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LIST OF LARGE SCALE EXHIBITS

Forty one (41) Watershed-wide exhibits have been prepared as standard 24”x36” paper maps and/or layer-based electronic maps in Portable Document Format (PDF). The 90-square mile watershed area has been divided into four quadrants, NW, SW, NE, and SE.

a) Exhibit Legend / Index Sheet
b) Soils/Rainfall Maps
c) Hydrologic Land Use Maps (2010 & 2030 hydrologic land use)
d) Hydrology Maps
e) Runoff Yield Maps (2010 and 2030 hydrologic land use conditions)
f) Hydrology Comparison Points Maps
g) Existing Storm Drain System/Deficiencies Map
h) Recommended Storm Drains/CIP Maps

LIST OF ACRONYMS

1D	1-Dimensional Floodplain Analysis
2D	2-Dimensional Floodplain Analysis
AF	Acre-Feet
BMP	Best Management Practices
CFS	Cubic Feet Per Second
CMP	Corrugated Metal Pipe
DFIRM	Digital Flood Insurance Rate Map
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FPS	Feet Per Second
GIS	Geographic Information System
HEC	Hydraulic Engineering Center (US Army Corps of Engineers)
HMS	Hydrologic Modeling System
HSPF	Hydrological Simulation Program-Fortran
MPD	Master Plan of Drainage
NPDES	National Pollutant Discharge Elimination System
O&M	Operation And Maintenance
QA/QC	Quality Assurance/Quality Control
RCP	Reinforced Concrete Pipe
ROW	Right-Of-Way
SOI	Sphere of Influence
SWMM	Storm Water Management Model
USGS	U.S. Geological Survey
VCFCD	Ventura County Flood Control District (Currently VCWPD)
VCPWA	Ventura County Public Works Agency
VCRAT	Ventura County Modified Rational Method Hydrology Software
VCWPD	Ventura County Watershed Protection District (Formerly VCFCD)
WMP	Watershed Master Plan

1. EXECUTIVE SUMMARY

1.1 General

This report presents the outcome of the update of the City of Simi Valley's Master Plan of Drainage. In order to make knowledgeable decisions concerning expenditures of public funds, governing agencies are obligated to study available design and construction alternatives and determine those actions which give the greatest value and benefit to the taxpaying public in return for dollar investment. In response to this need, the City authorized review and updating of their 1990 Master Plan of Drainage (MPD).

Described herein are the methodologies employed and results obtained in an engineering analysis of the localized drainage characteristics of the Simi Valley watershed, along with a program of recommended drainage infrastructure improvements to protect the community from localized flooding.

1.2 Background

The City's comprehensive drainage studies were initiated with a "Storm Drainage Survey" prepared by Brown and Caldwell Consulting Engineers, in October 1971. This was the first City-wide drainage study after City incorporation in October 1969. The earliest MPD for the City was limited in scope being completed in 1978. That study was jointly funded by the City and the Ventura County Watershed Protection District (VCWPD, formerly the Ventura County Flood Control District).

In 1990, the City updated the 1978 MPD to reflect the most current General Plan Land Uses and also include new drainage facilities constructed since the 1978 study. The 1990 MPD also established new 10-year and 100-year flow hydrology information for various drainage facilities, and added a drainage and detention basin policy required to offset downstream flooding concerns from new development projects. It also proposed new storm drains and regional detention basin facilities to further reduce the potential for downstream flooding due to anticipated growth. These facilities were prioritized in an updated Capital Improvement Plan for the City.

1.3 Objectives of the 2014 Update

This updated study was completed over a two and a half year period with objectives divided into the following subtasks:

- Creation of a Storm Drain System Geographic Information System Inventory with an Atlas
- Review & Update of the previous MPD meeting the latest standards

- Update of the 10-year and 100-year Hydrology incorporating the latest land use designations
- Update of the City's Drainage System Capital Improvement Plan
- Update of the City's Drainage Policy Recommendations

1.4 Process

This 2014 update also incorporates new scientific tools and technology to significantly improve how the drainage system is analyzed. The new MPD now includes detailed storm drain Atlas Maps that have been prepared using as-built and record drawings, as well as the latest Geographic Information System (GIS) information, Light & Detection Ranging (LiDAR) topographic data, aerial imagery, and a complete drainage facility geo-database. The project incorporates a series of new and more detailed hydrology models covering the entire 90-square mile study area for both the 10-year and 100-year storm return/recurrence periods for the City.

The storm drain system GIS inventory and atlas identify the existing three-dimensional drainage facility locations and attributes. This information was collected from (on file), as-built construction plans and placed into the City GIS. This geographic database (Geodatabase) information identifies storm drain system main lines, laterals, catch basins and inlets, open channels, box conduits, culverts and detention basins. The database also identifies whether a facility is privately owned and maintained or publicly owned and maintained for all facilities by entities such as the VCWPD, Caltrans, Metrolink and Rancho Simi Recreation and Park District.

1.5 Findings

This update of the City's hydrology models has resulted in a number of observations and findings.

a. Review & Update of the previous MPD It was found that the City's current drainage policies and requirements have served the City well and have helped to mitigate increases in runoff due to new development while controlling localized flooding. Currently, the City is built out to nearly 93 percent of the ultimate imperviousness. As the City reaches full build-out, stormwater and drainage policies will need to be adjusted and regulations revised to address complete build out and long term urbanization needs.

b. Hydrology Update - The hydrology models in this study have been created based on 2010 "present land use condition" with a projection for the 2030 build-out "future land use condition". In order to evaluate the effectiveness of the City's detention basin policy, the present land use condition models were also evaluated mathematically with and without detention basins.

c. Drainage System Capital Improvement Plan - The current hydraulic capacity of the City drainage facilities (for 30" in diameter or larger pipes) was estimated and then checked against the MPD updated future condition 10-year peak flows. This analysis identified that approximately 15% of the City's storm drains, 30" and larger, were potentially hydraulically deficient under a full flow capacity of less than a 10-year storm event.

d. Cost of Recommended CIP – The 2014 Analysis has identified storm drainage system deficiencies in 26 miles of the system with an associated approximate CIP cost of $58-million to correct.

e. Detention Basin Policy – As mentioned previously, the City's current detention basin policy has provided effective peak flow mitigation of runoff resulting from new development. However, overall analysis of the detention basins did not result in clear-cut conclusions or trends. As a result of the study it was found that some modification to the policy should be incorporated in revised Public Works Design Guidelines following this update.

1.6 Recommendations

The 2014 update of the MPD suggests various changes and additions to the current stormwater policies and procedures to address the evolving regulatory, environmental and economic conditions affecting existing and future multi-jurisdictional management of the stormwater system. The more prominent recommendations are summarized as follows:

a. Stormwater Detention Policy – It is recommended that the City work with outside jurisdictions such as Ventura County, Caltrans and Metrolink to convert existing natural stormwater impoundments into fully functional detention basins to further improve mitigating future development. The City should work with the VCWPD to develop an in lieu stormwater detention banking program and also move towards regional detention solutions within the Watershed to further protect the community and downstream properties.

b. Development Impacts - The City should consider preparation of a nexus study for adoption of a Stormwater Impact Fee program to fully mitigate the increased runoff from new development.

c. Capital Improvement - The City should complete a City-wide hydraulic and two-dimensional (2D) floodplain model in order to prioritize and validate all new development projects based on flood reduction benefit. Once the study is completed the impacts to localized drainage can be fully identified in greater detail and accuracy. The City can then prioritize interior drainage improvement projects based on flood damage reduction rather than pipe size deficiencies.

d. Storm Flow Monitoring - To aid the City-wide 2D rainfall-runoff modeling effort, the City should evaluate current weather measuring facilities and then as needed invest in new weather, rainfall, water level and stream gage flow monitoring systems to gather more data as necessary. This information, once augmented with NOAA precipitation and rainfall intensity mapping, will be used to calibrate the 2D floodplain models in compliance with FEMA flood mapping requirements for any updated studies the City is contemplating.

e. Public Works Department Policies and Procedures - It is recommended that the City also consider implementation of the following recommendations:

- The new Atlas should be maintained and updated annually as new drainage facilities are constructed in the study area. Budget for these updates should be incorporated into the yearly budget.
- New guidelines and requirements should be established for the preparation of Hydrology and Hydraulics reports.
- The MPD should be updated every ten (10) years to reflect changed land use and regulatory conditions.

1.7 Funding Options

The City Public Works Department conducts various activities associated with stormwater including, but not limited to: maintenance & operations, monitoring & enforcement and capital improvement. However, the City does not currently have a dedicated source of revenue or funding for stormwater management and must rely on its General Fund for the bulk of these services.

There are several possible sources that can provide fiscal support for stormwater activities. These sources include locally controlled funds such as taxes, fees and special assessments, as well as competitive sources like grants and bonds. These funding sources can serve as individual elements or be used in combination. While there are multiple funding options for stormwater management, there are two key considerations:

- Does the funding source provide a practical connection between costs and the stormwater impacts created, and
- Is the funding source stable and sustainable?

1.8 Conclusion

The City's Master Plan of Drainage continues to be an effective tool in providing effective infrastructure to manage runoff from the 10-year event storm. Less frequent, but higher volume 25 and 50-year storm events are generally conveyed by City streets and VCWPD channels. However, the 100-year event storm still poses a flood damage threat to the City along the Arroyo Simi and many of its tributaries.

Management of the 100-year storm is beyond the scope of this Master Plan of Drainage. This level of flood damage protection requires a multi-agency solution (VCWPD, Caltrans, Metrolink, etc.) that is best served by a Watershed Management Plan. This Plan can fully utilize the previously recommended City-wide hydraulic and 2D floodplain model to maximize and leverage the efforts of all agencies.

1.9 Acknowledgement

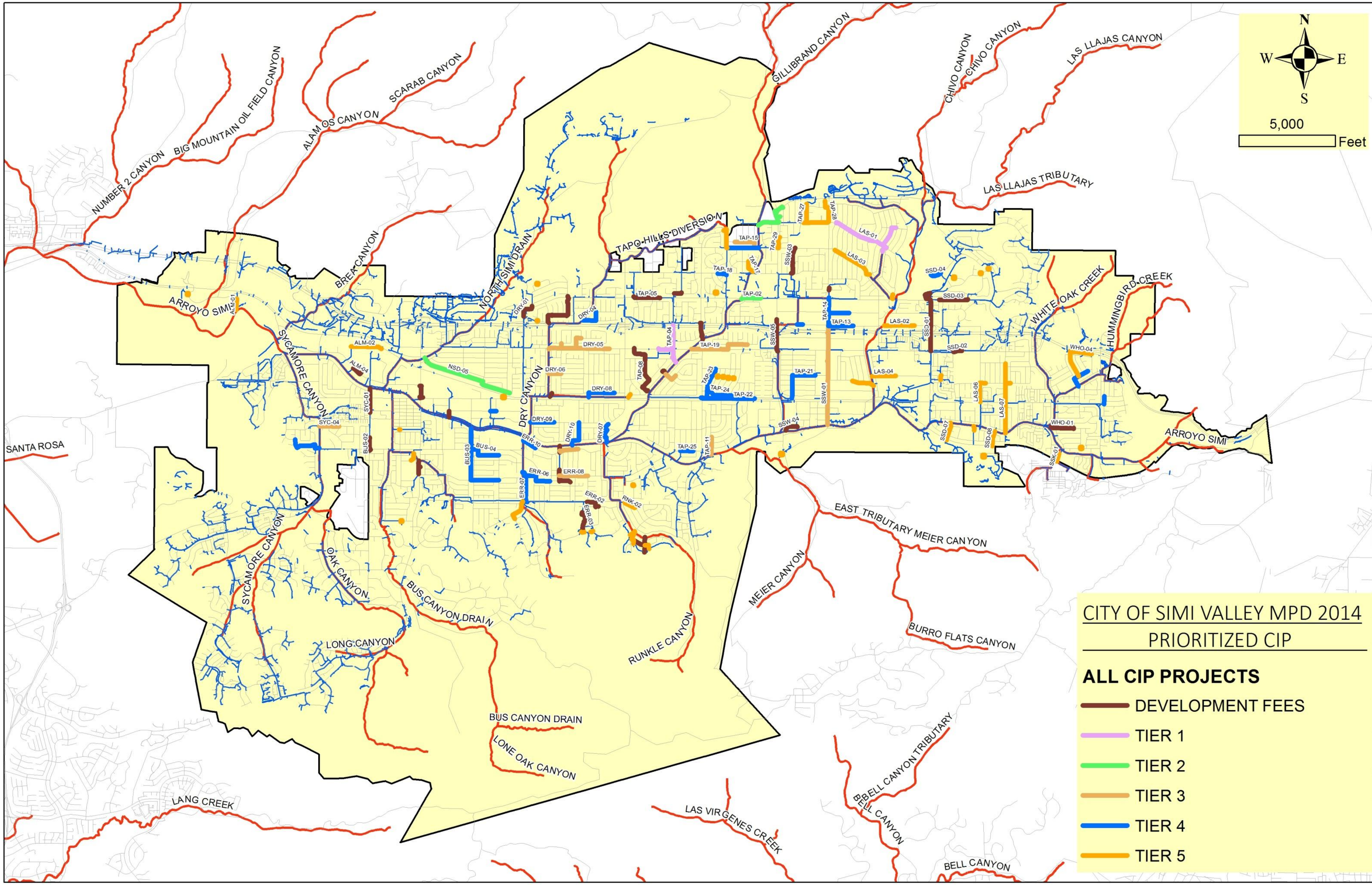
Kasraie Consulting would like to thank the City of Simi Valley, Public Works Department, for giving us the opportunity to complete this important and critical study, and for their contributions throughout the duration of the project. The City was especially helpful in providing all the available drainage system information, record drawings, and various study reports, location of drainage and maintenance hot spots and problem areas. The City staff also helped to rank priorities for the Capital Improvement Plan, and funding and fee mechanism for new projects.

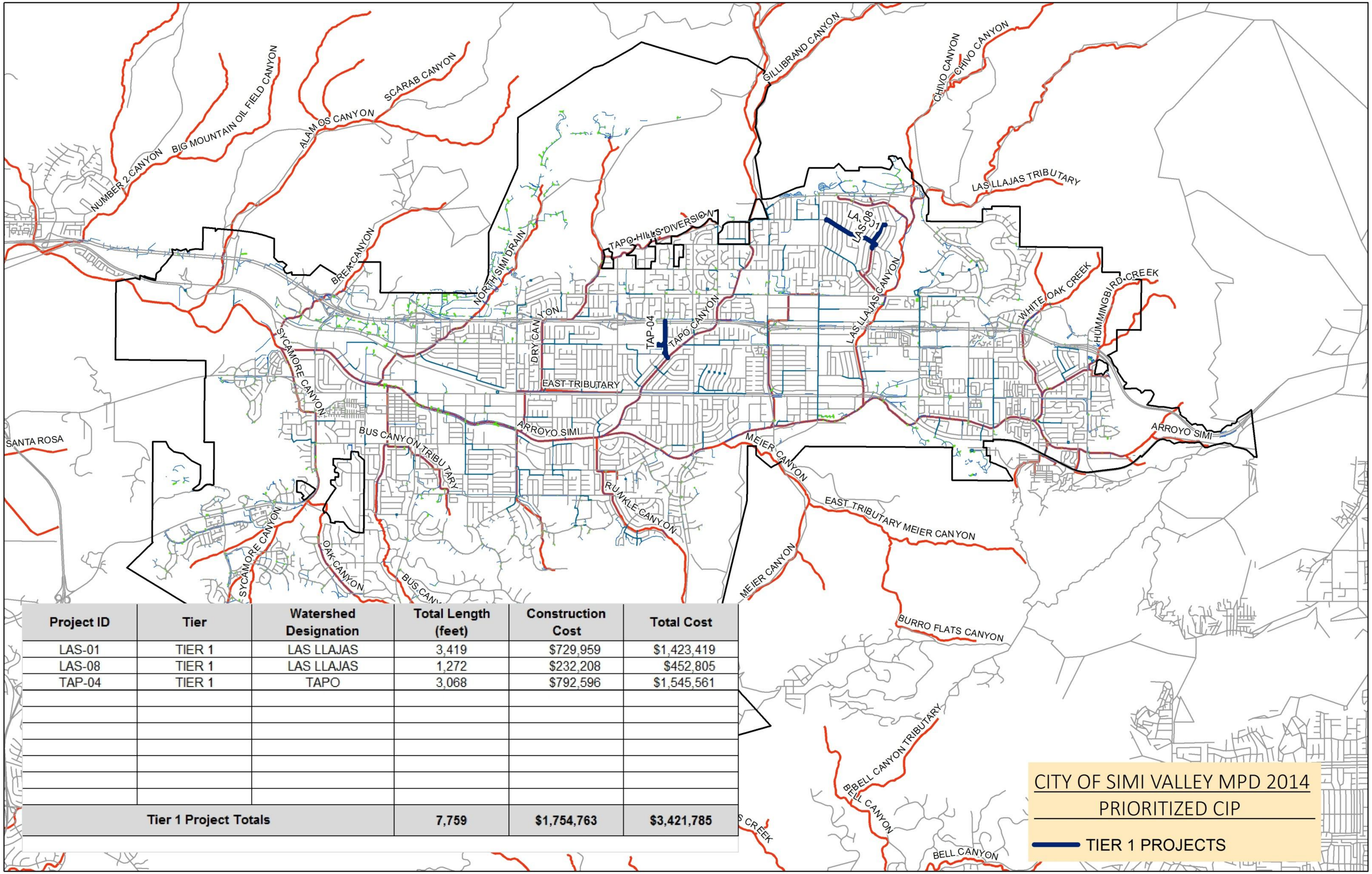
Special thanks are given to Mr. Ron Fuchiwaki, Public Works Director, Mr. Brent Siemer, Deputy Director / Development Services, and Mr. Chris Oberender, Deputy Director / Maintenance Division, along with the engineering staff of the City of Simi Valley.

The following project staff were the key individuals involved with the various elements of project. Their commitment to quality and dedication is hereby acknowledged as well.

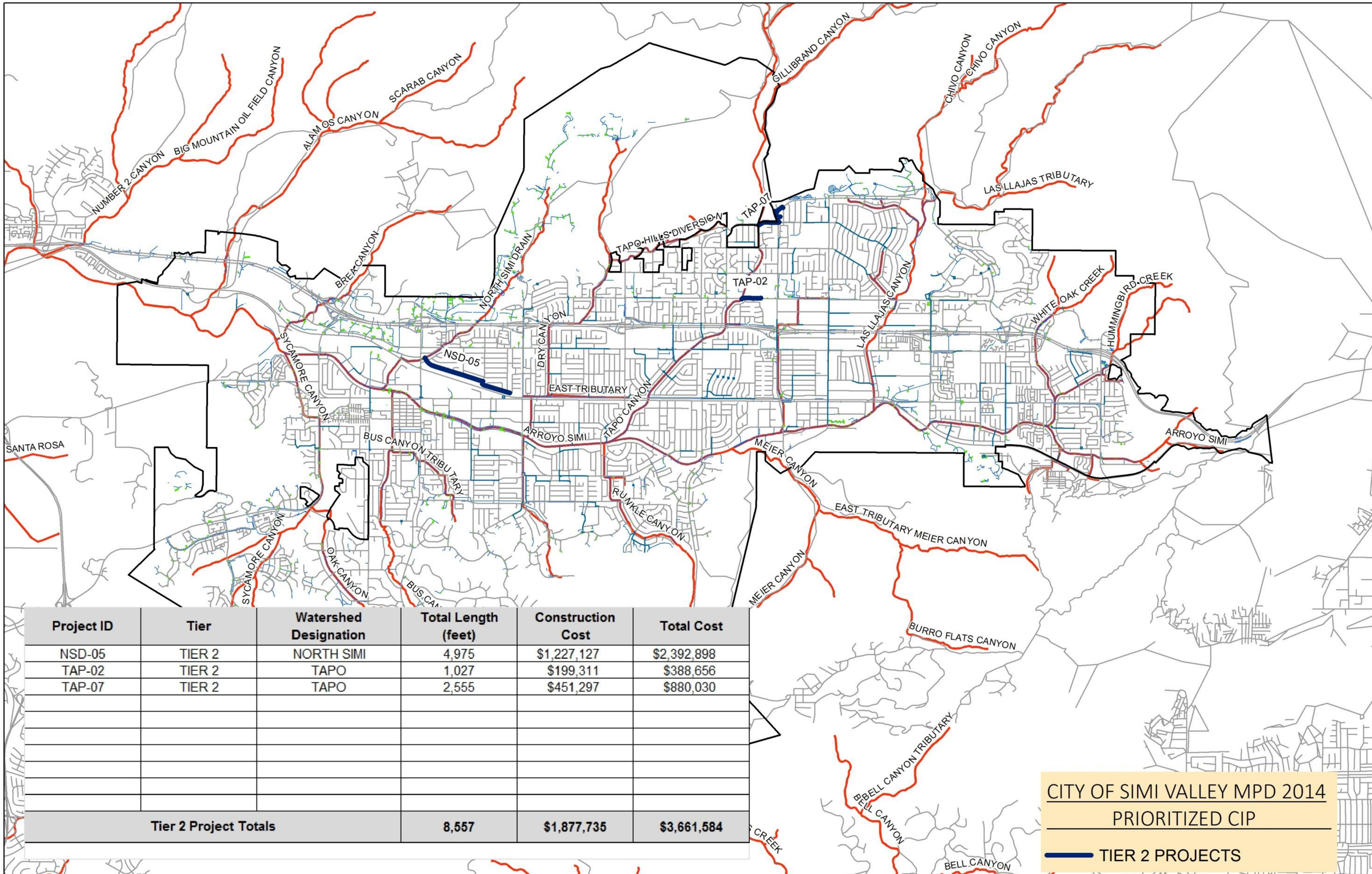
<u>Kasraie Consulting</u>
David Laak, Hydrologist
Rich Gleason, PE, Hydraulic Engineer
Dolores Taylor, PE, Senior Hydrologist
Hassan Kasraie, PE, President

