canal through a buried pipeline along a southern route where it terminates at the connection with the main transmission pipeline of the State RRVWSP. Features would include an intake on the Canal, pump station, Biota WTP, and pipelines. Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

ES.6.5 Alternative E – McClusky Canal and Missouri River North

This alternative would include the construction of features to provide up to 165 cfs from the McClusky Canal through a buried pipeline along a northern route where it terminates at the connection with the main transmission pipeline of the State RRVWSP. Features would include an intake on the Canal, pump station, Biota WTP, and pipelines as Phase 1. Phase 2 would include features required to provide up to 165 cfs from the Missouri River for a maximum total combination of 165 cfs. Reclamation would issue a repayment contract for water use out of the Canal and other permits to construct and maintain facilities on Reclamation's ROW.

ES.6.6 Alternative F – McClusky Canal and Missouri River South

This alternative would include the construction of features to provide up to 165 cfs from the Canal through a buried pipeline along a southern route where it terminates at the connection with the main transmission pipeline of the State RRVWSP. Features would include an intake on the canal, pump station, Biota WTP, and pipelines as Phase 1. Phase 2 would include features required to provide up

to 165 cfs from the Missouri River for a maximum total combination of 165 cfs. Reclamation would issue a repayment contract for water use out of the Canal and other permits to construct and maintain facilities on Reclamation's right-of-way.

ES.7 Biota WTP Options

Four Biota WTP options were evaluated for the ENDAWS Project to reduce the risk of a Project-related transfer of aquatic invasive species (AIS) into the Hudson Bay basin. The options were designed to provide a range of treatment methods, starting with disinfection and incrementally adding water treatment technologies to target different types of pathogens and biota, and increasing the level of protection with each option. The Biota WTP would be constructed within the MRB. Design information and cost estimates, for construction and operation, maintenance and replacement of the Biota WTP are described in Chapter 2 and Appendix B.

The Biota WTP options include:

- Disinfection - Sand/grit removal and disinfection using chlorination
- Enhanced Disinfection - Sand/grit removal and enhanced disinfection consisting of ultraviolet light (UV) and chlorination
- Conventional Treatment - coagulation/flocculation, high rate sedimentation, granular media filtration, UV, and chlorination
- Advanced Treatment - Advanced Treatment consisting of sand/grit removal, coagulation/flocculation, membrane filtration, UV disinfection, and chlorination.

Federal costs associated with Boundary Waters Treaty compliance, if any, are non-reimbursable. Capital costs and operation and maintenance costs associated with this facility will be negotiated with the Project sponsor to determine the appropriate level of federal cost share, if any. Each of the cost estimates represent costs that could be eligible for federal funding but does not guarantee funding will be requested or available. Any federal funding will be subject to annual appropriations.

ES.8 Preferred Alternative

Reclamation has chosen to identify a preferred alternative in this Draft EIS. Reclamation chose a matrix evaluation method that has been established to evaluate several factors and compare the alternatives to determine the best recommendation for the Project. Reclamation compared all alternatives in terms of reliability, environmental impacts and non-environmental issues identified during the EIS process, along with the estimated construction and annual operation, and maintenance and replacement costs. Based on this evaluation, the preferred alternative for the Project has been identified as **Alternative E – McClusky Canal and Missouri River North**. The preferred alternative includes the **Enhanced Disinfection Biota WTP Option.**

ES.9 Major Conclusions and Areas of Controversy

Chapter 3 summarizes the physical, biological, social, and economic resources (affected environment) and the effects of implementing each alternative on those resources. Under each resource topic is a discussion of impact indicators, methods, and the direct and indirect impacts of implementing each alternative. The consequences (+ or -) of the No Action Alternative are described and then the potential impacts (+ or -) of each action alternative are evaluated in comparison to the No Action Alternative. Potential impacts are quantified as appropriate and when supported by existing data or models. Where quantitative data are not available, impacts are described qualitatively. The duration of impacts is identified as either short term or temporary during construction, or long term or permanent during operations.

The impacts described in Chapter 3 would remain, even after the implementation of the environmental commitments. Environmental commitments associated with each alternative are described in Appendix D - Environmental Commitments.

Two resource areas in particular were the focus of public scoping comments and have been raised as concerns in other evaluations Reclamation has conducted on interbasin water transfer projects in the past. These issues are the potential transfer and consequences of AIS and the potential impacts of withdrawals from the Missouri River Mainstem Reservoir System (System). Potential impacts to many other resource areas are evaluated in this EIS, including but not limited to Land Resources, Historic Properties, Wetlands, Threatened and Endangered Species, etc.

ES.9.1 Aquatic Invasive Species

The affected environment for AIS of concern is composed of the MRB, which is a potential source of AIS, and the Hudson Bay Basin, the potential receptor of AIS. Information in this section is summarized from the analysis conducted on AIS for this Project. The Aquatic Invasive Species Risk and Consequence Analysis report (*Risk and Consequence Analysis* - Appendix F) documents the current distribution of these AIS; specifically, within the Missouri River Basin, Hudson Bay Basin, and adjacent basins.

The list of AIS of concern has been developed and refined over the past 20 years. The AIS of concern included both microscopic (viruses, bacteria, protozoa, myxozoa and cyanobacteria) and macroscopic (mollusks) organisms. Reclamation's most recent analysis of AIS was completed for the Northwest Area Water Supply Project, Supplemental Environmental Impact Statement. The resulting report, *Transbasin Effects Analysis Technical Report* (Reclamation 2013) was peer reviewed by technical experts, both within and outside of Reclamation, and builds on previous work on this topic. The independent peer review experts found that the analysis was "…based on the best available science and the result and conclusions were supported by that science, given the uncertainties inherent in the available data and topic knowledge." (Atkins 2012). The Risk and Consequence Analysis utilized the same methodologies of the *Transbasin Effects Analysis*, and used new data/information, available from 2012 through the present, to update species distribution information, transfer pathways, assess the risk of transfer, and the consequences of a transfer (project and non-project related).

The Risk and Consequence Analysis evaluated the distribution, transfer pathways, potential aquatic receptors of concern, the susceptibility of AIS to various water treatment technologies, the

uncertainties associated with the analysis, and the environmental and economical consequences of an AIS transfer.

The risk of AIS introduction to the HBB could be slightly increased with the implementation of any of the alternatives; No Action as well as the action alternatives. Each of the alternatives evaluated would add one, very-low-probability pathway, to the already wide variety of existing pathways. To further reduce the risk of transferring AIS, each alternative (including No Action) includes one or more water treatment processes designed to inactivate and/or remove microscopic organisms. In addition, these treatment systems are designed with controls to monitor the effectiveness of the treatment process and automatically adjust the process or shut down the treatment plant if warranted.

The numerous and diverse pathways that are already present would continue to exhibit far greater risk for introducing AIS (which are present in adjacent drainage basins) to the HBB. For example, birds and mammals can transport AIS across large geographic distances and constructed interbasin diversions also have the potential to transport invasive species across drainage basins. There are no standards for treatment of interbasin water transfers to control invasive species.

The potential impacts of an AIS introduction and establishment in the HBB would be the same under the No Action Alternative and all of the action alternatives because numerous pathways for AIS transfer already exist and each alternative evaluated includes an interbasin transfer from the Missouri River Basin to the Hudson Bay Basin. None of these alternatives would create new types of impacts or increase the severity of impacts that could result from AIS transfer under the existing pathways.

ES.9.2 Water Resources

The Missouri River flows 2,341 miles from Three Forks, Montana to its confluence with the Mississippi River near St. Louis, Missouri. The Missouri is the longest river in the United States, draining one-sixth of the country, and it is the main river in the Missouri River drainage basin. The U.S. Army Corps of Engineers (Corps) operates six dams and reservoirs on the Missouri River that are located in Montana, North Dakota, South Dakota, and Nebraska and referred to as the Missouri River Mainstem Reservoir System (System). This System of dams and reservoirs has the capacity to store 72.4 million acre-feet (MAF) of water, which makes it the largest reservoir system in North America. The Corps operates the System to serve congressionally authorized purposes of flood control, navigation, irrigation, hydropower, water supply, water quality, recreation, and fish and wildlife. The six dams and reservoirs are operated by the Corps as an integrated system, guided by the *Missouri River Mainstem Reservoir System Master Water Control Manual Missouri River Basin* (2018 Master Manual). In order to achieve the multipurpose benefits for which the System was authorized and constructed, the six system reservoirs are operated as a hydraulically and electrically integrated system. This means dam releases are coordinated in an effort to maintain desired levels in each reservoir and to meet flow requirements of downstream System purposes.

Reclamation partnered with the Corps to evaluate the potential impacts of Project withdrawals from the System. The analysis considered effects on System storage, reservoir levels, dam releases, and Missouri River flows. Results of this analysis are documented in the Corps' report which is a supporting document to this EIS, and Appendix H provides a summary of the step-by-step process Reclamation and the Corps followed in conducting the analysis.

The System storage of the six reservoirs ranges from 23.4 MAF at Garrison to 0.4 MAF at Gavins Point. The upper three reservoirs contain the majority of the combined storage capacity with approximately 65 MAF, which is almost 90 percent of the gross System storage. As a result, these three projects experience most of the variability in reservoir levels during periods of very high runoff or extended drought. The other three downstream reservoirs are operated much the same no matter the runoff conditions.

System runoff is the amount of precipitation (rainfall and snow) that falls on the MRB and enters the System. Not all of the runoff from the drainage basin is available for storage in the reservoirs or release for downstream purposes. Some runoff is lost through evaporation; some is diverted or withdrawn and used for agricultural, municipal, or other uses; and some is regulated by upstream reservoirs.

Dam releases refers to water discharged through the hydropower units or spillway to move water downstream through the System to serve authorized purposes. Factors such as the amount of storage and the magnitude and distribution of inflow received during the year can affect the timing and magnitude of individual dam releases. Adjustments to the amount of water transferred between reservoirs are made, when necessary, to achieve the desired volume of water in each reservoir and to maximize power generation.

Water releases from the upper three reservoirs are based on the need to balance the effects of depletions, sedimentation, and flood storage evacuation while ensuring that the three smaller downstream reservoirs maintain their pool elevation.

The Corps uses a HEC-ResSim model (ResSim Model) to simulate changes in operations of the System based on the 2018 Master Manual. For evaluations in this EIS, Reclamation provided the Corps with estimates of historic, existing, reasonably foreseeable depletions and potential ENDAWS Project withdrawals from the System for input into the ResSim Model. The ResSim Model produces hydrologic data that were used to evaluate the relative impacts of potential changes for each simulation. Simulations were analyzed using the ResSim Model to determine the consequences of No Action and impacts of action alternatives. The ResSim Model simulated an 89-year historical period (spanning March 1, 1930 through February 28, 2019). Daily inflow data for numerous MRB locations are available going back to 1930; therefore, this is the first year of the period for which ResSim Model simulations were conducted.

The results of this analysis showed that under the No Action Alternative, which includes withdrawals from Lake Sakakawea and the Missouri River, the amount of potential depletions is very small compared to existing and reasonably foreseeable future non-Project depletions.

For the five action alternatives, the volume of potential depletions is exactly the same as the No Action Alternative. The location of the intake would affect either Garrison or Oahe reservoir levels by 0.1 to 0.2 feet. The GDU facilities would not be able to deliver water during extended drought until the Snake Creek embankment is repaired or an alternate means to deliver water to the Canal is constructed. The effect of ENDAWS depletions under the two intake location alternatives compared to the No Action Alternative would be nearly identical. In general, depletion, system storage, reservoir levels, dam releases and river flow are nearly identical compared to No Action under the action alternatives; therefore, it is anticipated there would be negligible or no impact to meeting the Missouri River System's authorized purposes.

ES.9.3 Impact Summary

Given the implementation of best management practice, most construction impacts would be temporary, although some permanent impacts would result from construction of above ground features. Environmental commitments listed at the end of Chapter 2 and in Appendix D would be implemented to mitigate adverse environmental impacts not avoided by the implementation of best management practices. Table ES-1 illustrates a summary of the action alternative impacts in comparison to the No Action Alternative. All temporary impacts are evaluated and determined to be minimal.

Table ES-1: Summary of Impacts to Human and Natural Resources

Summary of Action Alternative Impacts Compared to No Action						
= No Change from the No Action						
↑ More impacts than the No Action						
↓ Less impacts or Beneficial impacts than the No Action						
Resource Issue	**No Action**	**State RRVWSP**	**McClusky Canal only North**	**McClusky Canal only South**	**McClusky Canal and Missouri River North**	**McClusky Canal and Missouri River South**
Aquatic Invasive Species						
Risk of Transfer to Hudson Bay Basin	The risk of aquatic invasive species transfers to and establishment in the Hudson Bay basin through existing pathways would continue. In comparison to existing pathways, the No Action Alternative interbasin transfer risk would be low and is reduced further with the inclusion of the State-proposed water treatment plant.	=	↓ (Biota water treatment)			

Summary of Action Alternative Impacts Compared to No Action						
= No Change from the No Action						
↑ More impacts than the No Action						
↓ Less impacts or Beneficial impacts than the No Action						
Resource Issue	**No Action**	**State RRVWSP**	**McClusky Canal only North**	**McClusky Canal only South**	**McClusky Canal and Missouri River North**	**McClusky Canal and Missouri River South**
Impacts to Hudson Bay Basin	Adverse environmental and economic impacts of aquatic invasive species could increase due to transfer through existing pathways, potential future invasions through new pathways, and expanded distribution and abundance of aquatic invasive species already in the Hudson Bay basin.	=	=	=	=	=
Climate Change						
Future water availability	Climate change assessments within the Missouri River Mainstem System indicate runoff in the basin will increase in the future, providing a reliable source of water.	=	=	=	=	=
Cultural Resources						
Historic Properties	No adverse effects to historic properties are anticipated.	NA	=	=	=	=
Native American Traditional Cultural Properties	Access to Native American traditional cultural property sites by traditional practitioners would not be restricted, nor would the pipeline route open new areas for access	NA	=	=	=	=

Summary of Action Alternative Impacts Compared to No Action						
= No Change from the No Action						
↑ More impacts than the No Action						
↓ Less impacts or Beneficial impacts than the No Action						
Resource Issue	**No Action**	**State RRVWSP**	**McClusky Canal only North**	**McClusky Canal only South**	**McClusky Canal and Missouri River North**	**McClusky Canal and Missouri River South**
Land Resources						
Protected Lands	Five parcels affected including easements, PLOTS, and ND State Trust Lands. (Parcels)	NA	↓ (1)^	↑ (9)^	↑ (8)^	↑ (14)^
Prime and Unique Farmland	No prime farmlands acres would be affected. (Acres)	NA	↑ (130)^	↑ (<1)^	↑ (135)^	↑ (<1)^
Water Resources						
System Storage	Missouri River Mainstem Systems decreased by 0.1195 MAF compared to no project.	=	=	=	=	=
Navigation Service	Service level changes by 1,000 cfs or less for 98 percent of the period. 2 percent the service level is either increased or decreased between 1,000 and 5,000 cfs. Service length changes of 1 day or less for 90 percent of the period and 3 years have greater than 2 days.	=	=	=	=	=

Summary of Action Alternative Impacts Compared to No Action						
= No Change from the No Action						
↑ More impacts than the No Action						
↓ Less impacts or Beneficial impacts than the No Action						
Resource Issue	**No Action**	**State RRVWSP**	**McClusky Canal only North**	**McClusky Canal only South**	**McClusky Canal and Missouri River North**	**McClusky Canal and Missouri River South**
System Reservoir Levels	Reservoir water surface elevations are lower. During extended drought scenarios, a greater than 1-foot change is anticipated 5 percent of the time (Garrison) and 12 percent of the time (Oahe). (Feet)	=	Garrison ↑ (0.1) Oahe ↓ (0.2) Others =			
Dam Releases and River Flow	Changes in releases greater than 1,000 cfs less than 2 percent of the time for four major reservoirs.	=	=	=	=	=
Water availability from GDU	Between 1934 and 1942 drought scenario, water could not be supplied from GDU for 1,376 days during that time period. (Days)	NA	↑ (-12)			
Threatened and Endangered Species						
Impacts to Species	No impacts to any threatened or endangered species.	NA	=	↑ (Dakota skipper^)	=	↑ (Dakota skipper^)
Wetlands and Riparian Areas						
Temporary Impacts	Temporary impacts to 3 acres of wetlands. (Acres)	NA	↑ (41^)	↑ (12^)	↑ (65^)	↑ (31^)
Permanent Impacts	No permanent wetland acreage impacts. (Acres)	NA	↑ (3^)	↑ (<1^)	↑ (3^)	↑ (<1^)

Summary of Action Alternative Impacts Compared to No Action						
= No Change from the No Action						
↑ More impacts than the No Action						
↓ Less impacts or Beneficial impacts than the No Action						
Resource Issue	**No Action**	**State RRVWSP**	**McClusky Canal only North**	**McClusky Canal only South**	**McClusky Canal and Missouri River North**	**McClusky Canal and Missouri River South**
Socioeconomics						
Regional Economic Effects	Minor, short term beneficial regional economic effects due to construction of the Central North Dakota Water Supply Project. These minor beneficial impacts are short-term, occurring only during the construction period and amount to about of 2% of North Dakota gross state output for a single year to about 4% of the gross regional product for one year in the 9-county region.	=	=	=	↓ (+0.5% to +1.0% of the gross regional product)	

^ Chapter 2 BMP's and Environmental Commitments will minimize effects to these resources to the extent practicable

Chapter 1 Purpose of and Need for Action

1.1 Introduction

On January 31, 2019, Garrison Diversion Conservancy District (Garrison Diversion), on behalf of the State of North Dakota, requested an additional 145 cubic feet per second (cfs) of water from the McClusky Canal as an alternate water source for a State-led Red River Valley Water Supply Project (State RRVWSP) (in the Hudson Bay Basin), which necessitates that Reclamation analyze the request to comply with National Environmental Policy Act (NEPA) and other applicable laws. The additional 145 cfs of water is in addition to a previous request by Garrison Diversion for 20 cfs of water from the McClusky Canal that was to be delivered to the State RRVWSP for use in the Missouri River basin (MRB). The previous request is referred to as the Central North Dakota Water Supply Project (CNDWSP) and was analyzed in an Environmental Assessment (EA). A Finding of No Significant Impacts (FONSI) was signed in 2018.

1.2 Background

The Garrison Diversion Unit (GDU) Principal Supply Works was authorized by the 1965 Garrison Diversion Unit Act to deliver Missouri River water throughout North Dakota. In 1944, the U.S. Congress passed the Flood Control Act (of which the Missouri-Basin Pick Sloan Act is a part), which authorized construction of dams on the Missouri River and its tributaries. The GDU was authorized in 1965, and construction began in 1967. The GDU project was designed to divert Missouri River water to central and eastern North Dakota for irrigation, municipal and industrial water supply, fish and wildlife conservation and development, recreation, flood control, and other project purposes. Most of the currently authorized principal supply works have been completed (Snake Creek Pumping Plant, McClusky Canal, and New Rockford Canal). The connecting link between the two canals, which would have been Lonetree Reservoir, has been deauthorized.

The GDU project was reauthorized in 1986, which resulted in a reduced emphasis on irrigation and increased emphasis on meeting the municipal, rural and industrial (MR&I) water needs throughout North Dakota. The 1986 Reformulation Act, which amended the 1965 Act, authorized a Sheyenne River water supply and release feature and a water treatment plant capable of delivering 100 cfs of water to eastern ND. The GDU Project was never fully completed nor delivered water to the Hudson Bay Basin (HBB), limiting intended benefits to North Dakota.

In 2007, the Bureau of Reclamation (Reclamation) completed an environmental impact statement (EIS) evaluating the Federal Red River Valley Water Supply Project (Federal RRVWSP), which would have provided Missouri River water to eastern North Dakota communities located in the HBB. The preferred alternative was controversial for several reasons and therefore, the Secretary of the Interior did not sign a Record of Decision (ROD). As a result, the State is pursuing its own State RRVWSP project with state and local funding. The State RRVWSP is being designed to meet the future water needs of central and eastern North Dakota through the year 2075.

1.3 Proposed Federal Action

The Department of the Interior, Reclamation, proposes to provide federal cost share funding for the construction of the ENDAWS Project. This is a bulk water supply project, which would deliver an alternate water supply to the State RRVWSP.

Garrison Diversion, acting on behalf of the State of North Dakota, requests the Bureau of Reclamation consider issuing a contract for up to 165 cfs of water from GDU facilities, as an alternate water supply for the State RRVWSP. Garrison Diversion estimates that using GDU facilities as an alternate water source could save millions of dollars in costs for construction and annual operations and maintenance; including decreased energy costs for pumping.

Reclamation is authorized under Section 7 of the Dakota Water Resources Act of 2000 (DWRA) to work with the State of North Dakota to plan, design and construct municipal, rural and industrial water supply projects. Reclamation's potential actions include:

- Construction of ENDAWS project features, which may include an intake and pump station located along the McClusky Canal, a biota water treatment plant, and a bulk transmission pipeline to deliver water to the main transmission pipeline of the State RRVWSP.
- Issuance of a water repayment contract for GDU facilities, and
- Issuance of permits to construct and maintain ENDAWS facilities on Reclamation rights-of-way.

1.4 Purpose of and Need for Action

The purpose of the Project is to respond to Garrison Diversion's request for a contract for up to 165 cfs of water from Reclamation's GDU to provide an alternate bulk water supply to the State RRVWSP. The need for Reclamation's proposed action is established by Reclamation's responsibility under DWRA, which authorizes Reclamation to jointly, with the State of North Dakota, construct MR&I water resource development projects to serve areas throughout the State of North Dakota.

The Project is being proposed and evaluated as an alternate bulk water supply to meet this need. The State of North Dakota is pursuing its own State RRVWSP project with their own Missouri River intake and has requested an alternative water supply from the McClusky Canal, a Reclamation facility.

1.5 Scope

The scope of this EIS focuses on developing and analyzing a course of action and alternatives to it that meet the purpose and need described previously. *The Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA* (40 CFR 1500-1508) defines the scope of an EIS as consisting of the range of actions, alternatives, and potential impacts to be considered.

1.5.1 Actions

Reclamation has determined that the geographic scope for the Project includes the following counties in North Dakota: Burleigh, Sheridan, and Wells. The geographic scope of the resource analysis is limited to areas that could be impacted by the alternatives being evaluated. Some resource analyses such as aquatic invasive species, socioeconomics, and Missouri River depletions extend beyond this geographic scope as described in Chapter 3.

1.5.2 Alternatives

Reclamation evaluated five action alternatives and a No Action Alternative as required by NEPA. The No Action Alternative was developed based on the environmental analyses and conclusions of the previously completed NEPA compliance documents for the CNDWSP, the proposed action selected in the FONSI (Reclamation 2018) is the No Action Alternative. As stated in the Council on Environmental Quality Regulations [Section 1502.14(d)], a no action alternative is to be considered as part of the NEPA process. Additional guidance from the Council of Environmental Quality is provided in the document NEPA's *Forty Most-Asked Questions*. This guidance states that the No Action Alternative can be defined as a continuing action of the current management direction. Therefore, Reclamation has defined the No Action Alternative to include the CNDWSP, which would provide 20 cfs of water from the McClusky Canal (Canal) to the State RRVWSP and can only be supplied to users within the MRB. The five action alternatives comprise a reasonable range of alternatives to provide an alternate water source for the proposed action that meet the purpose and need described above. In accordance with NEPA, each action alternative is compared to the No Action Alternative to identify the impacts associated with each alternative.

The action alternatives included in this analysis are described in detail in Chapter 2, they were developed to cover a reasonable range of options to provide an alternate source of water based on the request from Garrison Diversion. The alternatives were developed based on some overall assumptions which include:

- The State of North Dakota is planning to construct the State RRVWSP which will withdraw 165 cfs from the Missouri River and transfer it to the Sheyenne River in the HBB through a buried pipeline.
- The action alternatives that include the use of the McClusky Canal to deliver Missouri River water into the HBB include a proposed Biota WTP. The purpose of the Biota WTP is to treat the water prior to it being delivered into the HBB as a means of reducing the risk of transferring invasive species. Commitment made by the United States regarding waters between the US and Canada are included in the 1909 Boundary Waters Treaty between the United States and Canada. Section 1(h) of DWRA includes a provision that the Secretary of the Interior is responsible for determining treaty compliance in consultation with the U.S. Environmental Protection Agency (EPA) and the U.S. Department of State.

The alternatives and mitigation measures considered in this EIS are described in chapters two (Alternatives) and three (Affected Environment and Environmental Consequences).

1.5.3 Potential Impacts

The potential impacts considered in the EIS are direct, indirect, and cumulative effects that may result from the proposed action and alternatives. Areas affected by the Project vary with each alternative. The environmental consequences of No Action and the potential impacts of the action alternatives are discussed in detail in Chapter 3.

All of the alternatives, including No Action, use the Missouri River or water from a Missouri River Mainstem Reservoir System as the water source. The potential environmental impacts associated with importation through possible transfer of organisms between the MRB and the HBB and the ecological and economic consequences of unwanted transfer have been evaluated and are discussed in Chapter 3 and Appendix F. A depletion analysis on the Missouri River Mainstem Reservoir System, including river flows downstream of Gavins Point Dam to the confluence of the Mississippi River, has been completed in cooperation with the U.S. Army Corps of Engineers (Corps). The method of evaluation and the potential impacts are discussed in Chapter 3 and Appendix H.

1.6 Purpose of the Final EIS

Reclamation has prepared this Final EIS in response to substantive comments on the Draft EIS related to environmental issues. Comments were received from reviewing state and federal agencies, organizations, and interested and potentially affected members of the public. Some changes were incorporated into the Final EIS in response to comments on the Draft EIS, but these revisions do not fundamentally change the impact analysis, or the results presented in the EIS. The primary changes from the Draft EIS include:

- In response to concerns about the future operations of the biota water treatment plant and questions about how Reclamation would monitor the effectiveness of the treatment processes, Reclamation has included additional text within Chapter 2 which describes in more detail the operations of the biota water treatment plant and the monitoring actions that would occur to ensure the treatment processes operate as designed. This monitoring information is also added to Table 2-20 as an environmental commitment for the Project.
- In response to questions raised about the No Action Alternative, additional explanation is included in Chapter 2 to provide clarification of this alternative.
- In response to questions about wetland impacts Reclamation provided clarifying text in Chapter 3 further describing the NWI data as the best available data for the EIS analysis and clarifies the uses and limitations of these data in the analysis of wetland impacts.
- Appendix L includes all comment letters received on the Draft EIS and Reclamation's responses to these comments.

1.7 Final EIS Organization

The Final EIS is organized in the same manner as the Draft EIS. Chapter 1 introduces the Project, describes its background and the EIS process, and establishes the purpose and need for the Project. Chapter 2 describes the five action alternatives and the No Action Alternative. It also identifies the preferred alternative. Chapter 3 describes the environmental resources that would be affected by the alternatives and the impacts of the proposed alternatives. Chapter 4 describes consultation and coordination activities and the applicable laws, regulations, and executive orders.

1.8 EIS Process

Reclamation is the lead federal agency under NEPA and is responsible for the preparation of the EIS and for ensuring compliance with NEPA, the National Historic Preservation Act, and other federal laws. Cooperating Agencies assisting in the preparation of the EIS include the Corps, U.S. Environmental Protection Agency, SWC, North Dakota Game and Fish Department, and the Garrison Diversion Conservancy District. The U.S. Fish and Wildlife Service was invited to participate on the team but declined; however, they were involved in review of Reclamation's biological assessment and consultation for Section 7 of the Endangered Species Act. The Standing Rock Sioux Tribe and the Three Affiliated Tribes were also invited to participate as Cooperating Agency members, but no response was received.

This EIS analyzes and discloses the environmental impacts of the Project alternatives and has been prepared in compliance with NEPA, the Council on Environmental Quality's Regulations for Implementing NEPA (40 CFR 1500), and Reclamation's *NEPA Handbook* (Reclamation 2012b). The Final EIS is being made available to the public prior to a final decision on implementation of the proposed action.

1.8.1 Record of Decision

In accordance with NEPA requirements, there will be a minimum 30-day period between the availability of the Final EIS and the issuance of a Record of Decision (ROD). Comments on the Final EIS may be offered to Reclamation for consideration during this time. Following this 30-day period, Reclamation's Missouri Basin Regional Director will determine the appropriate final action and issue a ROD. Significant comments received and issues raised on the Final EIS will be identified. The selected alternative and the alternatives considered in the Final EIS will be disclosed. Alternative(s) considered environmentally preferable also will be identified. Factors considered with respect to the alternatives and how these considerations entered into the decision will be discussed. Reclamation will include environmental commitments, means to avoid or minimize environmental harm, and any monitoring or enforcement activities to ensure that environmental commitments will be met, if an action alternative is selected. This will complete the NEPA process.

Chapter 2 Alternatives

2.1 Introduction

This chapter describes the range of reasonable alternatives developed to meet the Project's purpose and need (Chapter 1), as well as a No Action Alternative. A no action alternative is required to be considered under NEPA (40 CFR 1502.14[d]) as a basis for comparison of the alternatives. In addition to the No Action Alternative, five action alternatives have been evaluated in detail, considering potential environmental effects, as well as technical and economic considerations such as reliability and cost.

The action alternatives were developed to provide an alternate source of water to the State RRVWS Project for MR&I uses. The action alternatives are identified by the water source utilized, either the McClusky Canal or the Missouri River or a combination thereof. The chapter concludes with a description of the preferred alternative.

Alternatives evaluated in detail in this EIS are:

No Action Alternative

- **Alternative A** or the No Action Alternative is defined as continuing action of the current management direction where the CNDWSP would include an intake into the McClusky Canal and a six-mile pipeline connection between the McClusky Canal and the State RRVWSP. The 20 cfs of water taken from the McClusky Canal can only be supplied to users within the Missouri River Basin. Reclamation completed an EA on the CNDWSP and a FONSI was signed in September 2018.

Action Alternatives

- **Alternative B - State Red River Valley Water Supply Project** – This alternative would be constructed by the State of North Dakota utilizing only the Missouri River as the sole source of water to provide 165 cfs for the RRWSP. Reclamation would not construct the CNDWSP or issue any contract for water use out of the McClusky Canal.

- **Alternative C - McClusky Canal Only North** – This alternative would include the construction of features to provide 165 cfs from the McClusky Canal along a northern route and terminate when it reached the main transmission pipeline of the State RRVWSP. The alternative includes the construction of a Biota WTP, and Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

- **Alternative D - McClusky Canal Only South** – This alternative would include the construction of features to provide 165 cfs from the McClusky Canal along a southern route and terminate when it reached the main transmission pipeline of the State RRVWSP. The

alternative includes the construction of a Biota WTP, and Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

- **Alternative E - McClusky Canal and Missouri River North** - This alternative would include the construction of features to provide up to 165 cfs from the McClusky Canal along a northern route and terminate when it reached the main transmission pipeline of the State RRVWSP as Phase 1, and features required to provide up to 165 cfs from the Missouri River as Phase 2 for a maximum total combination of 165 cfs. This alternative would include the construction of a Biota WTP and Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

- **Alternative F - McClusky Canal and Missouri River South** - This alternative would include the construction of features to provide up to 165 cfs from the McClusky Canal along a southern route and terminate when it reached the main transmission pipeline of the State RRVWSP as Phase 1, and features required to provide up to 165 cfs from the Missouri River as Phase 2 for a maximum total combination of 165 cfs. This alternative would include the construction of a Biota Water Treatment Plant and Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's right-of-way.

2.1.1 Definition of Key Terms

The alternatives presented in this EIS were developed in the *Appraisal-Level Design Engineering Report* (Appendix A), which includes the design and cost estimate details. Key terms used throughout that report and this SEIS are defined below.

- **Component** – A facility designed for the Project (i.e., pipeline, intake, pump station, reservoir, treatment facility) that forms an alternative when combined with other components.

- **Option** – An alternate way of implementing a component (e.g., biota water treatment).

- **Action alternative** – A combination of components and options that together are designed to meet the purpose and need of the Project.

- **Intake** – A facility that collects surface water from a surface water source, such as a river or lake.

- **Best management practices (BMPs)** – Methods that are commonly used in projects of this nature to avoid or reduce effects while an action is being implemented.

- **Federal Components** – facilities that could be eligible for federal funding under the North Dakota State MR&I Grant Program (outlined in Section 7 of DWRA). Approval of this project does not guarantee funding of these features will be requested or available, all costs are subject to annual appropriations from Congress and are limited by the program's authorized construction ceiling.

2.2 Alternatives Development

Garrison Diversion completed an analysis of the needs for the State RRVWS project to determine the amount of water to request from Reclamation. The ENDAWS project components are designed to provide up to 165 cfs to the State RRVWSP pipeline. This amount of water is needed to provide central and eastern North Dakota water as described in Appendix A. The developed alternatives were designed to determine whether they are feasible and practicable and to provide a cost basis for comparison. The design of the action alternatives was completed at an appraisal level (30 percent) and should only be used for comparison of the alternatives, these estimates and details are presented in Appendix A. In coordination with Garrison Diversion, Reclamation identified five alternatives to be evaluated at the appraisal level. Detailed descriptions of the alternatives, designs, drawings, and cost estimates are included in Appendix A which provides details used to develop the alternatives. The design assumptions, cost estimating methodology and analysis of available water sources are also included. All cost estimates presented in this Chapter are based on 2019 dollars. The availability of water from the Missouri River and the McClusky Canal was analyzed to determine if they could adequately provide water for the Project's need, and is detailed in Appendix A. From a quantity and quality standpoint the Missouri River would provide a reliable source of 165 cfs for project needs. The McClusky Canal is part of the GDU Principal Supply Works along with the Snake Creek Pumping Plant and Lake Audubon. Water is pumped from Lake Sakakawea by the Snake Creek Pumping Plant into Lake Audubon and gravity flows down the McClusky Canal.

The McClusky Canal is approximately 74 miles in length and has a partial full clay lining in selected areas which was designed to convey up to 1,950 cfs when Lake Audubon's elevation is 1,850 feet above mean sea level (ft msl). Lower levels in Lake Audubon reduces the capacity of the McClusky Canal to 1350 cfs. The Canal is operated to provide water for authorized uses and to maintain water quality. In 2018 an operational analysis of the Canal was completed to assess the Canal's ability to convey existing and future water demands, including 165-cfs for the State RRVWSP (*Technical Memorandum – McClusky Canal Operations Hydraulic Model*, AE2S 2018), Appendix A details the conclusions of that study, which require some repairs to the Canal and associated facilities to maintain required flows.

In 2006, the Corps required Lake Audubon be drawn down two feet in elevation below normal levels to limit the water surface level difference between Lake Audubon and Lake Sakakawea to 36.5 feet as a safety measure for the Snake Creek Embankment. Later in 2007, as part of the Corps Dam Safety Risk Management Process, a seepage analysis of the Snake Creek embankment was completed. This analysis determined that the risk of dam failure from under seepage is increased with head differentials greater than 43 feet. Based on this analysis, and a subsequent analysis completed in 2013, an Interim Risk Reduction Measure was implemented by the Corps in the 2019 *Snake Creek Dam and Lake Audubon Reservoir Water Control Manual*, Section 7 – Water Control Management that states:

> *"A dam safety concern arises at the Snake Creek Embankment during drought conditions when Garrison Reservoir's elevation falls more than 43 feet below Lake Audubon's elevation. This dam safety constraint requires Lake Audubon levels be decreased as necessary through operation of the conduit slide gate any time the Garrison Reservoir pool is, or is anticipated to be, more than -43 feet lower than the Lake Audubon pool level. During drought conditions, the performance of the embankment is monitored closely to evaluate the dam's integrity with regard to hydrostatic pressure and under-seepage. Based on the results of the embankment monitoring and the*

performance of the dam under these loading conditions, the 43-foot differential constraint may be adjusted to ensure safe and efficient operation of the embankment."

This means during a long-term drought; Lake Audubon would need to be drawn down to maintain less than 43-feet differential between Lake Audubon and Lake Sakakawea. This impacts the GDU's and the ability to deliver water down the McClusky Canal to meet all project needs if Lake Sakakawea's pool elevation falls below 1804.0 ft msl.

Concerns over the transfer of invasive species from the MRB to the HBB have led to the development of treatment options to adequately comply with the boundary waters treaty. Four treatment options were evaluated for biota removal and/or inactivation for the ENDAWS Project and cost estimates were developed for each, with details included in Appendix B. The treatment options build on each other and each option provides more treatment capabilities.

