PCWA-L-063

# Placer County Water Agency

Power System: 24625 Harrison St. • Mail: P.O. Box 667 • Foresthill, California 95631
(530) 367-2291 (530) 885-6917 FAX (530) 367-4440



April 15, 2004

Mr. Takeshi Yamashita, Regional Engineer
FEDERAL ENERGY REGULATORY COMMISSION
901 Market Street, Suite 350
San Francisco, CA 94103

Re: FERC Project No. 2079-CA

Dear Mr. Yamashita:

This letter concerns the Probable Maximum Flood Study of L. L. Anderson Dam, dated June, 2003, by Mead & Hunt, which we submitted to you by letter dated June 25, 2003. At that time we also submitted a copy to the California State Division of Safety of Dams (DSOD). In response to the submittal, we received a letter from DSOD concurring with the Study's finding that the current spillway capacity is inadequate to pass the PMF occurring during the winter months as well as during the months of October and April when the spillway gates are closed. The letter from DSOD went on to request that we provide the operating rule curve presently in place for the gate operation in October and April for DSOD's review.

We requested that Mead & Hunt perform some additional analysis so that we might better understand the situation in October and April and what could possibly be done to prevent overtopping of the dam due to a PMF occurring during those months. The results of the additional analysis and our resulting proposed plan were communicated to DSOD by letter dated March 19, 2004, a copy of which is enclosed. In response, we received a letter dated April 5, 2004 from David Gutierrez, Acting Chief, DSOD, notifying us that they were reviewing our proposed operating rule for the dam's spillway radial gates for the months of October and April and that they would provide us their comments when they had completed their analysis.

If you have any questions, please call me at (530) 885-6917.

Sincerely,

PLACER COUNTY WATER AGENCY

Stephen J. Jones
Power System Manager

Enclosure

cc: David Breninger
Edward Tiedemann
Kevin Goishi, PG&E

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March 19, 2004

Mr. David A. Gutierrez, Acting Division Chief
Division of Safety of Dams
1416 Ninth Street, P. O. Box 942836
Sacramento CA 94236-0001

RE: L. L. Anderson Dam, No. 1030, Placer County

Dear Mr. Verigin:

The purpose of this letter is to reply to your letter dated October 21, 2003 wherein you requested "the operating rule curve presently in place for the gate operation in October and April for our review." This request resulted from your review of the report of Probable Maximum Flood Study on L. L. Anderson Dam, dated June 2003, by Mead & Hunt, and your concurrence "with the report's finding that the current spillway capacity is inadequate to pass the Probable Maximum Flood occurring during the winter months as well as during the months of October and April when the spillway gates are closed."

In calculating the results of a PMF in April and October, Mead & Hunt assumed that the spillway gates were closed at the time the storm began, and that the reservoir had already filled to the maximum historic mid-month level, which is 5248.3 feet for April and 5234 feet for October. Since the ogee crest elevation is 5244.5, the maximum mid-month April level is 3.8 feet above the ogee crest, but the maximum mid-month October level is 10.5 feet below the ogee crest. To represent our flood operation procedures, Mead & Hunt assumed that the radial gates remained closed until the reservoir had risen to an elevation of 5262 feet (one foot below the top of the radial gates), and at that time we began progressively opening the radial gates with the goal of holding the reservoir below an elevation of 5263 feet as long as possible.

The PMP for the 72 hour April storm is 37.4 inches which results in a total flood volume into the reservoir of 99,500 AF, which results in a peak stage of 5273.8 feet, which is 0.6 feet above the lowest elevation of the dam crest. The PMP for the 72 hour October storm is 42.7 inches which results in a total flood volume into the reservoir of 115,900 AF, which results in a peak stage of 5274.3 feet, which is 1.1 foot above the lowest elevation of the dam crest. For the October PMF, the time from when the stage begins to rise until peak stage is reached is about 35 hours, while for the April PMF, this time is about 36 hours.

