

Water Storage in Montana

A Report Submitted to the Sixty Seventh Montana Legislature

Office of the Governor

Pursuant to Montana Code Annotated, Sec. 85-1-704

April 2021



Ruby River Dam, Madison County



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EXECUTIVE SUMMARY

Montana law requires the Governor to submit a report on water storage to the Legislature each regular session. The Governor's Report on Water Storage in Montana prioritizes new rehabilitation and construction projects for the upcoming biennium and summarizes projects that occurred during the previous biennium (Appendix A-MCA 85-1-703 Water Storage Policy). The Department of Natural Resources and Conservation Water Resources Division State Water Projects Bureau (SWPB) will be submitting to the Renewable Resource Grant and Loan Program (RRGL) three new Renewable Resource Grant and Loan Requests and four new projects proposed for funding using funds from the Water Storage Account and/or Hydropower Earnings Account. These State Special Revenue accounts are set aside to fund improvements for state owned water projects, including dams and canals.

New projects proposed for 2021 and 2022 timeframe:

- Ackley Lake Outlet Canal Rehabilitation Project (Judith Basin County), estimated cost \$160,046.85
- Deadman's Basin Supply Canal Rehabilitation Project (Wheatland County), estimated cost \$160,050.85
- Upper Musselshell Two Dot Canal Rehabilitation Project (Wheatland County), estimated cost \$170,046.85
- East Fork of Rock Creek Rehabilitation – Final Design \$800,000.00
- SWPB Flow Measurement Equipment Purchase - \$98,700.00

Ongoing / recently completed projects:

- Allendale Canal Intake and Fish Screen (Granite County), estimated cost \$2,862,000
- East Fork of Rock Creek Alternative Analysis (Granite County), complete
- East Fork Rock Creek Dam Rehabilitation Environmental Planning (Granite County), estimated cost \$500,000
- Painted Rocks Site Investigations and Feasibility Study (Ravalli County). Pending site investigations, cost estimated at \$750,000 and will occur over several years.
- Painted Rocks Dam Toe Access, estimated cost \$900,000
- Painted Rocks Dam Environmental Planning (Ravalli County), estimated cost \$500,000
- State Water Projects Planning Document, estimated cost \$125,000
- Nevada Creek Douglas Canal Rehabilitation (Powell County), estimated cost \$159,572.10
- Broadwater-Missouri Canal System Study and Master Plan (Broadwater County), estimated cost \$162,969.70

MONTANA STATE WATER PROJECTS DAMS



Figure 1 – Location Map of State Water Projects

STATE-OWNED WATER PROJECTS

Table 1 - List of State Water Projects

<u>Project Name</u>	<u>Year Completed</u>	<u>Storage (acre-feet)</u>	<u>Height (feet)</u>	<u>County</u>
<u>Ackley Lake Dam</u>	1938	6,722	51	Judith Basin
<u>Bair Reservoir Dam</u>	1939	7,300	106	Meagher
<u>Cooney Dam</u>	1937	28,230	102	Carbon
<u>Cottonwood Dam</u>	1953	1,905	39	Park
<u>Deadman's Basin Dam</u>	1941	72,218	60	Wheatland
<u>East Fork of Rock Creek Dam</u>	1938	16,040	88	Granite
<u>Fred Burr Dam</u>	1949	525	50	Ravalli
<u>Frenchman Dam</u> ¹	1952	2,801	44	Phillips
<u>Glacier Lake Dams</u>	1937	4,200	57 (N) 20 (S)	Carbon
<u>Martinsdale Dams</u>	1939	23,348	91 (N) 49 (E)	Wheatland & Meagher
<u>Middle Creek Dam (Hyalite)</u>	1951	10,184	125	Gallatin
<u>Nevada Creek Dam</u>	1938	11,152	105	Powell
<u>Nilan Dams</u>	1951	10,092	54 (N) 51 (E)	Lewis & Clark
<u>North Fork of Smith River Dam</u>	1936	11,500	84	Meagher
<u>Painted Rocks Dam</u>	1939	32,362	143	Ravalli
<u>Ruby River Dam</u>	1938	37,642	112.5	Madison
<u>Tongue River Dam</u>	1940	79,071	93	Big Horn
<u>Toston Dam</u> (Broadwater-Missouri)	1940	4,100	51.5	Broadwater
<u>Willow Creek Dam</u>	1938	18,000	105	Madison
<u>Yellow Water Dam</u>	1938	3,842	37	Petroleum

¹ With the exception of Frenchman Dam, all of the above listed dams are classified as high hazard. A “high-hazard” dam stores over 50 acre-feet and is not a reflection on the actual condition of the dam. This classification is not based on the condition of the dam. The classification is only a reflection of paved roads/structures in the downstream area that could possibly be inundated during a sunny weather dam failure.

I. INTRODUCTION

The Governor's Report on Water Storage in Montana reviews state water storage policy and statutory criteria used for prioritization of proposed projects; identifies water storage projects proposed for development, including the rehabilitation of existing projects and progress on new projects; and summarizes water storage projects in progress over the previous two years. The focus of this report is on projects that are funded by the state, and under the administration and ownership of the Montana Department of Natural Resources and Conservation (DNRC) State Water Projects Bureau (SWPB).

A. Water Storage and Hydropower Earnings Accounts:

State-owned water storage project dams classified as high-hazard that are in an unsafe condition receive first preference for use of funds from the state's Water Storage Special Revenue Account (Water Storage Account) (Section 85-1-704 MCA). This is a separate funding source from the Renewable Resource Grant and Loan program, which allocates interest revenue from the Resource Indemnity Trust Fund each biennium to be used exclusively for state-owned water storage projects. Another important funding source is the DNRC-SWPB Hydropower Program, where earned revenues from the sale of power are used to help finance the rehabilitation of other DNRC state-owned water storage projects, per MCA 85-1-220.

DNRC has requested additional spending authority from the Water Storage or Hydropower Earnings Accounts for the 2022-2023 biennium in the amounts of:

- \$800,000 for the final design of the East Fork Dam Rehabilitation Project, and
- \$98,700 for additional gaging stations at State Water Projects.

