RECLAMATION

Managing Water in the West

Northwest Area Water Supply Project Final Environmental Impact Statement on Water Treatment

U.S. Department of the Interior
Bureau of Reclamation
Great Plains Region
Dakotas Area Office

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List of Acronyms

ac-ft	acre feet
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CPI	Consumer Price Index
DAF	Dissolved Air Flotation
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERM	enteric redmouth disease
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FONSI	Finding of No Significant Impact
GARP	Genetic Algorithm for Rule-Set Production
IHNV	Infection hematopoietic necrosis virus
IMPLAN	IMpact analysis for PLANing
IPN	Infectious pancreatic necrosis virus
ITA	Indian trust assets
LT2	Long Term 2 Enhanced Surface Water Treatment Rule
mgd	million gallons per day
MR&I	municipal, rural and industrial
NDSDC	North Dakota State Data Center
NEPA	National Environmental Policy Act
NPDES	National Pollution Discharge Elimination System
NPDWR	National Primary Drinking Water Regulation
NTU	nephelometric turbidity units
OM&R	Operation, Maintenance and Replacement
Project	Northwest Area Water Supply Project
Reclamation	Bureau of Reclamation
SDWA	Safe Drinking Water Act
Service	U.S. Fish & Wildlife Service
SHPO	State Historic Preservation Officer
THPO	Tribal Historic Preservation Officer
USGS	U.S. Geological Survey
UV	Ultraviolet
WTP	Water Treatment Plant

Northwest Area Water Supply Project Final Environmental Impact Statement On Water Treatment

Divide, Williams, Burke, Renville, Bottineau, Pierce, McHenry, Ward, Mountrail and McLean Counties in North Dakota

Prepared by the U.S. Department of the Interior, Bureau of Reclamation

Cooperating Agencies:

- U.S. Army Corps of Engineers
- North Dakota State Water Commission
- Minot, North Dakota
- U.S. Environmental Protection Agency
- Garrison Diversion Conservancy District
- Three Affiliated Tribes

Abstract:

The Department of the Interior, Bureau of Reclamation proposes to construct a biota water treatment plant for the Northwest Area Water Supply Project (Project). The Project is a bulk water supply system that will serve the municipal and rural water needs of 10 counties within northwestern North Dakota. The source water for this system is Lake Sakakawea, a U.S. Army Corps of Engineers reservoir within the Missouri River basin. The majority of the communities and rural water systems to be served by the Project are located within the Hudson Bay basin. This interbasin transfer of water was a key issue evaluated in the planning and development of the Project. Reclamation completed a Final Environmental Assessment for the proposed Project in the spring of 2001 and based on the analyses completed, approved a Finding of No Significant Impact (FONSI) in September 2001. Project construction began in the spring of 2002. In the fall of 2002 the Province of Manitoba, Canada filed a lawsuit in U.S. District Court in the District of Columbia challenging the agency's issuance of a FONSI and requesting an injunction. The Court ordered Reclamation to revisit the FONSI upon completion of further environmental analyses to consider the potential impacts associated with not fully treating the Missouri River water at its source, and potential impacts that could occur due to pipeline leaks and possible failure of water treatment systems.

Reclamation proposes to construct a biota water treatment plant for the Project to fully treat the source water before it is delivered into the Hudson Bay drainage. Four treatment alternatives, including a no action alternative, have been evaluated to further reduce the risk of a Project-related biological invasion from the Missouri River basin to the Hudson Bay basin. Reclamation also contracted with the U.S. Geological Survey to evaluate the risk of transferring invasive species between these to basins including a failure analysis associated with the long-term operation and maintenance of Project facilities.

This Final Environmental Impact Statement (EIS) has been prepared pursuant to the National Environmental Policy Act to analyze and disclose the environmental impacts of the proposed action. This document responds to all substantive public comments on draft EIS. The preferred alternative was identified and the associated cost estimate provided.

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Introduction

Lake Sakakawea. (Photo courtesy of Garrison Diversion Conservancy District)

For many years, residents of northwestern North Dakota have experienced water supply problems. Existing ground water sources are of poor quality and the Souris River is a marginal source from both a quality and quantity standpoint. To resolve these problems the Northwest Area Water Supply project (Project) is being constructed. This Project is a bulk water supply system that will serve the municipal and rural water needs of the area (Figure 1.1). The planning, design and construction of the Project is a cooperative effort between the Bureau of Reclamation (Reclamation) and the state of North Dakota.

Reclamation provides technical and financial assistance to the state of North Dakota for the planning and development of municipal, rural and industrial (MR&I) projects throughout the state. The North Dakota State Water Commission is the sponsor of the Project, and has worked extensively with the communities and rural water systems involved to develop a plan that meets their water needs. Figure 1.1 identifies the communities and rural water systems that will be served, along with other geographic information about the Project service area.

The source water for this bulk water supply system is Lake Sakakawea, a U.S. Army Corps of Engineers (Corps) reservoir impounded by the Garrison Dam on the Missouri River. The Project has been issued a water permit by the North Dakota State Engineer with an authorized annual withdrawal of 15,000 acre feet (ac-ft). Water from Lake Sakakawea will be pumped 45 miles north to the city of Minot which will serve as the distribution point for city residents, as well as distributing water to other communities and rural water systems throughout the service area. Lake Sakakawea is located within the Missouri River drainage, while the majority of the communities and rural water systems to be served by the Project are located within the Hudson Bay drainage. Figure 1.2 shows the Missouri River drainage and the Hudson Bay drainage along with the location of the Project service area. This interbasin transfer of water was a key issue evaluated in the planning and development of the Project.

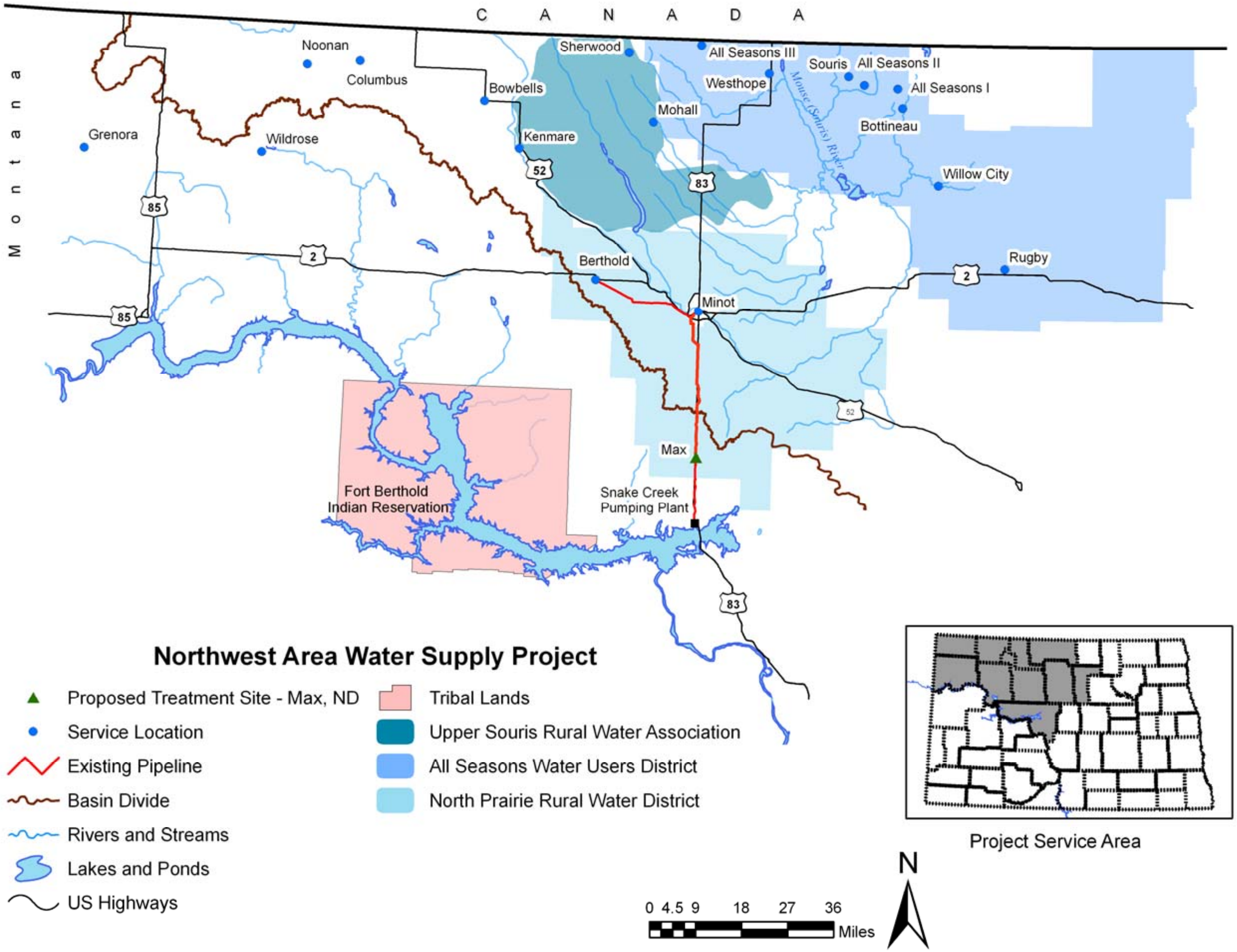

Figure 1.1 – Northwest Area Water Supply Project Service Area.

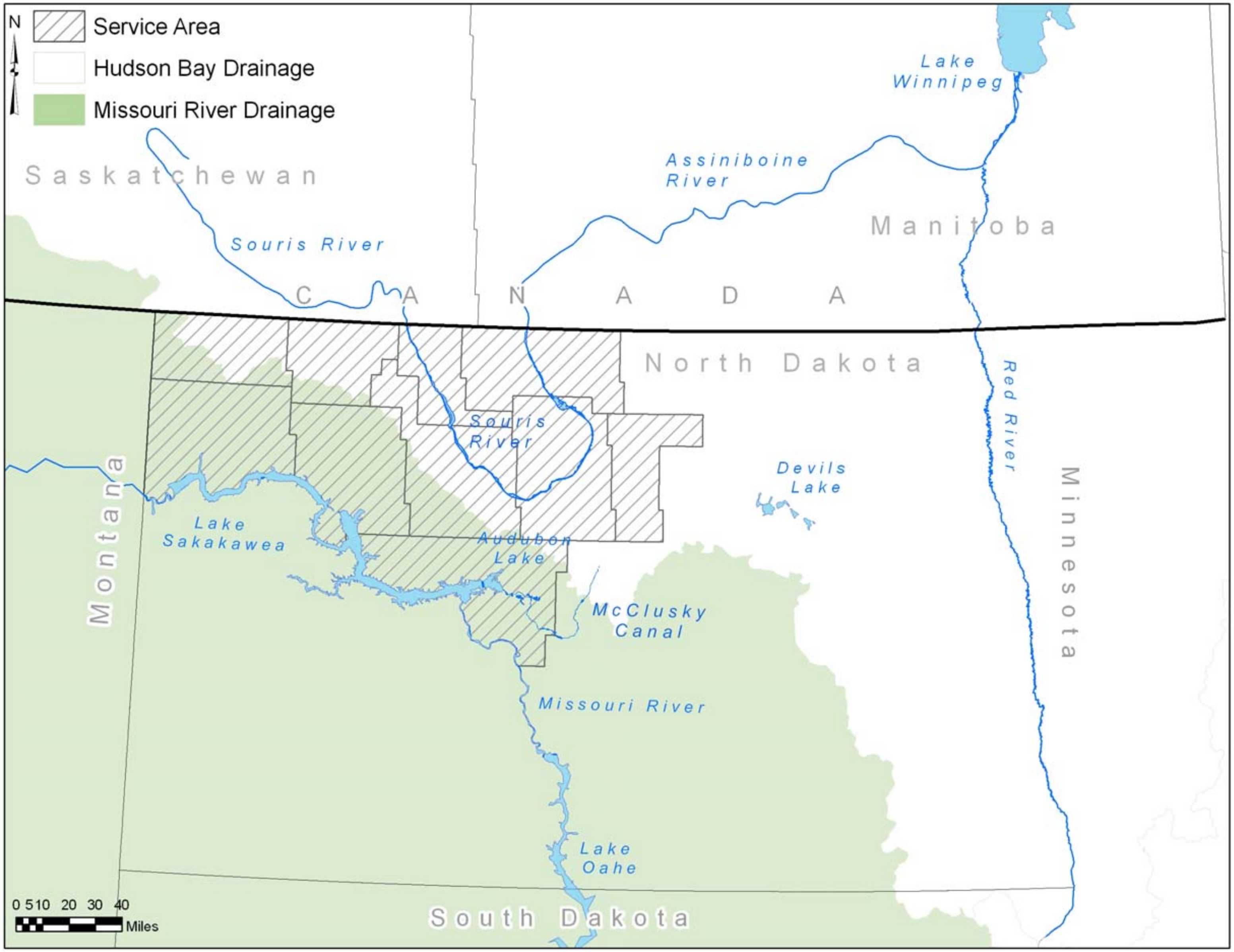

Figure 1.2 – Project Service Area in relation to the Missouri River Drainage and the Hudson Bay Drainage.

During planning of the Project, environmental issues associated with the construction, operation and maintenance of the Project were evaluated as required by the National Environmental Policy Act (NEPA). The Final Environmental Assessment[1] (EA) evaluated options to meet the need of the Project, described the potential impacts and identified environmental commitments to avoid, minimize or mitigate for the potential impacts of the Project. Based on the Final EA, Reclamation decided to proceed with the proposed project and approved a Finding of No Significant Impact[2] (FONSI) in September 2001 that established environmental commitments to avoid, minimize or mitigate potential impacts resulting from the Project.

Project construction began with a groundbreaking ceremony in April 2002. Shortly thereafter, the State Water Commission issued the first construction contract for 7.5 miles of the main water transmission pipeline between Lake Sakakawea and Minot. In October 2002, the Province of Manitoba, Canada filed a lawsuit against the Department of the Interior in U.S. District Court in Washington D.C. (*Government of the Province of Manitoba vs. Gale A. Norton, Secretary, U.S. Department of the Interior, et al*.). The Province challenged the FONSI issued for the Project and requested an injunction. An injunction would prohibit the authorization or expenditure of federal funds on the Project and stop construction activities.

Groundbreaking ceremony for the Project, April 2002.

On February 3, 2005 the Court ordered Reclamation to revisit the FONSI upon completion of further environmental analyses. The order stated that additional analyses should consider potential impacts associated with not fully treating the Missouri River water at its source, and potential impacts that could occur due to pipeline leaks and possible failure of water treatment systems. A second ruling from the Court on April 15, 2005 denied the request for an injunction. This allowed construction to continue under existing contracts, but required Reclamation to request permission from the Court for the design and construction of other Project features until additional environmental analyses are complete. Based on this direction from the Court, construction of the 45 miles of main water transmission pipeline between Lake Sakakawea and the city of Minot continued and was completed in 2008.

Reclamation issued a Notice of Intent in the *Federal Register* (Volume 71, Number 43:11226-11227) on March 6, 2006. The notice announced Reclamation's intent to prepare an Environmental Impact Statement (EIS) to address issues identified in the Court order and evaluate water treatment alternatives that would further reduce the risk of transferring invasive species[3] from the Missouri River drainage to the Hudson Bay drainage through the construction and operation of the Project.

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[1] **Environmental Assessment –** A document that describes the purpose and need for a proposed federal action and evaluates the possibility of significant impacts associated with the proposed action.

[2] **Finding of No Significant Impact**: A document prepared by the federal agency that provides the reasons why an action will not significantly affect the human environment and for which an Environmental Impact Statement will not be prepared.

[3] **Invasive species** – a nonindigenous species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

On December 21, 2007, Reclamation issued a Notice of Availability in the *Federal Register* (Volume 72, Number 245: 72756-72575) announcing the release of the Draft EIS (DEIS) for public review. The Notice of Availability included information about public hearings that were held and notified the public of the 60-day comment period. Upon a request from Manitoba Water Stewardship, Reclamation extended the public comment period for an additional 30 days. The public was notified of this extension through the publication of another notice in the *Federal Register* (Volume 73, Number 40:10806-10807). This EIS fulfills the Court's order for an integrated analysis of pipeline leakage and potential consequences of the failure to fully treat the Missouri River water prior to crossing the basin divide into the Hudson Bay drainage.

Pursuant to Section 102 (2)(c) of NEPA, Reclamation is the lead federal agency responsible for the preparation of the EIS. Reclamation's Regional Director of the Great Plains Region is the responsible official for the EIS, acting under the authority of the Secretary of the Interior.

This chapter provides background information about the Project, describes the proposed action and establishes the purpose and need for the EIS. Chapter two identifies the biota water treatment alternatives evaluated, provides cost estimates for each alternative, summarizes the environmental impacts, and identifies the preferred alternative. Chapter three describes the environment of the area affected by the alternatives. Impacts of the proposed alternatives are described in chapter four. Chapter five summarizes the consultation and coordination activities conducted in the process of preparing the EIS, as well as the applicable laws, regulation and executive orders that have been considered.

Proposed Action

Reclamation proposes to construct a biota water treatment plant (WTP) for the Project to treat the source water from Lake Sakakawea before it is delivered into the Hudson Bay drainage. Four treatment alternatives, a no action alternative and three action alternatives, have been developed to further reduce the risk of a Project-related biological invasion from the Missouri River basin to the Hudson Bay basin. As a part of this proposed action, Reclamation would implement construction methods and operational measures to further reduce the risk of a biological invasion that may occur as a result of an interruption in the treatment process and breach in the buried pipeline to the Minot WTP.

This Final EIS (FEIS) analyzes and discloses the environmental impacts of the proposed action. This document is being distributed to the public for 30 days prior to a decision being made by Reclamation regarding the proposed biota treatment process for the Project. The FEIS has been prepared in compliance with the NEPA. This FEIS responds to substantive comments related to environmental issues received on the DEIS with revisions to text, appendices and responses to comments in Appendix C.

Purpose and Need

The purpose of the proposed action is to adequately treat Project water from the Missouri River basin (Lake Sakakawea) to further reduce the risk of a Project-related biological invasion into the

Hudson Bay basin. Previous environmental analyses have shown that the risk of this Project transferring invasive species between these two drainage basins is very low (Reclamation 2001). The need for the proposed action is to comply with the Court's order of February 3, 2005. Reclamation has conducted additional analyses to address the Court's order regarding fully treating the water at its source, the potential for pipeline leaks, and failure of water treatment systems. Reclamation has evaluated a full range of treatment technologies to further reduce the risk of a Project-related biological invasion from the Missouri River basin to the Hudson Bay basin.

Project Authorization

The Garrison Diversion Unit MR&I water supply grant program was authorized by the U.S. Congress on May 12, 1986, through the Garrison Diversion Unit Reformulation Act. This act authorized the appropriation of $200 million of Federal funds for the planning and construction of water supply projects throughout North Dakota. This Project is being developed as a result of this authorization. The State MR&I program was established to treat and deliver drinking water to approximately 130 communities and rural residents throughout the State. Federal funds provided through this program are cost-shared with state and local funds at a ratio of 75% federal funds and 25% matching funds. The act also set aside $20.5 million for the planning and construction of water supply projects for the Standing Rock, Fort Berthold and Spirit Lake Indian reservations. The Dakota Water Resources Act of 2000 authorized an additional $200 million for the state MR&I grant program and $200 million for the tribal MR&I program including the Turtle Mountain Indian reservation and the Trenton Indian Service Area.

Each act includes language on compliance with the Boundary Waters Treaty established between the U.S. and Canada. Section 1(h) of the Dakota Water Resources Act states that "Prior to the construction of any water systems authorized under this Act to deliver Missouri River water into the Hudson Bay basin, the Secretary, in consultation with the Secretary of State and the Administrator of the Environmental Protection Agency, must determine that adequate treatment can be provided to meet the requirements of the Treaty…". It goes on to state that all costs (construction, operation, maintenance and replacement) of water treatment and related facilities attributable to meeting the requirements of the treaty are non-reimbursable. This means that all costs associated with compliance with the Boundary Waters Treaty would be funded by the federal government.

Project Background and History

Project planning was initiated by the State Water Commission in November 1987. An advisory committee was established in 1991 to assist the State Water Commission in developing the Project. Members of this committee represent the communities and rural water users within the Project service area. Over the next several years, community and rural water system needs were identified and alternatives to meet these needs were evaluated. Project alternatives and the associated environmental impacts were presented to the public for review and comment in the *Northwest Area Water Supply Draft Environmental Assessment* (Houston Engineering, Inc., et al. 1997). In response to comments received on the draft EA, additional analyses were conducted and the results were included in the Final EA (Houston Engineering, Inc., et al. 2001). Based on the Final EA, Reclamation decided to proceed with the Project and approved a FONSI (Reclamation 2001).

Construction of the Project began in April 2002 and the Impact Mitigation Assessment team was established. As described in the FONSI, the purpose of the Impact Mitigation Assessment team is to monitor the final design, construction, mitigation and operation of the Project. To date, each of the construction contracts awarded for the Project have been reviewed by this team and environmental impacts have been avoided or mitigated as required by the environmental commitments outlined in the FONSI.

In October 2002, the Province of Manitoba filed a lawsuit in U.S. District Court in Washington, D.C. While the legal challenge was being considered by the Court, construction continued on the main water transmission pipeline between Lake Sakakawea and Minot, North Dakota. In 2005, the Court ordered that further environmental analyses should be conducted and that construction could proceed on Project features that would not preclude a future decision on water treatment. The main transmission pipeline between Lake Sakakawea and Minot was completed in 2008 (see Fig. 1.1).

Project construction of main water transmission pipeline between Lake Sakakawea and Minot in 2002. (Photo courtesy of North Dakota State Water Commission)

In February 2006, Reclamation submitted a motion to the Court requesting approval to design and construct three additional project features in and around the Minot area. The Court approved this request and the North Dakota State Water Commission began construction of two of the features in the spring of 2007. Construction of the third feature began in February 2008.

In March 2008, a motion was submitted to the Court requesting approval for the design and construction of the five remaining segments of the northern portion of the distribution system. This motion was granted by the Court on March 17, 2008.

Cooperating Agencies

Reclamation invited other government agencies and entities to assist with the preparation of the EIS. A cooperating agency team was established to provide data, assist in review and contribute to the preparation of the EIS by reviewing preliminary chapters of the EIS. 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 environmental issues of the proposed Federal Action.

Table 1.1 identifies the Federal, state, tribal and local governmental agencies participating as members of this team. An invitation to participate as a member of this team was also extended to the Standing Rock Sioux Tribe; however no response to the invitation was received. The

U.S. Fish and Wildlife Service (Service) was also invited to participate, but declined. However, they continue to be actively involved with the Project as a member of the Impact Mitigation Assessment team. At the request of the Governor of North Dakota, the North Dakota State Water Commission is responsible for coordinating the resources for the state; including information and comments from the Department of Health and the Game and Fish Department because these state agencies were invited to participate on the cooperating agency team as well.

Table 1.1 – EIS Cooperating Agencies

* U.S. Army Corps of Engineers
* U.S. Environmental Protection Agency
* North Dakota State Water Commission
* Three Affiliated Tribes
* City of Minot
* Garrison Diversion Conservancy District

Scope of the EIS

The scope of the EIS focuses on the resources potentially affected by the proposed action. The Council on Environmental Quality regulations for implementing NEPA define the scope of an EIS as consisting of the range of actions, alternatives, and potential impacts to be considered.

The EIS considers actions that may be connected, cumulative, or similar. Connected actions are those that automatically trigger other actions that cannot, or will not, proceed unless other actions are taken previously or simultaneously. These actions could be interdependent parts of a larger action and depend on the larger action for their justification. Cumulative actions are "other past, present, and reasonable foreseeable future actions regardless of what agency (Federal of non-Federal) or person undertakes such other actions" (40 CFR Section 1508.7). Similar actions, when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography.

Reclamation was directed by the U.S. District Court (*Government of the Province of Manitoba vs. Gale A. Norton, Secretary, U.S. Department of the Interior, et al*.) to consider "an integrated analysis of the possibility of leakage and the potential consequences of the failure to fully treat the Missouri River water at its source given the agency's awareness of treatment-resistant biota". Reclamation determined that an EIS was appropriate for this action; to take a hard look at the concerns raised by the Court and to assure maximum public involvement in an issue that has high public interest.

This EIS focuses on evaluating environmental impacts associated with the proposed biota water treatment alternatives and potential interruption of the treatment process of each alternative.

Therefore, the scope of this EIS focuses on evaluating environmental impacts associated with the proposed biota water treatment alternatives in the event of an interruption in the treatment process for each alternative. To further reduce the risk of a Project-related biological invasion from the Missouri River basin to the Hudson Bay basin, Reclamation evaluated a range of biota water treatment technologies. Environmental impacts associated with the construction of biota WTP, as well as environmental impacts associated with an interruption in the biota water treatment process or infrastructure are evaluated. Reclamation enlisted the services of the Department of the Interior's lead scientific agency, the U.S. Geological Survey (USGS) to evaluate the risk of transferring invasive species between these basins including a failure analysis associated with the long-term operation and maintenance of Project facilities.

As stated previously, a Final EA has been completed for the Project. Environmental analyses conducted for the Final EA evaluated many resource areas and the results of these investigations showed no significant impacts to those resources. Based on these analyses, a FONSI (Reclamation 2001) was approved that determined there were no significant impacts and that an EIS did not need to be prepared. The FONSI summarized the potential impacts and identified environmental commitments to avoid, minimize or mitigate the impacts. A summary of the resource areas evaluated in the Final EA is provided in chapter three. Chapter four summarizes the potential impacts and environmental commitments identified for these resource areas in the FONSI.

Findings and environmental commitments in the Final EA and FONSI (Reclamation 2001) are incorporated by reference into this EIS, with the exception of the potential impacts and environmental commitments associated with the treatment of Missouri River (Lake Sakakawea) water and operation and maintenance of a biota WTP and related features. The design features and operational measures described in the Interbasin Biota section of the FONSI will be reviewed and revised as necessary in accordance with the alternative selected in the Record of Decision on the basis of information presented in this EIS.

Actions and Issues Addressed in the EIS

Statements and concerns regarding a variety of environmental issues were received during the public scoping for the DEIS. Reclamation considered the comments and determined that the following issues and actions are most relevant to the proposed action and would be evaluated in the EIS.

- Risk of Transferring Invasive Species
- Federally Listed Threatened and Endangered Species
- Historic Properties
- Social and Economic Conditions
- Indian Trust Assets
- Environmental Justice

Actions and Issues Outside the Scope of the EIS

Comments received during the public scoping of the EIS process included statements and concerns regarding a variety of issues. Reclamation considered the comments and determined that the following issues and actions are outside the scope of analysis for the EIS.

Evaluation of Potential Consequences to Canada

Comments suggested Reclamation should take a hard look at consequences (environmental, social, and economic) in Canada in the event of a transfer of invasive species as a result of this Project. The statutory provisions of NEPA (and the Council on Environmental Quality's regulations implementing NEPA) do not require assessment of environmental impacts within the territory of a foreign country; therefore this type of evaluation is considered outside the scope of the EIS. A recent ruling of the United States District Court, District of Nevada upholds this NEPA provision (*Consejo de Desarrollo Economico de Mexicali, AC; Citizens United for Resources and the Environment; and Desert Citizens Against Pollution vs. United States of America, Department of the Interior* 2:05-CV-0870-PMP).

Missouri River Water Depletions

Comments reflected the concerns of many who wonder how water withdrawals for this Project will impact the water level of Lake Sakakawea, as well as lower reaches of the Missouri River system. A concern was raised about cumulative impacts that could occur as a result of constructing multiple rural water projects that withdraw water from the Missouri River system, as well as expected increases in other diversions from the Missouri River. The effects of Project withdrawals from the Missouri River were evaluated in the Final EA which determined that "…the incremental effect of the NAWS withdrawal, when added to other past, present and reasonably foreseeable future withdrawals from the Missouri River system, will not be measurable at or below Lake Sakakawea" (Houston Engineering Inc. et al 2001:114). Therefore, further evaluation of this issue is not warranted.

Other Water Sources

Comments suggested that other sources of water, such as in-basin ground water sources or Devils Lake, be considered for the Project rather than the Missouri River. Other surface water and ground water sources were evaluated in the Final EA which documents the water quantity and/or water quality issues associated with these other sources. The Missouri River was identified as the most reliable supply of water for the majority of the Project service area; however a few communities would be better served by maintaining their current ground water source and updating their water treatment process. The FONSI states that "using groundwater and pre-treated Missouri River water would conserve groundwater resources and make maximum use of Missouri River water" (Reclamation 2001:6).

Global Climate Change

During public scoping, the question was asked whether the effects of global climate change on the Missouri River system would be evaluated in the EIS. Existing literature and science on climate change indicate that air temperatures are very likely to rise this century in the Project area. Changes in precipitation, annual streamflow, and drought frequency and intensity are very uncertain. Because of these uncertainties, changes in water demand, surface water hydrology, and ground water attributable to climate change cannot be accurately estimated. Furthermore, climate change would occur independently of the proposed action, and even during a severe drought, Project water demands would constitute a small fraction of the water available in Lake Sakakawea. For these reasons, an evaluation of global climate change is outside the scope of this EIS.

Alternatives

Reclamation considered reasonable alternatives to the proposed action that meet the purpose and need. Reclamation also considered a No Action Alternative, as required by NEPA implementing regulations. Chapter two provides detailed information on the range of water treatment technologies evaluated and chapter four describes the environmental consequences of each alternative and associated mitigation measures.

Purpose of the FEIS

Reclamation has prepared this FEIS to provide decision makers and the public with Reclamation's final analysis of the environmental effects of the alternatives and the proposed action. The FEIS includes responses to substantive comments received on the DEIS. Comments were received from reviewing tribes, state and federal agencies, organizations and interested and potentially affected members of the public. Revisions to the DEIS have been incorporated based on the comments received. However, the revisions do not substantively change the impact analysis or results presented in the DEIS. There are seven primary changes from the DEIS:

1) Information presented in chapter two describes how waste streams from the Minot WTP would be handled.
2) The cost estimate for the No Action Alternative was revised based on updated information provided in a comment letter.
3) Cost estimates for each alternative evaluated were indexed to 2008 dollar values.
4) The Preferred Alternative was identified and the associated cost estimate provided.
5) Additional information in chapters three and four discusses the potential impacts to waters in the United States portion of the Hudson Bay basin.
6) Additional information included in chapter four describes the potential impacts associated with biological invasions. However, these are not necessarily Project-related impacts since numerous competing non-Project pathways could produce the same impact.
7) Appendix C contains responses to the comments received on the DEIS.

Environmental Impacts

The potential impacts considered are direct, indirect, and cumulative effects that may result from the proposed action and alternatives. Potential environmental impacts associated with the possible transfer of invasive species between the Missouri River drainage and the Hudson Bay drainage are evaluated in chapter four. Social and economic impacts associated with increasing the level of water treatment were evaluated along with potential impacts associated with providing water treatment at another location in addition to or instead of at the existing Minot WTP. These and other environmental impacts of the proposed alternatives are evaluated in chapter four.

Concerns and Issues

Reclamation identified issues to be analyzed in the EIS and comments submitted by other Federal and state agencies, Tribes, organizations, international governments and members of the public offered additional issues. During the 60-day public scoping period, written comments were received along with verbal and written input provided by people who attended the public meetings. Reclamation hosted meetings in Bismarck, Fort Yates, Minot, New Town, Bottineau and Mohall, North Dakota during April and May, 2006.

A report titled, *Summary of Public Scoping* (Reclamation 2006) summarizes the comments received. Comments were received on the scope of actions, alternatives and impacts to be studied in the EIS process. This summary report was posted on Reclamation's Dakotas Area Office website (www.usbr.gov/gp/dkao). A letter was sent to individuals and organizations on the mailing list notifying them that report was available. Copies of the summary were also provided in electronic and paper form as requested.

The DEIS was released to the public for review on December 21, 2007. The public comment period concluded on March 26, 2008. During this public comment period Reclamation hosted public hearings which were held in February 2008 in Bismarck, Minot and New Town, North Dakota. Verbal testimony and written statements presented at the hearings are included in Appendix C along with the other comment letters and e-mails received.

What is Next?

In accordance with the NEPA, there will be a minimum 30-day period between the availability of the FEIS and the issuance of a Record of Decision. Comments on the FEIS may be offered to Reclamation for consideration. Upon completion of the FEIS and consultation with the Administrator of the Environmental Protection Agency (EPA) and the Secretary of State, Reclamation's Great Plains Regional Director will proceed in making a final decision for the Project. This decision will be documented in a Record of Decision. The intent is to meet the purpose and need of the proposed action and comply with the provisions of the Dakota Water Resources Act relative to the Boundary Waters Treaty of 1909. The NEPA process will be complete with the approval of a Record of Decision.