<u>Nobel Systems, Inc.</u>
Balaji Kadaba, GISP, Operations Manager
Michael Samuel, President

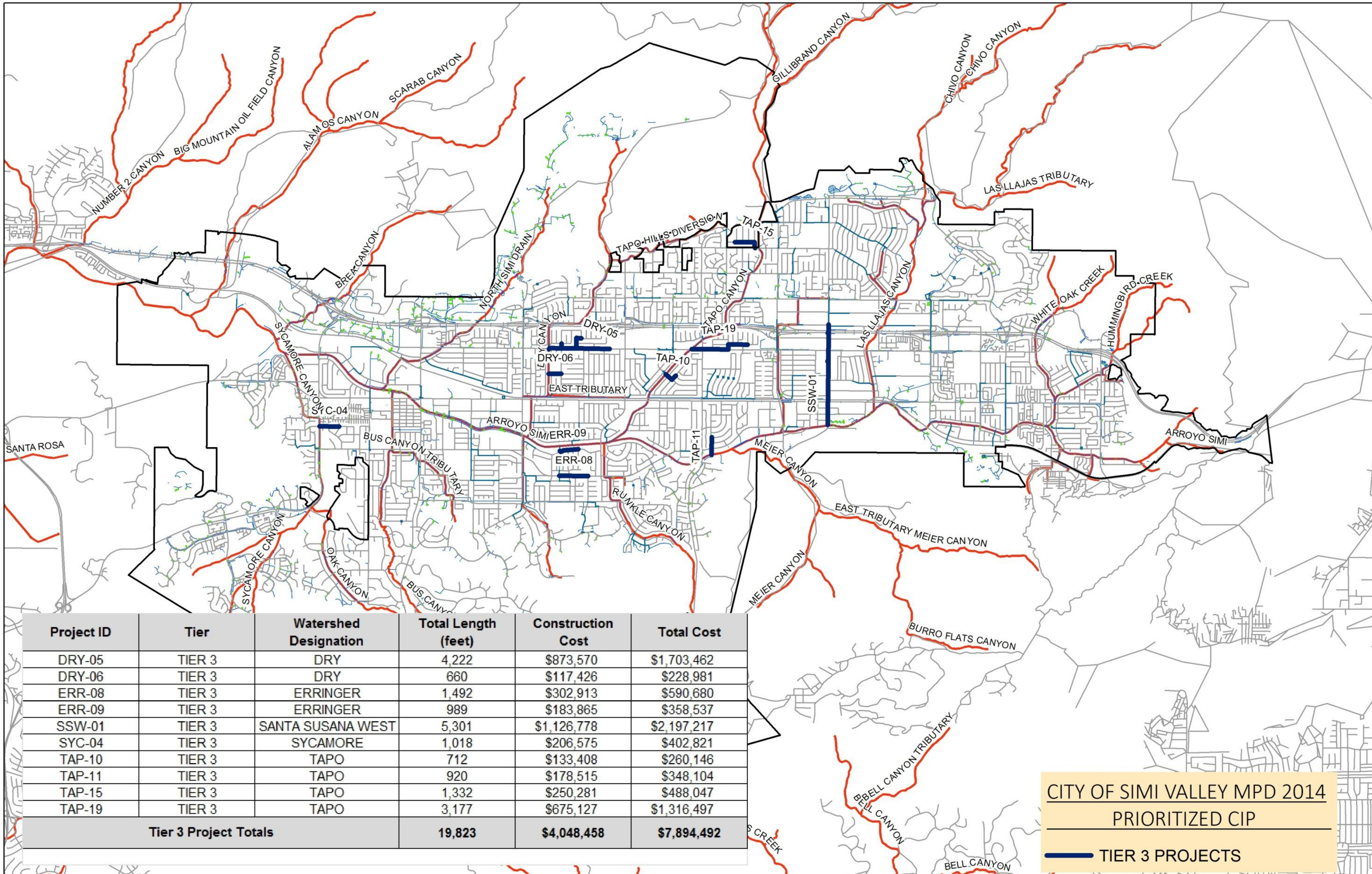

CITY OF SIMI VALLEY MPD 2014
PRIORITIZED CIP
ALL CIP PROJECTS
DEVELOPMENT FEES
TIER 1
TIER 2
TIER 3
TIER 4
TIER 5
N
W
E
S
5,000
Feet
NUMBER 2 CANYON
BIG MOUNTAIN OIL FIELD CANYON
ALAMOS CANYON
SCARAB CANYON
GILLIBRAND CANYON
CHIVO CANYON
LAS LLAJAS CANYON
LAS LLAJAS TRIBUTARY
TAPO HILLS DIVERSION
BREA CANYON
NORTH SIMI DRAIN
ARROYO SIMI
SYCAMORE CANYON
DRY CANYON
WHITE OAK CREEK
HUMMINGBIRD CREEK
SANTA ROSA
OAK CANYON
BUS CANYON DRAIN
LONG CANYON
RUNKLE CANYON
LONE OAK CANYON
LANG CREEK
LAS VIRGENES CREEK
MEIER CANYON
EAST TRIBUTARY MEIER CANYON
BURRO FLATS CANYON
BELL CANYON TRIBUTARY
BELL CANYON



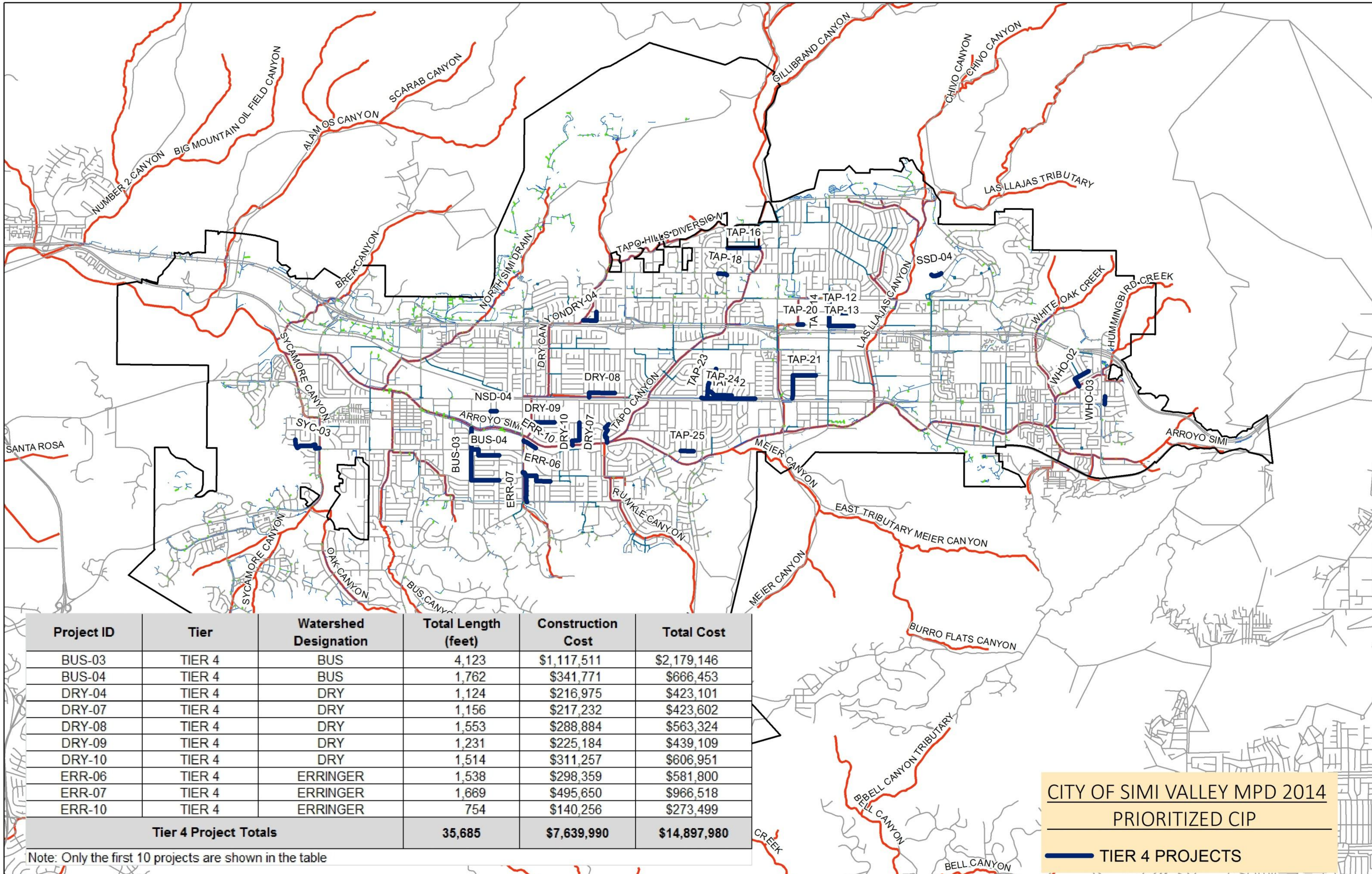
Project ID	Tier	Watershed Designation	Total Length (feet)	Construction Cost	Total Cost
LAS-01	TIER 1	LAS LLAJAS	3,419	$729,959	$1,423,419
LAS-08	TIER 1	LAS LLAJAS	1,272	$232,208	$452,805
TAP-04	TIER 1	TAPO	3,068	$792,596	$1,545,561
Tier 1 Project Totals			**7,759**	**$1,754,763**	**$3,421,785**



Project ID	Tier	Watershed Designation	Total Length (feet)	Construction Cost	Total Cost
NSD-05	TIER 2	NORTH SIMI	4,975	$1,227,127	$2,392,898
TAP-02	TIER 2	TAPO	1,027	$199,311	$388,656
TAP-07	TIER 2	TAPO	2,555	$451,297	$880,030
Tier 2 Project Totals			**8,557**	**$1,877,735**	**$3,661,584**

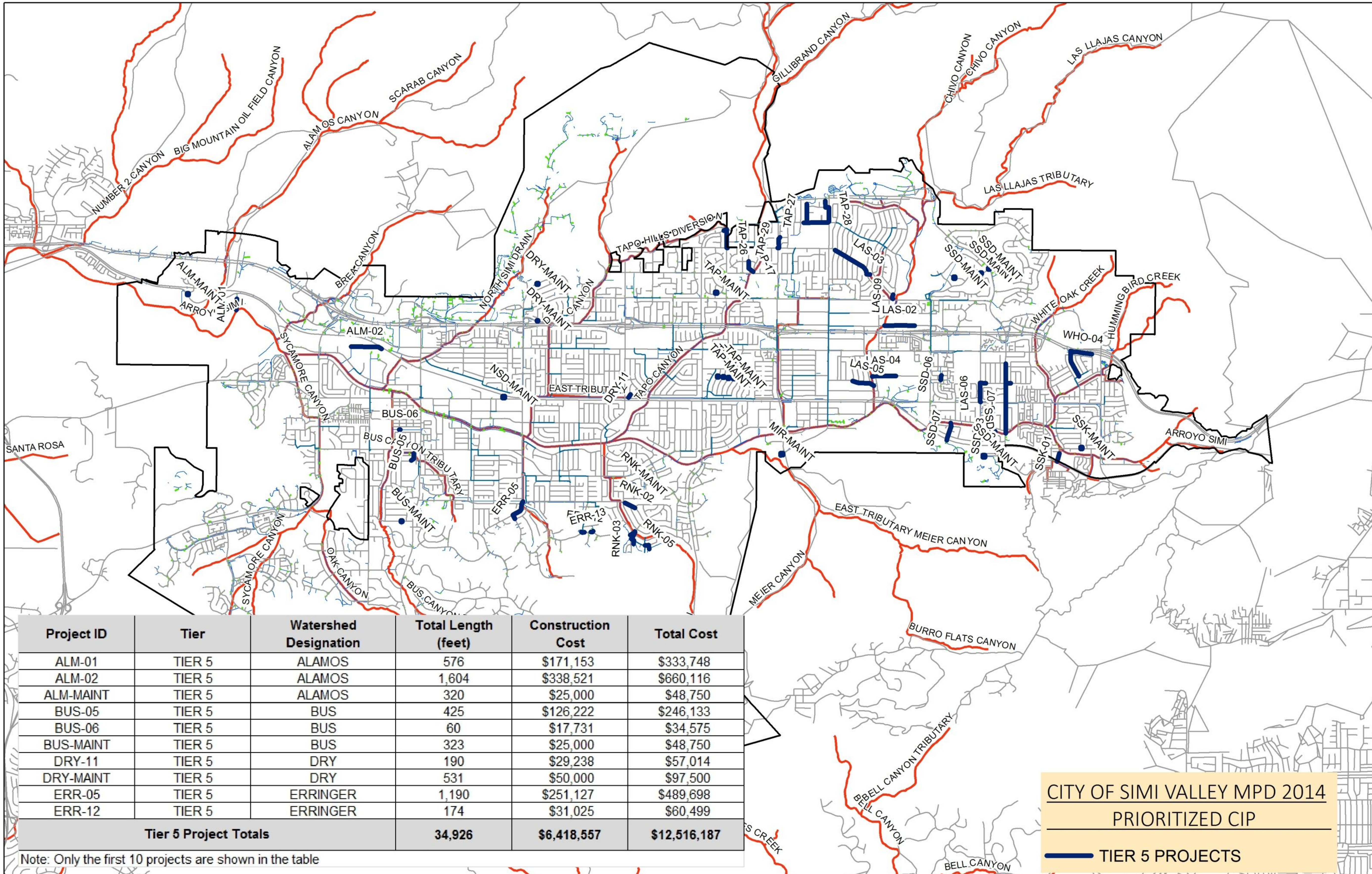


Project ID	Tier	Watershed Designation	Total Length (feet)	Construction Cost	Total Cost
DRY-05	TIER 3	DRY	4,222	$873,570	$1,703,462
DRY-06	TIER 3	DRY	660	$117,426	$228,981
ERR-08	TIER 3	ERRINGER	1,492	$302,913	$590,680
ERR-09	TIER 3	ERRINGER	989	$183,865	$358,537
SSW-01	TIER 3	SANTA SUSANA WEST	5,301	$1,126,778	$2,197,217
SYC-04	TIER 3	SYCAMORE	1,018	$206,575	$402,821
TAP-10	TIER 3	TAPO	712	$133,408	$260,146
TAP-11	TIER 3	TAPO	920	$178,515	$348,104
TAP-15	TIER 3	TAPO	1,332	$250,281	$488,047
TAP-19	TIER 3	TAPO	3,177	$675,127	$1,316,497
Tier 3 Project Totals			**19,823**	**$4,048,458**	**$7,894,492**



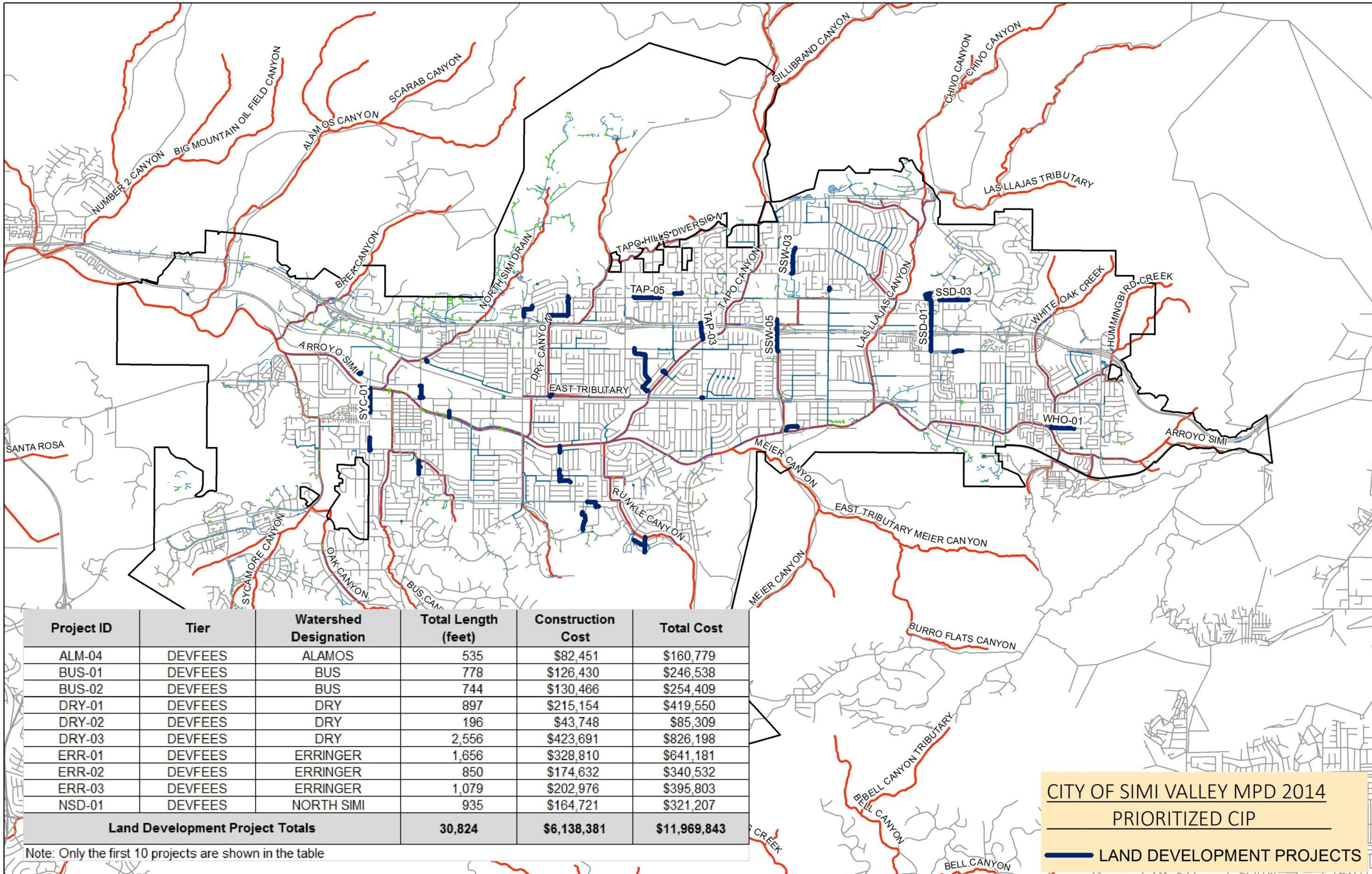
Project ID	Tier	Watershed Designation	Total Length (feet)	Construction Cost	Total Cost
BUS-03	TIER 4	BUS	4,123	$1,117,511	$2,179,146
BUS-04	TIER 4	BUS	1,762	$341,771	$666,453
DRY-04	TIER 4	DRY	1,124	$216,975	$423,101
DRY-07	TIER 4	DRY	1,156	$217,232	$423,602
DRY-08	TIER 4	DRY	1,553	$288,884	$563,324
DRY-09	TIER 4	DRY	1,231	$225,184	$439,109
DRY-10	TIER 4	DRY	1,514	$311,257	$606,951
ERR-06	TIER 4	ERRINGER	1,538	$298,359	$581,800
ERR-07	TIER 4	ERRINGER	1,669	$495,650	$966,518
ERR-10	TIER 4	ERRINGER	754	$140,256	$273,499
Tier 4 Project Totals			**35,685**	**$7,639,990**	**$14,897,980**

Note: Only the first 10 projects are shown in the table



Project ID	Tier	Watershed Designation	Total Length (feet)	Construction Cost	Total Cost
ALM-01	TIER 5	ALAMOS	576	$171,153	$333,748
ALM-02	TIER 5	ALAMOS	1,604	$338,521	$660,116
ALM-MAINT	TIER 5	ALAMOS	320	$25,000	$48,750
BUS-05	TIER 5	BUS	425	$126,222	$246,133
BUS-06	TIER 5	BUS	60	$17,731	$34,575
BUS-MAINT	TIER 5	BUS	323	$25,000	$48,750
DRY-11	TIER 5	DRY	190	$29,238	$57,014
DRY-MAINT	TIER 5	DRY	531	$50,000	$97,500
ERR-05	TIER 5	ERRINGER	1,190	$251,127	$489,698
ERR-12	TIER 5	ERRINGER	174	$31,025	$60,499
Tier 5 Project Totals			34,926	$6,418,557	$12,516,187

Note: Only the first 10 projects are shown in the table



Project ID	Tier	Watershed Designation	Total Length (feet)	Construction Cost	Total Cost
ALM-04	DEVFEES	ALAMOS	535	$82,451	$160,779
BUS-01	DEVFEES	BUS	778	$126,430	$246,538
BUS-02	DEVFEES	BUS	744	$130,466	$254,409
DRY-01	DEVFEES	DRY	897	$215,154	$419,550
DRY-02	DEVFEES	DRY	196	$43,748	$85,309
DRY-03	DEVFEES	DRY	2,556	$423,691	$826,198
ERR-01	DEVFEES	ERRINGER	1,656	$328,810	$641,181
ERR-02	DEVFEES	ERRINGER	850	$174,632	$340,532
ERR-03	DEVFEES	ERRINGER	1,079	$202,976	$395,803
NSD-01	DEVFEES	NORTH SIMI	935	$164,721	$321,207
Land Development Project Totals			**30,824**	**$6,138,381**	**$11,969,843**

Note: Only the first 10 projects are shown in the table

2. INTRODUCTION

2.1 General

Since its incorporation on October 10, 1969, the City of Simi Valley has proactively designed, constructed, maintained and improved a large storm drainage network.
In order to make knowledgeable decisions concerning expenditures of public funds, governing agencies are obligated to study available alternatives and determine those actions which give the greatest value and benefit to the taxpaying public in return for dollar investment. In response to this need, the City of Simi Valley authorized review and updates to the Master Plan of Drainage for the City. This report presents the outcome of that study. Described herein are the methodologies employed and results obtained in an engineering analysis of the drainage characteristics of the Simi Valley watershed, along with a program of recommended drainage-related facilities.

2.2 Scope of Work

The purpose of the MPD update is to provide engineering data meeting the needs of the City of Simi Valley. This consisted of analyzing the hydrologic characteristics of the 90-square mile Simi Valley watershed basin, and providing a planning framework within which the existing and future drainage system needs would be evaluated and acted upon.

