RECLAMATION
Managing Water in the West

EXECUTIVE SUMMARY
Final Report on Red River Valley Water Needs and Options

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

November 2005

United States Department of the Interior
The mission of the Department of the Interior is to protect and provide access to our nation's natural and cultural heritage and honor our trust responsibilities to tribes.

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

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

United States Department of the Interior

BUREAU OF RECLAMATION
Dakotas Area Office
P.O. Box 1017
Bismarck, North Dakota 58502

TAKE PRIDE IN AMERICA

NOV 28 2005

DK-500
ENV-6.00

Subject: Distribution of the *Final Report on the Red River Valley Water Needs and Options*

Dear Interested Party:

The final *Report on Red River Valley Water Needs and Options* is enclosed. The Executive Summary is provided in hardcopy format. The main report, appendices, and supporting documents are in electronic format on a compact disk located on the inside back cover of the Executive Summary.

This report has been prepared by the United States Department of the Interior, Bureau of Reclamation, pursuant to Section 8(b) of the Dakota Water Resources Act of 2000 (DWRA), which directs the Secretary of the Interior to conduct a comprehensive study of the water quality and quantity needs of the Red River Valley in North Dakota and possible options for meeting those needs. The purpose of the study was to identify options for meeting the comprehensive water quality and quantity needs that were deemed feasible from an engineering perspective. Reclamation evaluated seven engineering alternatives that met this criterion.

As required by the DWRA, the *Draft Report on Red River Valley Water Needs and Options* was distributed to states that may be affected by possible options to meet the identified needs and to federal agencies with relevant expertise. The DWRA mandated that such states and agencies be given not less than 120 days to review and comment on the study method, findings, and conclusions leading to any alternative that may have an impact on such states or on resources subject to such federal agencies' jurisdiction.

Besides the affected states and federal agencies who were mandated to receive the draft report, more than 400 interested agencies, organizations, and individuals also were given copies of the report. Comments were received from 31 entities and are posted on the Dakotas Area Office web site (www.rrvwsp.com). Comments received covered a wide spectrum of issues, including engineering criteria, compliance with the National Environmental Policy Act, agency policy, and legal and authority questions. Reclamation will provide a response to comments and make the comments and responses available to the public early in 2006. Comments and responses will be included in a separate document to be posted on our web site. Hard copies of the document will be mailed upon request.

After consideration of comments received on the draft report, Reclamation has produced a final report that will be transmitted to Congress. The DWRA also directs the Secretary of the Interior to jointly prepare an environmental impact statement (EIS) with the State of North Dakota. In preparing the EIS, Reclamation is representing the Secretary and Garrison Diversion Conservancy District is representing the State of North Dakota. The environmental effects of the options described in the *Final Report on Red River Valley Water Needs and Options*, along with No Action, are analyzed in the EIS. The draft EIS is scheduled to be distributed to the public in December 2005 for review and comment.

If you have any questions, please contact Signe Snortland, Dakotas Area Office, Bureau of Reclamation, at 701-250-4242 extension 3619.

Sincerely,

Dennis E. Breitzman
Area Manager

Enclosure

EXECUTIVE SUMMARY
Final Report on Red River Valley Water Needs and Options

CONTENTS

Cover Letter 1

Introduction and Scope of the Report 3

What is the Problem? 4-5

What is the Need? 6

Municipal, Rural, and Industrial Needs 6

Municipal and Rural Population Projections 6

Industrial Projections 7

Aquatic Needs 9

Water Quality Needs 9-10

Recreational Needs 10

Water Conservation Measures 11

Summary of Water Demands 12

Water Supply Shortages 13

What are the Potential Solutions? 14

Options 15-21

Option Cost Estimates 22

What is Next? 23

Photograph Labels and Credits 24

Introduction and Scope of the Report

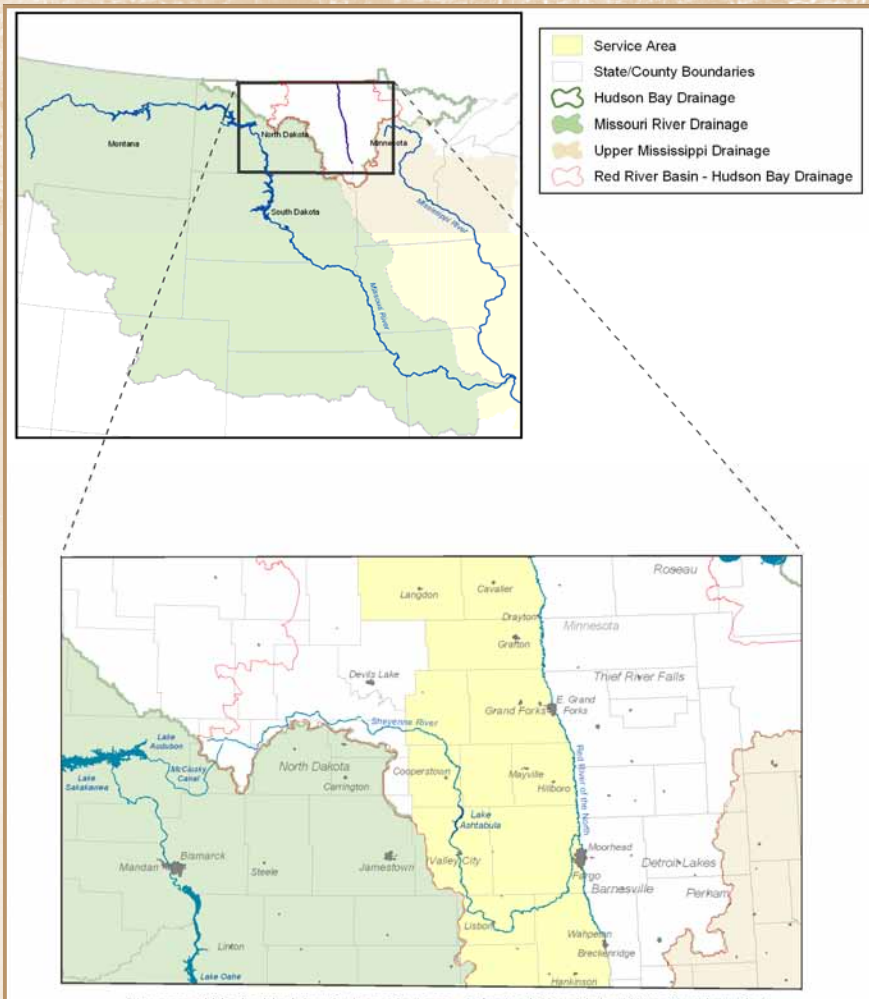
The *Final Report on Red River Valley Water Needs and Options* is a comprehensive study of the water quality and quantity needs of the Red River Valley in North Dakota through the year 2050 and seven possible options to meet those needs.

The Red River of the North is in the Red River Basin, which is a sub-basin of the larger Hudson Bay Basin. The north-flowing Red River begins at the confluence of the Bois de Sioux and Otter Tail Rivers near Wahpeton, North Dakota, forming the border between North Dakota and Minnesota before crossing the border into Canada. It ultimately flows into Lake Winnipeg, Manitoba.

The service area for the project includes the 13 eastern counties of North Dakota plus the Minnesota communities of Breckenridge, Moorhead, and East Grand Forks.

Questions considered in the report are:

- How much water is currently available in the service area?
- How much water is needed through the year 2050 (i.e., what is the water demand)?
- How much surface and groundwater would be available during a drought to meet the projected 2050 water demand?
- What reasonable and feasible options could supply the water demand using available water resources within the basin?
- What reasonable and feasible options could supply the water demand using water imported from outside the basin?
- What is the estimated cost of each option?



The area within the black box is the project area of the Red River Valley Water Supply Project. The yellow counties are in the Service Area.

Each of the seven options would provide a bulk water supply to municipalities, rural water systems, and industries. The distribution of this water would be the responsibility of rural water systems, municipalities, and industries; thus, distribution to the end user is not considered in this report.

What is the Problem?

Drought can occur anywhere in the northern plains of the United States, and the Red River Valley is no exception. For the last decade, water in the valley has been abundant due to a persistent wet cycle, so water supply appears sufficient at present. But computer modeling of the surface water hydrology as well as historic documents show that the valley is vulnerable to severe water shortages in an extended drought, such as the one experienced during the 1930s.

The residents of the Red River Valley would face a serious water shortage if a 1930s drought occurred today.