We requested that Mead & Hunt perform some additional analysis so that we might better understand the situation in October and April and what could be done to prevent overtopping of the dam due to a PMF occurring during these months. As a result of additional runs of their HEC-1 reservoir-routing model, Mead & Hunt reported that if the spillway gates were fully open at the outset of the October PMF storm, the storm would still overtop the lowest elevation of the dam crest by 0.4 feet, but if the spillway gates were fully open at the beginning of the April PMF storm, the maximum reservoir elevation would top out at 1.4 feet below the lowest elevation of the dam crest. Mead & Hunt reported, "Our model runs show that in April, it is possible to avoid dam overtopping by opening the spillway gates earlier than we assumed in our original analysis. In October, overtopping could be reduced but not entirely eliminated." This conclusion indicated that it should be possible to develop a gate operating rule that would prevent the April PMF from overtopping the dam, however, it does not appear possible to develop a rule to prevent an October PMF from overtopping the dam.

In order to understand what it might mean to operation of the Project if the spillway gates were fully opened on September 30 rather than on October 31, the enclosed table was prepared showing the water surface elevation on April 2, April 30, October 1, and October 31 for each year of the 37 years from 1967 – 2003, and the amount the water surface elevation was above the spillway ogee on each of these dates. As can be seen, there was not a single day the water surface elevation was above the ogee on October 1 or October 31 during this 37 year period. We could have fully opened the gates on September 30 of each year instead of October 31 of each year and it would have made no difference to the actual operation of the project.

Therefore, until such time that the L. L. Anderson Dam spillway is modified so that the reservoir can safely pass the PMF, we are proposing to continue to operate the Middle Fork Project with the goal of having the reservoir water level below the spillway crest by September 30 of each year so that the spillway gates can be opened to the full open position on that date.

We requested Mead & Hunt perform additional routings and analyses with the goal of identifying an operating rule that would permit some impoundment of water against the closed gates during the month of April. Mead & Hunt's analyses resulted in the following scenario:

- The initial reservoir level is 5248.3 feet, the maximum recorded mid-April level.

- The spill gates are closed and the only discharge is 13 cfs through the stream maintenance release outlet.

- As the PMF begins to flow into the reservoir, the gates remain closed until the reservoir stage reaches 5255 feet, which, for the April PMF hydrograph, would occur approximately 12 hours after the first detectable reservoir level rise. As can be seen from the enclosed table, only once during the 37 year period of 1967 through 2003 has French Meadows Reservoir ended the month of April at an elevation above 5255, which was April 30, 1989, when the reservoir ended the month at an elevation of 5256.9 feet.

- Beginning at elevation 5255 feet, opening of the gates begins with the intent of having the gates fully open before the reservoir elevation reaches 5256 feet, if the reservoir

elevation should keep rising. Based on the April PMF hydrograph, this transition would take place over approximately 2 hours.

- If the April PMF is occurring, the reservoir would then continue to rise to a peak stage of 5272.8 feet, 0.4 foot below the lowest point of the dam crest. The peak outflow would be 21,500 cfs, approximately half of the peak inflow of 42,400 cfs.

The reservoir stage hydrographs, along with the April PMF inflow hydrograph, are shown in the attached chart which was provided by Mead & Hunt. Mead & Hunt also pointed out that the April PMF hydrograph is an idealized shape representing a very severe precipitation time pattern. Actual floods, even if they approach the PMF peak or volume, might rise less consistently or less steeply than the PMF hydrograph, and, therefore, would result in a less rapid reservoir rise.

Mead & Hunt also emphasized the importance of the starting reservoir elevation of 5248.3 feet, adding: "The strategy described above would not work for an initial reservoir level higher than about 5250 feet." However, Mead & Hunt also states: "This strategy also assumes the mid-April PMP. If flood operations cause the reservoir to rise temporarily to 5250 feet or higher near the middle of the month, and significant amounts of rain are forecast, a return to a level of 5250 would be prudent. However, as the month of April nears its end, the PMP, the PMF and the necessary reservoir storage decrease, and the starting level of 5250 may be relaxed."

