CITY OF ADELANTO

DRAINAGE MASTER PLAN UPDATE

FINAL REPORT

May 2012

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CITY OF ADELANTO
DRAINAGE MASTER PLAN UPDATE

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CHAPTER 1
INTRODUCTION

CHAPTER 1
INTRODUCTION

AUTHORIZATION AND SCOPE OF WORK

City of Adelanto approved a proposal with So & Associates Engineers, Inc. in September of 2009 to update Drainage Master Plan. City's current Drainage Master Plan was prepared more than 20 years ago. Due to the fact that that tributary flows upstream from Victorville area were updated in a 2007 study, it became necessary to update the City's current Drainage Master Plan. The purpose of the Water Master Plan is also to enable the City of Adelanto to estimate the construction cost so that the "Drainage Impact fee" can be adjusted. The scope of the Drainage Master Plan includes the following tasks:

(1) Internal co-ordination and discussions to integrate the General Plan (GP) update prepared by City's planning staff into the Master Plan.

(2) Identify the various parcels and tracts impacted by the existing and proposed channels and identify the current and proposed land-use (GP update).

(3) Update the alignment of various channels proposed in the 1992 Master Plan to ensure that they are in proper locations.

(4) A quick verification of the estimated storm flows in existing and future channels under the 1992 Master Plan. Due to budget limitations, the verification will largely be focused on tributary areas.

(5) Review the design capacity of thee Existing and proposed drainage channels. Channel slopes in each segment of the channel will be projected from the current USGS topography maps obtained by City staff. Channel capacity will be estimated based on type of channel (rectangular, trapezoidal etc).

(6) Using the updated channel design to provide the required capacity, the amount of earth-work will be projected using the digital topo-map along each segment of channels (by capacity changes).

(7) Identify the alternatives for the improvement of the 1992 proposed channels. This task actually is to evaluate the effect without the tributary flows from Victorville. Based on this review, Adelanto City staff will discuss with Victorville staff as to funding and construction of the future channels.

(8) Develop preliminary construction cost based on the earthwork quantities in each segment of a channel. City staff will develop a "probable project cost" to include easements, environmental review, administration, engineering, and construction.

(9) City staff will review the projected probable total drainage improvement costs and evaluate the need to update the current drainage impact fee.

(10) Prepare a focus Drainage Report as an update for the 1992 Drainage Master Plan. This will rely on the technical memoranda/minutes prepared as each of the above key tasks is completed.

STUDY AREA

The study area includes all parcels within the City limits plus portions of land that may be considered for annexation by the City. The total area of the City includes approximately 34,565 acres (53.80 square miles) and additional 2,306 acres (3.6 square miles) that may be annexed into the City. Its sphere of influence extends that figure to approximately 77 square miles. Figure 1-1 shows the study area and the City of Adelanto boundary.

The City of Adelanto is located in the high desert region of San Bernardino County and is on the southwest end of the expansive Mojave Desert. The study area is located immediately to the West of Highway 395, generally bound by Palmdale Road on the South, Lessing Avenue on the West, and Oleander Street on the North.

LAND USE

Land use in the study area consists of a combination of residential, commercial, manufacturing/industrial, airport park, airport development district, public/semi-public open space, and specific plan area. The majority of the City is manufacturing/industrial and residential development (consisting of single family housing,) with commercial acreage fronting Palmdale Road and Highway 395, and towards north-end of the City along El Mirage Road. Based on historical growth within the City boundary, it is expected that single-family will continue to account for the majority of new growth during the initial planning period (5-year), with associated commercial/industrial developments. Figure 2-2 shows the location and distribution of the various categories of land use.

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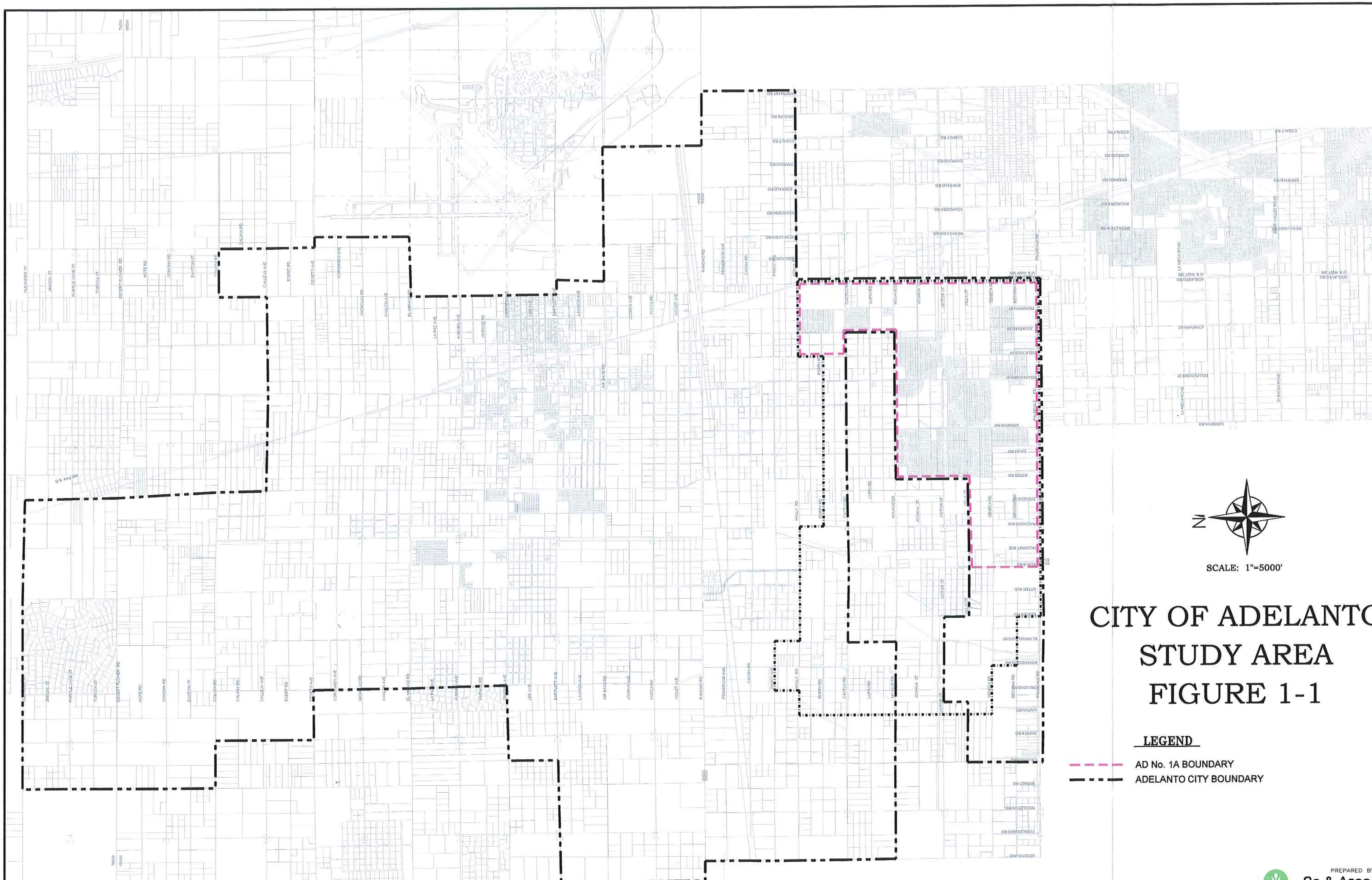
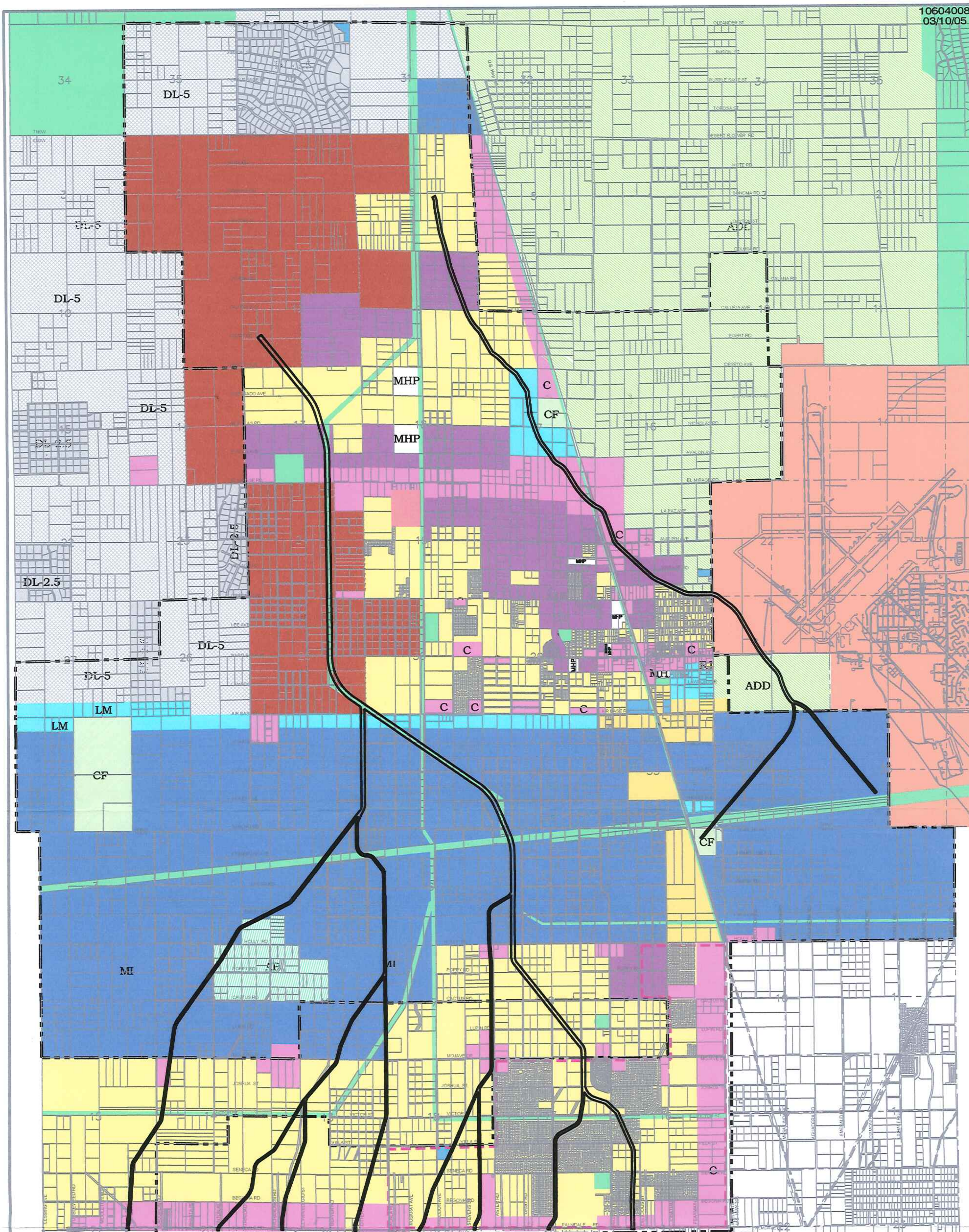