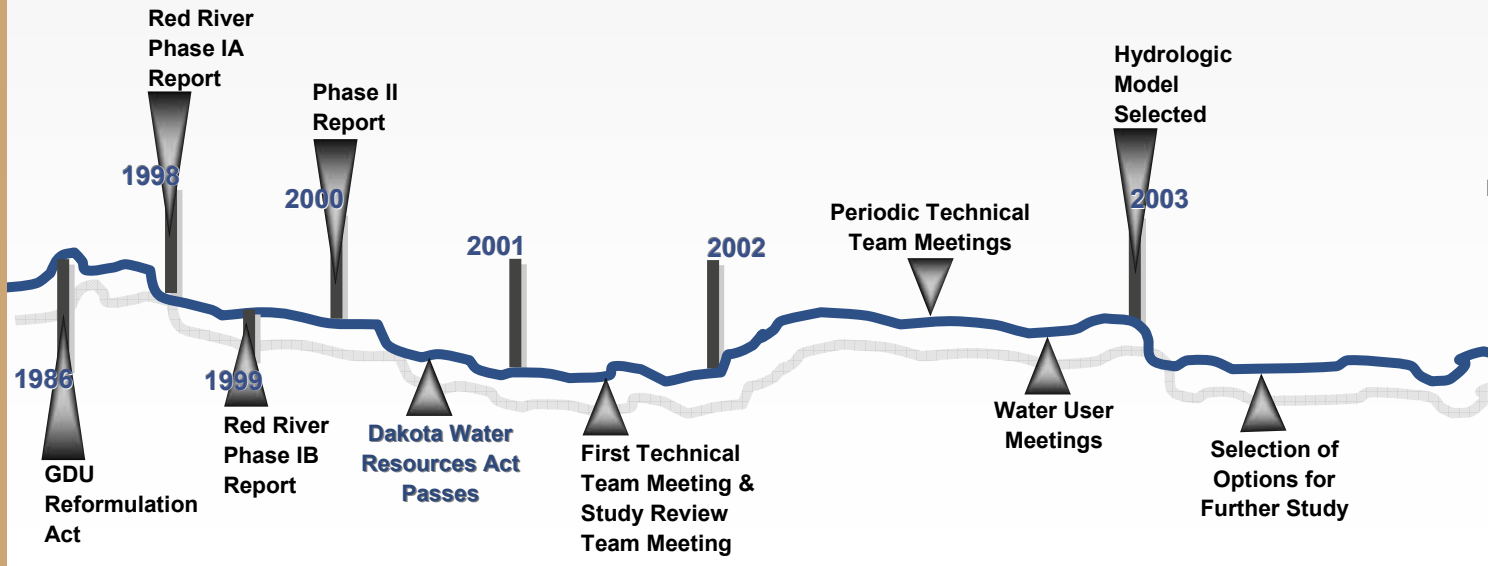
A drought frequency investigation of the Red River Valley was conducted by Meridian Environmental Technology, Inc. (2004) for the project. The fundamental conclusion of the study was that the 1930s drought was not an anomaly occurring every 1000 years; it was a climatic event likely to be repeated before 2050. Based on this conclusion and available (USGS) U.S. Geological Survey flow data, Reclamation selected the period of 1931-2001 for modeling hydrologic flow conditions. Hydrologic modeling revealed that the key period of low-flow events of particular interest is 1931-1940.

Droughts are a normal part of the long-term hydrological cycle in the Red River Valley. They complement long-term wet periods and associated flooding. In fact it is often difficult to determine when a drought begins or ends. A hydrologic drought with lower stream flow and lake and groundwater levels often results from extended drought conditions. Slower to respond to reduced precipitation, hydrologic droughts require time to deplete existing water reserves, including groundwater levels and upstream reservoirs.

The greater the demands on the water resources of an area, however, the greater the water shortages and the greater the impact felt by the populace. When a hydrologic drought occurs such as the one from 1931 to 1940, the Red River Valley is left with few options for supplying water for MR&I (municipal, rural, and industrial) uses. Because water systems are so dependent on surface water supplies, recovery from drought may take months or even years of above average precipitation.

Most of the population of the Red River Valley including the residents of Fargo and Grand Forks, North Dakota, and Moorhead and East Grand Forks, Minnesota, rely on the Red River of the North and its tributaries as primary or sole sources of water. In contrast, 11 of 12 rural water systems use groundwater as a source of supply in the service area.

Based on results of Reclamation's surface water hydrologic modeling, the Red River Valley would face critical water shortages if a 1930s drought



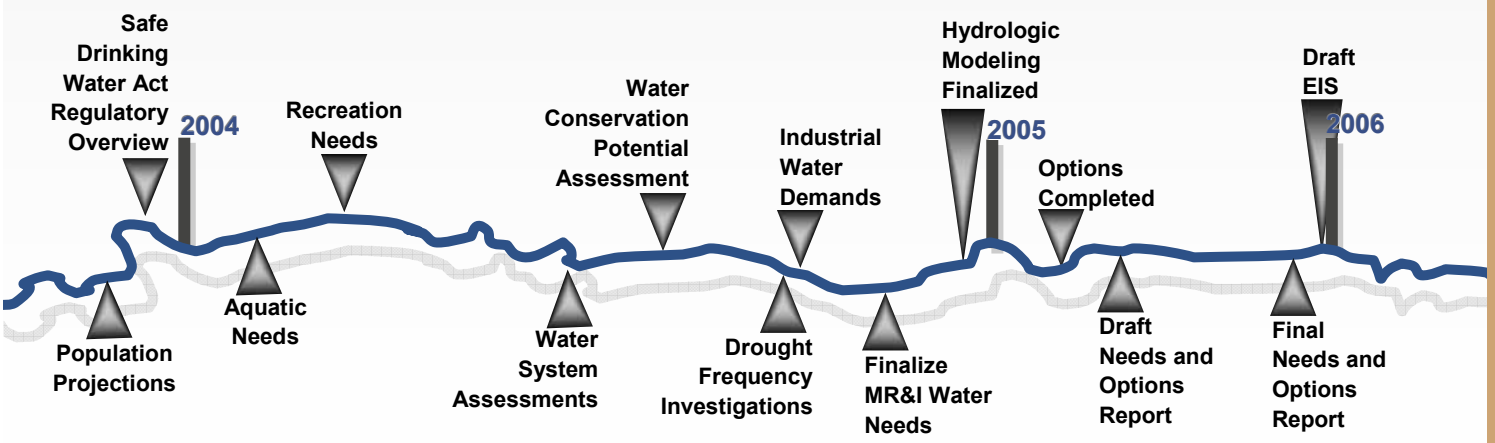
began today. The 2005 MR&I users in the service area would experience significant water shortages during a drought like the one that occurred from 1931 to 1940. In fact, the hydrologic model forecasts that the maximum annual water shortage could be 16% in the sixth year of an extended drought. The maximum single monthly water shortage could be a 46% deficit in February of the seventh year.

Looking into the future, if a 1930s drought hit the valley in 2050, hydrologic modeling results indicate that in the service area MR&I annual shortages could be 41% in the fourth year. Monthly shortages could be as high as 89% in March of the seventh year. Both the present day and future modeling simulations reveal a very serious water shortage during the winter when typical drought measures such as eliminating lawn watering are not applicable. In such an event, the water users in the valley would have to dramatically cut their commercial and indoor water use. At first glance a serious water shortage during the winter when consumption is lower may seem illogical; however, during the 1930s there were months of zero flow in the Red River in the winter and summer.

If a 1930s drought occurred in 2050, the worst monthly shortage could be as high as 89% in the Red River Valley.

Historic flow data show instances of low flow or even zero flow have occurred in the past due to drought and are likely to happen again. The most vulnerable cities would be in the Fargo-Moorhead greater metropolitan area (Fargo, West Fargo, Horace, and Harwood, North Dakota, and Moorhead and Dilworth, Minnesota); other water systems along the Red River would also experience shortages. As population centers such as Fargo, Moorhead, and Grand Forks grow, their dependence on the valley's water resources will make them increasingly vulnerable to water shortages.

Options for additional storage reservoirs, which could capture water during spring runoff, are limited because of the lack of topographic relief. Locations on which to build effective reservoirs have already been developed. The inability to capture and store large volumes of water in the spring when most runoff occurs makes communities much more dependent on the timing of precipitation to feed rivers. For example, most of the water demand in the Red River Valley is in the Fargo-Moorhead metropolitan area, while a significant amount of runoff is north in the lower basin below Fargo.



What is the Need?