B. Renewable Resource Grant and Loan (RRGL) Program:

The Montana Renewable Resource Grant and Loan (RRGL) Program provides grant and loan funding for projects that conserve, manage, develop, or protect renewable resources. RRGL loans are made available to public entities with proceeds from the sale of coal severance tax secured bonds and frequently are offered at a subsidized interest rate. The subsidy is paid with coal tax revenues. The DNRC-SWPB applied for three RRGL Program Grants for the 2022-2023 biennium to help fund the following:

- Ackley Lake Outlet Canal Rehabilitation Project (Judith Basin County), estimated cost \$160,046.85
- Deadman's Basin Supply Canal Rehabilitation Project (Wheatland County), estimated cost \$160,050.85
- Upper Musselshell Two Dot Canal Rehabilitation Project (Wheatland County), estimated cost \$170,046.85

C. Water Storage Project Classification and Terminology:

It is important to have a basic understanding of some principles and terms related to dam safety classification used in this report. Standards used by the State of Montana are as follows:

- **Unsafe spillway or dam** - A spillway that is deemed unable to safely pass the inflow design flood, or if the dam's structural integrity has become compromised since construction.
- **High-hazard dam** - A dam is high hazard if it stores more than 50 acre-feet and its failure has the potential for loss of human life, regardless of its current structural condition. It should be noted that the state's highest priority for repair and rehabilitation is assigned to dams classified as high-hazard that are in an unsafe condition. The high-hazard classification should not be confused with an assessment of a dam's structural integrity or condition.
- **Repair of a project** - Most often refers to scheduled or emergency action taken to return dam function to original design capacity or for a project to continue operation at a reduced, but safe level.
- **Rehabilitation** - Involves upgrading existing projects to comply with or exceed current design and safety standards. This often includes removal and full replacement of structural components, such as a new spillway.



Deadman's Basin Dam (Wheatland County)

D. DNRC State Water Projects Bureau:

The State Water Projects Bureau (SWPB) administers the operation, management, and rehabilitation of state-owned dams, canals, and hydropower projects under the purview of the DNRC Water Resources Division (WRD). A complete statewide location map of the projects is presented in Figure 1, and a list of projects is provided in Table 1. Additional information can be viewed on the DNRC WRD web site at: <http://dnrc.mt.gov/divisions/water/projects>. The SWPB also provides professional engineering and rehabilitation assistance on nine additional water projects owned by the Department of Fish, Wildlife and Parks (DFWP).

The SWPB markets water from the state-owned water storage projects primarily for irrigation and administers approximately 1,800 water-marketing contracts through local water user associations. Currently, 309,899 acre-feet of water is marketed by the SWPB to water users associations across the state. Revenue from the water purchase contracts, leasing of lands associated with the projects, and net revenue from hydropower generation supplements funds used for state water project rehabilitations. Debt repayment funds come from repayment contracts with the water users.

The SWPB ensures that projects are operated and maintained in a safe, efficient manner, are kept to current dam safety standards, and that repayment contracts are properly administered. The SWPB is also responsible for overseeing repairs, maintenance, and rehabilitation of approximately 250 miles of irrigation canals associated with state-owned projects. Canals are integral components of many state water projects, delivering water to off-stream reservoirs and water users served by the respective projects. The SWPB is responsible for identifying and correcting operational deficiencies on these canals, which includes maintaining and operating over 40 canal gauge stations to monitor water deliveries.



Middle Creek Cottonwood Canal North Flume (Gallatin County)

II. WATER STORAGE PROJECTS PRIORITIZED:

One of the requirements of the water storage report is to prioritize state-owned DNRC water project proposals for the upcoming biennium. Per the available funding, the following are SWPB's priorities:

1. DNRC Painted Rocks Dam Toe Access
2. DNRC East Fork Dam Rehabilitation Environmental Planning
3. DNRC Painted Rocks Dam Rehabilitation Environmental Planning
4. DNRC East Fork Dam Rehabilitation Final Design
5. DNRC State Water Projects Planning Document
6. DNRC Ackley Lake Outlet Canal Rehabilitation
7. DNRC Deadman's Basin Supply Canal Rehabilitation
8. DNRC Upper Musselshell Two Dot Canal Rehabilitation
9. DNRC State Water Projects Bureau Gaging Stations

Projects 1,2,3 and 5 are projects that are on-going from the 2019-2021 biennium. Project proposals for the 2022-2023 biennium and tabulates funding sources. Table 2 (page 17) lists ongoing or recently completed projects from the past biennium.

State-owned water projects that have dams classified as high-hazard that are in unsafe condition receive first preference for use of funds from the state's Water Storage Account. Additionally, revenue received from the state's Hydropower Earnings Account is used to assist in the rehabilitation costs of active state-owned water projects.

Other non-DNRC projects recommended for funding through the RRGL program include wastewater systems, municipal drinking water, water management, and irrigation water conveyance (not related to storage). Detailed project information and rankings on these non-state-owned projects can be viewed on the DNRC Grants and Loans Website at: <http://dnrc.mt.gov/divisions/cadd/resource-development>



Nevada Creek Dam Spillway (Powell County)

Table 2. New Projects – 2022-2023 Biennium Water Storage Project Proposals (in priority order)

Storage Project Name	RRGL Grant Amount Requested /	Water Storage Account	RRGL Loan	Other Funding
DNRC East Fork Rehabilitation Final Design				\$800,000 (Hydro Earnings)
DNRC Ackley Lake Outlet Canal Rehabilitation Project (Judith Basin County)	\$125,000 (Pending)			DNRC SWPB In-Kind Services: \$35,046.85
DNRC Deadman's Basin Supply Canal Rehabilitation Project (Wheatland County)	\$125,000 (Pending)			DNRC SWPB In-Kind Services: \$35,050.85
DNRC Upper Musselshell Two Dot Canal Rehabilitation Project (Wheatland County)	\$125,000.00			DNRC SWPB and Water User Association In-Kind Services: \$35,046.85 WUA: \$10,000.00
DNRC SWPB Gaging Stations				\$98,700.00 (Hydro Earning)

III. JUSTIFICATION FOR 2020-2021 BIENNIUM PROJECT PROPOSAL PRIORITIZATION:

New Projects:

A. DNRC East Fork Dam Rehabilitation Final Design

East Fork Rock Creek Dam (EFRCD) is classified as a high hazard dam and is located on the East Fork of Rock Creek in Granite County approximately 15 miles south of Philipsburg, Montana. The dam is owned by the Montana Department of Natural Resources and Conservation (DNRC). The dam and reservoir are located within the Beaverhead-Deerlodge National Forest and the DNRC has a special use permit from the Forest Service (USFS) to operate and maintain the dam.

