

# **WATER STORAGE**

**IN**

# **MONTANA**

**A Report Submitted to the  
Fifty-Eighth Montana Legislature**

**Governor Judy Martz**

**Pursuant to  
Montana Code Annotated, Sec. 85-1-704 (1991)**

**January 2003**



## TABLE OF CONTENTS

<b>Executive Summary .....</b>	<b>iv</b>
<b>Water Storage In Montana Project Location Map 2003 .....</b>	<b>vi</b>
<b>Table 1. Water Storage Project Proposals Ranked.....</b>	<b>vii</b>
<b>I. Introduction .....</b>	<b>1</b>
<b>II. Water Storage Policy and Statutory Criteria.....</b>	<b>1</b>
<b>Water Storage Project Prioritization Policy .....</b>	<b>1</b>
<b>Renewable Resource Grant and Loan Program .....</b>	<b>2</b>
<b>Water Storage Special Revenue Account.....</b>	<b>3</b>
<b>Water Storage Projects Prioritized .....</b>	<b>3</b>
<b>Justification for Project Prioritization .....</b>	<b>4</b>
<b>III. Water Projects Summarized .....</b>	<b>9</b>
<b>State-Owned Rehabilitation and Repair Projects (Ongoing or Completed) .....</b>	<b>9</b>
<b>Bair Dam Rehabilitation.....</b>	<b>10</b>
<b>Nevada Creek Dam Rehabilitation Phase I .....</b>	<b>10</b>
<b>Tin Cup Lake Dam.....</b>	<b>11</b>
<b>Mud Lake Dam Rehabilitation .....</b>	<b>12</b>
<b>Deadman's Basin Reservoir Supply Canal Drop Repairs .....</b>	<b>12</b>
<b>Martinsdale Reservoir Outlet Canal Drop Repairs .....</b>	<b>13</b>
<b>Painted Rocks Dam Gate Control Cable Replacement .....</b>	<b>13</b>
<b>Cooney Dam Riprap Replacement .....</b>	<b>14</b>
<b>Hydropower Program.....</b>	<b>14</b>
<b>Recent New Project Construction (Non-State).....</b>	<b>15</b>
<b>Carbone Dam Construction .....</b>	<b>15</b>
<b>South Hills Storm Water Retention Ponds .....</b>	<b>16</b>

<b>Non-State-owned Rehabilitation and Repair Projects.....</b>	<b>16</b>
<b>Lake Frances Dam Repair.....</b>	<b>16</b>
<b>Little Sleeping Child Dam Rehabilitation.....</b>	<b>17</b>
<b>Crazy Mountain Dam .....</b>	<b>17</b>
<b>State-Owned Dam and Canal Rehabilitation and Repair Proposals .....</b>	<b>18</b>
<b>Nevada Creek Dam Rehabilitation Phase II.....</b>	<b>18</b>
<b>North Fork Smith River Dam Rehabilitation.....</b>	<b>19</b>
<b>Upper Taylor Dam Rehabilitation (New RRGL).....</b>	<b>20</b>
<b>Nilan North Dam Rehabilitation.....</b>	<b>21</b>
<b>Canal Rehabilitation Proposals.....</b>	<b>21</b>
<b>Lower Willow Creek Dam (Carryover RRGL).....</b>	<b>22</b>
<b>Canyon Creek Lake Dam (Carryover RRGL).....</b>	<b>23</b>
<b>Basin Creek Dams #1 and #2 Rehabilitation (New RRGL) .....</b>	<b>24</b>
<b>Mill Lake Dam Rehabilitation (New RRGL).....</b>	<b>25</b>
<b>Dry Fork Dam Rehabilitation .....</b>	<b>25</b>
<b>Wyant Lake Dam Rehabilitation (Carryover RRGL).....</b>	<b>26</b>
<b>West Crane Sprinkler Irrigation Project Storage Alternatives Study.....</b>	<b>26</b>
<b>Big Lake Water Storage Study .....</b>	<b>27</b>
<b>IV. Seepage Monitoring for High-hazard Dams.....</b>	<b>28</b>
<b>Montana Reservoir Contents .....</b>	<b>30</b>
<b>Storage Contents -U.S. Bureau of Reclamation Reservoirs, December 1, 2002.....</b>	<b>30</b>
<b>DNRC State Water Projects Bureau - Reservoir Content Report, December 31, 2002.....</b>	<b>31</b>

## **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 is a review of state water storage policy and statutory criteria used to prioritize projects and a summary of water storage rehabilitation and repair projects occurring during the previous two years.

The report also includes a summary of new water storage proposals, including new projects and new repair and rehabilitation project proposals. The report includes a table summarizing projects for which funding is being requested, and a map indicating project locations.

The Department of Natural Resources and Conservation (DNRC) is requesting a Renewable Resource Grant and Loan (RRGL) Program grant in the amount of \$100,000, and a loan in the amount of \$425,000 for the rehabilitation of the North Fork Smith River Dam. Additional funding of \$300,000 for the project is requested as a biennial appropriation from the Water Storage Special Revenue Account.

The Nevada Creek Dam Rehabilitation Phase I is underway and is scheduled for completion by the end of 2002. Phase I includes construction of an outlet extension, toe berm, and drain system, as well as materials processing and dewatering of wells. Phase II at Nevada Creek, the construction of a new concrete spillway, will be contracted next year. DNRC is requesting \$500,000 from the Water Storage Special Revenue Account to complete the rehabilitation of Nevada Creek Reservoir and \$70,000 for the proposed rehabilitation of Nilan North Dam.

Rehabilitation has been completed on a number of State-owned projects over the past two years including Bair Dam, Mud Lake Dam, and Tin Cup Dam. The final phase of the rehabilitation of Bair Dam included a new concrete spillway, access roads, and an embankment raise. Site restoration and reclamation work is currently underway.

A bank stabilization project was also completed at Cooney Reservoir. Painted Rocks Dam, another state-owned project, had concrete spillway repair in October 2002 and gate control cable replacement in June of 2002. Repairs were made in 2002 by DNRC to canal outlet works associated with Deadman's Basin Reservoir and Martinsdale Reservoir.

DNRC's State Projects Bureau is planning four canal rehabilitation and maintenance projects over the next few years. The canals are an integral part of associated state-owned water storage projects. This report also provides a section on the state-owned and operated hydropower operations at the Broadwater Project on the upper Missouri River.

The Department of Corrections has submitted an RRGL grant application for the rehabilitation of Upper Taylor Dam, located on the State Prison Ranch in Powell County and ranked 39 of 73 RRGL applications. Hill County has applied for an RRGL grant to repair the outlet works of Beaver Creek Dam, which is owned by the county and used for recreation and flood control. Butte / Silver Bow has applied for a RRGL Program grant for the rehabilitation of Basin Creek Dams, ranked 41 of 73 proposals.

Non State-owned projects completed over the past two years include the rehabilitation of Lake Frances Dam, Crazy Mountain Dam, Little Sleeping Child, and the City of Missoula's South Hills Stormwater Retention Ponds, and the construction of Carbone Dam, a new, small private dam and reservoir in Big Horn County near Decker.

Several rehabilitation projects are being planned for privately owned dams including Lower Willow Creek, Canyon Creek Lake, Dry Fork, and Mill Lake dams. Proponents of the proposed West Crane Sprinkler Irrigation Project, located near Sidney, are requesting an RRGL grant to study alternatives to store irrigation water diverted from the Yellowstone River.