Population and industry are currently expanding in the Red River Valley. Growth, while beneficial for the economy, makes demands on water resources that can be problematic without proper planning. Planning is a lengthy process that involves determining future water demands, gaining an understanding of the water resources available for supply, and determining feasible options to meet future water needs.

The water needs evaluated in the Needs and Options Report were specified in the Dakota Water Resources Act of 2000 (DWRA). They are MR&I supplies, aquatic environment, water quality, recreation, and water conservation measures [DWRA Section 8(b)(2)]. The objective of the Red River Valley Water Supply Project is to meet MR&I water needs with water conservation through year 2050, while managing water resources to meet water quality, aquatic environment, and recreation needs.

Municipal, Rural, and Industrial Needs

There are 216 MR&I water systems in the Red River Valley serving communities ranging in size from small towns with populations of less than 100 to the city of Fargo with a population approaching 100,000 (2000 census). While this report considers the comprehensive water need of the entire population of the service area, only Fargo, Grand Forks, Moorhead, and West Fargo; medium-size cities with populations ranging from 1,000 to 15,000; and rural water systems are specifically addressed.

Scenario One: Reclamation's 2050 population projections x (per capita water demand – water conservation) + intermediate future industrial water demands + recreation consumptive use = water demand.

Scenario Two: Water users' 2050 population projections x (per capita water demand – water conservation) + high future industrial water demands + recreation consumptive use = water demand.

Municipal and Rural Projections

Predicting future population growth is key to estimating future water demands. Reclamation developed future population projections (Reclamation 2003b/ Revised 2005) in addition to an independent estimate by Northwest Economic Associates (2003). While these projections were similar, some municipalities in the Red River Valley provided their own population projections for consideration in the analysis.

Because consensus on future population could not be reached, Reclamation decided to use a range to reflect uncertainty in making projections through 2050. These population ranges were used to develop two demand scenarios. The projected population of the Red River Valley service area in 2050 would range from 479,252 in Scenario One to 565,653 in Scenario Two.

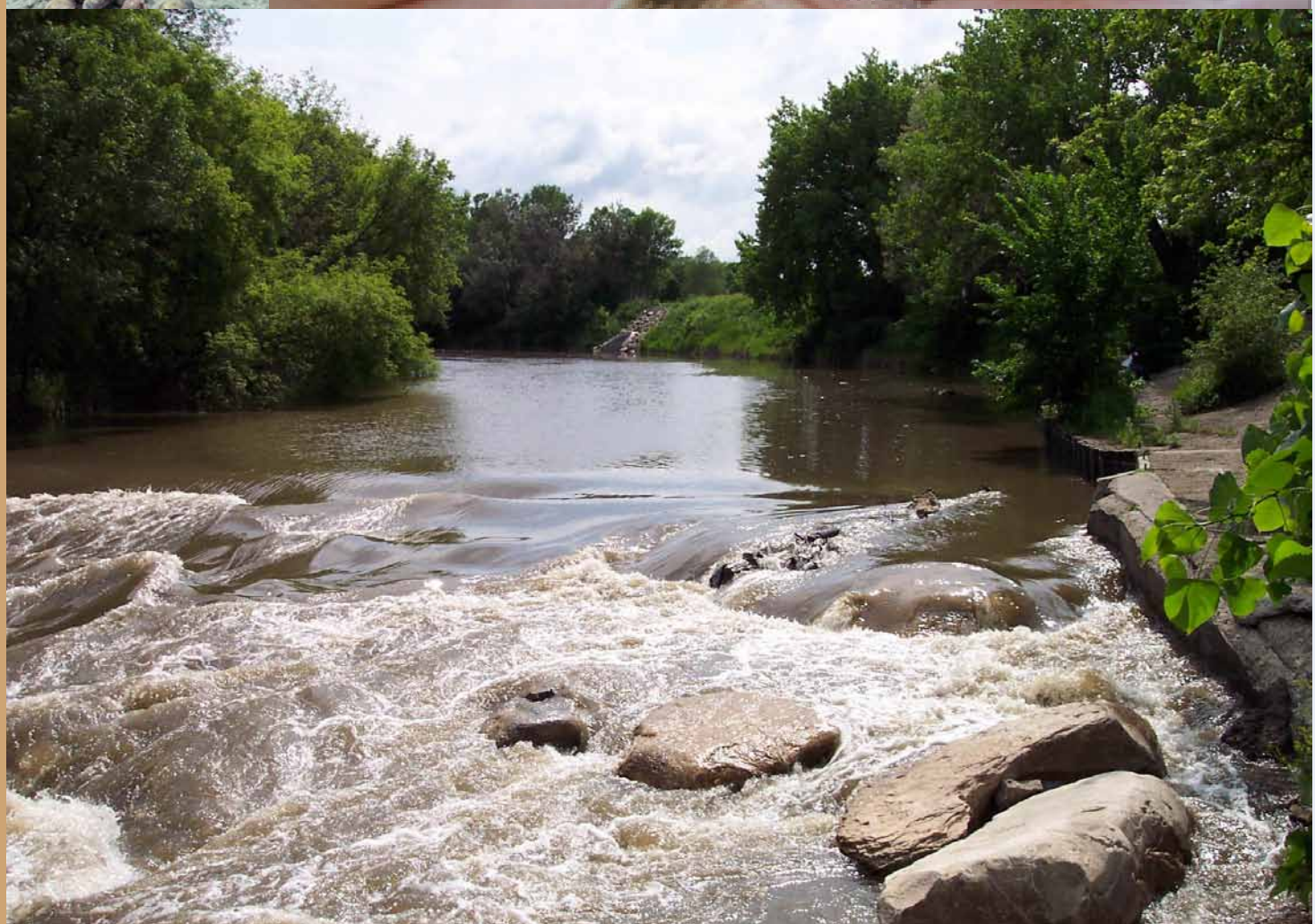
Based on the population projections for the municipal and rural systems, there would be an average annual water demand of 63,440 acre-feet per year in Scenario One or 74,075 acre-feet per year in Scenario Two. Maximum annual water demand would be 88,245 acre-feet per year for Scenario One or 102,980 acre-feet per year for Scenario Two.

Industrial Projections

Industrial water demands were quantified for existing and future industries. Existing industrial demands were based on past water use. Future industrial demands were estimated using the results of industrial development reports prepared by Reclamation and North Dakota State University. Future industrial water uses include manufacturing and agricultural processing; institutional use at universities, schools, hospitals, and local and state government; and commercial use for service trade, retail trade, financial, utilities, communications, and wholesale trade.

An acre-foot is defined as 1 acre of land covered by 1 foot of water. There are 325,851 gallons in 1 acre-foot of water.

By the year 2050, the Red River Valley is projected to need 22,566 acre-feet of water for industrial uses in an average year and 25,039 acre-feet in the maximum water use year for Scenario One. For Scenario Two, the Red River Valley is projected to need 36,510 acre-feet of water for industrial uses in an average year and 38,983 acre-feet in the maximum water use year.



Aquatic Needs

Reclamation conducted an instream flow assessment for the Sheyenne and Red Rivers, *Report on Red River Valley Water Supply Project Needs and Options, Aquatic Needs Assessment, Instream Flows for Aquatic Life and Riparian Maintenance, Final Report* (Reclamation 2003a). This was done by calculating seasonal habitat available for representative fish species at various flows and determining seasonal river flows that would maintain a diverse aquatic community. The habitat modeling component of the Instream Flow Incremental Methodology was used for this analysis.

The North Dakota Game and Fish Department, in a letter dated September 28, 2005, recommended establishing minimum instream flows on the Sheyenne and Red Rivers as part of the Red River Valley Water Supply Project. Their flow recommendations were based on a "fair" category using a hydrologic method of analysis.

For this report, neither the community-based flow regime developed by Reclamation or the flow regime recommended by the North Dakota Game and Fish Department were included in any of the options. Both would require expensive infrastructure to implement, and do not appear to be viable, because a project sponsor willing to cost-share the expense has not been identified.

Aquatic need was incorporated into the options by including a minimum fish and wildlife conservation pool of 28,000 acre-feet in Lake Ashtabula and by maintaining a minimum release of 13 cfs (cubic feet per second) from Baldhill Dam. These two operational criteria were included in hydrologic modeling of the options. Other actions and/or alternatives to meet the needs of the aquatic environment may be identified in the final environmental impact statement for the project.