This update focused on reassessing current area hydrology and system hydraulic capacities, confirming mainline storm drain flows, identifying operational deficiencies and then providing recommended drainage system improvements, while examining potential financing options for completing those improvements. Long-term maintenance needs and costs for maintaining the City's existing and future drainage infrastructure were evaluated as part of this update.

The scope of work included the following tasks:

a. Storm Drain System Geographic Information System (GIS) Inventory & Atlas
b. Review & Update of the previous MPD
c. Hydrology Update
d. Drainage System Capital Improvement Plan
e. Drainage Policy Recommendations

Stormwater quality effects and facilities fee recovery policy were originally part of this effort. However they were rolled into the City's own Watershed Management Plan (WMP).

This study utilized standard, well accepted methodologies and techniques of hydrologic and hydraulic analysis for master plans of drainage which are done on a macroscopic scale. The process consisted of gathering information for the existing condition (year 2010) and future condition (year 2030) hydrologic land use assumptions, soil types and existing drainage facilities. This data, in conjunction with an analysis of drainage area size and characteristics and estimate of conveyance structure configurations were entered into hydrologic computer software originally developed by Los Angeles County and augmented by Ventura County (VCRAT). This hydrologic model simulates a given design storm by performing certain scientific calculations, and develops storm runoff quantities or discharges. These discharges are then interfaced with existing facilities data to determine either their general adequacy or deficiency. Planning and sizing data for new recommended facilities to mitigate deficiencies is then generated through the application of standard full flow calculations.

After the plan of recommended facilities were developed, planning-level cost estimates were made based on that data. These provide public decision makers with an idea of the anticipated costs required to implement that plan. From these costs, administrative and political decisions can be made concerning the method and timing of funding.

2.3 Deliverables

Deliverables and specific tasks performed by Kasraie Consulting in preparation of the updated MPD 2014 include the following:

a) Review and update of the MPD 1990 by Hawks & Associates
b) Review and use of the VCWPD 2003/2004 hydrology models
c) Preparation of a detail Storm Drain System Atlas map book and digital Geodatabase. Nobel Systems, Inc. prepared the electronic geodatabases and related GIS data layers, as a sub-consultant to Kasraie Consulting. Kasraie Consulting provided project management and QA/QC of the storm drain databases on the City's behalf. City staff provided all the as-built and record drawings, and some field verification of existing facilities.
d) Preparation of maps, tables, and statistics of the 2010 present hydrologic land use condition, and the 2030 future hydrologic land use condition using the City's latest General Plan map.
e) Completion of hydrology calculations, mapping, and model results for the 10- and 100-year frequency storms in accordance with the VCWPD computerized hydrology methods. Models included a special "with" and "without" detention basin analysis to aid in updating the City's detention and drainage policy. Both 2010 and 2030 hydrologic land use condition assumptions were reflected in the hydrology models.
f) Creation of a comprehensive detention basin matrix of physical and hydrologic data, and performance evaluation for meeting City's detention basin requirements.
g) Preparation of preliminary analysis of the adequacy of City's existing drainage facilities 30" in diameter/height and larger by utilizing the computerized hydrologic data.
h) Assistance to City staff to identify and document Maintenance Hot Spots, and preparation of an alternatives map and the associated cost estimates.
i) Updating of an overall Recommended Storm Drains/CIP Map.

j) Preparation of order of magnitude engineer's cost estimates for the recommended storm drain systems.
k) Establishment and prioritization of a tier-based drainage system CIP to the year 2030.
l) Preparation of a narrative report describing the purpose of the technical study, the study area, existing facilities and recommended systems, engineering and planning criteria, estimated costs of the CIP, and conclusions and recommendations.
m) Addressing peer review comments by VCWPD, and incorporation of those comments into the final hydrological models and narrative report, if warranted.

The succeeding chapters in this Volume 1 of 3 represent major steps taken in the performance of the study. Volume 2 of 3 consists of various technical studies, procedures, and methods used. Volume 3 of 3 is our Storm Drain System Atlas book.

2.4 Vertical and Horizontal Datum

In compliance with the City of Simi Valley's Geographic Information System (GIS) and Geodatabase design, the datum for the hydrology modeling and LiDAR topography purposes are as follows:

Horizontal Datum:

California State Plane Coordinates System North American Datum 1983, Zone V Feet (NAD83)

Vertical Datum:

North American Vertical Datum 1988 Feet
(NAVD88)

The storm drainage-related invert elevations vertical datum captured in the geodatabase is the same as the vertical datum of the original record drawing, therefore many of those are in the National Geodetic Vertical Datum 1929 (NGVD29).

In Simi Valley, the elevations based on NAVD88 vertical datum are 2.60 to 2.73 feet, or 2.67 feet on average, higher than elevations based on NGVD29 vertical datum.

2.5 Historical Drainage Studies

The City's comprehensive drainage studies started with a "Storm Drainage Survey" prepared by Brown and Caldwell Consulting Engineers, in October 1971. This was the first City-wide drainage study after the City incorporated in October 1969.

The earliest Master Plan of Drainage Study for the City was completed in 1978, and was a joint funding effort of the City and the VCWPD (formerly the Flood Control District, VCFCD).

The decision by the City and County to fund the 1978 study resulted from a multiplicity of needs, varying for each agency, which could be combined and met efficiently by a single investigation. The purpose of the City's participation was to review and update their 1971 storm drainage survey, and to convert City drainage requirements to the newer Ventura County Flood Control District hydrology method, which was adopted by-the City in May of 1975.

In 1990, the City updated the Master Plan of Drainage again. This time, the MPD reflected the most current General Plan Land Use element and the drainage facilities that had been constructed since the 1978 study. The MPD 1990 established new 10-year and 100-year flow hydrology information under a future General Plan-based hydrologic land use only. Unlike the current MPD update, the MPD 1990 did not establish the hydrology at the "present" 1990 hydrologic land use condition. However, it did document various drainage facilities as well as a new /updated drainage and detention basin policy for new development projects. It also proposed additional storm drains and regional detention basin facilities, along with their approximate size, location and planning-level cost estimate. These facilities were also prioritized in an updated CIP.

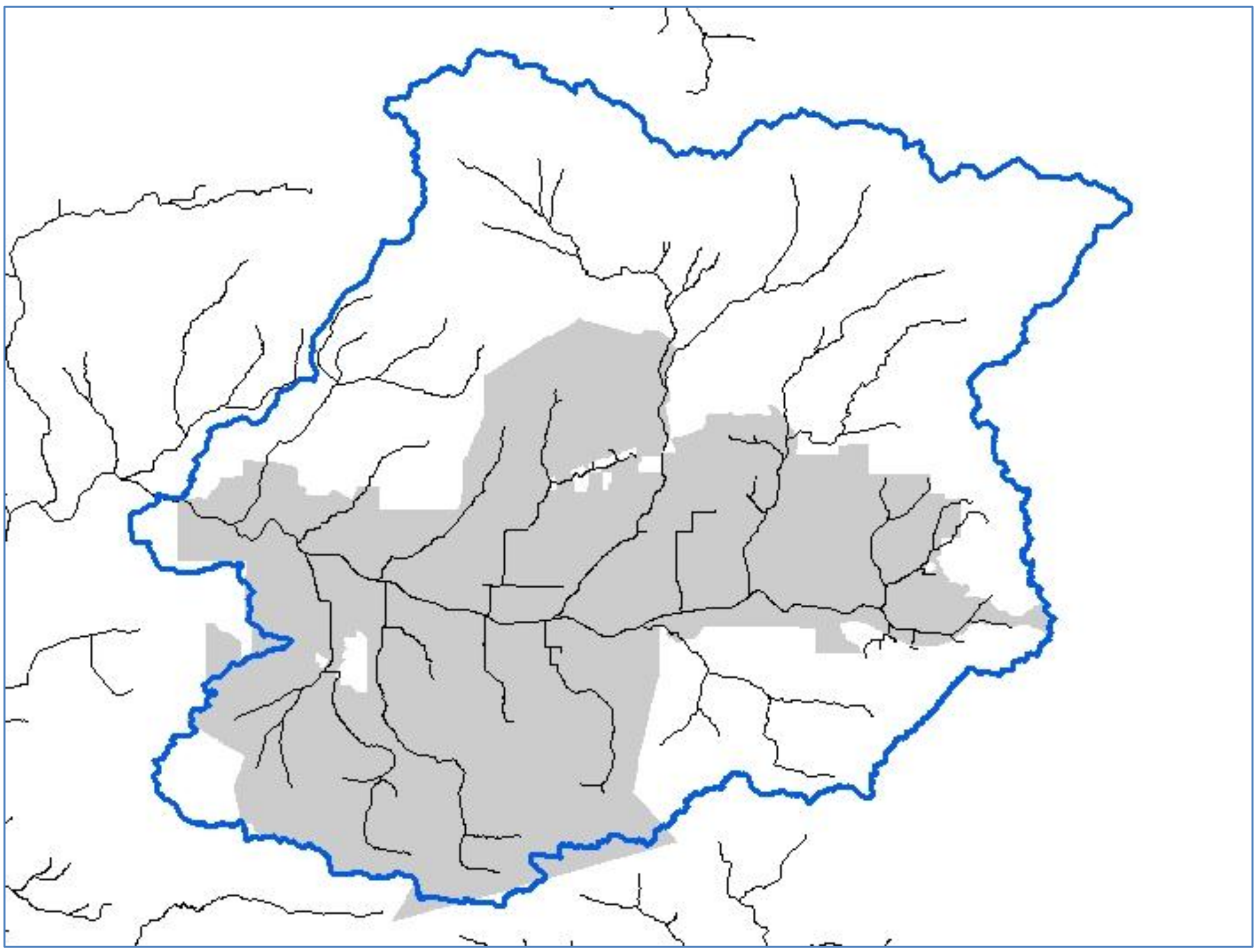
The MPD 2014 update was initiated in mid-2011 and it was completed in late 2013. This study reflects scientific tools and technology that have improved significantly since 1990. The new MPD includes detailed storm drain Atlas Maps that have been prepared using as-built and record drawings, the latest Geographic Information System (GIS) data layers, Light & Detection Ranging (LiDAR) topographic data, aerial imagery, and a complete drainage facility geo-database.

3. DESCRIPTION OF STUDY AREA

3.1 General

The City of Simi Valley is located in the southeastern portion of Ventura County immediately adjacent to Los Angeles County. It is situated approximately 30 air miles from the City of Ventura, and an equal distance from the Los Angeles Civic Center. The City is situated in the Simi Valley, which is defined by mountains on the north, south and east. The valley floor is located in the approximate center of the study watershed which is essentially rectangular-shaped with an average east-west length of 9 miles and an average north-south width of 10 miles. As drainage and detention facility needs are dependent not upon political boundaries but upon watershed characteristics, the study area is defined as the entire 90 square mile Simi Valley watershed basin. The location of the study area is shown below.

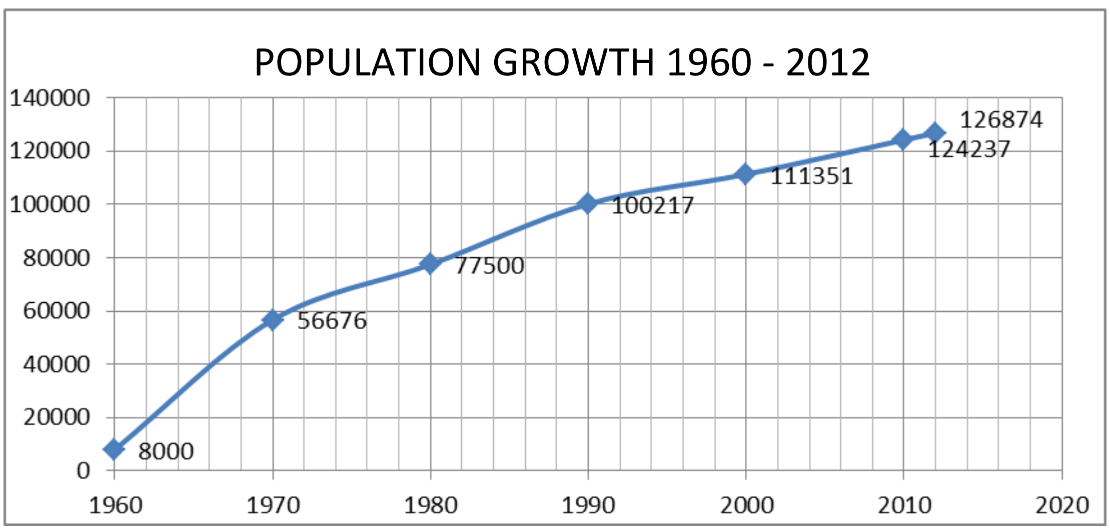
Figure 3-1 Simi Valley Watershed Map



The City of Simi Valley, with an estimated population of 126,414 (as of December 2011) is the third largest of Ventura County's ten cities. Occupying an area of approximately 42 square miles, it is located in Southeast Ventura County, adjacent to the northwestern boundary of the San Fernando Valley, approximately 30 miles northwest of downtown Los Angeles. The City was incorporated in October 1969 under the general laws of the State of California and operates under a General-Law/council-manager form of government.

The economy of the area is dependent on high technology, aerospace research and manufacturing, tourism, and upon its status as a commuter bedroom community for persons working in the San Fernando Valley and the Los Angeles Basin. The area experienced rapid growth in the early 1960's when near build-out of the San Fernando Valley occurred and the rural appeal of the then primarily agricultural Simi Valley made it highly attractive as a place of residence. The Simi Valley growth was encouraged by the introduction of the State water project into the area, and the completion of the State Highway 118 Freeway over Santa Susanna Pass, providing easy access from Simi Valley to the western end of the San Fernando Valley. From 1960 to 1970 the population in the study area increased from 8,000 persons to 57,000, at a rate of nearly 600 percent per decade.

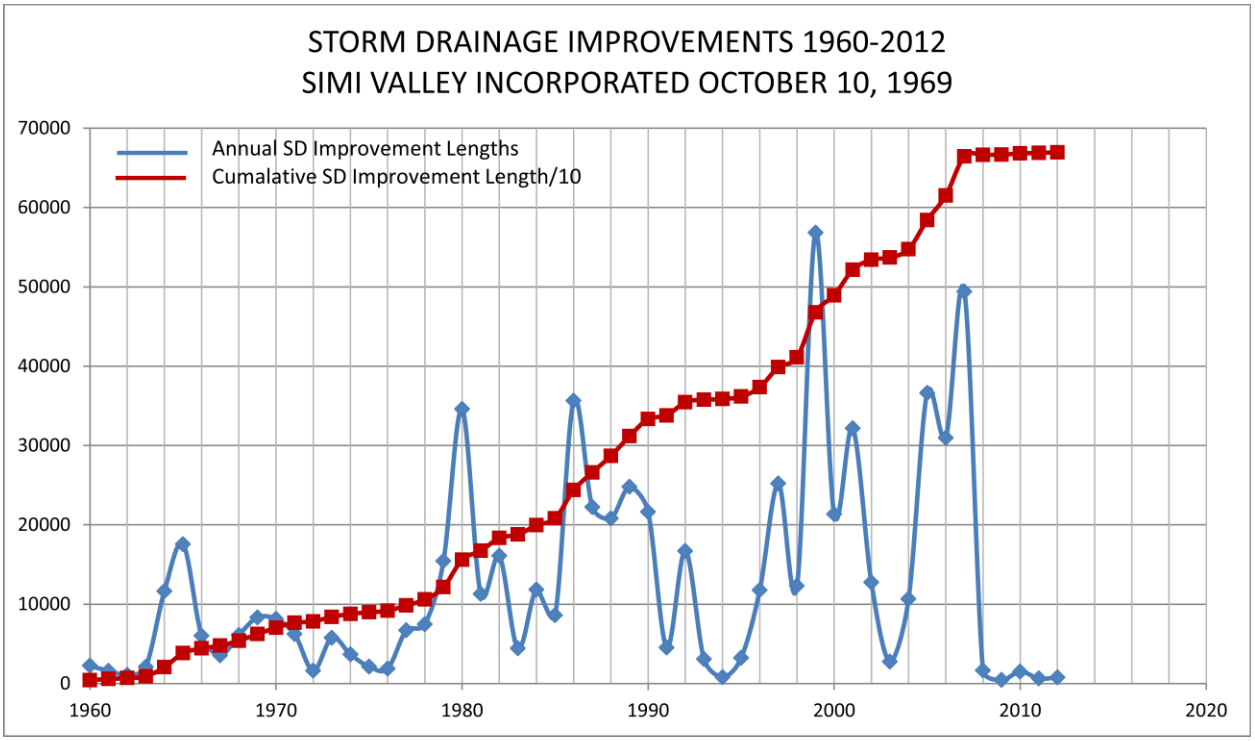
Figure 3-2 Simi Valley Population Growth



The population growth rate per decade decreased to 37 percent in the 1970’s, 29 percent in the 1980’s, and approximately 12 percent from 1990 to present time.

Storm drainage improvements within the study area of Simi Valley increased drastically from the decade before the City incorporated to the present. Investment in the drainage system has experienced ups and downs depending on the State and local economy. The five largest peaks in storm drainage construction were in 1999, 2007, 1986, 1980 and 1965, respectively. Due to the recent recession that began in late 2008, construction of major storm drainage facilities has essentially stalled over the past 5 years.

Figure 3-3 Simi Valley Storm Drainage Improvement History



3.2 Geographical Features

The developed portions of the City of Simi Valley are primarily situated on the valley floor. The watershed is defined by the Santa Susanna Mountains on the north and east and by the Simi Hills on the south. Santa Susanna Pass divides Simi Valley from the San Fernando Valley on the east and is formed by the juncture of the Santa Susanna Mountains with the Simi Hills. The Santa Susanna Mountains separate Simi Valley from the Santa Clara River valley and the City of Fillmore and community of Piru to the north. The Simi Hills also separate the valley from the City of Thousand Oaks to the southwest.

3.3 Watershed Characteristics Parameters

The compiled statistics provides a snapshot of important watershed characteristics along individual tributaries within the Simi Valley Watershed (see exhibit below and Table 3-1). Through the use of advanced geo-processing techniques, watershed parameters have been prepared within the entire 90.2 square mile watershed area, and summarized for each major sub-watershed. The characteristics parameters include: drainage area, land use types and sizes, estimated percent of impervious coverage, hydrologic data such as precipitation, infiltration rate, runoff volume, floodplain coverage, and channel lengths.

