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FINAL REPORT

FOR THE

BOULTER LAKE ENLARGEMENT
LEVEL II STUDY

MAY, 2007

Prepared for:

THE WYOMING WATER
DEVELOPMENT COMMISSION

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DAHLGREN CONSULTING, CHEYENNE, WY
REPORT

On The

BOULTER LAKE ENLARGEMENT

LEVEL II STUDY

May 2007

To The:

Wyoming Water Development Commission

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INTRODUCTION

Rio Verde Engineering was selected in May of 2005 by the Water Development Commission to perform the Boulter Lake Enlargement Level II Study. The sponsor for this study is the Upper Green River Water Basin Joint Powers Board (GRJPB) which was created to facilitate the development of water projects in the Upper Green River Basin. From the Green River Basin Plan and the Green River Groundwater Recharge and Alternate Storage Study, the East Fork of the New Fork River, Tributary of the Green River, was identified as an irrigation system with late summer water shortages. For this reason, research was conducted on the East Fork basin which identified Boulter Lake as a source of water storage for the East Fork Irrigation system. However, the outlet works for the lake had been vandalized which prevented operation and let only small flows pass through the outlet year-round. For these reasons, Boulter Lake was selected as a project for rehabilitation or enlargement.

Boulter Lake is located in Sections 24 and 25, T.32N., R.105W., 6th P.M., Sublette County, Wyoming in the Bridger-Teton National Forest. The actual dam is located 3.5 miles northwest of the Big Sandy Campground on the west side of the Wind River Mountains approximately 700 feet south of the Bridger Wilderness Area boundary line. The outlet of Boulter Lake flows northwest down Boulter Creek to the East Fork River. The approximate latitude, longitude, and elevation of the dam are 42°43’41”N., 109°18’43.5”W., and 9225 feet. Figure 1 is a location map showing the Boulter Lake area.
A water rights survey was conducted in 1920 by C.C. Feltner, Surveyor. The applicant was the East Fork Reservoir Association. A certification was issued by the State of Wyoming for irrigation water storage of 563 acre-feet under Permit No. 6310 with a priority date of July 24, 1934.

The dam is a composite structure consisting of earthfill embankment on the upstream side, a dry masonry core, and rock fill on the downstream side. The upstream face of the dam is armored with riprap. In 1970, the Soil Conservation Service prepared plans
showing rehabilitation work on the outlet. According to these plans, the dam was reconstructed in a manner similar to the original construction of the dam.

Boulter Lake Dam in 1990
SCOPE OF SERVICES

PROJECT SCOPING MEETING

On July 28, 2005, a scoping meeting was held at the Library in Pinedale, Wyoming. Attending the meeting were Cindy Stein, US Forest Service (USFS); Norm Richie, East fork Irrigation Association (EFIA); and representatives from the Upper Green River Joint Powers Board (UGRJPB), Wyoming Water Development Commission (WWDC), and Rio Verde Engineering (RVE). RVE presented the plan of action as detailed in the Proposal for Professional Services.

Discussion by those in attendance followed the presentation. Cindy Stein indicated that the Permit and Operating agreement between the USFS and EFIA needed to be updated. Further discussion with Ms. Stein covered the fact that part of the study should address the different requirements and associated costs between an environmental assessment (EA) and an environmental impact statement (EIS) and when a full NEPA document would be necessary. Mr. Richie indicated that enlargement of the Boulter Lake Dam may not be worth the cost. At the end of the meeting, we talked with Mr. Richie about the scope alteration which would provide the EFIA with an inventory of the ditches and structures.

As finalized at this meeting, the scope of work was to evaluate the existing dam and outlet works. From this evaluation, two rehabilitation plans were to be recommended – an economical repair and a comprehensive rehabilitation. At the same time, an analysis of the possibility of enlarging the dam was to be performed. Hydrology, topography, and geology of the basin were required to be part of the analysis. Finally, the Scope Alteration provided for an inventory of the main ditch structures on the irrigation system for the East Fork Association.
Preliminary Investigation

The original dam was constructed in 1920 or 1921 (Soil Conservation Service (SCS) design notes 4/70). An investigation in October, 1969, was conducted to determine how the original dam failed. This investigation was conducted by the SCS State Geologist, District Forest Service engineers and SCS Area Engineer (Geology report Nov. 24, 1969). “The failure was caused either by seepage along the corrugated metal pipe drawdown tube or corrosion and rupture of the tube which resulted in piping through the silty sand fill causing a collapse of the face of the dam (John W. McLellan, Geologist).” The original dam was a composite construction consisting of earth fill, rock fill, timber cribbing and grouted rock.

Other historical dates with facts and comments are as follows:

- **August 14, 1962.** Letter from Thomas J. Kovalicky, District Forest Ranger, to East Fork Irrigation Association referred to the Special Use Dam Permit and required that “The dam be repaired or breached before October 15, 1969. The dam will probably fail with the spring runoff unless the outlet works are repaired.” It also stated “No increase in the height of dam at this time.”

- **September 19, 1969.** Eleven (11) members of the East Fork Reservoir Association request technical assistance for repair and enlargement of Boulter Lake Reservoir (Group Enterprise Application and Working Agreement). The water was for irrigation on 6,870 acres.

- **August 21, 1969.** Work to proceed with repair and concern over access.

- **March 17, 1970.** Design review comments made by John Long, State Conservation Engineer for the SCS were “An inclined gate could be used with the lip of the gate placed at the same elevation as the original gate and then put a “gooseneck” in the pipe immediately below the concrete inlet. The disadvantage of this possibility is that sediment (rocks) could accumulate in this bend.”

- **June 22, 1970.** Letter from SCS engineer with plans for rehabilitation of the dam for USFS
• July 3, 1970. Forest Supervisor approval of SCS plans and specifications.

Construction of the existing dam occurred during the late fall of 1971 for a total cost of $16,251.11. Since that time, the following Safety of Dams Inspections and Reports have been performed by the State Engineer’s Office:

July 12, 1990, Russ Dahlgren
August 8, 1991, Unsigned
March 24, 1992, Russ Dahlgren letter to East Fork Irrigation Association
August 27, 1996, Loren Smith
October 9, 2001, John Dahlke

Reports for the above dates are contained in the Appendix.
Figure 3
Application Map
BOULTER LAKE RECONNAISSANCE / REHABILITATION ANALYSIS

A total of six trips were made into Boulter Lake. Five of those trips were made for this study. In March 2005, prior to the proposal, the first trip into Boulter Lake was made. This trip was for reconnaissance purposes for the proposal. Snow cover was such that general location and topography was all that could be ascertained.

Trip number 2 occurred in August, 2005 shortly after the scoping meeting. Four personnel from RVE and Russ Dahlgren from Dahlgren Consulting, Inc. went in on August 3 and came out on August 5. A majority of the field work was completed during this time.

**Field Surveying**

The shoreline of the lake was surveyed with GPS surveying equipment. This data was used to assess the water right capacity table for the lake and to evaluate the added volume.
from an enlargement. At the same time, a topographic survey of the dam site and the low area southwest of the dam was performed. From the Quad maps, it was not clear where the drainage basin started along the trails coming in from the southeast and south. These locations were identified by Latitude and Longitude points with hand held GPS units.

Field Analysis

Russ Dahlgren performed his geologic field work and worked with the RVE crew to analyze the existing dam. The rock on the downstream side of the dam had fallen down and covered the outlet pipe. This rock was moved to the sides to access the outlet pipe. From the initial reports of vandalism, we were concerned that the pipe was full of rock. Evidence of that was not visible from the outlet pipe. We were also able to check the condition of the pipe wall which did not show signs of corrosion. It was evident that debris in the emergency spillway had caused considerable erosion in and around the dam.
Inspecting the Dam

Uncovered Outlet Pipe
Debris in Spillway

Erosion of Downstream Spillway Bank
Enlargement possibilities were evaluated based on the site conditions and available material. The water level in the lake was too high to evaluate the intake which was an unexpected disappointment. Water flow through the pipe was estimated in an attempt to determine when the lake water level would be below the intake elevation. At that time, it was decided that it would take two more months.

Boulter Lake Dam in 2005
October 8, 2005 was the date of the next trip. Once again, the water level in the lake was too high to evaluate the intake. Upon further analysis of the emergency spillway, it was determined that if the debris were left in the spillway more erosion would occur during spring runoff. Therefore, the debris was moved downstream into the eroded bank area. Rock was gathered and placed in a hole, which had resulted from turbulent flow caused by the debris, on the upstream side of the dam in the floor of the emergency spillway.
Water Level in October of 2005

Debris Moved Out of Spillway
January 21, 2006 was the date of the next trip. For this trip, we had extra help from people that knew the area. Frosty Hittle had been into the site in a pickup in the 70’s. Once the snow was removed from over the intake area, four feet of water still existed over the intake. Pictures were taken of the intake which provided some insight as to the condition.
Taking Pictures of Inlet Structure

Rock in Inlet Opening
March 18, 2006 was the date of the next trip into Boulter Lake. During this trip, we made the most progress. The location of the intake had been marked with a dead tree on the January trip. From the snow’s profile, it was evident that the water level was near the level of the intake structure. After removing the snow, the water level was approximately one foot above the upper side of the intake structure. It was found that by standing in the water, the intake structure could be reached with hands. From the previous trip, we were able to see that the Stainless steel shaft was no longer attached to the slide gate over the intake pipe and that a cast iron hoop extended above the gate. Using hands to feel around the gate area, a rock that was wedged into the opening was removed. Almost immediately, a vortex started which indicated that the opening was clear. Probing with a bar proved that the pipe was clear, also.
Intake Locator

Research
Fishing for Rocks

Checking Pipe for More Debris
Vortex Created When Rocks Removed

June of 2006
The final trip into Boulter occurred on August 5, 2006. From the level of the lake on June 25, 2006 which was based on a report and pictures provided by community members that had been on the winter trips and had just visited the area, we knew that clearing the rock out of the opening was allowing the water from the spring melt to flow through the pipe at a faster rate. Knowing that the lake was going to empty out during the summer, we were concerned that vandalism would occur and that the pipe may be filled with rock. Therefore, plans were made for the August trip. Part of the plan included hauling in a grate to place over the opening. The purpose of the grate was to not allow rocks in the intake pipe.
An inspection of the intake gate did show that the flat part of the gate was bent into the opening. The gate frame was pulled up to the top of the intake and chained into place. A four foot by eight foot plate of expanded metal was used for the grate and bolted onto the rebar on the structure. With this trip our field work was completed.
Water Level

Chained Gate Frame
Summary

As a result of the field work and inspection of the existing dam and outlet works, the following items needed addressed:

1. Inlet gate is currently nonexistent.
2. Outlet pipe will need to have some form of flow control.
3. Dam is showing signs of erosion due to debris in the spillway.
4. Emergency spillway is showing signs of erosion due to the same debris.
5. Outlet structure and grate will need further evaluation for adequacy.
6. Vandalism proof repairs or rehabilitation.
7. Area of high water level versus water right information.
Information gained from the initial field work on enlargement issues are as follows:

1. Drainage basin area needs delineated based on actual field points.
2. Hydrology will determine size of possible enlargement.
3. Geology of dam site needs evaluated.
4. Topography of dam site will facilitate enlargement.
5. Emergency spillway location needs studied.
6. Borrow areas will need located.