Water Quality Needs

In general, surface waters in the Red River Valley are suitable for most designated uses. At most locations exceedances of water quality standards are fairly rare, and when they occur, often are caused naturally. Within the Red River Basin in North Dakota and Minnesota, the percentage of samples collected that have exceeded the numeric water quality standard for some of the more common parameters is less than:

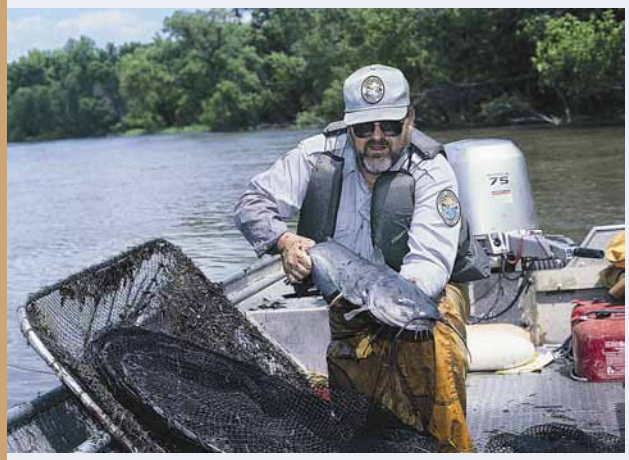
- 3% of the sulfate samples (general indicator of drinking water quality);
- 12% of the fecal coliform bacteria samples collected during the recreation season (indicator of contamination by warm blooded animals);
- 15% of the total dissolved solids samples (general indicator of quality), based only on Minnesota samples as North Dakota has no total dissolved solids standard; and
- 4% of the dissolved oxygen samples (indicator of aquatic biology health).

Although water quality in the Red River Valley is generally acceptable, the states of North Dakota and Minnesota have identified water quality impairments. The stressors that cause use impairment are most often associated with one or more of the following: ammonia concentrations, biochemical oxygen demand, dissolved solids, sedimentation, suspended solids (turbidity), bacteria from mammals, and trace metals like mercury.

(Water Quality Needs continued on page 10)

(Water Quality Needs continued from page 9)

The *Water System Assessment Executive Summary Final Report* (Reclamation 2004c) evaluated current and future water quality conditions for selected MR&I water systems in the Red River Valley in relation to the Environmental Protection Agency's primary, secondary, and potential future regulations under the Safe Drinking Water Act.



Drinking water standards considered in the assessments are described in the *Water Quality Needs, Regulatory Overview of the Safe Drinking Water Act Report* (Reclamation 2003d). Water system assessments determined that the only primary drinking water standard of concern was arsenic in some water systems. However, since compliance is mandatory by 2006, arsenic problems will be resolved by then. Some water systems also had secondary drinking water problems related to taste and odor.

Recreational Needs

Reclamation assessed future recreational water needs of the Red River Valley in the *Recreation Needs Assessment Final Report* (Reclamation 2003c). This report evaluated consumptive and non-consumptive uses of water for recreation. In terms of water demand, consumptive use (such as landscape irrigation) was defined as withdrawing water from the hydrologic system so that water was not available for other purposes. Non-consumptive use, such as fishing, was defined as water use where the water was available for other purposes.

There are 29 golf courses in the 13 eastern counties of North Dakota and the cities of East Grand Forks and Moorhead. Twelve are served by municipal systems, with the balance served from individual surface or groundwater permits. It was assumed that additional golf courses would be built as demands grow from an increasing population. Additional water needed by new golf facilities would average 290 acre-feet per year. Maximum recreation water demand for golf courses would be 417 acre-feet per year for both scenarios.

Water Conservation Measures

The *Water Conservation Potential Assessment Final Report* (Reclamation 2004b) evaluated reasonable and achievable water conservation measures for the Red River Valley Water Supply Project. DWRA specifies that water conservation measures were to be used in quantifying the comprehensive water needs of the valley. Water conservation is included in all project options as a feature. Project-wide, approximately 1.4 billion gallons (4,300 acre-feet) of water per year would be saved at an approximate annual cost of $780,000.

Water systems in the Red River Valley already have made significant progress in water conservation in the last 10 - 15 years. This is due to metering service connections, monitoring water use, repairing and replacing pipelines, and providing effective management of the water systems. Regulatory requirements have resulted in installation of water efficient plumbing fixtures in homes and businesses, significantly saving water. Water savings in the last 10 - 15 years are estimated to be between 4.3% to 33.2%, or from 5.0 to 37.3 gpc/day (gallons per capita per day), depending on the water system.

New water conservation measures were separated into summer and winter water use. Some measures were applied to baseline use (winter) because they apply to water uses generally uniform throughout the year. These water uses included in-home use and non-seasonal industrial, commercial, or institutional use. Other water conservation measures concern outside water use and were applied to summer water use. When developing estimated water demands, water conservation savings were applied on a month-by-month basis, depending on whether it was summer or winter use. Analysis shows the potential to conserve an additional 6.1% to 8.6 %, or 6.5 to 9.0 gpc/day.

Summary of Water Demands

To address some of the uncertainty in determining water demands, two scenarios were developed to present a reasonable range of future water demand estimates through 2050. The average annual water demand would be 86,297 acre-feet for Scenario One or 110,875 acre-feet for Scenario Two, for a difference of 24,578 acre-feet.

The maximum annual water demand is 113,702 acre-feet for Scenario One or 142,380 acre-feet for Scenario Two, for a difference of 28,678 acre-feet. In contrast, the current maximum annual water demand is estimated at 65,700 acre-feet, so water demand is expected to double in the next 45 years.

The estimated peak day water demand is 643 acre-feet per day or 772 acre-feet per day for Scenarios One or Two, respectively. The peak day water demand can also be expressed in million gallons per day at 209.5 mgd or 251.4 mgd for Scenarios One or Two, respectively.

Summary of Water Demand Estimates - Scenario One.

Water Uses	Average Annual Water Demand (ac-ft)	Maximum Annual Water Demand (ac-ft)	Peak Day Water Demand (ac-ft)
Municipal	57,053	79,442	503
Rural Water System	6,388	8,804	39
Industrial	22,566	25,039	96
Recreation	290	417	5
Total	**86,297**	**113,702**	**643**

Summary of Water Demand Estimates - Scenario Two.

Water Uses	Average Annual Water Demand (ac-ft)	Maximum Annual Water Demand (ac-ft)	Peak Day Water Demand (ac-ft)
Municipal	65,944	91,806	584
Rural Water System	8,131	11,174	49
Industrial	36,510	38,983	134
Recreation	290	417	5
Total	**110,875**	**142,380**	**772**

Red River 1910 | Red River 1936 | Red River 1970 | Red River 1988

Water Supply Shortages

Groundwater and surface water sources were evaluated to determine if there were adequate supplies to meet future water demands. Unallocated groundwater resources in North Dakota are very limited, so these only can be counted on to supplement surface water supplies. Under normal climatic conditions, there are adequate surface water sources to meet future water demands. During a drought, however, there will be water shortages.

Water shortages were estimated using a hydrologic model called StateMod. StateMod is a computer modeling program used to evaluate timing of river flows, water withdrawals, return flows, precipitation, and evaporation at many locations throughout the Red River Basin. The model is a water appropriation tool that was used to evaluate water supply options in the Red River Basin. Specific objectives were to:

- Examine surface water supply conditions to estimate 2005 and 2050 water supply shortages.
- Develop water supply options to meet future water needs.

Modeling was applied to the entire U.S. portion of the basin, up to the U.S.– Canadian border. Historic flow data from many locations for the period 1931 to 2001 were used.

Water demands were used for modeling Scenarios One and Two.

A water shortage is defined as the difference between the water demand and how much water is available on a daily, monthly, or annual basis. Unavailability or timing of supply can cause shortages. For example, during spring runoff high flows are available for use when demands are relatively low, but flows can be near zero during the late summer when the demand is highest. When this happens, water shortages can last days or months.

Total service area shortages in 2050 would be almost 37,000 acre-feet for Scenario One, or 53,000 acre-feet for Scenario Two during the worst year of a 1930s-style drought. The worst year corresponds to the 1934 flow year. This means the shortage could be encountered by the fourth year of a 1930s drought. Options were developed to meet these shortages.

Water shortage in 2050 in the service area during a 1930s drought would be 37,000 acre-feet (Scenario One) or 53,000 acre-feet (Scenario Two).

What are the Potential Solutions?

