US Army Corps
of Engineers
Omaha District

Draft

Big Bend Dam/Lake Sharpe Project
South Dakota

Surplus Water Report

Volume 1

Surplus Water Report
Appendix A – Environmental Assessment

August 2012

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BIG BEND DAM/LAKE SHARPE PROJECT
SOUTH DAKOTA

SURPLUS WATER REPORT

Omaha District
U.S. Army Corps of Engineers

August 2012

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Big Bend Dam/ Lake Sharpe Project
South Dakota
SURPLUS WATER REPORT

August 2012

Prepared By:

The U.S. Army Corps of Engineers, Omaha District

Omaha, NE

Abstract: The Omaha District is proposing to temporarily make available 62,268 acre-feet/year of surplus water (equivalent to 160,028 acre-feet of storage) from the system-wide irrigation storage available at the Big Bend Dam/Lake Sharpe Project, South Dakota to meet municipal and industrial (M&I) water supply needs. Under Section 6 of the Flood Control Act of 1944 (Public Law 78-534), the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any reservoir under the control of the Department. Terms of the agreements are normally for five (5) years, with an option for a five (5) year extension, subject to recalculation of reimbursement after the initial five (5) year period.

This proposed action will allow the Omaha District to enter into surplus water agreements with interested water purveyors and to issue easements for up to the total amount of surplus water to meet regional water needs. During the temporary period the Corps recommends that a comprehensive strategy to address long-term regional water needs be developed that may involve the Administration, Congress and stakeholders. The Proposed Action (temporary use of surplus water) will not impede the capability and function of Big Bend Dam/Lake Sharpe to serve its authorized purposes. An Environmental Assessment, which is attached to this Surplus Water Report, identifies the baseline environmental conditions and provides an analysis of potential impacts from the proposed use of surplus water. There are no significant environmental impacts associated with implementing the proposed action.
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EXECUTIVE SUMMARY

The Omaha District, U.S. Army Corps of Engineers (Corps) under the Operation & Maintenance Program has prepared this Big Bend Dam/Lake Sharpe, South Dakota Surplus Water Report to identify and quantify whether surplus water is available in the Project, as defined in Section 6 of the 1944 Flood Control Act. Surplus water agreements with water use based on this process may be executed with existing and potential future applicants, pursuant to policy, upon approval of this Report by the Assistant Secretary of the Army (Civil Works) and completion of required NEPA analysis. The term of proposed temporary surplus water use is for up to a five (5) year period, renewable for up to an additional five (5) year period, subject to recalculation of reimbursement after the initial five (5) year period.

This Surplus Water Report and accompanying Environmental Assessment investigate the engineering and economic feasibility and environmental effects of temporary use of up to 62,268 acre-feet/year of surplus water (160,028 acre-feet of storage) from the Big Bend Dam/Lake Sharpe, South Dakota Project. Surplus water, if available, may be used to meet existing and projected municipal and industrial (M&I) water supply needs in the region. The 62,268 acre-feet/year of yield (160,028 acre-feet of storage) evaluated for surplus water use in this report is an estimate that was selected to ensure that an adequate quantity of water was identified to meet the needs of existing and future M&I water users. This Surplus Water Report will serve as the basis to enter into temporary surplus water agreements.

A 10-year study period has been established for this surplus water study. The length of the study period was selected for several reasons. First, surplus water agreements may be executed for a five (5) year period, renewable for an additional five (5) year period. Second, prior to the end of the 10-year study period, the Corps recommends that a comprehensive strategy to address long-term regional water needs be developed that may involve the Administration, Congress and stakeholders. The surplus water agreements executed upon the approval of this Report will serve as measures to address temporary water needs of the region during the 10-year study period.

The Big Bend Dam/Lake Sharpe Project is a unit of the comprehensive Pick-Sloan Plan for development in the Missouri River Basin. The operation of the upper Missouri River's six mainstem reservoirs and the lower Missouri River's levees and navigation channel provides for flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, water quality, and recreation. The temporary use of 62,268 acre-feet/year of surplus water in Lake Sharpe would result in additional net annual depletions of 5,661 acre-feet from the system for the ten year period, beyond existing usage levels. The primary difference between with and without project conditions is that under without project conditions, the additional 5,661 acre-feet will come from groundwater sources and under with project conditions, withdrawal of the additional 5,661 acre-feet will come from the Big Bend Dam/Lake Sharpe Project. Both conditions assume continuation of existing use sourced from Lake Sharpe.

The Daily Routing Model (DRM), developed during the 1990's as part of the Master Manual Review and Update Study (Master Manual), was used as an analytical tool in this study to estimate the hydrologic effects that an additional 5,661 acre-feet of depletions would have at Lake Sharpe, the other system reservoirs, and free-flowing reaches of the Missouri River.

A comparison of DRM simulated water surface elevations, stream flows, and river stages between without project conditions and with project conditions resulting from an additional

depletion of 5,661 acre-feet from Lake Sharpe was performed to assess the magnitude of changes resulting from the proposed temporary use of surplus water from the Project. Modeling results indicate that stage and flow reduction estimates throughout the system are extremely small. Because the Missouri River projects are operated as an integrated system taking into account system withdrawals both in and outside of the Federal projects, no changes to system operations will be required as a result of the temporary use of surplus water from the Big Bend Dam/Lake Sharpe Project.

Under current policy pricing, the annual payment for surplus water would be $36.65 per acre-foot of yield (equivalent to $14.26 per acre-foot of storage) at FY 2012 price levels. In a memorandum dated May 8, 2012, the Assistant Secretary of the Army for Civil Works (ASA CW) directed the Corps of Engineers to initiate action immediately to purse notice and comment rulemaking to establish a nationwide policy for surplus water uses under Section 6 (Attachment 1). Pending completion of rule-making to establish a nationwide policy for surplus water uses under Section 6, surplus water agreements would be entered into at no cost. The term of these agreements would be for a period not to exceed the time needed to conclude the rulemaking process. All users of surplus water would need to enter into new or revised agreements implementing the nationwide policy price once the rule becomes effective.

An alternatives analysis was conducted, which assessed non-structural measures (conservation, recycling, and temporary permits to convert irrigation water to industrial use) and structural measures (project modifications to increase storage capacity, temporary use of surplus water including associated infrastructure, groundwater withdrawals including associated infrastructure, and surface water withdrawals including associated infrastructure). The No Action – Next Least Costly Alternative is withdrawal from groundwater.

A test of financial feasibility was conducted, which demonstrated that entering into agreements for the use of surplus water from the Big Bend Dam/Lake Sharpe Project is a lower cost alternative than the most likely, least costly alternative for providing the needed water supply. An analysis of environmental impacts was conducted using the same DRM outputs that were used to assess impacts to project purposes. The analysis of environmental impacts identified no significant impacts from providing surplus water from the Big Bend Dam/Lake Sharpe Project.

The temporary use of surplus water assessed in this report is both economically and financially justified and will not affect the authorized purposes of the Big Bend Dam/Lake Sharpe Project. It is recommended that 62,268 acre-feet/year of yield (equivalent to 160,028 acre-feet of storage) in the Big Bend Dam/Lake Sharpe Project be made available for temporary use for municipal and industrial water users. Pending completion of rule-making to establish a nationwide policy for surplus water uses under Section 6, surplus water agreements would be entered into at no cost.

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SURPLUS WATER REPORT

1. INTRODUCTION

1.1 Study Purpose

The purpose of the Big Bend Dam/Lake Sharpe Surplus Water Report is to identify and quantify whether surplus water is available in the Project, as defined in Section 6 of the 1944 Flood Control Act, that the Secretary of the Army can use to execute surplus water supply agreements with water users, and to determine whether use of surplus water is the most efficient method for meeting regional municipal and industrial (M&I) water needs.

This Surplus Water Report and attached Environmental Assessment (EA) investigate the engineering and economic feasibility and environmental effects of temporary use of up to 62,268 acre-feet of yield per year (160,028 acre-feet of storage) from the Big Bend Dam/Lake Sharpe Project to meet municipal and industrial (M&I) water supply needs in the region over the 10-year study period. This Report has been prepared by the Omaha District, U.S. Army Corps of Engineers (Corps) under the Operation & Maintenance Program. Surplus water agreements based on this process would be executed with potential easement applicants upon approval of this Report by the Assistant Secretary of the Army (Civil Works) and completion of required NEPA analysis. The term of a surplus water agreement is for up to a five (5) year period, renewable for up to an additional five (5) year period, subject to recalculation of reimbursement after the initial five (5) year period.

A 10-year study period has been established for this surplus water study. The length of the study period was selected for two reasons. First, surplus water agreements may be executed for a five (5) year period, renewable for an additional five (5) year period. Second, prior to the end of the 10-year study period, the Corps recommends that a comprehensive strategy to address long-term regional water needs be developed that may involve the Administration, Congress, and stakeholders. The surplus water agreements executed upon the approval of this Report will serve as measures to address temporary water needs of the region during the 10-year study period.

The temporary use of a total of 62,268 acre-feet/year of yield (160,028 acre-feet of storage) being requested is in excess of existing use plus the total amount for which easements have currently been requested. The amount of surplus water assessed in this analysis is based on potential future demand over the 10-year study period. The amount in excess of intake easement requests received to date has been included for the purposes of efficiency and responsiveness, so that potential requests over the period of analysis can be evaluated and approved in one single action by the Assistant Secretary.

1.2 Study Authority

The Big Bend Dam/Lake Sharpe South Dakota Surplus Water Report study is being conducted under the authority of Section 6 of Public Law 78-534, the 1944 Flood Control Act. Under Section 6, the Secretary of the Army is authorized to enter into agreements for surplus water with states, municipalities, private concerns, or individuals at any reservoir under the control of the Department of the Army. Specifically, Section 6 states that:

> *"[T]he Secretary of War is authorized to make contracts with States, municipalities, private concerns, or individuals, at such prices and on such terms as he may deem reasonable, for domestic and industrial uses for surplus water that may be available at any reservoir under the control of the War Department: Provided, That no contracts for such water shall adversely affect then existing lawful uses of such water."*

ER 1105-2-100, page 3-32, paragraph 3-8a states:

> *"The Secretary of the Army can also enter into agreements with states, municipalities, private entities or individuals for the use of surplus water as defined in, and under the conditions described in, Paragraph 3-8b(4). Surplus water can also be used to respond to droughts and other emergencies affecting municipal and industrial water supplies."*

ER 1105-2-100, paragraph 3-8b(4), entitled, "Surplus Water" states:

> *"Under Section 6 of the Flood Control Act of 1944, the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any reservoir under the control of the Department. These agreements may be for domestic, municipal, and industrial uses, but not for crop irrigation."*

ER 1105-2-100, paragraph E-57b(2) states:

> *(2) Classification.*
>
> *(a) Surplus Water will be classified as either:*
>
> *(1) water stored in a Department of Army reservoir that is not required because the authorized use for the water never developed or the need was reduced by changes that occurred since authorization or construction; or*
>
> *(2) water that would be more beneficially used as a municipal and industrial water than for the authorized purpose and which, when withdrawn, would not significantly affect authorized purposes over some specified time period.*
>
> *(b) An Army General Counsel opinion of March 13, 1986, states that Section 6 of the 1944 Flood Control Act empowers the Secretary of the Army to make reasonable reallocations between different project purposes. Thus, water stored for purposes no longer necessary can be considered surplus. In addition, the Secretary may use his broad discretionary authority to reduce project outputs, envisioned at the time of authorization and construction, if it is believed that the municipal and industrial use of the water is a higher and more beneficial use….*
>
> *(3) Requirements and Restrictions. Surplus water declarations will only be made when related withdrawals would not significantly affect authorized purposes. Surplus water agreements shall be accompanied by a brief letter Report similar to reallocation Reports and shall include how and why the storage is determined surplus. Surplus water agreements will normally be for small amounts of water and/or for temporary use as opposed to storage reallocations and a permanent*

right to that storage. Normally, surplus water agreements will be limited to 5 year periods. Use of the Section 6 authority should be encouraged only where non-Federal sponsors do not want to buy storage because the need of the water is short term or the use is temporary pending the development of the authorized use. The views of the affected state(s) will be obtained, as appropriate, prior to entering into any agreement under Section 6. The annual price deemed reasonable for this use of surplus water is determined by the same procedure used to determine the annual payment for an equivalent amount of reallocated storage plus an estimated annual cost for operation and maintenance, repair, replacement, and rehabilitation. The total annual price is to be limited to the annual costs of the least cost alternative, but never less than the benefits foregone (in the case of hydropower, revenues forgone).

1.3 Need for Surplus Water

Identification of surplus water within the Big Bend Dam/Lake Sharpe, South Dakota Project would allow the Corps of Engineers to satisfy temporary M&I water supply demands (including existing users and future demands should they develop) within the region. Approval of this Report is a necessary pre-condition to executing surplus water agreements with, and issuing easements to, applicants for withdrawal of surplus water from the Corps Project.

Temporary use of surplus water is not expected to cause significant adverse effects to existing authorized purposes and will not involve any structural changes to the project.

The Environmental Assessment (EA) is provided as Appendix A to this Report and further explains the needs, benefits and effects of this proposed use of surplus water in Lake Sharpe. Descriptions of existing conditions are contained in the Environmental Assessment and incorporated into this Surplus Water Report by reference, in the interest of brevity.

1.4 Report Organization

The Water Surplus Report summarizes the results of the technical investigations in support of a request for use of surplus water from the Big Bend Dam/Lake Sharpe Project. Report sections include:

Executive Summary

Section 1 – Introduction

Section 2 – Project Background

Section 3 – Plan Formulation

Section 4 – Plan Implementation

Section 5 – Conclusions

Section 6 - Recommendations

Technical appendices, which present details of technical investigations and supporting documentation, are provided in separate volumes. Technical Appendices include:

Appendix A Environmental Assessment / FONSI

2. PROJECT BACKGROUND

2.1 Project Location

The Big Bend Dam/Lake Sharpe Project is located in the Missouri River Valley in Buffalo, Hyde, Hughes, Stanley, and Lyman Counties in central South Dakota. The dam is located approximately 990 miles upstream from the mouth of the Missouri River at Fort Thompson, South Dakota. The embankment of the dam is 2 miles long. The left abutment of the dam is in Buffalo County and the right abutment is in Lyman County. The Big Bend Dam/Lake Sharpe Project, along with the other five Missouri River mainstem projects, are shown in Figure 2-1, and include: Fort Peck Dam/Fort Peck Lake, Garrison Dam/Lake Sakakawea, Oahe Dam/Lake Oahe, Fort Randall/Lake Francis Case, and Gavins Point Dam/Lewis & Clark Lake.

2.2 Project Authorization

Big Bend Dam was constructed as part of the Pick-Sloan Plan for development of the upper Missouri River Basin. Comprehensive development was proposed by the U.S. Army Corps of Engineers (Corps) in House Document 475 and by the Bureau of Reclamation (BOR) in Senate Document 191; the coordinated plan was presented to Congress in Senate Document 247 (all 78th Congress, 2nd session). Under this Act, the Corps was given the responsibility for development of projects on the main stem of the Missouri River. Tributary projects were made the responsibility of the Corps if the dominant purpose was flood control.

The Department of the Interior was designated as the marketing agent for all power, beyond project requirements, produced at Corps projects. The Department of the Interior subsequently designated the BOR as the marketing agent for power generated by the main stem projects. The Department of Energy Act (1977 Department of Interior Organization Act) established the Department of Energy and simultaneously withdrew the power marketing function from the Department of Interior and moved it to the new Department of Energy.

The Big Bend Dam/Lake Sharpe Project was authorized by the Flood Control Act of 1944, Public Law (P.L.) 78-534, along with four other Missouri River mainstem projects: Garrison Dam/Lake Sakakawea, Oahe Dam/Lake Oahe, Fort Randall/Lake Francis Case, and Gavins Point Dam/Lewis & Clark Lake. These five mainstem reservoirs are elements of the comprehensive development program in the Missouri River Basin, known as the Pick-Sloan Plan. This comprehensive plan became known as the Pick-Sloan Missouri Basin Program. Fort Peck Dam, located in northern Montana, was constructed prior to the Pick-Sloan Plan, but is operated as part of the Missouri River System.

2.3 Project Description

Big Bend Dam and Lake Sharpe, the impoundment created by the Big Bend Dam, is the second smallest and 3rd most downstream dam on the Missouri River. Authorized for flood damage reduction, hydroelectric power, navigation, irrigation, fish and wildlife enhancement, public water supply, improvement of water quality, and recreation, the Big Bend Dam/Lake Sharpe Project has approximately 200 miles of shoreline. Lake Sharpe was not intended to provide storage space to serve the Missouri River navigation project, like other main stem projects. However, releases from the main stem reservoirs that are intended to serve downstream navigation are passed through the Big Bend project.

2.3.1 Big Bend Dam

Big Bend Dam was named for the unique bend in the Missouri River 7 miles upstream from the dam. At this point in its course, the Missouri River makes almost a complete loop, traveling about 25 miles before returning to the "neck" where the land is only 1 1/2 miles wide. This is the location where steamboat passengers would disembark and walk across the "narrows" for a break in the monotony of the river journey and then wait for the boat to make its way around the "big bend" to pick them up.

The dam was completed in 1966 at a cost of $107 million. Big Bend hydroelectric power plant is operated to meet peak demands for electricity in the Missouri River Basin. The power plant houses eight units with combined maximum generation capacity of 493,300 kilowatts. This is enough power for about 95,000 homes. The first unit went into operation in 1964 and by 1966 all eight generators were producing commercial electricity.

2.3.2 Lake Sharpe

Lake Sharpe was named for former South Dakota Governor Merrill Q. Sharpe. Lake Sharpe has an (incremental) drainage area of 5,840 square miles and stretches 80 miles from Fort Thompson to Pierre, South Dakota. It is the second smallest of the six Missouri River multipurpose mainstem projects with a storage capacity of about 1,798,000 acre-feet. The lake is normally operated at a pool elevation of 1,420 feet msl with a maximum operating pool elevation of 1,423 feel msl. At maximum operating pool elevation of 1,423 msl Lake Sharpe is about 80 miles long and provides about 200 miles of shoreline. At maximum operating pool the surface area of the lake covers approximately 61,000 acres. Much of the project is bounded on the east side by the Crow Creek Sioux Reservation and on the west side by the Lower Brule Sioux Reservation (See Figure 2-2). The reservations have had a significant impact on the development and use of the project lands and waters. The numbered features shown on Figure 2-2 identify the location of the Project's 24 developed recreation areas.

Figure 2-1
Omaha District Civil Works Boundary and Mainstem Projects

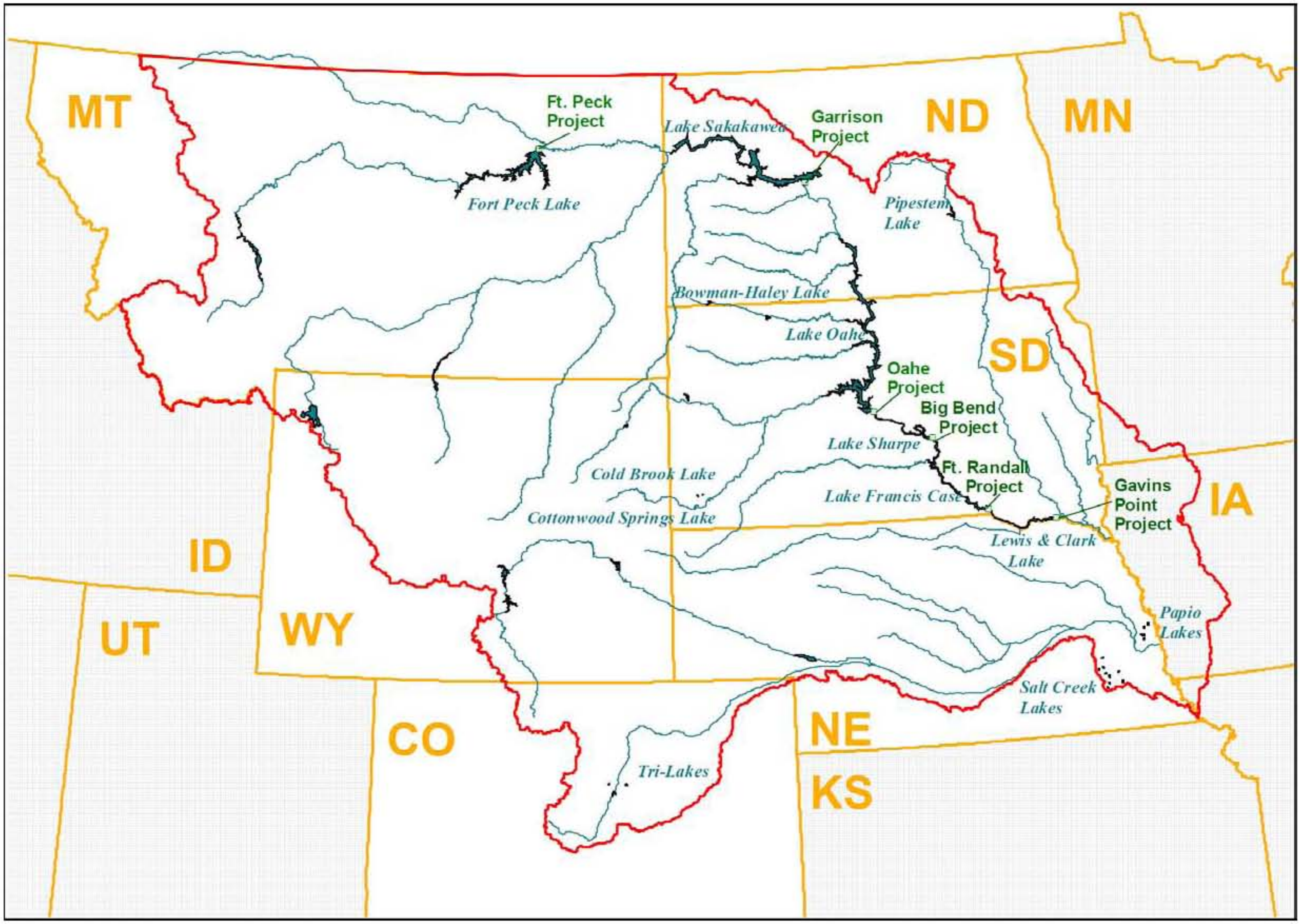
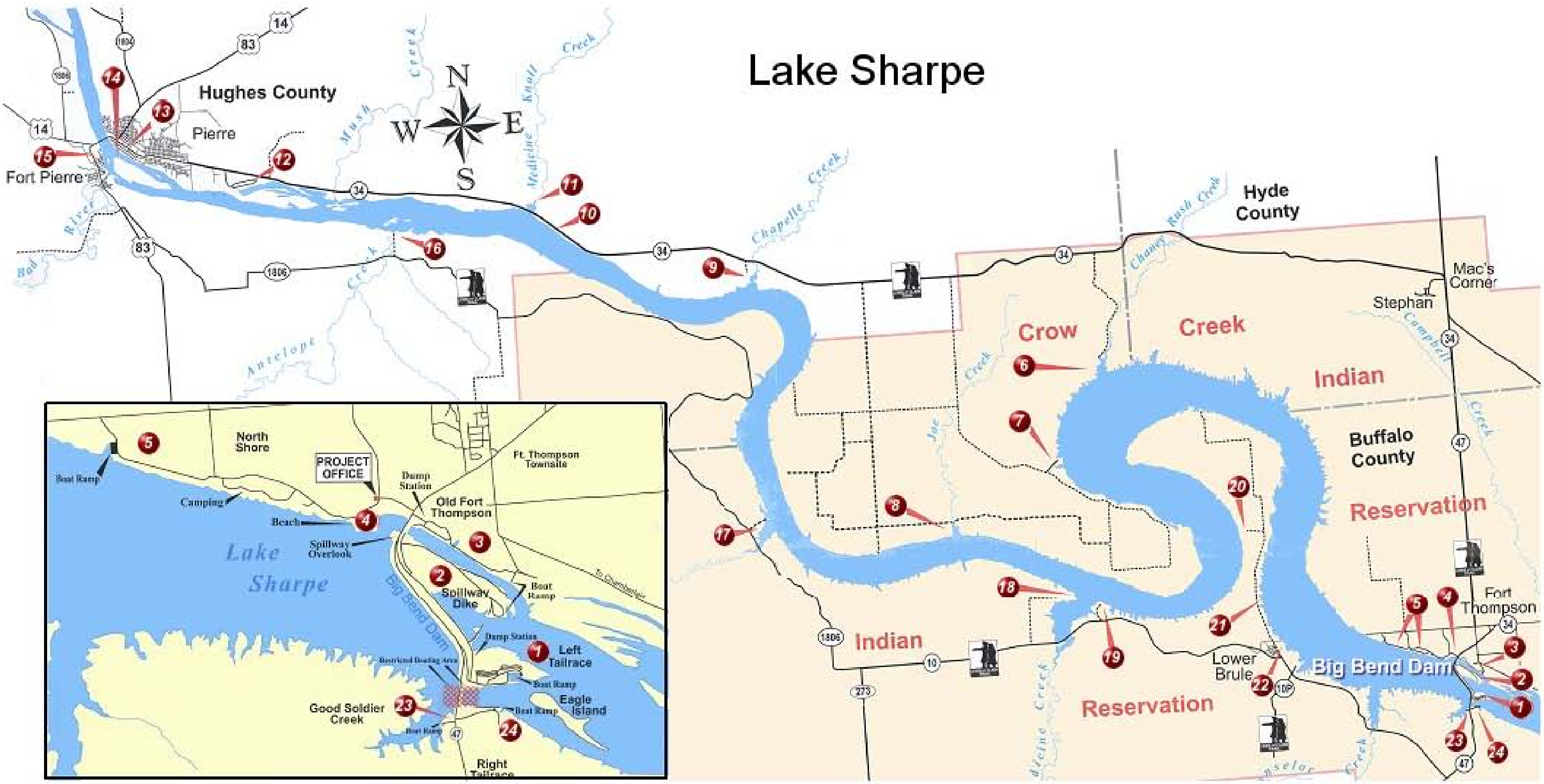


Figure 2-2
Big Bend Dam/Lake Sharpe Project, South Dakota



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2.4 Authorized Project Purposes[1]

The Big Bend Dam/Lake Sharpe Project is a unit of the comprehensive Pick-Sloan Plan for development in the Missouri River Basin. The operation of the upper Missouri River's six mainstem reservoirs and the lower Missouri River's levees and navigation channel provides for flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, water quality, and recreation.

The Missouri River begins at the confluence of the Jefferson, Madison, and Gallatin Rivers, near Three Forks in the Rocky Mountains of southwest Montana. Figure 2-1 illustrates the Upper Missouri River Basin. The Big Bend Dam/Lake Sharpe Project is operated as an integral component of the Missouri River Mainstem Reservoir System. To achieve full coordination within the entire Missouri River basin and to meet all of the authorized project purposes, operation of all six mainstem reservoirs is directed by the Missouri River Basin Water Management Division located in Omaha, Nebraska, part of the U.S. Army Corps of Engineers (Corps) Northwestern Division.

The six mainstem reservoirs operated by the Corps are listed in Table 2-1. Lake Sharpe provides a limited storage contribution to the mainstem system of reservoirs. It is the second smallest of the six reservoirs, with a storage capacity of approximately 1,798,000 acre-feet, which comprises about 2.5 percent of the total 73.1 MAF storage capacity in the mainstem system.

Table 2-1
Missouri River Mainstem Reservoirs

Project (Dam and Reservoir)	Incremental Drainage Area (Square Miles)	Year of Closure	Flood Control and Multiple Use Storage in Acre-Feet (AF)	Total Storage in Acre-Feet (AF)
Fort Peck Dam/ Fort Peck Lake	57,500	1937	2,704,000	18,463,000
Garrison Dam/ Lake Sakakawea	123,900	1953	4,222,000	23,821,000
Oahe Dam/ Lake Oahe	62,090	1958	3,201,000	23,137,000
Big Bend Dam/ Lake Sharpe	5,840	1963	117,000	1,798,000
Fort Randall Dam/ Lake Francis Case	14,150	1952	1,309,000	5,418,000
Gavins Point Dam/ Lewis & Clark Lake	16,000	1955	86,000	450,000

Source: Final Missouri River Mainstem System 2009-2010 Annual Operating Plan, Plate 2, Dec. 2009

[1] Big Bend Dam/Lake Sharpe Master Plan, Missouri River, South Dakota, Update of Design Memorandum MB-90, USACE, 2003

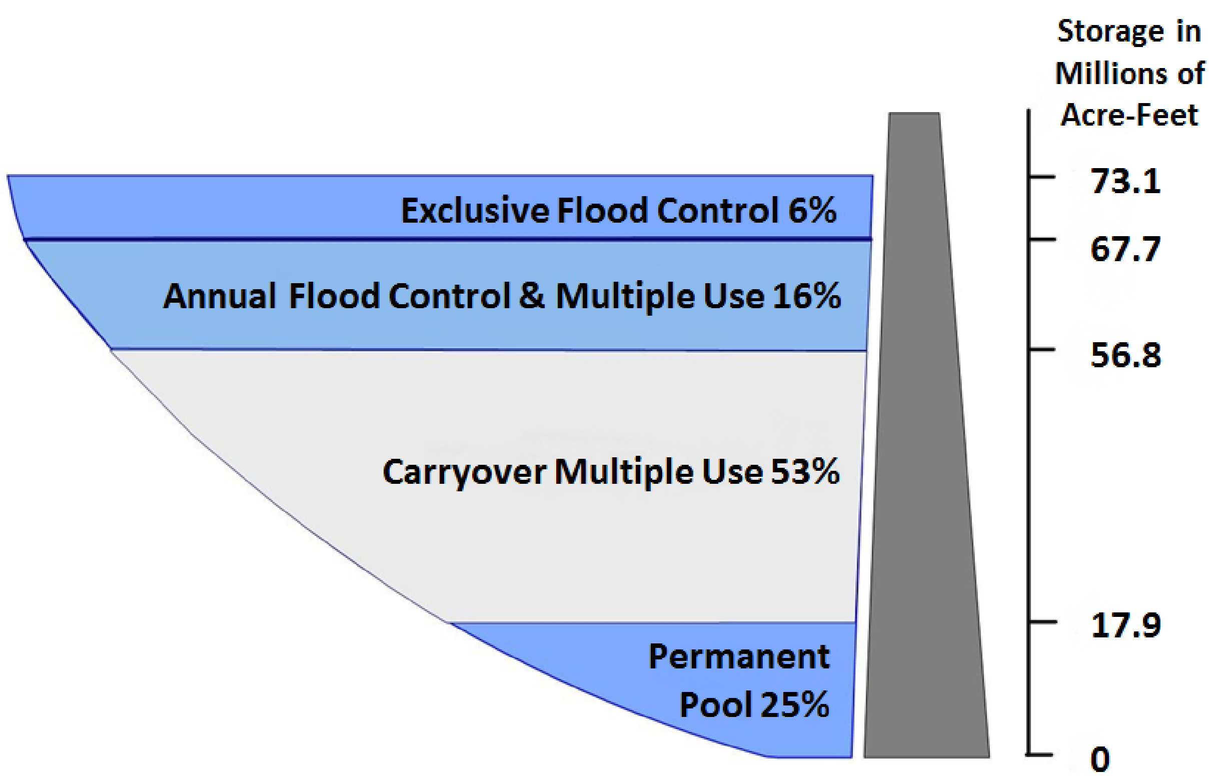
2.5 Missouri River System Reservoir Regulation

The six Missouri River projects are operated as an integrated system by the U.S. Army Corps of Engineers, Missouri River Basin Water Management Division. Operations of the system are guided by the Missouri River Basin Mainstem Reservoir System Master Water Control Manual (Revised March 2006) (Master Manual). In order to achieve the multi-purpose benefits for which they were authorized and constructed, the six system reservoirs are operated as a hydraulically and electrically integrated system. The Master Manual describes the integrated operation of these six projects. The Master Manual serves as a guide to meeting the operational objectives of the system when regulating the six system reservoirs. The Master Manual also includes the integrated operation of both System and tributary reservoir water control plans so that an effective plan for flood control and conservation operations exists within the basin.

Each of the six mainstem projects, including the Big Bend Dam/Lake Sharpe Project, has its own Water Control Manual. Annual water management plans (Annual Operating Plans, or AOPs) are prepared each year, based on the water control criteria contained in the Master Manual, in order to detail reservoir regulation of the system for the current operating year.

For the purpose of reservoir regulation, the storage capacity at Lake Sharpe (and for the five other mainstem reservoirs) is divided into four zones. Figure 2-3 displays the four zones and shows total capacity in each zone for all system reservoirs combined. The text following Figure 2-3 describes the storage volumes in each zone just for the Big Bend Dam/Lake Sharpe Project.

Figure 2-3
Missouri River System Storage Zones



For the Big Bend Dam/Lake Sharpe Project, starting at the bottom, there is the 1,621,000 acre-feet permanent pool between elevations 1345.0 and 1420.0 feet msl. This zone provides minimum power head and sediment storage capacity. Due to its small size Lake Sharpe does not currently include a carry-over multiple-use zone[2]. While a minor amount of space in Big Bend and Gavins Point was initially provided in this zone, deliberate drawdown into this zone is generally not contemplated. The next zone is the 117,000 acre-feet annual flood control and multiple use zone between elevations 1420.0 and 1422.0 feet msl. This is the desired operating zone. The Big Bend Dam/Lake Sharpe Project is the third most downstream of the System dams located between Lake Oahe and Lake Francis case and is primarily used to produce hydropower and to better serve System requirements. It provides very little flood control and is generally maintained in a narrow reservoir elevation band between 1419 and 1420 feet msl. The Annual Flood Control and Multiple Use Zone in Big Bend is not provided for seasonal regulation of flood inflows like the other major upstream projects, but the zone is used for day-to-day and week-to-week power operations. The exclusive flood control storage zone provides 60,000 acre-feet of storage. Lake Sharpe was not intended to provide storage space to serve the Missouri River navigation project, like other main stem projects. However, releases from the main stem reservoirs that are intended to serve downstream navigation are passed through the Big Bend project. Since the main stem reservoirs first filled to normal operating levels in 1967, the Lake Sharpe level has fluctuated between a maximum of elevation 1,422.1 to a minimum of 1,415.0 feet msl with an average level of 1,420.4 feet msl.

Regulating the Missouri River Mainstem Reservoir System is essentially a repetitive annual cycle. Unless water conservation measures are being implemented, the reservoirs are evacuated to the bottom of the annual flood control and multiple use zone (1420.0 msl for Lake Sharpe) by March 1. The Big Bend Dam generators provide enough electricity to meet the annual needs of 95,000 homes.

Table 2-2 shows the monthly average maximum and minimum and the annual average Lake Sharpe elevations and releases for the period since the mainstem reservoir system first filled to normal operating levels in June 1967 through March 2011. This actual 44-year period of record is comprised of 26 years of near normal or above normal annual runoffs and 18 years of drought (1977, 1980-81, 1987-92, and 2000-2008). As of spring 2011, the reservoir level reached its all-time high of 1422.1 feet msl in June 1991 and its all-time low of 1414.9 msl in October of 1996.

In 2011 the mainstem Missouri River Reservoir System experienced the largest volume of flood waters since the initiation of record-keeping in the nineteenth century[3]. The unprecedented runoff occurred because of record rainfall over portions of the upper basin, well above average plains and mountain snowmelt, historically high inflow into the system, and record peak releases from the System dams: 65,000 ft3/s at Fort Peck, 150,000 ft^3/s at Garrison, 160,000 ft^3/s at Oahe, 166,000 ft^3/s at Big Bend, 160,000 ft^3/s at Fort Randall, and 160,000 ft^3/s at Gavins Point[4].

[2] Missouri River Mainstem reservoir System, Master Control Manual, 2006, Page VII-6

[3] Missouri River Independent Review Panel (MRIRP). 2012. Review of the Regulation of the Missouri River Mainstem Reservoir System During the Flood of 2011. On Line at: www.nwd-mr.usace.army.mil/rcc/MRFTF/default.html

[4] Ibid.

Table 2-2
Summary of Lake Sharpe Pool Elevations and Releases by Month
(June 1967 –March 2011)

Month	Pool Elevation (feet msl)			Daily Release (1000 CFS)		
	Average Max	Average Min	Average Mean	Average Max	Average Min	Average Mean
Jan	1421.0	1419.8	1420.4	37.0	2.1	20.4
Feb	1421.0	1420.0	1420.5	33.6	0.8	18.3
Mar	1421.0	1419.8	1420.4	36.9	1.2	18.8
Apr	1421.0	1419.8	1420.4	36.3	3.6	20.7
May	1421.0	1419.8	1420.4	36.5	4.1	21.6
Jun	1421.0	1419.6	1420.3	43.1	4.3	24.7
Jul	1420.9	1419.5	1420.3	45.1	5.9	27.9
Aug	1420.9	1419.5	1420.2	46.2	6.8	31.1
Sep	1420.9	1419.5	1420.3	43.1	6.3	28.0
Oct	1421.0	1419.6	1420.3	37.4	4.2	23.2
Nov	1421.0	1419.9	1420.4	36.4	5.8	22.1
Dec	1421.0	1419.7	1420.4	38.7	2.3	20.6
Annual	1421.0	1419.7	1420.4	39.2	4.0	23.2

Source: U.S. Army Corps of Engineers, Northwest Division, Missouri River Basin Water Management Division, Monthly Project Statistics
http://www.nwd-mr.usace.army.mil/rcc/information.html

2.5.1 Flood Control

Lake Sharpe, centrally located in the main stem system, is operated to impound water for regulation, to assist in the control of floods by its flood control storage and temporary surcharge, and to provide further safety to the Fort Randall project for a flood event of spillway design magnitude. The project provides 60,000 acre-feet of exclusive flood control storage. Based on yearly Corps calculations of flood damages prevented, the main stem system has prevented $44.3 billion in damages (2010 dollars) through September of 2010, of which $0.5 billion was credited to the Big Bend project.

2.5.2 Navigation

The Missouri River Reservoir System is operated in part to meet the needs of downstream navigation interests. The normal 8-month navigation season extends from April 1 through November 30. During this period, System releases are scheduled, in combination with downstream tributary flows, to meet downstream target flows. Daily releases from Gavins Point Dam, commonly referred to as the system releases, fall into two classes. Open-water releases, generally in the range of 21,000 to 35,000 cfs, are made in support of Missouri River navigation and other downstream uses. Winter releases after the close of navigation season are much lower, and vary depending on the need to conserve or evacuate system storage while managing downstream river stages for water supply given ice conditions. In years with adequate water supply, System releases are scheduled to provide adequate flows for navigation at the target locations of Sioux City, Omaha, Nebraska City, and Kansas City (if navigation is occurring on the reaches associated with those targets). As described in the Master Manual, flow support for navigation and other downstream purposes is defined based on service level. A "full-service" level of 35,000 cfs results in target flows of 31,000 cfs at Sioux City and Omaha, 37,000 cfs at Nebraska City and 41,000 cfs at Kansas City. Similarly, a "minimum-service" level of 29,000 cfs results in target flow values of 6,000 cfs less than the full service levels.

The relation of system storage to navigation service level is presented in Table 2-3. Selection of the appropriate service level is based on the actual volume of system storage on March 15 and July 1st of each year. With the present level of streamflow depletions, inflows to the system are sufficient to support the minimum-service flow levels or higher for the full 8-month navigation season in 78 years of the 100-year record period (inflows from 1898 to 1997) and full-service flows or higher for the 8-month navigation season in 55 years of the 100-year period.

Table 2-3
Relation of System Storage to Navigation Service Level

Date	System Storage	Navigation Service Level
March 15	54.5 MAF or more	35,000 cfs (full-service)
March 15	49.0 to 31 MAF	29,000 cfs (minimum-service)
March 15	31.0 MAF or less	No navigation service
July 1	57.0 MAF or more	35,000 cfs (full-service)
July 1	50.5 MAF or less	29,000 cfs (minimum-service)

Although navigation on the Missouri River originally opened up settlement of this area of South Dakota, there is no commercial navigation through this reach of the river today. Releases from mainstem reservoirs serve navigation downstream from Gavins Point Dam in the lower reaches of the Missouri River, to its confluence with the Mississippi River.

2.5.3 Irrigation

The original planning studies carried out by both the Bureau of Reclamation (Senate Document 78-191) and the Corps (House Document 78-475) anticipated that Federal irrigation projects would be supported for the Missouri River Basin Mainstem System. The Corps plans allowed for an irrigation withdrawal from the Garrison Project to provide for water supply into the Dakotas. The Bureau's plans provided for over ninety new projects that would provide irrigation service to over 4,700,000 additional acres of land in the basin. Over half of these additional acres, or approximately 2,300,000 acres would be served by the existing Fort Peck project in Montana and three new mainstem projects. A key component of the Bureau's plan was the proposed Oahe project which would hold almost 7 million more acre-feet of water than the total of two projects that were planned by the Corps in the same area. Irrigation was also a primary component of the Corps cost allocations for the Mainstem System Projects. As an example, the Corps 1958 cost allocation report anticipated an average annual depletion from the mainstem system for irrigation of 6,387,000 acre-feet of which 2,534,000 would be for irrigation from tributaries above Sioux City and 3,853,000 acre-feet of depletion related to irrigation from main stem projects.

The Corps and Bureau's combined plan for the mainstem system (Senate document 78-247), was incorporated by Congress into the 1944 Flood Control Act. The combined plan for the mainstem system provided for the Corps' Garrison Project, the larger Oahe project that had been proposed by the Bureau, along with three smaller downstream projects, and the already constructed Ft. Peck Project in Montana. Thus, the mainstem projects as approved by Congress in the 1944 Flood Control Act included substantial capacity in the mainstem system which would be able to provide for the irrigation of 2,300,000 acres of land when fully developed.

Between 1944 and 1965, the Bureau of Reclamation carried out studies to assess the feasibility of irrigating lands planned for North Dakota by diversions from the Ft. Peck project. The studies indicated that the soil was not suitable for irrigation primarily because of glacial subsoil. The Bureau of Reclamation revised the diversion plan proposing to take water from the Garrison Dam to irrigate other lands to the east. With the new name "Garrison Diversion," the Bureau of Reclamation 1957 feasibility study on the redesigned project recommended irrigation of 1,007,000 acres and other water development in central and eastern North Dakota.

Because of changes to the Bureau's original irrigation plans for the upper basin and language in a 1964 appropriations act requiring specific reauthorization for all units of the Bureau's Pick-Sloan Missouri Basin Program, legislation was sought by the Bureau for the revised project plan. In 1965 Congress authorized the revised plan in the Garrison Diversion Unit Act and construction began in 1967. The GDU project was designed to divert Missouri River water to central and eastern North Dakota for municipal and industrial water, fish and wildlife development, recreation and flood control along with irrigation of 250,000 acres. The Snake Creek Pumping Plant, McClusky Canal, and New Rockford Canal are largely constructed components of the authorized Principal Supply Works of the GDU, however these features are not yet considered plant in service. The 1986 Garrison Diversion Unit Reformulation Act reduced irrigation emphasis of the GDU and increased the emphasis on meeting municipal, rural, and industrial Garrison Dam / Lake Sakakawea, North Dakota (MR&I) water needs throughout North Dakota. The Act authorized a Sheyenne River water supply and release feature and water treatment plant. Appraisal level studies were conducted from 1994 to 2000. The Dakota Water Resources Act of 2000 (P.L. 89-108) authorized the Secretary of the Interior to develop irrigation for 13,700 acres in the Turtle Lake service area, 10,000 acres in the McClusky Canal service area, 1,200 acres in the New Rockford Canal service area, 15,200 acres within the boundaries of the Fort Berthold Indian Reservation, and 2,380 acres within the Standing Rock Indian Reservation. In addition to the above projects, 31 agricultural irrigation water systems have intakes for withdrawing water directly from Lake Sakakawea, although the Army does not have authority to enter into agreements with irrigators.

Although the Bureau's originally envisioned Federal mainstem irrigation projects have not developed as initially planned, numerous irrigators withdraw water directly from the reservoirs and downstream river reaches. Demand for this irrigation use is relatively small and minimum releases established for water quality control and other uses are usually ample to meet the needs of irrigators. However, low reservoir levels and low river stages can at times make access to the available water supply difficult or inconvenient to obtain for these users. When reasonably possible, the system is regulated to serve this authorized project purpose. However present use for irrigation is relatively minor and the full mainstem system capacity originally planned for irrigation has not yet developed. There are currently 30 irrigation easements with allocations totaling 49,276 acre-feet per year (Table 3-4) at Lake Sharpe.

2.5.4 Municipal and Industrial (M&I) Water Supply

Water storage is included in Lake Sharpe for municipal and industrial use. A total of 115 water supply intakes are located on Lake Sharpe. These include 3 municipal intake facilities, 91 irrigation intakes, 19 domestic intakes, and 2 public intakes. The municipal water supply facilities serve a population of approximately 2,390 persons. Of the 115 water supply intakes, there are 22 water supply intakes serving the Lower Brule Reservation. These include a single municipal intake facility, 20 irrigation intakes, and 1 domestic intake. The municipal water supply facility serves a population of approximately 300 persons. Additionally, there are 55 water supply intakes serving the Crow Creek Reservation. These include a municipal intake facility, 51 irrigation intakes, and 3 domestic intakes. The municipal water supply facility serves a population of approximately 300 persons.[5] The municipalities of Lower Brule and Fort Thompson both obtain public water supplies from Lake Sharpe. Homes and farmsteads located close to the lake also withdraw water for domestic consumption. The Mni Wiconi Water Project in Lower Brule, South Dakota provides rural water to the local area. There are currently two easements with allocations totaling 7,150 acre-feet per year (Table 3-4) at Lake Sharpe.

2.5.5 Hydropower

The Big Bend power plant is operated to help meet peak-load demands for hydroelectric power in the Upper Missouri River basin. All power generated is marketed by the Western Area Power Administration (WAPA). The plant houses eight turbine and generator units with a combined generating capacity of 493,300 kilowatts. This is enough power for about 95,000 homes. The first unit went into operation in 1964 and by 1966 all eight generators were producing commercial electricity. The generators produce approximately 1 billion kilowatt-hours of energy each year. Big Bend power generation is integrated with the generation provided from other main stem projects, as well as that generated from other public and private facilities throughout the power marketing area.

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[5] Missouri River Mainstem Reservoir System Master Water Control Manual, USACE, 2006, page E-5

2.5.6 Fish and Wildlife

This project purpose is considered a high priority on all project lands, regardless of the land use classification. All areas classified as project operation or recreation are developed and managed for the incidental benefit to wildlife through a variety of different techniques including vegetation management alternatives to enhance and benefit wildlife species. The remaining project lands are also managed to enhance and benefit wildlife species.

Construction of the system has been one of the most important contributions to sport fishing in the Missouri River basin. The large, popular reservoirs attract fishermen from many states to fish for trophy size northern pike, walleye, sauger, lake trout, and chinook salmon. The construction and regulation of the system has, however, altered the natural streamflow of the Missouri River. An early spring rise and a late spring-summer rise characterized the natural hydrograph. High flows resulted from the plains snowmelt, from spring and summer rains, and from the mountain snowmelt. Low flows typically occurred in late summer and fall. Regulation of flows by the system has reduced spring flows and has increased late summer, fall, and winter flows to varying degrees, depending on how far downstream from Gavins Point the reach is located, thus altering the habitat of native riverine fish species. River reaches between the reservoirs are now characterized by cooler water temperatures with widely fluctuating daily stages. In addition, the system is regulated to provide protection for the three ESA listed species: the endangered interior least tern, the threatened piping plover, and the endangered pallid sturgeon. A detailed discussion of the effects of system operations on fish and wildlife is provided in the attached Environmental Assessment.

2.5.7 Recreation

Recreational use of project lands is encouraged through public parks and recreation facilities. Main stem projects are managed to provide a high quality outdoor-recreation experience and as much diversity as is practicable. Recreational planning and improvements are supportive of and compatible with the South Dakota Statewide Comprehensive Outdoor Recreation Plan (SCORP). Recreational planning is also done with input from local tribal communities through public meetings.

2.5.8 Water Quality

Water quality was specified as a project purpose in the authorizing documents in terms of silt control; soil-erosion prevention; pollution abatement; adequate and safe municipal water supplies; improving quality of water for irrigation; provision of water suitable for domestic, sanitary, and industrial purposes; and improving clarity of water for recreation and for fish and wildlife. Silt control was also expected to aid the navigation channel downstream.

The Clean Water Act (CWA) requires states to report on the quality of their waters including Section 305(b) (State Water Quality Assessment Report) and Section 303(d) identifying a list of a state’s water quality-limited waters needing total maximum daily loads (TMDLs). The primary purpose of the Section 305(b) State Water Quality Assessment Report is to assess and report on the extent to which beneficial uses of the state’s rivers, streams, lakes, reservoirs and wetlands are met. The South Dakota Department of Environment and Natural Resources (DENR) maintains a network of 151 active ambient monitoring stations located on various rivers and creeks within the state[6].

Currently, the DENR collects samples on a monthly, quarterly or seasonal basis. Samples are analyzed for specific conductance, pH, and dissolved oxygen, and then sent to a laboratory for additional analyses. Parameters most commonly sampled for include fecal coliform, E. coli bacteria, hardness, alkalinity, residue (total solids, total suspended solids, total dissolved solids), pH, ammonia, nitrates, and phosphorous (total and dissolved). Several stations are sampled for sodium, calcium, and magnesium during the irrigation. Data are later uploaded into the DENR internal database[7].

The Corps water quality management program for civil works projects is defined by the Corps primary water quality regulation – Engineer Regulation (ER) 1110-2-8154, *"Water Quality and Environmental Management for Corps Civil Works Projects."* ER 1110-2-8154 was updated in 1995 to encourage a holistic, ecosystem approach to water quality management.

The Corps of Engineers collects and analyzes water samples six times per year at the outflow of Oahe Dam, the outflow of Big Bend Dam, at Big Bend Dam, and upstream of Big Bend Dam. The outflow of Oahe Dam is considered inflow to Lake Sharpe. The United States Geological Survey collects and analyzes water samples six times per year on the Missouri River near Pierre, South Dakota.