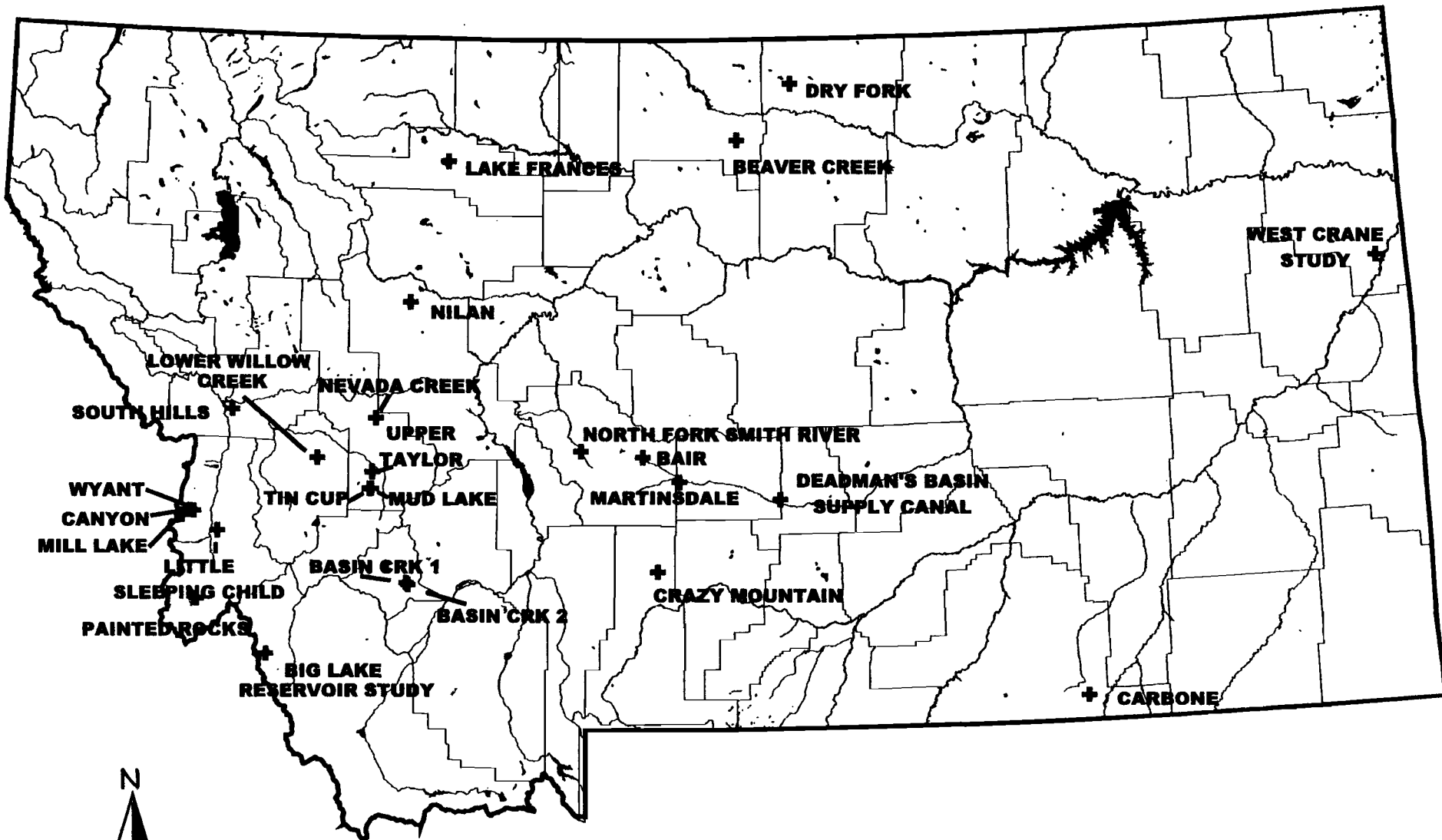
Seepage monitoring is required as a condition of the operating permits for all of the regulated high hazard dams in Montana. Failure of a dam classified as high hazard endangers lives, but the classification is not a reflection on the actual condition of the dam. Of DNRC's 21 water storage projects, 19 are classified as high hazard. DNRC's State Water Projects Bureau has submitted an application for a Renewable Resource Grant to establish a seepage-monitoring program at four state-owned dams with minimal monitoring capabilities.

Finally, reservoirs across the state have been drafted heavily over the past several years due to demand for water during the ongoing drought cycle. Below average mountain snow pack and seasonal precipitation have resulted in record low inflows at most projects statewide. It is expected to take two or more years for a number of reservoirs to recover average storage contents. See Table 2, U.S. Bureau of Reclamation Reservoirs, December 1, 2002 and Table 3, State Water Projects Bureau - Reservoir Content Report, December 31, 2002.

# WATER STORAGE IN MONTANA

## GOVERNOR'S REPORT

### 2003



25 0 25 50 75 Miles



January 2003

Figure 1.

**Table 1. Water Storage Project Proposals Ranked**  
Renewable Resource Grant and Loan Program 2003-2005 Biennium

<b>Storage Project Name And Applicant / Owner</b>	<b>RRGL Grant Rank/Amount Requested</b>	<b>Water Storage Special Revenue Account</b>	<b>RRGL Loan</b>	<b>Other (Funding source)</b>
1. Nevada Creek Dam Rehabilitation. Phase II (DNRC)		\$500,000	\$494,041 (Approved 2001)	\$1 Million Hydropower Earnings Account
2. North Fork Smith River Dam Rehabilitation. (DNRC)	Ranked 30 \$100,000	\$300,000	\$425,000 (Requested 2003)	
3. Upper Taylor Lake Dam (Dept. of Corrections State Prison Ranch)	Ranked 39 \$100,000			
4. Nilan Dam Rehabilitation. (DNRC)		\$70,000		
5. Seepage Monitoring of State- Owned Dams (DNRC)	Ranked 18 \$100,000			
6. Beaver Creek Dam Rehabilitation (Hill County)	Ranked 42 \$100,000			Hill County Taxpayers assistance
7. Basin Creek Dams Rehab. Butte / Silver Bow	Ranked 41 \$100,000			
8. Mill Lake Dam - Mill Creek Irrigation District	Ranked 17 \$100,000			
9. West Crane Sprinkler Project Storage Alternatives West Irrigation District	Ranked 73 \$99,500			



## **I. Introduction**

The Office of the Governor is required by statute to submit a report on water storage to the legislature each regular session. 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 during the previous two years. Project summaries provide information on background, status, and implementation strategy. The report includes a table summarizing the projects and a map indicating each project type and its location.

## **II. Water Storage Policy and Statutory Criteria**

The 1991 Montana Legislature passed into law a policy on water storage to define when 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 through 704 MCA). This law is based on the water storage section of the state water plan, developed over a two-year period by three technical committees and the State Water Plan Advisory Council, with participation and guidance from the Governor's Office and the Legislative Water Policy Committee. Montana's water storage policy is as follows:

*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; and*
- 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, and*
  - vi. environmental feasibility*

### **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 the resources (including specific budget requests), government actions, and other actions needed to accomplish the project; and*
  - 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) is 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; and*
  - 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; and*
  - c) accomplishes the goals listed in subsection (2)(a) through (2)(j).*
- (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; and*
  - c) Third preference must be given to the planning and construction of new water storage facilities.*

### **Renewable Resource Grant and Loan Program**

The Montana Renewable Resource Grant and Loan (RRGL) Program conducts a review of water project proposals prior to each legislative session. Resource-related projects that conserve, manage, develop, or initiate the beneficial use of a renewable resource are eligible. Grant applications for water storage-related proposals receive a high priority. The RRGL program ranks projects that promote water storage priorities established by the State Water Plan and the Montana Legislature through the water storage statute. Funding approved in a previous legislative session may need re-authorization, since projects can be delayed over a biennium for a variety of reasons.

## **Water Storage Special Revenue Account**

Dams classified as high-hazard that are in unsafe condition receive first preference for use of funds from the state's Water Storage Special Revenue Account (Section 85-1-631 MCA). This account was designated by the 1991 Legislature to allocate 25 percent of the grant funds available, or \$500,000 each biennium, under the Renewable Resource Grant and Loan (RRGL) program, to be used exclusively for water storage projects. This biennium, DNRC is requesting \$500,000 for the rehabilitation of Nevada Creek Dam, \$300,000 for the North Fork of Smith River Dam, and \$70,000 for Nilan North Dam.

## **Water Storage Projects Prioritized**

The following rehabilitation project proposals are prioritized by DNRC according to the criteria identified by Sec. 85-1-704 (4) MCA listed at the beginning of this report.

### **Storage Facility Rehabilitation Projects Proposed for Funding Under RRGL Program**

1. Nevada Creek Dam Rehabilitation Phase II (Water Storage Revenue Account)
2. North Fork Smith River Dam Rehabilitation (RRGL Rank 32)
3. Upper Taylor Lake Dam Rehabilitation (RRGL Rank 39)
4. Nilan Dam Rehabilitation (Water Storage Revenue Account)
5. Seepage Monitoring Project - State Owned Dams DNRC (RRGL Rank 18)
6. Beaver Creek Dam Rehabilitation (RRGL Rank 42)
7. Basin Creek Dams #1 and #2 Rehabilitation (RRGL Rank 41)
8. Mill Lake Dam Rehabilitation (RRGL Rank 17)
9. West Crane Irrigation Project Storage Alternatives Study (RRGL Rank 73)

### **Storage Rehabilitation Projects (Non-RRGL for 2003 Session)**

1. Lower Willow Creek Dam Rehabilitation
2. Dry Fork Dam Rehabilitation
3. Canyon Creek Lake Dam Rehabilitation
4. Wyant Dam Rehabilitation

## **New Storage Project Study Proposals**

1. West Crane Irrigation Project Storage Alternatives Study (RRGL Rank 73)
2. Big Lake Reservoir Study (Ongoing)

### **Justification for Project Prioritization**

The following rehabilitation projects are prioritized by DNRC according to the criteria identified by Sec. 85-1-704 (4) Montana Code Annotated (MCA) listed at the beginning of this report.

### **Rehabilitation Proposals For Funding Under RRGL Program (Summaries)**

#### **1) Nevada Creek Dam Rehabilitation Phase II (Water Storage Special Revenue Account)**

Nevada Creek Dam is located on Nevada Creek near Helmville, in Powell County. The dam is a high-hazard structure, which means that its failure could cause loss of human life. The existing spillway of the dam is severely deteriorated and would not withstand the flows of a large flood. Nevada Creek Dam needs rehabilitation to reduce the potential for significant loss of life and property damage downstream and to bring the dam into compliance with current Montana Dam Safety standards.

Rehabilitation will include replacing the existing spillway with a new reinforced concrete structure designed to meet current dam safety standards, and adding an emergency spillway. Funds were approved for rehabilitation of the dam during the FY '02 -'03 biennium. The initial bids to complete Phase I in FY '02 were rejected, which delayed the project by a year. More information on seepage through the dam was necessary to improve bidding documentation. Phase I of the project was re-bid in FY 2002 and will be completed in FY 2003. Phase II has been delayed and will be completed during the FY 04 - 05 biennium.

