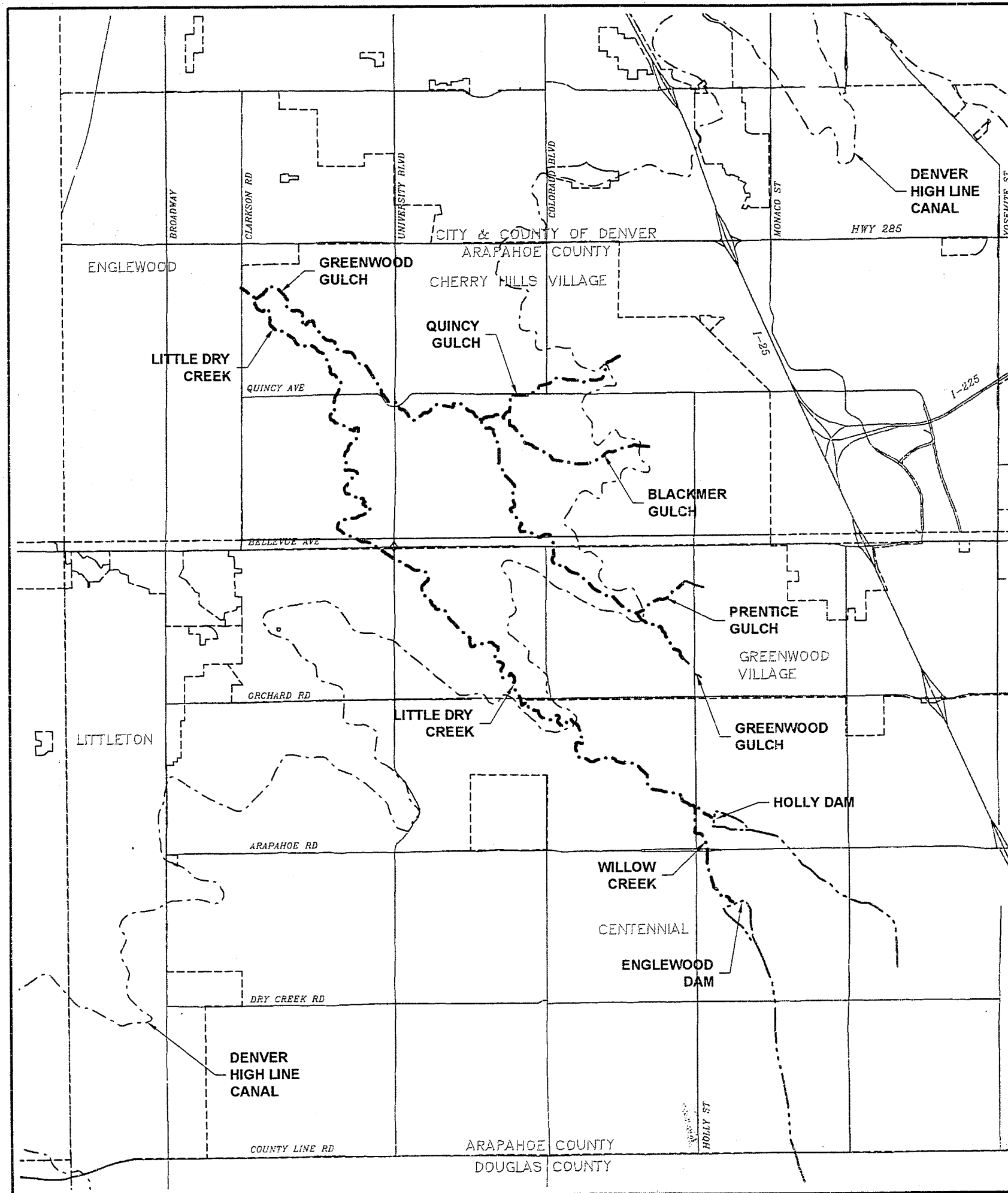




FLOOD HAZARD AREA DELINEATION

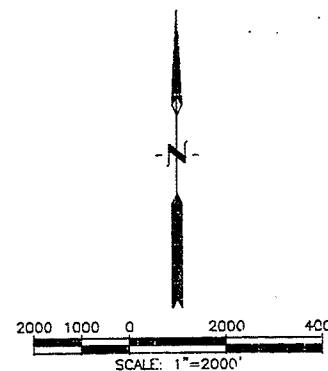
LITTLE DRY CREEK (ARAPCO) & TRIBUTARIES

ARAPAHOE COUNTY***CITY & COUNTY OF DENVER**
DENVER WATER*GREENWOOD VILLAGE
CHERRY HILLS VILLAGE*CITY OF LITTLETON****
SOUTH SUBURBAN PARKS AND RECREATION DISTRICT
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

AUGUST 2003



950 SOUTH CHERRY STREET SUITE 404
 DENVER, COLORADO 80246
 PHONE NO: (303) 757-8513
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LEGEND

- JURISDICTION BOUNDARY
- _____ ROADWAY
- DETAILED STUDY LIMIT

**FLOOD HAZARD AREA DELINEATION
FOR PORTIONS OF LITTLE DRY CREEK
(ARAPCO) WATERSHED**

Prepared For:

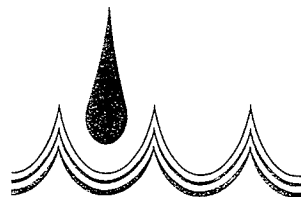
**Urban Drainage & Flood Control District
Arapahoe County • City and County of Denver
Denver Water Department • City of Littleton
City of Greenwood Village • City of Cherry Hills Village
South Suburban Parks and Recreation District**

Prepared By:

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August 2003

WRC File: 2099/12



WRC ENGINEERING, INC.