The 2010 South Dakota Integrated Report for Surface Water Quality Assessment includes the list of Section 303(d) TMDL waters for South Dakota. Table 2-4 shows the designated use, impairment, and support status for impaired waterbodies within the project area[8].

Table 2-4
Surface Waters on 303(d) TMDL List in the Project Area

Description	Assessment Unit ID	Designated Use	Impairment	Support Status
Oahe Dam to Big Bend Dam	SD-MI-R-SHARPE_01	Coldwater Permanent Fish Life	Temperature, water	Water is impaired or threatened and a TMDL is needed

[6] South Dakota Department of Environment and Natural Resources (SDDENR). 2011b. Water Quality Monitoring Network. Online at: http://denr.sd.gov/des/sw/wqmonitoring.aspx

[7] Ibid

[8] South Dakota Department of Environment and Natural Resources (SDDENR). 2010. The 2010 South Dakota Integrated Report for Surface Water Quality Assessment. Online at: http://denr.sd.gov/documents/10irfinal.pdf

2.6 South Dakota Water Permit Process[9]

In South Dakota, all water (surface and ground water) is either the property of the people of the state or of a tribe. Whether a water right permit is required depends on the type of water use. The only type of water use which does not require a water right permit is domestic use. However, even domestic use of water requires a permit if your water use exceeds either 25,920 gallons per day or a peak pump rate of 25 gallons per minute. The following types of water use require a water right permit assuming the use is from a private water supply rather than a water distribution system. If supplied by a water distribution system using more than 18 gallons per minute, the water distribution system needs to obtain a water right permit on behalf of the system water users:

- Commercial uses such as tourist attractions, truckstops, restaurants, campgrounds, motels, or any other type of business (see General Rule 74:02:01:01)
- Industrial uses where water is used for processing, cooling, dewatering, etc.
- Institutional uses such as churches, correctional facilities, etc.
- Irrigation use
- Municipal use (in excess of 18 gallons per minute)
- Rural water system use (in excess of 18 gallons per minute)
- Suburban housing development use (in excess of 18 gallons per minute)
- Recreation use
- Fish and wildlife propagation.

2.7 Corps of Engineers Surplus Water Agreements, Easements, and Permits

Surplus water agreements, easements, and any necessary permits will be required for any non-Federal entity requesting surplus water from the Big Bend Dam/Lake Sharpe Project. These are separate legal / regulatory instruments and are described individually below. As stated previously, the Corps of Engineers will not issue a surplus water agreement, water pipeline or water intake structure easement, or an accompanying permit with any non-Federal entity without their already having obtained a water allocation permit from the State of South Dakota or affected tribes.

2.7.1 Surplus Water Agreements

Surplus water agreements are negotiated agreements between the Army Corps of Engineers and a non-Federal entity for the authorized use of surplus water in a Corps project or facility. These agreements are executed under authority of Section 6 of the Flood Control Act of 1944 (33 U.S.C. 708). Execution of a Surplus Water Agreement may be required from any entity requesting water from the Big Bend Dam/Lake Sharpe Project.

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[9] See http://denr.sd.gov/des/wr/wateruse.aspx.

2.7.2 Easements

Easements are required for water pipelines and water intake structures on Corps project lands. No easement that supports a water supply agreement will be issued prior to the water supply agreement being executed by all parties (Corps of Engineers Real Estate Policy as of 2008). All future easements will contain an explicit reference to the surplus water agreement or water storage agreement and provide an explicit provision for termination of the easement for noncompliance with any of the terms and conditions of the surplus water agreement.

2.7.3 Regulatory Permits

Regulatory permits are required from the Corps of Engineers under Section 10 of the Rivers and Harbors Act for work or structures in, on, over or under navigable waters, and under Section 404 of the Clean Water Act for discharges of dredged or fill material into waters of the United States. The Missouri River is a navigable waterway subject to regulation under these statutory authorities. Any party intending to divert water from the Missouri River, and any action in or affecting the Missouri River, whether free flowing or impounded, may also require a regulatory permit from the U.S. Army Corps of Engineers.

2.7.4 Existing Agreements, Easements, and Permits

There is not a one-to-one correlation between existing agreements, easements and permits. Currently there are 45 water withdrawal related easements at the Big Bend Dam/Lake Sharpe Project. The total estimated water use associated with these easements is 56,607 acre-feet. Of these 45 easements 1 has expired, 10 will expire within the next 10 years, 15 will expire after the 10 year-period, and 17 are indefinite and will not expire.

2.7.5 Pending Agreements, Easement, and Permits

There are currently (June 2011) 5 pending withdrawal related easements for the Big Bend/Lake Sharpe Project. All requests are for an unspecified amount of irrigation water.

2.8 Historic Water Use

The five-county study area includes the first tier counties at the Big Bend/ Lake Sharpe Project, i.e., those counties that border Lake Sharpe. These first tier counties include Buffalo, SD, Hughes, SD, Hyde, SD, Lyman, SD, and Stanley, SD (Figure 2-4). In 2010 these counties had an estimated population of 27,075 and population has been relatively stable since 1960 (Table 2-5). Note that Hyde County has only four miles of lake shoreline, which are high cliffs that are not typical of the other counties.

Table 2-5
Historic Study Area Population

County, ST	1930	1940	1950	1960	1970	1980	1990	2000	2010
Buffalo, SD	1,931	1,853	1,615	1,547	1,739	1,795	1,759	2,032	1,912
Hughes, SD	7,009	6,624	8,111	12,725	11,632	14,220	14,817	16,481	17,022
Hyde, SD	3,690	3,113	2,811	2,602	2,515	2,069	1,696	1,671	1,420

Lyman, SD	6,335	5,045	4,572	4,428	4,060	3,864	3,638	3,895	3,755
Stanley, SD	2,381	1,959	2,055	4,085	2,457	2,533	2,453	2,772	2,772
Total	21,346	18,594	19,164	25,387	22,403	24,481	24,363	26,851	27,075

*American Community Survey Estimate

Source: US Census

The U.S. Geological Survey (USGS) estimates water use by county in five year cycles. The most recent data available is the 2005 estimate. The estimates for 2010 are projected to be available in 2014[10]. In 2005 and in previous years, agricultural use (irrigation and livestock) have been the dominant water use in the study area (Table 2-6 and Figure 2-5). Evaluating trends in this data can be problematic as the USGS has changed their methodology more than once since 1985, though some trends do persist. Recently there has been an upward trend in public use and a downward trend in domestic use. These trends likely represent large numbers of previously self-supplied domestic users converting to public & rural water supply systems, as those systems expand farther into rural areas. There are also recent and significant variations in Livestock water use. These changes are believed to be cyclical, due to weather conditions affecting irrigation. The significant change in irrigation water use between 1990 and 1995 is believed to be due to the change in USGS methodology between those years and is not representative of an actual major change in irrigation water use.

[10] http://water.usgs.gov/watuse/ accessed 21Jun12

Table 2-6
Historical Water Use in the 5-County Lake Sharpe Area (AF)

Use-Type	1985	1990	1995	2000	2005
Public	2,713	3,564	3,789	5,593	8,609
Domestic	1,300	426	504	404	146
Industrial	964	-	-	-	-
Power	-	-	179	135	22
Mining	191	67	56	-	314
Livestock	2,343	2,264	3,026	2,668	2,175
Aquaculture	1,939	-	-	-	-
Subtotal	9,449	6,322	7,555	8,799	11,265
Irrigation	59,509	65,910	28,404	27,126	27,731
Total	68,958	72,232	35,959	35,925	38,997

Source: US Geological Survey, Estimated Use of Water in the US, County-Level Data

*Public = Municipal + Rural Water Supply

Figure 2-4
Lake Sharpe Study Area

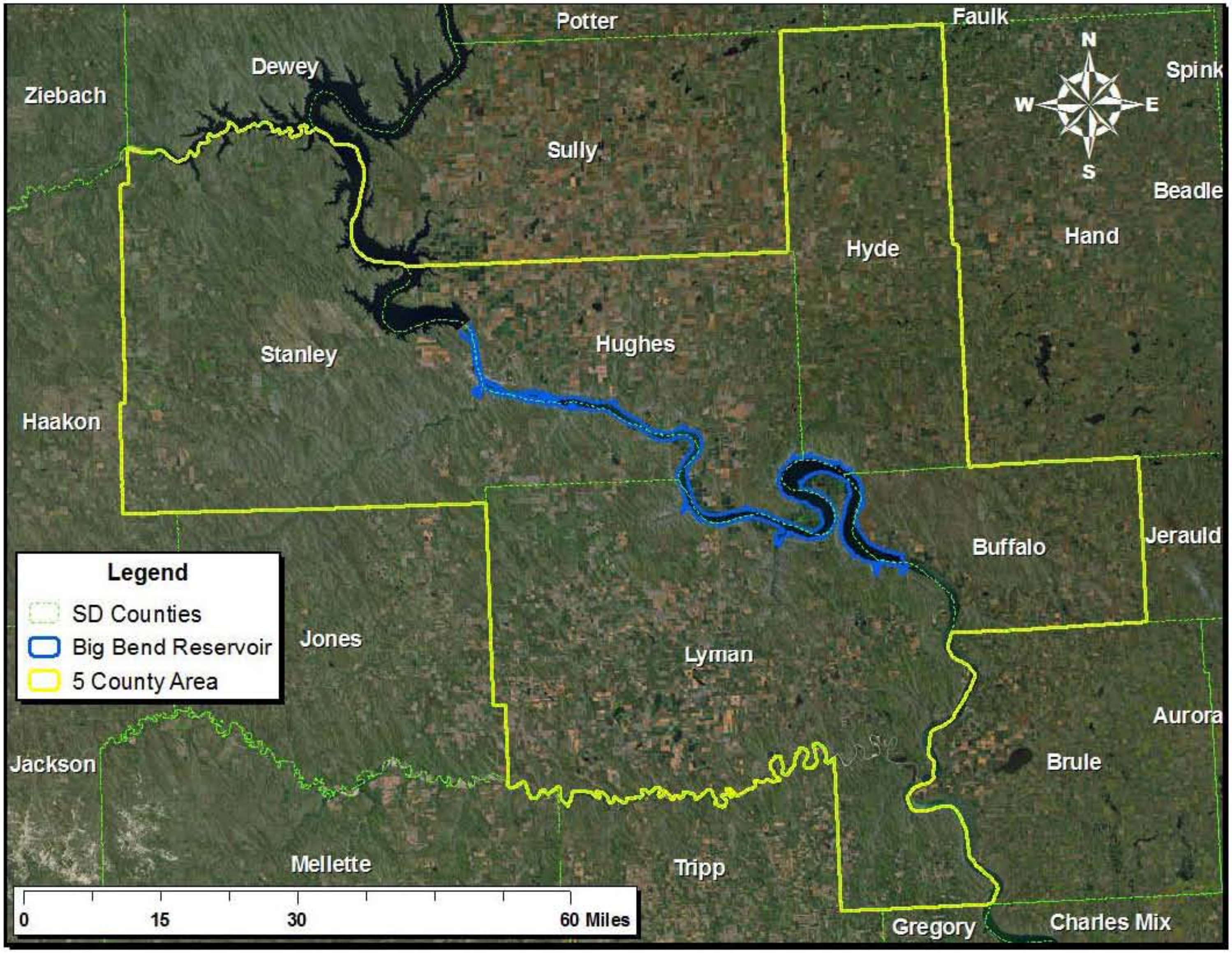
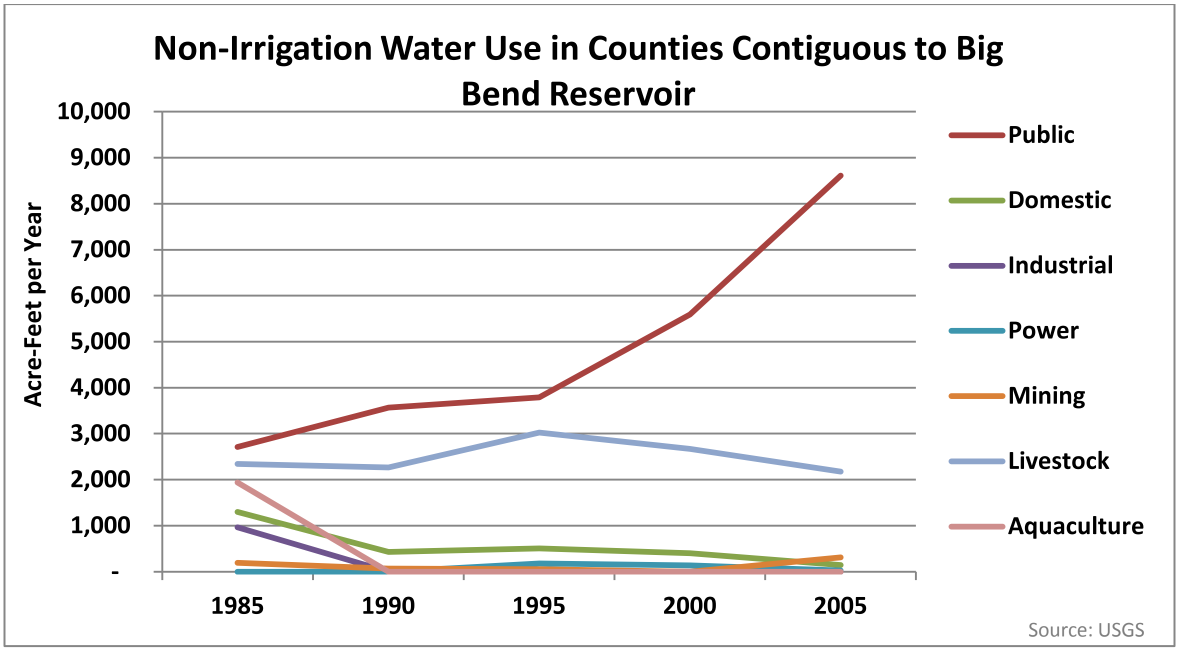


Figure 2-5
Historical Non-Irrigation Water Use in Counties Contiguous to Lake Sharpe



2.9 Corps Studies and Reports by Others

Numerous documents and reports have been prepared describing the Big Bend Dam/Lake Sharpe Project, project operations, operations of the Missouri River system, and water resources within the study area. A more comprehensive listing of past reports is contained in the Environmental Assessment (Appendix A). Principal source documents for this analysis included the following Corps of Engineers reports:

- Missouri River Mainstem Reservoir System Master Water Control Manual Missouri River Basin, Reservoir Control Center U. S. Army Corps of Engineers Northwestern Division - Missouri River Basin Omaha, Nebraska, Revised March 2006; and
- Big Bend Dam/Lake Sharpe Master Plan Missouri River, South Dakota Update of Design Memorandum MB-90, October 2003, revised 2005.

3. PLAN FORMULATION

Plan formulation for the Big Bend Dam/Lake Sharpe Surplus Water Study has been conducted in accordance with the six-step planning process described in *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (1983) and the *Planning Guidance Notebook* (ER 1105-2-100, dated April 2000). The six steps in the iterative plan formulation process are:

1. Specify water and related land resources problems and opportunities;
2. Inventory and forecast existing conditions;
3. Formulate alternative plans;
4. Evaluate alternative plans;
5. Compare alternative plans; and
6. Select the recommended plan.

The basis for selection of the recommended plan for the study is fully documented below, including the rationale used in plan formulation and plan selection. Should requests for additional temporary surplus water in amounts greater than those identified in this analysis materialize, then further study would be required. An analysis of long-term pool usage would determine if permanent changes are needed through development of a long-term strategy.

3.1 Problems and Opportunities / Need for Surplus Water

As stated in Section 1.1, the purpose of this study is to identify and quantify whether surplus water is available in the Project, as defined in Section 6 of the 1944 Flood Control Act, that the Secretary of the Army can use to execute surplus water supply agreements with water users, and to determine whether use of surplus water is the most efficient method for meeting regional municipal and industrial (M&I) water needs. The Omaha District, U.S. Army Corps of Engineers has received 5 requests to either replace or modify existing irrigation systems. All requests are for irrigation water.

As stated previously, there are a total of 45 easements with a total estimated use of 56,607 acre-feet of yield at Lake Sharpe (Table 3-1). It is assumed that easement holders will use their entire yield allotment. Out of the 45 total easements, 1 easement has expired, 10 easements with a total estimated use of 10,824.7 acre-feet of yield will expire within ten years, 15 easements with a total estimated use of 8,803 acre-feet of yield will expire after 10 years, and 17 easements with a total estimated use of 36,979.3 acre-feet of yield are indefinite and will not expire. Temporary use of 62,268 acre-feet/year of yield (equivalent to 160,028 acre-feet of storage) is being evaluated in this analysis. The 62,268 acre-feet/year of surplus water yield was selected by the Omaha District based on an estimated potential 10% growth in future M&I water demand from the existing total allocation of 56,607 acre-feet over the 10-year planning period. Since the State of South Dakota does not foresee an appreciable increase in future M&I demand at Lake Sharpe, there is little risk that the future demand will be more than 10% of the existing use. There is also little risk if the 10% demand does not develop as that simply means that water that has been determined temporarily available as surplus would not be utilized. This surplus water determination has been evaluated for the purposes of efficiency and responsiveness, so that storage volume associated with all reasonably foreseeable future surplus water needs over the period of analysis could be evaluated and approved in one single action by the Assistant

Secretary. Should resource impacts from the temporary use of 62,268 acre-feet/year of surplus water (equivalent to 160,028 acre-feet of storage) prove significant, then lesser amounts could be evaluated.

Table 3-1
Easements & Yield by Expiration & Use Type at Lake Sharpe

	Easements & AF		Easements & AF		Easements & AF		Easements & AF		Easements & AF
Use-Type	**Expired**	**Within 10 Years**		**After 10 Years**		**Perpetual**		**Total***	
Irrigation	1	5	10,820.7	9	8,098.5	15	30,357.3	30	49,276.5
Domestic		2	2.1	3	174.5			5	176.6
Municipal				1	528.0			1	528.0
Industrial						1	6,622.0	1	6,622.0
Other & Unknown	0	3	2.0	2	2.0	1	-	8	4.0
Total	1	10	10,824.7	15	8,803.0	17	36,979.3	45	56,607.0

*Total includes 2 easements with unknown expiration dates and unknown AF.

The problem of how best to provide cost effective municipal and industrial (M&I) water supply to support potential future water needs in central South Dakota, and the need for surplus water from the Big Bend Dam/Lake Sharpe project to meet future potential demand, is quantified in the following demand analysis.

3.2 Identification of Surplus Water

An agreement for "surplus water" conveys the right to use water from a Corps Project. The authority to enter into agreements for the use of surplus water was granted to the Secretary of the Army by Section 6 of the 1944 Flood Control Act, as amended. Section 6, states in relevant part as follows:

> *"That the Secretary of War [now Army] is authorized to make contracts with States, municipalities, private concerns, or individuals, at such prices and on such terms as he may deem reasonable, for domestic and industrial uses for surplus water that may be available at any reservoir under the control of the War Department: Provided, That no contracts for such water shall adversely affect the existing lawful uses of such water…"*

These agreements may be for domestic, municipal and industrial uses, but not for crop irrigation. The Corps' implementation guidance for Section 6 of the FCA, set forth in Section E-57 b., Appendix E, ER 1105-2-100, provides that surplus water can be, "*water stored in a Department of the Army reservoir that is not required because the authorized use for the water never* *developed or the need was reduced by changes that occurred since authorization or construction…"*. Thus, water can be identified as surplus because an authorized project purpose has not developed as anticipated. Corps guidance further provides that surplus water agreements will be accompanied by a brief report covering topics similar to those of storage reallocation reports and shall include how and why the storage is determined to be surplus.

This section is intended to answer the question of how and why water stored in a Corps' reservoir is determined to be surplus. In summary, in evaluating the Big Bend Dam/Lake Sharpe Project individually and as part of the Missouri River Main Stem System as a whole it appears clear that 62,268 acre-feet/year of water (equivalent to 160,028 acre-feet of storage) can be identified as temporary surplus water, the use of which over the next 10 years would not significantly affect project purposes (see Section 3.8.1.1 and Table 3-11). The following paragraphs provide justification for this conclusion.

3.2.1 Storage for Mainstem System Irrigation

As stated at the beginning of this section the Corps' implementation guidance for Section 6 of the FCA, set forth in Section E-57 b., Appendix E, ER 1105-2-100, provides that surplus water can be can be identified as surplus if an authorized project purpose has not developed as anticipated.

The planning documents for the mainstem system anticipated that approximately 2.3 million acres of land in the upper basin from Fort Peck to Sioux City would be irrigated out of the mainstem system[11]. The plan originally developed by the Department of the Army for the mainstem system was increased in the final joint plan by over 6 million acre-feet of storage to accommodate this projected irrigation need[12]. However, only a small fraction (approximately 15%) of the water in the mainstem system that was intended to be used for irrigation has been applied to that purpose to date. Because the mainstem system projects are operated as a system, the undeveloped irrigation needs would have been supplied directly by the Big Bend Dam/Lake Sharpe Project, or coordinated through intrasystem operations. Accordingly, utilizing only a small portion of the water in the mainstem reservoirs, including Lake Sharpe, which was originally anticipated to be used for irrigation and now is not anticipated to be fully used for that purpose within the next 5 to 10 years, to serve municipal and industrial needs is considered appropriate as that water is deemed surplus in accordance with current Corps guidance.

3.2.2 Impacts to Existing Lawful Uses of Water

In addition to determining that water stored in an Army reservoir is surplus because the authorized use for the water never developed or the need was reduced by changes that occurred since authorization or construction, Section 6 of the FCA also provides that "*no contracts for such water shall adversely affect then existing lawful uses of such water*." This condition is fulfilled in two ways. First, a condition of surplus water agreements is that the recipients of such agreements hold the necessary State water rights, or in applicable cases, a water right issued by the appropriate Tribal government. By requiring such rights, the Corps ensures that agreements for use of surplus water will not adversely affect any other preexisting lawful use of the water to

[11] Reference Section 2.5.3 Irrigation
[12] Senate Document 78-247

be agreed upon and that use of the water is consistent with water right priorities established by State or Tribal laws. A condition of Corps agreements for the use of surplus water requires that the recipient demonstrate an appropriate State or Tribal water right.

Second, in addition to requiring a State or Tribal water right to withdraw water, the Corps ensures that lawful downstream uses will not be adversely affected by ensuring that the use of the water will not significantly affect operations for authorized purposes. This report documents that the use of a projected 62,268 acre-feet/year of surplus water at Lake Sharpe would not significantly affect operations for authorized purposes. Lake Sharpe is formed by the waters of the Missouri River stored behind Big Bend Dam. Big Bend Dam is one of six mainstem dams operated as a coordinated unit providing flood control protection, storage for navigation, hydropower and other authorized uses. As described in this report the use of 62,268 acre-feet/year of water (equivalent to 160,028 acre-feet of storage) in a project with a total capacity of 1.9 million acre-feet of storage, and a system with a capacity of 73.1 million acre-feet of storage will have a very minimal effect on mainstem system and project operational needs. The net impacts associated with the use of an additional 5,661 acre-feet of water (i.e. potential water use in addition to existing use) on authorized project purposes as described in this report are summarized in section 3.8.1.

3.2.3 System Storage

The six mainstem system projects are operated in a hydraulically and electrically integrated system in order to achieve the multi-purpose benefits for which they were constructed[13]. The six mainstem projects together hold a combined storage of approximately 73.1 MAF. This storage is divided into as many as four zones per project, the exclusive flood control zone, which is used only for flood storage, the annual flood control and multiple use zone, which the projects normally operate under a wide range of runoff conditions, the carry over multiple use zone, and the permanent pool zone. Of the six system reservoirs, Fort Peck, Garrison, Oahe, and Fort Randall have annual flood control and multiple use storage as a designated storage zone, Big Bend and Gavins Point do not. See generally, Master Manual, Chapter VII. As indicated in the Master Manual the carry over multiple use zone provides a storage reserve for irrigation, navigation, power production, water supply, recreation, and fish and wildlife. The storage in this zone at Fort Peck, Garrison, and Oahe is designed to maintain downstream flows through a succession of well-below-normal runoff years. Serving the authorized purposes during an extended drought is an important regulation objective of the System and the primary reason the upper three System reservoirs are so large compared to other Federal water resource projects. See Section 6-02.3, Master Manual. Because federal irrigation projects have not developed as planned, the system-wide capacity to serve other authorized purposes during drought conditions has been greatly extended. The Permanent Pool Zone is an inactive zone and provides for a minimum power head, sediment storage capacity and other purposes.

3.2.4 Storage and Sediment

In its natural state, the Missouri River transported a sediment load averaging 25 million tons per year in the vicinity of Fort Peck, Montana; 150 million tons per year at Yankton, South Dakota;

[13] Missouri River Mainstem Reservoir System Master Water Control Manual Revised March 2006 (para. 1-02).

175 million tons per year at Omaha, Nebraska; and approximately 250 million tons per year at Hermann, Missouri, near its confluence with the Mississippi River[14]. With the construction of each of the System and tributary dams, the reservoirs have acted as catchments for the tremendous load of sediment carried by the Missouri River and its tributaries.

During the design phase of each of the main stem projects, sedimentation was acknowledged, sediment yield was estimated, and was a consideration in the project design. The major sedimentation processes affecting Lake Sharpe are transport and deposition of watershed sediments into the reservoir, littoral drift, and erosion of banks along the shoreline. Watershed sediments are transported to Lake Sharpe via the tributaries entering the reservoir. Erosion of the banks, the product of many physical agents (wind, waves, precipitation, freeze-thaw, and so forth), redistributes sediments from the flood control zones to the multiuse zone. Littoral drift, set in motion by wind and waves, moves sediment along the shoreline. Oahe Dam, just upstream of Lake Sharpe, traps nearly all of the sediment entering Lake Oahe. Therefore, most of the sediment in Lake Sharpe originates from the Bad River, other tributaries, and from the banks surrounding the reservoir.

Another major source of sediment deposits is in the banks that surround Lake Sharpe. The banks consist of material that is highly erodible and does not form protective beaches. When the banks are undercut and fall into the lake, the material is transported away from shore and deposits in deeper areas of the reservoir. Locally the surface area, near the normal operating pool, increases as the shoreline recedes (overall, this increase may be offset by a loss of surface area near deltas). Presently and in the near future sediment deposits in the lower half of the reservoir contain a higher percentage of material originating from banks than in the upper half of the lake.

By 1997, approximately 181,354 acre-feet of capacity had been lost, a 9 percent reduction in the original storage capacity. This equated to an average depletion rate of 5,300 acre-feet per year since closure of the dam. This rate is higher than the original projected rate of 4,300 acre-feet per year. However, it should be noted that the measured rate includes 19,000 acre-feet of sediment deposited in the delta of Lake Francis Case prior to the closure of Big Bend Dam. The future long-term deposition rate is expected to be near the original projection.

3.3 Water Supply Demand Analysis

For this study, water supply demand is assessed in two categories. The first is the existing water use by easement holders at Lake Sharpe; the second is water use in the four-county study area, which is inclusive of easement holders at Lake Sharpe. These two sources of demand are described separately in the sections below.

3.3.1 Water Supply Demand: Existing Lake Sharpe Water Users

One hundred and fifteen (115) water supply intakes are located on Lake Sharpe. Note that there are no intakes on Lake Sharpe in Hyde County, which has only four miles of shoreline, which are dominated by high cliffs. These intakes service 75 Lake Sharpe water rights holders, some of whom may share intakes, infrastructure, and easements[15]. Of the 115 water supply intakes, there

[14] Missouri River Mainstem Reservoir System Master Water Control Manual Revised March 2006 (para. 3-04).

[15] The number of Lake Sharpe water rights holders was estimated from state water permit data by identifying all water rights sourced from either Lake Sharpe or the Missouri River within a one mile area around the lake

are 22 water supply intakes serving the Lower Brule Reservation. These include a single municipal intake facility, 20 irrigation intakes, and 1 domestic intake. Irrigation use is the largest use of Lake Sharpe water (Table 3-2). Cabin owners own the majority of the domestic intakes, which are generally used in lawn watering, car washing, and fire protection. Domestic intakes along this reach are not generally used to provide drinking water, which is obtained from neighboring towns.[16]

Table 3-2
South Dakota Water Rights Permits Sourced from Lake Sharpe by Use Type

Use Type	Count	Average (AF/Yr)	Sum (AF/Yr)
Irrigation	74	1,371	101,466
Rural Water System	1	2,441	2,441
Total	75	1,385	103,907

Source: SD Department of Environment & Natural Resources, 2011 AF = Acre - Feet

Table 3-3
Water Rights Sourced from Lake Sharpe by County

County	Count	Average (AF)	Sum (AF)
Hughes	50	1,217	60,871
Buffalo	11	2,771	30,483
Lyman	9	820	7,380
Stanley	5	1,035	5,173
Total	75	1,385	103,907

Note: Hyde County has no intakes on Lake Sharpe
Source: SD Department of Environment & Natural Resources, 2011 AF = Acre - Feet

In order to accommodate these water right holders and their intakes the Corps has issued a total of 45 water intake easements around Lake Sharpe. Of these 45 water intake easements, 1 has expired, 10 easements with a total estimated use of 10,824.7 acre-feet are scheduled to expire within the next 10 years, 15 easements with a total allocation of 8,803.0 acre-feet are scheduled to expire after 10 years, 17 easements with a total allocation of 36,979.3 acre-feet are indefinite and will not expire. According to Corps policy, holders of these expired / expiring easements

[16] Missouri River Master Manual, Appendix E, page E-1

may be required to execute water supply agreements with the Corps of Engineers as a pre-condition to re-issuance of their current easements.

The quantities of water being withdrawn through these easements are difficult to determine from the available data. The Corps keeps records on easement allocations, but does not collect data on actual water usage. Tables 3-2 and 3-3 are derived from the South Dakota State Water Rights database. Water *rights* are available from that database, but not actual water *use*. The Corps has developed its own estimate of actual water use at Big Bend Dam/Lake Sharpe based on the assumption that the entire water right is equivalent to use.. Table 3-4 presents this estimate in acre-feet/year by use type. Type of use is estimated from permit information, which may not be complete. There is no data set that allows direct correlation of State water use permits with Corps easements.

Table 3-4
Easements & Acre-Feet at Lake Sharpe

Use-Type	Easements		Acre-Feet per Year	
Irrigation	30	66.7%	49,276	87.1%
Domestic	5	11.1%	177	0.3%
Municipal	1	2.2%	528	0.9%
Rural Water	-	0.0%		0.0%
Industrial	1	2.2%	6,622	11.7%
Other*	2	4.4%	2	0.0%
Unknown	6	13.3%	2	0.0%
Total	45	100.0%	56,607	100.0%

*Other Includes Livestock, Multipurpose, Sewer, Storm Sewer..., 2011

3.3.2 Total Water Supply Demand in the Study Area

The United States Geological Survey (USGS) estimates of general water use for the five-county area surrounding Lake Sharpe identify a total use of 38,997 acre-feet in 2005. The five-county study area consists of Hughes, Hyde, Buffalo, Lyman & Stanley counties, all within South Dakota. The study area is shown in Figure 2-4 and the estimated water use is shown in Table 3-5.

Table 3-5 displays average water use by type for the 5-county area. Annual total water use in the 5-county area for 2005 is estimated at 38,997 acre-feet. Over 82 percent of the estimated water use in the study area was from surface water. A little over 22 percent of the water use in the study area was for municipal and industrial (M&I) uses and about 85 percent of the M&I water use was from surface water sources.

Table 3-5
Water Use in the Five-County-Lake Sharpe Area

USGS General Water Use In the Big Bend Area (AF)

Use	Ground	Surface	Total
Public*	3,889.6	4,719.0	8,608.6
Domestic	145.7	-	145.7
Irrigation	1,614.1	26,117.2	27,731.3
Stock	863.1	1,311.5	2,174.6
Mining	134.5	179.3	313.9
Power	22.4	-	22.4
Total	6,669.4	32,327.1	38,996.5

*USGS' "Public" use-type most closely approximates municipal use

Includes records for the 5 counties surrounding the Reservoir

The 5-county study area is predominantly rural with a 2010 estimated population of 27,075. Population has been relatively stable since 1960 (see Table 2-4). Future growth in demand for non-irrigation water from Lake Sharpe is expected to be minimal. For planning purposes it is anticipated that a quantity of additional surplus water equivalent to 10 percent of existing water use from Lake Sharpe (or 5,661 acre-feet) will be more than sufficient to meet any likely future growth in demand over the next 5-10 years. This percentage was determined using best professional judgment and accounts for a variety of risk and uncertainty factors relevant to potential future water demand. These factors include potential changes in population, climate, industry, law, regulation, and consumption patterns – all of which could significantly affect demand for water over the next 5-10 years. Overall, it is estimated that 62,268 acre-feet/year of water would meet current (56,607 acre-feet) and potential future (5,661 acre-feet) water needs of the study area.

3.4 Planning Goals, Objectives, and Constraints

The following discussions identify the planning goals, objectives, and constraints used to formulate and evaluate the Federal interest in entering into agreements the use of surplus water from the Big Bend Dam/Lake Sharpe Project to meet future water supply needs in the planning area over the next 10 years.

3.4.1 Planning Goals and Objectives

The goal of the Surplus Water Report is to determine whether there is surplus water available in the Big Bend Dam/Lake Sharpe Project and to evaluate whether entering into agreements for the use of surplus water from the Project is the most cost effective means of meeting the near-term (10-year) water needs of the study area. The study area is defined as the 5-county area surrounding Lake Sharpe.

National water policy states that the primary responsibility for water supply rests with states and local entities, not the Federal government. However, the Corps can participate and cooperate with state and local entities in developing water supplies in connection with the construction, operation, or modification of Federal navigation, flood damage reduction, or multipurpose projects. Specifically, the Corps is authorized to provide storage in new or existing multipurpose reservoirs for municipal and industrial water supply. However, since water supply is a state and local responsibility, the cost of water supply storage and associated facilities in a Corps project must be paid for entirely by a non-Federal entity.

The Secretary of the Army is authorized to make agreements with states, municipalities and other non-Federal entities for the rights to utilize water supply storage in Corps reservoirs. The Secretary of the Army can enter into agreements with states, municipalities, private entities or individuals for the use of 'surplus water'. Under Section 6 of the Flood Control Act of 1944, the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any Corps reservoir. Surplus water agreements may be for domestic, municipal, and industrial uses, but not for irrigation.

Planning objectives for this study were developed to be consistent with Federal, State and local laws and policies, and technical, economic, environmental, regional, social, and institutional considerations. The planning objectives were used to help formulate and evaluate plans to avoid, minimize, and mitigate (if necessary), any adverse project impacts to the environment. Planning objectives also provide a decision framework to identify the least cost water supply alternative, avoid adverse social impacts, and meet local preferences to the fullest extent possible.

In pursuit of the project goal, the following Federal planning objectives were established:

- Determine if surplus water is available at the Big Bend Dam/Lake Sharpe Project and determine the storage amount to be evaluated for potential impacts, over the next 10 years;
- Anticipate demand and requests for surplus water agreements at the Project over the 10-year study period, including requests identified within this report and a forecast of additional requests;
- Determine repayment unit costs to apply to surplus water agreements.

Also in pursuit of the project goal, the following regional planning objectives were established:

- Provide sufficient water to meet the needs of existing and prospective applicants for new surplus water agreements at Big Bend Dam/Lake Sharpe for the next 10 years by the most efficient means;
- Provide sufficient water to meet the needs of current Big Bend Dam/Lake Sharpe water supply users whose existing easements will expire within the next 10 years.

This study develops and evaluates alternatives to determine how best to meet potential easement applicants' water needs within the constraints described below. The impacts of entering into agreements for the use of surplus water on other project purposes are assessed so that an optimal alternative that provides needed water supply and does not significantly impact other project purposes may be identified. The impacts assessed in this analysis include effects on: flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, recreation, water quality, and any associated environmental and economic effects.

3.4.2 Policy Guidance Considerations

Policy guidance considerations related to reservoir operations include maintenance of the project's ability to support currently authorized project purposes and to support other incidental uses. Currently authorized project purposes are: flood control, navigation, irrigation, hydropower, municipal and industrial (M&I) water supply, fish and wildlife, recreation, and water quality.

A second planning constraint relates to the requirements of Section 6 of the Flood Control Act of 1944. Under Section 6, the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any Corps reservoir. The formulation and evaluation of alternative plans is constrained by the limitations imposed by Congress and Corps policy for temporary use of surplus water. These constraints/limitations include, but are not limited to:

- No agreement for surplus water may significantly adversely affect existing lawful uses of such water;
- Surplus water agreements can only be granted if the Secretary can classify surplus water as either: 1) water stored that is not required because the authorized use for the water was never developed or if the need for the authorized use was reduced or eliminated by changes in water demand that occurred since authorization or construction of the project; or 2) water that would be more beneficially used as municipal and industrial water than for the authorized project purposes and which, when withdrawn, would not significantly affect authorized purposes over some specified period of time; and
- Agreements for temporary use of surplus water are time limited and can only be granted for a period of up to 5 years, with a 5-year renewal option (for a total period of 10 years).

3.5 Management Measures

A management measure is a feature (i.e., a structural element that requires construction or assembly on-site), or an activity (i.e., a nonstructural action) that can either work alone or be combined with other management measures to form alternative plans. Management measures were developed to address study area problems and to capitalize upon study area opportunities. Management measures for this study were derived from a variety of sources including prior studies, agency and public input, and the project delivery team (PDT).

3.5.1 Identification of Management Measures

The following management measures were identified for initial consideration:

Structural Measures (Features)

- Structural modifications to the project to increase storage capacity
- Provision of surplus water from system-wide storage for undeveloped irrigation to M&I water supply for up to 10 years, including associated infrastructure (i.e., intakes, pipelines, storage and distribution facilities)
- Groundwater withdrawals, including associated infrastructure

- Surface water withdrawals from the Missouri River upstream or downstream of Lake Sharpe, including associated infrastructure

Non-Structural Measures (Activities)

- Conservation / incentive programs / regulations / public education / drought contingency planning
- Water reuse / recycling
- Sale or lease of existing non-M&I use water right to an M&I use.

3.5.2 Screening of Management Measures

The following sub-sections evaluate and screen each of the structural and non-structural measures identified above to determine which measures should be carried forward in the planning process and included in the formulation of alternatives. The Water Resources Council's Principles and Guidelines[17] identify four criteria to be used in the formulation and evaluation of alternative plans: completeness, effectiveness, efficiency, and acceptability. At this phase of the planning process, management measures are screened, using these four criteria, to determine whether they have the potential to make meaningful contributions to achieving the goals and objectives of the project. While none of these criteria are absolute, it is clearly reasonable to screen out from further consideration any management measure that: 1) does not contribute to meeting study goals and objectives to any significant extent (completeness), 2) is not effective in resolving study area problems and needs (effectiveness), 3) is not an efficient means of solving the problem when compared to other potential measures (efficiency), or 4) is not an acceptable solution to other Federal and non-Federal agencies and affected publics (acceptability).

This is not to imply that some management measures that are screened out from further consideration may not be beneficial public policies or effective solutions to other legitimate problems of the study area. Rather, management measures are screened out from further consideration when it can be reasonably determined that they will not meaningfully contribute to meeting study goals and objectives or resolving the problems and needs that the study was initiated to address.

3.5.2.1 Structural Measures

Four structural measures are considered below. Two structural measures are screened out from further consideration (i.e., structural modifications to the project and surface water withdrawals from free-flowing reaches of the Missouri River). Two structural measures are carried forward into formulation of alternative plans: temporary provision of surplus water from Lake Sharpe and groundwater withdrawals.

17 Economic and Environmental Principles for Water and Related Land Resources Implementation Studies and The Economic and Environmental Guidelines for Water and Related Land Resources Implementation Studies, U.S. Water Resources Council, February 1983

Structural Modifications to the Project to Increase Storage Capacity

Corps of Engineers guidance[18] states that existing Corps projects may be modified to add storage for municipal and industrial water supply. Structural measures to increase the storage capacity of an existing dam typically include: auxiliary spillways, lined overflow sections, raising the dam, modifications to the existing spillway, and combinations of these measures. Environmental criteria that must be assessed when considering structural measures to increase storage capacity include: avoiding adverse impacts to the environment, mitigating any unavoidable environmental impacts, maintaining water quality and ecosystem functions during and after the modification, and achieving no net loss in environmental values and functions.[19]

The advantages of structural measures to increase storage capacity is that the needs of municipal and industrial water supply can be met without the negative effects on project users associated with taking water storage away from other authorized project purposes. The disadvantages of structural measures to increase storage capacity is that the studies necessary to design such modifications are lengthy and costly; and construction activities are similarly costly, time consuming, and can have significant impacts on the physical and natural environment. As a result, structural modifications to increase storage capacity are typically only considered when municipal and industrial water needs are so significant relative to total existing storage capacity that the effects of providing surplus water from existing storage would render the project unable to meet its authorized project purposes, and where the environmental effects of surplus M&I water use would exceed the environmental effects of structural modifications.

These considerations indicate that structural modifications would not be an effective measure for the Big Bend Dam/Lake Sharpe Project. The amount of water being requested, 62,268 acre-feet, is only about 0.4 percent of the net system yield of 15.2 million acre-feet, and the 14,548 acre-feet of storage required for a net additional depletion of 5,661 acre-feet would be less than 0.78 percent of total usable storage in Lake Sharpe. As described in Section 3.8.1.1, use of this small portion of total system yield will have negligible impacts on current authorized purposes and on environmental conditions at the project, or in upstream or downstream reaches of the Missouri River. Structural modifications to the project would require a far greater use of resources and cause far greater environmental impacts than would be reasonable for such a small change in system yield.

Structural measures to add additional storage at the Big Bend Dam/Lake Sharpe Project are also not efficient given that surplus water may only be made available for up to 10 years. In order to meet Corps design criteria, structural measures would need to be designed and built to last for the remaining life of the project, which is well in excess of the 10-year maximum term for surplus water.

Based on this assessment, structural measures involving modifications to the Big Bend Dam/Lake Sharpe Project to increase storage capacity have been eliminated from further consideration (screened out) for reasons of efficiency, effectiveness, and considerations of adverse effects on the environment.

[18] ER 1105-2-100, Planning Guidance Notebook, 22 April 2000, Paragraph 3-8.a.
[19] EM 1110-2-2300, General Design and Construction Considerations for Earth and Rock-Fill Dams, 30 July 2004

Surface Water Withdrawals from Free-Flowing Reaches of The Missouri River

A water allocation permit will be required from the State of South Dakota[20]. If channel alterations are necessary, then a regulatory permit must also be obtained from the Corps of Engineers. However, no surplus water agreement or easement is required from the Corps of Engineers for water obtained from river reaches not contained within a Corps reservoir or on Corps project lands. Water allocation decisions for free-flowing river reaches, depending on the scope of such a withdrawal, are generally under the purview of the State.

As a general matter the water supply users with active permits, expired or expiring permits, pending permits, or who might request permits for water withdrawals from Lake Sharpe in the future are located adjacent to Lake Sharpe and withdrawal from remote locations upstream or downstream of Lake Sharpe would require extensive pipeline systems to transport the water from the point of withdrawal to the point of use. Based on the distance water would need to be transported, this alternative would be inefficient. Municipal groundwater rights holders in the study area are fairly numerous and are smaller in size than surface water rights holders. Existing M&I use includes 3 surface water rights holders and 21 groundwater rights holders. The average non-project surface water rights holder has an M&I allotment of about 107 acre-feet while the average groundwater rights holder has an M&I allocation of about 618 acre-feet.

Surface water withdrawals from the free flowing reaches of the Missouri River are not carried forward as an alternative solution because surface water withdrawals are inefficient.

Groundwater Withdrawals

As with surface water withdrawals, a water allocation permit will be required from the State of South Dakota[21]. There are currently 92 groundwater rights-holders in the counties surrounding Lake Sharpe. The largest categories of groundwater rights-holders are irrigation and municipal. There are 42 irrigation rights-holders with an average withdrawal right of 702 acre-feet and 20 municipal rights-holders with an average withdrawal right of 646 acre-feet. Groundwater withdrawal from newly-constructed withdrawal wells is a viable alternative in most areas and is retained for further analysis.

Temporary Use of Surplus Water

Temporary use of surplus water in the Big Bend Dam/Lake Sharpe Project is considered a structural measure. In order to meet the completeness criterion, this measure includes the necessary investments by non-Federal entities to construct water intakes, pipelines, and water depots which may be necessary to deliver the purchased water to the end user.

Lake Sharpe is regulated as an integral component of the system of six main stem dams and lakes on the upper Missouri River. To achieve full coordination along the river, regulation of all six main stem reservoirs is directed by the Missouri River Region Reservoir Control Center located in Omaha, Nebraska.

The pool elevation in Lake Sharpe is held near elevation 1,420 feet mean sea level (msl), except for weekly cycling in response to high power load periods. Under such conditions, normal

[20] See Section 2.6 of this report for a discussion of permit requirements in South Dakota.
[21] See Section 2.6 of this report for a discussion of permit requirements in South Dakota.

reservoir levels fluctuate approximately 1 foot from elevation 1,420 feet msl during the course of a week. The storage lost during the week in response to producing peaking-power loads is regained during the succeeding weekend periods of lower power demands. Since the main stem reservoirs first filled to normal operating levels in 1967, the Lake Sharpe level has fluctuated between a maximum of elevation 1,422.1 to a minimum of 1,414.9 feet msl with an average level of 1,420.4 feet msl.

Lake Sharpe was not intended to provide storage space to serve the Missouri River navigation project, like other main stem projects. However, releases from the main stem reservoirs that are intended to serve downstream navigation are passed through the Big Bend Dam/Lake Sharpe Project.

As noted above the Big Bend Dam/Lake Sharpe Project is operated in a somewhat unique manner in that its pool elevation is very stable and its output reflects the input it receives from its much larger upstream project, Oahe Dam/Lake Oahe. As such, the temporary use of 160,028 acre-feet of storage in Lake Sharpe is best viewed in relation to overall system storage (73,081,000 acre-feet). Temporary use of 62,268 acre-feet/year of yield (equivalent to 160,028 acre-feet of storage) is very small (0.2%) relative to the total capacity of the six-project Missouri River System. The upstream flows entering Lake Sharpe provide a reliable source of surplus water that can be used to meet the temporary needs of M&I water users in the 5-county study area surrounding Lake Sharpe. The temporary use of surplus water from Lake Sharpe can be scaled to meet the entire identified water needs, and so fully meets the effectiveness criterion.

The costs of surplus water will include the prorated share of updated project costs, plus the full cost of all necessary infrastructure investments on and off project lands. These costs, when compared to the costs of purchasing water from multiple locations that are more distant from the water supply users, may prove to be the most cost effective means of achieving project objectives, and is therefore tentatively considered to meet the efficiency criterion, subject to more detailed analysis in the comparison of alternative plans.

Provision of surplus water from Lake Sharpe is an acceptable alternative to the State of South Dakota. This has been evidenced by the Governor's endorsement on public documents, consent at agency meetings, consent at public meetings, and state's willful collaboration with the Corps' study. Therefore, it is tentatively considered to meet the criterion of acceptability, subject to further analysis.

Consistent with the criteria of completeness, effectiveness, efficiency, and acceptability, the structural measure of temporary use of surplus water in the Big Bend Dam/Lake Sharpe Project is carried forward for further consideration into the formulation of alternative plans.

3.5.2.2 Non-Structural Measures (Activities)

Three non-structural measures are considered below: conservation / incentive programs, water reuse / recycling, and transfer of water rights from non-M&I use to M&I use. All three non-structural measures are screened out from further consideration based on discussions below.

Conservation / Incentive Programs / Regulations / Public Education / Drought Contingency Planning

The state of South Dakota maintains a variety of water conservation programs. Many of them are run through the county-level soil & water conservation districts. Each county has its own conservation district and each district is required to have a water conservation plan signed by the governing body of the district on file with the Bureau of Reclamation's Dakotas Area Office, Great Plains Region. The Bureau also assists the districts' water conservation efforts through a variety of grants and educational programs. Conservation districts also collaborate regionally and nationally through soil & water conservation societies. These organizations share best practices, educational curriculum, technical capacity and other resources with one another. The national organization publishes a monthly "conservogram" which is the Soil and Water Conservation Society's membership newsletter.

Conservation is a viable alternative for dealing with short-term water supply needs and temporary drought conditions but does not provide a complete solution to the water supply needs for existing water supply users with expiring easements and for potential new water supply users. Future without-project conditions assume that future state water planning will continue to address conservation, water use efficiency, drought management and water quality management. It is unlikely that additional efforts in these areas would sufficiently reduce the future needs of existing easement holders, or eliminate the needs of future water users and would therefore not be a complete or effective non-structural solution.

Water Reuse / Recycling

Water reuse / recycling may be a viable alternative for reducing the water supply needs for existing water supply users with expiring easements and for potential new water supply users but does not provide a complete solution for these users. Reused or recycled water is not suitable for M&I use without extensive treatment, however it may be suitable for landscape, but not crop, irrigation.

For reasons of lack of completeness and effectiveness, water conservation, incentive programs, regulations, public education, and drought contingency planning measures, and water reuse and recycling are eliminated (screened out) from further consideration in the formulation of alternative plans.

Conversion of Non- M&I Water Rights to M&I Water Rights

In some states, under certain circumstances, existing water rights for uses such as irrigation, fish and wildlife, and recreation may be converted to M&I use through the sale or lease of water rights. Water rights conversions are subject to regulations and limitations that protect the supply source and existing users. For example, conversions of water rights from irrigation to M&I use are typically at a lower acre-foot allocation for the M&I use because of the lost recharge to groundwater when the use is no longer irrigation. Conversion of water rights to M&I use does not occur very often.

Within the study area, there have been no conversions to municipal or industrial permits anytime in the last 37 years, since records began being kept. There have been about 25 conversions in the western part of the state near Rapid City. There conversions were spread out over about 20 years and total about 5,000 Acre-Feet.

