# THE INCREASING ROLE OF STATES IN WATER MANAGEMENT: THE WYOMING EXPERIENCE

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# The Increasing Role of States in Water Management: The Wyoming Experience

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The net effect of states providing large grants for water development is cheap water for some uses. The resulting low cost of water promotes an inefficient water-using policy rather than an efficient water-conserving policy. An alternative is for states to require project benefits to equal project costs and to limit grant size to identified public and secondary benefits. In this case project beneficiaries would pay for all project costs less identified public and secondary benefits, encouraging more efficient use of existing water supplies.

*Key words:* water development policy, state financing, policy criteria, water management.

Historically, the federal government has been instrumental in planning and developing the nation's water resources, primarily for economic development. In the first half of the nineteenth century, rivers were a principal means of transportation, and the federal government emphasized projects to improve rivers for navigation. With the Reclamation Act of 1902, the federal government became involved in irrigation projects as a way to supply water for settlement of the West. The general view that federal water projects have been a boon for economic growth still persists.

Support of federal water projects by local communities and states is understandable in that such projects potentially could provide local benefits while incurring relatively minor local costs. In particular, the construction of reservoirs, hydropower facilities, and irrigation systems creates additional employment and business activity in the project area. Waelti reports that for selected Bureau of Reclamation agricultural water supply projects only 18% of the costs were covered by nonfederal sources. For example, Gardner and Huffaker report that farmers in the San Joaquin Valley generally pay less than $20 per acre-foot for water which they estimate costs at least $300 per acre-foot. Taxpayers subsidize this water supply at around $280 per acre-foot. At the same time, Gardner and Huffaker's study shows the average value of water in the San Joaquin Valley to be about $50 per acre-foot or a net gain to irrigators of $30 per acre-foot. Thus, benefits of federal water projects may, to a large extent, occur in the immediate project area, while most project costs are shifted to the federal government and borne by the general population. Consequently, communities and states politically have supported federal water projects in their states or regions.

Since the early 1970s, federal support for water development projects has declined drastically, and several western states have initiated efforts to establish their own water development and management programs. Shifting financial responsibilities from federal to state governments has many implications in planning, evaluating, and adopting water management alternatives that are new to state water planning agencies. Numerous issues, questions, and controversies will arise as these state agencies develop policies and procedures for water development and management.

While the questions and choices appear to be numerous, Young suggests that the underlying issues are of only two types: one deals with policy criteria and the other with impact assessment. The first issue relates to the need

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to establish criteria to give direction to policies and to help determine whether a policy change represents an improvement over the existing situation. The second issue represents the need to estimate empirically the magnitude of impacts associated with policy choices. Both of these issues can be associated with perceptions about the importance of water in a state's economy.

The purpose of this paper is to evaluate, from an economic perspective, water development policies which may be initiated by states in response to declining federal support for water projects. Specifically, the paper uses a case study in Wyoming to illustrate how states may evaluate proposed development policies. In conducting this evaluation, the existing criteria regarding water development projects in Wyoming will be summarized and contending viewpoints regarding water development will be discussed. While the criteria mentioned are specific to Wyoming, the analysis and issues are relevant to other western states initiating their own water management programs.

## Water Development Policy and Criteria

The goals of Wyoming's program emphasize the development and preservation of Wyoming's water resources. In particular, projects providing new storage are given preference. These goals appear to be reasonable and beneficial but suggest that storage of surface water is the preferred method in meeting new demands. As suggested by Young, political and economic forces may well justify a rethinking of such state water policies.

The current political environment suggests that subsidies provided by the federal government for water storage will be limited in the future. This means that states, either through water users or citizens, will bear most of the cost of water supply projects. Economically, these new water supplies become available at progressively higher costs because of: (*a*) the limited sites remaining; (*b*) adverse external costs on third party interests; and (*c*) the increasing value of nonconsumptive instream uses. With the changing political and economic conditions, states need to expand their policy options and provide institutional arrangements to accommodate these changes.

Any decision on policy presupposes some systematic valuation or ranking of anticipated outcomes. In Wyoming, the Wyoming Water Development Commission (WWDC) has supported the general rule that water development projects for a present or defined need should be constructed, if they prove to be technically and legally feasible, and if project sponsors, primarily irrigators and municipalities, can support at least 25% of the project construction costs and all operation and maintenance costs. Based on these guidelines, consideration of economic feasibility is notably lacking and projects can be built if the sponsors can pay 25% of the development costs. Without other primary or secondary benefits, there is little or no economic benefit to the people of the state of Wyoming to help defray as much as 75% of the water project costs.