The reservoir impounded by the dam provides water for irrigation to the Flint Creek Water Users Association and offers recreational opportunities. The Flint Creek Water Users Association (WUA), as per contract with the DNRC, conducts day-to-day operations and maintenance. The DNRC performed a Feasibility Study for EFRCD that would evaluate the existing condition of the dam and develop conceptual alternatives that would bring the dam into compliance with the State of Montana Dam Safety Act.

The primary rehabilitation considerations addressed in the Feasibility Study included:

1. The existing spillway is undersized and in poor condition.
2. There is significant seepage through the foundation under the dam.
3. The outlet works is in relatively good condition but is over 80 years old.

Alternative rehabilitation measures for the spillway, seepage control, and the outlet works were developed and the recommended alternatives are proposed to be carried forward into a final design effort, that is anticipated to be completed in 2023.

The potential for improvement of Bull Trout habitat by increasing storage was also considered in evaluation of the alternatives. Raising the reservoir normal full pool by 2.5 feet would increase storage by approximately 1,000 acre-feet, which could be used as dedicated conservation storage.

The selected EFRCD rehabilitation alternative includes the following features:

- Removal and replacement of the existing concrete spillway with a new concrete structure.
- Rehabilitating the outlet works by refurbishing the existing valves and repairing or replacing other components of the outlet works system.
- A new gate house and gate tower access.
- Constructing various seepage control features along the downstream side of the dam.
- Installing new instrumentation to monitor performance of the new seepage control system.
- Constructing a new bridge across the spillway approach channel.
- Riprap repairs to the upstream dam face.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
State Special Revenue – Hydro Earnings	\$800,000	Uncommitted
TOTAL	\$800,000	



East Fork of Rock Creek Dam Spillway (Granite County)



Geotechnical Investigation Drilling at East Fork of Rock Creek Dam (Granite County)

B. DNRC Ackley Lake Outlet Canal Rehabilitation Project (Judith Basin County)

The State Water Projects Bureau has applied for funds from the RRGL program for the design and construction of the Ackley Lake Outlet Canal Rehabilitation Project, located in Judith Basin County, Montana. The Ackley Lake State Water Project, which consists of a reservoir, dam, supply and outlet canals, is owned by the DNRC but is maintained by the Ackley Lake Water Users Association (ALWUA). The Ackley Lake Outlet Canal is a critical conveyance canal for the ALWUA system, providing water to 4,500 acres of agricultural land and was designed to serve as a mechanism to quickly release flows from Ackley Lake.

A 2,200-foot section of the Outlet Canal is constructed on porous granular soils that allows water to escape from the canal bottom and side slopes which with sustained use of the Outlet Canal creates flooding in the downgradient Philbrook Cemetery and Hobson Philbrook Road. Due to flooding of downstream areas, the ALWUA is unable to rely on the Outlet Canal as a route for reducing water levels in Ackley Lake during flood events or high runoff conditions. As a result, the ALWUA is forced to maintain lower lake levels throughout the irrigation season to leave storage space available in the lake to account for future unexpected inflows.

The lower lake levels limit water users from utilizing their full allotment of water for irrigation purposes throughout the season, as lower lake levels are required to reduce the risk of dam failure from unexpected high-volume events. The proposed project will mitigate this water loss through seepage abatement measures and as a result conserve 750 acre-feet of water, restore crop production up to 16%, improve management of the ALWUA system, improve fish and wildlife habitat in the Judith River and Ackley Lake, and preserve recreational opportunities for Montanans.

The proposed project will involve reshaping and grading the existing canal to a consistent cross-sectional geometry and gradient, vegetation removal, and liner installation along a 2,200 linear foot reach of ALWUA Outlet Canal near the Philbrook Cemetery. The proposed project will provide conservation, preservation, development, and management benefits for the ALWUA shareholders and the State of Montana. Estimated Total Project Cost \$160,046.85.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
RRGL Grant	\$125,000.00	Uncommitted
DNRC SWPB In-Kind	\$35,046.85	Committed
TOTAL	\$160,046.85	



Ackley Lake Outlet Canal (near Philbrook Cemetery)

C. DNRC Deadman's Basin Supply Canal Rehabilitation Project (Wheatland County)

The Deadman's Supply Canal Rehabilitation Project is an effort by the DNRC State Water Project Bureau and the Deadman's Basin Water Users Association (DBWUA) to remove canal restrictions so high spring flows in the Musselshell River can be converted into storage water in Deadman's Basin Reservoir. Recently, the DBWUA spent \$84,400.00 completing Phase 1 of the rehabilitation project that restored about 3,000 feet of the canal. Phase 2 of the rehabilitation project will focus on widening and grading an additional 5,500 linear feet of canal. This effort will increase the flow rate from 350 CFS to the originally designed 600 CFS.

The Deadman's Supply Canal Rehabilitation project is vital for water conservation in the Musselshell River watershed. Having the ability to manage diversion and storage of high spring river flows ensures water is available late into the irrigation season. Release of stored water from Deadman's Basin Reservoir into the Musselshell River late in the summer helps preserve aquatic habitat, water quality, and irrigation operation along a 110-mile section of the river. Knowing there will be a steady supply of water throughout the irrigation season allows producers to maximize the development of their croplands. Estimated Total Project Cost \$160,050.85.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
RRGL Grant	\$125,000.00	Uncommitted
DNRC SWPB In-Kind	\$35,050.85	Committed
TOTAL	\$160,050.85	



Deadman's Basin Supply Canal Rehabilitation (Phase 1 Repairs)

D. DNRC Upper Musselshell Two Dot Canal Rehabilitation Project (Wheatland County)

The Two Dot Canal is part of the Upper Musselshell Project, owned and managed by the Montana DNRC and maintained and operated by the Upper Musselshell Water Users Association (UMWUA). Built in 1939, the Upper Musselshell Project consists of two storage reservoirs (Bair and Martinsdale), two supply canals, one outlet canal, and two distribution canals. Water from the Project is primarily used for agricultural irrigation, water-based recreation, and the regulation of stream flows. The primary purpose of the Two Dot Canal Rehabilitation Project is to mitigate seepage losses, therefore improving irrigation delivery efficiency, water conservation, management of the system, and agricultural production.

