Yakima River Basin
Water Enhancement Project, Washington

Damsite and Structure Review Team Report

Bureau of Reclamation
Boise, Idaho
January 1984

WYMER DAM AND RESERVOIR AND AFTERBAY DAM

Introduction

Wymer Afterbay Dam and Wymer Dam and Reservoir sites were visited Tuesday morning and early afternoon, Tuesday, November 2. The weather was sunny and bright with temperatures about 50 to 55° F. The DSRT visited this site Tuesday, November 2, 1982, and met with the landowner, Jack Eaton, to discuss problems associated with this site.

Description

An embankment dam is anticipated for this site. With a crest elevation of 1873 the dam would be about 515 feet high, have a crest length of 4620 feet, and contain about 30.7 million cubic yards of embankment material. The reservoir capacity would be about 320,000 acre-feet and would inundate about 2,300 acres of dry grazing lands.

In order to fill this reservoir, excess Yakima River water would be diverted during the off irrigation season at the Kittitas Reclamation District's (KRD) diversion point below Keechelus Lake and transported in the district's North Branch Canal to the termination point west of the Badger Pocket Area. From that point, water would be conveyed by gravity through a 3-1/2-mile-long tunnel into the North Fork of Squaw Creek where it would flow into the reservoir.

The KRD canal would be improved and the lower end of the North Branch Canal enlarged, Swauk pumping plant constructed on the Yakima River at Thorp, and a tunnel constructed at the lower end of the North Branch Canal through Manastash Ridge to the Wymer site. About 3 miles of Interstate 82 would be relocated.

Hydrology

The water supply to this site comes from three sources potentially: (1) Squaw Creek--minor, (2) pumping from the Yakima River--either near Thorp into the KRD canal or near the mouth of Squaw Creek, and (3) diversions from the Yakima into the KRD canal. The potential of these sources is dependent on the instream flow levels. In this regard the water supply for Wymer is not well defined at this time. However, best estimates thus far indicate a fairly good ratio of inflow to capacity for an offstream site. The ratio is about the same as the Bumping Lake enlargement (inflow averaging about half the capacity). As such, this would be a site for long-term carryover storage. In most all years the reservoir would only be partly drawn down, although when drawn down all the way during a drought it may take 3-5 years to refill.

The drainage area of Squaw Creek is about 98 square miles, and the average annual runoff is 248,000 acre-feet. Based on reconnaissance level data, the inflow design flood at the damsite is estimated to have a peak flow of 50,500 ft^3/s and a 5-day volume of 161,000 acre-feet.

Environmental Considerations

The construction of a reservoir on Squaw Creek would have an effect on water quality. Average depth of the water in the 320,000-acre-foot reservoir would be about 150 feet when full. An annual yield of 100,000+ acre-feet is projected for use mainly as fish flows. Under these conditions, the water in the reservoir would be replaced every 3 years.

The use of the North Branch Canal to divert water to the offstream storage site would occur during the nonirrigation season (October through April). Water at Easton Diversion Dam on the Yakima River is of excellent quality. The Bureau of Reclamation has monitored water quality monthly at Cle Elum on the Yakima for several years. Cle Elum is the first measuring station below Easton Diversion Dam. The following is a summary of selected parameters on 36 water samples collected over a 4-year period (1974-77).

EC_6 $X10^6$			Ortho P mg/L			Total P mg/L			NO_3-N mg/L			Suspended Solids mg/L		
High	Low	Mean	High	Low	Mean	High	Low	Mean	High	Low	Mean	High	Low	Mean
94	40	59	.030	.000	.005	.080	.000	.023	.50	.00	.04	34	1	6

Based on data collected by the Bureau of Reclamation on the effects of storage on water quality in the Yakima basin, little change would be expected.

The reservoir would stratify during the summer months with warm surface water and cold water in the deep zones. The thermocline would probably develop at a deeper depth than other reservoirs in the basin because there would be no inflow to the reservoirs during the summer months. Positive impacts would occur because of improved flows in the 1-1/2-mile section of Squaw Creek below the dam, possible lowered summer discharge temperatures if water is drawn from the hypolimnion, and from formation of a reservoir fishery and recreational site.

The primary wildlife values at this site are for raptors, especially prairie falcons. Other raptor species here include Swainson's hawks, osprey, red-tail hawks, and golden eagles. The Bureau of Land Management is currently considering establishment of a raptor preserve in the Burbank Valley over the next ridge toward Yakima.