Reauthorization of funding approved before the FY '02 - '03 biennium will be necessary. The funding would be used to pay the Phase II rehabilitation construction costs. Funding of \$1,500,000 for the Project is requested as a biennial appropriation and would come from the Water Storage Special Revenue Account (\$500,000) and the Hydro Earnings Account (\$1,000,000). The project will be rehabilitated during FY04. By replacing the primary spillway, the Project will meet State Dam Safety requirements. The rehabilitation will enhance dam longevity and promote effective water conservation for the beneficial use of Montana's citizens.

#### **2) North Fork Smith River Dam Rehabilitation (New RRGL Grant and Loan)**

The dam is located on the North Fork of the Smith River approximately 10 miles east of White Sulphur Springs. The dam, built in 1936, is classified as high-hazard, which means there may be loss of human life if the dam were to fail. The reservoir provides irrigation water to the North Fork Smith Water Users' Association, and is a popular recreation area.

Based on the spillway standards established by the Montana Dam Safety Program, the existing spillway on the North Fork of the Smith Dam is inadequate, both in capacity and condition. If a large flood occurs at this site, the inadequate capacity of the spillway would force the flood to overtop the earthen dam. Should the dam fail from such an event, the results would be devastating, both in loss of life and property.

Rehabilitation will include replacing the existing spillway, adding an emergency spillway, raising the dam crest to increase freeboard, and installing filters and drains to control and collect seepage. The estimated total cost of the Project at the feasibility stage is approximately \$825,000, not including the DNRC in-kind contribution. The Department is requesting a grant in the amount of \$100,000 and a loan in the amount of \$425,000 for the Project. The additional funding of \$300,000 for the Project is requested as a biennial appropriation and would come from the Water Storage Account. The proposal meets criteria 2 (b), (c) and (i), 3 (a), (b), and 4 (a) of the storage statute.

### **3) Upper Taylor Dam Rehabilitation (New RRGL)**

Upper Taylor Dam (Powell County) is owned by the Montana Department of Corrections State Prison Ranch and used for irrigation purposes. Upper Taylor was constructed in 1950 and is classified as high-hazard, since its failure could cause loss of life and extensive damage to the Town of Deer Lodge. The corrugated metal outlet pipe is in need of replacement. In addition, the emergency spillway is greatly undersized.

Due to the height of the dam, rehabilitation of this project is complex. Engineering analysis and design has been completed and an appropriate repair and rehabilitation plan selected. The Department of Corrections has submitted a Renewable Resource Grant Program application for \$100,000 to proceed with rehabilitation construction. The rehabilitation proposal clearly meets criteria 3 (a), and 3 (b) of the water storage statute.

### **4) Nilan North Dam Rehabilitation (Water Storage Special Revenue Account)**

Nilan Reservoir is located about seven miles west of Augusta in Lewis and Clark County. The Nilan North and East dams were constructed in 1952, and are classified as high hazard, which means there may be a loss of life if either dam were to fail. The reservoir provides 10,090 acre-feet of irrigation water to the Nilan Water Users' Association, and is a popular recreation area.

The outlet structure at the North Dam has deteriorated to the point that additional small repairs and patching are not economical or feasible. There is also a considerable amount of seepage that exits in the location of the outlet. Uncontrolled seepage along the side of the conduit could cause material to be removed from the dam embankment and cause failure of the dam.

The proposed repair work includes replacing the outlet structure, and installing filters and drains at the outlet structure to control and collect seepage. Funding of \$70,000 for the project would come from the Water Storage Special Revenue Account. Rehabilitation will provide a safe outlet structure, control seepage at the dam, enhance longevity of the dam, and promote conservation.

## **5) Dam Seepage Monitoring at State-Owned Dams (New RRGL)**

DNRC manages several state-owned high-hazard dams that do not have adequate seepage monitoring control systems. Seepage-monitoring programs at state-owned projects enable DNRC to determine the severity and extent of dam seepage, and whether the integrity of a particular dam is in jeopardy. The State Water Projects Bureau has submitted an application for a Renewable Resource Grant to establish a seepage-monitoring program at four additional DNRC dams, Painted Rocks, Cataract, Willow Creek and Yellow water. These four dams currently have minimal monitoring capabilities. The proposal meets criteria 3 (a), and (b) of the water storage statute and is ranked 18 of 73 grant RRGL grant applications.

## **6) Beaver Creek Dam Rehabilitation (New RRGL)**

Beaver Creek Dam is located approximately ten miles south of the City of Havre and is owned, operated, and maintained by Hill County. This structure was planned for multi-purpose uses and provides flood prevention, irrigation, and recreation. The control gate structures in the outlet pipes have degraded. Continued degradation will eventually hamper usage of water downstream. It also could prevent rapid emptying of the reservoir in a flood emergency.

A Renewable Resources Program grant application has been submitted by Hill County to assist in funding of the rehabilitation and is currently ranked 42 of 73 applications. Hill County residents will also pay part of the rehabilitation. The Dam Safety Program supports this grant because of the ever-present need to be able to lower the reservoir in an emergency. The proposal meets criteria 2 (b) and (c), and 3 (a), and (b) of the water storage statute.

## **7) Basin Creek Dams #1 and #2 Rehabilitation (New RRGL)**

Basin Creek Dams #1 and #2 are municipal water supply dams owned by the City of Butte-Silver Bow. These dams were built near the turn of the last century, and are considered to be high-hazard due to the potential for loss of life to the City of Butte, located below the dams. Both dams require rehabilitation to address a variety of deficiencies. Butte-Silver Bow submitted a Renewable Resource Grant application to assist in funding the spillway repairs. The project was recommended for funding, with an overall ranking of 41 of 73. The proposal meets criteria 3 (a), and (b) of the water storage statute.

## **8) Mill Lake Dam Rehabilitation (New RRGL)**

Mill Lake Dam is located in the Selway-Bitterroot Wilderness Area approximately fifteen miles west of the City of Hamilton. The dam is owned by the Mill Creek Irrigation District and is used for irrigation. The dam was built ninety-five years ago. Mill Lake Dam is experiencing excessive seepage around the outlet pipe and embankment. In addition, the spillway is unable to convey the design flood, a requirement of the U.S. Forest Service, which manages the wilderness area and regulates the dam. Repairs to this dam are challenging due to Forest Service restrictions on access and use of motorized equipment.

Unless the seepage can be mitigated, the water users could be restricted severely in future water usage. The district plans on improving the spillway capacity, controlling erosion at the spillway, repairing the outlet works, and improving the dam embankment to safely control seepage. A Renewable Resources Program grant, ranked 17 of 73 applications, has been submitted to assist the irrigation district with funds needed for repair. The proposal meets criteria 2 (b) and (c), and 3 (a), and (b) of the water storage statute.

## **9) West Crane Irrigation Project Storage Alternatives Study (New RRGL)**

The West Crane Irrigation District is planning for the construction of an 8,000-acre center pivot sprinkler irrigation project near Sidney. One consideration is to develop storage within the project area so that water could be pumped from the Yellowstone River continuously over a six to seven month period. The district has secured the water for the project by utilizing a water reservation from the Yellowstone River. A feasibility study has been completed and the majority of the preliminary permitting has been obtained.

Two alternatives for storage are possible. The first would involve construction of a 55-foot high dam just below an existing small dam. The resulting reservoir would provide about 5,000 acre-feet of storage, which would meet the peak irrigation needs of the project. The second alternative involves construction of several low-head dams. Off-peak water would be introduced into these basins to recharge groundwater and to provide short-term surface storage.

## **Storage Rehabilitation Projects (Non-RRGL 2003)**

### **1) Lower Willow Creek Dam Rehabilitation (Carryover RRGL)**

Lower Willow Creek Dam is owned by the Lower Willow Creek Irrigation District of Granite County. The dam was built in 1962 by the Natural Resource Conservation Service and is classified as a high-hazard dam due to the potential for loss of life below the dam. The dam has a serious seepage problem that has been steadily increasing over the past three years. Presently, the seepage is being carefully monitored. The NRCS has evaluated several alternatives to control or eliminate the seepage.

Funding for rehabilitation construction will come from the NRCS, the Lower Willow Creek Irrigation District, and funds remaining from a 2001 Renewable Resources Program grant, when the project was ranked 28 of 73 applications. The Dam Safety Program considers remediation a high priority and has, accordingly, encouraged NRCS and the Irrigation District to begin construction at the earliest opportunity. The proposal meets criteria 3 (a), and 3 (b) of the statute.

### **2) Dry Fork Dam Rehabilitation**

Dry Fork Dam and reservoir is a privately owned facility located ten miles north of Chinook. The dam and reservoir is used for irrigation and is open to the public for recreation. Dry Fork Reservoir

can store about 5,000 acre-feet of water, making it average in size for a privately owned dam. Since a pumping system from Battle Creek is no longer used, the dam is seldom filled. Therefore, downstream residents also benefit from flood storage. The spillway of Dry Fork Dam is grossly undersized. It is expected that at least three lives would be lost if the dam failed. The owners have agreed to make the dam spillway fully compliant with Montana Dam Safety Rules by 2005.

### **3) Canyon Creek Lake Dam Rehabilitation (Carryover RRGL)**

Canyon Lake Dam is a high mountain dam in the Selway-Bitterroot Wilderness west of Hamilton constructed in 1891. Portions of the dam have deteriorated over time and flood events have caused damage to the dam. The dam has been determined to be a high-hazard dam with numerous dam safety deficiencies.

