

Appendix B SMMP Technical Basis and Previous Studies

Flood management recommendations developed for the SMMP were based on numerous studies conducted up to date. These studies represent the SMMP's basis for:

1. Hydrologic conditions in the watershed and hydraulic analyses of Zone 7's flood control channels and arroyos;
2. Design standards for Zone 7 flood control channels;
3. Floodplain designation in the watershed; and
4. Regional detention storage at Chain of Lakes

An overview of these studies including a summary of their findings is provided below. Electronic copies of these studies have been included in the CD attached to this report.

B.1 SMMP Basis for Hydrologic/Hydraulic Analyses

The SMMP's basis for projected flows in Zone 7's streams was based on hydrologic and hydraulic analyses documented in the following references:

- ***Hydrologic Procedures and Design Discharges (Schaaf & Wheeler, December 1997)***

This study was commissioned by Zone 7 to update the design 100-year and 15-year peak discharges for channels and streams in the Zone 7 service area. In this study, a new HEC-1 hydrology model was developed to account for predicted future land use conditions. The model was based on the Alameda County Department of Public Work's model and was subsequently modified to reflect field observations and match results of frequency curve analysis at USGS gages. The result was a HEC-1 hydrology model based on predicted future land uses in the watershed as reflected in the general land use plans for local governments.

- ***Draft Zone 7 Special Drainage Area 7-1 Program Update of Channel Improvement Costs (Schaaf & Wheeler, June 2000)***

This study was used to obtain 100-year design peak discharges for Zone 7 flood control channels. Peak design flows identified in Schaaf & Wheeler's 1997 study were revised and finalized based on comments from Zone 7 flood control staff. Design discharges were then compared with those presented in Zone 7's 1966 "Green Book". In general, the new design discharges were within ten percent of Green Book values. A hydraulic analysis was also conducted to:

1. Evaluate the ability of Zone 7 flood control channels to convey design flows (i.e., peak discharges during the design flood);
2. Determine whether Zone 7 flood control channels meet velocity and freeboard standards; and
3. Evaluate the current channel capacities of unimproved channels within the Zone 7 service area and recommend increases in their size required to convey design flows.

The methodology used to develop revised design discharges was reviewed by the San Francisco District of the Corps of Engineers and by Dr. Paul Wu of Contra Costa County. Both reviews agreed that the recommended design flows adequately represented current flows and flows following buildout of the urban areas planned in the Tri-Valley region.

The report also updated channel improvement costs for Zone 7's Special Drainage Area (SDA) program based on revised peak design flows.

- **Issue Paper No. 2 Flood Flows in Zone 7 Channels (West Yost & Associates, March 2002)**

This study presents existing channel capacities for major Zone 7 flood control channels (i.e., Arroyo Mocho from the Chain of Lakes area to its confluence with ADLL, Arroyo las Positas from Airway Boulevard to its confluence with Arroyo Mocho, and ADLL). Both Arroyo Mocho and Arroyo las Positas were found to be undersized at the Chain of Lakes area. A more detailed discussion of these channels' capacities is provided in Chapter 3 (Needs and Opportunities), Chapter 4 (Regional Flood Protection), and Appendix F (Flow Scenarios).

B.2 SMMP Basis for Design Criteria

Design standards used in the SMMP to develop recommendations on flood control improvements were presented in the Schaaf & Wheeler's June 2000 study. A comparison of Zone 7's current design standards with those recommended by Schaaf & Wheeler and adopted in the SMMP are shown in Table B-1 below.

Table B-1: Green Book and Proposed SMMP Design Criteria

Design Flow	Minimum Freeboard	Maximum Velocity	Green Book Channel	SMMP Channel
100-year peak discharge	1 foot 2 feet within 100 feet upstream of crossing structures	6 ft/s	Drainage Area ≥ 10 miles ²	Drainage Area ≥ 1 miles ²
15-year peak discharge	1 foot 2 feet within 100 feet upstream of crossing structures	6 ft/s	Drainage Area < 10 miles ²	Drainage Area < 1 miles ²
100-year peak discharge	Contained within channel banks	6 ft/s	Drainage Area < 10 miles ²	Drainage Area < 1 miles ²

As shown above, Schaaf & Wheeler recommended updating design standards to change the area limitation for the 100-year design flow from 10 square miles to one square mile. West Yost & Associates concurred with this recommendation.

B.3 SMMP Basis for Floodplain Designation

The 100-year floodplain boundaries presented in the SMMP were obtained from Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRMs) developed by the Federal Emergency Management Agency (FEMA). In the mid to late 1970s, a FIS was completed for the cities and unincorporated county lands of the Zone 7 service area. A HEC-2 model was developed using surveyed cross sections, existing land use information, and peak flow rates. This model was used to delineate the 100-year and 500-year floodplains. In 1994, Borcalli & Associates Inc. updated FEMA's hydrologic analysis for the tri-valley area but excluded primary Zone 7 channels such as ADLL, Alamo Canal south of I-580, and Arroyo Mocho downstream of its confluence with Arroyo las Positas. These revisions were later used in a 1997 FEMA update to the area's FIS and FIRMs. As a result, the floodplain boundaries in the Pleasanton area near ADLL have not been changed since the mid-1970s.