Figure 3-4 Watershed Characteristics Map

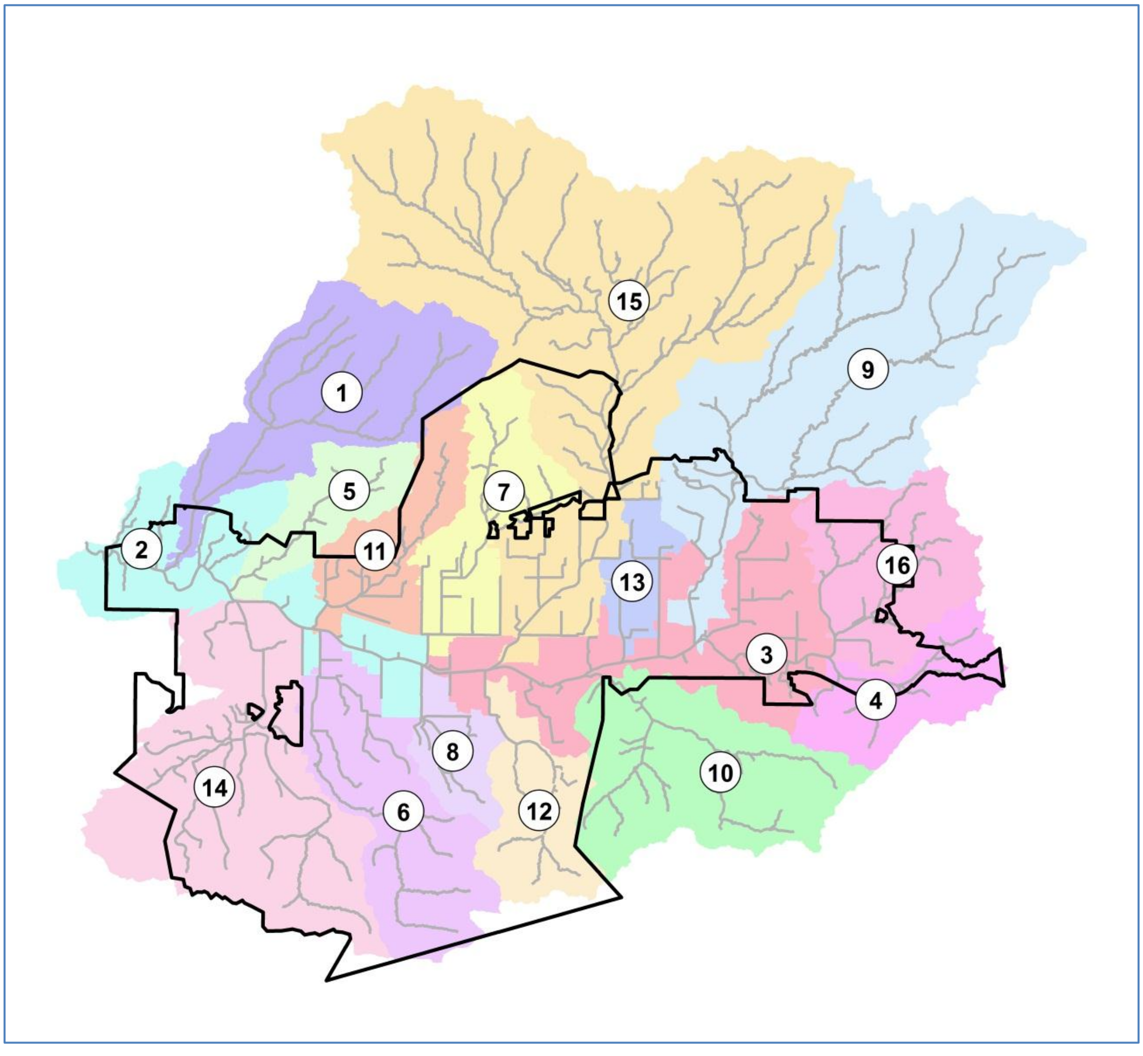


Table 3-1 Watershed Characteristics Parameters

WATERSHED CHARACTERISTICS PARAMETERS		TOTALS	ALAMOS CANYON	ARROYO SIMI-LOCAL DOWNSTREAM	ARROYO SIMI-LOCAL MIDDLE	ARROYO SIMI-LOCAL UPSTREAM	BREA CANYON	BUS CANYON	DRY CANYON	ERRINGER ROAD DRAIN
Drainage Area Total (Square Miles)		**90.2**	5.9	4.5	6.3	2.8	2.1	5.0	3.4	1.4
Drainage Area Total (Acres)		**57728**	3805	2848	4020	1804	1329	3192	2149	913
Drainage Area Within City (Acres)		**26412**	170	1902	3626	416	330	3137	2084	915
Percent Area Within City (%)		**46%**	4%	67%	90%	23%	25%	98%	97%	100%
Land Use (Acres)	Imperviousness									
Commercial	0.85	**568**		60	65	9	23		26	12
Industrial	0.72-0.85	**809**	8	253	190	11	156			
Mixed-Use	0.60	**345**		144	57			9		
Open Space	0.00	**39316**	3771	1399	909	1205	1086	1777	1036	421
Public-Semi Public	0.10-0.90	**2586**	1	252	296	207	1	86	220	15
Regional/Institution	0.10-0.47	**249**	10	223	1		15			
Residential	0.20-0.85	**10439**		304	1812	250		1070	616	378
Transportation	0.93	**3416**	15	213	690	122	48	250	251	87
Estimated Impervious Areas (Acres)		**9221**	21	768	1796	250	184	641	557	248
Estimated Impervious Areas (%)		**16%**	1%	27%	45%	14%	14%	20%	26%	27%
Hydrologic Curve Number	Minimum	**35**	59	57	50	69	61	62	60	59
	Maximum	**95**	70	93	93	85	95	87	92	85
	Average	**74**	61	71	80	75	71	76	74	76
10yr Rainfall (Inches)	Minimum	**4.5**	4.5	4.5	4.8	5.4	4.5	4.5	4.8	4.7
	Maximum	**6.7**	6.7	4.9	5.5	5.8	5.6	5.3	5.6	4.9
	Average	**5.1**	5.8	4.6	5.1	5.5	5.0	4.7	5.1	4.8
10yr Storm Runoff Volume (Acre-Feet)		**11254**	596	453	988	409	244	593	410	178
100yr Rainfall (INCHES)	Minimum	**6.5**	6.6	6.5	7.0	8.0	6.6	6.5	7.0	7.0
	Maximum	**10.0**	10.0	7.3	8.3	9.0	8.3	8.0	8.3	7.3
	Average	**7.6**	8.6	6.8	7.5	8.4	7.5	6.9	7.3	7.1
100yr Storm Runoff Volume (Acre-Feet)		**21497**	1244	849	1712	788	459	1094	736	326
FEMA 100yr Effective Flood Zone (Acres)		**3238**	120	569	472	77	82	213	157	47
FEMA 500yr Effective Flood Zone (Acres)		**3694**	120	665	546	81	82	284	207	52
Redline Channel Lengths (Miles)		**111.31**	9.71	4.73	5.74	4.29	2.45	7.26	6.27	1.66
Natural (Miles)		**60.66**	9.25	1.69	0.24	1.59	1.58	4.24	1.26	0.30
Improved or Engineered (Miles)		**50.65**	0.46	3.04	5.50	2.70	0.87	3.02	5.01	1.36

Table 3-1 Watershed Characteristics Parameters (Continued)

WATERSHED CHARACTERISTICS PARAMETERS		TOTALS	LAS LLAJAS CANYON	MEIER CANYON	NORTH SIMI DRAIN	RUNKLE CANYON	SANTA SUSANA WEST DRAIN	SYCAMORE CANYON	TAPO CANYON	WHITE OAK HUMMINGBIRD
Drainage Area Total (Square Miles)		**90.2**	12.6	6.0	2.6	2.7	1.2	9.1	20.6	4.1
Drainage Area Total (Acres)		**57728**	8038	3832	1685	1701	737	5834	13201	2640
Drainage Area Within City (Acres)		**26412**	996	230	1408	1679	737	4968	2502	1312
Percent Area Within City (%)		**46%**	12%	6%	84%	99%	100%	85%	19%	50%
Land Use (Acres)	Imperviousness									
Commercial	0.85	**568**			119		58	57	135	4
Industrial	0.72-0.85	**809**		32	97		18	41	3	
Mixed-Use	0.60	**345**	7		76		48	4		
Open Space	0.00	**39316**	7168	3737	690	1285	14	3368	9755	1695
Public-Semi Public	0.10-0.90	**2586**	126	3	47	171	10	287	599	265
Regional/Institution	0.10-0.47	**249**								
Residential	0.20-0.85	**10439**	569	39	430	186	420	1602	2273	490
Transportation	0.93	**3416**	168	21	226	59	169	475	436	186
Estimated Impervious Areas (Acres)		**9221**	414	56	648	157	448	1241	1371	421
Estimated Impervious Areas (%)		**16%**	5%	1%	38%	9%	61%	21%	10%	16%
Hydrologic Curve Number	Minimum	**35**	35	61	65	60	77	68	40	68
	Maximum	**95**	88	84	93	86	92	92	91	87
	Average	**74**	68	69	80	70	84	80	69	74
10yr Rainfall (Inches)	Minimum	**4.5**	5.0	5.0	4.6	4.9	5.0	4.5	5.0	5.2
	Maximum	**6.7**	6.0	5.6	5.7	5.7	5.0	4.9	6.7	6.0
	Average	**5.1**	5.6	5.3	5.0	5.1	5.0	4.5	5.5	5.6
10yr Storm Runoff Volume (Acre-Feet)		**11254**	1488	707	408	296	193	1158	2520	612
100yr Rainfall (INCHES)	Minimum	**6.5**	7.0	7.2	6.8	7.1	7.0	6.5	7.0	7.9
	Maximum	**10.0**	10.0	8.4	8.5	8.4	7.1	7.4	10.0	9.0
	Average	**7.6**	8.8	7.9	7.4	7.6	7.0	6.6	8.3	8.7
100yr Storm Runoff Volume (Acre-Feet)		**21497**	3159	1362	712	571	306	2026	4969	1182
FEMA 100yr Effective Flood Zone (Acres)		**3238**	110	64	147	29	25	481	595	50
FEMA 500yr Effective Flood Zone (Acres)		**3694**	120	64	153	29	74	510	627	80
Redline Channel Lengths (Miles)		**111.31**	14.50	7.24	3.39	3.43	1.84	10.35	21.99	6.46
Natural (Miles)		**60.66**	9.21	7.24	0.11	1.81	0.01	-0.30	18.67	3.76
Improved or Engineered (Miles)		**50.65**	5.29	0.00	3.28	1.62	1.83	10.65	3.32	2.70

4. EXISTING DRAINAGE SYSTEM

4.1 Storm Drain System Inventory and Atlas

The City of Simi Valley has made a significant investment in their library of as-built record drawings of the storm drain network, which is a critical source of information for the City's operations. As a part of the MPD 2014, the conversion of these paper records to an electronic format and subsequent incorporation into the GIS database was completed. Nobel Systems, Inc., a sub-consultant to Kasraie Consulting, had the responsibility of creating the storm drain system GIS and Atlas Maps.

The City required a Geodatabase and atlas of all existing storm drain facilities to be created from record drawings, field verification efforts, and other available local agency data. This database includes all pertinent drainage related improvements and it is based on improvement plans provided from the City of Simi Valley, Caltrans, and VCWPD. Along with these plans, data for publicly and privately maintained detention, water quality and debris facilities within the entire Simi Valley Watershed were included in the Geodatabase. To effectively manage the functionality, maintenance and periodic replacement of this extensive system, a comprehensive multipurpose GIS database was created that facilitates rapid, easy-to-read, and user-friendly retrieval of accurate and reliable infrastructure information. The GIS also offers the ability to create stormwater atlas maps.

The technical data capture and digitization of the data consisted of two phases:

- Phase I - Pilot Data Conversion
- Phase II - Data Conversion of Remaining City Areas

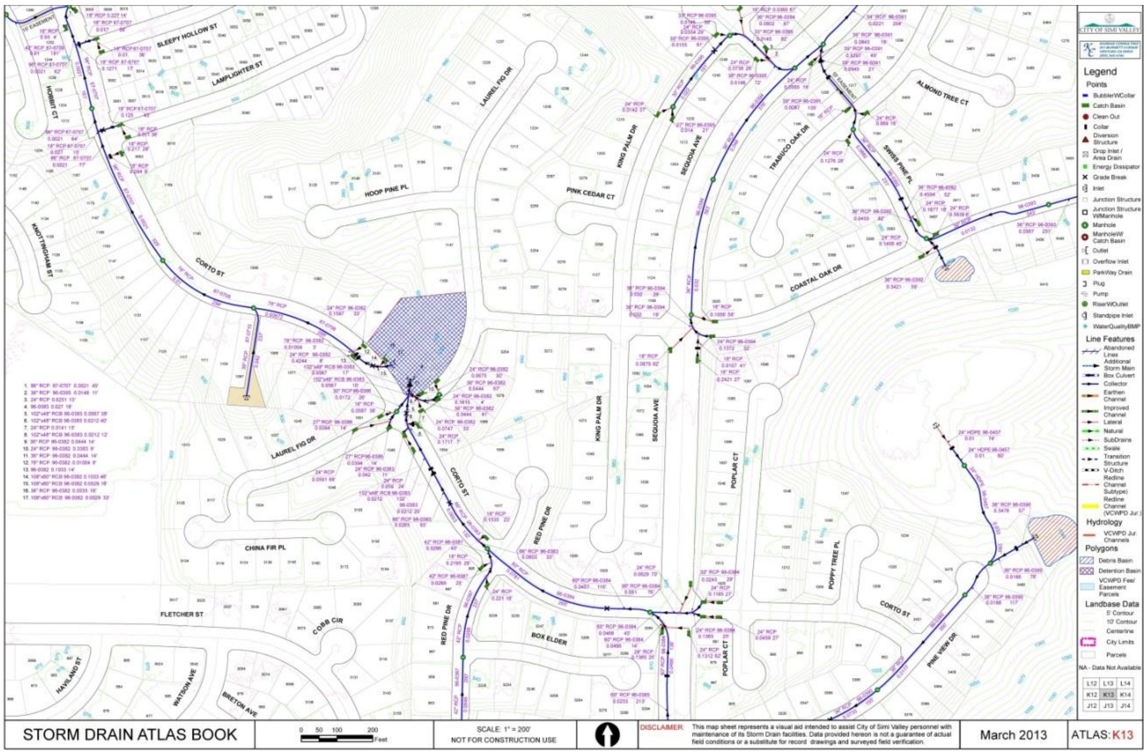
Information from numerous sources were collected and reviewed. Digital parcel, street centerline and other base map databases, and hard copy source documents were used to identify features and attributes to include in the Geodatabase. Many of the City's storm drain plans had already been scanned by the City staff in a TIFF format with a resolution between 150 and 300 dpi. The remaining hardcopy plans were scanned by the consultant team.
The geodatabase was created using the latest standards in GIS mapping and cartography. All of the data is captured and cataloged in the geodatabase and saved as layers of information in the computer. The geodatabase includes basic drainage system geometry such as storm drain sizes, dimensions, lengths, slopes, invert elevations, material, shape, record drawing numbers, date of construction, and many other relevant information. In addition, an Atlas book was prepared and delivered in PDF format as well as 11x17 hardcopy prints.

The storm drain system geodatabase and atlas are a major deliverable of MPD 2014, and therefore both were delivered electronically. The atlas book is included as Volume 3 of 3 within the final deliverables.

The following exhibit is a sample atlas sheet. The final product includes some 178 sheets, complete with an index map and legend sheets.

The enclosed Technical Appendix includes more details regarding the storm drain geodatabase, procedures used, the database structure, data capture and attribution, data migration, and the QA/QC process.

Figure 4-1 Sample Storm Drain System Atlas Sheet

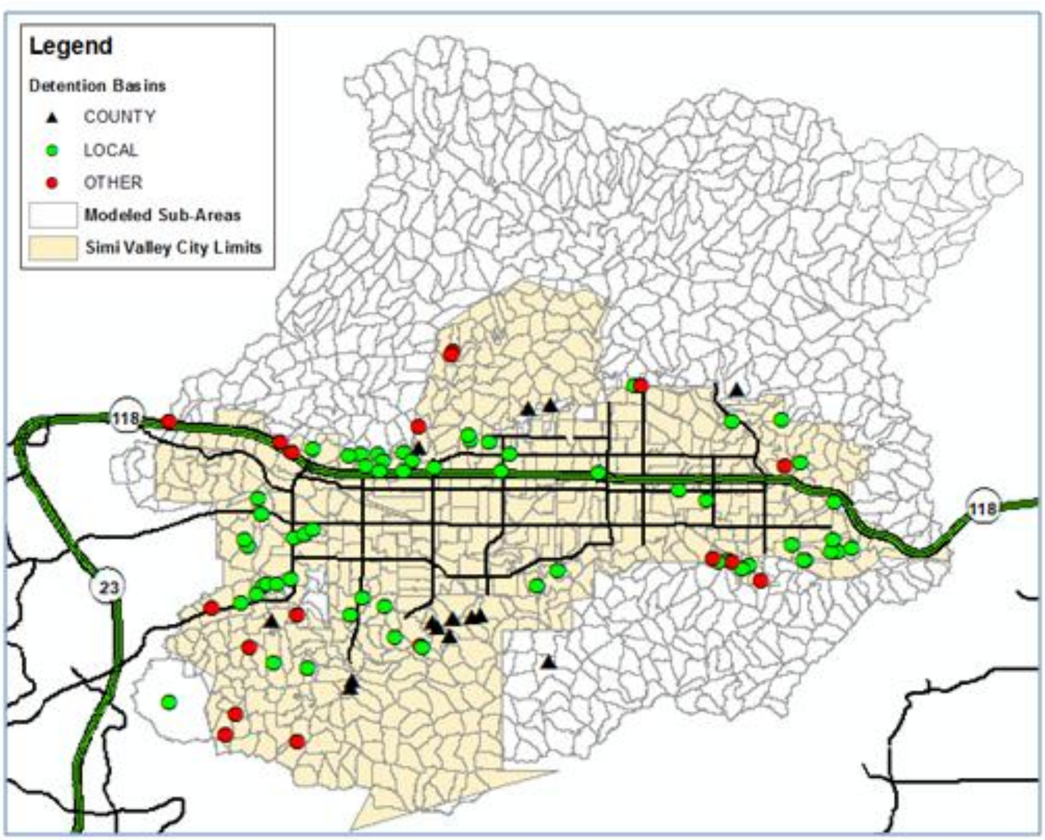


4.2 Detention Basin Inventory And Analysis

A major component of the MPD 2014 update is the consideration of stormwater detention. As the City of Simi Valley has developed and redeveloped, it has proactively developed a strong detention basin policy in coordination with its regional partner, the VCWPD. City's MPD 1978 and MPD 1990 incorporated on-site (local) and regional detention basins into existing and proposed drainage facilities with the purpose of reducing the modeled 100-year post-development runoff peak flows to 10-year post development levels. Detention basins must also be designed so that the resulting water surface elevations are at least one foot lower than any nearby residential pad or commercial finished floor elevation. The aim of the MPD 2014 was to independently evaluate existing facilities, determine their effectiveness in meeting the overall detention policy implemented in the MPD 1990, and to make recommendations for future changes to the detention policy, if warranted.

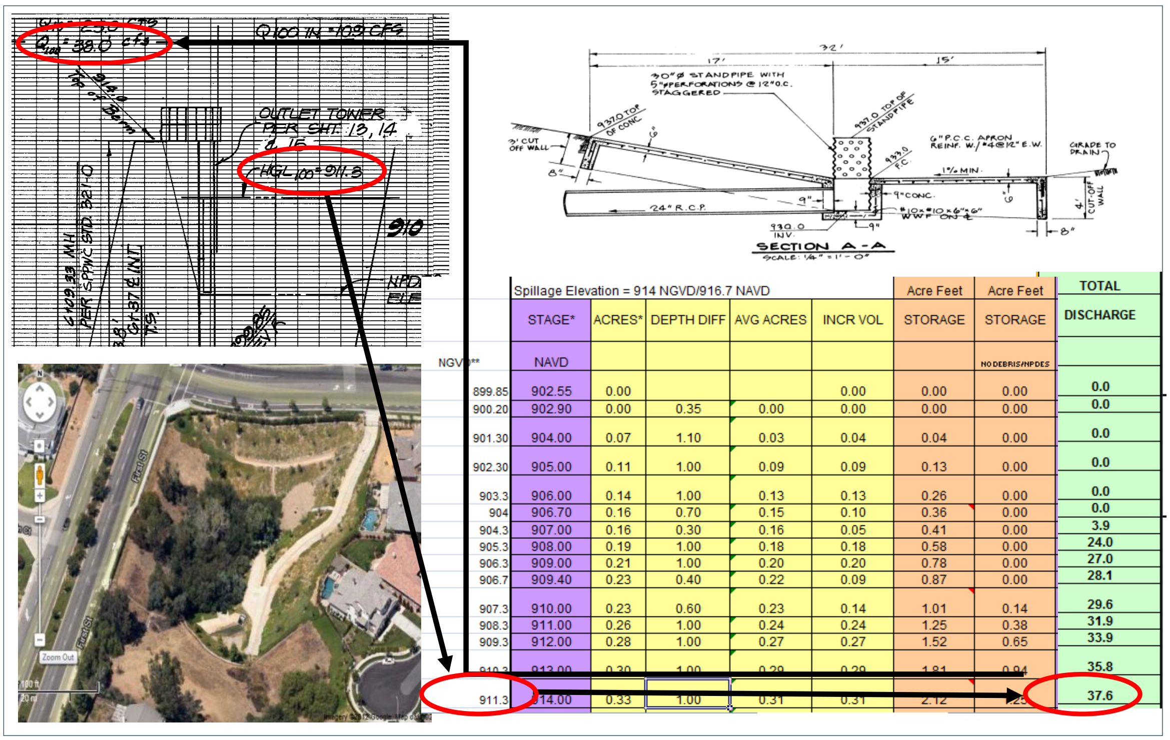
Detention basins provide significant benefits to the overall stormwater system including flood, pollutant, and erosion control. For the purposes of this study, only flood control aspects were analyzed. Numerous detention basins and locations having flow control potential were identified through examination of available facility plans, aerial photography, and documents from other local agencies. A total of eighty-nine locations were identified; fourteen Ventura County detention basins/dams, fifty-seven local detention basins, and nineteen "other" locations (including Bard Reservoir). See location map below:

Figure 4-2 Detention Basin Location Map



The MPD 2014 hydrology models include all of the above detention basins or ponding areas. To include detention basins in the hydrology models, special stage-storage-discharge rating curves were independently prepared for each detention facility. The following image presents a sample calculation that was cross-referenced with the calculations or information shown on the design plans. Similar analyses were done for all the detention basin facilities in the hydrology models.

Figure 4-3 Sample Detention Basin Parameters Sheet



	Spillage Elevation = 914 NGVD/916.7 NAVD					Acre Feet	Acre Feet	TOTAL
	STAGE*	ACRES*	DEPTH DIFF	AVG ACRES	INCR VOL	STORAGE	STORAGE	DISCHARGE
NGVD**	NAVD						NO DEBRIS/NPDES	
899.85	902.55	0.00			0.00	0.00	0.00	0.0
900.20	902.90	0.00	0.35	0.00	0.00	0.00	0.00	0.0
901.30	904.00	0.07	1.10	0.03	0.04	0.04	0.00	0.0
902.30	905.00	0.11	1.00	0.09	0.09	0.13	0.00	0.0
903.3	906.00	0.14	1.00	0.13	0.13	0.26	0.00	0.0
904	906.70	0.16	0.70	0.15	0.10	0.36	0.00	0.0
904.3	907.00	0.16	0.30	0.16	0.05	0.41	0.00	3.9
905.3	908.00	0.19	1.00	0.18	0.18	0.58	0.00	24.0
906.3	909.00	0.21	1.00	0.20	0.20	0.78	0.00	27.0
906.7	909.40	0.23	0.40	0.22	0.09	0.87	0.00	28.1
907.3	910.00	0.23	0.60	0.23	0.14	1.01	0.14	29.6
908.3	911.00	0.26	1.00	0.24	0.24	1.25	0.38	31.9
909.3	912.00	0.28	1.00	0.27	0.27	1.52	0.65	33.9
910.3	913.00	0.30	1.00	0.29	0.29	1.81	0.94	35.8
911.3	914.00	0.33	1.00	0.31	0.31	2.12	[illegible]	37.6

The MPD 2014 Technical Appendix includes a chapter on detention basins, and how they were mathematically incorporated into the overall hydrology models. It also includes detailed calculations, schematics, charts and diagrams used for the analyses. The reason to include all of the above was to ensure transparency and quick retrieval of information and the supporting parameters or documents.

The effectiveness of the City's detention basin policy was evaluated as part of this effort. Several benchmarks were examined to independently assess each detention basin's performance and effectiveness in meeting the City's requirements.
For the purposes of determining detention facility effectiveness, only those designed specifically for detention were reviewed (71 out of 89 modeled). The following table presents general detention basin size and service statistics:

Table 4-1 Detention Basin Statistics

Total Number of Detention Basins	71
Total Drainage Area Served by Detention Basins (ac)	16,431
Total Modeled Drainage Area (ac)	57,728
Percentage of Total Modeled Area Served by Detention Basins	26%
Detention Basin Drainage Area Modeled Range (ac, excl. 3 State-size Dams)	3 - 1,461
Detention Basin Drainage Area Modeled Average (ac, excl. 3 State-size Dams)	105
Detention Basin Storage Volume Range (ac-ft, excl. 3 State-size Dams)	0.1-87.4
Detention Basin Storage Volume Average (ac-ft, excl. 3 State-size Dams)	10.1

VCWPD operates and maintains three State-Size Dams, namely Las Llajas Canyon Dam, Runkle Canyon Dam, and Sycamore Dam. They collectively have a total design storage volume of 1,764 acre-feet up to the emergency spillway. All other City, County, and private detention basins and ponding areas modeled hold a total of 596 acre-feet of storage volume up to the emergency spillway.