In this largely agricultural study area, adequate irrigation water rights and irrigation water use are important inputs into agricultural production. It is unlikely that irrigation water rights would be available for conversion to M&I use in quantities that would meet the projected increase in demand. This alternative is not carried forward to further analysis because it would be ineffective in meeting the projected increase in demand.

3.6 Most Likely Future Without Project Condition

Under the most likely future without-project condition, the projected increase in demand (5,661 acre-feet) would most likely be met through groundwater withdrawals (current demand of 56,607 would continue to be sourced from the reservoir). Future M & I water providers are projected to choose the least costly water source that will provide them the required volume and quality of water they need to meet the projected demand of their clients, so long as the water can be delivered reliably (i.e., in the quantities needed, when needed). Therefore, the most likely future without project condition is defined as the least costly feasible measure for providing the quantity of water sufficient to meet the demands of M & I users from the multiple water sources currently available, excluding Lake Sharpe. The projected cost of groundwater withdrawals to meet the projected increase in demand is presented in the next section.

3.7 Alternatives Studied in Detail

The alternatives studied in detail include the No Action – Next Least Costly Alternative and the Proposed Action. For comparison purposes, both alternatives describe the most likely means of providing 62,268 acre-feet/year of water to meet the current (56,607 acre-feet) and potential future water needs of the study area (5,661 acre-feet). The No Action – Next Least Costly Alternative is development of new, non-Project groundwater sources in a manner similar to existing M & I groundwater use in the study area (5,661 acre-feet) and continuation of existing use sourced from the reservoir (56,607 acre-feet). The Proposed Action includes temporary use of 62,268 acre-feet/year of surplus water in the Big Bend Dam / Lake Sharpe Project (56,607 of which is continuation of existing use sourced from the reservoir).

3.7.1 No Action Alternative

Under the without-project condition, the no action alternative for providing an additional 5,661 acre-feet of water (beyond existing use) for M&I use is based on the characteristics of existing M&I use and users in the study area (Table 3-6 and Figure 3-1). Existing M&I use includes 5 surface water rights holders and 40 groundwater rights holders. The average non-project surface water rights holder has an M&I allotment of about 611 acre-feet while the average groundwater rights holder has an M&I allocation of about 340 acre-feet. The characteristics of existing M&I users indicate that future M&I users are more likely to be groundwater-sourced M&I users. The increase in demand included in the No Action Alternative can be reasonably represented by 17 groundwater-sourced M&I users with 340 acre-feet allocations each. The no action alternative also includes continuation of existing use of 56,607 acre-feet, which is assumed to continue to be sourced from the lake.

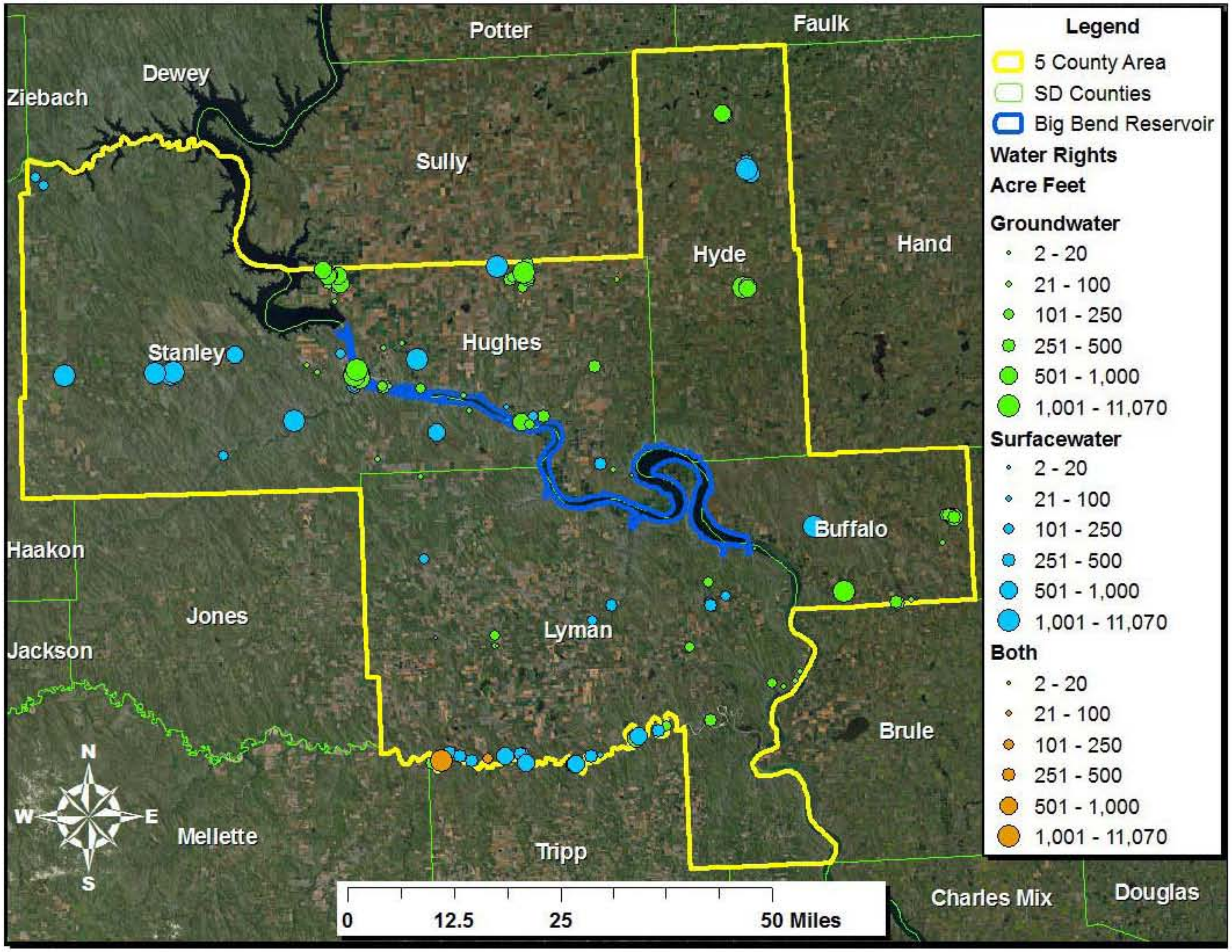
Table 3-6
Water Rights in the Five-County Lake Sharpe Area (AF)

Source & Use	Count	Average (AF)	Sum (AF)
Groundwater	92	486	44,720
Irrigation	42	702	29,488
Municipal	20	646	12,918
Multiple-Use	6	141	848
Commercial	8	59	469
Suburban Housing	6	76	457
Aquaculture	1	244	244
Domestic	4	40	160
Industrial	1	54	54
Recreational	2	16	31
Geothermal	1	27	27
Institutional	1	24	24
Surface water	48	989	47,471
Irrigation	41	1,075	44,090
Domestic	2	1,367	2,735
Municipal	3	107	322
Aquaculture	1	244	244
Multiple-Use	1	80	80
Both	2	699	1,398
Irrigation	2	699	1,398
Grand Total	142	659	93,589

*This table excludes withdrawals directly from the reservoir AF = Acre-Feet

Source: SD Dept. Environment & Natural Resources Water Rights Database

Figure 3-1
Water Rights in the Five-County Lake Sharpe Area (AF)



3.7.1.1 Groundwater Withdrawal – Projected Costs

Within the study area, both groundwater and surface water sources are available. However, M&I users are much more likely to be groundwater users. The preponderance of M&I water uses in the study area are sourced from groundwater. In total, 88% of non-irrigation water rights holders in the study area are sourced from groundwater. Thus, for the purposes of this analysis it is assumed that the future water users demanding the additional 5,661 acre-feet of yield will also source their water from ground water.

Projected non-irrigation groundwater sources consist of a combination of rural water & municipal systems (i.e. public) and individual private wells (i.e. domestic). Water from each of these sources combines to meet the required yield. Recent and relevant cost data were available for two public water systems (Williston and Lewis & Clark) and for domestic private wells. The data from the Williston system are from a proposed 50,441 acre-feet expansion that would be sourced from groundwater. The Lewis & Clark system is a newly constructed water system sourced entirely from groundwater. To best compare to water from the reservoir, data for each system include only the costs of raw water, not the cost of treated and delivered water. Table 3-7 displays the estimated cost per acre-foot yield for each of these systems. The most likely, least costly water supply alternative to meet projected water supply needs in the absence of the Federal action is assumed to be a combination of water systems similar to these and continued use of the reservoir to meet continuing existing demand. To provide an equivalent yield of 62,268 acre-feet per year this analysis assumes that existing demand would be sourced from the reservoir (56,607 acre-feet) and the potential future demand (5,661 acre-feet) would be sourced similarly to existing patterns of use among public and domestic water users in the study area. Using the most recent USGS estimates[22] of water use in the study area a ratio of public to domestic use can be calculated (96% & 4%, respectively). Applying this ratio to the required yield and the available cost data produces an estimate of 5,457 acre-feet from public sources at an average cost of $50.92 and 204 acre-feet from domestic sources at an average cost of $601.70 per acre-foot. The overall weighted average per acre-foot of yield is $70.80.

[22] 2005 (see Table 3-5)

Table 3-7
Cost of the Next Least Costly Alternative

	Public Systems		Domestic
	Lewis & Clark System	**Williston Expansion**	**Private Wells**
Total Cost	$26,013,000	$15,000,000	$7,000
Annual Cost	$1,466,746	$845,777	$395
O&M Costs	$769,000	$443,432	$207
Total Annual Cost	$2,235,746	$1,289,209	$602
Annual AF Yield	50,441	22,418	1
Cost/Acre-Foot	$44.32	$57.51	$601.70
Average Cost/AF		$50.92	$601.70
Ratio of Current Use		96%	4%
Projected Use (AF)		5,457	204
Total Cost		$277,827	$122,987
Total Average Weighted Cost Per Acre-Foot			**$70.80**

Note: Annual costs calculated at 4.125% for 30 years with payments made at the beginning of each period

3.7.1.2 Summary of Water Sources for the No Action Alternative

Table 3-8 indicates that the reservoir provide for the continued existing use portion of the no action alternative (56,607 acre-feet) and that groundwater sources will be used to meet the additional 5,661 acre-feet of water yield for the No Action Alternative.

Table 3-8
All Sources of Water for No Action Alternative

Water Source	Acre-Feet
From Lake Sharpe (current existing use)	56,607
From Ground Water (future additional use)	5,661
Total All Sources	**62,268**

3.7.2 Proposed Action –Use of Surplus Water

The proposed action for the Army Corps of Engineers would be to identify surplus water, as defined in Section 6 of the 1944 Flood Control Act, which the Secretary of the Army can make available to execute surplus water supply agreements with existing and prospective M&I water users, for up to 62,268 acre-feet/year of surplus water (equivalent to 160,028 acre-feet of storage) from Lake Sharpe.

3.8 Alternative Evaluation – Economic Analysis

The no action / least costly alternative plan (CC2010) and temporary use of surplus water plan (Proposed Action, or CC10BB) are evaluated and compared in this section of the Report. Specifically, this section provides discussions on project economic effects, calculates the cost of storage, and concludes with the identification of the least cost method of meeting the water supply needs of the project area.

3.8.1 Impacts on Authorized Project Purposes

The Big Bend Dam/Lake Sharpe Project provides benefits to the Nation as a component of the comprehensive Pick-Sloan Plan for development in the Missouri River Basin. The authorized purposes of the upper Missouri River's six mainstem reservoirs and the lower Missouri River's levees and navigation channel are flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, water quality, and recreation. In order to evaluate the effects of temporary use of surplus water in Lake Sharpe it is necessary to determine whether the depletions associated with the proposed use of surplus water would impact authorized project purposes through effects on reservoir water surface elevations and outflows.

Table 3-9 provides a comparison of the sources of water used to provide the 62,268 acre-feet/year of water under the no action alternative and the proposed action. The proposed action will result in a reduction in groundwater withdrawals of 5,661 acre-feet per year. The no action plan requires withdrawals of an additional 5,661 acre-feet from groundwater sources in the four-county study area surrounding Lake Sharpe. Both the proposed action and the no action plans assume continuation of withdrawals from existing users in the amount of 56,607 acre-feet. The proposed action also includes 5,661 acre-feet of surplus water yield from the Big Bend Dam/Lake Sharpe Project.

As described in Section 2.5, the six Missouri River mainstem reservoirs are operated as an integrated system to achieve the authorized project purposes. Therefore, the net impact on the Missouri River System from the use of surplus storage in the Big Bend Dam/Lake Sharpe Project is an increase in depletions of 5,661 acre-feet per year.

The allocation of surplus storage may potentially affect project purposes in numerous ways. For example if pool elevations are reduced due to increased depletions, then additional storage space may be available for flood control purposes (increase benefits) or recreational facilities may not have sufficient water during some drought conditions (reduce benefits). Increased depletions due to an allocation to surplus storage may reduce the volume of water available for downstream uses such as navigation (reduce benefits), water supply (reduce benefits), and hydropower. It is important to consider the scale of the proposed surplus water allocations and associated depletions in relation to the size of the overall Missouri River system. All effects to project purposes are extremely small (Table 3-10), even when considered cumulatively (Table 3-21).

Table 3-9
Sources of Water Withdrawals for No Action and Proposed Action Alternatives

Water Source	No Action (Acre-Feet)	Proposed Action (Acre-Feet)
From Lake Sharpe (existing use)	56,607	56,607
From Groundwater	5,661	0
From Lake Sharpe (additional use)	0	5,661
Total All Sources	**62,268**	**62,268**

3.8.1.1 Use of the Daily Routing Model (DRM) to Predict Hydrologic Impacts

The Daily Routing Model (DRM) was used as an analytical tool in this study to estimate the hydrologic and economic effects that additional depletions would have at Lake Sharpe, the other system reservoirs, and free-flowing reaches of the Missouri River. The DRM has undergone appropriate model review in compliance with EC-1105-2-412 and has been approved for regional use by the Engineering Community of Practice. Modeling of the movement of the water through the entire Missouri River Reservoir System was accomplished using the DRM, which was developed during the 1990’s as part of the Master Manual Review and Update Study. An 80-year period was selected as the period of record for each of the alternatives because this is the period that daily data are available on Missouri River inflows and flows. Daily records are available for the six dams since their respective dates of closure, and daily flow data are available for the majority of gaging stations since 1930 (USACE, 1998). The depletion and capacity curve data (computed using the sedimentation rate data) were the input files that were used to project elevation and flow for without and with project conditions.

The DRM was developed to simulate and evaluate alternative System regulation for all authorized purposes under a widely varying, long-term hydrologic record. The DRM is a water accounting model that consists of 20 nodes, including the six System dams and 14 gaging stations. In the DRM, each of the six System reservoirs was modeled, and the DRM provides output at locations (nodes) along river reaches between System projects: Wolf Point and Culbertson, Montana, and Williston and Bismarck, North Dakota; and ten locations along river reaches below the System: Sioux City, Iowa; Omaha, Nebraska City and Rulo, Nebraska; St. Joseph, Kansas City, Waverly, Boonville, and Hermann, Missouri on the Missouri River and St. Louis, Missouri on the Mississippi River.

The DRM performs a time-series analysis that simulates hydrologic output on a daily basis for each of the 80 years modeled from 1930 through 2009, assuming that the entire System was in place and fully operational for the full 80-year period. Using the full 80-year period of record for the simulation modeling allows the maximum amount of information, such as the occurrence and effects of wet years, dry years, and droughts, to be included in the estimate of average annual effects. As the depletion and capacity curve data are varied between the evaluation years for this analysis (i.e., 2010 and 2020), the DRM computes System storage, reservoir elevation, reservoir release, reservoir evaporation, and river flow data for each day of the modeling period.

Hydraulic impacts (changes to water surface elevations (WSE) in riverine reaches of the Missouri River) were estimated externally to the DRM model by combining DRM hydrologic output on streamflow with stage-discharge relationships provided at the DRM-modeled riverine nodes by the Omaha District.

Each DRM run provides 29,220 simulated values (80 years of daily values) for each parameter (i.e., water surface elevation, reservoir volume, and streamflow) at the 20 locations/model nodes in the system. These data should not be considered as estimates of actual calendar day values, but rather as simulation output values under the full range of climatological conditions existing over the 80-year period. To evaluate differences between two alternatives, the differences between each of the 29,220 daily values were determined and then sorted to establish a frequency distribution of modeled values. The distributions of the differences from the current conditions (without the additional depletions) for various DRM outputs (water surface elevation, reservoir volume, and streamflow) were then examined. Comparing the data distributions in this manner provides insight as to how the increased depletion scenario impacts the likelihood of occurrence of a given water surface elevation, reservoir volume, and streamflow over the entire 80-year period. Similarly, it can provide an estimate of the likelihood of a given magnitude of change in each parameter between No Action and with project conditions. It should be noted that the x-axis on all of the distribution plots are percent of the days, where 10 percent represents 2,922 days of the full 29,220 days of the 80-year period of analysis.

To examine the effects of just the additional depletions directly from System reservoirs, the simulations for one study year (2010) were completed under two separate planning scenarios: 1) baseline depletions (without project current condition), 2) 5,661 acre-feet of depletions at Lake Sharpe (with project condition). The model assumes that the historic System inflow data, adjusted assuming the depletions associated with current development in the basin, occurred over the 80-year modeling period.

The source of the actual System inflow data is the U.S. Geological Survey, which began acquiring daily data beginning in late 1929. The DRM adjusts these inflow data by the difference for depletions that have been estimated to occur between each year and 2002. The Bureau of Reclamation provided the monthly depletions, and these monthly data were further separated to daily values for use in the DRM. Inflow and depletion data are available for each of the DRM modeling reaches. The 2002 depletion data are assumed to remain constant through 2010 (assumes no change in system depletions from 2002 to 2010).

The proposed temporary use of an additional 5,661 acre-feet of water from Lake Sharpe would be a total depletion allowance that the easement holders would be allowed to remove over the span of a year. Daily (and yearly) withdrawals from the various intakes would be small relative to the total storage in the reservoir. To put 5,661 acre-feet of yield per year into a daily context, a withdrawal of 7.8 cubic foot per second, every day for an entire year, would yield 5,661 acre-feet of water. So, if water withdrawals were uniformly removed from Lake Sharpe throughout the year, there would be about 7.8 fewer cubic feet per second of water available for discharge at any given moment from the Big bend Dam as a result of the proposed action.

From monthly release data from the Corps of Engineers covering the period June 1967 through March 2011 from Big Bend Dam the maximum daily outflow from the dam is 74,300 cfs and the minimum is zero cfs[23]. If the depletions from the proposed action resulted in 7.8 cfs less being available for discharge, the potential decrease in the maximum daily release would be 0.01-percent of the maximum flow and an insignificant amount taken from storage when outflow is at its minimum of zero, or effectively unchanged.

This simple illustration[24] assumes that no changes would be made in reservoir operations to adjust for the 5,661 acre-foot depletion. In fact, adjustments would not need to be made in the vast majority of cases, because the 5,661 acre-foot net depletion, i.e. the 14,548 acre-feet of storage, represents approximately 0.305-percent of total storage in a reservoir that holds approximately 1,798,000 acre-feet. As the proposed 5,661 acre-feet in depletions represent a small change relative to the scale of the normal operations of the Big Bend Dam and the entire reservoir system, where actual operational changes in release rates are typically made in hundreds and thousands of cubic feet per second, the effects on pool levels and reservoir outflow would be very small.

In addition to estimating hydraulic effects, the DRM is also able to estimate economic effects to five authorized purposes of the project: flood control, navigation, hydropower, water supply and recreation. For each of these project purposes the DRM uses daily elevation, volume and streamflow outputs generated by the hydraulic portion of the model as inputs to the economic portion of the model. By using a series of algorithms customized for each project purpose, the DRM is able to determine economic benefits for each project purpose. The economic portions of the model were reviewed for adequacy consistent with model review criteria contained in EC 1105-2-412. Due to the small difference between the without and with-project conditions and the temporary nature of a surplus water agreement, the model was determined to be adequate for measuring the significance of impacts to other project purposes. While it is recognized that the model does need to be updated, the DRM and the economic modules provide the closest simulation available at this time.

Table 3-10 presents the National Economic Development (NED) benefits for the No Action and Proposed Action alternatives. This table shows that the removal of 5,661 acre-feet of water from Lake Sharpe will result in an average annual net gain of $215,160 of NED benefits, which is an increase of 0.0124 percent in average annual NED benefits (based on the 80-year period of analysis). This small positive change in average annual benefits is effectively no change. The breakdown of the impact on NED benefits among the individual project purposes is also presented.

[23] See http://www.nwd-mr.usace.army.mil/rcc/projdata/projdata.html.
[24] Appendix A: Draft Environmental Assessment contains the resulting model plots showing the impacts of depletions

Table 3-10
Annual NED Benefits for the No Action and Proposed Action Alternatives

Authorized Purpose	No Action CC2010 ($ millions)	Proposed Action CC10BB ($ millions)	Change ($ millions)	Change (percent)
Flood Control	$402.796	$403.062	0.266	0.0660%
Navigation	$6.716	$6.710	-0.007	-0.0988%
Hydropower	$632.513	$632.465	-0.047	-0.0075%
Water Supply	$607.254	$607.254	0.000	0.0001%
Recreation	$84.002	$84.004	0.003	0.0032%
Total	**$1,733.280**	**$1,733.495**	**0.215**	**0.0124%**

3.8.2 Water Storage-Yield Analysis

The updated cost of storage and any associated operations and maintenance costs are based on the proportion of the project's usable storage required to provide an additional yield of 5,661 acre-feet of water. The relationship between reservoir storage and yield is described in this Water Storage-Yield Analysis.

The sequential reservoir routing method was used to calculate the storage-yield ratio used in the computation of updated costs of storage. This is the same method that was used to calculate the storage-yield ratio for the Basin Electric water supply agreement in January 2005 at the Garrison/Lake Sakakawea Project. The storage-yield ratio was determined for the Basin Electric analysis and for this analysis from simulations conducted using the Daily Routing Model (DRM), which applied the reservoir system operational rules as described in the Missouri River Master Water Control Manual (Revised March 2006). Depletion (water demand or use) analyses in the upper Missouri River basin were conducted for this study and used in the DRM. These analyses determined that the ultimate depletion level would be approximately 8.1 million acre-feet. The 1930 to 1941 drought was the limiting drought in these analyses. As determined in these analyses, 39 million acre-feet of carryover multiple use storage in the Missouri River Mainstem Reservoir system would be required to support a depletion level of 8.1 million acre-feet per year, and a minimum annual flow of 8.8 million acre-feet per year at Sioux City, Iowa. The total yield in the analysis is 16.9 million acre-feet per year (8.1 + 8.8 million acre-feet). Dividing the carry over multiple use storage (39 million acre-feet) by the total yield (16.9 million acre-feet) results in a storage-yield ratio of 2.31.

This ratio is lower than the value of 2.59 computed for the Basin Electric water supply agreement. The difference is due to a slight increase in basin depletions since the previous studies were completed and changes to the Master Manual water control plan (a change in the system storage level at which navigation is not supported that year and increased seasonal non-navigation period releases). The navigation support change increased the simulated number of non-navigation years during the 1930s drought from 1 year under the former Master Manual to 3 years under the current Master Manual. Because of the effect of the navigation support change, another method for computing the storage-yield ratio was used to calculate an alternative value and confirm the results of the sequential reservoir routing.

This second method utilized a Rippl diagram to determine the yield that could be expected with a system carryover storage capacity of 39 million acre-feet. A Rippl diagram is a mass curve of accumulated system inflows. Tangents are drawn to the high points of the mass curve in such a manner that the maximum departure does not exceed the system storage capacity. The slope of the resulting line indicates the annual yield or demands that can be attained with the specified storage capacity. The critical drawdown period begins at the tangent and ends with the maximum departure between the inflow and demand curve. The point at which the demand curve intersects the inflow curve indicates that the system storage has refilled. System inflows for 2002 development conditions were accumulated over the period of 1930-2009 and used to determine the yield that could be supplied during the critical period, which extended from December 1930 to February 1942, as shown on Figure 3-2.

Results of this analysis indicate that the system yield is 17.0 million acre-feet per year. Based on results of the DRM simulations, average annual evaporation during the critical period is 1.8 million acre-feet per year. Subtracting evaporation from the system yield results in a net yield of 15.2 million acre-feet per year. Dividing the carryover multiple use storage (39 million acre-feet) by the net yield (15.2 million acre-feet) results in a storage-yield ratio of 2.57. A comparison of the storage-yield computations is shown in Table 3-11. It is recommended that a value of 2.57 be used for this analysis since it is close to what was previously used for the Basin Electric water supply agreement and can be supported by the Rippl diagram.

Figure 3-2
Rippl Diagram for Missouri River Reservoir System

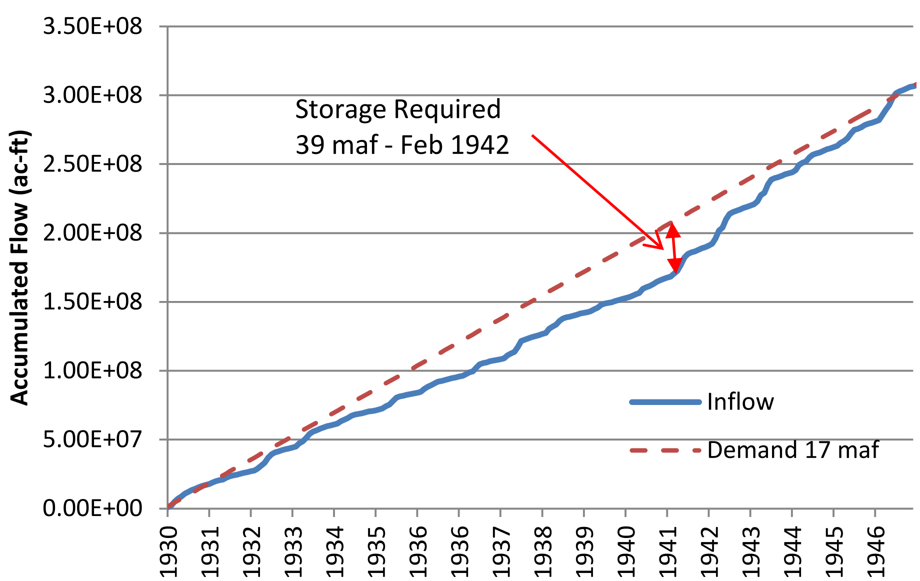


Table 3-11
Storage-Yield Ratios

Method	System Carry Over Multiple Use Storage (maf)	Yield (maf/yr)	Storage-Yield Ratio
Sequential Reservoir Routing (Basin Electric)	39	15.1	2.59
Sequential Reservoir Routing (DRM revised)	39	16.9	2.31
Rippl Diagram (Recommended)	39	15.2	2.57

3.8.3 Derivation of User Cost

The cost to entities executing surplus water agreements for the capital investment of storage in a Corps of Engineers' reservoir is calculated as the highest of:

- benefits foregone by the use of surplus water;
- revenues foregone by the use of surplus water;
- replacement cost of the storage necessary to provide the surplus water; or
- updated cost of storage in the Federal project.

3.8.3.1 Benefits Foregone

The Big Bend Dam/Lake Sharpe Project provides benefits to the Nation as a component of the comprehensive Pick-Sloan Plan for development in the Missouri River Basin. The authorized purposes of the upper Missouri River's six mainstem reservoirs and the lower Missouri River's levees and navigation channel are flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, and recreation. The Big Bend Dam/Lake Sharpe beneficial contributions to authorized project purposes are identified in Chapter 2.4 Authorized Project Purposes.

The temporary use of 62,268 acre feet/ per year of surplus water is being evaluated in this report. All but 5,661 acre-feet of that is existing use and is already calculated in existing benefits and revenues, therefore the affect of implementing the surplus water only comes from the net additional use. Chapter 3.8.1 Impacts on Authorized Project Purposes identifies that an additional 5,661 acre-feet of depletions from undeveloped system-wide irrigation storage would result in a positive NED impact to authorized project purposes of $215,160 per year.

Based on the 5,661 acre-feet of additional depletions due to potential surplus water agreements (net change of 5,661 acre-feet in System depletions) and the yield ratio of 2.57, an additional 14,548 acre-feet of storage would be required for the proposed action. Because there is no net loss of NED benefits for the proposed action, the benefits foregone per acre-foot of storage would be $0.00.

3.8.3.2 Revenues Foregone

Revenues foregone are defined as the reduction in revenues accruing to the U.S. Treasury based upon any existing payment agreements related to the project. Revenues foregone to hydropower would be based upon the projected reduction in hydropower output due to depletions associated with the use of surplus water or modified release schedule. Hydropower generated at Big Bend Dam is marketed through the Western Area Power Administration (Western), which is a Federal agency under the Department of Energy. Revenues from the sale of hydropower generated at the Big Bend Dam are paid to the U.S. Treasury to recover the Federal investment in the power generating facilities (with interest) and other costs assigned to power for repayment, such as aid to irrigation development (Western Area Power Administration, Annual Report, 2009).

Western provided a spreadsheet for this analysis with its most recent economic values for what it pays on an average monthly basis for power it purchases to meet its firm commitments to its customers, and a corresponding value for the revenue it receives for the power marketed in excess of its firm commitments. The temporary use of 62,268 acre feet/ per year of surplus water is being evaluated in this report. All but 5,661 acre-feet of that is existing use and is already calculated in existing benefits and revenues, therefore the affect of implementing the surplus water only comes from the net additional use. There is no discernible net loss in annual energy revenues for the 5,661 acre-feet of water to be removed on a temporary basis from Lake Sharpe. Since there is not net loss in revenues associated with the water to be removed, the cost per acre-foot of required storage is $0.00.

3.8.3.3 Replacement Costs

Since there is system-wide storage space available due to the undeveloped irrigation use there is no need to provide replacement storage for the 160,028 acre-feet of storage space that will be needed. Therefore, there are no replacement costs required for the proposed action.

3.8.3.4 Updated Cost of Storage

Surplus water is available at the Big Bend Dam/ Lake Sharpe Project because the originally envisioned irrigation use of the Missouri River Mainstem System (capacity for irrigation of 2,300,000 acres) was never developed. The updated cost of storage is calculated based on available capacity within all system zones: permanent pool, annual flood control & multiple use, and exclusive flood control. In a permanent reallocation, the portion of the permanent pool assigned to sediment storage would be excluded from the available capacity in computing the updated cost of storage. However, for a surplus water study, it is appropriate to include this capacity because sediment surveys[25] indicate that the portion of the zone assigned to sediment storage will not be full during the 10-year study period.

3.8.3.5 Assistant Secretary of the Army for Civil Works - Direction on Pricing

Surplus water is available at the Big Bend Dam/Lake Sharpe Project because the originally envisioned irrigation use of the Missouri River Mainstem System (capacity for irrigation of 2,300,000 acres) was never developed. In a memorandum dated May 8, 2012, the Assistant Secretary of the Army for Civil Works (ASA CW) directed the Corps of Engineers to initiate

[25] See note 6 of Plate 2, AOP

action immediately to purse notice and comment rulemaking to establish a nationwide policy for surplus water uses under Section 6 (Attachment 1). Pricing for use of surplus water at the Big Bend Dam/Lake Sharpe Project would be at no charge pending the completion of this nationwide rulemaking.

Usable Storage Calculations

The 2009 – 2010 Annual Operating Plan (AOP) presents the storage allocations and capacities based on the latest available storage data[26]. Usable storage includes the exclusive flood control pool, the flood control and multiple use zone, and the permanent pool (Table 3-12). Total usable storage is 1,798,000 acre-feet. The surplus water needs of an additional 62,268 acre-feet of yield requires 160,028 acre-feet of storage, which is 8.90% of total usable storage (160,028/1,798,000 = 8.90%).

Table 3-12
Usable Storage Calculations (acre-feet)

Exclusive Flood Control	60,000
Flood Control & Multiple Use	117,000
Permanent	1,621,000
Total	1,798,000
Required Storage to Provide An Additional Surplus Water Yield of 62,268 acre-feet	160,028
Proportion of Usable Storage	8.90%

Updated Construction Cost Calculations

Construction costs were updated using the Engineering News Record (ENR) construction cost index and the Corps of Engineers Civil Works Construction Cost Index System (CWCCIS) as identified in EM 1110-2-1304, revised 31 March 2011. The value of lands is updated by the weighted average update of all other project features, as per the Water Supply Handbook, revised IWR Report 96-PS-4, December 1998. Since the CWCCIS dates back only to 1967, the ENR construction cost index was used to update project costs to 1967. The ENR construction cost index values are presented in the Water Supply Handbook.

The costs to be assigned to surplus M&I water use include joint use costs and are exclusive of specific costs. Examples of specific costs excluded from the updated cost of storage include the specific construction costs of:

[26] See note 6 of Plate 2, AOP

- Recreation facilities;
- Flood control outlet works;
- Power intake works;
- Powerhouse;
- Turbines; and
- Generators.

The period of expenditure for each project feature is 1959 – 1963 (mid-point 1961) as identified in the 2009 – 2010 AOP. Table 3-13 shows the cost update calculations from the mid-point of expenditures (1961) to 1967, using the ENR construction cost index. Note that interest during construction is not included in this updating procedure. Table 3-14 shows the cost update calculations from 1967 to the first quarter of Fiscal Year 2012 using the CWCCIS, revised 31 March 2011. Note that the cost of lands and damages (Table 3-15) are updated based on the ratio of total FY12 updated costs (excluding lands and damages) to the total original 1959 costs (excluding lands and damages), as per the Water Supply Handbook (page 4-10).

Table 3-13
Updated Cost of Construction 1959 – 1967

Joint Use Cost Category	Original Cost ($)	Original Cost without IDC ($)	ENR Index 1961	ENR Index 1967	Update Factor	1967 Cost ($)
Main Dam	20,098,500	18,816,583	847	1074	1.268	23,859,516
Outlet Works	-	-	847	1074	1.268	-
Reservoirs	4,077,400	3,817,336	847	1074	1.268	4,840,401
Power Intake Works	-	-	847	1074	1.268	-
Fish & Wildlife	-	-	847	1074	1.268	-
Levees & Floodwalls	-	-	847	1074	1.268	-
Pumping Plant	-	-	847	1074	1.268	-
Roads & Bridges	2,691,300	2,519,644	847	1074	1.268	3,194,921
Buildings & Grounds	1,557,800	1,458,441	847	1074	1.268	1,849,310
Perm Operating Equip	1,332,000	1,247,043	847	1074	1.268	1,581,256
Relocations	6,420,400	6,010,896	847	1074	1.268	7,621,844

Table 3-14
Updated Cost of Construction 1967 – FY 2012

Joint Use Cost Category	1967 Cost ($)	1967 CWCCIS	FY12 CWCCIS	Update Factor	FY12 Cost ($)
Main Dam	23,859,516	100	747.12	7.471	178,259,215
Outlet Works	-	100	736.16	7.362	-
Reservoirs	4,840,401	100	821.93	8.219	39,784,704
Power Intake Works	-	100	755.03	7.550	-
Fish & Wildlife	-	100	736.16	7.362	-
Levees & Floodwalls	-	100	771.38	7.714	-
Pumping Plant	-	100	755.03	7.550	-
Roads & Bridges	3,194,921	100	759.26	7.593	24,257,755
Buildings & Grounds	1,849,310	100	755.03	7.550	13,962,844
Perm Operating Equip	1,581,256	100	755.03	7.550	11,938,958
Relocations	7,621,844	100	759.26	7.593	57,869,614
Lands and Damages	6,747,887*			9.627	64,963,331
Total					391,036,422

*Original 1959 cost without interest during construction

Table 3-15
Updated Costs of Lands and Damages

Total 1959 Cost Exclusive of Lands and Damages	$33,869,943
Total FY12 Cost Exclusive of Lands and Damages	$326,073,091
Ratio of Total FY12 Cost to Total 1959 Cost	9.627
1959 Cost of Lands and Damages	$6,747,887
Updated FY12 Cost of Lands and Damages	$64,963,331

The updated FY 2012 total cost of construction is $391,036,422 (excluding interest during construction). The proportion of usable storage for the 160,028 additional acre-feet recommended for surplus water use is 8.90%. At FY 2012 price levels, the updated cost of storage for the 160,028 acre-feet is $34,803,712 ($391,036,422 * 8.90% = $34,803,712). This equates to a total cost per acre-foot of storage of $217.48.

The total annual cost of surplus M&I water use to water users is calculated as the sum of annual payments to the Federal Government for the surplus water plus the proportional annual operation and maintenance costs. Annual payments are based on a 30-year payment schedule and the repayment rate identified in EGM 12-01 Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2012. The appropriate interest rate is the Water Supply Interest Rate based on PL 85-500, which is the interest rate used for water supply storage space in projects completed or under construction prior to enactment of PL 99-662 (17 Nov 1986). The FY12 interest rate is 4.125%. The annual payment for the updated cost of storage ($34,803,712) over a 30-year period at an interest rate of 4.125% is $1,962,411.

3.8.3.6 Annual Operations and Maintenance Costs

The updated cost of storage will be used as the cost to the surplus water users for the capital investment of surplus water use, as it is the highest cost out of the four cost calculation methods. The surplus water users are also responsible for a proportional share of operation and maintenance costs, the cost of updating the project's water management plan, and any costs specific to the provision of surplus water, such as environmental mitigation costs. As the provision of surplus water does not require an update to the project's management plan and does not require environmental mitigation, the surplus water users will be responsible for the proportional share of joint use operations and maintenance costs.

The operation and maintenance costs to be assigned to the provision of surplus water are based on the most recent 10-year average of joint use operation and maintenance costs at Lake Sharpe updated to FY12 dollars using CWCCIS (Table 3-16).

Table 3-16
Joint Use Operations and Maintenance Costs

Year	Joint Use O&M Costs ($)	FY CWCCIS	Update Factor	FY12 Cost ($)
FY01	Unavailable	503.32	1.505	NA
FY02	Unavailable	517.46	1.463	NA
FY03	Unavailable	529.95	1.429	NA
FY04	Unavailable	571.29	1.326	NA
FY05	Unavailable	608.36	1.245	NA
FY06	Unavailable	641.91	1.180	NA
FY07	2,785,937	673.52	1.124	3,132,360
FY08	3,666,384	716.54	1.057	3,874,791
FY09	3,181,536	703.00	1.077	3,427,143
FY10	3,713,368	716.68	1.057	3,923,679
4QFY12		757.27	average	3,589,493

The average joint use operations and maintenance costs for the most recent ten-year period are $3,589,493 in FY 2012 dollars (Table 3-16). The proposed proportion of usable storage for an additional 160,028 acre-feet is 8.90% (Table 3-12). For 2011, the annual operations and maintenance for the 160,028 acre-feet of storage is $319,478 ($3,589,493 * 8.90% = $319,478).

3.8.3.7 Annual Payment for Use of Surplus Water

The total annual cost of surplus water for 160,028 additional acre-feet of storage is $2,281,890 based on FY 2012 price levels. Payment required from each user will be calculated proportionate to the amount of required storage needed to support the requested yield, using an annual cost of $36.65 per acre-foot of yield (equivalent to $14.26 per acre-foot of storage) at FY 2012 price levels (Table 3-17).

Table 3-17
Annual Payment for Use of Surplus Water
(FY 2012 price levels)

Updated Cost of Storage	$34,803,712
Repayment Period	30 years
Repayment Rate	4.125%
Annual Payment	$1,962,411
Annual O&M Cost	$319,478
Total Annual Payment	$2,281,890
Acre-Feet of Storage	160,028
Annual Cost per Acre-foot of Storage	$14.26
Acre-Feet of Yield	62,268
Annual Cost per Acre-foot of Yield	$36.65

3.8.3.8 Summary of the User Cost of Storage Calculations

The four methods of determining the cost of storage in Lake Sharpe have been discussed in the previous subsections. Table 3-18 presents these results. The updated cost of storage is the highest value at $14.26 per acre-foot of storage (FY 2012 price levels).

Table 3-18
Annual Cost of Storage Computation Methods

Cost Calculation Method	Annual Cost per Acre foot of Storage
Benefits foregone	$0.00
Revenues forgone	$0.00
Replacement costs	$0.00
Updated cost of storage	$14.26

3.8.4 Test of Financial Feasibility

The test of financial feasibility compares the annual cost to surplus water user(s) under the proposed action to the annual cost of the most likely, least costly water supply alternative to meet projected water supply needs in the absence of the Federal action. The no action - next least costly alternative must be able to provide an equivalent quality and quantity of water which non-Federal interests could obtain in the absence of utilizing surplus water from the Federal project. The purpose of the test of financial feasibility is to demonstrate that provision of surplus water from the Federal project is the most efficient water supply alternative.

The most likely, least costly water supply alternative to meet projected water supply needs in the absence of the Federal action is groundwater withdrawal. As discussed in Section 3.7.1.1 the average annual cost for groundwater withdrawal is $70.80 per acre-foot per year. As discussed in Section 3.8.2.5 the average annual cost of surplus water from the 1,798,000 acre-feet of storage in the Big Bend Dam/Lake Sharpe Project (required to provide 62,268 acre-feet of additional yield) is based on the updated cost of storage method and is $2,281,890, which is $36.65 per acre-foot of yield (equivalent to $14.26 per acre-foot of storage) (FY 2012 price levels). The test of financial feasibility, comparing the cost of the next least costly alternative ($70.80 per acre-foot of yield) to the cost of the proposed action ($36.65 per acre-foot of yield), clearly demonstrates that temporary provision of surplus water from the Big Bend Dam/Lake Sharpe Project is the most efficient water supply alternative (Table 3-19).

Table 3-19
Annual Cost Comparison

Water Source	Acre-Feet/Yr	Cost / Acre-Foot	Total Cost
Groundwater	62,268	$70.80	$4,408,743
Surplus Water from Lake Sharpe	62,268	$36.65	$2,281,890
Annual Savings from using Surplus Water	-	$34.16	$2,126,853

Note: Totals affected by rounding -

3.9 Environmental Considerations

Because of the small magnitude of the predicted changes to discharges and water surface elevations of Lake Sharpe, the remaining five System reservoirs, and the riverine reaches of the Upper Missouri River as a result of the Proposed Action, the following environmental resources (as discussed in Section 5.3 of the accompanying Environmental Assessment) would not be expected to have any measurable change over the existing condition: soils, groundwater, water quality (including cold water habitat), air quality, demographics, socioeconomics, environmental justice, recreation, aesthetics, noise, cultural resources, vegetation and protected plants, fish and wildlife and protected animals. In addition, there would be no effects to project purposes anticipated (Section 3.8.1 Impacts to Authorized Project Purposes).

The expected environmental consequences of providing 62,268 acre-feet/year of surplus water from 160,028 acre-feet of storage (the Proposed Action) would not be expected to be significant and would not require the preparation of an Environmental Impact Statement. Note that additional environmental analyses will be conducted to evaluate specific easement and surplus water requests.

3.10 Cumulative Impacts

Surplus Water studies were conducted for each of the six mainstem reservoirs on the upper Missouri River system. Collectively, the six studies conclude that a total of 282,917 acre-feet/year of surplus water (equivalent to 727,097 acre-feet of storage) from the system-wide irrigation storage is temporarily available. The temporary use of up to 282,917 acre-feet/year of surplus water would result in additional net depletions of 17,156 acre-feet from the system for the ten year period, beyond existing usage levels, as shown in Table 3-20

Table 3-20
System-Wide Surplus Water

Project Dam and Reservoir	Proposed Surplus Water Action (Acre-Feet/Yr)	Associated Surplus Water Storage (Acre-Feet)	Additional Net Annual Depletion (Acre-Feet)
Fort Peck Dam/Fort Peck Lake	6,932	17,816	630
Garrison Dam/Lake Sakakawea	100,000	257,000	527
Oahe Dam/Lake Oahe	57,317	147,305	5,211
Big Bend Dam/Lake Sharpe	62,268	160,028	5,661
Fort Randall Dam/Lake Francis Case	27,973	71,890	2,543
Gavins Point Dam/Lewis & Clark Lake	28,427	73,058	2,584
Total System	282,917	727,097	17,156

The cumulative effects investigation of the temporary use of up to 282,917 acre-feet of yield/year (727,097 acre-feet of storage) from the six mainstem reservoirs to meet M&I water supply needs in the region over the 10-year study period shows that there are no significant adverse impacts. Details of the cumulative effects investigation are shown in the Environmental Assessment, Appendix A. Cumulative effects on the NED benefits of project purposes are slightly positive (Table 3-21) with the beneficial impact on flood control benefits offsetting the negative impacts to the benefits of other project purposes. Overall, the cumulative effect on system-wide NED benefits is an annual increase of $99,000, which is equivalent to an increase of less than one one-thousandth of total system benefits.

Table 3-21
Cumulative Annual NED Benefit Impacts

Authorized Purpose	No Action CC2010 ($ millions)	Proposed Action CC10FP ($ millions)	Change ($ millions)	Change (percent)
Flood Control	$402.796	$403.407	$0.611	0.1517
Navigation	$6.716	$6.693	-$0.023	-0.3385
Hydropower	$632.513	$632.179	-$0.334	-0.0528
Water Supply	$607.254	$607.223	-$0.030	-0.0050
Recreation	$84.002	$83.877	-$0.125	-0.1485
Total	**$1,733.280**	**$1,733.379**	**$0.099**	**0.0057**

Note: Impacts to Irrigation are included in the Water Supply category;

The goal of the cumulative benefits assessment is to show differences between alternatives, even if they are very slight. The numbers computed by the DRM were carried out to a thousandth of a percent in an effort to show these very small differences. The DRM and the economic modules are very complicated and rarely can results be simplified into an easy explanation. Brief clarifications of the numbers computed by the model in table 3-22 are shown below.

Flood Control - Either downstream flow was reduced very, very slightly, which caused a reduction of flood damages or the lake level was reduced just enough to result in lower damages to one or more recreation sites during a high reservoir pool condition.

Navigation - A season length was likely reduced a day or two in one or more years to cause the navigation benefits to be reduced in that year or several years (in only drought periods).

Hydropower - One would expect minor reductions in one or more years, overall the reduction in hydropower benefits is one half of one-tenth of a percent.

Water supply - Water supply benefits decrease very very slightly (one half of one hundredth of a percent). Irrigation benefits are computed as part of the water supply module of the Economic Impacts Model.

Recreation - Benefits decreased very slightly in one or more years due to a very small lowering of reservoir levels in a drought year.

Plan formulation for each of the six reservoirs was accomplished in accordance with the six-step planning process defined in ER 1105-2-100. The six recommended Surplus Water actions collectively provide a cost effective temporary solution to address the regional multi-state M&I water supply needs of users adjacent to the mainstem reservoirs for the next 10 years.

4. PLAN IMPLEMENTATION

4.1 Parties to Surplus Water Agreements

In accordance with ER 1105-2-100 (22 April 2000), the cost allocated to the surplus water user, i.e., the price to be charged for the capital investment for the storage required to provide the surplus water, will normally be established as the highest of the benefits or revenues foregone, the replacement cost, or the updated cost of storage in the federal project. As identified in Table 3-19 above, the costs to be assigned to M&I water supply storage are calculated as the updated cost of storage.

The repayment rate used to calculate annual payment for storage is the yield rate defined in Section 932 of the Water Resources Development Act of 1986. EGM 12-01 Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2012 identifies the appropriate interest rate as 4.125%. Payment amounts are recalculated based upon appropriate interest rate for the year an agreement or renewal is signed. The annual payment for the updated cost of storage is calculated over a 30-year period. The duration of the surplus water agreement shall be for a period not to exceed five (5) years. Upon expiration, the agreement may be extended for an additional period not to exceed five (5) years. Extensions shall be subject to recalculation of reimbursement. A surplus water agreement does not imply a permanent right to utilize the storage space.

4.2 Agency Coordination

In early September 2010, a letter was sent to Governors, state and federal agencies, and Tribes formally notifying them of the intent to undertake the surplus water studies and Environmental Assessment for the six Missouri River Projects[27] and inviting their representation at an informational meeting on 29 September 2010 in Bismarck, ND. Governors included in the correspondence were: Honorable Dave Heineman, Governor of Nebraska; Honorable Brian Schweitzer, Governor of Montana; Honorable Mike Rounds, Governor of South Dakota; Honorable John Hoeven, Governor of North Dakota; Honorable Chet Culver, Governor of Iowa; Honorable Jay Nixon, Governor of Missouri; and Honorable Mark Parkinson, Governor of Kansas. An example copy of one of these letters is attached in Appendix A of the Environmental Assessment.

In late April 2011, the Corps of Engineers formally invited the respective Tribes, federal, and state agencies to attend any of three informational meetings on the surplus water studies. The first was held on 10 May 2011 at the Fort Peck Interpretive Center, Fort Peck, Montana; the second was held on 11 May 2011 at the South Dakota Cultural Heritage Center, Pierre, South Dakota; and the third was held 23 May 2011 at the Zorinsky Federal Building, Omaha, Nebraska. The purpose of the meetings was to provide information to the attendees on the surplus water studies as well as give the agencies an opportunity to ask questions and provide initial feedback. Example copies of letters sent to both the Tribes and agencies are also attached

[27] Fort Peck Dam /Fort Peck Lake, Garrison Dam/Lake Sakakawea, Oahe Dam/Lake Oahe, Big Bend Dam/Lake Sharpe, Fort Randall Dam/Lake Francis Case, and Gavins Point Dam/Lewis & Clark Lake

in Appendix A of the Environmental Assessment. The distribution list of Tribes and agencies invited to participate in these meetings is provided below.

Tribes

Assiniboine and Sioux Tribes of Fort Peck, Poplar, Montana 59255

Chairman, A.T. Stafne

Vice Chairperson, Ms. Roxann Bighorn

Blackfeet Nation, Browning, Montana 59417

Chairman, Willie A. Sharp, Jr.

Vice Chairman, Peter “Rusty” Tatsey

Cheyenne River Sioux Tribe, Eagle Butte, South Dakota 57625

Chairman, Kevin Keckler

Vice Chairman, Ted Knife, Jr.