CITY OF ADELANTO STUDY AREA FIGURE 1-1

PREPARED BY:
So & Associates Engineers Inc.



CITY OF ADELANTO
LAND USE
FIGURE 1-2

CHAPTER 2
HYDRAULIC/HYDROLOGIC MODELING

CHAPTER 2
HYDROLOGIC/HYDRAULIC MODELING

HYDROLOGY

Defining the drainage areas contributing stormwater runoff to the drainage system is an important aspect in determining contributing sources and in accurate assessment of the capacity of the existing or proposed drainage system. Based on the existing topography, drainage area parameters, such as slopes, land use and imperviousness was determined. After the drainage area boundaries have been identified, the discharge from each drainage area was calculated using CIVILCADD software. CIVILCADD is a widely-used computer program created for San Bernardino County that allows flexibility for modeling the quantity of stormwater runoff from basins and drainage systems. SWMM 5.0 contains both Rational method and Unit Hydrograph method analysis. The preparation of a base hydrology model began with the collection of standard and assumed parameters. These were then incorporated into the CIVILCADD software package. After the base model was developed and an appropriate design storm selected, a hydrologic simulation was generated. The output of the simulation was reviewed and compared to standard Rational Method hand calculations to determine difference/percent error between methods.

HYDROLOGY DESIGN CRITERION

City of Adelanto sets the San Bernardino County Hydrology Manual. Figures 2-1 and 2-2 are the isohytels maps for 10-year and 100-year respectively for the desert area identified as Figures B-9 and B-10 respectively in County of San Bernardino Hydrology Manual. Figure 2-3 shows the hydrologic soil group map for the region.

The value for C is dependent on the type of surface material. The San Bernardino County Hydrology Manual includes a procedure for determining the value for rainfall intensity. The 1-hour precipitation from a county wide isohytels map was used to select an Intensity-Duration curve that can determine the rainfall intensity. The flow rate, Q, from the drainage area into the drainage system was determined using the following relationship:

$$Q = CIA$$

where Q = Flow rate, cubic feet per second

C = Storm water runoff coefficient, dimensionless

I = Historical rainfall intensity, inch per day

A = Surface area of drainage basin, square feet

The following design parameters were used in the hydrologic calculations:

- Runoff Coefficient "C" Value = 0.3
- Soil Group = C (sandy clay loam soil)
- Slope Used for Rainfall Intensity Curve "b" Value = 0.7
- SCS Curve Number for Soil (AMC 2) = 56
- Rainfall Intensity "i" Value for 100 Year Design Storm = 1.15 inch/hr
- Rainfall Intensity "i" Value for 10 Year Design Storm = 0.75 inch/hr
- Unit Hydrograph lag time = 0.8 t_c (time of concentration)

HYDROLOGIC MODELING

Hydrologic analysis was performed using "CIVILCADD – San Bernardino County Rational Hydrology and Unit Hydrograph" software. The preparation of the model began with the collection of standard and assumed parameters. These were then incorporated into the standard hydrology system model within the CIVILCADD software package. After the model was developed and an appropriate design storm year event selected, a simulation was generated. The software utilized the information to determine the runoff produced by a sub-watershed. Two hydrology methods were used to do the analysis:

- <u>Rational Method:</u>

  According to the Hydrology Manual, the rational method is used for tributary areas smaller than 640 acres (1 square mile). Whenever the tributary area exceeded more than 640 acres, Unit Hydrograph method was used. Both 10-year (1 hour) and 100-year (1 hour) storm events flow calculations were performed. The analysis reports are attached in Appendix A of this report.

- <u>Unit Hydrograph Method</u>

  As mentioned above, the Unit Hydrograph method was analyzed when the tributary areas exceeded 640 acres. The rational method was run up to 640 acres and from that point, the unit hydrograph analysis was continued downstream using the information from rational method analysis up to the point. Unit Hydrograph analysis was done for both 10-year and 100-year storm events. The analysis results are attaché din the appendix at the end of the report. A proposed system map showing the tributary areas is attached in Appendix A.

HYDRAULICS

The existing and proposed drainage systems within the City of Adelanto typically consist of open channels, culverts and associated outfalls. For this investigation, an outfall is identified as the point at which storm water is discharged from the drainage system into an existing wash. Drainage systems must adequately convey peak storm water flows during its design life. Peak flows anticipated for each drainage basin were determined and the ability for the pertinent, existing drainage system to convey the peak flows evaluated. Flows contributed by future connections were also considered when evaluating existing systems. Hydraulic assessment of the drainage systems included the following:

- the dimension and shape of the conveyance structures;
- the slope of the conveyance structures;
- the conveyance structure materials;
- the surface or finished grade elevations; and
- the flow line or invert elevations and flow capacity of systems.

HYDRAULIC DESIGN CRITERIA

The Manning's roughness coefficient "n" (Manning's n) for the sub-watershed pervious and impervious areas represents the roughness characteristics of the surface and is influenced by vegetation, channel irregularities, channel alignment, and scouring. LA County Flood Control District Hydraulic Design Manual was used for the hydraulic analysis. The following design parameters were used in the hydraulic calculations:

- Side Slope for the trapezoidal channel = 1:1
- Manning's Roughness Coefficient "n" = 0.015
- Minimum freeboard = 2.5
- Channel Height = 1.5 x Normal depth + Free Board

Stormwater runoff that is generated from upstream sub-watersheds flows to the low point, along with the accumulating precipitation. The surface runoff (Q) flowing to the channel is given by Manning's equation.