## Project Economic Analysis

While a number of criteria have been suggested, the overriding question is whether projected benefits exceed projected adverse costs. In particular, the economic analysis of a water project should compare benefits and costs with the project to benefits and costs without the project.

Results from such an economic analysis would be useful in assessing the economic desirability of a project as well as recommending financing plans and in particular the loan-grant mix. An evaluation of the proposed Middle Fork Project illustrates such an economic analysis and its potential use in decision making.

### *Middle Fork Project*

The Middle Fork Powder River flows out of the Big Horn Mountains in northcentral Wyoming (Johnson County). It is typical of streams in the West deriving most of its flows from spring snow melt and diminishing to a relatively low base flow in the summer, fall, and winter. The proposed Middle Fork Powder River Dam and Reservoir Project (Middle Fork Project) would regulate natural streamflows to provide reliable water supplies for irrigators, recreational users, and possible industrial users in northeast Wyoming.

In 1984, the Wyoming legislature authorized the WWDC to complete a level II study of the Middle Fork Project. The purpose of a level II study is to address project feasibility and provide enough information to allow com-

**Table 1. Estimated Costs and Benefits for the Middle Fork Project over a 50-Year Period**

| Item | Annual Costs and Benefits | Present Value of Costs and Benefits | |
|---|---|---|---|
| | | 4% | 8% |
| | | ($) | |
| Costs: | | | |
| Construction Costs | — | 69,000,000 | 69,000,000 |
| Operation & Maintenance Costs[a] | 111,000 | 2,385,000 | 1,358,000 |
| Total Costs | | 71,385,000 | 70,358,000 |
| Primary Benefits: | | | |
| Recreational | | | |
| Years 1–10 | 115,795 | 939,000 | 778,000 |
| Years 11–20 | 140,920 | 772,000 | 438,000 |
| Years 21–50 | 171,821 | 1,356,000 | 415,000 |
| Agricultural | 230,000 | 4,941,000 | 2,814,000 |
| Total Primary Benefits | | 8,008,000 | 4,445,000 |
| Remaining Costs[b] | | 63,377,000 | 65,913,000 |

[a] Annual operation and maintenance costs are $80,000 for the dam and reservoir and $31,000 for recreational facilities.
[b] Remaining costs are the present value of costs less the present value of benefits.

parison with other projects. Results from the water supply operation studies indicate that there would be a minimum storage of approximately 11,900 acre-feet to provide for fish and recreation uses (Harza Engineering Company 1985b). With this minimum pool, the Middle Fork Project would provide an average annual supply of 15,000 acre-feet for industry and 9,200 acre-feet for agriculture. The estimated construction cost of the project was approximately $69 million.

Given the limited ability of agriculture to pay for water and the lack of an identified industrial use, the state faces the question of whether to invest in a water project which appears to have a limited repayment ability. In attempting to evaluate the Middle Fork Project, the easiest alternative for comparison is that of the state investing funds equal to project costs and earning interest on that investment. Two evaluations are made in this analysis. The first evaluation estimates what the state would have to charge for industrial water from the Middle Fork Project to recapture its investment at two different interest rates. The second evaluation estimates what the cost to the state would be in foregone interest and unpaid capital costs.

The construction costs, annual operation and maintenance (O&M) costs, and the estimated benefits for the identified uses of recreation and agriculture are shown in table 1. The annual O&M costs consist of $80,000 for the dam and reservoir and $31,000 for the recreational site. Recreational benefits were obtained from a study conducted by the Wyoming Recreation Commission. Estimated benefits to agriculture are based upon a study of agricultural users' increase in net income as a result of the additional water. This net increase was reported to be $24 to $25 per acre-foot (Harza Engineering Company 1985a). Using $25 per acre-foot and an average of 9,200 acre-feet per year results in annual benefits of $230,000. The present value of these annual benefits in constant dollars over 50 years with 4% and 8% discount rates are shown in table 1.

Because of the controversy regarding the selection of an appropriate discount rate, two rates were used in the analysis. The 4% rate reflects the interest the state typically has charged on loans for irrigation projects, while the 8% rate reflects the average return on other state investments.

