WATER QUALITY EVALUATION

SAVERY-POT HOOK PROJECT

COLORADO, WYOMING

ENVIRONMENTAL PROTECTION AGENCY
REGION VIII DENVER, COLORADO

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WATER QUALITY EVALUATION
OF THE
SAVERY-POT HOOK PROJECT
COLORADO, WYOMING

An evaluation of the Bureau of Reclamation's proposed Savery-Pot Hook Project reveals that with adequate treatment municipal and other minor waste loadings will not significantly affect water quality for present and projected water uses in the Project area. Therefore, no storage in Savery and Pot Hook Reservoirs is needed to provide flow regulation for maintaining satisfactory organic water quality in the Colorado River. The use of Project water for irrigation purposes will result in a 2.5 mg/l increase annually in the total dissolved solids concentration of the Colorado River at Lake Mead. The economic impact of this salinity increase upon water users below Lake Mead is estimated to be $165,600 annually, based on 1970 economic conditions. This appraisal provides an estimate of the effect of salinity increases resulting from the Project and will be useful in evaluating and justifying control measures for water quality improvement. Control measures are recommended for incorporation into the construction and development of the Project to minimize the adverse effects of salinity.

Environmental Protection Agency
Region VIII
Denver, Colorado

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SUPPLEMENTAL WATER QUALITY EVALUATION REPORT on the SAVERY-POT HOOK PROJECT June 1971

Introduction

This report on the Definite Plan of the Bureau of Reclamation's (USBR) Savery-Pot Hook Project supplements the Public Health Service report entitled, "Public Health Aspects of the Savery-Pot Hook Project," dated December 1957 and revised in April 1960. The previous report pertained to the USBR feasibility studies for this Project.

A supplemental report was considered necessary because the following events have occurred since April 1960:

(1) The enactment of the Water Pollution Control Act, as amended (33 U.S.C. 466 et seq.) and issuance of Executive Order 11507, dated February 5, 1970; transfer of the Federal Water Quality Administration (FWQA) to the Department of the Interior; and subsequent transfer of the Federal Water Quality Administration to the Environmental Protection Agency on December 2, 1970;

(2) The USBR requested an updated water quality report;

(3) Changes have been made by the USBR in the proposed Project plan; and

(4) The Environmental Protection Agency has completed a study of the economic impact of salinity in Colorado River water.

The Savery-Pot Hook Project will provide water for irrigation, recreational, and fishery purposes. Principal Project features include two reservoirs: Savery Reservoir on Savery Creek in Wyoming and Pot-Hook Reservoir on Slater Creek in Colorado. Both creeks

are tributaries of the Little Snake River, an interstate stream. The Project reservoirs will supply 66,000 acre-feet of irrigation water for full service to 17,920 acres and supplemental service to 14,330 acres, in both Colorado and Wyoming.

Water Quality in the Project Area

A limited water quality survey was conducted by FWQA in July 1970 along the Little Snake River from Slater, Colorado to Baggs, Wyoming to check reported low dissolved oxygen concentrations and high pH values. The survey revealed dissolved oxygen concentrations ranging between 6.5 mg/l and 7.7 mg/l and pH values ranging between 7.5 and 8.0. The discharge ranged between 37 cubic feet per second and 42 cubic feet per second. It can be observed from the tabulation shown below that the values for these parameters meet the water quality standards criteria of the States of Colorado and Wyoming for this reach of the Little Snake River. Water quality standards criteria for other parameters are also being met in the Project area.

Water Quality Standards for the Little Snake River

Designated Water Use for the Little Snake River 2/	Standards of Quality 1/ Bacteria (Count/ 100 ml)	Dissolved Oxygen (mg/l)	Temp. oF	pH	Dissolved Solids (mg/l)
	State of Colorado				
Public Water Supply	< 1,000*	> 4	---	6.0-9.0	500
Cold Water Fishery	< 1,000	> 6	< 70	6.5-8.5	---
	State of Wyoming				
No use designated Basic standards apply	< 2,000**	> 6	< 78	6.5-8.5	---

1/ Adapted from State Water Quality Standards documents; refer to state standards for specific language and additional criteria.
2/ Little Snake River - from the source to intersection with county roads east of Powder Wash, Colorado (About 3 miles south of the Wyoming-Colorado stateline).

*Fecal coliforms (log mean value).
**Fecal coliforms (mean value).

The minimum flow through the Baggs-Dixon area required to assimilate domestic wastes and maintain a minimum dissolved oxygen content of 6.0 mg/l is 1.0 cubic feet per second (cfs). The assumptions used in calculating the minimum flow requirements are as follows:

1. The Dixon and Baggs, Wyoming populations in 2010 will be 200 and 400, respectively.
2. Each population equivalent contributes 0.17 pounds of five-day 20°C biochemical oxygen demand (BOD_5).
3. Waste treatment facilities in the Project area will remove 85 percent of the BOD_5 contributed by the entire population.