2.3 Alternatives Evaluated in the EIS

The alternatives evaluated in the EIS include the No Action Alternative and five action alternatives that cover a full range of reasonable alternatives for implementing the Project. A No Action Alternative is always included in an EIS and is the basis for which all other alternatives are compared (40 CFR Section 1502.14[d]). The alternatives are identified by the source of water they utilize such as the McClusky Canal, the Missouri River or a combination.

No Action Alternative – The Central North Dakota Water Supply Project would continue as approved by Reclamation.

Action Alternatives

Alternative B - State RRVWSP – The state of North Dakota would construct the RRVWSP as planned with the Missouri River as the source of water.

Alternative C - McClusky Canal Only North - would use water from the McClusky Canal to supply the State RRVWSP Main Transmission Pipeline with 165 cfs through the northern proposed ENDAWS pipeline and Biota WTP

Alternative D - McClusky Canal Only South - would use water from the McClusky Canal to supply the State RRVWSP Main Transmission Pipeline with 165 cfs through the southern proposed ENDAWS pipeline and Biota WTP

Alternative E - McClusky Canal and Missouri River North - would use water from the McClusky Canal or the Missouri River to supply the State RRVWSP Main Transmission Pipeline with 165 cfs through the Northern proposed ENDAWS pipeline and Biota WTP

Alternative F - McClusky Canal and Missouri River South - would use water from the McClusky Canal or the Missouri River to supply the State RRVWSP Main Transmission Pipeline with 165 cfs through the Southern proposed ENDAWS pipeline and Biota WTP

This Project is being planned under the statewide North Dakota MR&I Program which is administered through a cooperative agreement between the Garrison Diversion and Reclamation. That agreement lays out the responsibilities of the parties whereas, Garrison Diversion is responsible for following standard construction practices; procurement regulations; and all applicable local, state, or federal laws. Reclamation provides oversight and is the lead federal agency for NHPA and NEPA requirements. Reclamation ensures that all construction projects include the requirements and commitments made under those laws. Each of the action alternatives described in the EIS includes BMPs (Described in Section 2.7 Table 2.19). The BMPs will be followed during construction of the federal components described

under each of the action alternatives. Project features constructed under this MR&I program will be owned, operated & maintained by the Project sponsor.

Pipeline Routes for each of the alternatives were developed using various combinations of pipeline segments and hydraulic facilities as described in detail in the sections below. Included in Appendix A are the details of each of the alternatives and explanations of their formulation. Figure ES-3 of Appendix A names the various pipeline segments used throughout this chapter. The State RRVWSP consists of segments A, B, C, and D. The CNDWSP is depicted as segment E, which connects the McClusky Canal to the State RRVWSP. The ENDAWS Project includes various combinations of pipeline segments F, G, H, and I, which would connect the McClusky Canal to the State RRVWSP, see Appendix A for details.

2.3.1 Alternative A – No Action Alternative

The purpose of the No Action Alternative is to provide an appropriate base against which all other alternatives are compared. No Action is not the same as the existing conditions because future actions may occur regardless of whether any of the action alternatives is chosen in the EIS.

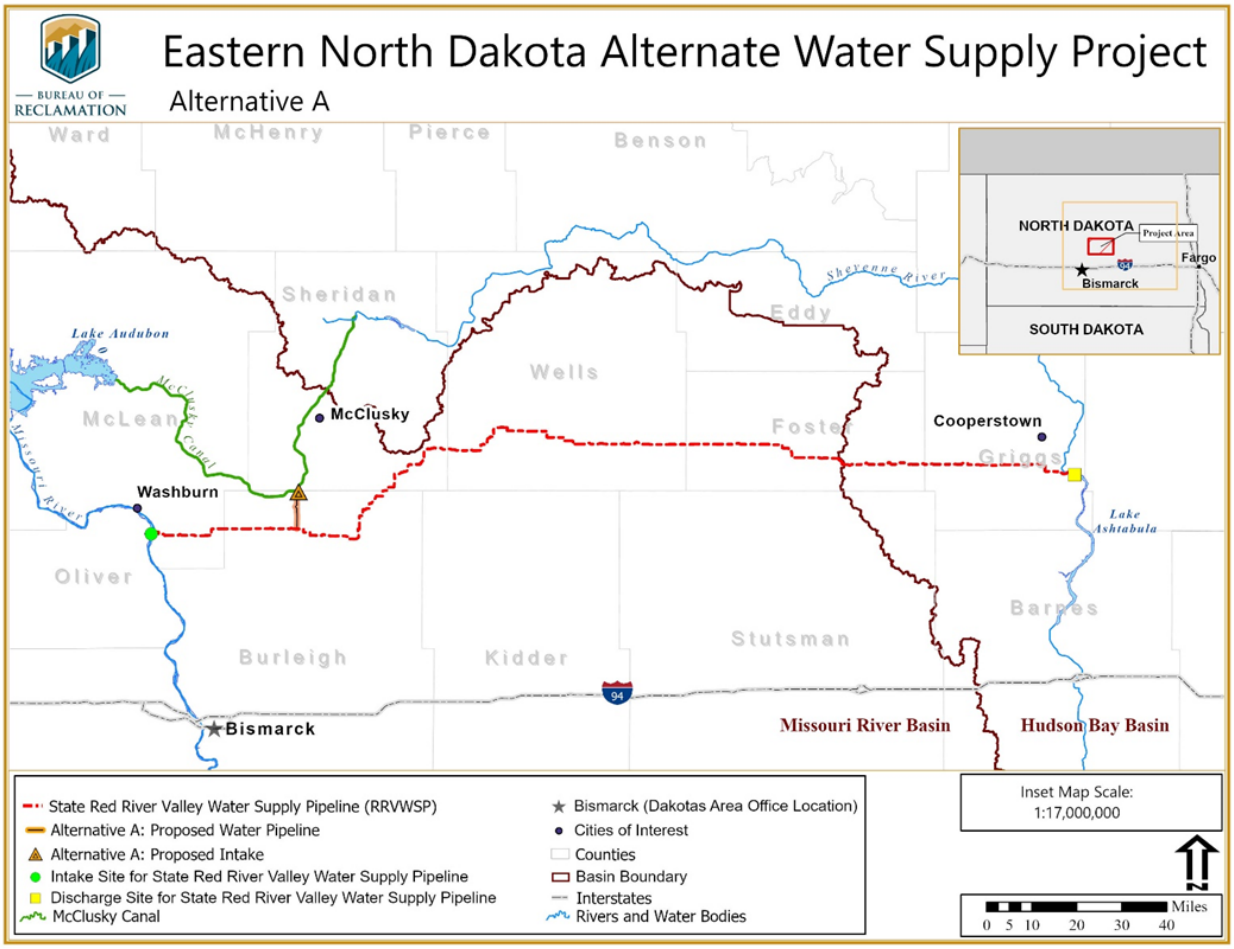

Figure 2-1: No Action Alternative – CNDWSP/State RRVWSP

The No Action Alternative was developed based on the environmental analyses and conclusions of the previously completed NEPA compliance documents for the CNDWSP. As stated in Chapter One, NEPA guidance allows an agency to define No Action as the continuing action of the current management direction; therefore, in this EIS the No Action Alternative is defined as the CNDWS Project which has been previously approved by Reclamation (Figure 2.1). Reclamation would construct the features described in the Finding of No Significant Impact completed for the project (Reclamation 2018). Other activities located in the Project Area that are likely to occur have also been considered under No Action to the extent that information is available.

CNDWSP would provide 20 cfs of water from the McClusky Canal for use within the MRB with in the CNDWSP area. The CNDWSP conveys water through a six-mile-long, 30-inch diameter pipeline which terminates when it reaches the State RRVWSP main transmission pipeline. Other features include the CNDWSP Intake and Pumping Station located on the McClusky Canal. The water provided by CNDWSP has been identified for industrial uses delivered to specified points in the Missouri River Basin. The end user would be responsible for compliance with all regulations.

The solid line in Figure 2.1 represents the buried pipeline (CNDWSP) and the dashed line shown in Figure 2.1 represents the State RRVWSP main transmission line. Table 2.1 shows each component that is included in the No Action Alternative and includes the estimated construction cost for the state components of the project and the federal components of the project. The pipeline segments included in each of the alternatives are designed and detailed in Chapter 6 of Appendix A and the construction cost estimates were developed in Chapter 7 of Appendix A.

Table 2-1: No Action Alternative Construction Cost

Component	Construction Cost*
State Project Components	
Pipeline (Segments A, B, C, D)	$934,382,000
Hydraulic Break Tank	$16,507,000
Control Valve Structure and Discharge Structure	$9,963,000
Missouri River Intake Pump Station	$57,773,000
Water Treatment Plant	$38,555,000
Main Pump Station 1	$36,908,000
Subtotal (State)	**$1,094,088,000**
Federal Components	
Central North Dakota Intake Pump Station	$8,662,000
Pipeline (Segment E)	$15,506,000
Subtotal (Federal)	**$24,168,000**
Alternative Total	**$1,118,000,000**

* Values in the table are rounded

The Federal Components listed in the table are the project features that could be eligible for federal cost share under the ND State MR&I program administered by Reclamation and authorized by the DWRA. Costs associated with this alternative will be negotiated with the Project sponsor to determine the appropriate level of federal cost share, if any. The federal portion of this cost share is limited by the construction cost ceiling established by the authorization.

2.3.2 Alternative B – State Red River Valley Water Supply Project

Alternative B is shown in Figure 2.2, this alternative represents the State RRVWSP. Alternative B is a State and local project being developed by Garrison Diversion to meet the future needs for participating communities in central and eastern North Dakota. Under this alternative, Reclamation would not construct the features of the CNDWSP as described under No Action and would not issue a repayment contract for 20cfs from the McClusky Canal. The state of North Dakota would continue with their plans to construct the State RRVWSP without any federal involvement by Reclamation.

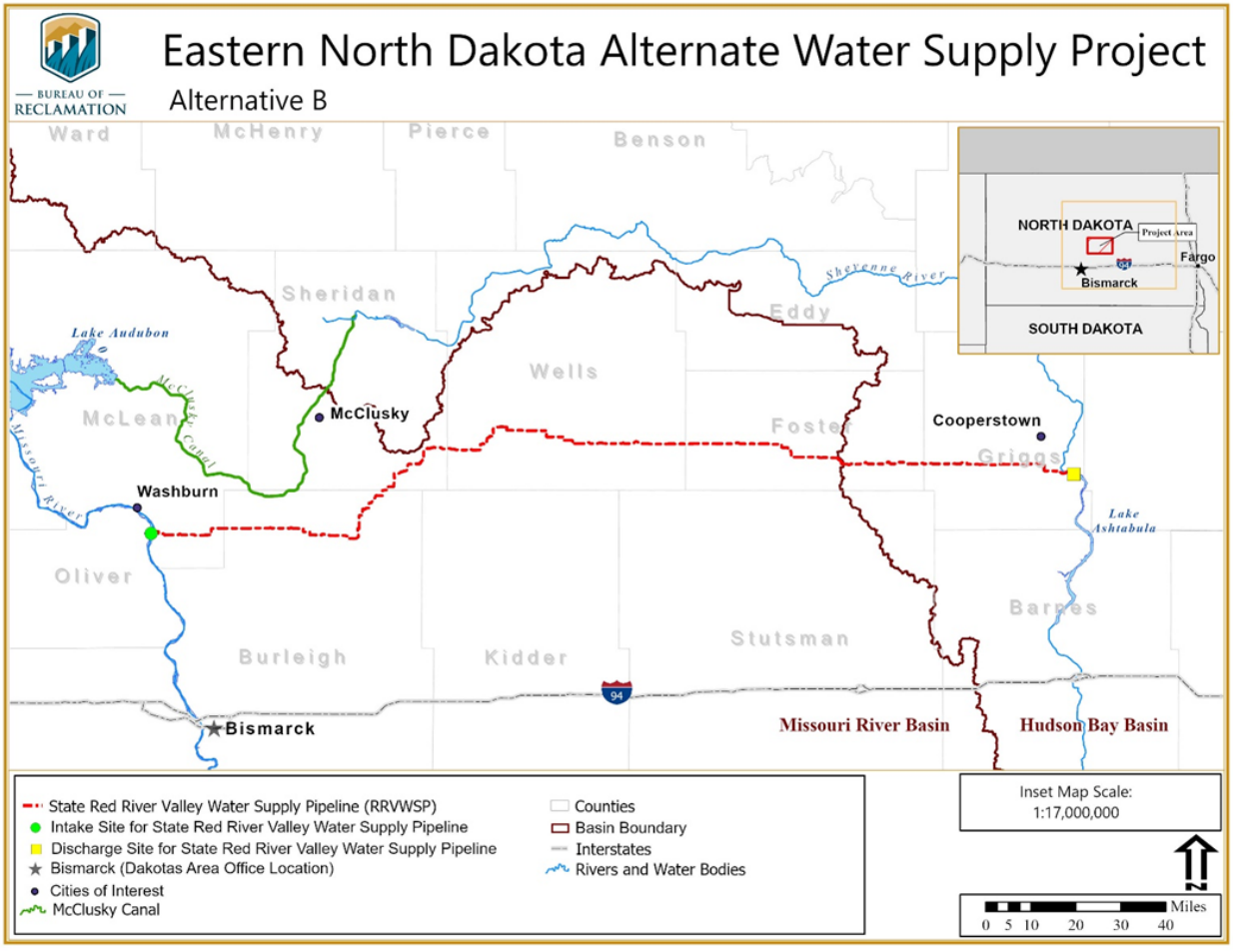

Figure 2-2: State RRVWSP Alternative

This alternative includes several features constructed by the state of North Dakota referred herein as "state components". This alternative includes a raw water intake and pump station on the Missouri River south of Washburn, North Dakota. The Missouri River Intake and Pumping Station facility

would pump 165 cfs of water to a State WTP approximately two miles east of the intake. The alternative is designed to provide 20 cfs to central North Dakota users in the MRB from the pipeline, five cfs to users on the pipeline after the continental divide between the MRB and HBB, and 140 cfs to the Sheyenne River above Lake Ashtabula. Main Pumping Station 1 adjacent to the State WTP would pump to a set of Hydraulic Break Tanks located approximately 60 miles east. Water would then flow by gravity from the Hydraulic Break Tank to the Control Valve Structure and Discharge Structure on the Sheyenne River approximately six miles south of Cooperstown, North Dakota. The State RRVWSP includes approximately 166 miles of 72-inch diameter buried pipeline (details for pipeline construction included in Appendix A).

The dashed line shown in Figure 2.2 represents the State RRVWSP which they are planning to construct, and Table 2.2 lists each component in this alternative along with the estimated construction cost. The pipeline segments included in each of the alternatives are designed and detailed in Chapter 6 of Appendix A and the construction cost estimates were developed in Chapter 7 of Appendix A.

Table 2-2: State Red River Valley Water Supply Alternative Construction Cost

Component	Construction Cost*
State Project Components	
Missouri River Intake Pump Station	$57,773,000
Water Treatment Plant	$38,555,000
Main Pump Station 1	$36,908,000
Hydraulic Break Tank	**$16,507,000**
Control Valve Structure and Discharge Structure	$9,963,000
Pipeline (Segments A, B, C, D)	$934,382,000
Alternative Total	**$1,094,088,000**

* Values in the table are rounded

2.3.3 Alternative C – McClusky Canal Only North

This alternative (Figure 2.3) would provide 165 cfs from the McClusky Canal approximately 1.5 miles northwest of McClusky, North Dakota near Canal Mile Marker (MM) 57. The McClusky Canal Intake and Pumping Station 1 would pump water from the McClusky Canal to a Biota WTP immediately adjacent to the intake facilities. The McClusky Canal Main Pumping Station 1 downstream of the Biota WTP would pump the treated water approximately 11 miles east to relocated Hydraulic Break Tank from the State RRVWSP near the intersection of North Dakota Highway 14 and North Dakota Highway 200, then flow by gravity approximately 21 miles to the connection with the State RRVWSP main transmission pipeline where the ENDAWS alternative terminates. The State RRVWSP main transmission pipeline continues to the Control Valve Structure and Discharge Structure on the Sheyenne River approximately six miles southeast of Cooperstown, North Dakota.

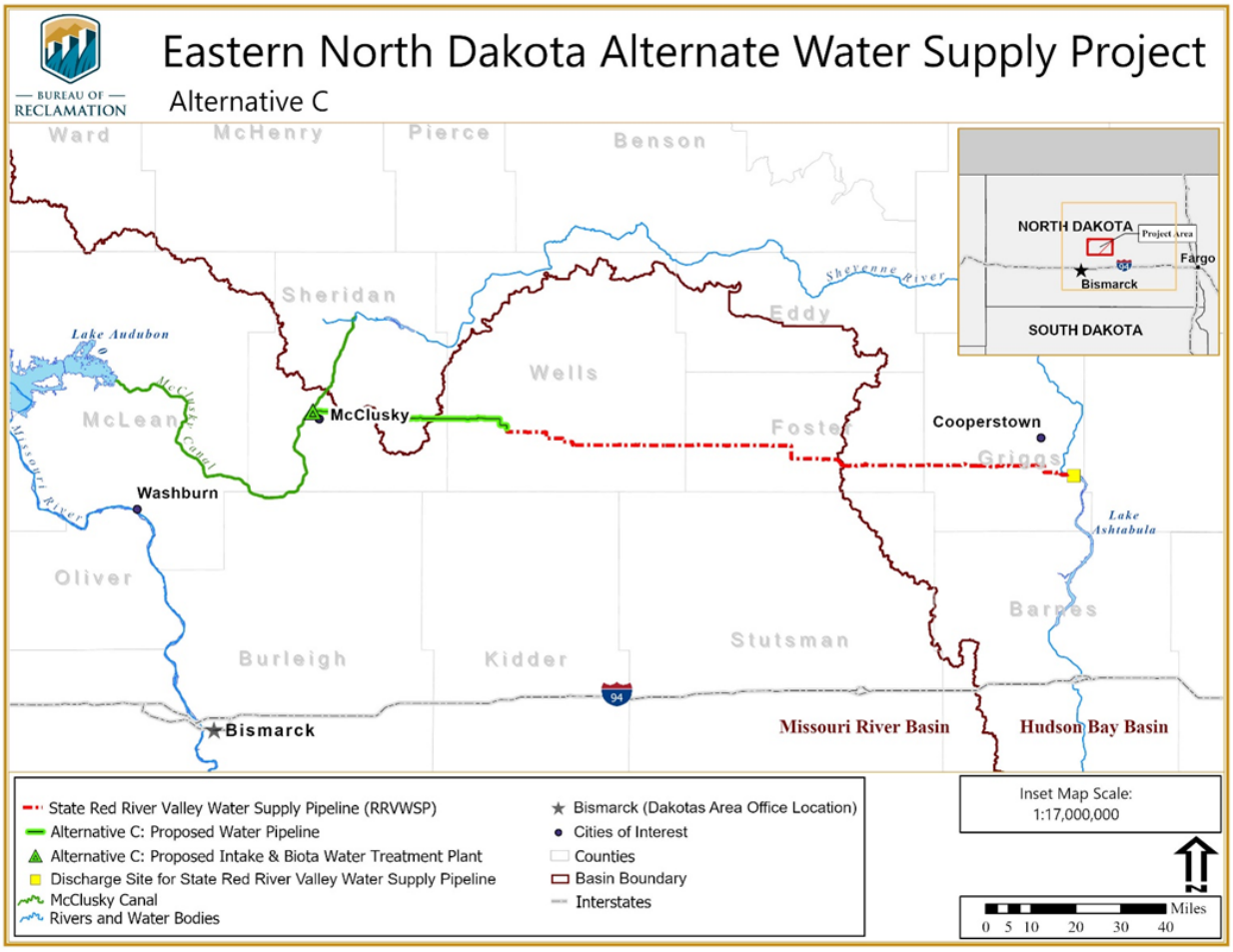

Figure 2-3: McClusky Canal Only North Alternative

The dashed line shown in Figure 2.3 represents the portion of the State RRVWSP utilized by this alternative. In Table 2.3 each component included in this alternative is shown as well as the estimated construction cost for the state and the federal components of the alternative. The pipeline segments included in each of the alternatives are designed and detailed in Chapter 6 of Appendix A and the construction cost estimates were developed in Chapter 7 of Appendix A.

Table 2-3: McClusky Canal Only North Alternative Construction Cost

Component	Construction Cost*
State Project Components	
Pipeline (Segment D)	$544,020,000
Hydraulic Break Tank	$16,461,000
Control Valve Structure and Discharge Structure	$9,963,000
Subtotal (State)	**$570,444,000**
Federal Components	
McClusky Canal Intake Pump Station 1	$28,246,000
McClusky Canal Main Pumping Station 1	$34,545,000
Pipeline (Segment G)	$189,735,000
Subtotal (Federal)	**$252,526,000**
Alternative Total	**$823,000,000**

* Values in the table are rounded

This Alternative would also include the construction of a Biota WTP to address concerns with project related biota transfer, these options are described in Section 2.4.7 of this Chapter. The addition of this feature would increase the total for this alternative to $879 M with Biota WTP Option 1; $893 M with Biota WTP option 2; $1,043 M with Biota WTP Option 3; and $1,063 M with Biota WTP Option 4.

The Federal Components listed in the table are the project features that could be eligible for federal cost share under the ND State MR&I program administered by Reclamation and authorized by the DWRA. Costs associated with this alternative will be negotiated with the Project sponsor to determine the appropriate level of federal cost share, if any. The federal portion of this cost share is limited by the construction cost ceiling established by the authorization.

2.3.4 Alternative D – McClusky Canal Only South

This alternative (Figure 2-4) would provide 165 cfs from the McClusky Canal approximately six miles southwest of McClusky, North Dakota near Canal MM 49. The McClusky Intake and Pumping Station 2 would pump water from the McClusky Canal to a Biota WTP approximately one mile east of the intake facilities. The McClusky Canal Main Pumping Station 2 adjacent to the Biota WTP would pump the treated water approximately 19 miles to the connection with the main transmission pipeline of the State RRVWSP where the ENDAWS alternative terminates. Treated water would continue to flow another six miles east to the Hydraulic Break Tank, then flow by gravity to the Control Valve Structure and Discharge Structure on the Sheyenne River approximately six miles south of Cooperstown, North Dakota.

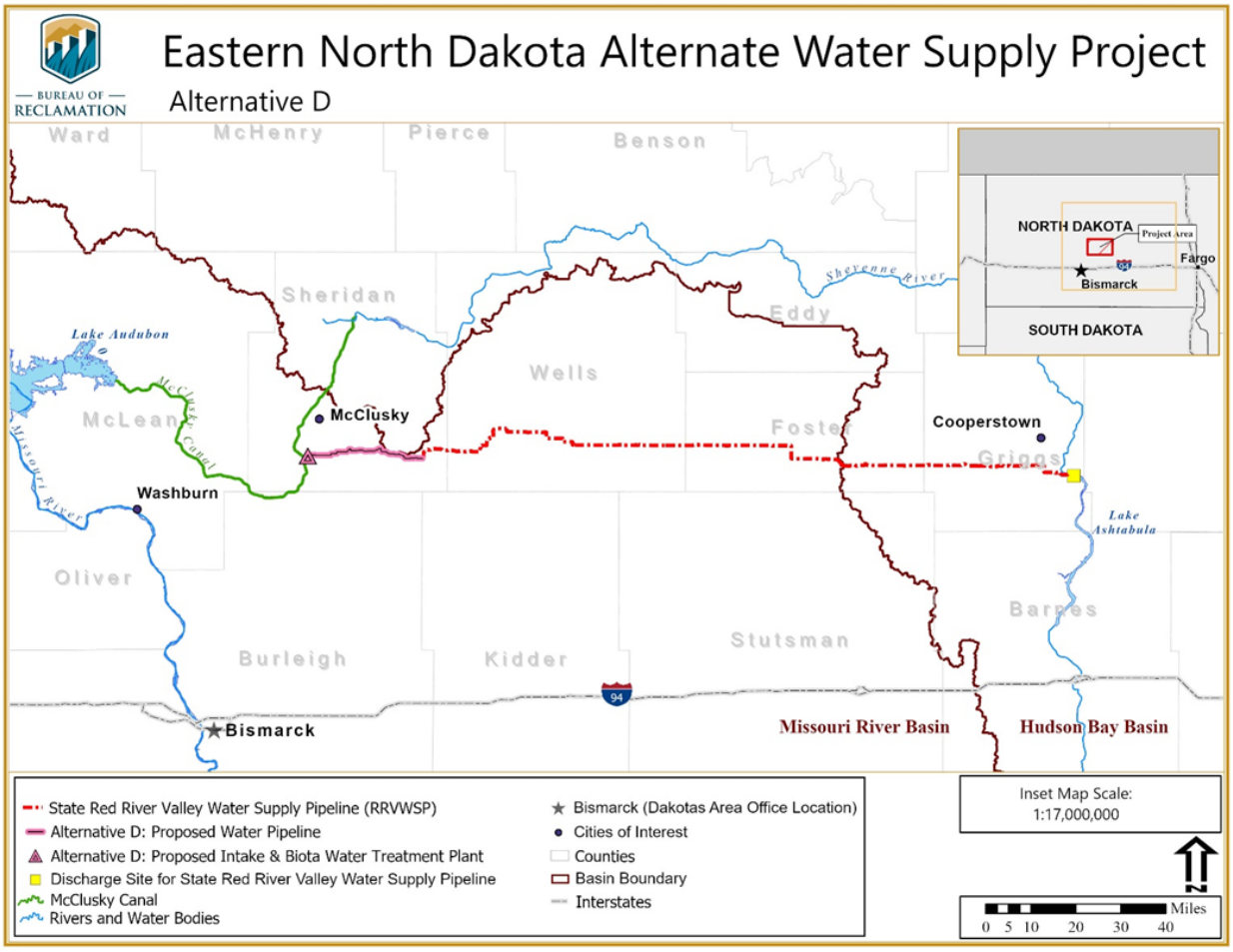

Figure 2-4: ENDAWS Route Option South Canal Supply Alternative

The dashed line shown in Figure 2.4 represents the portion of the State RRVWSP utilized by this alternative. In Table 2.4 each alternative component included in this alternative is shown along with the estimated construction cost for the state and federal components. The pipeline segments included in each of the alternatives are designed and detailed in Chapter 6 of Appendix A and the construction cost estimates were developed in Chapter 7 of Appendix A.

Table 2-4: McClusky Canal Only South Construction Cost

Component	Construction Cost*
State Project Components	
Pipeline (Segments C, D)	$635,959,000
Hydraulic Break Tank	$16,778,000
Control Valve Structure and Discharge Structure	$9,963,000
Subtotal (State)	**$662,700,000**
Federal Components	
McClusky Canal Intake Pump Station 2	$31,953,000
McClusky Canal Main Pumping Station 2	$35,258,000
Pipeline (Segment I)	$103,307,000
Subtotal (Federal)	**$170,518,000**
Alternative Total	**$833,000,000**

* Values in the table are rounded

This Alternative would also include the construction of a Biota WTP to address concerns with Project related biota transfer, these options are described in Section 2.4.7 of this Chapter. The addition of this feature would increase the total for this alternative to $889 M with Biota WTP Option 1; $903 M with Biota WTP Option 2; $1,053 M with Biota WTP Option 3; and $1,073 M with Biota WTP Option 4.

The Federal Components listed in the table are the project features that could be eligible for federal cost share under the ND State MR&I program administered by Reclamation and authorized by the DWRA. Costs associated with this alternative will be negotiated with the Project sponsor to determine the appropriate level of federal cost share, if any. The federal portion of this cost share is limited by the construction cost ceiling established by the authorization.

2.3.5 Alternative E – McClusky Canal and Missouri River North

This Alternative (Figure 2.5), would provide full redundancy by either taking 165 cfs from the McClusky Canal near MM 57 (approximately 1.5 miles northwest of McClusky, North Dakota) or taking 165 cfs from the Missouri River south of Washburn, North Dakota, or any combination thereof, for a maximum total of 165 cfs, the State RRVWSP pipeline diameter limits the total capacity of water crossing the continental divide.

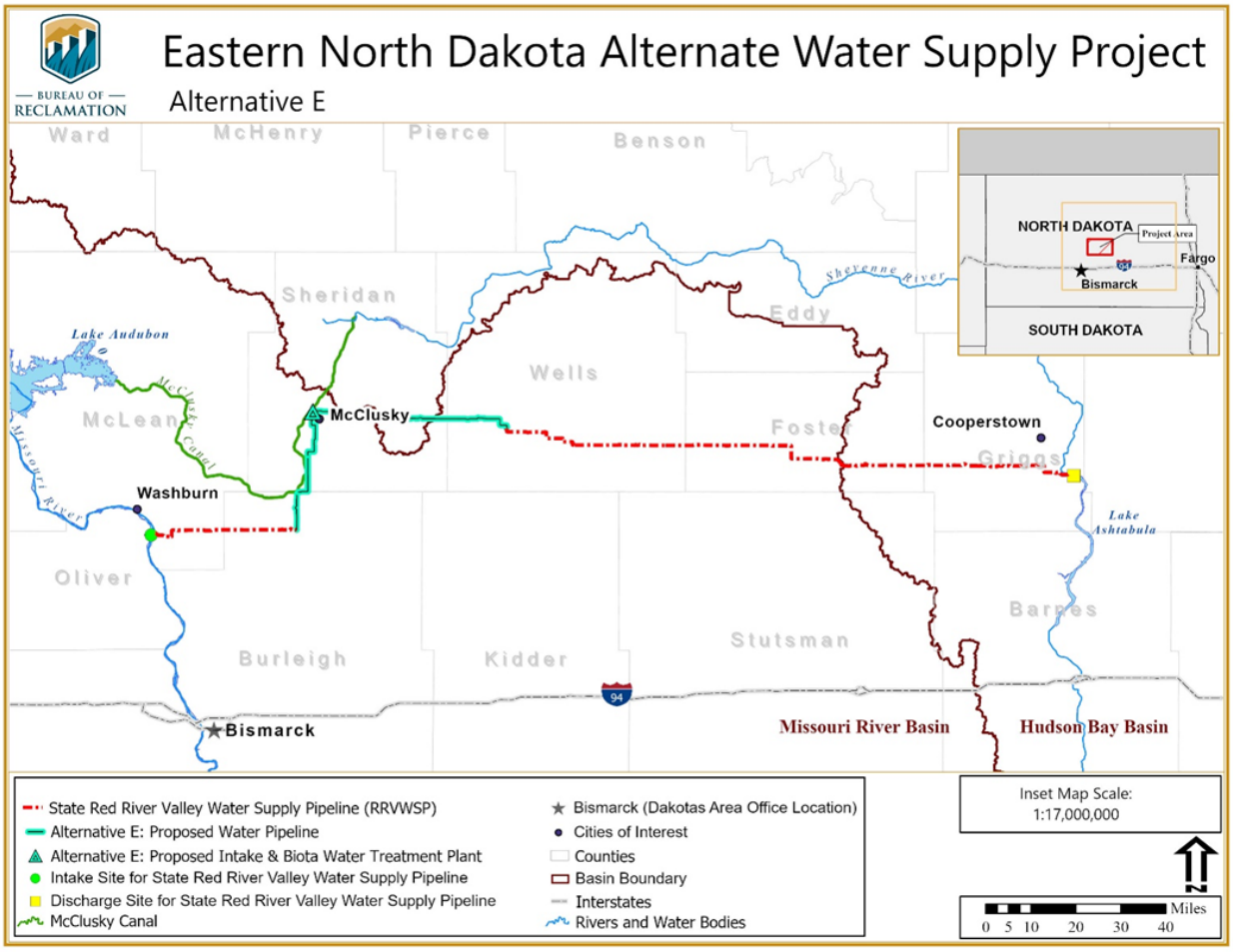

Figure 2-5: McClusky Canal and Missouri River North

This alternative was developed to provide this full capacity with two alternative water sources. Phase 1 would develop the facilities required to utilize the McClusky Canal, and Phase 2 would develop the facilities needed to utilize the Missouri River. For utilization of the McClusky Canal, the McClusky Canal Intake Pump Station near Canal MM 57 would pump water from the McClusky Canal to a Biota WTP immediately adjacent to the Canal. To utilize the Missouri River, the Missouri River Intake Pump Station facility would pump 165 cfs of water to a Sediment Removal Plant located approximately 2 miles east of the intake. The Sediment Removal Plant is intended to provide sand/grit removal only. After sand/grit removal, the Main Pumping Station 2 would pump the water to the Biota WTP adjacent to the McClusky Canal. The McClusky Main Pump Station 1 adjacent to the Biota WTP would pump the treated water approximately 10 miles east to the relocated Hydraulic Break Tank from the State RRVWSP. The treated water would flow by gravity to the connection with the main transmission pipeline of the State RRVWSP where the ENDAWS alternative terminates. The treated water would flow through this main transmission pipeline to the Control Valve Structure and Discharge Structure on the Sheyenne River approximately six miles southeast of Cooperstown, North Dakota. (See Figure ES-8 of Appendix A for details). All of the water, whether it is withdrawn from the Missouri River or from the McClusky Canal, is treated at the Biota WTP prior to being transferred into the HBB.

The dashed line shown in Figure 2.5 represents the portion of the State RRVWSP utilized by this alternative. In Table 2.5 each component included in this alternative is shown along with the estimated construction cost for the state and federal components of the alternative. The pipeline segments included in each of the alternatives are designed and detailed in Chapter 6 of Appendix A and the construction cost estimates were developed in Chapter 7 of Appendix A.

Table 2-5: McClusky Canal and Missouri River North Construction Cost

Component	Construction Cost*
PHASE 1	
State Project Components	
Pipeline (Segment D)	$544,020,000
Hydraulic Break Tank	$16,461,000
Control Valve Structure and Discharge Structure	$9,963,000
Subtotal (State)	**$570,444,000**
Federal Components	
McClusky Canal Intake Pump Station 1	$28,246,000
McClusky Canal Main Pumping Station 1	$34,545,000
Pipeline (Segment G)	$189,735,000
Subtotal (Federal)	**$252,526,000**
Phase 1 Subtotal	**$823,000,000**
PHASE 2	
State Project Components	
Pipeline (Segment A)	$130,210,000
Missouri River Intake Pump Station	$57,773,000
Sediment Removal Plant	$12,976,000
Main Pump Station 2	$36,114,000
Subtotal (State)	**$237,073,000**
Federal Components	
Pipeline (Segment E, F, H)	$131,346,000
Subtotal (Federal)	**$131,346,000**
Phase 2 Subtotal	**$368,419,000**
Alternative Total	**$1,191,419,000**

* Values in the table are rounded

This alternative would also include the construction of a Biota WTP to address concerns with Project related biota transfer, these options are described in Section 2.4.6 of this Chapter. The addition of this feature would increase the total for this alternative to $1,247 M with Biota WTP

Option 1; $1,261 M with Biota WTP Option 2; $1,411 M with Biota WTP Option 3; and $1,431 M with Biota WTP Option 4.

The Federal Components listed in the table are the project features that could be eligible for federal cost share under the ND State MR&I program administered by Reclamation and authorized by the DWRA. Costs associated with this alternative will be negotiated with the Project sponsor to determine the appropriate level of federal cost share, if any. The federal portion of this cost share is limited by the construction cost ceiling established by the authorization.

2.3.6 Alternative F – McClusky Canal and Missouri River South

This alternative (Figure 2.6) would also provide full redundancy by utilizing two water sources, either taking 165-cfs from near Canal MM 49 approximately six miles southwest of McClusky, North Dakota, or taking 165-cfs from the Missouri River south of Washburn, North Dakota, or any combination thereof, for a total of 165 cfs. Phase 1 would develop the facilities required to utilize the McClusky Canal, and Phase 2 would develop the facilities needed to utilize the Missouri River. For utilization of the McClusky Canal, the McClusky Intak Pump Station 2 would pump water from the McClusky Canal to a Biota WTP located approximately one mile east of the intake. To utilize the Missouri River, the Missouri River Intak Pump Station facility would pump 165 cfs of water to a Sediment Removal Plant located approximately two miles east of the intake. The Sediment Removal Plant is intended to provide sand/grit removal only. After sand/grit removal, the Missouri Pump Station 2 would pump the water to the Biota WTP near Canal MM 49. The McClusky Main Pump Station 2 adjacent to the Biota WTP would pump the treated water approximately 19 miles to the connection the main transmission pipeline of the State RRVWSP where the ENDAWS alternative terminates. Treated water would continue to flow five miles east to the Hydraulic Break Tank and then flow by gravity to the Control Valve Structure and Discharge Structure on the Sheyenne River approximately six miles south of Cooperstown, North Dakota. All of the water, whether it is withdrawn from the Missouri River or from the McClusky Canal, is treated at the Biota WTP prior to being transferred into the HBB.

