SYNOPSIS REPORT

MIDDLE FORK POWDER RIVER
DAM AND RESERVOIR PROJECT

1986
TABLE OF CONTENTS

SYNOPSIS REPORT

MIDDLE FORK DAM AND RESERVOIR PROJECT

<table>
<thead>
<tr>
<th></th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Proposed Configuration</td>
<td>1</td>
</tr>
<tr>
<td>II. Proposed Operation</td>
<td>3</td>
</tr>
<tr>
<td>III. Storage Permits, Option Agreements</td>
<td>4</td>
</tr>
<tr>
<td>IV. Potential Industrial Use</td>
<td>9</td>
</tr>
<tr>
<td>V. Potential Agricultural Water Supply Uses</td>
<td>13</td>
</tr>
<tr>
<td>VI. Recreational Benefits</td>
<td>15</td>
</tr>
<tr>
<td>VII. 404 Permit -- Key Issues</td>
<td>16</td>
</tr>
<tr>
<td>VIII. Conclusions</td>
<td>18</td>
</tr>
<tr>
<td>IX. Recommendations</td>
<td>22</td>
</tr>
</tbody>
</table>

PROPERTY OF
WYOMING WATER RESOURCES CENTER
13th AND LEWIS STREETS
LARAMIE, WY 82071-3067
(307) 766-2143
Synopsis Report
Middle Fork Dam and Reservoir Project

I. Proposed Configuration

A. Reservoir

The Middle Fork Reservoir will have a total capacity of 59,600 acre-feet, of which 47,700 acre-feet will be active storage for water supply and the remaining 11,900 acre-feet will be for the purposes of fisheries and recreation (minimum pool). The active storage for water supply will conform to active capacities of the two water storage permits (Nos. 7548R and 7549R) on file in the State Engineer's Office (SEO).

The minimum pool has been established as 20 percent of the total storage volume in accordance with Wyoming Game and Fish Department guidelines for fisheries and/or recreation. A new SEO water storage permit will be filed to increase the minimum pool from the permitted amount of 1,867.5 acre-feet (dead storage in Permit 7549R) to 11,900 acre-feet.

The Middle Fork Reservoir will accumulate significant quantities of sediment. Sediment accumulations in the reservoir in 50 and 100 year periods are estimated to be about 5,700 and 11,200 acre-feet, respectively.

B. Dam

A zoned embankment dam section has been selected for the proposed project. The section was designed to make efficient use of available construction materials from required excavation and from borrow areas near the site.

The dam crest will be 30 feet wide and approximately 2,200 feet long. The crest elevation is 5049 feet which provides a freeboard of 1.7 feet above maximum water level which would be reached under the Probable Maximum Flood condition. The embankment slope is 2.5H:1V on the upstream face of the dam. The downstream slope is 2.25H:1V in the central valley and steepens to 2H:1V on the abutments. The maximum height of the dam is approximately 190 feet, measured from the bottom of the core trench in the central valley, and will involve 2.3 million cubic yards of fill.

C. Outlet Works

The outlet works will be a multi-purpose facility that will be used for diversion during construction and for release of water supplies and flood flows during project operations. The outlet works are located at the base of the right abutment. The alignment generally parallels the valley walls so that the entire structure is founded on rock.
During operation of the reservoir, the outlet works will be able to pass the 100-year flood (peak reservoir inflow = 3,450 cfs) surcharging the reservoir less than one foot at the top of the active storage level. The design capacity of the outlet works is 1,800 cfs.

D. Emergency Spillway

The emergency spillway is located on the right abutment of the dam. The emergency spillway has been sized to pass the Probable Maximum Flood (PMF) which has a peak inflow of about 160,000 cfs and 4-day volume of 321,000 acre-feet. The emergency spillway will consist of a 500 foot-long shotcrete-lined approach channel, a crest structure, a 300-foot long lined channel section, and a 3,200-foot inclined channel section. The concrete ogee crest structure will have a crest elevation of 5032 feet and a length of 700 feet. The crest will be eight-feet above the approach channel level.
II. Proposed Operation

A. Storage/Yield Relationship

The Middle Fork Dam and Reservoir will be operated to provide water for three specific purposes; industrial uses, irrigation, and the maintenance of stream flows in the stretch of the Middle Fork below the dam and above the confluence of the Middle Fork and the Red Fork.