There are no industrial wastes in the area. Examination of the U.S. Geological Survey flow records for a 37-year period at a station near

Dixon indicates that the streamflow is greater than 1 cfs over 95 percent of the time. Generally, the low-flow periods occur during August and September.

The Project will cause a change in the low-flow pattern. Presently the irrigators divert most of the seasonal irrigation supply during the spring runoff period because storage is not available. During the latter part of the irrigation season the irrigators divert most of the available streamflow. After the Project is built, a fairly constant supply of water will be available throughout the growing season. Because of the complex pattern of water rights, diversions, and return flows in the Baggs-Dixon area, it is difficult to determine the precise flow of the Little Snake River in that area during the irrigation season. However, since high priority water rights downstream from Dixon will be met after the Project is built, it is anticipated that the minimum flows during August and September will exceed those occurring before the Project is built. Therefore, these flows will be more than adequate to meet the minimum flow required to assimilate domestic wastes. A discussion of the mineral quality of water in the Project area is included in the following sections.

Project Impact on Water Quality

The major impact of the proposed Project on water quality will result from increases in salinity (total dissolved solids) concentrations of the Colorado River. A comparison of the average annual pre-project and post-project flows and total dissolved solids (TDS) concentrations

at three locations downstream from the Project area is shown in the tabulation below.

River	Location	Pre-Project Flow (A.F.)	Pre-Project TDS Conc. (mg/l)	Post-Project Flow (A.F.)	Post-Project TDS Conc. (mg/l)	Change in TDS Conc. (mg/l)
Little Snake	Near Lily, Colorado	451,000	196	424,400	224	+ 28
Green	Ouray, Utah	4,505,500	382	4,478,900	386	+ 4
Colorado	Lake Mead	10,288,500	729.5	10,261,900	732	+2.5

Post-project TDS concentrations are based on an annual Project depletion of 26,600 acre-feet from the Little Snake River and its tributaries and an estimated annual Project salt load contribution of 8,960 tons from irrigation water use. This amounts to 0.5 tons of salt per acre from the new lands. The annual increase in TDS concentrations of 28 mg/l and 4 mg/l near Lily, Colorado and Ouray, Utah, respectively, will have no significant economic impact within and between the Project area and Lake Mead because: (1) the quantity of water used in these reaches is small, and (2) the magnitude of the salinity increase in the range of mineral quality existing in these reaches of the rivers will have very little effect on beneficial uses.

The estimated 2.5 mg/l increase in the TDS concentration at Lake Mead resulting from use of Project water will have a detrimental effect on all Colorado River waterusers below that point. Data developed by FWQA's Colorado River Basin Water Quality Control Project indicate that a 2.5 mg/l annual increase in the TDS concentration at Lake Mead

will result in an average annual direct equivalent penalty cost[1/] of about $109,000 and an average annual indirect equivalent penalty cost of about $56,600. These figures are based on a 100-year period of analysis, beginning in 1970, at 3-1/8 percent interest rate and include the direct and indirect effects upon agricultural, municipal, and industrial water users below Hoover Dam.

Storage for Streamflow Regulation

Mineral water quality will be degraded as a consequence of irrigation on the Savery-Pot Hook Project. This degradation will have no significant economic impact in the Project area or between the Project area and Lake Mead. Therefore, no flow regulation for mineral quality control to protect water uses above Lake Mead is necessary.

Below Lake Mead, mineral quality deterioration will cause downstream water users to suffer an annual economic loss estimated at $165,600, which clearly indicates the need to incorporate all possible water quality controls in the Project area or any other area in the Colorado River Basin. The large volumes of water stored in both Lakes Powell and Mead result in the releases from Lake Mead being fairly

1/ A penalty cost is defined as the difference between the detriments associated with the use of two different levels of water quality; thus, it is based on similar economic conditions which permits the cost effect of water quality to be isolated. Detriments are user costs incurred when a specific quality of water is used.

uniform in mineral quality regardless of any seasonal or annual fluctuations in flow and quality of the Colorado River and its tributaries above the reservoirs. Therefore, any regulation of flow achieved by storage of presently available water in the Project's two reservoirs (Savery and Pot-Hook) would not change the quality of water discharged from Hoover Dam.

In lieu of providing storage in the Project reservoirs for mineral quality control, salinity control features should be included as part of the proposed project to mitigate the expected adverse effect of the project on mineral quality. These salinity control features should be installed and operated in the Project area or any other area in the Colorado River Basin where they are found to be effective and efficient.

Present and projected municipal, industrial and rural organic waste loads within and below the Project area can be controlled with adequate treatment at the source. Therefore, inclusion of separable storage in Project reservoirs for regulation of streamflow for the purpose of water quality control is not needed.

Waste Source Control

Potential salinity control measures may be divided into two categories: water-phase and salt-phase. The former comprises possibilities for improving water quality by augmenting the water supply, while the latter includes prospects for improving water quality by reducing the salt input.

Several water-phase control measures described below appear to have some technical merit and should be incorporated in the Project.