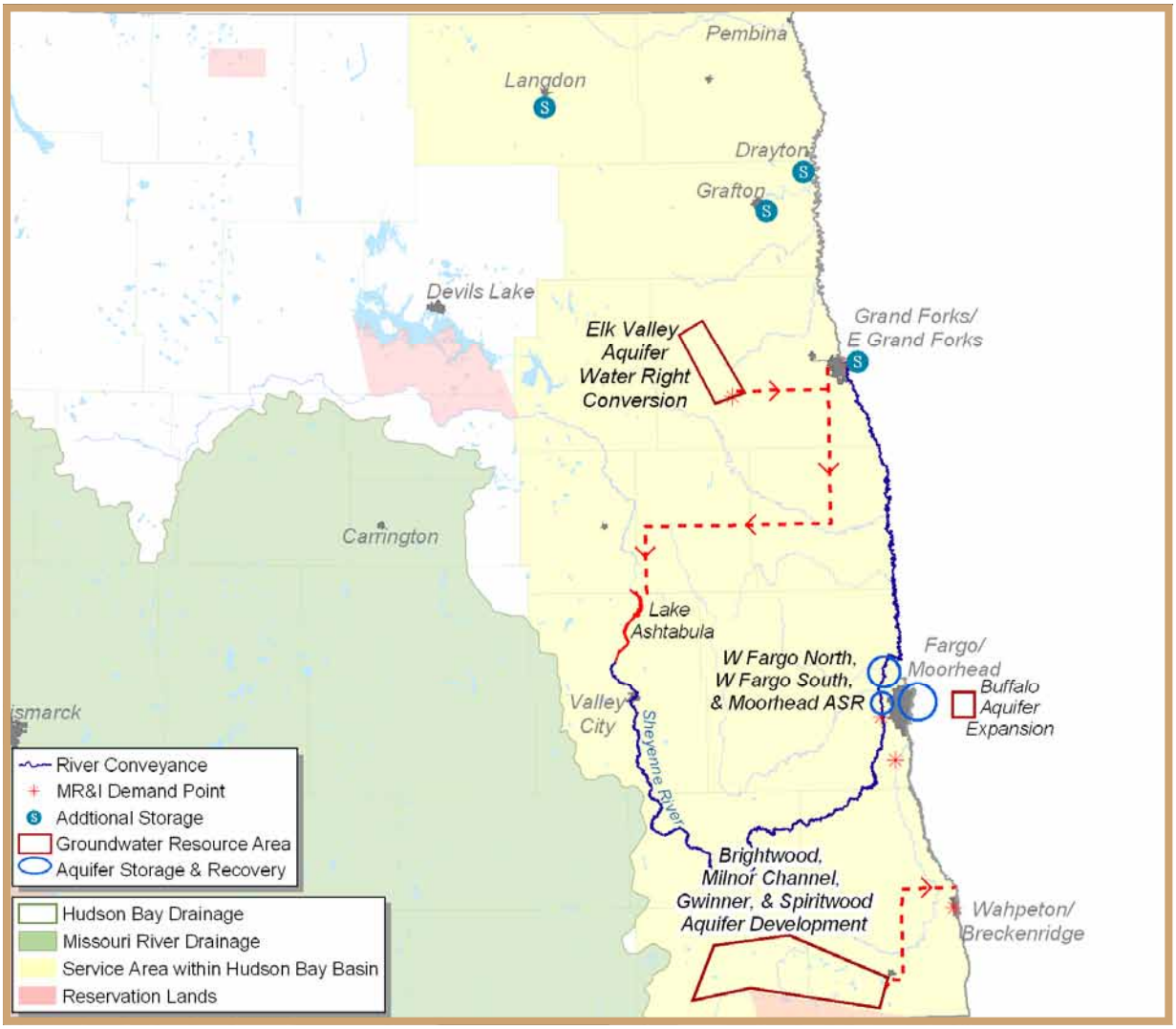
We cannot control the occurrence, location, or duration of a drought, but we can manage some of the impacts it would have on our activities. While drought cannot be forecast with any degree of accuracy, we can anticipate the potential for drought and develop plans to minimize its effects.

Seven options were developed to meet the needs of the Red River Valley through 2050. They include three in-basin options and four import options. Options that propose importing water from the Missouri River would have treatment plants designed to reduce the risk of interbasin transfer of biota that are not native to the Hudson Bay Basin.

The options use different methods to meet future water needs in the service area. Some would deliver enough water to meet the maximum month demand with peak day demands met locally, while other options would deliver enough water to meet both maximum month and peak day water demands. Six options would supplement current water supplies to meet the predicted water shortage. The seventh option, the (GDU) Garrison Diversion Unit Water Supply Replacement Pipeline, would replace all existing MR&I water supplies in the service area with water imported from the Missouri River.

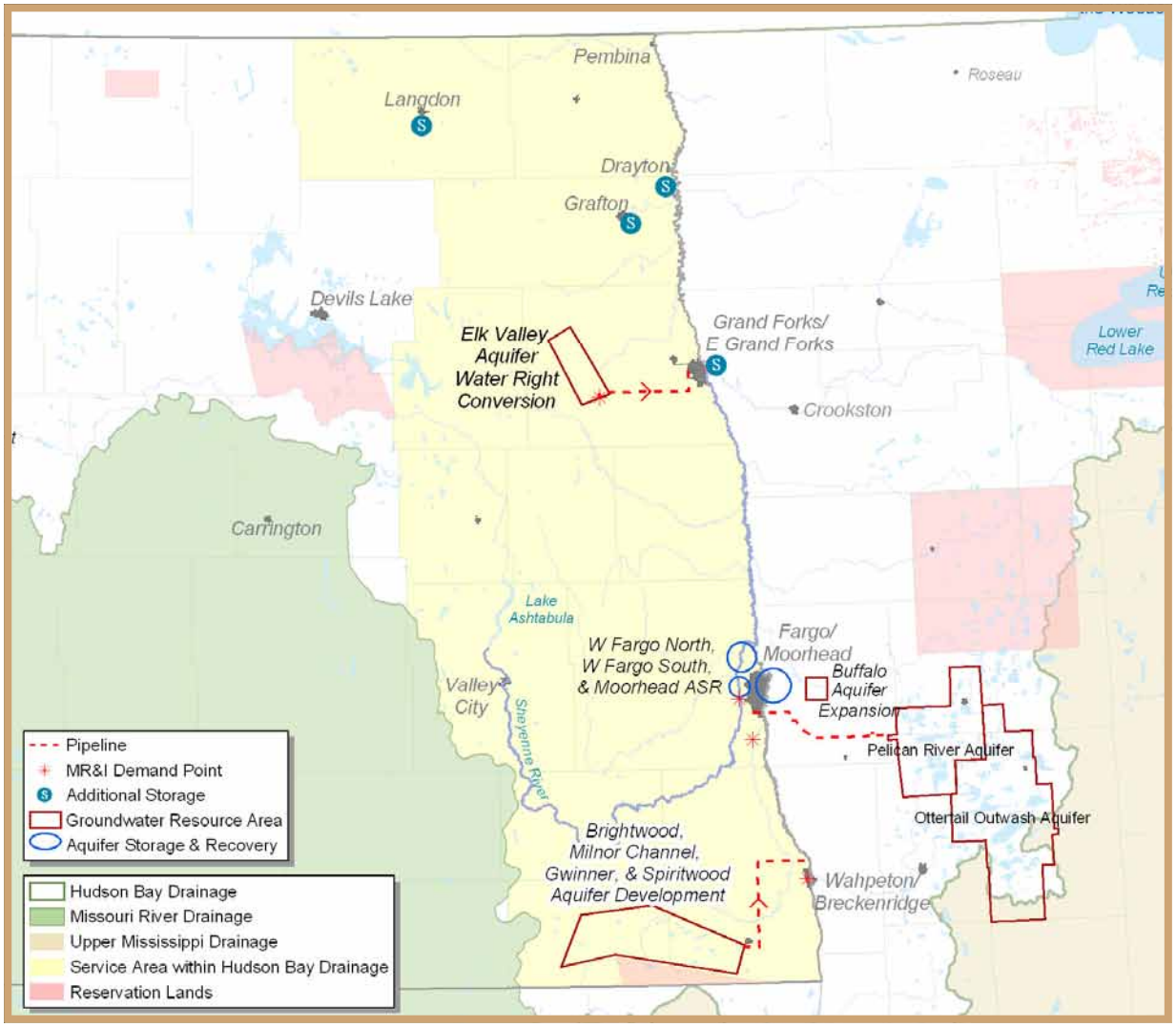
OPTIONS
North Dakota In-Basin

North Dakota In-Basin Alternative primarily would use the Red River and other North Dakota water sources to meet future water demands. The pipeline would capture Red River flows downstream of Grand Forks and recirculate flows back to Lake Ashtabula to meet MR&I water demands**.** The option also would include developing new groundwater sources in southeastern North Dakota and purchasing existing irrigation water rights in the Elk Valley Aquifer. Aquifer storage and recovery systems are proposed for Fargo, Moorhead, and West Fargo. Moorhead would continue to draw on Minnesota groundwater sources for some of their water demand. Additional storage reservoirs would be needed by communities in the northern end of the valley.