Based on forty years of record, the firm annual yield of the reservoir is estimated to be 27,000 acre-feet. There is 5,000 acre-feet of additional yield available 9 years out of 10. Reservoir capacity and yield is allocated as follows:

<table>
<thead>
<tr>
<th>Use</th>
<th>Capacity Required</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation Pool</td>
<td>11,900</td>
<td>0</td>
</tr>
<tr>
<td>Industrial</td>
<td>16,700</td>
<td>15,000</td>
</tr>
<tr>
<td>Agriculture (Powder River</td>
<td>5,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Reservoir Corporation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WWDC Reserve</td>
<td>2,050</td>
<td>1,500</td>
</tr>
<tr>
<td>Minimum Flow</td>
<td>10,000</td>
<td>6,500</td>
</tr>
<tr>
<td>Agriculture (non-firm)</td>
<td>13,950</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>59,600</td>
<td>32,000</td>
</tr>
</tbody>
</table>

The flow of the Red Fork degrades the water quality of the Middle Fork such that the only viable stream fishery is limited to the six stream miles downstream of the dam to the confluence of the Red Fork. Therefore, water released from storage for purposes of minimum flows could be retrieved just upstream of the Red Fork confluence. This would increase the industrial yield of the reservoir by 6,500 acre-feet, minus conveyance losses.
III. Storage Permits, Option Agreements

A. Summary of Reservoir Permits

<table>
<thead>
<tr>
<th>Permit Number</th>
<th>Priority Date</th>
<th>Active Storage</th>
<th>Inactive Storage</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>7548R</td>
<td>1940</td>
<td>41,110</td>
<td>0</td>
<td>Industrial 30,945.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Irrigation 10,164.7</td>
</tr>
<tr>
<td>7549R</td>
<td>1970</td>
<td>6,606</td>
<td>1867.5</td>
<td>Industrial 5,161</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Irrigation 1,445</td>
</tr>
<tr>
<td>N/A</td>
<td>1986</td>
<td>10,017</td>
<td>0</td>
<td>Designated as</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>conservation pool, but</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>permitted for recreation,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>irrigation and industrial</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>use</td>
</tr>
</tbody>
</table>

B. Summary of PRRC Agreement

Reservoir permits 7548R and 7549R are owned by the Powder River Reservoir Corporation, an organization of irrigators under the Sahara Ditch. In return for transfer to the state of the reservoir permits, lands owned by PRRC in the project area, and engineering and environmental studies paid for by PRRC, the state proposes to:

1. Pay the outstanding debts of the PRRC (debts were incurred to purchase lands, pay for engineering and environmental studies, and to secure legal services.)

2. Provide PRRC with 4,000 acre-feet of firm yield annually at a cost of $3.00 per acre-foot. PRRC is also eligible, along with other irrigators, to purchase non-firm yield when water is available.

3. Pay PRRC $50,000 for the option to acquire the permits. This option contract details the conditions for the transfer of PRRC assets to the state, and the sale of water to PRRC.

Provisions of the option contract to acquire the permits will be the subject of a public hearing and must be approved by the Governor.

C. Summary of Exxon Agreement

Exxon has a contract with PRRC under which Exxon lent money to PRRC for land purchase and engineering studies. In return, Exxon was to receive the industrial yield when the reservoir was constructed. During ongoing negotiations, the WWDC has proposed to give Exxon a first right of refusal on 15,000 acre-feet of firm yield at the dam outlet works and 6,500 acre-feet of storage that could be diverted just upstream of the Red Fork confluence.
In return, Exxon will pay a readiness-to-serve charge to the state and agree to meet any third-party offer or relinquish their claims to project yield. It is anticipated that the eventual sale of the industrial yield of the project will recoup a major portion or all of the state's capital investment. In addition, revenues generated by annual readiness to serve charges would more than offset normal operation and maintenance expenses.

The tentative Exxon/WWDC agreement would not only serve to recognize Exxon's contributions in maintaining the viability of the permits and the corporation's current position in the project but would also provide the avenue to open the market for industrial water sales to other potential purchasers.