Record of Decision

It is important for the reader to understand that a final decision regarding the proposed action has not been made at the time of publication of the FEIS. The identification of the preferred alternative does not indicate that a final decision has been made with respect to the proposed action. The final decision by the Reclamation's Great Plains Regional Director will be included in the Record of Decision.

No sooner than 30 days after the EPA has published the notice of availability for the FEIS, Reclamation will issue a Record of Decision. In addition to the final decision, the Record of Decision will also include the significant comments received and issues raised in the FEIS. The selected alternative and the alternatives considered in the FEIS will be discussed. Alternative(s) considered environmentally preferable will also be identified. Factors considered with respect to the alternatives and how these considerations entered into the decision will be discussed. Reclamation will identify all environmental commitments, means to avoid or minimize environmental harm, and any monitoring or enforcement activities to ensure that environmental commitments will be met.

Chapter Two
Alternatives

Introduction

This chapter describes a full range of reasonable treatment alternatives developed to meet the purpose and need for the proposed action as identified in chapter one. These alternatives were evaluated on the basis of technical and economic considerations such as treatment efficiency and cost.

Interior Photo of a Conventional Treatment Plant

The alternatives evaluated in the EIS include the No Action Alternative and three action alternatives. A no action alternative is required in an EIS [40 CFR Section 1502.14(d)] and is the basis to which all other alternatives are compared. All of the alternatives propose some level of treatment to further reduce the risk a Project-related biological invasion in the Hudson Bay basin.

The No Action Alternative includes the preferred treatment process disclosed in the Final EA (Houston Engineering Inc. et al. 2001) and FONSI (Reclamation 2001) prepared for the Project in 2001. This alternative and the three additional biota treatment alternatives were selected to represent a full range of treatment processes capable of reducing the potential risk of a Project-related biological invasion.

Treatment alternatives evaluated in detail in the EIS are:

- **No Action –** The preferred treatment alternative identified in the Final EA (Houston Engineering Inc. et al. 2001) and selected in the FONSI (Reclamation 2001) would include chemical disinfection of raw Missouri River water prior to being delivered into the Hudson Bay basin. Additional safeguards, including isolation valves and corrosion control measures, were included in the construction of the buried pipeline to ensure a reduced risk of a biological invasion due to pipe breach. Ultraviolet (UV) disinfection along with softening and filtration would be provided at the existing Minot WTP.

- **Basic Treatment –** This treatment alternative would include a pre-treatment (coagulation, flocculation, sedimentation) process followed by chemical and UV disinfection prior to the water crossing the drainage divide. The purpose of the pre-treatment process is to reduce raw water turbidity which can influence the effectiveness of the disinfection processes. Softening and filtration would be provided at the existing Minot WTP.

- **Conventional Treatment –**This treatment process would include a pre-treatment process of dissolved air flotation (DAF) followed by media filtration and disinfection using UV and chemicals (chlorine and chloramines) within the Missouri River basin. Softening and filtration would be provided at the existing Minot WTP.

- **Microfiltration -** This treatment alternative would include pre-treatment (coagulation, pin floc) followed by membrane filtration and chemical and UV disinfection processes prior to the water crossing the drainage divide. Softening and filtration would be provided at the existing Minot WTP.

Project Features Common to All Alternatives

Each of the alternatives evaluated in this EIS, including the No Action Alternative, have three Project features in common. These common features include 1) the proposed location of the biota WTP, 2) the use of the Minot WTP, and 3) an inlet structure to the biota WTP and a booster pump station to pump water from the biota WTP to the Minot WTP. Each of these three features is described in more detail on the following pages.

1. Proposed Biota Water Treatment Plant Location

Each of the alternatives included in this EIS would include a biota WTP designed to further reduce the risk of a Project-related biological invasion in the Hudson Bay basin. The location of this biota WTP would be near Max, North Dakota in a portion of SW ¼, south of the railroad tracks of Section 10, T150N, R83W. This site is approximately 41 acres in size (figure 2.1). This site was chosen and purchased by the state of North Dakota as part of the Project. It was selected based on the availability of power, pipeline hydraulics, and accessibility. The site is located within the Missouri River basin; before the water crosses the hydrologic/topographic divide (drainage divide) between the Missouri River and Hudson Bay basins. Construction of the water pipeline between Lake Sakakawea and the Minot WTP is substantially complete, with the exception of the small pipeline segment that would connect to a biota WTP at this site. Figure 2.1 shows the proposed location of the biota WTP and the portions of the water pipeline already constructed.

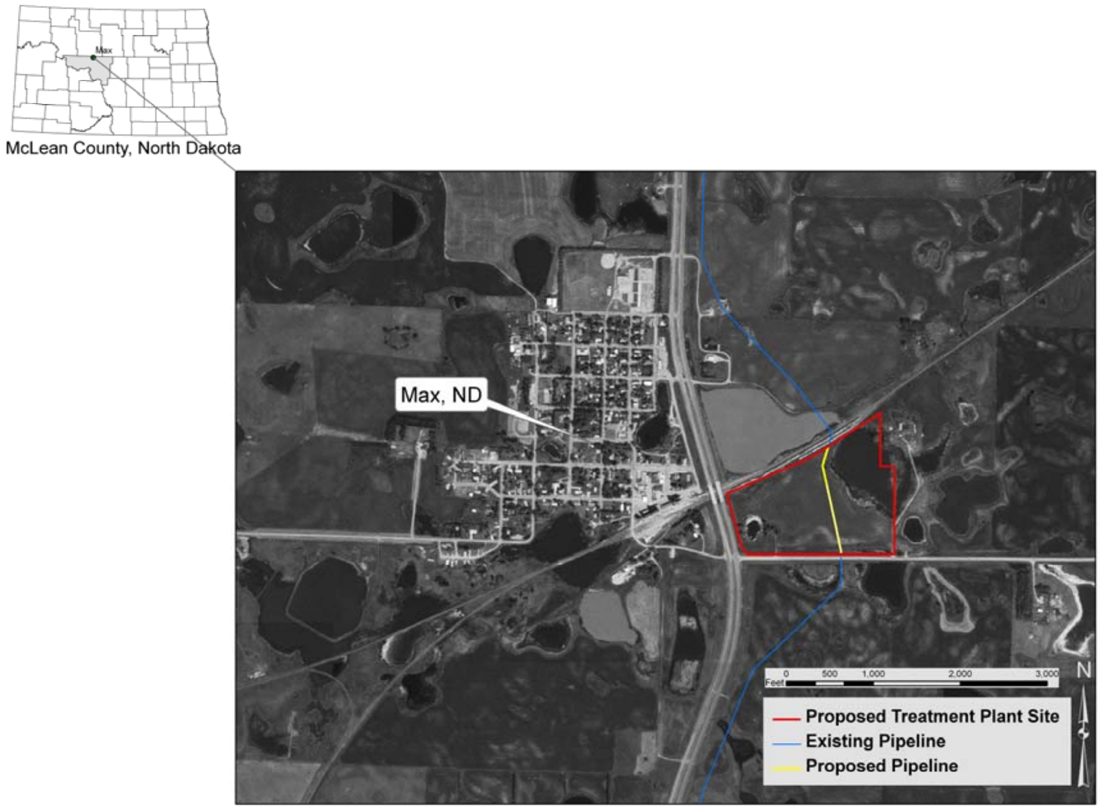


Figure 2.1 - Proposed Biota Water Treatment Plant Site near Max, ND.

2. Proposed Upgrade of the Minot Water Treatment Plant

Description of Existing Minot WTP

The current Minot WTP was constructed in 1952 and expanded in capacity in 1962. Though the plant was theoretically designed for a capacity of 18 million gallons per day (mgd), containing two identical treatment trains, the actual capacity is approximately 14 mgd due to hydraulic limitations.

In the past the city of Minot has utilized surface water from the Souris River and ground water from the Sundre and Minot Aquifers as water sources. Since 2000, the WTP has used ground water exclusively. The use of ground water is due to two main factors: 1) decreased flows in the Souris River make it a less reliable water supply and 2) there is more consistent water chemistry in the ground water, increasing its treatability. Although the city has not been utilizing their surface water source for several years, the WTP has the capability to treat surface water.

Proposed Improvements to the Minot WTP

As determined in the Final EA and FONSI, the water need for the Project is 26 mgd. Therefore, the Minot WTP would be expanded to a capacity of 26 mgd and a number of process improvements would be undertaken. The WTP expansion/improvements are planned in three construction phases as described in the *Northwest Area Water Supply Project - Minot Water*

Treatment Plant Improvements Project report (Houston Engineering, Inc. 2007). Costs for each of the phases are described below.

Phase 1, 2 and 3 improvements (totaling $31.1 million) to the Minot WTP would meet capacity requirements for the Project and Safe Drinking Water Act (SDWA) treatment requirements into the foreseeable future. The Minot WTP, along with the proposed upgrades, is included in all of the alternatives considered. The only possible change would relate to the use of UV disinfection at the Minot WTP. Three of the treatment alternatives, discussed later in this chapter, include the UV disinfection process at the proposed biota WTP which is within the Missouri River basin. It is proposed that duplicative processes at the Minot WTP would be eliminated if one of these alternatives was selected. The functionality of the Minot WTP, as it relates to the treatment alternatives proposed for the biota WTP, are discussed in each of the alternative descriptions provided in this chapter. In some alternatives the Minot WTP would be needed to meet SDWA primary treatment goals while in other alternatives it would provide additional aesthetic treatment in the form of softening. The Minot WTP treatment processes is shown in figure 2.2 which includes lime softening, filtration, UV disinfection and chlorine/chloramines (as discussed above).

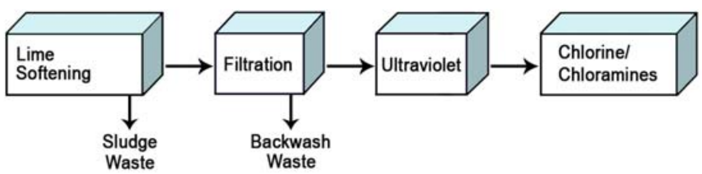


Figure 2.2 – Minot Water Treatment Plant Processes.

Phase 1 Phase 1 includes the construction of a 2 million gallon clearwell and high service pump station. This new clearwell replaces the existing, undersized clearwell. The new high service pump station replaces existing WTP pumps (which provides service to the city of Minot) and adds new pumps for conveyance of water to the remainder of the Project service area. The new high service pump station building is designed with space available for a UV disinfection system which would be required as part of the No Action Alternative. The cost of Phase 1 is $12.48 million based on 2008 bids.

Phase 2 This phase includes the construction of high-priority WTP modifications to improve its reliability and increase the actual capacity to 18 mgd. New influent flow facilities including new sleeve value, plant flash mix system and flow metering system are also proposed. A new clarifier building is proposed (equipment installation is included in Phase 3), along with yard piping improvements and rehabilitation of the WTP's sand filters. The estimated cost of Phase 2 is $13.7 million.

Phase 3 Phase 3 includes the installation of a new 10 mgd clarifier, carbon dioxide injection system, modification of the existing lime feed system, and the addition of two vertical turbine pumps to the high service pump station increasing the capacity of the WTP to 26 mgd. The estimated cost of Phase 3 is $4.9 million.

3. Biota WTP Inlet and Biota WTP Booster Pump Station

Each alternative, including No Action, evaluated in this EIS is composed of three main biota WTP features; the inlet structure, the biota treatment process, and the booster pump station. The inlet structure and treated water pumping (booster pump station) features are common to all alternatives with different levels of biota treatment occurring in-between these two features. The inlet and booster pump station that are included in each alternative were originally estimated by Houston Engineering, Inc. and Montgomery Watson Harza in December of 2006. These costs were included in the DEIS. Since the release of the DEIS those cost estimates were updated reflecting current prices and presented in the Montgomery Watson Harza technical memorandum *Draft NAWS Water Treatment without Flocculation and Sedimentation* (MWH 2008). The operation, maintenance, and replacement (OM&R) costs for the booster pump station included in each alternative were estimated by Houston Engineering, Inc. and Montgomery Watson Harza and presented in the draft report *Northwest Area Water Supply Project Electric Service Evaluation* (Houston Engineering, Inc. and Montgomery Watson Harza 2005). These OM&R costs were included in the DEIS. Reclamation updated the OM&R costs to reflect current 2008 expected prices using the Consumer Price Index (CPI).

Alternatives Evaluated in the EIS

Four biota water treatment alternatives were identified for detailed analysis, covering a full range of options for the Project. The alternatives evaluated in the EIS include the No Action Alternative and three action alternatives.

All of the alternatives propose some level of treatment to further reduce the risk of a Project-related biological invasion in the Hudson Bay basin.

Each biota WTP alternative has a maximum capacity of 26 mgd or approximately 40 cubic feet per second (cfs) with an average daily use of 10.5 mgd (12,000 ac-ft /year). The Project has a North Dakota state water permit which allows the withdrawal of up to 15,000 ac-ft of water annually from Lake Sakakawea on the Missouri River. The raw water would be pumped to the proposed biota WTP site via the buried pipeline already constructed. (see figure 2.1).

ALTERNATIVES IN THE FEIS

No Action –Includes chemical disinfection before the water is delivered into the Hudson Bay basin using chlorine and chloramines followed by softening, filtration, and UV disinfection at the Minot WTP.

Basic Treatment – Includes pre-treatment (coagulation, flocculation, sedimentation) UV disinfection and chemical disinfection using chlorine and chloramines at the proposed biota WTP prior to water crossing the drainage divide.

Conventional Treatment – Includes pre-treatment (DAF), media filtration, UV disinfection and chemical disinfection using chlorine and chloramines at the proposed biota WTP prior to water crossing the drainage divide.

Microfiltration – Includes coagulation, pin floc, microfiltration, UV disinfection, and chemical disinfection using chlorine and chloramines at the proposed biota WTP prior to water crossing the drainage divide.

No Action Alternative

The No Action Alternative was developed based on the environmental analyses and conclusions of the previously completed NEPA compliance documents prepared for the Project. The treatment process described in the Final EA (Houston Engineering Inc. et al. 2001) and selected in the FONSI (Reclamation 2001) 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. The No Action Alternative evaluated in this EIS would not be a change from the treatment process selected in the FONSI.

This alternative would include chemical disinfection of the raw water with a residual maintained in the pipeline for biofilm control. The water would be delivered across the drainage divide to the existing Minot WTP in the buried pipeline which has been constructed with additional safeguards to further reduce the risk of a Project-related biological invasion. At the Minot WTP it would be treated with UV disinfection, softening, and filtration prior to being distributed to the service area. In the No Action alternative the waste stream from the Minot WTP would be either treated to inactivate disinfectant resistant pathogens or transported to an appropriate disposal facility as described in the FONSI (Reclamation 2001).

Figure 2.3 shows the main treatment processes included in the No Action Alternative. Water would enter the biota WTP through the inlet structure and be treated with free chlorine. The design of this alternative includes five minutes of free chlorine contact time to achieve the desired level of disinfection. Ammonia would be added to form a chloramine residual in the pipeline to control biofilm. Finally, the booster pump station would pump the water through the existing pipeline, across the drainage divide to the Minot WTP. The Minot WTP would treat the water as described in the Proposed Improvements to the Minot WTP section including UV disinfection before it is distributed for use throughout the Project service area.

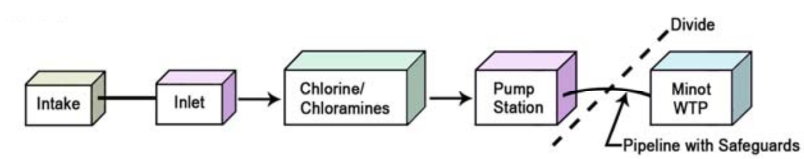


Figure 2.3 – No Action Alternative.

This treatment process, as described in the Final EA (Houston Engineering, Inc. et al. 2001), would provide control of invasive species through 3-log inactivation of *Giardia* and 4-log inactivation of viruses. A disinfection study was completed to determine the effectiveness of chlorine and chloramines. Details of the study methods and results are presented in the *NAWS Chloramine Challenge Study – Final Report* (Houston Engineering, Inc. et al. 1995). This alternative would not provide protection against organisms which are resistant to disinfectants like chlorine such as *Cryptosporidium* before the water crosses the drainage divide. Treatment for these types of organisms would be provided at the Minot WTP which includes UV disinfection and filtration.

The evaluation of this alternative in the Final EA also addressed concerns of a pipeline breach after the water had crossed the drainage divide between the Missouri River basin and the Hudson Bay basin. The reports, *NAWS Project Biota Transfer Control Measures* (Houston Engineering, Inc. et al. 1998) and the *NAWS Biota Transfer Control Measures Update* (Houston Engineering, Inc. and Montgomery Watson 2001) describe additional safeguards included in the design and construction of the main transmission pipeline and associated features to reduce the risk of a Project-related biological invasion in the Hudson Bay basin. These safeguards include isolation valves installed in strategic locations along the pipeline to minimize the volume of water released in the event of a pipeline breach in the Hudson Bay basin. Further, in locations where the pipeline crosses a coulee or drainage the joints are welded or constructed with restrained joint fittings and encased in concrete at the crossings (Houston Engineering, Inc. et al. 2001). The pipeline was constructed to meet State Health Department guidelines for domestic water supply systems with a bury depth of 7.0 feet to 7.5 feet. These safeguards are addressed through environmental commitments contained in the FONSI (Reclamation 2001) and have been installed during the construction of this main transmission pipeline. The State of North Dakota also included rigorous testing of the pipeline following installation with each segment exceeding the requirements defined for the *NAWS Project Biota Transfer Control Measures* (Houston Engineering, Inc. et al. 1998).

Evaluations of costs associated with the biota WTP for the No Action Alternative are presented in table 2.1. Reclamation indexed all costs shown in the table to represent current and comparable data. The methods and sources of information used in developing the No Action Alternative construction and OM&R costs estimates are provided in Appendix A.1.

To establish the cost of the entire biota WTP, the inlet and booster pump station estimates were added to the biota treatment estimate resulting in the overall contract cost. A rate of approximately 21% was added to the contract cost for contingencies resulting in a field cost of $9.1 million. Using the field cost, a typical rate of non-contract costs (25% +/-) was applied to account for engineering and contract administration to determine the total construction costs. This method resulted in a total construction cost estimate of approximately $11.5 million (rounded to the nearest $500,000) for the No Action Alternative. The OM&R cost was established for each portion of the alternative, this cost consists of estimates for labor, chemical costs, and energy required to operate the biota WTP and associated components for one year. For the No Action Alternative these costs total $271,000 per year.

Field Cost =
Contract Cost + Contingencies (21%+/-)

Total Construction Cost =
Field Cost + Non-Contract Costs (25%+/-)

Table 2.1 – No Action Alternative Cost Estimate.

Features	Construction Cost (2008)	Annual OM&R (2008)
WTP Inlet Structure	$117,000	$0.00
Biota Treatment – Chemical Disinfection	$3,152,000	$124, 000
Booster Pump Station	$4,192,,000	$147,000
Contract Costs	**$7,500,000**	
Contingencies (21%+/-)	$1,600,000	
Field Cost	**$9,100,000**	
Non-Contract Costs (25%+/-)	$2,400,000	
Total Construction / OM&R Costs	**$11,500,000**	**$271,000**

*Costs in the table are rounded.

Action Alternatives

Three action alternatives are evaluated in the EIS. Following is a description of these alternatives and their associated costs. As with the No Action Alternative, each alternative is composed of three main features in the Missouri River basin: the inlet, the biota treatment, and the booster pump station. The same inlet and booster pump station features are common to all three action alternatives with different levels of biota treatment occurring in-between these two features. Descriptions and detailed data on the development of the treatment aspects of each action alternative are found in the report *Water Treatment Plant for Biota Removal and Inactivation Appraisal Level Design & Cost Estimates* (Reclamation 2007). Included in the report are descriptions of each biota WTP alternative including Alternative A, Chlorination which is referred to as the No Action Alternative in this EIS. The action alternatives in this appraisal level report were referred to as Alternative B, Coagulation/Sedimentation, Alternative C, Coagulation/DAF/Filtration, and Alternative D, Coagulation/Microfiltration. In this EIS these same action alternatives are referred to as Basic Treatment, Conventional Treatment and Microfiltration, respectively.

Costs estimates presented for each alternative do not include costs associated with improvements to the Minot WTP because those costs are the same for each action alternative. These estimates are only for the biota WTP at the proposed location near Max, North Dakota (see figure 2.1).

Basic Treatment Alternative

In addition to the treatment provided in the No Action Alternative the treatment processes of this alternative includes a pre-treatment step (coagulation, flocculation, sedimentation) and UV disinfection as shown in figure 2.4. The coagulation/flocculation includes the addition of chemicals and mixing to form larger particles that will settle during the sedimentation step. UV disinfection has been shown to be effective against protozoa including *Cryptosporidium* and *Giardia*, and recently *Myxobolus cerebralis* (Hedrick et al. 2008). The UV disinfection process will be designed with a dosage of 40 mJ/cm^2. The pre-treatment is designed to reduce turbidity and increase the effectiveness of the disinfection processes, both UV and chlorine/chloramines.

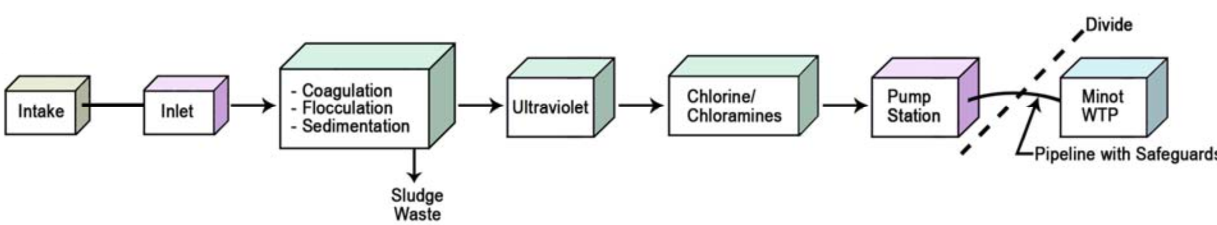


Figure 2.4 - Basic Treatment Alternative.

The final treatment step is chemical disinfection. This process is the same as presented in the No Action Alternative, providing inactivation of *Giardia* and viruses. Following this treatment the water would be pumped to the Minot WTP where it would be softened and filtered before being distributed to the Project service area. In the Basic Treatment Alternative the waste stream from the Minot WTP would be either treated to inactivate disinfectant resistant pathogens or transported to an appropriate disposal facility as described in the FONSI (Reclamation 2001).

The cost estimate for the treatment portion of the Basic Treatment Alternative was originally presented in *Water Treatment Plant for Biota Removal and Inactivation Appraisal Level Design & Cost Estimates* (Reclamation 2007) and presented in the DEIS. These costs have since been indexed to 2008 dollars values using Reclamation's cost indexing methods. This indexing resulted in an increase in cost of 1.67%.

The inlet and booster pump station features were estimated in a separate effort and presented in Appendix A.1. The appropriate contingencies and non-contract costs were added. As shown in table 2.2, this method resulted in a total construction cost of approximately $70 million (rounded to the nearest $1 million) with an annual OM&R cost, including labor, chemical costs and energy requirements, of approximately $1.9 million per year. The annual OM&R costs were also indexed to 2008 dollar values using the CPI. UV costs were adjusted to reflect the costs associated with a UV dosage of 40 mJ/cm^2 which has been shown to be effective in the inactivation of the myxospore stage of *Myxobolus cerebralis* (Hedrick et al. 2008).

Table 2.2 – Basic Treatment Alternative Cost Estimate.

Features	Construction Cost (2008)	Annual OM&R (2008)
Inlet	$117,000	$0
Biota Treatment – Coagulation/Sedimentation Treatment [1]	$41,850,000	$1,758,000
Booster Pump Station	$4,192,000	$147,000
Contract Costs	**$46,000,000**	
Contingencies (21%+/-)	$10,000,000	
Field Cost	**$56,000,000**	
Non-Contract Costs (25%+/-)	$14,000,000	
Total Construction / OM&R Costs	**$70,000,000**	**$1,905,000**

* Costs in the table are rounded.
[1] This cost was estimated in the DEIS (Reclamation 2007) and indexed to 2008 dollars values.

Conventional Treatment Alternative

Conventional treatment is defined as a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal (40 CFR 141.2). Sedimentation is defined as a process for removal of solids before filtration by gravity or separation (40 CFR 141.2). The DAF process removes particles through floatation and therefore is considered a type of sedimentation. The Conventional Treatment Alternative includes each of these processes; pre-treatment [coagulation, flocculation, sedimentation (DAF)], and filtration along with disinfection with UV and chlorine/chloramines. UV disinfection has been shown to be effective against protozoa including *Cryptosporidium* and *Giardia*, and recently *Myxobolus cerebralis* (Hedrick et al. 2008). The UV disinfection process will be designed with a dosage of 40 mJ/cm^2.

The Province of Manitoba, in their May 5, 2006 letter, to the U.S. Department of the Interior, suggested a form of conventional treatment for consideration. They also presented a report to Reclamation entitled *Report on the Review of the Proposed Pre-Treatment Process for the*

Northwest Area Water Supply Project (EarthTech and TetrES Consultants Inc. 2005). The report included a description of a treatment process, treatment goals and cost information for a treatment process referred to as In-Filter DAF. The In-Filter DAF process would be designed with a DAF unit and a media filter inside the same tank. According to the EarthTech et al. report, this design provides for spatial and cost savings with little impact on process flexibility or reliability (EarthTech and TetrES Consultants Inc. 2005).

Initially in the development of this EIS Reclamation considered this alternative as proposed, but technical and operational concerns were identified with using this design at the proposed location of the biota WTP. The following paragraph describes these technical and operational concerns.

First, the raw water pipeline between the proposed biota WTP site and Lake Sakakawea has been installed. Reclamation, working with the state of North Dakota and their consulting engineer, identified hydraulic limitations due to the pressure class of the pipe and the proposed treatment plant site. The pipeline design limits the water surface elevation entering the treatment facility to an elevation of 2107.5 feet, which is approximately two feet below the ground surface at that proposed location. In order for the water to maintain this elevation the treatment facility would have to be built below that elevation (2107.5 feet). For the In-Filter DAF system (DAF on top of a filter in the same tank) the entire process would be underground increasing construction costs (excavation and dewatering) and causing operation difficulties. For these reasons, the In-Filter DAF process was modified to include each process separately in a series. This treatment process is described in the following paragraphs and the name of the alternative was modified to reflect the change in layout and design from what was proposed as the In-Filter DAF process.

The Conventional Treatment Alternative includes the same basic concepts as the Basic Treatment Alternative (pre-treatment, UV disinfection, and chlorine/chloramines), this alternative however also includes media filtration as shown in figure 2.5. Design details for each of these processes are described in *Water Treatment Plant for Biota Removal and Inactivation Appraisal Level Design & Cost Estimates* (Reclamation 2007).

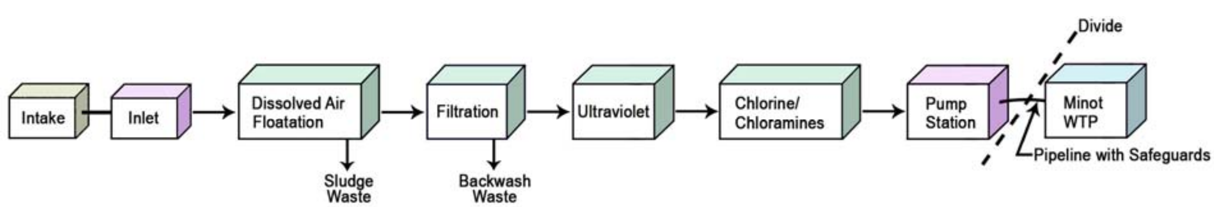


Figure 2.5 – Conventional Treatment Alternative.

The DAF process provides the pre-treatment step by floating small particles instead of settling them by gravity as in gravity sedimentation. This process has proven to be effective by using minute air bubbles to float light floc which is skimmed off and removed, leaving clearer water underneath. It is categorized as a “high rate clarification process” by the *Ten States Standards* and has been shown to provide effective clarification at higher loading rates than traditional sedimentation (Reclamation 2007).

The media filtration step uses a combination of silica sand below anthracite coal to remove particles as well as biological components, and also increases the effectiveness of both UV disinfection and chlorine/chloramines at inactivating organisms. The UV disinfection system provides inactivation of protozoa including *Cryptosporidium* and *Giardia,* and recently *Myxobolus cerebralis* (Hedrick et al. 2008). Following this treatment the water would be pumped to the Minot WTP where it would be softened and filtered before being distributed to the Project service area. This alternative provides inactivation and removal of biota in the Missouri River basin. Therefore, the disposal of waste streams from the Minot WTP will not be a concern. For this alternative, the environmental commitments for waste stream disposal identified in the FONSI would not apply.

The cost estimate for this alternative was developed in the same manner as the other action alternatives and is summarized in table 2.3. The associated contingency rates and non-contract costs were applied resulting in a total contract cost estimate of approximately $76 million (rounded to the nearest $1 million) and an OM&R cost of approximately $1.9 million per year. The annual OM&R includes labor, chemical costs, and energy requirements.

Table 2.3 – Conventional Treatment Alternative Cost Estimate.

Features	Construction Cost (2008)	Annual OM&R (2008)
Inlet	$117,000	$0
Biota Treatment –DAF/Filtration Treatment[1]	$46,030,000	$1,763,000
Booster Pump Station	$4,192,000	$147,000
Contract Costs	**$50,000,000**	
Contingencies (21%+/-)	$11,000,000	
Field Cost	**$61,000,000**	
Non-Contract Costs (25%+/-)	$15,000,000	
Total Construction / OM&R Costs	**$76,000,000**	**$1,910,000**

* Costs in the table are rounded.
[1] This cost was estimated in the DEIS (Reclamation 2007) and indexed to 2008 dollars values.

Microfiltration Treatment Alternative

The Microfiltration Alternative includes the same basic concepts as the previous two action alternatives: pre-treatment, UV disinfection and chlorine/chloramines. However, this alternative includes a more efficient type of filtration called microfiltration, which removes smaller particles from the water than the media filtration included in the Conventional Treatment Alternative. The Microfiltration Alternative includes coagulation to form pin-floc (pre-treatment), and microfiltration using membranes, along with UV disinfection and chlorine and chloramines disinfection as shown in figure 2.6. The UV disinfection process will be designed with a dosage of 40 mJ/cm^2.

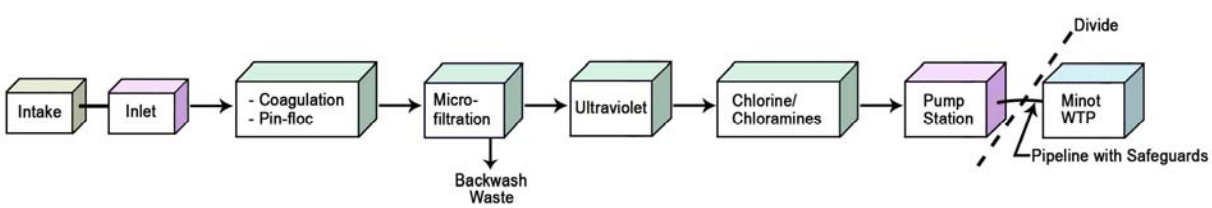


Figure 2.6 – Microfiltration Treatment Alternative.

The coagulation and pin floc are the addition of chemicals and mixing similar to that described in the Basic Treatment Alternative. The pin-floc formed is smaller and readily removed by the membranes, therefore no settling step is required.

The microfiltration system has two distinct stages where the backwash wastewater from the first stage is feed water for the second stage. This reduces backwash waste and increases the recovery of the system (Reclamation 2007). Microfiltration is proven to be very successful in removing turbidity, with typical product water of less than 0.1 nephelometric turbidity units (NTU). The process also results in a consistent treated water quality that is basically independent of raw water quality in most situations (AWWA 2005).

The UV disinfection system provides inactivation of protozoa including *Cryptosporidium* and *Giardia*, and recently *Myxobolus cerebralis* (Hedrick et al. 2008) at a proposed design dosage of 40 mJ/cm^2. Followed by the addition of free-chlorine for increased disinfection for *Giardia*, bacteria and viruses and the final step would be the conversion of the free chlorine to chloramines for a pipeline residual (Reclamation 2007). The treated water would be pumped to the Minot WTP where it would be softened and filtered before being distributed to the Project service area. This alternative provides inactivation and removal of biota in the Missouri River basin. Therefore, the disposal of waste streams from the Minot WTP will not be a concern. For this alternative, the environmental commitments for waste stream disposal identified in the FONSI would not apply.

The cost estimate for this alternative was developed in the same manner as the other action alternatives and is shown in table 2.4. The inlet and finished pumping costs associated with this alternative are detailed in Appendix A.1. Details of the Microfiltration Alternative cost estimate are presented in the report, *Water Treatment Plant for Biota Removal and Inactivation Appraisal Level Design & Cost Estimates* (Reclamation 2007). These costs have since been indexed to 2008 dollars values using Reclamation's cost indexing methods. The total construction cost of this alternative is approximately $92 million (rounded to the nearest $1 million) with annual OM&R costs of approximately $2.2 million. The annual OM&R costs include labor, chemical costs and energy requirements.