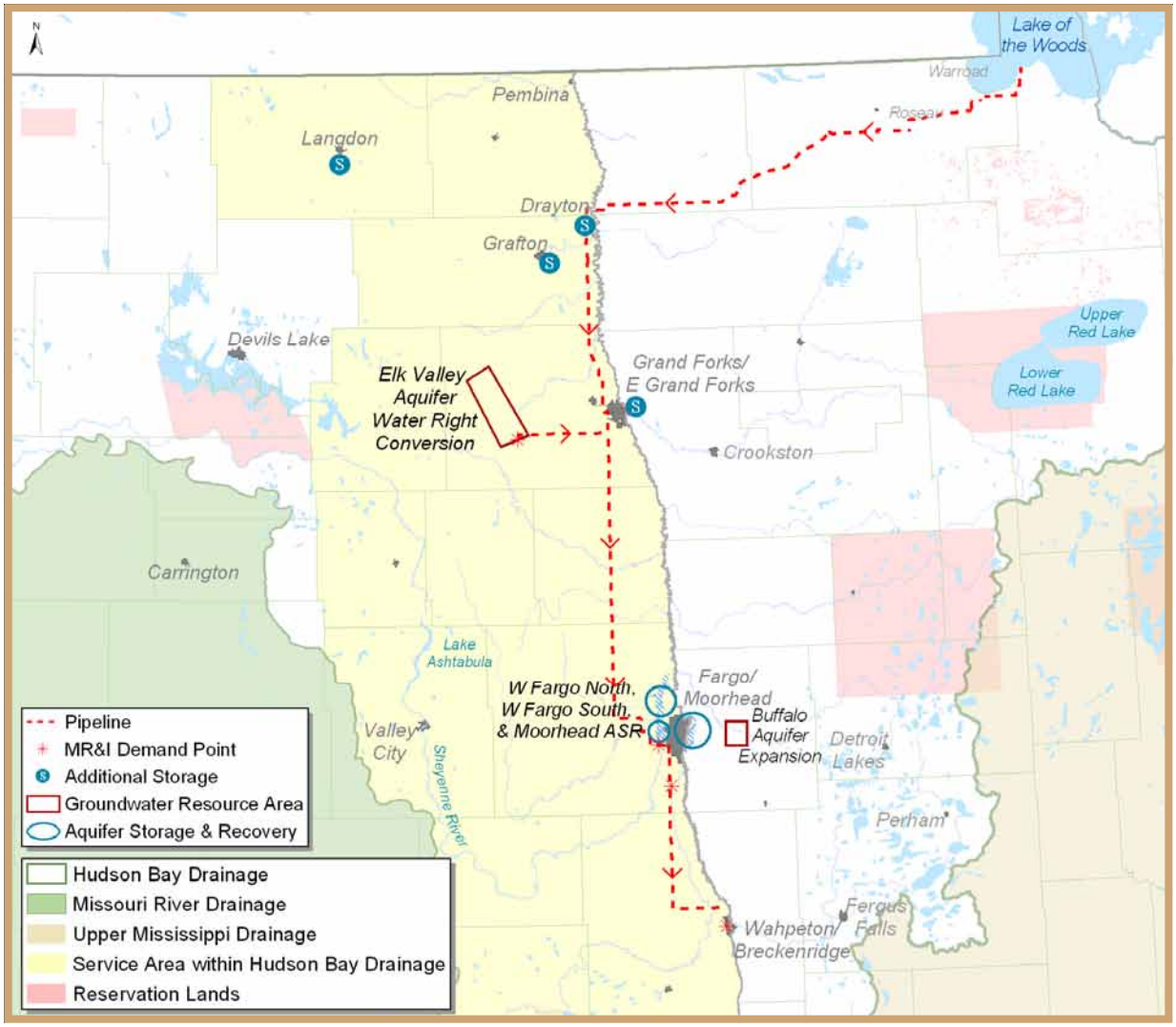
OPTIONS
Red River Basin

Red River Basin Alternative would draw on a combination of the Red River, other North Dakota water sources, and Minnesota groundwater to meet future water demands. A series of well fields would be developed in Minnesota with an interconnecting conveyance pipeline serving the Fargo-Moorhead metropolitan area. This option would rely on the existing storage and regulation capability of Lake Ashtabula to manage flows in the Sheyenne River. It would include the same North Dakota and Moorhead groundwater features as in the North Dakota In-Basin Alternative. Communities in the northern end of the valley would need additional storage reservoirs.



OPTIONS
Lake of the Woods

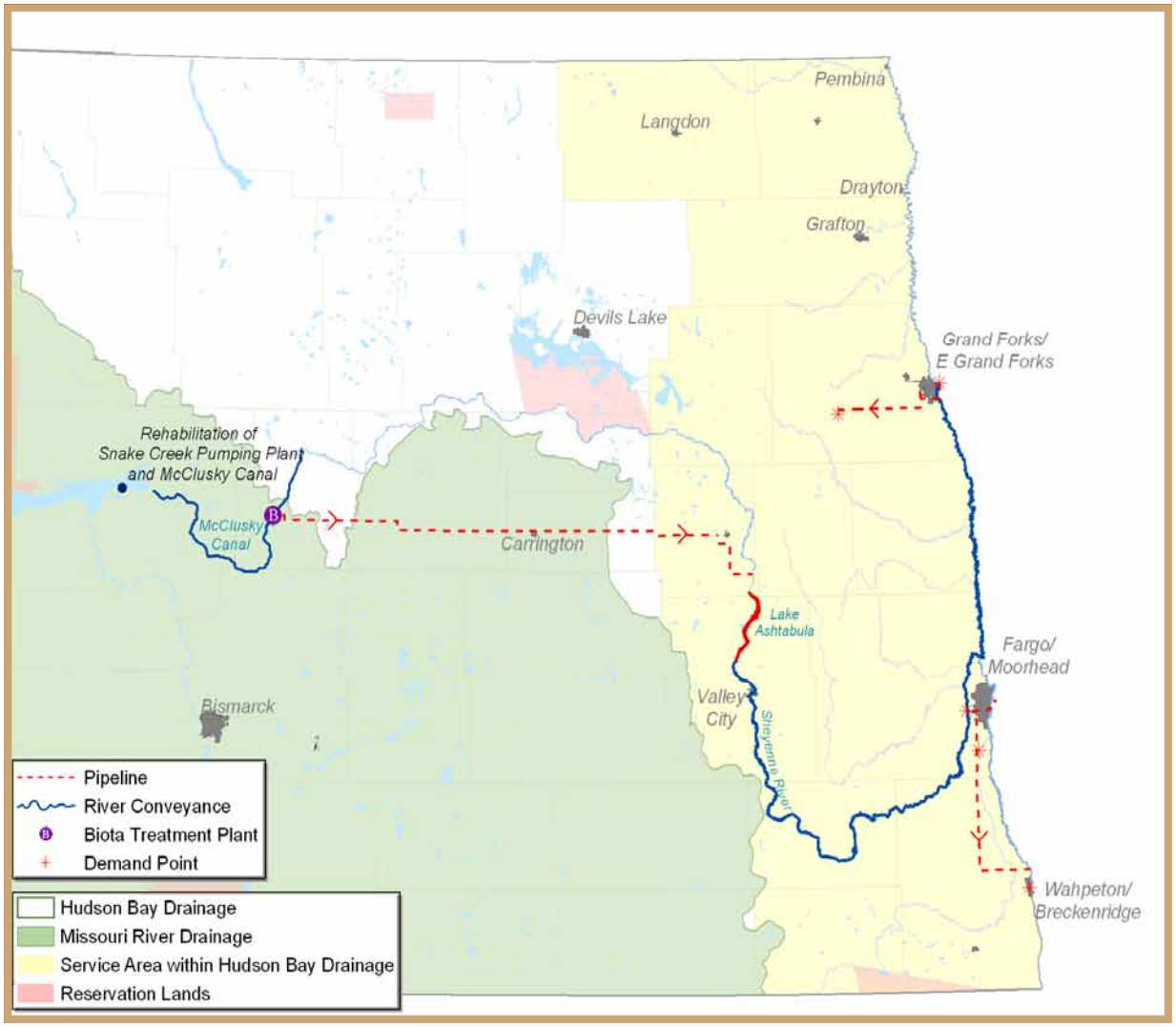
Lake of the Woods Alternative would use a combination of Red River, other North Dakota water sources, and water from Lake of the Woods to meet future water demands. The primary feature would be a pipeline from Lake of the Woods to the major population centers of the Red River Valley. Like the previous option, this option would rely on the existing storage and regulation capability of Lake Ashtabula. It would include the same North Dakota and Moorhead groundwater features as the North Dakota In-Basin Alternative, except the industrial water demands in southeastern North Dakota would receive water by pipeline from the Fargo area. Additional storage reservoirs would be needed by communities in the northern end of the valley.