Chippewa Cree Tribe of the Rocky Boy Reservation, Box Elder, Montana 59521-9724

Chairman, Jake Parker

Vice Chairman, Bruce Sunchild

Confederated Salish and Kootenai Tribes of the Flathead Reservation

Chairman, E.T. Bud Morgan

Vice Chairman, Joe Durglo

Crow Creek Sioux Tribe, Fort Thompson, South Dakota 57339-0050

Chairman, Duane Big Eagle Sr.

Vice Chairman, Wilfred Keeble

Crow Nations, Crow Reservation, Montana 59022

Chairman Cedric Black Eagle

Vice Chairman, Coolidge Jefferson

Eastern Shoshone Tribe, Wind River Reservation, Wyoming 82514

Chairman, Mike LaJeunesse

Vice Chairman, Wes Martel

Flandreau Santee Sioux Tribe, Flandreau, South Dakota 57028

President, Anthony Reider

Vice President, Cynthia Allen-Weddell

Gros Ventre and Assiniboine Tribes, Harlem, Montana 59526-9705

Chairman, Tracey King

Vice Chairperson, Ms. Mel L. Adams Doney

Iowa Tribe of Kansas and Nebraska, White Cloud, KS 66094

Chairman, Tim Rhodd

Kaw Nation, Kaw City, OK 74641

Chairman, Guy Munroe

Vice Chairman, Bill Kekahbah

Kickapoo Tribe of Kansas, Horton, KS 66439-9537

Chairman, Russell Bradley

Vice Chairman, Ms. Laura Razo

Lower Brule Sioux Tribe, Lower Brule, South Dakota 57548-0187

Chairman, Michael Jandreau

Vice Chairman, Floyd Gourneau

Northern Arapaho Tribe, Fort Washakie, Wyoming 82514

Chairperson, Mrs. Kim Harjo

Co-Chairman, Keith Spoonhunter

Northern Cheyenne Tribe, Lame Deer, Montana 59043

President, Leroy Spang

Vice President, Joe Fox, Jr.

Oglala Sioux Tribe, Pine Ridge, South Dakota 57770

Chairman, John Yellow Bird Steele

Vice Chairman, Tom Poor Bear

Omaha Tribe of Nebraska, Macy, Nebraska 68039-0368

Chairman, Amen Sheridan

Vice Chairman, Forrest Aldrich

Osage Nation, Pawhuska, Oklahoma 74056

Principal Chief, John D. Red Eagle

Assistant Chief, Scott Bighorse

Pawnee Tribe of Oklahoma, Pawnee, OK 74058

President, George E. Howell

Vice President, Charles Lone Chief

Ponca Tribe of Nebraska, Niobrara, Nebraska 68760

Chairperson, Ms. Rebecca White

Vice Chairman, James LaPointe

Prairie Band Potawatomi Nation, Mayetta KS 66509-8970

Chairman, Steve Ortiz

Vice Chairperson, Mrs. Joyce Guerrero

Rosebud Sioux Tribe, Rosebud, South Dakota 57570-0430

President, Rodney M. Bordeaux

Vice President, William Kindle

Sac and Fox of the Mississippi in Iowa/Meskwaki, Tama, IA 52339

Chairman, Adrian Pushetonequa

Vice Chairman, Jon Papakee

Sac and Fox Nation of Missouri in Kansas and Nebraska, Reserve, Kansas 66434

Chairperson, Ms. Twen Barton

Vice Chairperson, Mrs. Carey Wahwahsuck

Santee Sioux Nation, Santee, Nebraska 68760

Chairman, Roger Trudell

Vice Chairman, David Henry

Sisseton-Wahpeton Sioux Tribe, Agency Village, South Dakota 57262-0509

Chairman, Robert Shepherd

Vice Chairman, Gerald Rousseau

Spirit Lake Sioux Tribe, Fort Totten, North Dakota 58335

Chairperson, Ms. Myra Pearson

Vice Chairman, Darwin Brown

Standing Rock Sioux Tribe, Fort Yates, North Dakota 58538

Chairman, Charlie Murphy

Vice Chairman, Mike Faith

Three Affiliated Tribes, Fort Berthold Reservation, New Town, ND 58763

Chairman, Tex Hall

Vice Chairman, Scott Eagle

Turtle Mountain Band of Chippewa, Turtle Mountain Reservation Belcourt, North Dakota 58316

Chairman, Merle St. Claire

Vice Chairman, Curtis Poitra

Wichita and Affiliated Tribes, Anadarko, OK 73005

President, Stratford Williams

Winnebago Tribe of Nebraska, Winnebago, Nebraska 68071-0687

Chairman, John Blackhawk

Vice Chairman, Brian Chamberlain

Yankton Sioux Tribe, Marty, South Dakota 57361

Chairman, Robert Cournoyer

Vice Chairman, Ms. Karen Archambeau

Sac and Fox Nation of Oklahoma, Stroud, Oklahoma 74079

Ms. Sandra Massey

Region-Wide Contacts

Larry Svoboda, US Environmental Protection Agency Region 8, Denver CO 80202

Joe Cothern, US Environmental Protection Agency Region 7, Kansas City, KS 66101

Robin Johnson, Western Area Power Administration, Billings, MT 59107

Mike Ryan, Bureau of Reclamation Great Plains Regional Office, Billings, MT 59107

Dana Darlington, Missouri River Conservation Districts Council, Great Falls, MT 59401

USACE Regulatory Offices

Todd Tillinger, USACE Montana Regulatory Field Office, Helena, MT 59626

John Moeschen, Nebraska Regulatory Field Office, Omaha, NE 68138

Dan Cimarosti, USACE North Dakota Regulatory Field Office, Bismarck, ND 58504

Steven Naylor, USACE South Dakota Regulatory Field Office, Pierre, SD 57501

North Dakota

Dennis Breitzman, Bureau of Reclamation, Dakotas Area Office, Bismarck, ND 5850

Jeff Towner, US Fish and Wildlife Service, North Dakota Field Office, Bismarck, ND 58501

Terry Steinwand, North Dakota Game and Fish, Bismarck, ND 58501-5095

Dr. Terry Dwelle, North Dakota Department of Health, Bismarck, ND 58501-

Wayne Stenehjem, North Dakota Attorney General, Bismarck ND 58505

Doug Goehring, North Dakota Department of Agriculture, Bismarck, ND 58595

Todd Sando, PE, North Dakota State Engineer, Bismarck, ND 58505-0850

Paul Sweeney, North Dakota Natural Resource Conservation Service, Bismarck, ND 58505

Merlan E. Paaverud, Jr., North Dakota State Historical Society, Bismarck, ND 58505

Scott J. Davis, North Dakota Indian Affairs Commission, Bismarck, ND 58505

Mark Zimmerman, North Dakota Parks & Recreation Department, Bismarck, ND 58503

South Dakota

Pete Gober, US Fish and Wildlife Service, South Dakota Field Office, Pierre, SD 57501

Marty J. Jackley, SD Attorney General, Pierre, SD 57501

Walt Bones, SD Department of Agriculture, Pierre, SD 57501

Steven M. Pirner, P.E., SD Department of Environment and Natural Resources, Pierre, SD 57501

Jeff Vonk, SD Game Fish and Parks, Pierre, SD 57501

Doreen Hollingworth, SD Department of Health, Pierre, SD 57501

Leroy LaPlante, SD Department of Tribal Relations, Pierre, SD 57501

Jay Vogt, SD State Historical Society, Pierre, SD 57501

Janet Oertly, SD Natural Resources Conservation Service, Huron, SD 57350

Montana

Mark Wilson, US Fish and Wildlife Service, Montana Field Office, Helena, MT 59601

Dan Jewell, Montana Area Office, Bureau of Reclamation, Billings, MT 59107

Richard Opper, Montana Department of Environmental Quality, Helena, MT 59620

Mary Sexton, Montana Department of Natural Resources and Conservation, Helena, MT 59620

Joe Maurier, Montana Department of Fish, Wildlife, and Parks, Helena, MT 59601

Joyce Swartzendruber, Montana State Conservationist, Bozeman, MT 59715

Ron de Yong, Montana Department of Agriculture, Helena, MT 59601

Steve Bullock, Montana Attorney General, Helena, MT 59620

Mark Baumler, Montana Historical Society, Helena, MT 59620

Nebraska

Michael George, US Fish and Wildlife Service, Nebraska Field Office, Grand Island, NE 68801

Aaron Thompson, Bureau of Reclamation, Grand Island, NE 68802

Greg Ibach, NE Department of Agriculture, Lincoln, NE 68509

Jon Bruning, Nebraska Attorney General, Lincoln, NE 68509

Mike Linder, Nebraska Department of Environmental Quality, Lincoln, NE 68509

Rex Amack, Nebraska Game and Parks Commission, Lincoln, NE 68503

Michael Smith, Nebraska State Historical Society, Lincoln, NE 68501

Judi M. Gaiashkibos, Nebraska Commission on Indian Affairs, Lincoln, NE 68509

Brian Dunnigan, Nebraska Department of Natural Resources, Lincoln, NE 68509

Iowa

Bill Northey, Iowa Department of Agriculture, Des Moines, IA 50319

Roger Lande, Iowa Department of Natural Resources, Des Moines, IA 50319

Tom Miller, Iowa Attorney General, Des Moines, IA 50319

Missouri

Sara Parker Pauley, Missouri Department of Natural Resources, Jefferson City, MO 65102

Chris Koster, Missouri Attorney General, Jefferson City, MO 65102

Summary of Agency Meetings

The three agency coordination meetings were held in the respective states (MT/SD/NE) for the proposed projects. Surplus Water Reports are being completed for Ft. Peck Lake (Ft. Peck Project), Montana; Lake Oahe (Oahe Project), North and South Dakota; Lake Sharpe (Big Bend Project), South Dakota; Lake Francis Case (Ft. Randall Project), South Dakota and Lewis and Clark Lake (Gavins Point Project), South Dakota. Agencies and individuals that were in attendance at the meetings are listed below.

Affiliation	Individual
U.S. Department of the Interior – Bureau of Reclamation	Neil McPhillips
U.S. Department of the Interior – Bureau of Reclamation	Greg Gere
U.S. Fish and Wildlife Service – Biologist	Terry Quesinberry
U.S. Fish and Wildlife Service – Field Supervisor	Scott Larson
U.S. Fish and Wildlife Service – NE Field Supervisor	Mike George
U.S. Army Corps of Engineers – SD Regulatory Office	Steve Naylor
U.S. Army Corps of Engineers – Omaha District	Tiffany Vanosdall
U.S. Army Corps of Engineers – Omaha District	Eric Laux
U.S. Army Corps of Engineers – Fort Peck Lake Manager	Darin McMurry
U.S. Army Corps of Engineers – Regulatory	Mary Hoffman
U.S. Army Corps of Engineers – Regulatory	John Moeschen
U.S. Army Corps of Engineers – Water Supply Manager	Larry Janis
U.S. Bureau of Reclamation	Kelly Titensor
U.S. Bureau of Reclamation	Dan Fritz
U.S. Bureau of Reclamation	Nell McPhillips
Crow Creek Sioux	Wanda Wells
MT Department of Natural Resources and Conservation	Tim Bryggman
MT Department of Agriculture	Robyn Cassel
SD Department of Environment and Natural Resources	Mark Rath
SD Game Fish and Parks - Aquatics Chief	John Lott
SD Department of Natural Resources – Chief Engineer	Garland Erbele
ND Attorney General's Office – Assistant AG	Jennifer Verleger
ND State Water Commission	Kelly Casteel
ND State Water Commission	Bob Shaver

NE Game and Parks Commission	Gene Zuerlein
NE Historical Society	Terry Steinacher
NE Department of Natural Resources	Susan France
NE Department of Natural Resources	Steve Gaul
NE Department of Environmental Quality	John Bender
KS Water Office	Nathan Westrup
IA Department of Natural Resources	Michael Anderson
IA Department of Agriculture	Harold Hommes

Tiffany Vanosdall and Eric Laux (USACE, Omaha District) presented an overview of the proposed actions and information regarding:

- General information about Missouri River system, authorized purposes, storage;
- USACE water supply authorities and policies;
- Challenges of completing the study on the Missouri River;
- An Outline of a Surplus Water Report;
- Details of Demand, Storage Yield Analysis, Alternatives, Policy Pricing, Compensation to Others;
- The Requirements of the National Environmental Policy Act and Public Participation; and
- Data Gaps, Informational Needs, and Methods for Information Sharing.

Throughout the presentation, discussion occurred. The following summarizes the main points of the comments/questions received.

<u>Natural Flows</u>

Mark Rath (SDDENR) reiterated that the State’s positions are similar to the State of North Dakota relative to surplus water determination at Lake Sakakawea (i.e., the Missouri River natural flow, now impounded by Missouri River System reservoirs, remains subject to the exclusive authority and jurisdiction of the individual states and that natural flow would be sufficient to meet water supply needs of the states).

<u>USDOI, Bureau of Reclamation Projects</u>

Bureau of Reclamation stated that they had recently sent a letter to Colonel Ruch (Omaha District Commander) seeking to work with the Corps of Engineers on a comprehensive review of Reclamation's authorized projects with withdrawals from Lakes Oahe and Sakakawea. Coming to consensus on all projects that are congressionally-authorized should prevent future delays regarding the Corps' issuance of construction easements for Reclamation projects, and clarify that those projects would be exempt from Corps water supply agreements.

<u>Storage Yield Analysis</u>

The North Dakota State Water Commission (ND SWC) was interested in the methodologies employed to figure system yield in the Lake Sakakawea Report. The Corps of Engineers agreed to have our hydrologist provide a thorough explanation via phone or email.

Kansas Water asked if there was a yield report available regarding the Corps' computation of system yield. They would like to see the details of how that was computed. The Omaha District responded that they would provide the Lake Sakakawea Surplus Water Report and refer to sections that have that information. The Corps also offered to make their hydrologist available if there were any questions.

<u>Water Supply Demand Analysis</u>

While total demand appears to be sufficient to address demand that may be reasonable and foreseeable, some of the numbers within the demand analysis table appeared to be off. For example, the Corps' reported 16,000 AF of domestic use at Gavins Point was questioned. As a response, the Corps of Engineers would re-check the demand calculations as well as cross check the demand figures with data from SD DENR.

NGPC informed the Corps that they may have water intakes that are not covered under existing recreation leases. The Corps responded that the NGPC does currently have leases to use/manage recreational areas at Louis and Clark Lake. The Omaha District agreed to look to ensure water withdrawal is covered under those leases. NE DNR mentioned that water rights information for existing users can be obtained online, and that the data are in terms of the PLSS system.

<u>Alternatives for Meeting Water Demand</u>

Based on input from several individuals in attendance, water hauling for water distribution in rural South Dakota is still a common practice. Much of the reasoning behind the legislation for creating Rural Water Systems in South Dakota appears to be twofold: the transporting of water for rural domestic use is very expensive and Rural Water Distribution Systems offset those costs. Because of water quality concerns, ground water is not an option in many cases in both states. Thus, surface water is the main source for domestic use. SD DENR specifically stated that there are "not a lot of options" [outside of surface water] in South Dakota. The following were provided as potential points of contact for information regarding water hauling option: SD - Denny Davis, Association of Rural Water Systems, MT - Ron Miller - Ft. Peck Rural County Water District, and MT – Bobby Kirkland – Water Hauling - 406.526.3220

Based on their review of the Lake Sakakawea Surplus Water Report, NE DNR asked if existing users would need alternative sources of water, require new pipelines, etc. The Omaha District indicated that existing users would not be forced to utilize other sources under the no action alternative. It is assumed that if no federal action was to take place (to identify surplus water in the respective reservoirs), that existing water users would continue to withdraw water from the reservoirs.

<u>Charging for Water</u>

There was considerable discussion regarding the issue of charging for using water. Much of the discussion was captured in previous comments received by states on Lake Sakakawea Report. Of particular interest was the idea of what happens when Native Americans perfect their water right as many Tribes are currently undertaking such efforts. The Corps of Engineers' position (and the policy taken in the Lake Sakakawea Study) was that water rights are a pre-condition of entering into agreements with Corps for use of surplus water (tribal or state water rights). Tribes are not considered differently in this respect than a state or private entity. Legally the Corps can only enter into agreements with an individual or entity having that has a valid state or tribal water right.

Bureau of Reclamation discussed that they were beginning to move toward "market based" pricing for Municipal and Industrial water, and thought the Corps should look into this as well. The Corps indicated that eventually there would be discussions between Corps and Bureau regarding federal water supply policies, etc. But that this will most likely take place during the process of developing the long-term comprehensive strategy for the basin.

Future Water Use/Sources of M&I Demand

None of the representatives from SD or NE were aware of any large-scale users of water (i.e., ethanol or power plants) that were reasonably foreseeable within the next 10 years. As a result, the assumed 10% increase in demand--with no specifically designated future uses--was agreed to as a reasonable approach. The Bureau of Reclamation indicated that there could be fairly large BOR MR&I projects in next 10 years, but they wouldn't require water agreements with Corps, as they will be specifically authorized by Congress to use Missouri River water.

5. CONCLUSIONS

The purpose of the Big Bend Dam/Lake Sharpe, SD, Surplus Water Report is to identify and quantify whether surplus water is available in the Project, as defined in Section 6 of the 1944 Flood Control Act, that the Secretary of the Army can use to execute surplus water supply agreements with water users, and to determine whether use of surplus water is the most efficient method for meeting regional municipal and industrial (M&I) water needs.

This Surplus Water Report and attached Environmental Assessment investigate the engineering and economic feasibility and environmental effects of entering into agreements for the use of surplus water from 62,268 acre-feet/year of yield (equivalent to 160,028 acre-feet of storage) from system-wide irrigation storage available at the Big Bend Dam/Lake Sharpe Project to meet potential near-term municipal and industrial (M&I) water supply needs in the region.

This report:

- identifies temporary surplus water in the Big Bend Dam/Lake Sharpe Project associated with storage originally planned for mainstem system irrigation that has not developed to its originally projected capacity;
- establishes the need for water supply in central South Dakota based on expired and existing use, expiring water supply easements, and potential future requests for water supply easements at Lake Sharpe;
- assesses structural and non-structural alternative water supply measures;
- assesses potential impacts to project purposes using the DRM developed as part of the Master Manual Review and Update Study;
- assesses potential environmental impacts also using the DRM developed as part of the Master Manual Review and Update Study;
- uses the updated cost of storage method to calculate user costs; and
- conducts a test of financial feasibility indicating that provision of surplus water is the least cost water supply alternative.

The engineering and environmental analyses contained in this report indicate that there are no impacts to project purposes and no significant impacts to environmental resources due to the proposed action. The economic analysis of alternatives identifies the proposed action as the least cost water supply alternative.

6. RECOMMENDATIONS

I have carefully reviewed the water supply problems of the study area and the proposed solution documented in this report. There is a current and future need for additional municipal and industrial water supply in central South Dakota. Furthermore, it is evident through the analysis conducted for this surplus water report that surplus water is available in the Big Bend Dam/Lake Sharpe Project that can meet these M&I water demands and increase the benefits provided by the Federal project. Should requests for additional temporary surplus water in amounts greater than those identified in this analysis materialize, then further study would be required. An analysis of long-term pool usage would determine if permanent changes are needed through development of a long-term strategy.

Based on the findings of this study and the appended Environmental Assessment, it is recommended that surplus water associated with 62,268 acre-feet/year of yield (equivalent to 160,028 acre-feet of storage) in the Big Bend Dam/Lake Sharpe Project be made available for temporary use for municipal and industrial water supply and that authority be granted to execute surplus water agreements with easement applicants for a period of five (5) years, with an option to renew for an additional five (5) years.

The use of surplus water discussed in this report is economically justified and will not affect the authorized purposes of Big Bend Dam/Lake Sharpe Project.

Therefore, the Omaha District recommends that:

1. Use of surplus water from 62,268 acre-feet/year of yield (160,028 acre-feet of storage) by municipal and industrial water supply be approved for implementation; and
2. Under current policy pricing, the annual payment for surplus water would be $36.65 per acre-foot of yield (equivalent to $14.26 per acre-foot of storage) at FY 2012 price levels. However, pending completion of rule-making to establish a nationwide policy for surplus water uses under Section 6, surplus water agreements would be entered into at no cost. The term of these agreements would be for a period not to exceed the time needed to conclude the rulemaking process. All users of surplus water would need to enter into new or revised agreements implementing the nationwide policy price once the rule becomes effective.

All cost figures are calculated using the FY 2012 Water Supply Interest Rate of 4.125% based on PL 99-662. According to PL 99-622 these cost figures will need to be recalculated at appropriate times relative to future agreements.

When a request for water supply does materialize, the applicant would work directly with the local Project Office (e.g., Lake Sharpe Project Office) receiving the necessary instruction that has been established to evaluate water supply requests and their associated real estate outgrant requests[28]. Following the guidelines in the Real Estate Policy Guidance, the applicant would complete and submit the necessary request (typically including a request letter, maps/locations,

[28] U.S. Army Corps of Engineers (USACE). 2011. Operations Division Real Estate Policy. Omaha District, Northwest Division.

area of disturbance, development plan, regulatory permit application, and a preliminary environmental effects analysis). Once in receipt of a complete application, the District would complete the NEPA process, provide notification to the real estate office for issuance of an easement, and obtain the necessary permits prior to construction. Each Project Office has a set of conditions of consideration for evaluating requests for water intake site selection. These conditions of consideration have been developed to avoid important environmental resources and minimize the environmental consequences of intake construction and operation.

The recommendation contained herein reflects the information available at this time and current Departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendation may be modified before it is transmitted to higher authority for approval.

Robert J. Ruch
Colonel, Corps of Engineers
District Engineer

US Army Corps
of Engineers
Omaha District

Appendix A

Big Bend Dam/Lake Sharpe Project
South Dakota

Surplus Water Report

Environmental Assessment

August 2012

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1. Introduction

1.1 Purpose of the Surplus Water Report and Environmental Assessment

The purpose of the Big Bend Dam/Lake Sharpe Project Surplus Water Report is to identify and quantify whether surplus water is available in the Project, as defined in Section 6 of the 1944 Flood Control Act, that the Secretary of the Army can use to execute surplus water supply agreements with water users, and to determine whether use of surplus water is the most efficient method for meeting regional municipal and industrial (M&I) water needs. This Draft Environmental Assessment presents and provides an evaluation of the direct, indirect, and cumulative environmental impacts of the proposed action and the “no action” alternatives pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA) as implemented by the Council on Environmental regulations (40 CFR 1500, et seq.).

This Surplus Water Report (Report) and this Environmental Assessment (EA) investigate the engineering and economic feasibility and environmental effects of temporary use of up to 62,268 acre-feet of yield per year (160,028 acre-feet/year of storage) from the Big Bend Dam/Lake Sharpe Project to meet municipal and industrial (M&I) water supply needs in the region over the 10-year study period. This Report has been prepared by the Omaha District, U.S. Army Corps of Engineers (Corps) under the Operation & Maintenance Program. The water supply agreements based on this process would be executed with potential easement applicants upon approval of this Report by the Assistant Secretary of the Army (Civil Works) and completion of required NEPA analysis. The term of surplus water agreements is for up to a five (5) year period, renewable for up to an additional five (5) year period, subject to recalculation of reimbursement after the initial five (5) year period.

A 10-year study period has been established for the surplus water study and EA. The length of the study period was selected because surplus water agreements may be executed for a five (5) year period, renewable for an additional five (5) year period. In addition, prior to the end of the 10-year study period, the Corps recommends that a comprehensive strategy to address long-term regional water needs be developed that may involve the Administration, Congress and stakeholders. The surplus water agreements executed upon the approval of the Report and EA serve as measures to address temporary water needs of the region during the 10-year study period.

The 62,268 acre-feet/year of yield (160,028 acre-feet/year of storage) evaluated for surplus water use in this EA is an estimate that was selected based on an estimated potential 10-percent growth in future M&I water demand from the existing estimated use of 56,607 acre-feet/year over the 10-year planning period. This amount should ensure that an adequate quantity of water was identified to meet the needs of existing and future M&I water users. The amount has been chosen for the purposes of efficiency and responsiveness and so that potential requests over the period of analysis could be evaluated and approved.

1.2 Authority for the Proposed Action

The Big Bend Dam/Lake Sharpe Project, Surplus Water Report study is being conducted under the authority of Section 6 of Public Law 78-534, the 1944 Flood Control Act. Under Section 6, the Secretary of the Army is authorized to enter into agreements for surplus water with states, municipalities, private concerns, or individuals at any reservoir under the control of the Department of the Army. Specifically, Section 6 states that:

> *"[T]he Secretary of War is authorized to make contracts with States, municipalities, private concerns, or individuals, at such prices and on such terms as he may deem reasonable, for domestic and industrial uses for surplus water that may be available at any reservoir under the control of the War Department: Provided, that no contracts for such water shall adversely affect then existing lawful uses of such water."*

The Corps of Engineers' Planning Guidance Notebook, ER 1105-2-100, page 3-32 paragraph 3-8a states:

> *"The Secretary of the Army can also enter into agreements with states, municipalities, private entities or individuals for the use of surplus water as defined in, and under the conditions described in, Paragraph 3-8b(4). Surplus water can also be used to respond to droughts and other emergencies affecting municipal and industrial water supplies."*

ER 1105-2-100, paragraph 3-8b(4), entitled, "Surplus Water" states:

> *"Under Section 6 of the Flood Control Act of 1944, the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any reservoir under the control of the Department. These agreements may be for domestic, municipal, and industrial uses, but not for crop irrigation."*

ER 1105-2-100, paragraph E-57b(2) states:

> *(2) Classification.*
>
> *(a) Surplus Water will be classified as either:*
>
> *(1) water stored in a Department of Army reservoir that is not required because the authorized use for the water never developed or the need was reduced by changes that occurred since authorization or construction; or*
>
> *(2) water that would be more beneficially used as a municipal and industrial water than for the authorized purpose and which, when withdrawn, would not significantly affect authorized purposes over some specified time period.*
>
> *(b) An Army General Counsel opinion of March 13, 1986, states that Section 6 of the 1944 Flood Control Act empowers the Secretary of the Army to make reasonable reallocations between different project purposes. Thus, water stored for purposes no longer necessary can be considered surplus. In addition, the Secretary*

may use his broad discretionary authority to reduce project outputs, envisioned at the time of authorization and construction, if it is believed that the municipal and industrial use of the water is a higher and more beneficial use….

(3) Requirements and Restrictions. Surplus water declarations will only be made when related withdrawals would not significantly affect authorized purposes. Surplus water agreements shall be accompanied by a brief letter Report similar to reallocation Reports and shall include how and why the storage is determined surplus. Surplus water agreements will normally be for small amounts of water and/or for temporary use as opposed to storage reallocations and a permanent right to that storage. Normally, surplus water agreements will be limited to 5 year periods. Use of the Section 6 authorities should be encouraged only where non-Federal sponsors do not want to buy storage because the need of the water is short term or the use is temporary pending the development of the authorized use. The views of the affected state(s) will be obtained, as appropriate, prior to entering into any agreement under Section 6. The annual price deemed reasonable for this use of surplus water is determined by the same procedure used to determine the annual payment for an equivalent amount of reallocated storage plus an estimated annual cost for operation and maintenance, repair, replacement, and rehabilitation. The total annual price is to be limited to the annual costs of the least cost alternative, but never less than the benefits foregone (in the case of hydropower, revenues forgone).

1.3 Big Bend Dam Project Location, Background, and Overview

Completed in 1964, the Big Bend Dam/Lake Sharpe Project is located in the Missouri River Valley in Buffalo, Hyde, Hughes, Stanley, and Lyman Counties in central South Dakota (Figures 1 and 2). The dam is located at Fort Thompson, South Dakota, approximately 990 miles upstream from the mouth of the Missouri River. Authorized for flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, recreation and other purposes, the Big Bend Dam/Lake Sharpe Project creates an approximately 80 mile long and up to one mile wide pool on the main stem of the Missouri River from Fort Thompson (at the dam) to Pierre, South Dakota (See Figures 1 and 2). The reservoir covers approximately 60,000 acres with about 200 miles of shoreline, and 1.738 million acre-feet of water storage at full pool making Lake Sharpe one of the smaller Missouri River Mainstem Reservoirs. Big Bend Dam was named for the unique bend in the Missouri River seven miles upstream from the dam. At this point in its course, the Missouri River makes almost a complete loop, traveling about 25 miles before returning to the "neck" where the land is only 1 1/2 miles wide. This is the location where steamboat passengers would disembark and walk across the "narrows" for a break in the monotony of the river journey and then wait for the boat to make its way around the "big bend" to pick them up.

The prominent feature of the Big Bend drainage area is the single major tributary, the Bad River. The mouth of the Bad River is located in Fort Pierre, South Dakota, 78 miles upstream from Big Bend Dam and 7 river miles downstream from Oahe Dam. The 3,120- square-mile drainage area of the Bad River is located entirely in western South Dakota The remainder of the Big Bend drainage area, about 2,720 square miles, is drained by numerous small creeks discharging directly in Lake Sharpe. The largest of these is Medicine Knoll Creek, a left-bank tributary having a drainage area of about 800 square miles.

1.3.1 Project Authorization

Big Bend Dam was constructed as part of the Pick-Sloan Plan for development of the upper Missouri River Basin. Comprehensive development was proposed by the U.S. Army Corps of Engineers (Corps) in House Document 475 and by the Bureau of Reclamation (BOR) in Senate Document 191; the coordinated plan was presented to Congress in Senate Document 247 (all 78th Congress, 2nd session). Under this Act, the Corps was given the responsibility for development of projects on the main stem of the Missouri River. Tributary projects were made the responsibility of the Corps if the dominant purpose was flood control.

The Department of the Interior was designated as the marketing agent for all power, beyond project requirements, produced at Corps projects. The Department of the Interior subsequently designated the BOR as the marketing agent for power generated by the main stem projects. The Department of Energy Act (1977 Department of Interior Organization Act) established the Department of Energy and simultaneously withdrew the power marketing function from the Department of Interior and moved it to the new Department of Energy.

The Big Bend Dam/Lake Sharpe Project was authorized by the Flood Control Act of 1944, Public Law (P.L.) 78-534, along with four other Missouri River mainstem projects: Garrison Dam/Lake Sakakawea, Oahe Dam/Lake Oahe, Fort Randall/Lake Francis Case, and Gavins Point Dam/Lewis & Clark Lake. These five mainstem reservoirs are elements of the comprehensive development program in the Missouri River Basin, known as the Pick-Sloan Plan. This comprehensive plan became known as the Pick-Sloan Missouri Basin Program. Fort Peck Dam, located in northern Montana, was constructed prior to the Pick-Sloan Plan, but is operated as part of the Missouri River System.

1.3.2 Authorized Project Purposes

The Big Bend Dam/Lake Sharpe Project is a unit of the comprehensive Pick-Sloan Plan for development in the Missouri River Basin. The operation of the upper Missouri River’s six mainstem reservoirs and the lower Missouri River’s levees and navigation channel provides for flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, water quality, and recreation.

The Missouri River begins at the confluence of the Jefferson, Madison, and Gallatin Rivers, near Three Forks in the Rocky Mountains of southwest Montana. The Big Bend Dam/Lake Sharpe Project is operated as an integral component of the Missouri River Mainstem Reservoir System. To achieve full coordination within the entire Missouri River basin and to meet all of the authorized project purposes, operation of all six mainstem reservoirs is directed by the Missouri River Basin Water Management Division located in Omaha, Nebraska, part of the U.S. Army Corps of Engineers (Corps) Northwestern Division.

The six mainstem reservoirs operated by the Corps are listed in Table 1. Lake Sharpe provides a limited storage contribution to the mainstem system of reservoirs. It is the second smallest of the six reservoirs, with a storage capacity of approximately 1,798,000 acre-feet, which comprises about 2.5 percent of the total 73.1 MAF storage capacity in the mainstem system.

Table 1
Missouri River Mainstem Flood Control Reservoirs

Project (Dam and Reservoir)	Incremental Drainage Area (Square Miles)	Year of Closure	Flood Control and Multiple Use Storage in Acre-Feet (AF)	Total Storage in Acre-Feet (AF)
Fort Peck Dam/ Fort Peck Lake	57,500	1937	2,704,000	18,463,000
Garrison Dam/ Lake Sakakawea	123,900	1953	4,222,000	23,821,000
Oahe Dam/ Lake Oahe	62,090	1958	3,201,000	23,137,000
Big Bend Dam/ Lake Sharpe	5,840	1963	117,000	1,798,000
Fort Randall Dam/ Lake Francis Case	14,150	1952	1,309,000	5,418,000
Gavins Point Dam/ Lewis and Clark Lake	16,000	1955	86,000	450,000

Source: USACE, 2009a.

Figure 1
Omaha District Civil Works Boundary and Mainstem Projects

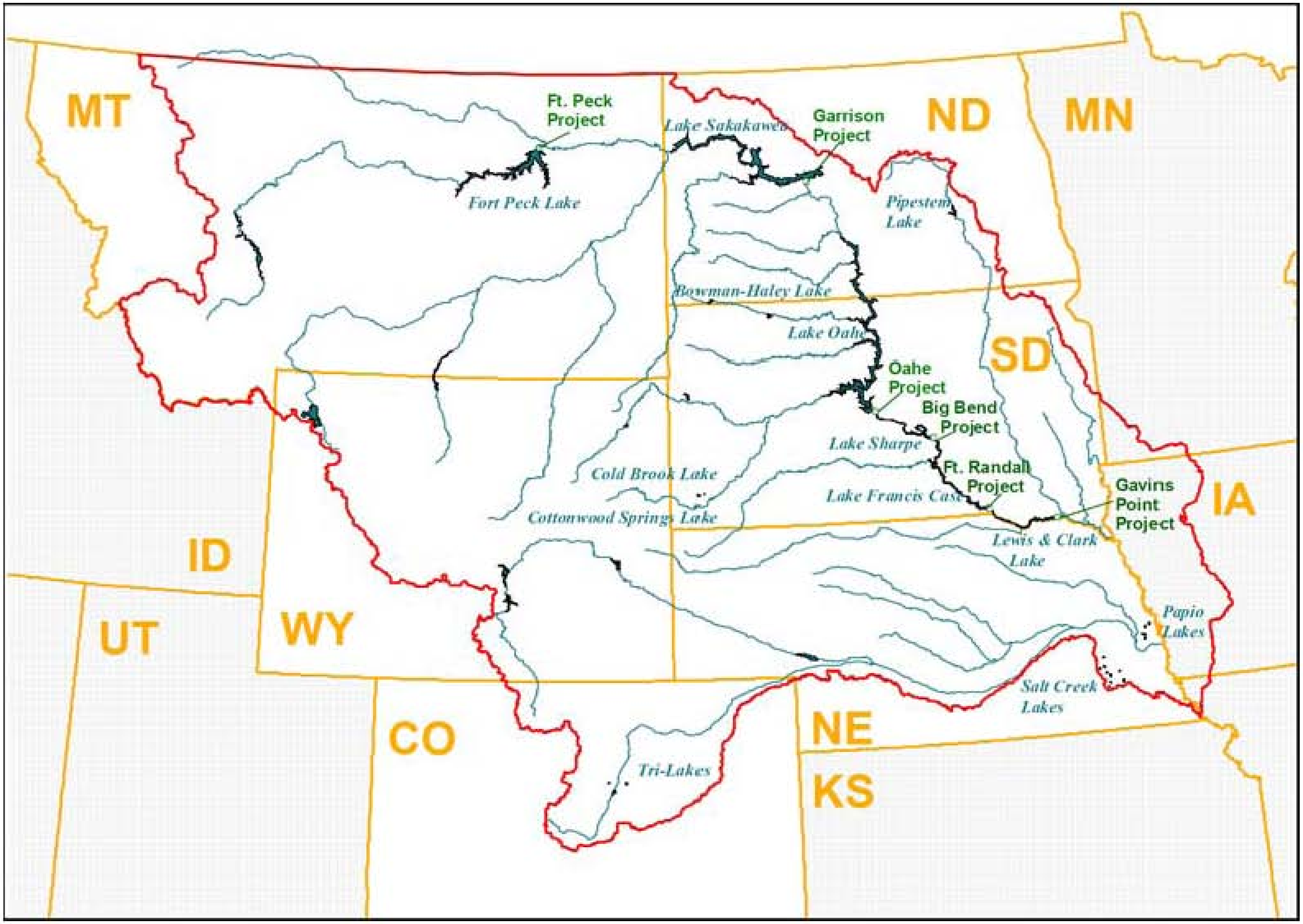
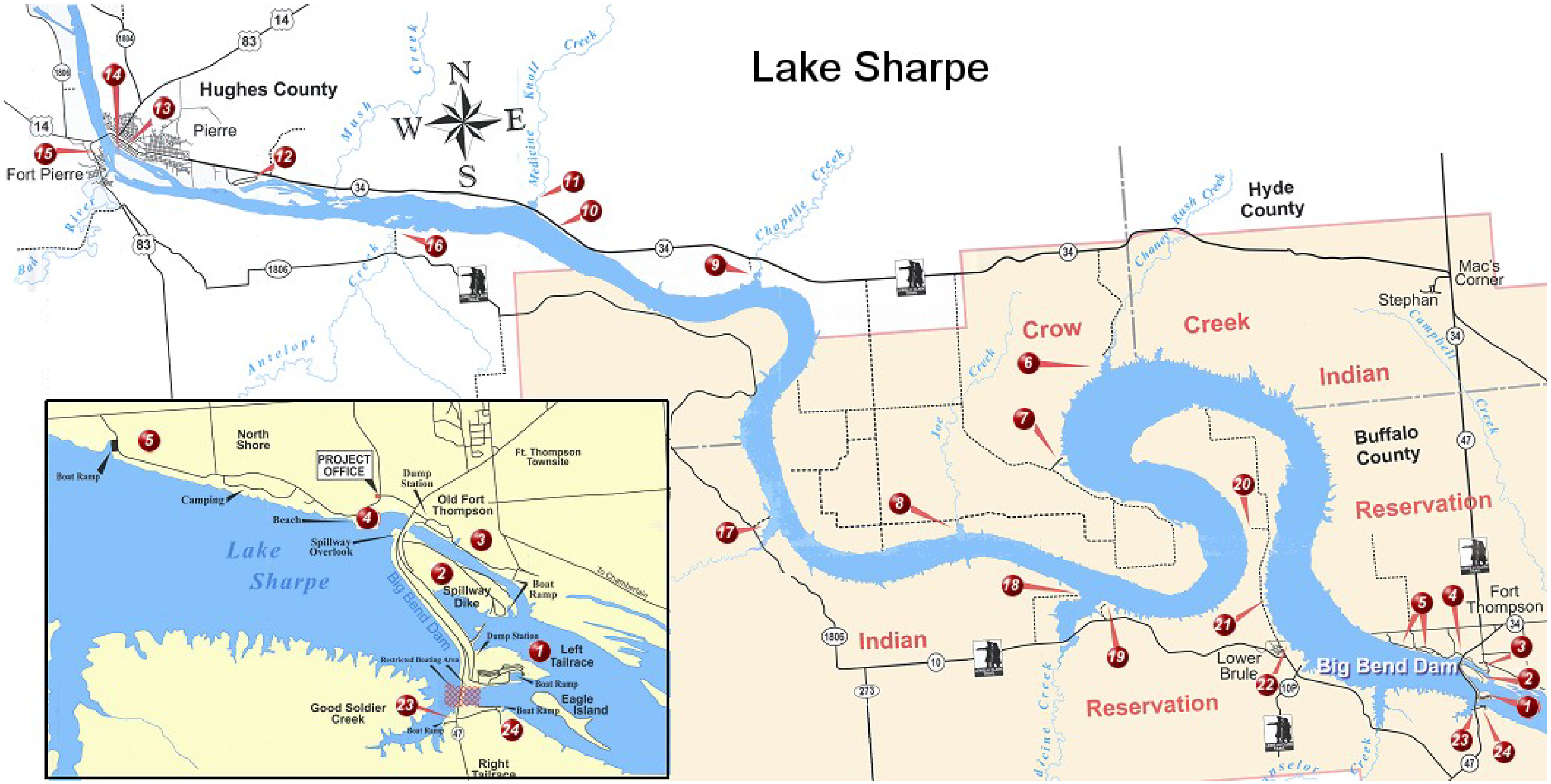


Figure 2
Big Bend Dam/Lake Sharpe Project, South Dakota



Note: The numbered red circles on Figure 2 designate public recreation facilities on Lake Sharpe (www.nwo.usace.army.mil/lake_proj/bigbend/map.html).

1.4 Prior Reports and NEPA Documents

The Army Corps of Engineers and other federal and non-federal entities have prepared a number of documents on the upper Missouri River system. The previous federal and non-federal studies have established an extensive database on the environment in the upper Missouri River system. These references are listed below, and are hereby incorporated-by-reference (40 CFR 1502.21).

- In March 2003, the Kansas City District and the Omaha District published a Final Environmental Impact Statement entitled, "Final Supplemental Environmental Impact Statement for the Missouri River Fish and Wildlife Mitigation Project." The project study area is located along 735 miles of the Missouri River from Sioux City, Iowa to the mouth of the river near St. Louis, Missouri. The purpose of this program was to restore fish and wildlife habitat losses resulting from construction, operation, and maintenance of the Missouri River Bank Stabilization and Navigation Project that provided a navigation channel from Sioux City to the mouth.

- In October 2003, the Omaha District published a Master Plan entitled, "Big Bend Dam/Lake Sharpe Master Plan with Integrated Programmatic Environmental Assessment Missouri River, South Dakota Update of Design Memorandum MB-90." The document was prepared to describe the operational plan and existing environmental conditions for the Big Bend Project in South Dakota.

- In October 2003, the Omaha District published a Master Plan entitled, "Gavins Point Dam/Lewis and Clark Lake Master Plan Missouri River, Nebraska and South Dakota, Update of Design Memorandum MG-123." The document was prepared to describe the operational plan and existing environmental conditions for the Gavins Point Dam/Lewis and Clark Lake in Nebraska and South Dakota.

- In December 2003, the U.S. Fish and Wildlife Service published an amendment to their 2000 Biological Opinion entitled "U.S. Fish and Wildlife Service Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System."

- In March 2004, the Northwestern Division of the Army Corps of Engineers published the Final Environmental Impact Statement for the Missouri River Master Water Control Manual entitled, "Missouri River Final Environmental Impact Statement, Master Water Control Manual Review and Update."

- In February 2006, the Northwestern Division of the Army Corps of Engineers published an Environmental Assessment entitled, "Environmental Assessment for the Inclusion of Technical Criteria for Spring Pulse Releases from Gavins Point Dam." The analysis in the document compares the impacts of the bimodal spring pulse technical criteria with the impacts of the spring pulse alternatives evaluated in the Master Water Control Manual FEIS (USACE, 2004).

- In December 2007, the Omaha District published the Master Plan and integrated Finding of No Significant Impact entitled, "Garrison Dam/Lake Sakakawea Master Plan with Integrated Programmatic Environmental Assessment Missouri River, North Dakota Update of Design Memorandum MGR-107D." The document was prepared to evaluate the environmental impacts associated with management of the Garrison Project in North Dakota.

- In August 2008, the Omaha District published the Master Plan and integrated Finding of No Significant Impact entitled, "Fort Peck Dam/Fort Peck Lake Master Plan with Integrated Programmatic Environmental Assessment Missouri River, Montana Update of Design Memorandum MFP-105D." The document was prepared to evaluate the environmental impacts associated with management of the Fort Peck Project in Montana.

- In January 2010, the Omaha District published the Master Plan and integrated Finding of No Significant Impact entitled, "Preliminary Final Oahe Dam/Lake Oahe Master Plan Missouri River, South Dakota and North Dakota Design Memorandum MO-224." The document was prepared to evaluate the environmental impacts associated with management of the Lake Oahe Project in North and South Dakota.

- In April 2010, the Omaha District published an Environmental Assessment entitled, "Missouri River Recovery Program, Emergent Sandbar Habitat Complexes in the Missouri River, Nebraska and South Dakota, Draft Project Implementation Report (PIR) With Integrated Environmental Assessment." These actions are being undertaken to address endangered species needs and mitigate for the loss of habitat that resulted from construction, operation, and maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP).

- In September 2010, the Omaha District published document entitled, Missouri River Mainstem System, 2010-2011 Draft Annual Operating Plan. The Annual Operating Plan (AOP) presents pertinent information and plans for regulating the Missouri River Mainstem Reservoir System (System) through December 2011 under widely varying water supply conditions. It provides a framework for the development of detailed monthly, weekly, and daily regulation schedules for the System's six individual dams during the coming year to serve the Congressionally-authorized project purposes.

- In October 2010, the Omaha District published an Environmental Impact Statement entitled, "Draft Programmatic Environmental Impact Statement for the Mechanical Creation and Maintenance of Emergent Sandbar Habitat in the Riverine Segments of the Upper Missouri River." This Draft Programmatic Environmental Impact Statement (PEIS) evaluates the potential environmental consequences of implementing the Emergent Sandbar Habitat (ESH) program on the upper Missouri River.

2 Purpose and Need for the USACE Action

2.1 Purpose and Need for the Reallocation of Storage

The purpose of this study is to identify whether there is a quantity of surplus water, as defined in Section 6 of the 1944 Flood Control Act, that the Secretary of the Army can use to execute surplus water supply agreements with water users, and to determine whether the use of surplus water is the most efficient method for meeting regional municipal and industrial (M&I) needs.

There are a total of 45 easements with a total allocation of 56,607 acre feet of yield at Lake Sharpe. Out of the 45 total easements, 1 easement has expired, 10 easements with a total allocation of 10,824.7 acre feet of yield will expire within ten years, 15 easements with a total allocation of 8,603 acre feet of yield will expire after 10 years, and 17 easements with a total allocation of 36,979.3 acre-feet of yield are indefinite and will not expire. Temporary use of 5,661 acre-feet/year of yield (equivalent to 14,548 acre feet of storage) is being evaluated in this analysis.

The 5,661 acre-feet of surplus water yield was selected by the Omaha District based on an estimated potential 10-percent growth in future M&I water demand from the existing total allocation of 56,607 acre-feet over the 10-year planning period. This surplus water determination has been evaluated for the purposes of efficiency and responsiveness, so that storage volume associated with all reasonably foreseeable future surplus water needs over the period of analysis could be evaluated and approved by the Assistant Secretary. Should resource impacts from the temporary use of 5,661 acre-feet/year of surplus water (equivalent to 14,548 acre feet of storage) prove significant, then lesser amounts could be evaluated.

2.1.1 Existing Lake Sharpe Water Users

One hundred and fifteen (115) water supply intakes are located on Lake Sharpe (none are present in Hyde County, SD). These intakes service 75 Lake Sharpe water rights holders, some of whom may share intakes, infrastructure, and easements.[1] Of the 115 water supply intakes, there are 22 water supply intakes serving the Lower Brule Reservation; these include a single municipal intake facility, 20 irrigation intakes, and one domestic intake. Irrigation use is the largest use of Lake Sharpe water (Table 2). Cabin owners own the majority of the domestic intakes, which are generally used in lawn watering, car washing, and fire protection. Domestic intakes along this reach are not generally used to provide drinking water, which is obtained from neighboring towns.[2]

In order to accommodate these water right holders and their intakes, the Corps has issued a total of 45 water intake easements around Lake Sharpe. Of these 45 water intake easements, one has expired, 10 easements with a total allocation of 10,824.7 acre-feet/year are scheduled to expire within the next 10 years, and 17 easements with a total allocation of 36,979.3 acre-feet/year are

[1] The number of Lake Sharpe water rights holders was estimated from state water permit data by identifying all water rights sourced from either Lake Sharpe or the Missouri River within a one mile area around the lake

[2] Missouri River Master Manual, Appendix E, page E-1

scheduled to expire after 10 years, 10 easements with a total allocation of 10,824.7 acre-feet/year are indefinite and will not expire. According to Corps policy, holders of these expired/expiring easements may be required to execute water supply agreements with the Corps of Engineers as a pre-condition to re-issuance of their current easements.

The quantities of water being withdrawn through these easements are difficult to determine from the available data. The Corps keeps records on easement allocations, but does not collect data on actual water usage. Tables 2 and 3 are derived from the South Dakota State Water Rights database. Water *rights* are available from that database, but not actual water *use*. The Corps has developed its own estimate of actual water use at Big Bend Dam/Lake Sharpe based on acre-feet allocations. Table 4 presents this estimate in acre-feet/year by use type. There is no data set that allows direct correlation of state water use permits with Corps easements.

Table 2
South Dakota Water Rights Permits Sourced from Lake Sharpe by Use Type

County	Count	Average (AF)	Sum (AF)
Irrigation	74	1,371	101,466
Rural Water System	1	2,441	2,441
Total	75	1,385	103,907

Table 3
Water Rights Sourced from Lake Sharpe by County

County	Count	Average (AF)	Sum (AF)
Hughes	50	1,217	60,871
Buffalo	11	2,771	30,483
Lyman	9	820	7,380
Stanley	5	1,035	5,173
Hyde	0	0	0
Total	75	1,385	103,907

Table 4
Easements and Acre-Feet/YR at Lake Sharpe

Use-Type	Easements		Acre-Feet/YR	
Irrigation	30	66.7%	49,276	87.1%
Domestic	5	11.1%	177	0.3%
Municipal	1	2.2%	528	0.9%
Rural Water	-	0.0%		0.0%
Industrial	1	2.2%	6,622	11.7%
Other*	2	4.4%	2	0.0%
Unknown	6	13.3%	2	0.0%
Total	45	100.0%	56,607	100.0%

2.1.2 Total Water Supply Demand

The United States Geologic Survey estimates of general water use for the four-county area surrounding Lake Sharpe identify a total use of 183,359 acre-feet in 2005 (USGS, 2005). The five-county study area consists of Buffalo, Hyde, Hughes, Stanley, and Lyman Counties.[3] The estimated area-specific water use data are shown in Table 5. Annual total water use in the 5-county area for 2005 is estimated at just less than 39,000 acre-feet/year. Over 82 percent of the estimated water use in the study area was from surface water. A little over 22 percent of the water use in the study area was for municipal and industrial (M&I) uses and about 85 percent of the M&I water use was from surface water sources.