August 6, 2003

Mr. Ben Urbonas, P.E.
Urban Drainage & Flood Control District
2480 West 26th Avenue, Suite 156-B
Denver, Colorado 80211

WRC File: 2099/11

RE: Flood Hazard Area Delineation
For Portions of Little Dry Creek (ARAPCO) Watershed

Dear Mr. Urbonas:

Enclosed herein is the Flood Hazard Area Delineation (FHAD) Report For Portions of Little Dry Creek (ARAPCO) Watershed. This report documents the FHAD Study process from initiation through final floodplain and floodway delineations. A synopsis of the project history, description of the study area and field inventory, summary of hydrology and hydraulic analyses, HEC-RAS water surface profile computer modeling for the 10-, 50-, 100- and 500-year storm events, and determination of 0.5 foot and 1.0 foot rise floodways are provided in the report.

The floodplain and floodway information provided herein should assist the Urban Drainage and Flood Control District and other project sponsors in updating the FEMA floodplain boundaries for Little Dry Creek and its tributaries to reflect the current watershed conditions and in administration of new and existing developments in the floodprone areas.

We appreciate the opportunity to prepare this analysis and look forward to completing the Major Drainageway Planning studies.

Respectfully submitted,

WRC ENGINEERING, INC.

Roger L. Miedew
25330

Roger L. Miedew, P.E.
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Principal-In-Charge

CONSULTING ENGINEERS

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I. INTRODUCTION

A. GENERAL

This report is part of a study authorized by the Urban Drainage and Flood Control District (UD&FCD) in conjunction with seven local sponsoring agencies in the agreement regarding Major Drainageway Planning of Denver High Line Canal and Flood Hazard Area Delineation for Portions of Little Dry Creek (ARAPCO) Watershed, dated March 5, 2002 (Agreement No. 01 - 10.05). This report documents the Flood Hazard Area Delineation (FHAD) for a portion of Little Dry Creek (ARAPCO) and its tributaries. The study area for Little Dry Creek begins at South Clarkson Street and extends upstream to the outlet of Holly Dam. Tributaries evaluated include portions of Greenwood Gulch, Willow Creek, Prentice Gulch, Quincy Gulch and Blackmer Gulch. The overall FHAD Study area is shown on Figure 1.

B. PURPOSE AND SCOPE

The scope of the FHAD study is as follows:

1. Gather and assemble available information on the existing drainage facilities and other applicable information.

2. Define water surface profiles for the 10, 50, 100, and 500-year storm events and 0.5 foot and 1.0 foot floodways.
3. Prepare plan and profile drawings of Little Dry Creek and its tributaries showing the limits of the 100-year floodplain and the 10-year and 100-year flood profiles.
4. Document the results of the study in the FHAD Report.

C. MAPPING AND SURVEYS

Mapping for this project was prepared by G-Squared, LLC under a separate contract with UD&FCD. The topography was compiled from aerial photographs taken in December 2001 and is based on NAVD 1988 vertical datum and NAD 1983 horizontal datum. The project mapping provided included additional field information and photographs for bridges and culverts. Site observations were conducted by WRC Engineering, Inc. personnel to evaluate channel roughness, identify other pertinent hydraulic conditions, and to supplement the mapping information provided.

II. STUDY AREA DESCRIPTION

The Little Dry Creek Watershed lies in the western portion of Arapahoe County and the northern portion of Douglas County, within the southern Denver metropolitan area. The watershed includes portions of Greenwood Village, Cherry Hills Village, and the City of Centennial and is located generally west of Interstate 25 covering a total area of approximately 25 square miles.