Table 2. 4 – Microfiltration Alternative Cost Estimate.

Features	Construction Cost (2008)	Annual OM&R (2008)
Inlet	$117,000	
Biota Treatment – MicrofiltrationTreatment[1]	$57,185,000	$2,065,000
Booster Pump Station	$4,192,000	$147,000
Contract Costs	**$61,000,000**	
Contingencies (21%+/-)	$13,000,000	
Field Cost	**$74,000,000**	
Non-Contract Costs (25%+/-)	$18,000,000	
Total Construction / OM&R Costs	**$92,000,000**	**$2,212,000**

* Costs in the table are rounded.
[1] This cost was estimated in the DEIS (Reclamation 2007) and indexed to 2008 dollars values.

Summary of Alternatives

This section compares the range of biota treatment processes considered in the EIS and the associated costs for each biota WTP alternative. Each of the alternatives includes a combination of treatment features to form a process that further reduces the potential risk of a Project-related biological invasion in the Hudson Bay basin. The biota WTP alternatives considered are generally listed in the order of their relative treatment inactivation/removal capability with the No Action Alternative providing the lowest level of biota treatment and the Microfiltration Alternative providing the highest level of biota treatment prior to the water crossing the basin divide. As would be expected, the cost of biota treatment increases with increased inactivation and removal efficiency. Table 2.5 provides a matrix showing the treatment processes that are included with each biota WTP alternative evaluated.

Table 2.5 – Proposed Treatment Alternatives and Treatment Processes Matrix.

Treatment Processes (Prior to the Basin Divide)	Proposed Treatment Alternatives			
	No-Action	Basic Treatment	Conventional Treatment	Microfiltration
Pre-Treatment		x	x	x
Media Filtration (approx. 5.0 micron)			x	
Membrane Filtration (approx. 0.1 microns)				x
UV Disinfection		x	x	x
Chemical Disinfection (Chlorine/Chloramines)	x	x	x	x

Relative Treatment Standards

The United States government has not developed water treatment standards, rules or regulations specifically for use in reducing the risk of a successful 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 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 U.S. 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 lamblia*, *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 (NPDWR) can be utilized as a basis of comparison to evaluate treatment efficiency. The SDWA and NPDWR regulate surface water and set reduction standards for the biological contaminants. There is a requirement of 3 log (99.9%) removal/inactivation of *Giardia* and 4 log (99.99%) removal/inactivation of viruses.

In order to address more recent concerns of other disinfection resistant protozoa such as *Cryptosporidium* the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) was established by EPA and requires up to 2.5 logs (99.68%) 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 bin 2, 3, and 4 would require 1.0, 2.0 and 2.5 logs of additional reduction for *Cryptosporidium*, respectively. The source water testing for LT2 has not been completed for drinking water systems in this area; therefore Missouri River *Cryptosporidium* data have not been collected for the Project. The best available information suggests that the Missouri River water would be categorized as bin 1 based on the rural nature of the watershed requiring the lowest level of reduction under LT2. Nonetheless, UV disinfection was designed for 3-log inactivation (bin 4) for *Cryptosporidium* and *Giardia* as an additional risk reduction method (Reclamation 2007) in the three action alternatives.

Alternative Costs

The cost estimates should only be used for comparative purposes when evaluating the differences between alternatives.

The cost estimate for the No Action Alternative was developed by Reclamation based on previous engineering and cost estimates prepared by the Project sponsor and their consulting engineer (Appendix A.1). Cost estimates for the Basic Treatment, Conventional Treatment and Microfiltration alternatives were developed by Reclamation and are provided in the report *Water Treatment Plant for Biota Removal and Inactivation Appraisal Level Design & Cost Estimates* (Reclamation 2007). This EIS contains the best available current information on the costs of the alternatives and reflects indexed cost to 2008 price levels. The contingency rate of approximately 21% was applied to each contract cost to account for unknowns along with approximate 25% to cover non-contract costs including contract administration and engineering design. The cost estimates are summarized by alternative in table 2.6.

The construction cost of a biota WTP is a federal expense, which means that the Project beneficiaries would not have to repay this federal cost. This is based on the premise that compliance with the Boundary Waters Treaty of 1909 is a federal responsibility. The OM&R costs associated with a biota WTP would also be funded by the federal government and have no repayment requirement.

The SDWA is strictly used as a basis of comparison in the EIS.

The best available information on water treatment effectiveness is found under the SDWA so it is used as the basis of comparing the biota water treatment alternatives. The use of SDWA treatment standards does not imply that the biota WTP alternatives considered in the EIS will be designed to meet SDWA standards. The SDWA is strictly used as a basis of comparison of effectiveness and cost of the treatment processes evaluated in the EIS. Table 2.6 lists three organisms of treatment concern in drinking water and their associated log reduction requirements under the SDWA. The table also shows the log reduction that each biota treatment alternative would receive under the current U.S. drinking water treatment regulations. The log reduction credits shown in the table are the minimum reduction this type of treatment process would typically achieve under normal operating conditions. This comparison does not differentiate between the reduction credits achieved through inactivation (disinfection) and those achieved through removal (filtration). The table also lists the estimated range of construction costs (with and without contingencies) for each biota WTP alternative and the associated annual OM&R costs.

Table 2.6 Summary of Design Capability and Construction Costs by Alternative.

Biota Treatment Alternative	**Viruses** (SDWA Requirement 4 log)	***Cryptosporidium*** (SDWA Requirement 2 log – bin 1) (SDWA Requirement 5.5 log – bin 4)	***Giardia*** *(SDWA Requirement 3 log)*	**Construction Costs (2008)** (Contract Costs + 25% Non-Contract Costs)	**Construction Costs (2008)** (Contract Costs + 21% Contingencies + 25% Non-Contract Costs)	**Annual OM&R Costs (2008)**
No Action	≥4	0	≥3	$9,400,000	$11,500,000	$271,000
Basic Treatment	≥4	≥3.5	≥3	$58,000,000	$70,000,000	$1,905,000
Conventional Treatment	≥4	≥5.5	≥3	$63,000,000	$76,000,000	$1,910,000
Microfiltration	≥4	≥5.5	≥3	$76,000,000	$92,000,000	$2,212,000

Table 2.6 shows that the No Action Alternative achieves adequate inactivation credits for viruses and *Giardia*, while it does not meet the SDWA standard for *Cryptosporidium.* The Basic Treatment Alternative achieves the log reduction requirements for viruses and *Giardia*, but only meets the *Cryptosporidium* inactivation requirements under bin 1 (2.0 credits required) and bin 2 (3.0 credits required). It does not meet the bin 3 and bin 4 requirements for *Cryptosporidium* which are 4.5 and 5.5 log reduction credits, respectively. The Basic Treatment Alternative does not include filtration so all *Cryptosporidium* reduction credits are provided through inactivation (disinfection) rather than removal (filtration).

Table 2.6 shows that the Conventional Treatment and Microfiltration alternatives meet all of the viruses, *Cryptosporidium* and *Giardia* reduction requirements under the current SDWA regulations by providing adequate inactivation credits for viruses and *Giardia*, and 5.5 log reduction credits (bin 4) of *Cryptosporidium*. Where some of the 5.5 log reduction credits for *Cryptosporidium* are achieved by providing a type of filtration in both treatment alternatives.

Table 2.6 also demonstrates the relationship between treatment efficiency and cost. As would be expected, the cost of the biota WTP alternatives increase as the treatment efficiency of the biota WTP increases. The Conventional Treatment and Microfiltration alternatives show the same log reduction based on SDWA minimum standards, but the Microfiltration Alternative is actually capable of providing more effective filtration (removal) as shown in figure 2.7.

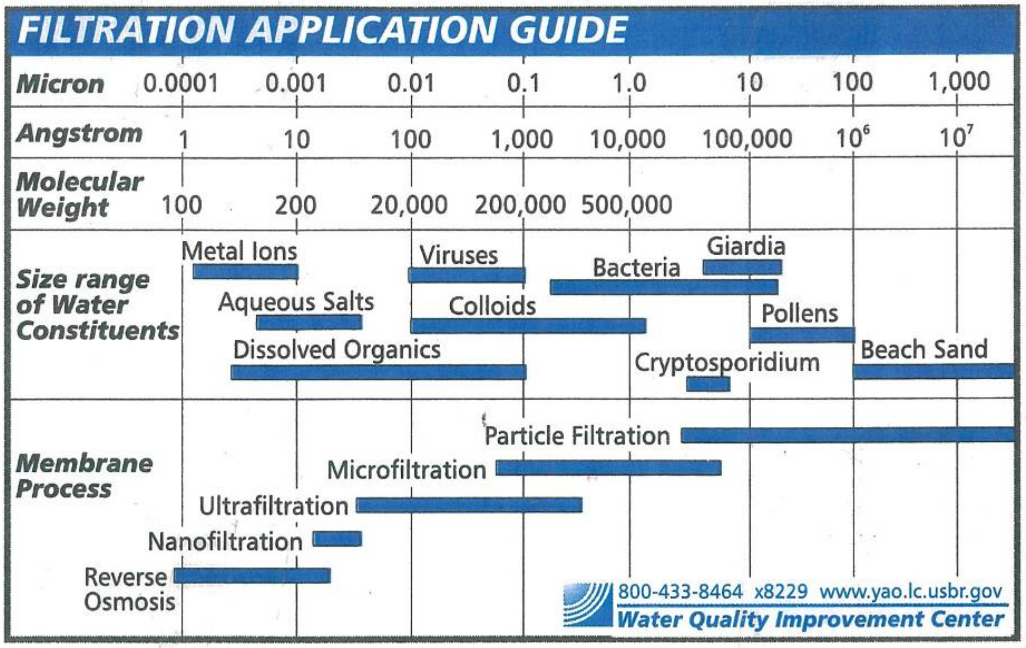


Figure 2.7 – **Filtration Application Guide (www.yao.lc.usbr.gov).**

The Conventional Treatment Alternative includes media filtration or what is referred to as particle filtration in figure 2.7. The figure shows that the Conventional Treatment Alternative would adequately remove *Cryptosporidium* and *Giardia* or other similarly sized organisms, but the pore size is not small enough to remove viruses. However, chlorine is very effective in the inactivation of viruses; therefore this alternative adequately addresses these biological contaminants.

The Microfiltration Alternative provides an additional level of particle removal as shown in figure 2.7. This form of filtration removes organisms approximately 1/100 the size of the particle filtration (media filtration) provided by the Conventional Treatment Alternative. However, the Microfiltration Alternative is still not effective in the removal of all viruses therefore chlorine is included in the treatment alternative. Table 2.6 shows that the Microfiltration Alternative has a total construction cost of $92 million, as compared to the Conventional Treatment Alternation at a cost of $76 million. This is an increase of $16 million for the increased level of filtration.

Province of Manitoba Biota Treatment Goals

A letter to Reclamation dated May 5, 2006, from the Province of Manitoba recommended biota treatment goals that should be applied in developing a “comprehensive biota pre-treatment alternative”. When considering this recommendation, Reclamation organized a conference call on December 8, 2006 to discuss further the specifics of their recommendation. Participants in the conference call included representatives from Reclamation, the Province of Manitoba and the State of North Dakota. During the call, Manitoba Water Stewardship further clarified their treatment goals. These treatment goals are listed in table 2.7. The Conventional Treatment and Microfiltration alternatives evaluated in the EIS meet the goals presented by Manitoba.

Table 2.7 – Manitoba Water Stewardship Biota Water Treatment Goals.

Parameter	Treated Water Goals for Biota Prior to Inter-basin Transfer	Comments
Turbidity	<0.3 NTU	This is necessary to ensure effectiveness of disinfection against viruses.
Disinfection-resistant Protozoa such as *Myxobolus cerebralis*	2.5 log (99.5%) removal	This should be achieved in a minimum of two separate barriers including filtration followed by UV disinfection prior to transfer across the continental divide from the Missouri River Basin to the Hudson Bay Basin.
Other Protozoa with similar characteristics as *Giardia* and *Cryptosporidium*	4 log (99.99%) total removal/inactivation with a minimum of 2.5 log by removal	This should be achieved in three separate barriers with disinfection achieved by UV and chlorination or ozonation prior to transfer across the continental divide from the Missouri River Basin to the Hudson Bay Basin.
Viruses	4 log (99.99%) inactivation	This can be achieved through disinfection.

Numerous interbasin water transfers take place throughout the United States without any water treatment for invasive species. However, to address compliance with the Boundary Waters Treaty, Reclamation considered the goals listed in table 2.7 when evaluating treatment processes for biota treatment. Reclamation interpreted these goals based on the best available scientific information which is provided in the SDWA and the associated treatment standards, rules and regulations. Although the SDWA standards for protection of human health may change in the future due to new information; the treatment goals in table 2.7 are not designed for protection of human health and will not change based on updated or new drinking water regulations. Reclamation will develop an adaptive management strategy to assess the effectiveness of the biota water treatment alternative selected. This strategy will address the potential for future invasive species concerns independent of modifications to the SDWA.

Summary of Environmental Consequences

Chapter four describes the environmental impacts of the proposed alternatives and presents discussions of the direct, indirect and cumulative effects and quantifies these effects whenever possible. Resources that were adequately analyzed in the Final EA and FONSI were not re-evaluated. The proposed alternatives are compared as to the beneficial, adverse, or minimal effect on the analyzed resource.

All of the alternatives (including No Action) include biota treatment and containment features to further reduce the risk of a Project-related biological invasion in the Hudson Bay basin. The risk of transferring macroscopic organisms (visible to the naked eye) through Project-related pathways is practically zero for all alternatives. Depending upon the alternative and the species, the risk of transferring microscopic invasive species through non-Project pathways is higher to much higher than the Project-related risk.

Based upon the number of barriers and their effectiveness, the alternatives vary in the amount of risk reduction that would be achieved. From lowest to highest risk reduction, the alternatives rank as follows:

No Action < Basic Treatment < Conventional Treatment < Microfiltration

The Conventional Treatment and Microfiltration alternatives, which include filtration, UV, and chemical disinfection, would provide water that meets SDWA standards before crossing the basin divide, and would pose the lowest risk of transferring invasive species. The probability of failure in such a multiple barrier control system resulting in a biological invasion is very low.

Overall, there is a high risk of biological invasions through non-Project pathways. With multiple-barrier control systems, the additional risk posed by the Project is negligible.

The analysis for federally listed threatened and endangered species and designated critical habitat resulted in a “no effect” determination for all alternatives.

A determination of “no historic properties affected” was already made for the No Action alternative and Reclamation anticipates the same determination will apply to the proposed action alternatives. During the final design phase for the selected alternative, Reclamation will consult with the North Dakota State Historic Preservation Officer, Tribal Historic Preservation Officer and tribes, as appropriate.

No impacts to Indian Trust Assets (ITA) or Environmental Justice issues of any significance were identified for any of the alternatives.

There would be varying degrees of beneficial social and economic impacts with each alternative due to the expenditure of Federal dollars for construction and OM&R costs in the local economy.

Identification of the Preferred Alternative

The Preferred Alternative for the Project has been identified by Reclamation as a combination of treatment processes evaluated in this EIS. This combination of treatment processes includes the chemical disinfection process evaluated as part of the No Action Alternative and the UV disinfection process evaluated as part of the action alternatives. The chemical disinfection process would include free chlorine treatment followed by ammonia addition to form chloramines. This alternative would be designed to provide control of invasive species by providing 3-log inactivation of *Giardia* and 4-log inactivation of viruses. As described in the No Action Alternative, chemical disinfection alone does not provide protection against organisms, such as *Cryptosporidium*, which are resistant to disinfectants like chlorine. Therefore, the Preferred Alternative will also include UV disinfection designed to achieve 3-log inactivation of *Cryptosporidium* and other similar types of organisms. Once the water is treated at the biota WTP it would be transferred across the drainage divide to the Minot WTP in the existing buried pipeline. This pipeline includes several safeguards which further reduce the risk of a pipeline break that would result in a Project-related biological invasion. At the Minot WTP it would be treated to Safe Drinking Water Act standards prior to being distributed to water users throughout the service area.

Figure 2.8 shows each of the treatment processes included in the Preferred Alternative. The Minot WTP would treat the water as previously described in the Proposed Improvements to the Minot WTP section excluding the UV disinfection which would be included at the biota WTP instead. Waste streams from the Minot WTP would be treated to inactivate disinfectant resistant pathogens, or transported to an appropriate disposal facility in the Hudson Bay basin, or transported for disposal within the Missouri River basin.

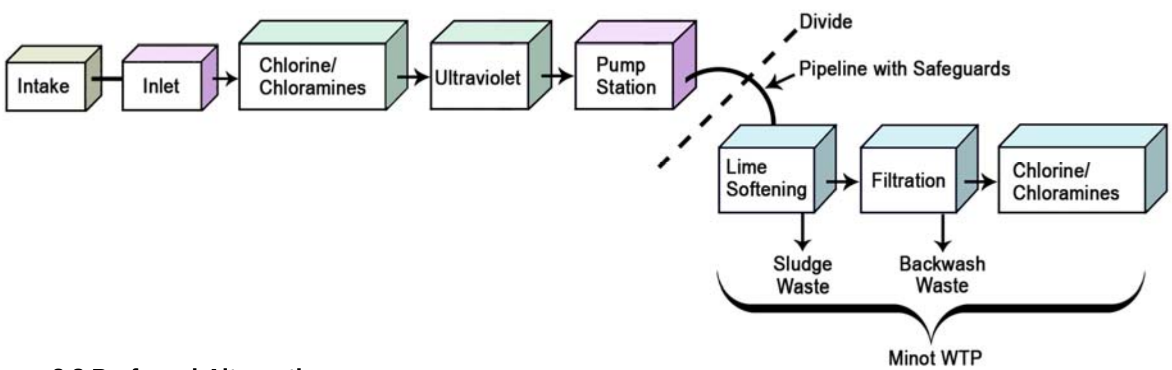


Figure 2.8 Preferred Alternative.

Reclamation considered several factors in the identification of the preferred alternative. These factors included the level of risk associated with the treatment process and pipeline failure, the effectiveness of each treatment process evaluated, and the overall cost including construction and OM&R. Each of the alternatives adequately reduces the risk of a Project-related biological invasion using various levels of water treatment technologies.

The No Action Alternative was determined to provide adequate treatment for this Project; however, Reclamation recognizes that the chemical disinfection included in No Action Alternative does not provide protection against disinfection resistant organisms such as *Cryptosporidium* before the water crosses the drainage divide. Disinfection resistant organisms are not inactivated or removed until the water is treated at the Minot WTP. UV disinfection is identified by the EPA as one of the Best Available Technologies for the inactivation of protozoa such as *Cryptosporidium*. Therefore, Reclamation is proposing to add UV disinfection to the chemical disinfection included in the No Action Alternative to target a wider range of organisms.

Each of the alternatives includes safeguards which are built into the existing water pipeline from Lake Sakakawea to the Minot WTP. These safeguards were recommended in the report *NAWS Project Biota Transfer Control Measures* (Houston Engineering, Inc. et al. 1998). The pipeline includes isolation valves to minimize the amount of water that would be released in the event of a pipeline breach in the Hudson Bay basin, as well as restrained joints encased in concrete at coulee or drainage crossings and other mitigation measures as described in the report.

In reviewing the overall costs of the alternatives, Reclamation compared the risk reduction achieved through the treatment processes of each alternative to the cost of constructing and operating and maintaining the biota WTP. The costs of the alternatives range from $11.5 million to $92 million. Information used in this review included a report provided by the North Dakota State Water Commission. Their consulting engineer completed a water treatment pilot-scale study using water from Lake Sakakawea. This study evaluated the treatment processes included in the Basic Treatment Alternative. The results of this study are presented in the report, *Pilot-Scale Water Treatment Study Snake Creek Pump Station Data Compilation Report, Northwest Area Water Supply Project* (MWH and Houston Engineering, Inc. 2007). This report is included as a supporting document.

The study showed that the pre-treatment process evaluated in the Basic Treatment Alternative (coagulation/flocculation/sedimentation) provided limited water quality improvement. The intended purpose of the pre-treatment process in the Basic Treatment Alternative is to reduce the turbidity; thereby increasing the UV transmittance (UVT) of the water. This study showed only a 2%-4% increase in UVT as a result of pre-treatment. The study also showed that the UVT of the untreated water from Lake Sakakawea was within an acceptable range to ensure effective UV disinfection without further turbidity reduction by filtration or some other means.

The No Action Alternative has an estimated construction cost of approximately $11.5 million while the Basic Treatment Alternative has an estimated cost of $70 million. The difference in alternative costs is a result of adding the pre-treatment process and UV disinfection. The approximate cost of the pretreatment process is $52.5 million and the approximate cost of the UV disinfection system is $6 million. Reclamation concluded that the minimal improvement in water quality provided by the addition of the pre-treatment process was not a cost effective approach to increasing the effectiveness of UV disinfection as originally designed in this alternative. In addition, the report's conclusions about the existing UVT in the source water demonstrated that additional risk reduction could effectively be achieved with UV disinfection. Based on this information, Reclamation is proposing to combine the most cost effective process (UV disinfection) of the Basic Treatment Alternative to the chemical disinfection process included in the No Action Alternative and identifying this combination as the Preferred Alternative.

Concerns have been raised that this Project could transfer *Myxobolus cerebralis*, commonly known as whirling disease, into the Hudson Bay basin. Although *Myxobolus cerebralis* is not currently found in the Missouri River basin, these concerns are addressed by the treatment processes included in the Preferred Alternative. A recent study (Hedrick et al. 2008) demonstrated that UV disinfection is highly effective for inactivation of the myxospore life stage of *Myxobolus cerebralis*, with greater than 5.05 log reduction being achieved using a dosage of 40 mJ/cm^2. Recognizing that there are no invasive species interbasin water transfer treatment requirements in the United States, the alternative as designed with the UV dosage of 40 mJ/cm^2 would provide adequate protection against the transfer of *Myxobolus cerebralis* based on this study.

The Preferred Alternative provides the most effective treatment, in terms of treatment effectiveness and costs, to adequately reduce the risk of a Project-related biological invasion. This conclusion is also supported by the EPA and the North Dakota State Department of Health as stated in their comment letters dated February 15, 2008 and March 25, 2008 respectively. Each of these agencies suggested combining the treatment processes from the No Action Alternative (chemical disinfection) with the UV disinfection process included in each of the action alternatives. In the comment letter received from the EPA (Appendix C) it states,

> *"EPA's analysis of the no action alternative concludes that this alternative adequately reduces the risk of transfer of invasive species from the Missouri River Basin to the Hudson Bay Basin."*
>
> *And*
>
> *"For the no action alternative, we suggest a minor design change to provide additional safeguards and risk reduction for the pipeline between Max and Minot and to further manage the risk uncertainties. The application of ultraviolet treatment (UV) technology at Max, instead of Minot, would provide additional safeguards at minimal additional cost and would result in a further reduction of biota prior to transfer over the basin divide. The design change would further reduce risks associated with breach of the pipeline."*

Cost estimates information for the processes included in the Preferred Alternative were provided to Reclamation by the North Dakota State Water Commission. The State Water Commission's consulting engineer presented the information to them in a technical memorandum, *Draft NAWS Water Treatment without Flocculation and Sedimentation* (MWH 2008) which is provided as a supporting document. Reclamation used data from the technical memorandum to estimate the construction costs associated with this alternative, just as with the other alternatives.

Annual OM&R costs for this alternative were developed by Reclamation based on the reports, *NAWS Project Pretreatment System Predesign Evaluation (*Houston Engineering, Inc. and Montgomery Watson Harza 2004*), Water Treatment Plant for Biota Removal and Inactivation Appraisal Level Design & Cost Estimates* (Reclamation 2007), and *Northwest Area Water Supply Project Electrical Service Evaluation* (Houston Engineering, Inc. and Montgomery Watson Harza 2005). This analysis and the complete cost estimate details are included in Appendix A.2 and summarized in Table 2.8. The OM&R estimates include the costs of a UV disinfection system designed to provide a dosage of at least 40 mJ/cm^2. This is the UV dosage demonstrated to be effective in the inactivation of myxospores, as reported by Hedrick et al. 2008.

The total construction cost for the Preferred Alternative is approximately $17.5 million including contingencies, and non-contract costs. The annual OM&R cost is estimated at approximately $306,000.

Table 2.8 – Preferred Alternative Cost Estimate.

Features	Construction Cost (2008)	Annual OM&R (2008)
Inlet	$117,000	
Biota Treatment	$7,165,000	$159,000
Booster Pump Station	$4,192,000	$147,000
Contract Costs	**$11,500,000**	
Contingencies (21%+/-)	$2,500,000	
Field Cost	**$14,000,000**	
Non-Contract Costs (25%+/-)	$3,500,000	
Total Construction / OM&R Costs	**$17,500,000**	**$306,000**

* Costs in the table are rounded to the nearest $500,000.

Conclusions

Several factors were considered in the process of identifying the Preferred Alternative. The effectiveness of the chemical and UV disinfection processes combined with the safeguards designed and constructed in the existing pipeline between Lake Sakakawea and the Minot WTP would result in a very low risk of a Project-related biological invasion from the Missouri River basin to the Hudson Bay basin. Information presented in this EIS summarizes Reclamation's efforts to evaluate the risk of a biological invasion between these two basins and the venues through which this may occur. The supporting documents included on the enclosed CD also discuss in detail what level of treatment can be achieved through the various treatment processes evaluated in the alternatives. Using this information and the estimated costs associated with the alternatives, Reclamation has made the following determinations: 1) The Preferred Alternative includes treatment processes which are capable of reducing the Project- related risks of a biological invasion even further than what can be achieved by the No Action Alternative, which has already been determined as an adequate level of treatment. 2) The safeguards designed and constructed into the existing water pipeline, along with the natural terrain that generally lacks surface drainage, provide a very low risk of a failure in the pipeline resulting in the transfer and establishment of any of the potentially invasive species evaluated in the EIS. And 3) the comparison of the estimated costs of each alternative and the level of risk reduction which can be achieved for these costs demonstrates that the Preferred Alternative is a means of achieving the most cost effective treatment for the Project.

Chapter Three
Affected Environment

Introduction

The environment of the area potentially affected by the alternatives is described in this chapter. The discussion focuses on the resources that could be affected by the Project's proposed alternatives. The geographic scope of this EIS evaluation is limited to the 41 acre construction area of the proposed biota WTP and related features located near Max, North Dakota.

Due to the focused scope of the proposed action and analysis in this EIS, some resources would not be affected by construction of any of the proposed alternatives such as climate and topography. Other potential temporary impacts, which would be directly associated with construction activities such as increases in traffic, noise and dust levels, would be avoided, minimized, or eliminated through common and routinely implemented construction techniques or conservation measures.

Table 3.1 list the resources described and evaluated in the Final EA (Houston Engineering, Inc. et al. 2001) for the Project service area. The findings and mitigation measures for each of these resource areas were documented in the FONSI (Reclamation 2001). Findings and environmental commitments in the Final EA and FONSI are incorporated by reference into this EIS, with the exception of the potential impacts and environmental commitments associated with the treatment of Missouri River water and operation and maintenance of a biota WTP and related features.

Table 3.1 - Northwest Area Water Supply Project Resource Investigation

Northwest Area Water Supply Project Final EA	
Resource Area	**Final EA (2001)**
Geology, Topography, and Soils	Section 3.1
Water Resources	Section 3.2
Vegetation	Section 3.3
Wildlife	Section 3.4
Fisheries	Section 3.5
Interbasin Biota	Section 3.6
Threatened and Endangered Species	Section 3.7
Wetlands	Section 3.8
Historic Properties	Section 3.9
Paleontological Resources	Section 3.10
Social/Economic	Section 3.11
Land Use and Ownership	Section 3.12
Indian Trust Assets	Section 3.13
Aesthetics	Section 3.14

As a result of these finding recorded in the FONSI (Reclamation 2001), construction of the main pipeline segment began in April 2002 and was determined to be substantially complete after the 2007 construction season. This buried pipeline, with the exception of the first seven miles just south of Minot, runs parallel to and on the east side of U.S. Highway 83. The pipeline route passes through commercial and residential areas in Minot. In the rural areas the pipeline is routed through cropland, pasture, hayland, and in some areas within the highway right of way. The Impact Mitigation Assessment team reviewed preliminary pipeline routing plans, conducted site reviews, and made recommendations for changes to the routing plans to avoid resource impacts. Pipeline routes were inspected by the Impact Mitigation Assessment team following construction to identify any permanent impacts that would need to be mitigated. Wetlands were avoided to prevent permanent impacts and pipeline segments were rerouted in some areas to avoid cultural resources and paleontological resources.

Through the efforts of the Impact Mitigation Assessment team and the implementation of mitigation measures, the construction area is returning to its pre-Project condition. Where the pipeline passed through cropland the route is undetectable with the exception of an occasional marker or relief valve. In areas where it passed through pasture, hayland or within the highway right of way, the planted vegetation is being reestablished. The vegetation along the edges of wetlands is also reestablishing itself.

Description of the Proposed Biota Water Treatment Plant Location

The area being evaluated in this EIS is the site of the proposed biota WTP near Max, North Dakota (Figure 2.1). Max is a small town of 287 residents located 28 miles south of Minot. It is situated south of the divide between the Missouri River and Hudson Bay drainages. The 41 acre site is located in the S½SW¼ of section 10, T.150N., R.83.W., in McLean County and was purchased by the state of North Dakota as part of the Project. Each of the alternatives evaluated has a biota WTP, including a pump station that would be constructed at this site. Each facility would have a unique design footprint relative to the type of treatment regime proposed in the alternative.

Proposed Biota WTP Site at Max, North Dakota.

Prior to this site being purchased by the state of North Dakota the land was used as cropland; but the soils are not classified as prime or unique farmland. A palustrine, emergent, seasonally flooded wetland about 7 acres in size is located along the northeast boundary of the site. Several small (less than 1 acre) palustrine, emergent, temporarily flooded and a small seasonal wetland are also located within the site area.

Issues identified in scoping or resources that potentially could be affected by the proposed action and alternatives are:

- Risk of transferring invasive species
- Federally listed threatened and endangered species
- Historic properties
- Social and economic conditions
- Indian trust assets
- Environmental justice

Risks of Transferring Invasive Species

Invasive Species

Most organisms fail to be established when introduced into a new environment. Of those that become established, most have only minor effects on their new ecosystem. But some non-indigenous species become invasive, reproducing and spreading rapidly with significant adverse ecological or economic consequences.

Nonindigenous species -- a species that does not occur naturally in a given area.
Invasive species -- a nonindigenous species whose introduction does or is likely to cause economic or environmental harm or harm to human health.
Pathways – the means by which species are transported from one location to another.

Nonindigenous species can alter population, community, and ecosystem structure and function (Elton 1958; Mooney and Drake 1986; Vitousek et al. 1996; Drake et al. 1989). Ecosystem-level consequences of invasive nonindigenous species have major ecological and economic consequences, and in some cases, can directly affect human health. Pimentel (2003) estimated that the economic impact of aquatic invasive species in the U.S. is $9 billion annually.

Most species that are considered highly invasive originate in a distant watershed, usually from another continent. This is not coincidental. Multiple potential invasion pathways link most adjoining watersheds. Species with life history characteristics favoring invasiveness usually have a large native distribution and broad physiological tolerance, which is indicative of their ability to disperse into previously unoccupied habitats. In many cases, this dispersal occurred long ago and the species are not regarded as invasive, but are merely considered common and widespread.

On the other hand, oceans are a formidable barrier to the natural dispersal of many freshwater organisms. Thus, zebra mussels needed a human-assisted

Zebra Mussels Hitchhiking on Recreational Boat (www.gov.mb.ca/waterstewardship/ais/index) pathway (ship ballast water) to disperse to North America from their native range in Eastern Europe. Once established in the Great Lakes, zebra mussels rapidly expanded their range through passive drifting of larvae and hitchhiking of adults and larvae on commercial and recreational boats.

The potential for transferring invasive aquatic species through operation of the Garrison Diversion Unit has been a concern to Canada since it was first authorized in 1965. As originally authorized, the Garrison Diversion Unit would have conveyed untreated Missouri River water through open canals to the Hudson Bay basin for irrigation and other purposes. All of the alternatives considered in this EIS use only closed conveyance (pipelines) and include biota treatment and control systems.

The Project, as designed, would deliver treated water from the upper Missouri River basin to the Hudson Bay basin through a buried water pipeline. The Project could be a new pathway for introducing invasive aquatic species into the Hudson Bay basin. Species differ markedly in their likelihood of becoming invasive. Nonetheless, there will always be uncertainty about how a species will react to a new environment. Thus, any species that is in the Missouri River basin but not in the Hudson Bay basin is potentially of concern.