The field analysis obtained over the various site visits provided the information to complete the study once the intake was opened to allow the storage water to drain out of the lake.
BOULTER LAKE

FIGURE 4. PLAN VIEW OF EXISTING DAM
BOULTER LAKE ENLARGEMENT

Purpose and Need

Any proposed enlargement of Boulter Lake will require justification through analysis of purpose and need. The purpose and need for the original dam on Boulter Lake was irrigation storage water. Controls on the outflow from the dam provided for late season flows to supplement natural flows down the East Fork River to the irrigation diversions. This purpose and need has not changed. However, the loss of control on the outflow has prohibited the irrigators from realizing the benefits of the dam.

The original water right for 563 acre-feet would provide a flow of 10 cubic feet per second (cfs) 28 days. If the dam were enlarged to hold 1,057 acre-feet, a flow of 20 cfs would last for 26 days. At 1 cfs per 70 acres, 20 cfs would supply 1,400 acres.

Given the importance placed on fisheries, the addition of any flow in late July would enhance the fisheries below the Boulter Creek inflow to the East Fork River and additional return flows downstream of the irrigated acres.

Hydrologic Analysis

The possibility of enlarging Boulter Lake Reservoir depends primarily on the available yield of the basin. A hydrologic analysis was performed to determine this yield. The drainage area of Boulter Creek above Boulter Lake Dam is 1340 acres as delineated in Figure 8.
The enlargement of Boulter Lake Dam is sized based on the yearly runoff volume which will fill the dam eight out of ten years or 80 percent of the time. Data was obtained from USGS stream gage records. Sites were analyzed on ten recording stream gage stations. For this study, five sites with mountain features similar to the Boulter Creek area were selected as being representative for computing runoff flow rates and volumes. There were no records available for comparison to the 2.09 square miles of the study site. The comparison site with the smallest drainage area that was used was 5.92 square miles and the largest was 79.2 square miles.

Figure 9 is a table comparing the study sites that were analyzed. Using an average of the five sites, the average 80 percent volume = 2532.5/5 = 506 Ac-Ft/Sq Mi. Applying this
to the Boulter Creek drainage, the predicted 80 percent yield or yield occurring 80 out of 100 years is 506 Ac-Ft/Sq Mi * 2.09 Sq Mi = 1057 Ac-Ft.

Historically the “Lake is emptied each year (built in 1920-1921),” according to the SCS Boulter Lake outlet repair (4-70) hydrology statement by John R. Long, State conservation Engineer. This volume is 563 acre-feet or 269.4 Ac-Ft/Sq. Mi. at 100 percent chance. Observation of the erosion debris and frequent use of the emergency spillway indicate a high drainage runoff yield. These facts indicate the 80 percent runoff flow of 1057 acre-feet is reasonable.

![Figure 10: Boulter Lake Stage-Storage Curve](image)

The original surface area of the lake before the dam was built was 27.4 acres and according to original water right permit data, the surface area of the lake at capacity
created by the dam is 41.9 acres. The active storage capacity of the dam is 563 acre-feet. The active water depth is 16 feet and the height of existing dam is 21 feet. Using the water rights capacity table and the topographic survey, a new capacity table was created. This data was plotted as seen in Figure 10 and projected to an active capacity of 1057 acre-feet as previously derived. The plot shows that for an enlarged capacity of 1057 acre-feet, active water depth will be 28.5 feet and a corresponding height of dam of 33.5 feet.

**Geologic Setting of Boulter Lake Reservoir**

Reconnaissance level engineering geological studies were completed for the Boulter Lake Reservoir dam site and reported in this report. Existing geologic information and reports were reviewed. A site visit was conducted on August 3 - 5, 2005.

The goals of the geological investigations included: (1) review the geologic conditions at the dam site; (2) assess the probable impact of geologic conditions on the proposed design and construction; (3) develop opinions concerning the feasibility of enlarging the dam; (4) and identify potential borrow areas for construction materials. Finally, recommendations and cost estimates for more detailed geologic investigations and/or geotechnical investigations that will be required during final design of the rehabilitation and/or enlargement project will be summarized and costs for this work will be presented.

The Boulter Lake dam site is located in the west side of the Wind River Mountain Range. The Wind River Range is a northwest trending mountain range, which contains a Precambrian basement core. The Wind River Range is approximately 125 miles long by 35 miles wide. On the east side of the mountains, Mesozoic and Paleozoic rocks lap against the basement rocks and dip into the Wind River Basin. On the west side of the Wind River Mountains, a major thrust fault, the Wind River Fault, has displaced the Precambrian rocks to the west over the younger Paleozoic and Mesozoic rocks. The trace of the Wind River Fault is generally covered with Tertiary and Quaternary deposits. Figure 11 shows the general geology of the area. Figure 12 is a cross section drawn near
the area of Boulter Lake. Both Figures 11 and 12 are taken from the map prepared by Worl, et al, 1986.

Figure 11

Figure 12
Cross Section B-B’ from Worl, 1986. Refer to Figure 11.
Legend for Figures 11 and 12
Boulter Lake Draft Report
QTc | CLASTIC SEDIMENTARY DEPOSITS (Quaternary and Tertiary). Thick sequences of coarse clastic sedimentary rocks along the west flank of the Wind River Range that intertongue with finer sediments in the basin. Extensive glacial deposits in major drainage basins along the west side of the range. Unconsolidated silt, sand and gravel deposits along major stream valleys.

Wpg | PORPHYRITIC BIOTITE-HORNBLENDE GRANITE TO GRANODIORITE (Late Archean). Grey porphyritic granite grading to granodiorite. Contains 15-25 percent feldspar and 3-10 percent biotite and hornblende. Accessory minerals include apatite, sphene, magnetite, and hematite.

Wgr | BIOTITE GRANITE (Late Archean). Light gray, equigranular, medium grained granite. Biotite makes up 1-10 percent of the rock.

Wgd | BIOTITE HORNBLENDE GRANODIORITE (Late Archean). Homogeneous medium to coarse-grained equigranular granodiorite. Biotite and hornblende make up 7-25 percent of the rock.

The rocks in the immediate area of the Boulter Lake dam and along Boulter Creek north of the dam are mapped as biotite and hornblende granodiorite (Worl, 1986). The rocks are Archean to Late Archean in age. The Precambrian rocks in the Wind River Range tend to be strongly jointed and locally are highly sheared. There is an obvious difference between the rocks on the east side and west side of the Boulter Lake dam and to the north downstream along Boulter Creek. To the east side of dam and creek, granodiorite is exposed. This rock tends to be rather massive and medium to slightly coarse grained. There is little deformation or foliation in the rocks. On the west side of Boulter Creek, the rocks are much more jointed and fractured. The rocks are finer grained. Also, mineralization in the fractures and joints is present in the rocks west of the creek. A major shear zone is mapped by Worl just to the west of the dam. The difference in the rocks on the east and west of the dam is likely associated with this shear zone, associated metamorphism and mineralization. South and west of Boulter Lake, rocks of Quaternary and Tertiary age are mapped. The hummocky terrain in the area immediately south and west of the lake indicates that the rocks are glacial deposits.

The east side of the dam appears to be sitting on the granodiorite rocks. The west end of the dam is sitting on glacial deposits and the more highly jointed, foliated and mineralized rock outcrop just downstream of the dam. Refer to Figure 13, which shows
the approximate distribution of the rock types near the reservoir. The following photos show the different types of rock exposed on the east and west sides of the lake and creek.

Figure 13
General Geology Map of the Boulter Lake Site.

Shows typical granodiorite rock exposed on east side of Boulter Lake.
This picture is taken looking across the dam toward the east (right) side of the dam and spillway. Note the fairly massive and “blocky” appearance of the bedrock.

This picture is taken from the east side of the reservoir looking downstream (northwest) toward dam and west abutment. Note the spillway on the right of the photo and the glacial deposits in the left abutment of the dam.
This picture shows the jointed and mineralized rocks that are exposed along the west side of Boulter Creek downstream of the dam.

Close-up of the joints and mineralization present in the rocks on the west side of Boulter Creek.
Geologic Conditions and Affects on Dam Construction/Rehabilitation

The affects or impacts that the geologic conditions will have on the proposed rehabilitation of the Boulter Lake dam are described in this section of the report. Contact between the different rock types, landslides, and seismicity are discussed.

Contact between Rock Types

A contact between the two different rock types that are exposed on the east and west sides of Boulter Creek downstream of the dam is inferred to be at approximately the location of the creek. This zone is a more easily eroded area and the location of the creek is probably due to this feature. The contact likely extends upstream through the dam and into Boulter Lake. A significant shear zone is shown on the map prepared by Worl to be located just west of Boulter Lake. The contact between the two rock types is likely associated with this zone. Contact low grade metamorphism and associated secondary mineralization due to the shear zone certainly impacts the different types of rocks exposed on the east and west sides of the creek.

This geologic feature will not have much impact to rehabilitation of the dam, provided that the height of the dam is not greatly increased over the height of the existing structure. The dam appears to be stable and excessive or unusual seepage does not appear to occur in the foundation of the dam. If major reconstruction and/or increasing the dam height is ever proposed, detailed investigations of the foundation materials should be undertaken. Construction of an impervious core, dental concrete, and pressure grouting are options that could be considered to cut-off seepage through the dam foundation.

Landslide Potential

No landslides have been mapped in the area around Boulter Lake by the Wyoming Geological Survey and no large active landslides appear to be present. However, there is colluvium on the east side of the Boulter Lake Dam and spillway. If extensive rehabilitation of the dam was to be undertaken, some scaling of the rocks above the
spillway would be recommended. This work will reduce the potential that any rock fall or small landslide would fill and block the spillway. The west side of the dam appears stable.