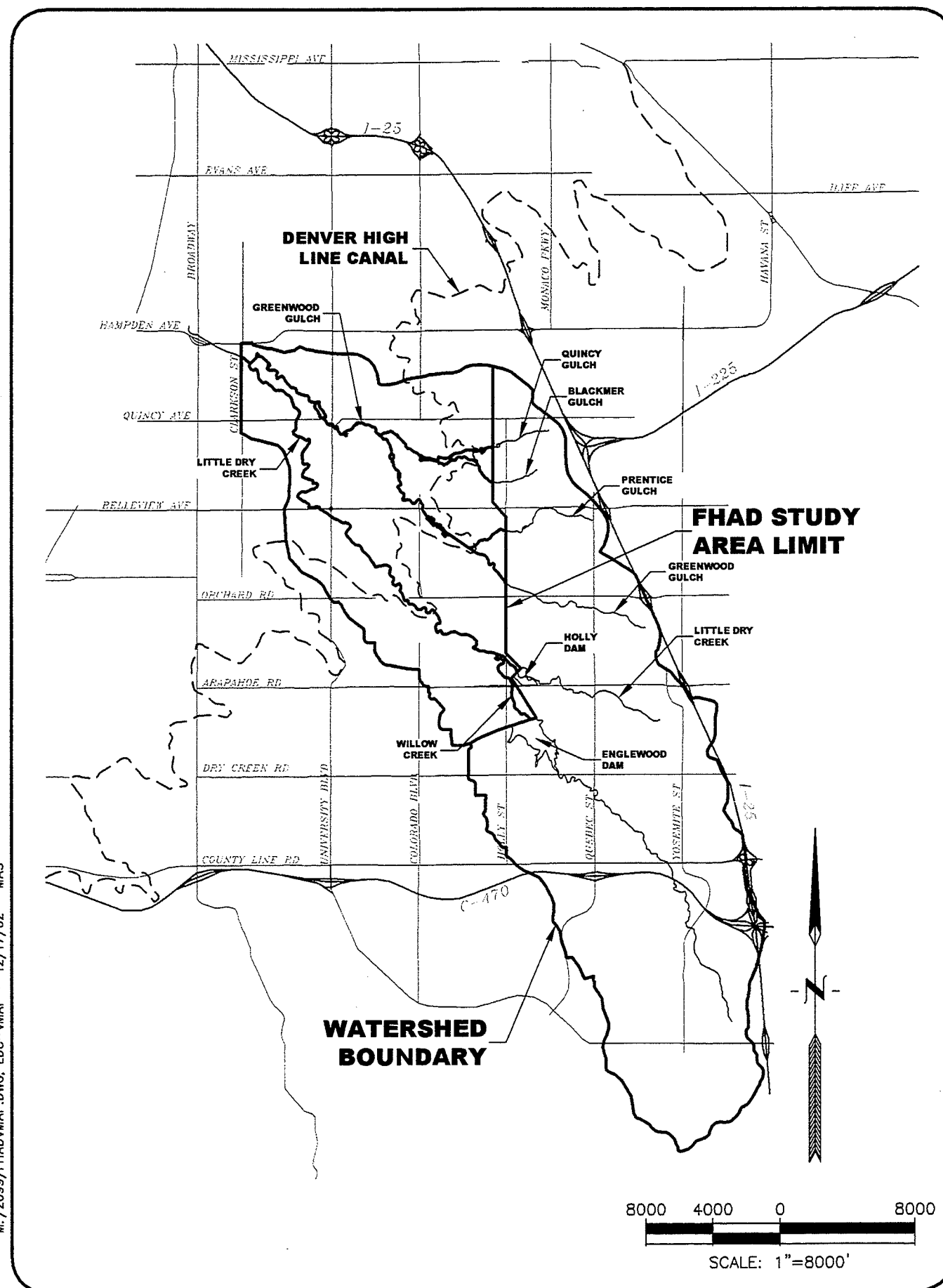
Two UDFCD flood control dams located within the upper watershed substantially reduce the downstream peak flood discharges. Englewood Dam lies on Willow Creek just upstream of its confluence with Little Dry Creek and Holly Dam lies on Little Dry Creek at the intersection of Arapahoe Road and Holly Street.

The total drainage area of Little Dry Creek and its tributaries downstream of the Englewood Dam and Holly Dam is 13.0 square miles at South Clarkson Street.

Land use of the study area includes low to high-density residential and commercial uses. Significant areas of open space are also present within the watershed including golf courses and natural open spaces. Vegetation within the watershed consists of native grasses in open areas, occasional wooded areas and urban landscaping in developed areas. Wetlands are also present along many of the drainageways.

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FLOOD HAZARD AREA DELINEATION
LITTLE DRY CREEK (ARAPCO) AND TRIBUTARIES

VICINITY MAP
LITTLE DRY CREEK

FIGURE
1

III. HYDROLOGIC ANALYSIS

A. GENERAL

The peak flow rate data for Little Dry Creek and its tributaries utilized for this FHAD study is based on the previously approved Little Dry Creek Hydrology Study prepared by McLaughlin Water Engineers, Ltd. (MWE) in 1986 (Reference 9) in support of a FEMA Letter of Map Revision (LOMR) for Little Dry Creek in Englewood, Colorado. The MWE 1986 study presented the 100-year flood discharge for the entire Little Dry Creek Watershed and their study has been reviewed and approved by FEMA.

In order to estimate the 10-, 50-, and 500-year storm peak discharge rates, WRC reproduced the 1986 study hydrologic models utilizing the current versions of CUHP and UDSWM computer programs. The 10-, 50-, and 500-year CUHP and UDSWM models were developed by WRC utilizing the reproduced MWE hydrologic models and the storm distribution information previously generated by MWE engineers. A more detailed discussion of previous studies and the determination of the 10-, 50-, and 500-year flood discharges are presented in the following sections.

B. PREVIOUS STUDIES

Floodplain information for Little Dry Creek and its tributaries shown on the Flood Insurance Rate Maps (FIRM) published in 1975 was based on the hydrologic and hydraulic study for Little Dry Creek prepared by McCall-Ellingson and Morrill, Inc. (MEM) in 1974 (Reference 6). Sellards and Grigg, Inc. (S&G) updated the MEM hydrology in 1981 as a part of an Economic Feasibility Analysis of Design Alternatives for Little Dry Creek in the City of Englewood (Reference 8). This update reflected the effects of improvements to Englewood Dam, construction of Holly Dam, and the changes in the hydrologic analysis method recommended by the UD&FCD.

In 1984, McLaughlin Water Engineers prepared information entitled "Technical Appendix A, Hydrology Evaluation of Little Dry Creek and Detailed Improvements Thru Englewood" in support of a Conditional Letter of Map Amendment for improvements in the City of Englewood (Reference 11). This information was developed based on a single drainage basin analysis for the areas downstream of Englewood and Holly Dams and included a hydrologic evaluation that utilized CUHP for generating hydrographs with routing by MITCAT (Massachusetts Institute of Technology Catchment Model). This hydrologic information was developed for the 10-, 50-, 100- and 500-year floods for the area downstream of Clarkson Street.