Regulation of Invasive Species

Most states, including North Dakota, have laws and regulations that prohibit the transportation or introduction of known invasive plants and animals. For example, in North Dakota the Game and Fish Department [North Dakota Century Code: 20.1-02-01 through 20.1-02-28] provides the Director of the Department with the authority to regulate the importation, introduction and transplanting of fish, fish eggs, and other aquatic animals into the waters of the state.

Discharge of Ballast Water- a Primary Source of Invasive Species
(http://massbay.mit.edu/exoticspecies/ballast/index.html)

There are few existing regulations or standards pertaining to microorganisms. Current Coast Guard regulations require ships to exchange ballast water at sea before entering the Great Lakes. The United Nations International Maritime Organization has adopted a treaty that sets ballast water treatment performance standards. Under the treaty, beginning in 2009 ships will be required to treat ballast water so that discharges contain less than 10 viable organisms greater than or equal to 50 micrometers in diameter per cubic meter. As a point of reference, many microorganisms are less than 50 micrometers in diameter, and thus would not be regulated under the standards. To become effective, however, the treaty must be ratified by 30 countries, which could take a decade or more.

Legislation has been introduced in the U.S. Congress (S. 725, introduced March 1, 2007)) to mandate considerably stricter standards for ballast water discharge. Under this proposed legislation, beginning in 2012 ballast water discharge would have to contain less than one living organism per 10 cubic meters that is 50 or more micrometers in diameter, and less than one living organism per 10 milliliters that is between 10 and 50 micrometers in diameter.

There are no current or proposed standards for treatment of interbasin water transfers to control invasive species. The EPA has published a final rule in the *Federal Register* (73 FR 33697) that generally exempts interbasin water transfers from regulation under the National Pollutant Discharge Elimination System (NPDES) permitting program.

As part of the EIS for the Red River Valley Water Supply Project, Reclamation contracted with the USGS Columbia Environmental Research Center in 2002 to evaluate the risks of invasive species transfers potentially associated with diversions of surface water from the Missouri River basin to the Hudson Bay basin. USGS was contracted for this analysis because they are considered the scientific arm of the Department of the Interior, have specific expertise in risk analysis, and produce independent, extensively peer-reviewed documents.

USGS produced three reports (USGS 2005a, USGS 2005b, USGS 2006) for the Red River Valley Water Supply Project EIS that evaluated risks and consequences of transferring potentially invasive species through that project.

USGS was also contracted to evaluate risks of invasive species transfer associated with potential interruption of the proposed biota treatment alternatives and a breach in the conveyance pipeline to the Minot WTP. That analysis (USGS 2007) is included as a supporting document to this EIS.

Potentially Invasive Species

The potentially invasive species evaluated by the USGS (2005a) encompassed a broad range of taxonomic classification and life history characteristics. This included viruses, bacteria, protozoa, macroinvertebrates, fish, macrophytic plants, and algae. The primary focus was on potentially invasive species that currently exist in the upper Missouri River basin but are not known to exist in the Hudson Bay basin. To cover a broad range of life history characteristics (including treatment resistance), selected representative species already inhabiting both basins were also evaluated. Although species already residing in both basins are not likely to be problematic with regard to interbasin water transfers, they may represent other aquatic species in the upper Missouri River basin with similar life history characteristics. This approach is similar to drinking water regulations, where only a small number of the potentially pathogenic organisms are regulated.

As part of the initial problem formulation, the potentially invasive species were characterized by their life history attributes likely to influence invasiveness. Each species was assigned a rank score in eight categories: trophic status, parental investment (fishes and aquatic invertebrates only), maximum adult size (fishes only), size of native range, physiological tolerance, distance from nearest native source, prior invasion success, and propagule pressure. An overall rank score was calculated for each species by dividing its total score by the maximum possible score. Thus, the highest possible overall rank score was 1.0, indicating that the species possesses life history characteristics likely to make it highly invasive.

> **Propagule Pressure**
> In the context of invasive species, propagule pressure refers to the number of seeds or offspring produced by an organism, as well as the frequency of introduction and the number of organisms introduced. Species with high propagule pressure are more likely to become invasive.

Rank scores ranged from nearly 1.0 (cyanobacteria, purple loosestrife, Eurasian water milfoil, bacterial and protozoan infectious disease agents) to less than 0.6 (Utah chub, paddlefish, pallid sturgeon). The nine highest ranking potentially invasive species were species that are widely distributed, not only in the Missouri and Hudson Bay basins, but throughout North America. Species with similar life history attributes that do not occur in the Hudson Bay basin would be of concern. It should be noted, however, that the characteristics that make these species potentially invasive are also responsible for their present widespread distribution (e.g., broad physiological tolerance and multiple dispersal pathways). Thus, it is unlikely that these species are endemic and restricted to the Missouri River basin. Furthermore, if introduced to the Missouri River basin, these species are likely to spread to the Hudson Bay basin with or without an interbasin water transfer by this Project.

Given the control systems proposed for the Project, the risk of transferring fishes, macroinvertebrates, and macrophytic plants through Project-related pathways is practically zero. Therefore, the analysis of risks for the Project is focused on the cyanobacteria, bacteria, viruses, protozoa, and myxozoa that were identified by the USGS (2005a) as being potentially invasive (Table 3.2). Some of these species are widespread in both the Missouri River basin and the Hudson Bay basin. They were included in the analysis to represent other organisms with similar life history characteristics. In particular, the species evaluated cover a range of treatment characteristics, including varying degrees of resistance to one or more disinfection processes. Whether or not an interbasin water transfer would present a significant new invasion pathway for similar species is dependent on treatment and containment effectiveness.

Table 3.2 – Potentially Invasive Species Evaluated.

Algae	Microorganisms and Disease Agents	
Blue-green algae (Cyanobacteria)	**Protozoa and Metazoa**	**Bacteria and Viruses**
*Anabaena flos-aquae**	*Myxosoma cerebralis (Myxobolus cerebralis)*	*Yersinia ruckeri* (Enteric Redmouth)*
*Microcystis aeruginosa**	*Polypodium hydriforme**	Infectious Hematopoietic Necrosis Virus
*Aphanizomenon flos-aquae**	*Cryptosporidium parvum**	*Escherichia coli* (various serotypes)*
	*Giardia lamblia**	*Legionella* spp.*
		Salmonella spp.

* Indicates the organism presently occurs or has been documented in the Hudson Bay basin but could also be transported via interbasin water transfer.

Bacterial and Viral Diseases of Fish Fishes are susceptible to a number of infectious diseases. Disease-related mortality is best documented for hatcheries and aquaculture facilities, although field observations of disease outbreaks are not uncommon.

In the wild, fish diseases are often undetected unless morbidity or mortality is evident (e.g., acute episodes manifested as "fish kills" or skin lesions indicative of disease). No natural waters with resident fish populations are considered free of disease, and under the right conditions, various diseases can be a source of significant mortality in wild populations (e.g., if water temperatures in a river become unusually high for extended periods). Once established, many diseases may be difficult to control and virtually impossible to eradicate. Prevention and control of any disease process under field conditions is challenging. Under cultured conditions, while more manageable, disease control still requires a significant investment of time and resources. In general, fish diseases in wild fish populations are poorly understood. Fish pathology is an infant science, and previously unknown disease organisms are still being discovered. Some may cause little or no harm to the natural host but may be highly pathogenic for other species not previously exposed to the disease organism. Obviously, unknown organisms possess unknown life history characteristics. Thus, it is not possible to predict the impacts of unknown pathogens or parasites, and the probability that some specific unknown organism would spread through Project or non-Project pathways cannot be estimated.

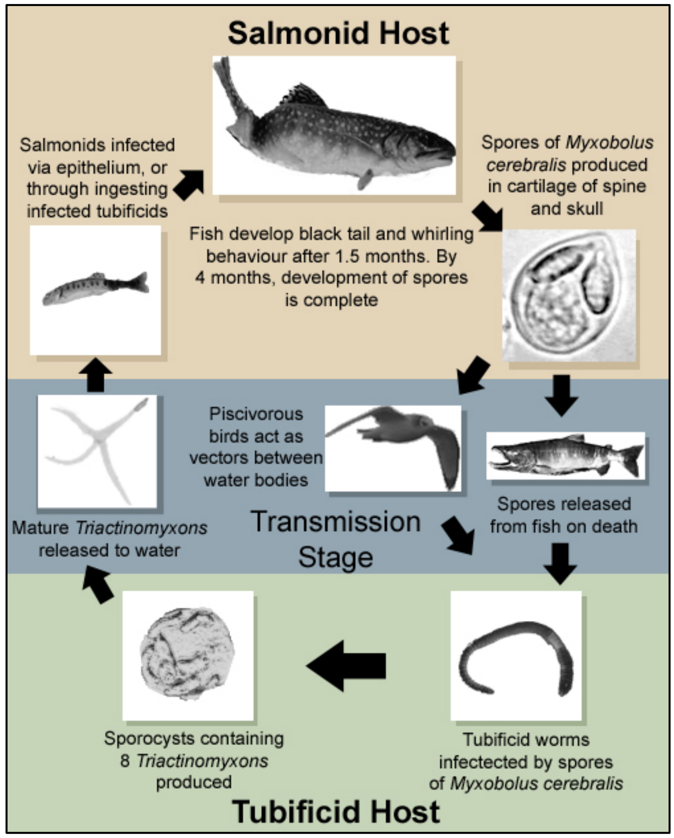
Some of the more common bacterial diseases to North American waters include furunculosis, bacterial kidney disease, coldwater disease, vibriosis, and enteric redmouth (ERM) disease (see, e.g., Noga 1996, Hoffman 1999, Wolf 1988).

ERM disease is one of the potentially invasive species evaluated. This is a systemic bacterial disease caused by *Yersinia ruckeri*. Salmonids such as rainbow trout are particularly susceptible to infection, and ERM occurs in salmonids throughout Canada and United States waters in both wild populations and in culture environments. ERM generally expresses itself by sustained low-level mortality, eventually resulting in high losses. ERM was first reported in rainbow trout from Idaho in the 1950's, then described by Rucker in 1966 (Rucker 1966). Since its initial isolation in Idaho which was associated with transportation of carrier fish, ERM has spread to virtually all trout-producing regions of the United States and Canada. The host range has also expanded to include other salmonids (e.g., Atlantic salmon and Pacific salmon) and non-salmonids such as emerald shiners (Mitchum 1981); fathead minnows (Michel et al. 1986); goldfish (McArdle and DooleyMartyn 1985); and farmed whitefish (Rintamaki et al. 1986).

Frequently diagnosed viral diseases in hatcheries (see, e.g., Roberts and Shepherd 1997) include infectious pancreatic necrosis virus (IPN), salmon papilloma, and infectious hematopoietic necrosis virus (IHNV). Each of these diseases may also be observed in wild populations. INHV is one of the potentially invasive species evaluated.

IHNV is endemic to the Pacific Northwest where the virus was first isolated from a disease outbreak in 1953 at two fish hatcheries in the state of Washington. IHNV was reported through the remainder of 1950's and 1960's throughout the Pacific Northwest and caused high mortality in salmon production (Wolf, 1988). The host range of IHNV is relatively broad and is known to naturally infect many salmonids. Sources of IHNV other than salmonid fish have not been identified, but potential sources include freshwater and marine invertebrates, sediment and other fish species (Bootland and Leong, 1999). Historically, the geographic range of IHNV was limited to the Pacific Rim of North America but, more recently, the disease has spread to continental Europe and Asia.

Protozoan and Metazoan Parasites of Fish During investigations completed for the Final EA, whirling disease was identified as a species of concern. Whirling disease is a parasitic infection of trout and salmon by the myxosporean protozoan *Myxobolus cerebralis.* It has caused severe impacts on some coldwater fisheries in North America. Heavy infection of young fish can result in high mortalities. When an infected fish dies, many thousands to millions of parasite spores are released to the water. Under some conditions, these parasitic spores can survive in a stream for 20 to 30 years. A recent study (Hedrick et al. 2008), however, found that the spores do not survive desiccation, freezing at -20 degrees Celsius, or prolonged exposure to temperatures over 22 degrees Celsius. Whirling disease occurs throughout Europe (Halliday 1976) where it probably originated. It was accidentally introduced into the U.S. (into Pennsylvania and Nevada) in about 1955 (Hoffman 1990). Whirling disease occurs in the upper Missouri River basin in Montana and Wyoming, but has not been detected in North Dakota or Canada.



Whirling Disease Life Cycle
(http://upload.wikimedia.org/wikipedia/en/4/45/LifeCycle%28Myxobolus_cerebralis%29.jpg)

Whirling disease presents a two-host life cycle involving a fish and the tubifex worm (Markiw and Wolf 1983; Wolf and Markiw 1984; Wolf et al. 1986), and two separate spore stages occur, one in each host. In brief, the life cycle begins with spores of *M. cerebralis* released to the aquatic environment when infected fish die and decompose or are consumed by predators or scavengers. The myxosporean-type spores are ingested by tubifex worms in whose gut the next phase of the life cycle continues. In the worm, transformation into the actinosporean, or *Triactinomyxon*, occurs. Once fully developed, *Triactinomyxon* spores are released from infected worms into the water for several weeks, where they enter susceptible fish such as rainbow trout through the skin, fins, oral cavity, upper esophagus, or lining of the digestive tract.

The source of the infective agent for fish is usually the water supply or earthen ponds inhabited by aquatic tubificid worms. An outbreak of the disease can occur after stocking with infected fish or transferring fish from facilities where the infection had not yet been detected. Predators and scavengers such as birds (Taylor and Lott 1978) that consume infected fish can release viable spores into the environment and may disseminate the parasite. Because of the multiple invasion pathways, some of which cannot be controlled (e.g., birds), the parasite is likely to continue to spread to uninfected watersheds. Salmonid fish have been stocked in some lakes and rivers in the Hudson Bay basin, but susceptible species are generally absent in the Souris River which is a sub-basin of the Hudson Bay basin. Thus, it is highly unlikely that *Myxobolus cerebralis* could complete its life cycle and cause significant impacts.

Another fish parasite evaluated is *Polypodium hydriforme*. It is a hydrozoan that infects the eggs of sturgeon and other primitive fish including sturgeon in Europe and North America, the kaluga in Russia, and the paddlefish in North America (see, e.g., Hoffman et al. 1974, Suppes and Meyer 1975, Holloway et al. 1991, Dick et al. 1991, Choudhury and Dick 1991, 2001). Relative to whirling disease and the literature available on *M. cerebralis*, few publications occur for *P. hydriforme*, yet the work reported for the parasite indicates the species currently occupies areas in both Missouri River and Hudson Bay drainages (see, e.g., Holloway et al. 1991, Dick et al. 1991).

Cyanobacteria Periodic blooms of cyanobacteria or blue-green algae have been reported in marine and freshwater bodies throughout the world. Although many blooms are merely an aesthetic nuisance, some species of cyanobacteria produce toxins that are harmful to fish, shellfish, humans, livestock and wildlife. Although these blooms historically have been considered a natural phenomenon, the frequency of occurrence of harmful cyanobacteria appears to have increased in recent years. Agricultural runoff and other pollutants of freshwater wetlands and water bodies have resulted in increased nutrient loading of phosphorus and nitrogen, thus providing conditions favorable to the growth of potentially toxic cyanobacteria.

Many of the organisms responsible for cyanobacterial blooms are widely distributed and not limited to either the Missouri River basin or the Hudson Bay basin. Natural weather-related events can aid dispersal of these organisms, and it is suspected that some organisms may be transported long distances in fishing boat live wells or by other human-aided transport mechanisms.

Waterborne Diseases of Terrestrial and Wetland Vertebrates Many diseases of terrestrial, avian and aquatic life are zoonotic, i.e., transmissible between humans and animals, causing infection in both species. Some of the more common waterborne strains of bacteria that are associated with disease outbreaks are *Legionella*, *Salmonella typhi*, *Escherichia coli* and Cholera.

Protozoa common in open bodies of water are much larger than bacteria and viruses. To survive harsh environmental conditions, some species can secrete a protective covering and form a resting stage called a “cyst.” Encystment can protect protozoa from drinking water disinfection efforts and facilitate the spread of disease.

Cryptosporidium parvum is a parasitic protozoan about five micrometers in diameter. *C. parvum* is predominately a parasite of newborn animals, and older animals generally develop milder infections, even when unexposed previously to this parasite.

Oocysts of *Cryptosporidium* are widespread in surface waters. Surface waters receiving runoff from livestock operations characteristically present high oocysts counts, while relatively “pristine” areas may have very few oocysts. Ruminants, cervids, swine, cats, dogs, and other mammals may all contribute to numbers of *Cryptosporidium* oocysts in the environment both in rural and urban areas.

Failures or overloaded public water utilities have occasionally resulted in community outbreaks of cryptosporidiosis. In other cases, infections have been acquired from swimming pools and water parks because of fecal accidents.

Giardia is one of the most common protozoan parasites in vertebrates, including humans. In vertebrates, the passage of *Giardia* species from one host to another occurs predominately via a fecal-to-oral route, most frequently through ingestion of contaminated water (e.g., drinking water or water ingested with foods washed with contaminated water).

Invasive Species Pathways

Although the Project-related risk of invasive species is specifically related to an interbasin water transfer, alternate and competing pathways exist. Non-Project pathways must be considered to assess the relative risk of biological invasions due to the import of Missouri River water by the Project. In addition, when multiple pathways exist, uncertainty as to cause and effect is increased. If an invasion occurs, it may be difficult or impossible to determine with any degree of certainty which pathways were used by the invading organism.

Natural pathways for dispersal of invasive organisms include animal transport, wind dispersal, major floods that temporarily link basins, and storms (e.g., tornadoes). In a sense, the native biota of the Hudson Bay basin are the result of numerous natural “invasions” that have occurred since the retreat of the last continental glaciers.

Human activity also provides pathways for dispersal of aquatic organisms from one basin to another. According to the EPA, human activities have increased the frequency by orders of magnitude by which non-native plants, animals, and pathogens are introduced to new areas. The following common pathways for introduction of invasive species were identified by the EPA (http://www.epa.gov/owow/invasive_species/pathways.html):

Human activities have increased the frequency by orders of magnitude by which non-native plants, animals, and pathogens are introduced to new areas.

- **Ballast Water** Since 95% of all foreign goods by weight enter the U.S. through its ports, the potential for invasive species impacts on coastal communities is immense.
- **Boat Hull, Fishing Boot, and Other Recreational Introduction** Boats, fishing boots (felt-soled wading boots transport whirling disease organisms from stream to stream) and equipment, diving gear, and other recreational equipment that are transported among several water bodies have been known to spread invasive species to new waters. Some zebra mussel and milfoil introductions have occurred in this manner.
- **Aquaculture Escape** Non-native shrimp, oysters, and Atlantic salmon in the Pacific Northwest, are just a few examples of non-native mariculture species that have generated concern over disease and other impacts that might arise from their escape.
- **Intentional Introduction** The introduction of nonindigenous species into ecosystems with few controls on reproduction or distribution.

- **Aquarium Release** Escapes or intentional release of unwanted pets can be a source of new non-native species in all parts of the country. The invasive algae Caulerpa is thought to have been introduced to U.S. waterways after being discarded from aquariums.
- **Live Food Industry** The import of live, exotic foods and the release of those organisms can result in significant control costs, e.g. the snakehead fish in Maryland. Asian swamp eels are spreading through the Southeast after introduction as a food source.
- **Vehicular Transportation** Both private and commercial transportation are major factors in the movement and range expansion of non-native species throughout the U.S.
- **Escaped Ornamental Plant, Nurseries Sale, or Disposal** Many invasive plant problems began as ornamental plantings for sale in nurseries and garden shops. Purple loosestrife, for example, is sold as an ornamental plant but takes over native vegetation in wetlands, and can clog western streams preventing water withdrawal and recreational uses. Only some problem species are currently banned from sale.

Purple Loosestrife
(http://www.great-lakes.net/envt/flora-fauna/invasive/loosestf.html)

- **Cross-basin Connection** From small channels to major intercoastal waterways, new connections between isolated water bodies have allowed the spread of many invasive species. Great Lakes invasions increased markedly after the opening of the St. Lawrence Seaway in 1959.
- **Fishing Bait Release** Discarding unused bait can introduce species that disrupt their new ecosystems and eliminate competing native species; examples include non-native crayfish, baitfish that overpopulate certain waters, and earthworms that are depleting the organic duff layer in northern forests where no indigenous earthworms existed.
- **Illegal Stocking** Although prohibited by law, people release fish into new waters and sometimes cause severe impacts. Yellowstone Lake's world-class cutthroat trout fishery is now jeopardized by an illegal release of lake trout.
- **Domestic Animals Gone Wild** The impact of feral house cats on birds and small mammals in natural areas is well documented; escaped feral pigs from farms have recently begun to do significant damage to soils and plants in the Smokey Mountains.
- **Pathogen Spread by Non-native to Vulnerable Native Species** Non-native species problems include pathogens carried by resistant non-natives to vulnerable native species. Whirling disease, which has decimated rainbow trout in many western rivers, was originally introduced when European brown trout, tolerant of whirling disease, were imported to U.S. waters and hatcheries.
- **Disposal of Solid Waste or Wastewater** Seeds, viable roots, or other propagules of invasive plants may be easily spread to receiving waters through wastewater discharge, then spread by water flow to distant areas downstream.
- **Science/Laboratory Escape, Disposal, or Introduction** Accidental or intentional release of laboratory animals has introduced some non-native species into U.S. waters.
- **Seafood Packing and Disposal** Much seafood is packed in seaweed prior to distribution. Because seafood is transported long distances, organisms in packing seaweed may reach new waters as an unintended by-product.
- **Biological Control Introduction** Ideally, introducing a second non-native species to control an invader should result in diminished numbers of both species after control is

- **Past Government Programs** The establishment of a new invader is sometimes an unanticipated outcome of a government program; kudzu, for example, was originally introduced through a government-sponsored erosion control program.
- **Moving and Depositing Fill in Wetland** Seeds and viable parts of invasive plants contained in fill material may rapidly colonize the new area and then compete with native species within the wetlands.
- **Land/Water Alteration** Many invaders are adept at rapid pioneering where soil has been disturbed or water levels or routes have been changed, leaving a temporary gap in occupation by native flora and fauna.

The probability that an organism will use a particular pathway to successfully invade the Hudson Bay basin will differ for each of the potentially invasive species. Thus, the pathways for introduction of cyanobacteria, for example, will be more numerous and more likely to yield successful invasions than the pathways available to pallid sturgeon.

Figure 3.1 shows the expansion of the distribution of New Zealand mudsnails (shown in red) in the western U.S. between 1995 and 2006. The figure illustrates how existing pathways can facilitate the transfer of invasive aquatic species between basins that lack a surface water connection. The first record of New Zealand mudsnails in the U.S. occurred in 1987 in Idaho's Snake River. It is believed they were accidentally introduced with stocked imported rainbow trout. Since 1995, mudsnails have jumped many basin divides and are now found in 10 western states. The snails have impacted Rocky Mountain trout streams and are apparently being spread by anglers. In 2001, New Zealand mudsnails were recorded in Lake Superior at Thunder Bay, Ontario, and in 2005, they were recorded in Duluth-Superior Harbor. Researchers suspect they arrived in the Great Lakes via ship ballast water.

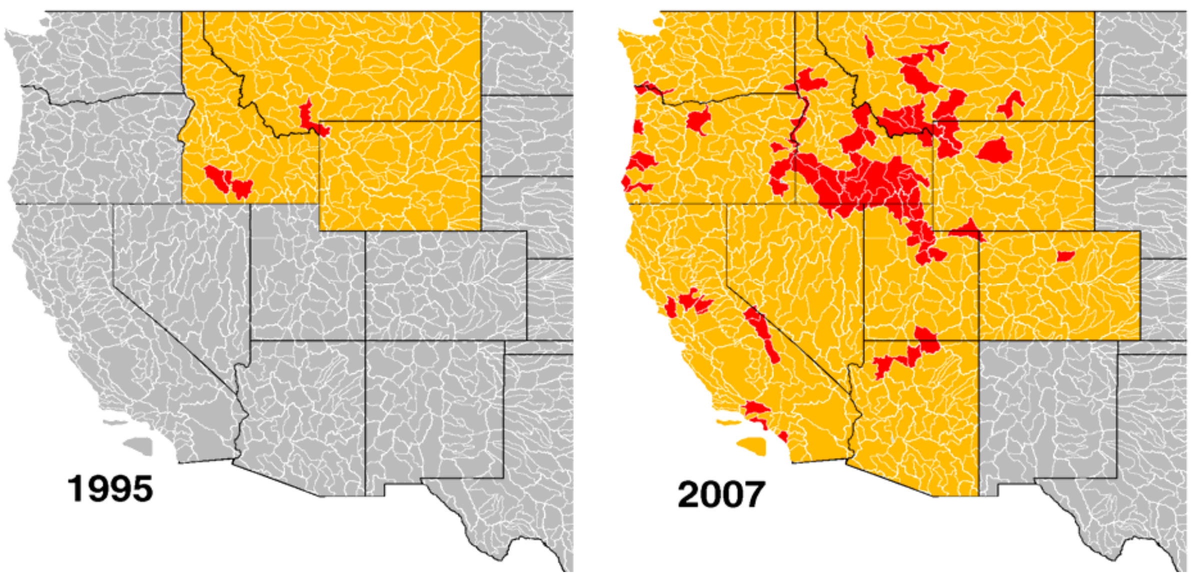


Figure 3.1 - Distribution of New Zealand Mudsnails in the Western U.S. in 1995 and 2007 (from http://www.esg.montana.edu/aim/mollusca/nzms/status.html

Existing Interbasin Water Transfers in the United States and Canada

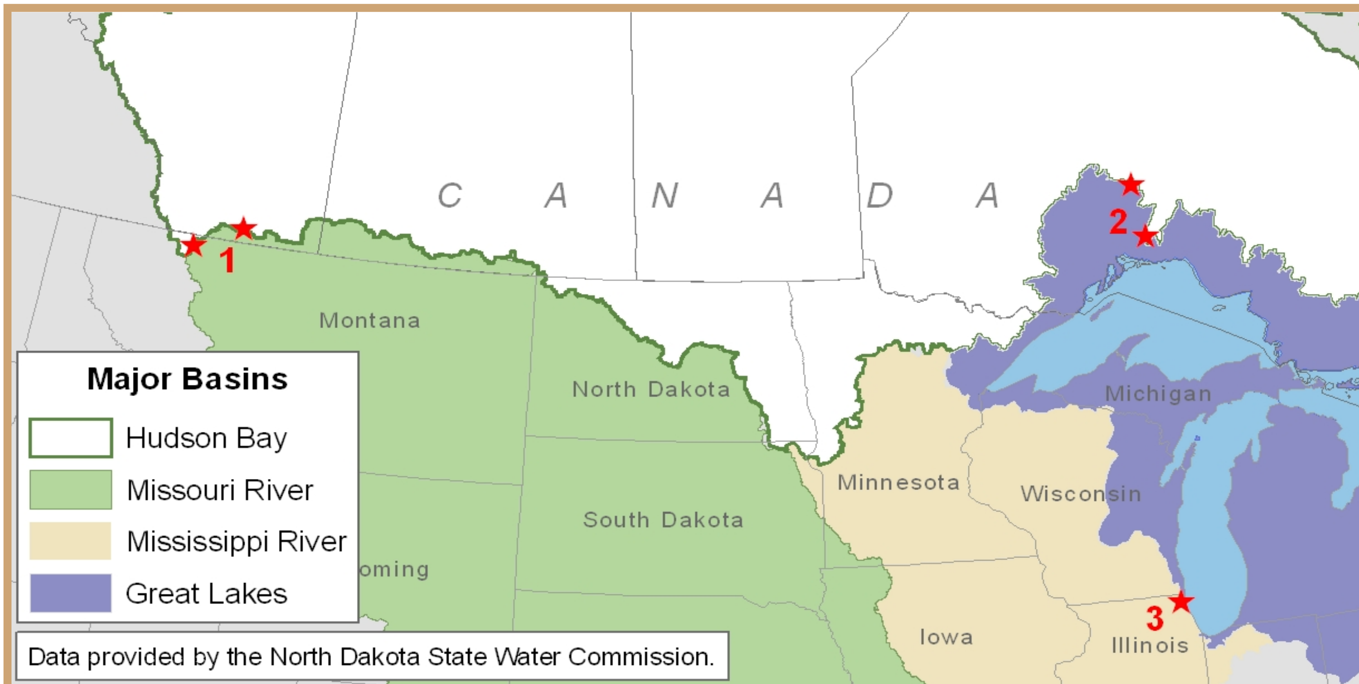
Numerous interbasin water transfers have been constructed in the U.S. and Canada. Petch (1985) inventoried interbasin water transfers in the western U.S. He identified 111 conveyances that exported an average of 12 million ac-ft per year from 1972 to 1982. This is equivalent to the average annual flow of the Mississippi River at Prescott, Wisconsin (Petch 1985). While many of the water transfers are between sub-basins, large diversions exist that transfer water between major drainage basins (i.e., across a continental divide). For example, in 1982, 437,222 ac-ft of water was exported from the upper Colorado River basin to the Missouri River basin. To our knowledge, none of this water was treated before crossing the basin divide.

In Canada, more streamflows are diverted out of their basin of origin than any other country in the world. For, example, the average rate of interbasin water transfer flow in Canada is 156,232 cfs, which is more than six times greater than the United States with a transfer rate of about 25,179 cfs. There are 62 diversion projects developed across 9 provinces of Canada. If all the diverted waters in Canada were concentrated in a “hypothetical river”, it would be the third largest river in Canada (Ghassemi and White 2007).

The North Dakota State Water Commission discusses some major interbasin water transfers in the U.S. and Canada (http://www.swc.state.nd.us/4dlink9/4dcgi /GetContentPDF/PB-499/Biota_Transfer_Slideshow.pdf). Figure 3.2 shows the locations of some of the existing major interbasin water transfers. Two of the Canadian projects (Long Lake and Ogoki River) transfer a combined average of about 4.1 million ac-ft of untreated water per year from the Hudson Bay basin to the Great Lakes basin.

The Chicago Sanitary and Ship Canal transfers an average of about 2.3 million ac-ft of untreated water from the Great Lakes basin to the Mississippi River basin. The Chicago Sanitary and Ship Canal has an electrical barrier designed to prevent movement of fish into the Great Lakes basin but has no barrier to prevent movement of invasive species from the Great Lakes basin to the Mississippi River basin. Transfer of water between the Great Lakes basin and other basins poses a high risk of invasive species transfer, because international shipping in the Great Lakes has been the pathway through which some of the most damaging invasive aquatic species (e.g., zebra mussels) have become established in North America.

In addition to these constructed interbasin diversions, basin divides may be naturally overtopped. For example, at high flow, a natural connection exists between the Mississippi River basin and the Hudson Bay basin at Browns Valley, Minnesota. The Corps of Engineers (unpublished report dated January 2000) estimated a 10-year recurrence interval for interbasin flow at Browns Valley (i.e., 10 percent chance in any given year), with a maximum estimated volume of 14,000 ac-ft transferred in July 1993.



1 Milk River and St. Mary River Diversions (650 cfs)
Purpose: Irrigation
Connections: Missouri River Basin and Hudson Bay Basin
Biota Transfer Controls: No

2 Ogoki River Diversion (4,275 cfs) and Long Lake Diversion (1,375 cfs)
Purpose: Hydroelectric Power Generation
Connections: Hudson Bay Basin to Great Lakes Basin
Biota Transfer Controls: No

3 Chicago Sanitary and Shipping Canal (3,200 cfs)
Purpose: Sewage dilution, navigation, and hydroelectric power generation
Connections: Great Lakes Basin to Mississippi River Basin
Biota Transfer Controls: Electric barrier, with additional controls proposed.

Figure 3.2 - Existing Interbasin Water Transfers in the United States and Canada.

Federally Listed Threatened and Endangered Species

During the preparation of the Final EA, the Service, as required by the Endangered Species Act (ESA), provided a list of federally listed endangered, threatened, and candidate species that were or could be present in the Project area. This list included the least tern, piping plover, whooping crane, black-footed ferret, gray wolf, pallid sturgeon, bald eagle, and peregrine falcon. Three species have been removed from the federal list since that time. They are the peregrine falcon delisted on August 25, 1999, the gray wolf on March 12, 2007, and the bald eagle on August 8, 2007. On September 29, 2008, the U.S. District Court for the District of Columbia overturned the Department of the Interior's decision to remove the gray wolf from federal ESA protections. The U.S. Fish and Wildlife Service is in the process of determining the most appropriate course of action.

Following the issuance of the FONSI in 2001, the Service designated critical habitat for piping plover in North Dakota in September 2002. The designated habitat is the Missouri River/Reservoirs and specific prairie alkali lakes in numerous counties. Some of these counties are within the Project service area. Critical habitat is a specific geographic area(s) that contain features essential for the conservation of threatened or endangered species and that may require special management or protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. An area is designated as "critical habitat" after the Service proposes a Federal regulation, receives and considers public comments, and publishes the final boundaries of the critical habitat area in the *Federal Register*.