**Seismic Setting and Earthquake Design**

Seismological characterizations of an area can range from an analysis of historic seismicity to a long-term probabilistic seismic hazard assessment. A complete characterization usually includes a summary of historic earthquakes, deterministic analyses on active faults, analyses and review of the Seismic Zone Map of the Uniform Building Code, “floating earthquake” analyses, and short- or long-term probabilistic seismic hazard analyses. Much of the following information is a summary of the report “Basic Seismological Characterization for Sublette County, Wyoming” by James C. Case, et al, 2002.

Information concerning the abridged Modified Mercalli Earthquake Intensity Scale and a table showing a comparison between the Mercalli Intensity Scale and peak ground accelerations are attached to this report.
Abridged Modified Mercalli Intensity Scale

Intensity value and description:

I  Not felt except by a very few under especially favorable circumstances.

II  Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.

III  Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing automobiles may rock slightly. Vibration like passing of truck. Duration estimated.

IV  During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing automobiles rocked noticeably.

V  Felt by nearly everyone, many awakened. Some dishes, windows, and so on broken; cracked plaster in a few places; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.

VI  Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster and damaged chimneys. Damage slight.

VII  Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving cars.

VIII  Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving cars disturbed.


X  Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed, slopped over banks.


XII  Damage total. Waves seen on ground surface. Lines of sight and level distorted. Objects thrown into the air.
Eighteen magnitude 2.5 or intensity III and greater earthquakes have been recorded in Sublette County. The two earthquakes with the epicenters closest to Boulter Lake are described below. On February 25, 1963 a magnitude 4.3, intensity V, earthquake occurred approximately 15 miles north-northeast of Big Sandy. In 1996, a magnitude 3.7 earthquake was recorded approximately 13 miles southeast of Big Sandy.

On September 27, 2001 a magnitude 4.3 event occurred approximately 25 miles northeast of Bondurant near the Teton-Fremont-Sublette County border. This event is approximately the same size as the 1963 event near Big Sandy, but is located at a much greater distance from Boulter Lake.

Several earthquakes have also been reported in all of the counties that surround Sublette County. The most active regions are in the Jackson area along the Teton fault, in the Star Valley area in Lincoln County and in Yellowstone National Park.

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<td>IV</td>
<td>1.4 – 3.9</td>
<td>Light</td>
<td>None</td>
</tr>
<tr>
<td>V</td>
<td>3.9 – 9.2</td>
<td>Moderate</td>
<td>Very Light</td>
</tr>
<tr>
<td>VI</td>
<td>9.2 – 18</td>
<td>Strong</td>
<td>Light</td>
</tr>
<tr>
<td>VII</td>
<td>18 – 34</td>
<td>Very Strong</td>
<td>Moderate</td>
</tr>
<tr>
<td>VIII</td>
<td>34 – 65</td>
<td>Severe</td>
<td>Moderate to Heavy</td>
</tr>
<tr>
<td>IX</td>
<td>65 – 124</td>
<td>Violent</td>
<td>Heavy</td>
</tr>
<tr>
<td>X</td>
<td>&gt;124</td>
<td>Extreme</td>
<td>Very Heavy</td>
</tr>
<tr>
<td>XI</td>
<td>&gt;124</td>
<td>Extreme</td>
<td>Very Heavy</td>
</tr>
<tr>
<td>XII</td>
<td>&gt;124</td>
<td>Extreme</td>
<td>Very Heavy</td>
</tr>
</tbody>
</table>

Modified Mercalli Intensity and peak ground acceleration (PGA) (Wald, et al 1999).

**Historical Seismicity**

Eighteen magnitude 2.5 or intensity III and greater earthquakes have been recorded in Sublette County. The two earthquakes with the epicenters closest to Boulter Lake are described below. On February 25, 1963 a magnitude 4.3, intensity V, earthquake occurred approximately 15 miles north-northeast of Big Sandy. In 1996, a magnitude 3.7 earthquake was recorded approximately 13 miles southeast of Big Sandy.

On September 27, 2001 a magnitude 4.3 event occurred approximately 25 miles northeast of Bondurant near the Teton-Fremont-Sublette County border. This event is approximately the same size as the 1963 event near Big Sandy, but is located at a much greater distance from Boulter Lake.

Several earthquakes have also been reported in all of the counties that surround Sublette County. The most active regions are in the Jackson area along the Teton fault, in the Star Valley area in Lincoln County and in Yellowstone National Park.
Deterministic Analysis of Regional Active Faults with Surficial Expressions

The Sublette County Seismicity report (Case 2002) does not mention any active fault systems within Sublette County with surficial expressions. However, a map prepared by King, et al, 1987, identifies a potentially active fault approximately 15 miles southwest of Boulter Lake, or approximately 5 miles west of Buckskin Crossing on the Big Sandy River. This fault zone appears to be associated with the Wind River Thrust fault.

Several fault systems with surface expression have been mapped in the counties around Sublette County. All of these faults have the potential to cause ground shaking at Boulter Lake. However, because of the distance from Boulter Lake to these fault systems, the peak ground acceleration will be less than approximately 3% of gravity.

Floating or Random Earthquake Sources

Many federal regulations require an analysis of the earthquake potential in areas where active faults are not exposed and where earthquakes are tied to buried faults with no surface expression. Regions with a uniform potential for the occurrence of such earthquakes are called tectonic provinces. Within a tectonic province, earthquakes associated with buried faults are assumed to occur randomly, and as a result can theoretically occur anywhere within that area of uniform earthquake potential.

“Floating earthquakes” are earthquakes that are considered to occur randomly in a tectonic province. Since all earthquakes are associated with specific faults, there is not a truly random distribution of earthquakes. However, if all buried faults within a tectonic province have not been identified, the distribution is considered to be random.

The U.S. Geological Survey delineated tectonic provinces in a report titled “Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States” (Algermissen and others, 1982). In that report, Sublette County was classified as
being in the “Wyoming Foreland Structure Province.” The largest “floating earthquake” in Sublette County was estimated to have a magnitude of 6.0 – 6.5.

Many building codes and Federal regulations specify the distance from the epicenter of the random earthquakes to the structure that is being designed. For example, for uranium mill tailings sites, the Nuclear Regulatory Commission requires that a floating earthquake be placed 15 kilometers from the site. During the design of a specific project, the floating earthquake for the tectonic province where the facility is located is assumed to occur the specified distance from the site and the ground motion is attenuated in the distance from the epicenter of the earthquake to the site. The attenuated ground motion is used as the peak ground acceleration for design of the facility.

For Sublette County, if one assumes that the floating earthquake would have a magnitude of 6.25 and that the earthquake occurred 15 kilometers from the site of the structure being designed, the design peak ground acceleration would be approximately 15% of gravity. This estimate is a conservative, but reasonable design value for a major reconstruction of the Boulter Lake Dam.

**Uniform Building Code Classification**

Sublette County is in Seismic Zones 1, 2 and 3 of the Uniform Building Code (UBC). The UBC Zones increase from Zone 0 (lowest risk) to Zone 4 (highest risk). The seismic risk for Sublette County increases from the southeast corner to the northwest corner of the County. Boulter Lake is in Zone 1, which requires design for peak acceleration of 5% to 10% of gravity for non-critical structures. Adoption of the International Building Code (IBC), as is being done by many counties in Wyoming, will likely require more stringent earthquake design criteria. For example, the UBC uses a 500-year earthquake (10% probability of exceedance in 50 years), while the IBC uses a 2500-year earthquake (2% probability of exceedance in 50 years).
Using the UBC criteria, the design peak acceleration at Boulter Lake will be approximately 7% of gravity. Using the IBC criteria, the design peak acceleration at Boulter Lake will be about 18% of gravity. Refer to Figures 14 and 15.

Figure 14
500 Year Earthquake, UBC Seismic Zone Map.
Feasibility of Rehabilitation or Enlarging the Dam

There are no geologic features that would make rehabilitation of the dam impossible or would lead to the dam being classified as “unsafe.” This small structure has preformed satisfactory at least since the 1970 rehabilitation work by the SCS. Maintenance and repair of the outlet works could be done without any significant concern about the geologic conditions. The only geotechnical investigations that would be necessary for replacement/repair of the outlet would be finding suitable material for backfilling the
embankment. If equipment was available, some scaling of the rock above the spillway could be done to minimize small rock falls.

Major reconstruction and/or enlargement of the dam is also considered feasible. Although investigations into the exact nature of the contact zone between the rock types in the stream below the dam should be done, we do not believe that this area will be a fatal flaw for enlargement of the dam.

**Availability of Dam Materials**

Materials needed to reconstruct, rehabilitate, or enlarge Boulter Lake Dam could likely be found near the dam site. Finer grained materials for the embankment part of the dam could be found in the glacial deposits south and west of the reservoir. Riprap and larger rock could be obtained from the east side of the dam and from material within the glacial deposits.

Processing and sorting of the material will be necessary to provide the required materials for each part or zone of the dam. Sufficient clay material will likely be the most difficult material to find, due to the typically silty nature of glacial deposits. The glacial deposits are likely to be heterogeneous and we anticipate that exploration and select processing of the onsite glacial material would provide enough silty clay or clayey silt material for an impervious core of the dam. In the worst case, the onsite soils may need to be treated and mixed with bentonite to provide a more impervious material.

**Recommendations for Future Geotechnical Investigations**

Investigation of the foundation conditions, particularly, the impacts due to the contact between the different rock types that outcrop on the east and west sides of the dam and stream below the dam is recommended. This contact is probably very close to the existing stream. In addition to investigations in the stream below the dam, investigations into the exact nature and quantity of embankment material near the dam should also be
conducted. The glacial material west and south of the dam should be the first choice for a source of borrow material and initial geotechnical investigations should be conducted in these areas to explore the quality and quantity of dam construction material.

Initial investigations would include test pits followed, if necessary, by borings. The greatest difficulty and cost with any geotechnical investigations will be getting equipment to the site to perform the work. Standard laboratory tests, such as gradations, atterberg limits, and strength tests should be conducted. The budget for this work, other than the costs to mobilize the equipment to the site should not be unusual or excessive.
ENVIRONMENTAL OVERVIEW

Introduction

A variety of federal, state, and local permits and approvals could be required for design and construction of any repair of the Boulter Lake Dam and for an enlargement of the dam and reservoir. It is likely that a 404 Permit from the US Army Corps of Engineers will be required for any work on the dam, whether it is repair of the existing dam or a raise of the dam and enlargement of the reservoir. The other key Federal permit is the Special Use Permit from the US Forest Service. In general, the permitting process will be easier for the options to repair or perform maintenance work on the existing dam, particularly if the work results in a “safer” facility. If an enlargement of the reservoir and raising of the dam was pursued, the permitting requirements will significantly increase.