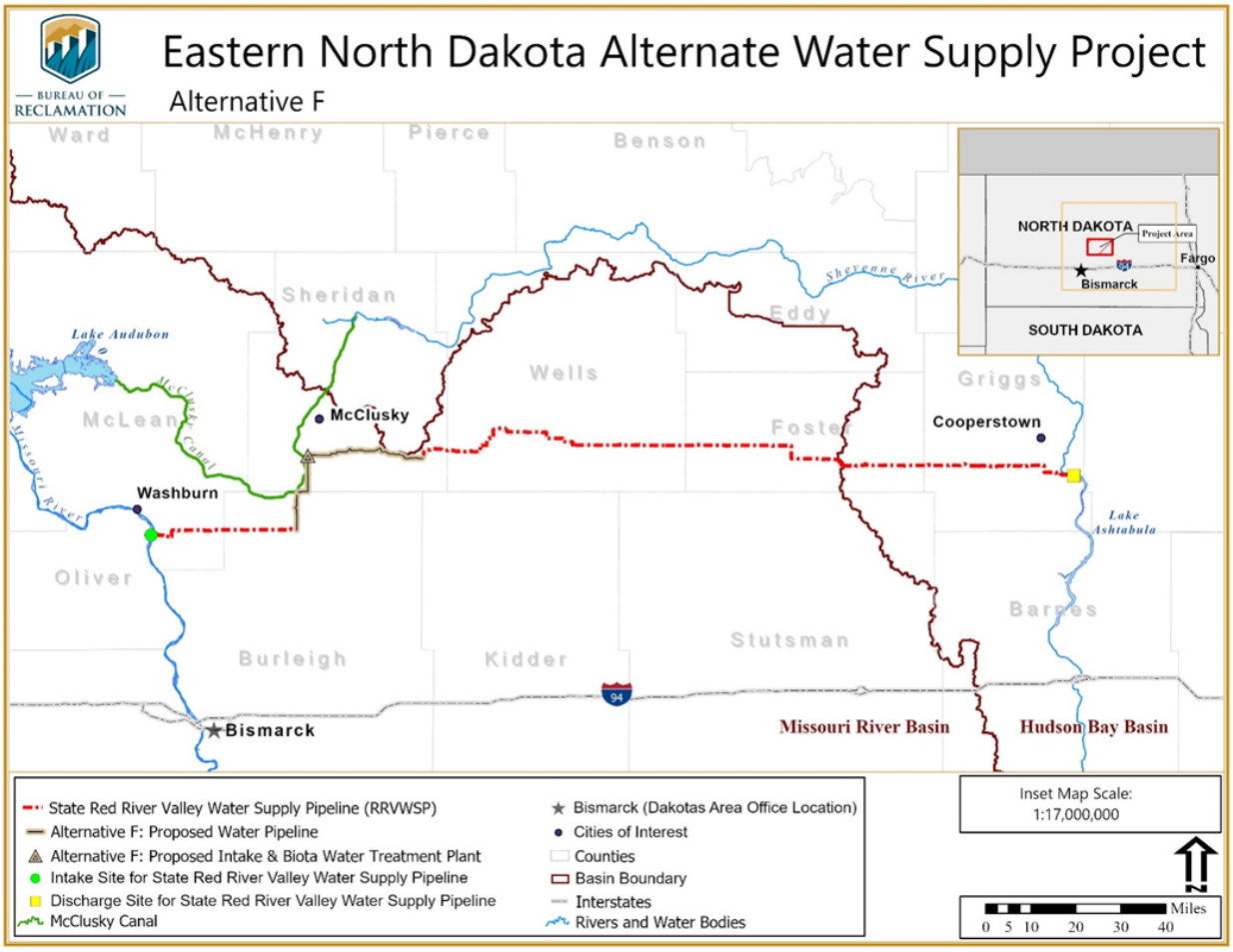

Figure 2-6: ENDAWS Route Option Canal and Missouri River South

The dashed line shown in Figure 2.6 represents the portion of the State RRVWSP utilized by this alternative. In Table 2.6, each component included in this alternative is shown along with the estimated construction cost for the state and federal components of the alternative. The pipeline segments included in each of the alternatives are designed and detailed in Chapter 6 of Appendix A and the construction cost estimates were developed in Chapter 7 of Appendix A.

Table 2-6: ENDAWS Route Option Canal and Missouri River South Construction Cost

Component	Construction Cost*
PHASE 1	
State Project Components	
Pipeline (Segments C, D)	$635,959,000
Hydraulic Break Tank	$16,778,000
Control Valve Structure and Discharge Structure	$9,963,000
Subtotal (State)	**$662,700,000**
Federal Components	
McClusky Canal Intake Pump Station 2	$31,953,000
McClusky Canal Main Pumping Station 2	$35,258,000
Pipeline (Segment I)	$103,307,000
Subtotal (Federal)	**$170,518,000**
Phase 1 Subtotal	**$833,000,000**
PHASE 2	
State Project Components	
Pipeline (Segment A)	$130,210,000
Missouri River Intake Pump Station	$57,773,000
Sediment Removal Plant	$12,976,000
Main Pump Station 2	$36,114,000
Subtotal (State)	**$237,073,000**
Federal Components	
Pipeline (Segment E, F)	$79,644,000
Subtotal (Federal)	**$79,644,000**
Phase 2 Subtotal	**$316,717,000**
Alternative Total	**$1,150,000,000**

* Values in table are rounded

This alternative would also include the construction of a Biota WTP to address concerns with Project related biota transfer, these options are described in Section 2.4.6 of this Chapter. The addition of this feature would increase the total for this alternative to $1,206 M with Biota WTP Option 1; $1,220 M with Biota WTP Option 2; $1,370 M with Biota WTP Option 3; and $1,390 M with Biota WTP Option 4.

The Federal Components listed in the table are the project features that could be eligible for federal cost share under the ND State MR&I program administered by Reclamation and authorized by the DWRA. Costs associated with this alternative will be negotiated with the Project sponsor to

determine the appropriate level of federal cost share, if any. The federal portion of this cost share is limited by the construction cost ceiling established by the authorization.

2.3.7 Biota Water Treatment Plant Options

Four Biota WTP options were evaluated for the ENDAWS Project to reduce the risk of a Project-related transfer of AIS into the Hudson Bay basin. The options were designed to provide a range of treatment methods, starting with disinfection and incrementally adding water treatment technologies to target different types of pathogens and biota, and increasing the level of protection with each option. The Biota WTP options were designed at the appraisal level, consistent with other components proposed in the alternatives. The methods and sources of information used in developing the designs and cost estimates are provided in Appendix B. At this level of design, the estimated costs should only be used for comparison of the options. The Biota WTP options include:

- Disinfection - Sand/grit removal and disinfection using chlorination
- Enhanced Disinfection - Sand/grit removal and enhanced disinfection consisting of ultraviolet light (UV) and chlorination
- Conventional Treatment - coagulation/flocculation, high rate sedimentation, granular media filtration, UV, and chlorination
- Advanced Treatment - Advanced Treatment consisting of sand/grit removal, coagulation/flocculation, membrane filtration, UV disinfection, and chlorination.

The proposed Biota WTP facility would be located adjacent to the McClusky Canal near MM 57, or near Canal MM 49 depending on the alternative. Each Option description below includes a process flow diagram as well as an estimate of the construction and operation, maintenance and replacement (OM&R) costs. Each of the Biota WTP options are designed for the peak flow of 107 million gallons per day (MGD). Detailed descriptions and additional information are included in Appendix B.

The U.S. government has not developed water treatment standards, rules, or regulations specifically for use in reducing the risk of an introduction of an invasive species through interbasin water transfers. *Giardia*, viruses, and *Cryptosporidium* have been used as surrogates for the selected aquatic invasive species (AIS) to quantify the level of inactivation that would be attained for each treatment process. Quantities are measured using "log inactivation," which is a measure of the percent of biota that are inactivated and/or removed as a result of a treatment process. For example, 2-log, 3-log, 4-log, and 5-log inactivation corresponds to 99 percent, 99.9 percent, 99.99 percent, and 99.999 percent inactivation/removal, respectively. *Myxobolus cerebralis* (whirling disease) is a fish pathogen that is resistant to certain types of water treatment technologies, because there has been interest in this specific species during previous evaluations, the potential to treat for this type of biota is evaluated for each option below. The summary here is intended to give a representation of the ability to target groups of organisms. Specific analysis is included in Appendix F.

Cost estimates for construction and OM&R were developed in detail in Appendix B. Significant cost savings for the Project Sponsor are expected due to the ENDAWS Project. Federal costs associated with Boundary Waters Treaty compliance, if any, are non-reimbursable. Each of the cost estimates presented in this section represent costs that could be

eligible for federal funding but does not guarantee funding will be requested or available. Capital costs and operation and maintenance costs associated with this facility will be negotiated with the Project sponsor to determine the appropriate level of federal cost share, if any. Reclamation will enter into a cooperative agreement with the Project Sponsor to define the Roles and Responsibilities of the parties and to provide Reclamation's continued oversight of the Biota Treatment Plant to ensure BWT compliance. Any federal funding will be subject to annual appropriations.

2.3.7.1 Disinfection Option

The Disinfection Option would include sand/grit removal and chemical disinfection of the raw water using free chlorine followed by ammonia addition to form chloramines. "Chloramines" are a disinfection residual maintained in the transmission pipeline that help to control biofilm and provide additional disinfection inside the pipe. Figure 2.7 shows the process flow diagram for the treatment processes included in this option. Water would enter the Biota WTP where sand/grit removal physically separates macro-organisms and fine material from the inflow before continuing to chlorine disinfection. Design details for this option are included in Appendix B.

Figure 2-7: Disinfection Process Flow Diagram

The Disinfection Option would provide 3-log inactivation of Giardia and 4-log inactivation of viruses. This option would not provide protection against organisms that are resistant to chlorine disinfectants, such as *Cryptosporidium* before the water is conveyed into the Hudson Bay basin. *Myxobolus cerebralis* has been used in the past for comparison to other types of species that may be resistant to certain types of treatment. Table 2.7 shows the log inactivation/removal credits this option would achieve on a variety of target species of biota.

Table 2-7: Disinfection Option Log-Inactivation

Target AIS	Removal - Intake Fine Screen and Sand/Grit	Inactivation - Chlorination	Total Log Reduction [b]
Giardia	0	>3.0	>3.0
Viruses	0	>4.0	> 4.0
Cryptosporidium	0	0	0
Myxobolus cerebralis[a]	1.0	>3.0	>4.0

[a] The log-inactivation is based on the design cT being in excess of literature values for whirling disease

[b] Total Log Reduction Column is not a cumulative total but reflects if the option meets/exceeds the established target

Estimated costs associated with this Biota WTP option are presented in Table 2.8. The estimated total construction cost for the disinfection treatment is $56.5 million, and the annual OM&R cost is estimated at $3.5 million.

Table 2-8: Disinfection Option Cost Estimates

Description	Construction Cost Estimate*	Annual OM&R Cost Estimate*
Sitework and Propane Yard	$12,299,000	$3,500,000
Sand/Grit Building	$10,981,000	
Disinfection Contact Basins	$24,109,000	
Chlorine Building	$3,313,000	
Office Building	$5,728,000	
Total	**$56,430,000**	**$3,500,000**

* Values in the table are rounded.

2.3.7.2 Enhanced Disinfection Option

The Enhanced Disinfection Option includes sand/grit removal, UV light irradiation followed by chlorine disinfection and chloramine formation. Irradiation with UV would be used to inactivate chlorine-resistant biota such as *Cryptosporidium* and *Myxobolus cerebralis*. Figure 2.8 shows the treatment processes included in this option.

Figure 2-8: Enhanced Disinfection Option

This option would be designed to provide 3-log inactivation of *Giardia* and 4-log inactivation of viruses (Table 2.9). As described in the Disinfection Option, chemical disinfection alone does not provide protection against organisms, such as *Cryptosporidium*, that are resistant to disinfectants like chlorine. This option would also include UV disinfection designed to achieve 3-log inactivation of *Cryptosporidium* and other similar types of organisms. Design details are included in Appendix B.

Table 2-9: Enhanced Disinfection Option Log-Inactivation

Target AIS	Removal - Intake Fine Screen and Sand/Grit	Inactivation - Chlorination	Inactivation - UV Disinfection [a]	Total Log Reduction [b]
Giardia	0	>3.0	>3.0	>3.0
Viruses	0	>4.0	0	> 4.0
Cryptosporidium	0	0	3.0	3.0
Myxobolus cerebralis	1.0	>3.0	>4.0	>4.0

[a] The log-inactivation is based on the design dosage of 40 mJ/cm^2

[b] Total Log Reduction Column is not a cumulative total but reflects if the option meets/exceeds the established target

Estimated costs associated with this Biota WTP option are presented in Table 2.10. Methods and sources of information used in developing the construction and OM&R cost estimates are provided in Appendix B. The estimated total construction cost for the Enhanced Disinfection is approximately $69.5 million, and the annual OM&R cost is estimated at $4.1 million.

Table 2-10: Enhanced Disinfection Treatment Option Cost Estimates

Description	Construction Cost Estimate*	Annual OM&R Cost Estimate*
Sitework and Propane Yard	$12,394,000	$4,100,000
Sand/Grit Building	$10,982,000	
Disinfection Contact Basins	$24,110,000	
Chlorine Building	$3,313,000	
Office Building	$18,655,000	
Total	**$69,454,000**	**$4,100,000**

* Values in the table are rounded

2.3.7.3 Conventional Treatment

"Conventional treatment" is defined as a series of processes, including coagulation, flocculation, sedimentation, and filtration, resulting in substantial particulate removal (40 CFR 141.2). The Conventional Treatment Option includes coagulation and flocculation, followed by high-rate sedimentation, media filtration, UV irradiation, and chemically disinfected with chlorine, followed by conversion to chloramines. Figure 2.9 shows the process flow diagram for this option. Design details for each of these processes are described in Appendix B.

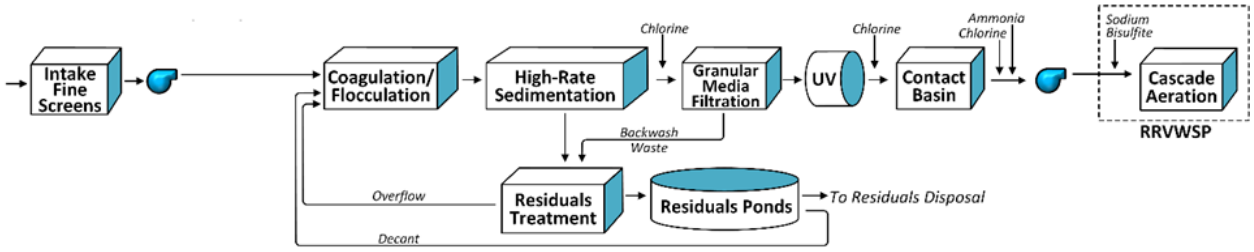

Figure 2-9: Conventional Treatment Option

Conventional Treatment plants have proven to be effective in treating drinking water systems throughout the U.S. The coagulation/flocculation step begins the treatment process with the addition of chemicals and mixing to form a floc which meets the plate settlers in the high-rate sedimentation step and settles out of suspension. The water then passes through the granular media filtration step that includes dual media filtration which is proven to have high particle removal and filtered water quality. Table 2.11 shows the expected removal/inactivation for the Conventional Treatment Option.

Table 2-11: Conventional Treatment Option Log-Inactivation and/or Removal Credits

Target AIS	Removal - Intake Fine Screen	Removal - Conventional Media Filtration	Inactivation - Chlorination	Inactivation - UV Disinfection [a]	Total Log Reduction [b]
Giardia	0	2.5	0.1	3.0	>3.0
Viruses	0	2.0	4.0	0	> 4.0
Cryptosporidium	0	2.5	0	3.0	>3.0
Myxobolus cerebralis	0	2.5	0	4.0	>4.0

[a] The log-inactivation is based on the design dosage of 25 mJ/cm^2

[b] Total Log Reduction column is not a cumulative total but reflects if the option meets/exceeds the established target

The cost estimate for this option was developed in the same manner as the other Biota WTP options, and the costs are summarized in Table 2.12. Methods and sources of information used in developing the construction and OM&R cost estimates are provided in Appendix B. The result is a total construction cost estimate of approximately $222 million and an annual OM&R cost of approximately $8.4 million.

Table 2-12: Conventional Treatment Option Cost Estimates

Description	Construction Cost Estimate*	Annual OM&R Cost Estimate*
Sitework and Propane Yard	$22,335,000	$8,400,000
Disinfection Contact Basins	$6,115,000	
Treatment Facility	$167,549,000	
Solids Equalization Basin	$2,828,000	
Residuals Thickening	$18,595,000	
Residuals Ponds	$4,547,000	
Total	**$221,969,000**	**$8,400,000**

* Values in the table are rounded

2.3.7.4 Advanced Treatment

This option includes the same basic concepts as the Conventional Treatment Option; however, it includes a more effective type of filtration using membranes. Membrane filtration can remove smaller particles from the water than the media filtration included in the Conventional Treatment Option. This option includes sand/grit removal, coagulation, flocculation, and membrane filtration, along with UV disinfection and chlorine/chloramines disinfection, as shown in Figure 2.10.

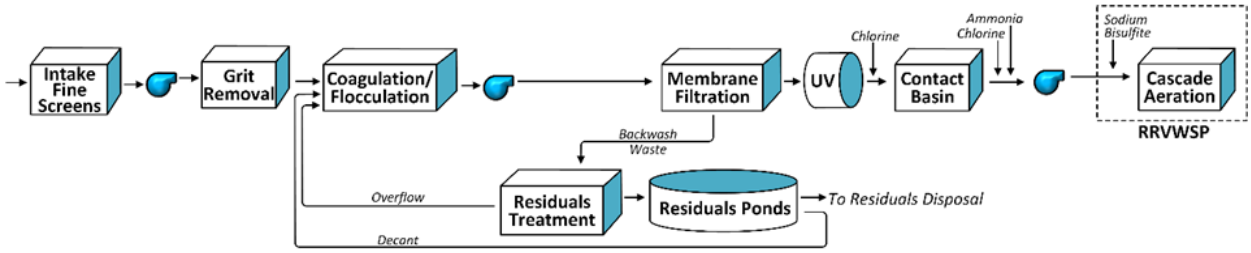

Figure 2-10: Advanced Treatment Option

The coagulation/flocculation process includes the addition of chemicals by slow mixing to form a floc around particles, which then can be readily removed by the membranes. Membrane filtration is proven to be very successful in removing turbidity, with typical product water of less than 0.1 nephelometric turbidity unit. The process also results in a consistent treated water quality that is basically independent of raw water quality in most situations (American Water Works Association 2005), which improves the effectiveness of the disinfection/UV process.

Table 2.13 includes the log-inactivation and removal credits assumed for each of the treatment processes included in this option. The UV disinfection system provides inactivation of protozoa including *Cryptosporidium*, *Giardia*, and *Myxobolus cerebralis*, followed by the addition of free chlorine for increased disinfection for Giardia, bacteria, and viruses. The final step would be the conversion of the free chlorine to chloramines for a pipeline residual. See Appendix B for details of this design.

Table 2-13: Advanced Treatment Option Log-Inactivation and/or Removal Credits

Target AIS	Removal - Intake Fine Screen and Sand/Grit	Removal - Membrane Filtration	Inactivation - Chlorination	Inactivation - UV Disinfection [a]	Total Log-Reduction [b]
Giardia	0	4.0	0.1	3.0	>3.0
Viruses	0	1.5	4.0	0	> 4.0
Cryptosporidium	0	4.0	0	3.0	>3.0
Myxobolus cerebralis	1.0	4.0	0	4.0	>4.0

[a] The log-inactivation is based on the design dosage of 25 mJ/cm^2

[b] Total Log Reduction column is not a cumulative total but reflects if the option meets/exceeds the established target

The cost estimate for this option was developed in the same manner as the other options and is shown in Table 2.14. Details of this estimate are included in Appendix B. The total estimated construction cost of this option is $242 million, with annual OM&R costs of approximately $9.4 million.

Table 2-14: Advanced Treatment Option Cost Estimates

Description	Construction Cost Estimate*	Annual OM&R Cost Estimate*
Sitework and Propane Yard	$24,047,000	$9,400,000
Sand/Grit Building	$10,982,000	
Disinfection Contact Basin	$6,115,000	
Treatment Facility	$184,424,000	
Residuals Thickening	$12,215,000	
Residuals Ponds	$4,119,000	
Total	**$241,902,000**	**$9,400,000**

* Values in the table are rounded

2.4 Summary of Biota WTP Options

Each of the options includes a combination of treatment processes that reduces the potential risk of a Project-related transfer of AIS into the Hudson Bay basin. The Biota WTP options represent a full range of available water treatment technologies. They are listed in the order of their relative treatment inactivation/removal capability, with the Disinfection Option providing the lowest level of biota treatment and the Advanced Treatment Option providing the highest level of biota treatment prior to the water being conveyed into the Hudson Bay basin. As would be expected, the cost of biota treatment increases with increased inactivation and removal efficiency. Table 2.15

provides a matrix showing the treatment processes included with each Biota WTP option being considered. Chapter 3 includes a detailed description and discussion of the risks and consequences associated with AIS.

Table 2-15: Proposed Biota Treatment Options and Treatment Processes Matrix

Treatment Processes	Proposed Biota Treatment Options			
	Disinfection	Enhanced Disinfection	Conventional Treatment	Advanced Treatment
River Intake Fine Screen	X	X	X	X
Sand/Grit Removal	X	X		X
High-Rate Sedimentation			X	
Media Filtration			X	
Membrane Filtration				X
UV Disinfection		X	X	X
Chlorine Disinfection	X	X	X	X

2.5 Relative Treatment Standards

As previously stated, the U.S. government has not developed water treatment standards, rules, or regulations specifically for use in reducing the risk of an introduction of an invasive species through interbasin water transfers. However, extensive research has gone into the development of standards, rules, and regulations for treating drinking water to reduce risks of transmitting pathogens to humans. The Safe Drinking Water Act (SDWA) sets forth the treatment measures that must be taken to effectively reduce the risk for transmission of human health diseases through drinking water systems. The EPA is responsible for developing regulations designed to comply with the SDWA and ensure that public water supplies used for human consumption provide for adequate treatment to reduce the risks of disease transmission to humans to an acceptable level.

Therefore, the SDWA and the associated research provide the best available information to compare treatment capabilities. The SDWA regulates *Giardia*, *Cryptosporidium*, and viruses as human health pathogens for drinking water systems. In the absence of interbasin water transfer treatment standards, the SDWA and the (National Primary Drinking Water Regulations can be used as a basis of comparison to evaluate treatment efficiency. The SDWA and National Primary Drinking Water Regulations set reduction standards, including the requirements of 3-log (99.9 percent) removal/inactivation of *Giardia* and 4-log (99.99 percent) removal/inactivation of viruses.

To address concerns of other disinfection-resistant protozoa such as *Cryptosporidium*, the Long Term 2 Enhanced Surface Water Treatment Rule was established by EPA and requires up to 2.5 logs (99.68 percent) of additional reduction (removal/inactivation), depending upon the levels of *Cryptosporidium* found in the source water, using bin classifications. "Bin classifications" are categories assigned to a drinking water treatment plant based on the *Cryptosporidium* data collected

from the source water for two years and calculating an annual mean concentration. Based upon these concentrations, drinking water systems are classified as bin 1, 2, 3 or 4. Bin 1 classification requires no additional treatment, and bins 2, 3, and 4 would require 1.0, 2.0, and 2.5 logs of reduction/inactivation for *Cryptosporidium*, respectively. Table 2.16 provides a summary of the treatment capabilities of each biota treatment option and the corresponding costs of that treatment. Recent research (as described in Appendix F) suggests that UV is effective against Whirling Disease at a much lower dosage than previous research had suggested. The Biota WTP designs include dosage levels significantly higher than that research suggests is necessary.

Table 2-16: Comparison of Biota Inactivation/Removal Effectiveness and Associated Costs

Biota Treatment Option	Viruses	Crypto-sporidium	Giardia	Myxobolus cerebralis	Construction Costs*	Annual OM&R Costs*
Disinfection	> 4	0	>3	>4	$56,500,000	$3,500,000
Enhanced Disinfection	> 4	3	> 3	> 4	$69,500,000	$4,100,000
Conventional Treatment	> 4	> 3	> 3	> 4	$222,000,000	$8,400,000
Microfiltration	> 4	> 3	> 3	> 4	$242,000,000	$9,400,000

* Values in the table are rounded

2.6 Operation and Maintenance Cost

The estimated costs associated with annual operation and maintenance of the alternatives evaluated are summarized in Table 2.17. Details regarding the methods and assumptions used in preparing these estimates are included in Appendix A and B. The ENDAWS Project would also include GDU Principal Supply Works capital repayment and annual operation and maintenance (O&M) fees. These costs have not been negotiated with state of North Dakota thus, are not included in the comparison of alternatives.

Table 2-17: Summary of Alternative O&M Costs

Route Option	Total O&M	Total O&M with BWTP			
		Option 1	Option 2	Option 3	Option 4
Red River Valley Water Supply Project	$14,710,000	-	-	-	-
Central North Dakota Water Supply Project	$13,550,000	-	-	-	-
ENDAWS Alternate Route Option - McClusky Canal North	-	$6,540,000	$7,140,000	$11,440,000	$12,440,000
ENDAWS Alternate Route Option - McClusky Canal South	-	$7,440,000	$8,040,000	$12,340,000	$13,340,000
ENDAWS Alternate Route Option - McClusky Canal and River North					
With Source from Missouri River	-	$15,970,000	$16,570,000	$20,870,000	$21,870,000
With Source from McClusky Canal	-	$6,540,000	$7,140,000	$11,440,000	$12,440,000
Blended Source Water (90% McClusky Canal; 10% Missouri River)	-	$7,640,000	$8,240,000	$12,540,000	$13,540,000
ENDAWS Alternate Route Option - McClusky Canal and River South					
With Source from Missouri River	-	$15,880,000	$16,480,000	$20,780,000	$21,780,000
With Source from McClusky Canal	-	$7,440,000	$8,040,000	$12,340,000	$13,340,000
Blended Source Water (90% McClusky Canal; 10% Missouri River)	-	$8,440,000	$9,040,000	$13,340,000	$14,340,000

The O&M costs presented in the table do not include costs associated with GDU capital repayment or GDU O&M payment requirements. The Project would pay these costs which are estimated at approximately $1.0 million per year to Reclamation.

2.7 Indication of the Preferred Alternative

Reclamation has chosen to identify a preferred alternative in this Draft EIS. According to *Reclamation's NEPA Handbook* (Reclamation 2012a), in identifying a preferred alternative, Reclamation should consider if an alternative exists which has consensus of the affected community, is reasonable and practicable, meets the purpose and need for action, and is within Reclamation's statutory authority to implement, Reclamation should designate it as the preferred alternative The preferred alternative should be an alternative that completes the action and that best meets the purpose and need for the action as defined in the EIS.

Reclamation chose a matrix evaluation method that has been established to evaluate several factors and compare the alternatives to determine the best recommendation for the Project. Reclamation compared all alternatives in terms of reliability, environmental impacts and non-environmental issues identified during the EIS process, along with the estimated construction and annual OM&R costs. Appendix C provides the detailed rationale for Reclamation's identification of the preferred alternative. Based on this information, the preferred alternative for the Project has been identified as Alternative E – McClusky Canal and Missouri River North. The preferred alternative includes the Enhanced Disinfection Option as the Biota WTP option. The estimated costs for the preferred alternative are shown in Table 2.18.

Table 2-18: Preferred Alternative Cost Estimate

Component	Construction Cost*
PHASE 1	
State Project Components	
Pipeline (Segment D)	$544,020,000
Hydraulic Break Tanks	$16,461,000
Control Valve Structure and Discharge Structure	$9,963,000
Subtotal (State)	**$570,444,000**
Federal Components	
McClusky Canal Intake Pump Station 1	$28,246,000
McClusky Canal Main Pumping Station 1	$34,545,000
Biota Water Treatment Plant (Enhanced Disinfection Option)	$69,454,000
Pipeline (Segment G)	$189,735,000
Subtotal (Federal)	**$321,980,000**
Phase 1 Subtotal	**$892,000,000**
PHASE 2	
State Project Components	
Pipeline (Segment A)	$130,210,000
Missouri River Intake Pump Station	$57,773,000
Sediment Removal Plant	$12,976,000
Main Pump Station 2	$36,114,000
Subtotal (State)	**$237,073,000**
Federal Components	
Pipeline (Segment E, F, H)	$131,346,000
Subtotal (Federal)	**$131,346,000**
Phase 2 Subtotal	**$368,419,000**
Alternative Total	**$1,260,419,000**

* Values in the table are rounded

With an estimated total construction cost of $1,260,419,000 and an annual OM&R cost of approximately $8,240,000, the preferred alternative would provide a reliable source of water to the State RRVWSP.

The risk of a Project-related transfer and establishment of AIS would be much smaller than the risk of transfer and establishment through existing non-Project pathways. To reduce the risk of a Project-related transfer of AIS into the Hudson Bay basin, this alternative would include the Enhanced Disinfection BWTP option, which provides protection against the organisms of concern.

2.8 Best Management Practices and Environmental Commitments

Table 2-19: Best Management Practices (Reclamation 2012a)

Resource	Best Management Practices
General	Construction activities would comply with all appropriate federal, state, and local laws and regulations. This list may include but is not limited to stormwater discharge permits, National Pollution Discharge Elimination System permits, Clean Water Act, and the Migratory Bird Treaty Act.
	Erosion control measures would be employed as appropriate and at stream crossings at all times: (a) Care would be exercised to preserve existing trees along the streambank. (b) Stabilization, erosion controls, restoration, and revegetation of all streambeds and embankments would be performed as soon as a stream crossing is completed and maintained until stable. (c) Riparian woody shrubs and trees would be replanted as necessary to preserve the shading characteristics of the watercourse and the aesthetic nature of the streambank. (d) At locations where soil conditions or slopes are such that erosion may occur along the pipeline trench, construction contractors would be required to construct earth berms perpendicular to the trench line at intervals sufficient to divert water from the trench. (e) In pasture and hayland, straw wattles shall be furnished and installed within 14 days of pipeline installation, at approximately the following intervals: Slope (%) — Interval (feet) 7-10 — 120 10+ — 50 (f) Straw wattles shall be a minimum of 6" diameter, and shall be installed across the entire width, plus 3' either side, of the disturbed area.
	Dump grounds, trash piles, and potentially hazardous waste sites would be avoided.
	All construction waste materials and excess or unneeded fill associated with construction would be disposed of on uplands; non-wetland areas.
	Standard construction, industry measures would be taken to minimize fugitive dust emissions during construction activities. Any complaints that may arise would be dealt with by the project sponsor and contractor in a timely and effective manner.
	New pipeline, to the extent possible, would be placed just outside and parallel to the road right of way.
	To the extent possible, construction would avoid wetlands; federal, state, and local wildlife areas and refuges; designated critical habitats; migratory bird habitat during the critical nesting season; known cultural resources and historic sites; hazardous material sites; and other resource sensitive areas noted below.

Resource	Best Management Practices
	During the final engineering design phase, Project components would be sited to minimize impacts on or avoid permanent structures and limit, to the extent practicable, impacts on existing land use.
	Construction limits would be clearly marked with stakes or fencing prior to beginning ground disturbing activities. No disturbance would occur beyond these limits other than non-destructive protection measures for erosion/sediment control.
	Material and equipment storage would be only within well-defined, designated staging areas placed outside of wetlands and other sensitive areas.
	Structures affected by pipeline construction, including utilities, roads, highways, rivers, canals, railroads, agricultural irrigation facilities, fences, and other structures, would be replaced, repaired, or restored to their current condition or better after construction.
	Construction debris would be hauled from the work site to a disposal location approved by the Contracting Officer or his/her representative.
	If established survey benchmarks must be removed or should any monuments be dislodged or damaged during construction, the National Geodetic Survey (Attn: N/CG 162, Rockville, Maryland 20852) would be contacted.
	No above ground structures that would interfere with the above ground movement of floodwaters would be placed in the flood plain or would be protected with flood protection.
	Water Treatment plant design and operations will include provisions for continuous monitoring of inlet and outlet turbidities in addition to key process units inside the water treatment plant. For the Biota Water Treatment Plant facility, operational plans will be developed and implemented prior to facility startup, including procedures by which chemical dosages for disinfection and other uses are varied based on inlet water quality and/or other variables.
Surface Water	Contractors would be required to make at least two boring attempts before using an alternate wetland, stream or river crossing method.
	Intermittent streams would be crossed only during low-flow periods and preferably when the streambeds are dry.
	Identified river or stream crossings would be performed by horizontal directional drilling operations whenever practicable, which would not disturb the stream channel or the adjacent wetlands.
Groundwater	Established ground water monitoring wells would be avoided. However, if any monitoring wells are inadvertently damaged or impacted during project construction, the Water Appropriation Division of the North Dakota Office of the State Engineer would be contacted.
Water Quality	As part of the National Pollution Discharge Elimination System permitting requirement, a Stormwater Pollution Prevention Plan would be developed and submitted to the North Dakota Department Environmental Quality prior to commencing construction activities.
	The Stormwater Pollution Prevention Plan would include erosion control measures to prevent or reduce erosion, soil loss, and nonpoint source pollution. These practices may include, but are not limited to, silt fencing, filter fabric, sediment logs, hay bales, temporary sediment ponds, check dams, and/or immediate mulching of exposed areas to minimize sedimentation and turbidity effects as a result of construction activities. The placement and specific measures used would be dictated by site specific conditions.