For the purpose of this EIS, Reclamation staff reviewed the data available for these federally protected species in relation to the proposed site for the construction of a biota WTP to evaluate potential impacts to these species.

Least Tern (Endangered)

In North Dakota, the least tern nests on sparsely vegetated sandbars on the Missouri and Yellowstone Rivers and on shorelines of Missouri River reservoirs. They feed mostly on small fish. Breeding season lasts from May through August, with peak nesting occurring from mid-June to mid-July.

Piping Plover (Threatened)

Piping plovers use barren sand and gravel shorelines of the Missouri River and shorelines of prairie alkali lakes. Critical habitat has been designated for the piping plover in North Dakota (*Federal Register* 67(176): 57638-57717). Critical habitat is defined in section 3(5) (A) of the ESA as:

i. The specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the ESA, on which are found those physical or biological features:
    a. essential to conserve the species and
    b. that may require special management considerations or protection; and
ii. specific areas outside the geographic area occupied by a species at the time it is listed, upon determination that such areas are essential to conserve the species.

Critical habitat receives protection under section 7 of the ESA through the prohibition against destruction or adverse modification of critical habitat with regard to actions carried out, funded, or authorized by a Federal agency. Destruction or adverse modification is defined as "...a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical."

In North Dakota all Missouri River critical habitat units consist of riverine and reservoir reaches. Some of the areas designated include Lake Sakakawea and riverine reaches below Garrison Dam. Prairie and alkali lakes and wetlands have also been designated as piping plover critical habitat in McLean County which is part of the Project service area.

Whooping Crane (Endangered)

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 whooping cranes migrate with sandhill cranes. Whooping cranes inhabit shallow wetlands but may also be found in upland areas, especially during migration. The whooping crane prefers freshwater marshes, wet prairies, shallow portions of rivers and reservoirs, grain and stubble fields, shallow lakes, and wastewater lagoons for feeding and loafing during migration.

Overnight roosting sites usually have shallow water in which whooping cranes stand. Whooping cranes roost on unvegetated sandbars, wetlands and stock dams. Fall migration occurs in North Dakota from late September to mid October, while spring migration occurs from late April to mid June. Birds can show up in all parts of North Dakota, although most sightings occur in the western two-thirds of the state. Whooping cranes are usually found in small groups of seven or fewer individuals. They are easily disturbed when roosting or feeding.

Pallid Sturgeon (Endangered)

The pallid sturgeon occupies the Missouri and Yellowstone Rivers in North Dakota. The Service estimates that an isolated remnant population of less than 50 individuals remains in the Garrison reach of the Missouri River. There are no recent records (within the last 20 years) of successful pallid sturgeon reproduction in this reach. The Garrison reach of the Missouri River is outside of the recovery priority areas identified in the Pallid Sturgeon Recovery Plan (Service 1993). Reaches outside the recovery priority areas are not excluded from recovery actions but are designated as lower priority, because these areas have been altered to the extent that major modifications would be needed to restore natural physical and hydrologic characteristics.

Black-footed Ferret (Endangered)

The black-footed ferret inhabits short-grass prairie and is found in close proximity to prairie dog towns. Within the Project area, Williams County has a historical occurrence of the black-footed ferret. However, no black-footed ferret populations are known to exist within North Dakota at this time.

Historic Properties

As a federal action the Project must comply with federal legislation concerning historic properties within the area of consideration for the federal action. Cultural resources are the physical remains of a site, building, structure, object, district, or property of traditional religious and cultural importance to Native Americans. Historic properties are significant cultural resources that are either included on or have been determined eligible for listing on the National Register of Historic Places. In compliance with Section 106 of the National Historic Preservation Act of 1996, as amended, this Project is being administered in accordance with a programmatic agreement executed by Reclamation, the Advisory Council on Historic Preservation, and the North Dakota State Historic Preservation Officer. This agreement addresses the agency's Section 106 responsibilities in North Dakota.

In preparation of the Final EA for the Project, Powers Elevation C., Inc, was contracted to complete a Class I level survey (literature search) from the records at the State Historical Society of North Dakota. The literature review was conducted for a two-mile wide corridor of the pipeline segments for the entire service area. Previous cultural resource investigations, surveys, evaluations, and mitigation projects in the areas of potential effects were also identified and reviewed.

The Project's main water transmission pipeline, which extends from Lake Sakakawea to Minot, has been surveyed at a Class III level (pedestrian survey). The Final EA also proposed a pump station to be located at the site near Max, ND (figure 2.1). This area was also surveyed at a Class III level. The North Dakota State Historic Preservation Officer was consulted and concurred with a determination of "no historic properties affected" (ND SHPO REF.: 89-0013). The Executive Director of the North Dakota Indian Affairs Commission was also consulted and no response was received.

Social and Economic Conditions

The following indicators are used to evaluate the current regional economic conditions in the Project area:

- Value of regional output for non-agricultural industries
- Value of agricultural production
- Household income
- Net farm income.

These indicators provide an understanding of the importance of different sectors of the economy on the region, the level of economic activity, and a basis for comparison to all of North Dakota from which the relative economic conditions of the region can be determined. To provide a context for these indicators and the magnitude of any impacts, this section describes the following aspects of the regional economy:

- Population

- Education
- Median family income and average weekly wage
- Unemployment rate
- Earnings by industry
- Employment and unemployment rate
- Poverty rate
- Value of agricultural production and cost of production
- Number of farms

Economic Impact Area

The Project area includes 10 counties: Bottineau, Burke, Divide, McHenry, McLean, Mountrail, Pierce, Renville, Ward, and Williams. There are two major cities within the area: Minot in Ward County and Williston in Williams County. Minot Air Force Base is a major employer located in Minot. The regional economic impact of the Project would go beyond the direct impact areas due to trade flows and economic links. The largest sectors in the region in terms of sales/receipts and annual payroll are retail trade, wholesale trade, health care related services, and government.

Current and Future Population

The Bureau of the Census and North Dakota State Data Center (NDSDC) estimated a 2000 population of more than 119,000 people for the ten county economic impact region. The population of this same region decreased to less than 112,500 people by 2006; a decline of approximately 5.5% from 2000 to 2006. In 2006, Minot and Williston accounted for about 42% of the regional population. The rest of the region is rural in nature. All of the counties in the Project area experienced a population decline from 2000 to 2006. NDSDC projections predict this population decline will continue in the area to the year 2020. However, the decline is predicted to moderate slightly over the next 10 years. The only counties that are projected to experience a population increase from now until 2020 are McHenry, McLean, Pierce, and Ward. Population estimates and projections from 2000 to 2020 are presented in Table 3.3 for the entire Project area and individual counties.

Table 3.3 – Population Estimates and Projections from 2000 to 2020.

County	April 2000 (Census)	July 2000 (NDSDC)	July 2006 (NDSDC)	2020 (NDSDC)	Change from 2000 to 2020
Bottineau	7,149	7,118	6,650	6,202	-13.25%
Burke	2,242	2,232	1,947	1,686	-24.80%
Divide	2,283	2,265	2,092	1,420	-37.80%
McHenry	5,987	5,952	5,429	5,701	-4.78%
McLean	6,631	6,603	6,442	6,503	-1.93%
Mountrail	9,311	9,265	8,543	8,423	-9.54%
Pierce	4,675	4,663	4,221	4,360	-6.74%
Renville	2,610	2,594	2,425	2,266	-13.18%
Ward	58,795	58,666	55,270	55,809	-5.08%
Williams	19,761	19,662	19,456	16,679	-15.60%
Regional Total	**119,444**	**119,020**	**112,475**	**109,0490**	**-8.70%**

Sources: U.S. Bureau of the Census, Washington, D.C. and the North Dakota State Data Center, Fargo, ND.

Education

Table 3.4 presents the level of education in the study area and North Dakota in 2000. This is the most recent educational attainment data available. The average percentage of high school graduates is lower than the North Dakota average for all of the counties in the study area except for Renville and Ward Counties. Ward County is the only study area county that exceeds the North Dakota average percentage of population 25 years of age or over with a bachelors degree or higher. The educational attainment rates indicate potentially limited labor supplies for some occupations that would require higher levels of education.

Table 3.4 – Educational Attainment (percent of total population over 25 years of age).

County/State	High School Graduate Or Higher	Bachelor's Degree or Higher
Bottineau	81.3%	14.9%
Burke	78.8%	12.0%
Divide	80.4%	13.3%
McHenry	76.9%	13.2%
McLean	79.0%	15.1%
Mountrail	77.9%	15.6%
Pierce	76.7%	14.7%
Renville	84.1%	16.1%
Ward	87.4%	22.1%
Williams	82.5%	16.5%
North Dakota	**83.9%**	**22.0%**

Source: U.S. Bureau of the Census, Washington, D.C.

Median Family Income, Average Wage, Poverty Rates, and Housing

The Project area has a relatively low family income level and weekly wage. This same area has a moderately high poverty rate compared to all of North Dakota. The housing unit vacancy rate is also quite high. These statistics indicate that there is some cause for concern about the economic health of this area and the need for increased economic opportunities that will generate employment and income growth. Table 3.5 presents income, poverty, and housing data for the Project area.

Table 3.5 – Income, Average Wage, Poverty Rates, and Housing Units for Project Area Counties.

County	2004 Median Family Income	Average Weekly Wage	Poverty Rate (2000)	Total Housing Units	Vacant Housing Units
Bottineau	$45,900	$471	12.8%	4,409	1,447
Burke	$38,500	$578	10.9%	1,412	399
Divide	$50,400	$415	10.9%	1,469	464
McHenry	$43,500	$482	6.6%	2,983	457
McLean	$45,800	$644	8.7%	5,264	1,449
Mountrail	$38,200	$493	7.3%	3,438	878
Pierce	$43,000	$449	16.2%	2,269	305
Renville	$45,400	$480	12.5%	1,413	328
Ward	$49,700	$531	14.8%	25,097	2,056
Williams	$50,800	$734	10.7%	9,680	1,585
ND Total/ave.	**$52,500**	**$587**	**8.6%**	**-**	**-**

Value of Agricultural Products, Number of Farms, and Farm Production Expenses

Agriculture represents an important part of the regional economy, both in terms of direct income and employment effects and spin-off support industries. Table 3.6 shows the value of agricultural products sold and table 3.7 shows total farm production expenses incurred to support agricultural production in the Project area. These tables show that the region produced over $700 million worth of agricultural products in 2002 requiring nearly $500 million worth of agricultural inputs. These values were considerably higher than in 1997. Although the value of products sold has increased, the number of farms has decreased. This pattern of fewer farms producing greater output mirrors the national trend. This represents a very important sector of the regional economy.

Table 3.6 – Value of Agricultural Production and Number of Farms in 1997 and 2002.

County	Total Value of Agricultural Products Sold ($1,000's)		Average Value of Agricultural Products Sold per Farm		Number of Farms	
	1997	2002	1997	2002	1997	2002
Bottineau	$61,580	$72,252	$71,688	$82,198	859	879
Burke	$28,841	$31,882	$56,997	$70,021	506	455
Divide	$63,763	$77,053	$36,090	$40,992	566	532
McHenry	$56,529	$67,467	$59,317	$74,880	953	901
McLean	$75,961	$84,271	$72,829	$91,798	1,043	918
Mountrail	$51,637	$53,402	$63,986	$78,302	807	682
Pierce	$36,342	$36,295	$70,842	$74,528	513	487
Renville	$93,169	$125,032	$38,106	$44,136	409	353
Ward	$67,764	$94,127	$85,518	$90,927	1,262	966
Williams	$59,877	$76,873	$53,350	$65,957	891	858
Total/Ave.	**$595,463**	**$718,654**	**$60,872**	**$71,374**	**7,809**	**7,031**

Table 3.7 – Farm Production Expenses in 1997 and 2002.

County	Total farm Production Expenses ($1,000's)		Average Production Expenses per Farm	
	1997	2002	1997	2002
Bottineau	$52,715	$57,612	$61,367	$65,468
Burke	$23,445	$26,255	$46,151	$57,702
Divide	$26,150	$28,587	$46,283	$53,734
McHenry	$45,110	$57,676	$47,385	$64,442
McLean	$59,146	$67,449	$56,871	$73,474
Mountrail	$39,199	$45,708	$48,513	$66,436
Pierce	$32,584	$32,056	$63,270	$65,688
Renville	$29,519	$40,640	$72,173	$115,783
Ward	$72,228	$71,144	$57,324	$74,031
Williams	$40,716	$51,149	$45,748	$59,823
Total/Ave.	**$420,812**	**$478,276**	**$54,509**	**$69,658**

Labor Force and Unemployment

The two counties that represent the largest percentage of the total regional labor force (Ward and Williams) have unemployment rates that are the same as or lower than the state average. Minot Air Force Base provides employment to approximately 1,200 civilian employees, as well as having about 4,300 military personnel as of 2002. However, the more rural counties do suffer from higher than average unemployment rates, indicating a need for expanded employment opportunities in some counties. Labor force and unemployment estimates for the study area are presented in table 3.8.

Table 3.8 – Labor Force and Unemployment Rates.

County	Labor Force (2006)	Unemployment Rate (2006)
Bottineau	3,408	3.8
Burke	1,014	2.7
Divide	948	3.8
McHenry	2,775	5.0
McLean	4,605	4.6
Mountrail	2,875	6.1
Pierce	1,879	4.5
Renville	1,305	3.1
Ward	28,274	3.2
Williams	12,479	2.1
ND Total/ave.	**357,960**	**3.2**

Earnings and Other Measures of Regional Economic Activity

In terms of total earnings, the major industry groups in the Project area are retail sales, wholesale trade, health care and social services, and accommodations and food services. The economy of the area is primarily centered on trade, services, and agriculture, which are sectors that typically do not provide high paying jobs. Retail trade is the single largest employment sector, followed by health care and social services, and accommodations and food services. Health care and social services provide the largest total payroll followed by retail trade and wholesale trade. The number of establishments, value of sales, payroll, and the number of employees by sector are presented in table 3.9. Data are not provided for some sectors within counties for confidentiality reasons. The data presented in Table 3.9 also shows that Ward and Williams counties combine to account for a majority of the regional economy.

Table 3.9 – Establishments, Sales, Payroll, and Employment by County.

County	Establishments	Sales/receipts (dollars)	Annual Payroll (dollars)	Employees
Manufacturing				
Ward	44	-	-	-
Wholesale Trade				
Bottineau	15	84,790	2,507	81
Burke	7	28,274	711	28
Divide	8	45,029	1,149	33
McHenry	10	-	-	-
McLean	19	-	-	-
Mountrail	14	-	-	-
Pierce	10	66,440	2,512	137
Renville	13	-	-	-
Ward	97	714,078	40,500	1,338
Williams	6	-	-	-
TOTAL	199	938,611+	47,379+	1,617+
Retail Trade				
Bottineau	51	57,661	4,802	303
Burke	12	9,978	904	68
Divide	14	12,365	1,029	74
McHenry	20	18,229	1,847	125
McLean	41	33,197	3,167	231
Mountrail	43	49,828	4,054	287
Pierce	28	60,711	4,091	281
Renville	12	16,801	1,305	81
Ward	302	817,500	80,281	4,565
Williams	129	237,117	23,508	1,380
TOTAL	652	1,313,387	124,988	7,395
Professional, Scientific, and Technical Services				
Bottineau	15	3,572	1,417	63
Burke	2	-	-	-
Divide	3	582	134	9
McHenry	4	-	-	-
McLean	10	-	-	-
Mountrail	6	1,133	519	26
Pierce	11	1,417	372	31
Renville	4	-	-	-
Ward	97	21,157+	5,378+	152+
Williams	44	10,794	5,132	169
TOTAL	196	38,655+	12,952+	450+
Administrative and Support and Waste Management and Remediation Services				
Bottineau	7	4,489	2,665	327
Divide	3	-	-	-
McHenry	4	-	-	-
McLean	7	1,966	483	64
Mountrail	3	-	-	-
Pierce	5	3,892	1,913	101
Renville	3	-	-	-
Ward	87	5,745+	2,657+	309+
Williams	29	14,407	6,670	417
TOTAL	148	30,499+	14,388+	1,218+

Table 3.9 (continued) – Establishments, Sales, Payroll, and Employment by County.

County	Establishments	Sales/receipts (dollars)	Annual Payroll (dollars)	Employees
Educational Services				
Bottineau	1	-	-	-
Pierce	1	-	-	-
Ward	7	-	-	-
Williams	2	-	-	-
TOTAL	11	-	-	-
Health Care & Social Asst.				
Bottineau	11	11,511	5,854	316
Divide	4	-	-	-
McHenry	6	-	-	-
McLean	16	14,060	8,071	438
Mountrail	14	12,646	6,473	333
Pierce	13	18,480	9,362	396
Renville	6	-	-	-
Ward	141	340,900	148,723	4,855
Williams	55	-	-	-
TOTAL	266	397,597+	178,483+	6,338+
Arts, Entertainment, & Recreation				
Bottineau	10	1,285	345	42
Burke	2	-	-	-
Divide	2	-	-	-
McHenry	2	-	-	-
McLean	6	-	-	-
Mountrail	4	294	105	1
Pierce	5	817	118	10
Renville	3	-	-	-
Ward	42	-	-	-
Williams	18	3,656	820	66
TOTAL	94	6,052+	1,388+	119+
Accommodations & Food				
Bottineau	30	5,011	1,423	142
Burke	12	-	-	-
Divide	8	-	-	-
McHenry	7	870	190	24
McLean	29	4,262	804	122
Mountrail	27	5,170	1,107	159
Pierce	15	3,476	852	99
Renville	13	968	133	16
Ward	139	72,768	21,086	2,439
Williams	58	22,540	7,051	787
TOTAL	338	115,065	32,646	3,788
Other Services				
Bottineau	12	-	-	-
Burke	5	-	-	-
Divide	9	1,184	188	21
McHenry	6	-	-	-
McLean	24	3,368	795	64
Mountrail	14	1,750	460	35
Pierce	11	2,464	550	39
Renville	6	-	-	-
Ward	144	48,641	15,040	811
Williams	70	19,010	4,884	326
TOTAL	301	76,417	21,917	1,296

Small Area and Municipality Economies

Data available for municipalities and smaller communities is fairly limited. However, Census data are available for small communities which provides some information for evaluating small community the economies. Municipal data for household size, housing, income, and poverty are presented in table 3.10.

Table 3.10 - Demographic and Economic Data for Municipalities in the Project Region.

Municipality	Household Size	Family Size	Housing Units	Vacant Units	Median Household Income	Per Capita Income	Poverty Level
Berthold	2.74	3.21	181	11	$35,000	$17,683	6.6%
Bottineau	2.10	2.86	1,114	135	$29,022	$16,530	10.9%
Bowbells	2.33	2.97	214	40	$30,455	$15,491	8.6%
Columbus	1.82	2.49	142	59	$17,679	$14,643	12.5%
Kenmare	2.15	2.85	553	85	$30,057	$15,428	10.7%
Minot	2.27	2.90	16,475	955	$32,218	$18,011	12.8%
Mohall	2.22	2.88	397	57	$30,139	$17,341	10.9%
Noonan	1.74	2.70	116	40	$20,000	$21,065	14.8%
Sherwood	2.18	3.08	138	21	$26,442	$14,756	7.3%
Souris	2.59	3.43	46	14	$21,250	$9,387	16.2%
Westhope	2.14	2.90	268	40	$26,964	$18,252	8.7%
Williston	2.30	2.96	5,912	657	$29,962	$16,656	13.4%

Data in table 3.10 indicate the larger municipalities have relatively high income, although not the highest in the region, and low vacancy rates for housing. The poverty rates in many of the municipalities are actually quite high, which may be due to the relatively high level of municipal employment in the retail and accommodations and food sectors.

Indian Trust Assets

The United States has a trust responsibility to protect and maintain rights reserved by or granted to American Indian tribes or to Indian individuals by treaties, statutes, and executive orders. This trust responsibility requires that all Federal agencies, including Reclamation, take all actions reasonably necessary to protect ITAs. ITAs are defined as legal interests in property held in trust by the United States for Indian tribes or individuals. Examples of things that may be trust assets include “lands, minerals, hunting and fishing rights, and water rights” (Reclamation 1993).

The method of analysis was to identify the federally recognized tribes in the Missouri River basin or those who have historic ties through treaties. The purpose was to identify tribes that might have ITAs that could be affected by the construction of the proposed alternatives and would need to be consulted.

Thirteen tribes have reservations located directly on the Missouri River, while fifteen tribes are scattered throughout the Missouri River basin. In North Dakota, the Three Affiliated Tribes and the Standing Rock Sioux Tribe have reservations located on the Missouri River.

Trust lands are the most commonly encountered ITA as these are lands set aside for Indians with “…the United States holding naked legal title and the Indians enjoying the beneficial interest”

(Canby 1991). Trust lands are most often encountered within or near reservations. No trust lands were identified in the area that would be affected by the Project alternatives.

According to Reclamation's (1993) ITA policy, hunting, fishing, and gathering rights may qualify as ITAs. This is because the right to continue hunting, fishing, and gathering was often retained in many treaties. However, no court has ruled on whether these activities constitute ITAs.

Tribal water rights, both surface and ground water, are a matter of Federal law. The basis for Indian water rights stems from the U.S. Supreme Court's decision in *Winters v. United States* (1908), which enunciated the Winters Doctrine. According to the doctrine, the establishment of an Indian reservation implied that sufficient water was reserved (or set aside) to fulfill purposes for which the reservation was created, with the priority date being the date the reservation was established. As such, Indian water rights constitute an ITA.

When a reservation is established with expressed or implicit purposes beyond agriculture, such as fishing and water supply, then water may also be reserved in quantities to sustain use. This concept was upheld in the U.S. Supreme Court in *Arizona v. California* (1963) where the court held that the tribes need not confine the actual use of water to agricultural pursuits, regardless of the wording in the document establishing the reservation. The amount of water quantified was still to be determined by the amount of water necessary to irrigate the "practicably irrigable acreage" on those reservations. The Court also held that water allocated should be sufficient to meet both present and future needs of the reservation to assure the viability of the reservation as a homeland. Case law also supports the premise that Indian reserved water rights are not lost through non-use.

Several Missouri River Basin tribes are in various stages of quantifying their water rights. Currently, the only tribal reserved water rights that have been quantified or are being quantified are:

- State of Wyoming settlement with tribes of the Wind River Reservation (adjudicated under the McCarran Amendment)
- Compact between the state of Montana and the tribes of the Fort Peck Reservation (awaiting congressional approval)
- Compact between the state of Montana and the tribes of the Fort Belknap Reservation (ratified by the state legislature)
- Compact between the state of Montana and the Crow tribe (ratified by the state legislature)
- Compact between the state of Montana and the tribes of the Rocky Boys Reservation (awaiting congressional approval)
- Compact between the State of Montana and the Northern Cheyenne Tribe (The Northern Cheyenne Reserved Water Rights Settlement Act [P.L. 102-374])

The Corps is the federal agency responsible for operations of the Missouri River. The Corps has recognized that certain Missouri River basin tribes are entitled to water rights in streams running through and along their reservations under the Winters Doctrine. The Corps' operational decisions concerning the Missouri River Mainstem Reservoir System are based on the water that is in the system and demands placed upon it. The Corps recognizes tribal water rights to the mainstem irrespective of whether those rights have been quantified. In doing so, the Corps has recognized that future quantification of these rights could affect operations. With respect to Indian Water Rights, the Manual states:

> "When a Tribe exercises its water rights, these consumptive uses will then be incorporated as an existing depletion. Unless specifically provided for by law, these rights do not entail an allocation of storage. Accordingly, water must actually be diverted to have an impact on the operation of the System. Further modifications to System operation, in accordance with pertinent legal requirements, will be considered as Tribal water rights are exercised in accordance with applicable law" (Corps 2004).

Environmental Justice

Environmental justice was evaluated using the following indicator:

- The proportion of physical or economic impacts compared to the distribution of specific population characteristics.

If the physical or economic impact from an alternative is proportionately greater for one population group than for the entire population, this indicates significant environmental justice impacts.

An evaluation of environmental justice impacts is mandated by Executive Order 12898 on Environmental Justice (February 11, 1994). Environmental justice addresses the fair treatment of people of all races and incomes with respect to Federal actions that affect the environment. Fair treatment implies that no group of people should bear a disproportionate share of negative impacts from an action. The impacts of an action can be considered disproportionately distributed if the percentage of total impacts imposed on a specific group is greater than the percentage of the total population represented by that group. A group can be defined by race, ethnicity, income, community, or some other grouping.

Evaluating potential environmental justice concerns requires an understanding of where the proposed action impacts are likely to occur and where potentially affected groups are located. The analysis relies on demographic data from sources such as the U.S. Bureau of the Census, individual counties and municipalities, and local school districts to determine the location of different groups of people. Identifying the location of specific groups can be difficult when nonpermanent residents, such as migrant workers, are in the affected area. Demographic data are poor for these groups of people. Census data do not account for all nonpermanent residents because some cannot be contacted or some may not want to be counted. However, Census data are typically the most complete and comparable demographic and economic data available for individuals and households.

Income, poverty, and unemployment data are presented in the description of the current regional economic conditions. The data indicate that Burke and Mountrail Counties have considerably lower median family income than other counties in the Project area. The poverty rate in Pierce County is higher than the other counties. These three counties have the potential for disproportionate impacts based on income. Alternatives that have a disproportionate adverse effect on those counties listed as having low incomes could potentially have environmental justice issues. However, given that the costs associated with construction and OM&R for each biota WTP alternative would be the responsibility of the federal government, there would be no environmental justice issues associated with disproportionate changes in water rates. Therefore, no environmental justice issues associated with low income would be expected.

U.S. Bureau of the Census data are also available for gender and race. Table 3.11 presents these data. These data indicate the distribution of population by gender and race is very similar for each of the counties, with the exception of Mountrail County, which has a relatively high percentage of Native American population. McLean and Williams counties have a somewhat greater proportion of Native Americans as well. Portions of McLean and Mountrail counties are located on the Fort Berthold Reservation. There could be some potential for disproportionate impacts in Mountrail, McLean, and Williams Counties if Native Americans were adversely and disproportionately affected. However, these impacts would need to be imposed on a distinct population. The potential for adverse Environmental Justice impacts may be higher for low income areas than for areas based on race. These impacts could be the result of any financial hardship that could occur as a result of payment for Project costs.

Table 3.11 –Gender and Race within Project Area Counties.

	Male (percentage)		**Female (percentage)**		**White (percentage)**		**Black (percentage)**		**Native American (percentage)**		**65 years of Age or older (percentage)**	
County	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**	**2000**	**2005**
Bottineau	50.4	50.8	49.6	49.2	97.4	96.9	0.2	0.3	1.5	1.8	21.3	20.7
Burke	50.4	50.1	49.6	49.9	99.2	99.3	0.3	0.3	0.2	0.2	25.1	23.8
Divide	50.2	50.4	49.8	49.6	99.2	99.1	0.0	0.0	0.1	0.2	29.5	27.5
McHenry	51.0	50.4	49.0	49.6	98.8	99.0	0.1	0.2	0.4	0.5	21.8	21.4
McLean	49.6	49.1	50.4	50.9	92.7	92.6	0.0	0.0	6.1	6.2	20.4	20.2
Mountrail	49.2	49.4	50.8	50.6	68.6	66.9	0.1	0.2	30.0	31.7	17.7	16.8
Pierce	49.1	48.8	50.9	51.2	98.6	97.7	0.1	0.3	0.7	1.4	24.1	24.5
Renville	50.1	50.9	49.9	49.1	97.9	97.9	0.2	0.8	0.7	0.6	22.0	20.5
Ward	49.8	49.7	50.2	50.3	93.2	92.8	2.3	2.2	2.1	2.3	12.5	13.6
Williams	49.0	48.4	51.0	51.6	93.2	92.7	0.1	0.2	4.4	4.8	16.5	16.9
ND average		**49.9**		**50.1**		**92.3**		**0.8**		**5.3**	**14.7**	**14.2**
US average		**49.0**		**51.0**		**74.7**		**12.1**		**0.8**	**12.1**	**12.4**

Note: Gender data is provide in table 3.11 but not used as a potentially affected group.

Chapter Four
Environmental Impacts

Introduction

This chapter describes the predicted impacts of the proposed alternatives on relevant environmental resources described in chapter three. Direct, indirect, and cumulative effects are considered and quantified whenever possible. Measures and commitments to mitigate adverse environmental impacts are also described.

Table 4.1 lists the resources described and evaluated in the Final EA and FONSI for the Project service area. The findings and mitigation measures documented in the FONSI (Reclamation 2001) for each of these resources within the Project service area are incorporated by reference into this EIS; therefore, no further analysis was completed for these resource areas.

The issues or resources identified in chapter three and analyzed in this chapter are:

- Risks of transferring invasive species
- Federally listed threatened and endangered species
- Historic properties
- Social and economic conditions
- Indian trust assets
- Environmental justice

Table 4.1 - Northwest Area Water Supply Project Resource Investigations and Conclusions.

Northwest Area Water Supply Project Final EA and FONSI		
Resource Area	**Final EA (2001)**	**Finding Recorded in the FONSI (2001)**
Geology, Topography, and Soils	Section 3.1	Temporary impacts during construction; mitigation measures identified.
Water Resources	Section 3.2	▪ Construction impacts to stream crossings would be minor and short-term; design features and mitigation measures would minimize or eliminate the impacts. ▪ The incremental effect of the Project withdrawal on flows in the Missouri River will not be measurable at or below Lake Sakakawea.
Vegetation	Section 3.3	Total of 4,057 acres would be temporarily affected by Project construction and permanent vegetation losses would involve less than 21 acres; design features and mitigation measures would minimize or eliminate the impacts.
Wildlife	Section 3.4	Approximately 7.5 acres of habitat would be permanently lost from construction of permanent facilities while other potential effects would be localized and temporary. Lost habitat will be replaced as determined by the Impact Mitigation Assessment team and other effects would be minimized or eliminated through design features and mitigation measures.

Fisheries	Section 3.5	▪ Potential impacts identified include the entrainment of fish eggs, larvae, and small aquatic animals through the intake structure; these impacts would be minimized or eliminated through design features and mitigation measures. ▪ Potential for accidental spills of pretreated water if a pipeline break were to occur near an intermittent or perennial stream; design features and mitigation measures will be implemented during construction, operation and maintenance of the Project.
Interbasin Biota	Section 3.6	The potential transfer of non-native biota from the Missouri River basin to the Hudson Bay basin is the specific concern associated with the proposed Project. Numerous, significant design features and operational measures are included which collectively provided a very low risk of biota transfer.
Federally Listed Threatened and Endangered Species	Section 3.7	The Final EA identifies all Federally-listed species known to occur, or could occur in the Project area. Any potential effects would be minimized or eliminated through design features and mitigation measures. No adverse effects are expected to result from construction, operation or maintenance of the Project.
Wetlands	Section 3.8	Potential effects include temporary disturbance and some permanent but replaceable losses. Most impacts will be minor and short-term and would be minimized or eliminated through design features and mitigation measures.
Historic Properties	Section 3.9	A class I literature review was completed for the two-mile wide corridor for each proposed pipeline segment to estimate effects on these resources. The North Dakota State Historic Preservation Officer concurred with a determination of no historic properties affected. Additional inventory, analysis, and consultation with the North Dakota Sate Historic Preservation Officer and Tribes are required after project designs are completed and pipeline centerlines are known. Potential impacts would be minimized or eliminated through design features and mitigation measures.
Paleontological Resources	Section 3.10	A literature and database search was completed to determine the general types of paleontological resources present within the Project service area. Additional inventory, analysis, and consultation with the North Dakota Geological Survey is required after project designs are completed and the pipeline centerlines are known. Potential impacts would be minimized or eliminated through design features and mitigation measures.
Social/Economic	Section 3.11	Potential positive effects include improved human health and quality of life, improved economic opportunities and increased employment. Negative effects on social and economic conditions resulting from construction and operation of the Project would be minor and localized.
Land Use and Ownership	Section 3.12	Approximately 95% of the lands that would be affected are privately owned and consist of farmland and rangeland. Impacts would be temporary and localized. These impacts would be minimized or eliminated through design features and mitigation measures.
Indian Trust Assets (ITAs)	Section 3.13	The Project will not significantly affect ITAs, either through construction on trust lands or through the withdrawal and use of Missouri River water. However, should Tribes with an interest in the Missouri River water pursue a settlement of their Winters Doctrine rights, the water available for the Project could be affected. Potential effects to ITAs would be minimized or eliminated through design features and mitigation measures.
Aesthetics	Section 3.14	Potential effects include visual and noise impacts which would be limited to the construction phase of the Project and would be temporary and localized. These impacts would be minimized or eliminated through design features and mitigation measures.