$$Q = (1.49/n)(AR^{2/3}\ S^{1/2})$$

where: Q = discharge, in cubic feet per second

A = cross-sectional area of flow, in square feet

R = hydraulic radius, A/P, in feet

P = wetted perimeter of flow, in feet

S = slope of the energy gradient

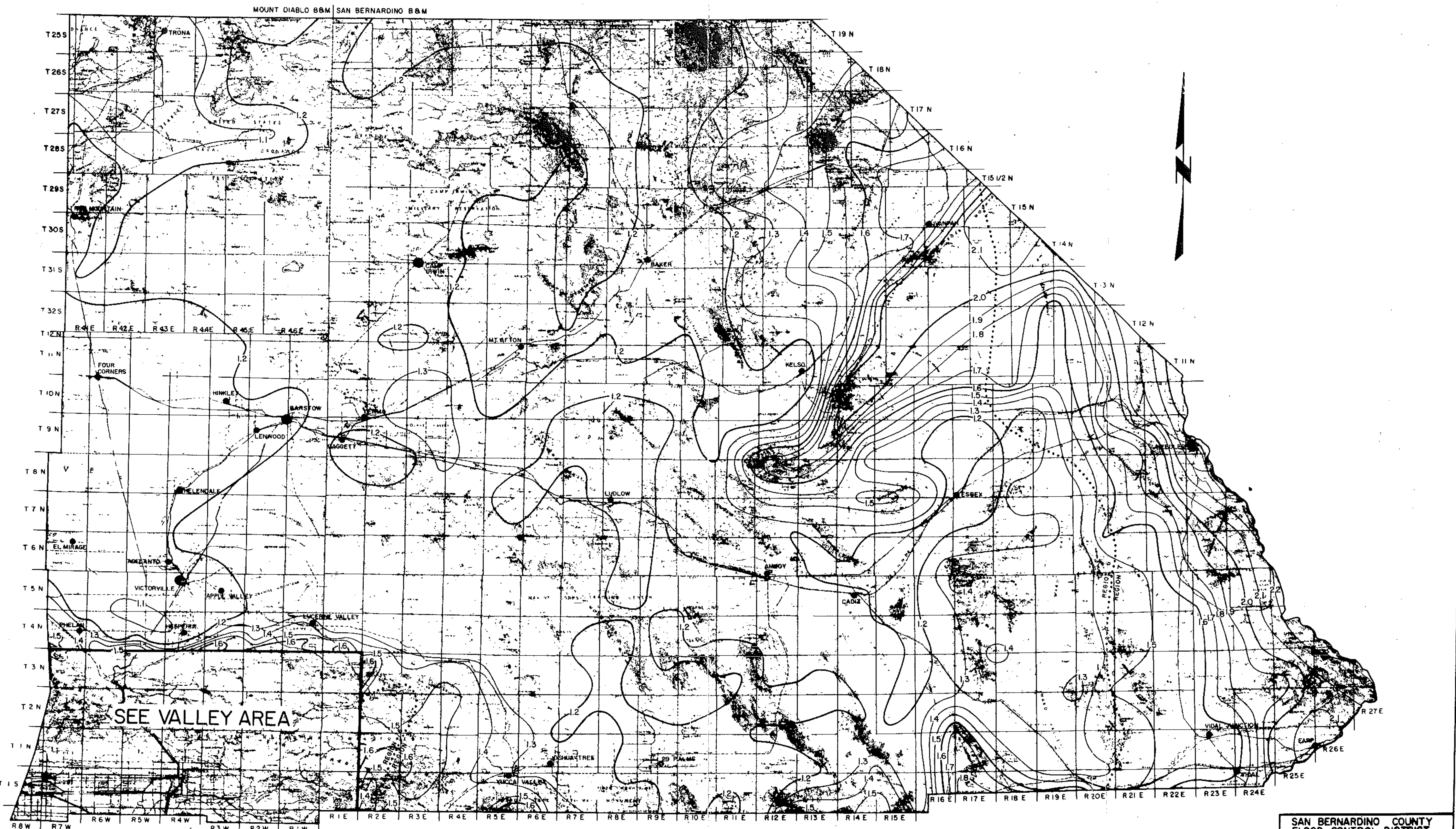
n = Manning's roughness coefficient

HYDRAULIC MODELING

The peak flow capacity calculated from hydrologic analysis as mentioned above was used to size the proposed drainage open channel. Online hydraulic calculator was used to determine the normal depth based on the peak design flow and assumed side slopes. The same base width as proposed in the 1992 Drainage Master Plan was considered for the calculation. The hydraulic calculations were performed at each channel segments whenever there was significant change in the direction of the channel and when other sub-channel(s) get connected to the channels. The channel slopes in each segment of the channel was projected from 2-feet contour maps provided by the City.

The typical drainage system requires and entrance and exit (nodes and links) as well as their respective parameters such as elevations, slopes, etc. Topographic maps with two-foot contours were utilized to determine ground line elevations for input into the model. City design standards were used as guide to determine typical roadway widths, slopes and curb and gutter geometry. where appropriate, to provide a means for determining appropriate sizing of junctions and depth of cover for assumed pipe networks. The conveyance systems developed for this project as well as the assumptions made for the completion of a pipe network are discussed in Section 3 of this report. The main components that describe nodes are the invert elevation and the height or depth from invert to ground surface, channel height. The City's 1992 Master Plan provided some of this critical information at existing drainage locations. Other information was collected from field investigation. The assumption of three feet of cover as the depth of fill, and usage of standard structures would results in a uniform cost estimate that is dependent on depths and footprint of excavation. The conveyance component of the model that comprise of peak flow, pipes, culverts, concrete channels, and natural channels. Channel slopes were determined by the conduit lengths and the difference in elevation between the upstream and downstream nodes. All pipes and culverts were modeled as trapezoidal channels.

In addition to inlets, culverts and channels, the City's storm drain system recommends the use of on-site detention basins. The purpose of a detention basin is to store storm water runoff flows for the attenuation the peak–flow resulting from a storm event. The typical detention basin is composed of an entrance conveyance. The basin is recommended to have a peak flow at 10 year storm event (Q_{10}). The basin can be a can be man-made of earth or concrete. The outlet of a basin can be designed to meter out the contained storm water by a flow metering device at a specified depth. The hydraulic calculations are presented in Appendix B attached at the end of this report.



SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

REDUCED DRAWING

0 1 2 3

3 INCHES ON ORIGINAL

FIGURE 2-2

LEGEND:

1.2 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

DESERT AREA

ISOHYETALS

Y_{100}-100 YEAR 1 HOUR

BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY [signature]

FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1" = 6 MI.		10 of 18

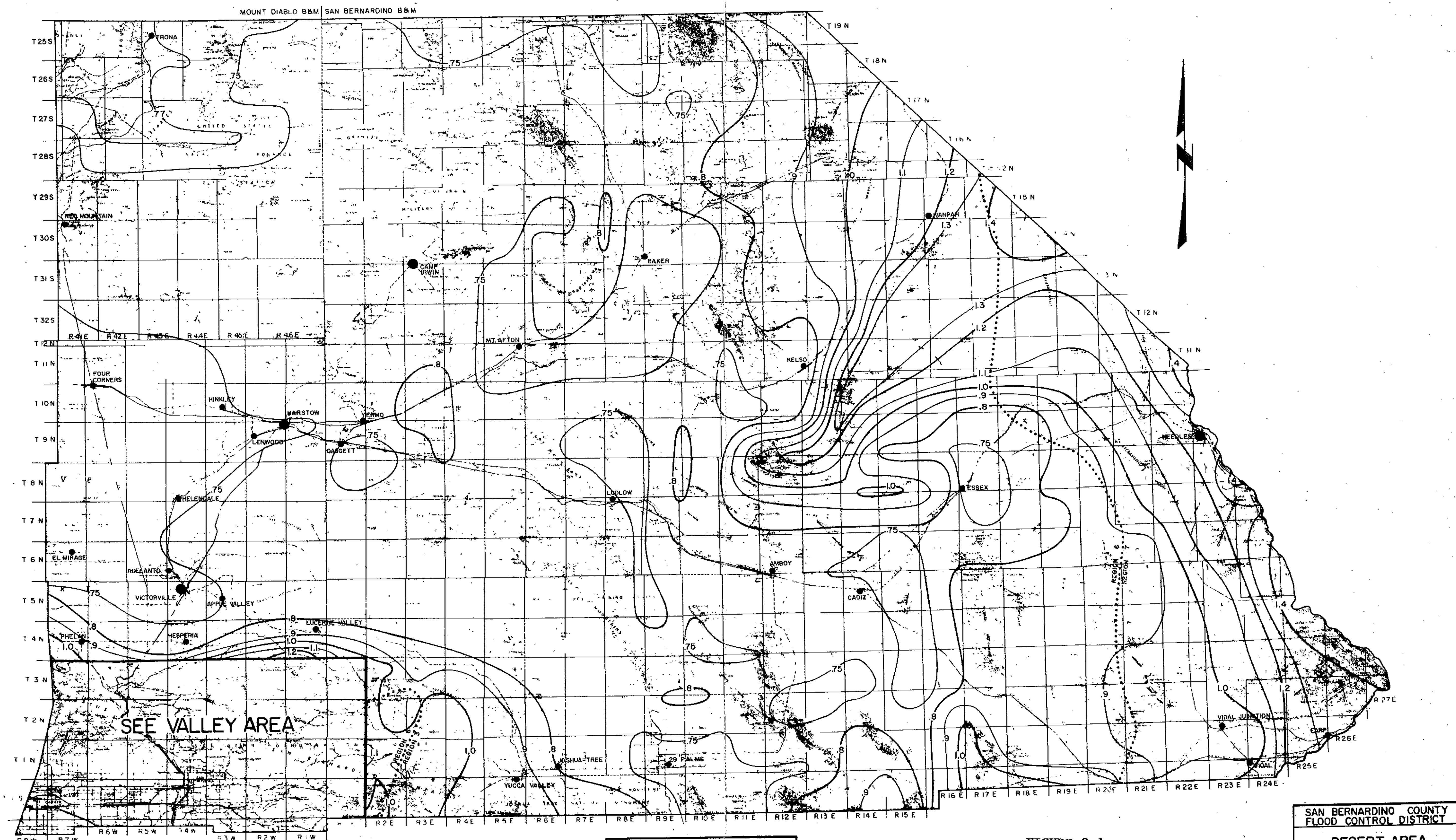


FIGURE 2-1

REDUCED DRAWING
0 1 2 3
3 INCHES ON ORIGINAL

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

DESERT AREA

ISOHYETALS

Y_{10} - 10 YEAR 1 HOUR

BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

LEGEND:

3.5 ISOLINES PRECIPITATION (INCHES)

APPROVED BY FLOOD CONTROL ENGINEER

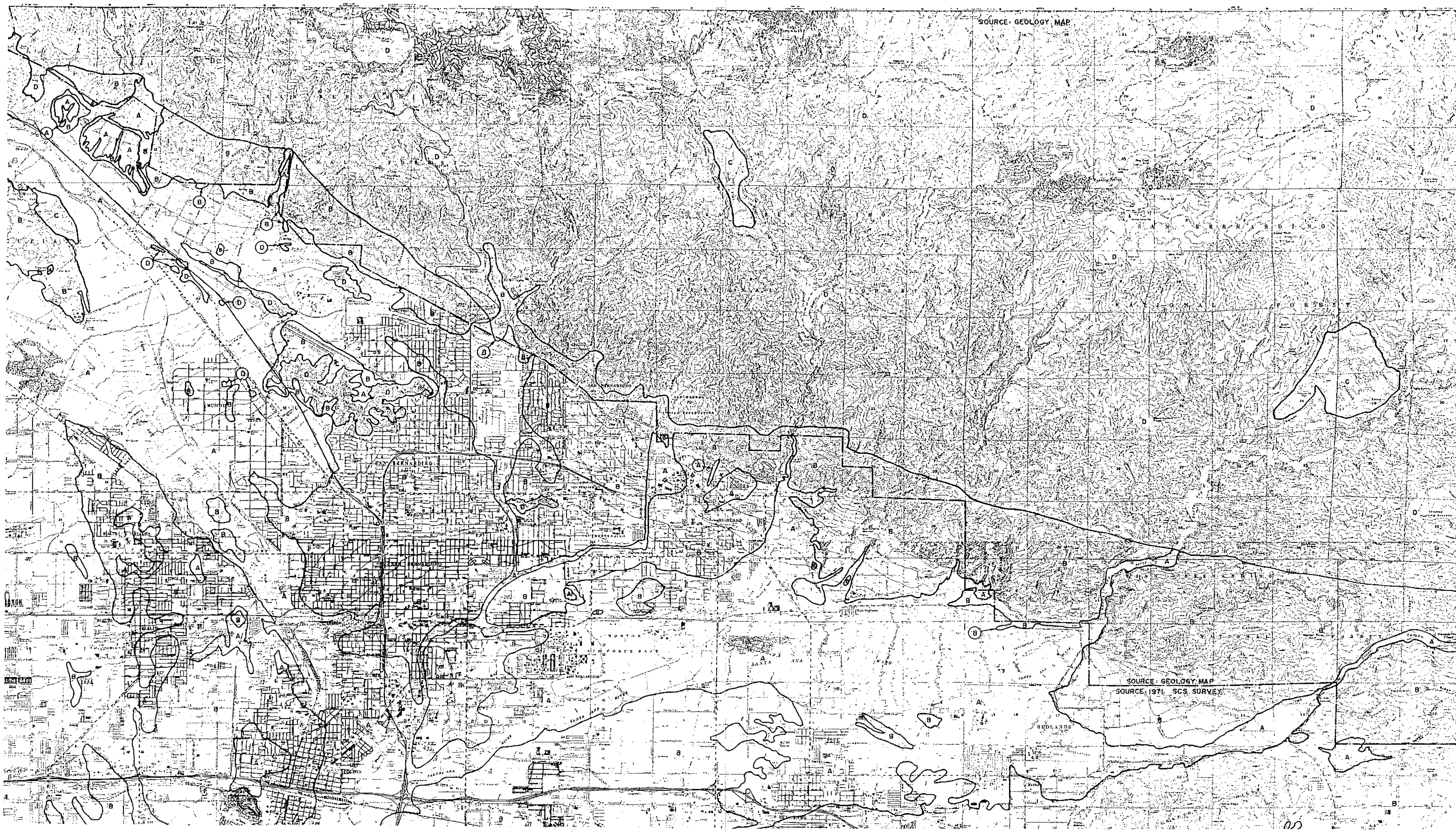
DATE	SCALE	FILE NO.	DRWG. NO.
1982	1" = 6 Mi.	WRD-1	9 of 12

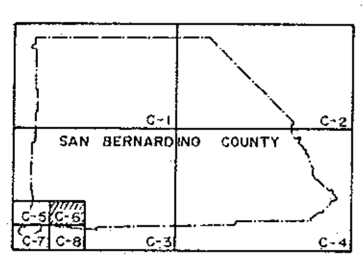
WATER RESOURCES DIVISION

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

FIGURE B-9





INDEX MAP

LEGEND

———	SOIL GROUP BOUNDARY
A	SOIL GROUP DESIGNATION
— - —	BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000

SCALE REDUCED BY 1/2

FIGURE 2-3

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP FOR SOUTHWEST-B AREA

CHAPTER 3
STORM DRAINAGE SYSTEM

CHAPTER 3
STORM DRAINAGE SYSTEM

EXISTING TOPOGRAPHY AND HYDROLOGY

Elevations within the City range approximately between 2,700 and 3,200 feet above mean sea level. The terrain generally slopes from southwest to northeast. The terrain has allowed the development to occur mostly in Assessment District 1A and towards the northern end of the City. The City's southern drainage area includes steep slopes and distinct drainage courses in comparison to the northern area that slopes approximately at a one percent (1%) gradient. The preliminary proposed slopes generally follow the contours of the area topography referencing the 2-feet contour maps provided by the City. Runoff through the drainage area eventually reaches Fremont Wash which lies within northwestern region of the City. The City's ground cover consists of scattered brush, grasses and Joshua tree.

Adelanto's climate is arid, typical of the southwest desert areas with an average annual rainfall of approximately 5.5 inches, and an average annual temperature of 63 degrees Fahrenheit.

PROPOSED DRAINAGE CHANNEL SYSTEMS

This update mostly confines the same channel configurations and numbering identified in the 1992 Drainage Master Plan as some developments have already occurred and some rights of way for the proposed channel in the previous master plan have been dedicated. However, this update has considered the existing sub-drainage areas, change in previous alignment due to development etc and has made the necessary changes accordingly. As shown in Figure 3-1, the analysis incorporates the downstream flows based on the drainage study by Victor Valley Developer's Association (VVDA), which proposes four (4) discharge points from the drainage area south of Palmdale Road and also the discharges shown in the Baldy Mesa Master Plan of Drainage (MPD). In addition, Figure

3-2 attached at the end of this Chapter shows the assigned tributary areas for hydrological analysis of the proposed drainage system.

The channels were designed for the difference between peak flow for 100 year and 10 year storm events ($Q_{100} - Q_{10}$). The 10 year storm flow (Q_{10}) is proposed to be retained by local facilities by development. Table 3-1 attached at the end of this Chapter shows the proposed design parameters of different channel sections based on the hydrology and hydraulic model analysis as described in Chapter 2. However, the analysis was also conducted for the proposed drainage system without including the flows from VVDA and Baldy Mesa MPD studies to evaluate the effect without the tributary flows from Victorville. This will help the City staff to discuss with City of Victorville staff as to funding and construction of the future channels. Table 3-2 at the end of this Chapter presents the proposed design parameters without including the upstream flows from outside the City boundary as dicussed above.