The 32-mile long Two Dot Canal System supplies irrigation water to farms and ranches surrounding the communities of Two Dot and Harlowton, Montana. Implementation of Two Dot Canal Rehabilitation project will conserve an estimated 38.4 million gallons of irrigation water lost to canal seepage and provide sustainable agricultural development by increasing crop production by 5% for the 2,500 acres below the project area. Water users near the end of the Two Dot Canal System will benefit from reliable water deliveries throughout the irrigation season. Estimated Project Cost \$170,046.85.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
RRGL Grant	\$125,000.00	Uncommitted
UMWUA Contribution	\$10,000.00	Committed
DNRC SWPB In-Kind	\$35,046.85	Committed
TOTAL	\$170,046.85	



Upper Musselshell Two Dot Canal Rehabilitation (near Mexican John drainage)

IV. ONGOING OR RECENTLY COMPLETED PROJECTS

Table 3. Ongoing or Recently Completed Projects

Ongoing / Recently Completed Projects	RRGL Grant Awarded	Water Storage Account	RRGL Loan	Other Funding
A. DNRC Allendale Canal Intake and Fish Screen (Granite Co.)				\$3,000,000; Natural Resources Damage Program Inter-Agency Agreement
B. DNRC East Fork of Rock Creek Alternative Analysis (Granite Co.)				Complete
C. DNRC East Fork Dam Rehabilitation Environmental Planning (Granite Co.)		\$500,000		
D. DNRC Painted Rocks Site Investigations and Feasibility Study (Ravalli Co.)				\$750,000; Combined Water Storage-Hydro Earnings
E. DNRC Painted Rocks Toe Access (Ravalli Co.)		\$900,000		
F. DNRC Painted Rocks Dam Environmental Planning (Ravalli Co.)		\$500,000		
G. DNRC Willow Creek Project Transfer (Madison Co.)				DNRC
H. MT DNRC State Water Projects Planning Document.		\$125,000		
I. DNRC Nevada Creek Douglas Canal Rehabilitation	\$124,331.50			DNRC SWPB and WUA In-Kind Services: \$25,240.60 WUA: \$10,000
J. DNRC Broadwater-Missouri Canal System Study and Master Plan	\$124,579.50			DNRC SWPB and WUA In-Kind Services: \$18,390.20 WUA: \$20,000

A. DNRC Allendale Canal Intake and Fish Screen (Granite County)-Ongoing

The Allendale Canal is part of the Flint Creek Project owned by the DNRC-SWPB and maintained and operated by the Flint Creek Water Users Association. This Project consists of a storage reservoir on the East Fork of Rock Creek, located about 20 miles southwest of Phillipsburg, a main diversion canal across the divide between Flint and Trout Creeks, and four distribution canals in the Flint Creek Valley, of which the Allendale Canal (125 cfs design capacity) is located furthest downstream on Flint Creek. The original construction work on the full project started August 1936 and was completed in November 1938.

The Montana Department of Justice, Natural Resources Damage Program (NRDP) is implementing the 2012 Restoration Plan that includes a goal of restoring the fishery of the Clark Fork River mainstem. To accomplish this goal some of the factors limiting fish populations in priority tributaries to the Clark Fork River are being addressed to improve the trout populations. The Allendale diversion has been identified as a diversion that entrains many fish, including trout. The installation of a fish screen on this diversion has been recommended by DFWP fishery biologists as a measure to improve trout recruitment to the Clark Fork River from Flint Creek.

The main goals for the Project are to:

- a. Effectively and safely screen fish from entering the Allendale Canal during irrigation season.
- b. Coordinate with adjacent private ditches / diversions to attempt to combine and include these diversions into the overall project, thus enhancing the overall results of preventing fish entrainment in irrigation systems.

DNRC-SWPB has contracted with Morrison Maierle for engineering services for the Allendale Canal Intake & Fish Screen project. A preliminary engineering report (PER) was submitted, followed by a revised PER based on significant comment received during an on-site field review meeting by project Stakeholders and representatives from adjacent private ditches/irrigators.

NRDP selected a preferred alternative and is funding improvements for the Allendale Intake & Fish Screen project that includes a new diversion and intake structure, new vertical flat-plate fish screen with bypass return, new canal flow measuring device, and incidentals. NRDP is also funding improvements to Flint Creek Private Irrigators involving new fish screens, new diversion and intake, new canal measurement devices, and incidentals.

DNRC, through Agreement with NRDP has fulfilled the planning/design and bidding phases, and will manage construction contract administration for two (2) bid schedules including Schedule 1 (Allendale Canal Intake & Fish Screen) and Schedule 2 (Flint Creek Private Irrigators Improvements). Project construction is underway, with completion tentatively schedule for the spring of 2021. Project cost to date - \$2,862,000; and the interagency agreement has a funding limit of \$3,000,000.

Funding is as follows:

Project Budget		
Funding Source	Amount	Committed/Uncommitted
MT Dept. of Justice, NRDP (Inter-Agency Agreement)	\$3,000,000	Committed
TOTAL	\$3,000,000	



Allendale Canal Fish Screen Installation



Allendale Canal Intake Structure on Flint Creek November 2020)

B. DNRC East Fork of Rock Creek Dam Alternatives Analysis (Granite County)-Completed 2019-2020

The East Fork of Rock Creek Dam is an on-stream reservoir located in Granite County, on the Beaverhead-Deerlodge National Forest and is operated under a USFS Special Use Permit. The dam is approximately 15 miles south of Philipsburg and is considered high hazard due to its potential for loss of life in the event of failure. The alternatives analysis, which was completed by DOWL Engineering inc., evaluated options to rehabilitate the dam to meet existing dam safety and operational criteria. The recommended improvements include replacing the spillway, installing seepage mitigation measures at the downstream toe of the dam, refurbishing the outlet works, and repairing damaged riprap on the upstream slope of the dam.