Preparation of permit applications, and compliance activities for the various regulations will require a serious and coordinated effort including development of acceptable mitigation plans. In the event that an enlargement of the dam is pursued, the longest time requirement would be associated with obtaining a 404 Permit from the US Army Corps of Engineers and associated National Environmental Protection Act (NEPA) compliance, particularly if an Environmental Impact Statement (EIS) is required. It is not unusual for the 404 permitting and EIS process to take 1-1/2 to 2 years or longer from the time that an application is submitted.

Other major permits and approvals, which could involve requirements for large amounts of information, important negotiations, or lengthy permitting processes, include the approval of Construction Plans for any new construction, repair, modification or enlargement of a dam from the Wyoming State Engineer, the Special Use permit from the US Forest Service, and perhaps Right-of-Way and land access agreements with land owners, which may include the Bureau of Land Management and private parties. Other State permits, particularly those necessary from the Wyoming Department of Environmental Quality, can be worked on and obtained simultaneously with the Federal
If the alternative to repair or maintain the existing dam is selected, a fairly simple 404 permitting process could be followed and perhaps an Environmental Assessment (EA) could be used. The differences between the two types of permitting procedures are outlined in the following section of the report.

**Summary of Permits**

The permits and approvals that are likely to be required are listed in Table X.1 and are described individually below. The list is based on our experience with similar projects.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Federal</strong></td>
<td></td>
</tr>
<tr>
<td>U.S. Army Corps of Engineers</td>
<td>• Permit for Discharge of Dredged or Fill Material (Section 404 Permit)</td>
</tr>
<tr>
<td></td>
<td>• Environmental Impact Statement or Environmental Assessment under</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>requirements of National Environmental Policy Act (NEPA)</td>
</tr>
<tr>
<td>U.S. Fish and Wildlife Service</td>
<td>• Compliance with Endangered Species Act, Section 7 consultation</td>
</tr>
<tr>
<td></td>
<td>• Compliance with Fish and Wildlife Coordination Act</td>
</tr>
<tr>
<td>U.S. Forest Service</td>
<td>• Special Use Permit</td>
</tr>
<tr>
<td></td>
<td>• Compliance with NEPA as a cooperating agency</td>
</tr>
<tr>
<td>Bureau of Land Management</td>
<td>• Compliance with NEPA as a cooperating agency</td>
</tr>
<tr>
<td>Advisory Council on Historic Preservation</td>
<td>• Compliance with cultural resources protection regulations</td>
</tr>
<tr>
<td>Department of the Treasury, Bureau of Alcohol,</td>
<td>• Explosive Users Permit</td>
</tr>
<tr>
<td>Tobacco, and Firearms</td>
<td></td>
</tr>
</tbody>
</table>

Table X.1

Boulter Lake Dam Project Permits and Approvals
Potentially Required by Federal, State, and Local Agencies
<table>
<thead>
<tr>
<th>State Agency</th>
<th>Requires Approval/Permit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wyoming Department of Environmental Quality</td>
<td>• Air Quality Division</td>
</tr>
<tr>
<td></td>
<td>• Water Quality Division</td>
</tr>
<tr>
<td></td>
<td>• Land Quality Division</td>
</tr>
<tr>
<td></td>
<td>• Solid and Hazardous Waste Division</td>
</tr>
<tr>
<td></td>
<td>• Open Burning Permit</td>
</tr>
<tr>
<td></td>
<td>• National Pollution Discharge Elimination Permits</td>
</tr>
<tr>
<td></td>
<td>• Water Quality Certification (401 Permits)</td>
</tr>
<tr>
<td></td>
<td>• Permits to construct of modify Public Water and Sewer Systems</td>
</tr>
<tr>
<td></td>
<td>• Small mining permit required. Review during the NEPA process.</td>
</tr>
<tr>
<td></td>
<td>• Any landfill will need a permit</td>
</tr>
<tr>
<td>Wyoming State Engineer’s Office</td>
<td>• Permit to Appropriate Water</td>
</tr>
<tr>
<td></td>
<td>• Approval of Plans and Specifications for the Dam</td>
</tr>
<tr>
<td>Wyoming State Historical Preservation Office</td>
<td>• Cultural Resource Clearance</td>
</tr>
<tr>
<td>Wyoming State Fire Marshall</td>
<td>• Review and approval of electrical plans</td>
</tr>
<tr>
<td>Sublette County</td>
<td>• Zoning and Land Use plans</td>
</tr>
</tbody>
</table>

US Army Corps of Engineers 404 Permit. Under the Clean Water Act, a Section 404 Permit is required for any discharge of dredged or fill material into waters of the United States. This permit would be issued through the US Army Corps of Engineers, Wyoming Regulatory Office (2232 Dell Range Blvd., Suite 210; Cheyenne, WY 82009; 307-772-2300). The proposed action must meet the U.S. Environmental Protection Agency’s 404(b)(1) guidelines to be certified.

Repair or enlargement of the Boulter Lake Dam will require 404 certification. Granting of a 404 Permit for any work on Boulter Lake could be considered a “major federal action” for purposes of the National Environmental Policy Act (NEPA). Section 404 of the Clean Water Act authorizes the COE to issue permits for discharges of dredged or fill material into the waters of the United States. Generally speaking, any blue line channel on a USGS map qualifies as “waters of the United States.” Wetlands are a special case of waters of the US. The 404 permitting process involves a permit application, opportunities for public notice and comment, and preparation of an alternatives analysis. The COE must also make sure that the discharge will not violate state water quality standards pursuant to Section 401 of the Clean Water Act.
Any enlargement of the reservoir or raise of the dam will most likely require an Environmental Impact Statement (EIS). An EIS is a complex and time-consuming process. Without an EIS, the time required to obtain an individual 404 Permit would be around 90 to 120 days from time of application. With an EIS, the time required would be around 1-1/2 to 2 years.

If the alternative to repair or maintain the existing dam is selected, a Nationwide 3 type of 404 Permit is the first choice. This will result in a fairly simple permitting process. If it can be demonstrated that the repair work will provide for a “safer” and more economic and useable facility, the work can be approved using an Environmental Assessment (EA).

A summary of the National Environmental Policy Act (NEPA) is contained in the following section of this report.

**US Forest Service, Special Use Permits.** A Special Use Permit would be required for inundation of any Forest Service land or to construct any dams, roads, supply canals, or other appurtenances associated with the projects. Coordination with the Forest Service will likely be through the Bridger-Teton National Forest District Office in Pinedale, Wyoming. Since Boulter Lake is located on Forest Service property, the Forest Service could become the lead Federal permitting agency.

**Endangered Species Act Compliance.** Compliance with the Endangered Species Act is the responsibility of the federal agency issuing a permit, or a lead federal agency in the NEPA process. Consultation with the US Fish and Wildlife Service (USFWS) by the lead federal agency is required and a 404 Permit or special use permit will not be issued until the USFWS Service has rendered its Biological Opinion regarding the impacts of the project on endangered and threatened species. Initial consultation and coordination would occur through the Wyoming Field Office of the USFWS Service (4000 Airport Parkway, Cheyenne, WY 82001 307-772-2374). The impacts of any project at Boulter Lake to the endangered Colorado River cutthroat trout will certainly need to be considered.
Fish and Wildlife Coordination Act Compliance. This act requires that all federal agencies consult with state and federal wildlife management agencies prior to approval of any federal action that may affect a body of water. The requirements are normally handled during the NEPA compliance process. Requirements for a Migratory Bird Permit, under the Migratory Bird Protection Act, would be determined during consultation with the USFWS Service.

Cultural Resource Compliance. The National Historic Preservation Act requires that all federal agencies inventory, evaluate and make an effort to preserve significant cultural resources on federal lands and on lands over which they have permit authority. A cultural resource clearance will be required, after completion of the EIS and approval of the project, but before construction. The lead agency, in consultation with the Wyoming State Historic Preservation Office (Barrett Building, 2301 Central Ave., Cheyenne, WY 82002; 307-777-7697) will determine the type and intensity of studies required. The state Historic Preservation Officer will have 30 days to review and comment on the survey report after submittal, including identification of stipulations for data recovery, site preservation, or other means of preserving significant cultural resources.

If properties eligible for the National Register were involved, the copy of the reports and comments would be sent to the Advisory Council on Historic Preservation for their concurrence. If additional archaeological sites are discovered during construction, the Interagency Archaeological Service’s Emergency Procedures for Consideration of Cultural Resources would be required, involving stopping of construction near the site while a professional assessment of its significance is conducted.

Wyoming Air Pollution Control Permits. No specific air quality permit for construction of a project is required from the Wyoming Department of Environmental Quality, Air Quality Division (250 Lincoln Street, Lander, WY 82520; 307-332-3144). However, the contractor will be required to notify DEQ Air Quality in writing of the work and will be expected to control fugitive dust or particulate matter when native soil is disturbed, soil is stockpiled, vehicles travel on unpaved roads and when mud or dirt is carried onto paved
roadways. If there are complaints due to dust, the DEQ may inspect the site to assure that dust control measures are in place and dust control activities are being undertaken. DEQ Air Quality will be notified during the NEPA process and will comment on the project, at that time.

A permit is required from the Air Quality Division for any burning activities on the construction site. An Opening Burning permit would be required for any open burning of debris or other materials related to construction. The application form requires information such as description of the burning site, debris to be burned, and date of burning, and should be submitted to the Air Quality Division.

**Wyoming Water Quality Permits.** The Wyoming DEQ, Water Quality Division (4th Floor West, Herschler Bldg., Cheyenne, WY 82002 307-777-7781) regulates the discharge of pollutants into the state surface and ground waters through the National Pollution Discharge Elimination System (NPDES) Permits. For the construction site, a Stormwater General Permit for Construction Activities is required for any surface water discharges. The permit must be applied for at least 10 days prior to the start of construction. Groundwater related activities, such as dewatering for construction, also require an NPDES Permit for Construction Dewatering that must be applied for at least 30 days prior to the anticipated date of discharge.

In addition, Water Quality Certification (401 certification) from the Water Quality Division is required by the Army Corps of Engineers prior to issuance of a 404 Permit. In a 401 certification, the state indicates its belief that a project will not violate water quality standards and includes any conditions that the State believes to be required. The 401 certification process would be coordinated by the Army Corps of Engineers and a separate application would not be required.

Construction of a new and/or any modifications to an existing public water and/or sewer system would also have to be permitted through the Wyoming DEQ Water Quality Division. A water supply system or sewage system for a construction camp would
require the permit from the DEQ.