Table 5
Water Use in the Five-County-Lake Sharpe Area

USGS General Water Use In the Big Bend Area (AF)			
Use	**Ground**	**Surface**	**Total**
Public*	3,889.6	4,719.0	8,608.6
Domestic	145.7	-	145.7
Irrigation	1,614.1	26,117.2	27,731.3
Stock	863.1	1,311.5	2,174.6
Mining	134.5	179.3	313.9
Power	22.4	-	22.4
Total	6,669.4	32,327.1	38,996.5

The 5-county study area is predominantly rural with a 2009 estimated population of 27,075. Population has been relatively stable since 1960. Future growth in demand for non-irrigation

[3] There are no water supply intakes from Lake Sharpe in Hyde County, SD.

water from Lake Sharpe is expected to be minimal. For planning purposes it is anticipated that a quantity of surplus water equivalent to an additional 10-percent of existing water use from Lake Sharpe (or 5,661 acre-feet/year) would be more than sufficient to meet any likely future growth in demand over the next 5-10 years. Overall, it is estimated that 62,268 acre-feet/year of water would meet current (56,607 acre-feet) and potential future (5,661 acre-feet) water needs of the study area.

3 Alternatives Formulation

3.1 Planning Goals and Objectives

The goal of the Surplus Water Report is to determine whether there is surplus water available in the Big Bend Dam/Lake Sharpe Project and to evaluate whether entering into agreements for the use of surplus water from the Project is the most cost effective means of meeting the near-term (10-year) water needs of the study area. The study area is defined as the 5-county area surrounding Lake Sharpe.

National water policy states that the primary responsibility for water supply rests with states and local entities, not the Federal government. However, the Corps can participate and cooperate with state and local entities in developing water supplies in connection with the construction, operation, or modification of Federal navigation, flood damage reduction, or multipurpose projects. Specifically, the Corps is authorized to provide storage in new or existing multipurpose reservoirs for municipal and industrial water supply. However, since water supply is a state and local responsibility, the cost of water supply storage and associated facilities in a Corps project must be paid for entirely by a non-Federal entity.

The Secretary of the Army is authorized to make agreements with states, municipalities and other non-Federal entities for the rights to utilize water supply storage in Corps reservoirs. The Secretary of the Army can enter into agreements with states, municipalities, private entities or individuals for the use of ‘surplus water’. Under Section 6 of the Flood Control Act of 1944, the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any Corps reservoir. Surplus water agreements may be for domestic, municipal, and industrial uses, but not for irrigation.

Planning objectives for this study were developed to be consistent with Federal, State and local laws and policies, and technical, economic, environmental, regional, social, and institutional considerations. The planning objectives were used to help formulate and evaluate plans to avoid, minimize, and mitigate (if necessary), any adverse project impacts to the environment. Planning objectives also provide a decision framework to identify the least cost water supply alternative, avoid adverse social impacts, and meet local preferences to the fullest extent possible.

In pursuit of the project goal, the following Federal planning objectives were established:

- Determine if surplus water is available at the Big Bend Dam/Lake Sharpe Project and determine the storage amount to be evaluated for potential impacts, over the next 10 years;

- Anticipate demand and requests for surplus water agreements at the Project over the 10-year study period, including requests identified within this report and a forecast of additional requests;
- Determine repayment unit costs to apply to surplus water agreements.

Also in pursuit of the project goal, the following regional planning objectives were established:

- Provide sufficient water to meet the needs of existing and prospective applicants for new surplus water agreements at Big Bend Dam/Lake Sharpe for the next 10 years by the most efficient means;
- Provide sufficient water to meet the needs of current Big Bend Dam/Lake Sharpe water supply users whose existing easements will expire within the next 10 years.

This study develops and evaluates alternatives to determine how best to meet potential easement applicants' water needs within the constraints described below. The impacts of entering into agreements for the use of surplus water on other project purposes are assessed so that an optimal alternative that provides needed water supply and does not significantly impact other project purposes may be identified. The impacts assessed in this analysis include effects on: flood control, navigation, irrigation, hydropower, municipal and industrial water supply, fish and wildlife, recreation, water quality, and any associated environmental and economic effects.

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3.2 Management Measures

A management measure is a feature (i.e., a structural element that requires construction or assembly on-site), or an activity (i.e., a nonstructural action) that can either work alone or be combined with other management measures to form alternative plans. Management measures were developed to address study area problems and to capitalize upon study area opportunities. Management measures for this study were derived from a variety of sources including prior studies, agency and public input, and the project delivery team (PDT).

3.2.1 Identification of Management Measures

The following management measures were identified for initial consideration:

Structural Measures (Features)

- Structural modifications to the project to increase storage capacity
- Provision of surplus water from undeveloped irrigation needs system-wide to M&I water supply for up to 10 years, including associated infrastructure (i.e., intakes, pipelines, storage and distribution facilities)
- Groundwater withdrawals, including associated infrastructure
- Surface water withdrawals from the Missouri River upstream or downstream of Lake Sharpe, including associated infrastructure

Non-Structural Measures (Activities)

- Conservation / incentive programs / regulations / public education / drought contingency planning
- Water reuse/recycling
- Sale or lease of existing non-M&I use water right to an M&I use.

3.2.2 Screening of Management Measures

The following sub-sections evaluate and screen each of the structural and non-structural measures identified above to determine which measures should be carried forward in the planning process and included in the formulation of alternatives. The Water Resource Council's Principles and Guidelines[4] identify four criteria to be used in the formulation and evaluation of alternative plans: completeness, effectiveness, efficiency, and acceptability. At this phase of the planning process, management measures are screened, using these four criteria, to determine whether they have the potential to make meaningful contributions to achieving the goals and objectives of the project. While none of these criteria are absolute, it is clearly reasonable to screen out from further consideration any management measure that: 1) does not contribute to meeting study goals and objectives to any significant extent (completeness), 2) is not effective in resolving study area problems and needs (effectiveness), 3) is not an efficient means of solving the problem when compared to other potential measures (efficiency), or 4) is not an acceptable solution to other Federal and non-Federal agencies and affected publics (acceptability).

This is not to imply that some management measures that are screened out from further consideration may not be beneficial public policies or effective solutions to other legitimate problems of the study area. Rather, management measures are screened out from further consideration when it can be reasonably determined that they will not meaningfully contribute to meeting study goals and objectives or resolving the problems and needs that the study was initiated to address.

3.2.2.1 Structural Measures

Four structural measures are considered below. Two structural measures are screened out from further consideration (i.e., structural modifications to the project and surface water withdrawals from free-flowing reaches of the Missouri River). Two structural measures are carried forward into formulation of alternative plans: temporary provision of surplus water from Lake Sharpe and groundwater withdrawals.

Structural Modifications to the Project to Increase Storage Capacity

Corps of Engineers guidance[5] states that existing Corps projects may be modified to add storage for municipal and industrial water supply. Structural measures to increase the storage capacity of

4 Economic and Environmental Principles for Water and Related Land Resources Implementation Studies and The Economic and Environmental Guidelines for Water and Related Land Resources Implementation Studies, U.S. Water Resources Council, February 1983

5 ER 1105-2-100, Planning Guidance Notebook, 22 April 2000, Paragraph 3-8.a.

an existing dam typically include: auxiliary spillways, lined overflow sections, raising the dam, modifications to the existing spillway, and combinations of these measures. Environmental criteria that must be assessed when considering structural measures to increase storage capacity include: avoiding adverse impacts to the environment, mitigating any unavoidable environmental impacts, maintaining water quality and ecosystem functions during and after the modification, and achieving no net loss in environmental values and functions.[6]

The advantages of structural measures to increase storage capacity is that the needs of municipal and industrial water supply can be met without the negative effects on project users associated with taking water storage away from other authorized project purposes. The disadvantages of structural measures to increase storage capacity is that the studies necessary to design such modifications are lengthy and costly; and construction activities are similarly costly, time consuming, and can have significant impacts on the physical and natural environment. As a result, structural modifications to increase storage capacity are typically only considered when municipal and industrial water needs are so significant relative to total existing storage capacity that the effects of providing surplus water from existing storage would render the project unable to meet its authorized project purposes, and where the environmental effects of surplus M&I water use would exceed the environmental effects of structural modifications.

These considerations indicate that structural modifications would not be an effective measure for the Big Bend Dam/Lake Sharpe Project. The amount of water being requested, 62,268 acre-feet/year, is only about 0.4 percent of the net system yield of 15.2 million acre-feet/year, and the 14,548 acre-feet/year of storage required for a net additional depletion of 5,661 acre-feet/year would be less than 0.78 percent of total usable storage in Lake Sharpe. Use of this small portion of total system yield will have negligible impacts on current authorized purposes and on environmental conditions at the project, or in upstream or downstream reaches of the Missouri River. Structural modifications to the project would require a far greater use of resources and cause far greater environmental impacts than would be reasonable for such a small change in system yield.

Structural measures to add additional storage at the Big Bend Dam/Lake Sharpe Project are also not efficient given that surplus water may only be made available for up to 10 years. In order to meet Corps design criteria, structural measures would need to be designed and built to last for the remaining life of the project, which is well in excess of the 10-year maximum term for surplus water. Based on this assessment, structural measures involving modifications to the Big Bend Dam/Lake Sharpe Project to increase storage capacity have been eliminated from further consideration (screened out) for reasons of efficiency, effectiveness, and considerations of adverse effects to the environment.

Surface Water Withdrawals from Free-Flowing Reaches of the Missouri River

A water allocation permit will be required from the State of South Dakota[7]. If channel alterations are necessary, then a regulatory permit must also be obtained from the Corps of

[6] EM 1110-2-2300, General Design and Construction Considerations for Earth and Rock-Fill Dams, 30 July 2004

[7] See Section 2.6 of this report for a discussion of permit requirements in South Dakota.

Engineers. However, no surplus water agreement or easement is required from the Corps of Engineers for water obtained from river reaches not contained within a Corps reservoir or on Corps project lands. Water allocation decisions for free-flowing river reaches, depending on the scope of such a withdrawal, are generally under the purview of the State.

As a general matter the water supply users with active permits, expired or expiring permits, pending permits, or who might request permits for water withdrawals from Lake Sharpe in the future are located adjacent to Lake Sharpe and withdrawal from remote locations upstream or downstream of Lake Sharpe would require extensive pipeline systems to transport the water from the point of withdrawal to the point of use. Based on the distance water would need to be transported, this alternative would be inefficient. Municipal groundwater rights holders in the study area are fairly numerous and are smaller in size than surface water rights holders. Existing M&I use includes 11 surface water rights holders and 54 groundwater rights holders. The average non-project surface water rights holder has an M&I allotment of about 335 acre-feet/year while the average groundwater rights holder has an M&I allocation of about 85 acre-feet/year. Surface water withdrawals from the free flowing reaches of the Missouri River are not carried forward as a viable alternative because surface water withdrawals are inefficient.

Groundwater Withdrawals

As with surface water withdrawals, a water allocation permit will be required from the State of South Dakota[8]. There are currently 92 groundwater rights-holders in the counties surrounding Lake Sharpe. The largest categories of groundwater rights-holders are irrigation and municipal. There are 42 irrigation rights-holders with an average withdrawal right of 702 acre-feet/year and 20 municipal rights-holders with an average withdrawal right of 646 acre-feet/year. Groundwater withdrawal from newly-constructed withdrawal wells is a viable alternative in most areas and is retained for further analysis.

Temporary Use of Surplus Water

Temporary use of surplus water in the Big Bend Dam/Lake Sharpe Project is considered a structural measure. In order to meet the completeness criterion, this measure includes the necessary investments by non-Federal entities to construct water intakes, pipelines, and water depots which may be necessary to deliver the purchased water to the end user.

Lake Sharpe is regulated as an integral component of the system of six main stem dams and lakes on the upper Missouri River. To achieve full coordination along the river, regulation of all six main stem reservoirs is directed by the Missouri River Region Reservoir Control Center located in Omaha, Nebraska.

The pool elevation in Lake Sharpe is held near elevation 1,420 feet mean sea level (msl), except for weekly cycling in response to high power load periods. Under such conditions, normal reservoir levels fluctuate approximately 1 foot from elevation 1,420 feet msl during the course of a week. The storage lost during the week in response to producing peaking-power loads is regained during the succeeding weekend periods of lower power demands. Since the main stem

[8] See Section 2.6 of this report for a discussion of permit requirements in South Dakota.

reservoirs first filled to normal operating levels in 1967, the Lake Sharpe level has fluctuated between a maximum of elevation 1,422.1 to a minimum of 1,414.9 feet msl with an average level of 1,420.4 feet msl.

Lake Sharpe was not intended to provide storage space to serve the Missouri River navigation project, like other main stem projects. However, releases from the main stem reservoirs that are intended to serve downstream navigation are passed through the Big Bend Dam/Lake Sharpe Project.

As noted above the Big Bend Dam/Lake Sharpe Project is operated in a somewhat unique manner in that its pool elevation is very stable and its output reflects the input it receives from its much larger upstream project, Oahe Dam/Lake Oahe. As such, the temporary use of 160,028 acre-feet/year of storage in Lake Sharpe is best viewed in relation to overall system storage (73.1 million acre-feet). Temporary use of 62,268 acre-feet/year of yield (equivalent to 160,028 acre-feet/year of storage) is very small (0.2-percent) relative to the total capacity of the six-project Missouri River System. The upstream flows entering Lake Sharpe provide a reliable source of surplus water that can be used to meet the temporary needs of M&I water users in the 5-county study area surrounding Lake Sharpe. The temporary use of surplus water from Lake Sharpe can be scaled to meet the entire identified water needs, and so fully meets the effectiveness criterion.

The costs of surplus water will include the prorated share of updated project costs, plus the full cost of all necessary infrastructure investments on and off project lands. These costs, when compared to the costs of purchasing water from multiple locations that are more distant from the water supply users, may prove to be the most cost effective means of achieving project objectives, and is therefore tentatively considered to meet the efficiency criterion, subject to more detailed analysis in the comparison of alternative plans.

Provision of surplus water from Lake Sharpe is an acceptable alternative to the State of South Dakota. This has been evidenced by the Governor’s endorsement on public documents, consent at agency meetings, consent at public meetings, and state’s willful collaboration with the Corps’ study. Therefore, it is tentatively considered to meet the criterion of acceptability, subject to further analysis.

Consistent with the criteria of completeness, effectiveness, efficiency, and acceptability, the structural measure of temporary use of surplus water in the Big Bend Dam/Lake Sharpe Project is carried forward for further consideration into the formulation of alternative plans.

3.2.2.2 Non-Structural Measures (Activities)

Three non-structural measures are considered below: conservation / incentive programs, water reuse / recycling, and transfer of water rights from non-M&I use to M&I use). All three non-structural measures are screened out from further consideration.

Conservation/Incentive Programs/Regulations/Public Education/Drought Contingency Planning

The state of South Dakota maintains a variety of water conservation programs. Many of them are run through the county-level soil & water conservation districts. Each county has its own conservation district and each district is required to have a water conservation plan signed by the governing body of the district on file with the Bureau of Reclamations Dakotas Area Office, Great Plains Region. The Bureau also assists the districts' water conservation efforts through a variety of grants and educational programs. Conservation districts also collaborate regionally and nationally through soil & water conservation societies. These organizations share best practices, educational curriculum, technical capacity and other resources with one another. The national organization publishes a monthly "conservogram" which is the Soil and Water Conservation Society's membership newsletter.

Conservation is a viable alternative for dealing with short-term water supply needs and temporary drought conditions but does not provide a complete solution to the water supply needs for existing water supply users with expiring easements and for potential new water supply users. Future without-project conditions assume that future state water planning will continue to address conservation, water use efficiency, drought management and water quality management. It is unlikely that additional efforts in these areas would sufficiently reduce the future needs of existing easement holders, or eliminate the needs of future water users and would therefore not be a complete or effective non-structural solution. Conservation and related activities would therefore be neither complete, nor effective non-structural solutions and are not carried forward for further consideration.

Water Reuse / Recycling

Water reuse / recycling may be a viable alternative for reducing the water supply needs for existing water supply users with expiring easements and for potential new water supply users but does not provide a complete solution for these users. Reused or recycled water is not suitable for M&I use without extensive treatment, however it may be suitable for landscape, but not crop, irrigation.

For reasons of lack of completeness and effectiveness, water conservation, incentive programs, regulations, public education, and drought contingency planning measures, and water reuse and recycling are eliminated (screened out) from further consideration in the formulation of alternative plans.

Conversion of Non- M&I Water Rights to M&I Water Rights

In some states, under certain circumstances, existing water rights for uses such as irrigation, fish and wildlife, and recreation may be converted to M&I use through the sale or lease of water rights. Water rights conversions are subject to regulations and limitations that protect the supply source and existing users. For example, conversions of water rights from irrigation to M&I use are typically at a lower acre-foot allocation for the M&I use because of the lost recharge to groundwater when the use is no longer irrigation. Conversion of water rights to M&I use does not occur very often.

Within the study area, there have been no conversions to municipal or industrial permits anytime in the last 37 years, since records began being kept. There have been about 25 conversions in the western part of the state near Rapid City. There conversions were spread out over about 20 years and total about 5,000 acre-feet/year.

In this largely agricultural study area, adequate irrigation water rights and irrigation water use are important inputs into agricultural production. It is unlikely that irrigation water rights would be available for conversion to M&I use in quantities that would meet the projected increase in demand. This alternative is not carried forward to further analysis because it would be ineffective in meeting the projected increase in demand

4 Alternatives Including the Proposed Action

The alternatives studied in detail include the No Action – Next Least Costly Alternative and the Proposed Action. For comparison purposes, both alternatives describe the most likely means of providing 62,268 acre-feet/year of water to meet the current (56,607 acre-feet/year) and potential future water needs of the study area (5,661 acre-feet/year). The No Action – Next Least Costly Alternative is development of new, non-Project groundwater sources in a manner similar to existing M&I groundwater use in the study area (5,661 acre-feet/year), and continuation of existing use sourced from the reservoir (56,607 acre-feet/year). The Proposed Action includes temporary use of 62,268 acre-feet/year of surplus water in the Big Bend Dam/Lake Sharpe Project (56,607 acre-feet/year of which is continuation of existing use sourced from the reservoir).

4.1 Most Likely Future Without Project Condition - No Action Alternative

Under the without-project condition, the No Action alternative for providing an additional 5,661 acre-feet/year of water (beyond existing use) for M&I use is based on the characteristics of existing M&I use and users in the study area. Existing M&I use includes five surface water rights holders and 40 groundwater rights holders. The average non-project surface water rights holder has an M&I allotment of about 611 acre-feet/year while the average groundwater rights holder has an M&I allocation of about 340 acre-feet/year. The characteristics of existing M&I users indicate that future M&I users are more likely to be groundwater-sourced M&I users. The No Action alternative could be reasonably represented by 17 groundwater-sourced M&I users with 340 acre-feet/year allocations each. The No Action alternative also includes continuation of existing use of 56,607 acre-feet/year, which is assumed to continue to be sourced from Lake Sharpe.

4.2 Proposed Action-Use of Surplus Water

The proposed action for the Army Corps of Engineers would be to identify surplus water, as defined in Section 6 of the 1944 Flood Control Act, which the Secretary of the Army can make available to execute surplus water supply agreements with existing and prospective M&I water users for up to 62,626 acre-feet/year of yield (equivalent to 160,028 acre-feet/year of storage) from Big Bend Dam/Lake Sharpe.

The 62,626 acre-feet/year of surplus water yield was selected by the Omaha District based on an estimated potential 10-percent growth in future M&I water demand from the existing total estimated use of 56,607 acre-feet/year over the 10-year planning period. This surplus water determination was evaluated for the purposes of efficiency and responsiveness, so that storage volume associated with future surplus water needs over the period of analysis could be evaluated and approved by the Assistant Secretary. Should resource impacts from the temporary use of

62,626 acre-feet/year of surplus water (equivalent to 160,028 acre-feet/year of storage) prove significant, then lesser amounts could be evaluated.

All future easements and water supply agreements require review by the Corps of Engineers prior to allowing placement of infrastructure. In this process, the Corps would complete NEPA evaluations on water intake and distribution infrastructure installation and operation. In addition, connected actions related to the water's intended use would be considered if the future use differed from existing usage. Within the environmental review process, the Corps would comply with the appropriate environmental laws and regulations.

5 Scope of the Analysis and Missouri System Overview

5.1 Scope of the Analysis

5.1.1 Context and Intensity

The National Environmental Policy Act (NEPA) and the Council on Environmental Quality's Implementing Regulations require that an Environmental Assessment identify the likely environmental effects of a proposed project and that the agency determine whether those impacts may be significant. The determination of whether an impact significantly affects the quality of the human environment must consider the *context* of an action and the *intensity* of the impacts (40 CFR 1508.27).

The term *context* refers to the affected environment in which the proposed action would take place and is based on the specific location of the proposed action, taking into account the entire affected region, the affected interests, and the locality. The term *intensity* refers to the magnitude of change that would result if the proposed action were implemented.

Determining whether an effect significantly affects the quality of the human environment also requires an examination of the relationship between *context* and *intensity*. In general, the more sensitive the context (i.e., the specific resource in the proposed action's affected area), the less intense an impact needs to be in order for the action to be considered significant. Conversely, the less intense of an impact, the less scrutiny even sensitive resources need because of the overt inability of an action to effect change to the physical environment. The consideration of context and intensity also must account for the indirect and cumulative effects from a proposed action.

5.1.2 Direct, Indirect, and Cumulative Effects

Direct effects are caused by the action and occur at the same time and place (40 CFR 1508.8) and would include effects to the environment within the footprint of disturbance for construction and operation of new water supply intakes at Lake Sharpe. Indirect effects are caused by the action, but typically occur later in time or are farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). For example, the indirect effect of the determination of surplus water in Lake Sharpe could include the granting of future easements for intake construction and the construction and use of water intakes and distribution. Indirect effects could also include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or the growth of industry.

A cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions” (40 CFR§1508.7). Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. These actions include on-site or off-site projects conducted by government agencies, businesses, or individuals that are affecting or would affect the same environmental resources as would be affected by the proposed action.

5.1.3 Scope of Analysis

As of May 2011, there were no pending requests for new M&I water supply easements at Lake Sharpe. In the absence of applications for new easements, construction and operation of new intake infrastructure is not reasonably foreseeable at this time. Evaluating the environmental consequences of theoretical new intakes, without any applicants requesting easements, would be too speculative to be meaningful. Therefore, the scope of analysis in the EA does not assess direct effects of new water supply intakes or water distribution systems, because there are none currently planned or reasonably foreseeable.

In addition, meetings with representatives of South Dakota confirmed that there are neither pending applications for easements, nor any known demand for industrial uses of surface water (e.g., ethanol processing plant, coal plant) from Lake Sharpe. Therefore, there is no reasonably foreseeable future industrial or municipal use for which, the environmental consequences of these connected actions could be reasonably evaluated in this EA.

Without easement applications for new water intakes and no plans for M&I usage for surface water from Lake Sharpe, the scope of the analysis is limited to the environmental effects of the depletions. Only effects that are reasonably foreseeable need be addressed in a NEPA analysis; impacts that are speculative and that depend on actions that are remote or hypothetical need not be considered. As such, the scope of the environmental analysis in this EA evaluates the indirect and cumulative effects of the depletions of the surplus water. For the proposed action, the area of potential influence for the analysis of effects consists of:

- Where depletions from Lake Sharpe would result in changes to the water surface elevation;
- Where depletions from Lake Sharpe would result in changes to the releases from the Big Bend Dam; and
- Where depletions from Lake Sharpe would result in changes to the releases from, and water surface elevations in the other Missouri River System reservoirs (Fort Peck, Garrison, Oahe, Fort Randall, and Gavins Point Dams); and
- Where the depletions from Lake Sharpe and the other Missouri River System reservoirs (Fort Peck, Garrison, Oahe, Fort Randall, and Gavins Point Dam) would result in changes to flow and water surface elevations downstream in the Missouri River (cumulative effects).

All future easements and water supply agreements would require review by the Corps of Engineers prior to allowing placement of infrastructure. In this process, the Corps would complete NEPA evaluations and comply with all appropriate environmental laws and regulations.

The proposed action being evaluated in this EA is the identification of surplus water in the Lake Sharpe/ Big Bend Dam Project in order to provide surplus water to M&I users in the vicinity. Because there are no applications currently before the Corps of Engineers for intakes at Lake Sharpe and there are no known industrial users identified or reasonably foreseeable, there are no induced effects evaluated or identified in this EA.

The decision to identify surplus water in Lake Sharpe would not result in direct environmental effects. However, USACE decision making to implement the proposed action could be *connected* (40 CFR 1508.25(a)(1)) to potential increased depletions from the reservoir and those depletions are the focus of the environmental analysis.

5.1.4 5,661 Acre-Feet/Year of Additional Depletions in Context

The Proposed Action for this EA is the temporary use of up to 62,268 acre-feet/year of yield (equivalent to 160,028 acre-feet/year of storage) from the Big Bend Dam/Lake Sharpe Project to meet municipal and industrial (M&I) water supply needs in the region over a 5-10 year period. The temporary use of 62,268 acre-feet/year of surplus water in Lake Sharpe would result in additional net annual depletions of 5,661 acre-feet from the system for the ten year period, beyond existing usage levels. The primary difference between with and without project conditions is that under without project conditions, the additional 5,661 acre-feet/year would come from groundwater sources and under with-project conditions, withdrawal of the additional 5,661 acre-feet/year would come from the Big Bend Dam/Lake Sharpe Project. This section is included to provide the reader with a context within which to understand the relative magnitude of the changes in the Missouri River and the Big Bend Dam/Lake Sharpe that are being proposed.

The proposed temporary use of the additional 5,661 acre-feet/year of water from Lake Sharpe would be a total depletion allowance that the easement holders would be allowed to remove over the span of a year. Daily (and yearly) withdrawals from the various intakes would be small relative to the total storage in the reservoir. To put 5,661 acre-feet per year into a daily context, a withdrawal of 7.8 cubic feet per second, every day for an entire year, would yield 5,661 acre-feet of water. So, if water withdrawals were uniformly removed from Lake Sharpe throughout the year, there would be 7.8 fewer cubic feet per second less water available for discharge at any given moment from the Big Bend Dam as a result of the proposed action.

From 1967 through 2002, annual release duration relationships from the Big Bend Dam/Lake Sharpe Master Plan recorded a maximum discharge of 74,300 CFS and a minimum of 200 CFS from the dam (USACE, 2003). If the depletions from the proposed action resulted in 7.8 CFS less being available for discharge, the potential decrease in the maximum daily release would be 0.01-percent less than the maximum flow and 3.9-percent less than the minimum flow.

This simple illustration assumes that no changes would be made in reservoir operations to adjust for the additional 5,661 acre-foot/year depletion. In fact, adjustments would not need to be made in the vast majority of cases, because the 5,661 acre-foot/year depletion represents approximately 0.8-percent of total storage in a reservoir that holds nearly 1,798,000 acre-feet. As proposed, the 5,661 acre-feet/year in additional depletions represent a small change relative to the scale of the normal operations of the Big Bend Dam and the entire reservoir system. Actual operational changes in release rates are typically made in hundreds and thousands of cubic feet per second, therefore, the effects on pool levels and reservoir outflow would be very small.

5.2 Missouri River System Description and Operation

The Missouri River System, including Lake Sharpe, is operated such that depletions could result in changes to all reservoirs and riverine sections. In other words, because of how the system is managed, water withdrawn from Lake Sharpe results in changes throughout the system. Understanding the routine aspects of System operation is important in order better understand the predicted effects from the removal of water from Lake Sharpe. The rest of this section contains detailed information on the entire System and System operations. It has been included in order provide a basis for understanding how the system is operated so that the consequence assessment, where depletions from Lake Sharpe have system-wide consequences, can be understood.

As originally shown in Figure 1, there are six Corps dams spanning the Missouri River control runoff from approximately half of the basin. Those six dams, from the upper three giants of Fort Peck in eastern Montana, Garrison in central North Dakota and Oahe in central South Dakota, to the lower three smaller reservoirs of Big Bend and Fort Randall in South Dakota, and Gavins Point along the Nebraska-South Dakota border, comprise the largest system of reservoirs in the United States (USACE, 2007c).

As shown in Table 6, the storage capacity of the six reservoirs ranges from over 23 MAF at Garrison and Oahe, to less than 0.5 MAF at Gavins Point. The System is also unique in the fact that 88-percent of the combined storage capacity is in the upper three reservoirs of Fort Peck, Garrison, and Oahe (USACE, 2007c). The lower three projects, Big Bend, Fort Randall, and Gavins Point, are regulated in much the same manner year after year regardless of the runoff conditions (USACE, 2007c).

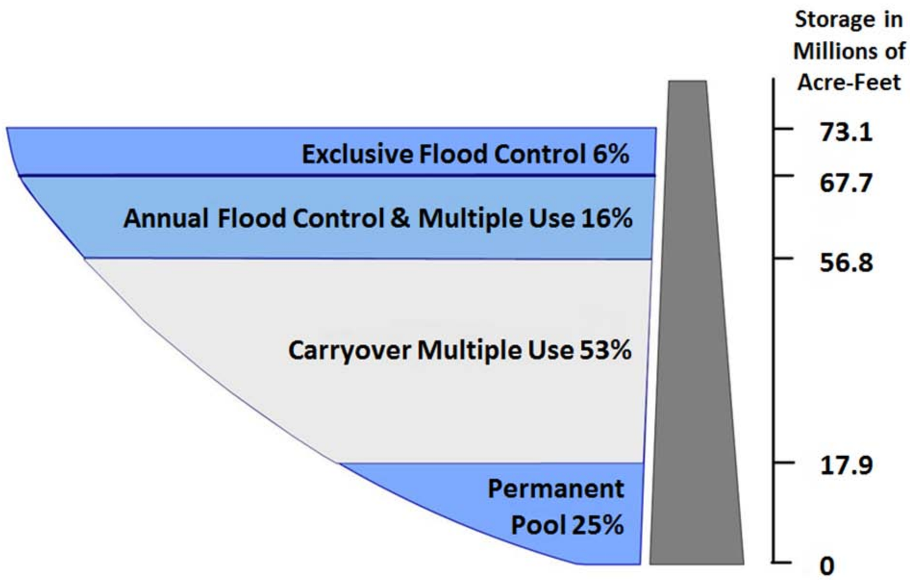
Table 6
Reservoir Storage Zones

Project	Top of Permanent		Top of Carryover Multiple Use		Top of Flood Control & Multiple Use		Top of Exclusive Flood Control	
	Cumul Storage (MAF)	Elev (ft MSL)	Cumul Storage (MAF)	Elev (ft MSL)	Cumul Storage (MAF)	Elev (ft MSL)	Cumul Storage (MAF)	Elev (ft MSL)
Fort Peck	4.2	2160.0	15.0	2234.0	17.7	2246	18.5	2250
Garrison	5.0	1775.0	18.1	1837.5	22.3	1850	23.8	1854
Oahe	5.4	1540.0	18.8	1607.5	22.0	1617	23.1	1620
Big Bend	1.6	1420.0	1.6	1420.0	1.7	1422	1.8	1423
Randall	1.5	1320.0	3.1	1350.0	4.4	1365	5.4	1375
Gavins Point	0.3	1204.5	0.3	1204.5	0.4	1208	0.5	1210
Total System	18.0		56.9		68.7		73.1	

As shown in Figure 3, the entire System's storage capacity is divided into four unique storage zones for regulation purposes; information on the unique storage zones for each of the six individual reservoirs is provided on Table 2. The bottom 25-percent of the total System storage capacity comprises the permanent pool designed for sediment storage, minimum fisheries, and minimum hydropower heads (USACE, 2007c). The largest zone, comprising 53-percent of the total storage capacity, is the carryover-multiple use zone which is designed to serve all project purposes, though at reduced levels, through a severe drought like that of the 1930's (USACE, 2007c).

The annual flood control and multiple use zone, occupying 16-percent of the total storage capacity, is the desired operating zone of the System (USACE, 2007c). Ideally the System is at the base of this zone at the start of the spring runoff season (March 1st of each year). Spring and summer runoff is captured in this zone and then metered out throughout the remainder of the year to serve the other project purposes, returning the reservoirs to the base of this zone by the start of the next runoff season (USACE, 2007c). The top 6-percent of the System storage capacity is the exclusive flood control zone. This zone is used only during extreme floods, and evacuation of this zone is initiated as soon as downstream conditions permit (USACE, 2007c).

Figure 3
Missouri River System Storage Zones



Overall System regulation follows the "water control plan" presented in the Master Water Control Manual (USACE, 2007b). Each of the six System dams also has an individual water control manual that presents more detailed information on its regulation. System regulation is in many ways a repetitive annual cycle; most of the year's water supply is produced by runoff from winter snows and spring and summer rains which increase System storage. After reaching a peak, usually during July, System storage declines until late in the winter when the cycle begins anew. A similar pattern may be found in releases from the System, with the higher releases from mid-March to late-November, followed by low rates of winter discharge from late-November until mid-March, after which the cycle repeats (USACE, 2007c).

The water control plan is designed to achieve the multipurpose objectives of the System given these cyclical events. The two primary high-risk flood seasons are the plains snowmelt season, (late February through April) and the mountain snowmelt period (May through July). Runoff during both of these periods may be augmented by rainfall. The winter ice-jam flood period extends from mid-December through February. The highest average power generation period extends from mid-April to mid-October, with high peaking loads during the winter heating season (mid-December to mid-February) and the summer air conditioning season (mid-June to mid-August).

The major maintenance periods for the System hydropower facilities extend from March through mid-May and September through November, which normally are the lower demand and off-peak energy periods. The normal 8-month navigation season extends from April 1st through November 30th during which time System releases are scheduled, in combination with downstream tributary flows, to meet downstream target flows. Winter releases after the close of navigation season are much lower, and vary depending on the need to conserve or evacuate System storage while managing downstream river stages for water supply given ice conditions (USACE, 2007c). Minimum release restrictions and pool fluctuations for fish spawning management generally occur from April through June. Gavins Point spring pulses, which are designed to cue spawning of the endangered pallid sturgeon, are provided in March and May with the flow magnitude, duration, and timing based on System storage, runoff forecast, and other criteria (USACE, 2007c). Nesting of the two federally protected bird species, the endangered interior least tern and the threatened piping plover, occurs from early May through mid-August.

Other factors may vary widely from year to year, such as the amount of water in storage and the magnitude and distribution of inflow received during the coming year. All of these factors affect the timing and magnitude of releases throughout the System. The gain or loss in the water stored at each reservoir must also be considered in scheduling the amount of water transferred between reservoirs to achieve the desired storage levels and to generate power. These items are continually reviewed as they occur and are appraised with respect to the expected range of operations (USACE, 2007c).

5.2.1 Intrasystem Regulation

Intrasystem regulation is an important tool in the management of water in the System to meet the authorized purposes. It is used to regulate individual reservoir levels in the System to balance or unbalance the water in storage at each project, to smooth the annual System regulation by anticipating unusual snowmelt runoff, to maintain the seasonal capability of the hydropower system, and to improve conditions for the reservoir fish spawn and recruitment. It also can be used to maintain stages on the open river reaches between projects at desirable levels. Intrasystem adjustments may also be used to meet emergencies, including the protection of human health and safety, protection of significant historic and cultural properties, or to meet the provisions of applicable laws including the Endangered Species Act (USACE, 2007c). These adjustments are made to the extent reasonably possible after evaluating impacts to other System uses, are generally short term in nature, and continue only until the issue is resolved (USACE, 2007c).

The presence of large reservoirs in the System increases intrasystem regulation flexibility. A small reservoir such as Big Bend or Gavins Point with storage of less than one-half million acre-feet can only tolerate a large difference between inflow and release for less than a day. To a lesser extent, Fort Randall operates similarly, although its carryover-multiple use and annual flood control and multiple use storage of nearly 3 MAF make possible significant storage transfers and flow differentials extending a month or more (USACE, 2007c). But it is the upper three large reservoirs of Fort Peck, Garrison, and Oahe, with their combined 37.4 MAF of carryover multiple-use storage plus an additional 10.1 MAF of annual flood control multiple-use storage, that provide the flexibility to adjust intrasystem regulation to better serve authorized purposes (USACE, 2007c).

5.2.1.1 Seasonal Intrasystem Regulation Patterns

Intrasystem regulation to meet the needs of power generation follows a regular seasonal cycle. Releases from Gavins Point are generally at their highest during the navigation season when downstream flow requirements are highest. Since Gavins Point reservoir is small, these releases must be backed up with similar magnitude releases from Fort Randall, and Fort Randall, in turn, requires similar support flows from Oahe via Big Bend. Here the chain can be interrupted; Oahe is large enough to support high releases for extended periods without high inflows. Power generation at Fort Peck and Garrison are held to lower levels during the summer to allow more winter hydropower production unless the evacuation of water accumulated in the flood control zones or the desire to balance or unbalance storage among the upper three projects becomes an overriding consideration (USACE, 2007c).

5.2.1.2 Winter Release Patterns

With the onset of the non-navigation season, conditions are reversed. Gavins Point releases drop to about one-third to slightly greater than half of summer levels and the chain reaction proceeds upstream, curtailing daily average discharges from Fort Randall, Big Bend, and Oahe (USACE, 2007c). During the winter release pattern, Fort Peck and Garrison daily releases are usually maintained at relatively high levels (within the limits imposed by downstream ice cover) to partially compensate for the reduction of generation downstream where high winter releases could result in significant flood damages in urban areas when the formation of ice impedes the flow (USACE, 2007c).

5.2.1.3 Balancing/Unbalancing the Upper Three Reservoirs

In the past, the volume of water stored in each of the upper three reservoirs was balanced by the first of March of every year (USACE, 2007c). However, intentionally unbalancing the water stored in the upper three reservoirs can benefit the reservoir fisheries and increase tern and plover habitat. All Annual Operating Plans since the 2000-2001 report have stated that unbalancing would be pursued during years when the reservoirs were at or near the base of their annual flood control pools on March 1st and when runoff forecasts were for median or greater annual runoff. However, drought conditions have prevented implementation of reservoir unbalancing to date (USACE, 2007c).

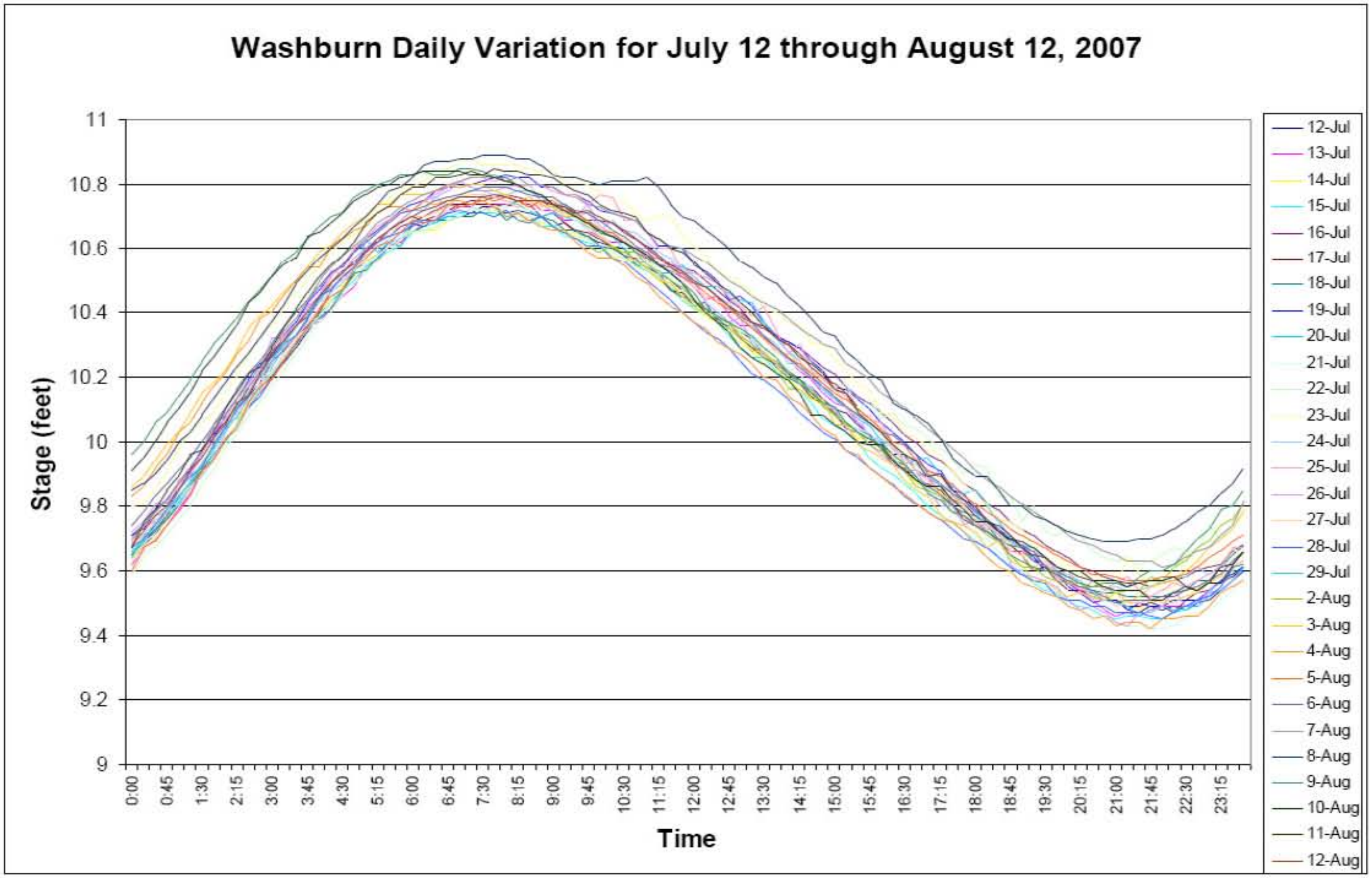
5.2.1.4 Short Term Intrasystem Adjustments

The interaction among projects described above, repeated as it is year after year, might make intrasystem regulation appear to be a routine and rigid procedure. However, routine regulation is often disrupted by the short-term extremes of nature. For example, heavy rains may raise river stages near the flood level, necessitating a release reduction at one project and a corresponding increase at others. Very hot or very cold weather may create sharp increases in the demand for power. Inflows for a week or for a season may concentrate disproportionately in one segment of the System, causing abrupt shifts in regulating objectives. In addition, short-term intrasystem adjustments are occasionally required to meet emergencies, including the protection of human health and safety, protection of significant historic and cultural properties, or to meet the provisions of applicable laws, including the Endangered Species Act. These adjustments are made to the extent possible after evaluating impacts to other System uses, are generally short term in nature, and continue only until the issue is resolved (USACE, 2007c). However, meeting the needs for short term intrasystem adjustments lead to great variability in releases and pool elevations year-to-year.

5.2.1.5 Hourly Fluctuation of Release Rates

With the exception of the Gavins Point Project, hourly release rates may vary widely as necessary to meet fluctuating power loads (USACE, 2007c) at all of the other projects (Fort Peck, Garrison, Oahe, Big Bend, and Fort Randall). Known as “power pulsing,” this daily practice for the upstream System reservoirs produces predictable, daily, and distinct changes to releases and the associated water surface elevations in the riverine reaches between power pulsed reservoirs. Figure 4 shows the daily stage variation at the Washburn, ND river gage, downstream of the Garrison Dam, for a one-month period between July 12 and August 12, 2007 (USACE, 2010). This figure is provided as an example to show the daily fluctuation in water surface elevation at the Washburn gage with daily highs around 10.7 feet and daily lows of approximately 9.5 feet. The daily effect to river stage of power pulsing at this gage shows a 1.2-foot up-and-down differential in the water surface elevation due to the changes to releases from Garrison Dam. The amplitude of these changes varies by reach, but power pulsing results in substantial daily variation in both flow and water surface elevation in the riverine reaches above the Gavins Point Reach.

Figure 4
Daily Stage Variation for a 31-Day Period Downstream of Garrison Dam



6 Affected Environment and Environmental Consequences

Use of the Daily Routing Model (DRM) to Predict Hydrologic Changes

The Daily Routing Model (DRM) (USACE, 1998) was used as an analytical tool in this assessment to estimate the hydrologic effects that an additional 5,661 acre-feet/year of depletions would have at Lake Sharpe, the other system reservoirs, and free-flowing reaches of the Missouri River. Modeling of the movement of the water through the entire Missouri River Reservoir System was accomplished using the DRM, which was developed during the 1990s as part of the Master Manual Review and Update Study. An 80-year period was selected as the period of record because this is the period that daily data are available on Missouri River inflows and flows. Daily records are available for the six dams since their respective dates of closure, and daily flow data are available for the majority of gaging stations since 1930 (USACE, 1998). The depletion and capacity curve data (computed using the sedimentation rate data) were the input files that were used to project elevation and flow for without and with project conditions.

The DRM was developed to simulate and evaluate alternative System regulation for all authorized purposes under a widely varying, long-term hydrologic record. The DRM is a water accounting model that consists of 20 nodes, including the six System dams and 14 gaging stations as shown in Figure 5. In the DRM, each of the six System reservoirs was modeled and the DRM provides output at locations (nodes) along river reaches between System projects: Wolf Point and Culbertson, Montana, and Williston and Bismarck, North Dakota; and ten locations along river reaches below the System: Sioux City, Iowa; Omaha, Nebraska City and Rulo, Nebraska; St. Joseph, Kansas City, Waverly, Boonville, and Hermann, Missouri on the Missouri River and St. Louis, Missouri on the Mississippi River.

The DRM is a time-series analysis that simulates hydrologic output on a daily basis for each of the 80 years modeled from 1930 through 2009, assuming that the entire System was in place and fully operational for the full 80-year period. As the depletion and capacity curve data are varied between the evaluation years for this analysis (i.e., 2010 and 2020), the DRM computes system storage, reservoir elevation, reservoir release, reservoir evaporation, and river flow data for each day of the modeling period. Hydraulic impacts (changes to water surface elevations (WSE) in riverine reaches of the Missouri River) were estimated externally to the DRM model by combining DRM hydrologic output on streamflow with stage-discharge relationships provided at the DRM-modeled riverine nodes by the Omaha District.

Each DRM run provides 29,220 simulated values (80 years of daily values) for each parameter (i.e., water surface elevation, reservoir volume, and streamflow) at the 20 locations/model nodes in the system. These data should not be considered as estimates of actual calendar day values, but rather as simulation output values under the full range of climatological conditions existing over the 80-year period.

Figure 5
Model Node Locations for the Daily Routing Model

To evaluate differences between two alternatives, the differences between each of the 29,220 daily values were determined and then sorted to establish a frequency distribution of modeled values. The distributions of the differences from the current conditions (without the additional depletions) for various DRM outputs (water surface elevation, reservoir volume, and streamflow) were then examined. Comparing the data distributions in this manner provides insight as to how the increased depletion scenario impacts the likelihood of occurrence of a given water surface elevation, reservoir volume, and streamflow over the entire 80-year period. Similarly, it can provide an estimate of the likelihood of a given magnitude of change in each parameter between No Action and with project conditions. It should be noted that the x axis on all of the distribution plots are percent of the days, where 10 percent represents 2,922 days of the full 29,220 days of the 80-year period of record.

To examine the effects of just the additional depletions directly from System reservoirs, the simulations for one study year (2010) were completed under three separate planning scenarios: 1) baseline depletions (without project current condition), 2) 5,661 acre-feet/year of additional depletions at Lake Sharpe (with project condition), and 3) 17,156 acre-feet/year of depletions (including 5,661 acre-feet/year at Lake Sharpe and varying amounts totaling an additional 12,593 acre-feet/year from the other five system reservoirs) to evaluate the cumulative effects of removing an additional 17,156 acre-feet/year of water from all six System reservoirs The model assumes that the historic System inflow data, adjusted assuming the depletions associated with current development in the basin, occurred over the 80-year modeling period.

The source of the actual System inflow data is the U.S. Geological Survey, which began acquiring daily data beginning in late 1929. The DRM adjusts these inflow data by the difference for depletions that have been estimated to occur between each year and 2002. The Bureau of Reclamation provided the monthly depletions, and these monthly data were further separated to daily values for use in the DRM. The 2002 depletion data are assumed to remain constant through 2010 (assumes no change from 2002 to 2010). The depletion data are adjusted upwards to 2020 by including other forecasted depletions (basin projects, population/M&I growth, and the Northwest Area Water Supply (NAWS) project). Simulations, including these projected additional system depletions for 2020, were used in the assessment of cumulative effects.

Modeled Differences: Depletions from Lake Sharpe

Because the Missouri River reservoirs are operated as an integrated system, the additional 5,661 acre-feet/year of yield from Lake Sharpe could conceivably reduce outflows and water surface elevations not just in Lake Sharpe, but also in the other five System reservoirs. Changes in water surface elevations have the potential to affect environmental resources throughout the system and the magnitude of predicted environmental consequences is proportional to the predicted changes. However, as stated in Section 5, the determination of whether an impact significantly affects the quality of the human environment must consider the *context* of an action and the *intensity* of the impacts (40 CFR 1508.27). The less intense of an impact, the less scrutiny even sensitive resources need because of the overt inability of an action to effect change to the physical environment.

Figures 6, 7, and 8, present the distributions (daily differences redistributed from minimum to maximum over the 29,220 daily values) of the differences in releases (KCFS, thousands of cubic feet per second) between No Action and the Proposed Action (additional 5,661 acre-foot/year depletion from Lake Sharpe) for Ft. Peck, Garrison, Oahe, and Gavins Point Dams, respectively. The acronym "BBWP" is an abbreviation for "Big Bend with Project" or the Proposed Action. DRM simulated discharge differences appear to be essentially unaffected from these three dams for about 95-percent of the days. The differences at each end of the distribution are dramatically larger; however, they are for a very few days of the 80-year period of record. Many of those for Fort Peck, Garrison, and Oahe Dams are due to the DRM selecting a release change at a slightly different time, resulting in a large difference of a day or two, or due to the selection of a different release for a short period because there is less or more water to move to balance the amount of water in storage among these three reservoirs. The difference at the ends of the distribution of the Oahe Dam figure are for only a few days, indicating that releases to the three lower reservoirs and the lower Missouri River are relatively unaffected by the removal of the additional 5,661 acre-feet of water from Lake Sharpe on an annual basis.