D. Discussion -- Yellowstone Compact

The Powder River Reservoir Corporation holds permit numbers 7548R and 7549R to construct a reservoir on the Middle Fork of the Powder River -- the permits the Commission is attempting to acquire. If the reservoir described in the permits is constructed and an appropriation of water is perfected in accordance with the permits, certificates of appropriation can be applied for and issued for the quantity of water covered by each permit. The priority of the appropriations will date from the filing of the underlying applications for the permits. Permit number 7548R covering 41,100 acre-feet was applied for March 7, 1940 and permit number 7549R covering 8,473.5 acre-feet was applied for December 19, 1970. Both permits were issued October 19, 1973. From a Wyoming water law standpoint, if those two permits are used to construct a dam on the Middle Fork, 41,100 acre-feet of water can be stored annually with a March 7, 1940 priority and 8,473.5 acre-feet of water can be stored annually with a December 29, 1970 priority.

The Powder River, of which the Middle Fork is a tributary, is an interstate stream rising in Wyoming and flowing into Montana. It is one of the interstate tributaries of the Yellowstone River apportioned by the Yellowstone River Compact. That compact was entered into in 1950 by the states of Montana, North Dakota and Wyoming and basically apportions the waters of the Yellowstone River and most of its interstate tributaries not allocated previously by the various state laws. Because the compact covers the waters of the Middle Fork of the Powder River, there has been some concern about the affect the compact has on the Middle Fork Dam if built with permit numbers 7548R and 7549R.

There are basically two compact issues to consider: the affect a reservoir built with the two permits will have on Wyoming's allocated share of the Powder River and the compact's affect on the trans-basin diversion of the waters stored in the reservoir out of the Yellowstone River basin. Neither issue prevents the construction of the Middle Fork dam using the two permits. The first issue involves Article V of the compact. That article provides in part:
(a) Appropriative rights to the beneficial uses of the water of the Yellowstone River system existing in each signatory state as of January 1, 1950, shall continue to be enjoyed in accordance with the laws governing the acquisition and use of water under the doctrine of appropriation.

(b) Of the unused and unappropriated waters of the interstate tributaries of the Yellowstone River as of January 1, 1950, there is allocated to each signatory state such quantity of that water as shall be necessary to provide supplemental water supplies for the rights described in paragraph (a) of this article V, such supplemental rights to be acquired and enjoyed in accordance with the laws governing the acquisition and use of water under the doctrine of appropriation, and the remainder of the unused and unappropriated water is allocated to each state for storage or direct diversions for beneficial use on new lands or for other purposes as follows:

(iv) Powder River (including the Little Powder River)

(A) To Wyoming . . . forty-two percent (42%)
To Montana . . . fifty-eight percent (58%)

(B) The point of measurement shall be below the last diversion from the Powder River above its junction with the Yellowstone River.

The second issue involves Article X of the compact. That article provides in part:

No water shall be diverted from the Yellowstone River basin without the unanimous consent of all the signatory states . . .

The affect Article V has on the Middle Fork Project is that, if permit 7548R is not considered a pre-compact appropriative water right, the entire 49,573.5 acre-feet stored with the two existing permits, to the extent it is consumed or transferred out of the Yellowstone River basin, will count against Wyoming's compact share. If permit 7548R is, as Wyoming insists, a pre-compact water right, the 41,100 acre-feet covered by that permit will not count against Wyoming's compact allocation. Of course, Montana questions the pre-compact status of permit 7548R. In any event, Wyoming's remaining allocation is sufficient to allow the construction of the Middle Fork Reservoir in its currently proposed configuration and the potential priority of permits 7548R and 7549R will insure its yield under Wyoming water law.
The effect Article X has on the Middle Fork Project again hinges on whether permit 7548R is pre-compact water right. If it is a pre-compact water right, the 41,100 acre-feet it covers can be transferred out of the Yellowstone River basin without seeking the unanimous consent of the three compact states. On the other hand, if it is not considered a pre-compact water right, the provisions of Article X must be adhered to in order to transfer that water out of basin. In either case, Article X does not preclude the trans-basin diversion of any of the water that may be stored in the Middle Fork Reservoir.

The Yellowstone Compact does not preclude the construction of the Middle Fork Reservoir using permits 7548R and 7549R. After all, along with the desire to remove all causes of future conflict between themselves, the various states entered into the compact to promote the beneficial use of water in the various states. In the final analysis, if permit 7548R is a pre-compact water right, that can be considered a "plus" for the project; if it is not, that is not necessarily a "negative" for the project because there remains sufficient unallocated water in the Powder River to allow it. Further, the compact does not preclude the use of its water out of basin if that is ultimately desirable.