In response to comments from FEMA and other reviewing agencies, MWE revised the 1984 hydrology to provide additional detail, including 22 drainage basins downstream of Englewood and Holly Dam instead of a single basin. The hydrographs were generated with CUHP (Version E/PC) and the UDSWMM model was used to route flows (Reference 3) instead of MITCAT. The revised hydrologic modeling was prepared for the 100-year storm only and presented in the MWE 1986 study, (Reference 9) which was ultimately adopted by FEMA.

C. DESIGN RAINFALL

For the Little Dry Creek watershed, a 3-hour design storm in the form of a detailed hyetograph from the 1986 MWE study (Reference 9) was utilized without any modification for the 100-year storm. Hyetographs for the 10-, 50-, and 500- year storms were obtained from the 1984 MWE study (Reference 10). The 3-hour storm distributions used in the Little Dry Creek FHAD study are listed for all recurrence intervals in 5-minute increments in Table III-1.

D. COLORADO URBAN HYDROGRAPH ANALYSIS

The Colorado Urban Hydrograph Procedure (CUHP) computer program was used to estimate storm runoff hydrographs for the various sub-watersheds. The model version used for this study was CUHP 2000, Version 1.1, (Reference 2). The sub-watershed input parameters required for CUHP are: sub-watershed identification number, drainage area, length and centroidal length, drainageway slope, impervious percentage, detention and retention storage losses, and initial infiltration rate losses. All hydrologic sub-watershed parameters used in the CUHP model were obtained from the 1986 MWE study. A summary of the CUHP input parameters used for the analysis is presented in Appendix A.

A sample CUHP input file for Little Dry Creek is included in Appendix B.

E. STORMWATER MANAGEMENT MODEL

The UDFCD SWMM program (Reference 3) was used to perform flow routing of the CUHP-generated runoff hydrographs. The version of the program used was UDSWM-2000, Version 1.4.1. The routing element parameters required for SWMM are: element number, type (e.g. direct flow, channel, pipe, etc.), length, slope, side slopes, and resistance coefficient value. SWMM parameters utilized in the model for the 100-year storm

were obtained from the 1986 MWE study (Reference 9). The SWMM model for the 100-year storm developed in the 1986 MWE study utilized outflow hydrographs from Englewood Dam and Holly Dam. The outflow hydrographs for the 10-, 50-, and 500- year floods were not available from the 1984 MWE study (Reference 10). For the 10-, 50-, and 500- year flood, inflow hydrographs from the 1984 MWE study were routed with SWMM. Storage-discharge relationships were developed by WRC based on Englewood Dam As-Built Construction Plans prepared by McCall-Ellingson and Morrill, Inc. in August 1974 (Reference 4), and Holly Dam As-Built Construction Plans prepared by McCall-Ellingson and Morrill, Inc. in July 1975 (Reference 5).

A summary of SWMM routing parameters from the MWE 1986 study is included in Appendix A. The routing information for the Englewood and Holly Dam and storage-discharge relationships are included in Appendix E. A sample SWMM input file for Little Dry Creek is included in Appendix C. Summary output from SWMM models for the 10, 50, 100 and 500-year storm events is included in Table III-2. A comparison of peak discharges determined in this study with those of the current FEMA Flood Insurance Study is included in Table III-3.

IV. HYDRAULIC ANALYSIS

A. GENERAL

The purpose of the hydraulic analysis is to determine the hydraulic conditions and associated capacities of the various channel reaches and structures. This determination requires the physical measurement of channel sections and structures as well as selection of appropriate and reasonable hydraulic parameters for purpose of analysis. For this study, the United States Army Corps of Engineers "HEC-RAS" River Analysis System Version 3.1, Beta (Reference 12) computer program version was used to determine the capacities of the various channel reaches and structures.

B. HYDRAULIC PARAMETERS

The HEC-RAS computer program requires the following information for hydraulic computations.

1. Channel Cross-Sections

A majority of the cross-sections for input into the HEC-RAS model were developed with HEC-GeoRAS based on topographic mapping produced by G Squared LLC for this project. Some cross sections were obtained from hardcopies of the topographic mapping. All cross-sections are stationed from left to right looking downstream and starting with a station designation of 0+00 unless noted differently on the plan drawings.

2. Manning's Roughness Coefficients

A field inventory of the study reaches was prepared for this project. The inventory sheets include

pertinent information on the individual channel reaches and present initial field estimates of relative Manning's roughness coefficients ("n" - values). Final estimates of "n"-values were derived from a comprehensive review of the field channel conditions as compared to generally accepted values based upon standard references and the experience of WRC and the UD&FCD Criteria (Reference 1). Generally, the "n"-values used for this study fall within the following descriptive ranges:

<u>Description</u>	<u>"n" value</u>
Maintained grass-lined channels with hard low flow channel	.030-.035
Un-maintained grassed areas, with unlined channel	.035-.045
Riprap/Gabions	.035-.040
Heavy brush/shrubs	.040-.060
Tall grassy vegetation with trees	.040-.045

Composite "n"-values were used in channel reaches which exhibited a high degree of roughness variability across the channel section.