The primary project goal is to rehabilitate the 111-year old dam for compliance with current dam safety requirements, for retaining full-storage, and to ensure an adequate and timely supply of irrigation water to the district. The water users received a renewable resources grant in 1991. The project has been delayed by continued negotiations with the Forest Service for access to perform construction. Rehabilitation of Canyon Creek Lake Dam clearly meets criteria 3 (a), and 3 (b).

### **4) Wyant Lake Dam Rehabilitation (Carryover RRGL)**

Wyant Dam is located on Canyon Creek in the Selway-Bitterroot Wilderness west of Hamilton. The dam was originally constructed in 1910, and over time, the dam embankment and outlet works have deteriorated. Additionally, the dam embankment height is insufficient to contain the flood required for a high-hazard dam. The application seeks partial funding to repair historic deterioration of the dam outlet works and embankment and to bring the dam into compliance with dam safety regulations. Construction will take place in September of 2003, with final design and permitting ongoing until that time. Details of this project are discussed in a following section of this report. The proposal was ranked 4th by the RRGL Program for the 2001 session.

## **New Water Storage Project Proposal**

### **1) Big Lake Water Storage Study**

The proposed project site is located approximately 14 miles southwest of Wisdom in the Big Hole River Valley. The proposed Big Lake Dam would be built between the Twin Lakes to store additional water in the upper lake. Recent estimates put the project cost estimate between \$5 million and \$10 million. Since 1996, the Big Hole Watershed Committee has been exploring the feasibility of building a storage project to provide water for flow to support the threatened grayling in the river during periods of low flow. During years of adequate stream flow, stored water could be used to augment local irrigation operations.



There are numerous environmental concerns associated with the site, including a population of lake trout, which has been determined to be a distinct ice-age relict population native to Montana. DNRC has collected hydrologic data on Big Lake Creek and diversions from the creek for two years to determine whether Big Lake Creek supplies water sufficient to support construction of a storage project. It is uncertain whether water released from the proposed storage project would actually make it to the Big Hole River.

### **Water Storage Project Classification and Terminology**

It is important that the reader have some background and basic understanding of some principles and terms related to dam safety classification used in this report. Standards used by the State of Montana classify a dam spillway as unsafe if it would be unable to route the maximum inflow design flood or if the dam's structural integrity has become compromised since construction.

The state's highest priority for repair and rehabilitation is assigned to dams classified as high-hazard and unsafe. The high-hazard classification should not be confused with an assessment of a dam's structural integrity or condition. A dam is classified as high-hazard if its failure has the potential for loss of human life, regardless of its current structural condition. All existing storage projects addressed in the Governor's Report are classified high-hazard, and will remain classified as high-hazard following the completion of any proposed work.

Repair of a project usually refers to scheduled or emergency action taken to resume dam function to original design capacity or at a reduced, but safe level. Rehabilitation involves upgrading existing projects to comply with or exceed current design standards and often includes repair work.

Design standards have evolved considerably since the construction of most of the state's dams and repair alone may not bring a facility up to current design standards. The storage capacity of a project is sometimes increased during rehabilitation, especially if enlargement is determined to be a cost-effective alternative.

### **III. Water Projects Summarized**

This section describes existing repair and rehabilitation projects in detail. Project descriptions include information on funding, background, status, and implementation strategy, where applicable. A number of rehabilitation projects started during the last biennium were completed in 2001 - 2002 while others are ongoing.

#### **State-Owned Rehabilitation and Repair Projects (Ongoing or Completed)**

This section contains current information concerning projects that were in progress when reported in the 2001 Governors Report on Water Storage, or were started during the past two years. Some projects have been completed during the last two years, while work on others is expected to continue into the next biennium.

## **Bair Dam Rehabilitation**

Bair Dam is an earth fill structure located on the North Fork of the Musselshell River in Meagher County, approximately one mile upstream of the Town of Checkerboard. The dam and reservoir are owned by DNRC and managed by the State Water Projects Bureau. The Upper Musselshell Water Users Association has operated the dam since 1940. The dam was constructed in 1939 and is 102 feet high, with a concrete chute spillway and a gated, reinforced concrete outlet conduit. The normal storage capacity of the reservoir is 7,200 acre-feet. The dam is a high-hazard structure, which means that its failure could cause loss of life.

### **Status**

Bair Dam suffered from several deficiencies and could not safely route the required inflow design flood for a dam of its size and hazard classification. DNRC contracted final design for the rehabilitation projects in two phases. Phase I part of the rehabilitation was completed in early 2002 and Phase II of the rehabilitation was substantially completed in December 2002.

### **Implementation Strategy**

A phased approach was used for construction. Phase I included excavation, drains, a new outlet terminal structure, and a toe berm. Phase II included a new concrete spillway, access roads, and a three-foot embankment raise. Bair Dam Phase II was delayed by a slope failure above the spillway, for which remediation construction has been completed.

### **Summary**

The rehabilitation of Bair Dam was completed in December 2002. The total cost of the rehabilitation project is estimated to be \$3 million dollars. Bair Dam is now in full compliance with the Montana Dam Safety Act.

## **Nevada Creek Dam Rehabilitation Phase I**

Nevada Creek Dam is located on Nevada Creek in Powell County, adjacent to State Highway 141, between the towns of Avon and Helmville. Nevada Creek is a major tributary of the Blackfoot River. The project is owned by DNRC and managed by its State Water Projects Bureau. The Nevada Creek Water Users Association has operated the dam since 1939.

### **Description**

The project consists of an earth fill dam, 105 feet in height, with a concrete chute spillway and a gated, reinforced concrete outlet conduit. The original construction was completed in 1938. The normal storage of the reservoir is 11,200 acre-feet. The dam is a high-hazard structure, which means that its failure could cause loss of human life.

## **Status**

Nevada Creek Dam suffers from several deficiencies and cannot safely route the required inflow design flood for a dam of its size and hazard classification. The spillway is in extremely poor condition, with severe concrete deterioration in the spillway floor and walls. Also, uncontrolled seepage flows of up to 500 gallons per minute exit at the toe of the dam, threatening the stability of the structure.

## **Implementation Strategy**

A phased approach is being used for construction. Completion of Nevada Creek Phase I is expected by the end of 2002. Construction includes an outlet extension, materials processing, stability berm, drain system, and dewatering wells. Nevada Creek Phase II includes a new concrete spillway and will be contracted next year, pending the reauthorization of funds.

## **Summary**

The rehabilitation project is tentatively scheduled for completion in December 2003. The total cost of the rehabilitation project is estimated to be \$2 million dollars. When complete, the rehabilitation of Nevada Creek Dam will bring the project into full compliance with Montana Dam Safety regulations.

## **Tin Cup Lake Dam**

Tin Cup Lake Dam is located on the prison ranch at the Montana State Prison, near Deer Lodge. The Montana Department of Corrections owns and operates Tin Cup Lake Dam. The dam is twenty-feet high and holds 120 acre-feet.

## **Background**

The dam is used for irrigation by the state prison ranch as well as for the City of Deer Lodge cemetery and golf course. The problems with the dam were twofold. First, seepage occurred on the downstream face of the dam. Limited seepage through earth filled dams is usually not serious, but since the seepage was exiting through the embankment and not the foundation, concern was high. Second, the spillway size was grossly inadequate for the size of flooding that could occur in the Tin Cup drainage.

## **Status**

Construction was completed during the fall of 2002. A series of berms and drains were installed to control seepage and stabilize the dam. An earthen spillway was added to convey floodwaters. The embankment height was increased an additional two and a half feet to provide more flood storage.

## **Summary**

Department of Corrections used the Montana Job Corps to complete the work and to keep costs low. The total cost was less than \$50,000, paid for entirely by the Department of Corrections.

## **Mud Lake Dam Rehabilitation**

Mud Lake Dam is located in Powell County, near the town of Deer Lodge. The dam 25 feet in height, stores 65 acre-feet of water, and is owned and operated by the Department of Corrections State Prison Ranch.

## **Status**

The corrugated metal outlet pipes in Mud Lake Dam are in very poor shape and are a threat to the integrity of the dam.

## **Strategy**

Corrections used a Renewable Resource Program grant to complete the rehabilitation of the dam. Rehabilitation consisted of removal and replacement of the outlet works.

## **Summary**

The project was completed in fall 2001 and currently meets Montana Dam Safety requirements.

## **Deadman's Basin Reservoir Supply Canal Drop Repairs**

Deadman's Basin Reservoir was built in 1941 and is located in Wheatland County near the Town of Harlowton. The dam crest is 60 feet in height and the reservoir capacity is 72,220 acre-feet. The dam is owned by DNRC and managed by the Deadman's Basin Water Users Association.

## **Background**

The Shawmut drop had deep voids beneath the chute that were filled, and a resulting structural crack in the headwall that was repaired. The Reservoir drop structure had numerous voids, deteriorated joints, freeze-thaw deterioration, and most seriously, a hole that had been eroded through the concrete stilling basin.

## **Summary**

DNRC's contractor filled the voids with drain gravel, repaired the deteriorated concrete, and placed a 6-inch reinforced concrete overlay over the stilling basin. DNRC repaired the Shawmut and Deadman's Reservoir drop structures on the supply canal in 2002.

## **Martinsdale Reservoir Outlet Canal Drop Repairs**

Martinsdale Dam and Reservoir located in Wheatland County, about 25 miles west of the Town of Harlowton. The dam was built in 1939, owned by Montana DNRC and managed by the Upper Musselshell Water Users Association, has a storage capacity of 23,110 acre-feet.

### **Background**

Water was piping beneath the structures and undermining the foundations.