Table 4-2 Detention Basins and Dams Volumes

State-size Las Llajas Canyon Detention Dam (ac-ft)	1,033
State-size Runkle Canyon Detention Basin (ac-ft)	71
State-size Sycamore Canyon Dam (ac-ft)	660
Three State-size Dams Total Volume (ac-ft)	**1,764**
All Other City, County, and Private Basins and Ponding Areas (ac-ft)	596

The following benchmarks were examined in order to more clearly quantify the detention basins' effectiveness, and to score and rank them. The complete analytical procedure and results are contained in the Technical Appendix.

a) Detention Basin Spill and Overflow – This is to determine if flood flows are likely to a spill over the detention basin's emergency spillway and/or overflow the top of the dam embankment during a 100-year storm event.
b) Outflow as a Percentage of the 10-year No Basin Flow – This is to determine if a detention basin meets the City's current policy of reducing the 100-year storm post-development peak flow to that of the 10-year storm post-development peak flow.
c) Percent Reduction – This variable is used to compare the effect of a single basin on 100-year flows.Cumulative Downstream Benefit – Peak reduction at the outlet does not give the complete picture of the benefits due to the detention basin. Hydrologic differences between the "with detention" and "without detention" 100-year peak flows were determined for each conduit in the downstream storm drain system.

5. HYDROLOGY

5.1 General

Calculations of hydrology and stormwater runoff for the City of Simi Valley's MPD 2014 update are based on the VCWPD Modified Rational Method (VCRAT) Version 2.6 software and procedures. The complete 10-year and 100-year VCRAT 2.6 hydrology input, output, and times of concentration are included in the Technical Appendix.

A complete hydrology model utilizes several watershed parameters, such as drainage area size, design rainfall totals, intensity and distribution, land use and land cover, hydrologic soil types, watershed and stream conveyance parameters, time of concentration and other drainage facility information such as detention basins.

Hydrology maps, provided at the end of the report as well as within the GIS data layers, depict the latest subarea delineation and stream routing network used in the hydrology models. Subarea features include identification numbers corresponding to the above Modified Rational Method hydrology models, drainage area size, and 10-year and 100-year unit runoff values. Stream routing links are labeled with the total calculated peak flows from the upstream node of each link. Special care needs to be taken when evaluating flows in stream routing links; as they are not always only based on the upstream flow. Sometimes the upstream and downstream flows need to be averaged, or a lateral at the downstream end brings additional flows into the stream. Features within the GIS data layers include additional, robust model input and output data not shown (for visual clarity) on the hydrology maps.

5.2 Subarea And Conveyance Delineation

To delineate the hydrology subareas and their conveyance paths, two hydrology related GIS software extensions, ArcHydro version 2.0 and HEC Geo-HMS version 10.0, were used in conjunction with ArcGIS and the ArcGIS 3D analyst extension.

The first step in creating a 3-dimensional surface from which hydrology subareas can be auto-delineated by the computer is to create a topographic basemap of ground surface elevations. An ESRI Terrain dataset was created from numerous tiles of 2005 LiDAR 10' Grid elevations covering the entire study, with the exception of an area of approximately 2600 acres, at the uppermost end of the Las Llajas watershed within Los Angeles County. LiDAR topography was not available for this area and instead an existing USGS 10-meter DEM was utilized. A study wide topographic GRID was then created from the terrain.

Next, a continuous polyline network representing underground storm drains, open channels and defined natural channel flow paths was created to represent flow through structures and sinks that were not correctly represented within the topography. Artificial sinks were filled and these additional features were subsequently incorporated, "burned", into the GRID using the

ArcHydro extension. This re-conditioned, hydrologically correct GRID, was then used to represent the flow of a single drop of water anywhere within the study area.

Once the hydrologic GRID with stream and storm drain network within ArcHydro were created, a threshold size range for each catchment (subarea) and major flow path was defined. The VCWPD Hydrology Manual recommends subareas for the VCRAT model to be sized between 20 to 80 acres because the VCRAT Time of Concentration (Tc) is limited to a range of 5 to 30 minutes. An initial size set for the auto-delineation of subareas was 10 – 20 acres. The final subarea sizes varied slightly from the desired 20-80 acre range due to the placement and location of storm drains and detention basins. Auto-delineation ultimately resulted in 45 subareas out of a total of 1100 subareas being less than 10 acres in size, or more than 100 acres.

Using the latest 2010 aerial imagery, 2005 LiDAR topography, Google Street View, field investigations and GIS basemap information in addition to the storm drain system atlas, detention basins, and major points of confluence or interest, smaller subareas were merged and larger subareas were divided so that they fell within the recommended size for the VCRAT program.

The hydrology models for the 2010 present land use condition and the 2030 future land use condition consist of some 1100 drainage subcatchment areas or subareas. The average size of the hydrology subarea for the MPD 2014 Update is 52 acres. Basic statistics of the hydrology subarea is as follows:

Table 5-1 Hydrology Subarea Statistics

STATISTICS	2010 LAND USE MODEL	2030 LAND USE MODEL
Count	1094	1109
Minimum (acres)	2	2
Maximum (acres)	156	156
Sum (acres)	57734	57734
Mean (acres)	52.3	51.5

Subarea boundaries from previous hydrology studies of the study area, including the MPD 1990 and the VCWPD 2003 Calleguas Creek Study, were also used in the QA/QC analysis of the subarea boundaries.

Every subarea was investigated to ensure that it made sense hydrologically, and appropriate edits were performed as necessary.
In addition to the subarea modifications, the conveyance paths or hydrolinks created as part of the subarea creation were also modified to represent a single polyline for each conveyance path for the VCRAT model.

For the area outside of the Ventura County not covered by the LiDAR topography, the latest 10-meter USGS Digital Elevation Model (DEM) for the 2600± acres area was downloaded and re-projected to the correct Coordinate System. Using additional GIS tools within the 3D Analyst, the subarea boundaries were auto-delineated. Because no storm drains exist for this area, only the 10-meter DEM was used for boundary delineation.

Once a complete coverage of appropriately sized subareas and their associated hydrolinks for the entire study area were created, ArcHydro was used to extract various parameters for use in the VCRAT model. Detailed descriptions of these various parameters are described below and include; Area (ac.), Design Rainfall, Hydrologic Soil Type, Effective Percent Impervious, Time of Concentration (Tc) and Conveyance Type/Length/Slope/Manning's "N" value.

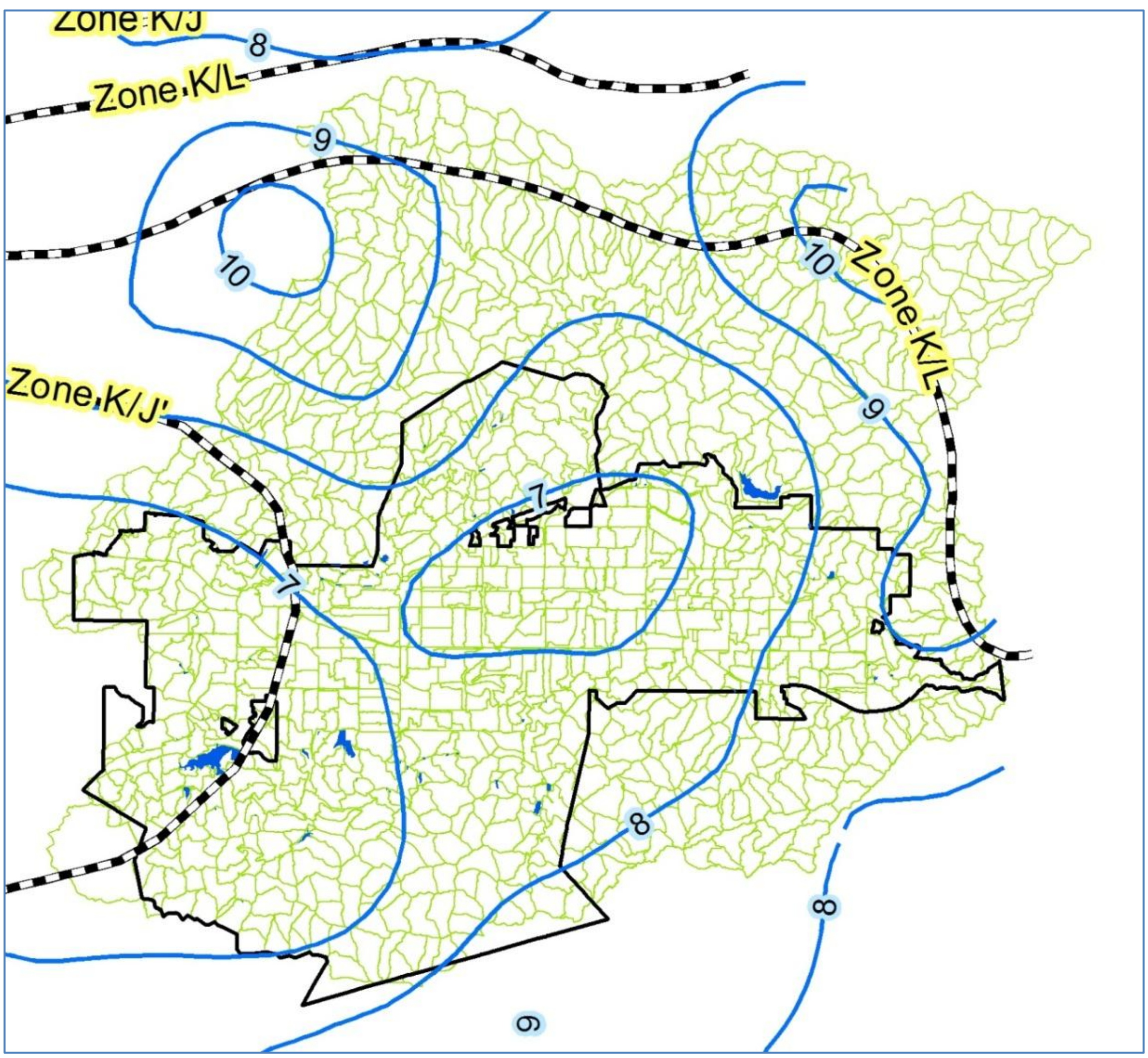
Per City guidance, two future large scale land development projects, which have been approved by the City, were also included in the future condition hydrology models. These t residential housing developments are Tract 5364 – Runkle Canyon Development and Tract 5734 – Lost Canyons Development. For these development areas, the future condition design project hydrology subareas and flowpaths, along with all of their VCRAT hydrologic parameters were obtained from the design engineers. This information was burned into the Citywide Future Condition VCRAT model, replacing the subareas and flowpaths that were created as described in the process above.

5.3 Rainfall

The current 2010 VCWPD Hydrology Manual contains both PDF maps and GIS shapefiles for the 24-hour 10-year, 24-hour 25-year, 24-hour 50-year and 24-hour 100-year rainfall isohyetals, in addition to the hydrologic rainfall zones used in the VCRAT model. Approximately 82% of the study subareas fall within VCWPD Rainfall Zone K, with a total 100-year design rainfall of 10.6" (10-year total = 5.53"). Approximately 10% of the study subareas fall within Rainfall Zone J', with a 100-year design rainfall of 6.66" (10-year total = 4.38"), with the remaining 8% of subareas falling within Rainfall Zone L, which has a total 100-year design rainfall of 15.0" (10-year total = 7.21"). Generally, the L-Zone produces more runoff than K-Zone, and the K-Zone areas produce more runoff than J or J'-Zones.

The above rainfall isohyetal information is based on rain gage records through 2006, while the rainfall zones are based on rain gage records through 1975.

Figure 5-1 Rainfall Map



5.4 Hydrologic Land Use

The hydrology modeling prepared in support of the MPD 2014 analyzes both the 2010 present land use condition, as well as the 2030 future land use condition. The Technical Appendix contains a chapter on the hydrologic land use analysis, tables, maps, and comparison.
The City of Simi Valley's latest General Plan Land Use map (adopted October 1, 2010) was used as the basis for the 2030 full build-out future condition hydrology land use and land cover assumptions for hydrologic modeling purposes.

To simulate runoff and hydrology under the present land use condition, City's 2010 aerial imagery was utilized. The 2030 hydrologic land use map was overlaid on top of the 2010 aerial imagery, and it was revised graphically to correctly reflect the current land use condition. For example, a given area which is planned to be developed in the future may be currently undeveloped or open space. The 2030 future land use map shows it as developed with a specified imperviousness (by land use type) whereas the 2010 present land use condition shows it as open space with zero imperviousness.

See the enclosed 2030 Hydrologic Land Use Maps. The following summary table presents the hydrology land use map designations, total area (sq. miles) of each designation, the average impervious and the assumed hydrologic effective percent impervious values used for the runoff factor for both scenarios.

The October 2010 General Plan map only covers the City's Sphere of Influence (SOI) geographic area. Watershedsdraining to the City and being modeled for the MPD, cover a larger area extending past the SOI. To ensure that all modeled subareas outside the SOI have designated land use(s), the 2006 General Plan Update GIS layer designations were used for those areas. After merging the 2010 General Plan Land Use with the 2006 General Plan Land Use for areas outside the SOI, it was discovered that additional areas outside the extent of these layers drained into the City. For these additional areas, the 2010 aerial photography was used to classify appropriate land use classes.

This composite GIS layer represents the future (2030) Hydrology Land Use layer to be used in the parameter extraction for the future condition VCRAT model.
To assess the existing condition land use cover and effective impervious values, the 2010 aerial photography was examined in comparison with the composite General Plan Land Use map. Those areas where the 2010 aerial photography showed a different land use type compared to the General Plan Land Use layer were identified. These areas are shown on a Comparison Map in the Technical Appendix. The appropriate effective impervious values were applied for the present condition land use based on the aerial photo.

Based on this analysis, the following two GIS layers with appropriate effective impervious values were created: (1) The 2010 Simi Valley Hydrology Land Use Layer and (2) 2030 Simi Valley Hydrology Land Use Layer. These shapefiles are contained in the Hydrology section of the Technical Appendix.

The hydrology subarea weighted average values of effective imperviousness were calculated through a GIS overlay analysis using the 2010 and 2030 Hydrology Land Use layers.

Table 5-2 Hydrologic Land Use Statistics

Hydrology Land Use	Theoretical Percent Impervious	Effective Percent Impervious	2010 Land Use Area (sq. mi.)	2030 Land Use Area (sq. mi.)	Percent Change (2030-2010) / 2030
OPEN SPACE	0.00	0.00	61.43	58.59	-5%
RESIDENTIAL	0.20-0.85	0.10-0.50	16.32	17.46	7%
COMMERCIAL	0.85	0.50	0.89	0.91	2%
INDUSTRIAL	0.72-0.80	0.50-0.70	1.27	2.57	51%
MIXED-USE	0.60		0.54	0.54	0%
PUBLIC/SEMI-PUB	0.10-0.90	0.05-0.60	4.04	4.09	1%
REG. FACILITY/INST	0.10-0.47	0.05-0.23	0.39	0.63	38%
TRANSPORTATION	0.93	0.70	5.34	5.41	1%
Reference: Assumed percent impervious factors per VCWPD Hydrology Manual		Total (sq. mi.)	**90.2**	**90.2**	

5.5 Effective Imperviousness

Effective imperviousness is less than total impervious area because some of the impervious area runoff passes through pervious areas where some infiltration can occur. The percent impervious used for the land use designations were obtained from the 2010 VCWPD Hydrology Manual Appendix 14A/14B. Effective impervious values for all land use designations were applied using the values from the Hydrology Manual. In some cases the land use designation from the Hydrology Land Use layer were not shown in the Hydrology Manual. For those instances, engineering judgment was used to determine appropriate effective impervious values.

The hydrology land use map Legend presents the assumed impervious values for the various land use designations.

5.6 Hydrologic Soil Types

The hydrologic soil types used in the VCRAT model for the MPD 2014 Update originated from the complex soil designations contained in the April 1970 Soil Conservation Service (SCS) Soil Survey. Please see the large hydrologic soils & rainfall maps enclosed at the end of the report, and the map below.

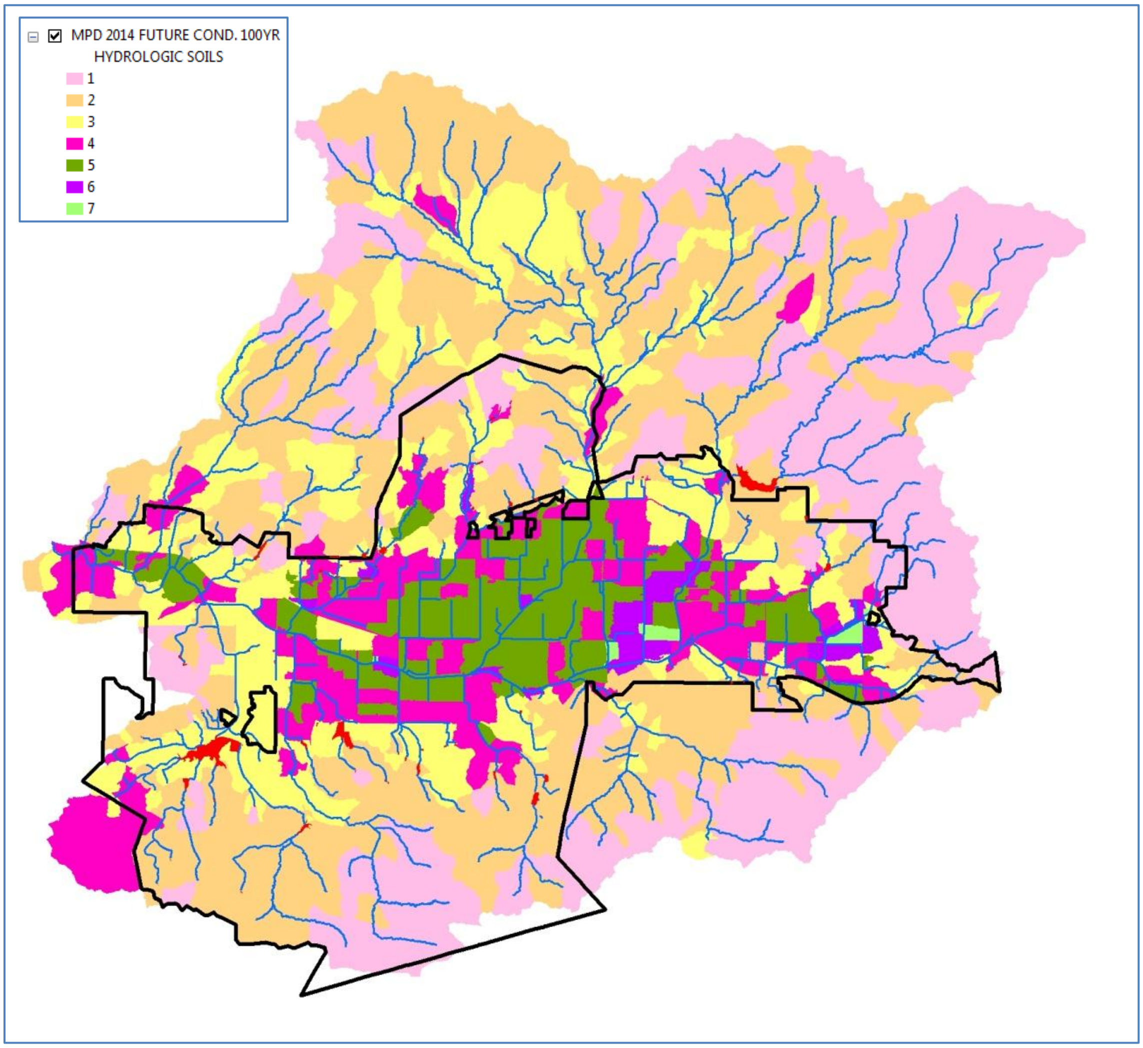


Figure 5-2 Hydrologic Soil Types

Soils in Ventura County were grouped into seven hydrologically homogeneous families. The upper and lower limits of the group of runoff coefficient curves for Ventura County were defined by considering a composite plot of all those developed by Los Angeles County Flood Control District using double-ring infiltrometer tests. Individual curves for undeveloped soils were determined theoretically by considering representative infiltration rates for various soil textures recommended by the SCS and the ASCE in their Hydrology Handbook.

The densest, hardest and least impervious soil is Soil 1. The loss rate used to produce this curve based on the relationship of the "C" value to rainfall intensity is 0.25 inches per hour. Soil 2 is more porous with a loss rate of 0.40 inches per hour but it also has a low percolation rate since it is mostly degenerated bedrock mixed with fine silt. Soil 3 is the most common soil in the agricultural areas of Ventura County. It is a rich loam that is ideal for farming. The loss rate is 0.5 inch per hour; however in the case of urbanization occurring in the valleys, the "C" value is often modified for impervious cover. Soil 4 is alluvial and usually is a mixture of loam and some gravel or sand. It typically occurs at the foot of eroding mountains and in old streambeds. Soil 4 loss rate is 0.75 inch per hour. Soil 5 occurs in well-drained areas and consists of mostly gravel materials. It quite often originates from water-borne soil that stays on the bottom of flow-paths while the lighter silt particles wash out. The final two soils, 6 and 7, comprise an even smaller percentage of the study area and have very high porosity and percolation rates. Drainage subareas that consist of mostly rocky soil, such as the Rocky Peak and Santa Susana areas of Simi Valley produce higher than average runoff due to limited infiltration and percolation rates.