3. Bridge/Culvert Parameters

Most of the bridges and culverts in the study reaches were analyzed using the bridge or culvert routines available in the HEC-RAS program. For this purpose, G-Squared LLC prepared a structure inventory which included measurements of the bridge and culvert sizes, shapes, upstream and downstream invert elevations,

and overflow elevations at the structure's centerline. Bridge pier coefficients were estimated from the HEC-RAS Users Manual based upon the observed pier shape. For roadway overtopping analysis, a weir coefficient of 2.6 to 3.0 was used. Expansion and contraction coefficients of 0.3-0.5 and 0.1-0.3, respectively, were typically used just upstream and downstream of bridges and culverts.

No additional "plugging factors" were used to artificially reduce the structure's hydraulic capacity. However, for those structures which were partially filled with sediment, the estimated hydraulic capacity of said structures assumes that the sediment level remains at the current level. On Little Dry Creek between Quincy Avenue and Belleview Avenue, there are several locations where existing bridges are located on private property and permission could not be obtained to determine bridge dimensions. These bridges appear to be small pedestrian bridges and at those locations, the Manning's coefficient was increased to .065 to account for additional losses.

C. ANALYZED FLOOD FREQUENCIES

For the purposes of this study, the hydraulic capacity of channels and structures were analyzed for the 10-, 50-, 100, and 500-year flood events based upon existing channel conditions. Please refer to Section III for a detailed discussion on the estimation of peak flow rates.

D. WATER SURFACE PROFILE DETERMINATION

Water surface profiles were determined using the HEC-RAS program with a sub-critical profile assumption. For some channel reaches, the HEC-RAS analysis, if allowed, would result in supercritical flow regimes and associated lower water surface elevations. However, given the general tendency of stormwater flows in natural channels to gravitate towards sub-critical flow conditions (through naturally occurring hydraulic jumps and other unmodelled energy losses), all supercritical flow regimes were modeled and reported with critical depth water surface elevations.

The starting water surfaces at the downstream end of Little Dry Creek are based on HEC-2 results just downstream of South Clarkson Street obtained from "Hydraulic Calculations For Little Dry Creek Through the City of Englewood" (Reference 13). The starting water surface elevations for the tributaries were based upon junction calculations based on the energy method within HEC-RAS.

Water surface profiles at dams/embankments and at crossings of the Denver High Line Canal were computed assuming embankments are stable for all flood events, even if there was a reasonable expectation of embankment failure during such events. This method produces a conservative estimate of upstream water surface elevations. Where drainageways discharge to the Denver High Line Canal (typical for all streams except the mainstem of Little Dry Creek), it is assumed that tributary flows will overtop the canal embankment and that flow is neither added from the canal nor lost to the canal at those locations. The computation of dam breach floodplains downstream of embankments was not included in the scope of this project.

E. SHALLOW FLOODING/INEFFECTIVE FLOW AREAS

Several locations in the study reaches include areas where flows were spatially varied and are not reflective of the main channel flood profile (i.e., on the downstream side of embankments where overflows occur) or where a flooded area is ineffective in conveyance of flood flows (i.e. ponding of backwater in a shallow depression adjacent to the main channel). For areas of shallow flooding not related to the flood profile, estimated boundaries of such areas are delineated generally following a perpendicular path to the topographic contours until such flows return to the main floodplain. Boundaries of ineffective flow areas are delineated based upon a level water surface at the same elevation as the main channel water surface at an estimated interface location. Cross-sectional area within the ineffective flow area is excluded from the hydraulic conveyance computation.

F. SPLIT FLOW AREAS

In the vicinity of the confluence of Greenwood Gulch and Little Dry Creek just east of South Clarkson Street, the capacity of Greenwood Gulch is very low and a large portion of the Greenwood Gulch flow continues to flow overland west toward South Clarkson Street. At this location, the flow overtops South Clarkson Street and continues to flow west, reentering Little Dry Creek downstream of South Clarkson Street and the FHAD study limit. This is designated as the Greenwood Gulch Bypass and was evaluated with a separate HEC-RAS analysis, that included a lateral weir with a portion of the flow being diverted southwest to Little Dry Creek. HEC-RAS included a flow optimization to determine the flow continuity toward South Clarkson Street and the flow diverted to Little Dry Creek for the 10-, 50-, 100-, and 500-year flood. A lateral weir is also included along Quincy Gulch north of East Quincy Avenue. At this location, lateral flow occurs over East Quincy Avenue and flows overland, entering Quincy Gulch further downstream.

The mapping prepared for the project indicated a potential split flow condition along the west bank of

Willow Creek south of Forest Way (Refer to Drawing Sheet 16). This area was filled recently in conjunction with site development and street construction, thus eliminating the potential split flow conditions. Relevant grading

plans for this area are included in Appendix E.

V. FLOOD HAZARD AREA DELINEATION

A. GENERAL

The Flood Hazard Area Delineation (FHAD) identifies those areas, structures, and buildings, which are expected to be inundated during a 100-year flood event. In addition, certain areas within the 100-year flood zone must be kept free of obstructions in order for the 100-year flood to be carried without significantly increasing the energy grade line. This area, identified as the floodway, is defined and determined as being the limit of encroachment into the 100-year floodplain where the resulting energy gradeline profile is not increased more than a specified limit (i.e., 0.5-feet).

B. FLOODPLAIN/FLOODWAY

The 100-year floodplain limits and water surface profiles are shown on the FHAD drawings, sheets 1 through 34. Also shown on these drawings are the 10-year water surface profile, cross-sections of crossing structures, and typical cross-sections of the channel for each sheet. Presented in Table V-1 is the pertinent floodplain/floodway information for this study. This table includes the description, labeling and stationing of cross-sections; thalweg elevations; 10-, 50-, 100-, and 500-year modeled peak runoff rates and water surface elevations; 100-year flow velocities, top widths and cross-sectional area of flow; 100-year, 0.5 and 1.0 foot rise floodway elevations; and left, right, and total floodway widths. A 1.0 foot rise floodway is what is used by the Federal Emergency Management Agency. The 0.5 foot rise floodway is the floodway adopted for floodplain regulation purposes by the local entities.