Resource	Best Management Practices
	In-stream flows would be maintained during stream crossing construction. Spoil, debris piling, construction materials, and any other obstructions would be removed from stream crossings to preserve normal water flow.
	Stream crossings would be routed, as practicable, to minimize disturbance. Intermittent streams would be crossed only during low-flow periods and preferably when streambeds are dry.
	Disturbed portions of the stream banks and beds of rivers, streams, and other waterways would be protected by rock riprap of adequate size and type to minimize erosion and scour. Any slopes greater than 3:1 would be protected with erosion-control blankets after seeding.
Aquatics	In-stream flows would be maintained during stream crossing construction. Water would be allowed to flow around or past stream crossings to preserve normal water flow downstream from construction.
	To minimize impacts to fisheries resources any stream identified as a fishery (confer with North Dakota Game and Fish Department) that cannot be directionally bored would be avoided from April 15 to June 1 and crossed later in the summer or fall when flows are low or the stream is dry.
	Avoid work in Class II or higher waters (fisheries – confirm with North Dakota Game and Fish Department) April 15 – June 1, or directionally bore. (North Dakota Century Code: CHAPTER 33-16-02.1 STANDARDS OF QUALITY FOR WATERS OF THE STATE)
	In consultation with the Service, the following screen and velocity recommendations would be incorporated into the design of intake structure(s) of the Project: 1) Intakes shall be screened and maintained with 1/4-inch or smaller mesh size opening. 2) Johnson intake screens shall have wire spacing 1/8 inch or smaller. 3) Intake velocities shall not exceed 1/2 foot per second with 20 feet of overhead water. 4) Intake velocities shall not exceed 1/4 foot per second where 20 feet of overhead water cannot be achieved. 5) Intakes shall be marked so they are observable during day and night hours, as appropriate.
Wetlands/Riparian Areas	Long- and short-term effects on wetlands and riparian areas would be avoided to the extent practicable and in compliance with Section 404 of the Clean Water Act
	Erosion control measures would be employed as appropriate and at stream crossings prior to construction activities. In addition: • Preserve, if feasible, existing trees along the stream bank. • Stabilize, control erosion, restore, and revegetate streambeds and embankments as soon as a stream crossing is completed, following vegetation best management practices, and maintain until stable. • Replant riparian, as necessary, woody shrubs and trees appropriate to ecological characteristics of the site to preserve shading characteristics of the watercourse and the aesthetic nature of the stream bank.
	Any equipment used previously in a water body that is jurisdictional under the Clean Water Act or a water body designated as infested by the North Dakota Game and Fish Department would be disinfected prior to entering Reclamation lands or facilities to prevent the spread of invasive aquatic species. Disinfection will occur as stated in the Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of

Resource	Best Management Practices
	Invasive Species. The manual may be accessed at: http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2012.pdf
	All temporarily disturbed wetlands would be reestablished following construction by doing the following: • Restore contours to previous elevations • Compact trenches sufficiently to prevent drainage along the trench or via bottom seepage • Salvage and replace topsoil • Backfill in such a manner as to not drain wetland or stream • Reestablish wetlands to similar type of wetland and wetland function
Vegetation and Land Use	To the extent practicable, construction would avoid: • Wetlands • Federal, state, and local wildlife areas and refuges • Native prairie However, if these areas are disturbed during pipeline construction, topsoil would be replaced, and revegetation plans would be specifically designed for these areas to ensure reestablishment of a similar type and quality of native vegetation recommended by local National Resources Conservation Service (NRCS) office and approved by the landowner. Impacts to federal or state wildlife areas may require additional agency review.
	Vegetated areas temporarily disturbed by construction (except cropland) would be revegetated with species appropriate to ecological conditions of the surrounding area, and in a manner that prevents erosion and noxious weed invasion. Reclamations Integrated Pest Management Plan would be utilized as a guide in preventing the spread of noxious weeds. Revegetation would occur as soon as practicable after construction and would follow all pertinent local and state regulations. Temporary seeding may be required when areas remain disturbed for more than 30 days.
	All equipment and recreational vehicles should be free of invasive species prior to entering Reclamation lands or facilities as stated in the Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species. The manual may be accessed at: http://www.usbr.gov/mussels/prevention/docs/EquipmentInspectionandCleaningManual2012.pdf
	Woody species including those bordering wetlands, shelterbelts, riparian woodlands, woody draws, or woodland vegetation would be avoided to the extent practicable. For unavoidable impacts to woody habitats, credit for equal value or environmental equivalent: (a) would be applied toward the impact and deducted from Reclamation's Mitigation Enhancement Ledger **or** (b) the Project sponsor may develop separate acceptable mitigation.
	Prior to beginning construction through PLOTS, Conservation Reserve Program lands, program or private wetlands, the project sponsor would consult with: (a) respective landowners, NRCS, and U.S. Department of Agriculture Farm Services Agency to ensure that landowner eligibility in farm subsidy programs (if applicable) would not be jeopardized by project actions and

Resource	Best Management Practices
	(b) ensure that Swampbuster requirements would not be violated by construction activities
	Topsoil would be removed and stockpiled separately from surface soils for reapplication following construction. In-stream flows would be maintained during stream crossing construction. Water would be allowed to flow around or past stream crossings to preserve normal water flow downstream from construction.
	If Project construction cannot avoid North Dakota Sate Trust Lands, then easements would need to be obtained prior to construction.
	Topsoil, soil amendments, fertilizers, and mulches would be reapplied selectively as appropriate, prior to revegetation during favorable plant establishment climate conditions to match site conditions and revegetation goals.
Wildlife	Identified potential habitat for federal or state threatened, endangered, critical habitat and sensitive species would be avoided if feasible.
	Construction would be prohibited within 1/2 mile of designated piping plover or interior least tern breeding areas during the breeding season (April 15 through August 31) when these species are present.
	If threatened or endangered species are identified and encountered during construction, all ground-disturbing activities in the immediate area would be stopped to consult with the U.S. Fish and Wildlife Service (Service) and determine appropriate steps to avoid affecting the species.
	Project sponsor is responsible for compliance with the Migratory Bird Treaty Act. Sites for project features would be selected to minimize potential for environmental impacts to nesting migratory birds. Construction would be timed to avoid migratory bird nesting. Avoid work around wetlands April 1 through July 15.
	Project sponsor is responsible for identifying bald eagle and raptor nests to ensure construction within 660 feet of visible nesting bald eagles or other raptors would be avoided from February through August.
	Project sponsor would coordinate with the Service's appropriate Refuges and Wetland Management Districts and provide the latest map version of project features to avoid impacts to Service lands, including wetland and grassland easements, national wildlife refuges, and waterfowl production areas (WPAs), allowing for identification of an avoidance route for the contractor. Any impacts to national wildlife refuges or WPAs would have to go through a refuge compatibility determination.
	The Project sponsors utility company is responsible for providing an Avian Protection Plan that follows the guidelines below. Project power lines would be: (a) Buried (Service 2010a) to minimize electrocution hazards to raptors and minimize impacts to all birds, bats, and particularly benefit whooping cranes. Use *Suggested Practices for Avian Protection on Power Lines - The State of the Art in 2006*, Avian Power Line Interaction Committee, Edison Electric Institute, Raptor Research Foundation, Washington, D.C., or similar standards would be used. Available online at https://www.aplic.org/uploads/files/2634/APPguidelines_final-draft_Aprl2005.pdf ***or*** (b) Any new, aboveground power lines and an additional equal length of existing power lines in the same vicinity must be marked with visibility enhancement

Resource	Best Management Practices
	devices to benefit migrating whooping cranes as well as all migratory birds and bats. Use Reducing Avian Collisions with Power Lines – The State of the Art 2012, Avian Power Line Interaction Committee, Edison Electric Institute, Raptor Research Foundation, Washington, D.C., or similar standards. Available online: https://www.aplic.org/uploads/files/15518/Reducing_Avian_Collisions_2012watermarkLR.pdf.
	If forested habitat is identified prior to construction activities, Reclamation would determine if bat surveys are required. If any tree (with a diameter of greater than 3 inches) removal activities cannot be avoided between April and September, then northern long-eared bat surveys would be conducted to confirm absence of the species. If any suitable roost sites, possible hibernacula, or the species are observed during the onsite meeting, then any steps taken to avoid and minimize disturbance of this habitat would be documented.
Noise and Vibration	Night construction would be avoided near residential and populated areas.
Visual Resources	As noted for vegetation, short-term disturbances associated with constructing facilities would be revegetated and/or landscaped.
	Existing topographic grades would be restored following pipeline excavation.
	Constructed facilities would be designed to blend with the architectural characteristics of surrounding structures.
	Valve boxes would be left above grade in a cultivated field if agreeable to the landowner or moved to the nearest fence or right-of-way. Valves would not be located adjacent to or in close proximity to a paved or graveled road and would be painted a neutral color that blends with the background, reduces visibility, and maintains the viewshed.
Historic Properties	Direct disturbance to historical properties would be avoided to the extent feasible.
	All known burials or cemeteries would be avoided to the extent possible. All such burials or cemeteries would be avoided to the extent possible. If a burial or cemetery cannot be avoided or is encountered during construction, Reclamation would comply with the Native American Graves Protection and Repatriation Act if graves are discovered on federal or trust lands or within reservation boundaries. Reclamation would comply with North Dakota Century Code 23-06-27: "Protection of Human Burial Sites, Human Remains, and Burial Goods" for graves on private or state-owned lands.
	If unrecorded cultural resources or traditional cultural properties are encountered during construction, all ground disturbance activity within the area would be stopped, Reclamation and appropriate authorities would be notified, and all applicable stipulations of the Section 106 programmatic agreement would be followed. Activities in the area would resume only when compliance has been completed.
Paleontological Resources	All previously recorded paleontological resources and paleontologically sensitive zones within the path of the alternative selected in the Record of Decision would be inspected in the field by a qualified paleontologist. Avoidance measures would be developed to avoid significant resources.
	Reclamation would consult with North Dakota Geological Survey to identify areas for paleontological survey where significant fossils are likely. Paleontological surveys would be completed prior to construction. Based upon survey data, Reclamation would consult with a qualified paleontologist about revising routes to avoid damaging significant fossil locations.

Resource	Best Management Practices
Hazardous Materials	A Hazardous Spill Plan or Spill Prevention, Control and Countermeasures Plan, whichever is appropriate, would be in place, stating what actions would be taken in the event of a spill, notification measures, and preventive measures to be implemented, such as the placement of refueling facilities, storage, and handling of hazardous materials.
	All equipment would be maintained in a clean and well-functioning operating condition to avoid or minimize contamination from automotive fluids.
	Before construction, a more detailed hazardous materials assessment in conformance with the scope and limitations of American Society for Testing Materials (ASTM) 1527-05: "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process" would be conducted to identify sites with soil and/or groundwater contamination not documented in readily ascertainable agency files (ASTM 2005).
	Any known solid waste disposal areas identified in the construction sites would be avoided or removed and properly disposed at a permitted solid waste disposal facility
	Equipment or vehicles would not be refueled within 100 feet of rivers, streams, or identified wetlands. If onsite fuel tanks are used, approved containment devices would be required.
	Identified evidence of hazardous materials, petroleum product spills, or other contamination would be avoided or excavated and properly disposed at a permitted waste disposal facility.
	If soil and/or groundwater contamination is encountered during construction, mitigation procedures would be implemented to minimize the risk to construction workers and to future operations.
Unique and Prime Farmland/ Agricultural Lands	To the extent feasible, construction activities on irrigated lands would be avoided during the growing season.
	Cropland disturbed by construction would be restored with topsoil to the depth, quality, grade, and relative density as the original surface as described for soils below. Pipelines crossing agricultural fields would be backfilled and compacted to prevent settling when the field is irrigated.
	Long-term effects on prime and unique farmland would be avoided to the extent feasible. If avoidance is not possible, Reclamation would complete and submit a Farmland Conversion Form (AD-1006) to the NRCS in compliance with the Farmland Protection Policy Act for any long-term change in land use.

Table 2-20: Environmental Commitments

Resource	Environmental Commitments
Surface Water	When pipeline construction through a stream or wetland basin is unavoidable, existing basin contours would be restored and trenches would be sufficiently compacted to prevent any drainage along the trench or through bottom seepage.
	Where open trench crossing of stream is required, the stream channel would be reestablished following pipe installation.
Biota Water Treatment	Any implemented treatment process that does not include filtration will monitor turbidity of incoming water and the Biota WTP will not be operated when the turbidity exceeds 10 Nephelometric Turbidity Units (NTU) downstream of the sand/grit removal process. Water will be evacuated from the Biota WTP and returned to the source until turbidity levels return to less than 10 NTU.
Vegetation and Wetlands	Where construction cannot avoid: Wetlands Federal, state, and local wildlife areas and refuges, and Native prairie. If these areas are disturbed during pipeline construction, topsoil would be replaced, and revegetation plans would be specifically designed for these areas to ensure reestablishment of a similar type and quality of native vegetation recommended by local NRCS office and approved by the landowner.
	Effects on jurisdictional wetlands and waters of the United States would require authorization from the U.S. Army Corps of Engineers. A compensatory mitigation plan may be required for the loss of any wetlands and would include methods to replace specific functions of affected wetlands.
	Lost wetlands would be replaced acre for acre with ecological equivalency or 1/2 acre for acre with ecological equivalency (adversely affected wetlands) as required by the Project's authorizing legislation: (a) by crediting previously completed wetland restoration for the Garrison Diversion Unit (GDU) and deducting those credits from Reclamation's Mitigation and Enhancement Ledger (MEL)[1] **or** (b) the Project sponsor may develop separate acceptable mitigation.

[1] Reclamation has credits for created and restored wetlands in the MEL that can be used to mitigate impacts to wetlands. The GDU MEL was developed according to the 1985 memorandum of understanding between Reclamation, the U.S. Fish and Wildlife Service (Service), and the North Dakota Game and Fish Department regarding the establishment of mitigation and enhancement debits and credits for wildlife purposes. The MEL documents GDU project impacts, mitigation requirements, and concurrence for planning purposes and for review by other agencies and the public. Projected impacts listed were first presented in the GDU Commission Report. The GDU Reformulation Act of 1986 resulted in the adjustment of the projected impacts to reflect modifications to the project. Impacts to date reflect modifications to the project.

Resource	Environmental Commitments
	Lost woodlands would be mitigated 2:1 (acres) in accordance with MEL[1]
	Lost grasslands would be mitigated 1:1 in accordance with MEL[1]
Wildlife	Pipelines, water treatment plants, and pump station facilities would be realigned, where feasible, to avoid sensitive wildlife habitat. If sensitive wildlife habitat cannot be avoided, then mitigation would be determined in coordination and agreement with Reclamation and the Project sponsor, including pertinent regulatory agencies.
	Preconstruction surveys may occur with the Project sponsor and Reclamation to identify sensitive habitats and wildlife use before construction to allow implementing best management practices and mitigation measures.
Historic Properties	Reclamation will continue complying with stipulations in *Programmatic Agreement Between the Bureau of Reclamation, The Advisory Council on Historic Preservation, and the North Dakota State Historic Preservation Officer for the Implementation of Reclamation Undertakings in North Dakota* for the life of the project and in consultation with tribes.
	Avoidance will be the preferred method for treating historic properties. However, should that not be possible, the programmatic agreement identifies the standards to be used in developing mitigation plans.
	Reclamation will consult under Section 106 of the National Historic Preservation Act with appropriate Indian Tribes regarding the locations of and potential impacts to properties of traditional religious and cultural importance. If any such properties cannot be avoided and must be mitigated, Reclamation will invite the appropriate Tribes to participate in development of an appropriate treatment plan.
	All gravel, fill, and rock materials will be obtained from a source approved by Reclamation to ensure compliance with Section 106 of the National Historic Preservation Act.

Chapter 3 Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic resources (affected environment) and the effects of implementing each alternative on those resources. The conditions of the resources reflect the effects of past and ongoing actions in the affected environment. The affected environment is not the same for all resources and is defined for each resource in the discussions below.

Under each resource topic is a discussion of impact indicators, methods, and the direct and indirect impacts of implementing each alternative. The consequences (+ or -) of the No Action Alternative are described and then the potential impacts (+ or -) of each action alternative are evaluated in comparison to the No Action Alternative. Potential impacts are quantified as appropriate and when supported by existing data or models. Where quantitative data are not available, impacts are described qualitatively. The duration of impacts is identified as either short term or temporary during construction, or long term or permanent during operations.

The consequences of Alternative B - State RRVWSP are described qualitatively for most resources because it is not fully known what environmental commitments or BMP's Garrison Diversion would implement for the State RRVWSP to avoid, minimize, or mitigate any potential effects. The consequences that might occur are disclosed to the extent that is reasonable.

The impacts described in Chapter 3 would remain even after the implementation of the environmental commitments. Environmental commitments associated with each alternative are described in Appendix D, "Environmental Commitments," and incorporated by reference here.

The alternatives evaluated in this EIS have been developed to a conceptual (30%) level of design with an operational life of 50 years; final design would be completed if an alternative is selected in the ROD. All numbers included in this EIS are estimates based on the best information and data available at the time the analysis was completed, and therefore may change in the final design phase. After an alternative is selected in the ROD and the design is further developed, additional NEPA analysis may be required to ensure any impacts not foreseen in this EIS are disclosed. Any additional NEPA analysis would be tiered to this EIS.

3.1 Other Minor Issues

NEPA regulations call for identifying, at an early state in the NEPA process, the significant environmental issues deserving of detailed study and de-emphasizing insignificant issues; thus, narrowing the scope of the EIS analysis (40 CFR 101.1[d]). During the initial stages of preparing the EIS, Reclamation conducted preliminary analyses on several issues that were not identified during public scoping; as well as preliminary analyses on other topics identified as a potential concern during scoping. The results of these preliminary analyses found that the effects of the alternatives on these resources would be insignificant. Most Project effects on these resources would be temporary

(lasting only during construction) and would not result in a significant impact. Table 3.1 identifies the resources and the justification for excluding them from further analysis in the EIS. Additional detail regarding the preliminary analyses for these resources is included in Appendix E.

Table 3-1: Other Minor Issues

Resource	Exclusion Justification
Aesthetics	Aesthetics is considered a minor issue since visual changes from new components would be temporary or the new components would be visually compatible with the character of their surroundings or located underground and therefore not visible.
Air Quality	Standard construction industry measures would be taken to minimize fugitive dust emissions during construction activities. The operation of the Biota WTP and other alternative features would be regulated by state/local authorities in accordance with permit conditions; therefore, no air quality standards would be violated, either directly or indirectly.
Earth Resources	Temporary and short-term impacts would be limited to the potential for erosion and sedimentation and the removal of topsoil during construction.
Noise	The increased noise levels would be temporary during construction activities and construction would primarily occur in sparsely developed rural areas. Construction activities would comply with all appropriate local laws and regulations, including those intended to minimize noise impacts.
Public Service and Utilities	There would not be an undue increase in the demand for public services and utilities.
Transportation	Construction and operational activities are anticipated to have negligible impacts within the project area.
Green House Gas Emissions	Fossil fuel-burning equipment operated during construction would generate greenhouse gas emissions, but this would be temporary and would not occur on an annual basis. No direct annual emissions would result from the operation of Project components. Negligible amounts of GHG emissions would be generated by vehicles used for periodic maintenance of Project components.
Wildlife	Minimal temporary impacts to local wildlife during construction activities.

Resource	Exclusion Justification
Indian Trust Assets	There are no trust lands within the project area and the federal government recognizes the reserved water rights of tribes within the Missouri River Basin and acknowledges that future quantification of these rights could affect operations of the Missouri River Mainstem Reservoir System.
Paleontological Resources	Paleontological resources have not been raised as a concern during agency/public scoping and have not been identified in the project area.
Environmental Justice	Construction and operational activities are expected to have positive impacts on the counties/communities within the project area.
Water Quality	Any impacts to the receiving basin water quality are expected to be beneficial and equal for all alternatives. No Water quality impacts are anticipated due to Project withdrawals from the Missouri River

3.2 Aquatic Invasive Species

The affected environment for AIS of concern is composed of the MRB, which is a potential source of AIS, and the HBB, the potential receptor of AIS. Information in this section is summarized from the analysis conducted on AIS for this Project. The Aquatic Invasive Species Risk and Consequence Analysis report (Risk and Consequence Analysis - Appendix F) documents the current distribution of these AIS; specifically, within the MRB, HBB, and adjacent basins.

The list of AIS of concern has been developed and refined over the past 20 years (Appendix F). The AIS of concern included both microscopic (viruses, bacteria, protozoa, myxozoa and cyanobacteria) and macroscopic (mollusks) organisms. Reclamation's most recent analysis of AIS was completed for the Northwest Area Water Supply Project, Supplemental Environmental Impact Statement. The resulting report, *Transbasin Effects Analysis Technical Report* (Reclamation 2013) was peer reviewed by technical experts, both within and outside of Reclamation, and builds on previous work on this topic. The independent peer review experts found that the analysis was "…based on the best available science and the result and conclusions were supported by that science, given the uncertainties inherent in the available data and topic knowledge." (Atkins 2012). The Risk and Consequence Analysis utilized the same methodologies of the *Transbasin Effects Analysis*, and used new data/information, available from 2012 through the present, to update species distribution information, transfer pathways, assess the risk of transfer, and the consequences of a transfer (project and non-project related). Information presented in this section is a summary of the information presented in the Risk and Consequence Analysis.

3.2.1 Aquatic Invasive Species of Concern

Table 3.2 includes the taxonomic groups and common names of individual AIS of concern evaluated in this EIS. The list of AIS includes seven major taxonomic groups of organisms

exhibiting a range of sizes and susceptibilities to chemical and physical variabilities (e.g. water treatment technologies). A broad range of life histories was evaluated to ensure that the biota water treatment options being considered (see Chapter 2) would protect against a variety of species including unknown and emerging organisms.

A comment received during public scoping recommended the consideration of another virus species, Sturgeon Iridovirus, as an AIS species of concern in relation to its potential effect on the lake sturgeon fishery in the Red River Valley. In considering this, Reclamation reviewed the process through which the AIS species of concern in Table 3.2 were identified, reviewed previous AIS analyses for the evaluation of this specific virus species, and tasked the consultant preparing the Risk and Consequence Analysis to research and evaluate new scientific data/publications regarding the Sturgeon Iridovirus. The research conducted and the conclusions reached are discussed in more detail in the Technical Memorandum included in Appendix G. The conclusion of the research was that there is still very little known about this virus; however specific conclusions were:

1) The Missouri River sturgeon iridovirus is associated with mortalities in cultured sturgeon but has not been identified as a mortality factor in the wild;

2) it is unknown whether the lake sturgeon, which belongs to a different genus than pallid sturgeon and shovelnose sturgeon, is susceptible to the Missouri River sturgeon iridovirus, and

3) ultraviolet irradiation of water is currently used in hatcheries to inactivate the virus.

Based on the conclusions of this research, Reclamation determined the taxonomic group of viruses, already identified as species of concern, encompass a broad range of life histories and characteristics of viruses that is inclusive of the sturgeon iridovirus; thus, the list of AIS species of concern remains unchanged.

Table 3-2: Aquatic Invasive Species of Concern

Taxonomic Group	Common Name of Species or Disease / Condition	Present in the Hudson Bay Basin	Present in the Missouri River Basin
Virus	Infectious pancreatic necrosis virus (IPNV)	Unknown	Unknown
	Infectious hematopoietic necrosis virus (IHNV)	Unknown	Unknown
	Viral hemorrhagic septicemia virus (VHSV)	Unknown	Unknown
	Channel catfish virus (CCV)	Unknown	Unknown
	Spring viremia of carp virus (SVCV)	Unknown	Unknown
	Infectious salmon anemia virus (ISAV)	Unknown	Unknown
Bacteria	Bacterial kidney disease (BKD)	Yes	Yes
	Furunculosis	Yes	Unknown

Taxonomic Group		Common Name of Species or Disease / Condition	Present in the Hudson Bay Basin	Present in the Missouri River Basin
		Strep	Yes	Yes
		Columnaris disease	Yes	Unknown
		Pseudomonas aeruginosa	Yes	Yes
		Cholera	Unknown [a]	Unknown [a]
		Edwardsiella spp. infections	Yes	Unknown
		Mycobacterium spp. infections	Yes	Yes
		Enteric redmouth disease (ERM)	Yes	Yes
		E. coli	Yes	Yes
		Legionnaire's disease	Unknown	Unknown
		Salmonella	Yes	Yes
Animalia	**Mollusks**	Zebra mussel	Yes	Yes
		Quagga mussel	Unknown	Yes
		New Zealand mudsnail	Unknown	Yes
	Parasites	*Polypodium*	Yes	Yes
		Whirling disease	Unknown	Yes
		Actheres pimelodi (parasitic copepod)	Yes	Unknown
		Ergasilus spp. (parasitic copepod)	Yes	Unknown
		Icelanonchohaptor microcotyle (parasitic flatworm)	Unknown	Yes
		Corallotaenia minutia (Parasitic tapeworm)	Yes	Unknown
Protozoa		*Giardia* (backpacker's diarrhea)	Yes	Yes
		Entamoeba histolytica	Unknown	Unknown
		Cryptosporidium	Yes	Yes
		Ich or white spot disease	Yes	Yes
		Ichthyophonosis	Unknown	Unknown
Fungi		Branchiomycosis	Yes	Yes
		Saprolegniosis or winter fungus disease	Yes	Yes
		Black yeast	Yes	Yes
		Phoma herbarum	Yes	Yes

Taxonomic Group	Common Name of Species or Disease / Condition	Present in the Hudson Bay Basin	Present in the Missouri River Basin
Cyanobacteria	Anabaena flos-aquae (blue-green algae)	Yes	Yes
	Microcystis aeruginosa (blue-green algae)	Yes	Yes
	Aphanizomenon flos-aquae (blue-green algae)	Yes	Yes

Notes:

NA = not applicable; Unknown = has not been detected; not currently known to be present

[a] The bacterium that causes cholera is not known to be present; however, other species of this genus are ubiquitous in aquatic systems. Source: Northwest Area Water Supply Project, Transbasin Effects Analysis (Reclamation 2013).

The *Transbasin Effects Analysis* (Reclamation 2013) provided detailed information on the life history of each AIS of concern, including the susceptibility of each species to various treatment technologies, based on an extensive literature review conducted. This life history information was reviewed, and research was conducted for additional information sources as part of the Risk and Consequence Analysis. Data presented in the *Transbasin Effects Analysis* were found to still accurately reflect the life histories of these AIS of concern; however, new distribution data were available for some species and updated information is presented in Appendix F and summarized here.

3.2.2 Distribution

As shown in Table 3.2 above, the presence of virus species of concern is unknown within the MRB and HBB. A recent review of information from the U.S. Fish & Wildlife National Wild Fish Health Survey Database (Appendix F) indicates the documented virus distribution in the *Transbasin Effects Analysis* remains accurate since there have been no new detections since 2005.

Seven of the bacteria AIS of concern are present within both the HBB and the MRB, while three bacteria species have been documented as present within the HBB but unknown within the MRB. The distribution of two bacteria AIS of concern, Cholera and Legionnaire's disease, is unknown in both the HBB and the MRB. A recent review of information from the U.S. Fish & Wildlife National Wild Fish Health Survey Database (Appendix F) indicates the documented bacteria AIS distribution in the *Transbasin Effects Analysis* remains accurate, since there have been no new detections since 2005.

Distribution of the three mollusk species of concern has also been updated since the publication of the *Transbasin Effects Analysis*. As noted in Table 3.2, the zebra mussel is present in both basins; however, the Quagga mussel and the New Zealand mudsnail were reported as only being present in the MRB based on data from the USGS Nonindigenous Aquatic Species database (Appendix F).

One of the parasite species of concern is found in both the HBB and the MRB; *Polypodium hydriforme*. Whirling disease and the parasitic flatworm have been documented in the MRB but are unknown in the HBB. The parasitic copepods and parasitic tapeworm have been documented in the HBB but are unknown in the MRB. A recent review of information from the U.S. Fish & Wildlife National Wild Fish Health Survey Database (Appendix F) indicates the documented parasite species distribution in the *Transbasin Effects Analysis* remains accurate, since the databases have not been updated since 2013.

Table 3.2 shows that three protozoa species of concern are documented in both the HBB and the MRB and the other two protozoa species presence within these basins is unknown. The distribution of these species has not changed from what was documented in the *Transbasin Effects Analysis*. The *Transbasin Effects Analysis* also documents the distribution of the Fungi and Cyanobacteria species of concern as present in both the HBB and the MRB which is unchanged.

3.2.3 Transfer Pathways

Most AIS are very small (Figure 5-2 of Appendix F) so thousands of cells/single-celled organisms could potentially be contained in a single drop of untreated water or in waste products of birds, fish, and mammals and spread the AIS from one drainage basin to another. Concentrations of AIS vary widely in the different possible sources. The viability of an individual transfer pathway also varies, as does the potential for successful establishment of the AIS in a new environment. These variabilities limit the ability to directly compare the volumes of transferred water or materials to assess transfer risk. Volume is one of several important factors when considering the transfer risk; however, it is not as important as other factors because of the potential for AIS to be present in an exceptionally small volume of water.

A number of pathways could potentially facilitate the transfer of AIS to the HBB from adjacent or neighboring drainage basins, including the MRB, the upper Mississippi Basin, the Pacific Northwest Basin and the Great Lakes Basin. Because these drainage basins share a boundary with the HBB, each poses a potential risk from natural and man-made sources. Potential biota transfer pathways include physical and biological pathways (see Table 3.3) It is important to understand these potential pathways to assess the baseline risk of a potential AIS transfer in the absence of the Project. These non-project and Project pathways are discussed in more detail in Chapter 4 of Appendix F.

Table 3-3: Physical and Biological Biota Transfer Pathways

Interbasin Connections and Water Diversions	Aquaculture Facilities
Intrabasin Connections	Stocking/Hatcheries
Hull/Anchor/Superstructure Fouling	Recreational Boating
Canals and Diversions	Fish Transport
Pet/Aquarium Releases	Avian Transport
Aquatic Plants	Mammalian Transport
Fishing Equipment	Weather-Related Events
Use and Disposal of Live Bait	Climate Change

The various transfer pathways could directly impact the surface waters, surface soils and/or sub-surface soils within the HBB. As stated in the *Risk and Consequence Analysis* (Appendix F), the most direct impact could be to the receiving waters of the HBB.

3.2.4 Potential Aquatic Receptors of Concern

Aquatic habitats in the HBB that may support organisms potentially at risk from AIS associated with the Project include the Sheyenne River, Red River and downstream to Lake Winnipeg in the Province of Manitoba, Canada. Lake Winnipeg is the tenth largest freshwater lake in the world. The lake is used for fisheries tourism, recreation, hydropower and provides water to downstream communities and watersheds. Aquatic organisms (receptors) potentially at risk from impacts associated with the establishment of invasive species were identified within the HBB (Appendix F, Chapter 4). Aquatic receptors include commercially and recreationally valuable fish species that could be at risk from the introduction and establishment of AIS through any of these pathways. Direct affects to an aquatic receptor could be an infection or an indirect affect could be a result of a community shift, such as the loss of a food source or the creation of new niche habitat. Geographic distribution and extent of susceptible host species may affect the successful establishment of an AIS population.

3.2.5 AIS Susceptibility to Biota Water Treatment Processes

As a means of further reducing the risk of transferring AIS of concern, four Biota WTP options were designed to include different treatment processes and combinations of processes to inactivate and/or remove AIS. Although the United States has not established treatment standards relative to AIS, as explained in Chapter 2, there are water treatment standards established for drinking water which are used as a guide in evaluating the effectiveness of these treatment processes relative to AIS. The Biota treatment processes were evaluated in terms of their effectiveness on *Giardia*, viruses, *Cryptosporidium* and *Myxobolus cerebralis* (whirling disease) because they serve as surrogates for other potential AIS that may be present in the source water. Chapter 2 provides a detailed discussion of the Biota WTP options and Table 3.4 illustrates the effectiveness of the different biota treatment processes on the AIS.

Table 3-4: Biota Treatment Options and Associated Log-Removal/Inactivation

Biota Treatment Option	Pathogen	Intake Fine Screen Removal	Conventional Media Filtration Removal[1]	Membrane Filtration Removal[2]	UV Light Inactivation [3]	Chlorine Disinfection Inactivation	Total
1	*Giardia*	0	0	0	0	>3.0	>3.0
	Cumulative	0	0	0	0	>3.0	
	Viruses	0	0	0	0	> 4.0	> 4.0
	Cumulative	0	0	0	0	> 4.0	
	Cryptosporidium	0	0	0	0	0	0
	Cumulative	0	0	0	0	0	
	Myxobolus cerebralis[6]	1.0	0	0	0	>3.0	>4.0
	Cumulative	1.0	1.0	1.0	1.0	>4.0	
2	*Giardia*	0	0	0	>3.0	>3.0	>3.0
	Cumulative[5]	0	0	0	>3.0	>3.0	
	Viruses	0	0	0	0	>4.0	>4.0
	Cumulative	0	0	0	0	>4.0	
	Cryptosporidium	0	0	0	3.0	0	3.0
	Cumulative	0	0	0	3.0	3.0	
	Myxobolus cerebralis[6]	1.0	0	0	>4.0	>3.0	>4.0

Biota Treatment Option	Pathogen	Intake Fine Screen Removal	Conventional Media Filtration Removal[1]	Membrane Filtration Removal[2]	UV Light Inactivation [3]	Chlorine Disinfection Inactivation	Total
	Cumulative[5]	1.0	1.0	1.0	>4.0	>4.0	
3	**Giardia**	**0**	**2.5**	**0**	**3.0**	**0.1**	**>3.0**
	Cumulative[5]	0	2.5	2.5	>3.0	>3.0	
	Viruses	0	2.0	0	0	4.0	>4.0
	Cumulative[5]	0	2.0	2.0	2.0	>4.0	
	Cryptosporidium	0	2.5	0	3.0	0	>3.0
	Cumulative[5]	0	2.5	2.5	>3.0	>3.0	
	Myxobolus cerebralis	0	2.5	0	4.0	0	>4.0
	Cumulative[5]	0	2.5	2.5	>4.0	>4.0	
4	*Giardia*	0	0	4.0	3.0	0.1	>3.0
	Cumulative[5]	0	0	>3.0	>3.0	>3.0	
	Viruses	0	0	1.5	0	4.0	>4.0
	Cumulative[5]	0	0	1.5	1.5	>4.0	
	Cryptosporidium	0	0	4.0	3.0	0	>3.0
	Cumulative[5]	0	0	>3.0	>3.0	>3.0	
	Myxobolus cerebralis	1.0	0	4.0	4.0	0	>4.0
	Cumulative[5]	1.0	1.0	>4.0	>4.0	>4.0	

Notes:

1. Includes coagulation, flocculation, and sedimentation processes.
2. Includes sand/grit removal, coagulation, and flocculation processes and uf membranes.
3. Uv log-inactivation is based on an applied dose of 40 mj/cm^2 for option 2 and 25 mj/ cm^2 for options 3 and 4.
4. The log-inactivation/removal credits shown above are based upon 'expected values' for appraisal-level bwtp designs and are subject to change as the design is further refined.
5. Actual cumulative log-inactivation and/or log-removal values are likely to be higher than the minimum totals shown for each treatment option. Bench- and/or pilot-scale testing would be necessary to confirm higher cumulative values (e.g., *giardia* removal/inactivation for membrane filtration, uv disinfection, and chlorine disinfection is 4.0-, 3.0-, and 0.1-log, respectively, for option 4. Total committed cumulative log-removal/inactivation for this approach is >3.0, which is the same as for the single process of uv disinfection in the enhanced disinfection approach.).
6. In options 1 and 2, the log-inactivation is based on the design ct being in excess of literature values for whirling disease removal.

3.2.6 Uncertainty

Invasive species are a serious problem in locations where they have caused economic damages to fisheries, infrastructure and other resources. Changes in ecosystem dynamics and impacts on biodiversity and habitats are other impacts that are not readily measurable. Invasive species may be introduced through multiple pathways, both intentional and unintentional. It is also difficult to predict which species will become established and just as challenging to control or eradicate a species once established. Historical accounts of invasive species establishment can assist in predicting future locations of introduction and spread, but this approach is not infallible. As the *Transbasin Effects Analysis* (Reclamation 2013) explains, there are instances where an invasive species with no invasion history has had very large impacts, yet other instances where an impact prediction made from establishment of a species in one ecosystem may not apply to another ecosystem. Aquatic systems are complex and local conditions vary; therefore, it is usually not feasible to determine the pathway through which an invasion occurs. In addition, little empirical evidence exists on the time lapse between introduction of a species and the establishment of that species in an environment/location.

The lack of comprehensive species distribution information represents an uncertainty that reduces the ability to identify the most likely sources of introduction, characterize the risks of these transfer mechanisms, and predict the potential impacts of an AIS establishment. The lack of well-documented impacts of AIS and related organisms in other aquatic systems also represents uncertainty. These uncertainties related to predicting, controlling, and estimating the impact of AIS are discussed in detail in the *Transbasin Effects Analysis* (Reclamation 2013). These conclusions were reviewed as part of the *Risk and Consequence Analysis* (Appendix F) and determined to still be valid; therefore, the likelihood of transfer and the consequence of transfer are addressed qualitatively.

3.2.7 Risk Analysis

Data availability and uncertainty resulted in a qualitative approach to evaluate the risk of AIS interbasin transfer. Qualitative risk assessments are common, acceptable, valid and considered best practice. They also can be successfully applied when data gaps exist; such as insufficient data on community structure and functioning (Reclamation 2013).

As previously stated, numerous existing pathways (Table 3.3) could potentially facilitate the transfer of AIS to the HBB from adjacent or neighboring drainage basins; including, the MRB, the upper Mississippi Basin, the Pacific Northwest Basin and the Great Lakes Basin. Because these drainage basins share a boundary with the HBB, each poses a potential risk from natural and man-made sources. As the Missouri River Basin shares the largest boundary with the HBB, it provides the greatest risk of biota transfer from these existing pathways. Through the evaluation of the risk associated with these existing pathways, it was determined that human transfer risks are higher than risks from natural pathways. Human pathways such as bilge water discharge, aquarium trade, fish stocking programs, boating, aquiculture facilities, bait buckets, etc., have a greater risk of transferring AIS. The rapid distribution of zebra mussels and the New Zealand mudsnail throughout North American basins demonstrates the relative high risk of the human transfer pathway.

Intrabasin and interbasin diversions are also existing transfer pathways for AIS. Some of these diversion projects do not contain any type of water treatment process; while others employ various water treatment processes which would reduce that specific project's risk of transfer of AIS. The risk of AIS transfer is discussed in more detail in Chapter 4 of the *Risk & Consequence Analysis* (Appendix F).

3.2.8 Consequences of AIS

The impacts resulting from spread and establishment of introduced species may be unique based on the mode and severity of infection within preferred hosts, and the potential for adverse effects translated to the population level. The potential environmental consequences are not specific to any one pathway of introduction. It is possible that some of these species could have an impact in a newly encountered aquatic system; however, others likely would not. Uncertainty in the context of predicting potential effects is enormous.