Chukar, gray partridge, pheasant, California quail, and sage grouse are found in the area. The largest known sage grouse strutting area is found here. The riparian cover present provides insects and winter thermal cover. The area has a few resident deer, and some deer winter in the valley. A small remnant pronghorn antelope herd is found here.

At present, there is no significant fishery in Squaw Creek. Prior to the heavy grazing regime, it was reported that the creek supported spawning runs of trout.

Negative impacts from constructing an offstream storage reservoir here would be a significant decline in upland game birds, loss of strutting ground, elimination of the resident deer, probable disturbance of the remnant antelope herd, reduction in Yakima River flows to 150 ft^3/s from the KRD's diversion

point below Keechelus Lake to the mouth of Squaw Creek, and complete displacement of all other wildlife within the reservoir area. The feeder canal system from the Yakima River could be hazardous to big game. The reduction in Yakima River flows would be detrimental to both resident and anadromous fish, river boaters, and probably waterfowl.

The reservoir would probably develop into a good, highly used smallmouth bass and planted trout fishery. It would also be a popular location for water sports such as swimming, water-skiing, and boating. Realization of benefits would require certain restraints on magnitudes of discharge rates and fluctuations and reservoir level fluctuations.

The beauty of the existing canyon would be inundated. Archeological sites of unknown significance remaining after salvage would be damaged by fluctuating water levels and wave action.

The preliminary area-capacity curve and reservoir map were developed using Geological Survey 7-1/2-minute quadrangle maps, Wymer and Badger Gap.

Geology of the Site

Data Reviewed

Preliminary Findings Report, Yakima River Basin Water Enhancement Project. (October 1982)

Field Review of Potential Reservoir Site by the Damsite and Structure Review Team, Yakima River Basin Water Enhancement Project, Washington

Geologic Appraisal Study, Potential Damsites, Yakima River Basin Water Enhancement Project, Washington, November 1981

Site Geology.--Relatively flat-lying lava flows of lightly to moderately fractured basalt forms the canyon walls of Squaw Creek. The canyon sides rise on a slope of about 20°, scattered deposits of slope-wash up to 5 feet thick occur on each abutment. The narrow canyon bottom is underlain by alluvial deposits estimated to be less than 10 feet deep.

There is no known faulting within several miles of the dam and reservoir site.

Design

Data Reviewed.--The data reviewed by the designers were limited to:

Preliminary Findings Report (October 1982)

Geologic Appraisal Study of Potential Damsites, Yakima River Basin Water Enhancement Project, Washington (November 1981)

Geologic Appraisal Study of Potential Damsites, Yakima River Basin Water Enhancement Project, Washington (November 1981)

Preliminary Assessment Report, Squaw Creek Off Channel Storage Project - Steve Mitchell - State of Washington (April 1972)

Structural Features

Embankment Dam.--As is evident from the previous section on damsite geology, the data available on site geology and borrow availability are extremely limited. The height of the embankment structure required at this site is slightly in excess of 500 feet with a crest length of over 4,600 feet. Because of the indications of massive basalt overlain by shallow alluvial deposits (10 feet at most) over the entire site, there is little concern at this time for the competency of the foundation. However, the axis should be shifted upstream about 1,000 feet from that previously assumed. The assumed left abutment appears too narrow to support the embankment and provide a sufficiently long seepage path through the abutment. Borrow material for an earthfill embankment appears scarce. Therefore, consideration should be given for a concrete-faced rockfill structure at this site. Since basalt outcroppings are found within the reservoir area in many locations, the borrow source for rockfill is likely to come from the reservoir rim. Processing of the rockfill for the gradations necessary within the embankment will be required, and may yield concrete aggregate for the concrete face and hydraulic structures. Although little data are available on seismic potential in the area, there would be little concern for the performance of a rockfill dam under relatively large seismic loading at this site.

An afterbay dam will probably be required downstream of Wymer Dam if pumping is required from the Yakima River. The afterbay dam is envisioned to have a structural height of about 100 feet. Site foundation conditions appear to be much the same as at the Wymer site. Since borrow availability would still be in question, some type of rockfill structure may be best suited for this site also.

For the purposes of the elimination process, a concrete-faced rockfill dam with 1.5:1 upstream and downstream slopes may be assumed for Wymer Dam. A similar structure may be assumed for the afterbay. The entire foundation may be assumed to be stripped to bedrock at each site. Data gathering for the elimination process is not critical for an adequate determination of construction costs.

