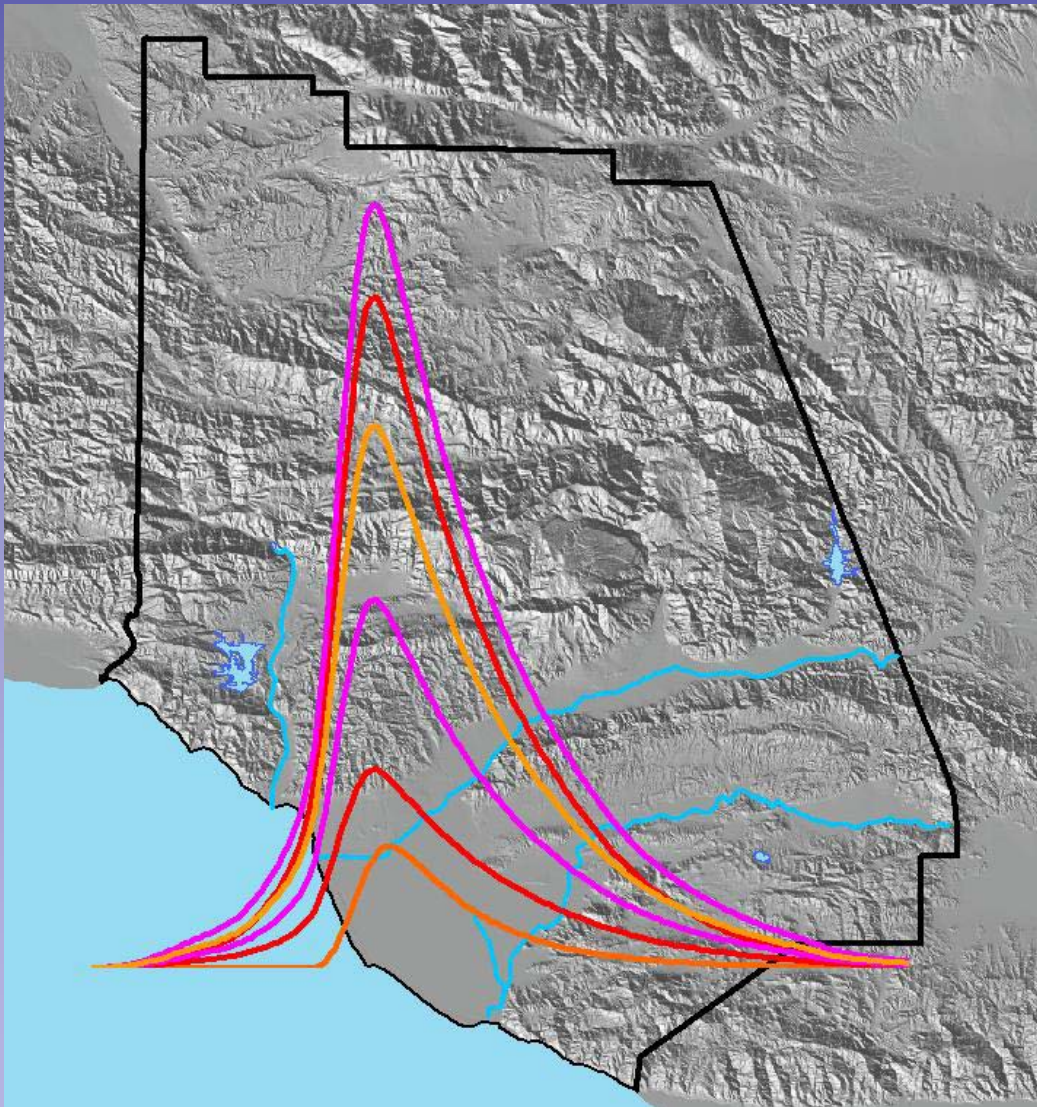


# VENTURA RIVER WATERSHED DESIGN STORM MODELING

## ADDENDUM I



August, 2010

Hydrology Section  
Water Resources Technology Division  
Ventura County Watershed Protection District



Ventura County  
Watershed Protection District  
Hydrology Section  
Project 11033

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## EXECUTIVE SUMMARY

This report documents the work done by the Ventura County Watershed Protection District (District) using the calibrated Ventura River HSPF Model (Tetra Tech 2009 Draft). The model was previously used to provide the design storm peaks for hydraulic modeling and floodplain mapping of the river and its tributaries for the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS). The report prepared by the District (February, 2010) served as the basis for the hydrology evaluation performed by FEMA's contractor for the study. The approach involved identifying a storm that caused saturated conditions in the model and then applying 100-yr design storm balanced hyetographs for each rain gage used in the HSPF Model. Flood Frequency Analysis (FFA) results of stream data from gaged tributaries were used to calibrate the model in the modeling. Ungaged tributary HSPF results were verified by comparing the HSPF results to previous modeling study results.