It should not be assumed that an aquatic system would necessarily be negatively impacted by introduced AIS. Adverse impacts are not always highly deleterious. The *Transbasin Effects Analysis* (Reclamation 2013) employed a conservative approach by assuming that AIS establishment could more likely result in negative impacts to the HBB. An in-depth analysis of potential consequences of an AIS establishment was conducted for the *Transbasin Effects Analysis* (Reclamation 2013) and that analysis' data and results were reviewed as part of the Risk and Consequence Analysis. This review determined that the environmental and economic impacts are representative of the potential impacts. The use of existing analyses, such as this to inform this NEPA analysis, is in conformance with direction provided in Executive Order 13807 and Secretarial Order 3355.

The unintended introduction and establishment of AIS could potentially affect local economies in the Hudson Bay basin, particularly the economies of the communities adjacent to Lake Winnipeg and the greater economy of the Province of Manitoba. Economic sectors most at risk from the introduction of nonindigenous fish pathogens and parasites are recreational and commercial fishing, aquaculture, and non-fishing recreation.

The majority of AIS are represented by fish pathogens and parasites; therefore, the consequence analysis focused on the potential impacts on wild and reared fish populations, natural components of the HBB ecosystems, and human health and economics (commercial fishing, recreational fishing and non-fishing recreation). As stated in Appendix F, historical aquatic invasions were reviewed and these cases indicate that it is difficult to predict the impacts of species introductions due to site-specific environmental conditions that directly affect the outcome; however, they do provide observational evidence of consequences of AIS transfer.

Table 3.5 Provides a summary of the potential environmental and economic consequences of an AIS transfer in the HBB; regardless of the pathway(s) of introduction and temporal patterns of introduction and establishment. As previously mentioned, due to the degree of uncertainty regarding AIS species and limited data, determining the pathway of AIS transfer is almost impossible.

Table 3-5: AIS Potential Consequences Summary Table

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Ictalurid Herpesvirus 1 (channel catfish virus)	Causes limited mortality among wild fish. Primarily a disease of farmed catfish. Environmental impacts not expected.	Economic impacts not expected (pathogen problematic in southern U.S.). Absence of intensive catfish aquaculture in the HBB.
Novirhabdovirus spp. (infectious hematopoietic necrosis virus)	Chinook salmon and brown trout hosts for virus could potentially be affected.	Impacts to Chinook salmon and brown trout (both non-native species) recreational fisheries could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Adverse impacts to the commercial fishing sector (e.g., Chinook salmon) (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Aquabirnavirus spp.(infectious pancreatic necrosis virus)	Salmonid species could be differentially affected due to variable virulence among viral strains.	Impacts to recreational fisheries of salmonids could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Adverse impacts to the commercial fishing sector (salmonids) (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Isavirus spp. (infectious salmon anemia virus)	Some species of salmonids and non-salmonids may be susceptible.	Impacts to recreational fisheries could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Adverse impacts to the commercial fishing sector (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Rhabdovirus carpio (spring viremia of carp virus)	Primarily a disease of carp and carp aquaculture. Carp species are susceptible, and mortalities could occur at high infection rates.	Adverse impacts to the commercially valuable carp fishing sector (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Novirhabdovirus spp. (viral hemorrhagic septicemia virus)	Infection could result in mortalities of valuable game fish, such as crappie or muskellunge.	Impacts to recreational fisheries (e.g. crappie, muskellunge) could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors.
Renibacterium salmoninarum (bacterial kidney disease)	Present in the HBB. BKD infections could result in salmonid species mortalities. Infected individuals could also be largely asymptomatic.	Adverse impacts would be likely more problematic in aquaculture facilities. Commercial aquaculture is a small component of the Manitoba economy; therefore, potential economic losses would likely be minimal. However, potential impacts to salmonid recreational fisheries could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Adverse impacts to the commercial fishing sector (salmonids) (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Flavobacterium columnare (columnaris disease)	Present in the HBB. More common in hatchery conditions (especially in catfish growing regions). Potential to cause mortalities of wild fish, including channel catfish.	Impacts to recreationally- valuable catfish fisheries (e.g., channel catfish) could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential adverse impacts to the commercial fishing sector (e.g., channel catfish) (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Edwardsiella spp.	Present in the HBB. Common in catfish rearing regions, but *Edwardsiella* spp. can affect catfish (channel catfish, brown bullhead), as well as other wild species (e.g., black crappie, largemouth bass). Large mortalities do not appear frequent so population declines of recreational fisheries would be unlikely or rare.	Economic effects would not be expected due to the low likelihood of population-level effects to recreational fisheries.

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Yersinia ruckeri (ERM)	Present in the HBB. May affect salmonid and non- salmonid fish species. Based on its history, outbreak could cause large mortalities or fishery declines. Incremental or additive adverse effects to fish not expected as a result of additional transfers (from any adjacent drainage basin).	Impacts to recreational fisheries (salmonids) could result in decreased expenditures by recreational anglers and decreased revenues, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential adverse impacts to the commercial fishing sector (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish
Aeromonas salmonicida (furunculosis)	Present in the HBB. May affect several species of salmonids, however, native salmonids such as brook trout could be at a greater risk than introduced salmonid species. Incremental or additive adverse effects to fish not expected as a result of additional transfers.	Impacts to recreational fisheries, including brook trout could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors.
Streptococcus spp.	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.
Escherichia coli	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers
Legionella spp.	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.
Mycobacterium spp.	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Pseudomonas spp.	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers	No adverse economic effects expected as a result of additional transfers
Salmonella spp.	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.
Vibrio cholera (cholera)	Not endemic to the U.S., therefore low chance of introduction and potential associated impacts to HBB.	No adverse economic effects expected from this extremely rare pathogen.
Potamopyrgus antipodarum (New Zealand mudsnail)	Dense populations of New Zealand mudsnails could threaten (out-compete) native mollusks, overgraze algae, and change energy flows and disrupt food-webs. In extreme situations, fish population declines could occur as a result of food web structure alterations.	Impacts to recreational fisheries (related to population declines in only the most extreme circumstances) could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential adverse impacts to the commercial fishing sector (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Dreissena polymorpha (zebra mussel)	Present in the HBB. Ecosystems could be impacted as populations of zebra mussels remove (filter) phytoplankton disrupting food webs. In extreme situations, fish population declines could occur as a result of food web structure alterations.	Economic impacts could include declines of commercially valuable fisheries, such as lake whitefish. Fishery declines could result in reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish. Zebra mussels could also cause "fouling" of port infrastructure, which is costly to remediate.

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Dreissena rostriformis bugensis (quagga mussel)	Ecosystems could be impacted as populations of quagga mussels remove (filter) phytoplankton disrupting food webs. In extreme situations, fish population declines could occur as a result of food web structure alterations.	Impacts to recreational fisheries (related to population declines in only the most extreme circumstances) could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential impacts to commercial fisheries could result in reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Myxobolus cerebralis (whirling disease)	The susceptibility of lake whitefish and other native fish (in the HBB) to whirling disease has not been verified. There is a lack of vulnerable salmonid populations in the North Dakota region of the HBB. *Myxobolus cerebralis* could be transferred from drainage basins other than the MRB to regions of the HBB (e.g., Canada) supporting populations of susceptible salmonid species, which could potentially be impacted from infection.	Impacts to recreational fisheries (e.g., rainbow trout) could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential adverse impacts to the commercial fishing sector (e.g., rainbow trout) (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Polypodium hydriforme	Present in the HBB. Parasite can reduce the number of viable eggs of sturgeon and paddlefish; however, infection does not appear to cause population-level effects. No adverse effects expected as a result of additional transfers.	Economic impacts not expected due to a lack of potential for population-level effects.
Actheres pimelodi	Likely a normal component of fish parisitofauna in the HBB. No records regarding the potential for mortalities in wild fish populations. Unknown potential for environmental impacts, including population-level effects of wild fish.	Unknown potential for economic impacts.

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Ergasilus spp.	Likely a normal component of fish parisitofauna in the HBB. No records regarding the potential for mortalities in wild fish populations. Unknown potential for environmental impacts, including opulation-level effects of wild fish.	Unknown potential for economic impacts.
Icelanonchohaptor microcotyle	Organism is extremely rare. Unknown potential for environmental impacts, including population-level effects of wild fish.	Unknown potential for economic impacts.
Corallotaenia minutia	Organism is extremely rare. Unknown potential for environmental impacts, including population-level effects of wild fish.	Unknown potential for economic impacts.
Cryptosporidium parvum (crypto)	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.
Giardia lamblia (giardia)	Ubiquitous in aquatic systems including the HBB. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.
Entamoeba histolytica	Not common in U.S. and other industrialized countries so low likelihood of transfer to the HBB. Potential to cause human illness through contaminated water (feces).	No adverse economic effects expected from this pathogen that is extremely rare in the U.S.

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Ichthyophthirius multifiliis (ich or white spot disease)	Could cause mortalities of captive or wild fish, including pre-spawning salmonids.	Impacts to recreational fisheries could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential adverse impacts to the commercial fishing sector (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Ichythyophonus hoferi (ichthyophonosis)	Could cause mortalities of captive or wild fish. Unknown potential for causing population-level impacts to fish hosts.	Impacts to recreational fisheries could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential adverse impacts to the commercial fishing sector (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Saprolegnia spp. (saprolegniosis or winter fungus disease)	Infections are most common in captive fish (e.g., catfish aquaculture), so reared populations could be at risk. Unknown potential for causing population-level impacts to wild fish hosts	Channel catfish are not raised in aquaculture facilities in Manitoba. Therefore, no adverse economic effects are expected in the local economy. In addition, aquaculture is a small component of Manitoba's economy.
Branchiomyces spp. (branchiomycosis)	Infections are most common in captive fish (e.g., catfish and salmonid aquaculture), so reared populations could be at risk. Unknown potential for causing population-level impacts to wild fish hosts.	Potential adverse impacts to aquaculture and the commercial fishing sector could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.
Phoma herbarum	Potential to impact salmonids including Chinook salmon based on experimental evidence of fingerling mortality (study results may not be indicative of natural effects of infection).	Impacts to recreational fisheries (e.g., Chinook salmon) could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors. Potential adverse impacts to the commercial fishing sector (e.g., Chinook salmon) (including processors, wholesalers, etc.) could include reduced profit, employment, and catch value, while consumers may be adversely impacted by increased price or reduced availability/quality of local fish.

AIS	Potential Environmental Consequences in HBB	Potential Economic Consequences in HBB
Exophiala spp. (black yeast)	Potential to cause mortalities of salmonid (e.g., lake trout) and non-salmonid species (channel catfish) in the HBB. Unknown potential for causing population-level effects in fish hosts.	Impacts to recreational fisheries (e.g., lake trout, channel catfish) could result in decreased expenditures by recreational anglers, decreased value of the recreation experience to recreationists, and decreased revenues in associated economic sectors.
Anabaena flos-aquae (blue-green algae)	Present in the HBB, including Lake Winnipeg. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.
Aphanizomenon flos- aquae (blue-green algae)	Present in the HBB, including Lake Winnipeg. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.
Microcystis aeruginosa (blue-green algae)	Present in the HBB, including Lake Winnipeg. Incremental or additive adverse effects not expected as a result of additional transfers.	No adverse economic effects expected as a result of additional transfers.

3.2.9 Environmental Consequences

This section describes the risks of introducing AIS of concern into the HBB under the No Action Alternative and the action alternatives. It also analyzes the impacts that could result from the introduction and establishment of AIS in the HBB, including Canada. As already explained, numerous transfer pathways already exist and would continue under all the alternatives. Each alternative also includes some form of water treatment within the MRB, prior to the water being delivered into the HBB.

3.2.9.1 Alternative A – No Action Alternative

The No Action Alternative would be a continuation of the existing transfer pathways in which all or some of these pathways have contributed to the expansion of AIS. The risk of AIS transfer through this additional interbasin connection, in comparison to existing pathways, would be very low. In addition, the No Action Alternative includes a state water treatment plant located within the Missouri River basin which includes sand/grit removal and chemical disinfection processes for treating the water prior to it being delivered through a pipeline and being released into the Sheyenne River. The implementation of this treatment process further reduces an already very low, Project-related risk of AIS transfer. The potential environmental and economic consequences of an AIS transfer into the HBB are described in Table 3.5.

3.2.9.2 Alternative B - State's Red River Valley Water Supply Project

This alternative is very similar to No Action in that it would be a continuation of the existing transfer pathways in which all or some of these pathways have contributed to the expansion of AIS. In addition, the risk of AIS transfer through this additional interbasin connection, in comparison to existing pathways, would be very low; the same as the No Action alternative. This alternative includes the same state water treatment plant located within the Missouri River basin as is included in the No Action Alternative. This state water treatment plant includes sand/grit removal and chemical disinfection processes for treating the water prior to it being delivered through a pipeline and being released into the Sheyenne River. The risk of AIS transfer for this alternative is the same as the No Action Alternative. The potential environmental and economic consequences of an AIS transfer into the HBB are the same as the No Action Alternative. See Table 3.5.

3.2.9.3 Alternative C, D, E (Preferred Alternative), and F

These four action alternatives include the McClusky Canal as a water source for the proposed Project. Like the No Action Alternative, each of these action alternatives would be a continuation of the existing transfer pathways which contribute to the expansion of AIS. The risk of AIS transfer through this additional interbasin connection, in comparison to existing pathways, again, would be very low. In addition, the inclusion of a range of treatment processes within the Biota WTP would further reduce this very low risk. Appendix F, Section 5.0 provides a detailed discussion on the effectiveness of the treatment processes included in the Biota WTP options to inactivate/remove AIS. The risk reduction provided by the water treatment technologies proposed for the Biota WTP, would be equal to, or provide even greater risk reduction than the treatment process included in the No Action Alternative. The additional biota WTP processes incrementally reduce the Project-risk of AIS transfer based on the organism's susceptibility to the different treatment technologies as illustrated in Table 3.4. The potential environmental and economic consequences of an AIS transfer into the HBB are the same as the No Action Alternative. See Table 3.5.

3.2.10 Cumulative Effects

AIS biota transfer pathways associated with all the alternatives would contribute to the existing and reasonably foreseeable non-Project biota transfer pathways to result in a potential cumulative risk of transferring AIS between the Missouri River and the Hudson Bay basins. Existing non-Project pathways and reasonably foreseeable pathways pose a combined risk in the absence of the Project alternatives. In comparison to the risk of non-Project pathways, the risk contributed by the No Action and the action alternatives are very low considering the built-in engineering controls that would be implemented, and the cumulative risk posed by the Project would be negligible. In addition, the biota treatment options have been designed to treat a broad range of AIS life history categories to further minimize the potential risks.

Although the No Action and action alternatives would contribute to the total cumulative transfer risk, the existing risk, reasonably foreseeable risk from the alternatives and cumulative risk all would have the same effects if an establishment of AIS were to occur in the Hudson Bay basin. A biological invasion may be attributable to a single transfer pathway, the identity of which would more than likely be unknown. The biological invasion could also be attributable to multiple pathways with effects in the same location. However, the impacts associated with that invasion could be associated with a specific introduction source or multiple sources, and therefore would not be cumulative. The potential impacts associated with an AIS establishment would be independent of the introduction source. The impact would only vary in accordance with the AIS introduced and the

location of the introduction, such as within an area that supports susceptible host species for pathogens and/or parasites.

3.2.11 Summary

The risk of AIS introduction to the HBB could be slightly increased with the implementation of any of the alternatives; No Action as well as the action alternatives. Each of the alternatives evaluated would add one, very-low-probability pathway, to the already wide variety of existing pathways. To further reduce the risk of transferring AIS, each alternative (including No Action) includes one or more water treatment processes designed to inactivate and/or remove microscopic organisms. In addition, these treatment systems are designed with controls to monitor the effectiveness of the treatment process and automatically adjust the process or shut down the treatment plant if warranted.

The numerous and diverse pathways that are already present would continue to exhibit far greater risk for introducing AIS (which are present in adjacent drainage basins) to the HBB. For example, birds and mammals can transport AIS across large geographic distances and constructed interbasin diversions also have the potential to transport invasive species across drainage basins. There are no standards for treatment of interbasin water transfers to control invasive species.

The potential impacts of an AIS introduction and establishment in the HBB would be the same under the No Action Alternative and all of the action alternatives because numerous pathways for AIS transfer already exist and each alternative evaluated includes an interbasin transfer from the Missouri River Basin to the Hudson Bay Basin. None of these alternatives would create new types of impacts or increase the severity of impacts that could result from AIS transfer under the existing pathways.

3.3 Climate Change

The affected environment includes the Upper Missouri River Basin which has a typical continental climate characterized by large annual, daily, and day-to-day temperature changes; light to moderate precipitation which tends to be irregular in time and coverage; low relative humidity, plentiful sunshine, and nearly continuous air movement.

Climate change is expected to continue and is considered reasonably foreseeable. The objective of this analysis is to evaluate potential impacts of future climate change in the Upper Missouri River Basin on streamflow in the Missouri River which is the water source for all alternatives being evaluated, including No Action.

Reclamation, in partnership with the Corps, completed an evaluation of future climate change in the Upper Missouri River Basin in support of a Supplemental EIS prepared for the Northwest Area Water Supply Project (Reclamation 2015), which also uses the Missouri River as a source water for that project. This analysis compared data from a reference hydrology period (1950-1999) to future hydrology periods (2040-2069). Detailed discussion of Reclamation's climate change projections and how these data were used by the Corps in their Daily Routing Model for the Missouri River Mainstem System are included in Chapter 4 of the *Northwest Area Water Supply Project Supplemental EIS* (Reclamation 2015).

The results of this analysis showed the potential future climate effects on temperature, precipitation, and runoff within the Missouri River basin, as well as effects on Missouri River Reservoir operations and downstream flows. A summary of the results is presented here, due to the fact that they directly correlate to the future outlook period of the ENDAWS Project and the source water for the Project.

The Great Plains is projected to generally become warmer and wetter as a result of climate change. Increased temperatures are expected to change the seasonal pattern of runoff and stream flow. Projections showed that warmer winters would result in more winter precipitation falling as rain and less as snow. Snowpack would also likely decrease, winter stream flow would increase, and spring runoff would occur earlier. For Lake Sakakawea, the results suggest that Lake Sakakawea elevations and reservoir storage were likely to increase in the future as a result of climate change. Garrison Dam discharge was also projected to increase under climate change.

Stream flows in the lower Missouri River basin are affected by mainstem dam and reservoir operations and runoff below Gavins Point Dam, the lowermost dam on the Missouri River System. Kansas City was selected as a representative location in the lower basin to evaluate potential climate change effects on streamflow. Results of the analysis showed similar results for this lower basin region. The mean annual reservoir discharge was projected to increase in all months and the average annual streamflow, under the median projection, increased in every year of the period of analysis.

More recently, the Corps completed a qualitative assessment of climate change while developing their Missouri River Recovery Management Plan Environmental Impact Statement, which was completed in 2018. This climate change assessment is documented in the *Missouri River Recovery Program Management Plan EIS – Summary of Hydrologic Engineering Analysis* (Corps 2018a). The Corps' assessment included a review of numerous publications on climate change from various sources, as well as using various tools to refine the assessment. This literature review revealed a consensus that temperature and precipitation in the Missouri River basin have increased and these increased temperatures cause more winter precipitation to fall as rain rather than snow, resulting in less mountain snowpack accumulation in the western portion of the basin. These results mirror the results of Reclamation's analysis for the Northwest Area Water Supply Supplemental EIS discussed above.

Several tools from the US Geological Survey (USGS) and the Corps were used by the Corps' to further refine available data on climate change (*Missouri River Recovery Management Plan – Climate Change*, 2018b). The Corps' Climate Hydrology Assessment Tool was used to detect trends in observed annual maximum daily flows at select USGS gage sites as well as projecting future trends in annual maximum monthly flow. Various gage station data from sites throughout the Missouri River basin were selected to provide a broad review of the Mainstem System as well as tributaries to the Missouri River. Noting the limitations of this tool and the data available, the Corps reported the majority of the results showed no statistically significant trends within the observed historic record, while all the future projected trends for the Missouri River basin showed a significant increasing streamflow trend.

3.3.1 Environmental Consequences

The No Action Alternative and each of the action alternatives rely on the Missouri River Mainstem System as the water source for the Project. Whether water would be withdrawn from the Missouri River near Washburn, North Dakota or from Lake Sakakawea and delivered through the GDU Principle Supply Works, this is a reliable water supply for the Project considering future climate

change. The most recent climate change assessments within the basin indicate that runoff in the basin will likely increase. Increased runoff would generally be reflected in higher reservoir levels, higher reservoir releases, and higher streamflow in the lower basin and downstream of the mainstem reservoir system.

3.4 Cultural Resources

Two types of cultural resources are analyzed in this EIS: historic properties and Native American traditional cultural properties.

3.4.1 Historical Properties

3.4.1.1 Affected Environment

A Class I cultural resource overview, describing, in general, the types of known resources in the study area, has been prepared for this EIS; it is summarized below (Cox 2020). The literature search to identify known historic properties was conducted using the National Register of Historic Places (NRHP), the North Dakota State Historic Preservation Office (NDSHPO) database, and General Land Office plat maps. The NRHP and SHPO database show that no sites in the study area are currently listed on the NRHP.

The study area is located at the convergence of the Southern Missouri River Study Unit, the Sheyenne River Study Unit, and the James River Study Unit, which are three of 13 Study Units (drainage basins) used for prehistoric and protohistoric archeological site studies and management in North Dakota. As of 5 August 2015, there were 1,482 archeological sites and 911 archeological site leads and isolated finds in the state site files for the Southern Missouri River Study Unit (Gregg et al. 2016). Cultural material scatters, stone circles, and cairns represent most of the site types in the Southern Missouri River Study Unit. As of 5 August 2015, there were 841 archeological sites and 696 archeological site leads and isolated finds in the state computerized site data file for the Sheyenne River Study Unit (Swenson and Bleier 2016a). Cultural material scatters, mounds and graves represent the most common site types in the Sheyenne River Study Unit. As of 5 August 2015, there were 690 archeological sites and 528 archeological site leads and isolated finds in the state site file system for the James River Study Unit (Swenson and Bleier 2016b). Other than cultural material scatters, the site types most represented in the James River Study Unit are mounds and stone circles. A number of graves, other rock features, and cairns have also been recorded.

Stone circle sites, also called tipi ring sites, are distinguished by one or more circular rings of stone. Cairn are a pile or clustering of stones of varying size and shape. Rock cairns have been used for various purposes including, but not limited to, capping human burials, and ceremony, cache, trail, and boundary markers. Cultural material scatters can include (but are not limited to) prehistoric occupation sites, lithic scatters, historic dump sites, and sites consisting of the skeletal remains of prey animals. Occupation sites are scatters of artifacts, bone, pottery shards, and fire-cracked rock. Lithic scatters are distinct accumulations of stone (lithic) tools and/or debris from tool making. The sites consisting of faunal remains lack artifacts, but they appear to have been made as the result of human activity. Historic dump sites most often contain refuse from residential and/or industrial activities and can consists of everything from household trash to car parts and building debris.

Documented sites range from Archaic to protohistoric Native American sites and historic Euro-American and Native American sites. The literature search indicates that there is an overall low site density across the study area. However, there is an exception to the low site density found within the cites of Denhoff, Goodrich, and McClusky, North Dakota. The three cities contain a high number of historic architectural sites (n=153 total). The three cities make up the majority of the architectural sites found within the study area, and approximately one-half of the total sites identified within the study area. Previously documented prehistoric sites in the study area consist of stone circles, cairn, other rock alignment, lithic scatters, and isolated lithic debitage and tools. The lithic sites contain primarily Knife River Flint which is the most common lithic material found in central North Dakota. Prehistoric sites are more likely to be found on ridgetops, terraces, and near water sources.

Previously documented historic sites are primarily the previously mentioned architectural sites in the towns of Denhoff, Goodrich, and McClusky, North Dakota. Additional sites include farmsteads, cultural material scatters, dumps, schoolhouses, and isolated historic objects such as wagons and farm equipment. The historic cultural material scatters commonly contain tin cans, glass, ceramics, wood, wire, nails, and other metal artifacts. In addition to the documented sites, General Land Office plats indicate the presence of wagon roads, trails, and farm fields. The highest probability areas for historic sites in the area are on private land, along US Highway 52 and North Dakota Highway 200, and at the intersection of county roads and section corners.

3.4.2 Native American Traditional Cultural Properties

3.4.2.1 Affected Environment

In conformance with Executive Order 13007, potentially affected Native American tribes were notified of the proposed project and asked if they had interest in serving as members of the Cooperating Agency Team or as interested consulting parties and to identify any known traditional cultural properties they would like Reclamation to consider in the planning process. The Cheyenne River Sioux Tribe, Crow Creek Sioux Tribe, Lower Brule Sioux Tribe, Oglala Sioux Tribe, Rosebud Sioux Tribe, Standing Rock Sioux Tribe, Flandreau Santee Sioux Tribe, Mandan Hidatsa and Arikara Nation, Turtle Mountain Band of Chippewa, Red Lake Band of Chippewa Indians, White Earth Nation of Minnesota Chippewa, Spirit Lake Tribe, Yankton Sioux Tribe, Sisseton-Wahpeton Oyate Tribe, Crow Nation, Fort Peck Assiniboine & Sioux Tribes, Lower Sioux Indian Community, Upper Sioux Community, and Northern Cheyenne Tribe, were all sent scoping information and a Class I file search summary with project description and maps, and no tribe identified any sacred sites. Lack of identification early in the planning process does not guarantee that such sites do not exist, as tribes can be reluctant to share this information. Reclamation will continue to conduct tribal consultation throughout the identification and evaluation phase after a preferred alternative is chosen. Consultation is an ongoing process. If sacred sites are identified by tribes, project effects on those sites will be considered and avoided, if possible.

3.4.2.2 Environmental Consequences

The issue identified in terms of historic properties are adverse effects on historic properties. Potential impacts on this issue are described in terms of the likelihood of historic properties being present. A Class I overview was conducted to determine the likelihood of historic properties in the study areas for the alternatives (Cox 2020).

Issues identified in terms of Indian sacred sites include changes in access or physical impacts on Indian sacred sites. Potential impacts on these issues are described in terms of the presence of Indian sacred sites or access to sites. Each alternative was assessed as to whether it would block currently open roads or make previously inaccessible areas accessible. Native American Indian tribes were consulted to determine if there was sharable knowledge of sacred sites.

The potential for direct impacts on cultural resources from development, including ancillary facilities, such as access roads, transmission lines, and pipelines, is directly related to the amount of land disturbance and the location of the project.

Also considered are the indirect effects, such as impacts on the cultural landscape from erosion of disturbed land surfaces and increased human accessibility to possible site locations. Increases in human access can result in looting, vandalism, and trampling of cultural resources, and they could result from the establishment of corridors or facilities in otherwise intact and inaccessible areas.

Visual degradation of the setting associated with significant cultural resources, including rock art sites, could result from development. This could affect significant cultural resources for which visual integrity is a component of their significance, such as sacred sites and landscapes and historic trails and landscapes. Noise degradation of settings associated with significant cultural resources and sacred landscapes also could result from the presence of development; this could affect the pristine nature and peacefulness of a culturally significant location.

3.4.3 Alternative A – No Action Alternative

Siting and design would include measures to minimize adverse effects on cultural resources as described in the Finding of No Significant Impact issued by Reclamation for the CNDWSP (Reclamation 2018).

3.4.3.1 Historic Properties

This alternative was analyzed in the *Environmental Assessment for Issuance of a Water Service Contract to Garrison Diversion Conservancy District for the Central North Dakota Water Supply Project, North Dakota* (Reclamation 2018). Four cultural resources were identified in the Class I cultural resource literature review with all the resources being located more than 500-feet from the project area. Work would take place within the McClusky Canal ROW and on private lands. Any work within the Canal ROW falls under the *Programmatic Agreement between the Bureau of Reclamation, the Advisory Council on Historic Preservation, and the North Dakota State Historic Preservation Officer for the Implementation of Reclamation Undertakings in North Dakota* (MOU No. 3-FC-60-03300), Part II(c) (1) and Appendix I (B) (5). Reclamation recommended an updated Class I file search and Class III cultural resource inventory be completed for the portions of the project that fall outside of the existing Canal ROW prior to the commencement of ground-disturbing activities.

3.4.3.2 Traditional Cultural Properties

Alternative A would not restrict access to Native American traditional cultural property sites by traditional practitioners, nor would the pipeline route open new areas for access. Additional analysis of potential impact to traditional cultural properties would be conducted in consultation with regional Native American tribes as part of the Class III cultural resource inventory for this alternative, if selected.

3.4.4 Alternative B - State's Red River Valley Water Supply Project

Alternative B would not receive any Federal funding, and as such, would not be subject to review by Reclamation under Section 106 of the NHPA. Garrison Diversion would be responsible to comply with the rules and regulations for cultural resources management as determined by NDSHPO and the North Dakota Century Code.

3.4.5 Alternative C - McClusky Canal Only North

Siting and design would include measures to minimize adverse effects on cultural resources (see Appendix D).

3.4.5.1 Historic Properties

A total of 218 cultural resources were identified in the Class I literature review of Alternative C. Of the 218 resources, 187 of the resources consist of architectural sites in and around the towns of Denhoff, Goodrich, and McClusky, North Dakota. The sites are discussed in detail, and their NRHP eligibility status are listed in *Denhoff, Goodrich, Martin, and McClusky, Sheridan Co.: North Dakota Cultural Resources Survey Final Report 1988-1989* (Grander and Kelley 1989, SHSND Manuscript #4900). The remaining 31 sites consist of 22 sites that are currently *Unevaluated* for listing on the NRHP, and 9 sites that have been determined to be *Not Eligible* for listing on the NRHP. Five of the resources are located within 500-feet of the proposed Alternative. Three of the resources are currently *Unevaluated* for listing on the NRHP with the remaining two have previously been determined to be *Not Eligible*. Reclamation recommends an updated Class I file search and Class III cultural resource inventory be completed for all portions of the Project Area for Alternative C prior to the commencement of ground-disturbing activities. Under the NHPA, criteria are used to determine a cultural resource site's NRHP eligibility (36 CFR 60.4). In addition, criteria in 36 CFR Part 800 are applied to determine effects to historic properties. Any new cultural resources and historic properties identified during the survey(s) will be evaluated for listing on the NRHP, as necessary. Newly recorded resources whose significance cannot be established prior to disturbance will be left unevaluated for the NRHP. Previously identified cultural resources and historic properties will be assessed based on their previous NRHP evaluations.

- Cultural resources determined to not be NRHP eligible are managed to the discretion of Reclamation.

- The preferred treatment of the unevaluated cultural resource sites would be avoidance. However, if avoidance is not possible, the unevaluated sites within the area of potential effect would be evaluated for eligibility to the NRHP. Reclamation would then consult with the NDSHPO on the determination of NRHP eligibility and effects in accordance with the NHPA.

- As stated above, cultural resource sites that are included in or eligible for listing on the NRHP are given special status as historic properties. The preferred treatment of historic properties would be physical avoidance through the planning and design of activities and facilities and/or the avoidance of adverse effects. Reclamation would consult with the NDSHPO on the determination of effect in accordance with the NHPA if avoidance is not possible. The resolution of adverse effects would be done in consultation with the NDSHPO and tribes.

With the above stipulations, Reclamation has determined Alternative C would have no effect on historic properties.

3.4.5.2 Traditional Cultural Properties

Alternative C would not restrict access to Native American traditional cultural property sites by traditional practitioners, nor would the pipeline route open new areas for access. Additional analysis of potential impact to traditional cultural properties would be conducted in consultation with regional Native American tribes as part of the Class III cultural resource inventory for this alternative, if selected.

3.4.6 Alternative D – McClusky Canal Only South

Siting and design would include measures to minimize adverse effects on cultural resources (see Appendix D).

3.4.6.1 Historic Properties

A total of eight cultural resources were identified in the Class I literature review of Alternative D. The eight sites consist of two sites that are currently *Unevaluated* for listing on the NRHP, and six sites that have been determined to be *Not Eligible* for listing on the NRHP. None of the resources are located within 500-feet of the proposed Alternative. Reclamation recommends an updated Class I file search and Class III cultural resource inventory be completed for all portions of the Project Area Alternative D prior to the commencement of ground-disturbing activities. Under the NHPA, criteria are used to determine a cultural resource site's NRHP eligibility (36 CFR 60.4). In addition, criteria in 36 CFR Part 800 are applied to determine effects to historic properties. Any new cultural resources and historic properties identified during the survey(s) will be evaluated for listing on the NRHP, as necessary. Newly recorded resources whose significance cannot be established prior to disturbance will be left unevaluated for the NRHP. Previously identified cultural resources and historic properties will be assessed based on their previous NRHP evaluations.

- Cultural resources determined to not be NRHP eligible are managed to the discretion of Reclamation.

- The preferred treatment of the unevaluated cultural resource sites would be avoidance. However, if avoidance is not possible, the unevaluated sites within the area of potential effect would be evaluated for eligibility to the NRHP. Reclamation would then consult with the NDSHPO on the determination of NRHP eligibility and effects in accordance with the NHPA.

- As stated above, cultural resource sites that are included in or eligible for listing on the NRHP are given special status as historic properties. The preferred treatment of historic properties would be physical avoidance through the planning and design of activities and facilities and/or the avoidance of adverse effects. Reclamation would consult with the NDSHPO on the determination of effect in accordance with the NHPA if avoidance is not possible. The resolution of adverse effects would be done in consultation with the NDSHPO and tribes.

With the above stipulations, Reclamation has determined Alternative D would have no effect on historic properties.

3.4.6.2 Traditional Cultural Properties

Alternative D would not restrict access to Native American traditional cultural property sites by traditional practitioners, nor would the pipeline route open new areas for access. Additional analysis

of potential impact to traditional cultural properties would be conducted in consultation with regional Native American tribes as part of the Class III cultural resource inventory for this alternative, if selected.

3.4.7 Alternative E (Preferred) – McClusky Canal and Missouri River North

Siting and design would include measures to minimize adverse effects on cultural resources (see Appendix D).

3.4.7.1 Historic Properties

A total of 250 cultural resources were identified in the Class I literature review of Alternative E. Of the 218 resources, 187 of the resources consists of architectural sites in and around the towns of Denhoff, Goodrich, and McClusky, North Dakota. The sites are discussed in detail, and their NRHP eligibility status are listed *in Denhoff, Goodrich, Martin, and McClusky, Sheridan Co.: North Dakota Cultural Resources Survey Final Report 1988-1989* (Grander and Kelley 1989, SHSND Manuscript #4900). The remaining 63 sites consist of 43 sites that are currently Unevaluated for listing on the NRHP, and 20 sites that have been determined to be *Not Eligible* for listing on the NRHP. Fifteen of the resources are located within 500-feet of the proposed Alternative. Ten of the resources are currently *Unevaluated* for listing on the NRHP with the remaining five have previously been determined to be *Not Eligible*. Reclamation recommends an updated Class I file search and Class III cultural resource inventory be completed for all portions of the Project Area Alternative E prior to the commencement of ground-disturbing activities. Under the NHPA, criteria are used to determine a cultural resource site's NRHP eligibility (36 CFR 60.4). In addition, criteria in 36 CFR Part 800 are applied to determine effects to historic properties. Any new cultural resources and historic properties identified during the survey(s) will be evaluated for listing on the NRHP, as necessary. Newly recorded resources whose significance cannot be established prior to disturbance will be left unevaluated for the NRHP. Previously identified cultural resources and historic properties will be assessed based on their previous NRHP evaluations.

- Cultural resources determined to not be NRHP eligible are managed to the discretion of Reclamation.

- The preferred treatment of the unevaluated cultural resource sites would be avoidance. However, if avoidance is not possible, the unevaluated sites within the area of potential effect would be evaluated for eligibility to the NRHP. Reclamation would then consult with the NDSHPO on the determination of NRHP eligibility and effects in accordance with the NHPA.

- As stated above, cultural resource sites that are included in or eligible for listing on the NRHP are given special status as historic properties. The preferred treatment of historic properties would be physical avoidance through the planning and design of activities and facilities and/or the avoidance of adverse effects. Reclamation would consult with the NDSHPO on the determination of effect in accordance with the NHPA if avoidance is not possible. The resolution of adverse effects would be done in consultation with the NDSHPO and tribes.

With the above stipulations, Reclamation has determined Alternative E would have no effect on historic properties.

3.4.7.2 Traditional Cultural Properties

Alternative E would not restrict access to Native American traditional cultural property sites by traditional practitioners, nor would the pipeline route open new areas for access. Additional analysis of potential impact to traditional cultural properties would be conducted in consultation with regional Native American tribes as part of the Class III cultural resource inventory for this alternative, if selected.