Additionally, it should be pointed out that open spaces within urban areas that have been altered or disturbed during construction would generally have higher rates of runoff, compared with natural and undisturbed open space areas. This is due to the required compaction for a development project, or the mere movement of heavy equipment during construction which consolidates the soil, reducing its porosity. To indirectly account for this, the weighted average soil numbers were rounded to the higher runoff producing category.
The following table presents the area of each hydrologic soil group and the percentage of total area within the MPD 2014 study area. The total watershed area is approximately 90.2 square miles.

Table 5-3 Hydrologic Soil Types Areas

HYDROLOGIC SOIL TYPES 1-7	AREA (SQ MI)	PERCENT OF TOTAL
1 (most runoff, least infiltration)	39.4	44%
2	18.8	21%
3	6.8	7%
4	12.1	13%
5	9.9	11%
6	0.3	1%
7 (least runoff, most infiltration)	2.9	3%
Total Watershed Area	**90.2**	**100%**

5.7 Stream Routing

Within the Modified Rational Method Hydrology Model, specific conveyance sections including natural mountain channel, natural valley channel, standard street section, circular pipe and rectangular or trapezoidal channels may be utilized. Pipe diameter or channel side slopes, bottom width and depth may be specified in addition to the composite lining roughness values for each reach.

Channel length and slope plus the section data described above provide the information necessary for the system to route the hydrographs in a drain from one confluence to the next downstream confluence.

For the MPD 2014 models, the representative average slope of each reach was estimated by using the River Length and River Slope tools in Geo HEC-HMS based on the composite LiDAR hydrologic terrain surface.

Within the VCRAT 2.6 model software, the stream routing conveyance type, length and slope were entered. Roughness values for the main Arroyo Simi Channel were entered for both the channel bottom and side slopes in addition to the side slope information for the applicable trapezoidal channel sections. No conveyance size (Pipe diameter or channel bottom width and depth) information was entered. This information was estimated automatically by the software and does not necessarily correspond to the actual constructed storm drain size, type and geometry. This is a commonly-accepted approach, since the only purpose is to arrive at a reasonably accurate flow velocity for stream routing purposes.

After analyzing the calculated velocities from VCRAT for both the 10 and 100 year storm events, it was noted that the velocities were much higher than those occurring in reality. When compared to stream gage records, the FEMA FIS report for Ventura County, and various other hydraulic studies of Arroyo Simi, it was decided to limit the velocity to a maximum of 16 feet per second within VCRAT 2.6 for the main Arroyo Simi Channel downstream of Tapo Canyon to the end of the study area at the western City limit. This 16 fps velocity was the average velocity through this reach from the detailed FIS hydraulic studies which were in the range of 12 to 21 fps.

5.8 Time of Concentration

One of the most important parameters in Modified Rational Hydrology Modeling is the Time of Concentration (TC). With recommended subarea sizes from the VCWPD Hydrology Manual of 20 to 80 acres, TCs are required to fall between 5 to 30 minutes. Longer TCs within the 29-30 minute range are a rare occurrence found within subareas of very flat slope and porous soil quality. The conditions that effect the concentration time include the size of the initial subarea, the soil type, percent impervious, the slope and conveyance type of the different reaches, the roughness of the reaches, the total length of travel for the slowest drop of rain to the outlet and most important of all, the intensity of the rainfall.

The VCWPD TC Calculator (2008) was used to calculate TCs for a sample of 50 subareas within the MPD 2014. An effort was made to calculate the TCs on a wide representative sample of development and soil types as well as in the more mountainous areas and flatter slopes.
The TC Calculator 2008 input, output, and summary files and examples are contained in the Hydrology Section of the Technical Appendix.

In addition to the calculated 50 subareas from the MPD 2014 Update, TCs calculated by others within the study area were used to analyze results and to aid in applying TCs to the remaining subareas through engineering judgment. TCs calculated by RBF Consulting (a Michael Baker company) for the proposed Lost Canyon Development (September 2012) were included in this analysis in addition to the TC samples included in the 2010 VCWPD Hydrology Manual. A concerted effort was made to compare the newly calculated TCs with the above sources in addition to the TCs used in the previous MPD 1990 and the VCWPD 2003 Calleguas Creek Watershed Model.

Detailed comparison tables of the results are also contained in the Hydrology Section of the Technical Appendix.

On average, the 50 TCs calculated using the 2008 TC Calculator were shorter (faster) than the same (or similar) subarea TCs used in the MPD 1990 and the 2003 Calleguas Model. In comparison to the averages from the entire 1990 MPD TCs , the newly calculated TCs were on average 1 minute shorter for the 100-year and 2 minutes shorter and for the 10-year analysis. In comparing the averages of the calculated 50 TCs with the averages of the similar 2003 Calleguas Creek Hydrology Study TCs, the calculated TCs were approximately 3 minutes shorter than the 2003 100-year TCs, and approximately 4 minutes shorter for the 10-year TCs.
After in-depth analyses and comparison of the 50 calculated TCs and those from other sources, a clear relationship or trend between TCs of similar land uses, sizes, slopes and other parameters could not be found.

Several discussions with City staff were conducted on this matter about how to reconcile the application of the TCs for the MPD 2014 Update. City staff also met with VCWPD staff to discuss the differences in the calculated TCs using the TC Calculator and those calculated by hand from previous studies. VCWPD staff was aware of the differences arising between the two methods for TC calculation. It was agreed that by using a combination of calculated TCs from the VCRAT calculator in addition to those TCs used for the 1990 and 2003 Hydrology studies, engineering judgment could be used to apply TCs for the entire MPD 2014 Update study area.

Every subarea was evaluated in detail. Based on the above information updated revised TC was applied as necessary for both the 10-year and 100-year models through engineering judgment.

6. WATERSHED ANALYSES AND COMPARISON

6.1 General

MPD 2014 has updated the City's hydrology models; therefore it is important to compare the results of the current hydrology with the previous studies to identify any wide variation or discrepancy.

Two types of comparison have been done; watershed runoff production/yield factor mapping; and peak flow comparison at one hundred and nine location points throughout the study area.

The enclosed large-scale exhibits include the color maps of the watershed yield values as cfs per acre. They are prepared under both the 2010 and 2030 hydrologic land use conditions. These maps show the overall hydrology results at the subcatchment/subarea level, by mapping the final peak flow ratio over the drainage area size. These maps do not reflect stream or detention basin routing.
Comparison of peak flows was also done at over a hundred location points. The peak flows at the comparison points do reflect stream and detention basin routing as well.

The following presents the results of the various comparative analyses. Some brief narratives are also provided in cases where there is a 10 percent difference between the key models. The 10 percent threshold is chosen as it is customary for hydrologic evaluations. No two hydrology models and parameters are always identical, and considering the very high number of assumptions made for this sort of hydrologic modeling, a 10 percent variation, up or down, is reasonable.

6.2 Comparison of Drainage Area Sizes

The following table compares the drainage area sizes and statistics for each of three hydrology models for the Simi Valley Watershed; namely MPD 2014, MPD 1990, and VCWPD's 2003/2004 Calleguas Creek models. All the models were prepared for both a "present" and a "future" hydrologic land use condition, except the MPD 1990 which is only a "future" General Plan condition. The VCWPD Hydrology Manual guideline is to limit the drainage area size between 20 to 80 acres, but under a few specific conditions all the models deviated from this guideline. This was necessary because of the presence of detention basins, inlets, outlets, bridge crossings, or other physical features where flow rates were necessary.

Table 6-1 Hydrology Subarea Comparison Statistics

NAME OF MODEL	1990 SIMI VALLEY 'FUTURE' MPD (ONLY)	2003 VCWPD 'PRESENT' CALLEGUAS	2004 VCWPD 'FUTURE' CALLEGUAS	2014 SIMI VALLEY 'PRESENT' MPD UPDATE	2014 SIMI VALLEY 'FUTURE' MPD UPDATE
Total Number of Subareas	555	653	657	1094	1110
Total Drainage Area (acres)	57691	57678	57678	57734	57734
Average Subarea Size (acres)	62	88	88	52	52
Minimum Subarea Size (acres)	3	3	3	2	2
Maximum Subarea Size (acres)	146 (within City only)	669	669	156	156

The major differences between the MPD 2014 model and the two previous hydrology models is the extensive usage in the MPD 2014 of the latest LiDAR topography, aerial imagery and the actual storm drain atlas for both subarea and flow path delineation, and the use of GIS to more accurately extract the required input model parameters.

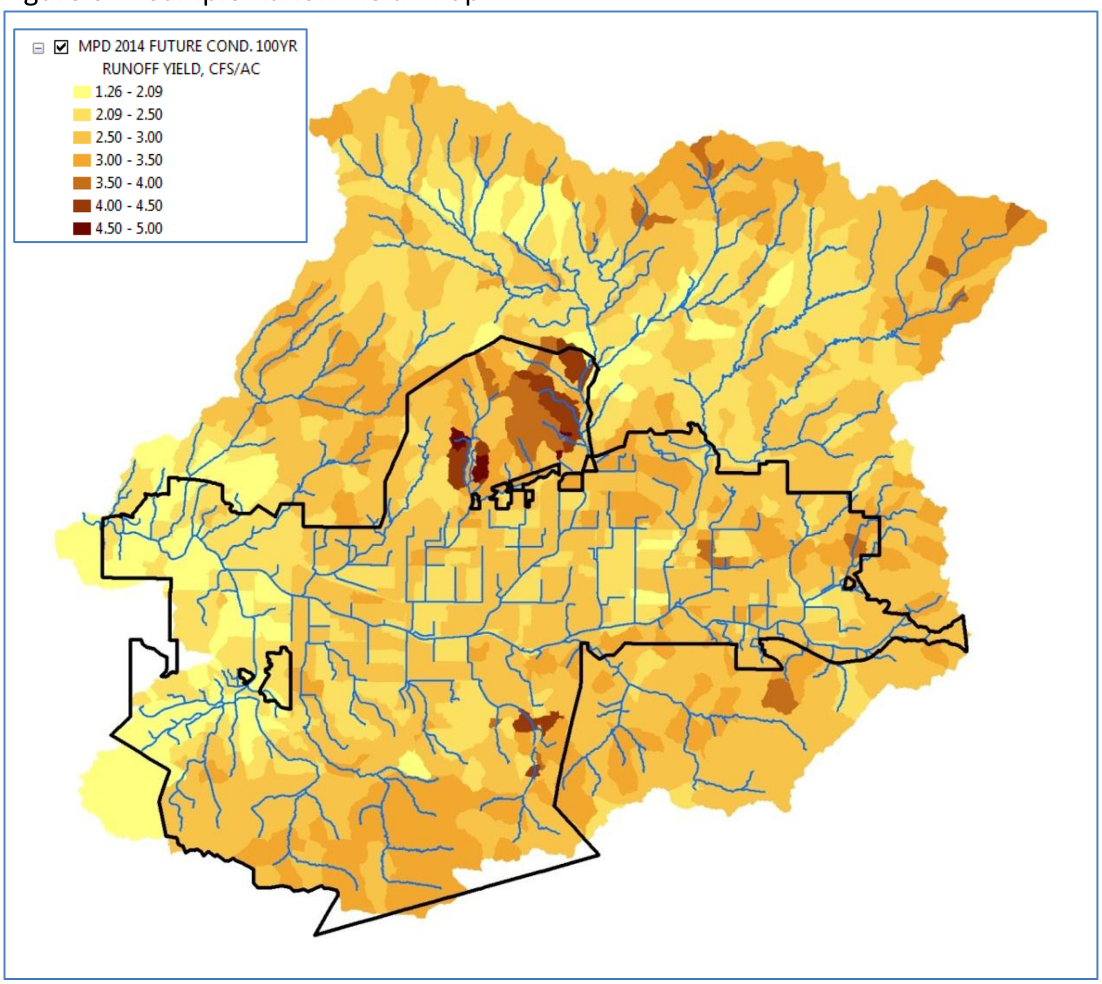
6.3 Comparison of Runoff Yield

The most equitable and fair comparison between hydrology models is to compare the unit runoff values (cfs-per-acre), known as Runoff Yield. The comparison is on a subarea level after all the watershed parameters, such as drainage area, rainfall, time of concentration, imperviousness, soil type, watershed shape, longest flow path, slope, etc. are taken into account and the final calculations are completed.

The overall 100-year unit runoff values (cfs/acre) for all subareas have been calculated and summarized for the current MPD 2014 Present and Future Condition study, VCWPD's 2003 and 2004 model and the MPD 1990. The MPD 2014 runoff yield maps for both the 2010 and 2030 hydrologic land use conditions are enclosed in the large scale exhibits at the end of the Report.

The following exhibit is a sample 100-year 2030 Future Condition runoff yield map.

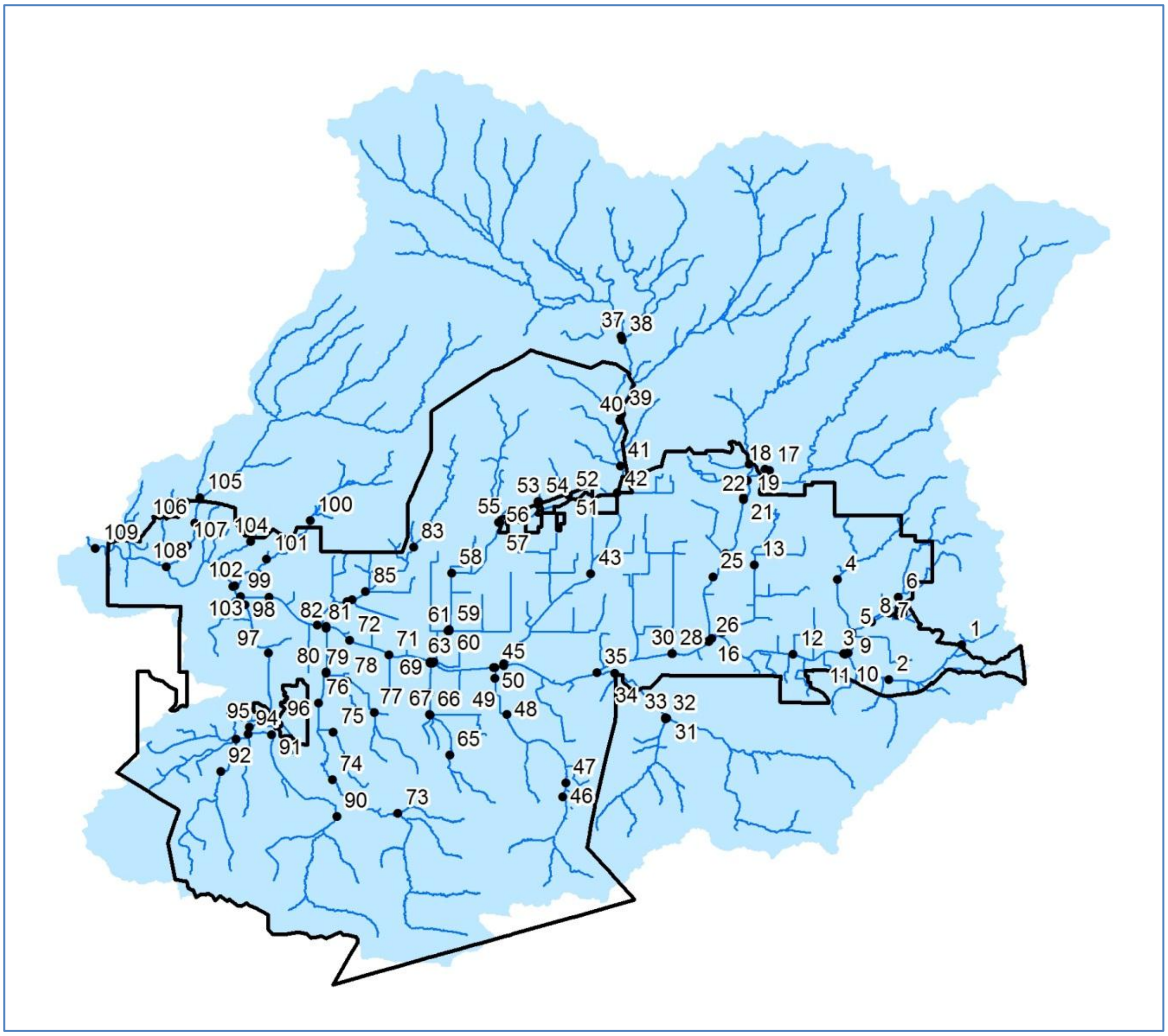
Figure 6-1 Sample Runoff Yield Map



6.4 Comparison of Peak Flows

Because the subarea unit runoff or Runoff Yield values comparison does not compare runoff values in streams or channels, and it does not reflect the detention basin effects, a second set of comparisons are required to compare the overall peak runoff differences at selected concentration points such as bridges, culverts, confluences, junction structures and other key points. See the enclosed Hydrology Comparison Tables (6-2) and Comparison Points Location Maps at the end of the Report, also see below.

Figure 6-2 Comparison Points Map



Several major comparative analyses are performed by compiling all the hydrologic model results from the various sources and conditions and tabulating them in the same manner. The hydrology models consist of thousands of concentration points, which would make the comparison rather difficult. Therefore, the model results were further summarized corresponding to the above common 109 comparison points. This allows for a reasonable and valid comparison.

The comparison points were selected along the storm drain system or the stream network throughout the City. The calculated 100-year peak runoff values from numerous models or conditions were tabulated and compared with the results of the MPD 2014 100-year 2030 future hydrologic land use condition. Comparison is done against the future condition hydrology results as a benchmark and for clarity.

The comparison tables include the hydrology model identification numbers, drainage areas, runoff yield and peak flows. All the tables report peak flows without any areal reduction. The only exception is the last table of results which does include areal reduction factors applied so the MPD 2014 numbers could be compared with VCWPD 2004 matrix of peak flow rates.

Because of the important role that detention basins and dams play in the City's overall drainage system, a special comparison table was prepared which mathematically compares the peak flows with and without detention basins under the 2010 present hydrologic land use condition.

The following is a list of comparison tables for the 100-year storm event, provided at the end of the Study Report:

Table 6-2 Comparison Tables List

1-MPD 2014 Present Condition With and Without Detention Basins (No Areal Reduction) 2-MPD 2014 Future Condition vs. MPD 2014 Present Condition (No Areal Reduction) 3-MPD 2014 Future Condition vs. MPD 1990 Future Condition (No Areal Reduction) 4-MPD 2014 Future Condition vs. VCWPD 2004 Future Condition (No Areal Reduction) 5-MPD 2014 Future Condition vs. VCWPD 2004 Future Condition (With Areal Reduction)

The following is a brief narrative and observations made about each comparison table:

COMPARISON TABLE 1 - MPD 2014 Present Condition With and Without Detention Basins (No Areal Reduction)

This table summarizes the 100-year peak flow results under the present 2010 hydrologic land use condition with all the modeled detention basins in place, vs. a version of the same model with all the detention basins and dams removed. The purpose of this sensitivity analysis is to possibly quantify the peak reduction and attenuation benefit that the detention basins provide. The table shows that approximately two thirds of the comparison points register a net reduction in peak flow, which is significant. The largest peak reduction in the entire drainage system happens at the Las Llajas Canyon Dam with an 89% reduction (Comparison point # 18). Bus Canyon at Royal Avenue (Comparison point # 80) shows a slight increase in peak flow as a result of upstream detention and changing peak time. However, the difference is hydrologically insignificant.

COMPARISON TABLE 2 - MPD 2014 Future Condition vs. Present Condition (No Areal Reduction)

This table summarizes the 100-year peak flow results under both the MPD 2014 future and present hydrologic land use conditions.

Runkle Canyon - It was noted that at Comparison point #46 (Inflow to Runkle Canyon Detention Basin) the Future Condition 100-year flow was approximately 11% higher than at the same location in the Present Condition 100-year VCRAT model. The Future Condition MPD 2014 Model in this watershed includes the latest approved hydrology and detention basin modeling for the proposed housing development, Tract 5364, as submitted by Sikand Engineering. As shown in their report 'Hydrology Study for Tract No. 5364 – Runkle Canyon – 4-29-2009' and reflected in the MPD 2014 Future Condition Hydrology Models, the proposed development upstream of the Runkle Detention Basin causes an increase in the basin inflow when compared to the undeveloped land use classifications shown in the Present Condition hydrology model.

Alternatively, Comparison point #48 shows a 12% decrease in flow between the Future Condition 100-year model when compared to the Present Condition 100-year flow for the main Runkle Canyon Channel at Fitzgerald Road. This decrease in the Future Condition Model peak flow is due to the 2 additional proposed detention basins downstream of the Runkle Detention Basin (Proposed Basin 65C and Proposed Basin 83E in VCRAT model). These 2 proposed basins capture runoff from 2 main tributaries to the Runkle Canyon Channel.

Dry Canyon - At Comparison points #56 through #63 (not including Comparison point #60), there is an increase in flow in the Future Condition 100-year model compared to the Present Condition 100-year flow ranging from 18% to 33%. The Future Condition MPD 2014 Model in this watershed includes the latest approved hydrology and detention basin modeling for the proposed housing development, Lost Canyons, as submitted by RBF Consulting. As shown in their report 'Lost Canyons Development –

Hydrology and Water Quality Assessment Main Report/Errata Sheets – Tract Map 5734 – September 2012' and reflected in the MPD 2014 Future Condition Hydrology Models, the proposed development within the Dry Canyon watershed causes an increase flow in the main Dry Canyon Channel when compared to the undeveloped land use classifications shown in the Present Condition hydrology model. This increase is caused by the increase in effective percent impervious, shorter times of concentration, and changes in conveyance types.

Brea Canyon - At Comparison point #100 (at Brea Canyon Fire Road), there is an increase in flow in the Future Condition 100-year of 10% when compared to the Present Condition 100-year flow. This increase is due to the proposed change in General Plan Land Use as shown on the City's 2030 General Plan Land Use Map. The area upstream of Comparison point #100 is projected to change from its current open space condition to an Industrial Land Use. This change in land use is reflected in a slightly shorter time of concentration and increased effective percent impervious used in the Future Condition Model.

COMPARISON TABLE 3 - MPD 2014 Future Condition vs. MPD 1990 Future Condition (No Areal Reduction)

This table summarizes the 100-year peak flow results under a future hydrologic land use condition for the MPD 2014 and MPD 1990 models.