*Primary benefits.* The initial construction cost of $69 million plus the present value of annual O&M costs (at the 4% discount rate) totals $71.4 million. Deducting the present value of annual primary benefits to recreational and agricultural users leaves about $63.4 million in expenditures above the quantified primary benefits to recreation and agriculture.

At the present time, there is no identified user for the 15,000 acre-feet of surplus water. The amount the state must charge to cover the $63.4 million at a 4% return depends on when in the future the sale of water occurs. Table 2 summarizes the annual charges required to

**Table 2. Annual Charges to Recover Project Expenditures and a 4% Rate of Return**

| Period of Water Sales[a] | Present Value of Remaining Costs[b] (millions) | Equivalent Annual Total Costs[c] (millions) | Annual Costs per Acre-Foot | Present Value of Foregone Interest (millions) |
|---|---|---|---|---|
| | Primary Benefits Only | | | |
| I. Sales began in year 1 | $63.4 | $2.95 | $197 | — |
| II. Sales began in year 11 | 93.8 | 4.74 | 316 | $20.6 |
| III. Sales began in year 21 | 138.9 | 8.03 | 535 | 34.5 |
| IV. Sales began in year 31 | 205.6 | 15.13 | 1,009 | 43.9 |

[a] Period of water sales represents the time, in a 50-year life, over which the 15,000 acre-feet are sold. For example, II means that no water is sold in the first 10 years and all water is sold from years 11 to 50.
[b] The present value of remaining costs represents the present value of costs less the present value of benefits. The values are taken from table 1.
[c] Equivalent annual total costs represent annual payments for the respective repayment periods which would equal the corresponding present value of remaining costs discounted at 4%.

provide a 4% return on the remaining $63.4 million expenditure for the Middle Fork Reservoir under several scenarios. For example, if the water sales began in year 1 and continued over the 50 years, the state would have to charge $197 per acre-foot annually. If no sales occurred for 20 years and the costs were recovered in the remaining 30 years, the state would need to charge $535 per acre-foot annually to recover the $63.4 million with a 4% rate of return.

Alternatively, what would be the cost to the state in foregone interest associated with delayed sales of the 15,000 acre-feet of surplus water? The present value of this foregone interest is shown in the last column of table 2. These results indicate, for example, that if the sale of surplus water were delayed for 20 years, the additional cost to the state in foregone interest would be $34.5 million, which is half again the initial construction cost of $69 million. Alternatively, this could be viewed as a conservative estimate of the cost of developing water 20 years prior to an identified demand.

Both approaches are conservative in terms of the interest rate used and the implicit assumption that the surplus water would be sold within the first 20 years. These approaches are also consistent with Wyoming Statute 41-2-122 (b) (v), which recommends financing plans to reimburse all expenditures of state funds except those expenditures allocated to state benefits.

The above analysis of the Middle Fork Project indicates that after accounting for irrigation and recreation benefits, the state would have to justify its remaining expenditures of $63 million. It seems quite likely that with no identified use, the state may own projects such as the Middle Fork and have a difficult time justifying the state's investment from an economic efficiency standpoint.

Some may argue that the 4% interest rate is too low. The last columns of tables 1 and 3 present the same results using a 50-year life and an 8% interest rate. If water sales began in year 1 and continued over the 50 years, the state would need to charge $359 per acre-foot to recover state expenditures with an 8% interest rate (table 3).

The results in tables 1–3 show a large variation in water charges depending on the interest rate and any delay in water sales. The results also show that the benefits to the state from recreational and agricultural uses are relatively small compared to project costs. This in turn suggests that the state would have a difficult time recovering its expenditures if the only uses were recreation and agriculture. If water for industrial and municipal use were involved, the charges required to cover state expenditures might be quite high. Furthermore, this cost would rise rapidly if water sales were delayed. Based on the above analysis, this project does not appear to be feasible either in terms of economic efficiency or cost recovery.