The proposed three main channel systems are assigned as Channels 1, 2 and 3 are described as follows:

Channel 1A

This is a proposed regional channel running along Adelanto Road from Rancho Road to Crippen Avenue connecting to a junction with Channel 1. The design capacity of the sub-channel is 1,028 cfs with a bottom width of 12 feet and a channel depth of 12 feet. The total tributary area served by Channel 1A is approximately 2.3 square miles.

Channel 1

It runs along northwesterly from Rancho Road to discharge storm water to Fremont Wash downstream. The maximum design capacity of the channel is 4,430 cfs with bottom widths varying from 25 feet to 50 feet and the channel depths from 4 feet to 8 feet. The total tributary area served by Channel 1 is approximately 11.14 square miles not including the flow that from Channel 1A.

Channel 2A, 2B and 2B1

These proposed regional branch channels of Channel 2 run generally in northerly direction carrying storm water from Palmdale Road to junctions at Channel 2. The total tributary area covered by these sub-channels is approximately 1.5 square miles.

Channel 2

This is the longest and the largest regional channel running northwesterly from Palmdale Road to Freemont Wash. The maximum design capacity of the channel is 16,519 cfs with bottom widths varying from 50 feet to 100 feet and the depths from 2 feet to 10 feet. Channel 2 covers a total tributary area of approximately 12.85 square miles in addition to the flows from Channel 3 and Channels 2A, 2B, 2B1, 3A, 3B1 and 3B.

Channel 3A1, 3A and 3B

Channels 3A1 and 3A are secondary channels (less than 750 cfs design capacity) while Channel 3B is regional channel running northeasterly from Palmdale Road to join to junctions at Channel 3, serving a total tributary area of 1.5 square miles.

Channel 3

Channel 3 is a regional channel that runs northerly mostly along Koala Road carrying storm drain from Palmdale Road to get connected to junction at Channel 2. The maximum design capacity of the channel is 2,345 cfs with maximum bottom width of 25 feet and channel depth of 6 feet. The total tributary area served by Channel 3 is 8 square miles not including the flows from Sub Channel 3A, 3A1 and 3B.

Freemont Wash

The natural drainage course at the extreme north of the watershed which is not the part of the proposed drainage system will directly flow to the Freemont wash. These courses were identified in the study so that drainage easement along these natural streams is assessed in the future as the development occurs in the vicinity of the area. The total tributary area following the natural streamline to reach the wash is approximately 4.8 miles.

PROPOSED QUANTITIES AND COST ESTIMATES

The quantities presented in Table 3-3 attached at the end of this report was prepared using information from proposed drainage system quantity takeoffs. The culvert box crossings are proposed such that closed conduits are installed for any major regional collectors and greater street sections that cross the channels. The street sections that are smaller than the regional channels would be Arizona Crossings, specifically designed to facilitate road access over creeks even during flash flooding incidents. Vendor quotes and recent unit costs for similar Projects having similar site conditions were used to find the unit prices which are as follows:

S.N.	Quantity Description	Unit	Unit Cost
1	Soil Excavation	CY	$6.45
2	Soil Export	CY	$10.33
3	10" Thick Gunite Side Slopes w/ #4 @ 18" O.C. Both Ways	SF	$6.78
4	10" Thick Gunite Channel Bottom w/ #4 @ 18" O.C. Both Ways	SF	$5.92
5	3.3' Thick, D50=18", Grouted Rip-Rap Channel Bottom w/ 9" Thick #3 Backing on Filter Fabric per Caltrans Spec. 72-1 & 72-5, Method B Placement	SF	$15.33
6	Finish Grade Earthen Channel Bottom w/ 9" Thick Layer of #3 Backing Size Rock	SF	$2.53
7	Finish Grade Earthen Channel Bottom	SF	$0.94
8	Right of Way (R/W)	AC	$25,180
9	Crossings	EA.	$ 1.5 M

A brief summary of the estimates presented in Table 3-3 is shown below:

Channel #	Channel Properties						Construction Costs					Cost ($x10³)
	Lineal Feet (ft)	Bottom Area (ft²)	Side Slope Area (ft²)	Earthwork Cut (cy)	Crossings (each)	R/W (ac.)	Channel Bottom ($x10³)	Side Slopes ($x10³)	Earthwork ($x10³)	Crossings ($x10³)	R/W ($x10³)	
1A	11,553	138,636	657,841	279,258	7	20	$1,088	$4,460	$2,234	$10,500	$508	**18,790**
1	37,899	1,681,550	2,105,131	689,693	10	113	$13,196	$14,273	$5,517	$15,000	$2,845	**50,831**
2A	11,553	404,355	592,487	90,367	0	28	$3,173	$4,017	$723	$0	$715	**8,628**
2B1	7,308	87,696	416,126	40,448	0	14	$688	$2,821	$324	$0	$363	**4,196**
2B	16,523	198,276	1,051,939	173,523	2	33	$1,556	$7,132	$1,388	$3,000	$840	**13,916**
2	48,097	4,173,470	2,737,402	1,808,603	19	201	$32,751	$18,560	$14,468	$28,500	$5,066	**99,344**
3A1	6,380	95,700	200,876	24,203	1	13	$751	$1,362	$194	$1,500	$321	**4,127**
3A	14,555	229,900	540,604	43,530	5	29	$1,804	$3,665	$348	$7,500	$721	**14,039**
3B	24,758	618,950	1,269,696	337,134	8	57	$4,857	$8,609	$2,697	$12,000	$1,445	**29,608**
3	25,188	799,720	1,434,233	333,269	7	63	$6,276	$9,724	$2,666	$10,500	$1,584	**30,750**
Total	**203,814**	**8,428,253**	**11,006,335**	**3,820,028**	59	572	**$66,140**	**$74,623**	**$30,558**	**$88,500**	**$14,407**	**274,228**
											Contingency (25%)	**68,557**
											Total Construction Cost	**342,786**

DRAINAGE IMPACT FEE (DIF) REVIEW

The proposed facility improvements should adequately serve existing customers and permit future growth to continue. New drainage facilities should be prioritized based on the location of proposed growth analyses to enhance system reliability.

1. <u>Estimated Future Growth</u>:

- Total Projected Growth at Near Saturation (based on Water/Sewer Master Plan-2005) = 87,163 EDUs

  * EDUs = equivalent dwelling units

- Current Customers (information by City staff) = 8,022 EDUs
- Future Customers (subject to DIF) = 87,163 – 8,022 = 79,141 EDUs

2. <u>Based on Summary Table above:</u>

Total Project Probable Costs (including Administration, engineering, and site acquisition)		= $ 342,786,000.00
Proposed Drainage Impact Fee	= $ 342,786,000/79,141	= **$ 4,331.00 per EDU**
Current Drainage Impact Fee		= $ 3,132.00 per EDU

TABLE 3-1: PROPOSED RUNOFF QUANTITY, RETENTION STORAGE AND REVISED CHANNEL DESIGN (INCLUDING VVDA & BALDY MESA MPD FLOW)

Notes:

[1] Proposed peak flow based on 10 year & 100 year-flood events

[1] Calculated Using "CIVILCADD -San Bernardino County Rational Hydrology and Unit Hydrograph Programs"

[1] Runoff Coefficient "C" Value = 0.3 (unimproved area)

[1] Rainfall Intensity "i" Value for 100 Year Design Storm = 1.15 inch/hr, 10 Year Design =0.75 inch/hr.

[1] Soil Group = C (sandy clay loam soil); Slope Used for Rainfall Intensity Curve "b" Value = 0.7; SCS Curve Number for Soil (AMC 2) = 56

[2] By Development

[3] Based on "Adelanto Master Plan of Drainage-November 1992" and County Drainage Master Plan

[4] Based on Required Total Cumulative Flow calculated (refer to column 8)

[5] Same as designed in the previous master plan, side slope assumed as 1:1

[6] Channel Height = 1.5 x normal depth + 2.5' (per LA County Flood Control District Hydraulic Design Manual)