### **Strategy**

The contractor used concrete and clay to support the unstable foundation walls and cutoff to extend the life of the structures. Additional riprap was placed downstream from the upper structure to alleviate future erosion damage.

### **Summary**

In 2002, DNRC completed the repair work on the two drop structures on the Martinsdale Outlet Canal that were at risk of failure.

## **Painted Rocks Dam Gate Control Cable Replacement**

Painted Rocks Dam and Reservoir are owned by the State of Montana Department of Natural Resources and Conservation, and used for irrigation, recreation and flood control. The dam is located in Ravalli County, approximately 30 miles southwest of Darby.

### **Description**

The project consists of a rolled earth fill dam 143 feet in height, a concrete chute spillway, a small gatehouse with two self-sealing rectangular slide gates located on the east side of the dam crest, and a circular 10-foot diameter concrete lined rock outlet tunnel. The reservoir storage capacity at maximum capacity is 32,362 acre-feet. The State Water Conservation Board constructed the dam in 1939 with funds from the Public Works Administration.

DNRC's Water Resources Division - Missoula Water Rights Office, operates the project working with, and on behalf of, the State Water Projects Bureau. The water users association has a water marketing agreement with Montana Fish, Wildlife, and Parks to use stored water to augment streamflow on the Bitterroot River during the late summer months. The dam is a high-hazard structure, which means that its failure could cause loss of life.

### **Summary**

Repairs to the project's concrete spillway were performed in October 2002. Repairs from freeze-thaw damage were made to section joints, wall tops, and one bridge pier for a total of \$24,000. The

gate control cables were also replaced at Painted Rocks Dam in June 2002. The old cables were corroding and due for replacement. The cables are replaced routinely every seven to ten years. The cost for the new cables and installation was \$10,500.

### **Cooney Dam Riprap Replacement**

Cooney Dam and Reservoir are located on Red Lodge Creek in Carbon County, approximately seven miles west of the Town of Boyd. The dam is owned by the Montana Department of Natural Resources and Conservation. The earth fill dam is 102 feet in height, has a crest length of 2,369 feet, and impounds 28,230 acre-feet of water at full pool. The water is used for supplemental irrigation on approximately 20,000 acres. The original dam was completed in 1937.

### **Status**

The dam was rehabilitated in 1982 to meet current dam safety standards. Cooney Dam is classified as a high-hazard dam. A dam is classified as high-hazard if failure of the dam would endanger lives and property downstream.

### **Implementation Strategy**

The project involved the replacement of approximately 1,000 cubic yards of bedding rock and approximately 2,200 cubic yards of rock riprap along the reservoir side of the dam. The work was performed to replace and enhance the existing riprap that protects the face of the dam from erosion and serves to stabilize the earthen structure. The project was completed in December 2002.

### **Summary**

The replacement riprap should have a service life of 50 years. The total project cost was approximately \$158,000.

### **Hydropower Program**

The hydropower program administers the development and operation of hydropower facilities on state-owned water projects. To date, one hydropower facility, the Broadwater Power Project near Toston, has been built. With a maximum rated capacity of 10 megawatts, the project began generating power in June 1989. DNRC owns and operates the facility and contracts with Northwestern Energy to sell the energy.

### **Broadwater Hydropower Project**

Earned revenues from Broadwater are used to pay for rehabilitating other state-owned water projects. The main purpose of these funds are to help in the maintenance and repair of 22 major projects, which include 24 designated high hazard dams, and 250 miles of irrigation canals. Most of these large projects were completed in the 1930's and 1940's, and have significant needs.

Many of these dams were classified as unsafe due to inadequate spillway capacities during a 1980 U.S. Army Corps of Engineers statewide inspection.

Presently, the sale of electricity to Northwestern Energy averages roughly \$.06/Kw-Hr based on contract rates paid for capacity and energy. These rates were developed by Montana Power Company and approved by the Public Service Commission in the late 1980's to comply with the Public Utilities Regulatory Policies Act of 1978 (PURPA). Broadwater is a qualifying facility under PURPA. The power purchase contract was signed in 1987 with a term of 35 years and specifies energy and capacity rates for each of those years with an annual escalation factor for energy.

Based on 2002 rates and assuming mean river flow, Broadwater should generate roughly \$3.4 million in earned income from energy and capacity sales. After debt payments and operation expenses, approximately \$1.3 million would be available for maintenance and repair of state-owned dams. Drought conditions in the Missouri River will reduce the net revenue figure by as much as 50 percent, depending on winter weather for 2002. DNRC also has a statutory appropriation of \$500,000 per biennium to fund emergency repairs and maintain an emergency repairs fund.

To date, Broadwater has generated revenue for the rehabilitation program in each year of its 13-year existence. Hydropower earnings totaling approximately \$167,000 are used for the annual partial repayment of the 0% interest loan to the Northern Cheyenne Tribe for the Tongue River Dam Rehabilitation Project.

The rehabilitation of the East Fork Dam, completed in FY1997, utilized \$478,000 in hydro-earnings. DNRC received spending authority for up to \$3.1 million of hydro-earnings for the current biennium (FY2002-2003) for the rehabilitation of Bair and Nevada Creek dams. The Nevada Creek Dam rehabilitation plan also proposes to use \$1,000,000 in hydro-earnings for next biennium (FY2004-2005).

### **Recent Accomplishments at Broadwater Project**

Improvements to the PLC-based automated control system are ongoing in a continued commitment to better manage reservoir and tailwater levels. A new trash rake machine was procured and installed for spring runoff 2002. For the first time, operators were able to maintain the turbine intake clear of debris throughout the period of spring runoff. It is anticipated that the machine will increase power generation resulting in a payback on the investment in 4-7 years. In addition, the left abutment retaining wall was strengthened and additional improvements to the trash handling system were commenced. Finally, the project's construction bonds were refinanced at a lower interest rate that will reduce annual operating costs.

### **Recent New Project Construction (Non-State)**

#### **Carbone Dam Construction**

A new dam was recently built in Bighorn County near Decker, Montana.

## **Background**

Carbone Dam is owned by Spring Creek Coal Company. It protects an open pit coal mining operation from storm water inflows. If possible, some water will also be stored for mine usage. The dam is thirty feet in height and over one-half mile in length. Because the dam serves the critical role of protecting workers immediately downstream, the dam is classified as high hazard.

## **Status**

The dam was completed during the summer of 2002.

## **South Hills Storm Water Retention Ponds**

### **Background**

The South Hills Storm Water Retention Ponds are located in the City of Missoula. The City of Missoula owns the pond embankments. The dams are only seven feet in height, but they hold 84 acre-feet of water. Since failure of the dams would result in floodwaters hitting homes and businesses immediately, the embankments are classified high hazard. Construction of the dams has allowed for the neighborhood to be classified as outside the 100-year floodplain of Pattee Creek.

### **Status**

The construction of the dams was completed in the summer of 2002.

## **Non-State-owned Rehabilitation and Repair Projects**

### **Lake Frances Dam Repair**

Lake Frances is located in Pondera County, one mile west of the Town of Valier.

### **Description**

Two dams measuring twenty and sixty feet in height create the reservoir. Storage is 105,000 acre-feet, which is considered large for a privately owned dam in Montana. The Pondera County Canal and Reservoir Company owns the dams. The water is used for irrigation, for municipal use by the City of Conrad, and for recreation by the general public. The dams were constructed in 1908-1909.

### **Background**

Both dams are classified high-hazard and are regulated by the DNRC Dam Safety Program. A geotechnical analysis detected voids within the sixty-foot high dam. Voids in dams are considered serious since they can grow in size, sometimes leading to dam failure.



## **Status**

A program to inject grout into the voids was implemented during the fall of 2001. Indications during the spring of 2002 show less seepage from the embankment after construction.

## **Summary**

The repair is considered a success and the dam now complies with Montana Dam Safety standards.

## **Little Sleeping Child Dam Rehabilitation**

Little Sleeping Child Dam is located in Ravalli County, southeast of Hamilton. The reservoir is owned privately, is used primarily for recreation, and is closed to the general public.

## **Background**

The dam was constructed in the 1940's and had a rated storage capacity of 80 acre-feet. However, recent testing revealed that storage capacity has been reduced to 65 acre-feet due to the effects of siltation. The reservoir is small for a high hazard dam, at 65 acre-feet, but due to development downstream, the dam owner's engineer estimates that five lives would be lost if the dam fails.

In August and September 2000, forests in the drainage area above the dam were burned extensively during a wildfire event. In October 2000, the Natural Resources Conservation Service (NRCS) completed an evaluation of the potential for damage from flooding runoff, taking into consideration the loss of vegetation in the burned areas of the drainage. The NRCS concluded that there was a high probability that the dam could fail during spring runoff in 2001, due to insufficient spillway capacity.

## **Strategy**

An engineering design was completed and construction commenced in the fall of 2002. Since the dam is privately owned, the dam owners are limited to \$5,000 in assistance from the state.

## **Summary**

The Montana Dam Safety Program recently ranked rehabilitation of this dam as a high priority. The owners completed construction of a new emergency spillway in December 2002.

## **Crazy Mountain Dam**

Crazy Mountain Dam is located in Park County, approximately fifteen miles northeast of the Town of Clyde Park.

