Status Report

Work to Date on the Development of the VARQ Flood Control Operation at Libby Dam and Hungry Horse Dam

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Prepared by

U.S. Army Corps of Engineers
Northwestern Division
North Pacific Region
Portland, Oregon

EXECUTIVE SUMMARY

Introduction

This report documents the work undertaken to date by the Corps of Engineers on the development of a modified flood control operation at Libby Dam and Hungry Horse Dam called VARQ. This report is in response to the Supplemental Biological Opinion on the Operation of the Federal Columbia River Power System dated May 14, 1998, which calls for a status report on the work to date on VARQ. The steps that will be undertaken in the future to make a decision whether to implement VARQ are also identified.

VARQ was developed to improve the multi-purpose operation of Libby and Hungry Horse while not reducing the level of flood protection in the Columbia River. VARQ reduces the contribution of reservoir space at Libby and Hungry Horse for system flood control of spring runoff in the Columbia River in years when the potential for flooding is moderate. Correspondingly, the procedure was designed to provide higher outflows from the projects during the spring runoff than are presently made under the current flood control operation. These outflows are more consistent with releases made to meet flow objectives for the ESA listed Kootenai River white sturgeon and Columbia and Snake River salmon and steelhead.

Prior Studies

The VARQ concept was first introduced during the screening of operational alternatives in the 1995 System Operation Review. A favorable response by the SOR flood control work group triggered additional efforts by the Corps to fully develop the procedure. A formalized VARQ procedure for Libby and Hungry Horse was tested in a 50-year reservoir regulation study of Columbia River system flood control and the results are documented in the 1997 Columbia River Basin System Flood Control Review Study report. The positive results of this work led to the pursuit of a feasibility study of impacts to local flood control on the Kootenay and Flathead Rivers and a determination of impacts to the production of hydropower. Work to date on the VARQ flood control procedure is summarized in the following sections of this report.

Section 1: Impacts to System Flood Control

Section 1 contains a report on the impacts to system flood control on the Columbia River with VARQ at Libby and Hungry Horse. At the heart of this work is a 50-year daily reservoir regulation study of the Columbia River which was performed by water management staff at the Corps of Engineers, Northwestern Division, North Pacific Region office. Key results of this analysis can be summarized as follows.

- Impacts to system flood control as measured at Birchbank, BC, The Dalles, Oregon, and the Portland/Vancouver harbor are negligible.

- On average the VARQ operation adds about 10,000 cfs to the springtime flow at The Dalles, Oregon in the flood control reservoir simulations.

- The VARQ operation triggers additional flood control draft at Grand Coulee in years of normal to below normal water supply conditions as measured at The Dalles, Oregon. Results of the 50-year hydro-regulations showed less than a foot difference in average monthly elevation between the VARQ and base case simulations. The average difference in April 30 elevations for the 50-year period was 1.2 feet lower in the VARQ simulations than in the base case simulations. The maximum difference was 7.7 feet. On average, the VARQ operation adds about two to four days to the flood control evacuation and refill cycle of the reservoir.

Section 2: Impacts to Local Flood Control on the Kootenay River

Section 2 contains a report on the analysis of local impacts to the Kootenay River caused by the VARQ flood control procedure at Libby Dam. This study was conducted by the Corps' Seattle District and is an in-depth look at the VARQ operation and it's affect on Lake Koocanoosa, the Kootenay River below Libby Dam, Duncan Dam, and Kootenay Lake. To test the full impact of VARQ, reservoir simulations were made under various operating scenarios to meet ESA flow objectives for Kootenai River sturgeon and Columbia and Snake River salmon. The study addressed the risks, benefits, and costs associated with the VARQ operation. Key results of this analysis can be summarized as follows.

- Depending on water supply conditions, the VARQ operation can require up to 1.5 million acre-feet less flood control storage space than the current flood control procedure. Lake Koocanusa has the potential to be up to 45 feet higher during the winter months. VARQ outflows during the spring refill are generally higher than releases from the current flood control operation, but less than flows needed to meet ESA flow objectives to benefit listed fish.

- There is no increase in out-of-bank flooding downstream of Libby Dam under the VARQ flood control plan.

- The VARQ flood control plan does not significantly impact the rate of deterioration of the levees below Bonners Ferry, Idaho.

- The VARQ operation increases the risk of spill at Libby Dam during the later stages of refill. This is alleviated when releases to meet ESA requirements for listed fish are factored into the operation.

- The VARQ operation has essentially no impact at Duncan Dam.

- The VARQ operation would result in higher Kootenay Lake elevations in Canada than the current flood control operation. The one-percent exceedance lake level would be approximately one half foot higher with the VARQ operation as compared to the current flood control operation. The VARQ operation increases the Kootenay Lake peak daily springtime outflow by approximately 5,000 cfs for all frequency events. These effects are relatively consistent for reservoir simulations that included operational scenarios to meet ESA flow objective for Kootenai River white sturgeon and Columbia and Snake River salmon. To date, we do not know the flood damage impact of these differences at Kootenay Lake. We are coordinating with Canada and are prepared to perform a flood damage analysis when appropriate.

