From: Malcolm Leytham
To: LornaEllestad
Subject: draft memo on hydrology issues
Date: Wednesday, January 06, 2010 10:36:26 AM
Attachments: Skagit_Hydrology_Doc_Update_Memo#1_rev1.doc

Lorna:

Here is a draft memo on the hydrology issues for your comments - I have purposely kept it simple.

Malcolm

Malcolm Leytham
Northwest Hydraulic Consultants
16300 Christensen Road, Suite 350
Seattle, WA 98188
Phone: (206)-241-6000
mLeytham@nhc-sea.com

Memorandum

Northwest Hydraulic Consultants
16300 Christensen Road, Suite 350
Seattle, WA 98188
206.241.6000
206.439.2420 (fax)

DATE: 6 January 2010
PROJECT: 21739
TO: Lorna Ellestad
TOTAL PAGES: 3
COMPANY/AGENCY: Skagit County
FROM: Malcolm Leytham
SUBJECT: Skagit Hydrology Documentation Update – Outstanding Issues

In the course of the on-going updates to the GI hydrology technical documentation, two issues have been identified which require discussion and resolution:

1) Consideration of Seasonal Variation in Flood Control Storage

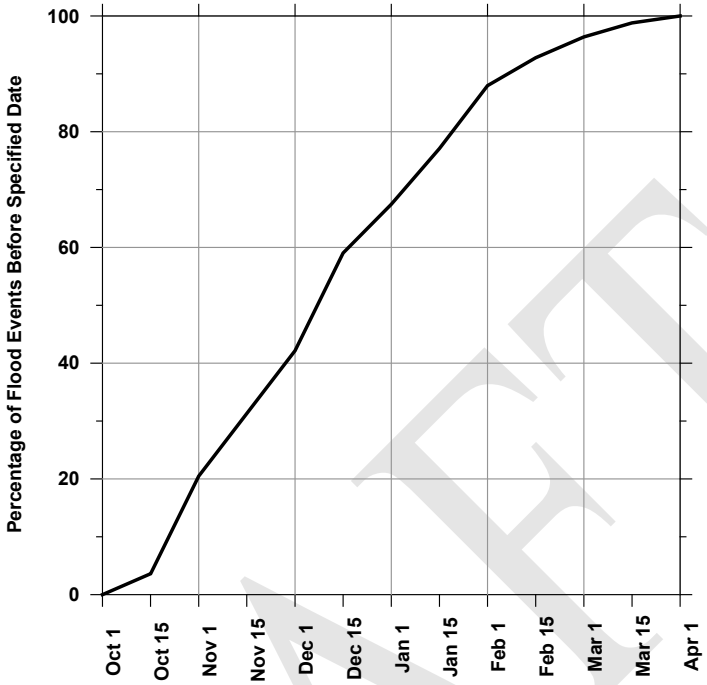
Under current license agreements, the flood control storage required at the Baker and Ross projects varies seasonally as follows:

Date	Required Flood Control Storage (acre ft)	
	Upper Baker	Ross
October 1	0	0
October 15	8,000	20,000
November 1	16,000	43,000
November 15	74,000	60,000
December 1	74,000	120,000
March 1	74,000	120,000

Hydrologic analyses of existing condition regulated flows conducted to date have ignored the seasonal variation of flood control storage and have assumed that the required maximum amount of storage (74,000 acre-ft at Upper Baker and 120,000 acre-ft at Ross) is available throughout the October-March flood season. Note that the full amount of flood control storage assumed in the analyses is not actually required until December 1 of each flood control season. Many of the large floods in the historical record have however occurred in November or even October (e.g. the flood of October 2003) when required flood control storage is substantially less than that assumed in the current existing condition analyses.

The present assumption regarding flood control storage appears to conflict with both Corps and FEMA policies requiring that only dedicated flood control storage be considered when analyzing the effects of reservoir regulation on downstream flood flows.

The reconstructed record of unregulated 1-day peak flows for the Skagit River near Concrete shows that 42% of winter flood events occur prior to 1 December. The seasonal variation of unregulated 1-day peak flows is illustrated below:



The assumption that the full amount of flood control storage is available will result in understatement of existing condition regulated flood flows, but by an unknown amount.

Some indication of the effects of having less than the full amount of flood control storage is provided by the comparison of regulated and unregulated discharges. After considering seasonal weighting of regulated flows (approximately 40% of floods occur before 1 December) we expect that the 100-year regulated discharge at Mount Vernon could increase by between 5,000 and 10,000 cfs. This however is little more than an educated guess, and we recommend that detailed analysis should be undertaken.

2) Use of 1925-1943 Unregulated Data

The hydrologic analyses of unregulated maximum annual daily flows at Concrete described in the 2004 draft of the Hydrology Technical Documentation made use of data from the four historic floods (water years 1898, 1910, 1918 and 1922) and the period of systematic record water years 1944 through 2004.

For the most recent update to hydrologic analyses, the following data were available:

- Historic flood data as updated by the USGS in SIR 2007-5159
- Unregulated maximum annual daily flows for water years 1925 through 1943 taken from a Corps study conducted in the 1960s. These are observed discharges at Concrete with a simple correction for storage change at the Ross/Diablo and Baker River projects, without consideration of routing times.

- Unregulated maximum annual daily flows for water years 1944 through 2007 as described in the 2004 report with separate deregulation of Skagit and Baker River flows and consideration of routing times.

From examination of the analysis results that have been provided for updating the documentation, and from correspondence with Ted Perkins, it appears that the 1925-1943 data have only been used to a limited extent. The bulk of the results provided for updating the hydrology report were apparently based on use of updated historic flood data and the 1944 through 2007 record. Complete analyses have not been performed using the full record and the question arises as to what should be presented in the hydrology documentation and how should it be presented. Possible options are:

- Conduct complete analyses using the full record now available (historic events plus the period 1925-2007) and update the documentation accordingly.
- Update the documentation to present results of currently available analyses (historic events plus the period 1944-2007) acknowledging that the 1925-1943 data were considered but not used.

We note that the same issue may apply to the FIS. In this case the draft 2008 FIS report cites use of data from 1925 through 2007 (plus the historic events) but it appears that the key results (e.g. estimated 100-year regulated discharges) rely on analysis of the shorter 1944 through 2007 record. In other words the FIS documentation may be inconsistent with the actual analysis, however this has not yet been confirmed.

Use of the longer record length 1925 – 2007 should in principle provide greater confidence in the hydrologic analyses (reflected in tighter confidence bounds on frequency analyses) but the impact on flow quantiles is probably quite modest.

We would suggest completing the analyses using the full record length now available.