Adaptive Management

What Is Adaptive Management?

Managers in many fields adjust their strategies as new information accumulates and as new practices are developed. Adaptive management is a strategy for addressing a changing and uncertain environment that relies on common sense and learning. Adaptive management looks for ways to understand the behavior of ecosystems and draws upon theories from ecology, economics and social sciences, engineering, and other disciplines. Adaptive management incorporates and integrates concepts such as social learning, operations research, economic values, and political differences with ecosystem monitoring, modeling, and science (National Research Council 2004).

The goal of adaptive management is to enhance scientific knowledge and reduce uncertainties. The uncertainties that are part of any system can come from a number of sources. Parma et al. (1998) and Regan et al. (2002) describe causes of uncertainty in natural systems. Sources of uncertainty include natural variability, incomplete data, and social and economic changes and events, all of which may affect natural resources systems. Adaptive management works to create policies that help organizations, managers, and other stakeholders respond to and even take advantage of unanticipated events (Holling 1978; Walters 1986; National Research Council 2004).

Application of adaptive management is intended to support actions when the scientific knowledge of their effects on ecosystems is limited (Holling 1978). This does not mean that actions are delayed or postponed until there is agreement that we have learned a sufficient amount about an ecosystem. Rather, adaptive management provides a means to adjust management actions when new information becomes available.

Adaptive management consists of a set of principles used to guide the implementation of management actions (National Research Council 2004). The fundamental principles of adaptive management, while useful for evaluating problems and adjusting strategies, are not designed to be a strict roadmap to a specific endpoint (National Research Council 2004). Rather, the principles set forth a mechanism that will assist in recognizing when changes occur and management should be adjusted. The principles are based on several important aspects of systems.

First, as we learn more about the interactions between humans, their environments, and potential impacts of human activities, there may be a need to develop new courses of action. Second, the environment in which we live is highly variable and is always changing, and these factors can impact operations of projects. Finally, the objectives that society has for a specific project and the outcomes from that project may change, resulting in a need to change how the project is operated (National Research Council 2004).

The basic theme of adaptive management is to continually evaluate project operations and develop courses of actions that can respond to change. This means that project managers must revisit objectives and develop a range of choices for how they will manage a project if changes occur. Managers must also use the information gained through evaluation and apply it to future decisions. A key to successful implementation of any adaptive management strategy is to involve stakeholders in the learning and evaluation processes.

Where Has Adaptive Management Been Used?

Adaptive management has been used on water resource projects in many areas of the United States. For example, the U.S. Department of the Interior used an adaptive management approach to restoring riparian habitat in the Grand Canyon by releasing large quantities of water from Glen Canyon Dam. A number of projects have incorporated adaptive management to address recovery of threatened or endangered species, or in ecosystem restoration programs. For example, the Corps incorporated adaptive management into restoration efforts in the Florida everglades.

Reclamation has used adaptive management strategies in the development of water projects in North Dakota. As projects are undergoing final design and construction, Reclamation has established teams of stakeholders to review projects for environmental compliance. These teams evaluate specific project features as they are being designed and built and monitor environmental compliance. This program allows construction to proceed despite changes (e.g. unanticipated discovery of cultural resources), respond to the changes, (re-route the pipe to avoid the site), and "adapt" to conditions in the field.

How Will Adaptive Management Be Used?

After a Record of Decision has been completed for the proposed action, Reclamation will develop an adaptive management strategy to assess the effectiveness of the biota water treatment alternative selected to further reduce the risks of transferring non-native species. Reclamation will develop the adaptive management plan in accordance with the Department of the Interior policy guidance and technical guide (see Appendix B).

Impacts to the Proposed Biota Water Treatment Plant Location

As stated in chapter three, the affected area being evaluated is the 41 acre site of the proposed biota WTP (Figure 2.1). All of the alternatives, including No Action, propose the construction of a biota WTP at this site. Each proposed biota WTP would have a unique design footprint relative to the type of treatment regime proposed in the alternative. The No Action Alternative would have the least direct impact with the loss of about an acre of cropland. The three proposed action alternatives would have very similar direct impacts due to construction of the facilities on approximately 7.5 acres. No prime or unique farmlands are found at the site.

Environmental Mitigation

The final designs of the biota WTP will determine if the wetlands on the site would be affected. A total of approximately 7 acres of seasonal wetlands (PEMC) and less than 2 acres of temporary wetlands (PEMA) could potentially be impacted (see figure 4.1). Wetlands are always avoided if possible but if they can not be avoided they will be mitigated on an acre for acre basis.

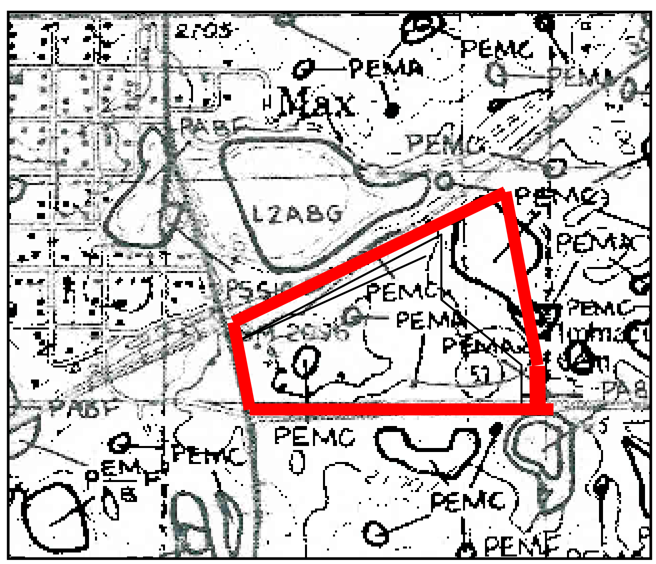


Figure 4.1 National Wetland Inventory Map of the Proposed Treatment Site.

Risks of Transferring Invasive Species

All of the alternatives considered in this EIS would deliver treated water through a buried pipeline from the Missouri River basin to the Hudson Bay basin. An interbasin water transfer could provide a pathway for introducing invasive aquatic species to the Hudson Bay basin.

Nonindigenous species - a species that does not occur naturally in a given area.
Invasive species - a nonindigenous species whose introduction does or is likely to cause economic or environmental harm or harm to human health.
Pathway – the means by which species are transported from one location to another.

The pathways responsible for initial introduction of invasive species are usually different from the pathways through which invasive species spread once they become established. Because most invasive species in North America had their origin on another continent, prevention of new invasions must focus on pathways that potentially link these distant watersheds. For example, many invasive species in the Great Lakes were initially transferred via ship ballast water. After species such as zebra mussels became established in the Great Lakes, numerous pathways (both natural and human mediated) were responsible for their subsequent spread throughout the Great Lakes and into adjacent basins.

Regulation of Invasive Species

There are currently no treatment standards for ballast water or interbasin water transfers to reduce the risk of biological invasions. International ballast water treatment standards have been proposed, and even more stringent standards are envisioned in a bill currently introduced in the U.S. Congress (see chapter three). Because ballast water is such an important pathway for initial introductions of invasive species, enactment of strict ballast water treatment standards would greatly reduce the risk of spreading invasive species through many other pathways, including interbasin water transfers. In other words, invasive species cannot spread in North America if their arrival can be prevented. On the other hand, many invasive species are impossible to eradicate, and nearly impossible to contain once established, because numerous pathways usually link adjacent watersheds.

"Every Day, Large Quantities of Ballast Water from All Over the World are Discharged into United States Waters" U.S. Department of Homeland Security (http://www.uscg.mil/hq/g-m/mso/ans)**.**

All of the alternatives evaluated in this EIS include treatment within the Missouri River basin and conveyance of the treated water in buried pipeline to the Minot WTP. The water would be further treated at the Minot WTP before distribution to communities and rural water systems in the service area. This constitutes a higher level of treatment than the strictest standards proposed for ballast water. Thus, ship ballast water and other pathways related to international commerce will continue to pose a higher risk of biological invasions than existing or proposed interbasin water transfers.

Risk Analysis

Reclamation contracted with USGS Biological Resources Division to evaluate the risks of transferring invasive species as a result of an interruption of the treatment process at the biota WTP and a breach in the conveyance pipeline to the Minot WTP. The risk analysis was completed in 2007, and is included as a supporting document to this EIS. The risk analysis was peer-reviewed by technical experts both within and outside of USGS.

Based on previous analyses conducted for the Red River Valley Water Supply Project (USGS 2005a, 2005b, 2006), the risk of transferring macroscopic organisms (visible to the naked eye) is practically zero. Therefore, for this Project, the analysis focused on microorganisms and disease agents (see Table 3.2). While it is not possible to evaluate or even identify all potentially invasive microorganisms in the Missouri River basin, the species evaluated presented a wide range of life history attributes (including treatment resistance), and may be representative of unknown species (either presently occurring or yet to be introduced) with similar life history characteristics.

The risk analysis followed a series of steps that incorporated problem formulation, identification of potential pathways for movement of organisms between the two basins, analysis and data synthesis, and risk characterization, including analysis of uncertainties associated with risk estimates.

For a successful invasion to occur, these three steps must take place in the following order:

1) Transfer of invasive species successfully completed.
2) Invasive species establishes a reproductive population.
3) Reproductive population of the invasive species attains sustainable numbers and causes impacts in receiving system.

Each of the proposed alternatives includes a control system to further reduce the risk of transferring invasive species. These control systems, which include biota water treatment and conveyance pipeline to the Minot WTP, are described in chapter two. The primary focus of the risk analysis was a failure in components of the biota water treatment and the conveyance pipeline to the Minot WTP that could result in transfers of invasive species. The analysis relied on existing failure rate data from a variety of sources, including historical data about the device or system under consideration, government and commercial failure rate data, handbooks of failure rate data for various components, and field and laboratory testing.

In addition to the potential for control system failure, other factors must be considered in characterizing Project-related risks. These factors include the likelihood that an invasive species of concern occurs in the source water, and if it does occurs, what is its population density. These are critical factors in determining the risk that a species will be transferred. Likewise, the occurrence and population density of susceptible hosts in the receiving waters are critical. These factors determine whether or not a pathogen or parasite will become established and cause impacts.

System failure rates change with time, and can often be depicted by a “bathtub curve” (figure 4.2). Most systems are initially characterized by a relatively high, but rapidly decreasing failure rate. For example, failures occurring immediately following start up may reflect malfunctions associated with manufacturing defects.

Following the “early failure period,” the failure rate levels off and remains relatively constant throughout “useful life of the system.” During this period, the failure rate will be low. Systems generally function most of their lifetimes in this flat portion of the bathtub curve, but if the system is not repairable and remains in use long enough, failure rates will increase as materials wear out. System failures that occur years after start up may reflect failures in pipes associated with age-related corrosion.

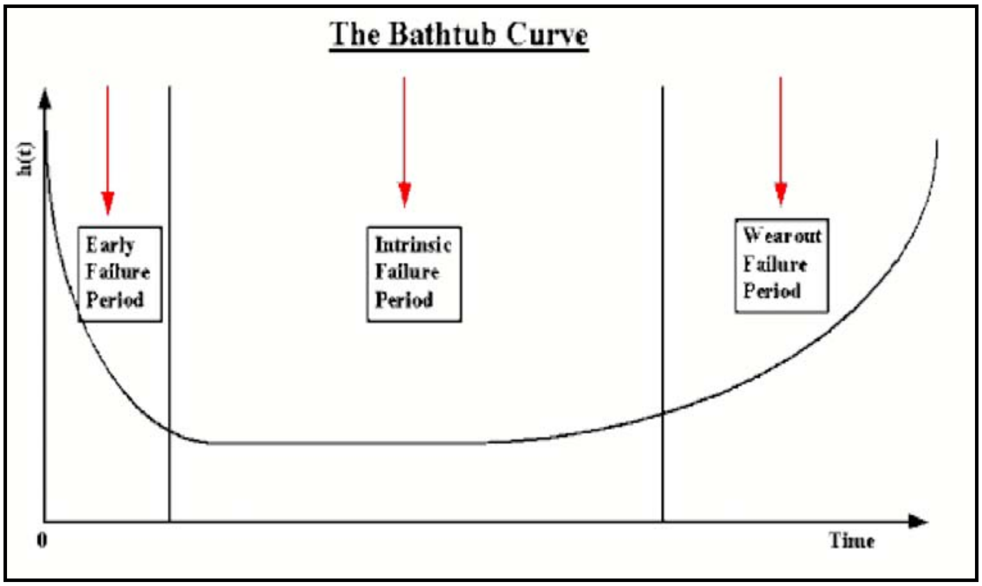


Figure 4.2 – A “Bathtub Curve” Represents the Lifetime Distribution of Failures for Many Engineered Systems (original figure modified from National Institute of Standards and Technology).

Probability of Control System Failure

Control system failure was simulated using statistical models to estimate failure probabilities for each alternative (see USGS 2006 for an explanation of analytical methods). Figure 4.3 shows the results of a simulation of failures over time for a generalized water treatment and transmission system applicable to any of the proposed alternatives. The analysis simulates a 10,000-day (approximately 27-year) period that includes an early failure period, a period of useful life (characterized by constant failure rate), and late life (characterized by increasing failure rate). The simulation follows a typical bathtub curve.

Failures during the “start up” period are conservatively assumed to always increase the risk of transferring invasive species. In reality, failures in water treatment, and the conveyance pipeline to the Minot WTP could also reduce risks of biological invasions, if those failures resulted in an interruption of water transfer.

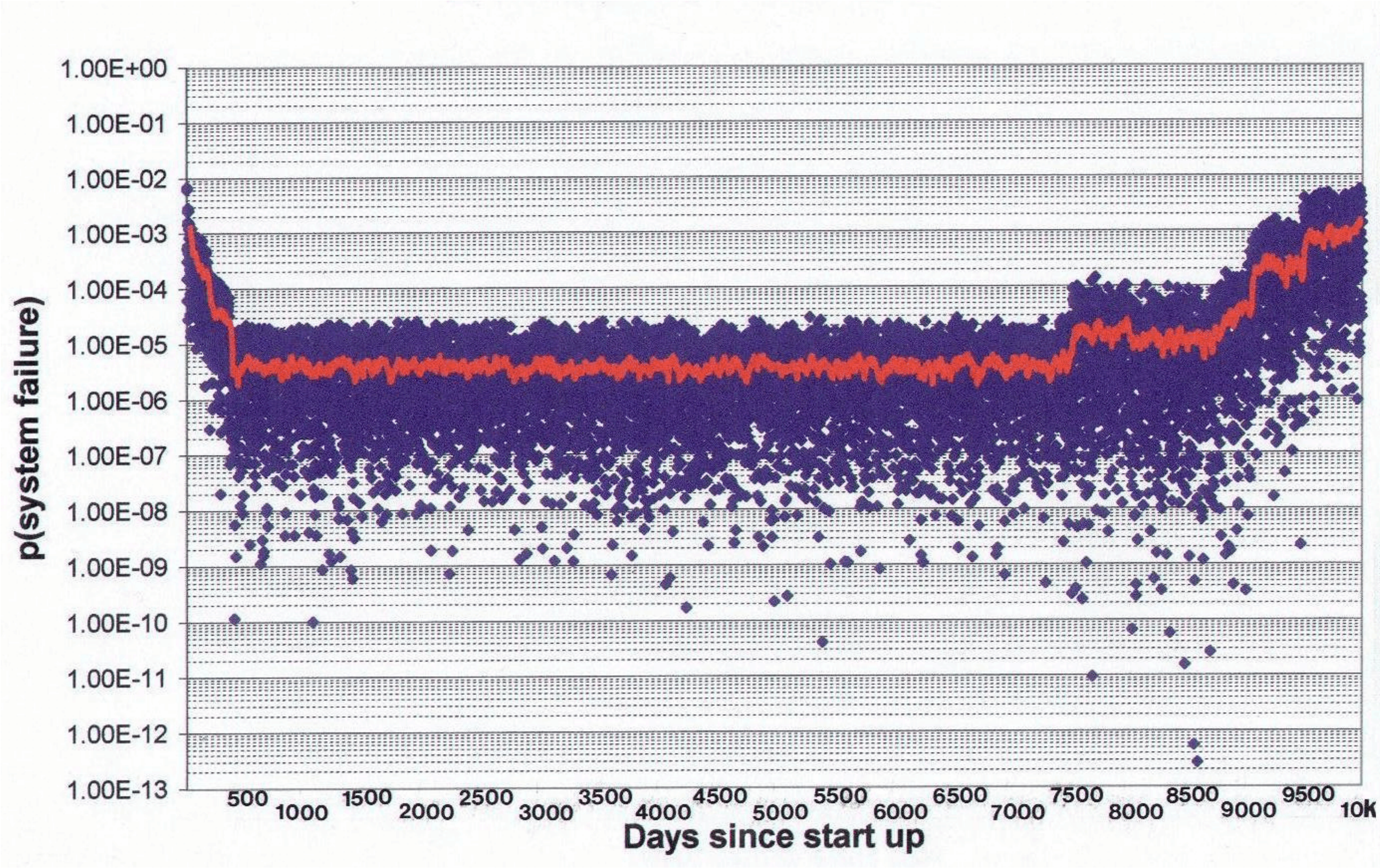


Figure 4.3 – 10,000-day Simulation of the Life-Time Distribution of Control System Failure.

Following the start-up period, the intrinsic failure period (day 361 through day 7,500) assumes that the system is designed to meet SDWA disinfection standards, including LT2, yet still has the potential to fail. During the intrinsic failure period, the system could fail to meet performance criteria for a variety of reasons. For example, undetected leaks could release enough microorganisms into the environment over time to establish a population in the receiving waters.

Age-related failures become dominant factors in evaluating system performance beyond the intrinsic failure period, with an increasing failure rate as the system ages. The analysis showed that system failures that result in a biological invasion would be very unlikely. This is not surprising, as the biota treatment processes proposed in the EIS are commonly used for drinking water and have a long history of safe and reliable operation. Given the conceptual designs presented in the EIS, the simulation illustrated in figure 4.3 yielded the following risk estimates for system failure that results in a biological invasion:

- Risk of system failure during early failure period (initial year of operation) is conservatively estimated at 1 out of 10,000.
- Risk of system failure during intrinsic failure period (bounded between 1-year and up to 20-years service life) is conservatively estimated at 1 out of 100,000.
- Risk of system failure during wear out failure period (beyond 20 years service life) is conservatively estimated at 1 out of 1,000.

Regardless of when system failure occurs, these conservative estimates assume that a single system failure would transfer an invasive species, and a sustainable population would be established as a result of that system breach. As noted in USGS (2006), this fails-once assumption may be possible, but is not likely, and depends on when and where the failure occurs.

The failure analysis demonstrates the need for regular maintenance and replacement of system components to reduce risks due to system aging. The typical bathtub curve represents the lifetime distribution of failures for a system that is “left alone” (i.e., does not receive regular maintenance). Given the operation and maintenance features incorporated into each of the alternatives, including continuous monitoring of the biota WTP, alternate distributions that reflect regular maintenance and replacement more accurately represent the expected failure rates for the Project’s biota treatment and conveyance system. In fact, replacement of worn parts with new ones that are technologically superior may not only extend the useful life of the system, but may reduce risks of biological invasions due to system failure. Similarly, water treatment plants that are regulated under the SDWA are regularly maintained and upgraded, often decreasing human health risks over time.

Potential Biological Consequences and Risk Characterization for Species Evaluated

Nonindigenous species can alter population, community, and ecosystem structure and function (Elton 1958; Mooney and Drake 1986; Vitousek et al. 1996; Drake et al. 1989). Ecosystem-level consequences of invasive nonindigenous species have major ecological and economic consequences, and in some cases can directly affect human health.

Pimentel (2003) estimated that the economic impact of aquatic invasive species in the United States is $9 billion annually. Pimentel’s estimates were based on introductions of macroscopic species. As noted previously, given the control systems proposed for each of the alternatives, the Project-related risk of transferring macroscopic organisms is practically zero.

The potential consequences associated with biological invasions of the Hudson Bay basin could be realized through either Project or non-Project pathways. Project-related invasions would occur if invasive species are transferred from Lake Sakakawea to the Souris River and become established in the Hudson Bay basin as a result of control system failure. Non-Project pathways include not only alternate modes of transfer from Lake Sakakawea to the Souris River, but also pathways linking other basins (e.g., Great Lakes and Mississippi River basins) to the Hudson Bay basin.

It is not possible to quantify the impacts that an invading species will have on its new ecosystem. In some cases (e.g., zebra mussel), impacts that an organism has had elsewhere might be a reasonable predictor of its potential impact in the Hudson Bay basin if transferred through the Project. In other cases, the impact could be quite different. For example, a transfer of *Myxobolus cerebralis* (the causative agent of whirling disease) might have little impact, since the salmonid hosts are not present in the Souris River. This was noted by the Government of Canada in there comment letter on the Red River Valley Water Supply Project DEIS, which stated "…there are very few water bodies in the Canadian portion of the area where there are self supporting populations of rainbow trout (*Oncorhynchus mykiss*), and those salmonids that are resident in the area of concern are relatively unaffected by the presence of *M. cerebralis*." Even in watersheds where the pathogen and susceptible hosts coexist, outcomes of *M. cerebralis* introductions have ranged from no apparent effect on populations of susceptible fish (Modin 1998) to catastrophic declines (Vincent 1996).

Also, it must be noted that even in the absence of an interbasin water transfer, biological invasions of the Hudson Bay basin are likely to occur due to multiple competing pathways (see spatiotemporal analysis in USGS 2005a). Although competing pathways are much more sporadic than the interbasin water transfer that will occur as a result of this Project, water treatment would greatly reduce the risk of biota transfer through the operation of the Project. This is particularly true for macroscopic organisms, where any of the treatment processes evaluated would be virtually 100 percent effective. While existing and potential future policies and regulations may help to limit the establishment and spread of invasive species, it is highly unlikely that the problem can ever be eliminated.

Fish Diseases Fishes are susceptible to numerous parasites and infectious diseases. The documented fish pathogen and parasite communities in the source and receiving waters are very similar, particularly for fish species that occur in both basins. Dick et al. (2001) reported only two out of 44 parasites that occurred in the Missouri River in North Dakota that have not been reported in the Red River drainage or other Manitoba waters. While it is possible that there are unknown or undocumented fish diseases in Lake Sakakawea, it is unlikely that such diseases would cause significant impacts in the Hudson Bay basin and still remain undetected in Lake Sakakawea.

Impacts associated with fish diseases are best documented for hatcheries and aquaculture facilities, although field observations of disease outbreaks are not uncommon. In general, fish diseases in wild fish populations are poorly understood and are often undetected. No natural waters with resident fish populations are considered free of disease. Fish diseases that become established in wild populations may be difficult to control and impossible to eradicate. However, transfer of disease agents does not equate to their establishment. Diseased fish may be transferred to aquaculture or hatchery facilities and cause significant impacts to those facilities, yet never be detected in wild fish populations.

While the spectrum of fish diseases far outreaches the four disease agents evaluated in USGS (2007), the species evaluated can be used to illustrate the process available to address any number of species that are currently recognized as causative agents of fish disease (in aquaculture or in the wild). As such, the potentially invasive species evaluated contributed to generalized interpretations of risks associated with other disease causing agents that could be transferred by the Project.

Most fish diseases are likely to present relatively limited data for a comprehensive analysis of risks focused on a quantitative or probabilistic evaluation, and a qualitative approach must therefore be employed out of necessity. Such an evaluation must include consideration of the known distributions of both the disease agents and susceptible fish species. The fish disease and parasite communities of the Missouri River basin in North Dakota and the Hudson Bay basin are very similar, particularly for fish species that occur in both basins (see Dick et al. 2001).

Whirling disease is a parasitic infection of trout and salmon by the myxosporean protozoan *Myxobolus cerebralis* that has caused severe impacts on some coldwater fisheries in North America. This parasite targets cartilaginous tissue and infection can cause deformities of the skeleton and nerve damage that results in “blacktail.” The disease is named for the erratic, tail-chasing “whirling” in young fish that are startled or fed. Heavy infection of young fish can result in high mortalities.

Whirling disease has caused significant economic impacts in the western United States. As of 2002, Congress has appropriated $6 million to battle the parasite. The Whirling Disease Foundation has raised more than $2 million for research, education, and outreach. The State of Montana has contributed more than $4 million for empirical tests and monitoring designed to assess the disease's impact on trout and to track the parasite's spread (Palmer 2002).

Young and adult trout and salmon are susceptible to *M. cerebralis* infection, but the severity of the infection decreases with age (Markiw 1992). When fish are infected at an older age, they are usually asymptomatic, healthy-looking, and of normal size, but may carry the spores of *M. cerebralis*. Severe mortalities of 90% or more may occur among newly hatched fish exposed to the infective agent (Markiw 1991). When an infected fish dies, many thousands to millions of the parasite spores are released to the water.

M. cerebralis, as the causative agent of whirling disease, is currently a serious disease problem in many states of the western U.S., including neighboring Montana immediately west of North Dakota. Since its initial record of occurrence in Pennsylvania in 1956, whirling disease outbreaks have occurred in no fewer than 21 states. Whirling disease myxospores are highly resistant, and can survive in the environment for 30 years or more under some environmental conditions, if not immediately ingested by their intermediate host. Recent studies, however, demonstrate that myxospores do not survive desiccation, freezing, or prolonged exposure to temperatures above 22 degrees Celsius (Hedrick et al. 2008). In characterizing risks potentially associated with *M. cerebralis* or any other disease agent, host distributions (primary and intermediate) are critical to the evaluation.

Not all salmonid species are equally susceptible to infection. For example, rainbow trout are most susceptible to the disease and brook trout much less so. Lake trout apparently cannot be infected and do not acquire the disease (O'Grodnick 1979). The susceptibility of lake whitefish, a commercially important species in Lake Winnipeg, has not been determined.

The intermediate host, *Tubifex tubifex*, is a commonly occurring aquatic worm and would likely not limit the spread of whirling disease, if *M. cerebralis* traveled to the Hudson Bay basin by means of any pathway. But the occurrence of susceptible fish (e.g., rainbow trout) in the receiving waters would strongly influence the extent to which risks of whirling disease might be realized. Rainbow trout are widely stocked, and have been recorded in several streams of the Red River basin adjacent to the Souris River basin. The Red River and Souris River basins are both sub-basins of the Hudson Bay basin. However, there is little natural reproduction of rainbow trout or other salmonids known to be susceptible to whirling disease in the receiving waters.

Risks associated with interbasin transfers of the causative agent of whirling disease would be greatly reduced and have the lowest uncertainty with treated water delivered via buried pipeline (USGS 2005a). Whirling disease has never been detected in North Dakota, and the relatively low population densities and lack of natural reproduction of salmonids in the state greatly reduces the risk that the causative agent will become established and cause significant impacts anywhere in North Dakota. The low-risk forecasts for an emergence of whirling disease in the Souris River basin are reinforced by the lack of documented occurrence in the source water (Lake Sakakawea) and the relatively sparse trout fishery in the importing region. Unlike those areas of the western U.S. (e.g., Montana and Colorado) where outbreaks have been well characterized, the receiving system in the Souris River basin of North Dakota has a relatively underdeveloped trout fishery, with no natural reproduction. Risks could be realized if resistant stages of *M. cerbralis* completed a successful transit from Missouri River waters to receiving waters of the Souris River basin after breaching biota water treatment countermeasures, but the probability of such an event is very low. In particular, source water fully treated in the Missouri River basin compliant with LT2 (as in the Conventional Treatment Alternative and the Microfiltration Alternative) would present negligible risks for transmission of whirling disease. UV disinfection is highly effective for both spore phases of *Myxobolus cerebralis* (Hedrick et al. 2007, Hedrick et al. 2008). Therefore, alternatives employing UV disinfection, with or without filtration, would also present a very low risk of transferring whirling disease. With treatment, uncertainties associated with risk estimates for whirling disease and other disease agents that could potentially be transferred by the Project would be markedly reduced.

Polypodium hydriforme is a parasitic hydrozoan of sturgeon. Although the existing information and available data for this causative agent of fish disease were relatively limited (see USGS 2007 Appendix 2), the risks associated with transfer of *P. hydriforme* through the Project would be low to very low, depending on the alternative. Given that the disease is widely distributed and naturally occurring in the Hudson Bay Basin, and monitoring programs for the disease are relatively underdeveloped (yielding small sample sizes for evaluation), it is unlikely that an outbreak of disease caused by *P. hydriforme* could be linked to the Project or any other potential pathway without high uncertainty. Other potential disease agents of concern (e.g., *Icelanochohaptor microcotyle*, *Corallataenia minutia*, *Actheres amblopltis*, *Ergasilus cyprinaceus*; see Dick et al. 2001) are characterized by uncertainties that exceed those of *P. hydriforme*, and any estimates of risks beyond those forecasts for *P. hydriforme* would be largely unsupported by empirical data.

Enteric redmouth disease is a systemic bacterial disease caused by *Yersinia ruckeri*. Enteric redmouth disease occurs in salmonids throughout Canadian and United States waters in both wild populations and in culture environments. The disease has also been documented in non-salmonids such as emerald shiners, fathead minnows, goldfish, and farmed whitefish. Enteric redmouth disease was first reported in rainbow trout from Idaho in the 1950's, then described by Rucker in 1966 (Rucker 1966). Enteric redmouth disease generally expresses itself by sustained low-level mortality, which may eventually result in high losses. Typical symptoms include lethargy, anorexia, and subcutaneous hemorrhages in and around the mouth, oral cavity, and at the base of fins. Internal hemorrhaging and inflammation of the gastrointestinal tract also occur. If fish survive, their skin darkens and their behavior becomes altered, e.g., the typical survivor shuns other fish and seeks shelter (Busch 1983; Rucker 1966). The original source of *Y. ruckeri* is uncertain, since the isolate from Idaho was contemporaneous with isolates in West Virginia and Australia in the 1950's (Bullock et al. 1977). Enteric redmouth has not been documented in North Dakota, but has been documented in hatcheries within the Hudson Bay basin in Canada. To date, it does not appear to be established in wild fish populations in the Hudson Bay basin (Dick et al. 2001). Given the present and historic distribution of *Y. ruckeri*, it is very unlikely to be transferred by the Project. However, stocking of fish transferred from watersheds where the disease is endemic to waters in the Hudson Bay basin remains a potential pathway for future invasions.

Infectious Hematopoietic Necrosis Virus (IHNV) is a rhabdovirus that primarily affects salmonids. IHNV is endemic to the Pacific Northwest where the virus was first isolated from a disease outbreak in 1953 at two fish hatcheries in the state of Washington. The distribution of the virus first characterized from the Northwest has subsequently been observed throughout the United States and Canada and has been identified in Minnesota, Montana, South Dakota, Alaska, West Virginia and British Columbia. It has also been observed in Europe and Asia with outbreaks reported in France, Italy, Belgium, Japan, Taiwan, and Korea. Currently, IHNV is not believed to exist in wild fish populations within either the Missouri River basin or the Hudson Bay basin.

The spread of IHNV is believed to have originally been from the practice of feeding fry with meal composed of ground adult fish and viscera, but more recently it has been a consequence of shipping IHNV contaminated eggs and fry from the Pacific Northwest of the United States and from Canada (Wolf 1988). IHNV infections may cause severe mortalities in young fish, generally as fry or fingerlings. Survival and percent mortality from IHNV are directly correlated to the age and size of the fish. The younger the fish, the more susceptible they are to this disease. Young fish infected with the virus show external signs of infection within a week of exposure. Mortalities usually begin four or five days after exposure with peak counts about ten days after exposure. Generally, after 40 or 50 days there are usually no more mortalities (Chiou 1996).

IHNV may survive for several months in water and infect fish (Mulcahy et al. 1983). IHNV is then either absorbed through the skin and gills or it is consumed orally. Therefore, infected water may also be a potential source of viral infections, but it is not likely that IHNV could survive a winter in the environment. Although IHNV may be waterborne, a Project-related invasion is very unlikely due to the lack of documented occurrence in North Dakota and the effectiveness of all treatment alternatives for viruses.

Although relatively limited in its characterization, Pallid Sturgeon Iridovirus, and other fish viruses (see MacConnell et al. 2001) would also present a similar range of risks, although risks across disease agents such as these would inherently vary as a function of host species (including alternate hosts and intermediate hosts).

Waterborne diseases of terrestrial vertebrates (including humans) A range of waterborne diseases of terrestrial and wetland vertebrates was considered as part of the risk analysis. In contrast to most of the disease agents for freshwater fishes, these diseases of terrestrial and wetland vertebrates would not be considered as a potential invasive species, since each is naturally occurring and widely distributed in both the Missouri River basin and the Hudson Bay basin. These organisms, however, are examples of waterborne disease agents that are potentially subject to outbreaks in the receiving area, could be representative of other as yet unknown disease organisms, and present a range of life history characteristics, including varying degrees of resistance to one or more disinfection technologies.