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow: Cum.(Q_{100} - Q_{10}) (cfs)	Required Drainage Channel Flow: Q_{100} from VVDA & Baldy Mesa MPD (cfs)	Required Drainage Channel Flow: Total Cum. Flow (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Flow Cap. (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Base Width (ft.)	Drainage Channel Design Data per Previous Master Plan[3]: Water Depth (ft.)	Revised Drainage Channel Design Data[4]: Design Flow (cfs)	Revised Drainage Channel Design Data[4]: Base Width[5] (ft.)	Revised Drainage Channel Design Data[4]: Normal Depth (ft.)	Revised Drainage Channel Design Data[4]: Critical Depth (ft.)	Revised Drainage Channel Design Data[4]: Channel Height[6] (ft.)	Revised Drainage Channel Design Data[4]: Top Width (ft.)
Channel 1A																
Reach 1	Q_{100}	1800.00	1225.16	880	920	-	920	158	12	10	920	-	-	-	-	-
	Q_{10}	880.00														
Reach 2	Q_{100}	103.59	153.45	39	65	-	985	158	12	10	985	-	-	-	-	-
	Q_{10}	39.08														
Reach 3	Q_{100}	75.38	101.20	32	43	-	1028	158	12	10	1028	12	6	5	12	36
	Q_{10}	32.27														
Channel 1																
Reach 1	Q_{100}	1419.00	1263.90	638	781	-	781	1789	25	8.5	781	25	4	3	9	43
	Q_{10}	638.45														
Reach 2	Q_{100}	1149.00	1039.29	443	706	-	1487	1937	50	8.5	1487	50	4	3	9	68
	Q_{10}	442.80														
						Flow from Channel 1A	1028									
Reach 3	Q_{100}	727.95	697.00	298	430	-	2944	2376	50	7.5	2944	-	-	-	-	-
	Q_{10}	298.34														

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow: Cum.(Q_{100} - Q_{10}) (cfs)	Q_{100} from VVDA & Baldy Mesa MPD (cfs)	Total Cum. Flow (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Flow Cap. (cfs)	Base Width (ft.)	Water Depth (ft.)	Revised Drainage Channel Design Data[4]: Design Flow (cfs)	Base Width[5] (ft.)	Normal Depth (ft.)	Critical Depth (ft.)	Channel Height[6] (ft.)	Top Width (ft.)
Reach 4	Q_{100}	706.69	817.52	268	438		3382	2376	50	7.5	3382	50	7	5	12	75
	Q_{10}	268.31														
Reach 5	Q_{100}	1800.18	1927.14	846	954	-	4336	3100	50	8.5	4336	-	-	-	-	-
	Q_{10}	846.35														
Reach 6	Q_{100}	152.23	281.25	58	94	-	4430	3100	50	8.5	4430	50	8	6	14	78
	Q_{10}	57.97														
Reach 7	Q_{100}	1044.49	1281.46	511	534	-	534	Fremont Wash								
	Q_{10}	510.99														
Channel 2A																
Reach 1	Q_{100}	132.07	133.11	64	68	2019.00	2087	2020	35	6	2087	-	-	-	-	-
	Q_{10}	63.61														
Reach 2	Q_{100}	111.27	107.18	58	53	-	2141	2020	35	6	2141	35	5	5	10	54
	Q_{10}	58.19														
Channel 2B1																
Reach 1	Q_{100}	90.28	91.85	43	47	862.00	909	725	12	6.5	909	-	-	-	-	-
	Q_{10}	43.27														
Reach 2	Q_{100}	69.71	77.71	33	37	-	946	725	12	6.5	946	12	5	5	10	32
	Q_{10}	32.62														
Channel 2B																
Reach 1	Q_{100}	139.54	121.10	69	71	1283.00	1354	450	12	5.5	1354	12	6	6	12	36
	Q_{10}	68.88														
					Flow from Channel 2B1		946									
Reach 2	Q_{100}	29.53	36.29	13	16	-	2316	1275	12	8	2316	-	-	-	-	-
	Q_{10}	13.22														
Reach 3	Q_{100}	173.72	221.80	72	102	-	2418	1275	12	8	2418	-	-	-	-	-
	Q_{10}	71.88														
Reach 4	Q_{100}	136.03	202.10	53	83	-	2501	1275	12	8	2501	12	9	9	16	44
	Q_{10}	53.04														

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow: Cum.(Q_{100} - Q_{10}) (cfs)	Required Drainage Channel Flow: Q_{100} from VVDA & Baldy Mesa MPD (cfs)	Required Drainage Channel Flow: Total Cum. Flow (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Flow Cap. (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Base Width (ft.)	Drainage Channel Design Data per Previous Master Plan[3]: Water Depth (ft.)	Revised Drainage Channel Design Data[4]: Design Flow (cfs)	Revised Drainage Channel Design Data[4]: Base Width[5] (ft.)	Revised Drainage Channel Design Data[4]: Normal Depth (ft.)	Revised Drainage Channel Design Data[4]: Critical Depth (ft.)	Revised Drainage Channel Design Data[4]: Channel Height[6] (ft.)	Revised Drainage Channel Design Data[4]: Top Width (ft.)
Channel 3A1																
Reach 1	Q_{100}	54.69	53.25	27	27	-	27	600	15	6	27	15	1	1	3	22
	Q_{10}	27.26														
Channel 3A																
Reach 1	Q_{100}	167.27	154.97	83	84	-	84	400	12	5	84	-	-	-	-	-
	Q_{10}	82.96														
Reach 2	Q_{100}	62.57	65.68	31	32	-	116	400	12	5	116	12	1.5	1	5	22
	Q_{10}	30.57														
					Flow from Channel 3A1		27									
Reach 3	Q_{100}	61.77	73.37	29	33	-	177	1000	20	6	177	20	1	1	5	29
	Q_{10}	28.54														
Channel 3B																
						1810	1810	1765	25	7	1810	-	-	-	-	-
Reach 1	Q_{100}	181.31	235.90	74	108	-	1918	2275	25	7	1918	-	-	-	-	-
	Q_{10}	73.79														
Reach 2	Q_{100}	223.46	382.01	91	133	-	2050	2275	25	7	2050	25	5	5.5	10	46
	Q_{10}	90.94														
Channel 3																
						1337	1337	650	20	5.5	1337	-	-	-	-	-
Reach 1	Q_{100}	1474.51	727.10	720	754	1337.00	2091	850	20	5.5	2091	20	6	6	12	43
	Q_{10}	720.38														
					Flow from Channel 3A		177									
Reach 2	Q_{100}	126.94	214.51	50	77	-	2345	1925	25	7.5	2345	25	6	6	12	48
	Q_{10}	49.93														
Reach 3	Q_{100}	2717.00	2258.70	1365	1352	-	3697	4725	75	10	3697	-	-	-	-	-
	Q_{10}	1365.17														
					Flow from Channel 3B		2050									
Reach 4	Q_{100}	75.56	78.12	36	39	-	5786	4725	75	10	5786	-	-	-	-	-
	Q_{10}	36.36														
Region 5	Q_{100}	1991.24	1872.77	960	1031	-	6817	4725	75	10	6817	75	6.5	6	12	99
	Q_{10}	960.20														

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow: Cum.(Q_{100} - Q_{10}) (cfs)	Required Drainage Channel Flow: Q_{100} from VVDA & Baldy Mesa MPD (cfs)	Required Drainage Channel Flow: Total Cum. Flow (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Flow Cap. (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Base Width (ft.)	Drainage Channel Design Data per Previous Master Plan[3]: Water Depth (ft.)	Revised Drainage Channel Design Data[4]: Design Flow (cfs)	Revised Drainage Channel Design Data[4]: Base Width[5] (ft.)	Revised Drainage Channel Design Data[4]: Normal Depth (ft.)	Revised Drainage Channel Design Data[4]: Critical Depth (ft.)	Revised Drainage Channel Design Data[4]: Channel Height[6] (ft.)	Revised Drainage Channel Design Data[4]: Top Width (ft.)
Channel 2																
Region 1	Q_{100}	299.10	296.58	141	158	647.00	805	5050	50	8.5	805	50	2	2	6	62
	Q_{10}	141.46														
					Flow from Channel 2A		2141									
Region 2	Q_{100}	116.40	135.87	62	54	-	3000	7450	80	8.5	3000	-	-	-	-	-
	Q_{10}	62.02														
Region 3	Q_{100}	1130.29	750.79	533	597	-	3597	7450	80	8.5	3597	80	4	4	9	98
	Q_{10}	533.25														
					Flow from Channel 2B		2501									
Region 4	Q_{100}	24.12	30.76	11	13	-	6111	9000	90	9.5	6111	90	5	5	10	111
	Q_{10}	10.91														
Region 5	Q_{100}	354.87	536.75	122	232	-	6343	9350	100	10	6343	-	-	-	-	-
	Q_{10}	122.39														
Region 6	Q_{100}	1098.43	871.18	450	649	-	6992	9350	100	10	6992	100	6	5	12	124
	Q_{10}	449.55														
Region 7	Q_{100}	534.72	437.19	216	319	-	7311	14500	100	12.5	7311	-	-	-	-	-
	Q_{10}	215.69														
					Flow from Channel 3		6817									
Region 8	Q_{100}	638.70	801.04	242	397	-	14525	14500	100	12.5	14525	100	9	8	16	133
	Q_{10}	241.86														
Region 9	Q_{100}	373.52	630.87	144	229	-	14754	15000	100	12.5	14754	-	-	-	-	-
	Q_{10}	144.23														
Region 10	Q_{100}	373.52	225.44	44	330	-	15084	15000	100	12.5	15084	-	-	-	-	-
	Q_{10}	43.59														
Region 11	Q_{100}	2652.12	3519.09	1217	1435	-	16519	15000	100	12.5	16519	100	10	9	17	134
	Q_{10}	1217.17														
Fremont Wash																
Region 1	Q_{100}	3215.62	3086.01	1643	1573	-	Fremont Wash									
	Q_{10}	1642.71														

