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MEMORANDUM

TO: Paul Wagner, NMFS

FROM: FPC Staff

DATE: November 13, 2015

SUBJECT: Request for Further Information re: 10/28/15 FPC Sockeye Memo

This memorandum is in response to your request, during the November 10, 2015, Fish Passage Advisory Committee (FPAC) meeting, for additional clarification regarding information contained in the October 28, 2015, FPC memo "Requested data summaries and actions regarding sockeye adult fish passage and water temperature issues in the Columbia and Snake rivers." The memo states that river temperatures with dams in place are higher than they would be without dams. You questioned that conclusion based on language contained in the U.S. Army Corps of Engineers (COE) 2003 *Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers* (2003 WQP). Based upon this report, you explained your conclusion that, while dams increase the duration of high temperatures because the impounded system takes longer to cool down, the average temperature was the same with or without dams. You referenced the following statement from the WQP: "According to RBM10 simulations, the effect of the dams on average temperature during the hot period of the year (June through August) is minimal with temperature going from 18.9°C with the reservoirs in place to 19.1°C for a near-natural river condition," as the basis for your question.

We reviewed the language in the 2003 WQP. The language references the COE's 2002 Environmental Impact Statement (EIS) on the Lower Snake River Juvenile Salmon Migration Feasibility Report as the source. The 2002 EIS statements are, in turn, based on a Normandeau Associates appendix to the EIS – Appendix C, *Water Quality*. The temperatures cited are average temperatures over June, July and August and are based on runs of RBM10 that the Environmental Protection Agency conducted. The EIS was an evaluation of the breaching of the lower Snake River dams, and the EIS reported the average temperature that covered the years 1980, 1984, 1988 (pre-Dworshak selective withdrawal of cool water releases) and 1994, 1995 and 1997 (post-Dworshak selective withdrawal of cool water releases). The years chosen were supposed to represent low, average, and high flow years under the pre-Dworshak and post-

Dworshak conditions. At this point we are not sure why the data suggest such similar average temperatures for a near natural river versus an impounded river, with a near natural condition generating a higher average temperature. There are several possibilities that might be causing the result including: (1) the use of average temperatures; (2) the combining of years of pre- and post-Dworshak operations; (3) the six years used may not have been representative enough of the variation of temperature; or possibly, (4) the version of the model used.

The temperature language cited was retained by the COE in the WQP through the 2009 version. However, the COE acknowledged in 2002 that there may have been some issues with the information they present by stating,

> **"Further information on modeling water temperatures in the geographic scope of this plan will be available in the near future. EPA is developing much of this information for the TMDL process. Because the models being used for this have been updated since the Corps 2002, the newer modeling runs may present different results as what was presented in the previous section."**

There was no further updating beyond the 2002 language in the report, and as we know, the Total Maximum Daily Load (TMDL) development was halted in 2003 prior to the release of the temperature TMDL.

The draft 2003 Temperature TMDL included information on runs of the RBM10 model. The model was run using a 30-year record (1970–1999) for weather and flow data. The effect of Dworshak releases is specifically removed from the data set, so as to not bias results. The model provides output as an average cross-sectional temperature on a daily time step. In order to simulate the effects of the dams, each dam is mathematically removed and the model is run to determine the effect of each dam removed. The following table is taken from the draft TMDL. It shows the maximum effect of each dam on temperature at each dam site.

Table 4-2: Each dam's maximum effect on temperature at that dam site. (Taken from 2003 Draft TMDL.)

Facility	Maximum Impact	Facility	Maximum Impact
Grand Coulee	6.23°C	John Day	1.39°C
Chief Joseph	0.69°C	The Dalles	0.147°C
Wells	0.22°C	Bonneville	0.27°C
Rocky Reach	0.13°C	Lower Granite	2.08°C
Rock Island	0.07°C	Little Goose	2.18°C
Wanapum	0.86°C	Lower Monumental	1.31°C
Priest	0.28°C	Ice Harbor	1.20°C
McNary	0.36°C		

As you can see, based on this modeling all of the dams have a positive effect on temperature, and the maximum temperature effect ranges from 0.07°C to 6.23°C. The collective maximum effect of the Snake River dams could exceed 6°C.

The draft 2003 TMDL RBM10 Model results are consistent with those used by NMFS in the November 3, 2015, *Biological Opinion for the Environmental Protection Agency's Proposed Approval of Certain Oregon Water Quality Standards Including Temperature and Intergravel Dissolved Oxygen*. In the Biological Opinion NMFS is making the point that without dams the maximum daily mean temperature occurs earlier in the season.