**Wyoming Land Quality Mining Permits.** Any project at Boulter Lake could also require that a Mining Permit be obtained from the Wyoming DEQ, Land Quality Division (2500 Lincoln St., Lander, WY 82520; 307-332-3144). In the past, we have received indications from the DEQ Land Quality that Wyoming Water Development projects are exempt from these permits. However, the letter from John Erickson with the DEQ in Lander indicates that the exemption would be granted only if the quarry or borrow site is in the *direct supervision and control of the public agency*.

DEQ anticipates that issues such as baseline environmental work, archeology and cultural resource assessments and surveys, mining and development plans, and site reclamation will be covered during the NEPA process. DEQ is a cooperating agency during the NEPA process and they may comment on and review any mining related issues during the NEPA process.

**Water Rights and Dam Construction Permits.** A permit to appropriate water must be obtained from the Wyoming State Engineer (4th Floor East Wing, Herschler Bldg., Cheyenne, WY 82002; 307-777-7354) before any construction on a facility may begin. In addition, the State Engineer must approve the drawings and specifications for construction of a new facility and/or enlargement or modification of an existing dam. The State Engineer may inspect the construction work and will continue to monitor and inspection the operation and maintenance of the dam.

**Highway Use Permits.** The Wyoming Department of Transportation will require permits for over length, over weight, or over wide vehicles or loads. Annual, single-trip or special permits are available. An Access Permit would be required for access to the State Highway System, during construction or for continued use.

**Wyoming Fire Marshall.** The Wyoming Fire Marshall’s Office (2500 Academy Court, Riverton, WY 82501; 307-856-8190) may be involved with plan review for any
electrical plans associated with construction of the dam or appurtenances.

**National Environmental Policy Act Compliance.**

The National Environmental Policy Act of 1969 and its implementing regulations require that all federal projects consider the effects of a proposed action and its effects on the environment. Compliance with the National Environmental Policy Act is usually coordinated by one agency, designated the lead agency, where more than one federal agency is involved. The Forest Service would most likely be the lead federal agency for any work at Boulter Lake. The lead agency is responsible for compliance with other federal regulations, including compliance with the Endangered Species Act and Fish and Wildlife Coordination Act, and cultural resource regulations as described below. Other federal agencies, such as the BLM and the Corps of Engineers, which would need to issue a right-of-way permit, special use permits, and the 404 permit may be involved as cooperating agencies. State agencies such as the Wyoming State Engineer’s Office, DEQ or Wyoming Game and Fish Department may also be cooperating agencies.

**Required Steps for NEPA**

The two basic approaches to NEPA compliance involve an environmental assessment (EA) or an Environmental Impact Statement (EIS). An EA is often the first phase in NEPA compliance and provides an initial analysis of the environmental resources that might be affected by the proposed action. An EA is used to present a preliminary assessment of environmental impacts and to assess the need for changes in the design, or additions, in response to assess impacts. Based on the conclusions in the EA, the lead federal agency then either prepares a Finding of No Significant Impact (FONSI), or an EIS, if the agency determines that the proposed action may significantly affect the environment. An EIS is a detailed statement to describe the impacts, any unavoidable adverse impacts, and alternatives to the proposed action.
While an EA is often the first phase and is the most common form of NEPA compliance, it is possible to skip the EA phase and move directly into the EIS when it is apparent that adverse impacts will result. Alternatively, it is possible to issue an EA with recommendations for mitigation in order to support a FONSI (often referred to as a mitigated FONSI). This practice has been criticized by some environmental groups but has been supported by an overwhelming majority of case law over the last 20 years. Typically, only several hundred EIS are actually prepared each year throughout the federal government, usually for large, controversial projects with significant environmental impacts that are not susceptible to mitigation. Early consultation with the lead agency can better define the process to be followed (EA or EIS).

The actual preparation of an EA or EIS is by the federal lead agency, or by a third party contractor who is selected and supervised by the lead agency. The third-party relationship is the result of the EA/EIS being prepared by a contractor under the direction of a Federal Agency, but with funding provided by the project proponent. When a third party contractor is used for NEPA related work, a conflict-of-interest disclosure statement is required indicating that they have no financial or other interest in the outcome of the proposed action. Financial interests include the promise of future design or construction work. The purpose of the disclosure is to preserve the objectivity and integrity of the NEPA process, as directed by 40 C.F.R. 1506.5c and as clarified in the Forty Most Asked Questions Concerning CEQ’s NEPA Regulations (46 Fed Reg 18026, March 23, 1981, as amended by 51 Fed Reg 15618, April 25, 1986).

We believe that repair or maintenance work on the existing Boulter Lake Dam will only require an EA. Hopefully, the EA will result in a FONSI and the work can proceed in a timely manner. However, significant impacts to the environment, including work in wetland areas below the dam may require a more detailed Environmental Impact Statement even to repair the dam. If an EIS is required, there are a number of procedural steps that ensure an adequate and open analysis of environmental issues. Those steps are:

1. Publish Notice of Intent (NOI). The first formal step in EIS preparation is to publish an NOI in the Federal Register, which serves as the official legal notice that a federal
agency is commencing an EIS. The NOI includes a description of the proposed action, possible alternatives, the scoping process, and the name and address of the contact at the lead agency.

2. **Scoping.** Scoping refers to the process where public input is solicited on the issues and potential impacts to be addressed in the EIS, and the methods by which they will be evaluated. Scoping also involves consultation with other federal agencies that might have involvement with the proposed action, and to allocate assignments between the lead agency and cooperating agencies on EIS preparation.

3. **Draft EIS.** After the scoping process is complete, the draft EIS is prepared. This may require significant field investigations to describe the affected environment and to define mitigation options.

4. **Circulate Draft EIS for Review.** Once the draft EIS is available for comment, it must also be filed with EPA. EPA has one week to publish a notice in the Federal Register that the document is now available for review. In addition to filing, EPA also reviews the EIS, and as part of their review, they rate the document on both adequacy and environmental impacts. Depending on the lead agencies policy and practice, public hearings may also be required. The comment period must be at least 45 days long, calculated from the date of publication in the Federal Register.

5. **Final EIS.** The Final EIS is prepared after the comment period is closed. The Final EIS must contain responses to all comments received and must discuss any opposing views.

6. **Circulate Final EIS for Review.** The lead agency files the Final EIS with EPA, who must publish a notice in the Federal Register. The 30-day public review period for the Final EIS begins on date that notice is given in the Federal Register. Although there is no requirement for the lead agency to respond to comments received during this period, the administrative record should indicate that they considered such comments prior to making a decision.

7. **Record of Decision (ROD).** After the review period, and assuming that the EIS meets all adequacy standards, the lead agency may adopt the EIS. After the EIS has been adopted, the lead agency will make a decision on the proposed action. The ROD is a written public record explaining why the decision was made.

If required, the EIS will need to discuss and evaluate several issues and there will need to be analyses and studies to obtain the required information. The EIS will include the following sections, as a minimum:

- **The Purposed and Need** for the project will need to be discussed and evaluated. If there is no compelling need for the project, it is unlikely that the necessary Federal permits for the project can be obtained.

- **Alternatives to the Proposed Reservoir** will need to be developed and evaluated. The Federal agencies will lean toward the least environmentally damaging alternative.

- **The affected Environment and Consequences** will need to be reviewed and
discussed. Specifically the following issues need to be evaluated; land use, impacts to farm and range land, changes to the flood plain, wetlands, cultural resources, biological resources including threatened and endangered species, aquatic and terrestrial habitat, water quality issues, socio-economic issues, air quality, transportation, and noise.

- Summary of any Mitigation required and conceptual designs for the mitigation work will need to be developed.

- A section of the EIS will need to discuss Land Use Planning.

- A section presenting Agency Comments and Coordination and a section presenting Public Comments will need to be included in the EIS.

**Assessment/Opinion of Permitting Difficulty**

We believe that the work to repair the outlet at Boulter Lake will be considered maintenance work and the necessary Forest Service special use permit and FONSI can be rather quickly obtained. This effort should be through an EA.

Obtaining the necessary Federal permits to enlarge the reservoir or raise the dam could be a difficult and long process. There is no certainty that a permit will be issued, unless there is compelling need for the project. The purpose and need assessment phase of the permitting process will be key. The need for the additional water stored in the enlarged reservoir will certainly have to be demonstrated. Alternative analyses and environmental studies will be required. The State and the project sponsors should plan on the full Environmental Impact Statement process for options to raise the existing dam and enlarge the reservoir.

**Budget Costs for Environmental and Mitigation Work**

The budget for the environmental assessment and permitting for a project to maintain/repair the existing Boulter Lake dam should be less than approximately $5000 to $10,000, depending upon the amount of baseline assessment required by the Forest Service.
If an enlarged reservoir is pursued, than the EIS for a project with this size and scope could be in the range of $100,000 to $150,000. This budget is for the EIS only and does not include any required mitigation work. Land will need to be obtained for the mitigation sites. The mitigation will need to include wetlands mitigation and likely some mitigation of the loss of the big game habitat. Any areas that are obtained for habitat replacement or wetlands mitigation will likely require new fences.

Construction costs for the creation of new wetlands could be in the range of $25,000 to $40,000 per acre. This assumes that there is land available and that it is suitable for mitigation work. The construction budget for the wetlands mitigation could easily exceed $500,000 for a large increase in dam height and enlargement. This figure does not include the EIS, land acquisition, monitoring, or continued operation and maintenance work for the wetlands mitigation areas. However, based on field observations of the slopes surrounding the lake, less than 2 acres of wetlands would be inundated which would include the area along the creek below the dam. The final quantity would have to be quantified from an actual delineation of the wetlands.

**USFS – Pinedale Ranger District**

Discussions held with Cindy Stein from the Pinedale Ranger District covered the Forest Service’s stance on operations, maintenance, repair, and enlargement. First and foremost is their requirement to update the Special Use Permit and Operating Agreement. The 1939 Special Use Permit is included in Appendix A it is not legible, but neither is the Forest Service’s copy. In 1934, the East Fork Irrigation Association was issued a Special Use Permit for Boulter Lake by the U.S. Forest Service. However, when it came time to repair the dam in 1969, the East Fork Reservoir Association made the application to the Soil Conservation District. Because the East Fork Reservoir Association was responsible for the cost of the repairs in 1970, those owners and their associated acres (see Appendix) were used for the economic analysis. Because neither association is a legal entity, the UGRJPB would be required to sponsor any project that may include water development funds.
The East Fork Reservoir Association can give the reservoir to the USFS. However, the Forest Service will require that the Association pay to breach or stabilize the dam. Basically, the Reservoir Association must use it or lose it. The dam has seen very little care or maintenance over the last 20 years. For that reason, some work on the face of the dam near the elevation of the emergency spillway and the floor of the emergency spillway will need work to extend the dam's effectiveness. The dam, as it currently exists, is not unstable but will require work to maintain its current condition. The first two options deal with repair or reconstruction of the existing dam. Both of these would fall under Categories of Exclusion and would require internal input with allowance for public input. The third option of enlarging the dam would require an EA (EIS not usually required) with the full NEPA process.