Two preferred alternatives were identified- one that maintains the existing spillway crest elevation and one that raises the spillway crest 2.5-feet to provide additional storage in case if this is required as a mitigative measure by the USFS. The estimated cost for the rehabilitation is \$12M with the dam raise and \$11.5M without it. Prior to constructing the recommended improvements, it will be necessary to complete the USFS Special Use Permit renewal and subsequent National Environmental Policy Act (NEPA) analyses, which includes consultation with the USFWS on how the dam and reservoir can be operated with minimal impacts to Bull Trout, a threatened species under the Endangered Species Act (ESA).

Project Summary

East Fork Rock Creek Dam Project Statistics

Year Constructed	1938
Height:	88 feet
Normal Storage:	16,040 acre-feet
Surface Area:	390 acres
Number of Water Users:	67
Water Contract Volume:	27,180 Acre-Feet

Primary Deficiencies

- **Spillway Capacity** – The spillway does not have adequate capacity to safely pass the required inflow design flood.
- **Foundation Seepage** – High foundation pressure and seepage requires further review and possible remediation.

Status

The alternatives analysis is complete. Future plans include completing environmental compliance actions, final design, and construction of the preferred alternative.



East Fork of Rock Creek Dam Spillway

C. DNRC East Fork Dam Rehabilitation Environmental Planning (Granite County)- Ongoing

This project performs the necessary analyses for coordination with the U.S. Forest Service (USFS) and U.S. Fish and Wildlife Service (USFWS) to ensure compliance with NEPA and ESA. Identifying an efficient path forward that addresses the significant environmental consultation and compliance required for the future rehabilitation is the focus of this planning study. The rehabilitation NEPA analysis, which will include consultation with the USFWS on how the dam and reservoir can be operated and managed with minimal impacts to Bull Trout, a threatened species under the ESA, will be an integral component of this study. This information is needed before any future rehabilitation can proceed. Estimated Project Cost \$500,000.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
Water Storage Account	\$500,000	Committed
TOTAL	\$500,000	

D. DNRC Painted Rocks Site Investigations and Rehabilitation Feasibility Study (Ravalli County)-Ongoing

Painted Rocks Dam is an on-stream reservoir located in Ravalli County, Montana. The dam is approximately 30 miles southwest of the town of Conner and is classified as a high hazard dam due to the potential loss of life in the event of a dam failure.

This project provides the funds necessary to evaluate alternatives to rehabilitate Painted Rocks Dam to meet existing dam safety and operational criteria. The existing spillway stilling basin requires repair, the outlet works are obsolete, and the project configuration limits site access for repair and maintenance activities. The alternatives analysis will determine the required spillway capacity and preferred configuration; identify any embankment stability issues; evaluate the cost and feasibility of developing a secondary outlet structure and provide final design and construction documents for a maintenance access road. The potential for increased storage and hydropower will also be evaluated. This work is necessary for the department to make decisions regarding rehabilitation efforts on this high hazard dam. The project is estimated to cost \$750,000. This is a multi-year project that will require funding over several years. Funding is as follows:

Proposed Project Budget		
Funding Source	Amount	Committed/Uncommitted
Combined Water Storage Account/Hydro Earnings	\$750,000	Committed
TOTAL	\$750,000	

Project Summary

Painted Rocks Project Statistics

Year Constructed	1939
Height:	143 feet
Normal Storage:	32,362 acre-feet
Surface Area:	655 acres
Safe Spillway Capacity:	<30,000 cfs
Required Spillway Capacity:	29,035
Number of Water Users:	41

Primary Deficiencies

- **Spillway Condition** – The spillway walls and stilling basin require repair.
- **Spillway Capacity** – The estimated safe capacity exceeds the required capacity by a small margin.
- **Outlet Works** – The existing gate system is obsolete and requires modernization. It is difficult to shut the gates and gate adjustments lack precision. This compromises the ability to conduct maintenance and repair activities and reduces the efficiency of project operations. Additionally, the outlet works discharge into the same stilling basin as the spillway, which further limits repair and maintenance options.
- **Access** – There is no provision for reliable access to the critical toe area of the dam. This greatly inhibits the ability to safely and efficiently conduct inspections and perform maintenance and repair activities.

Project Scope

- **Surveying** – Conduct property boundary, topographic, and bathymetric surveys of reservoir and reservoir rim.
- **Hydrologic Analysis** – Compute the Inflow Design Flood that the spillway is required to pass.
- **Preliminary Geotechnical Investigation** – Embankment and foundation subsurface investigation, test pits, and stability analyses.
- **Water Availability Analysis** – Evaluate legal and physical water availability for a potential future dam raise.
- **Hydropower Evaluation** – Evaluate the potential for hydropower development.
- **Maintenance Access Road** – Design access road for heavy construction equipment for the future rehabilitation, and to provide all-weather access to the dam toe during routine operations.

Status

- On-going. Anticipated completion by the summer of 2021



Painted Rocks Dam Spillway

E. DNRC Painted Rocks Dam Toe Access (Ravalli County)- Ongoing

DNRC-SWPB is in the process of conducting a feasibility study to identify future rehabilitation alternatives for Painted Rocks Dam. This project includes the preparation of final design documents to provide access to the toe of the dam. Access is needed for ongoing operations and maintenance of the dam as well as future rehabilitation efforts. This task will include construction of a bridge over the West Fork of the Bitterroot River approximately one-quarter mile downstream of the dam. It will also include improvements to an existing access road and improvements to an existing 2-track road on the west side of the river, from the new bridge to the downstream toe of the dam.

A final construction package for the bridge, including plans, construction specifications and permitting, is scheduled for completion by the spring of 2020. The updated engineer's estimate of probable cost is \$200,000 above the committed amount. The increased cost is primarily due to the time that has elapsed since the original estimate (time value of money), a longer span that was required to meet USFS requirements, and additional recommended improvements to the bridge abutments and the approach road.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
Water Storage Account	\$900,000	Committed
TOTAL	\$900,000	



Toe area of Painted Rocks Dam, currently inaccessible by vehicle without fording river.