E. Discussion -- Water Rights

Aside from the possible effects the compact may have on the Middle Fork Project, the potential effect the state's water right abandonment laws might have on the Middle Fork Reservoir has been a concern to some. Like any other water right under Wyoming's prior appropriations doctrine, a storage right is subject to abandonment for failure to beneficially use the water for the purpose it is appropriated. Storage in itself is not generally considered a beneficial use which prevents abandonment.

Although subject to abandonment for nonuse, there are procedures provided in the abandonment statutes that can be used to forestall the abandonment of reservoir storage water rights. Reservoir water rights like other water rights are subject to abandonment if they are not beneficially used for five successive years when the water was available for such use. In 1977, however, the legislature added language to the abandonment laws that allowed the holder of a reservoir right to apply to the Board of Control for an extension of time in which to apply the water to beneficial use. The Board can grant the extension for a period not to exceed five years if the holder of the water right "demonstrates the exercise of due diligence toward the utilization of the appropriation, reasonable cause exists for nonuse. Reasonable cause includes, but is not limited to delay due to court or developing, financing and constructing projects for the application of stored water to beneficial use which require in excess of five (5) years to complete, delay due to requirement of state and federal statutes and rules and regulations thereunder and any other causes beyond the control of the holder of the appropriation." (emphasis added) W.S. 41-3-401 (1977). The Board can grant additional extensions of not more than five years.
In the end, if the holder of the Middle Fork Reservoir storage water rights is unable to use the water stored, or a portion thereof, for five years, that does not necessarily leave the water right vulnerable to abandonment. The water right holder can get an extension of time in which to use the water if he can show the requisite diligence. The time extension provisions should ease the minds of those concerned about the potential abandonment of the storage water right associated with the Middle Fork Reservoir once it is constructed. Those liberal provisions do not, however, completely foreclose the possibility that a storage right would be abandoned; they are of no help to the unwary who fail to exercise the requisite diligence or who fail to take advantage of them in a timely manner.
IV. Potential Industrial Use

The basic philosophy of the WWDC has been to evaluate the Middle Fork project to determine if the project would provide a sufficient industrial firm yield that could be marketed at a price that would offset development costs, while maintaining a reservoir operation that could provide additional water to agriculture and provide a quality reservoir fishery.

In order to get an indication of potential industrial users, the WWDC requested that the Economic Development and Stabilization Board provide information regarding energy development that could be served by the Middle Fork project. Enclosed is a map and legend denoting the locations of energy development in the area.

Review of the map indicates that industry would either have to transport water to the energy resource or the energy resource to the water. At this point in time, it would be best to assume that the water would be transported to the energy resource. The transportation costs would add to the overall water supply costs for the potential industrial user. In 1984, Harza Engineering Company, at the direction of WWDC, estimated the costs of conveying Middle Fork storage to Gillette and the North Platte basin. The estimates indicated that development of a transmission system to Gillette would cost $107,700,000 with operation and maintenance costs approximating $1,660,000 per year. The costs to transport water to the North Platte basin were estimated at $79,200,000 with annual O&M costs of $2,040,000. It should be noted that these estimates were based on 1984 construction costs and prices would probably escalate until the facilities were constructed.

Review of the map also denotes that the majority of the energy development is outside the limits of the Yellowstone River basin. Therefore, the trans-basin issues of the Yellowstone Compact become very important to the marketability of the water.

In order to evaluate potential industrial use of Middle Fork storage, alternate water supplies should also be considered. The Level I report prepared for the WWDC in 1983 identified, analyzed, and compared several water development options such as reservoirs on Crazy Woman Creek and Clear Creek. The information presented in the report indicated that the Middle Fork project was the most efficient project when considering project yield and development costs. In addition, the storage alternatives in the lower basin would have greater impacts on water quality than the Middle Fork project and would also require costly transmission systems to serve industrial users. The WWDC also evaluated water development opportunities in northeast Wyoming. The report concluded that while there may be feasible development in the form of small projects for a limited number of beneficiaries, large development projects did not appear feasible. It has been suggested that Texaco's Lake DeSmet project could compete with the Middle Fork project in the water sales market. However, it appears that if Texaco were interested in selling its Lake DeSmet water supply, it would want to include its mineral rights in the sale. This would make the DeSmet
supplies less attractive as an industrial supply for a Gillette area project.