**Sedimentation and Erosion**

Analysis of the existing dam has shown that the only erosion that has occurred in the area was a result of the emergency spillway being clogged with debris. Water flowing over the debris caused the flow to divert out of the emergency spillway channel and erode part of the spillway bank. Further erosion occurred when the debris created turbulent flow in the emergency spillway channel. During the October, 2005 site visit, the debris was moved out of the spillway and the holes in the bottom of the spillway were refilled with rock. When we were able to see the intake structure, no sediment existed in the intake area. Due to the location and topography of the drainage area for Boulter Lake, reservoir sedimentation is not currently and is not anticipated as an issue. However, all design work around the dam site must include provisions to reduce or eliminate potential sediment and erosion problems.
CONCEPTUAL DESIGN AND COST ESTIMATES

Alternative ‘A’

Alternative A looks at the most economical short-term approach to making the dam and outlet structure functional. For this alternative, a minimal amount of labor and equipment are required to install the improvements. The original capacity of the dam is maintained. Flow control on the dam’s outlet works is re-established to provide for operation of the dam for its intended purpose. The erosion problems caused by debris in the emergency spillway are repaired with native rock and imported cement for grout. Debris reaching the spillway is addressed with the log boom. The existing inlet structure and new flow control would prohibit vandalism. This option minimizes the cost of final designs and permitting because it is maintenance on an existing structure that has a special use permit. The main issue would be to execute a new Special Use Permit with an Operation Plan for the U.S. Forest Service.

1. Install 24-inch by 18-inch diameter 7 Ga. (3/16”) welded steel pipe reducer at the outlet end of the existing welded steel pipe. An 18-inch flanged butterfly valve would be bolted to the end of this reducer and an 8-foot long 18-inch diameter HDPE pipe would be bolted to the outlet side of the valve. A 42-inch diameter CMP pipe 6’-0” long with locking cover would be installed as a gate house structure notched to fit over the 18-inch valve and pipe.

2. The existing grate over the inlet structure will remain.

3. Debris will be removed from the emergency spillway. Rock will be installed in existing pockets and grouted in place.

4. A log boom will be installed in front of the emergency spillway to keep trash out of the spillway.

5. Installation: This Alternative “A” work can be accomplished with hand tools and labor. Delivery of tools and materials by helicopter would reduce the time and disturbance, but at significant cost. Delivery by 4-wheel ATV’s and trailers would take several trips with some impact to the route.
6. Equipment Required:
   a. ATV’s with 4-wheel drive and winch and trailer
   b. Gas powered concrete mixer
   c. Gas powered welder
   d. Breast drill with bits
   e. Metal Saw
   f. Hand tools: wrenches, pliers, shovels, pick, crow bar, cant hook, hammers, axe.

### Alternative A Cost Estimate

<table>
<thead>
<tr>
<th>Item</th>
<th>#</th>
<th>Units</th>
<th>Cost/Unit</th>
<th>Cost</th>
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<tr>
<td>Preparation of Final Designs</td>
<td></td>
<td></td>
<td></td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Permitting and Mitigation</td>
<td></td>
<td></td>
<td></td>
<td>$1,000.00</td>
</tr>
<tr>
<td>Legal Fees</td>
<td></td>
<td></td>
<td></td>
<td>$100.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>#</th>
<th>Units</th>
<th>Cost/Unit</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization</td>
<td>1</td>
<td>Lump Sum</td>
<td>$4,000.00</td>
<td>$4,000.00</td>
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<td>Lin. Feet</td>
<td>$300.00</td>
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<td>Dresser Coupling</td>
<td>1</td>
<td>Each</td>
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<td>$3,500.00</td>
</tr>
<tr>
<td>18-Inch Butterfly Valve</td>
<td>1</td>
<td>Each</td>
<td>$4,000.00</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>42-Inch Dia. CMP Housing</td>
<td>6</td>
<td>Lin. Feet</td>
<td>$100.00</td>
<td>$600.00</td>
</tr>
<tr>
<td>Debris Removal</td>
<td>1</td>
<td>Lump Sum</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Grouted Rock</td>
<td>20</td>
<td>CY</td>
<td>$400.00</td>
<td>$8,000.00</td>
</tr>
<tr>
<td>Log Boom</td>
<td>50</td>
<td>Lin. Feet</td>
<td>$80.00</td>
<td>$4,000.00</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtotal</td>
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</tr>
<tr>
<td>Engineering (10%)</td>
<td>$2,700.00</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$29,700.00</td>
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<tr>
<td>Contingency(15%)</td>
<td>$4,455.00</td>
</tr>
<tr>
<td>Construction Cost Total</td>
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</tr>
</tbody>
</table>

**Total Project Cost** $36,255.00
BOULTER LAKE

FIGURE 16. ALTERNATIVE 'A' PLAN VIEW
PROFILE VIEW CL OF PIPE

NOT TO SCALE

BOULTER LAKE

FIGURE 17, ALTERNATIVE 'A' PIPE CL PROFILE

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Alternative ‘B’

Alternative B provides for the design and repair of the Boulter Lake dam to restore the reservoir to its original capacity with a minimum of construction cost. This alternative looks at the most economical long-term approach to making the dam and outlet structure functional. For this alternative as with the previous alternative, a minimal amount of labor and equipment are required to install the improvements. This alternative would accomplish all of the repairs listed in Alternative A, but with a more complete plan. New pipe would be installed inside the existing pipe. The existing intake structure would be removed and a new structure installed. Vandalism proof flow controls will be installed on the new pipe. The same repairs would be made to the face of the dam and floor of the spillway. Once again costs to provide designs and permitting would be minimized because of the Special Use Permit. Both the design and permitting would require more effort than Alternative A.

1. Use existing 24-inch WSP, 7 gauge (3/16”) in place with a grouted 18-inch HDPE pipe with snap joints.
2. Remove existing reinforced concrete inlet structure sufficiently to install the 18-inch grouted insert pipe and install a steel or an HDPE fabricated inlet structure. The inlet structure will be covered with a fabricated steel shell that will allow passage of flow and prevent debris from being placed to restrict flow. This shell would have a removable locked section allowing access to the structure for cleaning. The inlet structure and shell would be fabricated in sections for ease of shipment and be reinforced as necessary with angle iron. The structures would be coated with a bituminous paint or equal coating.
3. An 18-inch diameter butterfly valve will be installed in the downstream end of the HDPE pipe with a 42-inch diameter housing pipe 6-foot long with locking lid.
4. An 8-foot long 18-inch diameter HDPE pipe would be bolted to the outlet side of the valve.
5. The emergency spillway would be cleaned of debris. All unstable rocks and fractures need to be grouted.

6. Installation: This Alternative “B” work can be accomplished with hand tools and labor. Delivery of tools and materials by helicopter would reduce the time, but at considerably higher cost. Delivery by 4-wheel ATV’s and trailers would take several trips with more impact to the access route.

7. Equipment Required:
   a. ATV’s with 4-wheel drive and winch
   b. Gas powered concrete mixer
   c. Breast drill with bits
   d. Metal Saw
   e. Hand tools: wrenches, pliers, shovels, pick, crow bar, cant hook, hammers, axe.

---

**Alternative B Cost Estimate**

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<thead>
<tr>
<th>Item</th>
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<th>Units</th>
<th>Cost/Unit</th>
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</tr>
</thead>
<tbody>
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<td>Preparation of Final Designs</td>
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<td>Lump Sum</td>
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<td>$8,000.00</td>
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<tr>
<td>Permitting and Mitigation</td>
<td>1</td>
<td>Lump Sum</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
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<tr>
<td>Legal Fees</td>
<td>1</td>
<td>Lump Sum</td>
<td>$300.00</td>
<td>$300.00</td>
</tr>
<tr>
<td>Mobilization</td>
<td>1</td>
<td>Lump Sum</td>
<td>$8,000.00</td>
<td>$8,000.00</td>
</tr>
<tr>
<td>18-inch Dia HDPE Pipe, Grouted</td>
<td>60</td>
<td>Lin. Feet</td>
<td>$100.00</td>
<td>$6,000.00</td>
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<td>Inlet Structure Removal</td>
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<td>Lump Sum</td>
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<td>Steel Inlet Structure (10 Ga)</td>
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<td>Lbs</td>
<td>$5.00</td>
<td>$2,250.00</td>
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<td>18-Inch Butterfly Valve</td>
<td>1</td>
<td>Each</td>
<td>$4,000.00</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>42-Inch Dia CMP Gate Housing</td>
<td>6</td>
<td>Lin. Feet</td>
<td>$100.00</td>
<td>$600.00</td>
</tr>
<tr>
<td>Groutec Rock</td>
<td>20</td>
<td>CY</td>
<td>$400.00</td>
<td>$8,000.00</td>
</tr>
<tr>
<td>Debris Removal</td>
<td>1</td>
<td>Lump Sum</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Log Boom</td>
<td>50</td>
<td>Lin. Feet</td>
<td>$80.00</td>
<td>$4,000.00</td>
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<tr>
<td><strong>Subtotal</strong></td>
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<td></td>
<td><strong>$36,350.00</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Engineering (10%)</strong></td>
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<td></td>
<td><strong>$3,635.00</strong></td>
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</tr>
<tr>
<td><strong>Subtotal</strong></td>
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<tr>
<td><strong>Contingency (15%)</strong></td>
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<tr>
<td><strong>Construction Cost Total</strong></td>
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</tr>
<tr>
<td><strong>Total Project Cost</strong></td>
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<td></td>
<td><strong>$50,782.75</strong></td>
<td></td>
</tr>
</tbody>
</table>
BOULTER LAKE

FIGURE 19. ALTERNATIVE 'B' PLAN VIEW
PROFILE VIEW CL OF PIPE

INLET DETAILS

SCALE: 1" = 5'

BOULTER LAKE

FIGURE 20. ALTERNATIVE 3' PIPE CL PROFILE

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Alternative ‘C’

Alternative C is the Boulter Lake Enlargement which is sized to fill 80 percent of the time based on the basin hydrology. Construction of this option requires that we remove the existing dam and excavate a core trench. Another aspect of this alternative is that the emergency spillway is moved to the southwest to increase the safety of the dam and to provide materials for construction. This alternative requires that we deal with all of the permitting and mitigation for enlarging the dam. As a minimum, an EA will be required for the NEPA process. This process would include the following items of work:

- USFS Special Use Permit
- COE 404 Permit
- USFWS Endangered Species and Migratory Bird Reviews
- Cultural Resource Review
- Water Rights Permits
- Safety of Dam Review
- NPDES Permit
- Wetland Delineation and Mitigation

Other requirements prior to permitting would be detailed plans and specifications, soils study of borrow area, and review of site geology.