F. DNRC Painted Rocks Dam Environmental Planning (Ravalli Co) Ongoing

The focus of this planning study is providing the environmental data and analyses necessary for compliance with the Montana and National Environmental Policy Acts and ESA. This planning report will provide the basis for the permitting related consultation with the USFWS on how the dam and reservoir can be operated and managed with minimal impacts to Bull Trout, a threatened species under the ESA. This is a necessary and critical component of the future dam rehabilitation. Estimated Project Cost \$500,000.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
Water Storage Account	\$500,000	Committed
TOTAL	\$500,000	



Painted Rock Dam and Reservoir

G. MT DNRC State Water Projects Planning Document- Ongoing

This planning project includes contracted services of \$125,000 to conduct a full inventory, condition assessment, preliminary cost estimates to repair, rehabilitate, and / or provide necessary alterations, and economic analysis of 18 active state-owned water storage projects consisting of 23 dams, 2 dikes, and approximately 250 miles of supply and delivery canals. The report will provide a priority list of projects for rehabilitation efforts and identify those state-owned projects with minimal benefit to the State for future transfer from state ownership. Divesting these projects from state ownership will result in significant operations and maintenance cost savings and reduced liability. An overview of the State Water Projects Bureau is provided in Table 1. Figure 1 provides a map showing the locations of active state water project dams. Estimated Project Cost \$125,000.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
Water Storage Account	\$125,000	Committed
TOTAL	\$125,000	

H. DNRC Nevada Creek Water Project Douglas Canal Rehabilitation (Powell County)-Ongoing

The Nevada Creek Water Project and the 12.6 mile-long Douglas Canal System provides water for the irrigation of 6,100 acres near Helmville. Ranching and farming operations and many other local families rely on system water for crop irrigation and livestock watering, with an estimated crop value of \$3.6 million and a potential \$11 million beef industry. Recreational opportunities also rely on project water and contribute significantly to the local and state economy.

The Douglas Canal Rehabilitation project is an effort by the DNRC-SWPB in cooperation with the Nevada Creek Water Users Association (NCWUA) to enhance water and habitat conservation through the installation of water measurement systems, the rehabilitation and replacement of dilapidated and/or failing structures in the Douglas Canal System, and the rehabilitation of sections of stream bank along Nevada Creek. From its inception, the project has focused on efforts that not only increase the functionality of the existing irrigation infrastructure but also enhance natural resource conservation, preservation, development, and management.

Funding and implementing the Douglas Canal Rehabilitation will have many benefits. Rebuilding the irrigation infrastructure will preserve irrigated cropland, the area's beef industry and the local economy in general, which is heavily dependent on agriculture and outdoor recreation. Installing water measuring devices in the canal and stream gives the NCWUA the tools to accurately measure, manage, and conserve water. Rebuilding the degraded streams banks protects local infrastructure and increases the quality of aquatic and riparian habitat, enhancing both fisheries and wildlife resources. Estimated Total Project Cost \$159,572.10.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
RRGL Grant	\$124,331.50	Committed
NCWUA Funding	\$10,000	Committed
DNRC SWPB and NCWUA In-Kind	\$25,240.60	Committed
TOTAL	\$159,572.10	



Douglas Canal Rehabilitation Construction Photos (November 2020)



Douglas Canal Rehabilitation Construction Photos (November 2020)

I. DNRC Broadwater-Missouri Canal System and Master Plan (Broadwater County)- Ongoing

The Broadwater Missouri Canal System provides irrigation water for 21,000 acres from Toston to Townsend. Water from the system supports approximately 200 farming and ranching operations and many other local families. Irrigated crops have an estimated annual value of \$12.6 Million. Annual revenues are even greater if beef production and related agricultural support industries are considered. The Toston Diversion Dam diverts water to the Broadwater Missouri Canal System and the Toston Hydroelectric Plant. Water conveyed through the hydroelectric plant produces electricity that is sold under contract to Northwester Energy.

The Broadwater Missouri Canal System Master Plan Project is an effort by the DNRC-SWPB to qualify and quantify structural and management problems in canal system to increase water conservation and reduce operation and maintenance costs for the benefit of the Broadwater-Missouri Water Users Association (BMWUA). Developing a Master Plan is the first step in a comprehensive effort to increase the efficiency of the canal system, enhance safety, and to identify tools needed to more effectively manage the system.

The Master Plan is designed to identify areas where rehabilitation and irrigation management efforts can have the greatest positive impact on water conservation. Planning for the rehabilitation and preservation of vital irrigation infrastructure, identifying water conservation opportunities, and developing a strategy for effective system management are the primary, significant benefits of a master plan. Conserving water also has a direct, positive effect on State revenues. Estimates from canal flow records indicate 41,000 acre-feet of water seeps out or is wasted out of the canal system annually. If 41,000 acre-feet of additional water was sent through the hydroelectric plant, it would generate an additional \$61,400.00 in annual revenue for DNRC-SWPB. With a master plan in place, the BMWUA and the DNRC-SWPB can begin work on improving and enhancing canal system maintenance and operations, so current and future generations can continue to rely on the critical water it provides. Estimated Total Project Cost \$162,969.70.

Project Budget		
Funding Source	Amount	Committed/Uncommitted
RRGL Grant	\$124,579.50	Committed
BMWUA Funding	\$20,000	Committed
DNRC SWPB and NCWUA In-Kind	\$18,390.20	Committed
TOTAL	\$162,969.70	

V. MT DNRC HYDROPOWER PROGRAM

The Hydropower Section of the DNRC-SWPB administers the development and operation of hydropower facilities on state-owned water projects. To date, one hydropower facility, the Broadwater Power Project near Toston, Montana has been built.

A. DESCRIPTION

The Broadwater Power Project is a 10 megawatt, run-of-river hydroelectric project owned and operated by the DNRC-SWPB in conjunction with the Broadwater-Missouri Water Users Association (BMWUA). The Project is located on the Missouri River, near the town of Toston, Montana. The site is about 20 river miles downstream of the headwaters of the Missouri River and about 20 river miles upstream from Canyon Ferry Reservoir.

The Broadwater Project is a concrete gravity overflow dam, with a total length of approximately 705 feet. It is 24 feet high to the top of the gravity overflow section and 40 feet high to the tops of the abutment walls on either end. The maximum dam height from the bottom of foundation concrete to the top of the abutments is approximately 50 feet. The upstream face of the dam is vertical. The downstream face is a modified ogee section with an apron that extends 75 feet downstream from the upstream face of the dam. At either end of the dam, parallel to its axis, are counterfort abutment walls, which extend into the abutments and function as concrete seepage cutoff walls.