The current report describes work done to update the HSPF model based on site-specific studies done since February, 2010. This version of the addendum contains information about adjustments to the model due to a redelineation of the Canada De San Joaquin (CSJ) watershed based on consultant feedback and field visits to the watershed. The watershed contributing flow to the culvert under Ventura Avenue has been revised from 1,020 ac as shown in the original HSPF model (Tetra Tech, 2009) to 842 ac in this revised model. Another 91 ac of the original watershed, now new subarea 878, drains to the downstream end of the CSJ culvert under Ventura Avenue. In addition, a 121 ac watershed, new subarea 879, has been created from portions of the two mainstem subareas (875 and 876) so that the storage effects of the lower CSJ in the vicinity of the OST Inc. yard can be modeled more accurately.

As shown in Table ES-1, the resultant 100-yr peak discharge from the HSPF model at Ventura Avenue for subarea 874 has decreased from 2,420 cfs to about 1,870 cfs. The 100-yr discharge for subarea 878 is 331 cfs. The outflow from subarea 879 after routing has a 100-yr peak of about 980 cfs. The capacity of the culvert under Ventura Avenue is about 2,000 cfs based on the HEC-RAS analysis by FEMA's contractor for the draft phase of the study.

**Table ES-1 Canada de San Joaquin Design Storm Peak Flow Comparison**

Name	Size (ac)	HSPF Node	Source	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	200-Yr (cfs)	500-Yr (cfs)	Ratio Type
<b>Undeveloped Multipliers</b>	<b>NA</b>	<b>NA</b>	<b>WPD</b>	<b>0.043</b>	<b>0.143</b>	<b>0.262</b>	<b>0.484</b>	<b>0.711</b>	<b>1.000</b>	<b>1.345</b>	<b>1.952</b>	<b>Undeveloped</b>
Canada de San Joaquin at Ventura Ave February 2010	1,020	874	HSPF	100	350	630	1,170	1,720	2,420	3,250	4,720	Superseded-Undeveloped
Canada de San Joaquin at Ventura Ave	842	874	HSPF	80	270	490	910	1,330	1,870	2,520	3,650	Undeveloped
Canada de San Joaquin Western Portion	91	878	HSPF	10	50	90	160	240	331	450	650	Undeveloped
Canada de San Joaquin below Ventura Ave	1,054	879	HSPF	40	140	260	470	700	979(1)	1,320	1,910	Undeveloped

Note (1): Peak flow at subarea outlet after routing: should not be used in steady-state flow models but should be verified with a detailed unsteady-state flow model using combined hydrographs from subareas 874, 878, and local inflow from 879.

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## 1. INTRODUCTION

This report provides updates to the design peak flows used for floodplain mapping of the Ventura River Watershed by the Federal Emergency Management Agency (FEMA). The floodplain mapping project by FEMA's consultant will update the floodplain shown on current Flood Insurance Rate Maps (FIRMs). The work done previously to provide model results for the Flood Insurance Study (FIS) was documented in the District's February 2010 report. In that report, the calibrated Ventura River HSPF Model (Tetra Tech 2009 Draft) was used as the basis for generating the tributary design storm peaks for use in hydraulic modeling of the river and its tributaries in this study. The design storm flows for the Ventura River mainstem were provided by the USBR as a result of their work on the Matilija project. (USBR, 2004). The tributaries in the study included most of the creeks downstream of the Matilija Dam.

Since that report was published, other projects evaluating the hydrology in the watershed have been finished and have provided better information related to the hydrology of various watersheds. This addendum contains information about adjustments to the model due to a redelineation of the Canada De San Joaquin (CSJ) watershed based on consultant feedback and field visits to the watershed. The revised boundaries are shown in Figure 1.

## 2. HYDROLOGY UPDATE

### **2.1. Boundary, Land Use, and Ftable Changes**

The updated Canada de San Joaquin (CSJ) boundary was revised based on topographical information supplied by an engineering consultant hired to evaluate the watershed and field visits by District staff to confirm topographical breaks and flow patterns. The new information caused the watershed contributing flow to the culvert under Ventura Avenue to be revised from 1,020 ac as shown in the original HSPF model (2009) to 842 ac in this revised model. Another 91 ac of the original watershed drains to the downstream end of the CSJ culvert under Ventura Avenue. In addition, a 121 ac watershed has been created from portions of the two subareas incorporating the mainstem (875 and 876) so that the storage effects of the lower CSJ in the vicinity of the OST Inc. yard can be modeled more accurately.