White Oak Creek – The peak 100-yr flows from the MPD 2014 Future Condition Model at comparison Points #4 and #5 are 196% and 145% lower, respectively, than the MPD 1990 Future Condition Model at the same locations. The MPD 2014 model includes 3 detention basins upstream of these locations which decrease the peak flow while the MPD 1990 did not include any detention basins in the upstream watershed. The impact of the detention basins can also be seen in the other Comparison Points (#9 and #10) downstream within the White Oak Creek watershed.

Marr Diversion – Comparison Point #21 (Marr Diversion U/S Las Llajas Canyon) shows the MPD 2014 100-year flow 158% less than the MPD 1990 100-year flow. The MPD 1990 model doesn't show the diversion of a portion of flow upstream to Chivo Canyon. The drainage areas reflect this difference with the VCWPD 2004 area 61% larger than MPD 2014.

Meier Canyon – Comparison Points #31 through #34 show a peak flow reduction of approximately 15% for the MPD 2014 compared to the MPD 1990. This is caused by a combination of larger subarea sizes and slightly steeper conveyance slopes used in the MPD 1990 model.

Tapo Hills Diversion – Comparison Points #51 through #54 show a large percentage difference in peak flows both for the inflow and the outflow of the Tapo Hills basins. The MPD 2014 inflow to Tapo Hills #1 basin is 73% higher than the MPD 1990, while the MPD 2014 inflow to Tapo Hills #2 basin is 77% higher than MPD 1990. The MPD 1990 has 2 Input Hydrographs used to simulate the routed outflow from the detention basins resulting in the large percentage difference for the basin inflows. The outflow from the Tapo Hills Diversion #1 in the MPD 2014 model is 87% lower than the MPD 1990 outflow. This is also a result from the assumptions used in the MPD 1990 input hydrographs used to represent the routed basin outflow. The MPD 2014 100-yr outflow from Tapo Hills Diversion #1 matches closely with those shown on the design plans.

Dry Canyon – The peak 100-yr flow from the MPD 2014 at Comparison Points #56 and #57 (Dry Canyon U/S and D/S Tapo Hills Diversion) are approximately 20% lower than those in the MPD 1990 model. The MPD 2014 model includes 4 proposed detention basins as part of the Lost Canyons development, while the MPD 1990 model contains no detention in the upper watershed.

Erringer Drain – Comparison Points #65 through #69 show a reduction in flow in the MPD 2014 model ranging from 464% to 36% compared to the MPD 1990 model. This is due to the inclusion of 6 detention basins of various sizes functioning in the Erringer Drain watershed in the MPD 2014 model. The detention basins reduce flow for both the main stem of Erringer Drain and it's major tributaries. No detention basins were included in this watershed in the MPD 1990.

Bus Canyon – Within the Bus Canyon watershed, an Input Hydrograph was used in the MPD 1990 to represent the routed outflow from a proposed Bus Canyon detention basin. However, it is not clear if that proposed basin was ever constructed. The assumptions used in the MPD 1990 for the Input Hydrograph differed from those used in the MPD 2014 model. The MPD 2014 model also includes 6 detention basins within the Bus Canyon watershed which are not included in the MPD 1990 model.

North Simi Drain – The MPD 1990 does not include any detention basins within the North Simi Drain watershed. The MPD 2014 includes 13 various sized detention basins which reduce the peak 100-yr flow from the upper watershed area to the confluence of North Simi Drain with Arroyo Simi.

Sycamore Canyon – The MPD 2014 shows an 80% increase in the 100-yr peak flow at Comparison Point #95 (Outflow from Sycamore Canyon Dam) when compared to the MPD 1990. The MPD 1990 used an Input Hydrograph within the VCRAT model to simulate the routed outflow for the Sycamore Canyon Dam. This Input Hydrograph was Areally Reduced and used different assumptions for the functioning of the Detention Basin resulting in the differences.

Brea Canyon – D/S Highway 118 - Comparison Point #101 shows a large reduction in the MPD 2014 flow versus the MPD 1990 model. The MPD 2014 model includes a large detention basin (Brea Canyon Unit III) upstream of Hwy. 118, which reduces the flow by over 50%. The MPD 1990 model does not include this basin. A portion of the contributing watersheds are in the J' rainfall zone, and are represented as such in the MPD 2014 model, while the MPD 1990 model uses the K rainfall zone, which is a higher intensity and total design rainfall depth.

Alamos Canyon - Similar to Brea Canyon, portions of the watershed fall within the J' rainfall zone. The MPD 2014 model used the J' rainfall for those subareas while the MPD 1990 model used the K rainfall zone, resulting in the higher runoff values.

COMPARISON TABLE 4 - MPD 2014 Future Condition vs. VCWPD 2004 Future Condition (No Areal Reduction)

This table summarizes the 100-year peak flow results under a future hydrologic land use condition for the MPD 2014 and VCWPD "With Project" models.

Hialeah Springs Canyon at Highway 118 - It was noted that at Comparison point #1 the MPD 2014 Future Condition 100-year flow is 23% lower than the VCWPD 2004 100-year flow. At this location the VCWPD 2004 model delineated a drainage area that is 16% larger than the MPD 2014 drainage area. In addition to the larger drainage area, the conveyance slopes for the VCWPD 2004 study upstream of this point are slightly steeper than those used in the MPD 2014.

Arroyo Simi at Kuehner Drive - At Comparison Point #2 the MPD 2014 Future Condition 100-year flow is 25% lower than the VCWPD 2004 100-year flow. This appears to be caused by the cumulative effect of slightly steeper conveyance slopes from all contributing areas and slightly lower times of concentration used for the VCWPD 2004 model.

White Oak Creek - The difference noted in the upper portion of the White Oak Creek watershed and shown in Comparison point #4, with the MPD 2014 100-year flow rate 15% less than the VCWPD 2004 occurs due to the usage of an input hydrograph at the basin location upstream of this comparison point in the VCWPD 2004 model. This input hydrograph was used to model the Mt. Sinai basin and it used different assumptions for both basin inflow and the routing through the detention basin.

Chivo Canyon/Las Llajas - At Comparison Point #19 and #20 (Chivo Canyon U/S Las Llajas/Las and Llajas Canyon D/S Chivo Canyon) the MPD 2014 100-year flow is 29% less than the VCWPD 2004 model. At these locations, the reason for the increased runoff in the VCWPD 2004 model is due to its large subarea sizes upstream. The average size of the VCWPD 2004 subarea draining to Comparison Point #19 is 421 acres compared to the average size of 81 acres in the MPD 2014 model. The larger subarea size with a limit on the maximum length of time of concentration of 30 minutes causes a much higher cfs/acre yield.

Marr Diversion - Comparison Point #21 (Marr Diversion U/S Las Llajas Canyon) shows the MPD 2014 100-year flow 179% less than the SVMPD 2004 100-year flow. The VCWPD 2004 model doesn't show the diversion of a portion of flow upstream to Chivo Canyon. The drainage areas reflect this difference with the VCWPD 2004 area 62% larger than MPD 2014.

Las Llajas Canyon - Comparison Points #22 through #26 show a 100-year flow from the MPD 2014 model ranging from 20% to 27% less when compared to the VCWPD 2004 model. The higher flow rate for the VCWPD 2004 model is due to large subarea sizes in both the Las Llajas and Chivo Canyon upper watersheds resulting in a much higher cfs/acre yield.

Tapo Canyon - The Comparison points (#37 through #44) show a 100-year flow from the MPD 2014 model ranging from 18% to 35% lower than those in the VCWPD 2004 model. Again this is due to the much larger subarea size in the upper watershed area in VCWPD 2004 model compared to the MPD 2014 model, resulting in a higher runoff.

Runkle Canyon - Comparison Point #47 (Outflow Runkle Detention Basin) shows a 143% decrease in flow in the MPD 2014 model compared to the VCWPD 2004 model. The stage-storage-discharge table used for this basin in the MPD 2014 model assumed a completely cleaned out basin based on the design condition shown in VCWPD's Detention Basin Manual, allowing more storage volume within the basin and a lower outflow. This effect can also be seen in the downstream comparison points of Runkle Canyon. Currently, VCWPD, the City, and Tract 5364 are in discussions about the detention basin clean-out by the developer.

Dry Canyon - The Dry Canyon watershed Comparison Points #56 - #63 show an increase in the MPD 2014 100-year flow compared to the VCWPD 2004 model. For Comparison Points #56 and #57 show an increase of 88% and 71% respectively in the MPD 2014 model. The VCWPD 2004 model included a proposed Dry Canyon Basin which reduced the 100-year flow by 87% at Comparison Point #56 but was never built. The proposed Lost Canyons development hydrology which is represented in the MPD 2014 Future Condition Model includes 4 smaller detention basins on the tributaries instead of a large state size dam on the main stem.

Sycamore Canyon Watershed - The 100-year inflow and outflow to the Sycamore Canyon Dam in the MPD 2014 model is 22% and 36% lower respectively than the VCWPD 2004 model. This watershed was looked at in detail and the main reason for the higher inflow was the cumulative impact of larger subarea sizes and the related parameters in addition to a higher outflow from the Oak Canyon Detention Basin #1 and other detention basins within the watershed. The lower basin outflow for the MPD 2014 model is associated with the decreased inflow, a slightly larger Hydrograph adjustment (Fattening) factor, and a stage-storage-discharge table that represents the removal of debris from its design plans. VCWPD's latest hydrology study "Sycamore Detention Basin Hydrology Update, November 2013" advocates using the HSPF model, and not VCRAT. Therefore, their analysis and conclusions are different than MPD 2014.

Brea Canyon – D/S Highway 118 - Comparison Point #101 shows a large reduction in the MPD 2014 flow versus the VCWPD 2004 model. The MPD 2014 model includes a large detention basin (Brea Canyon Unit III) upstream of Hwy. 118, which reduces the flow by over 50%. The VCWPD 2004 model does not include this basin. A portion of the contributing watersheds are in the J' rainfall zone, and are represented as such in the MPD 2014 model, while the VCWPD 2004 model uses the K rainfall zone, which is a higher intensity and total design rainfall depth.

Alamos Canyon - Similar to Brea Canyon, portions of the watershed fall within the J' rainfall zone. The MPD 2014 model used the J' rainfall for those subareas while the VCWPD 2004 model used the K rainfall zone, resulting in the higher runoff values.

COMPARISON TABLE 5 - MPD 2014 Future Condition vs. VCWPD 2004 Future Condition (With Areal Reduction)

This table also summarizes the 100-year peak flow results under a future hydrologic land use condition for the MPD 2014 and VCWPD "With Project" models, just like Comparison Table 4 except that the VCWPD areal reduction factors were applied to the unreduced flow rates in the previous Comparison Table 4.

The variation and differences for this comparison table are similar to the previous Table 4, as the only difference is the application of the areal reduction factors.

Calculating areal reduction factors is extremely complex in cases where there are many detention basins. Therefore a precise analysis should be done on a case by case basis, as needed.

However, for comparative purposes, the VCWPD's areal reduction factors were used in this table, but no guarantee is made as to the accuracy and applicability of such areal reductions factors.

7. DRAINAGE SYSTEM CAPITAL IMPROVEMENT PLAN (CIP)

An important element of the MPD 2014 was to evaluate the existing drainage system deficiencies and to prepare a prioritized CIP to mitigate local or regional flooding.
The development of a drainage system CIP with a plan of recommended facilities provides a vehicle by which landowners or developers and the City, representing the interests of the public, may be apprised of the need for additional drainage facilities. Furthermore, it provides an order of magnitude cost to meet the desired level of flood protection.

Because the City did not have a formal drainage system CIP program for many years, it was imperative that a complete list of potential drainage deficiencies be complied from different sources. The sources of information are as follows:

a. **Maintenance Hot Spots** - Drainage deficiencies identified by City Maintenance Division staff referred to as maintenance hot spots
b. **Structural Deficiencies** - Deficiencies identified based on material, slope and age of facilities
c. **Hydraulic Deficiencies** - Deficiencies identified based on compliance with the City's Q10 capacity requirement
d. **Recommended Facilities** - "Proposed" facilities from MPD 1990, that are not yet built

Several new or replacement drainage facilities were recommended in order to mitigate local and regional drainage deficiencies. This document provides prioritization of the recommended projects to assist in creating a logical timeline for implementation and future budgeting. It also contains description of the problem, preliminary solutions, order of magnitude cost estimates and location maps. The prioritization was based on various factors including severity of the deficiency or problem (in meeting City's 10-year storm requirement), current FEMA's floodplain and flood hazard boundaries, VCWPD's known drainage system deficiencies, funding and budget availability and overall impact or benefit to the community.

For ranking and project scoring purposes, if the deficiency was in the FEMA flood hazard area, it was ranked lower than a similar deficiency out of it since fixing the deficiency would not take care of the overall problem in that area. Conversely, if the deficiency was near a VCWPD priority improvement, it was ranked higher than a similar deficiency away from it since fixing the City deficiency would help take care of the overall problem in that area.

The following sources of information were collected and analyzed as the basis for the City prioritized CIP projects: localized flooding and maintenance hot spots identified and documented with the help of City Maintenance staff (referred to as the Maintenance Hot Spots), existing drainage facility full-flow hydraulic and structural deficiencies identified by MPD 2014, MPD 1990, proposed regional drainage improvement studies by others and numerous meetings with City staff.

7.1 MAINTENANCE HOT SPOTS

Throughout the years City staff, and in particular Public Works Department maintenance personnel, have observed areas throughout the City with recurring localized flooding during storm events. These known areas of localized ponding or flooding are referred to as Maintenance Hot Spots. Maintenance Hot Spots typically differ from Capital Improvement Projects in that they experience flooding at various frequency storms and impacts range from flooded intersections, debris in streets, clogging of local storm drain inlets with sediment or debris.

For the initial identification of Maintenance Hot Spot locations, the City Maintenance staff provided a map with notes on the problem(s) for each location. This information was digitally converted to GIS. Some of the locations needed additional descriptions of the localized problem so meetings were held with Maintenance Staff to further verify their locations and clarify the specific problem(s) at each location. Initially there were 41 Maintenance Hot Spots identified and verified by City Staff.

In addition to the current 41 locations, research was conducted on historical documents provided by the City which categorized localized flooding, capacity issues and impacts of sediment and debris. These documents included a series of hard copy maps with hand written notes labeled by city staff describing both larger CIP type problems in addition to smaller, more localized Maintenance Hot Spots which have occurred over time and were known as the City CIP/Hot Spot Maps.

Also included in this research were the Problem Areas Identified by City staff from the 1983 City of Simi Valley Prioritization Study. The information from the 1983 report was also shown in the City of Simi Valley 1990 Master Plan of Drainage which also included a brief description of the problem, its location and a probable solution. 15 additional Maintenance Hot Spot locations were added to the original 41 for a total of 56 hot spot locations.

All of the problem locations identified on the City CIP/Hot Spots Maps were digitized into GIS and all handwritten comments were captured into the GIS attribute table. This data layer was then merged with the 56 Maintenance Hot Spot Locations which allowed KC to analyze spatially the problem areas and any overlap between historical problems and the currently identified Maintenance Problem areas.

The Problem Areas Identified by City of Simi Valley Staff from the 1983 City of Simi Valley Prioritization Study were then added to this composite data layer based on their location description. All of the locations were compared with both the historical storm drain system and the newly updated storm drain system atlas. This comparison allowed KC to visually analyze new storm drain related projects which had occurred since the initial identified 1983 Maintenance Hot Spots. The GIS analysis of the various sources also allowed the locations of the problem areas to be compared to each other, which allowed easier identification of how those problem areas overlapped with each other and also their historical recurrence and severity. Meetings were conducted with City staff to prioritize the Maintenance Hot Spot problems based on their severity, impact on infrastructure and citizens in addition to funding and also relationship to larger future CIP plans.

The final product created from the above analysis and data sources was a GIS data layer containing a description of the location, brief overview of problem, probable solution, as well as the priority given to each problem area, the source of the data and whether the solution is considered a Maintenance issue or a CIP issue.

7.2 EXISTING FACILITIES STRUCTURAL DEFICIENCIES

As an additional source of information, criteria established by the City of Thousand Oaks were used to identify potential structural deficiencies. This technique identified additional potential deficiencies by isolating the Corrugated Metal Pipes (CMP) storm drains which were built before 1977 with a 0.01 or flatter slope. Additionally Reinforced Concrete Pipes (RCP) built on or before 1972 were identified in the same manner. These criteria were established as part of a City of Thousand Oaks (an adjacent city with similar drainage facilities and topography) 1999 CMP Remediation Study prepared by Hawks & Associates. In that study, the majority of the CMPs were found to be in average to good condition, which is significant considering that most of the drains were 30 years old. However, with only a few exceptions, all drains (CMPs and RCPs) showed some corrosion within the bottom third of the pipe. This corrosion is more severe in arch metal pipes and pipes that have relatively flat slopes where ponding of water can occur. The result of the special structural deficiency analysis is provided in the form of a GIS data layer and maps.

7.3 EXISTING FACILITIES HYDRAULIC DEFICIENCIES

Hydraulic deficiencies were identified by integrating/overlaying the storm drain atlas, hydrologic features (subareas, nodes, hydrolinks), and VCRAT model results.   Estimated full flow capacities of each feature were then calculated and compared against the projected 10-year future condition discharge rates that they are estimated to convey. A 30-inch storm drain size was selected as the threshold for this analysis due to the accuracy of hydrologic modeling drainage area size limitations and to a lesser extent the enormity/complexity of the storm drain system and cost of analysis involved. Municipalities generally have a minimum storm drain pipe size of 18”, due to maintenance related concerns. As a result, even if a smaller pipe may be adequate to maintain flow capacity, the City will use the minimum 18” pipe.

Within the City of Simi Valley’s storm drain system, roughly 66 miles, a little more than half, of the underground circular pipes are 30” in diameter or larger. There are approximately 57 miles of circular storm drains less than 30” in diameter, including 27 miles of 18” RCPs used to connect catch basin inlets to the storm drain mainlines.

Potential hydraulic deficiencies have been identified by estimating a "full flow" condition capacity for the City owned and maintained storm drain infrastructure that is:

- 30" in diameter or larger,
- arch pipes with a base width 30" or greater
- open channels with either basewidth or height 30" or greater

The storm drain "full flow" capacity was estimated by using the Manning's formula to calculate the discharge assuming the drain is flowing full. The Manning's formula takes into account the storm drain size and dimensions, flow area, wetted perimeter, slope and the material roughness factor.

Since the hydrologic subareas and flow concentration points are not necessarily at the inlet to every pipe needing to be analyzed, an estimated percentage of modeled 10-year peak flow arriving to the drain was calculated on a segment by segment basis within GIS. Inlet points were generated for each pipe analyzed, each containing a unique identifier that could be linked back to the storm drain atlas geodatabase. Drainage areas for each segment inlet were delineated based on the same hydrologically correct terrain (which accounts for the storm drains as well as other conveyance features), process and extension (ArcHydro for ArcGIS) used to delineate the hydrologic subarea boundaries for the VCRAT model. Each of the drainage areas retain the same unique identifier as the inlet and pipe segment.

Spatial analysis was then performed by overlaying the drainage areas on top of the future condition VCRAT Subarea boundaries with the Q10 local and contributed flows attached. The 10-year future condition yield for both the local (individual subarea) and the cumulative runoff was calculated. Using a weighted average overlay with the yield factors and the drainage areas, an average yield per acre was calculated and then multiplied by the drainage area to determine the peak future condition (prorated) Q10 delivered to each storm drain segment.
The "full flow" values were then compared to the newly calculated, prorated 10-year peak flows from the VCRAT hydrology model.

In addition to comparison with the full flow capacity, Design Q's captured from construction plans were also analyzed and compared to the full flow capacities. For those storm drains with Design Q's shown on their as-built plans, the design Q was captured in GIS. If the plan contained a design Q50 or Q100, the County's peak flow multiplier was used to adjust the design Q to an equivalent Q10 value. The design Q10, if available, was then compared to the modeled Q10 for each segment and the higher of these values was then used for the final comparison to the full flow capacity value.

The larger of either the peak future condition Q10 (calculated above) or the design Q10 was then compared to the calculated "full flow" capacity for that segment to determine the adequacy to convey the modeled flows and/or the severity of the deficiency of storm drain segment. Every segment was evaluated to ensure the correct calculated flows were applied and that the ratio of modeled Q10 vs. the capacity was accurate. It was found that of the approximately 2800 storm drain segments, approximately 350 were deficient with a future Q10 or design Q10 (whichever is larger) greater than the capacity. Based on storm drain length, this equates to 15% of the storm drains analyzed having deficient capacity to carry the greater of the future Q10 or Design Q10.

7.4 HISTORICAL CIP ANALYSIS

The locations of CIP projects identified as part of the MPD 1990 were added to GIS along with their unique ID numbers. The location of the recommended projects were then graphically and qualitatively analyzed against the existing storm drain system atlas information to identify which of those past recommended projects had been built since 1990. It was determined that approximately one third of the previously recommended projects have either been built as shown, or some other drainage improvement such as a detention basin or a diversion pipe has been built in their place to alleviate local flooding.

The remaining projects were kept in the current recommended CIP. Because many of the drainage projects were recommended in streets with no storm drains, their inclusion in the MPD 2014 helps to identify a potential flood hazard and the associated cost to remedy the situation.

The viability of a major street drainage improvement project can only be assessed through a detailed 2-dimensional flood hazard analysis and mapping project, as recommended. Therefore, some of the previously recommended drainage improvements are included in the current CIP as a place-holder for cost estimating purposes, and to identify a potential flood hazard. The need for specific drainage improvement projects and their prioritization ranking will become clear once a thorough City-wide floodplain study is conducted.

7.5 RECOMMENDED DRAINAGE SYSTEM SELECTION

To mitigate or lessen the effect of localized or regional flooding and drainage deficiencies, many new storm drains are recommended as part of this effort. The above four sources of potential drainage deficiencies and required solutions were compiled to create a comprehensive catalog of potential drainage deficiencies that can be used by the City for correction and mitigation in an orderly and timely manner, as the CIP budget allows.
The location, alignment, and size of the recommended storm drains are very approximate in nature, and they should not be used for design purposes without additional verification or detailed study. This information is primarily complied for budget estimating purposes and as a place holder for potential future CIP projects, so that the community is aware of drainage improvement needs in a certain part of the City.

