New River Dam

PMF Update

Technical Memo

September 2014

INTEROFFICE MEMORANDUM

Date: September 30, 2014

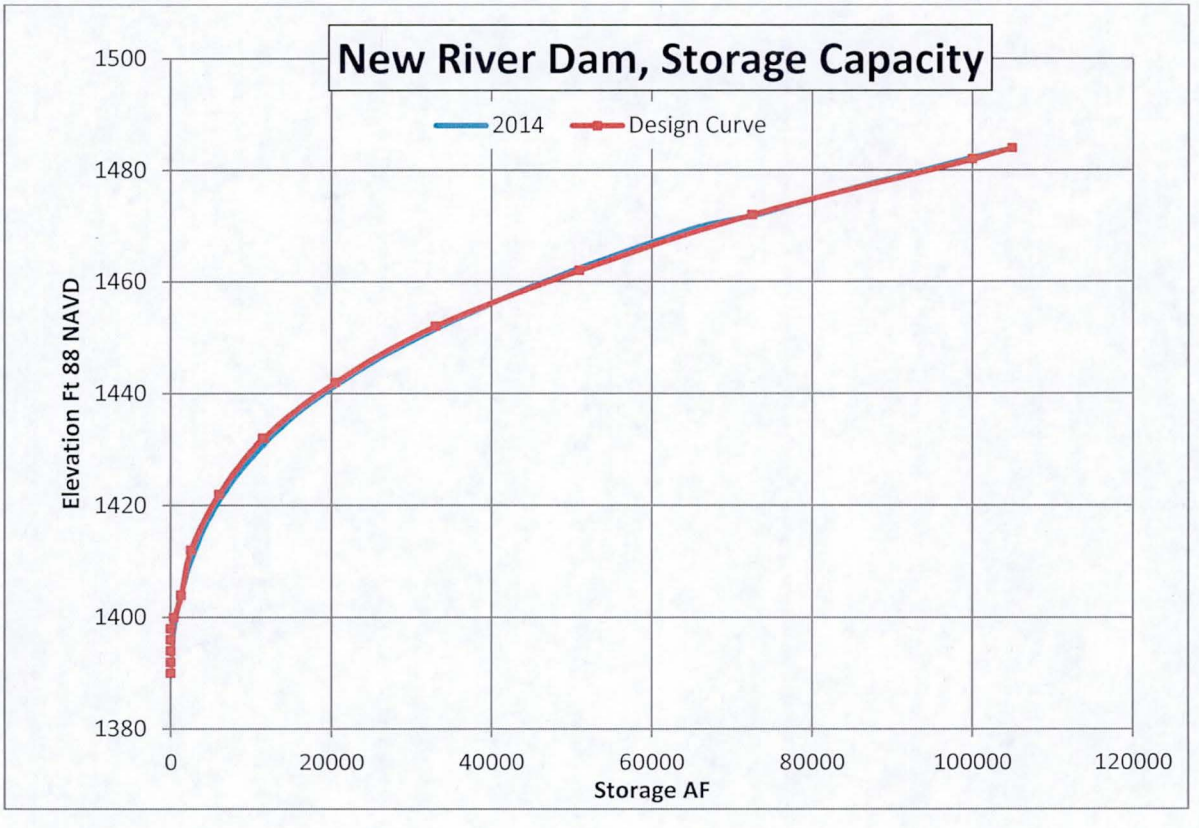
To: Files

From: Ken Rakestraw, Hydrology & Hydraulics Branch

Subject: **New River Dam, Statewide PMP Analysis Update**

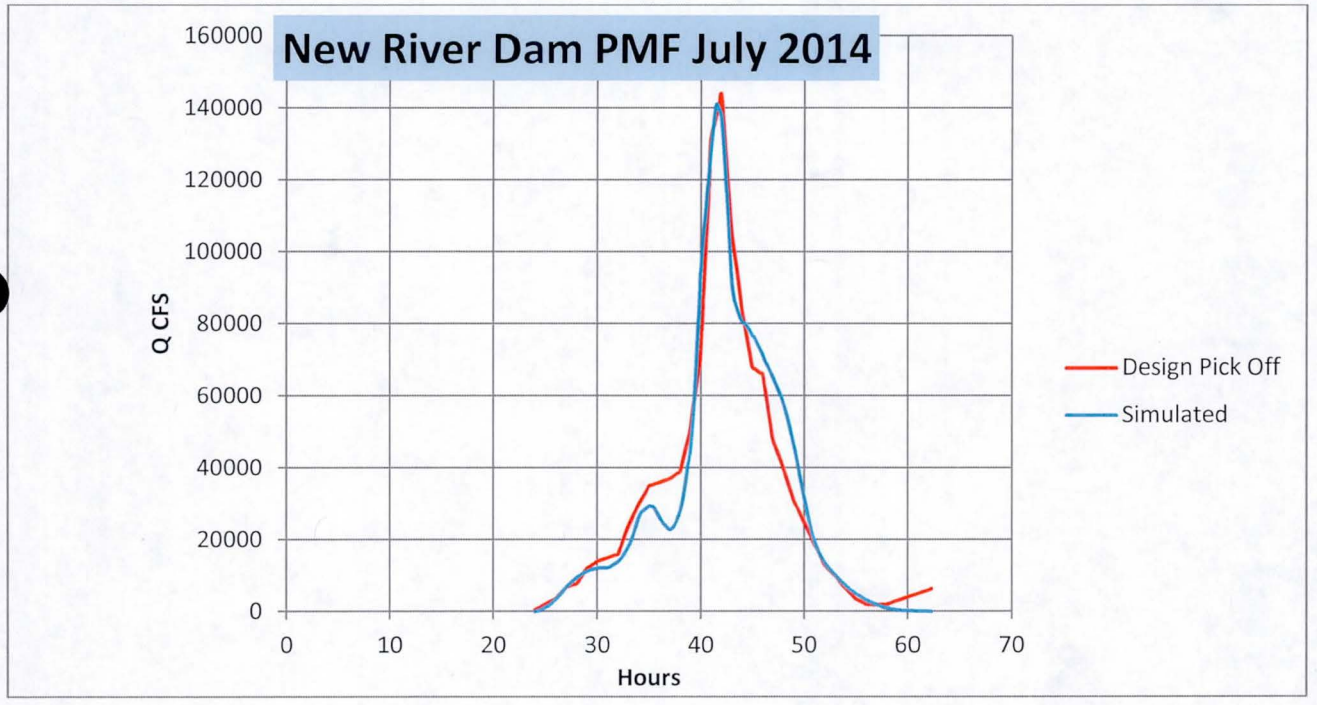
The purpose of the analysis was to evaluate the effects of the new Statewide PMP on the maximum water surface elevation at New River Dam. The most recent topographic mapping in the area (April 2003) was used to generate a new elevation-capacity table. The elevation-capacity relationship was then compared to the design values (see "Final, New River Dam Design Memorandum No. 3, General Design Memorandum Phase II, Project Design Part 3", FCD Dams Library, D370.00.06A.82A, Plate 21, ***hereafter referred to as Design Memorandum***). Figure 1 shows the comparison and indicates that there has been little if any sedimentation since the Dam was constructed.

FIGURE 1



Since a HEC-1 hydrology model was not available, the Design Memorandum was reviewed to evaluate the methods and parameters used to compute the Reservoir Inflow Design Hydrograph for the Design PMP. It was found that the Inflow Design Hydrograph was based on a 72-hour PMP rainfall depth of 18.75 inches, S-graph was used for unit hydrographs, Muskingum routing was used for routing of hydrograph from the upper basin to the Dam, and the rainfall losses were based on the constant loss method. Utilizing this data, a HEC-1 model was developed to compute the Design Inflow Hydrograph. As an initial goal, efforts were made to simulate the inflow hydrograph shown on Plate 20 (peak flow = 144,000 cfs). Rainfall distribution for the Design PMP was picked off from Plate 20 as well. Unit hydrograph values were picked off Plate 20, and loss and hydrograph routing parameters from the Design Memorandum were used. These efforts did not result in adequate simulation of the Design Inflow Hydrograph. Next, unit hydrograph values were obtained using program MCUHP2. These values also did not result in adequate simulation of the Design Inflow Hydrograph. At this point, unit hydrograph values were manipulated on a trial-error basis to try to better simulate the Design Inflow Hydrograph. Figure 2 shows the resulting Design Inflow Hydrograph plotted against the simulated hydrograph.