TABLE 3-2: PROPOSED RUNOFF QUANTITY, RETENTION STORAGE AND REVISED CHANNEL DESIGN (WITHOUT INCLUDING VVDA & BALDY MESA MPD FLOW)

Notes:

[1] Proposed peak flow based on 10 year & 100 year-flood events
[1] Calculated Using "CIVILCADD -San Bernardino County Rational Hydrology and Unit Hydrograph Programs"
[1] Runoff Coefficient "C" Value = 0.3 (unimproved area)
[1] Rainfall Intensity "i" Value for 100 Year Design Storm = 1.15 inch/hr, 10 Year Design =0.75 inch/hr.
[1] Soil Group = C (sandy clay loam soil); Slope Used for Rainfall Intensity Curve "b" Value = 0.7; SCS Curve Number for Soil (AMC 2) = 56
[2] By Development
[3] Based on "Adelanto Master Plan of Drainage-November 1992" and County Drainage Master Plan
[4] Based on Required Total Cumulative Flow calculated (refer to column 8)
[5] Same as designed in the previous master plan, side slope assumed as 1:1
[6] Channel Height = 1.5 x normal depth + 2.5' (per LA County Flood Control District Hydraulic Design Manual)

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow: Cum.(Q_{100} - Q_{10}) (cfs)	Required Drainage Channel Flow: Total Cum. Flow (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Flow Cap. (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Base Width (ft.)	Drainage Channel Design Data per Previous Master Plan[3]: Water Depth (ft.)	Revised Drainage Channel Design Data[4]: Design Flow (cfs)	Revised Drainage Channel Design Data[4]: Base Width[5] (ft.)	Revised Drainage Channel Design Data[4]: Normal Depth (ft.)	Revised Drainage Channel Design Data[4]: Critical Depth (ft.)	Revised Drainage Channel Design Data[4]: Channel Height[6] (ft.)	Revised Drainage Channel Design Data[4]: Top Width (ft.)
Channel 1A (No Flow from VVDA or Baldy Mesa MPD)															
Reach 1	Q_{100}	1800.00	1225.16	880	920	920	158	12	10	920	-	-	-	-	-
	Q_{10}	880.00													
Reach 2	Q_{100}	103.59	153.45	39	65	985	158	12	10	985	-	-	-	-	-
	Q_{10}	39.08													
Reach 3	Q_{100}	75.38	101.20	32	43	1028	158	12	10	1028	12	6.27	4.91	12	36
	Q_{10}	32.27													
Channel 1 (No Flow from VVDA or Baldy Mesa MPD)															
Reach 1	Q_{100}	1419.00	1263.90	638	781	781	1789	25	8.5	781	25	4.19	2.99	9	43
	Q_{10}	638.45													
Reach 2	Q_{100}	1149.00	1039.29	443	706	1487	1937	50	8.5	1487	50	4.25	2.96	9	68
	Q_{10}	442.80													
					Flow from Channel 1A	1028									
Reach 3	Q_{100}	727.95	697.00	298	430	2944	2376	50	7.5	2944	-	-	-	-	-
	Q_{10}	298.34													

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow: Cum.(Q_{100} - Q_{10}) (cfs)	Required Drainage Channel Flow: Total Cum. Flow (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Flow Cap. (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Base Width (ft.)	Drainage Channel Design Data per Previous Master Plan[3]: Water Depth (ft.)	Revised Drainage Channel Design Data[4]: Design Flow (cfs)	Revised Drainage Channel Design Data[4]: Base Width[5] (ft.)	Revised Drainage Channel Design Data[4]: Normal Depth (ft.)	Revised Drainage Channel Design Data[4]: Critical Depth (ft.)	Revised Drainage Channel Design Data[4]: Channel Height[6] (ft.)	Revised Drainage Channel Design Data[4]: Top Width (ft.)
Reach 4	Q_{100}	706.69	817.52	268	438	3382	2376	50	7.5	3382	50	6.56	5.04	12	75
	Q_{10}	268.31													
Reach 5	Q_{100}	1800.18	1927.14	846	954	4336	3100	50	8.5	4336	-	-	-	-	-
	Q_{10}	846.35													
Reach 6	Q_{100}	152.23	281.25	58	94	4430	3100	50	8.5	4430	50	7.82	6.00	14	78
	Q_{10}	57.97													
Reach 7	Q_{100}	1044.49	1281.46	511	534	534	Fremont Wash								
	Q_{10}	510.99													
Channel 2A (Flow from VVDA)															
Reach 1	Q_{100}	132.07	133.11	64	68	68	2020	35	6	68	-	-	-	-	-
	Q_{10}	63.61													
Reach 2	Q_{100}	111.27	107.18	58	53	122	2020	35	6	122	5	1.50	2.25	5	15
	Q_{10}	58.19													
Channel 2B1 (Flow From VVDA)															
Reach 1	Q_{100}	90.28	91.85	43	47	47	725	12	6.5	47	-	-	-	-	-
	Q_{10}	43.27													
Reach 2	Q_{100}	69.71	77.71	33	37	84	725	12	6.5	84	5	1.25	2.00	4	14
	Q_{10}	32.62													
Channel 2B (Flow From VVDA)															
Reach 1	Q_{100}	139.54	121.10	69	71	71	450	12	5.5	71	5	1.00	1.60	4	13
	Q_{10}	68.88													
					Flow from Channel 2B1	84									
Reach 2	Q_{100}	29.53	36.29	13	16	171	1275	12	8	171	-	-	-	-	-
	Q_{10}	13.22													
Reach 3	Q_{100}	173.72	221.80	72	102	273	1275	12	8	273	-	-	-	-	-
	Q_{10}	71.88													
Reach 4	Q_{100}	136.03	202.10	53	83	356	1275	12	8	356	10	2.00	3.00	6	21
	Q_{10}	53.04													

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow		Drainage Channel Design Data per Previous Master Plan[3]			Revised Drainage Channel Design Data[4]					
					Cum.(Q_{100} - Q_{10}) (cfs)	Total Cum. Flow (cfs)	Flow Cap. (cfs)	Base Width (ft.)	Water Depth (ft.)	Design Flow (cfs)	Base Width[5] (ft.)	Normal Depth (ft.)	Critical Depth (ft.)	Channel Height[6] (ft.)	Top Width (ft.)
Channel 3A1 (No Flow from VVDA or Baldy Mesa MPD)															
Reach 1	Q_{100}	54.69	53.25	27	27	27	600	15	6	27	15	0.54	1.00	3	22
	Q_{10}	27.26													
Channel 3A (No Flow from VVDA or Baldy Mesa MPD)															
Reach 1	Q_{100}	167.27	154.97	83	84	84	400	12	5	84	-	-	-	-	-
	Q_{10}	82.96													
Reach 2	Q_{100}	62.57	65.68	31	32	116	400	12	5	116	12	1.50	1.37	5	22
	Q_{10}	30.57													
					Flow from Channel 3A1	27									
Reach 3	Q_{100}	61.77	73.37	29	33	177	1000	20	6	177	20	1.45	1.32	5	29
	Q_{10}	28.54													
Channel 3B (Flow From Baldy Mesa MPD)															
						0	1765	25	7	0	-	-	-	-	-
Reach 1	Q_{100}	181.31	235.90	74	108	108	2275	25	7	108	-	-	-	-	-
	Q_{10}	73.79													
Reach 2	Q_{100}	223.46	382.01	91	133	240	2275	25	7	240	10	2.00	2.50	6	14
	Q_{10}	90.94													
Channel 3 (Flow From Baldy Mesa MPD)															
						-	650	20	5.5	-	-	-	-	-	-
Reach 1	Q_{100}	1474.51	727.10	720	754	754	850	20	5.5	754	15	2.50	4.00	6	28
	Q_{10}	720.38													
					Flow from Channel 3A	177									
Reach 2	Q_{100}	126.94	214.51	50	77	1008	1925	25	7.5	1008	25	2.50	3.50	6	38
	Q_{10}	49.93													
Reach 3	Q_{100}	2717.00	2258.70	1365	1352	2360	4725	75	10	2360	-	-	-	-	-
	Q_{10}	1365.17													
					Flow from Channel 3B	240									
Reach 4	Q_{100}	75.56	78.12	36	39	2639	4725	75	10	2639	-	-	-	-	-
	Q_{10}	36.36													
Region 5	Q_{100}	1991.24	1872.77	960	1031	3670	4725	75	10	3670	75	2.50	4.00	6	88
	Q_{10}	960.20													