OPTIONS

GDU Import to Sheyenne River

GDU Import to Sheyenne River Alternative would use a combination of the Red River, other North Dakota in-basin sources, and Missouri River water to meet future water demands. The principal feature of this option would be a pipeline from the McClusky Canal to Lake Ashtabula that would release treated Missouri River water into the Sheyenne River. The pipe would be sized so peak day demands could be met by Lake Ashtabula releases. The option would include a biota treatment plant at the McClusky Canal and a pipeline to serve industrial water demands in southeastern North Dakota. The biota treatment process would use coagulation, flocculation, sedimentation, and ultraviolet disinfection.



OPTIONS

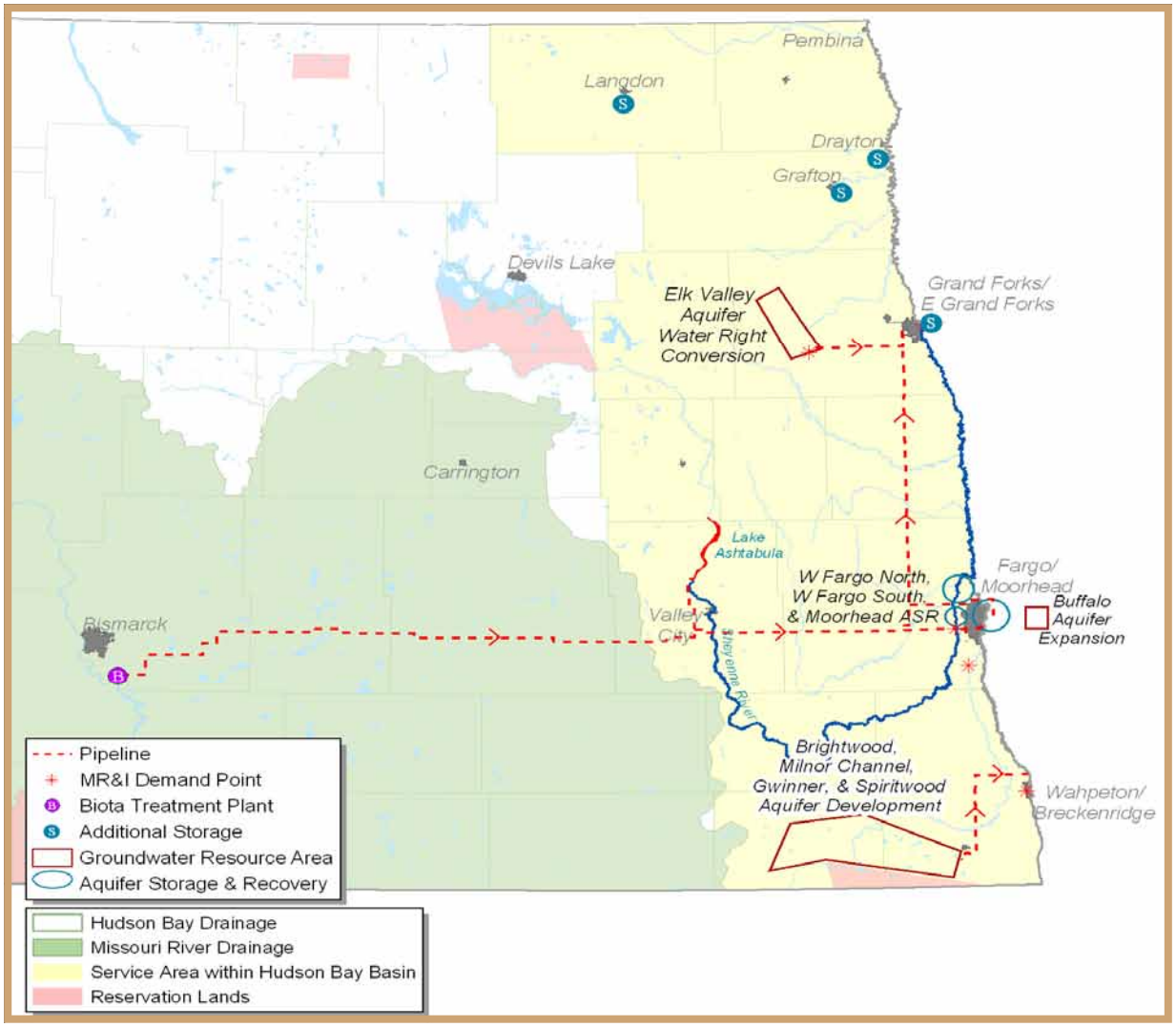
GDU Import Pipeline

GDU Import Pipeline Alternative proposes a combination of the Red River, other North Dakota in-basin water, and imported Missouri River water to meet future water demands. The principal feature of the option would be a pipeline from the McClusky Canal to the Fargo and Grand Forks metropolitan areas sized to meet peak day shortages. It would include a biota treatment plant at the McClusky Canal and a pipeline to serve industrial water demands in southeastern North Dakota. The option would rely on the existing storage and regulation capability of Lake Ashtabula to meet some of the downstream MR&I water demands. The biota treatment process would use coagulation, flocculation, sedimentation, and ultraviolet disinfection.

OPTIONS

Missouri River Import to Red River Valley

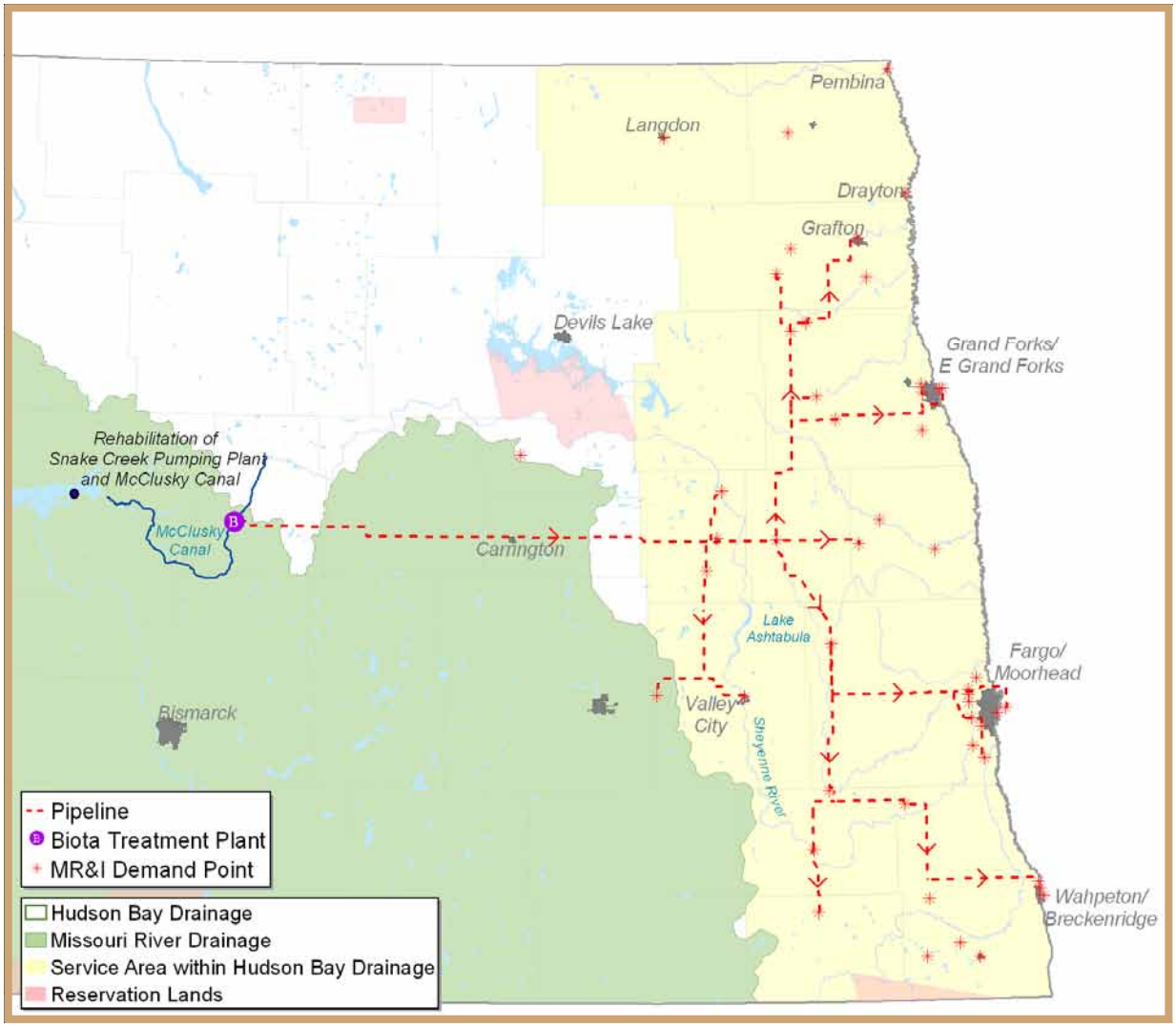
Missouri River Import to Red River Valley Alternative would use a combination of the Red River, other North Dakota in-basin water sources, and imported Missouri River water to meet future water demands. The principal feature would be a pipeline from the Missouri River at Bismarck to the Fargo and Grand Forks metropolitan areas. The option would include a biota treatment plant at the Missouri River. The biota treatment process would use coagulation, flocculation, sedimentation, and ultraviolet disinfection. The size of the pipeline would be optimized by including a spur pipeline to release treated Missouri River water into Lake Ashtabula. The lake would be a regulating reservoir. The option would include the same North Dakota and Moorhead groundwater features as the North Dakota In-Basin Alternative. Communities in the northern end of the valley would need additional storage reservoirs.