Cryptosporidium parvum is a parasitic microsporidian parasite that presently challenges water treatment systems (Embrey et al. 2002), and has received much attention within the context of risk evaluations focused on human health and diseases in other terrestrial vertebrates. With treatment that incorporates filtration or UV disinfection and complies with SDWA disinfection standards, the risks of *C. parvum* being transferred from the Missouri River basin to the Souris River basin in sufficient numbers to document increased disease occurrence range from low to very low.

Giardia lamblia is a parasitic protozoan that remains a public health concern in untreated waters intentionally or accidentally consumed, or in treated waters contaminated prior to ingestion. As with other microorganisms considered in this analysis, risks associated with *G. lamblia* being transferred through the Project range from low to very low when water of the Missouri River is piped to distribution systems in the Souris River basin following passage through a control system that meets SDWA disinfection standards.

Commonly encountered waterborne bacteria that have a long history of cause-effect relationships with disease in terrestrial vertebrates were evaluated in the risk analysis. *Escherichia coli* has numerous serotypes that currently occur in both the Missouri River basin and the Souris River basin, yet it could potentially be transferred through the Project (see USGS 2007 Appendix 2). It is highly unlikely, however, that outbreaks of any of various diseases associated with serotypes of *E. coli* could be unequivocally linked to interbasin water transfers. Project-related risks are conservatively rated as being low to very low, if implemented via a control system characterized as previously noted for reducing risks associated with microsporidians and viruses. From a technical perspective, linking Missouri River source waters with increased disease outbreaks in the Souris River basin is highly unlikely unless sufficient "fingerprinting" of source waters and waters available to end-users were routinely completed (see Grayman et al. 2001).

Risk analysis for *Salmonella* spp. tracks a course similar to that of serotypes of *E. coli*. *Salmonella* spp. (including *S. typhi, S. typhmurium,* and other serotypes associated with other waterborne infectious diseases) were considered, not because Reclamation and stakeholders anticipated an outbreak of typhoid fever, but rather these species present a long history in infectious disease and a rich technical literature with respect their role as sources of waterborne diseases.

For the characterization of risks potentially associated with the Project, these disease agents, as were the serotypes of *E. coli*, are currently cosmopolitan in their distribution; hence, any risks associated with these disease agents would require an analysis of shifts in metapopulations, most likely manifested as disease outbreaks in the importing basin. Establishing causal linkages between source waters and disease outbreaks in the importing basin may defy attribution, since it is unlikely that outbreaks of any of various diseases associated with *Salmonella* spp. could be unequivocally linked to interbasin water transfers, as would be the case anticipated for serotypes of *E. coli*. However, if interbasin water diversions were implemented via a control system characterized as previously noted for reducing risks associated with microsporidians and viruses, risks of waterborne disease outbreaks associated with *Salmonella* spp. originating from waters from the Missouri River would be low to very low, depending on the alternative.

Legionella spp., as most commonly exemplified by *L. pneumoniae,* are ubiquitous and occur in a wide range of freshwater environments. As summarized in Appendix 2 of USGS (2007), a wide range of Legionellaceae, including *L. pneumoniae*, could potentially be transferred by the Project. Risks of interbasin transfers of the Legionellaceae, including *L. pneumoniae* and other members of the family are low to very low under a conservative scenario wherein source waters are treated in the Missouri River basin prior to piped transfers to distribution nodes in the Souris River basin. In such a scenario for interbasin water diversion, control systems including multiple technologies (e.g., conventional pre-treatments with DAF or pressure-driven filtration devices followed by combinations of chemical treatments to maintain chlorine residues) would reduce risks to levels similar to those for other disease agents evaluated. Under this conservative scenario, this very low risk reflects, in part, our relatively limited technical ability to distinguish between sources of the disease agents.

Cyanobacteria Cyanobacteria present a significant challenge to water systems throughout North America (see, e.g., Knappe et al. 2004) and the rest of the world (Chorus and Bartram 1999). Species evaluated in the risk analysis included *Anabaena flos-aquae*, *Microcystis aeruginosa*, and *Aphanizomenon flos-aquae*. All of these species are widely distributed throughout North America, including the Missouri River basin and the Hudson Bay basin. Each of these species has a long history of causing water quality problems for fish and wildlife (see Wobeser 1997), domestic livestock (see Svrcek and Smith 2004; see also http://www.ext.nodak.edu/extpubs/ansci/animpest/v1136w.htm last accessed May 21, 2007), and public health (Chorus and Bartram 1999). The current analysis of risks clearly indicates that, if conditions amenable to cyanobacterial growth exist within the water distribution system (including storage reservoirs), a margin of safety will be achieved with control systems that incorporate sufficient water treatment technology (e.g., DAF, slow sand filtration, membrane filtration with sufficiently low rejection value) to reduce risks associated with cyanobacteria and their associated toxins.

Risks associated with interbasin transfers of cyanobacteria are relatively low to very low, if scenarios involve multiple technologies to implement interbasin water diversions. Risks associated with Project-related transfers of cyanobacteria can be significantly decreased through control system design, yet the source and receiving waters may provide conditions sufficient to support cyanobacterial growth. Wherever conditions of temperature, light, and nutrient status are conducive to algal or cyanobacterial growth, surface waters may experience proliferation of these aquatic organisms, frequently as an algal or cyanobacterial “bloom” when the event is dominated by a single (or a few) species.

Risks Associated With Non-Project Pathways

As noted in chapter three, there are many potential pathways through which biological invasions can occur. From the perspective of competing risks, if a biological invasion is considered a failure, then each of the many different ways that a failure can occur are competing. The series of events required for a successful invasion—dispersal followed by colonization and establishment of sustainable populations in newly occupied habitats—may be realized via different “flows of events” to achieve the same end-state. These flows of events vary from being highly independent to highly dependent and interdependent processes (see USGS 2005a). Thus, the same impact may occur with or without the Project, and the important question is whether or not the Project substantially increases the overall risk of invasion when all potential invasion pathways are considered collectively.

The risk of transfer through non-Project pathways varies greatly among the potentially invasive species, and is dependent upon many factors, including life history attributes (e.g., method of reproduction and number of offspring produced), abundance, number of available pathways, and availability of suitable habitat in the receiving watershed. In this sense, suitable habitat includes susceptible host species for pathogenic and parasitic organisms.

In particular, the dispersal mechanisms for a species play a key role in determining the likelihood that it will invade previously unoccupied but suitable habitat. Dispersal of invasive species often involves a combination of diffusive movement and jump events. An example of diffusive dispersal would be the gradual downstream or upstream movement of introduced fish in a river system to adjacent suitable habitat. Such movement of fish provides an efficient mechanism for transferring any pathogens and parasites they may be harboring. Many factors can limit diffusive dispersal, including unsuitable habitat, competing species, and physical barriers such as dams.

Jump events, by contrast, involve the movement of organisms from one suitable habitat to another over some intervening distance of unsuitable habitat (e.g., movement from one river to another across terrestrial habitat). Jump dispersal is often human-aided. For example, recreational boats and boat trailers are a primary pathway for dispersal of Eurasian watermilfoil between unconnected water bodies (http://www.dnr.state.mn.us/invasives/aquaticplants/milfoil/index.html). In Minnesota, Eurasian watermilfoil has spread to at least 197 water bodies throughout the state since it was first detected in Lake Minnetonka in 1987 (http://files.dnr.state.mn.us/eco/invasives/infestedwaters_newmilfoil.pdf).

In the case of whirling disease and many other fish parasites and pathogens, movement of infected fish (including stocking) is the primary pathway through which the organism has historically spread (Bartholomew et al. 2005, Bullock and Cipriano 1990, Plumb 1972; see also Whirling Disease Initiative at http://whirlingdisease.montana.edu/about/faq.htm#11). Other potential pathways for introduction of whirling disease include sale of infected fish products for human consumption and recreational activities that transfer mud or water from endemic to unaffected waters (Bartholomew et al. 2005), and piscivorous birds (Taylor and Lott 1978, El-Matbouli and Hoffman 1991, Kerans et al. 2007) . For any pathway, the proximity of endemic waters to unaffected waters is an important consideration in evaluating risk of transfer and establishment. In other words, the shorter the distance an organism has to travel, the more likely it is to be transferred.

The physical characteristics of the microorganism are also important. Whirling disease myxospores are physically adapted to settle out of the water column to increase the chance of infecting *Tubifex tubifex,* which lives in the bottom sediments (Bartholomew et al. 2005). This adaptation decreases the potential for myxospores to disperse by drifting long distances downstream (e.g., from the Missouri River in western Montana to central North Dakota, or from the Souris River in North Dakota to Lake Winnipeg). On the other hand, whirling disease actinospores are adapted to remain suspended in the water column, but are short-lived, decreasing the chance that they will complete their life cycle if released into a waterbody lacking susceptible fish.

Because of the number and complexity of competing pathways, it is difficult to quantify the risk of transferring invasive species through non-Project pathways.

USGS (2007) developed a simple model to analyze competing pathways (Project and non-Project) as risk factors influencing biological invasions. The simulation was derived from the fault-probability trees considered in USGS (2005a) and the failure analysis considered in USGS (2006). Project-related risks assumed treatment meeting disinfection standards (including LT2) under SDWA, and were based on empirical estimates of treatment and conveyance failure.

The probability of Project-related biological invasions was much lower and less variable than for any of the competing non-Project pathways considered in the simulation. Project-related risks presented a relatively limited and well defined output distribution characteristic of engineered systems, while a wider range of variability was evident in competing non-Project pathways.

Additionally, past experience shows that invasions of the Hudson Bay basin through non-Project pathways from the Missouri River basin or from other adjoining basins are almost certain to occur.

As part of the risk analysis conducted for the Red River Valley Water Supply Project, USGS (2005a) predicted the potential distribution for several invasive species using Genetic Algorithm for Rule-Set Production (GARP), an expert system and machine-learning approach to predictive modeling (Stockwell and Peters 1999). GARP looks at the biological and physical habitat where a species is present and characterizes the potential distribution in areas that are not presently occupied.

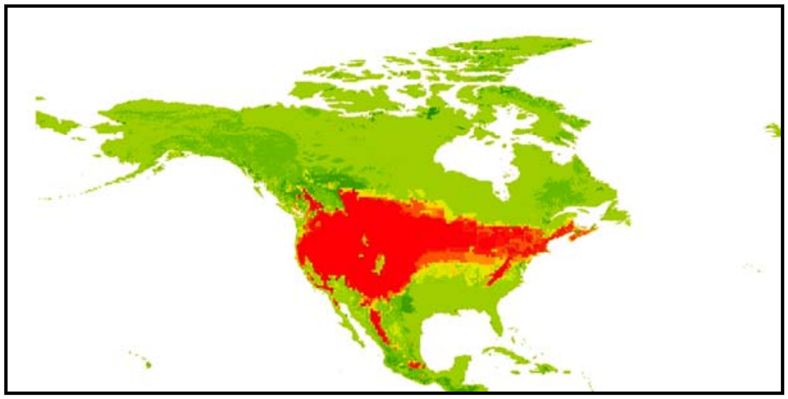


Figure 4.4 – Current Distribution of New Zealand Mudsnail in North America. Red color indicates areas with documented occurrence. Source: http://nas.er.usgs.gov/ARCIMS/interactive/interactive.asp?speciesID=1008

Figure 4.4 shows the current distribution of New Zealand mudsnails in the U. S., and figure 4.5 shows the North American distribution predicted by GARP. The figures illustrate that New Zealand mudsnails are likely to become established in the Red River basin, even in the absence of an interbasin water transfer. These projections are consistent with data on the spread of New Zealand mudsnail in the western U. S. since it was first recorded in the mid-1990s.

Comparison of Alternatives

The risk analysis (USGS 2007) demonstrated that, with effective treatment, the risk of transferring invasive species through the Project would be low to very low for all of the alternatives. Within this low risk category, however, there are some differences in risk among the alternatives due to differences in biota treatment.

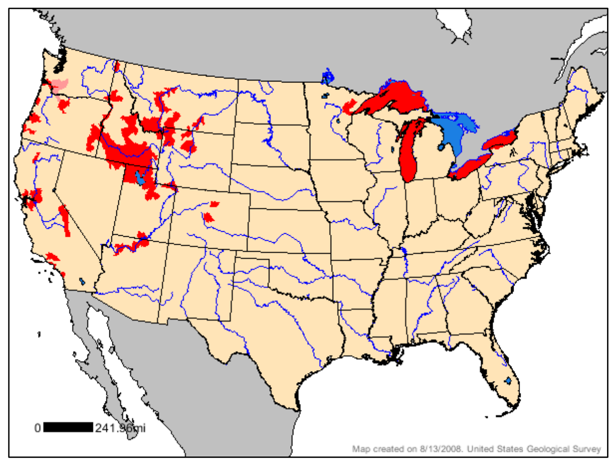


Figure 4.5 – Predicted Distribution of New Zealand Mudsnail in North America. Red Color Indicates Areas Included in 75% to 100% of Model Predictions (from USGS 2005a).

Table 4.2 summarizes the risk reduction for each alternative. All of the proposed treatment regimes include multiple processes. To compare risk reduction related to treatment failure, risk reduction credits were assigned for each process included in a treatment regime. The assigned values are simple binary scores or categorical rank-scores weighted so that increasing value indicated greater reduction in risks. Following the assignment of risk reduction credits to each compartment within each alternative, component scores were summed to yield total risk reduction credits. On the basis of this categorical analysis, the alternatives yielded a range of risk reduction credits achieved for each system - in ascending order, No Action < Basic Treatment < Conventional < Microfiltration.

Potential breaches in the water transmission pipeline are the same for all alternatives; hence, water transmission risks are not incorporated into this analysis. Given the pipe materials and countermeasures such as cathodic protection incorporated into the pipeline's construction, conveyance risks across for each alternative would be considered low. Nonetheless, as additional treatment processes are added within the Missouri River basin, the risk that a pipeline breach would result in a biological invasion decreases because there is less chance that viable organisms would be present within the pipeline. The Conventional Treatment and Microfiltration alternatives have the highest risk reduction score, because these have the most redundancy in the treatment regime and are less likely to fail, or to allow a transfer of invasive organisms. The addition of the filtration process in these options provides an additional barrier that the No Action and Basic Treatment alternatives do not provide.

Table 4.2 – Risk Reduction Rank Scores.

Alternative	Step 1	Step 2	Step 3	Step 4	Step 5	Total Rank Score
No Action	Chlorination-Chloramination				Minot WTP	
Rank	1				2	**3**
Basic Treatment	Coagulation-Flocculation-Sedimentation	UV	Chlorination-Chloramination		Minot WTP	
Rank	1	1	1		1	**4**
Conventional	Dissolved Air Flotation	Media Filtration	UV	Chlorination-Chloramination	Minot WTP	
Rank	1	1	1	1	1	**5**
Microfiltration	Coagulation-Pin Floc	Microfiltration	UV	Chlorination-Chloramination	Minot WTP	
Rank	1	2	1	1	1	**6**

No Action This alternative would rely on chemical disinfection using chlorine/chloramine, with a chloramine residual maintained in the pipe for biofilm control. In addition to these treatment countermeasures, several mechanical and structural features and operational procedures were incorporated into this alternative as described in the *NAWS Project Biota Transfer Control Measures* (Houston Engineering, Inc. et al. 1998) and the *NAWS Project, Biota Transfer Control Measures Update* (Houston Engineering, Inc. and Montgomery Watson 2001). The No Action Alternative would meet or exceed SDWA disinfection standards for viruses and *Giardia* prior to crossing the basin divide (Table 2.6). No log reduction credits would be received for *Cryptosporidium*, which is resistant to chlorination. Water would not be compliant with SDWA until after final treatment (including filtration) at the Minot WTP. The Minot WTP currently includes conventional lime softening and would implement ultraviolet radiation for additional disinfection if this alternative was selected (Reclamation 2001).

Of the alternatives evaluated, No Action has the lowest risk reduction score (table 4.2). As such, an interruption in the treatment process at the biota WTP and breach in the conveyance pipeline would pose a higher risk of transferring invasive species than the other alternatives. Nonetheless, because the water would be pre-treated and delivered in a buried pipeline, the risk of biological invasions would be low. For an invasion to occur, viable organisms would have to survive disinfection, escape into the environment through a breach in the pipeline, disperse into surface waters in the Souris River basin, reproduce, and cause impacts.

In summary, the Project-related risk of transferring invasive species from the Missouri River basin to the Souris River basin is low under the No Action Alternative. Overall, the risk of transferring invasive species through non-Project pathways would be high, but the risk would vary substantially from species to species, depending on life history attributes and the number and magnitude of potential invasion pathways.

Basic Treatment This alternative includes a coagulation-flocculation-sedimentation basin along with UV disinfection, chlorine disinfection and chloramine residual within the Missouri River basin, with the finishing treatment process (lime softening and filtration) occurring at the Minot WTP.

Basic Treatment yielded an intermediate risk reduction score— greater risk reduction than that observed for No Action, yet not as great as those scores attained by the Conventional Treatment and Microfiltration alternatives. As compared to No Action, the additional treatment processes within the Missouri River basin provides a greater level of disinfection as well as redundancy within the control system, thereby reducing the risk that a single interruption of the treatment process would result in a biological invasion. Furthermore, some organisms (e.g., whirling disease myxospores and *Cryptosporidium*) are resistant to chemical disinfection, but can be inactivated with UV disinfection. Basic Treatment would meet or exceed SDWA disinfection standards for viruses and *Giardia* and the bin 1 disinfection standard for *Cryptosporidium* prior to crossing the basin divide (Table 2.6).

In summary, the Project-related risk of transferring invasive species from the Missouri River basin to the Souris River basin is very low under the Basic Treatment Alternative. Overall, the risk of transferring invasive species through non-Project pathways would be high, but the risk would vary substantially from species to species, depending on life history attributes and the number and magnitude of potential invasion pathways.

Conventional Treatment This alternative includes DAF pre-treatment, followed by media filtration, UV irradiation, and chlorination with a chloramination process in place to maintain a chlorine residual within the transmission system. DAF has been used in management of invasive species (e.g., for managing ballast water, where typical body sizes of aquatic nuisance species range from 0.02 to 10,000 micrometers). Such a particle-size range would be effective against various microorganisms (e.g., protozoa, dinoflagellates, and bacteria), various planktonic species, plants, insects, other arthropods, worms, mollusks, and vertebrates (see USGS 2005a). Bench-scale experiments focused on managing ballast water have demonstrated particle removal efficiencies as high as 98% for a freshwater matrix (see Voon 2002, USGS 2005a,b).

For this alternative, DAF would be used as part of a multiple step treatment process that meet or exceed all SDWA disinfection standards for viruses, *Cryptosporidium*, and *Giardia* prior to crossing the basin divide (Table 2.6).

With pre-treatment and media filtration, the risk of transferring macroscopic organisms such as fish or aquatic invertebrates would be essentially zero. The proposed treatment would meet SDWA disinfection standards, which would ensure that the risk of transferring microorganisms would be very low. Overall, the risk of a biological invasion occurring through non-Project pathways would be much greater than the risk due to Project pathways for most potentially invasive species.

Microfiltration For particles larger than viruses, microfiltration provides a practically absolute barrier, and is granted substantial log removal credit for *Giardia* and *Cryptosporidium* when applied to drinking water applications. Final treatment at Minot WTP would rely on lime softening capacity currently in place, and no additional plant upgrades would be required.

This alternative includes microfiltration with UV disinfection and chlorination. With disinfection and microfiltration, the risk of transferring macroscopic organisms would be essentially zero. The proposed treatment would meet SDWA disinfection standards, which would ensure that the risk of transferring microorganisms would be very low. The Microfiltration Alternative would meet or exceed all SDWA disinfection standards for viruses, *Cryptosporidium*, and *Giardia* prior to crossing the basin divide (Table 2.6).

Overall, the risk of a biological invasion occurring through non-Project pathways would be much greater than the risk due to Project pathways for most potentially invasive species.

Preferred Alternative This alternative includes UV disinfection and chlorination at Max, with the finishing treatment process (lime softening and filtration) occurring at the Minot WTP. The combination of UV disinfection and chlorination would effectively treat all of the microorganisms evaluated, including spore-forming organisms such as *Cryptosporidium* and *Myxobolus cerebralis*. Risk reduction would be similar to the Basic Treatment Alternative which relies on the same disinfection technologies. As compared to No Action, the additional treatment process within the Missouri River basin provides a greater level of disinfection as well as redundancy within the control system, thereby reducing the risk that a single interruption of the treatment process would result in a biological invasion.

In summary, the Project-related risk of transferring invasive species from the Missouri River basin to the Souris River basin is very low under the Preferred Alternative. Overall, the risk of transferring invasive species through non-Project pathways would be high, but the risk would vary substantially from species to species, depending on life history attributes and the number and magnitude of potential invasion pathways.

Cumulative Effects

Biological invasions of the Hudson Bay basin have occurred in the past and will likely occur in the future with or without this Project. With the proposed control systems, particularly for alternatives including filtration, the additional risk posed by the Project is negligible, both in terms of the occurrence and timing of future biological invasions. Therefore, no cumulative effects are anticipated.

The risks of transferring invasive species via the Project's facilities have been carefully estimated and are on the low to very low end of the scale. Among the alternatives evaluated, Conventional Treatment and Microfiltration would provide the greatest risk reduction. The Preferred Alternative would provide effective treatment for a broad range of microorganisms, including all of the potentially invasive species evaluated in the EIS.

The Red River Valley Water Supply Project is a potential future action that would transfer water from the Missouri River basin to the Hudson Bay basin. That project would include a multiple-barrier treatment process with disinfection and filtration of water prior to crossing the basin divide. Previous analyses demonstrated that the risk of transferring invasive species through that project would be very low.

The Devils Lake Outlet is a state project that releases water from Devils Lake, a normally non-contributing sub-basin of the Red Rive Basin, to the Sheyenne River, a tributary of the Red River. Ongoing studies have not demonstrated the occurrence of any parasites or pathogens in Devils Lake that do not also occur in the Hudson Bay Basin.

Risks posed by this Project would be very low, and would not significantly increase the overall risks associated with non-Project pathways. No other federal, state or local government actions in the Project area that would cumulatively lead to an increased risk of transferring invasive species were identified. It is recognized that multiple pathways independent of the Project exist for biological invasions. However, the Project is not connected with these other risks and would not contribute to adverse cumulative effects.

Summary and Conclusions

With the multiple barriers included in all alternatives, the risk of biological invasions through Project pathways would be low to very low for all potentially invasive species identified. Therefore, no Project-related impacts are anticipated under any of the alternatives evaluated. However, the risk will never be zero. Competing non-Project pathways will probably lead to establishment of some invasive species in the near future, following the trend that has lead to species invasions of the Hudson Bay basin in the past, even in the absence of imported water from the Missouri River basin.

Risks exist in a changing landscape of time and space, and the risks associated with invasive species illustrate such an observation. In 1977, the International Joint Commission (IJC) listed pallid sturgeon as a "trashfish" that could be transferred to the Hudson Bay basin through the Garrison Diversion Unit. Today, the U.S. spends millions of dollars in an effort to recover the pallid sturgeon from the brink of extinction. For some potentially invasive species, however, the IJC's findings of unacceptable risks of biological invasions resulting from water diversions envisioned in the mid-1970s and early 1980s (see IJC 1977, Section 1) were justified given the control systems proposed at that time. With the control technologies developed in the intervening 30 years and proposed in this EIS, along with the differences in purpose and scope between this Project and the Garrison Diversion Unit as envisioned in the 1970s, those findings are not applicable to this Project.

A primary goal of the risk analysis and this EIS is the identification of risk reduction tools to minimize unintentional introductions of invasive species. Elimination of all risks of species invasion may be a management goal, but attaining zero risk is highly unlikely within the context of competing pathways.

On the other hand, a Project-related risk of "very close to zero" would be achieved with control systems proposed in this EIS. Although some people may consider elimination of interbasin water transfers a viable risk avoidance option, there are multiple non-Project pathways through which invasive species may be transferred. Hence, this default risk strategy would probably fail within the larger picture, since competing pathways are likely to yield successful species invasions (USGS 2005a).

To further reduce the risks of biological invasions associated with an interruption in the treatment process at the biota WTP and a breach in the conveyance pipeline to the Minot WTP, a framework for evaluating the condition of water treatment components and developing long-term monitoring programs would be part of the operation and maintenance of the biota WTP.

Environmental Mitigation

The resources described and evaluated in the Final EA (Houston Engineering, Inc. et al. 2001) and the FONSI (Reclamation 2001) are listed at the start of this chapter (see table 4.1). The findings and mitigation measures documented in the FONSI for each of these resources within the Project service area are incorporated by reference into this EIS. The mitigation measures in the FONSI related to risks of interbasin biota transfer are superseded by the environmental mitigation measures below.

- A computerized supervisory control data acquisition system will be designed to monitor the entire operation of the biota WTP.
- Standby power units will be located at the biota WTP to ensure continuous monitoring in case of a temporary or total power outage.
- All waste streams from the biota WTP will be retained and disposed of at an approved disposal site within the Missouri River basin.
- For the No Action, Preferred, and Basic Treatment alternatives all waste streams from the Minot WTP will be treated to inactivate disinfectant resistant pathogens, or transported to an appropriate disposal facility in the Hudson Bay basin, or transported for disposal within the Missouri River basin.
- Water quality monitoring of raw water sources will be implemented prior to the final design to determine how seasonal changes in water quality may affect the biota WTP design.
- A long-term monitoring plan for the biota WTP will be developed to assess treatment efficacy.
- An emergency response plan, will be developed for the biota WTP, with special emphasis on preventing potential transfer of invasive species in the event of a plant malfunction.
- Reclamation will assume ultimate responsibility for the construction and OM&R of the biota WTP.

- Reclamation will coordinate with the State of North Dakota through the State Water Commission, to assure adequate operation, maintenance, and replacement of the delivery system biota transfer control measure features including isolation valves.

- Reclamation will develop an adaptive management plan, in accordance with the Department of the Interior's policy guidance (Order 3270) and the report *Adaptive Management, the U.S. Department of The Interior Technical Guide* (Williams, B.K. et al. 2007). The plan will be implemented to assess control system efficacy and make modifications to the control system if the risk changes significantly.

Federally Listed Threatened and Endangered Species

ESA requires consultation with the Service on discretionary federal actions that may affect federally listed threatened and endangered species and designated critical habitat. This section constitutes the Endangered Species Biological Assessment as required under Section 7 of the ESA.

Reclamation has consulted with the Service under the procedures of Section 7 of the ESA. During the preparation of this EIS, the Service was contacted during the scoping process and invited to be a cooperating agency. The Service declined to become a cooperating agency but continues to be a member of the Impact Mitigation Assessment team and remains involved as a reviewing agency. Potential impacts to federally threatened and endangered species were evaluated for the Project in the Final EA and documented in the FONSI (Reclamation 2001). The Service concurred with Reclamation's findings that no adverse effects to threatened or endangered species were expected from construction, operation or maintenance of the Project. Any potential effects, including those identified during final design and construction, would be minimized or eliminated through design features and mitigation measures.

In 2001 when the Final EA was prepared there was no designated critical habitat for the piping plover. In September 2002, the Service designated critical habitat for piping plover in North Dakota along the Missouri River/Reservoir and for specific prairie alkali lakes in numerous counties in the Project area. However, alkali wetlands were always noted and avoided in the proposed pipeline routing for the Project.

Section 7 of the ESA implementing regulations (50 CFR 402) states that the effects of a proposed action are added to the environmental baseline to determine if the species likely would be jeopardized by a proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions, and other human activities in the action area. It also includes anticipated impacts of all proposed federal actions in the action area that have already undergone formal or early section 7 consultation and the impact of state and private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline is a "snapshot" of a species health at a specified point in time. Usually, this is the current condition.

Analysis of potential impacts used the resource information described in the affected environment in chapter three to establish current conditions. Analyses of impacts to resources were used to analyze potential impacts to federally protected species and designated critical habitat.

Direct impacts to federally listed species could include direct and indirect mortality or temporary displacement of species caused by construction activities (habitat destruction and habitat disturbance). Most potential impacts would likely be temporary in nature, allowing species to return after habitat is restored. No direct or indirect impacts were identified for any of the alternatives construction, operation, or maintenance activities for the federally listed least tern, piping plover, whooping crane, or pallid sturgeon.

There is designated critical habitat for the piping plover in Mclean County, but the two closest alkali wetlands Crystal Lake and Engle Lake are located approximately 6 and 7 ½ miles, respectively, to the southwest of Max and would not be affected.

Environmental commitments will be incorporated into all the action alternatives to avoid potential adverse effects; e.g., conducting pre-construction surveys and avoiding these species habitats. Because environmental commitments would be incorporated to avoid potential adverse impacts, and any potential adverse impacts would not result in take and are extremely unlikely to occur. Reclamation has determined there would be "no effect" to least tern, piping plover, whooping crane, or pallid sturgeon.

The Project's effects on threatened and endangered species are the same as (i.e. not changed from) those considered and evaluated in the Final EA and the determinations of "no effect" recorded in the FONSI (Reclamation 2001) remain the same. This EIS affirms these determinations and as such no further or formal consultation with the Service is necessary.

Environmental Mitigation

The following commitments would be implemented to avoid adverse impacts to all federally listed species:

- In areas with migratory bird crossing concerns, all permanent and temporary power or communication lines associated with the construction area would be buried where practical. If burial were not possible, the lines would be designed and located to avoid raptor collisions and/or electrocutions pursuant to Avian Power Line Interaction Committee protocol (1994, 1996, and 2005). Expanded protection measures for above ground power lines would also include: provision of greater than 90-inch spacing between conductors or grounding features; appropriate insulation of exposed conducting features; use of anti-perching devices as appropriate; avoidance of steel pole use where practical; and appropriate use of line aviation markers where power lines may occur adjacent to significant habitat areas e.g. adjacent to or across wetlands, native prairie, and feeding areas.

- The Impact Mitigation Assessment team will review the location of the biota WTP to determine if additional field surveys are needed to determine the occurrence of listed species.

- If threatened or endangered species are encountered during construction, Reclamation would immediately consult with the Service to determine appropriate steps to avoid any effects to these species, including cessation of construction in the area.

Historic Properties

Section 106 of the National Historic Preservation Act requires that federal agencies consider the effects of federal undertakings on historic properties. Historic properties are significant cultural resources; including sites, buildings, structures, objects, or districts, or properties of traditional religious and cultural importance to Native Americans; that are either included in or have been determined eligible for inclusion in the National Register of Historic Places.

To evaluate the effects of a proposed undertaking on historic properties, federal agencies are required to consult with the appropriate State Historic Preservation Officer (SHPO), any tribe or Tribal Historic Preservation Officer (THPO) with a historic interest in the Project undertaking area of potential effects, and the interested public. Environmental documents prepared in compliance with the NEPA can be used to examine and address these effects and as the basis for consultation.

As documented in the Final EA and FONSI, cultural resource records were searched at the North Dakota State Historical Society and the resulting Class I literature review report entitled *Northwest Area Water Supply Project, Bottineau, Burke, Divide, McLean, Mountrail, Renville, Ward, and Williams Counties, North Dakota: A Class I Cultural Resource Inventory,* (Olson 1998) was prepared.

As Project construction proceeded, 32 of the 41 acres at the proposed site for the biota WTP were surveyed at a Class III pedestrian level on September 24, 2003. The resulting report *Eleven Mile Survey for the NAWS Water Pipeline and 32 Acre Pump Station in McLean and Ward Counties, North Dakota: A Class III Cultural Resource Inventory*, was prepared by William J. Bluemle, Metcalf Archaeological Consultants, Inc. (2005). This report documents that no cultural resources were found at the site. The North Dakota State Historic Preservation Officer was consulted and concurred with a determination of "no historic properties affected" (ND SHPO REF.: 89-0013). The Executive Director of the North Dakota Indian Affairs Commission was also consulted and no response was received.

Reclamation has a cooperative agreement with North Dakota Geological Survey and they have reviewed their Fossil Site Database and conducted field inventories of the Project's mainline corridor alignment as construction progressed between Minot and Lake Sakakawea. No fossil sites were discovered during the paleontological field survey in the Max Area. Their conclusion was that glacial drift is generally unfossiliferous and it is unlikely that paleontological resources would be encountered during construction. (North Dakota Geological Survey letter dated August 24, 2004).

No Action Alternative The proposed site for this alternative has been surveyed at a Class III level and the SHPO and North Dakota Indian Affairs Commission were consulted on a determination of "no historic properties affected." Therefore, this alternative has no potential to impact cultural resources.

Action Alternatives Within the 32 acres evaluated in the Class III survey of the proposed site, cultural resource sites were identified. The exact locations of the proposed treatment facilities may or may not fall within the area previously surveyed. Once the final design is determined, if the footprint of the facility falls outside of the previously surveyed area, there is the possibility that cultural resources could be impacted and an additional survey may be warranted based on consultation with the SHPO.