Figure 6
Fort Peck: Release-Difference Distribution - Proposed Action Minus No Action

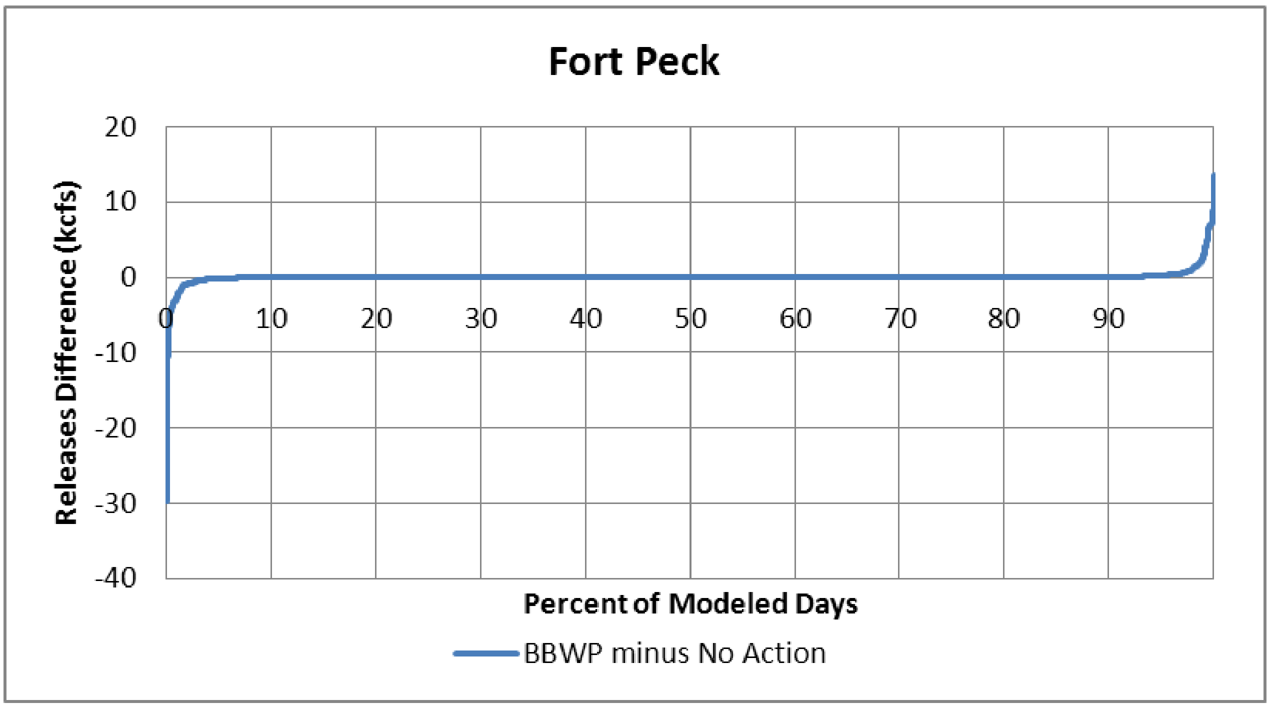


Figure 7
Garrison: Release-Difference Distribution - Proposed Action Minus No Action

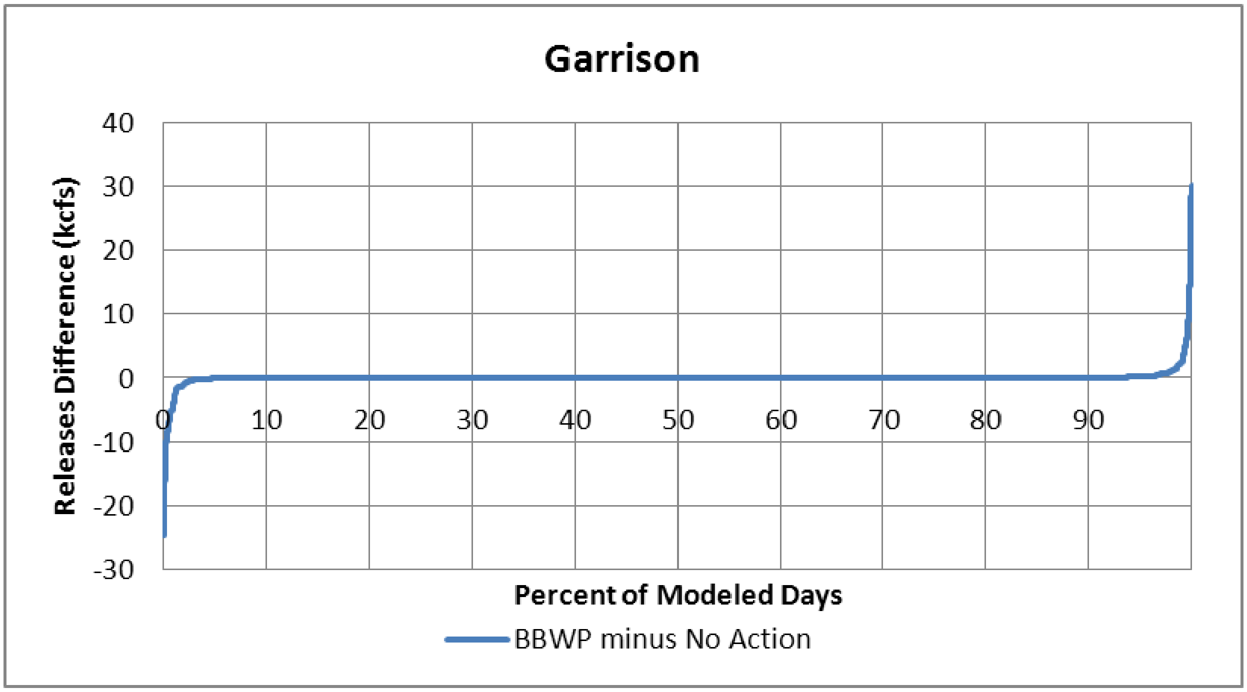
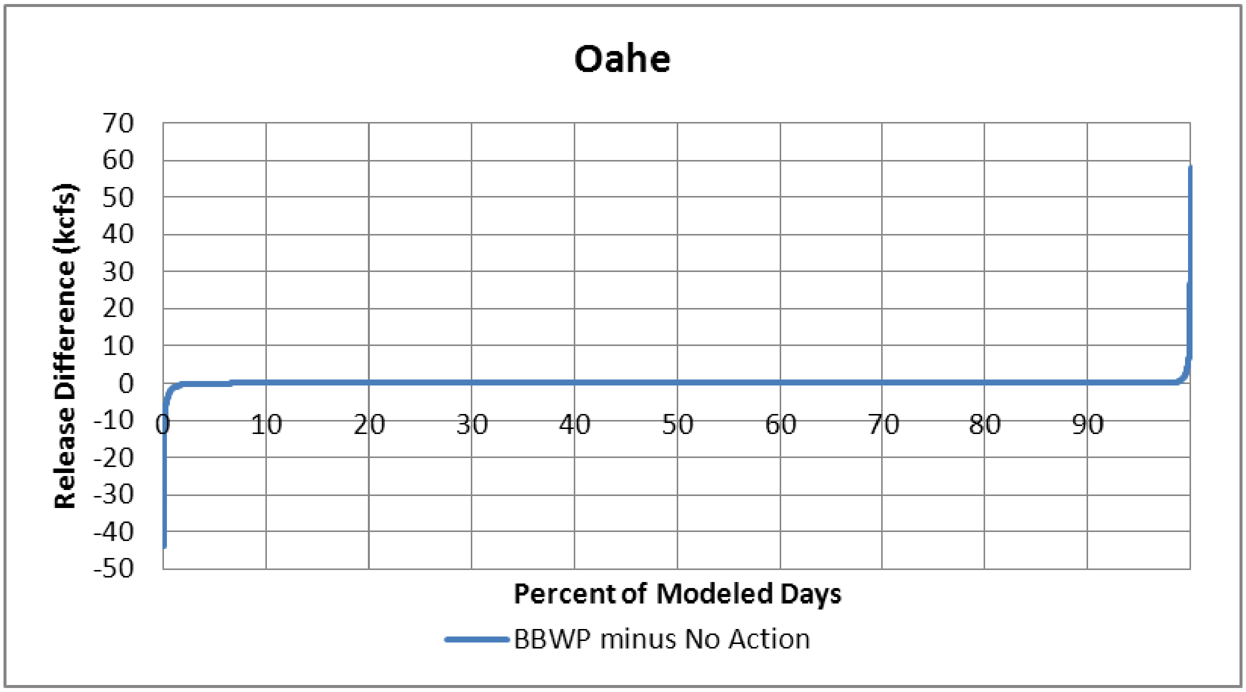


Figure 8
Oahe: Release-Difference Distribution - Proposed Action Minus No Action



Figures 9, 10, and 11 present the reservoir stage distributions for the differences in the reservoir water surface elevations (WSE) between the No Action and the Proposed Action alternatives for the three upper reservoirs of Ft. Peck, Garrison, and Oahe, respectively. The differences in the three lower reservoirs, Big Bend, Fort Randall, and Gavins Point are essentially unaffected by changes at the upper three reservoirs; therefore, no figures are presented for these three lower reservoirs. All three figures show that the levels for the three larger reservoirs are unaffected about 90 to 95 percent of the days. The larger differences are at each end of the distribution plot, and these differences are for relatively short periods in several of the years of the 80-year period of record.

Figure 9
Fort Peck Lake: WSE Difference Distribution - Proposed Action Minus No Action

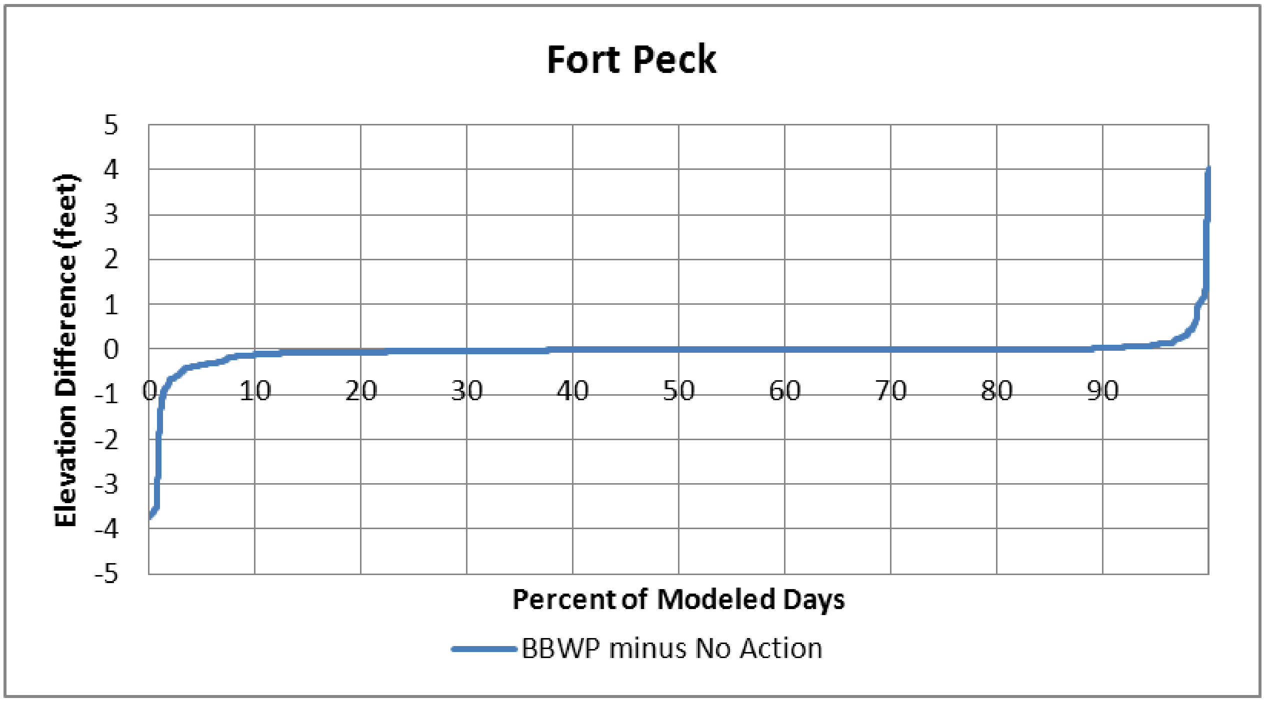


Figure 10
Garrison: WSE Difference Distribution - Proposed Action Minus No Action

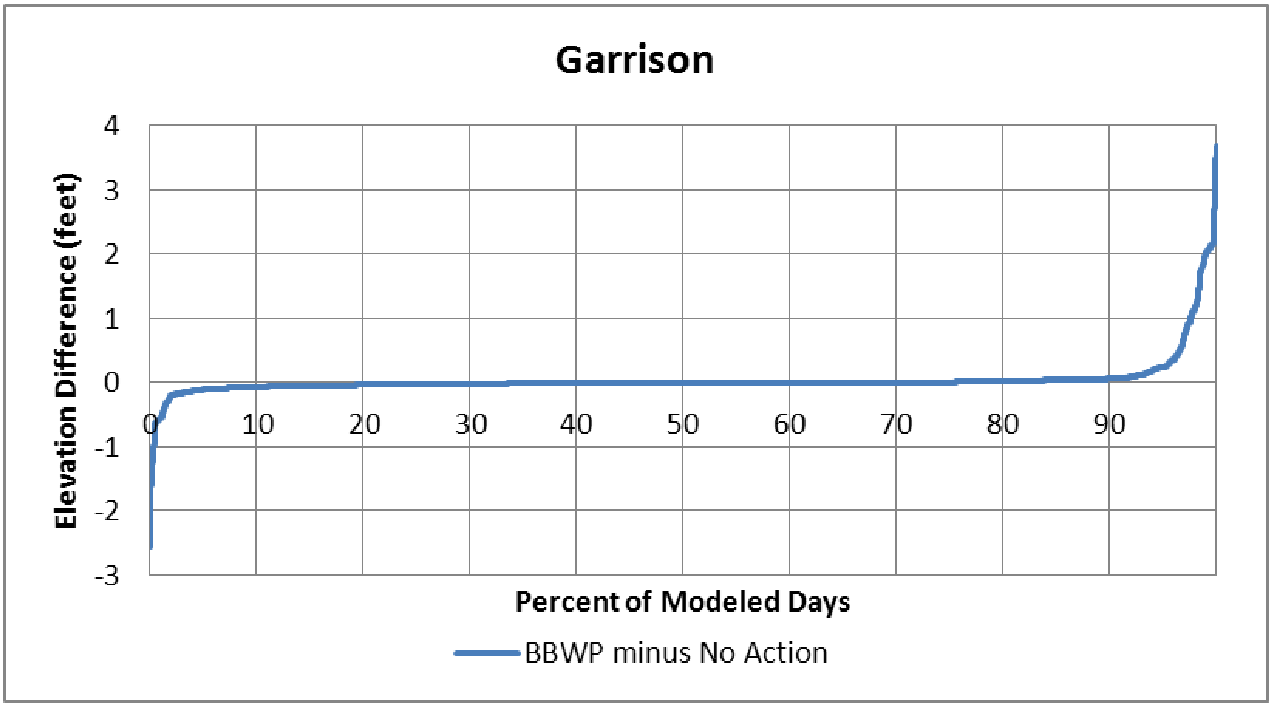
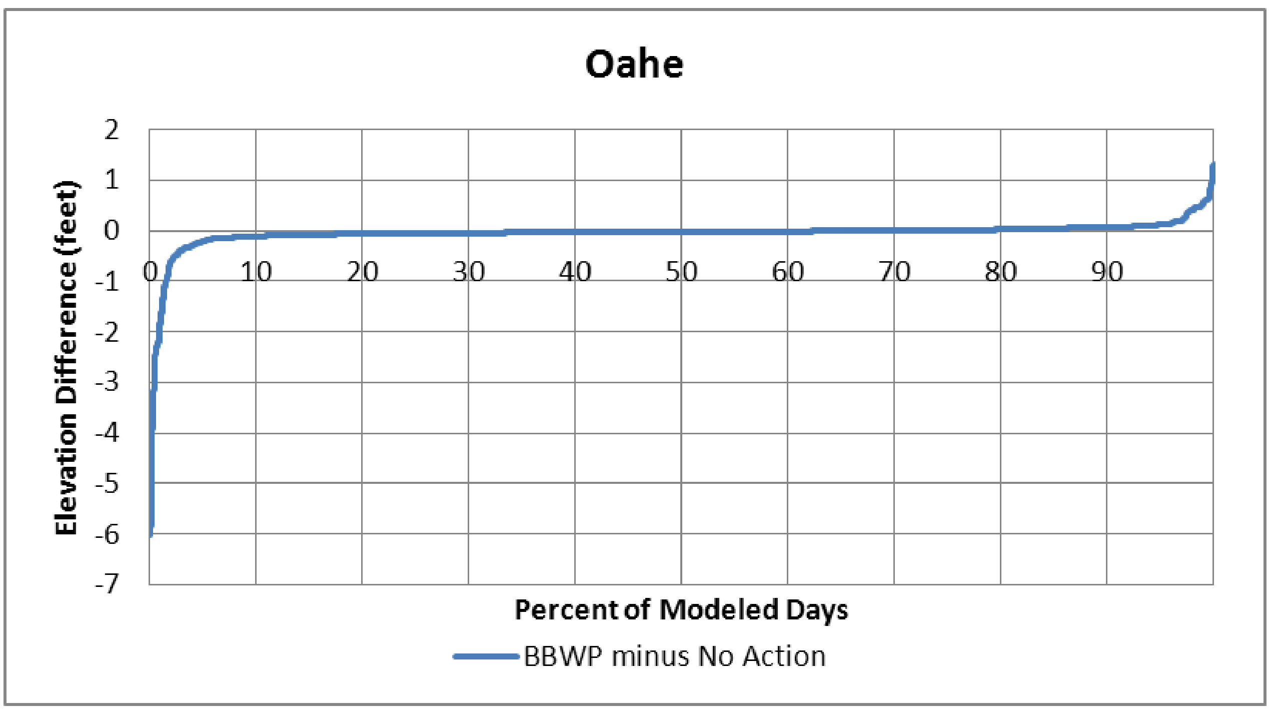
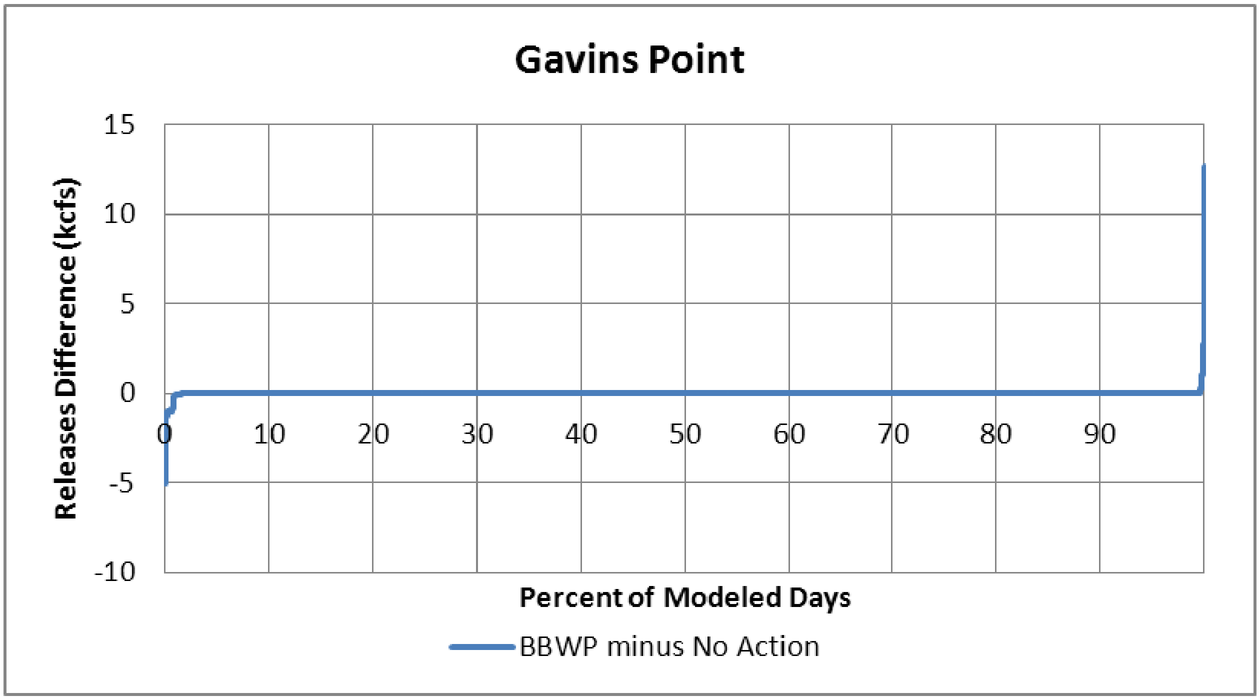


Figure 11
Oahe: WSE Difference Distribution - Proposed Action Minus No Action



Releases from Gavins Point Dam were plotted to examine any potential differences between the No Action and Proposed Action alternatives. Figure 12 is the release distribution plot for Gavins Point Dam releases to the lower Missouri River. This figure shows that there are essentially no differences between these two alternatives for about 95-percent of the days. The differences at each end of the distribution plot are likely due to small changes in navigation service levels and season lengths on the lower Missouri River.

Figure 12
Gavins Point: Release Difference Distribution - Proposed Action Minus No Action



6.1 Resources Considered but Not Carried Forward for Analysis

Section 102.2 of the National Environmental Policy Act instructs that federal agency NEPA documents "shall be analytic rather than encyclopedic." In an effort to eliminate resources from discussion that do not influence decision making, the following resources were considered, but not carried forward for analysis: topography, geology, stratigraphy, seismology, soils, solid and hazardous waste, and noise. These resources are not expected to be affected by implementing the proposed action nor would the selection of alternatives be influenced by these resources.

6.2 Groundwater

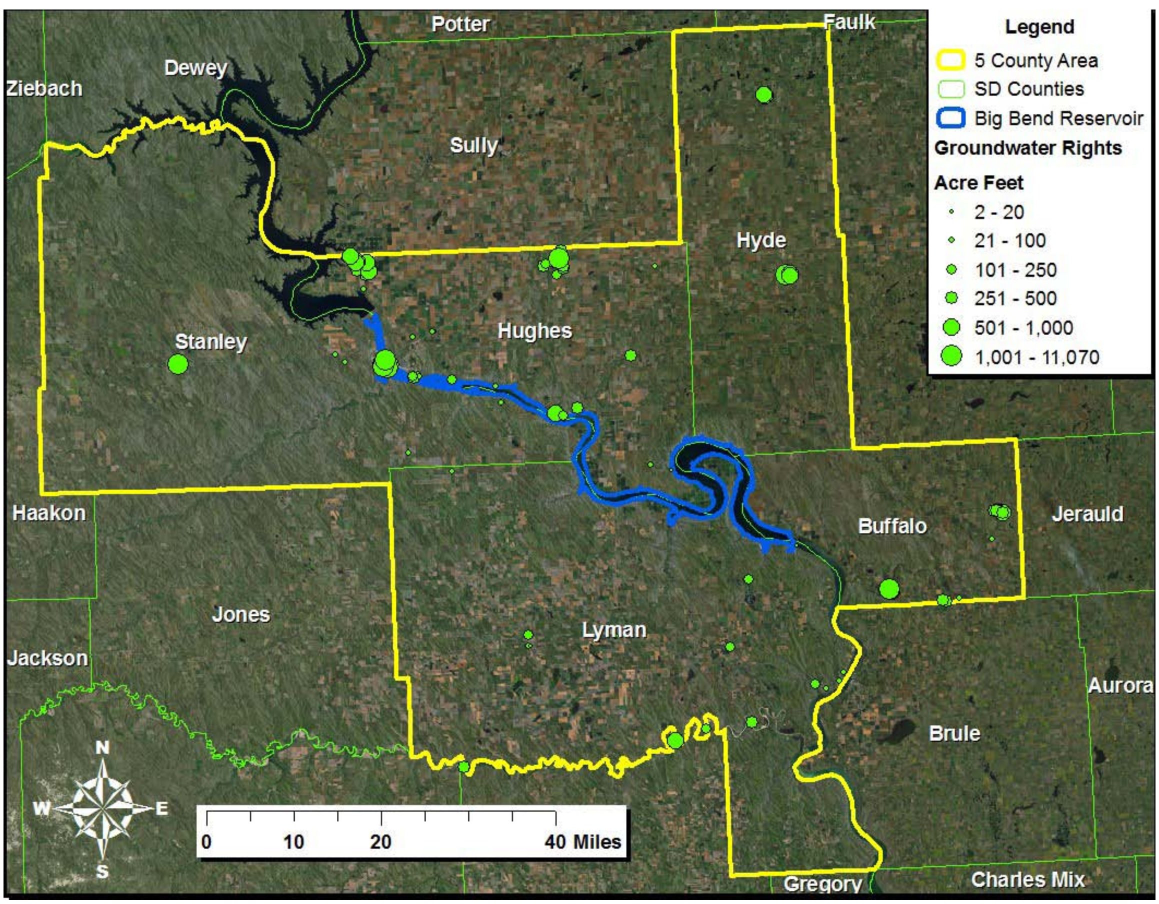
6.2.1 Existing Condition

A soil or rock material that yields water to wells or springs at a sufficient rate to be used as a water supply is called an aquifer. If ground water is confined it is said to be under artesian conditions; if ground water is only under atmospheric pressure, it is unconfined, or it is said to be under water-table conditions (Jorgensen, 1971).

Groundwater near Lake Sharpe occurs in bedrock aquifers (layers of bedrock that hold groundwater), glacial drift aquifers (layers of rock material transported and deposited by a glacier that hold groundwater), and alluvial aquifers (clay, silt, sand, gravel, or similar detrital material deposited by running water that hold groundwater). Though they have a great capacity to transmit water, these limited formations are too small to store large capacities of water. As such, they are not a reliable water source for large-scale (i.e., industrial) water supply. Shallow aquifers of less than 100 feet deep, are found east of Lake Sharpe and generally follow the courses of present streams.

In South Dakota, nearly 52-percent of public drinking water is sourced from groundwater, while approximately 74-percent of residents in South Dakota use groundwater as their source of drinking water. Western South Dakota is underlain by deeply-buried bedrock-type aquifers, which are highly mineralized. Glacial outwash aquifers provide most of groundwater east of the Missouri River in South Dakota, and groundwater of this type is generally better quality than the deeper aquifers west of the river. Though South Dakota is underlain by several aquifers, water-shortage can be an issue during seasons of drought due to varying water quality, aquifer yield, and aquifer depth (Iles, 2008). Figure 13 shows the current groundwater rights and the volume of those rights in the counties surrounding Lake Sharpe.

Figure 13
Current Groundwater Rights Surrounding Lake Sharpe



6.2.2 Environmental Consequences

No Action

Under the no action alternative, there would be no change to the water supply from Lake Sharpe and there would be no new depletions from Lake Sharpe within the Big Bend Project lands. However, because surface water was not made available from Lake Sharpe, new M&I water supply would be met by new groundwater sources. Based on the region's existing groundwater supply and the current lack of demand for M&I water, taking no action would be expected to have little effect on existing groundwater resources in proximity to Lake Sharpe.

Proposed Action

Implementing the Proposed Action would lessen the demand for groundwater resources buy utilizing surface water from Lake Sharpe, but because there is so little demand, utilizing surface water instead of groundwater would not be expected to have any discernible effects on groundwater near the Big Bend Project, Lake Sharpe, or within the region.

6.3 Water Quality

6.3.1 Existing Condition

The Clean Water Act (CWA) requires states to report on the quality of their waters including Section 305(b) (State Water Quality Assessment Report) and Section 303(d) identifying a list of a state's water quality-limited waters needing total maximum daily loads (TMDLs). The primary purpose of the Section 305(b) State Water Quality Assessment Report is to assess and report on the extent to which beneficial uses of the state's rivers, streams, lakes, reservoirs and wetlands are met. The South Dakota Department of Environment and Natural Resources (DENR) maintains a network of 151 active ambient monitoring stations located on various rivers and creeks within the state (SDDENR, 2011b).

Currently, the DENR collects samples on a monthly, quarterly or seasonal basis. Samples are analyzed for specific conductance, pH, and dissolved oxygen, and then sent to a laboratory for additional analyses. Parameters most commonly sampled for include fecal coliform, E. coli bacteria, hardness, alkalinity, residue (total solids, total suspended solids, total dissolved solids), pH, ammonia, nitrates, and phosphorous (total and dissolved). Several stations are sampled for sodium, calcium, and magnesium while irrigation is ongoing. Data are later uploaded into the DENR internal database (SDDENR, 2011b).

The Corps water quality management program for civil works projects is defined by the Corps primary water quality regulation – Engineer Regulation (ER) 1110-2-8154, *"Water Quality and Environmental Management for Corps Civil Works Projects."* ER 1110-2-8154 was updated in 1995 to encourage a holistic, ecosystem approach to water quality management.

The Corps of Engineers collects and analyzes water samples six times per year at the outflow of Oahe Dam, the outflow of Big Bend Dam, at Big Bend Dam, and upstream of Big Bend Dam. The outflow of Oahe Dam is considered inflow to Lake Sharpe. The United States Geological

Survey collects and analyzes water samples six times per year on the Missouri River near Pierre, South Dakota.

The 2010 South Dakota Integrated Report for Surface Water Quality Assessment includes the list of Section 303(d) TMDL waters for South Dakota. Table 7 shows the designated use, impairment, and support status for impaired waterbodies within the project area (SDDENR, 2010).

Table 7
Surface Waters on 303(d) TMDL List in the Project Area

Description	Assessment Unit ID	Designated Use	Impairment	Support Status
Oahe Dam to Big Bend Dam	SD-MI-R-SHARPE_01	Coldwater Permanent Fish Life	Temperature, water	Water is impaired or threatened and a TMDL is needed

6.3.2 Environmental Consequences

<u>No Action</u>

Under the no action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the water supply, and there would be no new depletions from Lake Sharpe. Any new demand for water would be expected to be met through groundwater sources. There would be no expected effects to the water quality of Lake Sharpe or downstream of the Big Bend Dam as a result of taking No Action.

<u>Proposed Action</u>

As described in Section 5.2, the Big Bend Project is regulated in much the same manner year after year regardless of the runoff conditions. Section 6 also illustrates that changes to the water surface elevations of the System reservoirs as a result of depletions in any single reservoir is confined to the upper three (Fort Peck, Garrison, and Oahe). There would be almost no differences in the three lower reservoirs, including Lake Sharpe, because of how the lower three reservoirs are operated. As a result, depletions from Lake Sharpe would not result in changes to the water surface elevations in Lake Sharpe. Absent changes to the water surface elevations, surface water quality in the lake would not be affected.

Figures 5, 6, and 7 as well as Figures 8, 9, an 10 show the modeled differences in dam release and water surface elevation for the big three upstream reservoirs (Fort Peck, Garrison, and Oahe). These figures indicate that for more than 90-percent of the days modeled, there would be no difference in the dam discharge or the water surface elevation at any of these reservoirs as a result of annually removing 5,661 acre-feet of water from Lake Sharpe. The larger differences are at each end of the distribution plots, and these differences are for relatively short periods in several of the years of the 80-year period of record. As a result of the modeling, there would be no effects to the water quality of Lake Sharpe or any of the other System reservoirs as a result of implementing the proposed action.

Figure 10 depicts the release distribution plot for Big Bend Dam releases to the lower Missouri River. This figure shows that there are essentially no differences between No Action and the Proposed Action for more than 95 percent of the days modeled. The differences at each end of the distribution plot are likely due to small changes in navigation service levels and season lengths on the lower Missouri River. As a result, implementing the Proposed Action would likely lead to no effects to water quality downstream of the Big Bend Dam.

6.4 Air Quality

6.4.1 Existing Condition

The U.S. Environmental Protection Agency (USEPA) Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, called "criteria" pollutants. They are carbon monoxide, nitrogen dioxide, ozone, lead, particulates of 10 microns or less in size (PM-10 and PM-2.5), and sulfur dioxide. Ozone is the only parameter not directly emitted into the air but forms in the atmosphere when three atoms of oxygen (0^3) are combined by a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of NOx and VOC, also known as ozone precursors. Strong sunlight and hot weather can cause ground-level ozone to form in harmful concentrations in the air.

The Clean Air Act General Conformity Rule (58 FR 63214, November 30, 1993, Final Rule, Determining Conformity of General Federal Actions to State or Federal Implementation Plans) dictates that a conformity review be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more NAAQS. A conformity assessment would require quantifying the direct and indirect emissions of criteria pollutants caused by the Federal action to determine whether the proposed action conforms to Clean Air Act requirements and any State Implementation Plan (SIP).

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions "conform with" (i.e., do not undermine) the approved State Implementation Plan (SIP) for their geographic area. The purpose of conformity is to (1) ensure Federal activities do not interfere with the air quality budgets in the SIPs; (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the NAAQS. Federal agencies make this demonstration by performing a conformity review when the actions they are planning to carry out will be conducted in an area designated as a non-attainment or maintenance area for one of the criteria pollutants.

If one or more of the priority pollutants was not in attainment, then the proposed action would be subject to detailed conformity determinations unless these actions are clearly de minimus emissions. Use of the de minimus levels assures that the conformity rule covers only major Federal actions (USEPA, 1993). A conformity review requires consideration of both direct and indirect air emissions associated with the proposed action. Sources that would contribute to direct emissions from this project would include demolition or construction activities associated with the proposed action and equipment used to facilitate the action (e.g., construction vehicles). To be counted as an indirect emission, the Federal proponent for the action must have continuing control over the source of the indirect emissions. Sources of indirect emissions include commuter activity to and from the construction site (e.g., employee vehicle emissions). Both stationary and mobile sources must be included when calculating the total of direct and indirect emissions, but this project would involve only mobile sources.

For each of the counties surrounding Lake Shape, all six criteria pollutants are in attainment of the air quality standards (USEPA, 2011).

6.4.2 Environmental Consequences

No Action

Under the No Action alternative, the Corps of Engineers would not make a determination of surplus water and there would be no change to the water supply from Lake Sharpe. There would be no new depletions from Lake Sharpe, and any increase in M&I water supply demand would be met with groundwater withdrawals. The effects to air quality would not be predicted to change from the existing conditions.

Proposed Action

Implementing the Proposed Action would not have any effect on the air quality of the Big Bend Project, Lake Sharpe, or the region.

6.5 Land Use

6.5.1 Existing Condition

General land uses in the project area was primarily used for farming and grazing prior to its purchase by the Corps of Engineers. Local residents cut portions of timbered Missouri River bottoms for firewood, rough lumber, and fence posts.

Today, agriculture represents the primary use of 95-percent of the land in the five counties adjacent to Lake Sharpe in the Missouri River Basin. The remainder is devoted to recreation, wildlife, transportation, and urban areas. Of the total agricultural area, 55-percent is used for pasture and range and 45-percent is used for cropland. Woodlands are restricted to bottomlands adjacent to streams and areas where plantings have been made. Water bodies in this drainage make up about 1-percent of the total area, but the rivers, lakes, reservoirs, farm ponds, and other bodies of water are extremely important to the region's economy.

6.5.2 Environmental Consequences

No Action

Under the no action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the water supply, and there would be no new depletions from Lake Sharpe. Taking no action would not have any effect on the land use practices of the Big Bend Project, Lake Sharpe, or the surrounding areas.

Proposed Action

Implementing the Proposed Action would not have any effect on the land use practices of the Big Bend Project, Lake Sharpe, or the surrounding region. As stated in Section 10.2, Summary of

Agency Meetings, representatives from South Dakota were not aware of any large-scale users of water (i.e., ethanol or power plants) that were reasonably foreseeable within the next 10 years. Identifying surplus water, as defined in Section 6 of the 1944 Flood Control Act, which the Secretary of the Army can make available to execute surplus water supply agreements with prospective M&I water users will not be likely to have effects on patterns of land use.

6.6 Demographics

6.6.1 Existing Condition

At the time of the 2010 census, South Dakota had a total population of 814,180 people ranking 46th out of the 50 States. With 68,976 square miles of area, the South Dakota population density in 2010 was 10.5 persons per square mile. By comparison, the 2000 population density for the entire United States was 79.6 persons per square mile.

Table 8 lists both historical and projected census population totals through 2025. The demographics data presented in Table 9 are historical counts through the 2010 census, limited to the contiguous five counties (i.e., first tier counties) that contact Lake Sharpe in South Dakota. The combined population of the five counties increased by an average of 21-percent from 1970 to 2010, but Hyde and Lyman counties each declined substantially over the 40-year period. Hughes County experienced an increase of 5,390 people between 1970 and 2010.

Table 8
South Dakota Census Historical and Projected Population

Year	Population	Percent Change
1960	681,000	--
1970	666,000	-2.2
1980	691,000	3.8
1990	696,000	0.7
2000	754,844	8.5
2025	866,000	14.7

Source: 2000 U.S. Census Data.

Table 9
Historic Population Data for Lake Sharpe Area of Influence

County	1970	1980*	1990	2000	2010	Percent Change 1970 to 2010
Buffalo	1,739	1,795	1,759	2,032	1,912	9.9
Hughes	11,632	14,220	14,817	16,481	17,022	46.3
Hyde	2,515	2,069	1,696	1,671	1,420	-43.5
Lyman	4,060	3,864	3,638	3,895	3,755	-7.5
Stanley	2,457	2,533	2,453	2,772	2,966	20.7
Totals:	22,403	24,481	24,363	26,851	27,075	20.9

Source: U.S. Census Bureau, 2000 Decennial Census.

In the five counties contiguous to Lake Sharpe, Hughes County was the only county that had an urban population and the City of Pierre contained 84.2 percent of the population of Hughes County in 2000.

6.6.2 Environmental Consequences

No Action

Under the no action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the water supply, and there would be no new depletions from Lake Sharpe. Under the No Action alternative, the trends of growth of population observed in the recent years in South Dakota would be expected to continue.

Proposed Action

The environmental consequences of implementing the Proposed Action on demographics of the regions would be minimal. The changes to population in the area of influence has occurred based on factors other than the availability of water from Lake Sharpe for M&I. In addition, there are no large-scale users of water (i.e., ethanol or power plants) reasonably foreseeable within the next 10 years that could lead to changes in demographics.

6.7 Employment/Income

6.7.1 Existing Condition

The most recent year for which the US Bureau of the Census has published comprehensive income data is 1999. The median household income in South Dakota is $46,244, and the per capita income is $17,562. Table 10 shows the median household income, medium family income, and the per capita income reported by the 2000 Census (1999 data) for each of the five first tier counties.

Table 10
Income Data for Lake Sharpe Area of Influence and South Dakota (1999)

County	Median Household Income	Median Family Income	Per Capita Income
Buffalo	$12,692	$14,167	$5,213
Hughes	$42,970	$51,235	$20,689
Hyde	$31,103	$40,700	$16,356
Lyman	$28,509	$32,028	$13,862
Stanley	$41,170	$47,197	$20,300
South Dakota	$35,282	$43,237	$17,562

Source: U.S. Census Bureau, 1999.

South Dakota's per capita income in 1999 was about 81-percent of the $21,587 per capita income for the entire United States. The economy of South Dakota is highly dependent on agriculture, so median income in South Dakota tends to vary with agricultural yields (which vary greatly with rainfall if not irrigated) and crop prices, which did not increase in the 1990s in proportion to the cost of most other goods and services.

The relatively low median and per capita income in the Lake Sharpe area may be partly due to the lack of a major urban center within these counties. Lacking urban centers, a higher proportion of agricultural workers are included in the calculations compared to South Dakota as a whole. Of the five counties adjacent to the Big Bend project, Hughes County, where the State Capital of Pierre is located, is the only predominantly urban county. In the non-urban counties, the population is low and decreasing, per capita income is low, and median age is rising.

6.7.2 Environmental Consequences

No Action

Under the no action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the water supply, and there would be no new depletions from Lake Sharpe. Under the No Action alternative, the employment and income trends observed in the recent years in South Dakota would be expected to continue.

Proposed Action

The environmental consequences of implementing the Proposed Action on employment and income within the first tier counties would be minimal. Changes in employment and income would not be expected to be altered from current patterns and trends of change based on the identification of an additional 5,661 acre-feet of surplus water in Lake Sharpe.

6.8 Environmental Justice

6.8.1 Existing Condition

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Population and Low-Income Populations (Executive Order, 1994), directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority population and low-income populations. When conducting NEPA evaluations, the USACE incorporates Environmental Justice (EJ) considerations into both the technical analyses and the public involvement in accordance with the USEPA and the Council on Environmental Quality guidance (CEQ, 1997).

The CEQ guidance defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan native, Asian or Pacific Islander, Black, not of Hispanic origin, and Hispanic (CEQ, 1997). The Council defines these groups as minority populations when either the minority population of the affected area exceeds 50 percent of the total population, or the percentage of minority population in the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

Low-income populations are identified using statistical poverty thresholds from the Bureau of the Census Current Population Reports, Series P-60 on Income and Poverty (U. S. Bureau of the Census, 2000). In identifying low-income populations, a community may be considered either as a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. The threshold for the 2000 census was an income of $17,761 for a family of four (U.S. Bureau of the Census, 2000). This threshold is a weighted average based on family size and ages of the family members.

Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low Income Populations," issued in 1994, directs Federal and state agencies to incorporate environmental justice as part of their mission by identifying and addressing the effects of all programs, policies and activities on minority and low-income populations. The fundamental principles of EJ are as follows:

1. Ensure the full and fair participation by all potentially affected communities in the decision-making process;
2. Prevent the denial of, reduction in or significant delay in the receipt of benefits by minority and low-income populations; and
3. Avoid, minimize or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

In addition to Executive Order 12898, the Environmental Justice analysis is being developed per requirements of "Department of Defense's Strategy on Environmental Justice" (March 24, 1995).

Per the above directives, EJ analyses identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of the project on minority and low-income populations. The methodology to accomplish this includes identifying low-income and minority populations within the study area, as well as community outreach activities such as stakeholder meetings with the affected population.

Table 11 shows the 2009-estimated population and the ethnic mix (as a percentage) for each of the five first tier counties surrounding Lake Sharpe. The higher percentage of Native Americans in Hughes and Lyman Counties relative to the other counties can be attributed to the locations of the Crow Creek Indian Reservation and the Great Sioux Reservation.

Table 11
Percent Race by County

County	2009 Population Estimate	White	Black	American Indian	Hawaiian-Pacific Islander	Two or More Races	Hispanic
Buffalo	2,067	17.7	0.4	79.2	0.0	2.7	3.0
Hughes	16,969	85.4	0.5	11.4	0.1	1.7	2.8
Hyde	1,393	88.2	0.1	10.9	0.0	0.8	0.6
Lyman	3,981	59.9	0.1	37.7	0.0	2.1	1.4
Stanley	2,792	89.4	0.2	7.7	0.0	2.0	0.90
South Dakota	814,180	87.4	1.0	8.2	0.1	1.8	2.9

Source: U.S. Census Bureau, 1999.

6.8.2 Environmental Consequences

No Action

Under the no action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the water supply, and there would be no new depletions from Lake Sharpe. There would be no disproportionate effects to minority or low-income communities as a result of implementing the No Action alternative.

Proposed Action

Compliance with Executive Order 12898 on Environmental Justice requires an evaluation of the nature of the proposed actions and the human context into which those actions would be undertaken. In order to have potential Environmental Justice impacts, a proposal must have potential for disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Native American tribes. This action has been evaluated for potential disproportionately high environmental effects on minority or low-income populations and there would not be a high human health or environmental impact on minority or low-income populations. Implementation of the Proposed Action would not result in measurable changes to environmental resources that individuals involved in subsistence fishing or hunting utilize. Implementation of the Proposed Action would not create disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or Native American tribes.

6.9 Recreation

6.9.1 Existing Condition

Recreation facilities at Lake Sharpe vary from primitive areas to well-developed campgrounds. Lake Sharpe has 24 designated recreation areas which include boat ramps, camping, picnic tables and grills, swimming beaches, playgrounds, trails, and a marina.

Fishing is the major recreational activity participated in by visitors to Lake Sharpe. The popularity and success of fishing at Lake Sharpe is a direct result of stable lake levels and good water quality. Fishing success is also affected by adequate lake access, availability of fish habitat, and adequate aquatic plant growth. Lake Sharpe is located in a part of central South Dakota that serves as a major destination area for fishing parties from South Dakota and adjacent states. The most abundant game fish in Lake Sharpe is walleye, but smallmouth, largemouth, crappie, northern pike, and catfish can also be caught. All public lands around the Lake Sharpe and Missouri River area are open to hunting, except developed recreation areas (USACE, 2011).

The South Dakota Department of Game, Fish and Park (SDGFP), through its Division of Parks and Recreation, prepares the Statewide Comprehensive Outdoor Recreation Plan (SCORP) in order to identify the recreation needs and desires of South Dakotans and to recommend actions to meet those needs. For this planning process, the State was divided into six Planning and Development Districts; Lake Sharpe is located in Planning and Development District 5.

6.9.2 Environmental Consequences

No Action

Under the No Action alternative, there would be no identification of surplus water within Lake Sharpe and no new water supply available for M&I users. Taking no action would not be expected to have any effect on recreation at Lake Sharpe or on the Big Bend Project lands.

Proposed Action

Water levels are a key factor in recreational use of the reservoirs and river reaches. The modeled differences in water surface elevations between No Action and the Proposed Action in the DRM simulation output for Lake Sharpe and all 18 model nodes were negligible. These modeled output show that at the 50^{th} percent frequency (representing average conditions), all of the System reservoirs would show virtually no difference in water surface elevation. In addition, the model predicted there would nearly immeasurable changes in stages at all riverine (non-reservoir) model nodes. All of these simulated stage reduction estimates are too small to be distinguishable from the No Action alternative. Therefore, the change in water surface elevations between No Action and the Proposed Action conditions would not result in discernible effects to recreation.

6.10 Aesthetics and Visual Resources

6.10.1 Existing Condition

The Big Bend Dam/Lake Sharpe project is an outstanding scenic landmark in this region of South Dakota. The only distractions in the area's aesthetic environment include large power transmission lines and supporting stations that are located mostly in the vicinity of the dam embankment and powerhouse.

The S-shaped design of the Big Bend Dam embankment along with the rugged and scenic shoreline and open water of Lake Sharpe are attractive visual resources. The unique S-shape design was created when the north end of the embankment was moved toward the west to protect an important resource. Rugged bluffs and prairie grasslands with some dense stands of trees in a few ravines surround the lake. In addition to the undisturbed vistas during daylight hours, the night sky has little interference (i.e., light pollution) because project lands are such a large distance from municipal light sources. The general lack of major roads and large residential communities accentuates the visually open landscape of the Great Plains (USACE, 2007). A 2001 analysis modeling light pollution in the United States showed that large areas of pristine dark skies can be viewed in South Dakota (Albers and Duriscoe, 2001).

6.10.2 Environmental Consequences

<u>No Action</u>

Under the no action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the water supply, and there would be no new depletions from Lake Sharpe. This would result in little difference in the predicted aesthetic effects between the Proposed Action and No Action.

<u>Proposed Action</u>

The effects to aesthetics as a consequence of implementing the Proposed Action would be expected to be minimal. The estimated change to the water surface elevation from implementing the proposed action would be indiscernible from the No Action alternative and no new intakes or infrastructure is part of the Proposed Action.

6.11 Cultural Resources

6.11.1 Existing Condition

The cultural history of central South Dakota is detailed in the Big Bend/Lake Sharpe Master Plan (USACE, 2003) and is herein incorporated-by-reference. Many significant cultural resources are located on the culturally-rich Lake Sharpe Project lands. These resources represent physical remains that archaeologists refer to as sites, objects, artifacts, features, components, structures, and a number of other terms that describe the physical remains of past human occupation and use.

The Big Bend/Lake Sharpe Project has 461 recorded historic properties, excluding isolated finds and 12 are presumed destroyed. The Big Bend Project has the highest concentration of cultural resource sites of any of the Omaha Districts main stem reservoirs, averaging approximately two sites per shoreline mile (USACE, 2003). Many of these sites have not been evaluated for their eligibility for listing on the National Register of Historic Places (NRHP). The sites range from single artifacts a few inches in length to a site over one-half mile in length.

6.11.2 Environmental Consequences

No Action

Under the No Action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the M&I water supply, and there would be no new depletions from Lake Sharpe. As a result of taking No Action, the majority of water to supply the new demand would likely be provided by groundwater, but not on project lands. There would be no expected effects to cultural resources as a result of implementing No Action.

Proposed Action

There are no new intakes or water supply infrastructure proposed as part of the Proposed Action. All future easements and water supply agreements would require review by the Corps of Engineers prior to allowing placement of infrastructure. In this process, the Corps would complete NEPA evaluations and avoid culturally important sites when evaluating locations for intakes. Implementing the Proposed Action would not have any effect on the cultural resources of the Big Bend Project, Lake Sharpe, or the region.