3.4.8 Alternative F – McClusky Canal and Missouri River South

Siting and design would include measures to minimize adverse effects on cultural resources (see Appendix D).

3.4.8.1 Historic Properties

A total of 34 cultural resources were identified in the Class I literature review of Alternative F. The 34 sites consist of 20 sites that are currently *Unevaluated* for listing on the NRHP, and 14 sites that have been determined to be *Not Eligible* for listing on the NRHP. None of the resources are located within 500-feet of the proposed Alternative. Reclamation recommends an updated Class I file search and Class III cultural resource inventory be completed for all portions of the Project Area Alternative F prior to the commencement of ground-disturbing activities. Under the NHPA, criteria are used to determine a cultural resource site's NRHP eligibility (36 CFR 60.4). In addition, criteria in 36 CFR Part 800 are applied to determine effects to historic properties. Any new cultural resources and historic properties identified during the survey(s) will be evaluated for listing on the NRHP, as necessary. Newly recorded resources whose significance cannot be established prior to disturbance will be left unevaluated for the NRHP. Previously identified cultural resources and historic properties will be assessed based on their previous NRHP evaluations.

- Cultural resources determined to not be NRHP eligible are managed to the discretion of Reclamation.

- The preferred treatment of the unevaluated cultural resource sites would be avoidance. However, if avoidance is not possible, the unevaluated sites within the area of potential effect would be evaluated for eligibility to the NRHP. Reclamation would then consult with the NDSHPO on the determination of NRHP eligibility and effects in accordance with the NHPA.

- As stated above, cultural resource sites that are included in or eligible for listing on the NRHP are given special status as historic properties. The preferred treatment of historic properties would be physical avoidance through the planning and design of activities and facilities and/or the avoidance of adverse effects. Reclamation would consult with the NDSHPO on the determination of effect in accordance with the NHPA if avoidance is not possible. The resolution of adverse effects would be done in consultation with the NDSHPO and tribes.

With the above stipulations, Reclamation has determined Alternative F would have no effect on historic properties.

3.4.8.2 Traditional Cultural Properties

Alternative F would not restrict access to Native American traditional cultural property sites by traditional practitioners, nor would the pipeline route open new areas for access. Additional analysis

of potential impact to traditional cultural properties would be conducted in consultation with regional Native American tribes as part of the Class III cultural resource inventory for this alternative, if selected.

3.5 Land Resources

The affected environment for land resources consists of the 150-foot ROW, Biota WTP with 150-ft buffer, and intake facilities with a 150-ft buffer for each alternative. National Land Cover Database (Homer et al 2020) was reviewed for each alternative to determine the land cover type within the affected environment. Refer to Table 3.6 for an overview of each alternative.

Table 3-6: Land Cover Class by Alternative within the affected environment (acres)

Land Cover Class	A	B	C	D	E	F
Hay/Pasture	2	NA	48	5	58	7
Developed, Open Space	23	NA	36	21	72	49
Herbaceous	16	NA	149	202	312	292
Cultivated Crops	69	NA	365	194	537	303
Emergent Herbaceous Wetlands	2	NA	36	10	42	12
Open Water	NA	NA	8	< 1	8	< 1
Developed, Low Intensity	< 1	NA	< 1	NA	1	< 1
Barren Land	NA	NA	NA	NA	< 1	NA

3.5.1 Protected Lands

The affected environment includes several types of special land uses protected by federal legislation and federal and state land management programs. These include North Dakota State Trust Lands, wetland and grassland easements managed by the USFWS and Natural Resource Conservation Services (NRCS), and wildlife management areas, and Private Lands Open to Sportsmen (PLOTS) administered by the North Dakota Game and Fish Department (NDGF). Please refer to Table 3.7 for the type of protected lands, number of plots within the affected area, and acreages of these protected lands that occur within the affected environment as denoted by the number in parentheses.

Table 3-7: Protected Lands Plots by Alternative (affected acres)

Protected Land (acres)	A	B	C	D	E	F
Conservation Easements	2 USFWS WE	NA	0	1 NRCS WE (15)	0	1 NRCS WE (15)
PLOTS	2 (2)	NA	0	4 (42)	5 (21)	7 (63)
Wildlife Management Area	0	NA	0	0	1 (18)	1 (18)
North Dakota State Trust Lands	1 (9)	NA	1 (7)	4 (37)	2 (16)	5 (46)

3.5.1.1 Wetland and Grassland Easements

Wetland and grassland easements are legal agreements with the USFWS or NRCS that pay landowners to permanently protect wetlands and/or grasslands on their property. A grassland easement is similar to a wetland easement, and in North Dakota, is frequently used in combination with wetland easements to protect grass uplands around wetlands. All USFWS easements that may occur within the affected environment are not documented in Table 3.7. During a final design phase, Reclamation would ensure the USFWS is provided with the latest-version route maps of the pipeline delivery system to ensure that the USFWS-appropriate Refuge and Wetland Management District personnel, can identify where the pipeline and USFWS lands interface; thus, allowing for identification of an avoidance route for the contractor.

3.5.1.2 Private Land Open to Sportsmen

The PLOTS program started in 1997 when the NDGF was authorized to establish programs for landowner assistance that encouraged public access to private lands for hunting. The goal of the PLOTS program is to provide walk-in public access for hunting on private land.

3.5.1.3 Wildlife Management Areas

Wildlife management areas are generally composed of habitats that are important for wildlife such as native grasslands, wetlands, watersheds, and forest lands. Wildlife management areas are open to the public for recreational purposes; generally, hunting, fishing, nature study, hiking, and primitive camping.

3.5.1.4 North Dakota State Trust Lands

The Enabling Act of 1889 provided land grants, including Sections 16 and 36 in every township, to the State of North Dakota for the support of colleges, universities, the state capitol, and other public institutions. Revenues are generated through agricultural leases (grazing), rights-of-way, saltwater disposal, gravel and scoria mining, oil and gas leasing; as well as management of coal, potash, and other mineral leasing operations on the 706,600 surface acres and 2.6 million mineral acres managed by the Trust.

3.5.2 Prime and Unique Farmlands

The Farmland Protection Policy Act of 1994 was enacted to reduce the amount of highly productive farmland being converted to nonagricultural uses as a result of various federal programs. The act defines farmland as prime farmland, unique farmland, and land of statewide or local importance. Farmland was reviewed for each action alternative, please see Table 3.8 for prime and unique farmland in the affected environment (NRCS 2020).

Table 3-8: Prime and Unique Farmland by Alternative (acres)

Prime and Unique Farmland	A	B	C	D	E	F
All areas are prime farmland	NA	NA	130	< 1	135	< 1
Farmland of statewide importance	56	NA	224	100	321	165
Prime farmland if drained	NA	NA	7	NA	7	NA
Not prime farmland	NA	NA	290	334	572	498

3.5.3 Environmental Consequences

3.5.3.1 Alternative A – No Action Alternative

As determined in the CNDWSP EA and FONSI, temporary and permanent impacts to protected lands would be avoided using environmental commitments and BMP's. If the alignment crosses any easements, the USFWS requests a meeting with Garrison Diversion and Reclamation before siting or construction for avoidance purposes. The Project construction would avoid all easements by either boring underneath the easements or rerouting around the easements. If construction cannot avoid North Dakota State Trust Lands within the affected environment, an easement would need to be obtained prior to construction. Reclamation and Garrison Diversion would work with the private landowners enrolled in PLOTS to ensure future enrollment would not be affected by Project construction. As determined in the CNDWSP EA and FONSI, no prime farmlands would be impacted by the No Action Alternative.

3.5.3.2 Alternative B – State RRVWSP

Alternative B would consist of the State RRVWSP, with no federal facilities constructed. It is reasonable to assume protected lands would be present within the 150-ft ROW for Alternative B; however, acreages were not calculated for this alternative because there is no federal nexus. The impacts that may occur to protected lands are unknown because no environmental commitments or BMP's have been identified for the State RRVWSP. Garrison Diversion is responsible for determining compliance with all regulations, obtaining required easements, and applicable permitting. According to Garrison Diversion (2017), the following land reclamation actions would be implemented as part of the State RRVWSP:

- Excavate and segregate soils into three categories; black topsoil, brown root growing zone, and gray no grow zone;
- Fill trench with appropriate soils for maximum growing conditions;

- Crop Damage Policy that works for the landowners;
- Investigate BMPs used by other water systems and industry leaders

3.5.3.3 Alternatives C, D, E (Preferred Alternative), and F

Under each of these action alternatives, no permanent impacts would occur as a result of construction of above ground facilities; however, temporary impacts associated with pipeline construction may occur on protected lands. The environmental commitments and BMP's in Appendix D and those described below would avoid, minimize, or mitigate any temporary impacts.

If the alignment crosses any easements, the USFWS requests a meeting with Garrison Diversion and Reclamation before siting or construction for avoidance purposes. Construction activities would avoid all easements by either boring underneath the easements or rerouting around the easements. Reclamation and Garrison Diversion would work with the private landowners enrolled in PLOTS to ensure future enrollment would not be affected by the construction of any of these alternatives. Reclamation owns the wildlife management area (Old Johns Lake) that exists within the affected environment for alternatives E and F. Reclamation would work with our managing partner, the NDGF, to ensure all BMP's and environmental commitments as described in Appendix D are followed during construction and post construction.

If construction actions cannot avoid North Dakota State Trust Lands within the affected environment, an easement would need to be obtained prior to construction. For areas where prime farmland would be permanently converted to non-agricultural uses, Reclamation would complete and submit a Farmland Conversion Form (AD-1006) to the NRCS in compliance with the Farmland Protection Policy Act, as also described in Appendix D. Long-term effects on prime farmland would be avoided to the extent feasible, and all disturbed farmland would be restored with topsoil to the same depth, quality, grade, and relative density as the original surface, consistent with the BMPs in Appendix D. To the extent feasible, construction activities on irrigated lands would be avoided during the growing season. Because most impacts on prime farmland would be temporary in duration, and include environmental commitments and BMPs, the overall impact on this resource would be negligible.

3.6 Water Resources

3.6.1 Missouri River Mainstem Reservoir System and Operations

3.6.1.1 Affected Environment

The Missouri River flows 2,341 miles from Three Forks, Montana to its confluence with the Mississippi River near St. Louis, Missouri. The Missouri is the longest river in the United States, draining one-sixth of the country, and it is the main river in the Missouri River drainage basin. The Corps operates six dams and reservoirs on the Missouri River that are located in Montana, North Dakota, South Dakota, and Nebraska (Figure 3.1) and referred to as the Missouri River Mainstem Reservoir System (System)[2]. This System of dams and reservoirs has the capacity to store 72.4

[2] Information presented on the Missouri River Reservoir System and its operation is summarized from the *Missouri River Mainstem Reservoir System Master Water Control Manual Missouri River Basin* (Corps 2018) and other Corps reports as identified in the text and "References" chapter.

million acre-feet (MAF) of water (Corps 2018), which makes it the largest reservoir system in North America. The Corps operates the Missouri River System to serve congressionally authorized purposes of flood control, navigation, irrigation, hydropower, water supply, water quality, recreation, and fish and wildlife.

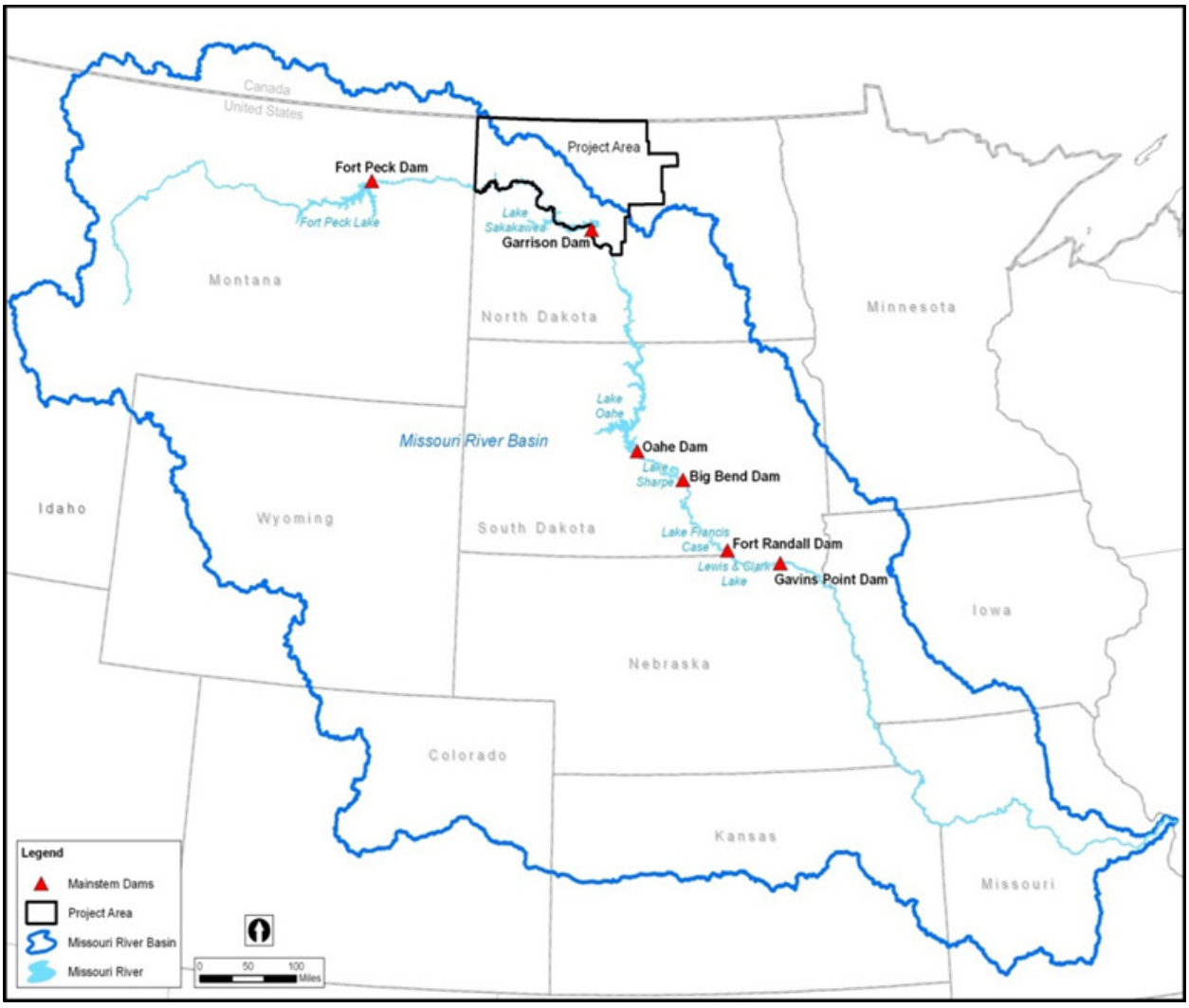

Figure 3-1: Missouri River Drainage Basin and Corps Dams (Corps 2018)

3.6.1.2 System Storage

"System storage" refers to the volume of space available within all of the Missouri River System reservoirs to store water for later use. "Reservoir storage" refers to space available within a specific reservoir. System storage is divided into four unique storage zones for regulation purposes (Corps 2018). Figure 3.2 shows the System storage for all reservoirs. The total gross System storage of the upper three reservoirs is approximately 64.9 MAF; all six reservoirs combined have a current System storage of approximately 72.4 MAF (Corps 2018).

The permanent pool accounts for 24 percent of the System storage and holds approximately 17.6 MAF (Figure 3.2, Corps 2018). This pool is designed for sediment storage, minimum reservoir levels

for fisheries, and minimum hydropower reservoir levels. Above the permanent pool is the carryover multiple use zone comprising 53 percent of the total System storage and holds approximately 38.5 MAF. This zone is designed to store water to serve all authorized purposes, though at reduced levels, though a severe drought. Above the carryover multiple use zone is the annual flood control and multiple use zone, which accounts for 16 percent of the System storage – approximately 11.6 MAF. At the top is the exclusive flood control zone for 7 percent of System storage, which has a capacity of approximately 4.7 MAF. This zone is utilized during extreme flooding conditions and is evacuated as soon as downstream conditions allow. Table 3.9 shows the reservoir storage zones for each of the reservoirs.

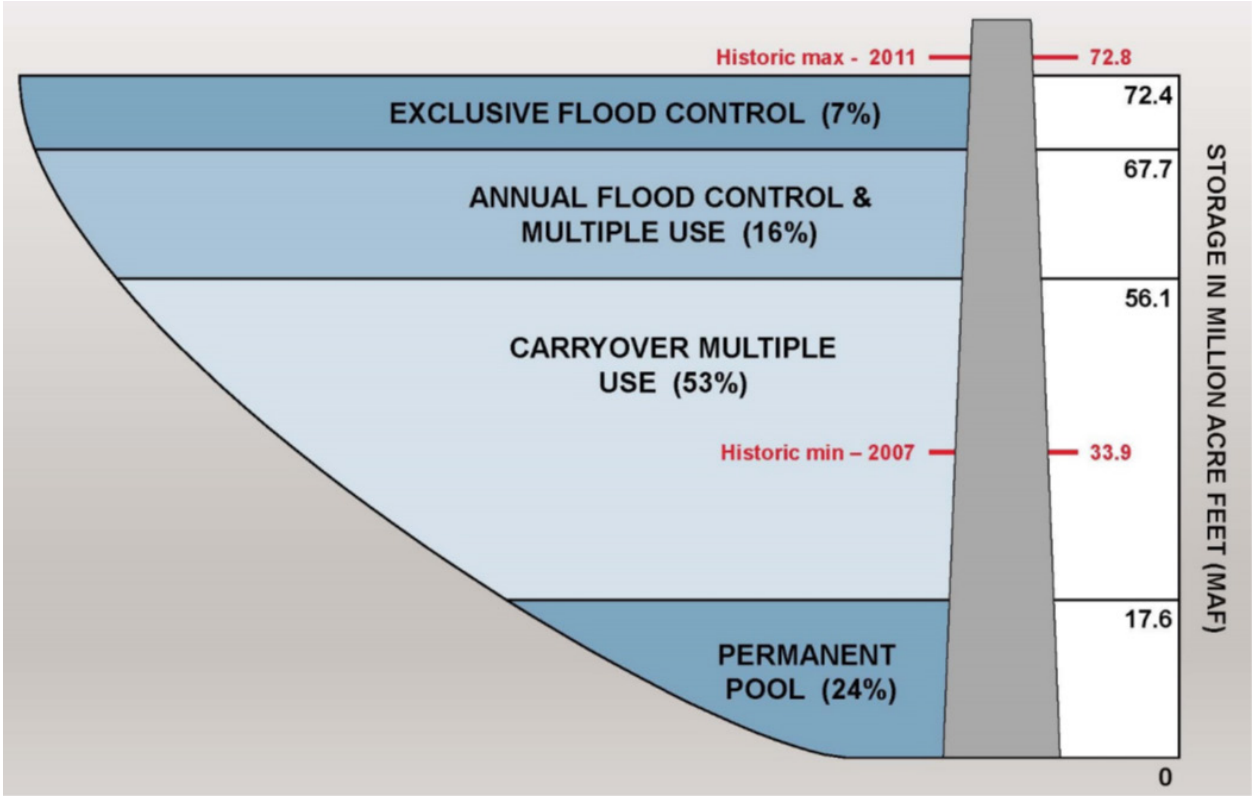

Figure 3-2: Missouri River Mainstem System Storage to Top of Zone in 2018

The System storage of the six reservoirs ranges from 23.4 MAF at Garrison to 0.4 MAF at Gavins Point (Corps 2018). The upper three reservoirs contain the majority of the combined storage capacity with approximately 65 MAF, which is almost 90 percent of the gross System storage. As a result, these three projects experience most of the variability in reservoir levels during periods of very high runoff or extended drought. The other three downstream reservoirs are operated much the same no matter the runoff conditions.

Table 3-9: Reservoir Storage Zones by Corps Project

Project	Top of Permanent Pool		Top of Carryover Multiple Use		Top of Flood Control & Multiple Use		Top of Exclusive Flood Control	
	Storage (MAF)	Elev. (ft msl)	Storage (MAF)	Elev. (ft msl)	Storage (MAF)	Elev. (ft msl)	Storage (MAF)	Elev. (ft msl)
Fort Peck	4.1	2,160.0	14.8	2,234.0	17.5	2,246.0	18.5	2,250.0
Garrison	4.8	1,775.0	17.7	1,837.5	22.0	1,850.0	23.4	1,854.0
Oahe	5.3	1,540.0	18.7	1,607.5	21.9	1,617.0	23.0	1,620.0
Big Bend	1.6	1,420.0	1.6	1420.0	1.7	1,422.0	1.8	1,423.0
Fort Randall	1.5	1,320.0	3.0	1,350.0	4.3	1,365.0	5.3	1,375.0
Gavins Point	0.3	1,204.5	0.3	1204.5	0.4	1,208.0	0.4	1,210.0
Total System	**17.6**	—	**56.1**	—	**67.7**	—	**72.4**	—

Note: ft msl = feet above mean sea level; MAF = million acre-feet

Source: Corps 2018

3.6.1.3 System Runoff

"Runoff" is the amount of precipitation (rainfall and snow) that falls on the MRB and enters the System. It can be estimated at a number of points in the watershed based on meteorological and streamflow data. Nearly 75 percent of the total annual runoff that enters the System occurs during the 5-month March-July period. On average, 25 percent of the annual runoff above Sioux City, Iowa occurs in March and April from snowmelt and early spring rains. 50 percent of the annual runoff occurs in May, June, and July from the mountain snowpack melting plus late spring and summer rains (Corps 2018).

Although the annual runoff can vary dramatically from year to year, the average annual runoff above Sioux City, Iowa is 25.8 MAF. Corps records dating back to 1898 indicate that runoff has varied from a high of 61.0 MAF in 2011 to a low of 10.7 MAF in 1931 (Corps 2018). In this 122-plus year period, the MRB has experienced four periods of significant drought. These include the record 12-year drought from 1930 to 1941, the 8-year drought from 1954 to 1961, and the 6-year drought that began in 1987 and ended abruptly with the flood of 1993. A more recent significant drought occurred between 2000 and 2007. This was the longest lasting drought since the System first filled with water in 1967. This drought resulted in a historical low System storage level of 33.9 MAF.

Not all of the runoff from the drainage basin is available for storage in the reservoirs or release for downstream purposes. Some runoff is lost through evaporation; some is diverted or withdrawn and used for agricultural, municipal, or other uses; and some is regulated by upstream reservoirs, as discussed below.

3.6.1.4 System Operations

The Missouri River System is regulated to serve the congressionally authorized purposes of flood control, navigation, hydropower, irrigation, water supply, water quality control, recreation, and fish and wildlife. The six dams and reservoirs are operated by the Corps as an integrated system, guided by the *Missouri River Mainstem Reservoir System Master Water Control Manual Missouri River Basin* (2018 Master Manual) (Corps 2018). In order to achieve the multipurpose benefits for which the System was authorized and constructed, the six system reservoirs are operated as a hydraulically and electrically integrated system. This means dam releases are coordinated in an effort to maintain desired levels in each reservoir and to meet flow requirements of downstream System purposes. Overall System regulation follows the water control plan presented in the 2018 Master Manual.

The annual target is to draw the Missouri River System reservoirs down to the bottom of the annual flood control and multiple use zone by March 1st, this is the desired operating zone of the System (Figure 3.2). Because the major portion of the annual runoff enters the reservoirs between March and July, storage accumulates and usually reaches a peak during early July. Water releases from System dams are scheduled throughout the remainder of the year to serve the other projects purposes.

During periods of normal to above-normal runoff, water releases from the reservoirs remove water stored in the annual flood control and multiple use zone (Figure 3.2), drawing the reservoir down to the top of the carryover multiple use zone by the following March 1st, when the cycle begins once more. During periods of extended drought, water is taken from the large carryover multiple use zone. The conservation storage provided in the carryover multiple use zones of the six mainstem reservoirs was designed to serve all project purposes through a drought like that of the 1930s, although at reduced levels.

3.6.1.5 Dam Releases

Dam releases refer to water discharged through the hydropower units or spillway to move water downstream through the System to serve authorized purposes. Factors such as the amount of storage and the magnitude and distribution of inflow received during the year can affect the timing and magnitude of individual dam releases. Adjustments to the amount of water transferred between reservoirs are made, when necessary, to achieve the desired volume of water in each reservoir and to maximize power generation.

Water releases from the upper three reservoirs are based on the need to balance the effects of depletions, sedimentation, and flood storage evacuation while ensuring that the three smaller downstream reservoirs maintain their pool elevation. Water releases from Gavins Point Dam are made to meet lower Missouri River navigation targets and flood control requirements, and to meet flood storage release requirements from the System reservoirs, as well as lower Missouri River flow requirements in non-navigation years. Summer releases from Gavins Point Dam are generally at their highest during the navigation season, when downstream flow requirements are highest. During the winter, with the onset of the non-navigation season, the conditions are reversed. Gavins Point

Dam water releases decrease by about one-third to slightly more than one-half of summer release levels.

3.6.1.6 Sedimentation

The Missouri River System was built with the knowledge and understanding that, over time, the sediments carried by the Missouri River and its tributaries would slowly accumulate in the bottom of the reservoirs (Figure 3.3, Corps 2018).

One effect of this sedimentation is that it slowly fills the reservoirs, resulting in a reduction of the available space to store water. The permanent pool of each reservoir was designed as storage space that would fill with sediment at some point in the future.

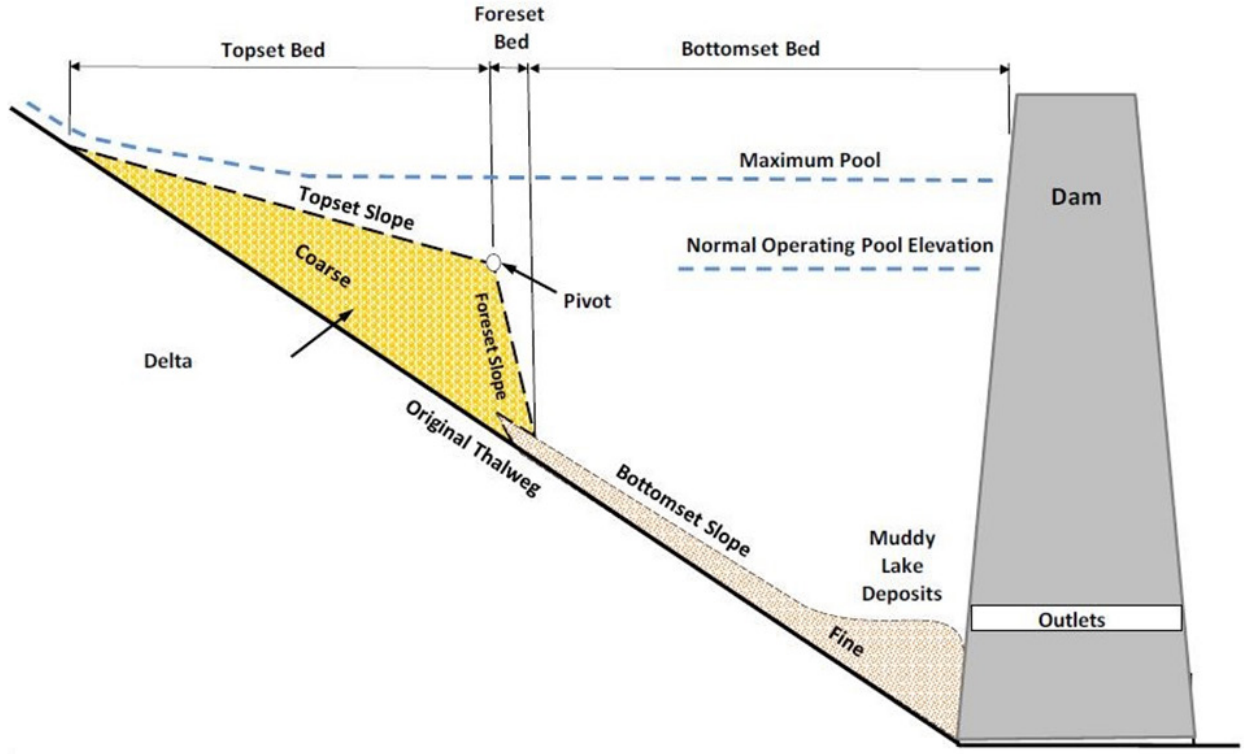

Figure 3-3: Sediment Accumulation behind Dams

Continuing hydrographic resurveys, sediment sampling activities, and special studies of the mainstem reservoirs aid in planning and in meeting short-term and long-term needs related to sediment. Each reservoir reach is surveyed at 10- to 25-year intervals to update reservoir capacities, evaluate impacts of erosion or sedimentation on project functions, and for other purposes relevant to the Corps' operation of the Missouri River System. Sediment accumulation over the years has resulted in losses of System storage (Corps 2018). The accumulation of sediment in reservoir headwaters and at the mouths of sediment-laden tributaries has affected project purposes by reducing channel capacity and raising water surfaces. Table 3.10 shows the change in System storage that has occurred since 1973.

Table 3-10: Changes in System Storage over Time Due to Sedimentation

Source Report	Total System Storage (MAF)	Storage at Base of Flood Control Pool (MAF)	Storage Lost due to Sedimentation since 1974 (MAF)
1972 – 1973 Annual Operating Plan	74.7	58.3	N/A
November 2018	72.4	56.1	2.3 MAF
Future 2075	68.9	52.6	5.8 MAF

Note: MAF = million acre-feet; N/A = not applicable
Source: Corps 2018 and Corps 2020

3.6.2 Garrison Diversion Unit Principal Supply Works

3.6.2.1 Affected Environment

The GDU Principal Supply Works, authorized in 1965, includes Snake Creek Pumping Plant, Audubon Lake, McClusky Canal, and the New Rockford Canal. The GDU project was designed to divert Missouri River water to central and eastern North Dakota for irrigation, municipal and industrial water supply, fish and wildlife, recreation, flood control, and other project purposes.

Located in north-central North Dakota, Lake Audubon was created when the Corps constructed the Snake Creek Embankment in 1953. The embankment dividing Garrison Reservoir from Lake Audubon provides a crossing for U.S. Highway 83, the Canadian Pacific Railway and utilities. The embankment also provides a means for managing water levels in Lake Audubon for recreation, fish and wildlife, and diversion of Missouri River water via the McClusky Canal. At the time of construction, a gated control structure was incorporated into the embankment to allow water level management by gravity flow between Lake Audubon and Garrison Reservoir. The Snake Creek Pumping Plant was completed in 1975 in order to pump water from Garrison Reservoir to Lake Audubon and to manage Lake Audubon at a higher level than Garrison Reservoir. Figure 3.4 shows the historic elevations of Lake Audubon to that of Garrison Reservoir.

Lake Audubon has a capacity of 340,700 acre-feet (ac-ft) (at 1847.2 msl) and surface area of 18,000 acres. The lake is managed between elevation 1,845.0 and 1,847.2 ft msl. Management of the lake is as follows: (1) After spring ice out, the water level in Lake Audubon is raised to 1,847.2 ft msl using pumps at the Snake Creek Pumping Plant. (2) The water surface elevation is maintained at 1,847.0 ft msl +-0.2 ft from May until September. (3) After Labor Day, Lake Audubon is gradually lowered to approximately 1,845.0 ft msl by November 15.

McClusky Canal is approximately 74 miles long with an original design capacity of 1,950 cfs at a Lake Audubon elevation of 1,850 ft msl. Lake Audubon is currently operated at 1,847.0 ft msl which reduces the maximum capacity down the McClusky Canal to 1,350 cfs.

The first 59 miles of the canal, located within MRB, are supplied with water through the canal headworks from Lake Audubon. The Painted Woods Outlet at Canal MM 36 is the primary outlet used to manage water levels in the canal. Water is released down this outlet when inflows from runoff exceed the target water elevations and to improve water quality. There are two earthen plugs at Canal MM 58 and 59 on the McClusky Canal that prevent the flow of Missouri River water to the HBB. The canal from MM 59 to 74 is not in operation and is in a dewatered state. The goals of water operations on the canal are to maintain target water elevations within different reaches of the canal and meet requests for water use.

McClusky Canal currently delivers water to irrigate 7,300 acres of the authorized 23,700 acres, six Wildlife Development Areas totaling nearly 9,000 acres, recreation in six in-line canal lakes and three lakes adjacent to the Canal, and livestock water along Turtle Creek and Painted Woods Creek.

McClusky Canal slide repairs are taking place between Canal MM 20-22, upstream of the proposed ENDAWS intake, to repair portions of the canal which have slumped in, reducing canal capacity. Slide repair work was initiated the fall of 2017 and is anticipated to be complete over the next three to four years.

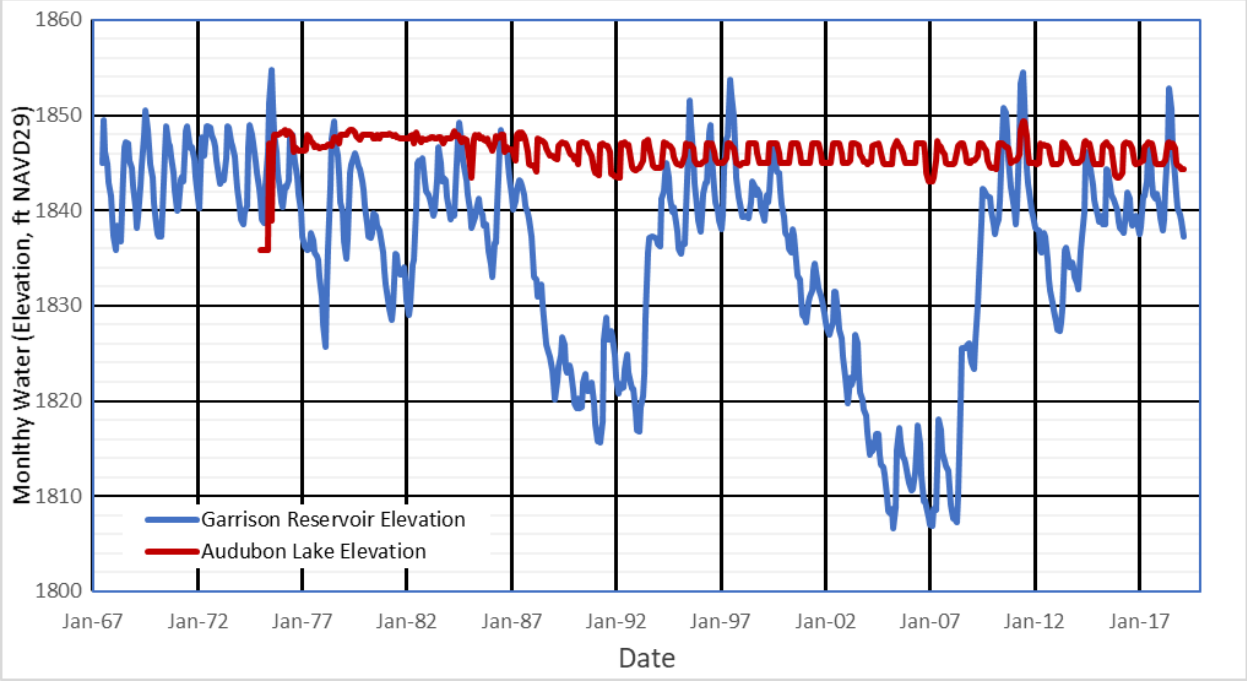

Figure 3-4: Lake Audubon and Garrison Reservoir Water Surface Elevations

The Corps identified a dam safety issue with the Snake Creek Embankment. An interim risk reduction measure was implemented in the Corps' 2019 *Section 7 Corp's Lake Audubon Reservoir Water Control Manual*. The manual states Lake Audubon water surface elevation will be decreased as necessary through operation of the Snake Creek embankment conduit when Garrison Reservoir is more than 43-feet lower than the Lake Audubon. During drought conditions, the performance of the embankment is monitored closely to evaluate the dam's integrity and the 43-foot differential constraint may be adjusted to ensure safe and efficient operation of the Snake Creek embankment. This means during a long-term drought; Lake Audubon would need to be drawn down to maintain

less than 43-feet of differential between Lake Audubon and Garrison Reservoir. This impacts the ability of GDU to deliver water down the McClusky Canal to meet all GDU project needs if Garrison's reservoir level falls below 1804.0 feet.