## **Background**

Crazy Mountain Dam is owned by Philip Morris, USA. Guests of Philip Morris use the reservoir exclusively for recreation. The dam is 40 feet high and holds 100 acre-feet. The reservoir volume is considered small for a private dam in Montana. The dam had excessive seepage on the downstream face. Seepage at earth filled dams is usually not serious, but since the seepage was exiting through the embankment and not the foundation, concern was high.

## **Status**

A filter and berm were placed on the downstream embankment to control seepage. Construction was completed in the 2002.

## **State-Owned Dam and Canal Rehabilitation and Repair Proposals**

### **Nevada Creek Dam Rehabilitation Phase II**

Nevada Creek Dam is a high-hazard, unsafe earthen embankment dam located near Helmville, Montana. The dam and reservoir are adjacent to Montana Highway 141. Nevada Creek is a tributary of the Blackfoot River. The reservoir has a storage capacity of 11,207 acre-feet at the spillway crest, and is used primarily for irrigation. The reservoir is also used for water-based recreation and the regulation of stream flow rates. The dam was constructed in 1938. Nevada Creek Dam is owned by the Department of Natural Resources and Conservation and operated by the Nevada Creek Water Users Association.

## **Current Status**

The dam is classified as high hazard, meaning loss of life could occur should the dam fail. Phase I of the rehabilitation, which involves an outlet extension, materials processing, toe berm, drain system, and dewatering wells, is currently underway and should be completed by December 2002. Phase II will involve the construction of the new concrete spillway.

## **Implementation Strategy**

Funds were approved for rehabilitation of the dam during the FY '02 - '03 biennium. The rehabilitation was planned in two phases. The initial bids to complete Phase I in FY02 were rejected, delaying the project by a year. More information on seepage through the dam was necessary to improve the bidding documentation. Phase I of the project was re-bid in FY 2002 and will be completed in FY 2003. Combining Phases I and II had been considered, but the funding source, the hydro-earnings account, was lower than expected. Therefore, Phase II was delayed and completion is now planned for the FY '04 - '05 biennium.

Funds approved during the FY '02 - '03 biennium need to be reauthorized for future use. The funding would be used to pay the Phase II rehabilitation construction costs. Funding of \$1,500,000 for the Project is requested as a biennial appropriation and would come from the Water Storage Account (\$500,000) and Hydro-Earnings Account (\$1,000,000). The project will be rehabilitated

during FY '04. By replacing the primary spillway, the project will meet State Dam Safety requirements. The repairs and improvements will enhance the dam's longevity and promote effective water conservation for the beneficial use of Montana's citizens.

### **Summary**

The reauthorization of funds to complete the rehabilitation will be presented to the 2003 Legislature. Phase II is anticipated to be completed by December 2003, if the funding is reauthorized.

### **North Fork Smith River Dam Rehabilitation**

The dam is located on the North Fork of the Smith River approximately 10 miles east of White Sulphur Springs, Montana. The dam, built in 1936, is 84 feet high and 1,300 feet long. The earthen embankment is classified as high-hazard, which means there may be loss of life if the dam were to fail. The reservoir provides 11,406 acre-feet of irrigation water to the North Fork Smith Water Users Association, and is a popular recreation area.

### **Current Status**

The U.S. Corps of Engineers inspected the dam in 1980, under the National Dam Inspection Program, P.L. 92-367. The Corps declared the dam to be unsafe due to inadequate spillway capacity to meet the dam safety standards in effect at that time. The existing spillway concrete has deteriorated to the point that additional small repairs and patching are not economical or feasible. The ongoing deterioration is now primarily a function of continuous freeze / thaw damage through the winter.

### **Implementation Strategy**

In 1995, HKM Associates completed a feasibility study and alternative evaluation to upgrade the dam to meet dam safety standards. Final design and construction were delayed at that time because the State Dam Safety Section was establishing new spillway standards for high hazard dams.

Based on the new spillway standards established by Dam Safety, the existing spillway on the North Fork of the Smith Dam is inadequate, both in capacity and condition. If a large flood occurs at this site, the inadequate capacity of the spillway would force the flood to overtop the earthen dam. Should the dam fail from such an event, the results would be devastating, both in loss of life and property.

Rehabilitation will include replacing the existing spillway with a two-cycle labyrinth weir, adding an emergency spillway and rock-lined auxiliary spillway channel, raising and leveling the dam crest to increase freeboard, and installing filters and drains to control and collect seepage.

## **Summary**

The estimated total cost of the project at the feasibility stage is approximately \$825,000, not including the DNRC in-kind contribution. The Department is requesting a grant in the amount of \$100,000 and a loan in the amount of \$425,000 for the project. The additional funding of \$300,000 for the project is requested as a biennial appropriation and would come from the Water Storage Special Revenue Account.

## **Upper Taylor Dam Rehabilitation (New RRGL)**

Upper Taylor Dam is located in the Montana State Prison west of the City of Deer Lodge. The Montana Department of Corrections owns and operates Upper Taylor Dam. The dam is 40 feet in height and holds 300 acre-feet of water. The dam is used for irrigation by the state prison ranch.

## **Background**

The Department of Corrections submitted an application for a grant to the Renewable Resource Program for the 2001 legislative session for engineering services to develop a rehabilitation design for Upper Taylor Dam. With the project analysis and design phase complete, Corrections is prepared to begin rehabilitation construction with the approval of the current grant application.

## **Status**

The problems with the dam are two-fold. First, the principal and emergency spillways are grossly undersized. It is estimated that the loss of 20 lives, in the northwest section of the City of Deer Lodge, could be expected if the dam were to fail. Furthermore, the corrugated metal outlet pipe has reached the end of its design life. Significant corrosion of the outlet pipe could lead to failure of the entire dam.

## **Strategy**

The Department of Corrections has applied for a Renewable Resources Program grant to fund one-third of the needed cost for repair. The remaining two-thirds of the necessary funding will come from proprietary State Prison Ranch funds. The work will include an enlarged, rock-lined emergency spillway and a slip lining of the current outlet pipe.

## **Summary**

The Dam Safety Program rates the rehabilitation of this dam as the highest safety priority of all state-owned dams. The rehabilitation of the primary and emergency spillways of Upper Taylor Lake Dam would bring the facility into compliance with Montana Dam Safety standards. The RRGL Program has ranked the proposed rehabilitation of Upper Taylor Lake Dam 39 of 73 applications.

## **Nilan North Dam Rehabilitation**

Nilan Reservoir North Dam is located about seven miles west of Augusta in northern Lewis and Clark County. The repair work at the North Dam would include replacing the outlet structure and installing filters and drains at the outlet terminal structure to control and collect seepage. The dam was constructed in 1952, and is classified as high-hazard, which means there may be loss of life if the dam were to fail. The reservoir provides 10,090 acre-feet of irrigation water to the Nilan Water Users Association, and is a popular recreation area.

### **Status**

The outlet structure at the North Dam is structurally in very poor condition. The structure has deteriorated to the point that additional small repairs and patching are no longer economical or feasible. The accelerating deterioration is primarily a function of continuous freeze-thaw damage and resulting severe cracking. There is also a considerable amount of seepage that exits in the location of the outlet. Uncontrolled seepage along the side of the conduit could cause material to be removed from the dam embankment and cause failure of the dam.

### **Implementation Strategy**

The proposed drain installation would encircle the end of the conduit to safely discharge seepage water that finds its way to the conduit. Funding of \$70,000 for the Project will be requested as a biennial appropriation and would come from the Water Storage Account.

### **Summary**

The rehabilitation will provide a safe structure outlet structure at the North Dam, and will control seepage at the dam. The repairs and improvements will enhance the longevity of the dam, and promote effective water conservation.

## **Canal Rehabilitation Proposals**

The Canal Operations Program is responsible for identifying and correcting operational deficiencies on state-owned canals. The SWPB is responsible for maintaining 250 miles of major irrigation canals on ten state-owned projects. The canal projects are not being considered for funding at this time. Inclusion of the canal project proposals in this report is intended as informational.

### **Status**

The canals are integral components of the various water projects and serve to deliver water to the water users served by the respective projects. Many were constructed in the 1930s and 1940s and are in an unsafe condition due to severe structural deficiencies.

## **Implementation Strategy**

DNRC plans to work on four projects over the next few years. They include:

- The Flint Creek Siphon - The siphon is a 54 -inch diameter, 4,056 foot-long steel pipe installed in 1938. Work to be done involves leak repairs and metal treatment to extend the lifespan of the pipe. If replaced, the estimated cost is \$1.5 million.
- Deadman's Basin Supply Canal - The canal is 11.5 miles long and is the only source of water for Deadmans Basin Reservoir. The proposed work involves increasing the capacity of the canal from 300 to 600 cfs, reshaping and lining the channel, and replacing a deteriorating drop structure. The repairs will likely cost in excess of \$500,000.
- Martinsdale Canal Drop Structures - The canal delivers water from Martinsdale Reservoir to the Musselshell River. The existing concrete drop structures and control sections are deteriorating and are at risk of collapse. Long-term repairs would involve replacing the structures at a cost of about \$200,000.
- Nevada Creek Canals - There are 2 main delivery canals from the Nevada Creek Reservoir; the 13.4 mile-long North Canal, and the 12.6 mile-long Douglas Canal. Both canals have severe operational deficiencies, including channel erosion, excessive siltation, and high seepage loss. A complete rehabilitation would cost in excess of \$250,000.

## **Summary**

Repairing and rehabilitating the state-owned canal projects would serve to eliminate a potential public safety hazard and greatly help to conserve water by reducing loss from excessive, preventable seepage. Various funding sources will be secured for these rehabilitation and repair projects, including RRGL funds, water storage accounts, and hydropower earnings.