The 10-, 50-, 100-, and 500-year flood profile elevations were determined using the U.S. Army Corps of Engineers HEC-RAS water surface profile computer program (Reference 12). The 0.5 foot and 1.0 foot rise floodways were determined using encroachment Method 5 and Method 1 of the HEC-RAS program. This

method as applied herein sets left and right encroachment targets based upon equal conveyance reductions and adjusts them until the target level of a 0.5 or 1.0 foot rise in the 100-year energy grade line elevation was achieved.

There are several locations within the study limits where application of the regulatory floodway would result in only a few feet of allowable encroachment due to hydraulic constraints. In these areas, the floodway was set equal to the floodplain (i.e. no encroachment). The floodway left and right widths are measured from the stationing line which is not always the low point of the channel.

The flood contours shown on the drawings are shown such that interpolation between contours should result in a 100-year water surface profile which is within 0.5 feet $\pm$ of the computed 100-year water surface profile.

C. COMPARISON WITH CURRENT EFFECTIVE FLOOD INSURANCE STUDY

A comparison was made between the current effective Flood Insurance Study (FIS) that was revised in 1995 (Reference 7) with the current FHAD results and observations:

All streams studied in this FHAD were addressed in the current FEMA FIS. No additional streams were studied. In general the 100-year floodplain is consistent with that shown in the current FIS. In some areas channel aggregation is occurring. Channel degradation is also occurring in several reaches including portions of Willow Creek in the vicinity of Holly Avenue, Little Dry Creek downstream of Bellevue Avenue and downstream of Colorado Boulevard.

VI. REFERENCES

1. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, March 1969, Revised May 1975, Revised May 1984, Revised June 2001.
2. Colorado Urban Hydrograph Procedure Computer Program - PC Version of CUHP, User Manual, Urban Drainage and Flood Control District, February 2001.
3. UDSWMM 2000 PC Program & Users Manual, Urban Drainage and Flood Control District, February 2001.
4. Englewood Dam Construction Plans, McCall-Ellingson and Morrill, Inc., in August 1974.
5. Holly Dam Construction Plans, McCall-Ellingson and Morrill, Inc., July 1975.
6. Major Drainageway Planning, Little Dry Creek, Volumes 1 and 2, McCall-Ellingson and Morrill, Inc., May 1974.
7. Flood Insurance Study, Arapahoe County, Colorado and Incorporated Areas, Federal Emergency Management Agency, Revised August 16, 1995.
8. Economic Feasibility Analysis of Design Alternatives for Little Dry Creek, Sellards and Grigg, Inc., December 1981.
9. Hydrologic Evaluation, Little Dry Creek, City of Englewood, Cherry Hills Village, Greenwood Village, Arapahoe County, McLaughlin Water Engineers, Ltd., July 1986.
10. Technical Appendix A, Hydrology Evaluation of Little Dry Creek and Detailed Improvements Thru Englewood, McLaughlin Water Engineers, Ltd., Submitted to FEMA June 13, 1984.
11. HEC-GeoRAS, An Extension For Support of HEC-RAS using ArcView, Version 3.0, U.S. Army Corps of Engineers, Hydrologic Engineering Center, April 2000.
12. HEC-RAS, River Analysis System, Version 3.1, U.S. Army Corps of Engineers, Hydrologic Engineering Center, November 2002.
13. Hydraulic Calculations for Little Dry Creek Through The City of Englewood, McLaughlin Water Engineers, Ltd., April 1989.

TABLES

TABLE III - 1
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Incremental Rainfall / Return Period

Time (min)	10 - Year (in)	50 - Year (in)	100 - Year (in)	500 - Year (in)
10	0.1	0.08	0.06	0.09
20	0.11	0.12	0.19	0.15
30	0.28	0.15	0.24	0.2
40	0.71	0.34	1.02	0.54
50	0.21	1.05	0.41	1.53
60	0.11	0.26	0.36	0.43
70	0.06	0.15	0.2	0.18
80	0.05	0.08	0.07	0.1
90	0.05	0.06	0.07	0.08
100	0.04	0.06	0.06	0.08
110	0.04	0.06	0.05	0.07
120	0.04	0.05	0.05	0.07
130	0.04	0.05	0.04	0.07
140	0.04	0.05	0.04	0.07
150	0.03	0.04	0.04	0.06
160	0.03	0.04	0.04	0.06
170	0.03	0.04	0.03	0.04
180	0.03	0.03		0.03

TABLE III - 2
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Peak Flow Summary