6.12 Vegetation and Listed Species

6.12.1 Existing Condition

Terrestrial vegetation on the Big Bend Project lands is typical of that found in the northern Great Plains. Mixed prairie vegetation dominates the landscape but ribbons of eastern deciduous woodland are found on the floodplains along the larger intermittent drainageways, along the reach of the Missouri River below Oahe Dam, and within many of the larger draws along the main stem and its tributaries. Eastern red cedar (*Juniperus virginiana*) woodlands have developed in several of the upland draws in the lower part of the project. A periodically flooded area below Big Bend Dam supports wetland scrub-shrub and forested vegetation. Patches of shrubland often border the bottomland woodlands but may also exist in favorable areas within draws and north-facing slopes of the uplands. Numerous tree plantings for wildlife habitat exist on the upper terraces and benches and on nearly flat bottomlands along entering tributaries. Areas dominated by clay soils occupy most of the landscape around Lake Sharpe. Western wheatgrass (*Pascopyrum smithii*) and green needlegrass (*Nassella viridula*), both midheight species, are usually the dominant species with the short grasses, such as blue grama (*Bouteloua gracilis*) and buffalo grass (*Bouteloua dactyloides*), as secondary species. When such sites are overgrazed or otherwise disturbed, the midheight grasses are replaced by the short grasses and a disclimax[9] short-grass prairie quickly develops.

9 A disclimax is a relatively stable ecological community often including species foreign to the region.

Fertile land developed in loess, coarser bedrock, or glacial till can be found on the broad tablelands or on lower terraces along the lake. These areas have good moisture-retention capabilities and support mid-height grasses, such as green needlegrass (*Nassella viridula*), and Western wheatgrass (*Pascopyrum smithii*). Grasses, including needle-and-thread (*Stipa comata*), porcupine (*Miscanthus sinensis*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and side-oats grama (*Bouteloua curtipendula*), may also occur. Forbs such as lead plant (*Amorpha canescens*) and snowberry (*Symphoricarpos albus*) are abundant in these areas and shrubs are common.

A few range sites around Lake Sharpe are located within draws or on low alluvial terraces containing medium-textured alluvium where added water is received each year because of slope or drainageway runoff. Warm-season, tallgrass vegetation dominates these sites and the predominant species include big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). Mid-height species in these areas include side-oats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyrium scoparium*), and green needlegrass (*Nassella viridula*).

On steeply sloping land, Pierre Shale outcrops support a community characterized by sparse cover of low-growing shrubs and herbs that are tolerant of high salinities and other unfavorable soil conditions. A Slick spot community, similar to the Pierre Shale community in its sparse cover and salt-tolerant vegetation, is less common but occurs on bottomlands and lower slopes.

Aquatic vegetation at Lake Sharpe is most extensive in the upstream reach near the Bad River delta. Lesser areas are found within the embayments and deltas of entering tributaries. Rooted emergent forms, such as river pondweed (*Potamogeton*), are common in the embayment areas, such as the Good Soldier Bay. An epiphytic algae community is also present in shallow, clear water and may be attached to macrophytes, rock, or logs.

Western Prairie Fringed Orchid *(Platanthera praeclara)* - Federally Threatened

The Western prairie fringed orchid (*Platanthera praeclara*) is a perennial which grows up to three feet high and is distinguished by large, white flowers that come from a single stem. The flowers are fringed on the margins giving them a feathery appearance.

Historically, the orchid was found throughout the tall grass regions of North America, but tall grass prairie has been reduced to less than two-percent of its former range. The prairie fringed orchids were added to the U.S. List of Endangered and Threatened Wildlife and Plants on September 28, 1989 (USFWS, 2011). The western prairie fringed orchid is a very rare species, and a status survey found no populations in South Dakota (USFWS, 2004). Possible habitat may exist, mainly in the easternmost counties of South Dakota, but not in the counties adjacent to the Big Bend project (USFWS, 2004).

6.12.2 Environmental Consequences

No Action

Taking no action would not have any effect on the vegetation of the Big Bend Dam Project, Lake Sharpe, or the region.

Proposed Action

Implementing the Proposed Action would not have any effect on the soils of the Big Bend Project, Lake Sharpe, or the region. Any future request for easements and water supply agreements could result in effects to vegetation of the Big Bend Project, but would require review by the Corps of Engineers prior to allowing placement of infrastructure. In this process, the Corps would complete additional NEPA evaluations and comply with all appropriate environmental laws and regulations.

Listed Species Effects Determination

This Environmental Assessment represents the assessment and findings regarding the Proposed Action and serves as the Biological Assessment regarding the Proposed Action to federally listed species as requested under Section 7 of the Endangered Species Act.

Western Prairie Fringed Orchid (*Platanthera praeclara*) - Federally Threatened

The Western prairie fringed orchid has not been observed on the Big Bend Project lands. The Proposed Action does not include any ground-disturbing actions and therefore would not have the potential to affect the species.

The finding is a determination of no effect to the Western prairie fringed orchid.

6.13 Fish and Wildlife and Listed Species

6.13.1 Existing Condition

Large numbers of channel catfish, smallmouth bass, and walleye are caught at Lake Sharpe. A small but growing fishery for Chinook salmon, sauger, smallmouth bass, and rainbow trout exists in the Oahe tailwaters. Also, large catches of white bass are made at times in the Oahe tailwaters and Big Bend tailwaters (USACE, 2003).

Large mammals that occupy project lands and surrounding lands include white-tailed deer, and pronghorn antelope. Elk and bison had been locally extirpated since the 1880s. However, the Lower Brule Sioux Tribe and the Crow Creek Sioux Tribe reintroduced these animals into game ranges in the Lake Sharpe area and the buffalo are managed as a hunting resource. Elk are free roaming within the Lower Brule Sioux Tribe game ranges and are also subject to harvest (USACE, 2003). Small mammals known to utilize project and surrounding lands include beaver, muskrat, raccoon, badger, mink, least weasel, red fox, striped skunk, coyote, bobcat, white-tailed jackrabbit, eastern cottontail and fox squirrels. A small number of porcupines live in the bottomland woodlands along the tributaries. Very few prairie dogs live on projects lands; prairie dogs are found in larger numbers on adjacent rangelands bordering Big Bend Project lands (USACE, 2003).

Extensive migrations of many waterfowl and other water birds occur along the Central Flyway, which passes through the Lake Sharpe area. Large water birds, such as the double-crested cormorant, great blue heron, white pelican, and American bittern, sandhill cranes use the area during migration (USACE, 2003).

Birds of prey found at the project include the bald eagle, golden eagle, osprey, and numerous species of hawks, falcons, and owls. The prairie falcon can be found in the rough breaks and badland areas along the lake. The short-eared owl and northern harrier can be found in low-lying prairie areas or marshes and great-horned owls nest in bottomland forests (USACE, 2003).

Protected Species

This Environmental Assessment represents the assessment and findings regarding the Proposed Action and serves as the Biological Assessment regarding the Proposed Action to federally listed species as requested under Section 7 of the Endangered Species Act.

As shown in Table 12, there are currently 9 species with the potential to occur in proximity to the project area that are listed as federally threatened or endangered species and protected under the Endangered Species Act. The table also lists two candidate species; effects determinations are not required for candidate species unless the Proposed Action is likely to jeopardize the continued existence of the species. The USFWS encourages agencies to avoid impacts to candidate species and for that reason, the analysis and finding of effects is included.

Table 12
Federally Listed Fish and Wildlife

Common Name	Scientific Name	Federal Listing Status	Year Listed
pallid sturgeon	*Scaphirhynchus albus*	Endangered	1990
shovelnose sturgeon	*Scaphirhynchus platorynchus*	Threatened	2010
Topeka shiner	*Notropis topeka*	Endangered	1998
black-footed ferret	*Mustela nigripes*	Endangered	1967
gray wolf	*Canis lupus*	Endangered	1974
whooping crane	*Grus americanus*	Endangered	1967
interior least tern	*Sterna antillarum*	Endangered	1985
piping plover	*Charadrius melodus*	Threatened	1985
American burying beetle	*Nicrophorus americanus*	Endangered	1989
Sprague’s pipit	*Anthus spragueii*	Candidate	2010
Dakota skipper	*Hesperia dacotae*	Candidate	1975

Pallid Sturgeon (*Scaphirynchus albus*) - Federally Endangered

Sturgeon (including the pallid sturgeon) and paddlefish are the only living descendants of an ancient group of Paleozoic fishes (USACE, 2007). The pallid sturgeon was listed as an endangered species in 1990 primarily due to the loss of habitat from alterations to the Missouri River and the construction of the extensive system of dams in the upper reaches (USACE, 2007). Commercial fishing may have also played a role in the pallid sturgeon's decline (USACE, 2007). These species are adapted to large, turbid, warm-water rivers and fishermen occasionally catch pallid sturgeon in the Yellowstone and Missouri rivers in North Dakota (USACE, 2007).

Pallids spawning requirements are not well known, but spawning is believed to occur in May or June over gravel or other hard surfaces. Pallid sturgeon feed on aquatic insects, mollusks, and small fishes (USACE, 2007). Habitat requirements for the pallid sturgeon are still being determined; however, some clues to their habitat can be inferred from areas where most pallid sturgeon (and their close relative, the shovelnose sturgeon) have been captured, most often over a sandy substrate. Pallids have been captured most frequently in waters flowing with velocities between 0.33 and 0.98 feet per second in South Dakota (USACE, 2007) and between 1.3 and 2.9 feet per second in Montana (USACE, 2007).

Pallid sturgeon populations or individuals are found in only a few selected areas within the Missouri River. Based on research data, 50 to 100 pallid sturgeon were estimated between Oahe Dam and Big Bend Dam (Eco-Tech, Inc. 2001). In this reach, 20 pallid sturgeon were captured from 1990 through 1993, but only two were captured since then, in 1994 and 1995, and none since then (Krentz, 2004). Most of these pallid sturgeon came from the upper end of Lake Sharpe (USFWS, 1997). Telemetry studies conducted on Lake Sharpe pallid sturgeon from 1989 to 1991 indicated that pallid sturgeon over 11 pounds were most often found over mud substrates, while pallid sturgeon less than 11 pounds were most often found over gravel substrates (Ericson, 1992). There is no evidence of pallid sturgeon reproduction at the Big Bend Project. The Pallid Sturgeon Recovery Plan identified six recovery-priority management areas that still provide suitable habitat, but it does not include any areas within the Oahe or Big Bend Projects (USFWS, 1993).

Shovelnose Sturgeon (*Scaphirhynchus platorynchus*) - Federally Threatened

Effective October 1, 2010, the USFWS has listed the shovelnose sturgeon (*Scaphirhynchus platorynchus*) as threatened under the Similarity of Appearance clause of the Endangered Species Act[10] based on similarity to the endangered pallid sturgeon (*Scaphirynchus albus*) (USFWS, 2010). The shovelnose sturgeon and the endangered pallid sturgeon are difficult to differentiate in the wild and inhabit overlapping portions of the Missouri and Mississippi River basins.

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[10] Section 4(e) of the Endangered Species Act and implementing regulations (50 CFR 17.50–17.52) authorize the Secretary of the Interior to treat a species as an endangered or threatened species even though it is not itself listed if: (a) The species so closely resembles in appearance a listed endangered or threatened species that law enforcement personnel would have substantial difficulty in attempting to differentiate between the listed and unlisted species; (b) the effect of this substantial difficulty is an additional threat to an endangered or threatened species; and (c) such treatment of an unlisted species will substantially facilitate the enforcement and further the purposes of the Act.

Commercial harvest of shovelnose sturgeon in the four states where shovelnose and pallid sturgeon co-exist (IL, KY, MI, and TN) has resulted in the documented take of pallid sturgeon where the two species coexist and is a threat to the pallid sturgeon (USFWS, 2010).

Under this special rule, take of any shovelnose sturgeon, shovelnose-pallid sturgeon hybrids or the roe associated with or related to a commercial fishing activity is prohibited within the geographic areas set forth in the rule. The shovelnose and shovelnose-pallid sturgeon hybrid populations covered by the rule occur within Missouri River in South Dakota (USFWS, 2010).

Topeka Shiner (*Notropis topeka)* - Federally Endangered

The Topeka shiner is a fish species that was formerly widespread in western tributaries of the Mississippi River, from central Missouri to southern Minnesota, west to southeastern South Dakota and western Kansas. They are listed as federally endangered and state-listed endangered in South Dakota (SDGFP, 2010).

Topeka shiners inhabit a variety of high-quality prairie streams, but they are intolerant of certain human-caused disturbances and habitat alterations. For example, streams that have been channelized or impounded or that drain cultivated fields generally are not suitable habitat. It still occurs in all six states in its historical range but is now restricted to small areas in Kansas, Missouri, Iowa, Nebraska, South Dakota, and Minnesota, with most of the remaining populations existing in Kansas. In South Dakota, the Topeka shiner was formerly common in the Big Sioux, Vermillion, and James River drainages and still persists there but in low numbers.

Black-Footed Ferret (*Mustela nigripes*) - Federally Endangered

The black-footed ferret (*Mustela nigripes*) is one of the most endangered mammals in North America. The species was listed as endangered in 1967 under a precursor to the Endangered Species Act of 1973 (Volume 32 Federal Register [FR] 4001). Black-footed ferrets once ranged throughout the Great Plains. It has been calculated that if all suitable habitat had been used, as many as 5.6 million black-footed ferrets may have existed in the late 1800's (USFWS, 1995). Populations declined dramatically in the 1900's. The rapid decline of black-footed ferrets has been linked to the eradication of prairie dogs over a large portion of their historic range. Prairie dogs now occupy less than 1-percent of their historic range (USFWS, 1995). Threats to black-footed ferrets also include canine distemper. Black-footed ferrets are susceptible to predation by golden eagles, great-horned owls, and coyotes. They are also susceptible to road kills and trapping (USFWS, 1995). Of the reintroduction sites, only the Conata Basin site in South Dakota (approximately 150 miles west of the Big Bend Dam) is considered to have a sizeable self-sustaining ferret population (USFWS, 2008a).

The black-tailed prairie dog is currently found in all five counties adjacent to the Big Bend Project and the Lake Sharpe area may have been in the historic range of the black-footed ferret, but no known sightings of the ferret have been documented.

Gray Wolf (*Canis lupus*) - Federally Endangered

The gray wolf (*Canis lupus*) was historically found throughout North America, with the exception of parts of the southwestern and southeastern United States. The gray wolf was historically present throughout South Dakota where it was known as the Plains wolf, the buffalo wolf, or the lobo wolf (USACE, 2003), but there are no known populations of wolves in South

Dakota. They are listed as federally endangered South Dakota has not state-listed the species (SDGFP, 2010). As such, the gray wolf would be exceedingly unlikely to occur within the project area.

Whooping Crane (*Grus americana*) - Federally Endangered

The whooping crane was listed as endangered in 1967 under a precursor to the Endangered Species Act of 1973 (Volume 32 Federal Register [FR] 4001). Unregulated hunting for sport and food combined with the loss of large expanses of wetlands habitat caused the massive decrease in numbers of whooping cranes. Breeding populations of the crane were extirpated from the U.S. portion of its historic breeding range by the early 1900's. They are listed as federally endangered and also state-listed endangered South Dakota (SDGFP, 2010).

Because of intense conservation efforts and captive breeding programs, the whooping crane population now numbers more than 450 individuals. The whooping crane migrates through western and central counties of South Dakota during the spring (late April to mid-June) and the fall (late September to mid-October). Whooping cranes use open sand and gravel bars or very shallow water in rivers and lakes for nightly roosting. Cranes seen feeding during the migration are frequently within short flight distances of reservoirs, lakes, and large rivers that offer bare islands for nightly roosting. Whooping cranes do not readily tolerate disturbances to themselves or their habitat. Whooping cranes only use the Lake Sharpe project area as migratory transients. Sightings have been reported in the upper reservoir, near the DeGrey area, and at a marsh complex along the lake several miles north of Lower Brule (USACE, 1995). None of the designated critical habitat for whooping cranes is located on Big Bend Project lands or at Lake Sharpe.

Interior Least Tern (*Sterna antillarum athalassos*) - Federally Endangered

The interior population of the least tern uses several major river systems of the United States including the upper Missouri River. The stabilization of these river systems for navigation, flood control, hydropower generation, and irrigation has led to a loss of much of the sandbar habitat the species requires for nesting and led to the degradation of the remaining habitat. Consequently, in 1985, the interior population of the least tern was listed as endangered by the USFWS (50 FR 21792).

Interior least terns have been observed in Hughes and Stanley counties, nesting on the islands downstream from Oahe Dam, but not on a regular basis (USACE, 2003). The least tern is not currently found in Hyde, Buffalo, or Lyman counties (USFWS 2004) and least terns are so uncommon at Lake Sharpe that the USACE does not survey for them during their annual interior least tern monitoring program.

Piping Plover (*Charadrius melodus*) - Northern Great Plains population- Federally Threatened

The piping plover is a shorebird that favors coastal beaches, alkali wetland, lakeshores, reservoir beaches, and riverine sandbars for nesting and chick rearing. In 1985, the USFWS listed the Northern Great Plains population as threatened (50 FR 50726). The Northern Great Plains population extends across three Canadian provinces and eight American states. The 2006 International Piping Plover Adult Census found about 4,700 adult plovers in the northern Great Plains (USGS, 2007). An important nesting area for piping plovers in the northern Great Plains is the Missouri River, where 1,311 adult plovers were counted in 2006. Normally an adult pair will raise one brood of chicks during the nesting season and re-nesting commonly follows if a nest or a young brood is lost. The eggs will hatch after 27 to 31 days of incubation and the chicks fledge about 20 to 25 days after hatching. Piping plovers feed primarily on insects and aquatic invertebrates, and soon after hatching, the chicks begin foraging for themselves.

The USFWS designated critical habitat for the Northern Great Plains population of the piping plover (67 FR 57638), including the Missouri River, in September 2002. Designated areas of critical habitat include prairie alkali wetlands and surrounding shoreline; river channels and associated sandbars and islands; and reservoirs and inland lakes and their sparsely vegetated shorelines, peninsulas, and islands.

The USFWS has designated critical habitat for the piping plover in Hughes and Stanley counties (USFWS, 2002), where the piping plover is known to occur, but no critical habitat has been designated on Lake Sharpe (USACE, 2004c.) Use of the Big Bend Project area by the piping plover has not been regular. Because the Lake Sharpe pool elevation is so stable, grasses and shrubs may grow to the edge of the lake, and there are few un-vegetated beach areas. Other potential factors such as predation and/or human disturbance may also be involved (USACE, 2003).

Bald Eagle (*Haliaeetus leucocephalus)* - State Threatened

Bald eagles are known to occur in all five counties bordering the Big Bend project (USFWS, 2004). Up to 200 eagles use the upper end of Lake Sharpe during the late fall and winter, primarily on Farm Island and LaFramboise Island. The availability of food and roosting cover in this area is critical to its use by eagles for overwintering (USACE 1995). In the spring of 2002 and again in the spring of 2003, a pair of bald eagles nested five miles downstream of Big Bend Dam on the east bank, within the Crow Creek Tribal Reservation, but did not produce any fledgling chicks. The bald eagle was de-listed (i.e., removed from the list of threatened and endangered species) on June 29, 2007. However, the U.S. Fish and Wildlife Service continues to work with state wildlife agencies to monitor eagles for at least five years, as required by the Endangered Species Act. If at any time it appears that the bald eagle again needs the Act's protection, the U.S. Fish and Wildlife Service can propose to re-list the species.

The bald eagle remains protected by the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA). In July 2007, the National Bald Eagle Management Guidelines (the Guidelines) (72 FR 31156 31157) were released for public review to identify certain human-caused impacts to bald eagles that are still prohibited by law. Commercial and residential development, forestry practices, outdoor recreation, natural resource recovery operations, and other human activities can potentially interfere with bald eagles or permanently degrade or destroy bald eagle nesting, roosting, and foraging areas (USACE, 2007). In some cases, such impacts amount to violations of the provisions of the BGEPA or the MBTA that protect bald eagles.

The USFWS developed the Guidelines to advise landowners, land managers, and others who share public and private lands with bald eagles when and under what circumstances the protective provisions of the BGEPA may apply to them. The Guidelines were designed to promote the continued conservation of the bald eagle following its removal from the Federal List of Endangered and Threatened Wildlife and Plants (protection under the ESA).

The Guidelines are intended to:

1. Publicize the provisions of the BGEPA that continue to protect bald eagles, in order to reduce the possibility that people will violate the law;
2. Advise landowners, land managers, and the general public of the potential for various human activities to disturb bald eagles; and
3. Encourage land management practices that benefit bald eagles and their habitat.

During the critical nesting periods, construction activities and other forms of disturbance should not be permitted within ¼ mile of the active nest tree or perch trees if the activity is not visible from the nest. If the eagles have line-of-sight vision from these trees to the construction activities or other types of disturbance, the distance is one half mile (USACE, 2007). The presence of human activity in this area would usually cause nesting disturbance.

American Burying Beetle (*Nicrophorus americanus*) - Federally Endangered

The American burying beetle is approximately one and half inches long with a shiny black body and orange-red markings. Historically this beetle was found in 35 states, the District of Columbia, and three Canadian provinces. Currently, natural populations only exist in Rhode Island, Oklahoma, Arkansas, and Nebraska. In July 1989 the American burying beetle was added to the Federal Register of endangered species (USFWS, 2011).

The American burying beetle is presently not known to exist in the Lake Sharpe area, but status surveys have not been completed. The beetle has been found in Gregory, Tripp, and Todd counties (USFWS, 2004), mostly in southern Tripp County, and all other survey efforts in South Dakota, including surveys on Big Bend project lands, have been negative. Based on results of previous surveys and lack of suitable habitat, the beetle is unlikely to occur in the Big Bend Project area (USACE, 2004c).

Sprague's Pipit (*Anthus spragueii*) - Candidate Species

Sprague's Pipit is a small (approximately 5.5 inches in length) grassland specialist bird endemic to the mixed-grass prairie in the northern Great Plains of North America. They are currently a Candidate Species for federally listing as endangered or threatened (USFWS, 2010a). After having been petitioned for listing in 2008 (WEG, 2008), the USFWS determined that the petition presented substantial information indicating that listing the Sprague's Pipit was warranted but was precluded by higher listing priorities (USFWS, 2010a). They are not state-listed in South Dakota (SDGFP, 2010). The following species information is taken from the USFWS 2010 Sprague's Pipit Conservation Plan (USFWS, 2010a).

Sprague's Pipits breed in the northern Great Plains, with their highest numbers occurring in the central mixed-grass prairie of north-central and eastern Montana, North Dakota, and northwestern and north-central South Dakota. Sprague's Pipits are closely associated with native prairie grassland throughout their range and are less abundant (or absent) in areas of introduced grasses. Generally, pipits prefer to breed in well-drained native grasslands with high plant species richness and diversity.

The principal causes for the declines in Sprague's Pipit range and populations are habitat conversion (to seeded pasture, hayfield, and cropland) as well as overgrazing by livestock. In addition to the habitat losses from changes in land use, energy development, introduced plant species, nest predation and parasitism, drought, and fragmentation of grasslands are all threats that currently impact Sprague's Pipits populations throughout their present range.

Sprague's Pipits are likely influenced by the size of grassland patches and the amount of grassland in the landscape. Pipits had a 50-percent probability of occurring on patches $\geq$ approximately 400 acres; pipits were absent from grassland patches < 72 acres. The shape of the habitat is also important; sites with a smaller edge-to-area ratio had higher pipit abundance, and were an important predictor of their occurrence. No consistent effect of patch size was found on nest success. Sprague's Pipits rarely occur in cultivated lands, and are uncommon on non-native planted pasturelands. They have not been documented to nest in cropland, in land in the Conservation Reserve Program, or in dense nesting cover planted for waterfowl habitat.

The conversion, degradation, fragmentation, and loss of native prairie are the primary threats to Sprague's Pipit populations. The once abundant grasslands of the Great Plains have been drastically reduced, altered, and fragmented by intensive agriculture, roads, tree plantings, encroachment by woody vegetation, invasion of exotic plants, and other human activities, including the removal of native grazers and a change in the natural fire regime. In the United States, about 60-percent of native mixed-grass prairies in Montana, North Dakota, and South Dakota have been converted to cropland. Grassland conversion has greatly reduced the quality and availability of suitable habitat for Sprague's Pipits.

Fragmentation of native prairie has likely contributed to the decline of Sprague's Pipit populations through a reduction in average patch size, increased isolation of habitat patches, and increase in the ratio of edge-to-interior in habitat and potentially, an increase in parasitism. In fragmented landscapes, habitat interior species such as Sprague's Pipits may experience lower reproductive success when nesting near habitat edges, where they are more susceptible to nest predators and brood parasites (e.g., brown headed cowbird). Sprague's Pipit abundance has been inversely correlated with distance to cropland and to water.

Sprague's Pipits may avoid roads and trails during the breeding season and the increased roads densities associated with energy development may have negative effects on Sprague's Pipit habitat. The type of road (e.g., secondary or tertiary, the presence of deep ditches on the sides, heavily graveled) and the level of traffic are the potential issues in determining the degree of effect roads and trails have on Sprague's Pipit populations. In Saskatchewan, Sprague's Pipits were significantly more abundant along trails (wheel ruts visually indistinct from surroundings) than along roadsides (fenced surfaced roads with adjacent ditches), which may be attributed to the reduction of suitable habitat associated with the road right-of-way. Sprague's Pipits avoidance of roads may also be due to the roadside habitat which tended to have non-native vegetation, dominated by smooth brome (*Bromus inermis*).

The candidate species receive no legal protection under the Endangered Species Act; that is, there are no legal prohibitions under the federal Endangered Species Act against taking candidate species. The Fish and Wildlife Service works to implement conservation actions for candidate species that may eliminate the need to list the species as threatened or endangered.

Dakota Skipper (*Hesperia dacotae*) - Candidate Species

The Dakota skipper (*Hesperia dacotae*) is a small butterfly with a 1-inch wingspan. Like other skippers, they have a thick body and a faster and more powerful flight than most butterflies. The upper side of the male's wings range from tawny-orange to brown with a prominent mark on the forewing; the lower surface is dusty yellow-orange. The upper side of the female's wing is darker brown with tawny-orange spots and a few white spots on the margin of the forewing; the lower side is gray-brown with a faint white spotband across the middle of the wing. Dakota skipper pupae are reddish-brown and the larvae (caterpillars) are light brown with a black collar and dark brown head.

Dakota skippers are found in undisturbed native prairie containing a high diversity of wildflowers and grasses. Habitat includes two prairie types: 1) low (wet) prairie dominated by bluestem grasses, wood lily, harebell, and smooth camas; and 2) upland (dry) prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, pale purple coneflower and upright coneflowers and blanketflower (USGS, 2006a). The Dakota skipper is found in the northeastern part of South Dakota, but has not been sighted in any counties adjacent to the Missouri River (USFWS, 2004).

The Dakota skipper is a candidate for listing under the Endangered Species Act. Candidate species are those for which U.S. Fish and Wildlife Service has sufficient information to list as threatened or endangered. To determine the order in which it proposes species for listing, the USFWS assigns listing priority numbers to candidate species based on the magnitude and immediacy of threats and the species' taxonomic distinctiveness. Listing priority numbers range from 1 (high priority) to 12 (low priority) and the Dakota skipper has a listing priority number of 11 (USFWS, 2009).

Candidate species receive no legal protection under the Endangered Species Act; that is, there are no legal prohibitions under the federal Endangered Species Act against taking candidate species. The Fish and Wildlife Service works to implement conservation actions for candidate species that may eliminate the need to list the species as threatened or endangered.

6.13.2 Environmental Consequences

No Action

Under the No Action alternative, the Corps of Engineers would not make a determination of surplus water, there would be no change to the M&I water supply, and there would be no new depletions from Lake Sharpe. Fish and wildlife trends observed over the last several years would be expected to continue. There would be no effect to the listing status or populations of endangered or threatened species.

Proposed Action

As described in Section 5.2, the lower three reservoirs (Lake Sharpe, Lake Francis Case, and Lewis and Clark Lake) are regulated in much the same manner year after year regardless of the runoff conditions in the basin. Because of how the System is operated, depletions from Lake Sharpe under the Proposed Action would result in small changes to the water surface elevations of the upper three System reservoirs (Fort Peck, Garrison, and Oahe), but not to Lake Sharpe. Therefore, the proposed depletions from Lake Sharpe would not result in changes to releases from the Fort Randall Dam or the Gavins Point Dam. As a result, there would be no predicted changes to the water surface elevations of Lake Sharpe or releases from the Big Bend Dam as a result of implementing the Proposed Action. Absent changes to the water surface elevations or releases, the Big Bend Project/Lake Sharpe fish and wildlife resources would not be affected.

Listed Species Effects Determinations

This Environmental Assessment represents the assessment and findings regarding the Proposed Action and serves as the Biological Assessment regarding the Proposed Action to federally listed species as requested under Section 7 of the Endangered Species Act.

Pallid Sturgeon (*Scaphirynchus albus*) - Endangered

Because depletions from Lake Sharpe would not result in changes to the water surface elevations in the lake (as described above) and because downstream of the Big Bend Dam there are essentially no differences between No Action and the Proposed Action for more than 95 percent of the days modeled, effects of the depletions on the pallid sturgeon would be highly unlikely.

The finding is a determination of may affect, but not likely to adversely affect the pallid sturgeon.

The finding with respect to the pallid sturgeon critical habitat is not likely to adversely affect or adversely modify the critical habitat for the pallid sturgeon.

Shovelnose Sturgeon (*Scaphirhynchus platorynchus*) - Threatened

Because this species is listed as threatened, but is not biologically threatened or endangered, no Biological Assessment or further Section 7 consultation under the Endangered Species Act would be required with the USFWS.

Because the proposed projects are not associated with commercial fishing, a determination for the shovelnose sturgeon is not required.

Topeka Shiner (*Notropis topeka)* - Endangered

In South Dakota, the Topeka shiner was formerly common in the Big Sioux, Vermillion, and James River drainages and still persists there but in low numbers. Because the species requires high-quality prairie streams, and are intolerant of human-caused disturbances and habitat alterations, they are highly unlikely at the Big Bend Project/Lake Sharpe.

The finding is a determination of no effect to the Topeka shiner.

Black-Footed Ferret (*Mustela nigripes*) - Endangered

The Big Bend Project area lies within the historic range for the black-footed ferret, but the black-footed ferret is not found on Big Bend Project lands. As such, the black-footed ferret would not be likely to occur within any areas potentially affected by the proposed action.

The finding is a determination of no effect to the black-footed ferret.

Gray Wolf (*Canis lupus*) - Endangered

There are no known populations of wolves in South Dakota. In addition, the gray wolf has not been observed near Lake Sharpe and effects to the gray wolf would be highly unlikely.

The finding is a determination of no effect to the gray wolf.

Whooping Crane (*Grus americana*) - Endangered

Other than a potential for brief stoppage during seasonal migration, the whooping crane would not be likely to occur within the Lake Sharpe Project area. Effects of the Proposed Action on the whopping crane would be highly unlikely.

The finding is a determination of may affect, but not likely to adversely affect the whooping crane.

Interior Least Tern (*Sterna antillarum athalassos*) - Endangered

The interior least tern is uncommon the Big Bend Project and Lake Sharpe does not provide good least tern habitat. Given that the depletions were shown to have very little effect on Lake Sharpe, the Big Bend Dam discharge, or the Missouri River system, the effect of the Proposed Action on the interior least tern would be negligible.

The finding is a determination of may affect, but not likely to adversely affect the interior least tern.

Piping Plover (*Charadrius melodus*) - Northern Great Plains population - Threatened

The Big Bend Project/Lake Sharpe do not provide good habitat for the piping plover and no critical habitat has been designated at Lake Sharpe (USACE, 2004c). Given that the depletions were shown to have very little effect on Lake Sharpe, the Big Bend Dam discharge, or the Missouri River system, the effect of the Proposed Action the piping plover would be negligible.

The finding is a determination of may affect, but not likely to adversely affect the piping plover.

The finding with respect to the piping plover critical habitat is a determination that the project would not impact the critical habitat for the piping plover.

Bald Eagle (*Haliaeetus leucocephalus) - Not Listed*

The bald eagle is common at the Big Bend Project. Because Lake Sharpe and the Big Bend Project is regulated in much the same manner year after year regardless of the runoff conditions, depletions from Lake Sharpe would not result in changes to the water surface elevations in Lake Sharpe.

The finding is a determination of no effect to the bald eagle.

American Burying Beetle (*Nicrophorus americanus*) - Endangered

The American burying beetle is presently not known to exist in the Lake Sharpe area, but status surveys have not been completed. The beetle prefers habitat with significant humus or topsoil suitable for burying carrion. Effects of the Proposed Action on the American burying beetle would be highly unlikely.

The finding is a determination of no effect to the American burying beetle.

Sprague's Pipit (*Anthus spragueii*) - Candidate

Sprague's Pipits breed in the northern Great Plains, with their highest numbers occurring in the central mixed-grass prairie of north-central and eastern Montana, North Dakota, and northwestern and north-central South Dakota. They are considered a migrant in the area of the Big Bend Project and would not be expected to be found breeding in the adjacent counties in South Dakota. Determinations are not required for candidate species unless the Proposed Action is likely to jeopardize the continued existence of the species. The USFWS encourages agencies to avoid impacts to candidate species and for that reason, the analysis and finding of effects is included.

The finding is a determination of not likely to adversely affect for the Sprague's Pipit

Dakota Skipper (*Hesperia dacotae*) - Candidate

The Dakota skipper is not found in the portions of South Dakota potentially affected by the proposed action and would therefore not be likely to affect the habitat or a population of the Dakota skipper. Determinations are not required for candidate species unless the Proposed Action is likely to jeopardize the continued existence of the species. The USFWS encourages agencies to avoid impacts to candidate species and for that reason, the analysis and finding of effects is included.

The finding is a determination of not likely to adversely affect the Dakota skipper.

7 Cumulative Effects of the Proposed Action

NEPA requires a Federal agency to consider not only the direct and indirect impacts of a proposed action, but also the cumulative impact of the action. A cumulative impact is defined as "*the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR§1508.7).*" Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. These actions include on- or off-site projects conducted by government agencies, businesses, or individuals that are within the spatial and temporal boundaries of the actions considered.

7.1 Effects of Depletions

As stated the beginning of Section 6, three separate planning scenarios were used to evaluate the magnitude of the predicted environmental effects. The indirect effects were evaluated based on the baseline depletions (No Action) and the additional 5,661 acre-feet of depletions at Lake Sharpe (Proposed Action). In addition, a total of 17,156 acre-feet of additional depletions was assessed to evaluate the cumulative effects of making surplus water available from each of the other five system reservoirs. This section addresses these cumulative effects to system hydrology.

The source of the actual System inflow data is the U.S. Geological Survey, which began acquiring daily data beginning in late 1929. The DRM adjusts these inflow data by the difference for depletions that have been estimated to occur between each year and 2002. The Bureau of Reclamation provided the monthly depletions, and these monthly data were further separated to daily values for use in the DRM. Inflow and depletion data are available for each of the DRM modeling reaches; the 2002 depletion data are assumed to remain constant through 2010 (assumes no change from 2002 to 2010).

Because the Missouri River reservoirs are operated as an integrated system, 5,661 acre-feet of additional depletions at Lake Sharpe and 17,156 acre-feet/year in additional system depletions could conceivably reduce releases and water surface elevations throughout all six System reservoirs and the free-flowing reaches of the Missouri River. Reductions in reservoir releases and lake elevations have the potential effect on resources through these reductions in flows and water surface elevations.

As described in Section 5.2, 88-percent of the System's combined storage capacity is in the upper three reservoirs of Fort Peck, Lake Sakakawea, and Lake Oahe. The lower three projects (Big Bend, Fort Randall, and Gavins Point) are regulated in much the same manner, regardless of the runoff conditions. Therefore, potential cumulative effects to water surface elevations would only be observed in the upper three reservoirs.

Figures 14, 15, and 16 show the duration plots for the water surface elevations of the big three upper reservoirs (Fort Peck Lake, Lake Sakakawea, and Lake Oahe). The line label "CUMWP" is an abbreviation for "cumulative with project." For nearly all days modeled, the differences in the duration plots of the differences in daily values (comparing same day to same day) were the same or resulted in less than a foot of elevation difference. Figure 17 shows the duration plots for the releases from Gavins Point Dam showing the cumulative effects on discharges (in thousands of cubic feet per second, KCFS) from the downstream-most reservoir in the system. The figure indicates that the cumulative effect of implementing of the temporary water supply projects on each of the System reservoirs would result in virtually no change to the discharge from the Gavins Point Dam, relative to the current conditions. Because of the overt inability of the cumulative depletions to effect change to the physical environment (water surface elevations and discharge), there would be no discernible change to the authorized project purposes of flood control, navigation, hydropower, water supply, or recreation.

Figure 14
Cumulative Fort Peck Lake WSE Difference Distribution

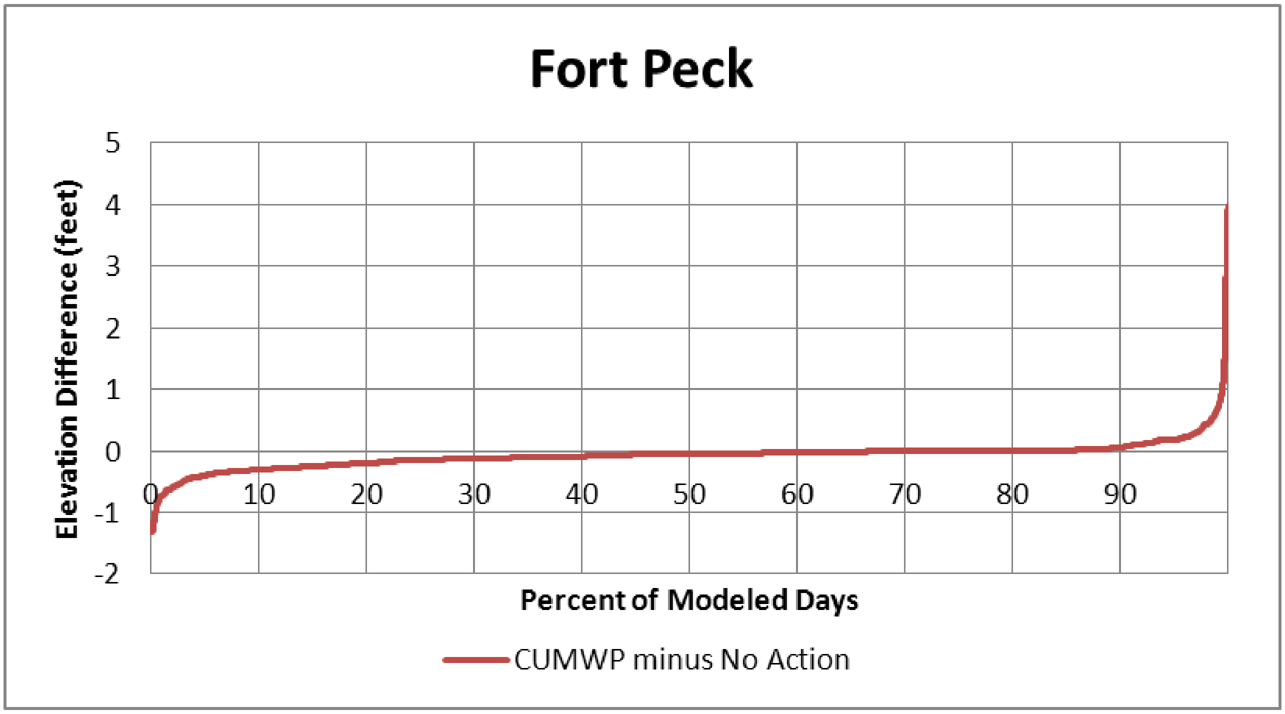


Figure 15
Cumulative Lake Sakakawea WSE Difference Distribution

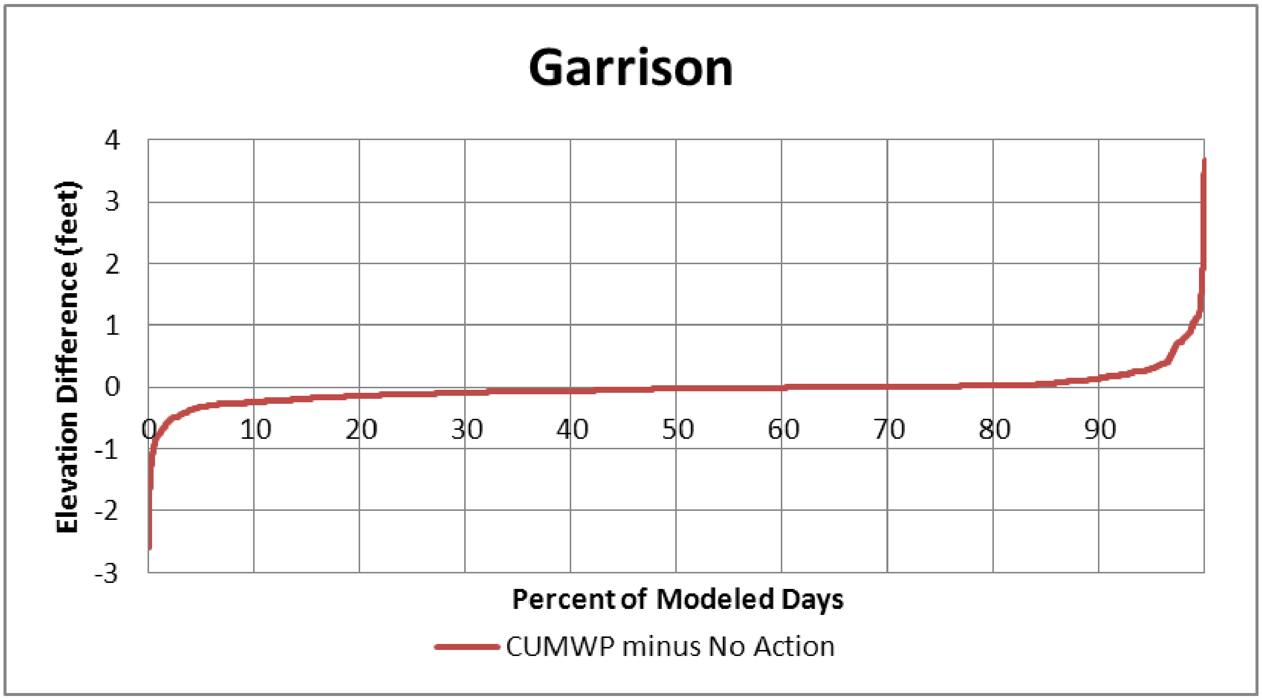


Figure 16
Cumulative Lake Oahe WSE Difference Distribution

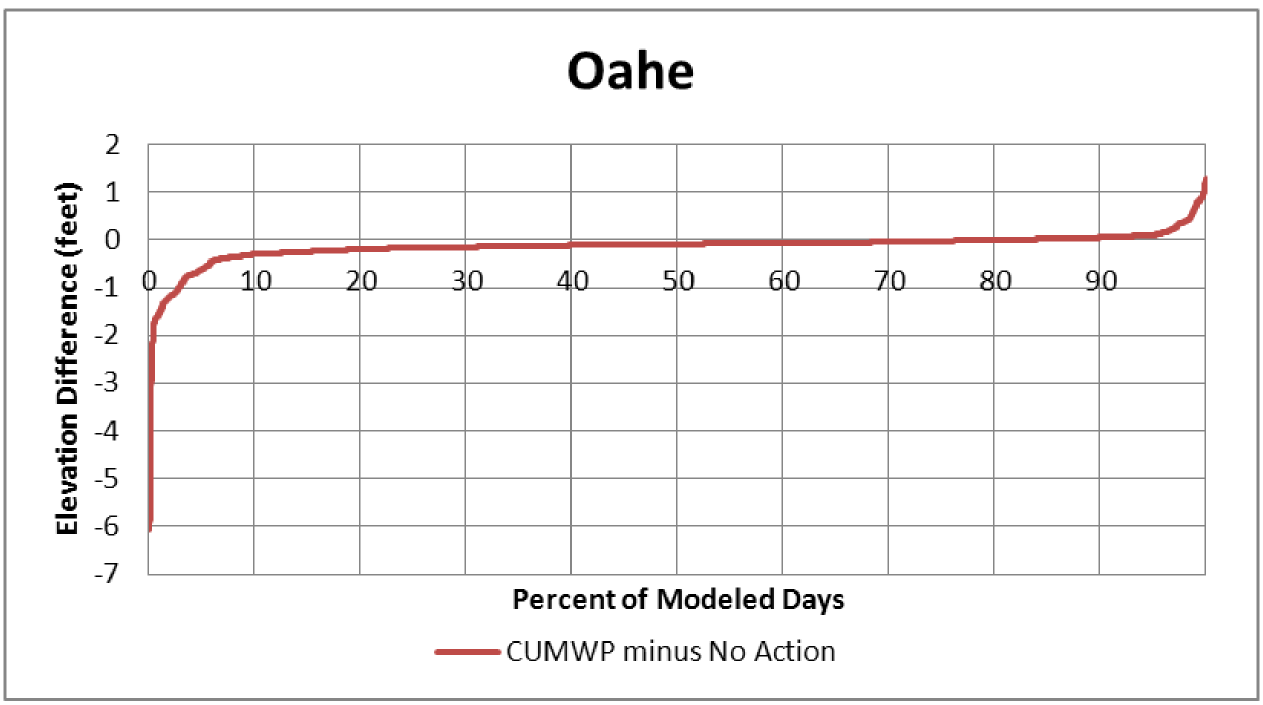
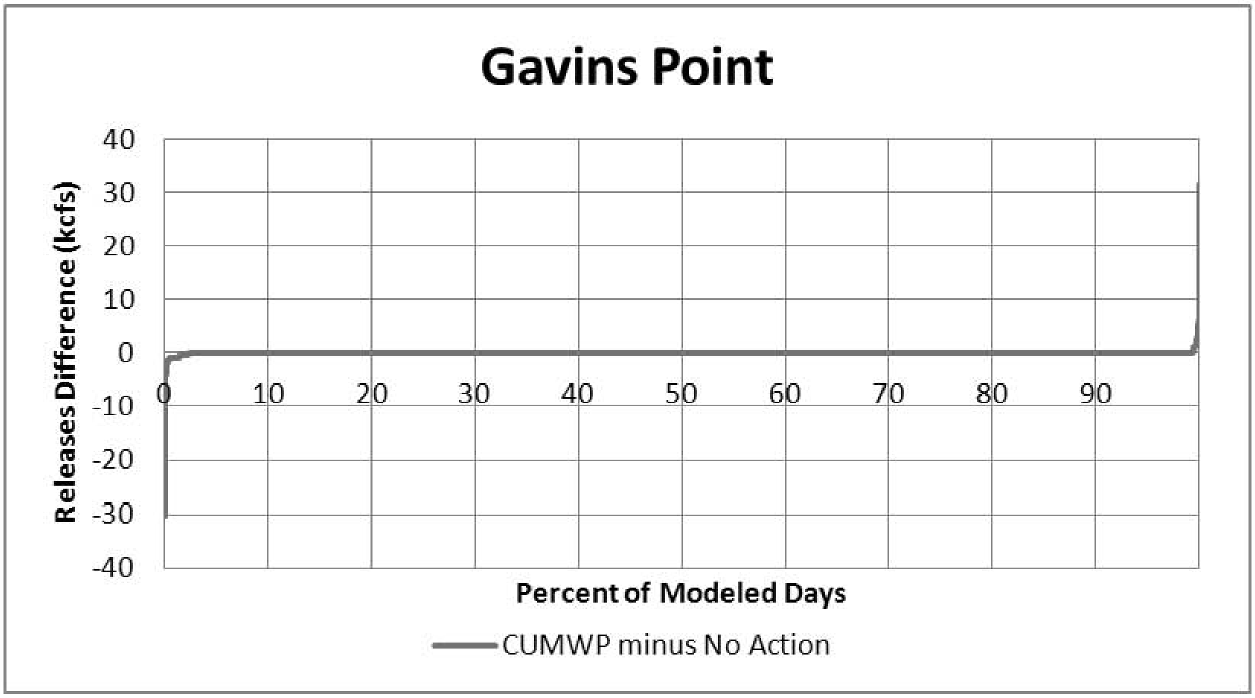


Figure 17
Cumulative Gavins Point Dam Release Difference Distribution



8 Compliance with Environmental Laws and Regulations

Making the surplus water determination would not occur until the Proposed Action achieves environmental compliance with all applicable laws and regulations as described below. Environmental compliance for the proposed action would be achieved upon coordination of this Environmental Assessment with appropriate agencies, organizations, and individuals for their review and comments.

American Indian Religious Freedom Act (AIRFA) of 1978, 42 U.S.C. 1996.

In compliance.

The American Indian Religious Freedom Act (AIRFA) calls for the U.S. government to respect and protect the rights of Indian tribes to the free exercise of their traditional religions. The courts have interpreted this act as requiring agencies to consider the effects of their actions on traditional religious practices. Federal agencies must make reasonable efforts to ensure religious rights are accommodated. AIRFA does not protect Native American religions beyond the guarantees of the First Amendment. There is no affirmative relief provision under the act. It merely provides that any subsequent federal laws enacted take into consideration religious practices of Native Americans. This project would not adversely affect the protections offered by this Act.

Bald Eagle Protection Act, 16 U.S.C. Sec. 668, 668 note, 668a-668d.

In compliance.

The Bald Eagle Protection Act contains requirements on Corps projects concerning bald eagles. This project would not adversely affect bald eagles or their habitat.

Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq.

In compliance.

The purpose of this Act is to protect public health and welfare by the control of air pollution at its source, and to set forth primary and secondary National Ambient Air Quality Standards to establish criteria for States to attain, or maintain. No emissions would occur as a result of implementing the Proposed Action.

Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq.

In compliance.

The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters (33 U.S.C. 1251). The Corps regulates discharges of dredge or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act. This permitting authority applies to all waters of the United States including navigable waters and wetlands. The Section 404 requires authorization to place dredged or fill material into water bodies or wetlands. If a section 404 authorization is required, a section 401-water quality certification from the state in which the discharge originates is also needed. The proposed determination of surplus water could lead to the eventual granting of easements and installation of water intakes at various locations on the Lake Sharpe shoreline including placement of the intake structure, pipeline, utility lines for power and then the length of pipeline to the terminus. Each proposed new intake would be subject to regulatory review and separate assessment under NEPA.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

Not applicable.