3.6.3 Analysis

Alternatives considered would all withdraw water from the Missouri River. These withdrawals could affect the Missouri River's water resources; including, system storage, reservoir levels, dam releases and river flows. Potential impacts by alternatives on other related Missouri River uses and resources are discussed in the appropriate resource sections of this chapter. To evaluate this issue, Reclamation partnered with the Corps to complete the study, *Missouri River Mainstem HEC-ResSim Modeling for ENDAWS EIS: Final, Mainstem Missouri River Reservoir Simulation Scenarios Technical Report* (Simulation Report) (Corps 2020).

3.6.4 Methods

Removal of water from the Missouri River would result in varying levels of impacts, depending primarily on the volume of water being removed. In this EIS, alternatives were analyzed based on the Project's forecasted annual withdrawal from the System of up to 119,500 ac-ft (0.1195 MAF) per year.

The alternatives would pump water from Garrison Reservoir, the Missouri River, or some combination of both to meet North Dakota's future water needs, most of which are located within the HBB. This trans-basin diversion of water would result in minimal return flows to the MRB. Potential impacts of this trans-basin water diversion on Missouri River resources were evaluated using the best available information and most current data regarding hydrologic effects by the use of water in the Missouri River.

The Missouri River Mainstem Reservoir System is managed by the Corps, in compliance with the Master Water Control Manual Missouri River Basin (2018 Master Manual) (Corps 2018). The Corps uses a HEC-ResSim model (ResSim Model) to simulate changes in operations of the System based on the 2018 Master Manual. For evaluations in this EIS, Reclamation provided the Corps with estimates of historic, existing, reasonably foreseeable depletions and potential ENDAWS Project withdrawals from the Missouri River System for input into the ResSim Model. The ResSim Model produces hydrologic data that were used to evaluate the relative impacts of potential changes for each simulation. Results of this analysis are documented in the Simulation Report (Corps 2020). Appendix H provides a summary of the step-by-step process Reclamation and the Corps followed in conducting the analysis. Details on both Reclamation's depletion database and the Corps' Simulation Report of this EIS can be found in their respective reports as supporting documents (Reclamation 2012b and Corps 2020).

Five simulations of the potential changes that affect System regulation were analyzed (Corps 2020). These simulations include:

- No Project Year 2017 (NP2017) (Existing Condition) – Simulation of Missouri River System operations with existing (2017) level of Missouri River depletions.
- No Project Year 2075 (NP2075) – Simulation of future (2075) Missouri River System operations with existing conditions; 0.85 MAF of reasonably foreseeable future non-Project Missouri River depletions; and, decreased storage capacity of 3.5 MAF due to sedimentation.

Reasonably foreseeable future non-Project depletions include planned/authorized projects that could withdraw water from the Missouri River System or its tributaries.

- No Action Depletion (CNDWSP) - Simulation of future (2075) Missouri River System operations, including existing conditions; future non-Project depletions; sedimentation and the annual Missouri River depletions up to 0.1195 MAF, split 0.105 MAF from Garrison to Oahe reach of the Missouri River; and, 0.0145 MAF from the Garrison Diversion Unit (Fort Peck to Garrison reach). All action alternatives are compared to No Action as required by NEPA.
- Missouri River Intake Depletion (State RRVWSP) – Simulation of future (2075) Missouri River System operations, including existing; non-Project depletions; sedimentation; and, the annual Missouri River depletions of 0.1195 MAF withdrawn from the Missouri River near Washburn, North Dakota (Garrison to Oahe reach).
- McClusky Canal Intake Depletion (ENDAWS) – Simulation of future (2075) Missouri River System operations, including existing conditions; future non-Project depletions; sedimentation; and, the annual ENDAWS Project Missouri River depletions of 0.1195 MAF withdrawn from Garrison reservoir via the Garrison Diversion Unit (Fort Peck to Garrison reach).

Simulations were analyzed using the ResSim Model to determine the consequences of No Action and impacts of action alternatives. The ResSim Model simulated an 89-year historical period (spanning March 1, 1930 through February 28, 2019). Daily inflow data for numerous MRB locations are available going back to 1930; therefore, this is the first year of the period for which ResSim Model simulations were conducted. For the NP2017 simulation, present-level depletions were used to adjust the historical flows to simulate the 2017 level of development in all years. Reservoir sedimentation (i.e., decreased storage capacity), reasonably foreseeable future non-Project depletions, and Project depletions were then added to the remaining simulations to demonstrate the potential effects of each. For each simulation, the ResSim Model routes the flows through the System following the criteria of the 2018 Master Manual. The ResSim Model compared alternatives based on monthly average reservoir releases, end-of-month reservoir elevation, end-of-month System storage, end-of-month navigation service level, and navigation end date, and river flow. These values will be summarized in four variables: System storage, reservoir levels, dam releases, and river flow. Dam release and river flow simulation comparisons at 1,000 cfs was chosen to reduce the influence of modeling error. Modeling error is due to simplifications of the model and parameters which can cause uncertainty. Also, the Corps System regulation orders are issued in the nearest 500 cfs.

The volume of water stored in the System varies with changes in annual inflows into the Missouri River and the amount of water released from the System to meet its authorized purposes. Daily decisions regarding the operation of the System depend on the amount of water stored in the System. Reservoir releases are coordinated in an effort to maintain the desired level in each reservoir and to meet the flow requirements of the authorized purposes on the lower Missouri River downstream from the System. Hence, this analysis evaluates potential hydrologic changes and impacts on water resources in view of integrated system operations.

3.6.5 Results – No Project Year 2075 Projection

Reservoir sedimentation is a naturally occurring result of the creation and operations of the System. In the Corps analysis (2020), sedimentation proved to have a large effect on the System with the loss of 3.5 MAF of storage capacity, primarily in the carryover multiple use zone and permanent pool.

Future population growth, irrigated agriculture growth, and additional projects withdrawing water from the System and its tributaries would result in future depletions of water in the System. Missouri River depletions are expected to increase by year 2075 due to increasing populations within the MRB and additional projects that would withdraw water from the Missouri River. Future non-Project depletions that would reduce inflows to the System reservoirs are forecasted to reach 0.85 MAF by 2075.

3.6.5.1 System Storage

From 2020 to 2075, sedimentation is projected to reduce System storage capacity by 3.5 MAF and reduce the top of the carryover multiple use zone to 52.6 MAF. This is a 5-percent reduction in the amount of storage capacity in the System, resulting in a loss of flexible operating storage and increased reservoir water levels due to displacement of the water by the sediments (Corps 2020).

Future non-Project depletions of 0.85 MAF would reduce the amount of water in System storage, especially during extended droughts. This reduction in System storage would carry over to the water surface elevations in each of the three, larger System reservoirs (Fort Peck, Garrison, and Oahe), as levels would drop in increasing amounts in the droughts as the depletions continue to accumulate each year. Releases from the System reservoirs would drop with the increasing non-Project depletions, with the amount of release reductions being nearly equivalent to the amount of the cumulative depletions above each reservoir.

In examining a 1930s-type drought (1930 to 1945), the Corps analysis found that from 1930 to 1939, NP2075 would result in lower annual minimum System storage levels than the No Project Year 2017 (existing conditions). However, from 1940 to 1942, the System storage levels would be higher than existing conditions because the additional sedimentation and non-Project future depletions would result in reduced navigation in years 1939-1940 (Figure 3.5, Corps 2020). By the fall of 1940, System storage in NP2017 is approximately 4 MAF less than the NP2075. The combination of drought conservation measures and increased runoff reduces the difference in System storage to less than 2 MAF by 1946. This is because during some droughts, navigation service would be minimal or suspended due to 2018 Master Manual's operating criteria to conserve water. The suspension of navigation flows during drought would mean that these flows would be stored in the reservoirs rather than being released to serve downstream navigation.

Navigation service-level is set on March 15th, for the first half of the navigation season, and reassessed on July 1st for the remainder of the navigation season for service level and season length. Navigation service would be reduced in more years under NP2075 than it would in NP2017. The most notable differences between NP2017 and NP2075 simulations occurs in the early 1940s, with NP2075 having the higher water surface elevation due to navigation service reductions in years 1939 and 1940.

3.6.5.2 Reservoir Levels

As sedimentation continues to cause the storage volume to decrease in the six reservoirs, the water surface elevations would increase. Future non-Project depletions would reduce the volume of water in the reservoirs, especially during extended droughts. Additionally, reservoir levels would be higher in the years when drought conservation measures are implemented. This would result in slower drawdown in the April to June timeframe, resulting in higher water surface elevations in System reservoirs in those months. These increases would be primarily in the three, largest system reservoirs – Fort Peck, Garrison, and Oahe. The most notable differences between NP2017 and NP2075

simulations occurs in late 1939 through 1942, with NP2075 having the higher water surface elevation due to navigation service reductions in 1939 and 1940. Garrison's reservoir level during the 1930's drought is shown in Figure 3.6.

3.6.5.3 Dam Releases

The Corps makes decisions on releases from the System based on the amount of water available in System storage. During non-drought periods, the goal each year is to have the volume of water in System storage at the base of the flood control storage zone on March 1st.

During extended droughts, the amount of water in System storage drops well below the base of the flood control storage zone throughout the year. Minimum System storage level on the specific storage check days (March 15, July 1, Sept 1) is especially important during drought, as it is the primary factor for determining dam releases.

Water releases from the six System dams would be affected by accumulating sediment and future non-Project depletions.

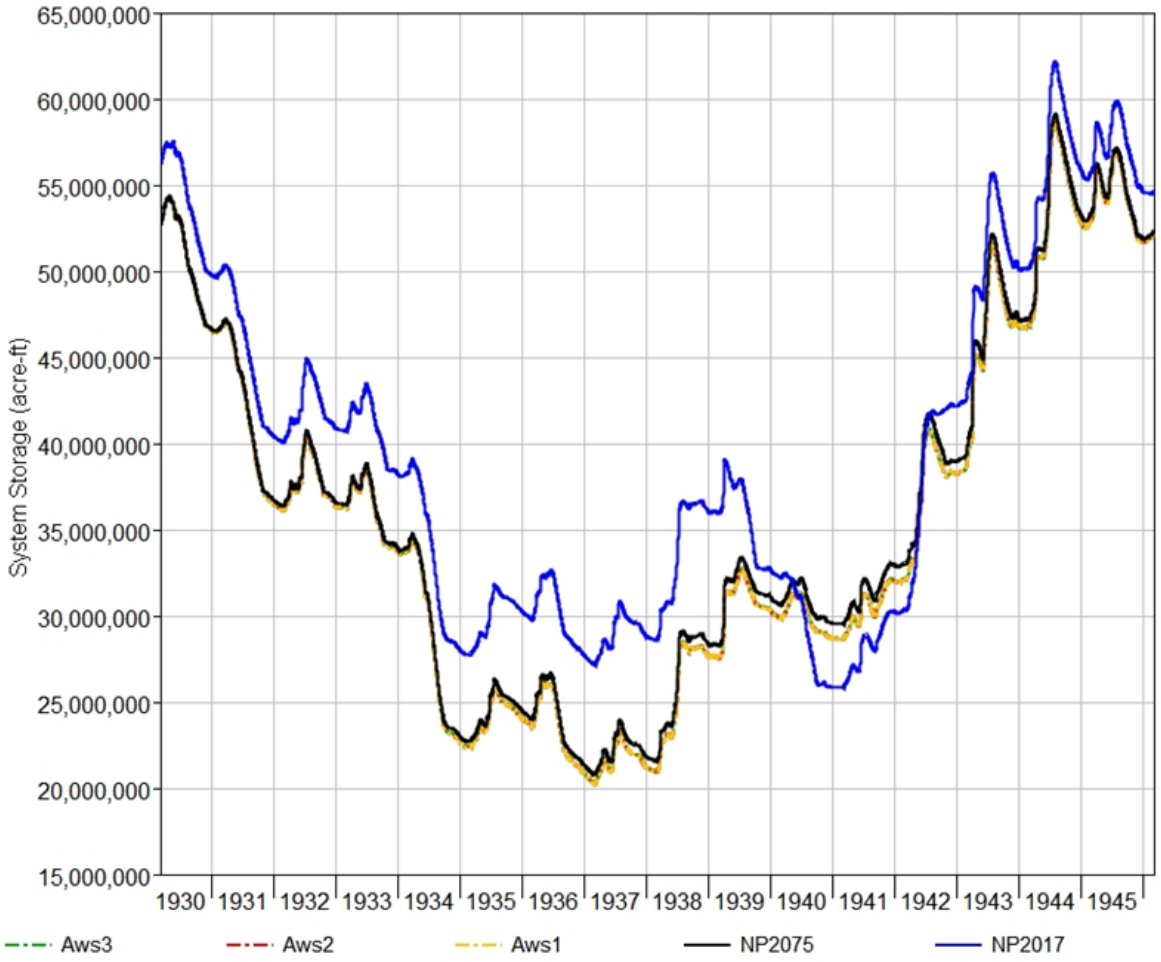

Figure 3-5: System Storage During the 1930's

3.6.5.4 Summary

The Corps analysis shows that NP2075 would result in lower annual minimum System storage levels than the NP2017. In prolonged droughts, such as the 1930s, the 2018 Master Manual's drought conservation measures reduce or eliminate the navigation service level and season length. These drought conservation measures would generally result in faster System storage recovery.

3.6.6 Environmental Consequences

3.6.6.1 Alternative A – No Action Alternative

As noted in Chapter 2, the No Action Alternative represents future conditions in 2075 without the ENDAWS Project. The No Action includes, existing depletions; future non-Project depletions; future reservoir sedimentation; and, up to 0.1195 MAF per year, split 0.105 MAF per year from Garrison to Oahe reach of the Missouri River, and 0.0145 MAF per year from GDU facilities. The GDU project withdraws water from the Fort Peck to Garrison reach of the System. The results are described in the Corps Simulation Report and are summarized in Appendix H as ENDAWS Scenario 1. The consequences explained below for the No Action are compared to NP2075. The other action alternative's depletion impacts were compared to No Action.

System Storage

The Corps analysis found, in general, System storage is lower than NP2075, but approximately 85 percent of the 89-year period has less than 0.5 MAF change in System storage. During the 1930's drought, the No Action depletion results in System storage difference greater than 0.5 MAF. This is noted in the fall of 1942 when System storage peaked at approximately 0.9 MAF less than NP2075. The combination of drought conservation measures and increased runoff reduces this difference in System storage to less than 0.2 MAF by 1946.

Service levels are different mainly in flood evacuation years because of differences in System storage. These differences in System storage can increase or decrease service levels, which determines releases from Gavins Point. Service level changes by 1,000 cfs or less for 98 percent of the 89-year period. For less than 2 percent of the period, the service level is either increased or decreased between 1,000 and 5,000 cfs. The increases and decreases of service level, greater than 1,000 cfs, generally occur during flood evacuation years when the service level has been increased above full service (Corps 2020).

Navigation season length show changes of 1 day or less for 90 percent of the 89-year period and 3 years have greater than 2 days. In 1942 and 1943, as the reservoirs recover from the 1930's drought, the navigation season length is shorter by 4 or 5 days. In 2015, the navigation season is extended by 10 days under the NP2075 simulation to evacuate storage, but a normal 8-month navigation season occurs under No Action.

In summary, simulated minimum System storage for No Action decreased by about 0.1195 MAF compared to NP2075. The differences between the two simulations occur in extended drought periods when the depletions exacerbate the drought effects.

Reservoir Levels

The three largest mainstem reservoirs follow the same trend as the System storage, since nearly 90 percent of the System storage resides in those reservoirs. The general trend is lower reservoir levels

due to the No Action depletion compared to NP2075. Table 3.11 summarizes the percentage of reservoir level change for the 3 largest mainstem reservoirs.

Table 3-11: Percent of reservoir level change compared to NP2075

Reservoir	Less than 1-foot change (%)	Greater than 1-foot higher (%)	Greater than 1-foot change during extended droughts (%)
Fort Peck	90	0.5	-
Garrison	88	1	5
Oahe	88	2	12

To put these potential water elevation changes under No Action in perspective, the average annual reservoir level in Fort Peck Reservoir fluctuates about 10 feet. The Garrison Reservoir water level fluctuates approximately 11 feet, and the reservoir level at Oahe Reservoir fluctuates approximately 12 feet. Since water surface elevations under No Action are within the range of average pool fluctuations at these reservoirs, consequences of the No Action compared to NP2075 would generally be negligible. Figure 3.6 shows the simulated minimum Garrison reservoir elevation differences during the 1930's drought.

As discussed in Chapter 2, the Corps identified a dam safety issue with the Snake Creek Embankment, the embankment that impounds water in Audubon Lake for the GDU. An interim risk reduction measure was implemented in the Corps' 2019 *Snake Creek Dam and Lake Audubon Reservoir Water Control Manual, Section 7 – Water Control Management*.

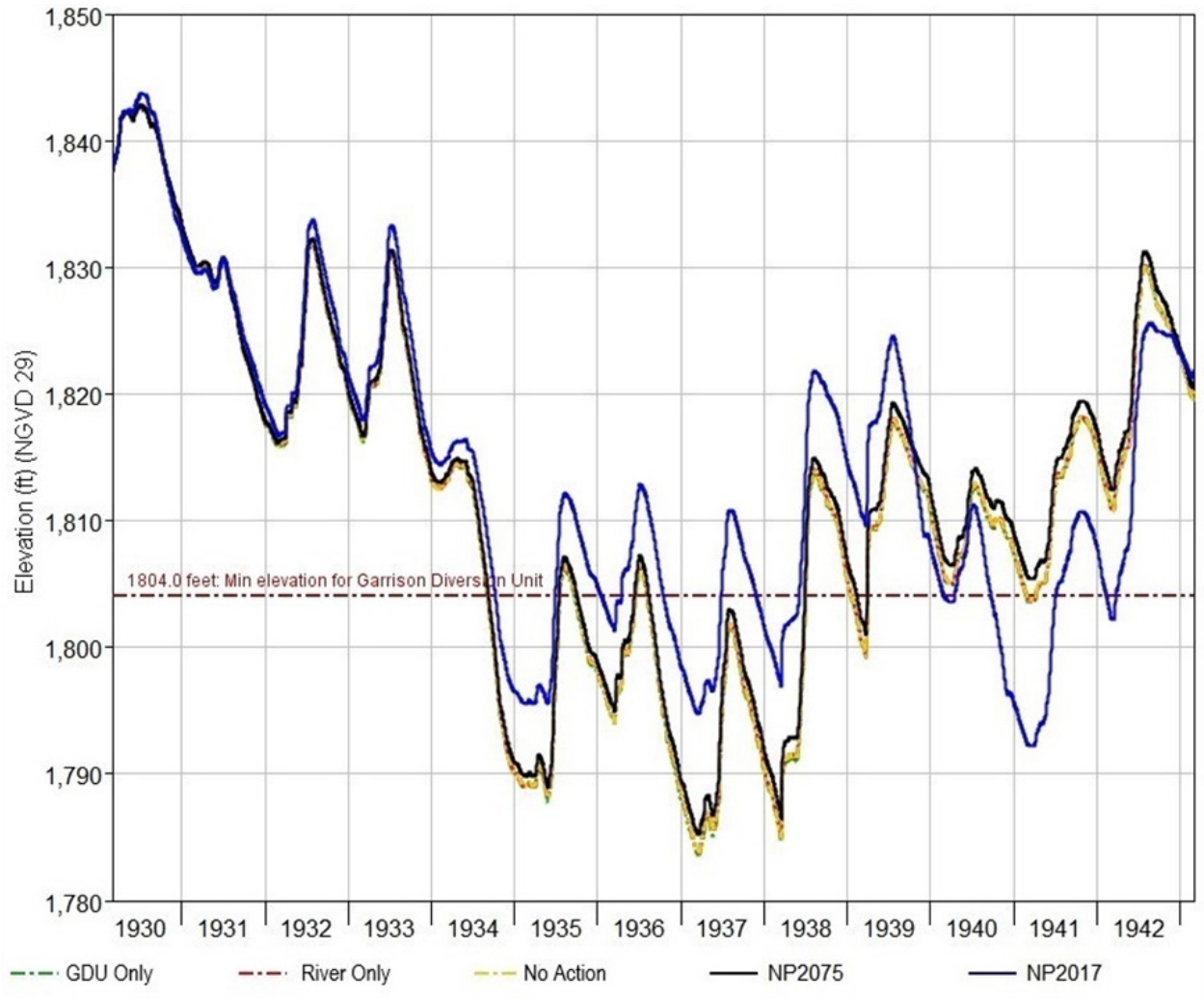

Figure 3-6: Annual Minimum Garrison Reservoir Levels in 1930-1943 for Simulations

This means during a long-term drought; Lake Audubon would need to be drawn down to maintain less than 43-feet of differential between Lake Audubon and Garrison Reservoir. This impacts the ability of GDU to deliver water down the McClusky Canal to meet all GDU project needs if Garrison's reservoir level falls below 1804.0 feet. This affects Reclamation's ability to deliver water from GDU in No Action, unless the embankment is repaired, or an alternate means to transport water into the McClusky Canal is constructed.

Figure 3.6 (Corps 2020) shows the period between 1934 and 1942 when Garrison reservoir level falls below elevation 1804. The pool elevation falls below 1804.0 feet for 1,376 days for this Alternative. This equates to the potential for water to not be supplied about 42 percent of the time between 1934 and 1942. Garrison pool elevation does not fall below 1804.0 feet during any other years in the 89-year period of record (Corps 2020).

Dam Releases and River Flow

Water releases are needed to meet lower Missouri River navigation and flood control requirements, and to meet flood storage evacuation requirements from the system reservoirs, as well as flow

requirements on the lower river in non-navigation years. The analysis found the release differences to be nearly identical in simulated annual releases from all six mainstem dams when comparing the No Action Alternative to NP2075 (Corps 2020). Table 3.12 summarizes the analysis as a percentage of time dam releases are greater or less than 1,000 cfs when comparing the No Action Alternative to NP2075. Releases greater than 1,000 cfs occur during flood evacuation years when the 2018 Master Manual activates flood evacuation rules. Less than -1,000 cfs indicates releases would be less as a result of the No Action Alternative.

Table 3-12: Percent of Time Dam Release Change Comparing No Action to NP2075

Dam	Less than 1,000 cfs (%)	Greater than 1,000 cfs (%)	Less than 1,000 cfs (%)
Fort Peck	98	1	1
Garrison	96	2	2
Oahe	93	2	5
Gavins Point	96	2	2

Differences in river flows would closely resemble the changes in releases at the nearest upstream reservoir. At Bismarck, North Dakota; Sioux City, Iowa; Omaha, Nebraska; Nebraska City, Nebraska; and Kansas City, Missouri, 96 percent of the 89-year period have changes less than 1,000 cfs.

3.6.6.2 Alternative B – State RRVWSP

As described in Chapter 2, the State RRVWSP would withdraw water from the System via an intake near Washburn, North Dakota. The intake would withdraw water from the System's Garrison to Oahe reach. The State RRVWSP would withdraw up to 0.1195 MAF per year at a rate up to 165 cfs. The Corps analysis evaluated changes in the System as a result of this action. The results of the analysis are described in the Corps Simulation Report and is summarized in Appendix H as ENDAWS Scenario 2. The impacts explained below for the Missouri River Intake simulation are compared to No Action. In general, depletion impacts in comparison to No Action are nearly identical.

System Storage

Due to the same total volume of water (0.1195 MAF) for this alternative, compared to No Action, the differences between these two simulations are identical. The System storage, navigation service level, and season length are exactly the same as described in No Action (Corps 2020).

Reservoir Levels

No action withdraws 0.105 MAF of water from Missouri River intake and the remaining 0.0145 MAF from GDU. Whereas, this alternative withdraws the full 0.1195 MAF from the Missouri River intake. The Corps analysis showed that 0.0145 MAF whether withdrawn from Garrison or Oahe reservoirs would result in no measurable difference to the mainstem reservoir levels when compared to No Action. In comparison, the 2075 storage volumes of the Garrison and Oahe reservoirs carryover multi-use zones are 16.9 and 17.9 MAF, respectively.

The Missouri River intake would be able to deliver water at all times from the Missouri River and is not impacted by the Corps' risk reduction measure on the Snake Creek embankment like the No Action Alternative.

Dam Releases and River Flow
Since system storage and reservoir levels would be identical to No Action, dam releases and river flow would be the same as No Action (Corps 2020).

3.6.6.3 Alternatives C, D, E (Preferred Alternative), and F

Chapter 2 describes North Dakota's request to utilize Reclamation's existing GDU facilities to supply up to 165 cfs (0.1195 MAF per year) to the State's RRVWSP as an alternate bulk water supply. The GDU facilities include Snake Creek Pumping Plant, Lake Audubon, and McClusky Canal. Snake Creek Pumping Plant withdraws water from the System's Garrison reservoir, and discharges into Lake Audubon, where water gravity flows down the McClusky Canal. The analysis results are described in the Corps Simulation Report and are summarized in Appendix H as ENDAWS Scenario 3. The impacts explained below for the McClusky Canal intake simulation are compared to No Action.

System Storage
Due to the same total volume of water (0.1195 MAF) for this alternative, compared to No Action, the differences between these two simulations are identical. The System storage, navigation service level, and season length are exactly the same as described in No Action (Corps 2020).

Reservoir Levels
The McClusky Canal intake alternative withdraws the full 0.1195 MAF from Garrison reservoir. This alternative results in Garrison reservoir level approximately 0.1-foot lower than No Action. Conversely, Oahe reservoir level would be 0.1-0.2 feet higher. As mentioned in No Action, Garrison and Oahe typically fluctuate annually 11 and 12 feet, respectively. The other four mainstem reservoirs would have no change in reservoir level. Thus, the effects on reservoir levels would be very small compared to No Action (Corps 2020).

The Corps risk reduction affects Reclamation's ability to deliver water from GDU is similar to No Action. The pool elevation falls below 1804.0 feet for 1,388 days for this Alternative. This equates to 12 more days in 1934 through 1942 that water may not be supplied (Corps 2020). The State's request for water during this period ranges from 31 to 165 cfs with 79 percent of the time requiring the full 165 cfs. The time periods when water would not be available via GDU would be from August 1934 through June 1935 and August 1936 through June 1938.

Dam Releases and River Flow
The Corps' analysis (2020) demonstrates that depletions from the Missouri River via GDU alternatives would have very little effect on System storage, reservoir level compared to No Action. The differences in dam releases and river flow would be nearly identical to No Action.

3.6.7 Cumulative Effects

Cumulative effects were accounted for in the analysis of Missouri River water resources by including existing depletions, reasonably foreseeable future non-Project depletions, and future reservoir sedimentation, in the No Action Alternative. Details on this analysis can be found in Appendix H and in the Corps Simulation Report (2020). The Missouri River Intake Alternative and McClusky

Canal Intake Alternative would have negligible effects on Missouri River System water resources when compared to No Action.

Climate change could have a cumulative effect on System operations by altering the timing and magnitude of runoff. About 75 percent of the climate projections analyzed would result in increased runoff in the MRB, which would generally increase streamflow and reservoir levels.

3.6.8 Summary

Under NP2075, continuing deposition of sediments into the System reservoirs would reduce the storage capacity of each reservoir. Future reasonably foreseeable non-Project depletions, which would reduce volume in the System, are forecasted to reach 0.85 MAF by 2075. This reduction in System storage would generally result in lower water surface elevations during droughts in each of the three, larger system reservoirs (Fort Peck, Garrison, and Oahe) as the depletions continue to accumulate each year. Drought conservation measures in the 2018 Master Manual would reduce navigation service levels and season length.

Under the No Action Alternative, 0.1195 MAF per year would be split 0.105 MAF from Garrison to Oahe reach of the Missouri River, and 0.0145 MAF from GDU. The amount of potential depletions is very small compared to existing and reasonably foreseeable future non-Project depletions. System storage is typically less than 0.5 MAF, navigation service levels and length are generally less than 1,000 cfs and 1 day, and reservoir releases are typically within 1,000 cfs compared to NP2075.

For the five action alternatives, the volume of potential depletions is exactly the same as the No Action Alternative. The location of the intake would affect either Garrison or Oahe reservoir levels by 0.1 to 0.2 feet. The GDU facilities would not be able to deliver water during extended drought until the Snake Creek embankment is repaired or an alternate means to deliver water to the McClusky Canal is constructed. The effect of ENDAWS depletions under the two intake location alternatives compared to the No Action Alternative would be nearly identical. In general, depletion, system storage, reservoir levels, dam releases and river flow are nearly identical compared to No Action under the action alternatives; therefore, it is anticipated there would be negligible or no impact to meeting the Missouri River System's authorized purposes.

3.7 Threatened and Endangered Species

Reclamation consulted the USFWS, North Dakota Ecological Service's Office website (https://www.fws.gov/northdakotafieldoffice/SEtable.pdf) and the Information, Planning, and Conservation System (https://ecos.fws.gov/ipac/) to obtain a list of threatened and endangered species and critical habitats associated with the affected area (Table 3.13). For the purposes of NEPA analysis, any potential impacts on federally listed species are evaluated similarly to the other resources discussed in this chapter by comparing the action alternatives to what is expected to occur under the No Action Alternative. The potential consequences associated with the No Action Alternative are as described in the CNDWSP EA and FONSI and incorporated by reference.

Reclamation will coordinate with the USFWS to comply with Section 7 of the Endangered Species Act regarding Preferred Alternative E. Reclamation is preparing a biological assessment and will coordinate with the USFWS to obtain their concurrence on the determinations of effect. It is

anticipated this concurrence will be received prior to the distribution of the Final EIS. This information will be included as an appendix to the Final EIS.

Analysis of potential impacts on federally protected species was based on descriptions of the affected environment and analyses of impacts on related resources (e.g., water quantity, vegetation, and wetlands) in this chapter. The resource analyses considered applicable BMPs and environmental commitments (Appendix D). Additionally, federal and state lists and databases were searched to determine the distribution and occurrence of these species within the affected environment.

Table 3-13: Threatened and Endangered Species within the affected environment

Group	Species	Federal Status[1]
Bird	Interior Least Tern *(Sterna antillarum athallasos)*	E
	Whooping Crane *(Grus americana)*	E
	Piping Plover *(Charadrius melodus)*	T
	Rufa Red Knot *(Calidris canutus rufa)*	T
Fish	Pallid Sturgeon *(Scaphirhynchus albus)*	E
Mammal	Northern Long-Eared Bat *(Myotis septentrionalis)*	T
Insect	Dakota skipper *(Hesperia dacotae)*	T

[1]T = threatened, E = endangered

Reclamation's Biological Assessment for the RRVWSP (Reclamation 2007b), and Reclamation's supplemental memo to the USFWS regarding the Biological Assessment for the RRVWSP (Reclamation 2008), have previously found no adverse modification to critical habitat on Lake Sakakawea, the Garrison reach of the Missouri River, Audubon Lake, or the McClusky Canal and Not Likely to Adversely Affect any threatened or endangered species, including the interior least tern, piping plover, critical habitat for the piping plover, pallid sturgeon, gray wolf, and whooping crane as a result of the project depletions from the Missouri River. The USFWS concurred with that finding. Reclamation also completed a Biological Assessment for the Northwest Area Water Supply, which received a concurrence letter from the USFWS dated April 2, 2015, confirming the above conclusion (Reclamation 2015b). The Simulation Report (Corps 2020) discussed in the Water Resources Section of Chapter 3 indicates negligible changes in system storage, reservoir levels, dam releases and river flow between the No Action and action alternatives. Depletion amounts discussed in that section are comparable to the RRVWSP and Northwest Area Water Supply analyses. Therefore, to avoid duplication of effort and redundancy, Reclamation incorporates by reference that review and those findings and concurrence regarding the lack of effect on federally listed species and their critical habitat due to depletions from Lake Sakakawea, the Garrison reach of the Missouri River, Lake Audubon, or the McClusky Canal. The use of existing analyses to inform this NEPA analysis is in conformance with direction provided in Executive Order 13807 and Secretarial Order 3355.

Due to the previous analysis of Missouri River depletions being incorporated by reference, the affected environment for each species is the same, defined as the 150-ft pipeline ROW, biota water

treatment plant footprint with 150-ft buffer, and intake facility footprint with a 150-ft buffer for each alternative, as appropriate.

3.7.1 Interior Least Tern

3.7.1.1 Population Rangewide

There are three subspecies of least tern: the eastern or coastal least tern (*Sterna antillarum antillarum*) that breeds along the Atlantic and Gulf Coast, the California least tern (*Sterna antillarum browni*) that breeds along the California Coast, and the interior least tern (*Sterna antillarum athallasos*) that extends from Texas to Montana, and from eastern Colorado and New Mexico to southern Indiana. Historically, interior least terns utilized major river systems from Texas to Montana, and from eastern Colorado and New Mexico to southern Indiana. Wintering locations have been documented along the Central American and South American coasts, from Venezuela to northeastern Brazil. Habitat loss due to dams and channelization and inadequate regulatory mechanisms along the altered river system was a major contributor to their population decline and subsequent listing as endangered in 1985 (*Federal Register* 50:21784-21792). Partial monitoring data from 2012 show population estimates at 13,855 (USFWS 2013a). Since 1994, interior least tern population estimates have exceeded the 7,000 rangewide population goal listed in the 1990 Recovery Plan. On October 23, 2019, the USFWS proposed to delist the interior least tern. The USFWS cites evidence indicating the threats that required the listing of the interior least tern have been eliminated or reduced, allowing the interior least tern population to increase across most of its range (USFWS 2019).

3.7.1.2 Affected Environment

In North Dakota, the interior least tern nests on sparsely vegetated sandbars on the Missouri River and on shorelines of Missouri River reservoirs, where they feed mostly on small fish. Most interior least terns in North Dakota are on the Garrison Reach of the Missouri River. Partial monitoring data for the Missouri River from 2012 show interior least tern numbers at 742, which exceeds the recovery target of 400 from the 1990 Recovery Plan. The most current data for North Dakota, from 2005, showed 225 interior least terns, which is just below North Dakota's recovery target of 250 (USFWS 2013a). Breeding season lasts from May through August, with peak nesting from mid-June to mid-July. Although the affected environment contains small fish at the McClusky Canal intake, the interior least tern preferred nesting and foraging habitat of sandy, vegetated shorelines and sandbars, does not occur within the affected environment.

3.7.2 Whooping Crane

3.7.2.1 Population Rangewide

The whooping crane was listed as endangered in 1967 (CFR 32:4001). Whooping crane recovery efforts have made great strides since that time, with new populations being established in Florida and Wisconsin. The birds that migrate through North Dakota are part of the Aransas-Wood Buffalo population. Approximately, 504 whooping cranes were estimated during the winter 2018-2019 survey, centered on the Aransas National Wildlife Refuge (Butler and Harrell n.d.).

The whooping crane recovery plan includes scientific information about the species and provides objectives and actions needed to down-list the species (Canadian Wildlife Service and U.S. Fish and Wildlife Service 2007). Recovery actions designed to achieve these objectives include protection and enhancement of the breeding, migration, and wintering habitat for the Aransas-Wood Buffalo

population. The goals are to allow the wild flock to grow and reach ecological genetic stability; reintroduction and establishment of geographically separate self-sustaining wild flocks to ensure resilience to catastrophic events; and maintenance of a captive breeding flock that is genetically managed to retain a minimum of 90 percent of the whooping cranes' genetic material for 100 years.

3.7.2.2 Affected Environment

The whooping crane passes through North Dakota each spring and fall while migrating between its breeding territory in northern Canada and wintering grounds on the Gulf of Mexico, frequently migrating with sandhill cranes. Whooping cranes are usually found in small groups of seven or fewer individuals and are easily disturbed when roosting or feeding. They prefer freshwater marshes, wet prairies, shallow portions of rivers and reservoirs, grain and stubble fields, shallow lakes, and wastewater lagoons for feeding, loafing, and roosting. Fall migration occurs in North Dakota from late September to mid-October, while spring migration occurs from late April to mid-June. Birds can appear in all parts of North Dakota, although most sightings are in the western two-thirds of the state. In 2018, the USGS delineated a migration corridor that outline the percentage of confirmed crane sightings based on current and historical sighting reports (Pearse et al 2018). The affected environment is located within the migration corridor where 75 to 95 percent of sightings have occurred. According to the observation data, confirmed whooping crane sightings have occurred within two miles of the nearest action alternatives (C and E), a majority of which have typically spent only a day in the area, consistent with migration (Tacha et al 2010). According to National Land Cover Database data, the affected environment contains suitable migration habitat for the whooping crane in the form of croplands and wetlands. Details on this habitat are presented in Table 3.6 of the Land Resources Section and Table 3.14 in the Wetland and Riparian Areas Section.