Mead & Hunt also pointed out that as time progresses to the end of April and on into May, the potential PMP and, therefore, PMF, becomes smaller and smaller. For example, the mid-April PMP is about 78 percent of the all-season PMP, and the mid-May PMP is about 60 percent of the all-season value. Based on a straight line interpolation between the mid-April PMP and the mid-May PMP, the end-of-April PMP is 88 percent of the mid-April PMP. The runoff volume ratio at these three times (mid-April, end-of-April, and mid-May) would roughly be the same as the PMP ratio.

Based on the above summary of analysis performed by Mead & Hunt, in order to protect the dam from being overtopped during the month of April by an April PMF, we are proposing to continue closing the gates on April 2, as we have in the past, but between April 2 and 14, we will not allow the reservoir to rise above 5248 feet, and we will spill water in order to observe this maximum operating level April 2 – 14. From April 14 through the end of the month, we will not allow the reservoir to rise above an elevation corresponding to a straight line drawn from 5248 to 5255 on a chart where elevation is on the vertical axis and time is on the horizontal axis. The increase in allowable reservoir elevation between the middle and end of April is due to the 12 percent drop in the PMP between the middle and end of April.

We would also pay close attention to snowpack, weather forecasts and inflow into the reservoir. The elevation of the reservoir is monitored remotely during the day, Monday through Friday, at our Ralston Powerhouse and at PG&E's Drum Powerhouse. Drum Powerhouse is staffed with Opertors 24 hours/day, year-round. In additional, when reservoir elevation and weather conditions require, an operator will be dispatched to monitor the situation at the dam and begin opening the gates when necessary. By carefully keeping track of reservoir elevation, water

content on the slopes above the reservoir in the form of snow, inflow and weather forecasts, we would anticipate any potential need for an operator to operate the gates so that an operator will be on duty at the gates should gate opening need to begin.

If you have any questions, please call me at (530) 885-6917.