The updated boundaries were used in a GIS analysis to revise the land use acreages applied in the model. This work was done using files supplied by Tetra Tech. Draft HEC-RAS models of the CSJ prepared by FEMA's first consultant in their floodplain mapping project, HDR, were used to provide an Ftable for the new subarea 879 of the lower CSJ where the OST Inc. storage yard and business are located. The new Ftable is used in the channel routing calculations of the HSPF program. The new Ftable reflects the significant storage for runoff provided by the relatively flat area and small channel. An Ftable was also prepared for the new subarea 878 covering the western portion of the CSJ watershed by assuming the

culvert was an open channel 3-ft wide. This approach was used to provide a theoretical hydrograph to the hydraulic model who can then use the hydraulic model to attenuate or divert the flow during that portion of the study. Figures 2 and 3 show the new Ftables used in the model.

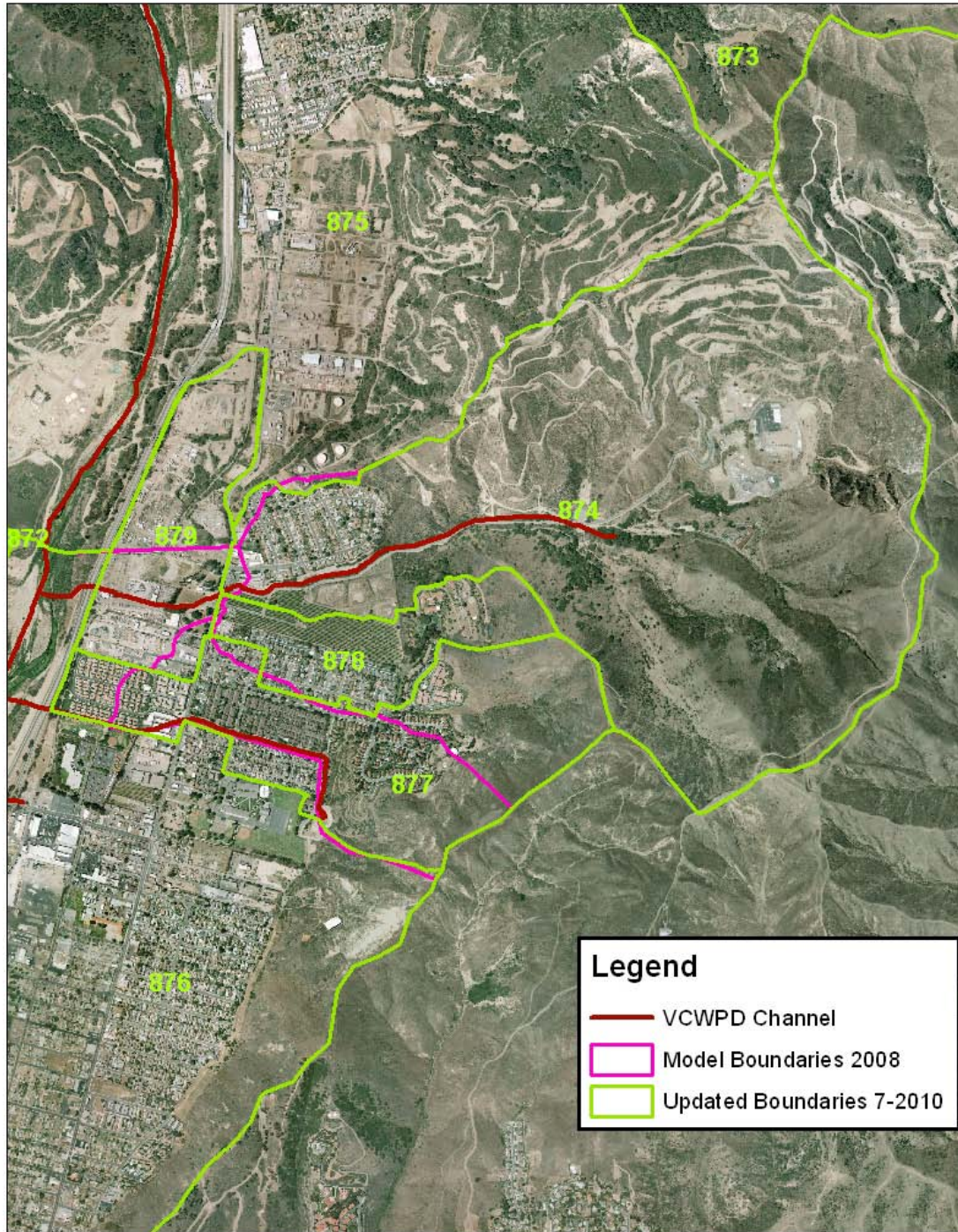


Figure 1 – Revised Model Boundaries



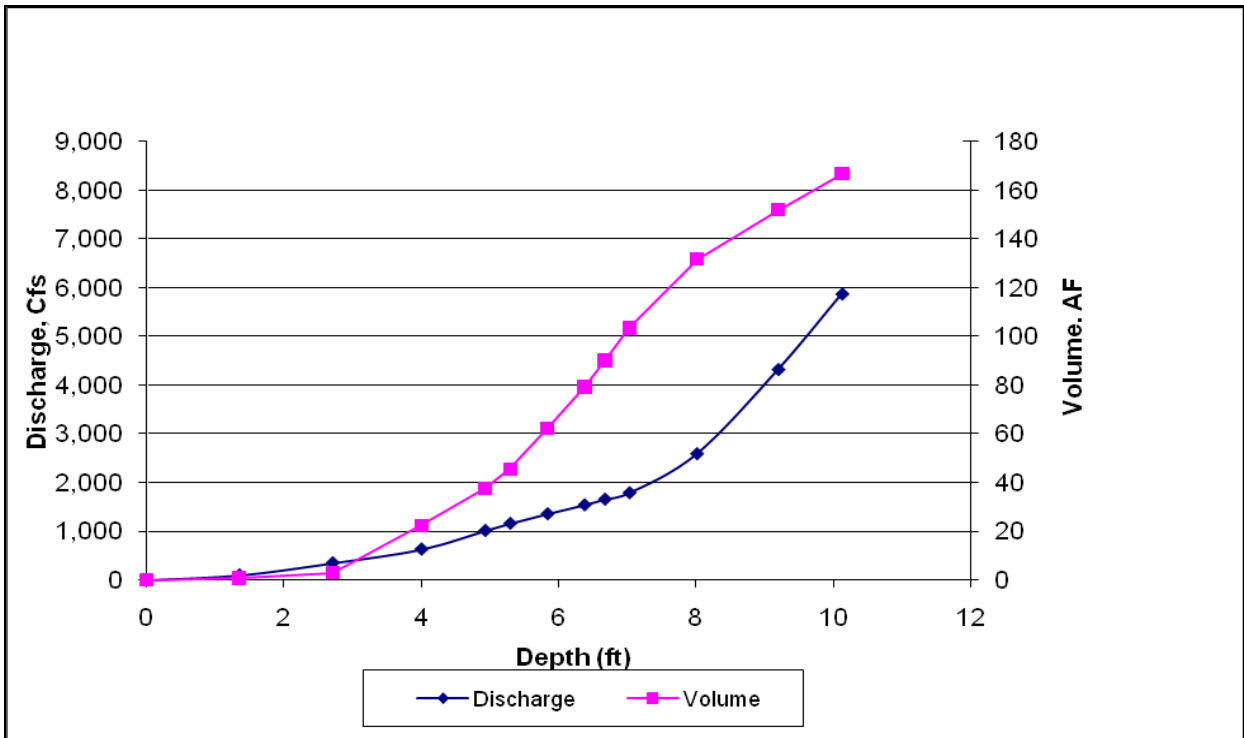


Figure 2 – Subarea 879 Ftable Stage-Storage-Discharge Data

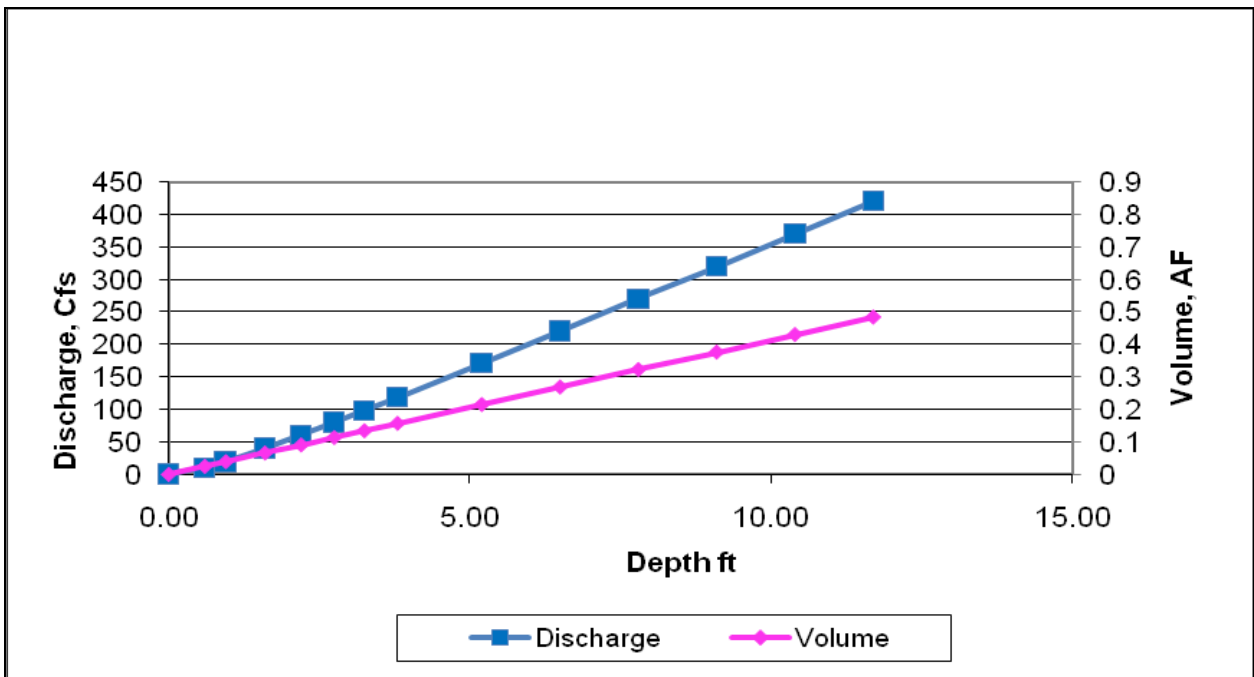
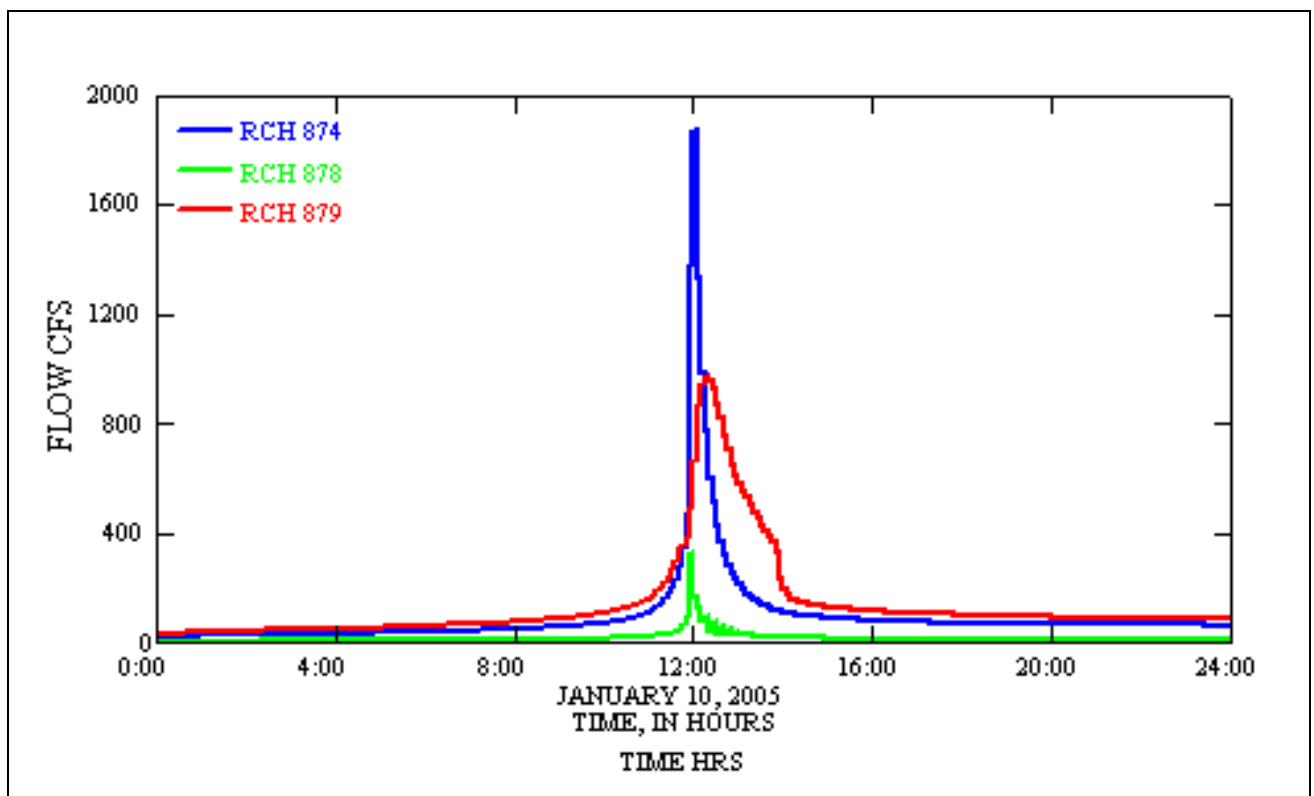