## **Non-State Dam Rehabilitation and Repair Proposals**

### **Lower Willow Creek Dam (Carryover RRGL)**

Lower Willow Creek Dam is located in Granite County, near Hall, Montana. The dam is owned and operated by the Lower Willow Creek Irrigation District.

### **Background**

A potentially serious seepage problem has developed at the dam. Seepage at earthen dams is often not serious, but in this case, the seepage also conveys a great deal of sediment. Whenever seepage moves material, it becomes of great concern.

## **Status**

At present, the dam is being carefully monitored.

## **Strategy**

The Natural Resources Conservation Service (NRCS) is planning on funding remediation using some of its funding, funding from the Lower Willow Creek Irrigation District, and funds remaining from a 2001 Renewable Resources Program grant, when the project was ranked 28 of 71 applications.

## **Summary**

The NRCS is presently evaluating several alternatives to control or eliminate the seepage. The Dam Safety Program considers remediation a high priority and has, accordingly encouraged NRCS and the Irrigation District to begin construction at the earliest opportunity.

## **Canyon Creek Lake Dam (Carryover RRGL)**

Canyon Lake Dam is a high mountain dam in the Selway-Bitterroot Wilderness west of Hamilton. The dam was constructed in 1891. The dam is owned and operated by the Canyon Creek Lake Water Users Association.

## **Background**

With time and use, portions of the dam have deteriorated, and episodic flood events have damaged the dam. Canyon Lake Dam has numerous deficiencies. Access to the dam has been by trail, but the trail has deteriorated over time. The dam is classified high hazard by the U.S. Forest Service.

## **Status**

The water users received a Renewable Resources Program grant in 1991 for the design phase and another RRGL grant in 2001, when the project was ranked 5th of 62 applications. The project has been delayed by continued negotiations with the Forest Service for access to perform construction. In addition, a large influx of population in the area in recent years, with resulting subdivision of land, has resulted in great difficulty in the organization of water users.

## **Strategy**

The goals of the project are to upgrade the dam to comply with current dam safety standards and to ensure an adequate and timely supply of irrigation water to the district. Specific objectives include raising the dam crest, constructing a new emergency spillway, and replacing the existing outlet works. The irrigation district is hoping to integrate the rehabilitation of Canyon Creek Lake Dam with the neighboring Wyant Lake Dam rehabilitation project.

## **Basin Creek Dams #1 and #2 Rehabilitation (New RRGL)**

Basin Creek Dams are located above the city of Butte, in Silver Bow County. They are used to supply municipal water to the City of Butte. The dams were built in the late 1800's and early 1900's. Butte purchased the dams in the early 1990's.

### **Background**

A Renewable Resource Program grant application was submitted in 2001 to assist in funding of the rehabilitation, but was ranked low of the applications received and not funded.

### **Status**

No major site improvements have been completed on either dam since initial construction. A large portion of south Butte would be inundated if either dam were to fail. Hence, both dams require significant upgrades to ensure safety of the populace. The emergency spillway on each dam must be expanded and rehabilitated to allow them to safely pass large storm events. Basin Creek Dam #1 requires refurbishing of the parapet wall, valves, and other upgrades.

### **Strategy**

The City of Butte will also use its own resources for this rehabilitation. Not only do these dams pose a threat to a large population area, but also the City of Butte depends on these dams for a large portion of their drinking water. Therefore, the Dam Safety Program puts a high priority on rehabilitation of these dams.

### **Summary**

The RRGL Program has ranked the rehabilitation of Basin Creek Dams 41 of 62 proposals. As unsafe high-hazard dams, the proposal to rehabilitate Basin Creek Dams meets preference criteria 3 (a), (b), and (c) of the water storage statute.

## **Beaver Creek Dam Outlet Works Repair (New RRGL)**

Beaver Creek Dam is located approximately ten miles south of Havre. The dam is owned, operated and maintained by Hill County. This structure was planned for multi-purpose uses and provides flood prevention, irrigation, and recreation. The dam was completed in 1974.

### **Status**

The gate structures in the outlet pipes have degraded. Continued degradation will eventually hamper usage of water downstream. It also could prevent rapid emptying of the reservoir in an emergency.



## **Strategy**

A Renewable Resources Program grant application has been submitted by Hill County to assist in funding of the rehabilitation and is currently ranked 42 of 62 applications. Hill County residents will also pay part of the rehabilitation. The Dam Safety Program supports this grant because of the need to always be able to lower the reservoir in an emergency.

## **Mill Lake Dam Rehabilitation (New RRGL)**

Mill Lake Dam is located in the Selway-Bitterroot Wilderness area and is located approximately fifteen miles west of Hamilton. The dam is owned by the Mill Creek Irrigation District, regulated by the U.S. Forest Service, and is used for irrigation. The dam was built ninety-five years ago.

## **Status**

Mill Lake Dam is experiencing excessive seepage around the outlet pipe and embankment. In addition, the spillway is unable to convey the Probable Maximum Flood, which is a requirement of the U.S. Forest Service, which manages the wilderness area. Repairs to this dam are challenging because of Forest Service restrictions. Unless the seepage can be mitigated, the water users could be restricted severely in future water usage.

## **Strategy**

The district plans on improving the spillway capacity, controlling erosion at the spillway, repairing the outlet, and improving the dam embankment to safely control seepage.

## **Summary**

A Renewable Resources Program grant, ranked 17 of 73 applications, has been submitted to assist the irrigation district with funds needed for repair. Mill Lake Dam is an unsafe, high hazard dam in need of rehabilitation to meet standards of the Montana Dam Safety Program.

## **Dry Fork Dam Rehabilitation**

Dry Fork Dam is owned privately and located ten miles north of the Town of Chinook. The dam and reservoir are used for irrigation and the reservoir is open to the public for recreation. The storage capacity is about 5,000 acre-feet.

## **Background**

Since a pumping system from Battle Creek is no longer used, the dam is seldom filled. Therefore, downstream residents also benefit from flood storage.

## **Status**

The spillway for this dam is significantly undersized according to code. It is expected that at least three lives would be lost if the dam failed. The Montana Dam Safety Program and the dam owner have agreed, in consideration of financial hardship, to make the dam safe in 2005.

## **Strategy**

The dam owners have chosen to bring the spillway into compliance with standards. Since the dam is privately owned, \$5,000 is the maximum in state assistance that can be offered.

## **Summary**

The rehabilitation of Dry Fork Dam will result in a safe storage facility in compliance with Montana Dam Safety standards.

## **Wyant Lake Dam Rehabilitation (Carryover RRGL)**

Wyant Lake Dam is located on Canyon Creek in the Selway-Bitterroot Wilderness west of Hamilton. The dam was originally constructed in 1910 and is managed by the Canyon Creek Lake Water Users.

## **Background**

Over time, the embankment and outlet works have deteriorated. Additionally, the dam is insufficient to contain the flood required by the U.S. Forest Service for a high-hazard dam. The water users received a renewable resources grant in 1991.

## **Status**

The project has been delayed by continued negotiations with the Forest Service for access to perform construction. The water users group is planning to coordinate the rehabilitation of Wyant Lake Dam with the rehabilitation of neighboring Canyon Creek Lake Dam.

## **Strategy**

The goals of the project are to add spillway capacity and replace an outlet that is failing.

## **New Water Storage Project Proposal (Non-State)**

### **West Crane Sprinkler Irrigation Project Storage Alternatives Study**

The West Crane Irrigation District is planning for the construction of an 8,000-acre center pivot sprinkler irrigation project near Sidney.

## **Background**

The district has secured the water necessary for the project by utilizing a water reservation from the Yellowstone River. A feasibility study has been completed and a majority of the preliminary permitting has been obtained. A basic goal is to find methods to bring costs to affordable levels.

## **Strategy**

One consideration is to develop storage within the project area so that water could be pumped from the Yellowstone River continuously over a six- to seven-month period. The peak irrigation can then be diverted from the storage that would be closer to the area to be irrigated. This reduces the length of pipeline needed as well as the number of pumps.

Two alternatives for storage are possible. The first would involve construction of a 55-foot high dam just below an existing small dam. The resulting reservoir would provide about 5,000 acre-feet of storage, which would meet the peak irrigation needs of the project. The second alternative involves construction of several low-head dams. Off-peak water would be introduced into these basins to recharge groundwater and to provide short-term surface storage.

## **Status**

The feasibility of both alternatives hinges on underground aquifer characteristics. The area must be drilled, tested, and analyzed.

## **Summary**

Funding for the analysis has been requested through a Renewable Resources Program grant application.

## **Big Lake Water Storage Study**

The proposed project site is located approximately fourteen miles south and eleven miles west of the town of Wisdom. The site is located at Twin Lakes, in the Beaverhead National Forest. The lakes are supplied by Big Lake Creek, which originates on the Continental Divide and runs northeasterly to its confluence with the Big Hole River less than one mile west of Wisdom.

The Twin Lakes consist of an upper lake of approximately 72 surface acres, and a lower lake of approximately 10 surface acres. The lakes are joined together by a shallow, narrow passage, which flows from the upper lake into the lower lake. The proposed dam would be built across the passage to store additional water in the upper lake.

The dam would measure about 1,300 feet in length and 20 feet height, increasing water depth in the lake by about 12 feet and impounding an additional 1,000 acre-feet of water. Recent estimates

based on field inspections of surface geology at the site put the construction estimate much higher, anywhere from \$5 million to \$10 million.