1. Construction for enlargement of Boulter Lake would require removal of existing pipes in the dam; installation of new principal spillway and draindown pipe. Estimated quantities of work include excavating approximately 3000 cubic yards of material in the existing dam. The foundation of the dam would need to be cored down to solid material. The new dam would be constructed with a core of compacted fine material consisting of silt and silty sands with a shell of rock fill on both upstream and downstream faces. This will require approximately 12,700 cubic yards of fill. An internal filtered drainage system would be required to prevent excessive seepage and provide stability. There
would be a principal spillway drop inlet pipe and barrel to carry normal flows. The outlet pipe would be installed to release irrigation storage flows controlled by a hydraulic gate control system.

2. **Installation:** This Alternative “C” requires construction using earthmoving equipment, such as the following:
   a. Trackhoe
   b. Small dozer
   c. 4-wheel drive articulating dump trucks
   d. vibratory sheeps foot roller
   e. sprinkler system with pump
   f. concrete mixer and grout for high slump pipe backfill
   g. fuel and service truck
   h. gravel gradation screening facility

3. Construction time on dam is estimated at 6 weeks. This does not include ingress and egress mobilization.

### Alternative C Cost Estimate

<table>
<thead>
<tr>
<th>Item</th>
<th>#</th>
<th>Units</th>
<th>Cost/Unit</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization</td>
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<td>Lump Sum</td>
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<td>$16,000.00</td>
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<td>Excavation</td>
<td>3000</td>
<td>CY</td>
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<tr>
<td>Existing Conduit Removal</td>
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<td>Lump Sum</td>
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<td>Earthfill</td>
<td>12700</td>
<td>CY</td>
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<td>Filter Drain</td>
<td>1200</td>
<td>CY</td>
<td>$30.00</td>
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<td>6-Inch Dia. Drain pipe</td>
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<td>Lin. Feet</td>
<td>$8.00</td>
<td>$4,000.00</td>
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<tr>
<td>36-Inch Dia HDPE Riser w/ base</td>
<td>30</td>
<td>Lin. Feet</td>
<td>$500.00</td>
<td>$15,000.00</td>
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<td>18-Inch Dia. HDPE Pipe</td>
<td>300</td>
<td>Lin. Feet</td>
<td>$100.00</td>
<td>$30,000.00</td>
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<tr>
<td>Rock Riprap</td>
<td>2000</td>
<td>CY</td>
<td>$50.00</td>
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<td>18&quot; Butterfly Valve</td>
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<td>Lump Sum</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
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<td>Trash Rack</td>
<td>1</td>
<td>Each</td>
<td>$1,500.00</td>
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<tr>
<td>Pipe Support</td>
<td>1</td>
<td>Each</td>
<td>$400.00</td>
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<td><strong>Subtotal</strong></td>
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<td><strong>Engineering (10%)</strong></td>
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<td><strong>Total Project Cost</strong></td>
<td></td>
<td></td>
<td>$745,063.50</td>
<td></td>
</tr>
</tbody>
</table>
**ECONOMIC ANALYSIS**

It should be noted that the adjudicated water right acres in the Division 4 Tab Book under the East Fork New Fork River are 11,412.8 acres. Because it is the East Fork Irrigation or Reservoir Association, the cost of enlargement may not be spread over all of the adjudicated acres.

Costs and associated per acre costs for the three alternatives are summarized in the following table. The 2007 costs of each alternative were projected to 2009 construction costs using a 4 percent inflation rate. A Working Agreement for Group Enterprise was signed on September 19, 1969 to create the East Fork Reservoir Association. The association was created in order to receive state or federal assistance in the proposed repair of Boulter Lake Reservoir in 1970. The association was originally formed by eleven land owners and comprised of 6870 acres. A 50 percent WWDC grant and 50 percent WWDC loan at an interest rate of 6 percent was used to formulate the per acre cost to the sponsor and the annual per acre cost to the sponsor.

**Figure 25**
Boulter Lake Alternatives Cost Matrix

<table>
<thead>
<tr>
<th>Alternative</th>
<th>2007 Costs</th>
<th>2009 Costs</th>
<th>WWDC Grant</th>
<th>Sponsor Share</th>
<th>Cost/Acre</th>
<th>Annual Pymnt</th>
<th>Pymnt/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative A</td>
<td>$36,255.00</td>
<td>$39,213.41</td>
<td>$19,606.70</td>
<td>$19,606.70</td>
<td>$2.85</td>
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<tr>
<td>Alternative B</td>
<td>$50,782.75</td>
<td>$54,926.62</td>
<td>$27,463.31</td>
<td>$27,463.31</td>
<td>$4.00</td>
<td>$2,394.38</td>
<td>$0.35</td>
</tr>
<tr>
<td>Alternative C</td>
<td>$745,063.50</td>
<td>$805,860.68</td>
<td>$402,930.34</td>
<td>$402,930.34</td>
<td>$58.65</td>
<td>$35,129.30</td>
<td>$5.11</td>
</tr>
</tbody>
</table>

A benefit/cost analysis was performed to evaluate the feasibility of each alternative. The Consumptive Irrigation Requirement for pasture grass and grass hay in the Pinedale area according to WWRC Publication #92-06, “Consumptive Use and Consumptive Irrigation Requirements in Wyoming” is 10.08 inches for May, June, and July. It was assumed that this is enough time to grow a hay crop which was assumed to yield 1 ton/acre. Furthermore, it was assumed that a ton of hay in the Pinedale area would sell for approximately $85/ton and that it would take an investment of $30/ton to produce it.
Flood irrigation is typical in the area and is usually assumed to be approximately 50 percent efficient. However, due to the distance the water has to travel from the reservoir to any irrigable lands, an irrigation efficiency of 45 percent was used. The following table shows the number of acres that can be expected to be irrigated by the storage and the benefit/ratio for each alternative.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>2009 Costs</th>
<th>Cost/yr (20yrs)</th>
<th>Storage</th>
<th>Efficiency</th>
<th>CIR(in)</th>
<th>Acres Served</th>
<th>Inc/acre</th>
<th>Total Inc/yr</th>
<th>Benefit/Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative A</td>
<td>$39,213.41</td>
<td>$3,418.80</td>
<td>563</td>
<td>45.00%</td>
<td>10.08</td>
<td>301.61</td>
<td>$55.00</td>
<td>$16,588.39</td>
<td>4.9</td>
</tr>
<tr>
<td>Alternative B</td>
<td>$54,926.62</td>
<td>$4,788.75</td>
<td>563</td>
<td>45.00%</td>
<td>10.08</td>
<td>301.61</td>
<td>$55.00</td>
<td>$16,588.39</td>
<td>3.5</td>
</tr>
<tr>
<td>Alternative C</td>
<td>$805,860.68</td>
<td>$70,258.61</td>
<td>1,057</td>
<td>45.00%</td>
<td>10.08</td>
<td>566.25</td>
<td>$55.00</td>
<td>$31,143.75</td>
<td>0.4</td>
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</tbody>
</table>

This benefit/cost analysis shows that Alternative A and Alternative B have a benefit/cost ratio greater than one, which means that it would be an economically feasible project. Alternative C on the other hand, has a benefit/cost ratio less than one, which would mean that it would not be economic feasible. However, this analysis is only from a single agricultural perspective. Benefits from storage can often be more than what can easily be calculated. Timing of irrigation or stock water can prove to be extremely valuable to a particular operation. Late season irrigation water for fall pasture or timely irrigation of a hay crop when direct flows are at a minimum are some examples. Also, storage may prove beneficial to interests other than agricultural, such as providing more stabilized flows in the system for fisheries or wetland habitat.

**NEXT PHASE OF STUDY**

It would be Rio Verde’s recommendation that for Alternatives A and B that no further study be performed. The permitting, coordination, plans and specifications, and inspection are simple and straightforward tasks. However, if Alternative C is selected as the preferred alternative, then the tasks for the next phase of study will be as follows:

1. Meet with USFS.
2. Perform site geology.
3. Perform soil studies on borrow area.
4. Provide full design with specifications.
5. Obtain Special Use Permit.
6. Develop operating plan.
7. Develop EA.
   a. Archeology.
   b. Endangered Species.
   c. Migratory Birds.
   d. Wetlands – 404 Permit.
   e. DEQ approval.
   f. Mitigation.
10. Work with USFS on NEPA process.
11. Continue all above items until permit to construct is issued by USFS.
12. Bid project.
13. Contract administration, inspection, construction staking, and testing.

For the above tasks and scope of work the estimated cost of engineering is $74,590.00, permitting and mitigation is $150,000.00, construction is $445,900.00, and contingency is $73,573.50.

**CONCLUSIONS**

Boulter Lake Reservoir was constructed in the early 1920’s for water storage for water right holders on the East Fork River. The Boulter Lake Dam failed in 1969 and was later rehabilitated in 1973. After reconstructions, vandals damaged the slide gate making it unusable. From that time, little care has been given to the maintenance and upkeep of the dam. As far as the Forest Service is concerned, the Association needs to use the dam and water or lose it. In either case – repair or return, the Association may be required to
cover the costs of stabilization and rehabilitation. New Special Use Permits and Operating Agreements need to be completed and filed with the Forest Service.

Three alternatives have been presented with plans and associated costs. The three choices cover a band-aid approach on the economical side to a full blown enlargement. The two lower cost alternatives provide the highest benefit cost ratio. The third and highest cost alternative cannot be supported by agriculture alone. Other beneficial uses for the water will be required for purpose and need to justify enlargement of the dam.