SWMM Conveyance Elements	10 - Year (cfs)	50 - Year (cfs)	100 - Year (cfs)	500 - Year (cfs)
1	1865	3599	4501	6716
2	1824	3597	4541	6802
3	885	1516	1782	2555
4	855	1399	1725	2511
5	843	1490	1825	2627
6	721	1233	1442	2050
7	313	458	532	694
8	168	190	193	205
9	937	1988	2592	3993
10	981	2029	2620	4020
11	796	1550	1945	2967
12	1038	1916	2320	3472
13	800	1322	1503	2286
14	846	1291	1256	2042
16	317	592	675	954
18	327	661	808	1251
19	174	339	378	612
21	135	261	312	479
98	1191	1935	*	2586
99	2537	4410	*	6434
198	147	162	*	591
199	168	190	*	205
301	1922	3670	4572	6821
302	1872	3663	4610	6915
303	916	1577	1856	2666
304	943	1570	1934	2832
305	1007	1881	2308	3368
306	998	1758	2109	3058
307	942	1572	1682	2558
308	476	773	752	1193
309	975	2084	2725	4202
310	1034	2164	2813	4308
311	859	1693	2147	3270
312	1156	2191	2640	3959
313	1058	1842	2112	3225
314	1482	2343	2284	3760
316	377	712	811	1163
318	389	794	985	1523
319	437	839	945	1505
321	280	538	642	986
328	644	1307	1587	2442
336	1435	2553	2922	4389
339	1845	3633	4581	6855
378	531	874	822	1316
381	1256	2557	3291	5014

*SWMM Routing Elements 98, 99, 198 & 199 are inflow and outflow hydrographs for Englewood Dam and Holly Dam added to SWMM model for the 10 -, 50 -, & 500 - year storm events.

Table III - 3
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Peak Flow Comparison

Flooding Source and Location	Current FEMA Adopted Flow Rate* (cfs)				1986 McLaughlin Study	2002 WRC Engineering FHAD Study** (cfs)			
	10-Year	50-Year	100-Year	500-Year	100-Year	10-Year	50-Year	100-Year	500-Year
Blackmer Gulch									
At Confluence with Greenwood Gulch	1390	1850	1950	2330	1587	644	1307	1587	2442
At Confluence with Quincy Gulch	780	1040	1100	1330	985	389	794	985	1523
Little Dry Creek									
Clarkson Street	2275	3750	4580	5970	4581	1845	3633	4581	6855
Prentice Gulch									
At Mouth	640	870	920	1030	811	377	712	811	1163
Quincy Gulch									
At Confluence with Blackmer Gulch	610	810	850	1000	642	280	538	642	986
Greenwood Gulch									
At Bellview Road	1800	2550	2750	3200	2640	1156	2191	2640	3959
At Confluence with Prentice Creek	1700	2300	2450	2800	2112	1058	1842	2112	3225

* From the Arapahoe County FIS dated August 16, 1995

** Estimated Utilizing the 1986 McLaughlin hydrologic models.

Table V - 1
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Floodplain Table