A map of the FEMA 100-year floodplain boundary was shown in Figure 1-5 of Chapter 1 (Background). This figure represents the original 1997 FEMA floodplain modified to exclude areas where Letters of Map Revisions (LOMRs) have been adopted by FEMA. These areas include lands adjacent to Altamont Creek (in Northeast Livermore), areas within the Chain of Lakes, and the area in the City of Pleasanton, between the confluence of ADLL with Arroyo Mocho and Pleasanton Canal (Valley Trails and Del Prado

neighborhoods). It is important to note that this figure does not reflect all LOMRs. Instead, only those that removed a significant area out of FEMA's 100-year floodplain were shown.

B.4 SMMP Basis for Regional Storage Solution

The concept of using regional detention storage to reduce excessive storm flows downstream of the Chain of Lakes area has been analyzed in numerous studies. An overview of these studies and a summary of their findings is provided below. Copies are also included in this appendix.

- ***Upper Alameda Creek Urban Study (U.S. Army Corps of Engineers, July 1985)***

In 1975, Zone 7 was designated as the local agency responsible for sponsorship and coordination of the Upper Alameda Creek Urban Study. The study was completed in 1985. The Urban Study focus was primarily on water resources management plans, and integration of the plans with urban area comprehensive planning. The water resources planning components initially examined included flood control, point and non-point source wastewater management, water supply, wetlands and habitat preservation, and recreation. The primary planning objectives were eventually limited to those related to the flooding problems in the study area within Pleasanton.

Five alternatives were developed to reduce flooding including:

1. A no action alternative;
2. Three alternatives proposing to increase conveyance capacity along ADLL; and
3. One alternative proposing to store storm water in the Chain of Lakes.

Of the five alternatives, only the storm water storage alternative was determined to be cost effective. All remaining alternatives were found to have benefit-to-cost ratios less than one.

- ***Feasibility Study; Storage on Arroyo Mocho/Arroyo las Positas (Schaaf & Wheeler, March 1998)***

In 1998, Schaaf & Wheeler conducted a hydrologic, hydraulic, and cost analysis of three alternatives for detention storage at the Chain of Lakes. The study evaluated the feasibility of using upstream storage to reduce peak flows downstream of the Chain of Lakes. Three alternatives were investigated:

1. Dam on Arroyo Mocho near an existing stream gage;
2. Storage of Arroyo Mocho flows at the COL; and
3. Storage of combined flows from Arroyo Mocho and Arroyo las Positas at Lake H and Cope Lake.

The first alternative was determined to be infeasible from a hydrology standpoint since "a reservoir 150 feet high would produce only negligible reductions in peak discharge on the Arroyo de la Laguna" (Schaaf & Wheeler, March 1998). The second alternative was also found to be infeasible since results from the hydrology analysis showed that "flood detention storage for the Arroyo Mocho flows alone would not result in a significant reduction in discharge downstream" (Schaaf & Wheeler, March 1998). Alternative 3 was found to be feasible from a hydrology, hydraulic, and cost standpoint. As described in the study, "storage near the vicinity of the confluence of Arroyo Mocho and Arroyo las Positas is feasible and warrants further, more detailed investigation into the hydrology, hydraulics, and costs of such a facility" (Schaaf & Wheeler, March 1998).

- ***Conceptual Alternatives Analysis, Arroyo de la Laguna Flood Control Project (Mackay & Somps, September 1998)***

In 1998, Mackay & Somps completed an analysis of conceptual alternatives to provide 100-year floodplain reduction and remediation of devastating effects of bank failures and downcutting in the riparian areas of ADLL downstream of Bernal Avenue. The purpose of the report was to provide a summary of alternatives to elicit feedback from Zone 7 and project stakeholders. No recommendations were made.

Nine conceptual alternatives were developed to represent a wide array of possible solutions to the flooding and maintenance problems. These included:

- Alternatives proposing to increase the capacity at ADLL by widening the top of banks (i.e., flattening the side slopes);
- Alternatives proposing to increase the capacity at ADLL by providing an above-ground or underground bypass channel; and
- Alternatives proposing to store flows at the COL.

All five storage alternatives were found to meet flood control objectives including “flood threat elimination” along ADLL, particularly in the Valley Trails neighborhood. They were therefore found to be feasible warranting further technical evaluation.

- ***Technical Memorandum No. 5 Task E: Evaluation of Problem Areas & Identification of Solutions; Appendices; Flood Control Master Plan (West Yost & Associates, November 2001)***

West Yost & Associates conducted a hydraulic analysis of Zone 7 flood control channels and arroyos to determine channel response to varying flows and channel configurations. This analysis was used to determine the adequacy of Zone 7’s flood control system including its ability to convey design flows, acceptability of flow velocities, and resulting floodplain boundaries. The hydraulic analysis was based on hydrologic modeling and resulting peak design flow rates presented in Schaaf & Wheeler’s June 2000 study. A HEC-RAS model was developed from previous HEC-2 and RAS models obtained from numerous sources. This model was restricted to Zone 7’s “primary channel system” including Arroyo de la Laguna and Arroyo Mocho from Alameda Creek to Stanley Boulevard in the Chain of Lakes area. The analysis was therefore restricted to approximately 11.7 miles of channel, out of the 40 miles located within the Zone 7 service area. The SMMP relied on this hydraulic analysis to evaluate conditions in the channels under different regional flood control alternatives including regional detention storage at the Chain of Lakes.

Seven regional flood control alternatives were modeled including Alternative 4: Quarry Storage. Under this alternative, WYA analyzed the feasibility of storing 4,400 acre-feet (AF) of storm water at the Chain of Lakes. As described in the report, “a combination of storage and channel modifications is probably the only solution to reduce peak flows in ADLL and maximize flood control benefits” (WYA, November 2001).

For reference purposes, electronic copies of all studies discussed above are included in the CD attached to this report.