## **Background**

The Big Hole Watershed Committee is a group of concerned ranchers, fishing guides, and conservation group representatives assembled to address issues within the Big Hole River basin. One of the major focal points of the Committee is to resolve low streamflows, which impact the fluvial arctic grayling in the Big Hole River. Montana FWP biologists have identified the river reach in the vicinity of Wisdom as critical for survival of the species.

Since 1996, the committee has been exploring the feasibility of building a storage project to provide water flow augmentation in the river during periods of low flow. During years of adequate streamflow, stored water could be used to augment local irrigation operations.

## **Status**

In July, 1998, a geologist from the U.S. Bureau of Reclamation conducted a preliminary reconnaissance visit to the Twin Lakes site and produced a report detailing his concerns about the suitability of the site for a storage project. One observation was that surface material at the site appeared too coarse for use in dam construction, noting that suitable material would have to be brought in from other areas, greatly adding to the project cost.

## **Summary**

Reclamation has concluded that without an exploratory drilling program, which would reveal the underlying geology of the area, it cannot make an informed determination as the feasibility of a storage project at the site. DNRC has collected hydrologic data on Big Lake Creek and diversions from the creek for four years. The results of this study will be completed by spring, 2003.

## **IV. Seepage Monitoring for High-hazard Dams**

Montana is home to 3,519 dams with storage capacities of over 50 acre-feet of water. Most of these earth-filled dams were built 40 to 80 years ago and have no provision for control or monitoring of seepage. Today, earth-filled dams are designed with seepage control structures to limit the passage of seepage through the dam.

By carefully monitoring seepage through dams, problems can often be identified prior to the development of an emergency situation. A dam seepage-monitoring program is in progress for all state-regulated, high-hazard dams. Seepage monitoring plans will eventually be developed and implemented for all high-hazard dams in Montana located above significant downstream populations.

## **Seepage Monitoring of State-Owned Dams**

DNRC manages several state-owned high-hazard dams that do not have adequate seepage control systems. Seepage-monitoring programs at state-owned projects enable DNRC to determine the severity and extent of dam seepage, and whether the integrity of a particular dam is in jeopardy.

DNRC has installed seepage-monitoring devices in seven state-owned dams over the past two years: Ackley Lake (Judith Basin County), Deadman's Basin Dam (Wheatland County), Ruby Dam (Madison County), Nilan Dams (Lewis and Clark County), Cottonwood Dam (Park County), Bair Dam (Meagher County), and Nevada Creek Dam (Powell County).

The State Water Projects Bureau has submitted an application for a Renewable Resource Grant to establish a seepage-monitoring program at four additional DNRC dams, Painted Rocks, Cataract, Willow Creek and Yellow water. These four dams currently have minimal monitoring capabilities.

The seepage monitoring data collected on DNRC's projects is maintained in "DamSmart". DamSmart is a computer database, which allows monitoring well data to be recorded, graphed and compared with reservoir levels, weir and flume flows, and water conditions around the dam. These data are used in conjunction with annual inspections and monthly reviews.

The state has recommended a three-phase program, to ensure that all issues are addressed and the most cost-effective approach is taken at each storage project:

**Phase I** - This phase began with an intensive field inventory of all dam seepage. In some instances, shallow hand-driven monitoring wells will be installed. Existing data is being carefully reviewed, and recommendations for further data collection and analysis will be made. Cost estimates to implement recommendations will also be determined during this phase. This phase has essentially been completed.

**Phase II** - Currently underway, this phase consists of implementing the recommendations made during the Phase I portion of the investigation. If drilling is necessary, it is completed during this phase. DNRC would provide technical assistance on a case-specific basis.

**Phase III** - This phase consists of developing methods and procedures to collect and analyze the data on a frequent, long-term basis. Public safety is not the only justification for implementation of a dam seepage-monitoring program. In the event of dam-related litigation, monitoring records provide critical evidence demonstrating that a dam was operated and maintained in a conscientious manner. Finally, maintaining a dam seepage-monitoring program demonstrates that a certain standard of care is exercised by dam owners and regulators on behalf of the public.

**TABLE 2<sup>(1)</sup>**

<b>U.S. Bureau of Reclamation Reservoirs</b>						
<b>Reservoir</b>	<b>Drainage</b>	<b>January 1, 2003</b>			<b>Year Ago (1/01/02)</b>	
		<b>Contents (ac-ft)</b>	<b>% of Avg.<sup>(2)</sup></b>	<b>% of Capacity</b>	<b>Contents (ac-ft)</b>	<b>% of Avg.</b>
<b>Clark Canyon<sup>(4)</sup></b>	Beaverhead	43,300	32	24	60,900	44
<b>Canyon Ferry</b>	Missouri	1,636,200	98	84	1,392,900	83
<b>Gibson</b>	Sun	39,600	103	40	21,900	57
<b>Lake Elwell</b>	Marias	799,100	108	84	688,800	93
<b>Sherburne</b>	St. Mary & Milk	11,500	58	17	16,100	81
<b>Fresno<sup>(3)</sup></b>	Milk	51,300	137	50	9,700	26
<b>Nelson</b>	Milk	61,800	109	78	31,200	55
<b>Bighorn Lake<sup>(5)</sup></b>	Bighorn	651,800	71	58	740,200	80
<b>Hungry Horse</b>	South Fork Flathead	2,551,000	105	80	2,560,000	106

Notes

- (1) Information provided by U.S. Bureau of Reclamation (USBR).
- (2) Percent of 1971-2000 average storage.
- (3) Fresno average storage revised according to results of sediment study.
- (4) Lowest end-of- December storage of record.
- (5) Second lowest end-of-December storage of record.

**MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION  
WATER RESOURCES DIVISION - STATE WATER PROJECTS BUREAU**

**RESERVOIR CONTENT REPORT**

**December 31, 2002**

All Contents in Acre-Feet

Reservoir Name	Capacity (Useable Contents)	Content Records Available	Average #YRS of Record (1960-1999)	% Average 12/31/2002	Contents			% CAPACITY PRESENT 12/31/2002	Reading Date	Comments (UPDATES) MID-MONTH DATA
					Last Year 12/31/2001	Last Month 11/30/2002	Present 12/31/2002			
ACKLEY	5,815	27	3,500	43	1,290	1,680	1,515	26	12/11/02	11/30 storage est'd; 1,515 AF ON 12/11/02
BAIR	7,005	40	3,600	40	1,330	1,240	1,440	21	1/3/03	11/30/02 storage estimated
CATARACT	1,478	0			400		380	24	12/31/02	12/31/02 STORAGE ESTIMATED
COONEY *	28,140	20	17,590	110	16,050	18,960	19,310	69	1/2/03	19,510 AF ON 12/11/02
COTTONWOOD	1,900	0			189	849	849	45	12/31/02	12/31/02 STORAGE EST'D @ NO CHANGE
DEADMAN'S BASIN	72,220	32	43,080	31	11,430	10,610	13,270	18	1/3/03	12/31 est'd based upon 12/9 and 12.18 inflows
E.F. ROCK CREEK	16,043	10	8,840	54	4,140	4,080	4,770	30	12/31/02	4,400 AF ON 12/16/02
FRENCHMAN	3,752	7	2,520	107	1,480	2,630	2,700	72	12/31/02	
MARTINSDALE	23,112	35	9,480	9	187	880	846	4	1/3/03	855 AF ON 12/10/02
MIDDLE CREEK *	10,184	10	5,710	94	6,450	4,890	5,350	53	12/31/02	12/31 estimated using 12/28 measurement data
NEVADA CREEK *	11,152	31	4,240	130	4,740	4,910	5,520	49	12/30/02	
NILAN	10,092	24	5,780	124	3,410	6,700	7,150	71	1/2/03	11/30 storage estimated
N.F.K. SMITH RIVER *	11,406	36	5,820	68	1,200	3,720	3,970	35	1/3/03	
RUBY RIVER *	36,633	31	20,540	91	16,640	14,430	18,660	51	12/31/02	
TONGUE RIVER *	79,071	3	29,010	109	20,680	30,770	31,490	40	1/2/03	31,310 AF ON 12/16/02
W.F. BITTERROOT	31,706	20	11,700	55	8,840	5,650	6,380	20	12/31/02	
WILLOW CREEK	17,731	32	9,430	0		10,660				no 12/31 data available
YELLOWWATER	3842	6	1,450	5	375	70	70	2	12/31/02	12/31/02 STORAGE EST'D @ NO CHANGE

\* Note: Ruby River capacity reflects capacity at concrete crest elevation; capacity at top of flashboards is 37,612 A.F.

\* Note: Middle Creek capacity reflects capacity after 1993 dam rehabilitation; prior capacity was 8,027 A.F.. Average storage shown is for post rehabilitation data.

\* Note: Tongue River capacity reflects capacity after 1999 dam rehabilitation; prior capacity was 68,040 A.F.. Average storage is post rehabilitation data.

\* Note: Cooney capacity reflects capacity after 1982 dam rehabilitation; prior capacity was 24,195 A.F.. Average storage shown is for post rehabilitation data.

\* Note: NFK Smith capacity reflects capacity at top of flashboards; capacity at concrete crest elevation is 10,698 A.F.

\* Note: Nevada Creek Reservoir Capacity reflects live storage capacity survey conducted in year 2000. Prior live storage capacity documented as 12,723 AF.