The spillway consists of seven spillway bays, each 54 feet wide, separated by six reinforced concrete piers, each three feet wide and about 20 feet long. The original spillway was fitted with needle beams and flashboards to regulate the water levels. Seven rubber gates are now used to control water levels. Each fiber reinforced rubber gate is approximately 54 feet long and 11½ feet tall and can be individually regulated to control the reservoir pool level when the Missouri river flows exceed the 6600 cubic feet per second (cfs) turbine rating or when the turbine is offline.

Air bag inflation is regulated through four compressor houses that sit atop the concrete piers between the spillway sections. Compressors and valves inflate and deflate the gates in response to commands received from the Powerhouse Control Room. The gates in the six northern bays are automatically regulated to maintain the headwater elevation. The gate in the southernmost bay is controlled manually. Air pressure signals from the gates are transmitted to the controller in the Powerhouse. Inflation pressures required for their operation are approximately equal to the maximum hydrostatic pressure exerted on them by the water retained behind them, or about 5 pounds per square inch.

The powerhouse is a reinforced concrete structure constructed in the left abutment between 1987 and 1989. Electric power was first generated at this installation in June 1989. The powerhouse is approximately 160 feet long, with a maximum width of 46 feet and a maximum height above the foundations of about 64 feet. To construct the powerhouse, a portion of the concrete counterfort abutment wall constructed as part of the original dam was removed. The powerhouse contains a single, horizontally mounted double-regulated Kaplan turbine in a pit-type configuration. The turbine has a capacity of approximately 10 megawatts (MW) at a rated head of 21 feet and flow of about 6630 cfs. It typically operates at a 1.0 power factor.

Water flows into the powerhouse through two inclined trash racks, each 20 feet wide and 40 feet high. The trash racks are cleared of debris with an automated trash rake. The water then flows on either side of a concrete and steel turbine pit, through 16 turbine wicket gates, then through the turbine. Flow from the turbine discharges into a draft tube 30 feet high, 40 feet wide, and 90 feet long.

The Broadwater Project is on the Missouri River and forms a reservoir with a surface area of 327 acres. The original design storage capacity was approximately 4,100 acre-feet at full pool, but a 2008 bathymetric survey found the reservoir volume to be approximately 1,900 acre-feet due to silting over the intervening years. The drainage area feeding the Project is about 14,669 square miles.

The generator produces power at 4160 volts ac, which is stepped up in voltage to 100 kilovolts (kV) using an on-site transformer. The power is then transmitted over a 3-mile long transmission line to the DNRC-SWPB owned Broadwater Substation where it connects to the NorthWestern Energy 100kV line between Townsend and Trident.

B. FINANCING/REVENUE

Original construction bonds were issued September 1991 for \$21,735,000 which was used to cover the cost of constructing the Broadwater Project. The bonds were refinanced Sept 2001 to lower the cost of the debt payment. The last payment on the construction bonds was made on December 1, 2017.

All the electricity produced is sold to NorthWestern Energy under a 35-year Power Purchase Agreement which runs through June 2024. Revenues remaining after bond payments and operation costs are used to help finance the rehabilitation of other DNRC-SWPB water projects. For average water flows, Broadwater generates roughly 53 million kilowatt-hours of electricity and earns between \$4,000,000 and \$5,000,000 in energy and capacity revenue annually. After construction bond payments and operating expenses, approximately \$2.0 million is available to rehabilitate state-owned dams annually. Gross revenues for the last seven fiscal years were:

- Fiscal Year 2020: \$6,314,040
- Fiscal Year 2019: \$5,610,863
- Fiscal Year 2018: \$4,642,635
- Fiscal Year 2017: \$5,058,265
- Fiscal Year 2016: \$4,751,849
- Fiscal Year 2015: \$5,126,321
- Fiscal Year 2014: \$4,221,877

C. HISTORY

The DNRC-SWPB owns and operates the Broadwater Project. It was one of many state-owned water storage projects built by the Montana State Water Conservation Board (Board). These projects were built during the 1930's to take advantage of the federal government's Public Works Administration's efforts to offset depression era economics as well as mitigating the effects of long-term drought. The DNRC-SWPB is the successor to the Board. Original construction of what was then known as the Broadwater-Missouri Dam was completed in 1940.

In May 1982, the DNRC submitted an application for license for the Broadwater Dam Project to the Federal Energy Regulatory Commission (FERC). Between 1987 and 1989, the powerhouse was constructed in the left abutment containing a single, pit-Kaplan 10 MW hydroelectric generating unit. Commercial power production began in June 1989.

In 2000, a rock embankment jetty was placed between the canal and turbine intakes. It extends out from the dam 130 feet into the reservoir to separate the flow paths of the irrigation diversion and the powerhouse intake. A primary design consideration of the jetty was minimizing the amount of debris at the canal diversion headgates.

A new automated track rake was installed at the turbine intake in 2002. The trash rake cleans debris from the intakes of the powerhouse and greatly reduces shutdowns of the power plant for intake cleaning and maintenance. Also, a new structural steel deck was constructed upstream of the dam at river left, adjacent to the powerhouse, during the summer of 2002 to facilitate handling and storage of debris.

A bridge construction project replaced the original timber deck over the dam's spillway during the summer and fall of 2006. The original bridge structure (built in 1940) was removed, new concrete pedestals were poured in place, and a steel girder structure with a reinforced concrete deck was installed. The approaches at both ends of the bridge were regraded and Mechanically Stabilized Earth (MSE) block retaining walls were built to stabilize the steep side slopes. At the same time, an MSE block retaining wall was installed with new fencing around the canal intake to facilitate maintenance and public safety. The bridge serves as a primary maintenance access and provides public recreational access to the east side of the river.

In 2012, the rubber bladder gate in Bay 5 failed along a seam. Analysis determined the remaining gates had exceeded their design life and required replacement. All seven rubber gates were replaced in 2014. MWH Americas was the design engineer, Dyrhoff Limited was the supplier for the replacement gates (which were manufactured by Huaxia), and NW Construction completed the installation. As part of this effort, additional site improvements were made: steel bulkheads were procured to replace the old wooden flashboards; ladders and catwalks were installed to facilitate inspection of the gates and spillway; and additional valves were added to allow air pressure control of individual gates, instead of in pairs. Also, the approach to the left side of the spillway bridge was paved to provide safer access to the bridge deck.