In our opinion, Alternative B needs to be completed to restore the dam to a useable condition. This alternative provides the best long term solution for the life of the existing dam. Care needs to be given in the drafting of the Operating Agreement to insure that maintenance and upkeep of the rehabilitated dam is ongoing. Justification for this approach is clear and convincing from an economic standpoint. Any time that we can store water for agricultural use in a manner that is economically beneficial, all efforts should be made to make sure that it happens. Alternative C cannot be supported by agriculture and is unlikely to be supported by the East Fork Irrigation Association. That is not to say, however, that Alternative C is not a feasible project if it is supported by other multiple use interests.

SCOPE ALTERATION

When the RVE Team was selected for the Boulter Lake Enlargement, Level II Study, the WWDC added the Proposed Scope Alteration to the project scope. The Scope Alteration was to provide an inventory of the existing system and analysis of the potential needs for rehabilitation of the downstream irrigation system for users of Boulter Lake storage water diverting from the East Fork River. At the end of the scoping meeting, discussion of the proposed inventory was discussed with Norm Ritchie. At that time we noticed some resistance from Mr. Ritchie. In trying to set up to perform the inventory, the RVE Team was told that they did not need the inventory performed. Consequently, the RVE Team did not work on the Scope Alteration.
March 24, 1992

Fast Park Irrigation Association
C/o Jep Richie
Boulder, WY 82923

RE: Boulter Lake Reservoir, Permit No. 6316 RBS

Dear Mr. Richie,

Enclosed is a copy of the Wyoming Dam Inspection Report describing the conditions of the Boulter Lake Reservoir dam that were observed during the recent inspection of this reservoir. This inspection was done as part of the Periodic Dam Inspection Program authorized by the Wyoming Safety of Dams Law (W.S. 41-3-307 through 41-3-318). We stress that the recent inspection was only a visual inspection and that no detailed engineering investigations or analyses were done during the inspection. We urge you to frequently inspect and monitor the conditions of your dam. If questionable or unusual conditions develop, promptly notify this office and/or the Forest Service.

In general, the dam appeared to be in good condition during the inspection and no restrictions upon storage of water in the reservoir are warranted, at this time. We recommend maintenance work to address the following conditions:

1. There is some settlement within the rock fill on the upstream slope of the dam and on the crest near the rock wall. The low areas should be filled and monitored for additional settlement.

2. The handwheel on the outlet gate turns freely, but the gate doesn't appear to move. The gate should be checked and repaired, as necessary.

3. Erosion is occurring in the spillway. Efforts have been made in the past to control this erosion by placing a concrete cap on the rock wall in the center of the spillway. Additional work of this type should be done to control the erosion; however, the freeboard (the difference in elevation between the spillway crest and the top of the dam) must remain at 5' or more.
4. Several trees, driftwood, and other debris has floated into the spillway. This material should be removed from the spillway.

5. The seepage below the dam should be monitored.

If you have any questions concerning the matters mentioned in this letter, the enclosed report, or any other aspect of the Safety of Dams Program, please feel free to contact this office.

Thank you in advance for your cooperation.

Sincerely,

[Signature]

Russell Dahlgren
Asst. Safety of Dams Engineer

Enclosures

cc: -Rich Kennedy, Engineer US Forest Service, Forest Service Building, P.O. Box 1388, Jackson, WY 83001
- John Teichert, Superintendent Water Division Four
- Bob Johnson, Water Commissioner, Pinedale, WY
# Wyoming Dam Inspection Report

**Date:** 3-20-94

**Name of Dam:**<br>**Location:**<br>**Owner:**<br>**County:**<br>**Subsidiary:**

**Address:** 1111 Main St, Cheyenne, WY 82001

**Notices:**<br>**Date:** 3-20-94<br>**City:** Cheyenne<br>**State:** WY<br>**Zip Code:** 82001

**Type:**<br>**Number:**<br>**Location:**

**Height:**<br>**Significance:**<br>**Year:**

**Length:**<br>**Capacity:** (cubic yards)<br>**Bedrock:**

**Debris:**<br>**Actual:**<br>**Estimated:**

**Note:**

**EVALUATION CRITERIA**

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*Please note: The evaluation criteria listed above are for internal use only and may not be applicable to all dam inspection procedures.**
Wyoming Dam Inspection Report

Name of Dam: ___________________________ Date: ___________________________

State: WY, District No.: 7

County: __________ Location: __________ Recl: __________

Section: __________ Township __________ Range: __________

Type of Dam: __________ Contact: __________ Notes: __________

Estimated Capacity: __________ Capacity: __________

Estimated Height and Crest Level: __________ Elevation: __________

Source: Stream Dam located on water supplied from - including dam and reservoir construction.

Printed Pattern: __________ Notes: __________

Estimated Spillway Width: __________

Estimated Functional Spillway to Be Used: __________

Sign and Type of Control: __________ (Manual or Automatic). __________

Location: (Section, Township, Range, Elevation) __________

DIRECTIONS: Mark an ‘X’ in the Yes or No column and circle the word or phrase which applies. Use check mark to completely describe or explain condition as materialized from the program below. Fill in all blanks. If applicable enter N/A or Non-Applicable space.

Yes  No

1. Are there trees or other objects on the dam that prevent access to any necessary dam maintenance?

2. Is there erosion or movement of material on the upstream face that affects the integrity of the dam?

3. Are there cracks, holes, or erosion on the upstream face that prevent access to any necessary dam maintenance?

4. Are there cracks, holes, or erosion on the downstream face that affect the integrity of the dam?

5. Are there trees or other objects on the upstream face that prevent access to any necessary dam maintenance?

6. Are there trees or other objects on the downstream face that prevent access to any necessary dam maintenance?

7. Are there trees or other objects on the embankment that prevent access to any necessary dam maintenance?

8. Are there objects on the embankment that affect the integrity of the dam?

9. Are there objects on the embankment that prevent access to any necessary dam maintenance?

10. Are there objects on the embankment that affect the integrity of the dam?

N/A
The diagram shows the layout of the area with labels indicating different sections and directions. The key points are marked with arrows and numbers, indicating the scale and orientation. The legend is not clearly visible, but it seems to provide information about the map's features. The map includes a north arrow to indicate the direction. The purpose of the diagram is likely to show the location of certain points of interest or areas within a larger region.
Local Time: __________

Duration: __________

Location: __________

Date: __________

Time: __________

Estimated Depth (ft): __________

Estimated Duration (h): __________

Source (Dam, Reservoir, or other): __________

Rating: __________

Estimated Spillway Width: __________

Estimated Flow Rate (cfs): __________

Size and Type of Outlet Pipe: __________

Direction: __________

Reason: __________

Note: __________
APPLICATION
for
GROUP ENTERPRISE ASSISTANCE

TO: Soil Conservation District

Placedale, Wyoming

We (I) the undersigned, representative(s) of an organized group of farmers and ranchers hereby apply for technical assistance in planning and carrying out the following group enterprise:

1. Location of proposed work: Section 24 - T. 32 R. W. 103 W. 6th P. M.

2. Kind of project: Repair and Improvement of Squaw Lake Reservoir


4. The project will accomplish: Provide storage water for irrigation purposes for eleven ranchers.

5. __________________ of the farms and ranches involved now have Conservation Plans developed with your District.

6. We propose to finance this project by: With State or Federal assistance.

7. We desire to complete this project not later than: Dec. 1970

Name of Group: Luskford Reservoir Association

Date: ________________________

By: ________________________

Name: ________________________
Signature: ____________________

Name: ________________________
Signature: ____________________

Name: ________________________
Signature: ____________________

Name: ________________________
Signature: ____________________

Name: ________________________
Signature: ____________________
It is agreed that the Soil Conservation District will:

1. Furnish technical service to plan, layout, and supervise construction of the work to the extent that such technical services is available to the District.

2. ______________________________________________________________________

It is understood that the undersigned applicants will:

1. Obtain necessary right of way, water rights, and meet any other legal requirements.

2. Provide for the necessary materials, equipment, and labor to complete the work.

3. Maintain all work carried out under this agreement in a manner satisfactory to the District governing body.

4. Encourage adoption of soil and water conservation practices in accordance with the Soil Conservation District work plan on lands affected by this proposed work.

5. ______________________________________________________________________

It is mutually understood that:

1. Any work planned as a result of this agreement may be changed at any time by the consent of both parties.

2. Neither the Soil Conservation District nor the undersigned applicants shall be liable for any damage to property belonging to the other resulting from the carrying out of this proposed job, except damages caused by negligence or wilful misconduct. The enterprise will protect and save harmless the District from all claims or damages to persons or property resulting from work done in accordance with the plan.

Signatures of Applicants:

[Signatures]

Approved and agreed to:

BY: ____________________________
(Chairman)

Soil Conservation District

[Signature]
(Date)
C. M. Jackson
Carrie Jackson
Pharmacist
R. W. Surry
D. H. Surry

R. H. Laughter
L. H. Laughter

R. D. Laughter
L. D. Laughter

T. B. Maloney
T. B. Maloney

E. E. Rogers
E. E. Rogers

J. M. Rogers
J. M. Rogers

E. C. Coster
E. C. Coster

J. S. Price
J. S. Price

Frank Faye
Frank Faye

V. E. Wilborn
V. E. Wilborn

68.78
SPECIAL USE PERMIT

W. E. McHie, Secretary-Treasurer, Big Horn, Wyoming

The following undersigned, Peter L. Dyer, operator, issue in - 10 E. - B. A.

The purpose of issuing upon behalf of Dyer Excavations, is to remove

of the land on which lie subject to the terms of the Special Use Permit, as follows:

1. The permittee shall pay to the Secretary of the Interior, or such officer as he or she may designate, for the

of the permit, the sum of $100.00 per year, payable in advance, on or before January 1 of each year.

1. The permittee shall comply with the regulations of the Department of Agriculture, including the National Forest, and shall keep all permit restrictions and regulations applicable to the permit. The permittee shall keep the permit in a safe and secure condition and expose all permit and permit restrictions and copies as required by the Forest Service.

2. This permit is subject to all existing laws, rules, and regulations.

3. The permittee shall use all reasonable care in the transportation of the materials and equipment of the

250 acres.
1.  This permit confers no right upon the permittee or any of the users involved and shall be subject to approval of the State if the work is to be covered with earth.

2.  All costs to be charged will be charged to timber price, except that such timber may be used free of charge in the construction of same.

3.  This approval is conditioned upon the approval of the State Water and Fish Commission and that of the State Engineer.

4.  The Government will not be responsible for any damage done by the breaking of the dam and the permittee will be responsible to actual damages for any damage that may result to Government property through such breakage of same.

5.  This permit will be subject to the control of the Federal Forester, in which event the permittee agrees to remove the dam and fill in the cut and restore the lake back to its normal water levels.

6.  All borrow pits will be graded off and left in finished condition.