FIGURE 2

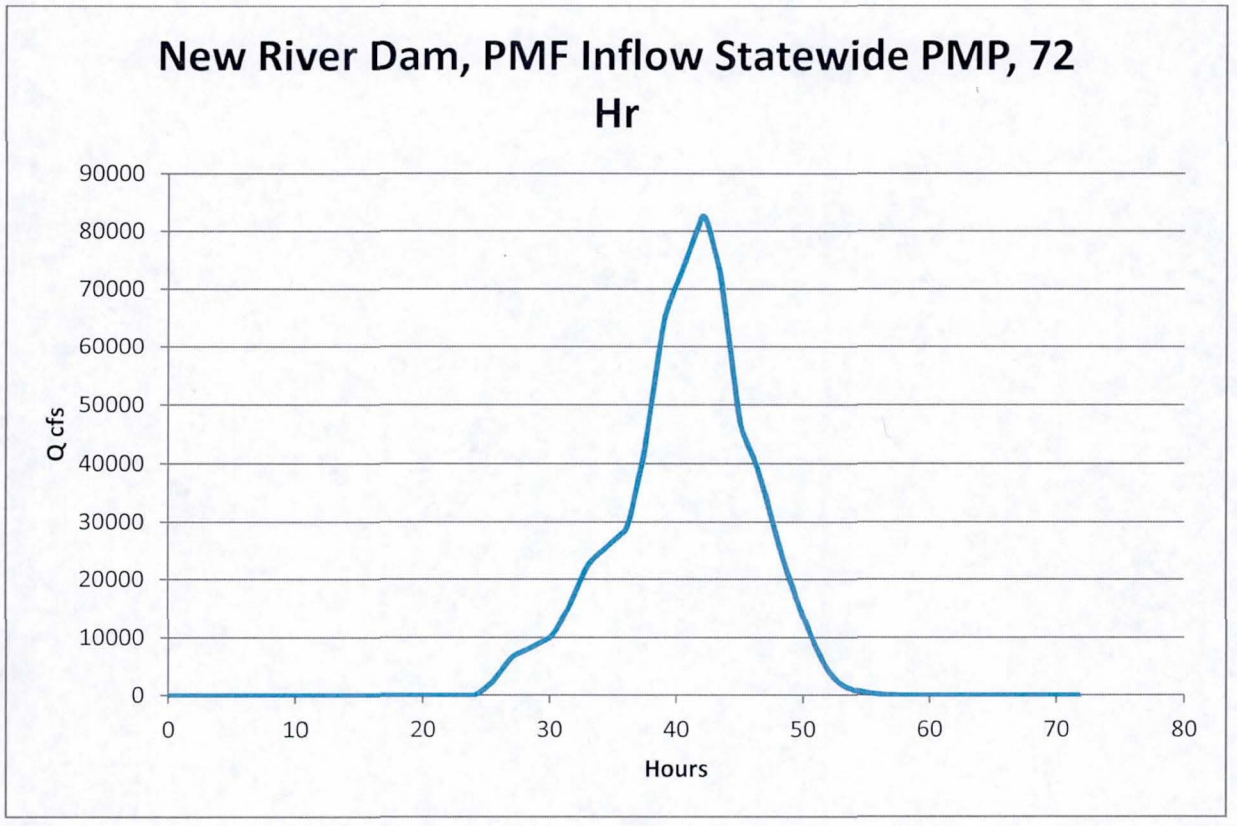


The simulated hydrograph was then routed through the reservoir using the criteria utilized in the Design Memorandum. This included starting the routing at the Emergency Spillway elevation (1458.2 feet, NAVD) and utilizing the design Elevation-Capacity relationship with sediment storage removed. Outflow rating for the Principal Outlet was taken from Plate 22 and Emergency Spillway rating was taken from Plate 24. The result of the routing produced a maximum water surface within 0.71 feet of that reported in the Design Memorandum and the peak outflow computed was 1,343 cfs greater (4%) than the peak outflow reported in the Design Memorandum.

The PMP Tool which was developed for the Arizona Statewide PMP Study was used to calculate the rainfall depths for the 6-hr local, 72-hour tropical, and 72-hour general winter storms. Shape file of the New River Watershed and output files from the PMP Tool are provided on the attached CD. The resultant PMP precipitation depth is 15.67 inches (72-hour Tropical Storm). This compares to the design PMP precipitation depth of 18.75 inches (72-hour storm).

Using the hydrology model that was developed to simulate the Design Inflow Hydrograph, the Updated PMP rainfall and temporal distribution was input into the model. Figure 3 shows the resultant Inflow Hydrograph.

FIGURE 3



This hydrograph was routed through the Reservoir starting the routing with the Reservoir water surface at emergency spillway level. The elevation-capacity table based on the April 2003 aerial mapping was used in the routing. The routing resulted in a maximum water surface elevation of 1478.38 ft, 5.53 ft. lower than the maximum water surface determined from the simulated inflow design routing. Since there is no significant difference when comparing the 2003 Elevation-Capacity to the original design Elevation-Capacity, this difference is due solely to the difference in rainfall depths/distributions.

A review was made of the methods used in the design studies regarding wind setup and wave runup. The original design determined the following values:

Dam Embankment 5.6 ft

Dike Number 1 5.2 ft

Dike Number 2 2.9 ft

The method used in the Design Study followed the procedures in ETL 1110-2-221. This is also known as the USBR ACER Memorandum No. 2 and is the methodology currently in use by the Flood Control District. No attempt was made to recalculate the wave action freeboard for the revised PMF.

The following HEC-1 files (and output files) developed for the analysis are provided on the attached CD:

1) Test7d_route.dat – Design reservoir inflow picked off Design Report exhibit with Reservoir Routing based on original Net Capacity/Discharge. Begin storage routing at emergency spillway level.

2) Test7B2.dat – Simulation of design inflow hydrograph using hydrologic modeling. Reservoir Routing based on original Net Capacity/Discharge. Begin storage routing at emergency spillway level.

3) Test7bB.dat – Updated PMF reservoir inflow based on Statewide PMP analysis using simulated design inflow hydrology. Reservoir Routing based on original Net Capacity/Discharge. Begin storage routing at emergency spillway level.