Spillway and outlet works for rockfill dam.--Since the flood potential is low on this basin and the storage per foot of reservoir is fairly large, it is reasonable to store the entire flood and provide an emergency spillway for safety of the dam. The emergency spillway could be located through the reservoir rim approximately one-half of a mile upstream of the right abutment. An excavated channel with a grade sill located at elevation 1830 or 1870, depending on the reservoir capacity, would direct excess storage down a draw to Scorpion Coulee Creek and to the Yakima River. The outlet works would be best located as a tunnel through the right abutment. A conduit through the embankment would not be feasible because of high embankment loads on the

structures. The outlet works would be utilized to satisfy downstream requirements, evacuate the reservoir in case of emergency, and possibly to evacuate a flood surcharge pool. A drop inlet structure with its sill located at the maximum silt level could be tied into the outlet tunnel located at river level. Locating the tunnel at river level would allow its use for diversion upon closure of the dam.

As was previously mentioned, an afterbay reservoir will be located downstream of the main dam. Therefore, the outlet works tunnel must exit into the afterbay or be extended through the abutment and exited downstream of the afterbay dam. Further studies are required to determine the most feasible outlet work arrangement. Initially, it appears that a tunnel into the afterbay would have problems in stilling discharges and placing the discharge end above sediment in the afterbay. This scheme would be cheaper than the other scheme and would utilize a common exit conduit from the afterbay.

If the tunnel were extended downstream of the afterbay, a stilling basin could be located in the area and utilized both for diversion, evacuation, and required downstream discharges. Sediment buildup would not be a problem in this situation. It is anticipated that a power-pumping plant capable of pumping approximately 500 ft^3/s be located downstream of the dam along the bank of the Yakima River. This would require a 1-mile-long penstock to the dam. It is planned that discharges for irrigation requirements can be utilized to generate power to offset the cost of pumping water for refilling the reservoir. This penstock can be utilized to provide downstream requirements and could be designed to evacuate the reservoir if the river outlet works were inoperable.

RCC (Roller-Compacted Concrete) or concrete butress.--The strength of the basalt abutments and foundation would be ideal for an RCC or concrete buttress dam. However, there is not adequate natural materials available for either of these types of dams. Concrete aggregate sand and RCC material would have to be crushed and processed from basalt in the area. This along with no potential saving by locating the spillway over the dam would make these dam types relatively expensive.

Additional Data Required

For Elimination Process.--None

For Appraisal Design

Topography (1" = 200') 5-foot contour interval

Geologic mapping on new topography covering damsite, power-pumping plant site, and discharge alinement

Geologic mapping along the alinement of inlet canal and tunnel

Structural height requirements for afterbay

Reconnaissance for borrow availability (earthfill and rockfill materials and concrete aggregate - including quantity, quality, and excavation difficulty)

Hydrology data - maximum probable flood, diversion floods, tailwater studies, sediment studies

Power and pumping plant operating criteria - pumping requirements and power discharges and head requirements

Outlet works discharge versus head requirements

Reservoir operation requirements minimum releases during construction

Information on relocation of highway

Access to the site and structures

Power availability

SATUS DAM AND RESERVOIR

Introduction

Satus damsite was visited Saturday morning, November 6. The weather was clear and warm with temperatures in the 40's. The DSRT visited this site Saturday morning, November 6, 1982.

Previous Studies

The Bureau of Indian Affairs prepared the Irrigation Feasibility Report for the Mabton Project, Yakima Indian Reservation, Washington, dated May 1969, revised August 1972. The report proposed to construct a dam on Satus Creek about 9 miles south and 4 miles west of Toppenish, Washington. The reservoir formed by this dam would have a storage capacity of about 85,000 acre-feet. The first investigation of this dam and reservoir site was made in 1914 by L. M. Holt, Supervising Engineer for the Irrigation Branch, BIA. Using the new criteria to estimate the inflow design flood would necessitate enlargement of the spillway and outlet works, as designed for this feasibility report.

Description

Satus damsite is located on Satus Creek about 9 miles south and 4 miles west of Toppenish, Washington, in section 19, T. 9 N., R. 20 E., W.M. This multiple-purpose storage will be utilized to serve the needs of irrigation, fish and wildlife, and outdoor recreation. Reservoir management would be utilized to maintain water quality control and reduce damage caused by flooding. Reservoir sizes being studied range from 63,000 to 106,000 acre-feet.