ATTACHMENTS D.1 & D.2

Without-Project Stage versus Frequency Curves

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GENERAL

The UNET hydraulic models were used to route the regulated flood hydrographs through the system of tributary and mainstem channels in each basin for the various storm events and centerings. UNET modeling results were reported at each index point as a plot of event frequency versus water surface elevation. For example, the peak simulated water surface elevation produced by the various storm centerings for a flood event with a 2% probability of occurring in any year forms one point on the curve, the peak from the event with a 1% probability of occurring forms another point, and so forth. Peak water surface elevations from UNET for the various centerings are plotted for each of the event frequencies and connected to form a stage-frequency curve. The location of the index points is shown on Plate 7 for the Sacramento River Basin and on Plate 27 for the San Joaquin River basin in Appendix D, Hydraulic Technical Documentation.

HYBRID RATING CURVES

For reaches with levees, the stage-frequency curve may flatten or become horizontal at the point where the levee in that reach fails (at the LFP elevation) or when nearby levees upstream fail. After failure, the water surface elevation remains relatively constant for all higher flow frequencies because flows are escaping into the floodplain through the levee break. The HEC-FDA model requires a complete stage-frequency curve to the top of the levee, so the upper end of the curve is extrapolated above the frequency of levee failure using the infinite-channel UNET run. The infinite channel run assumes that no levee breaks occur (infinitely high levee elevations) and that all water is contained within the main channels. The portion of the infinite channel frequency curve above the frequency of levee failure is translated down to meet the baseline (with-failure) curve where it intersects the LFP and flattens. The resulting hybrid curve, a combination of the with- and without levee failure scenarios, is then entered into HEC-FDA.

Because no floods with less than a 50% probability of exceedence were modeled in the Sacramento River basin, the hybrid curve was manually extended downward using the slope of the curve between the 50% and 10% exceedence plot points, and the adjacent ground elevation. In the San Joaquin River basin, the 50% exceedence flood was not modeled, but the curve was extended using the water surface elevation at the time the topographic surveys were performed, which corresponds to nearly a 100% chance of occurring in any year. The development of the hybrid stage-frequency curve is shown in Figure 1.

INDEX POINTS VERSUS BREAKOUT POINTS

In the Sacramento River basin, the final set of stage versus frequency curves were developed using the methodology whereby the index points were located at the location of the initial breakout points. This approach simplified the overall analysis since information pertaining to the initiation of damages did not have to be translated to the index points from some other location in the damage area.