It appears that initially the primary competition in the water sales market would come from groundwater. The recently shelved Hampshire Energy Project near Gillette proposed to develop groundwater sources for its water supply. This proposed project's water supply was to consist of 15 groundwater wells in the Lance Fox Hills Formation (approximate depth 3750 feet). The anticipated yield of the well field was 6500 acre-feet per year. The anticipated construction cost was estimated to be $6,000,000. While groundwater appears to be more economical in terms of initial capital investment; limited groundwater supplies, pumping costs, and potential aquifer depletion may restrict or eliminate the use of groundwater for future projects.
ENERGY DEVELOPMENTS IN THE AREA OF THE MIDDLE FORK PROJECT
LEGEND

ENERGY DEVELOPMENTS IN THE AREA OF THE MIDDLE FORK PROJECT

1. Black Hills Bentonite Mine
2. Black Hills Bentonite Mine
3. Black Hills Bentonite Mill
4. Triton Coal Buckskin Surface Mine
5. Carter Rawhide Surface Coal Mine
6. Fort Union Surface Coal Mine
7. Amax Belle Ayr Surface Coal Mine
8. Carter South Rawhide Surface Coal Mine
10. Kerr-McGee Clovis Point Surface Coal Mine
11. Wyodak Surface Coal Mine
12. Carter Caballo Surface Coal Mine
13. Mobil Caballos Rojo Surface Coal Mine
14. Cordero Surface Coal Mine
15. Anaconda Coal Creek Surface Coal Mine
16. Kerr-McGee Jacobs Ranch Surface Coal Mine
17. Thunder Basin Black Thunder Surface Coal Mine
18. Triton North Rochelle Surface Coal Mine
19. North Antelope Surface Coal Mine
20. Rochelle Surface Coal Mine
21. Antelope Surface Coal Mine
22. Glenrock Dave Johnston Surface Coal Mine
23. Everest Mineral In-situ Uranium Mine
24. Lake DeSmet Coal Deposit
25. Coal Slurry Line
26. Westrans Slurry Line
V. Potential Agricultural Water Supply Uses

The Middle Fork reservoir could serve to supply supplemental water to 5,700 acres presently irrigated by the Sahara Ditch (21 operators) and 600 acres presently irrigated by existing ditches below the proposed dam and above the Sahara Ditch.

Surveys were undertaken to identify potential new agricultural uses in the Middle Fork valley. The surveys indicated the possibility of developing 1,500 acres of new lands. The 1,500 acres would be divided between Middle Fork ditches (300 acres) and an enlargement of the Sahara Ditch (1,200 acres).

A break even ability to pay analysis was performed to provide an indication of the benefits that could be achieved by the agricultural users if the project was implemented. The analysis estimated that irrigators could pay approximately $26.00 per acre-foot for supplemental water. However, the ability to pay for water for new lands would be considerably less due to costs associated with additional conveyance systems and preparing the lands to receive water.

As noted in subsection III B of this report, through preliminary negotiations with the Powder River Reservoir Corporation for procurement of reservoir permits, the price for agricultural water has tentatively been established at $3.00 per acre-foot. Those irrigators which are not members of the PRRC would also be provided the opportunity to purchase water at this price. The WWDC has set aside a reserve of 1,500 acre-foot of firm yield. The purpose of this reserve is to provide assurance that water commitments can be made given the fact that mother nature does not have a computer. However, after the project has been operated long enough to develop a yield history, the reserve could be marketed. In addition, the 5,000 acre-foot of water that will be available 9 years out of 10 is earmarked for agricultural purposes.

Water stored under the 1940 permit predates the 1945 priority of the second cfs provision. Under Wyoming water law, the reservoir may legally take water for storage under the 1940 permit. This will reduce surplus water on the stream, but will not adversely affect irrigated agriculture. In fact, the Middle Fork Reservoir will enhance agricultural productivity by making late-season water available on a regular basis.

Annual crop irrigation requirements in the Middle Fork Valley are about 1.6 acre-feet/acre. At a diversion of 1 cfs/70 acres over the growing season, 3.8 acre-feet/acre would be diverted, yielding an irrigation efficiency of 42 percent, which is typical of conditions such as those on the Middle Fork.