D. IRRIGATION

The project was originally constructed in 1940 as an irrigation diversion structure by the State Water Conservation Board as the Broadwater-Missouri Diversion Project. Water from the reservoir continues to be used for irrigation. It is diverted into the main canal through a headgate structure to the west of the powerhouse. The turbine and canal intakes are separated by a rock embankment jetty.

Immediately downstream of the irrigation canal intake, a transition section conveys the flow from the intake to a box culvert section ten feet wide by seven feet high, approximately 400 feet long. The box culvert discharges through another transition section into the main Broadwater-Missouri Canal. At the end of the main canal, approximately 1.5 miles from the intake, an 84-inch diameter steel pipe flume, 667 feet long, conveys much of the flow across the Missouri River into the Eastside Canal.

The main Broadwater-Missouri Canal has a capacity of 342 cfs and is 1½ miles long before it splits into the Eastside and Westside Canals. The Eastside Canal has a capacity of 262 cfs and is 34.3 miles long while the Westside Canal has a capacity of 90 cfs and is 12.4 miles long. The dam is operated by the DNRC-SWPB in conjunction with the BMWUA. Prior to construction of the powerhouse, BMWUA operated the dam. After project modifications in 1989, the BMWUA role is limited to the operation of the irrigation canal system, while SWPB personnel operate and maintain the dam and powerhouse.

E. FUTURE PLANS

The FERC-issued license for the Broadwater Power Project was issued for 35 years and expires on July 1, 2024. The initial steps toward relicensing are being taken on what is expected to be a lengthy and time-consuming process. A great deal of interaction with FERC and stakeholders will be required and is ongoing. No changes to Project operation are expected because of relicensing. Project Staff is conducting studies and are preparing for a draft relicensing application in January of 2022 and final application in June

of 2022. The Power Purchase Agreement (PPA), currently with NorthWestern Energy, also expires as of July 1, 2024. A replacement PPA will need to be in place before then.

With the completion of bond repayment, additional funding is available for application to catching up on deferred maintenance and upgrades. This effort includes the following items:

- A Preliminary Engineering Report on alternatives to replace the rock jetty originally constructed to reduce debris loading on the Broadwater-Missouri Canal intakes is underway. In addition to jetty replacement, work will include installing erosion control measures along the bank at the BLM Upper Toston Recreation Site and assessing existing irrigation canal control gates alternatives.
- A long-term renewal for the lease of space on a radio tower by which the Project receives its Internet signal was completed.
- A new control room has been constructed. It provides a better and safer environment for Operators with less electrical equipment nearby, and more space for operating interfaces and camera displays.
- The existing hatches on the Powerhouse roof are past their useful lifetime and are presenting sealing issues. They are being replaced with weatherproof metal hatches.
- The existing cooling water pumps from the original construction of the facility are being replaced with Variable Frequency Drive pumps for better control. The existing manual strainers are being replaced with automatic self-cleaning strainers. Additional instrumentation is being added.
- The controller for the station water pump ceased working and the entire system is being replaced with an updated system, including separating it from the gate flushing system for better performance and control
- The two dewatering pumps, used to remove water from the waterway prior to entry for inspection or maintenance, are being replaced.
- The station air compressor is obsolete and allows excessive water vapor in the lines. It is being replaced with a compressor and dryer of modern design.
- The electric motors, blowers, and valve actuators in all four blowerhouses were recently replaced.



Broadwater Power Project, Missouri River near Toston, Montana

VI. APPENDIX A

A. Water Storage Policy and Statutory Criteria

The 1991 Montana Legislature passed into law a policy to define when water storage is the best solution for solving specific water problems. When storage is determined to be the best alternative, the policy identifies criteria to use in ranking state-funded projects. (Sections 85-1-701-704 MCA).

85-1-703. Water storage policy

(1) The legislature recognizes that water resources needs are growing, existing water facilities are aging and in need of repair, and new water storage projects have become more difficult to complete. Other types of actions will be needed to solve many emerging problems, but if storage is the best way to meet growing water needs and solve problems, it should be actively pursued. In determining the best solution for a particular water management problem, the state shall

- a. carefully define the problem*
- b. identify all options to solve the problem, including water storage*
- c. determine whether water is physically and legally available to solve the problem*
- d. select the option that best meets the following criteria*
 - i. technical feasibility*
 - ii. financial feasibility*
 - iii. economic feasibility*
 - iv. political feasibility*
 - v. legal feasibility*
 - vi. environmental feasibility*

B. Water Storage Project Prioritization Policy

The statute calls for this report to the legislature and describes its requirements. The statute also identifies different criteria to be used to prioritize new water storage projects, storage rehabilitation projects, and budget priorities for the allocation of state water storage development funds. Section 85-1-704 prioritization of water storage projects - governor's report, states:

- 1) The governor shall submit to each regular session of the legislature a report identifying specific water storage projects proposed for development, including the rehabilitation of existing projects and new project proposals. The report must contain:*
 - a. a list of water storage project priorities*
 - b. an implementation strategy for each priority project that identifies resources (including specific budget requests), government actions, and other actions needed to accomplish the project*
 - c. a progress report on the development of water storage projects during the previous 2 years*
- 2) In setting priorities among new water storage projects, the governor shall consider whether a project:*
 - a. Solves a severe water problem*
 - b. Provides multiple uses and benefits*
 - c. Provides for public uses*
 - d. Shows strong evidence of broad citizen support*
 - e. Able to obtain non-state sources of funding*
 - f. Protects and seeks to enhance social, ecological, cultural, aesthetic values*
 - g. Improves local and state economic development*

- h. Could resolve Indian and Federal reserved water rights issues*
- i. Supports water conservation activities*
- j. Promotes the use of water reserved under Montana law*

3) In setting priorities among water storage rehabilitation projects, the governor shall consider whether the project:

- a. Is needed to protect public safety*
- b. Has impacts if not repaired or rehabilitated*
- c. Accomplishes the goals listed in subsection (2a) through (2j)*

4) In establishing budget priorities for the allocation of state storage development funds:

- a. First preference must be given to projects that resolve threats to life and property posed by high-hazard facilities that are in an unsafe condition*
- b. Second preference must be given to projects that improve or expand existing water storage facilities*
- c. Third preference must be given to the planning and construction of new water storage facilities*

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North Fork Smith River Dam, Meagher County