Tributary Area No.	Peak Flow[1] Q (cfs)		Study Area A (ac.)	Req. Retention Vol[2]; Q_{10} (cfs)	Required Drainage Channel Flow: Cum.(Q_{100} - Q_{10}) (cfs)	Required Drainage Channel Flow: Total Cum. Flow (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Flow Cap. (cfs)	Drainage Channel Design Data per Previous Master Plan[3]: Base Width (ft.)	Drainage Channel Design Data per Previous Master Plan[3]: Water Depth (ft.)	Revised Drainage Channel Design Data[4]: Design Flow (cfs)	Revised Drainage Channel Design Data[4]: Base Width[5] (ft.)	Revised Drainage Channel Design Data[4]: Normal Depth (ft.)	Revised Drainage Channel Design Data[4]: Critical Depth (ft.)	Revised Drainage Channel Design Data[4]: Channel Height[6] (ft.)	Revised Drainage Channel Design Data[4]: Top Width (ft.)
Channel 2 (flow From VVDA)															
Region 1	Q_{100}	299.10	296.58	141	158	158	5050	50	8.5	158	10	1.50	2.00	5	20
	Q_{10}	141.46													
					Flow from Channel 2A	122									
Region 2	Q_{100}	116.40	135.87	62	54	334	7450	80	8.5	334	-	-	-	-	-
	Q_{10}	62.02													
Region 3	Q_{100}	1130.29	750.79	533	597	931	7450	80	8.5	931	40	1.70	2.50	5	50
	Q_{10}	533.25													
					Flow from Channel 2B	356									
Region 4	Q_{100}	24.12	30.76	11	13	1300	9000	90	9.5	1300	50	2.00	3.00	6	61
	Q_{10}	10.91													
Region 5	Q_{100}	354.87	536.75	122	232	1532	9350	100	10	1532	-	-	-	-	-
	Q_{10}	122.39													
Region 6	Q_{100}	1098.43	871.18	450	649	2181	9350	100	10	2181	100	2.00	2.50	6	111
	Q_{10}	449.55													
Region 7	Q_{100}	534.72	437.19	216	319	2500	14500	100	12.5	2500	-	-	-	-	-
	Q_{10}	215.69													
					Flow from Channel 3	3670									
Region 8	Q_{100}	638.70	801.04	242	397	6567	14500	100	12.5	6567	100	3.50	5.00	8	116
	Q_{10}	241.86													
Region 9	Q_{100}	373.52	630.87	144	229	6796	15000	100	12.5	6796	-	-	-	-	-
	Q_{10}	144.23													
Region 10	Q_{100}	373.52	225.44	44	330	7126	15000	100	12.5	7126	-	-	-	-	-
	Q_{10}	43.59													
Region 11	Q_{100}	2652.12	3519.09	1217	1435	8561	15000	100	12.5	8561	100	4.00	6.00	9	117
	Q_{10}	1217.17													
Fremont Wash															
Region 1	Q_{100}	3215.62	3086.01	1643	1573	Fremont Wash									
	Q_{10}	1642.71													

TABLE 3-3 : PROPOSED QUANTITIES AND IMPROVEMENT COSTS

Channel #	Total Flow (cfs)	Channel Cross Section				Channel Properties						Construction Costs					Cost ($\$x10^3$)
		Base Width (ft)	Top Width (ft)	Channel Height (ft)	R/W (ft)	Lineal Feet (ft)	Bottom Area (ft^2)	Side Slope Area (ft^2)	Earthwork Cut (cy)	Crossings (each)	R/W (ac.)	Channel Bottom ($\$x10^3$)	Side Slopes ($\$x10^3$)	Earth work ($\$x10^3$)	Crossings ($\$x10^3$)	R/W ($\$x10^3$)	
Channel 1A																	
Segment 1	1,028	12	36	12	76	11,553	138,636	657,841	279,258	7	20						
				Sub-Total		11,553	138,636	657,841	279,258	7	20	$1,088	$4,460	$2,234	$10,500	$508	**18,790**
Channel 1																	
Segment 1	781	25	43	9	107	8,536	213,400	413,619	55,000	2	21						
Segment 2	1,487	50	68	9	138	5,960	298,000	288,797	69,000	2	19						
Segment 3	3,382	50	74	12	134	11,007	550,350	626,751	266,059	3	34						
Segment 4	4,430	50	78	14	138	12,396	619,800	775,965	299,634	3	39						
				Sub-Total		37,899	1,681,550	2,105,131	689,693	10	113	$13,196	$14,273	$5,517	$15,000	$2,845	**50,831**
Channel 2A																	
Segment 1	2,141	35	55	10	107	11,553	404,355	592,487	90,367	0	28						
				Sub-Total		11,553	404,355	592,487	90,367	0	28	$3,173	$4,017	$723	$0	$715	**8,628**
Channel 2B1																	
Segment 1	946	12	36	12	86	7,308	87,696	416,126	40,448	0	14						
				Sub-Total		7,308	87,696	416,126	40,448	0	14	$688	$2,821	$324	$0	$363	**4,196**
Channel 2B																	
Segment 1	1,354	12	36	12	82	6,703	80,436	381,676	70,394	1	13						
Segment 2	2,501	12	44	16	92	9,820	117,840	670,262	103,129	1	21						
				Sub-Total		16,523	198,276	1,051,939	173,523	2	33	$1,556	$7,132	$1,388	$3,000	$840	**13,916**
Channel 2																	
Segment 1	805	50	62	6	138	7,680	384,000	306,974	288,793	2	24						
Segment 2	3,597	80	98	9	168	10,145	811,600	491,585	381,485	3	39						
Segment 3	6,111	90	110	10	182	4,933	443,970	252,985	185,496	3	21						
Segment 4	6,992	100	124	12	194	6,784	678,400	386,289	255,100	2	30						
Segment 5	14,525	100	132	16	204	6,852	685,200	467,682	257,658	5	32						
Segment 6	16,519	100	134	17	204	11,703	1,170,300	831,887	440,071	4	55						
				Sub-Total		48,097	4,173,470	2,737,402	1,808,603	19	201	$32,751	$18,560	$14,468	$28,500	$5,066	**99,344**

TABLE 3-3 : PROPOSED QUANTITIES AND IMPROVEMENT COSTS

Channel #	Total Flow (cfs)	Channel Cross Section				Channel Properties						Construction Costs					Cost ($\$x10^3$)
		Base Width (ft)	Top Width (ft)	Channel Height (ft)	R/W (ft)	Lineal Feet (ft)	Bottom Area (ft^2)	Side Slope Area (ft^2)	Earthwork Cut (cy)	Crossings (each)	R/W (ac.)	Channel Bottom ($\$x10^3$)	Side Slopes ($\$x10^3$)	Earth work ($\$x10^3$)	Crossings ($\$x10^3$)	R/W ($\$x10^3$)	
Channel 3A1																	
Segment 1	27	15	21	3	87	6,380	95,700	200,876	24,203	1	13						
				Sub-Total		6,380	95,700	200,876	24,203	1	13	$751	$1,362	$194	$1,500	$321	**4,127**
Channel 3A																	
Segment 1	116	12	22	5	80	7,650	91,800	284,137	22,879	2	14						
Segment 2	177	20	30	5	92	6,905	138,100	256,466	20,651	3	15						
				Sub-Total		14,555	229,900	540,604	43,530	5	29	$1,804	$3,665	$348	$7,500	$721	**14,039**
Channel 3B																	
Segment 1	2,050	25	45	10	101	24,758	618,950	1,269,696	337,134	8	57						
				Sub-Total		24,758	618,950	1,269,696	337,134	8	57	$4,857	$8,609	$2,697	$12,000	$1,445	**29,608**
Channel 3																	
Segment 1	2,091	20	44	12	90	12,246	244,920	697,301	162,030	1	25						
Segment 2	2,345	25	49	12	103	8,317	207,925	473,579	110,044	3	20						
Segment 3	6,817	75	99	12	169	4,625	346,875	263,353	61,195	3	18						
				Sub-Total		25,188	799,720	1,434,233	333,269	7	63	$6,276	$9,724	$2,666	$10,500	$1,584	**30,750**
				Total		**203,814**	**8,428,253**	**11,006,335**	**3,820,028**	**59**	**572**	**$66,140**	**$74,623**	**$30,558**	**$88,500**	**$14,407**	**274,228**
														Contingency (25%)			**68,557**
														Total Construction Cost			**342,786**

CITY OF ADELANTO
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