A prime reason for the diversion of surplus water is to take all the water possible when available. By diverting more water than necessary to satisfy crop irrigation requirements, irrigators build up soil moisture. Irrigators hope that the built-up soil moisture will
sustain plant growth later in the season when no water is available for diversion. In areas with sandy and gravelly soils and during hot, dry summers of low runoff, crops will usually suffer late season stress even with heavy soil saturation in the spring.

The construction of Middle Fork Reservoir will help eliminate late season water shortages. Instead of over-diverting in the spring, irrigators could divert their 1 cfs/70 acre appropriations with the knowledge that reservoir water will be available to meet late season needs. A more proper seasonal water application rate will not only enhance crop yield but will also offer side benefits such as reduced river salinity. Though the Middle Fork Reservoir may reduce the surplus water available on the river in the spring, the benefits of late season water should more than offset the loss of the surplus water during spring runoff.
VI. Recreational Benefits

A. Reservoir Fishery

The Wyoming Game and Fish has advised that the Middle Fork Reservoir would be a high quality reservoir fishery provided that a minimum pool, a boat ramp, and an access road to the boat ramp is provided. The reservoir could support 88 pounds/acre of trout and provide up to 7,260 fisherman days of use per year. The reservoir could supply fishery benefits of approximately $210,000/year.

B. Stream Fishery

The Middle Fork Reservoir will inundate 12.5 stream miles and 1,625 stream habitat units. The Wyoming Game and Fish has advised us that it will be difficult to replace the lost stream habitat with a fishery downstream of the dam. The only suitable stream fishery below the dam is above the confluence of the Red Fork. The flow of the Red Fork degrades the water quality of the Middle Fork such that the only potential fishery is limited to the six stream miles immediately below the dam. In addition, the property adjacent to the stream is privately owned; therefore, it would be difficult, if not impossible to obtain public access to the stream fishery.

C. Other

The Wyoming Recreation Commission was requested to analyze the recreational benefits that could be achieved by the Middle Fork Reservoir. The WRC concluded that the reservoir could provide recreational benefits; however, "unless Middle Fork would provide an outstanding fishery, use should be encouraged at existing sites rather than building this new site."
VII. 404 Permit -- Key Issues

A. Water Quality

During the 1985 Legislature, Joint Resolution No. 4 was passed which initiated a cooperative effort to resolve problems associated with water resources development in the Yellowstone River basin by the states of Wyoming and Montana. On October 25, 1985, representatives of Wyoming and Montana held the first meeting to discuss issues and concerns. It was apparent that Montana's primary concern was water quality of the Powder River and the impacts of a Middle Fork Reservoir on that water quality. Irrigators in Montana advised that degradation of existing water quality could cause severe impacts to their operations.

The WWDC has been performing water quality impact analyses for the Middle Fork project. These analyses indicated that following construction of the Middle Fork Reservoir, TDS concentrations in the Middle Fork Powder River will be essentially unchanged from October to February, slightly increased (about 10 percent) in the spring (March-May), unchanged in June, and appreciably lower (10-20 percent) during the summer irrigation season (July-September). With the project, water quality will be improved during the summer irrigation season because of the large releases from storage for supplemental irrigation supply. This will benefit downstream irrigators. The analyses also generally indicates that after project construction, the TDS concentration at Moorhead will be slightly increased (3 to 14 percent) during October-May, unchanged during June and July, and slightly improved (4 to 6 percent) during August and September. The percentage change in Powder River water quality at Moorhead is generally small. However, the studies were scoped to determine if impacts would exceed Wyoming water quality standards and if impacts were a potential fatal flaw. While the studies indicated that Wyoming water quality standards would not be exceeded and that the impacts did not impair project feasibility, additional work will be required for the 404 Permit/Environmental Impact Statement process.

During the October 25, 1985 Montana/Wyoming meeting, it was decided that the WWDC and representatives of Montana would meet to discuss the water quality analyses performed to date. The meeting will also serve to obtain input from Montana. The meeting will be helpful in determining the scope of studies needed for the environmental impact statement.