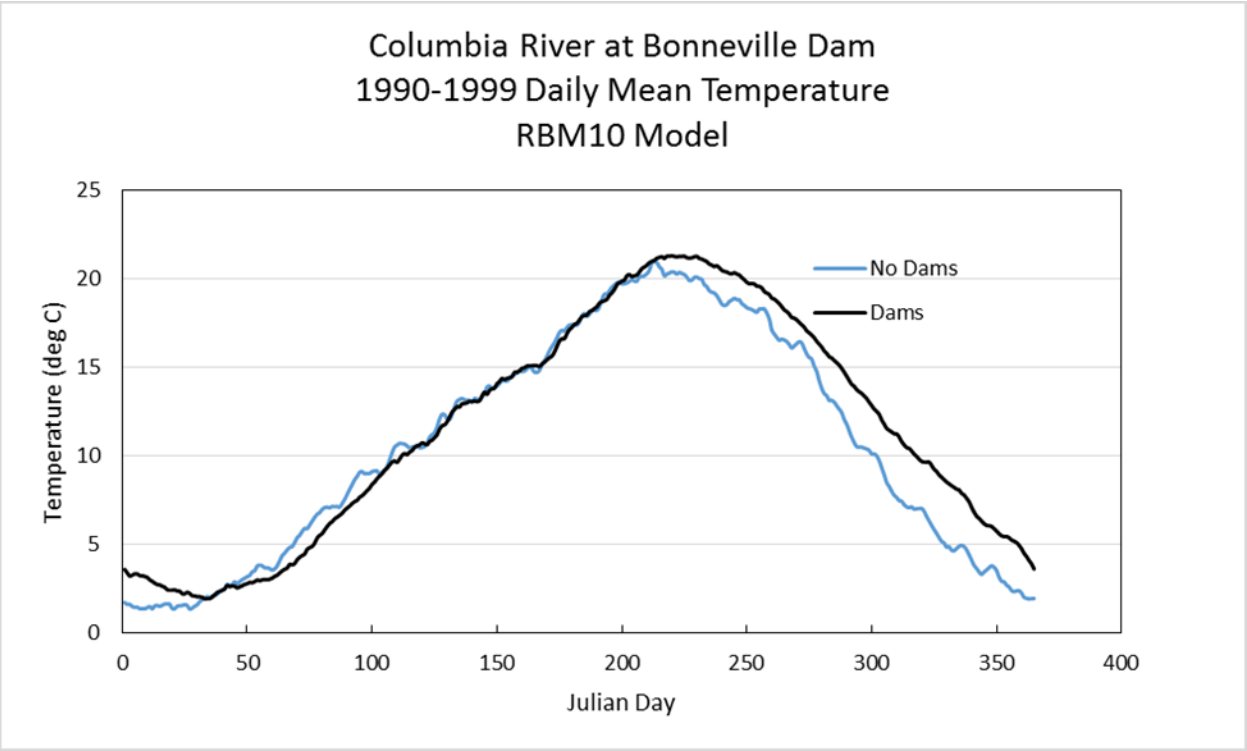

Figure 29. Daily mean temperatures at Bonneville Dam (RM 145) for 1990–1999 with and without mainstem Columbia River Dams. Julian day 200 is July 18 in non-leap years and July 19 in leap years. Source: RBM10 model runs in Excel spreadsheet provided by EPA (March 26, 2015, e-mail from Rochelle Labiosa, EPA, to Jeff Lockwood, NMFS, regarding Columbia River temperature plots).

The graph of 1990–1999 simulations does show the peak temperature at Bonneville is slightly less with no dams in place, and then subsequent daily mean temperatures are considerably less with no dams in place. The maximum daily average difference based on visual inspection is somewhere between 2° and 3° C for this data set. You can also see from the graph that if the data were averaged for June–August, as was done by Normandeau Associates, the average would be lower for the no dam scenario. In the Normandeau Associates assessment, the no dam "breach option" produced a higher average temperature.

In summary, we were unable to pinpoint exactly why the Normandeau Associates assessment produced results that are contrary to all subsequent output from the RBM10 model. We are also unable to explain why these results were retained verbatim in subsequent versions of the Water Quality Plan, in spite of the COE's own cautionary note regarding the possibility that the results could be incorrect. Our overall conclusion is that the Normandeau Associates' assessment is unreliable and inconsistent with other analysis and, therefore, should be regarded cautiously.