Sincerely,

PLACER COUNTY WATER AGENCY

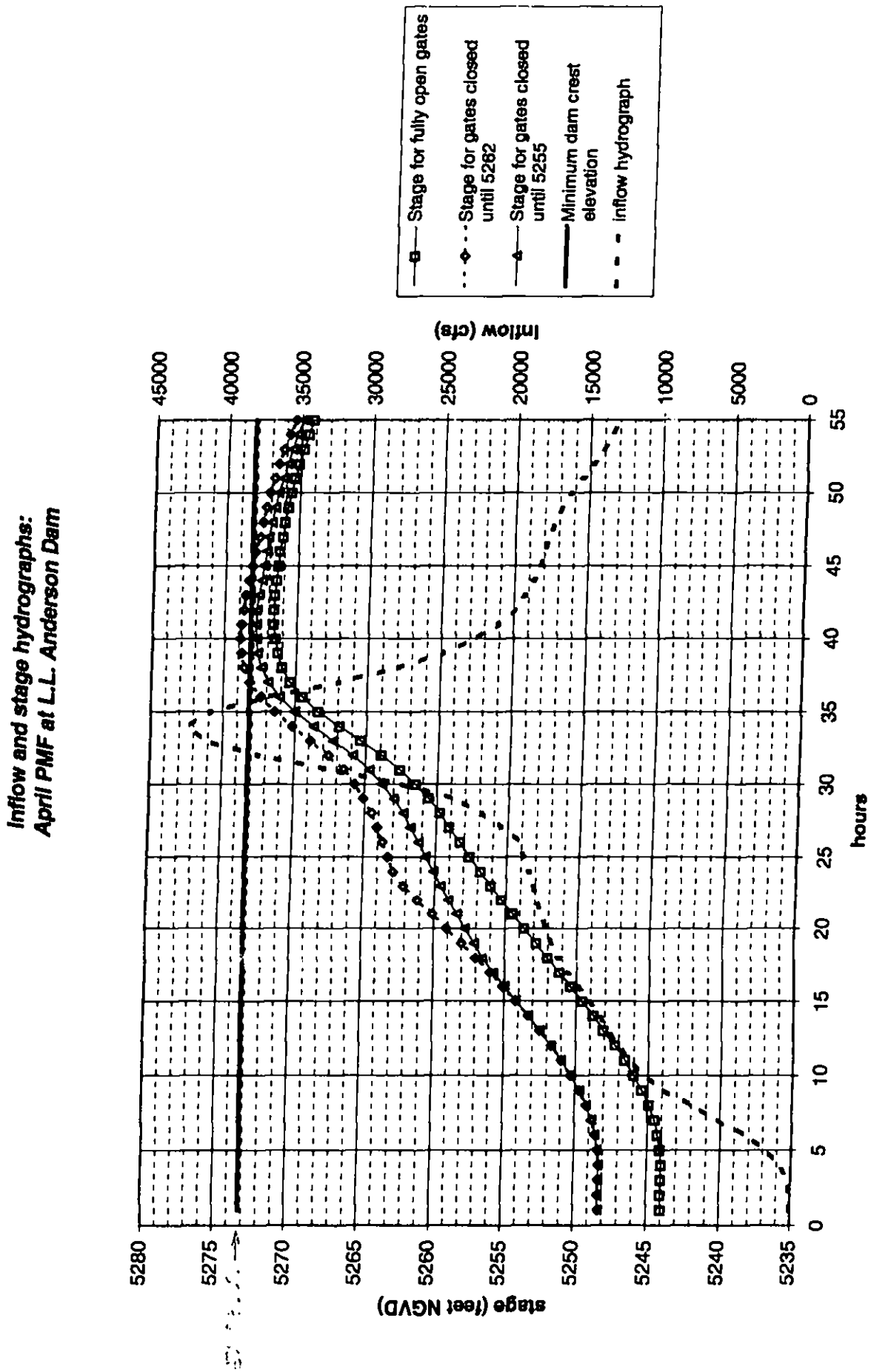
Stephen J. Jones
Power System Manager

Enclosure

cc: David Breninger
Richard C. Harlan
Edward Tiedemann
Kevin Goishi, PG&E

# L.L. ANDERSON DAM RESERVOIR
## FERC PROJ. NO. 2079-CA
## CALIFORNIA SAFETY OF DAMS DAM NO. 1030

| YEAR | Res. Elev. April 2 | Feet above ogee | Res. Elev. April 30 | Feet above ogee | Res. Elev. Oct. 1 | Feet above ogee | Res. Elev. Oct. 31 | Feet above ogee |
|---|---|---|---|---|---|---|---|---|
| 1967 | 5226.3 | -18.2 | 5217.3 | -27.2 | 5222.7 | -21.8 | 5210.0 | -34.5 |
| 1968 | 5230.7 | -13.8 | 5245.8 | 1.3 | 5227.0 | -17.5 | 5214.3 | -30.2 |
| 1969 | 5184.3 | -60.2 | 5194.5 | -50.0 | 5218.6 | -25.9 | 5204.2 | -40.3 |
| 1970 | 5221.7 | -22.8 | 5228.6 | -15.9 | 5211.3 | -33.2 | 5193.1 | -51.4 |
| 1971 | 5193.5 | -51.0 | 5211.9 | -32.6 | 5216.7 | -27.8 | 5195.9 | -48.6 |
| 1972 | 5210.0 | -34.5 | 5227.8 | -16.7 | 5241.3 | -3.2 | 5225.3 | -19.2 |
| 1973 | 5178.5 | -66.0 | 5207.5 | -37.0 | 5215.6 | -28.9 | 5203.6 | -40.9 |
| 1974 | 5228.7 | -15.8 | 5240.5 | -4.0 | 5230.4 | -14.1 | 5213.6 | -30.9 |
| 1975 | 5177.6 | -66.9 | 5182.9 | -61.6 | 5230.3 | -14.2 | 5216.0 | -28.5 |
| 1976 | 5175.0 | -69.5 | 5185.6 | -58.9 | 5175.5 | -69.0 | 5175.2 | -69.3 |
| 1977 | 5176.8 | -67.7 | 5181.8 | -62.7 | 5171.5 | -73.0 | 5171.0 | -73.5 |
| 1978 | 5191.8 | -52.7 | 5216.2 | -28.3 | 5232.6 | -11.9 | 5230.7 | -13.8 |
| 1979 | 5214.4 | -30.1 | 5234.3 | -10.2 | 5227.2 | -17.3 | 5206.6 | -37.9 |
| 1980 | 5225.3 | -19.2 | 5229.2 | -15.3 | 5228.5 | -16.0 | 5208.1 | -36.4 |
| 1981 | 5200.0 | -44.5 | 5220.3 | -24.2 | 5219.3 | -25.2 | 5199.7 | -44.8 |
| 1982 | 5242.8 | -1.7 | 5246.6 | 2.1 | 5221.1 | -23.4 | 5209.1 | -35.4 |