B. Archaeology

The Office of the Wyoming State Archaeologist has completed the cultural resource surveys on project lands. Eight-six (86) potential archaeological sites have been located. Eleven (11) of these sites have been tested. The tested sites were located in those areas which would be impacted by construction. Two (2) additional sites within the construction impact area will require testing. Of the eleven (11) sites tested, three (3) sites were cleared, while the remaining eight (8) were identified as candidates for mitigation. Mitigation within
the construction impact area is typically allowing removal of arti­facts prior to construction. The best estimate available to date indicates that the costs for mitigation could be $750,000.

The remaining seventy-five (75) sites are in the reservoir area. Seventeen (17) of these sites were not considered eligible for addi­tional investigations. The remaining fifty-eight (58) sites will require either a test program, a historic evaluation, surface col­lection, or photographic documentation. The estimated budget to perform this work is $600,000 to $800,000. In the reservoir area, the archaeological impacts can be mitigated by removal, protection, or inundation. Obviously, mitigation by inundation is less costly and would be the preference of the WWDC. However, there is the possibil­ity that mitigation by removal or protection may be required to meet federal requirements. Assuming that the percentage of candidates for mitigation are the same in the reservoir area as they are in the construction area, mitigation could be required on as many as forty (40) sites. Costs to mitigate this many sites could approximate $4,250,000.

In summary, budgets of $600,000-$800,000 would be required to complete required testing programs in the project area. It may require $5,000,000 to mitigate impacts to archaeological sites to obtain the necessary federal permits.

C. Need

The federal permitting process addresses project benefits and impacts. Projects tend to be evaluated on the basis of need and mitigation of impacts. During the environmental impact statement process, it is unlikely that there will be an identified user for all of the project storage and yield. This could place added emphasis on mitigation of impacts.
VIII. Conclusions:

A. Narrative

The Middle Fork project is the most efficient surface water development project in the northeast corner of Wyoming. While the initial development costs are higher than originally anticipated, the Middle Fork would be the most economical surface water project in Northeast Wyoming. Therefore, it can be concluded that if industry has an interest in developing energy resources in the area, the Middle Fork project is the most viable surface water source.

If implemented in the manner outlined in this report, the project will provide secondary benefits in the form of agricultural water, a reservoir fishery, and flood control. Another secondary benefit is that constructing the project will strengthen Wyoming's position that the 1940 water right is a pre-compact water right and not subject to the limitations of the Yellowstone Compact. Therefore, implementing the Middle Fork project could serve to increase Wyoming's right to store water in the Powder River basin as 41,100 acre-feet of Middle Fork storage would not count against our compact allocation.

As previously discussed, the WWDC is negotiating with the Powder River Reservoir Corporation and Exxon to acquire the reservoir permits, project lands, etc. The purchase of water by PRRC and the proposed readiness to serve payments to be made by Exxon will generate sufficient income to the project to more than offset normal operation and maintenance costs until the industrial supplies are sold. The final purchase price for the industrial supply could offset both development and operation and maintenance costs.

Water development is becoming more costly. In addition there is a continuing trend to restrict the amount of developable water through the generation of federal regulations and requirements. The question, therefore, becomes what is an acceptable risk and how aggressive the water development program should be.

There are risks involved in the WWDC's implementation of the project. Of primary concern is the fact that presently there is not a defined user for the industrial yield. While secondary benefits are important, the project should not be constructed unless it is felt that the industrial water will be sold, put to beneficial use, and serve as a sound investment for Wyoming's future. The fact that there is not a defined user may cause problems in acquiring the necessary federal 404 permit as need for the project is a consideration in the 404/EIS process.

Another risk pertains to Wyoming water law and the fact that the WWDC will be put in a position of proving diligence until such time as the industrial water is put to beneficial use. In addition, the fact that the water will not have a defined use will make it more vulnerable to abandonment than if the use existed.
There is also the problem associated with sedimentation. The life of the project will be less than can be anticipated for the typical reservoir due to sediment accumulation. As previously noted, the minimum pool could be lost to sediment in 100 years. This could result in the future necessity to increase the height of the dam or dredge the reservoir to retain the long term recreation benefits.

The issue of the archaeological mitigation is a concern.

Another primary concern is the price that an industrial user would be required to pay for the water. A potential industrial purchaser would not only have to reimburse the State of Wyoming for development costs but would also have to pay the construction, operation and maintenance costs to provide a conveyance system to the ultimate point of use. Assuming this ultimate point of use will be in the area of Gillette, Wyoming; the water could cost as much as $1,000–$1400 per acre-foot. At this price, the Middle Fork project could find it difficult to compete in the water market with groundwater until such time as the groundwater resources in the Gillette area are committed.