3.7.3 Piping Plover

3.7.3.1 Population Rangewide

Three sub-populations of piping plover have been identified: an interior Great Plains population, Atlantic Coast population, and a Great Lakes population. The piping plover was listed as threatened in 1985 (CFR 50:50726-50734). The breeding range includes Alberta, Saskatchewan, Manitoba, Montana, North Dakota, Minnesota, South Dakota, Nebraska, and Iowa. Wintering locations includes the Atlantic Coast from North Carolina south to Florida and on the Gulf of Mexico from Florida to Texas; northern Cuba, Puerto Rico, Bahamas, Greater Antilles, eastern Mexico, and the Yucatan Peninsula. Piping plover numbers have declined due to dams and channelization, reducing suitable habitat. In 2011, the adult population of piping plovers was estimated at approximately 5,723, with 2,249 estimated in the Northern Great Plains (Elliott-Smith et al. 2015). The USFWS designated critical habitat for the Great Plains breeding population in 2002 (CFR 67:57637), Great Lakes breeding population in 2001 (CFR 66:22938), and the winter piping plover population in 2001 (CFR 66:36038).

3.7.3.2 Affected Environment

Piping plover nesting and foraging habitat in North Dakota consists of barren sand and gravel bars and shorelines of the Missouri River and shorelines of prairie alkali lakes. The piping plover occurs in ND from mid-April to August, with peak breeding season from May to mid-July. In 2011, the adult population of piping plovers was estimated at approximately 623 in North Dakota. The piping plover preferred nesting and foraging habitat of barren sand and gravel bars and shorelines of alkali lakes does not occur within the affected environment.

Designated critical habitat of the piping plover in North Dakota includes numerous alkaline lakes, Lake Sakakawea and the Missouri River. The nearest designated critical habitat to the action alternatives (C and E) occurs in McLean County at an alkaline lake complex approximately 13 miles west. No designated critical habitat occurs within the affected environment.

3.7.4 Rufa Red Knot

3.7.4.1 Population Rangewide

The rufa red knot was listed as threatened in 2014 (CFR 79:73706-73748). The red knot migrates between its breeding grounds in the Canadian Arctic and several wintering regions, including the southeast United States, the northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. During both the northbound and southbound migrations, red knots use key staging and stopover areas to rest and feed. Long-distance migrant shorebirds are highly dependent on the continued existence of quality habitat at a few key staging areas. These areas serve as steppingstones between wintering and breeding areas. Many of the key migration staging areas are along the coasts but there are records that show small numbers (fewer than 10) of red knots migrating together in the interior states as well.

3.7.4.2 Affected Environment

While little is known about interior migrating red knots, they are believed to be rare migrants through North Dakota, occasionally utilizing wetlands as stopover habitat. Migration through North Dakota occurs from mid-May and mid-September to early October. Geolocator results from a study of eight knots wintering in Texas found five of the birds used the Northern Great Plains (Saskatchewan, Canada and North Dakota) as a stopover (USFWS 2013). According to Ebird.org, 23 observations have been documented in North Dakota, with the nearest observations to the Action Area at Lonetree Wildlife Management Area (in 1998) and Hurdsfield Lake (in 2019) (eBird 2020). Suitable stopover habitat in the form of wetlands occurs within the affected environment. See Table 3.14 in the Wetland and Riparian Areas Section.

3.7.5 Pallid Sturgeon

3.7.5.1 Population Rangewide

The pallid sturgeon was listed as endangered in 1990 (*Federal Register* 55:36641-36647). The pallid sturgeon requires turbid water and flow rates of large, free-flowing rivers. Historically, the geographic range included the lower 200 miles of the Yellowstone River; the Missouri River (from Fort Benton, MT to St. Louis, MO); the Mississippi River from St. Louis south to Louisiana; larger tributaries include the Platte, Kansas, St. Francis, Ohio, Arkansas, and Yazoo/Big Sunflower Rivers; and the Atchafalaya River. The total length of the pallid sturgeon's historical range was approximately 3,515 river miles (USFWS 2014). A majority of its habitat has declined due to river channelization, construction of impoundments, and related changes in water flow. Today, the pallid sturgeon has been limited to fragmented segments of free-flowing rivers within its historical range.

3.7.5.2 Affected Environment

An estimated 125 wild Pallid Sturgeon remain in the Missouri River downstream of Fort Peck Dam to the headwaters of Lake Sakakawea including the lower Yellowstone River (USFWS 2014). The affected environment does not contain habitat for the pallid sturgeon.

3.7.6 Dakota Skipper

3.7.6.1 Population Rangewide

The Dakota skipper was listed as threatened with a 4(d) rule in 2014 (*Federal Register* 79:63672-63748). Critical habitat was designated in 2015 (*Federal Register* 80: 59248-59384), with 38 units identified in three states including North and South Dakota, and Minnesota. Historically, the Dakota skipper had been recorded from northeast Illinois to southern Saskatchewan, although they likely occurred throughout the prairie in north-central U.S. and south-central Canada. The Dakota skipper requires high quality native prairie for each of the four stages of its life cycle. Two distinct habitat types have been identified, moist bluestem prairie and upland prairie on hillsides and ridges. This species is in decline due to the widespread conversion of native prairie to agricultural uses (USFWS 2016).

3.7.6.2 Affected Environment

Dakota skipper observations have occurred historically in Wells, Sheridan, Kidder, and Burleigh Counties. Dakota skipper is known to currently be present in Wells County (USFWS 2018). No critical habitat occurs in the affected environment. Based on National Land Class Database data, herbaceous vegetation (grasslands) occur in each of the action alternatives. See Table 3.6 in the Land Resources Section.

3.7.7 Northern Long-Eared Bat

3.7.7.1 Population Rangewide

The northern long-eared bat was listed as threatened in 2015 (CFR 80:17974-18033) with a 4(d) rule in 2016 (CFR 81:1900-1922). The range of the northern long-eared bat includes much of the eastern and north-central United States and most of the Canadian provinces. The northern long-eared bat spends winters hibernating in caves and mines. In summer, the northern long-eared bat roosts underneath bark of live and dead trees, rock crevices, caves, mines, barns, and sheds. The dramatic decline of the northern long-eared bat is due to white-nose syndrome. There are many unknowns regarding white-nose syndrome, however it is expected that the disease will spread throughout the United States. Other sources of decline include impacts to hibernacula, degradation of summer habitat, and wind farm operation.

3.7.7.2 Affected Environment

Little work has been conducted in North Dakota to document the distribution of the northern long-eared bat in in the state. Summer surveys in North Dakota (2009 – 2011) documented this species in the Turtle Mountains, the Missouri River Valley, and the Badlands (Gillam and Barnhart 2012). Gillam and Barnhart (2012) found most of this bat species using tree roosts particularly cottonwoods. To date, no hibernacula or bat activity during the winter months has been documented in the state. National Land Class Database does not indicate any forested areas within the action alternatives. Review of 2018 National Agriculture Imagery Program aerial imagery indicates few trees in the action alternatives, with a majority of those trees associated with tree rows planted by private landowners.

3.7.8 Environmental Consequences

3.7.8.1 Alternative A – No Action Alternative

The analysis in the CNDWSP EA and FONSI contained information regarding the absence of suitable habitat and recorded observations of the species listed above within the No Action Alternative affected environment. In combination with the BMP's and environmental commitments contained within the CNDWSP EA and FONSI, the No Action Alternative will have no impact on the interior least tern, piping plover, piping plover designated critical habitat, pallid sturgeon, rufa red knot, whooping crane, northern long-eared bat, and gray wolf.

Dakota skipper is not present within the affected environment of the No Action Alternative; therefore, this alternative will have no impact on the Dakota skipper.

The following environmental commitments were contained within the analysis for the CNDWSP EA and FONSI:

- Reclamation will require that Garrison Diversion incorporate into their construction plans, instructions to the contractor that in the event that any threatened or endangered species are encountered during activities, the contractor will contact Reclamation. Reclamation will consult with the USFWS to determine the appropriate steps to avoid any effects to these species, including cessation of construction.

- The 0.11 acres of trees identified in the CNDWSP EA and FONSI would be removed during the non-active time of year from November 1 to March 31

- Additionally, any new, above ground power lines and an additional equal length of existing power lines in the same vicinity must be marked with visibility enhancement devices to benefit migrating whooping cranes as well as all migratory birds and bats.

3.7.8.2 Alternative B – State RRVWSP

Garrison Diversion is planning to construct the State RRVWSP and is responsible for determining if they would have incidental take of a species under ESA regulations. According to Garrison Diversion 2017, the following land reclamation actions would be implemented as part of the State RRVWSP:

- Excavate and segregate soils into three categories; black topsoil, brown root growing zone, and gray no grow zone;

- Fill trench with appropriate soils for maximum growing conditions;

- Crop Damage Policy that works for the landowners;

- Investigate BMPs used by other water systems and industry leaders

3.7.8.3 Alternatives C, D, E (Preferred Alternative), and F

Due to the distance of the affected environment to the Missouri River where interior least tern, pallid sturgeon, and critical habitat (including alkali lakes) for piping plover are known to occur, in

addition to the absence of suitable habitat within the affected environment, the action alternatives C, D, E, and F would have no impact on the interior least tern, piping plover, or pallid sturgeon.

Wetlands and croplands providing potential habitat for whooping crane occur in the affected environment. Construction disturbances to wetlands and croplands for whooping crane would be temporary in duration and cease upon the completion of construction. Cropland would be re-planted, and wetlands reclaimed to pre-construction conditions upon completion of construction. Wetlands are also suitable habitat for rufa red knot. Observations of both rufa red knot and whooping crane are rare in North Dakota and generally occur for short periods (1-2 days) during spring and fall migration periods. No recorded observations of either species has occurred within the affected environment. The action alternatives C, D, E, and F would have no impact on the rufa red knot and whooping crane.

Northern long-eared bat may use suitable roosting trees within the affected environment. Reclamation could find no record of maternity roost trees or hibernacula identified within the affected environment. Any trees that cannot be avoided during construction of any action alternative would be removed during the non-active time of year from November 1 to March 31; therefore, action alternatives C, D, E, and F would have no impact on the northern long-eared bat.

Dakota skipper is known to be present in Wells County and sightings have been observed in Township 145 North, Range 75 and 76 West, where Alternatives D and F are proposed. According to National Land Class Database, action alternatives C, D, E, and F include herbaceous vegetation (grasslands) that may be suitable to Dakota skipper. Action alternatives C, D, E, and F may impact Dakota skipper; however, using the revegetation and reclamation techniques during and after construction described in Appendix D, no permanent impacts to native vegetation preferred by Dakota skipper would occur.

Environmental Commitments pertaining to Threatened and Endangered Species are also described in Chapter 2 and Appendix D.

3.8 Wetland and Riparian Areas

The affected environment (150-foot ROW, Biota WTP with 150-ft buffer, and intake facilities with a 150-ft buffer for each alternative) is located within the Prairie Pothole Region, which contains many small depressional wetlands that store surface water or groundwater, recharge groundwater with surface water, provide surface water from groundwater, and provide a source of atmospheric water (LaBaugh et al. 1998).

National Wetlands Inventory (NWI) (NWI, 2015) data created by the USFWS is intended to be reconnaissance level information on location, type, and size of wetland resources. According to the Services NWI data limitations, exclusions and precautions disclaimer: "A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis". No field wetland delineations or determinations have been conducted to date. According to the National Wetlands Inventory using the system described by Cowardin et al. (1979), two wetland classifications consisting of freshwater wetlands (palustrine [P]), and rivers and streams (riverine [R]) wetlands, occur within the 150-foot right-of-way. Some of the wetlands are classified as being partially

excavated, drained or ditched. The vegetation of the freshwater wetlands includes wetland grasses and forbs (persistent emergent vegetation [EM]), aquatic vegetation (aquatic bed [AB]), and trees (forested vegetation [FO]). The water regimes for the freshwater wetlands include the temporarily flooded water regime (A), seasonally flooded water regime (C), and semi-permanently flooded water regime (F). The differences between the water regimes are as described:

- Temporarily flooded wetlands receive most of their water from snowmelt and direct precipitation. These types of wetlands are typically farmed each year, since the water has evaporated by mid-summer.

- Seasonally flooded wetlands indicate they are wet most of the growing season and become dry towards the end of the season; however, the water table is often near the ground surface.

- Semi-permanently flooded wetlands indicate the surface water persists throughout the growing season in most years; however, the water table is often near the ground surface in dry years.

Two types of riverine wetlands occur within the action alternatives (R4SBC and R2UBGx). R2UBGx includes the Canal wetland that is contained within an excavated, low gradient, slow velocity channel with sand or mud bottom, and surface water is present throughout the year. R4SBC includes an intermittent streambed that is seasonally flooded. Please refer to Table 3.14 for a summary of wetland acreages by alternative.

Table 3-14: Summary of NWI Wetlands in the affected environment by Alternative

Alternative	Federal Features	NWI Wetlands in 150 ft-ROW (acres)	PEM	PAB	PFO	RIV
Alternative A	Pipeline	2	2	< 1		
	Intake	< 1				
	Total	**3**				
Alternative B	None	NA				
Alternative C	Pipeline	38	38	< 1	< 1	< 1
	Intake	2				2
	Connection	< 1	< 1			
	Biota WTP	3	3			
	Total	**43**	**41**	**< 1**	**< 1**	**3**
Alternative D	Pipeline	7	7			
	Intake	3	1			2
	Connection	2	2			
	Biota WTP	< 1	< 1			
	Total	**13**	**11**	**0**	**0**	**2**
Alternative E	Pipeline	62	62	< 1	< 1	< 1
	Intake	2				2
	Connection	< 1	< 1			
	Biota WTP	3	3			
	Total	**68**	**66**	**< 1**	**< 1**	**3**

Alternative	Federal Features	NWI Wetlands in 150 ft-ROW (acres)	PEM	PAB	PFO	RIV
Alternative F	Pipeline	26	26			< 1
	Intake	3	1			2
	Connection	2	2			
	Biota WTP	< 1	< 1			
	Total	**32**	**30**	**0**	**0**	**3**

3.8.1 Environmental Consequences

3.8.1.1 Alternative A – No Action Alternative

The No Action Alternative includes approximately three acres of wetlands. Environmental commitments described by the EA and FONSI for the CNDWSP included the avoidance of wetlands, either by boring underneath the wetlands, or rerouting around the wetlands. No permanent impacts on wetlands and riparian habitats would occur as a result of the No Action Alternative.

3.8.1.2 Alternative B – State RRVWSP

Alternative B would consist of the State RRVWSP, with no federal facilities constructed. It is reasonable to assume wetlands and riparian areas would be present within the 150-ft ROW for Alternative B; however, the wetland acreages were not calculated for this alternative because there is no federal nexus. The impacts that may occur to wetlands and riparian areas are unknown because environmental commitments or BMP's addressing wetland impacts have not been identified for the State RRVWSP. Garrison Diversion would be responsible for compliance with Corps permitting requirements in addition to any other state or federal agency consultations regarding stream and wetland crossings needed for the State RRVWSP.

3.8.1.3 Alternatives C, D, E (Preferred Alternative), and F

Temporary and permanent impacts on wetlands and riparian habitats have the potential to occur as a result of the construction of bulk distribution pipelines, a biota water treatment plant, and an intake on the Canal associated with each alternative C, D, E, and F. Wetland acreages and types differ for the action alternatives C (43 acres), D (13 acres), E (68 acres), and F (32 acres), which would change the amount and types of wetlands and riparian impacts potentially affected for each alternative. However, avoidance, minimization and mitigation strategies resulting from the BMPs and environmental commitments (Appendix D) and the Environmental Commitments section below) would be implemented for each alternative C, D, E, and F.

BMPs and environmental commitments are fully described in Chapter 2 and Appendix D. Wetland and riparian impacts would be avoided to the extent practical through on-site re-routing around wetland basins or boring underneath. In the event wetlands could not be avoided during construction of any of the action alternatives; construction BMPs, regulatory requirements, and mitigation commitments described in Chapter 2 and Appendix D would be followed.

Given the implementation of the best management practices and environmental commitments, no unavoidable adverse impacts would occur from construction of Project components related to the action alternatives C, D, E, and F.

3.9 Socioeconomics

3.9.1 Affected Environment

This analysis is based on the state and local perspectives. The state perspective includes all of North Dakota while the local perspective includes 9 North Dakota counties: Burleigh, Cass, Foster, Grand Forks, Griggs, McLean, Sheridan, Stutsman, and Wells County. Additional information supporting this section is provided in Appendix I, Socioeconomics.

3.9.1.1 Methodology

A regional impact analysis is used to evaluate the short-term effects from construction of the ENDAWS Project alternatives. The primary purpose of a regional impact analysis is to evaluate the effect of an alternative on income, employment, and the value of output produced in the study area. For this analysis, two different impact regions are identified, and the regional impacts are estimated for each region.

The regional economic impacts from each project proposal are analyzed using the IMPLAN (IMpact analysis for PLANing) model and estimated construction expenditures within the study region. Only expenditures that represent additional expenditures in the region, not including transfers of expenditures from one sector to another, are included in the estimation of regional impacts. The IMPLAN sectors used to estimate regional impacts were construction of other new nonresidential structures.

The regional impacts associated with each alternative are measured in terms of changes in employment, labor income, and value of output. Employment is measured in terms of total jobs, which includes full-time and part-time employment. Part-time employment could be temporary or longer-term jobs working fewer than 40 hours per week. Labor income is measured in terms of employee compensation. Industry output is a measure of the value of industry's total production and is comparable to Gross Regional Product.

The extent of the impact of each alternative on the regional and state economy is evaluated by comparing the change in the value of output to gross regional product and gross state product. The construction impacts are short-term effects that will occur only during the period of construction.

3.9.1.2 Existing Conditions

Demographics and Population

Population estimates for July 1, 2019 were obtained from the Bureau of the Census and population projections for 2010 to 2040 were obtained from the North Dakota Department of Commerce, for North Dakota Counties. Population projections for the Expected Migration Scenario and the 2019 Census estimates are shown in Table 3.15.

Table 3-15: North Dakota County and State level population projections.

Counties	2019	2020	2025	2030	2035	2040
Burleigh County	95,626	100,986	107,205	110,932	112,983	113,937
Cass County	181,923	188,810	203,784	214,719	222,826	228,895
Foster County	3,210	3,384	3,409	3,434	3,446	3,438
Grand Forks County	69,451	76,955	82,966	89,081	94,535	98,121
Griggs County	2,231	2,196	2,114	2,039	1,965	1,897
McLean County	9,450	10,332	10,870	11,275	11,519	11,673
Sheridan County	1,315	1,336	1,331	1,316	1,300	1,284
Stutsman County	20,704	21,207	21,314	21,379	21,352	21,232
Wells County	3,834	4,143	4,120	4,109	4,087	4,053
Regional Total	**387,744**	**409,349**	**437,113**	**458,284**	**474,013**	**484,530**
North Dakota	**762,062**	**824,344**	**884,874**	**931,506**	**966,375**	**991,522**

The current population of the economic impact region represents slightly over half of the total state population. Population projections indicate the study area will grow into the future. Using the population projection data from the North Dakota Department of Commerce, the average annual population growth from 2010 to 2040 is projected to be 1.195% percent for the 9-county region, compared to 1.302% for all of North Dakota. Although population growth for the study area is projected to be less than for all of North Dakota, there are some areas within the study area that are projected to grow faster than the State average. For example, Cass County, which includes Fargo, has a projected annual growth rate of about 1.424% from 2010 to 2040. The population of the economic impact region is projected to grow in the future but at a rate that is lower than the state as a whole.

Housing and Development
Based on 2018 data from the U.S. Census 5-year American Community Survey, households in the 9-county economic impact region represent a little over one-half (51.4%) of total households in North Dakota, but slightly less than one-half (48.6%) of total housing units in the State. This indicates a relative housing shortage in the region. As a result of the relative housing shortage, the 9-county region accounts for a little over 80% of the building permits issued in North Dakota in 2018.

The percentage of owner-occupied housing in the economic impact region is higher than the state average in all but two counties in the region. Cass County and Grand Forks County have a lower than average percentage of owner-occupied housing because they include the two largest public universities in the state, where a large percentage of the population would be renting. Housing and rental costs in the region are generally lower than the state average except for Burleigh, Cass and Grand Forks Counties which are the most populous counties in the state.

Employment and Income
Income, poverty, and unemployment data for the economic impact area indicates the area has relatively high unemployment. However, some counties in the region have relatively high income and low poverty while others have low income and high poverty.

County level unemployment data is from the Bureau of Labor Statistics Local Area Unemployment Median household income, per capita income, median value of owner-occupied housing, and median gross rent are from American Community Survey 2014 to 2018 5-year estimates. Unemployment is from January 2019 to February 2020 and the state level North Dakota data is for 2019 (U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics; 2020).

Two counties in the study area, Burleigh and McLean, have median household income that is greater than the average for all of North Dakota and two counties, Burleigh and Cass, have estimated per capita income that is greater than for all of North Dakota. Cass County, which includes Fargo, is the most populous county in North Dakota and Burleigh County, which includes Bismarck, is the second most populous. McLean County is much less populated but includes the town of Garrison. All of the other counties in the economic impact region have incomes lower than the state average.

Five counties in the economic impact region (Burleigh, Cass, Foster, Griggs, and McLean) have a poverty percentage less than the state average and all of the economic impact area counties have an unemployment rate higher than for all of North Dakota. Finally, all of the counties in the area have unemployment rates higher than the North Dakota average.

3.9.2 Environmental Consequences

3.9.2.1 Regional Economic Impacts
The short-term regional economic effects are as listed in Table 3.16. These effects are considered positive regional effects. These regional impacts are not comparable to economic benefits from a broad national perspective.

Table 3-16: Summary of Regional Economic Impacts by Alternative

Total Estimated Construction Costs	Estimated Costs or Expenditures	Total Economic Effect Employment (Jobs)	Total Economic Effect Labor Income	Total Economic Effect Output
Alternative A – No Action				
9-County Region	551,740,514	9,763	603,795,317	1,100,231,969
State	551,740,514	9,308	584,100,299	1,060,377,190
Alternative B – State Red River Valley Water Supply Project				
9-County Region	539,888,854	9,553	590,825,494	1,076,598,440
State	539,888,854	9,108	571,553,535	1,037,599,762
Alternative C – McClusky Canal Only North				
9-County Region	432,480,198	7,572	473,283,209	862,413,631
State	432,480,198	7,296	457,845,321	831,173,578
Alternative D – McClusky Canal Only South				
9-County Region	437,569,108	7,743	478,852,237	862,561,482
State	437,569,108	7,382	463,232,698	840,953,835
Alternative E – McClusky Canal and Missouri River North				
9-County Region	613,260,468	10,851	650,404,988,	1,222,909,601
State	613,260,468	10,346	649,228,422	1,178,610,951
Alternative F – McClusky Canal and Missouri River North				
9-County Region	592,725,281	10,488	648,646,857	1,181,960,152
State	592,725,281	10,000	627,488,839	1,139,144,855

A comparison of impacts for each alternative indicate the regional impacts from each alternative are of a very similar magnitude, with the value of output varying by about 42% from lowest to highest impact. The alternate with the smallest regional impact, and lowest cost, is Alternative C and the greatest regional impact are Alternatives E and F.

The regional economic impact results presented in Table 3.16 indicate the regional impacts for the smaller 9-county region are actually larger than the impacts for the entire state. This result can occur when the smaller subset region is surrounded by more rural regions. An evaluation of regional economic impacts for a large study area, such as an entire state, would be expected to have larger impacts than for a smaller area, such as a sub-set of counties within the state because larger geographies typically capture more production as local. However, in some cases the economy of a subset of the larger region may reflect greater indirect and induced impacts than that of the larger region.

In this situation there may be a small difference in production between the smaller geography and the larger one, but a significant increase in demand for the larger area. The supply relative to demand

is much higher in the smaller region than in the larger region. As a result, the larger region sees a much larger increase in demand for the products produced in the smaller geography but does not substantially increase the supply available to meet that demand. This result applies to labor income as well. The regional impacts for the 9-county region and the state-wide regional impacts can be assumed to be essentially the same.

According to the Bureau of Economic Analysis (BEA), the gross regional product of the 9-county region was about $25.6 billion and the gross state product of North Dakota was about $56.1 billion in 2018. The gross regional product of the 9-county economic impact region accounted for about 46% of total gross state product, indicating the region represents a significant part of the North Dakota economy.

The impacts on the value of regional output presented in Table 3.16 can be compared to gross regional and state impacts to evaluate the extent of regional impacts. The short-term impact ranged from 3.4% of the value of regional output for Alternative C to 4.8% of the value of output for Alternatives E and F for one year in the 9-county region. The range of impact at the state levels ranged from 1.5% to 2.1% of gross output for a single year.

3.9.2.2 Alternative A – No Action Alternative

Alternative A or the No Action Alternative is defined as the CNDWSP which includes an intake into the McClusky Canal and a six-mile pipeline from the Canal which terminates when it reaches the State RRVWSP main transmission pipeline.

Regional Economic Effects

The regional economic effects from construction of an intake and a six-mile pipeline connection are anticipated to be minor beneficial impacts on the regional and state economy in terms of employment, income, and value of output. These minor beneficial impacts are short-term, occurring only during the construction period and amount to less than 2% of North Dakota gross state output to about 4% of the gross regional product for one year in the 9-county region. The impacts of No Action are anticipated to be negligible over the long term.

Cumulative Effects

Under the No Action Alternative, the project would not contribute to the cumulative effects to socioeconomics expected from the past, present, and reasonably foreseeable future actions.

3.9.2.3 Alternative B – State RRVWSP

This alternative would be constructed by the State of North Dakota utilizing only the Missouri River as the sole source of water to provide 165 cfs for the RRWSP. Reclamation would not construct the CNDWSP or issue any contract for water use out of the McClusky Canal.

Regional Economic Effects

The regional economic effects from construction of the State RRVWSP are anticipated to be minor beneficial impacts on the regional and state economy in terms of employment, income, and value of output. These minor beneficial impacts are short-term, occurring only during the construction period and amount to less than 2% of North Dakota gross state output to about 4% of the gross regional product for one year in the 9-county region. The impacts of Alternative B are anticipated to be negligible over the long term.

Cumulative Effects
Under Alternative B, the project would not contribute to the cumulative effects to socioeconomics expected from the past, present, and reasonably foreseeable future actions.

3.9.2.4 Alternative C – McClusky Canal Only

This alternative would include the construction of features to provide 165 cfs from the McClusky Canal along a northern route to the main transmission pipeline of the State RRVWSP, including a Biota WTP. Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

Regional Economic Effects
The regional economic effects from facility construction and a Biota WTP are anticipated to be minor beneficial impacts on the regional and state economy in terms of employment, income, and value of output. These minor beneficial impacts are short-term, occurring only during the construction period and amount to about 1.5% of North Dakota gross state output to about 3.4% of the gross regional product for one year in the 9-county region. The impacts of Alternative C are anticipated to be negligible over the long term.

Cumulative Effects
Under Alternative C, the project would not contribute to the cumulative effects to socioeconomics expected from the past, present, and reasonably foreseeable future actions.

3.9.2.5 Alternative D – McClusky Canal Only South

This alternative would include the construction of features to provide 165 cfs from the McClusky Canal along a southern route to the main transmission pipeline of the State RRVWSP, including a Biota WTP. Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

Regional Economic Effects
The regional economic effects from facility construction and a Biota WTP are anticipated to be minor beneficial impacts on the regional and state economy in terms of employment, income, and value of output. These minor beneficial impacts are short-term, occurring only during the construction period and amount to about 1.5% of North Dakota gross state output to about 3.4% of the gross regional product for one year in the 9-county region. The impacts of Alternative D are anticipated to be negligible over the long term.

Cumulative Effects
Under Alternative D, the project would not contribute to the cumulative effects to socioeconomics expected from the past, present, and reasonably foreseeable future actions.

3.9.2.6 Alternative E (Preferred) – McClusky Canal and Missouri River North

This alternative would include the construction of features to provide up to 165 cfs from the McClusky Canal along a northern route to the main transmission pipeline of the State RRVWSP as Phase 1, and features required to provide up to 165 cfs from the Missouri River as Phase 2 for a maximum total combination of 165 cfs. This alternative would include the construction of a Biota WTP and Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

Regional Economic Effects
The regional economic effects from both Phases of the Project and construction of a Biota WTP are anticipated to be minor beneficial impacts slightly greater than Alternatives A, B, C, and D on the regional and state economy in terms of employment, income, and value of output. These minor beneficial impacts are short-term, occurring only during the construction period and amount to about 2.1% of North Dakota gross state output for a single year to about 4.8% of the gross regional product for one year in the 9-county region. The impacts of Alternative E are anticipated to be negligible over the long term.

Cumulative Effects
Under Alternative E, the project would not contribute to the cumulative effects to socioeconomics expected from the past, present, and reasonably foreseeable future actions.

3.9.2.7 Alternative F – McClusky Canal and Missouri River South
This alternative would include the construction of features to provide up to 165 cfs from the McClusky Canal along a southern route to the main transmission pipeline of the State RRVWSP as Phase 1, and features required to provide up to 165 cfs from the Missouri River as Phase 2 for a maximum total combination of 165 cfs. This alternative would include the construction of a Biota WTP and Reclamation would issue a repayment contract for water use out of the McClusky Canal and other permits to construct and maintain facilities on Reclamation's ROW.

Regional Economic Effects
The regional economic effects from both Phases of the Project and construction of a Biota WTP are anticipated to be minor beneficial impacts slightly greater than Alternatives A, B, C, and D on the regional and state economy in terms of employment, income, and value of output. These minor beneficial impacts are short-term, occurring only during the construction period and amount to about 1.3% of North Dakota gross state output for a single year to about 4.6% of the gross regional product for one year in the 9-county region. The impacts of Alternative F are anticipated to be negligible over the long term.

Cumulative Effects
Under Alternative F, the project would not contribute to the cumulative effects to socioeconomics expected from the past, present, and reasonably foreseeable future actions.

3.9.2.8 Comparative Analysis of Alternatives

Socioeconomic effects for the six alternatives are presented in Table 3.17.

Table 3-17: Summary of socioeconomic effects by alternative

Alternative	Effects
A - No Action	The No Action Alternative would have minor beneficial regional economic effects in the short term due to construction of the CNDWSP.
B, C, and D	Alternatives B, C, and D would have minor beneficial regional economic effects in the short term due to construction of project features. These effects would be very similar to No Action.
E and F	Alternatives E and F would have minor beneficial regional economic effects in the short term, but the effects will be slightly greater than the effects of No Action and Alternatives B, C, and D.

Chapter 4 Public Involvement, Consultation, and Coordination

4.1 Introduction

This chapter details the consultation and coordination among Reclamation and other Federal, State, and local agencies, Native American Indian tribes, and the public in preparing this EIS. The Notice of Intent to prepare this EIS was published in the *Federal Register* on November 13, 2019 (77 FR 175). Since then, Reclamation has solicited input from a broad range of constituencies as part of the ongoing public involvement process.

Reclamation sought comments and involvement during the planning and preparation of this EIS through the following actions, inviting input from the general public:

- Communication and consultation with a variety of Federal, State, and local agencies, Native American Indian tribes, and interest groups, including cooperating agencies
- The formal EIS scoping process
- ENDAWS EIS project website. The web address is: https://www.usbr.gov/gp/dkao/nepa/endaws/index.html. Material posted on the Project website includes information regarding the preparation of this EIS.

4.2 Public Outreach and Involvement

The public has specific opportunities to comment during three phases:

- Public scoping began with publication of a Notice of Intent to prepare the EIS in the *Federal Register* on November 13, 2019 and ended on December 13, 2019
- Public review of and comment on the Draft EIS
- Public review of the Final EIS

Reclamation held three public meetings during the scoping period. The purpose of the meetings was to provide the public with opportunities to become involved, to learn about the ENDAWS project and planning process, and to offer comments. The scoping notification process was used to solicit initial comments on the Project. Below is a list of the dates and locations of the scoping meetings held for the Project:

- October 22, 2019, Fargo, North Dakota
- October 23, 2019, Bismarck, North Dakota
- October 24, 2019, Jamestown, North Dakota

Each meeting consisted of an open house format where Reclamation staff were available to share information about the Project, background information, planned analyses, and the NEPA process. During each open house meeting, the public was invited to participate by sharing information, comments, concerns, and ideas relating to the proposed Project and the EIS.

Issues to be analyzed in the Draft EIS were identified by Reclamation, the cooperating agency meeting held January 30, 2020, and from twelve written comments submitted by agencies, tribes, organizations, and the public. Some issues identified in the letters are outside of the scope of this analysis. Comments were considered and incorporated into the document where applicable. A copy of letters received can be found in Appendix J.

Reclamation is releasing this Draft EIS to the public for review and comment. An electronic version of the Draft EIS, Appendices and Supporting Documents was posted on the ENDAWS EIS Project website and a letter notifying interested parties that it is available was distributed to agencies/person included in Appendix K.

4.3 Agency and Tribal Coordination

As discussed in Chapter 1, Reclamation invited several other federal and state agencies and tribes to participate as cooperating agencies. Governmental agencies invited to participate as members of this team were chosen because they have jurisdiction by law or have special expertise with respect to the Project. Reclamation has entered into Memoranda of Agreement with each Cooperating Agency to formalize roles and responsibilities. Reclamation convened this Cooperating Agency Team so they could provide data and contribute to the preparation of the EIS, including a review of preliminary draft chapters.

In 2019, Reclamation sent letters to Native American Indian tribes that could have an interest in the project. The letter invited the tribes to meet with Reclamation to discuss their interest in the project and any resources that could be affected by the project. Letters were sent to 29 tribes located in the Region or who have historically been affiliated within the project area. None of the tribes expressed an interest in being involved with the project as it progresses.

Reclamation will continue to involve the tribes and to coordinate and consult with them after a preferred alternative is identified in order to identify, document, and avoid effects to resources such as historic or traditional cultural properties.

4.4 Other Consultation and Coordination

Reclamation is coordinating and consulting with the USFWS to comply with Section 7 of the Endangered Species Act regarding the preferred alternative. Reclamation is preparing a biological

assessment and will collaborate with the USFWS to obtain their concurrence on the determinations of affect. It is anticipated this concurrence will be received prior to the distribution of the Final EIS. This information will be included as an appendix to the Final EIS. As discussed in Chapter 3, consultation will be ongoing with the NDSHPO and Tribes for the preferred alternative, prior to construction.

In compliance with the Dakota Water Resource Act of 2000, the Secretary of the Interior would consult with the Administrator of the Environmental Protection Agency and the Secretary of State to determine that adequate treatment to meet the requirements of the 1909 Boundary Waters Treaty is included in the preferred alternative. A Secretarial Determination identifying the adequate treatment level would be signed to document this consultation process.

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Chapter 5 List of Preparers

Reclamation, Missouri Basin Region, Dakotas Area Office (DKAO) in Bismarck, North Dakota, prepared this EIS. It had assistance from the following:

- Reclamation's Missouri Basin Regional Office in Billings, Montana
- Technical Service Center (TSC) in Denver, Colorado

The names of persons who prepared various sections, provided extensive background information, or participated to a significant degree in reviewing the present document are listed below.

Name	Position	Office	EIS Responsibility
Reclamation			
Damien Reinhart	Supervisory Natural Resource Specialist	DKAO	Team lead, general EIS documentation, introduction, public involvement, and compiling list of preparers
Kate Kenninger	Natural Resource Specialist	DKAO	Biological resources team member
Andrea Gue	Natural Resource Specialist	DKAO	Biological resources team lead, preparation of affected environment, environmental consequences, and mitigation
Alicia Waters	Program Analyst	DKAO	Preparation of affected environment, environmental consequences, technical editor
Dani Fettig	Civil Engineer	DKAO	Preparation of alternatives, appendices, and oversight of the draft appraisal-level design engineering and biota water treatment plant appraisal-level design report preparation

Name	Position	Office	EIS Responsibility
Nathan Kraft	Civil Engineer	DKAO	Preparation of affected environment and environmental consequences, and oversight of Missouri River depletions analysis with the Corps of Engineers
Matthew Cox	Area Archaeologist	DKAO	Lead for historic properties analysis in the affected environment and environmental consequences chapters, and Section 106 compliance
Steve Piper	Economist	Reclamation Technical Service Center	Socioeconomic analysis
Patience Hurley	Public Affairs Specialist	DKAO	Review for 508 compliance, news and media releases, public events coordinator
Buddy Fazio	Environmental Specialist	Missouri Basin Region	Reviewer
Sarah Denali	Natural Resource Specialist	Missouri Basin Region	Reviewer
Bryan Wilson	Solicitor	Missouri Basin Region	Reviewer

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Missouri River Mainstem HEC-ResSim Modeling	
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