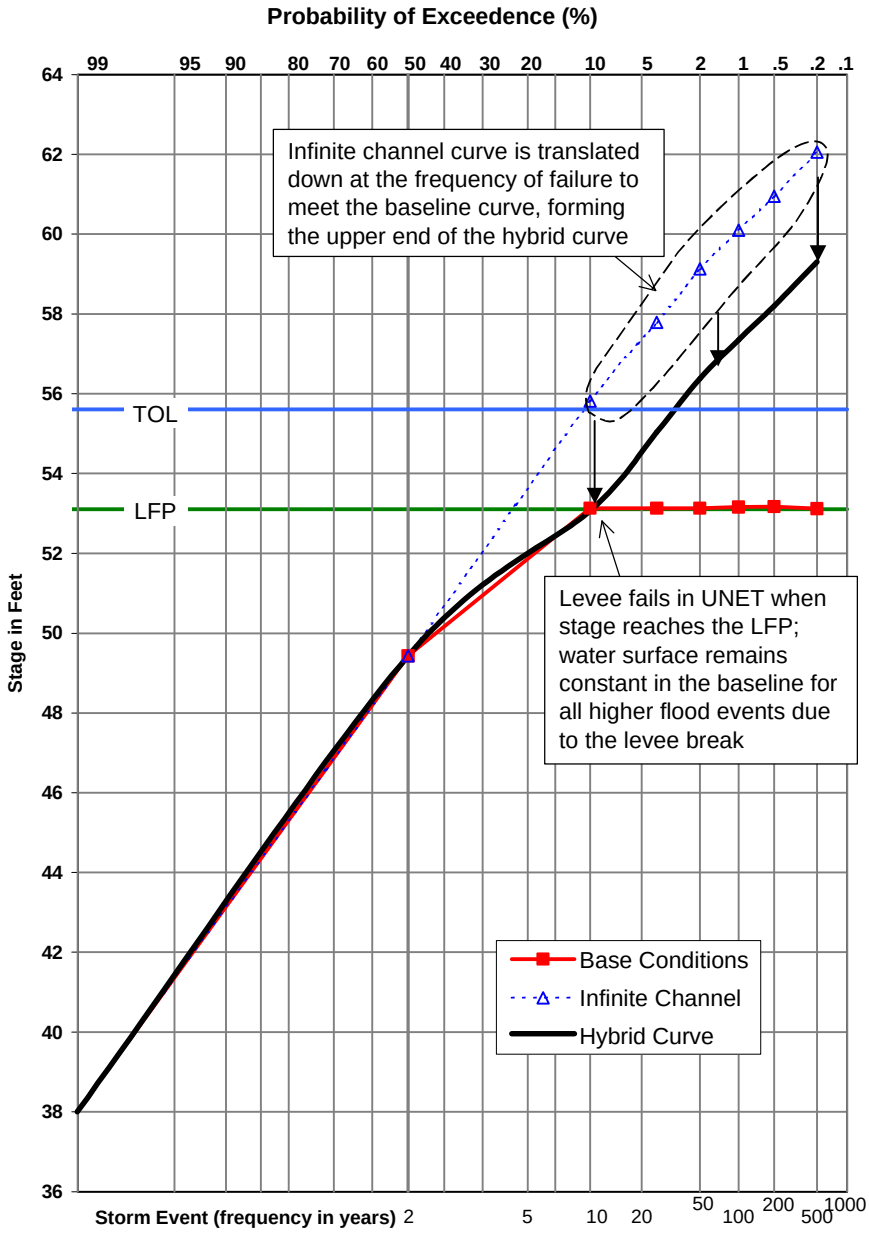

FIGURE 1 – CONSTRUCTION OF THE HYBRID STAGE-FREQUENCY CURVE

However, in the San Joaquin River basin, the index points were established early on and it was preferred not to move them. Therefore, during the initial part of the without-project analysis, locations were identified where the most frequent flood events would initiate damages for each damage area. The river stage corresponding to the initiation of damages (e.g., the elevation of the LFP or top of bank) were translated to the corresponding index point using frequency as the common variable. Likewise, the top of levee, PFP, PNP, and toe elevations were also translated to the index point for incorporation to the HEC-FDA program.

LIMITIATIONS OF DATA

The Corps of Engineers, Sacramento District, in cooperation with The Reclamation Board, State of California, developed the stage versus frequency relationships illustrated herein in support of the basin-wide, planning-level Sacramento and San Joaquin River Basins Comprehensive Study. The purpose for developing the rating curves was to provide a means for understanding and representing the channel hydraulics at discrete locations (i.e., at index points) in the Sacramento and San Joaquin River systems.

The results are meant to support a Corps of Engineers' economic inundation analysis and, therefore, the analysis utilized assumptions and basin-wide hydrology that inherently may not be appropriate for localized studies.

Extreme care must be exercised when using data from these rating curves given the levee failure and numerous other assumptions used in the basin-wide hydraulic modeling effort. These curves represent only one of many possible stage versus frequency relationships.

DISCLAIMER

The Corps of Engineers and the Reclamation Board, State of California make no warranty regarding the accuracy or use of this data. Constructive use of this information requires application by qualified hydrologic/hydraulic engineers familiar with hydraulic and economic analyses associated with flood damage reduction efforts.