B. Schedule

The following schedule was developed to sequence events in a manner that would minimize risk by limiting expenditures prior to receipt of a 404 Permit. As there is not an identified need for the project, it would be more cost efficient to insure a 404 permit was available prior to committing to the major expenditures required to prepare plans and specifications and to mitigate the archaeological sites.
Task

Archaeological
1. Testing - Reservoir Area
2. Development of State/Federal/MOA
3. Mitigation - Construction Area
4. Mitigation - Reservoir Area

Design
1. Diversion and Sediment Control
2. Road
3. Dam and Spillways

404 Process
1. Submit application
2. Water quality analyses
3. Draft/EIS
4. Public Review Process
5. Final EIS
6. Permit Procurement

Permits
1. Options on Reservoir Permits
2. Resolve Article X issues
3. DEQ - 401 Permit
4. SEO - Permit to construct

Land Acquisition
1. Appraisals
2. Negotiations
3. Purchases

Construction
1. Roads
2. Dam
C. Cost Estimates

1. Development Cost Estimates

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level II and III Costs</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Construction Costs (1985 Prices)</td>
<td>$43,500,000</td>
</tr>
<tr>
<td>Escalation to 1991 Costs (5%/year)</td>
<td>$14,800,000</td>
</tr>
<tr>
<td>Mitigation -- Archaeological</td>
<td>$5,800,000</td>
</tr>
<tr>
<td>Mitigation -- Other</td>
<td>$250,000</td>
</tr>
<tr>
<td>Options on PRRC Properties</td>
<td>$50,000</td>
</tr>
<tr>
<td>Costs to Exercise Options</td>
<td>$1,400,000</td>
</tr>
<tr>
<td>Land Acquisition</td>
<td>$500,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$69,300,000</strong></td>
</tr>
</tbody>
</table>

Annual Cost (7%, 35 years) = $5,352,000
Operation and Maintenance = $80,000
Total Annual Costs = $5,432,000

Cost per acre-foot of total firm yield (27,000 acre-feet) = $201
Cost per acre-foot of industrial yield (15,000 acre-feet) = $362
Cost per acre-foot of industrial yield and collecting minimum flows (21,500 acre-feet) = $253

2. Cost to a Potential Industrial User in the Gillette Area

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle Fork Water Supply</td>
<td>$69,300,000</td>
</tr>
<tr>
<td>Middle Fork/Gillette Pipeline (1984 prices)</td>
<td>$107,700,000</td>
</tr>
<tr>
<td>Escalations of Pipeline costs to 1994 costs (5%/year)</td>
<td>$67,700,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$244,700,000</strong></td>
</tr>
</tbody>
</table>

Annual Cost (7%, 35 years) = $18,899,000
Operation and Maintenance - Dam = $80,000
Operation and Maintenance - Pipeline = $1,660,000
Total Annual Costs = $20,639,000

Cost per acre-foot of industrial yield (15,000 acre-foot) = $1376
Cost per acre-foot of industrial yield and collecting minimum flows (21,500 acre-feet) = $960
IX. Recommendations

The Water Development Commission is requesting that existing restrictions on the previously allocated Level III budget of $3,000,000 be removed to allow implementation of the schedule depicted on page 21 of this report. The 1986 activities would include the following:

1. Perform archaeological testing of the project area. This work will serve to develop an archaeological mitigation plan and budget. Archaeological clearance is required to obtain the federal 404 permit.

2. Commence the federal 404 process. The 404 process will serve to identify the mitigation required to alleviate project impacts.

3. Continue water quality impact analyses. This work will serve to address Montana's concern regarding water development in the Powder River basin. The on-going Wyoming-Montana meetings would serve as the platform to address this issue.

4. Continue efforts to negotiate an option to acquire reservoir permits. The option agreement will serve to open the market for agricultural and industrial water sales to all potential purchasers.

5. Monitor Yellowstone Compact discussions. The Yellowstone Compact Commission is posturing to discuss Article X issues which may affect the project.

Subsequent to the generation of the above WWDC recommendations, the Select Water Committee voted to introduce legislation which would provide a construction budget of $66,300,000 to implement the Middle Fork project.