In the above examples, the expenditures allocated were equal to the estimated primary benefits from agriculture and recreation. The only reason for the state to provide grants further reducing project costs to be reimbursed by users would be if additional state or public benefits could be identified. In the case of the Middle Fork Project, some additional state or public benefits might be provided from instream flow or secondary benefits associated

**Table 3. Annual Charges to Recover Project Expenditures and an 8% Rate of Return**

| Period of Water Sales[a] | Present Value of Remaining Costs[b] (millions) | Equivalent Annual Total Costs[c] (millions) | Annual Costs per Acre-Foot | Present Value of Foregone Interest (millions) |
|---|---|---|---|---|
| | Primary Benefits Only | | | |
| I. Sales began in year 1 | $65.9 | $5.39 | $359 | — |
| II. Sales began in year 11 | 65.9 | 11.93 | 795 | $35.4 |
| III. Sales began in year 21 | 65.9 | 27.28 | 1,819 | 51.8 |
| IV. Sales began in year 31 | 65.9 | 67.54 | 4,503 | 59.4 |

[a] Period of water sales represents the time, in a 50-year life, over which the 15,000 acre-feet are sold. For example, II means that no water is sold in the first 10 years and all water is sold from years 11 to 50.
[b] The present value of remaining costs represents the present value of costs less the present value of benefits. The values are taken from table 1.
[c] Equivalent annual total costs represent annual payments for the respective repayment periods which would equal the corresponding present value of remaining costs discounted at 8%.

with the recreational, agricultural, and industrial uses of the water.

*Secondary benefits.* Increased regional economic activity is sometimes included as a secondary benefit of water development projects. But these estimates are not strictly a measure of economic value since they do not distinguish between costs and benefits. Furthermore, this approach does not consider the opportunity cost of investing these funds in some other alternative. Thus, the use of secondary impacts to measure these benefits generally will overstate the true value.

The secondary benefits from the Middle Fork Project are not an important consideration in this analysis since they probably would be minimal. The majority of recreational users likely would be Wyoming residents. As a result, the expenditures associated with recreational use of Middle Fork Reservoir, from the State's perspective, would be largely a redistribution of expenditures and not a net increase in economic activity.

In the case of irrigated agriculture, the increase in production would result in an associated increase in economic activity. Assuming a final demand multiplier of two means that the secondary impact would be $316,000 annually for irrigated agriculture if all the production went to export sales. The present value of this annual increase over 50 years would be between $4 million and $7 million depending on the discount rate. Since this figure includes both costs and benefits and because the opportunity costs of other primary resources probably are not zero, the true secondary benefits from irrigated agriculture likely would be less than $1 million. This suggests that consideration of secondary benefits is not critical to the analysis of the Middle Fork Project since it would not significantly affect the results. Thus, the secondary impacts of irrigation and recreation are not included in this analysis.

## Hypotheses to Support Development

With some realization of the costs involved, what are some hypotheses that have been used to support a state's investment in projects like the Middle Fork? For each of the hypotheses presented, relevant issues and the validity of the hypothesis are discussed.

### *Economic Development: The Importance of Water*

Perhaps the hypothesis used most frequently is that the availability of water promotes economic development. While it is true that water has some influence on industrial development, it should be remembered that water is but one of many resources that must be available before economic development occurs.

Lewis et al. conclude that "in many nonagricultural industries water price is unimportant in location and production decisions because of the fact that water is a relatively insignificant cost item." This relationship between the cost of water relative to the inputs and construction costs would be true for most large industrial projects. The present examples of unused water in Lake DeSmet near Buffalo, Wyoming, and in Fontenelle Reservoir north

of Green River, Wyoming, should suggest that the availability of water is not sufficient to bring about economic development. This position is also supported by conclusions of Lewis et al. when they state, "In the absence of other conditions for growth, it is unlikely that water investment will have more than a negligible impact on the rate or pattern of growth."

### *Construction Costs as a Benefit*

Local impacts of construction expenditures for water projects are sometimes mentioned as a benefit of current and future water development projects. From a statewide perspective this is not appropriate, because most of the funding for these projects is internal to the state. Thus, these expenditures represent redistribution of existing dollars within the system not new dollars to the state's economy. Redistribution of existing dollars creates gainers and losers within the state but results in no net gain for the state as a whole.

From a county or multicounty perspective, there may be some short-run benefits from construction, since these expenditures represent new dollars coming to the local economy. However, construction-related employment and income effects on local communities are relatively small, because the capital-intensive nature of construction activities limits the goods and services purchased from local communities. The direct effect of construction projects on the local economy is generally limited to the contractors' on-site labor expenditures in terms of: (*a*) expenditures by nonresident construction workers for lodging, food, beverages, and gasoline; and (*b*) wages paid to resident construction workers.