Before any feature of an alternative is constructed, the objective will be to identify and evaluate any historic properties that could be affected by the undertaking and either avoid the properties or mitigate any adverse effects to these properties. These activities will be done in consultation with SHPO, THPOs, and tribes. Avoidance is the preferred method of mitigating any adverse effects, as it would preserve the property. However, should avoidance not be possible, mitigation measures developed in consultation with the appropriate SHPO and, if applicable, tribes and THPOs, would be implemented. These mitigation measures also would preserve the data represented by and contained within the property, thereby minimizing any direct effects.

Environmental Mitigation

If unanticipated cultural resources are encountered during construction, all ground disturbing activities in the immediate area of the resource will be stopped until Reclamation can consult with the SHPO and appropriate Tribes and evaluate the resource per 36 CFR Part 800.13. (Sept. 10, 2001 FONSI – Pg. 17)

Social and Economic Conditions

This section of the EIS examines the potential effects of the proposed action on social and economic conditions. This includes regional economic impacts from construction and OM&R of the proposed alternatives.

Four biota water treatment alternatives are under consideration for the Project which have a wide range of estimated costs and would therefore have a wide variety of potential impacts on the regional economy. Each of the alternatives would have a positive influence on the regional economy. These impacts are the result of facility construction expenditures, annual OM&R expenditures, and any potential increase in local commercial and domestic activities that is directly related to improved water treatment. The analysis presented in this section describes each of the potential regional economic impacts associated with the treatment alternatives, the methods used to estimate these impacts, and provides impact estimates.

The regional economic impacts from construction and operation of facilities associated with each alternative stem from capital, labor, energy, and other related expenditures within the region. These expenditures generally lead to positive impacts on regional output and employment.

The study area considered in a regional economic impact analysis is generally limited to those areas that experience a direct impact from any potential construction or changes in operations. From an economic perspective, these direct impacts may extend well outside of traditional impact areas of other resources in order to account for flows of goods, services, and payments to major trade centers outside of direct impact areas. In addition, different types of impacts will have different affected areas. There are two major impact categories: impacts from construction activities and impacts from OM&R expenditures. Construction impacts would occur wherever construction activity takes place.

The following indicators are used as a measure of the impacts from each alternative on the regional economy:

- The value of regional output produced in the study area
- Regional income
- Regional employment

The regional impacts from construction and OM&R expenditures were analyzed using the IMpact analysis for PLANing (IMPLAN) model. The IMPLAN model uses the Department of Commerce national input-output model to estimate flows of commodities used by industries and commodities produced by industries. Social accounts are included in the IMPLAN model data base for each region under consideration. Social accounts represent the flow of commodities to industry from producers and consumers, as well as consumption of the factors of production from outside the region. Social accounts are converted into input/output accounts and the multipliers for each industry within the region, which accounts for the multiple effects of changes in spending associated with land retirement. The IMPLAN model also accounts for the percentage of expenditures in each category that would remain within the region and expenditures that would flow outside the region.

In order to estimate the regional economic impacts associated with each alternative, estimates of construction expenditures were input into the IMPLAN model. Estimating the impacts of construction and OM&R activities requires expenditure estimates by category. This allows a more accurate accounting of expenditures that would stay within the impact region and materials/services that are only available outside the region.

The impacts associated which each of the alternatives are based on changes in industry output, employee compensation, and employment. Industry output is a measure of the value of industry's total production and is comparable to Gross Regional Product. Employee compensation represents wages and benefits paid to employees.

Construction and Operation, Maintenance, and Repair Impacts

In order to estimate the regional economic impacts from construction and annual OM&R costs, the estimated costs and categories of costs were estimated. The costs used to estimate impacts from construction and OM&R expenditures are shown in table 4.3.

Information from final cost estimates for the Lewis and Clark Regional Water Supply Project were used to disaggregate costs into cost categories. The percentage of costs attributed to each category for construction were: materials 56.2%, labor 23.4%, fuel 2.9%, and equipment 17.5%. For OM&R the approximate costs were: materials 16.8%, labor 27.7%, energy 18.8%, and equipment 36.7%.

Table 4.3 – One-time Construction Costs and Annual OM&R Costs.

Alternatives	Construction Costs (1,000's)				Annual OM&R Costs (1,000's)			
	Materials	Labor	Fuel	Equipment	Materials	Labor	Energy	Equipment
No Action	$6,472	$2,690	$328	$2,010	$45.5	$75.1	$50.9	$99.5
Basic Treatment	$39,396	$16,373	$1,995	$12,236	$320.0	$527.7	$358.1	$699.1
Conventional	$42,773	$17,776	$2,166	$13,285	$320.9	$529.1	$359.1	$701.0
Microfiltration	$51,778	$21,519	$2,622	$16,082	$371.6	$612.7	$415.9	$811.8
Preferred	$9,849	$4,093	$499	$3,059	$51.4	$84.8	$57.5	$112.3

In order to estimate the true regional impacts associated with building and operating a biota WTP, it is important to know where the funds for construction and operations are coming from. If the Project is funded locally, funds that would otherwise be spent on other non-water treatment goods and services could not be spent. Therefore, the positive impacts from construction and operation expenditures are lower than if funding comes from outside the impact region. The EIS assumes that the construction and OM&R of the biota WTP alternatives considered in the EIS would be funded by the Federal Government because the treatment of water prior to transfer into the Hudson Bay basin is a Federal responsibility under the Boundary Waters Treaty. The impact estimates are presented in tables 4.4 and 4.5.

Table 4.4 – One-time Construction Impacts Associated with Each Alternative Assuming Project Costs are Funded from Outside the Impact Region.

Alternatives	Total Output	Employee Compensation	Employment
	(million $'s)	(million $'s)	(jobs)
No Action	14.6	3.1	138.3
Basic Treatment	89.4	19.1	842.0
Conventional	97.0	20.8	914.1
Microfiltration	117.4	25.2	1,106.6
Preferred	22.3	4.8	210.5

Table 4.5 – Annual OM&R Related Impacts Assuming Cost are Funded from Outside the Impact Region.

Alternatives	Total Output	Employee Compensation	Employment
	(thousand $'s)	(thousand $'s)	(jobs)
No Action	348.7	74.0	3.1
Basic Treatment	2,451.1	520.4	22.1
Conventional	2,457.6	521.7	22.1
Microfiltration	2,846.1	604.2	25.6
Preferred	393.7	83.6	3.5

Construction of a biota WTP and the associated OM&R costs would have positive regional economic impacts because these impacts are driven by expenditures. It is important to note that the construction impacts are one-time impacts that would occur over the entire construction period, while the OM&R impacts are annual impacts that would continue to occur over the entire lifetime of the facility. Therefore, the construction and OM&R impacts are not directly comparable.

Potential Impacts That Were Not Quantified

Each of the alternatives could generate beneficial impacts to the local economy if the treatment expands the number of potential commercial water uses that can be supported and/or improves the quality of water for domestic use. If implementation of any of the alternatives leads to the location of activities and production in the impact area that otherwise could not be supported in the area, then this would result in positive regional economic impacts. Similarly, if advanced biota water treatment alternatives affected domestic water use, then there could be regional economic impacts associated with those domestic water expenditures. Any non-construction regional impacts are likely to be fairly small compared to the construction and OM&R impacts. However, the potential does exist for some positive regional economic impacts in addition to the impacts estimated above for the advanced treatment alternatives.

Environmental Mitigation

Since there would be no negative economic and social impact results based on these analyses, there are no environmental commitments associated with economic and social issues.

Indian Trust Assets

This section discusses the effects of the proposed alternatives and the consequences on ITAs. There are no trust lands, hunting, fishing and gathering rights issues in the proposed action area, however there could be a potential Indian water rights issue.

Water Rights

If Missouri River tribes quantify their reserved water rights and put the water to beneficial use, the volume of water available for other users in the basin may be affected. The Corps (2004) has stated, "until such time as the tribes quantify their water rights and consumptively withdraw their water from the Mainstem Reservoir System, the water is in the system." The Corps intends to operate the Missouri River using the water currently in the system.

Any future tribal water rights settlements may require additional analysis of potential impacts on the Missouri Reservoir System.

Cumulative Effects

With respect to potential Indian water rights to the Missouri River, cumulative effects concern the amount of water that potentially would be available for other projects if tribes quantified their reserved rights. Quantification could affect Project water users and other Missouri River water users with permits junior to Indian water rights.

Environmental Mitigation
Since there would be no ITAs affected, there are no environmental commitments associated with ITAs.

Environmental Justice

This section of the EIS addresses the effect of the proposed action on environmental justice issues. Executive Order 12868 requires federal agencies to consider whether the impacts of their action will disproportionately affect low income or minority populations. Most of rural North Dakota can be considered as a low income population.

Information from the U.S. Bureau of Census, individual counties and municipalities, and local school districts provided the demographic data to determine the locations of potentially affected groups in the Project area. Groups can be defined by race, ethnicity, income, community, or some other grouping. Census data are typically the most complete and comparable demographic and economic data available for individuals and households.

Income, poverty, and unemployment data are presented in the description of the current regional economic conditions.

No environmental justice issues were identified in the preparation of the Final EA and FONSI (Reclamation 2001). Additionally, none of the alternatives considered would disproportionately affect any low income or minority population. The costs associated with construction and OM&R for each of the biota WTP alternatives would be funded by outside sources, so there would not be any disproportionate changes in costs to end users in the from of increased water rates. Therefore, no environmental justice issues associated with lower income groups would be expected.

Potential Impacts to Funding of North Dakota MR&I Water Supply Projects Outside the Project Service Area
There are other areas in North Dakota in need of MR&I water supply improvements outside of the Project service area. Some of these areas include Indian reservations and low income rural populations. It is unknown what level of future funding at the state and federal level would be available for this Project and other MR&I water supply projects. Future legislation and funding cannot be controlled or predicted at this time.

Cumulative Effects
There are no cumulative effects associated with environmental justice issues for any of the alternatives considered in the EIS.

Environmental Mitigation
Since there are no environmental justice issues of concern there are no environmental commitments associated with environmental justice.

Chapter Five
Consultation and Coordination

This chapter describes public involvement activities, agency consultation and coordination, and acknowledges the people who assisted in the preparation of the EIS.

Public Involvement Program

In 2006, Reclamation began a public involvement program to provide the public, organizations, and government agencies a variety of methods to learn about and participate in the development of this EIS. For this NEPA process the program included a scoping notice, public scoping meetings, a summary of public scoping report, a website, public hearings and a comment period on the DEIS.

Scoping Notice

A scoping notice was prepared to provide the public with information on the proposed action and an opportunity for people to express their thoughts and comments. The notice announced the intent to prepare an EIS and was published in the March 6, 2006, *Federal Register* Volume 71, Number 43:11226-11227. Dates and locations of public scoping meetings were identified in a subsequent notice in the *Federal Register*, Volume 71, Number 68:18115-18116 on April 10, 2006. Materials for the scoping notice were mailed on April 7, 2006, to approximately 100 individuals, agencies, and organizations. The scoping notice was used to solicit initial comments on the proposed action.

Public Scoping Meetings

The intent of the public scoping meetings was to inform people about the proposed action and to collectively identify key issues. The *Federal Register* notice and news releases to local media announced a series of public meetings. The locations and dates for these meetings were:

- Bismarck, North Dakota April 25, 2006
- Fort Yates, North Dakota April 27, 2006
- Minot, North Dakota May 1, 2006
- New Town, North Dakota May 2, 2006
- Bottineau, North Dakota May 3, 2006
- Mohall, North Dakota May 4, 2006

A total of 28 written comments were received in response to the initial public scoping effort. All comments were reviewed and compiled in a summary document, *Summary of Public Scoping* (Reclamation 2006), which is included as supporting documents.

Public Hearings

In December 2007, Reclamation released the DEIS for public review and comment. A Notice of Availability for the DEIS was published on December 21, 2007 in the *Federal Register* Volume 72, Number 245: 72756-72757. The 60-day public review period for the DEIS began with the publication of this notice. The public was encouraged to provide written comment or participate in the public hearings hosted by Reclamation at three locations in North Dakota. Public hearings were held at the following locations and corresponding dates:

- Bismarck, North Dakota — February 4, 2008
- Minot, North Dakota — February 5, 2008
- New Town, North Dakota — February 7, 2008

The public comment periods was extended for an additional 30 day at the request of Manitoba Water Stewardship. The public was notified of this time extension through another notice in the *Federal Register* (Volume 73, Number 40: 10806-10807). The public comment period closed on March 26, 2008.

Website

Information about the Project and information for the EIS was posted on the website for Reclamation's Dakotas Area Office (www.usbr.gov/gp/dkao). The information posted included the Final EA and FONSI, Federal Register notices, the public scoping notice, public comment letters received during scoping and the summary of public scoping report. Also, the DEIS along with supporting documents used in preparing the DEIS were posted on this website. During the public comment period for the DEIS, all the comment letters received and the transcripts from the public hearings were posted on the website. Upon release of this FEIS, the contents of the FEIS and supporting documents were posted on the website as well.

Cooperating Agency Team

Reclamation established a Cooperating Agency Team to facilitate transfer of information among agencies through meetings and communication at key steps in the process. Cooperating agencies provided information on their special expertise or jurisdiction related to the Project and reviewed draft DEIS chapters and analyses. The following organizations participated as cooperating agencies:

* U.S. Army Corps of Engineers
* City of Minot, North Dakota
* Garrison Diversion Conservancy District
* North Dakota State Water Commission
* U.S Environmental Protection Agency
* Three Affiliated Tribes

Cooperating Agency Team meetings were held on August 22, 2006, July 25, 2007 and September 25, 2008 in Bismarck, North Dakota.

Environmental Protection Agency Consultation

The EPA has several important roles and responsibilities in the development of an EIS. One of their roles is to provide guidance to federal agencies on filing EISs, including draft, final, and supplemental EISs and as required by NEPA and Council on Environmental Quality regulations. EPA also performs substantive reviews of EISs pursuant to NEPA and Section 309 of the Clean Air Act. The DEIS and FEIS have been filed with EPA.

Endangered Species Act Consultation

Federal agencies are required to consult with the Service under Section 7 of the ESA when federally listed species may be affected by an agency action. During the preparation of the Final EA, Reclamation consulted with the Service regarding protected species that may be found in the Project area and potentially affected by the construction and operation of the Project. Findings in the FONSI documented that there would be no adverse effect to threatened or endangered species. Upon initiating this EIS, Reclamation invited the Service to participate as a member of the cooperating agency team. The Service respectfully declined the invitation; choosing to participate in the process in a reviewing capacity and continues to participate as a member of the Impact Mitigation Assessment team. Based on a review of the site proposed for the biota WTP, Reclamation has determined that there is no effect on threatened and endangered species associated with this proposed action.

Native American Consultation

In accordance with Secretarial Order 3206, NEPA and related laws, regulations, and policies, Reclamation initiated consultations with the Standing Rock Sioux Tribe and the Three Affiliated Tribes regarding the Federal-Tribal trust and ITA responsibilities. The purpose of this consultation was aimed at gathering and considering tribal issues and concerns about the proposed action. Comments from tribes were solicited during the scoping process. Reclamation requested that the tribes identify any ITAs that could be affected by the proposed alternatives and invited them to meet and consult on impacts to any potentially affected ITAs. The Three Affiliated Tribes responded to this request by participating as a member of the Cooperating Agency Team. The Standing Rock Sioux Tribe provided written comments during the scoping period but did not respond to Reclamation’s invitation to participate as a cooperating agency or meet to discuss potentially affected ITAs.

Tribal water rights settlements, treaty rights, and ITAs were concerns raised by the tribes during the scoping period. Each of these tribes were sent a copy of the DEIS during the public comment period and each tribe provided testimony during the public hearings and comments on the DEIS. Each of these tribes also received a copy of the FEIS.

Cultural Resources Consultation

As a part of the identification of cultural properties under Section 106 of the National Historic Preservation Act, Reclamation consulted with the SHPO and THPO during the preparation of the Final EA and FONSI. As construction of the main delivery pipeline between Lake Sakakawea and the city of Minot progressed additional consultation was initiated in compliance with the environmental commitments established for the Project. The majority of the site for the proposed biota WTP was evaluated during this process therefore no further consultation was required during the preparation of this EIS. Upon selection of a biota WTP alternative in the Record of Decision and the initiation of final design for that alternative, Reclamation will review the Class III survey to ensure that the affected area has been reviewed. At that time, Reclamation will decide whether future cultural resource consultations are required.

Coordination and Compliance with Other Applicable Laws, Regulations, and Policies

Analysis and implementation of the proposed action requires consistency, coordination and compliance with multiple federal and state laws, regulations, executive orders, and policies. The following have been considered during the evaluation of this proposed action.

Archaeological Resource Protection Act of 1979

This Act protects archaeological resources on federal and tribal lands and requires a permit to remove archaeological resources from these lands. Permits may be issued to educational or scientific institutions only if the removal would increase knowledge about archaeological resources. The proposed location for the biota WTP is not located on federal or tribal lands; therefore no consultations were initiated with respect to this Act.

Boundary Waters Treaty of 1909

The 1986 Garrison Diversion Unit Reformulation Act and the Dakota Water Resources Act specifically mandate compliance with the Boundary Waters Treaty of 1909. Article IV of the Treaty sets forth an agreement that "boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other." The Treaty provides principles and mechanisms to avoid and resolve disputes regarding water resources along the boundary between the U.S. and Canada.

Clean Water Act of 1977 (as amended)

The Clean Water Act is the principal law governing pollution control and water quality of navigable waterways of the U.S. Section 402 of the Act establishes a NPDES permitting program to regulate the point source discharge of pollutants into waters of the U.S. North Dakota administers state-level NPDES programs pursuant to authority delegated by the EPA. It is noteworthy that EPA issued agency guidance in April 2006, advising of its position that NPDES permits were not necessary for transbasin diversions of water. The EPA published a final rule in the *Federal Register* (73 FR 33697) that generally exempts interbasin water transfers from regulation under the NPDES permitting program.

Section 404, administered by the Corps with oversight from EPA, is another permitting program that regulates activities of the placement of dredged or fill materials into waters of the U.S. The Corps issues nationwide permits on a state, regional, or nationwide basis for similar activities that cause only minimal adverse environmental effects both individually and cumulatively. Individual permits may also be issued for specific activities on specific water bodies under Section 404. If the Corps determines that an individual Section 404 permit is required, a North Dakota State Water Quality Certification Permit (Section 401) would also be required.

Farmland Protection Policy Act of 1995

The purpose of this Act is to ensure that impacts to prime or unique farmlands are considered in federal projects. It requires federal agencies to consider alternative actions that could lessen impacts and to ensure that their actions are compatible with state, local government, and private programs to protect prime and unique farmland. The Natural Resources Conservation Service is responsible for administering this Act.

Fish and Wildlife Coordination Act of 1958 (as amended)

The Act provides a procedural framework for the orderly consideration of fish and wildlife conservation measures to be incorporated into federal projects and federally permitted or licensed water resource development projects. Agencies that construct, permit, or license projects impacting a water body must consult with the Service and the state agency having jurisdiction over fish and wildlife resources (North Dakota Game and Fish Department). Full consideration must be given to the recommendations made through this consultation process. Section 2 states that fish and wildlife conservation shall receive equal consideration with other project purposes and will be coordinated with other features of water resource development projects. Reclamation has complied to the Act through consultation with the Service and providing opportunities for the North Dakota Game and Fish Department to comment.

Migratory Bird Treaty Act and Executive Order 13186 (January 2001)

Under the provisions of this Act it is unlawful “by any means or manner to pursue, hunt, take, capture [or] kill” any migratory birds except as permitted by regulations issued by the Service. Migratory birds include all native birds in the U.S. with the exception of non-migratory species managed by states. The Service has defined “take” to mean “pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture or collect” any migratory bird or any part, nest, or egg of any migratory bird (50 *Code of Federal Regulations* Section 10.12).

Native American Graves Protection and Repatriation Act (Public Law 101-601)

This Act establishes federal policy with respect to Native American burials and graves located on federal or tribal lands. Federal agencies are required to consult with and obtain the concurrence of the appropriate tribes with respect to activities that may result in the disturbance and/or removal of burials and graves from federal lands or lands held in trust for a tribe. The proposed location for the biota WTP is not located on federal or tribal lands; therefore no consultations were initiated with respect to this Act.

National Historic Preservation Act of 1966 (as amended)

The Act establishes protection of historic properties as federal policy in cooperation with states, tribes, local governments, and the public. Historic properties are those buildings, structures, sites, objects, and districts, or properties of traditional religious and cultural importance to Native Americans, determined to be eligible for inclusion in the National Register of Historic Places. Section 106 of the Act requires federal agencies to consider the effects of proposed actions on historic properties and gives the Advisory Council on Historic Preservation an opportunity to comment. The lead federal agency is responsible for consultation with the SHPO and/or THPO, tribes, applicants, interested parties, and local governments regarding federal undertakings. When previously unidentified cultural resources are encountered, an environmental commitment is included to comply with the Act.

National Invasive Species Act of 1996

The purpose of the Act is fivefold: (1) to prevent unintentional introduction and dispersal of non-indigenous species into the waters of the U.S. through ballast water management and other requirements; (2) to coordinate federally funded or authorized research, prevention control, information dissemination, and other activities regarding the zebra mussel and other aquatic nuisance species; (3) to develop and carry out environmentally sound control methods to prevent, monitor, and control unintentional introductions of non-indigenous species from pathways other than ballast water exchange; (4) to understand and minimize economic and ecological impacts of non-indigenous aquatic nuisance species that become established, including the zebra mussel; and (5) to establish a program of research and technology development and assistance to states in the management and removal of zebra mussels. To comply with the Act, each alternative proposed incorporates design features to minimize invasion of non-indigenous biota.

Executive Order 13112 for Invasive Species

In 1999, an executive order was issued to prevent the introduction of invasive species and to provide for their control. It directs federal agencies to identify applicable actions and to use programs and authorities to minimize the economic, ecological, and human health impacts caused by invasive species. To meet the intent of this order, each alternative proposed includes environmental commitments to prevent and control the spread of invasive species from the Project.

Executive Order 12114 for Environmental Effects Outside of the United States

This order, established in 1979, addresses the issue of how the environmental review process should be implemented for major federal actions having significant effects outside the borders of the United States. Section 1 of the Executive Order provides that it is the U.S. government's "exclusive and complete determination of the procedural and other actions to be taken by Federal agencies to further the purpose of the National Environmental Policy Act, with respect to the environment outside the U.S., its territories and possessions."

Other Executive Orders

Executive Order 11990 (Protection of Wetlands) directs federal agencies to avoid destruction, loss, or degradation of wetlands. Executive Order 13007 (Indian Sacred Sites) orders federal agencies to accommodate Indian tribes' requirements for access to and ceremonial use of sacred sites on public lands and to avoid damaging the physical integrity of such sites. Executive Order 12898 (Environmental Justice) directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. These orders were applied in the development of the EIS.

North Dakota State Burial Law

If human remains or burial goods are discovered during construction of a biota WTP, any human remains or burial goods would be dealt with in accordance with the Native American Graves Protection and Repatriation Act and/or state law. *North Dakota Century Code* 23-06-27 - Protection of Human Burial Sites, Human Remains, and Burial Goods - protects human burial sites and burial goods on private lands and on state and political subdivision lands in North Dakota.

List of Preparers

These people were directly responsible for preparation of the FEIS.

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Ronald Melhouse, Environmental Specialist, Reclamation
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Steven Piper, PhD, Economist, Reclamation
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Distribution List

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The entities listed below received a printed copy of the DEIS and/or FEIS or an Executive Summary with a compact disc of the DEIS and/or FEIS.

U.S. Federal Agencies

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Todd Lindquist – Garrison Project Office
Dan Cimarosti - Bismarck Regulatory Office
Tim Fleeger – Omaha District
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Larry D. Jannis – Omaha District
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Bureau of Land Management
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North Dakota Congressional Delegation
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Honorable Byron Dorgan – Senator
Honorable Earl Pomeroy – Representative

USDA Rural Utilities Service
Rod Beck

Federal Highway Administration
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State Agencies and Local Officials
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Dale Frink – State Engineer, State Water Commission
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Mayor, City of Wildrose
Mayor, City of Columbus
Mayor, City of Grenora
Mayor, City of Souris
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Mayor, City of Bottineau
Mayor, City of Westhope
Mayor, City of Kenmare
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Burke County Commission
McHenry County Commission
Bottineau County Commission
Divide County Commission
Mountrail County Commission
Renville County Commission
Ward County Commission
Williams County Commission
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Elgin Crows Breast – Tribal Historic Preservation Officer, Cultural Preservation Office, Three Affiliated Tribes

Martin Gipp – Standing Rock Sioux Tribal Offices

Honorable Ron His Horse Is Thunder – Chairman, Standing Rock Sioux Tribe

Everett J. Iron Eyes Sr. – Water Administrator – Standing Rock Sioux Tribe

H Texx Lone Bear – Fort Berthold Rural Water Director – Three Affiliated Tribes

Nathan Hale – Councilman, Three Affiliated Tribes

Evelyn Hale – Councilwoman, Three Affiliated Tribes

Bryon Olson – Tribal Archaeologist – Standing Rock Sioux Tribe

Janet Thomas – Executive Director – Standing Rock Sioux Tribe

Tim Mentz - Tribal Historic Preservation Officer, Standing Rock Sioux Tribe

Adrienne Swallow – Standing Rock Sioux Tribe

Chuck Meyer – Department of Natural Resources, Water Resources Program, Red Lake Band of Chippewa

Dawnette Owens – Project Coordinator, Mni Sose Intertribal Water Rights Coalition, SD

Honorable Marcus D. Wells Jr. – Chairman – Mandan-Hidatsa-Arikara Nation

Geraldine Agard – Secretary – Standing Rock Sioux Tribe

Barry Benson – Councilman – Three Affiliated Tribes

Jesse Taken Alive – Standing Rock Sioux Tribe

Archie Fool Bear – Standing Rock Sioux Tribe

V. Judy Brugh – Councilwoman – Three Affiliated Tribes

Mike Claymore – Standing Rock Sioux Tribe

Jesse McLaughlin – Standing Rock Sioux Tribe

Avis Little Eagle – Vice Chairwoman – Standing Rock Sioux Tribe

Matt Lopez – Standing Rock Sioux Tribe

Alma Mentz – Standing Rock Sioux Tribe

Mervin Packineau – Councilman, Three Affiliated Tribes

Randy Phelan – Three Affiliated Tribes

Ralph Walker – Manager, Standing Rock Water System

Malcolm Wolf – Councilman, Three Affiliated Tribes

Frank Whitecalfe – Councilman, Three Affiliated Tribes

Organizations

Richard Fugleberg – Director, Garrison Diversion Conservancy District

Norman Haak – Director, Garrison Diversion Conservancy District

David Johnson – Director – Garrison Diversion Conservancy District

Mike Dwyer – North Dakota Water Users Association

Dave Koland – General Manager, Garrison Diversion Conservancy District

Melody Kruckenberg – North Dakota Rural Water Systems Association

John Leininger – Director, Garrison Diversion Conservancy District
Maurice Orn - Director, Garrison Diversion Conservancy District
James Burbidge – Director, Garrison Diversion Conservancy District
Richard Cayko – Director, Garrison Diversion Conservancy District
Cliff Hanretty – Director, Garrison Diversion Conservancy District
Don Baasch – North Dakota Wildlife Federation
Gary Pearson – National Wildlife Federation, ND
Rick Anderson – Chairman & Director, Garrison Diversion Conservancy District
Maynard Helgaas – Director, Garrison Diversion Conservancy District
LeRoy Johnson – Director, Garrison Diversion Conservancy District
Steve Metzger – Director, Garrison Diversion Conservancy District, ND
Norman Rudel – Director – Garrison Diversion Conservancy District
Mark Sherfy - President, North Dakota Chapter Wildlife Society
Genevieve Thompson – Executive Director, Audubon Dakota Chapter
Ken Vein - Director, Garrison Diversion Conservancy District
Kelly Klosterman – Director, Garrison Diversion Conservancy District
E. Ward Doeser – Director, Garrison Diversion Conservancy District
Jean Schafer - Executive Director, North Dakota Water Coalition
Roger Johnson - Director, Garrison Diversion Conservancy District
Bill Krivarchka – Director, Garrison Diversion Conservancy District
Jon Lindgren – Director, Garrison Diversion Conservancy District
Rick Olson – Manager – Williams Rural Water Association
George Azure – Manager - Belcourt Public Utilities
The Nature Conservancy
Sierra Club
David Conrad – Senior Water Resource Specialist – National Wildlife Federation
Warren Lyons – Director, Garrison Diversion Conservancy District
Harlan Opdahl – Director, Garrison Diversion Conservancy District
Caroline Downs – The Kenmare News
Wanda Emerson – Northwest Area Water Supply Advisory Committee
Roger Hagen – Houston Engineering, Inc.
John Peyerl – Director, Garrison Diversion Conservancy District
Charles Richter – Director, Garrison Diversion Conservancy District
Gary Hager – Northwest Area Water Supply Advisory Committee
Myron Hahn – Oak Creek Water Resource District
Maurice Foley – Ward County Water Resource
Brent Bogar – Northwest Area Water Supply Advisory Committee
Eugene Hanson – Mountrail Water Resource District
Larry Hanson – Northwest Area Water Supply Advisory Committee
John Hanzel – Mountrail County Rural Water, Inc.
Darrell Hournbuckle – Interstate Engineering, Inc.
Clifford Issendorf –Northwest Area Water Supply Advisory Committee
Travis Johnson – Houston Engineering, Inc.
Glen Koroluk – Water Caucus Coordinator – Manitoba Eco-Network
Alan Lee – Northwest Area Water Supply Advisory Committee
William Lynard – Montgomery-Watson-Harza
Kevin Martin – Houston Engineering, Inc.

Shawn McKenna – North Dakota Wildlife Federation
Gene Nygaard – Divide County Water Resource District
Lynn Oberg – Chair, McLean County Water Resource District
Ralph Packulak – North Prairie Rural Water
Lynn Oberg – Manager, McLean/Sheridan Rural Water
Kenny Rogers – Northwest Area Water Supply Advisory Committee
Ken Royse – Director, Garrison Diversion Conservancy District
Tim Schindler – Director, Garrison Diversion Conservancy District
Reginal Rudolph – Garrison Rural Water Association
Dan Schaefer – All Seasons Water Users Association
Bob Schempp – Northwest Area Water Supply Advisory Committee
Dennis Wendel – Director, Garrison Diversion Conservancy District
Ervin Schultz – Burke County Water Resource District
Gene Siercks – Boundary Creek Water Resource District
Kieth Skaare – Williams County Water Resource District
Henry VanOffelen – Minnesota Center for Environmental Advocacy
Charlie Vein – Advanced Engineering & Environmental Services
James Burbidge – Renville County Water Resource District
Eldon Greenberg – Garvey Schubert Barer
Thelma Paulson – Peterson Coulee Outlet Association
Nick Schroeck –Great Lakes Environmental Law Center

Individuals

Lynn Aas
Dick Anderson
Lester Anderson
Joletta Bird Bear
Theodora Bird Bear
Paul Christianson
Scott Dragar
Pat Lauer
Jon Nelson
Connie Ory
Wallace Schultz
Neil Stessman
Tillie Walker
Jason Sorenson
John Geddie
Jill Schram
James Hatlelid
Paul T. Kramer
F. Bruce Walker
Robert M. Dick
John Coughlin
Jim Myers

Canadian Agencies, Officials, Organizations, Individuals, and Libraries

Don Norquay – Assistant Deputy Minister of Transportation, Manitoba
Tobias Nussbaum – Director - Foreign Affairs and International Trade Canada
Wayne Dybvig – Executive Director, Transboundary Waters Unit, Environment Canada
Dwight Williamson – Director, Water Science and Management Branch, Manitoba Water Stewardship
Dennis Wright – Department of Fisheries and Oceans, Winnipeg, Manitoba
Tom Selinger – Canadian Consulate General
Al Beck – Environmental Operations - Manitoba Water Stewardship
David Henry – Americas Directorate - Environment Canada
Jenna Mackay-Alie – Americas Directorate - Environment Canada
Blair McTavish – Manitoba Water Stewardship
Jim Petsnik – Manitoba Water Stewardship
Robert Oleson
Beatrice Olivastri – Friends of the Earth – Canada

Henry David Venema – International Institute for Sustainable Development
Dana Vindasius – Environment Canada
David Whorley – Environment Canada
Kim Perry Butler – Foreign Affairs and International Trade Canada
Millennium Library, Winnipeg, Manitoba, Canada

Libraries

North Dakota

Bureau of Indian Affairs, Fort Berthold Agency, New Town, North Dakota
Bureau of Reclamation, Dakotas Area Office, Bismarck, North Dakota
Standing Rock Administrative Service Center, Fort Yates, North Dakota
Bismarck Public Library
Minot Public Library
Mohall Public Library
Bottineau City Hall
North Dakota State Library

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