OPTIONS

GDU Water Supply Replacement Pipeline

GDU Water Supply Replacement Pipeline Alternative would use water imported from the Missouri River to replace other water supplies in the service area and to meet future water demands. The principal feature of the option would be a pipeline from the McClusky Canal into the Red River Valley interconnecting most of the cities, rural water systems, and industries. A few extreme northern and southern water systems would not be connected to the system, but capacity to serve them in the future is provided for in the design. The conveyance pipeline would have the capacity to meet the peak day water demand of the entire service area. The option would include a biota treatment plant at McClusky Canal. A water treatment plant for this option includes additional processes to deliver water treated to SDWA standards to the Red River Valley. Numerous water systems in the valley use groundwater and lack the capability to treat surface water. Therefore, treated water must be supplied to these systems or they would have to adapt their current groundwater water treatment plant to treat surface water. To address this problem, the entire service area would receive bulk-treated water in this option. The treatment process would use lime softening, micro-filtration, and ultraviolet disinfection to generate a source of water that fully complies with the SDWA.



Option Cost Estimates

The following tables summarize estimated construction costs of the seven options. Total construction cost estimates developed for each option include contingencies for contractor overhead and profit (30%), contractor costs (15%), unlisted items (5%), contingencies (25%), and non-contract engineering and administration (25%). Annual (OM&R) operation, maintenance, and replacement costs are shown in the last column. Option costs include features that would supply bulk water to the Red River Valley service area. These cost estimates should only be used for comparative purposes when evaluating the differences between options. They are provided to decision makers for the purpose of determining whether more detailed investigations of the Project are justified. ***These estimates are not suitable for requesting authorization or construction fund appropriations from Congress***.

Summary of Option Cost Estimates – Scenario One.

Option	Construction Cost (2005 Dollars)	Annual OM&R Costs (2005 Dollars)
North Dakota In-Basin	$560,000,000	$6,700,000
Red River Basin	$550,000,000	$7,500,000
Lake of the Woods	$940,000,000	$7,800,000
GDU Import to Sheyenne River	$430,000,000	$3,800,000
GDU Import Pipeline	$1,200,000,000	$5,300,000
Missouri River Import to Red River Valley	$880,000,000	$9,900,000
GDU Water Supply Replacement Pipeline	$2,230,000,000	$25,400,000

Summary of Option Cost Estimates – Scenario Two.

Option	Construction Cost (2005 Dollars)	Annual OM&R Costs (2005 Dollars)
North Dakota In-Basin	$640,000,000	$7,500,000
Red River Basin	$750,000,000	$8,900,000
Lake of the Woods	$1,110,000,000	$8,800,000
GDU Import to Sheyenne River	$590,000,000	$5,000,000
GDU Import Pipeline	$1,410,000,000	$6,300,000
Missouri River Import to Red River Valley	$1,010,000,000	$11,000,000
GDU Water Supply Replacement Pipeline	$2,520,000,000	$31,700,000

What is Next?

The Final Needs and Options Report (*Final Report on the Red River Valley Water Needs and Options*) has been distributed to interested agencies, organizations, and individuals. Reclamation will transmit this report to Congress, as required by the Dakota Water Resources Act of 2000[Section 8(b)(3)].

The Act also directs the Secretary to jointly prepare an EIS (environmental impact statement) for the project with the State of North Dakota. In preparing the EIS, Reclamation is representing the Secretary, and Garrison Diversion Conservancy District is representing the State of North Dakota. The environmental effects of the options in the Final Needs and Options Report, along with the No Action Alternative, are analyzed in the EIS. The draft EIS is scheduled for distribution to the public for comment in December 2005.

DWRA also specifies the process for selecting a preferred alternative for the project. After the Final Needs and Options Report and Final EIS are completed, "the Secretary shall transmit to Congress a comprehensive report which provides:

(i) a detailed description of the proposed project feature;

(ii) a summary of major issues addressed in the environmental impact statement;

(iii) likely effects, if any, on other States bordering the Missouri River and on the State of Minnesota; and

(iv) a description of how the project feature complies with the requirements of section 1(h)(1) of this Act (relating to the Boundary Waters Treaty of 1909)" [Section 8(a)(3)].

After transmitting the comprehensive report to Congress, "the Secretary, in consultation and coordination with the State of North Dakota in coordination with affected local communities, shall select 1 or more project features described in subsection (a) that will meet the comprehensive water quality and quantity needs of the Red River Valley. The Secretary's selection of an alternative shall be subject to judicial review" [Section 8(d)(1)].

Photograph Labels and Credits

Cover: Temporary Intake Pipe into Red Lake River for Grand Forks, August 28, 1910 (photo courtesy of the City of Grand Forks).

Pages 2 and 3: Overview of the Red River (photo courtesy of Garrison Diversion Conservancy District).

Pages 4 and 5: Temporary Intake Pipe into Red Lake River for Grand Forks, August 28, 1910 (photo courtesy of the City of Grand Forks).

Page 6: Girl Drinking from a Hose (photo courtesy of Garrison Diversion Conservancy District).

Page 7: Crystal Sugar Plant (**http://www.crystalsugar.com**).

Construction in Fargo, North Dakota (photo courtesy of Garrison Diversion Conservancy District).

Page 8: Collecting Mussels (photos courtesy of C. Grondahl, North Dakota Game and Fish Department).

Lake Sturgeon Fingerling (photo courtesy of Minnesota Department of Natural Resources).

Red River near Breckenridge, Minnesota.

Page 10: Golfing and Fishing (photos courtesy of Garrison Diversion Conservancy District).

Taplin Gorge Reservoir near Fergus Falls, Minnesota.

Lynn Schlueter with catfish (photo courtesy of ND Game and Fish Department).

Page 11: Water Conservation and West Fargo Water Tower (photos courtesy of Garrison Diversion Conservancy District).

Page 13: Red River in Fargo in 1910 below the Northern Pacific Bridge (Institute for Regional Studies, North Dakota State University Libraries, Fargo, 328-2-18).

Red River in 1936 (photo courtesy of Garrison Diversion Conservancy District).

Red River in Fargo at a Low Water Level, September 29, 1970 (Institute for Regional Studies, North Dakota State University Libraries, 2049-59-9).

Red River in 1988 (photo courtesy of Garrison Diversion Conservancy District).

Page 14: Overview of the Red River (photo courtesy of Garrison Diversion Conservancy District).

The attached CD contains the following information:

- *Final Report on Red River Valley Water Needs and Options*
- Appendixes
- Supporting Documents

An electronic version of the *Final Report on Red River Valley Water Needs and Options* is available at the following web address: http://www.usbr.gov/gp/dkao.