| 1983 | 5193.6 | -50.9 | 5187.7 | -56.8 | 5234.9 | -9.6 | 5218.4 | -26.1 |
| 1984 | 5235.6 | -8.9 | 5242.8 | -1.7 | 5218.9 | -25.6 | 5202.7 | -41.8 |
| 1985 | 5206.2 | -38.3 | 5234.7 | -9.8 | 5216.2 | -28.3 | 5195.9 | -48.6 |
| 1986 | 5246.0 | 1.5 | 5249.9 | 5.4 | 5218.7 | -25.8 | 5202.1 | -42.4 |
| 1987 | 5214.4 | -30.1 | 5231.9 | -12.6 | 5196.6 | -47.9 | 5196.0 | -48.5 |
| 1988 | 5218.5 | -26.0 | 5229.4 | -15.1 | 5198.3 | -46.2 | 5197.7 | -46.8 |
| 1989 | 5231.1 | -13.4 | 5256.9 | 12.4 | 5218.5 | -26.0 | 5206.5 | -38.0 |
| 1990 | 5213.3 | -31.2 | 5232.4 | -12.1 | 5184.6 | -59.9 | 5166.1 | -78.4 |
| 1991 | 5179.9 | -64.6 | 5197.9 | -46.6 | 5165.9 | -78.6 | 5158.8 | -85.7 |
| 1992 | 5189.4 | -55.1 | 5207.7 | -36.8 | 5164.3 | -80.2 | 5164.3 | -80.2 |
| 1993 | 5194.8 | -49.7 | 5213.8 | -30.7 | 5212.2 | -32.3 | 5191.8 | -52.7 |
| 1994 | 5206.3 | -38.2 | 5219.9 | -24.6 | 5181.2 | -63.3 | 5174.0 | -70.5 |
| 1995 | 5220.7 | -23.8 | 5228.4 | -16.1 | 5227.1 | -17.4 | 5207.2 | -37.3 |
| 1996 | 5239.4 | -5.1 | 5253.7 | 9.2 | 5226.0 | -18.5 | 5213.7 | -30.8 |
| 1997 | 5235.3 | -9.2 | 5251.3 | 6.8 | 5223.9 | -20.6 | 5212.6 | -31.9 |
| 1998 | 5214.7 | -29.8 | 5215.4 | -29.1 | 5224.6 | -19.9 | 5208.4 | -36.1 |
| 1999 | 5227.6 | -16.9 | 5229.4 | -15.1 | 5228.5 | -16.0 | 5213.0 | -31.5 |
| 2000 | 5220.5 | -24.0 | 5243.1 | -1.4 | 5216.2 | -28.3 | 5206.3 | -38.2 |
| 2001 | 5200.4 | -44.1 | 5215.7 | -28.8 | 5179.3 | -65.2 | 5177.5 | -67.0 |
| 2002 | 5194.0 | -50.5 | 5224.1 | -20.4 | 5222.3 | -22.2 | 5211.6 | -32.9 |
| 2003 | 5221.5 | -23.0 | 5227.6 | -16.9 | 5227.9 | -16.6 | 5215.2 | -29.3 |
| Average | 5210.3 | -34.2 | 5223.4 | -21.1 | 5212.9 | -31.6 | 5200.4 | -44.1 |




*Inflow and stage hydrographs:*
*April PMF at L.L. Anderson Dam*