After consultation with City staff, the maintenance hot spots were divided into routine operational maintenance items for the Maintenance Division to take care of as their routine annual activity. However, 17 potential projects were categorized as proposed CIP projects since they appear to be larger and more involved projects than routine maintenance. In addition, some 100 unique project locations have been compiled and categorized as proposed CIP projects from the various sources as outlined before.

Some of the above 117 unique projects are rather long and costly to construct. Therefore they might have to be built in phases over several years. There are approximately 244 individual or phased projects that need to be prioritized and budgeted to be built. The total construction cost in 2013 dollars is approximately \$54.4M, with roughly half (\$27.9M) as the basic mainline facility cost plus an additional \$26.5M for the various appurtenance, contingencies and other project expenses.
The following section summarizes the steps taken to determine an order of magnitude cost for each proposed project.

7.6 RECOMMENDED DRAINAGE SYSTEM COST ESTIMATING

The total construction and placement cost of the proposed storm drains is approximately twice as much as the basic unit cost of the storm drain, when the associated design, management and permitting costs are taken into account. The total construction cost is based on the following formula as a function of the mainline storm drain cost of an equivalent pipe size (length * unit cost):

> Total Storm Drain System Construction Cost =
> Mainline Equivalent Pipe Size Cost
> Plus
> Appurtenances estimated at 25% of the above cost
> Plus
> Contingencies estimated at 20% of the above subtotal
> Plus
> Design/Permitting/Inspection/Administration at 30% of the above subtotal

The estimation of the proposed drainage system construction costs included in this report is based upon unit prices obtained from a review of storm drain construction costs for recent projects in the Ventura County area, the latest ENR Construction Cost Index 2013 for Los Angeles (projected through 2030), City's recent unit price survey and cost estimates for some recent street improvement projects, and other cost estimating sources. These resources provide reasonably anticipated costs of construction as of the date of this report.

Right-of-way for construction of drainage facilities are generally not incurred by governmental agencies. Sufficient right-of- way is usually typically already available in existing streets and local policies mandate the dedication of right-of-way as a condition for land development. Therefore, no allowance has been made for this item in the project estimates.

Because this is a planning-level effort and a macroscopic view of the proposed drainage system requirements for the City, all proposed storm drains were assumed to be of an average equivalent pipe size with a certain alignment and length, such as 1000 feet of 48" RCP. Furthermore, cost of the proposed storm drain appurtenances was estimated at 25% of the storm drain construction cost. Engineer's cost estimates for several storm drain systems were looked at in order to estimate an average cost of the storm drain appurtenances, such as manholes, junctions, inlets, outlets, catch basins, transitions, etc. The range was found to be 11% to 31% of the mainline storm drain construction cost. Therefore a 25% factor was chosen as an appropriate estimate of the cost of the additional elements of the proposed storm drain facilities.

Additional allowances were made for engineering, administrative costs, and contingencies. These allowances amount to an additional 20% for contingencies and 30% for other costs which include engineering design and permitting, construction inspection, surveying, testing, preparation of As-Built plans and administrative costs.

Contingency costs were included to allow for uncertainties that are associated with the limited information that is available when planning storm drain projects. Contingencies include such things as unexpected soil conditions or groundwater, unanticipated cost increases, variations in final design quantities and changes in construction materials or techniques that cannot be anticipated with preliminary estimates. An allowance of 20% was made in cost estimates for such contingencies.

While inflation in the construction industry has moderated in recent years, annual increases in the range of 2% to 3% have been common over the last two or three decades. Therefore, it is recommended that the cost estimates provided in this report be reviewed and updated at the time of actual project design, to reflect changing economic conditions.

One accepted method of periodically revising construction cost estimates is to utilize the Engineering News Record (ENR) Construction Cost Index. The Engineering News Record is a widely circulated construction periodical and their index is a respected reflection of the combined costs of basic construction materials and construction labor as sampled in 20 major cities throughout the United States. A supplemental index is also published for the same costs in selected individual cities, including Los Angeles. As of July 2013, the ENR Construction Cost Index (1913 Base = 100) for Los Angeles was 10350. The future change in either index can be applied to the cost estimates in this report to quickly obtain a current estimate for a project.

7.7 CAPITAL IMPROVEMENT PLAN (CIP) & PRIORITIZATION

The ranking and prioritization of recommended drainage projects is rather subjective and it requires a great deal of professional flood protection and engineering judgment. Prioritization performed as part of this effort is only for reference and discussion purposes, and a decision to build any of these projects will require more detailed and comprehensive evaluation. Please see the recommended drainage policy changes.

The previous sections of the report described the methods and procedures by which all known potential drainage deficiencies were compiled, categorized, and cost estimated.
This section describes how the recommended drainage system elements were scored and prioritized to be recommended for the CIP over the next 15 years to the year 2030.
In addition to looking at the recommended project cost estimate, it is imperative to prioritize projects on the basis of how they actually mitigate flooding, road closures, and provide public safety.

The final projects selected for inclusion in the multi-year CIP program were first qualitatively prioritized by City and consultant staff based on their knowledge of how the drainage system functions during severe rain storms, and field observations over the years.
Quantitative ranking was also done in order to score projects meeting certain criteria, or combination of criteria.
In addition to the project cost and qualitative ranking, many other factors were also considered and quantified when prioritizing and ranking these projects. They are as follows:

a) The existence of storm drainage facility within public rights of way. For example, if two storm drains of the same size were recommended on two different streets, one with an existing drainage system and one without; the storm drain recommended for the street without an existing drainage system was ranked higher.
b) Average slope of streets was used to rank priority for the recommended storm drains. Street slopes were categorized into three categories, flat slopes less than 0.5%, medium slopes between 0.5% and 1.5%, and slopes steeper than 1.5%. The steeper the street slope is, the higher the conveyance capacity is also. Flatter streets tend to cause more ponding and flooding.
c) Recommended storm drain sizes were used as a factor. Storm drains were categorized based on the equivalent pipe diameter less than 36”, between 36” and 60”, and 66” and larger. Larger pipes generally provide a higher degree of flood protection.
d) VCWPD prioritization of larger drainage infrastructure under their purview was a factor in ranking City’s recommended projects. VCWPD’s recent Upper Calleguas Creek and other studies evaluated their regional facility deficiencies, studied potential improvements, and established benefit/cost ratios for their facility improvements. VCWPD has prioritized Tapo Canyon and Bus Canyon as requiring sizable investment in regional capital improvement. Consequently, it would be wise to also improve more of the City’s drainage infrastructure within these large watershed areas.

e) City's MPD 1990 and other sources were also a factor in ranking recommended drainage system improvements.
f) FEMA's effective flood hazard areas are deemed to be an important factor in deciding where to build new drainage facilities. Currently FEMA is showing over 5 square miles of floodplains within the heart of the City. Recommended storm drains outside the known and mapped floodplains got a higher priority score. That is because City storm drains within a known floodplain may not necessarily eliminate flooding from the area and relieve property owners of the burden of mandatory flood insurance. Much of the current FEMA floodplains have been mapped as a result of the deficiencies in the larger regional drainage infrastructure, not as a result of City's storm drains deficiencies. Therefore, even if a certain City storm drain is upgraded within a known floodplain, the overall floodplain may not be revised which would translate into a low benefit cost ratio.
g) Lastly, the source of funding was an important factor in deciding how to rank the recommended storm drains. Projects that might be constructed by the development community were separated from the rest of the projects that will require general fund or other grant monies.

City's general fund cannot adequately pay for all the required drainage improvements. Therefore, a tiered prioritization approach may be appropriate. By excluding the projects that the development community might be conditioned to build over the years or contribute funding for, a smaller and more manageable list of projects is selected and ranked.

The total cost of all projects identified, regardless of the source of funding and prioritization ranking, add up to approximately $58 M.

It is anticipated that the portion of the drainage system that is impacted by developments will be paid for with new stormwater development impact fees. Alternatively, the developers might be required by the City to construct such improvements.

At the time of this printing, the City is working on West Los Angeles Avenue widening project, which includes some drainage elements. The currently-planned and budgeted drainage improvements are removed from the recommended CIP list of projects. Furthermore, currently planned drainage improvements that are required of Tract 5601 along LA Avenue and Madera Road are also excluded from the recommended CIP list of projects.

Therefore, there is approximately $42.4 M worth of drainage improvements that the City might have to pay for with general fund, grant monies, or new assessment fees.
The following table summarizes the above total drainage improvement costs:

Table 7-1 Summary Drainage Improvement Costs

1	Recommended CIP Projects	$42.4 M
2	Current LA Avenue Widening & Tract 5601 Projects Excluded	$ 3.5 M
3	Projects To Be Paid For With Land Development Fees or By Developers	$12.0 M
SUM	All Projects Identified	$57.9 M

Because the general fund cannot pay for the all the projects at once, a tiered budgeting approach is provided below. The basic assumption is that the projects or a subset of them will be constructed over the next 15 years, to the year 2030. For example, to build all $42M worth of projects in 15 years, the City would have to invest approximately $3M per year. However, assuming the City invests $200K per year, only $3M worth of projects will be completed in 15 years; if the City invests $1M per year, $15M worth of projects will be constructed in 15 years, and so forth.

Therefore, the prioritized list of projects were tiered and grouped in the above fashion. The following summarizes the total costs of projects according to the above tiered system:

Table 7-2 Total Prioritized CIP Projects Costs

1	Tier 1 Projects @ $200K Per Year	$ 3.4 M
2	Tier 2 Projects @ $500K Per Year	$ 7.1 M
3	Tier 3 Projects @ $1M Per Year	$15.0 M
4	Tier 4 Projects @ $2M Per Year	$30.0 M
5	Tier 5 Projects @ $3M Per Year	$42.4 M

8. MPD REVENUE SCENARIOS & IMPLEMENTATION OPTIONS

This chapter provides an overview of the current and potential revenue sources used to support the City's Stormwater Program activities.

8.1 Stormwater Utility/Enterprise Fund

A stormwater utility treats stormwater management as a public service that is provided like water and sewer service. The utility operates as a dedicated enterprise fund and is often supported by a variety of funding sources. Stormwater activities typically included in an enterprise fund include:

a. Maintenance & Operations
b. Monitoring and Enforcement
c. Capital Improvement

The City of Simi Valley conducts all of the activities listed above; however, it does not currently have stormwater utility/enterprise fund for stormwater management.

8.2 Existing Program Expenditures

a. Maintenance and Operation

The City's expenses for Stormwater maintenance and operation activities are currently $300,500 per year (FY 2013-14). The Storm Drain Maintenance Section is responsible for all storm drains and channels within the City limits. The Flood Crews' duties include cleaning catch basin drains, clearing flood channels, and making small repairs to these drainage structures. The crews are vital to maintaining the storm drain system thus preventing damages related to flooding.

b. Monitoring and Enforcement

The City's expenses for monitoring and enforcement are currently $689,300 per year (FY 2013-14). The Environmental Compliance Division provides Stormwater Quality Management and Household Hazardous Waste/Hazardous Materials services to the community. The Hazardous Materials program safely disposes hazardous materials used in City operations, gives Hazardous Materials Awareness and First Responder training to City employees, and runs the community Household Hazardous Waste (HHW) Disposal program. The Stormwater Management Program manages the water quality portion of the City's storm drain system. The staff administers the program, and provides, construction, planning and land development review and guidance; public outreach; industrial/commercial business inspections; illicit discharge control; and public agency coordination services. The City has a Clean Water Act responsibility mandated by the National Pollutant Discharge Elimination System (NPDES) permit to assure the surface waters are safe for humans, animals, plants, and the environment. City Stormwater Program staff's primary responsibility is to educate and train the community on the complex permit requirements, interfacing regularly with industry personnel, City employees, and the general public.

c. Capital Improvement

The City does not currently have an established five-year capital improvement budget for stormwater that will provide $200,000 per year beginning FY 2013-14. Projects have been identified and prioritized by the update of the Master Plan of Drainage. These projects will be included in subsequent years and included in the Capital Improvement Plan.

8.3 Existing Program Revenue

a. General Fund

Funding for maintenance and operation activities is allocated on an annual basis form the General Fund. The City does not have a multi-year plan dedicated to resolve problem maintenance areas or “hot spots”, therefore no revenue has been dedicated to that effort.

b. Private Development Stormwater Impact Mitigation

Drainage studies are required for discretionary review to identify and mitigate impacts to downstream stormwater deficiencies. As a result CIP deficiencies have historically been borne by private development. Now that the City has reached 90% build-out, there is significantly reduced opportunity for CIP work to be applied as conditions of approval to new development projects.

8.4 Funding Alternatives for Stormwater Management

Maintenance activities and capital improvements to address stormwater-related issues require financial resources. Fortunately, there are several possible sources that could provide this support. These sources include locally controlled funds such as taxes, fees and special assessments, as well as competitive sources like grants and bonds. These funding sources can serve as individual elements or be used in combination. Although there are multiple funding options, two key considerations are:

- Whether the funding source provides a practical connection between costs and the stormwater impacts created, and
- Whether the funding source is a stable and sustainable.

Seven (7) potential funding sources are detailed as follows:

1. Property Taxes/General Fund

The most common source for funding stormwater management is through the municipal general fund. The general fund consists primarily of property taxes and covers a full range of municipal services. It is also subject to competing demands and has limited growth potential. Stormwater management activities are usually low priorities for general funds unless recent events have garnered attention (e.g., flooding,) or regulatory requirements have been enacted.

In addition, use of the general fund does not always reflect the true cost certain communities have in relation to their stormwater impacts. This is the case for communities with tax-exempt properties that contribute stormwater to the system but do not contribute to the general fund. The County Watershed Protection District collects a special property related tax to fund Regional compliance with FEMA's NFIP, to monitor and study regional storm water flows and systems, and to facilitate Regional storm water management cooperation.

The City of Simi Valley does not currently have a dedicated source of property tax revenue for stormwater management.

2. **Grants**

There are state and federal grants available for stormwater management activities, such as educational programs, maintenance and physical improvements. These grants are always competitive, typically one-time or time-constrained funding sources, and likely to require a local funding match. Examples of these funding sources include:

a) **FEMA Flood Mitigation Assistance (FMA)** This program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). Funding for FEMA grants are managed by the State Emergency Management Agency The program provided funding through the following three programs:
b) **Planning Grants** to prepare Flood Mitigation Plans.
c) **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures.
d) **Management Cost Grants** for the State to help administer the FMA program and activities. Up to ten percent (10%) of Project grants may be awarded to States for Management Cost Grants.
e) **California Emergency Management Agency (CalEMA)** – The Hazard Mitigation Grant Program (HMGP). This program provides grants to state and local governments to implement long-term hazard mitigation measures after a major disaster declaration.
f) **Pre-Disaster Mitigation (PDM)** – This program provides grants to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event.
g) **Flood Mitigation Assistance (FMA)** – These grants assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.
h) **State Water Resources Control Board** – Proposition 84 Integrated Regional Stormwater Management (IRWM) Grant Program. This program funds projects designed to reduce and prevent storm-water contamination of rivers, lakes, and streams. These grants are to be used to provide matching grants to local public agencies.
i) **Proposition 1E Stormwater Flood Management Grant** – The Department of Water Resources IRWM Grant Program is designed to encourage integrated regional management of water resources, including flood management, and provide funding for projects that support integrated water management planning and implementation.

3. Bonds/Loans

Bonds and loans also represent funding that is available for stormwater management. They typically provide project specific financing that requires proposed improvements to be ready for construction and meet the priorities set by the funder. Although repayment terms can offer low or no interest financing, these sources do require full repayment from municipal recipients.

4. Development Impact Mitigation Fee

A development impact mitigation fee is an exaction that is imposed as a precondition for the privilege of developing land. As a part of the discretionary approval process for development within California, projects must identify and mitigate all environmental impacts. Stormwater impacts are one of many items that must be mitigated both on and off-site.
Master Plans of Drainage identify existing and future deficiencies in a municipality's storm drainage system. Development proposals are routinely required to mitigate these deficiencies as a condition of project approval. In some cases, the development must fully mitigate offsite deficiencies. However, in many cases a development contributes to only a small percentage of the deficiency and a development impact mitigation fee is necessary to meet State nexus criteria.

A nexus study must be prepared to serve as the basis for establishing development impact fees under AB 1600 legislation, as codified by California Government Code Section 66000 *et seq*. This code section requires that a reasonable relationship, or nexus, must exist between the fee and its purpose. Each local agency must perform the following tasks before imposing a fee:

- Identify the purpose
- Show how it is to be used
- Show a reasonable relationship between the fee's use and the type of development project on which the fee is imposed
- Show a reasonable relationship between the need for the public facility and the type of project on which the fee is imposed; and
- Demonstrate a reasonable relationship between the amount of the fee and the cost of public facility

The development impact fee must be based on the proportionate share of the total facility use that each land use represents. Life cycle operations and maintenance costs of the proposed facility may also be included in the fee. Life cycle costs are defined as the sum of the capital costs, installation costs, energy costs, operating costs, maintenance costs, and improvement repair and replacement costs over the lifetime of the facility.

The City of Simi Valley does not currently have development impact mitigation fee revenue for stormwater management.

5. **Stormwater Permit/Connection Fee(s)**

Permit and connection fees are applicable mainly to new developments. Stormwater permits are assessed for construction activities that disturb an existing site and could discharge stormwater to surface waters. Connection fees are assessed when the new development connects into the municipal storm sewer system. The permit and connection fees are valuable sources of funding to manage stormwater impacts and infrastructure needs in developing or redeveloping areas; however, they are site specific and can be an unreliable source when development slows.

> There certain general principals related to stormwater service charges. First, for a stormwater service charge to be regarded as a fee, rather than a tax, the overall cost of the program must be reasonably related to the service being provided, and the funds raised must be segregated for use by the stormwater program. Second, the fee should be proportional to the property's contribution to stormwater runoff. Third, participation in the program should be characterized as "voluntary." And fourth, in states with constitutional provisions governing the imposition of any new tax, it may be necessary to seek voter approval for a fee even if it is designed to be service-based.[1]

The City of Simi Valley does not currently have stormwater permit or connection fee revenue for stormwater management.

6. **Special Assessment/Benefit Districts**

Special assessments can be used in locations or districts that benefit exclusively from a particular public investment. This would be the case where several neighborhoods in a community need to have stormwater infrastructure installed or replaced. These improvements can be offset by charges only to those properties located within the benefiting neighborhoods. As with permit and connection fees, special assessments are a method to improve conditions within a specific area, but after work is complete, funding is not available for other stormwater management projects or needs.

This funding source relies on property assessments based on the contribution of stormwater runoff to municipally managed storm sewer system. In most locations, the assessment is based on the amount of impervious surface on a site. Due the structure of the utility, fees are directly related to stormwater management benefits received and create a reliable source of funding that is dedicated to meeting stormwater needs and impacts.

In the State of California, storm drainage is largely an unfunded mandate. Moreover, due to Proposition 218 limitations, few agencies within the State have a proactive user rate funded

[1] National Association of Flood and Stormwater Management Agencies. Guidance for Municipal Stormwater Funding.

storm drainage program. Agencies such as Los Angeles were successful in garnering public support for storm drainage fees and fee increases, while others have maintained their current fee levels as they had implemented a storm drainage fee prior to passage of Proposition 218. Finally, while some other agencies collect storm drainage related costs through wastewater or water user bills, most agencies still use general fund revenues and/or underfund their true storm drainage needs.

The City of Simi Valley does not currently have special assessment or benefit district revenue for stormwater management.

7. Local Option Sales Tax

A local option sales tax is a special-purpose tax implemented and levied at the city or county level and appended onto a state's base sales tax rate. A local option sales tax is often used as a means of raising funds for specific local or area projects, such as improving area streets and roads, or refurbishing a community's downtown area. Municipalities within California can add up to 2% in local add-on sales taxes subject to a supermajority vote. Local option sales taxes are typically used for transportation projects and programs.

The City of Simi Valley does not currently have local option sales tax revenue for stormwater management.

8.5 Funding Comparison Matrix

The comparative matrix identifies the benefits and challenges of these various funding sources:

Table 8-1 Funding Comparison Matrix

Funding Source	Benefits	Challenges
Property Taxes and General Fund	Existing funding source	Dependent on competing needs and priorities
	Utilizes existing funding system	Tax exempt properties do not contribute
	Can be leveraged to payback bonds or loans	Does not fully reflect contribution of runoff
	Tax deductible	
Grants	Existing funding source	One-time source
	Does not require repayment	Competitive process
		Requires local funding match
		Time-constrained
Bonds/Loans	Existing funding source	One-time source
	Can support construction ready projects	Requirement to pay back bond/loan amount
		Possible interest charges
		May require advance design and plans
Development or Construction Fees	Addresses new construction stormwater impacts	Specific only to stormwater impacts for sites under construction
	Addresses new connections to the existing stormwater system	Funding not available for regional projects or system wide improvements
	Fee can include life-cycle and maintenance costs	Full cost-recovery fee may be a detriment to development activity
Special Assessment	Can help with stormwater system improvements in specific locations	Only addresses improvements in specific location(s)
	Directly connects improvements to those receiving the benefit	Funding not available for regional or system wide improvements
		Requires super majority of voting property owners to implement tax assessment
Benefit Assessment	Can help with stormwater system improvements in specific locations	Only addresses improvements in specific location(s)
	Directly connects improvements to those receiving the benefit	Funding not available for regional or system wide improvements
	Can be easily implemented by development projects who is already majority owner	Requires majority plus 1 of voting property owners to implement property tax assessment
		Requires nexus study to implement
Stormwater Utility and/or Enterprise Fund	Directly related to stormwater impacts	Feasibility study needed to implement fee structure and administration
	Creates a funding source that can leverage grant and bond opportunities	Requires super majority of voters to implement property tax assessment
	Dedicated city-wide funding source	
	Stable funding source	