Considering construction costs as a benefit is also not appropriate from an economic development perspective due to the temporary nature of these expenditures. The construction phase of most projects generally lasts only four to five years, so the impact of these expenditures on local communities does not represent "sustainable" economic development. One of the goals of economic development should be to promote long-run stability. Construction expenditures should not be viewed as contributing to economic development since they are not sustainable.

In summary, consideration of the local impacts of construction expenditures for water projects as a benefit is questionable since the expenditures do not represent a net gain to the state's economy, only limited purchases are made locally, and the expenditures are temporary in nature. In the final analysis, the benefit from a water project is the use of the water not the expenditures to build it.

### *Use It or Lose It*

Another popular hypothesis is that water supplies left uncaptured will be used and inevitably acquired through years of use by downstream interests. While such a scenario is a possibility, most major rivers in the West have court decrees or interstate compacts which specifically indicate a state's share of unappropriated waters as of a specific date. Before a state would lose its share of unappropriated water in a specific river, the existing court decree or interstate compact would have to be changed. Furthermore, any change in an interstate compact would have to be ratified by the Congress of the United States, which would amount to a reversal of long-standing entitlements to water. It seems unlikely that Congress would approve such an act.

Additional protection of a state's water rights provided by storage may be exaggerated beyond that already provided by compacts. For example, storage of water without application to a use is not recognized as a beneficial use in Wyoming. Furthermore, once water is stored to reservoir capacity, additional stream flows have to be released. Downstream users may use water even with a storage project if the water is not applied to a beneficial use in that state. Thus, the only additional support water storage would add if faced with a "use it or lose it" situation is the argument that use was intended.

### *Water Storage: The Only Alternative*

Given Wyoming's emphasis on water development projects, the underlying hypothesis is that surface storage is the least expensive and preferred means to meet new demands. This position is further complicated by the fact that water demand projections generally are based on existing water use. The implicit hypothesis is that the quantity of water used is a fixed requirement, and water use is essentially independent of price. While water storage receives the emphasis, there are a number of

potential alternatives to consider in meeting new demands.

One such alternative is the reallocation of water among existing uses. In the West, agriculture uses the most water. Agricultural water use is the lowest valued use; as a result, it has been a source for transferring or leasing water to municipalities and industry. Although a sensitive issue, the cost of reallocating water among existing uses may be substantially less than developing new supplies. Other possible alternatives include groundwater, realistic pricing of water, water conservation, and education. Some combination of the above alternatives shows promise as a less expensive solution to meeting new demands.

### *Increasing Costs*

Another argument used to support the construction of water projects is that inflation will increase the cost of future state water projects. It must be remembered that inflation occurs throughout the economy and as a result affects the benefits from a project as well as the costs. The overall result of such general inflation is that the relative relationship between benefits and costs tends to remain fairly constant in most cases.

Two more likely reasons why the cost of water storage projects may increase in the future are the costs associated with third party impacts and the increased value of instream flows.

## Conclusions

Wyoming through its Water Development Commission has taken the position of providing large grants to state water development projects, even though estimated public and secondary benefits are insufficient to offset such grants. The net effect of the state's water development policy is cheap water for some water users. However, large opportunity costs to the state and its people go unrecognized. Furthermore, the low cost of water results in an inefficient water-using policy rather than an efficient water-conserving policy.

An alternative is for states to require that project benefits equal project costs and that grants be limited to identified public and secondary benefits. This would result in project benefits equaling project costs less the identified public and secondary benefits. Not only do estimated costs greatly exceed benefits, but based on analysis of the Middle Fork Project as a case example, it appears that Wyoming is taking a large risk if it expects to receive reimbursement for its expenditures. It also appears that allowing up to 75% in grants for state water projects is not justified based on the estimated benefits to the state from projects such as the Middle Fork.

If states are going to require reimbursement of their expenditures except those allocated to state benefits, then analyses identifying and evaluating all benefits and costs are needed. This would help states make financial decisions on size of grant, if any, and what charges would be needed to recover costs. Such analyses would also help states make informed decisions regarding the desirability of water projects. Furthermore, states should consider alternatives such as reallocation, water pricing, and conservation as possibilities for meeting new water demands.

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