Figure 3 – Subarea 878 Ftable Stage-Storage-Discharge Data

2.2. Model Results

The resultant 100-yr peak discharge at Ventura Avenue from subarea 874 from the HSPF model using the updated watershed boundary is about 1,870 cfs. This is a decrease from the 2,420 cfs obtained from the original model with a 1,020 ac watershed. The capacity of the culvert under Ventura Avenue is a little more than 2,000 cfs based on the HEC-RAS analysis by FEMA's contractor for the draft phase of the study. If those results are confirmed by the next contractor and if the flow from the western CSJ subarea 878 into the culvert under Ventura Avenue does not decrease the culvert capacity below 1,870 cfs, there may not be a breakout or flooding at Ventura Avenue from the CSJ culvert.

The new 100-yr peak flow for subarea 878 was 331 cfs, and the outflow peak from subarea 879 due to the combined upstream and local inflow is attenuated down to about 980 cfs due to the small channel and available overbank storage in the relatively flat subarea. This 980 cfs result should be confirmed by a more detailed hydraulic model. Figure 4 shows the resultant hydrographs. Table 1 shows a summary of the peak hydrology information based on the design storm ratios used in the February 2010 report.



**Figure 4 – Canada de San Joaquin Hydrographs**

### **2.3. Hydraulic Constraints**

The hydrology reported in this addendum does not reflect a detailed hydraulic analysis of flow capacities and possible breakouts affecting peaks and hydrographs in the model. In particular, subarea 878 has a number of local storage areas and

culverts that may not be able to accept all of the flow from a storm with a recurrence interval longer than the 10-yr. This would cause street flow and storage and affect the peak and hydrograph from this subarea. The hydraulic engineer should adjust the hydrology results as necessary to reflect actual drainage conditions.

For subarea 879, the attenuated peak flow from the subarea outlet at the Ventura River of about 980 cfs is based on the storage associated with the subarea and the Modified Puls routing using the Ftable information. For hydraulic modeling, it is recommended that this area be studied using the combined flow hydrographs from subareas 874 and 878 plus the local inflow from 879 in an unsteady flow analysis using HEC-RAS due to the more complex routing schemes available in that program. The peak flow from the HSPF model subarea 879 should not be used in a steady-state flow model.

### **2.4. Model File Summary**

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Contains ftable data, HEC-RAS Model.

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Storm Model  
Contains spreadsheet with summary of model results.

K:\PR\hydrology\Watersheds\Ventura\WPP-Prop50\HSPF\DesignStorm\Design  
Storm Model\Updated6-09\Updated2010  
Contains hydrographs and updated model files for this addendum.

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2010\2010Addendum  
This report.

**Table 1. Canada de San Joaquin Design Storm Peak Flows**

Name	Size (ac)	HSPF Node	Source	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)	200-Yr (cfs)	500-Yr (cfs)	Ratio Type
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Note (1): Peak flow at subarea outlet after routing: should not be used in steady-state flow models but should be verified with a detailed unsteady-state flow model using combined hydrographs from subareas 874, 878, and local inflow from 879.

### 3. REFERENCES

Tetra Tech 2009 Draft, Baseline Model Calibration and Validation Report: Ventura River Watershed Hydrology Model (February 12, 2009)

USBR, 2004. Matilija Dam Ecosystem Restoration Feasibility Study Final Report, September, 2004 (United States Bureau of Reclamation 2004)

VCWPD, 2010. Ventura River Watershed Design Storm Modeling. February, 2010.