Typically CERCLA is triggered by (1) the release or substantial threat of a release of a hazardous substance into the environment; or (2) the release or substantial threat of a release of any pollutant or contaminant into the environment that presents an imminent threat to the public health and welfare. To the extent such knowledge is available, 40 CFR Part 373 requires notification of CERCLA hazardous substances in a land transfer. This project would not involve any real estate transactions.

Endangered Species Act, as amended. 16 U.S.C. 1531, et seq.

Partial compliance.

Section 7 (16 U.S.C. 1536) states that all Federal departments and agencies shall, in consultation with and with the assistance of the Secretary of the Interior, insure that any actions authorized, funded, or carried out by them do not jeopardize the continued existence of any threatened or endangered (T&E) species, or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary to be critical.

This Environmental Assessment represents the assessment and findings regarding the Proposed Action and serves as the Biological Assessment with a determination of no effect to the Western prairie fringed orchid, Topeka shiner, black footed ferret, gray wolf, American burying beetle, and the bald eagle. The findings also allow a determination of may affect, but not likely to adversely affect the pallid sturgeon, interior least tern, piping plover, whooping crane, Dakota skipper, and the Sprague's pipit. The findings allow a determination of not likely to adversely affect and not be expected to adversely modify the critical habitat for the pallid sturgeon or piping plover. A letter concurring that this project would have no effect on, or would not likely adversely affect, threatened and endangered species is expected from the USFWS.

Environmental Justice (E.O. 12898).

In compliance.

Federal agencies shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. The project does not disproportionately affect minority or low-income populations.

Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(12), et seq.

Not applicable.

The Act establishes the policy that consideration be given to the opportunities for outdoor recreation and fish and wildlife enhancement in the investigating and planning of any Federal navigation, flood control, reclamation, hydroelectric or multi-purpose water resource project, whenever any such project can reasonably serve either or both purposes consistently. There is no opportunity to enhance recreational resources in conjunction with this project.

Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq.

In compliance.

The FWCA requires governmental agencies, including the Corps, to coordinate activities so that adverse effects on fish and wildlife would be minimized when water bodies are proposed for modification. There are no new intakes or water supply infrastructure proposed as part of the Proposed Action. All future easements and water supply agreements require review by the Corps of Engineers prior to allowing placement of infrastructure. In this process, the Corps would complete NEPA evaluations and comply with all appropriate environmental laws and regulations, including the Fish and Wildlife Coordination Act.

Land and Water Conservation Fund Act (LWCFA), as amended, 16 U.S.C. 4601-4601-11, et seq.

Not applicable.

Planning for recreation development at Corps projects is coordinated with the appropriate states so that the plans are consistent with public needs as identified in the State Comprehensive Outdoor Recreation Plan (SCORP). The Corps must coordinate with the National Park Service (NPS) to insure that no property acquired or developed with assistance from this Act will be converted to other than outdoor recreation uses. If conversion is necessary, approval of NPS is required, and plans are developed to relocate or re-create affected recreational opportunities. No lands involved in the proposed project were acquired or developed with LWCFA funds.

Migratory Bird Treaty Act

Partial compliance.

The Migratory Bird Treaty Act of 1918 (MBTA) is the domestic law that affirms, or implements, the United States' commitment to four international conventions with Canada, Japan, Mexico and Russia for the protection of shared migratory bird resources. The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts and nests. The take of all migratory birds is governed by the MBTA's regulation of taking migratory birds for educational, scientific, and recreational purposes and requiring harvest to be limited to levels that prevent over utilization. Executive Order 13186 (2001) directs executive agencies to take certain actions to implement the act. The Corps will be in consultation with the USFWS with regard to this activity’s potential effects on migratory birds.

National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq.

Partial compliance.

This Act instructs federal agencies having direct or indirect jurisdiction over a proposed federal or federally-assisted undertaking to take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. Discussions between the Corps and South Dakota State Historic Preservation Office (SHPO) are ongoing, and final coordination with regard to this law will be completed. The Corps has made the determination that the proposed project will have no effect on cultural resource and SHPO concurrence is expected.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4321, et seq.

In compliance.

This environmental assessment (EA) has been prepared in accordance with the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR 1508.9).

1990 - Native American Graves Protection and Repatriation Act (P.L. 101-601; 25 U.S.C § 3001-13; 104 Stat. 3042)

The Native American Graves Protection and Repatriation Act (NAGPRA) addresses certain Native American and Native Hawaiian cultural items. In part, it establishes a process to follow in the event of an inadvertent discovery of human remains, funerary, sacred, and other objects of cultural patrimony from sites located on land owned or controlled by the federal government.

Noise Control Act of 1972, 42 U.S.C. Sec. 4901 to 4918.

In compliance.

This Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. Federal agencies are required to limit noise emissions to within compliance levels.

North American Wetlands Conservation Act, 16 U.S. C. Sec. 4401 et. seq.

Not applicable.

This Act establishes the North American Wetlands Conservation Council (16 U.S.C.4403) (NAWCC) to recommend wetlands conservation projects to the Migratory Bird Conservation Commission (MBCC). Section 9 of the Act (16 U.S.C. 4408) addresses the restoration, management, and protection of wetlands and habitat for migratory birds on Federal lands. Federal agencies acquiring, managing, or disposing of Federal lands and waters are to cooperate with the Fish and Wildlife Service to restore, protect, and enhance wetland ecosystems and other habitats for migratory birds, fish and wildlife on their lands, to the extent consistent with their missions and statutory authorities. There will be no disposal of land with this project.

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403)

In compliance.

This law prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The Secretary's approval authority has since been delegated to the Chief of Engineers. Lake Sharpe is considered a "navigable water of the United States," but there are no new intakes or water supply infrastructure proposed as part of the Proposed Action. All future easements and water supply agreements require review by the Corps of Engineers prior to allowing placement of infrastructure. In this process, the Corps would complete NEPA evaluations and comply with all appropriate environmental laws and regulations, including Section 10 of the Rivers and Harbors Act.

Watershed Protection and Flood Prevention Act, 16 U.S.C. 1101, et seq.

Not applicable.

This Act authorizes the Secretary of Agriculture to cooperate with states and other public agencies in works for flood prevention and soil conservation, as well as the conservation, development, utilization, and disposal of water. This act imposes no requirements on Corps Civil Works projects.

Floodplain Management (E.O. 11988).

In compliance.

Section 1 requires each agency to provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities for (1) acquiring, managing, and disposing of federal lands and facilities; (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. The proposed project would not affect the flood holding capacity or flood surface profiles of any stream.

Protection of Wetlands (E.O. 11990).

In compliance.

Federal agencies shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agencies responsibilities. Each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands, which may result from such use. In making this finding, the head of the agency may take into account economic, environmental and other pertinent factors. Each agency shall also provide opportunity for early public review of any plans or proposals for new construction in wetlands.

There are no new intakes or water supply infrastructure proposed as part of the Proposed Action. All future easements and water supply agreements require review by the Corps of Engineers prior to allowing placement of infrastructure. In this process, the Corps would complete NEPA evaluations and comply with all appropriate environmental laws and regulations, including E.O. 11990.

CEQ Memorandum, August 10, 1980, Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers In the Nationwide Inventory.

Not applicable.

This memorandum states that each Federal agency shall take care to avoid or mitigate adverse effects on rivers identified in the Nationwide Inventory (FR 1980). No portion of Lake Sharpe is listed on the Nationwide Rivers Inventory.

Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et sq.

In compliance.

This act establishes that certain rivers of the Nation, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The area in which the direct effects of the proposed activity would occur is not designated as a wild or scenic river, nor is it on the National Inventory of Rivers potentially eligible for inclusion. The downstream indirect effects of the proposed action would be indiscernible from existing conditions within segments of the Missouri River designated as Wild and Scenic Rivers.

9 Summary of Environmental Effects

Because of the small magnitude of the modeled changes to discharges from the Big Bend Dam and water surface elevations of Lake Sharpe, the remaining five System reservoirs, and the riverine reaches of the Upper Missouri River as a result of the Proposed Action, the following environmental resources discussed in Section 6 would not be expected to have any measurable change over the existing condition or effects from implementing the Proposed Action: groundwater, water quality, air quality, land use, demographics, employment/income, environmental justice, recreation, aesthetics/visual resources, land use, cultural resources, vegetation/terrestrial habitat, and fish and wildlife. In addition, there would be no effects to project purposes anticipated.

This Environmental Assessment represents the assessment and findings regarding the Proposed Action and serves as the Biological Assessment with a determination of no effect to the Western prairie fringed orchid, Topeka shiner, black footed ferret, gray wolf, American burying beetle, and the bald eagle. The findings also allow a determination of may affect, but not likely to adversely affect the pallid sturgeon, interior least tern, piping plover, whooping crane, Dakota skipper, and the Sprague's pipit. The findings allow a determination of not likely to adversely affect and not be expected to adversely modify the critical habitat for the pallid sturgeon or piping plover.

The expected environmental consequences of implementing the Proposed Action to identify surplus water storage, as defined in Section 6 of the 1944 Flood Control Act, which the Secretary of the Army can make available to execute surplus water supply agreements with prospective M&I water users for up to 14,548 acre-feet of storage (additional 5,661 acre-feet of yield) from Lake Sharpe would not be expected to be significant and would not require the preparation of an Environmental Impact Statement.

As stated in Section 5.1.3, the scope of the environmental analysis in this EA evaluates the indirect and cumulative effects of the depletions of the surplus water. As applicants submit requests for surplus water, applicants would need to prepare site-specific analyses to assess the site-specific effects of the water supply intake infrastructure and distribution. The applicant would work directly with the local Project Office (e.g., Lake Sharpe Project Office) receiving the necessary instruction that has been established to evaluate water supply requests and their associated real estate outgrant requests (Real Estate Policy Guidance; USACE, 2011a).

Following the guidelines in the Real Estate Policy Guidance, the applicant would complete and submit the necessary request (typically including a request letter, maps/locations, area of disturbance, development plan, regulatory permit application, and draft NEPA documentation). Once in receipt of a complete application, the District would complete the NEPA process, provide notification to the real estate office for issuance of an easement, and obtain the necessary permits prior to construction. Each Project Office has a set of conditions of consideration for evaluating requests for water intake site selection. These conditions of consideration have been developed to avoid important environmental resources and minimize the environmental consequences of intake construction and operation.

10 Coordination, Consultation, and List of Preparers

10.1 List of Tribes, Agencies, and Persons Consulted

In early September 2010, a letter was sent to Governors, state and federal agencies, and Tribes formally notifying them of the intent to undertake the surplus water studies and Environmental Assessment and inviting their representation at an informational meeting on 29 September 2010 in Bismarck, ND. Governors included in the correspondence were: Honorable Dave Heineman, Governor of Nebraska; Honorable Brian Schweitzer, Governor of Montana, Montana State Capitol Building; Honorable Mike Rounds, Governor of South Dakota; Honorable John Hoeven; Governor of North Dakota; Honorable Chet Culver, Governor of Iowa; Honorable Jay Nixon; Governor of Missouri; and Honorable Mark Parkinson, Governor of Kansas. An example copy of one of these letters is attached in Appendix A.

In late April 2011, the Corps of Engineers formally invited the respective Tribes, federal, and state agencies to attend any of three informational meetings on the surplus water studies. The first was held on 10 May 2011 at the Fort Peck Interpretive Center, Fort Peck, Montana; the second was held on 11 May 2011 at the South Dakota Cultural Heritage Center, Pierre, South Dakota; and the third was held 23 May 2011 at the Zorinsky Federal Building, Omaha, Nebraska. The purpose of the meetings was to provide information to the attendees on the surplus water studies as well as give the agencies an opportunity to ask questions and provide initial feedback. Example copies of letters sent to both the Tribes and agencies is also attached in Appendix A. The distribution list of Tribes and agencies invited to participate in these meetings is provided below.

<u>Tribes</u>

Assiniboine and Sioux Tribes of Fort Peck, Poplar, Montana 59255
    Chairman, A.T. Stafne
    Vice Chairperson, Ms. Roxann Bighorn
Blackfeet Nation, Browning, Montana 59417
    Chairman, Willie A. Sharp, Jr
    Vice Chairman, Peter "Rusty" Tatsey
Cheyenne River Sioux Tribe, Eagle Butte, South Dakota 57625
    Chairman, Kevin Keckler
    Vice Chairman, Ted Knife, Jr.
Chippewa Cree Tribe of the Rocky Boy Reservation, Box Elder, Montana 59521-9724
    Chairman, Jake Parker
    Vice Chairman, Bruce Sunchild
Confederated Salish and Kootenai Tribes of the Flathead Reservation
    Chairman, E.T. Bud Morgan
    Vice Chairman, Joe Durglo
Crow Creek Sioux Tribe, Fort Thompson, South Dakota 57339-0050
    Chairman, Duane Big Eagle Sr.
    Vice Chairman, Wilfred Keeble
Crow Nations, Crow Reservation, Montana 59022
    Chairman Cedric Black Eagle
    Vice Chairman, Coolidge Jefferson

Eastern Shoshone Tribe, Wind River Reservation, Wyoming 82514
Chairman, Mike LaJeunesse
Vice Chairman, Wes Martel
Flandreau Santee Sioux Tribe, Flandreau, South Dakota 57028
President, Anthony Reider
Vice President, Cynthia Allen-Weddell
Gros Ventre and Assiniboine Tribes, Harlem, Montana 59526-9705
Chairman, Tracey King
Vice Chairperson, Ms. Mel L. Adams Doney
Iowa Tribe of Kansas and Nebraska, White Cloud, KS 66094
Chairman, Tim Rhodd
Kaw Nation, Kaw City, OK 74641
Chairman, Guy Munroe
Vice Chairman, Bill Kekahbah
Kickapoo Tribe of Kansas, Horton, KS 66439-9537
Chairman, Russell Bradley
Vice Chairman, Ms. Laura Razo
Lower Brule Sioux Tribe, Lower Brule, South Dakota 57548-0187
Chairman, Michael Jandreau
Vice Chairman, Floyd Gourneau
Northern Arapaho Tribe, Fort Washakie, Wyoming 82514
Chairperson, Mrs. Kim Harjo
Co-Chairman, Keith Spoonhunter
Northern Cheyenne Tribe, Lame Deer, Montana 59043
President, Leroy Spang
Vice President, Joe Fox, Jr.
Oglala Sioux Tribe, Pine Ridge, South Dakota 57770
Chairman, John Yellow Bird Steele
Vice Chairman, Tom Poor Bear
Omaha Tribe of Nebraska, Macy, Nebraska 68039-0368
Chairman, Amen Sheridan
Vice Chairman, Forrest Aldrich
Osage Nation, Pawhuska, Oklahoma 74056
Principal Chief, John D. Red Eagle
Assistant Chief, Scott Bighorse
Pawnee Tribe of Oklahoma, Pawnee, OK 74058
President, George E. Howell
Vice President, Charles Lone Chief
Ponca Tribe of Nebraska, Niobrara, Nebraska 68760
Chairperson, Ms. Rebecca White
Vice Chairman, James LaPointe
Prairie Band Potawatomi Nation, Mayetta KS 66509-8970
Chairman, Steve Ortiz
Vice Chairperson, Mrs. Joyce Guerrero
Rosebud Sioux Tribe, Rosebud, South Dakota 57570-0430
President, Rodney M. Bordeaux

Vice President, William Kindle

Sac and Fox of the Mississippi in Iowa/Meskwaki, Tama, IA 52339

Chairman, Adrian Pushetonequa

Vice Chairman, Jon Papakee

Sac and Fox Nation of Missouri in Kansas and Nebraska, Reserve, Kansas 66434

Chairperson, Ms. Twen Barton

Vice Chairperson, Mrs. Carey Wahwahsuck

Santee Sioux Nation, Santee, Nebraska 68760

Chairman, Roger Trudell

Vice Chairman, David Henry

Sisseton-Wahpeton Sioux Tribe, Agency Village, South Dakota 57262-0509

Chairman, Robert Shepherd

Vice Chairman, Gerald Rousseau

Spirit Lake Sioux Tribe, Fort Totten, North Dakota 58335

Chairperson, Ms. Myra Pearson

Vice Chairman, Darwin Brown

Standing Rock Sioux Tribe, Fort Yates, North Dakota 58538

Chairman, Charlie Murphy

Vice Chairman, Mike Faith

Three Affiliated Tribes, Fort Berthold Reservation, New Town, ND 58763

Chairman, Tex Hall

Vice Chairman, Scott Eagle

Turtle Mountain Band of Chippewa, Turtle Mountain Reservation Belcourt, North Dakota 58316

Chairman, Merle St. Claire

Vice Chairman, Curtis Poitra

Wichita and Affiliated Tribes, Anadarko, OK 73005

President, Stratford Williams

Winnebago Tribe of Nebraska, Winnebago, Nebraska 68071-0687

Chairman, John Blackhawk

Vice Chairman, Brian Chamberlain

Yankton Sioux Tribe, Marty, South Dakota 57361

Chairman, Robert Cournoyer

Vice Chairman, Ms. Karen Archambeau

Sac and Fox Nation of Oklahoma, Stroud, Oklahoma 74079

Ms. Sandra Massey

Region-Wide Contacts

Larry Svoboda, US Environmental Protection Agency Region 8, Denver CO 80202

Joe Cothern, US Environmental Protection Agency Region 7, Kansas City, KS 66101

Robin Johnson, Western Area Power Administration, Billings, MT 59107

Mike Ryan, Bureau of Reclamation Great Plains Regional Office, Billings, MT 59107

Dana Darlington, Missouri River Conservation Districts Council, Great Falls, MT 59401

<u>USACE Regulatory Offices</u>

Todd Tillinger, USACE Montana Regulatory Field Office, Helena, MT 59626

John Moeschen, Nebraska Regulatory Field Office, Omaha, NE 68138

Dan Cimarosti, USACE North Dakota Regulatory Field Office, Bismarck, ND 58504

Steven Naylor, USACE South Dakota Regulatory Field Office, Pierre, SD 57501

<u>North Dakota</u>

Dennis Breitzman, Bureau of Reclamation, Dakotas Area Office, Bismarck, ND 5850

Jeff Towner, US Fish and Wildlife Service, North Dakota Field Office, Bismarck, ND 58501

Terry Steinwand, North Dakota Game and Fish, Bismarck, ND 58501-5095

Dr. Terry Dwelle, North Dakota Department of Health, Bismarck, ND 58501-

Wayne Stenehjem, North Dakota Attorney General, Bismarck ND 58505

Doug Goehring, North Dakota Department of Agriculture, Bismarck, ND 58595

Todd Sando, PE, North Dakota State Engineer, Bismarck, ND 58505-0850

Paul Sweeney, North Dakota Natural Resource Conservation Service, Bismarck, ND 58505

Merlan E. Paaverud, Jr., North Dakota State Historical Society, Bismarck, ND 58505

Scott J. Davis, North Dakota Indian Affairs Commission, Bismarck, ND 58505

Mark Zimmerman, North Dakota Parks & Recreation Department, Bismarck, ND 58503

<u>South Dakota</u>

Pete Gober, US Fish and Wildlife Service, South Dakota Field Office, Pierre, SD 57501

Marty J. Jackley, SD Attorney General, Pierre, SD 57501

Walt Bones, SD Department of Agriculture, Pierre, SD 57501

Steven M. Pirner, P.E., SD Department of Environment and Natural Resources, Pierre, SD 57501

Jeff Vonk, SD Game Fish and Parks, Pierre, SD 57501

Doreen Hollingworth, SD Department of Health, Pierre, SD 57501

Leroy LaPlante, SD Department of Tribal Relations, Pierre, SD 57501

Jay Vogt, SD State Historical Society, Pierre, SD 57501

Janet Oertly, SD Natural Resources Conservation Service, Huron, SD 57350

Montana

Mark Wilson, US Fish and Wildlife Service, Montana Field Office, Helena, MT 59601

Dan Jewell, Montana Area Office, Bureau of Reclamation, Billings, MT 59107

Richard Opper, Montana Department of Environmental Quality, Helena, MT 59620

Mary Sexton, Montana Department of Natural Resources and Conservation, Helena, MT 59620

Joe Maurier, Montana Department of Fish, Wildlife, and Parks, Helena, MT 59601

Joyce Swartzendruber, Montana State Conservationist, Bozeman, MT 59715

Ron de Yong, Montana Department of Agriculture, Helena, MT 59601

Steve Bullock, Montana Attorney General, Helena, MT 59620

Mark Baumler, Montana Historical Society, Helena, MT 59620

Nebraska

Michael George, US Fish and Wildlife Service, Nebraska Field Office, Grand Island, NE 68801

Aaron Thompson, Bureau of Reclamation, Grand Island, NE 68802

Greg Ibach, NE Department of Agriculture, Lincoln, NE 68509

Jon Bruning, Nebraska Attorney General, Lincoln, NE 68509

Mike Linder, Nebraska Department of Environmental Quality, Lincoln, NE 68509

Rex Amack, Nebraska Game and Parks Commission, Lincoln, NE 68503

Michael Smith, Nebraska State Historical Society, Lincoln, NE 68501

Judi M. Gaiashkibos, Nebraska Commission on Indian Affairs, Lincoln, NE 68509

Brian Dunnigan, Nebraska Department of Natural Resources, Lincoln, NE 68509

Iowa

Bill Northey, Iowa Department of Agriculture, Des Moines, IA 50319

Roger Lande, Iowa Department of Natural Resources, Des Moines, IA 50319

Tom Miller, Iowa Attorney General, Des Moines, IA 50319

Missouri

Sara Parker Pauley, Missouri Department of Natural Resources, Jefferson City, MO 65102

Chris Koster, Missouri Attorney General, Jefferson City, MO 65102

10.2 Summary of Agency Meetings

The three agency coordination meetings were held in the respective states (MT/SD/NE) for the proposed projects. Surplus Water Reports are being completed for Ft. Peck Lake (Ft. Peck Project), Montana; Lake Oahe (Oahe Project), North and South Dakota; Lake Sharpe (Big Bend Project), South Dakota; Lake Francis Case (Ft. Randall Project), South Dakota and Lewis and

Clark Lake (Gavins Point Project), South Dakota. Agencies and individuals that were in attendance at the meetings are listed below.

Affiliation	Individual
U.S. Department of the Interior-Bureau of Reclamation	Nell McPhillips
U.S. Department of the Interior-Bureau of Reclamation	Greg Gere
U.S. Fish and Wildlife Service - Biologist	Terry Quesinberry
U.S. Fish and Wildlife Service - Field Supervisor	Scott Larson
U.S. Fish and Wildlife Service - NE Field Supervisor	Mike George
U.S. Army Corps of Engineers - SD Regulatory Office	Steve Naylor
U.S. Army Corps of Engineers - Omaha District	Tiffany Vanosdall
U.S. Army Corps of Engineers - Omaha District	Eric Laux
U.S. Army Corps of Engineers - Fort Peck Lake Manager	Darin McMurry
U.S. Army Corps of Engineers - Regulatory	Mary Hoffman
U.S. Army Corps of Engineers - Regulatory	John Moeschen
U.S. Army Corps of Engineers - Water Supply Manager	Larry Janis
U.S. Bureau of Reclamation	Kelly Titensor
U.S. Bureau of Reclamation	Dan Fritz
Crow Creek Sioux	Wanda Wells
MT Department of Natural Resources and Conservation	Tim Bryggman
MT Department of Agriculture	Robyn Cassel
SD Department of Environment and Natural Resources	Mark Rath
SD Game Fish and Parks - Aquatics Chief	John Lott
SD Department of Natural Resources - Chief Engineer	Garland Erbele
ND Attorney General’s Office - Assistant AG	Jennifer Verleger
ND State Water Commission	Kelly Casteel
ND State Water Commission	Bob Shaver
NE Game and Parks Commission	Gene Zuerlein
NE Historical Society	Terry Steinacher
NE Department of Natural Resources	Susan France
NE Department of Natural Resources	Steve Gaul
NE Department of Environmental Quality	John Bender
KS Water Office	Nathan Westrup
IA Department of Natural Resources	Michael Anderson
IA Department of Agriculture	Harold Hommes

Tiffany Vanosdall and Eric Laux (USACE, Omaha District) presented an overview of the proposed actions and information regarding:

- General information about Missouri River system, authorized purposes, storage;
- USACE water supply authorities and policies;
- Challenges of completing the study on the Missouri River;
- An Outline of a Surplus Water Report;

- Details of Demand, Storage Yield Analysis, Alternatives, Policy Pricing, Compensation to Others;
- The Requirements of the National Environmental Policy Act and Public Participation; and
- Data Gaps, Informational Needs, and Methods for Information Sharing.

Throughout the presentation, discussion occurred. The following summarizes the main points of the comments/questions received.

<u>Natural Flows</u>
Mark Rath (SDDENR) reiterated that the State's positions are similar to the State of North Dakota relative to surplus water determination at Lake Sakakawea (i.e., the Missouri River natural flow, now impounded by Missouri River System reservoirs, remains subject to the exclusive authority and jurisdiction of the individual states and that natural flow would be sufficient to meet water supply needs of the states).

<u>USDOI, Bureau of Reclamation Projects</u>

Bureau of Reclamation stated that they had recently sent a letter to Colonel Ruch (Omaha District Commander) seeking to work with the Corps of Engineers on a comprehensive review of Reclamation's authorized projects with withdrawals from Lakes Oahe and Sakakawea. Coming to consensus on all projects that are congressionally-authorized should prevent future delays regarding the Corps' issuance of construction easements for Reclamation projects, and clarify that those projects would be exempt from Corps water supply agreements.

<u>Storage Yield Analysis</u>

The North Dakota State Water Commission (ND SWC) was interested in the methodologies employed to figure system yield in the Lake Sakakawea Report. The Corps of Engineers agreed to have our hydrologist provide a thorough explanation via phone or email.

Kansas Water asked if there was a yield report available regarding the Corps' computation of system yield. They would like to see the details of how that was computed. The Omaha District responded that they would provide the Lake Sakakawea Surplus Water Report and refer to sections that have that information. The Corps also offered to make their hydrologist available if there were any questions.

<u>Water Supply Demand Analysis</u>

While total demand appears to be sufficient to address demand that may be reasonable and foreseeable, some of the numbers within the demand analysis table appeared to be off. For example, the Corps' reported 16,000 AF of domestic use at Gavins Point was questioned. As a response, the Corps of Engineers would re-check the demand calculations as well as cross check the demand figures with data from SD DENR.

NGPC informed the Corps that they may have water intakes that are not covered under existing recreation leases. The Corps responded that the NGPC does currently have leases to use/manage recreational areas at Louis and Clark Lake. The Omaha District agreed to look to ensure water withdrawal is covered under those leases. NE DNR mentioned that water rights information for existing users can be obtained online, and that the data are in terms of the PLSS system.

Alternatives for Meeting Water Demand

Based on input from several individuals in attendance, water hauling for water distribution in rural South Dakota is still a common practice. Much of the reasoning behind the legislation for creating Rural Water Systems in South Dakota appears to be twofold: the transporting of water for rural domestic use is very expensive and Rural Water Distribution Systems offset those costs. Because of water quality concerns, ground water is not an option in many cases in both states. Thus, surface water is the main source for domestic use. SD DENR specifically stated that there are "not a lot of options" [outside of surface water] in South Dakota. The following were provided as potential points of contact for information regarding water hauling option: SD - Denny Davis, Association of Rural Water Systems, MT - Ron Miller - Ft. Peck Rural County Water District, and MT – Bobby Kirkland – Water Hauling - 406.526.3220

Based on their review of the Lake Sakakawea Surplus Water Report, NE DNR asked if existing users would need alternative sources of water, require new pipelines, etc. The Omaha District indicated that existing users would not be forced to utilize other sources under the no action alternative. It is assumed that if no federal action was to take place (to identify surplus water in the respective reservoirs), that existing water users would continue to withdraw water from the reservoirs.

Charging for Water

There was considerable discussion regarding the issue of charging for using water. Much of the discussion was captured in previous comments received by states on Lake Sakakawea Report. Of particular interest was the idea of what happens when Native Americans perfect their water right as many Tribes are currently undertaking such efforts. The Corps of Engineers' position (and the policy taken in the Lake Sakakawea Study) was that water rights are a pre-condition of entering into contract with Corps for use of surplus water (Tribal or state water rights). Tribes are not considered differently in this respect than a state or private entity. Legally, the Corps can only enter into agreements with an individual or entity that has a valid state or Tribal water right.

Bureau of Reclamation discussed that they were beginning to move toward "market based" pricing for Municipal and Industrial water, and thought the Corps should look into this as well. The Corps indicated that eventually there would be discussions between Corps and Bureau regarding federal water supply policies, etc. But that this will most likely take place during the process of developing the long-term comprehensive strategy for the basin.

Future Water Use/Sources of M&I Demand

None of the representatives from SD or NE were aware of any large-scale users of water (i.e., ethanol or power plants) that were reasonably foreseeable within the next 10 years. As a result, the assumed 10-percent increase in demand--with no specifically designated future uses--was agreed to as a reasonable approach. The Bureau of Reclamation indicated that there could be fairly large BOR MR&I projects in next 10 years, but they wouldn't require water contract with Corps, as they will be specifically authorized by Congress to use Missouri River water.

10.3 Public Participation

Held For Comments On Draft Environmental Assessment That Will Be In The Final EA.

10.4 List of Preparers

Environmental Manager	Eric Laux, CENWO
Project Manager	Tiffany Vanosdall, CENWO
Review	Catherine Grow, Office of Counsel, CENWO
DRM Assessment Modeler	Roy F. McAllister, Jr., CENWO
Economist/Planner	David Miller, David Miller & Associates, Inc.
NEPA Specialist	Michael McGarry, David Miller & Associates, Inc.
Economist/Planner	Dr. Jerry Diamantides, David Miller & Associates, Inc.
Economist/Planner	Alex Hettinger, David Miller & Associates, Inc.
Environmental Planner	Emma Brower, David Miller & Associates, Inc.
Environmental Planner	Corey Miles, David Miller & Associates, Inc.
Economist/Planner	John Burns, Burns Consulting

Additional Persons Consulted

NAME	AFFILIATION
Dennis Davis	SD Rural Water Association

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Appendices

Appendix A - Gubernatorial, Tribal, and Agency Correspondence

Example Letter to the Governors

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

REPLY TO
ATTENTION OF

SEP 21 2010

District Commander

Honorable Dave Heineman
Governor of Nebraska
P.O. Box 94848
Lincoln, Nebraska 68509-4848

Dear Governor Heineman:

The U.S. Army Corps of Engineers, Omaha District (Corps) has received new requests for water storage at several of its reservoirs, which cannot be processed until a Surplus Water Letter Report with appropriate National Environmental Policy Act documentation has been completed for each of the reservoirs. The purpose of a Letter Report is to identify and quantify surplus water storage, which the Secretary of the Army can use to execute temporary (5-10 years) surplus water storage contracts. The Letter Reports will also determine the updated cost of water storage. A system wide reallocation study will be undertaken in the future to address the needs for long-term water storage.

The Letter Reports will be completed in accordance with Engineering Regulation-1105-2-100, Planning Guidance Notebook and the Revised U.S. Army Institute for Water Resources Report 96-PS-4, a Handbook on Water Supply Planning and Resource Management. The Water Surplus Letter Report Outline will include the following:

1. Purpose
   a. Request for Municipal and Industrial water supply
   b. Authority for seeking reallocation

2. Project Background
   a. Project authorization, construction and operation history
   b. Project purpose and outputs
   c. Project map and pertinent data table
   d. Information on previous water supply agreements

3. Economic Analysis
   a. Water supply demand analysis
   b. Analysis of water supply alternatives (benefits)
   c. Impacts on other project purposes (benefits forgone)
   d. Information on approved cost allocation

4. Derivation of User Cost
   a. Water supply storage/yield analysis
   b. Cost of storage analysis

-2-

c. Revenues foregone and cost account adjustments
d. Summary, user cost

5. Other Considerations
   a. Test of financial feasibility
   b. Cost account adjustments
   c. Environmental considerations

6. Conclusions and Recommendations
   a. Summarization of findings
   b. Reference applicable appendices
   c. Recommendation of District Engineer

7. Appendices
   a. National Environmental Protection Act Documentation (Environmental Assessment/Finding of No Significant Impact)
   b. Documentation of opportunity for public review action
   c. Letters and views of Tribes, federal, state and/or local interests affected by the action

The Corps is committed to transparent communication regarding these important decision documents. The Corps is contacting state, tribal and federal agencies to assist in development of the Surplus Water Letter Reports which will be provided for your review and comment in January 2011. If you have any additional questions regarding the letter reports please contact the Project Manager, Mr. Larry Janis, Branch Chief Recreation and Natural Resources by telephone at (402) 995-2697 or by email at larry.d.janis@usace.army.mil. The Corps looks forward to working with you in the completion of this important report.

Sincerely,

FOR
Robert J. Ruch
Colonel, Corps of Engineers
District Commander

Example Letter to Tribes

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

REPLY TO
ATTENTION OF

District Commander

«Prefix» «FirstMiddle_Name» «Last_Name», «Suffix»«Title»
«Organization»
«Address1»
«Address2»
«City», «State» «Zip»

Dear «Salutation» «Last_Name»:

The U.S. Army Corps of Engineers (Corps), Omaha District has received requests for water supply at the Missouri River mainstem reservoirs. These requests cannot be processed until a Surplus Water Report, with appropriate National Environmental Policy Act documentation, has been completed for each reservoir. The purpose of the reports is to identify and quantify surplus water, which the Secretary of the Army can use to execute temporary (5-10 years) surplus water agreements. The reports will also determine the updated cost of water storage.

Surplus Water Reports will be completed for Ft. Peck Lake (Fort Peck Project), Montana; Lake Oahe (Oahe Project), North and South Dakota; Lake Sharpe (Big Bend Project), South Dakota; Lake Francis Case (Fort Randall Project), South Dakota and Lewis and Clark Lake (Gavins Point Project), South Dakota. The reports will be completed in accordance with ER-1105-2-100, Planning Guidance Notebook and the Revised IWR Report 96-PS-4, A Handbook on Water Supply Planning and Resource Management. The Surplus Water Report Outline will include the following:

1. Purpose
    a. Request for Municipal and Industrial water supply
    b. Authority for seeking reallocation
2. Project Background
    a. Project authorization, construction and operation history
    b. Project purpose and outputs
    c. Project map and pertinent data table
    d. Information on previous water supply agreements
3. Economic Analysis
    a. Water supply demand analysis
    b. Analysis of water supply alternatives (benefits)
    c. Impacts on other project purposes (benefits forgone)
    d. Information on approved cost allocation

4. Derivation of User Cost
    a. Water supply storage/yield analysis
    b. Cost of storage analysis
    c. Revenues foregone and cost account adjustments
    d. Summary, user cost
5. Other Considerations
    a. Test of financial feasibility
    b. Cost account adjustments
    c. Environmental considerations
6. Conclusions and Recommendations
    a. Summarization of findings
    b. Reference applicable appendices
    c. Recommendation of District Engineer
7. Appendices
    a. NEPA Documentation (EA/FONSI)
    b. Documentation of opportunity for public review action
    c. Letters and views of tribes, federal, state and/or local interests affected by the action

The Corps is committed to transparent communication regarding these important decision documents. We will be holding agency meetings in Fort Peck, Montana; Pierre, South Dakota and Omaha, Nebraska. The agency meeting in Fort Peck will be held on 10 May 2011 at the Fort Peck Interpretive Center, Yellowstone Road, Fort Peck, Montana from 2:30-4:00 PM MDT. The agency meeting in Pierre will be held on 11 May 2011 at the South Dakota Cultural Heritage Center, 900 Governors Drive, Pierre, South Dakota from 1:00-3:00 PM CDT. The agency meeting in Omaha will be held on 23 May 2011 at the Zorinsky Federal Building, 1616 Capitol Ave, Omaha, Nebraska from 1:00-3:00 PM CDT. The purpose of the meetings is to provide information to the Tribes and agencies on the studies; as well as, providing them with an opportunity to ask questions and provide initial feedback. If you are interested in participating in this effort, please contact Tiffany Vanosdall via phone, mail, fax, or email:

U.S. Army Corps of Engineers
Attention: CENWO-PM-AA (Tiffany Vanosdall)
1616 Capitol Avenue
Omaha, Nebraska 68102-4901
Phone number: (402) 995-2695
Fax number: (402) 995-2758
E-mail: tiffany.k.vanosdall@usace.army.mil

The Corps looks forward to working with you in the completion of these important reports. If you have any additional questions or concerns please feel free to contact my Tribal Liaison, Mr. Joel Ames at (402) 995-2909 or by e-mail at joel.o.ames@usace.army.mil.

Sincerely,

Robert J. Ruch
Colonel, Corps of Engineers
District Commander

OMAHA DISTRICT TRIBAL LEADERS INFORMATION

updated January 24, 2011 (Price)

TTL	Dist Ttl.	District	Additional District	States	Tribal Name	Title	Name	Effective	Address 1
1	1	Omaha		MT, CANADA	Assiniboine and Sioux Tribes of Fort Peck, Fort Peck Reserva	Chairman	A.T. (Rusty) Stafne		PO Box 1027
		Omaha		MT, CANADA	Assiniboine and Sioux Tribes of Fort Peck, Fort Peck Reserva	Vice Chairperson Ms.	Roxann Bighorn		PO Box 1027
2	2	Omaha		MT	Blackfeet Nation	Chairman	Willie A. Sharp, Jr		
		Omaha		MT	Blackfeet Nation	Vice Chairman	Peter "Rusty" Tatsey		
3	3	Omaha		SD	Cheyenne River Sioux Tribe	Chairman	Kevin Keckler		P.O. Box 590
		Omaha		SD	Cheyenne River Sioux Tribe	Vice Chairman	Ted Knife Jr.		P.O. Box 590
4	4	Omaha		MT	Chippewa Cree Tribe of the Rocky Boy Reservation	Chairman	Jake Parker		na
		Omaha		MT	Chippewa Cree Tribe of the Rocky Boy Reservation	Vice Chairman	Bruce Sunshild		na
5	5	Omaha	Walla Walla	MT, ID, CANADA	Confederated Salish & Kootenai Tribes of the Flathead Rese	Chairman	E.T. Bud Moran		P.O. Box 278
		Omaha	Walla Walla	MT, ID, CANADA	Confederated Salish & Kootenai Tribes of the Flathead Rese	Vice Chairman	Joe Durglo		P.O. Box 278
6	6	Omaha		SD	Crow Creek Sioux Tribe	Chairman	Duane Big Eagle Sr.		P.O. Box 50
		Omaha		SD	Crow Creek Sioux Tribe	Vice Chairman	Wilfred Keeble		P.O. Box 50
7	7	Omaha		MT, WY	Crow Nations, Crow Reservation	Chairman	Cedric Black eagle		na
		Omaha		MT, WY	Crow Nations, Crow Reservation	Vice Chairman	Coolidge Jefferson		na
8	8	Omaha		WY	Eastern Shoshone Tribe, Wind River Reservation	Chairman	Mike LaJeunesse		P.O. Box 538
		Omaha		WY	Eastern Shoshone Tribe, Wind River Reservation	Vice Chairman	Wes Martel		P.O. Box 538
9	9	Omaha		SD	Flandreau Santee Sioux Tribe	President	Anthony Reider		P.O. Box 283
		Omaha		SD	Flandreau Santee Sioux Tribe	Vice President	Cynthia Allen-Weddell		P.O. Box 283
10	10	Omaha		MT	Gros Ventre & Assiniboine Tribes, Fort Belknap	Chairman	Tracey King		na
		Omaha		MT	Gros Ventre & Assiniboine Tribes, Fort Belknap	Vice Chairperson	Ms. Mel A. Adams Doney (Female ? On Title)		na
11	11	Omaha		SD	Lower Brule Sioux Tribe, Lower Brule Reservation	Chairman	Micheal Jandreaux		na
		Omaha		SD	Lower Brule Sioux Tribe, Lower Brule Reservation	Vice Chairman	Floyd Gourneau		na
12	12	Omaha		WY, CO, NE	Northern Arapaho Tribe, Wind River Reservation	Chairperson	Mrs. Kim Harjo		PO Box 396, Fort Washakie, WY 82514
		Omaha		WY, CO, NE	Northern Arapaho Tribe, Wind River Reservation	Co - Chairman	Keith Spoonhunter		PO Box 396, Fort Washakie, WY 82514
13	13	Omaha		MT	Northern Cheyenne Tribe	President	Leroy Spang		P.O Box 128
		Omaha		MT	Northern Cheyenne Tribe	Vice President	Joe Fox Jr.		P.O Box 128
14	14	Omaha		SD, NE	Oglala Sioux Tribe	Chairman	John Yellow Bird Steele		P.O. Box 2070
		Omaha		SD, NE	Oglala Sioux Tribe	Vice Chairman	Tom Poor Bear		P.O. Box 2070
15	15	Omaha		NE, SD, KS, MO, IA	Omaha Tribe of Nebraska	Chairman	Amen Sheridan		P.O. Box 368
		Omaha		NE, SD, KS, MO, IA	Omaha Tribe of Nebraska	Vice Chairman	Forrest Aldrich		P.O. Box 368
16	16	Omaha		NE, SD, IA	Ponca Tribe of Nebraska	Chairman	Ms. Rebecca White	Jan-11	PO Box 288
		Omaha		NE, SD, IA	Ponca Tribe of Nebraska	Vice Chairman	James LaPointe	Jan-11	PO Box 288
17	17	Omaha		SD, NE	Rosebud Sioux Tribe	President	Rodney Bordeaux		P.O. Box 430
		Omaha		SD, NE	Rosebud Sioux Tribe	Vice President	William Kendle		P.O. Box 430
18	18	Omaha	Kansas City	NE, KS, IA	Sac and Fox Nation of Oklahoma	Chairperson	Ms. Stella Nullake		na
		Omaha	Kansas City	NE, KS, IA	Sac and Fox Nation of Oklahoma	Vice Chairman	NA		
19	19	Omaha		NE, KS, IA	Santee Sioux Nation	Chairman	Roger Trudell		na
		Omaha		NE, KS, IA	Santee Sioux Nation	Vice Chairman	David Henry		na
20	20	Omaha		SD, ND, MN	Sisseton-Wahpeton Sioux Tribe	Chairman	Robert Shepherd	effective 1-2011	PO Box 509
		Omaha		SD, ND, MN	Sisseton-Wahpeton Sioux Tribe	Vice Chairman	Gerald Rousseau	effective 1-2011	PO Box 509
21	21	Omaha		ND, KS	Spirit Lake Sioux Tribe	Chairman	Ms. Myra Pearson		P.O. Box 359
		Omaha		ND, KS	Spirit Lake Sioux Tribe	Vice Chairman	Darwin Brown		P.O. Box 359
21	21	Omaha		ND, SD	Standing Rock Sioux Tribe	Chairman	Charles W. Murphy		PO Box D
		Omaha		ND, SD	Standing Rock Sioux Tribe	Vice Chairman	Mike Faith		PO Box D
22	22	Omaha		ND, MT	Three Affiliated Tribes, Fort Berthold Reservation	Chairman	Tex Hall		na
		Omaha		ND, MT	Three Affiliated Tribes, Fort Berthold Reservation	Vice Chairman	Scott Eagle		na
23	23	Omaha		ND, CANADA	Turtle Mtn. Band of Chippewas, Turtle Mtn. Reservation	Chairman	Merle St. Claire		PO Box 900
		Omaha		ND, CANADA	Turtle Mtn. Band of Chippewas, Turtle Mtn. Reservation	Vice Chairman	Curtis Poitra		PO Box 900

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24	24	Omaha	Kansas City	SD, NE, KS, MO, IA	Winnebago Tribe of Nebraska	Chairman	John Blackhawk		P.O. Box 687
		Omaha	Kansas City	SD, NE, KS, MO, IA	Winnebago Tribe of Nebraska	Vice Chairman	Brian Chamberlain		P.O. Box 687
25	25	Omaha		SD, NE, IA, KS	Yankton Sioux Tribe	Chairman	Robert Cournoyer		P.O. Box 248
		Omaha		SD, NE, IA, KS	Yankton Sioux Tribe	Vice Chairman	Ms. Karen Archambeau		P.O. Box 248
1	1	Kansas City	Tulsa	MO, KS	Osage Nation	Principal Chief	John D. Red Eagle		P.O. Box 779
		Kansas City	Tulsa	MO, KS	Osage Nation	Assistant Chief	Scott Bighorse		P.O. Box 779
2	2	Kansas City		MO, KS, IA	Iowa Tribe of Kansas and Nebraska	Chairman	Tim Rhodd, Chairperson		
		Kansas City		MO, KS, IA	Iowa Tribe of Kansas and Nebraska	Vice Chairman			
3	3	Kansas City		KS, MO	Prairie Band Potawatomi Nation	Chairman	Steve Ortiz		na
		Kansas City		KS, MO	Prairie Band Potawatomi Nation	Vice Chairperson	Mrs. Joyce Guerrero		na
4	4	Kansas City		KS, MO	Kickapoo Tribe of Kansas	Chairman	Russell Bradley		na
		Kansas City		KS, MO	Kickapoo Tribe of Kansas	Vice Chairman	Laura Razo Ms.		na
5	5	Kansas City		KS, MO	Kaw Nation	Chairman	Guy Munroe		Drawer 50
		Kansas City		KS, MO	Kaw Nation	Vice Chairman	Bill Kekahbah		Drawer 50
6	6	Kansas City		KS, NE	Pawnee Indian Tribe of Oklahoma	President	George E. Howell		PO Box 470
		Kansas City		KS, NE	Pawnee Indian Tribe of Oklahoma	Vice Presidnet	Charles Lone Chief		PO Box 470
7	7	Kansas City		KS	Wichita and Affiliated Tribes	President	Stratford Williams		PO Box 729
		Kansas City		KS	Wichita and Affiliated Tribes	Vice President	vacant		PO Box 729
8	8	Kansas City		NE, IA, MO, KS	Sac and Fox Nation of Missouri in Kansas and Nebraksa	Chairperson	Ms. Twen Barton		na
		Kansas City		NE, IA, MO, KS	Sac and Fox Nation of Missouri in Kansas and Nebraksa	Vice Chairman	Mrs. Carrie Wahwahsuck		na
9	9	Kansas City		IA, NE, KS, MO	Sac and Fox of the Mississippi in Iowa/Meskwaki	Chairman	Adrian Pushetonequa		
		Kansas City		IA, NE, KS, MO	Sac and Fox of the Mississippi in Iowa/Meskwaki	Vice Chairman	Jon Papakee		

Page 2 of 4

Example Letter to State and Federal Agencies

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

REPLY TO
ATTENTION OF

April 29, 2011

Planning, Programs, and Project Management Division

«Prefix» «FirstMiddle_Name» «Last_Name», «Suffix»«Title»
«Organization»
«Address1»
«Address2»
«City», «State» «Zip»

Dear «Salutation» «Last_Name»:

The U.S. Army Corps of Engineers, Omaha District (Corps) has received requests for water supply at the Missouri River mainstem reservoirs. These requests cannot be processed until a Surplus Water Report, with appropriate National Environmental Policy Act documentation, has been completed for each reservoir. The purpose of the Report is to identify and quantify surplus water, which the Secretary of the Army can use to execute temporary (5-10 years) surplus water agreements. The Reports will also determine the updated cost of water storage.

Surplus Water Reports will be completed for Ft. Peck Lake (Ft. Peck Project), Montana; Lake Oahe (Oahe Project), North and South Dakota; Lake Sharpe (Big Bend Project), South Dakota; Lake Francis Case (Ft. Randall Project), South Dakota and Lewis and Clark Lake (Gavins Point Project), South Dakota. The Reports will be completed in accordance with ER-1105-2-100, Planning Guidance Notebook and the Revised IWR Report 96-PS-4, A Handbook on Water Supply Planning and Resource Management. The Water Surplus Report Outline will include the following:

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    a. Water supply demand analysis
    b. Analysis of water supply alternatives (benefits)
    c. Impacts on other project purposes (benefits forgone)
    d. Information on approved cost allocation

Printed on Recycled Paper

4. Derivation of User Cost
    a. Water supply storage/yield analysis
    b. Cost of storage analysis
    c. Revenues foregone and cost account adjustments
    d. Summary, user cost
5. Other Considerations
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    b. Cost account adjustments
    c. Environmental considerations
6. Conclusions and Recommendations
    a. Summarization of findings
    b. Reference applicable appendices
    c. Recommendation of District Engineer
7. Appendices
    a. NEPA Documentation (EA/FONSI)
    b. Documentation of opportunity for public review action
    c. Letters and views of tribes, federal, state and/or local interests affected by the action

The Corps is committed to transparent communication regarding these important decision documents. We will be holding agency meetings in Fort Peck, Montana; Pierre, South Dakota and Omaha, Nebraska. The agency meeting in Fort Peck will be held on 10 May 2011 at the Fort Peck Interpretive Center, Yellowstone Road, Fort Peck, Montana from 2:30-4:00 PM MDT. The agency meeting in Pierre will be held on 11 May 2011 at the South Dakota Cultural Heritage Center, 900 Governors Drive, Pierre, South Dakota from 1:00-3:00 PM CDT. The agency meeting in Omaha will be held on 23 May 2011 at the Zorinsky Federal Building, 1616 Capitol Ave, Omaha, Nebraska from 1:00-3:00 PM CDT. The purpose of the meetings is to provide information to the agencies on the studies as well as give the agencies an opportunity to ask questions and provide initial feedback. If you are interested in participating in this effort, please contact Tiffany Vanosdall via phone, mail, fax, or email:

U.S. Army Corps of Engineers
Attention: CENWO-PM-AA (Tiffany Vanosdall)
1616 Capitol Avenue
Omaha, Nebraska 68102-4901
Phone number: (402) 995-2695
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E-mail: tiffany.k.vanosdall@usace.army.mil

The Corps looks forward to working with you in the completion of these important reports.

Sincerely,

Kayla A. Eckert Uptmor

Kayla A. Eckert Uptmor
Chief, Planning Branch