(1) Phreatophyte eradication on Project lands and along canals and drains could prevent loss of water and make more water

available for dilution. It should be recognized, however, that phreatophyte eradication may result in loss of wildlife habitat and winter protection for cattle and sheep.

(2) Better control of the quality of water applied through conservation irrigation; the use of irrigation and cropping methods that best fit a particular soil, slope, crop and water supply also offer possibilities for controlling mineral quality.

(3) Installing closed conveyance systems or lining canals and major laterals can result in higher delivery efficiencies and consequently improved water quality. The reduction in water loss would prevent unnecessary leaching of salts from non-project soils. Proper land preparation by grading and leveling also conserves water.

Potential salt-phase control measures include the careful selection of land to be irrigated and the provision of better land drainage. Because of the high water table in the Project area, improved land drainage is especially needed. Those lands naturally high in alkaline or sodic salts should be eliminated from consideration in favor of soils having low natural salt content. The leaching of irrigated lands can be assisted by installing subsurface drainage systems for lands to be newly irrigated on terraces or mesas and alluvial fans above the river flood plains. Also protective or cut-off drains could be provided at the base of the escarpments to prevent return flows from these higher lands from encroaching on lower flood plain lands. With installation of such a drainage system, the salt load over a number of years may be reduced. Other measures could include sealing of saline wells and springs, interception and transport

of highly saline waters to impervious evaporation ponds, and desalting. Some of these measures are included in the project plan. Lands naturally high in alkaline or sodic salts were eliminated from consideration during normal land classification procedures. The project plan provides for the inclusion of drains and the lining of canals and major laterals.

In order to minimize water quality problems associated with Project construction activities, the Project contract documents should contain clauses making it the responsibility of the contractor to comply with all applicable Federal, state, county and local laws concerning pollution of rivers and streams. This would require the contractor to give careful attention to pollution problems such as disposal of sanitary wastes and production of sediment during construction.

It is anticipated that both Project Reservoirs will provide diversified recreational opportunities, such as picnicking, camping, fishing and boating. Recreational uses expected at the reservoirs are potential sources of pollution that, if not properly controlled, could create local water quality problems both in the reservoir and in downstream reaches of the Little Snake River. Sanitary waste disposal systems with no surface effluent discharges will be required at all recreation areas. In addition, facilities to receive and treat the contents of boat waste holding tanks and containers should be provided at appropriate locations. Provisions should also be made to require that fuel dispensing equipment on docks be provided with safety features that will prevent the accidental discharge of petroleum products to the reservoirs. The essential features of waste disposal facilities for recreational areas should be submitted to the Environmental Protection Agency during the early stages of planning.

Conclusions

1. Releases and bypasses from Project reservoirs to serve project and non-project lands below the Baggs-Dixon area in addition to natural flows of the Little Snake River will be adequate to assimilate tributary wastes after adequate treatment. Therefore, inclusion of separable storage in the Project reservoirs for regulation of stream flow for the purpose of water quality control is not needed.
2. Irrigation by Project developed water will increase the salinity (total dissolved solids) concentration in the Colorado River at Lake Mead by 2.5 mg/l. This increase in salinity will result in an estimated average annual total equivalent penalty cost of $165,600.
3. Regulation of flow achieved by storage of presently available water in Savery and Pot-Hook Reservoirs would not change the mineral quality of water discharged from Hoover Dam.
4. Project construction activities and wastes generated by recreational activities may cause water quality degradation in the Project reservoirs and the Little Snake River unless adequate water pollution control measures are provided.

Recommendations

To mitigate the potential losses to downstream water users resulting from the proposed Project, it is recommended that:

1. The proposed Project be operated in coordination with all other Federally-funded water resources projects in the Colorado River Basin to meet State-Federal water quality standards.

2. Additional salinity control features be included as a part of the proposed project to mitigate the expected adverse effects of the project on water quality. Some salinity control features are included in the project plan. Other measures that should be considered are the sealing of saline wells and springs, interception and transport of highly saline waters to impervious evaporation ponds, desalting, and phreatophyte control. The Project Definite Plan should provide for installation and operation of salinity control measures in the Project area or any other area in the Colorado River Basin where they are found to be effective and efficient.
3. Provisions be included in Project construction specifications to assure that appropriate steps are taken by the contractor during Project construction to protect the quality of the Little Snake River; and
4. The wastes associated with recreational activities at the proposed Savery and Pot-Hook Reservoirs be adequately treated in systems that will not discharge treated effluent to the reservoirs.

References Cited

1. U.S. Department of the Interior, "Quality of Water, Colorado River Basin," Progress Report No. 4, January, 1969.

2. W. V. Iorns, C. H. Hembree, and G. L. Oakland, "Water Resources of the Upper Colorado River Basin - Technical Report," Geological Survey Professional Paper 441, 1965.

3. W. V. Iorns, C. H. Hembree, D. A. Phoenix, and G. L. Oakland, "Water Resources of the Upper Colorado River Basin-Basic Data," Geological Survey Professional Paper 442, 1964.

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