Section 3: Impacts to Local Flood Control on the Flathead River

Section 3 contains a report on the analysis of local impacts to the Flathead River downstream of Hungry Horse Dam caused by the VARQ operation. This study was conducted by the Corps' Seattle District and was limited to evaluating the hydrologic effects of the VARQ operation. Economic impacts were not addressed, nor were operational scenarios to meet ESA flow objectives for listed fish. Key results of this analysis can be summarized as follows.

- Depending on the water supply forecast, the VARQ operation requires up to approximately 0.4 million acre-feet less flood control storage space than the current flood control operation. VARQ outflows are generally higher during the spring refill than releases from the current flood control operation.

- The VARQ operation does not increase the frequency of flooding on the Flathead River at Columbia Falls, Montana, downstream of Hungry Horse.

- The VARQ operation lessens the likelihood of spilling water to reach flood control target elevations in the winter months and does not substantially increase the risk of spill during the spring refill season.

- The minimum instream flow requirement of 3,500 cfs for the Flathead River at Columbia Falls limits the value of the VARQ operation in years with low winter runoff. Inflow to Hungry Horse is often insufficient to compensate for the discharge necessary to meet the minimum flow requirement causing the reservoir to draft below the VARQ flood control target elevations.

Section 4: Impacts to Hydropower Production

Section 4 contains a report on the impacts to hydropower production on the Columbia River caused by the VARQ operation at Libby and Hungry Horse. Various operational scenarios were analyzed in conjunction with the VARQ operation, including the Libby sturgeon operation from the 1995 Biological Opinion and the sturgeon operation from the draft 1996 Recovery Plan. Changes to hydropower production and reservoir operations were determined by 60-year hydro-regulation studies using the Corps' HYSSR model. This work was performed by water management staff at the Corps of Engineers, Northwestern Division, North Pacific Region office. Key results of this analysis can be summarized as follows.

Winter/Spring:

- In the U.S. system, the VARQ operation caused higher reservoir elevations at Libby and Hungry Horse and slightly lower elevations at Grand Coulee. VARQ resulted in lower outflows at Libby, Hungry Horse, Grand Coulee, and other downstream projects. As a result, VARQ caused lower energy generation due to reduced outflow and higher capacity due to increased head.

- The same general trends were experienced in the Canadian system as the U.S. system, with lower energy generation in the winter/spring period, and very small changes in capacity.

Summer/Fall:

- In the U.S. system, reservoir elevations for the VARQ operation tend to start out higher and get closer to the base condition later. Summer outflows are much higher with the VARQ/1995 Sturgeon Biological Opinion operation than the base condition operation. Summer outflows for the VARQ/Recovery Plan operations are similar to the base condition operation. Outflows are about the same in the fall for the different operating scenarios. Energy generation was higher in the summer through fall period for the VARQ operations and capacity was about the same as reservoir elevation approach the base conditions.

- The same general trends were experienced in the Canadian system, with higher energy generation in summer through fall, and very small changes in capacity.

Annual Comparison:

- The energy analysis showed that there is an overall increase in the average monthly and total annual hydro system generation for all VARQ alternatives compared to the base conditions. The energy production cost results show that although there were

fluctuations in the monthly costs, there was a net decrease in the energy production costs for the overall hydro system.

Future Work

The Corps of Engineers has identified the following tasks that need to be performed to complete the work on the development of the VARQ flood control operation.

- Coordinate with Canada as required by the Columbia River Treaty. Paragraph V of the Protocol Annex to Exchange of Notes provides that the entities shall, pursuant to Article XIV (2)(a) of the Treaty, cooperate on a continuing basis to coordinate the operation of hydroelectric plants on the Kootenay River and elsewhere in Canada in accordance with the provisions of Article XII (5) and Article XII (6) of the Treaty.

- Complete economic analysis of the impacts of the VARQ operation. The work to date includes only an analysis of the impact on the U.S. section of the Kootenai River and an analysis of impacts on the Columbia River hydropower system. Work remains to be done to determine the economic impacts on the Flathead River caused by the VARQ operation at Hungry Horse. In addition, more work needs to be done on the Kootenai River to better define the potential economic effects caused by the Libby operation. The current analysis is based on operations for listed sturgeon, which have since been modified, and utilizes estimated agricultural effects provided by an Idaho State University Agricultural Extension Agent. These data have not been evaluated or verified by the Corps of Engineers. Additional data should be gathered and the latest ESA operations modeled. Canada has not yet identified impacts caused by the Libby VARQ operation and this may play a role in the U.S./Canadian coordination as required by the Columbia River Treaty. And finally, work still remains to be done to summarize the total economic impacts of the VARQ operation.

- Coordinate with the Bureau of Reclamation on the VARQ operation at Hungry Horse and the effects at Grand Coulee. To date, the Bureau of Reclamation has identified some modifications to the VARQ storage reservation diagram for Hungry Horse that would simplify the operation. These modifications are currently under consideration. Further analysis of the effects at Grand Coulee is necessary.

- Complete appropriate Endangered Species Act compliance and National Environmental Policy Act documentation. This includes coordination with the public, state and Federal agencies, and the Tribes.

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