Reach	Station Number	Stream Number	Thalweg Elevation (ft)	10 Year		50 year		100 Year					100 Year 0.5' EGL				100 Year 1.0' EGL				500 Year	
				Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Total Width (ft)	Velocity (ft/sec)	Area (sq. ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	Flow (cfs)	CWSEL (ft)
Little Dry Creek	92+85	92+85	5328.5	1323	5334.4	2452	5336.8	3146	5338.9	73	6.1	513	5338.9	73	36	37	5338.9	73	36	37	4822	5342.9
	93+42	93+42	5328.4	1323	5334.7	2452	5337.2	3146	5339.4	222	4.3	727	5339.4	222	140	82	5339.4	222	140	82	4822	5343.1
	96+73	96+73	5328.2	1323	5336.4	2452	5338.5	3146	5340.1	163	4.5	696	5340.1	163	87	76	5340.1	163	87	76	4822	5343.2
	103+61	103+61	5336.7	943	5341.4	1577	5342.7	1934	5343.2	54	10.5	185	5343.2	54	20	34	5343.2	54	20	34	2832	5344.7
	108+18	108+18	5337.7	943	5346.0	1577	5347.1	1934	5347.6	139	4.6	417	5347.9	64	19	45	5347.9	64	19	45	2832	5348.5
	108+69	108+69	5337.6	943	5346.1	1577	5347.0	1934	5347.3	51	8.2	236	5347.8	48	25	23	5347.8	48	25	23	2832	5347.7
	108+89	108+89	5339.1	943	5346.1	1577	5347.4	1934	5348.6	221	4.2	456	5348.6	60	36	24	5348.6	60	36	24	2832	5350.0
	109+14	109+14	5339.1	943	5346.5	1577	5348.1	1934	5348.9	152	3.5	553	5349.2	77	15	62	5349.2	77	15	62	2832	5350.0
	111+98	111+98	5340.2	943	5347.0	1577	5348.5	1934	5349.2	177	3.1	629	5349.6	140	44	96	5349.6	120	34	86	2832	5350.4
	112+06	112+06	5340.2	943	5347.1	1577	5348.5	1934	5349.3	183	3.0	639	5349.6	140	44	96	5349.6	120	34	86	2832	5350.4
	113+44	113+44	5341.6	943	5347.2	1577	5348.6	1934	5349.3	146	4.2	459	5349.7	80	41	39	5349.4	45	31	14	2832	5350.5
	114+03	114+03	5341.6	943	5347.3	1577	5348.7	1934	5349.4	172	4.7	414	5349.8	130	71	59	5350.3	130	71	59	2832	5350.6
	114+09	114+09	5341.7	943	5348.1	1577	5349.2	1934	5349.6	186	4.3	455	5350.0	130	71	59	5350.4	130	71	59	2832	5350.7
	118+32	118+32	5344.5	943	5350.1	1577	5350.9	1934	5351.3	383	4.5	435	5351.4	269	71	198	5351.4	192	57	135	2832	5351.9
	118+51	118+51	5344.5	943	5351.2	1577	5351.6	1934	5351.7	480	3.6	538	5352.0	269	71	198	5352.3	192	57	135	2832	5352.2
	121+53	121+53	5346.2	943	5351.9	1577	5352.6	1934	5352.9	180	5.5	355	5353.0	103	77	26	5353.3	65	44	21	2832	5353.3
	129+82	129+82	5349.6	943	5355.3	1577	5356.4	1934	5356.9	124	5.7	338	5357.1	54	23	31	5357.5	46	19	27	2832	5357.9
	134+89	134+89	5351.7	943	5357.5	1577	5358.4	1934	5359.0	194	3.7	523	5359.4	200	181	19	5359.8	195	176	19	2832	5360.0
	136+03	136+03	5352.6	943	5358.3	1577	5359.0	1934	5359.2	159	6.4	300	5359.5	155	126	29	5359.9	145	116	29	2832	5360.0
	136+15	136+15	5352.7	943	5359.3	1577	5360.1	1934	5360.4	176	3.7	522	5360.5	150	121	29	5360.5	150	121	29	2832	5361.1
	138+97	138+97	5354.1	943	5359.8	1577	5360.6	1934	5361.0	106	5.8	335	5361.0	65	25	41	5361.0	65	25	40	2832	5361.7
	142+45	142+45	5355.6	943	5360.9	1577	5361.9	1934	5362.4	165	4.3	452	5362.6	165	73	92	5362.6	125	68	57	2832	5363.3
	142+57	142+57	5355.6	943	5361.1	1577	5362.2	1934	5362.6	172	3.9	500	5362.8	165	74	91	5362.8	125	69	56	2832	5363.5
	146+02	146+02	5356.4	943	5362.1	1577	5363.0	1934	5363.4	146	4.4	441	5363.5	140	53	87	5363.5	140	53	87	2832	5364.3
	146+10	146+10	5356.4	943	5362.3	1577	5363.2	1934	5363.6	144	4.1	471	5363.6	135	53	82	5363.6	135	53	82	2832	5364.4
	148+77	148+77	5357.8	943	5363.1	1577	5363.9	1934	5364.6	173	6.2	310	5364.6	173	140	33	5364.6	173	140	33	2832	5365.2
	148+85	148+85	5357.8	943	5364.6	1577	5365.2	1934	5365.5	202	4.2	457	5365.5	202	164	38	5365.5	202	164	38	2832	5366.0
	150+25	150+25	5357.8	943	5364.8	1577	5365.5	1934	5365.8	134	5.5	349	5365.4	45	34	11	5365.1	34	23	11	2832	5366.4
	150+97	150+97	5358.9	943	5365.1	1577	5365.8	1934	5366.1	134	7.1	274	5366.9	87	53	34	5367.6	84	51	33	2832	5366.7
	151+20	151+20	5360.0	943	5365.9	1577	5366.5	1934	5366.8	147	5.5	349	5367.3	87	54	33	5367.8	84	52	31	2832	5367.5
	151+79	151+79	5360.1	943	5366.2	1577	5366.7	1934	5367.0	65	6.2	314	5367.5	65	36	29	5368.0	65	36	29	2832	5367.6
	152+35	152+35	5360.5	1007	5366.4	1881	5367.9	2308	5368.4	73	5.2	448	5368.8	68	38	30	5369.3	68	38	30	3368	5370.7
	152+92	152+92	5362.0	1007	5366.4	1881	5368.0	2308	5368.5	405	6.2	375	5369.0	127	37	90	5369.3	72	37	35	3368	5371.1
	154+05	154+05	5362.1	1007	5367.2	1881	5368.9	2308	5369.5	412	2.2	1029	5369.6	185	47	138	5370.0	85	47	38	3368	5371.6
	156+88	156+88	5362.1	1007	5368.3	1881	5369.2	2308	5369.4	192	8.6	267	5370.2	119	33	86	5370.8	74	33	41	3368	5371.6
	164+21	164+21	5364.2	1007	5371.3	1881	5373.2	2308	5373.7	422	3.6	642	5373.6	150	20	130	5373.6	80	20	60	3368	5373.8
	166+25	166+25	5364.7	1007	5372.6	1881	5374.3	2308	5374.6	427	3.1	748	5375.0	160	62	98	5375.0	140	42	98	3368	5375.3
	166+37	166+37	5364.7	1007	5372.7	1881	5374.4	2308	5374.7	424	3.0	758	5375.1	160	63	97	5375.1	140	43	97	3368	537

Table V - 1
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Floodplain Table

Reach	Station Number	Stream Number	Thalweg Elevation (ft)	10 Year		50 year		100 Year					100 Year 0.5' EGL				100 Year 1.0' EGL				500 Year	
				Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Total Width (ft)	Velocity (ft/sec)	Area (sq. ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	Flow (cfs)	CWSEL (ft)
Little Dry Creek	229+60	229+60	5394.6	1007	5400.9	1881	5401.9	2308	5402.4	403	4.2	545	5402.6	280	14	266	5403.2	63	14	49	3368	5403.5
	231+19	231+19	5395.4	1007	5401.2	1881	5402.4	2308	5403.0	432	3.6	649	5403.2	282	11	271	5403.9	87	11	76	3368	5403.7
	231+25	231+25	5395.4	1007	5401.2	1881	5402.6	2308	5403.1	429	3.6	644	5403.3	282	11	271	5404.0	93	11	82	3368	5403.7
	235+10	235+10	5396.7	1007	5403.4	1881	5404.4	2308	5404.4	204	5.1	449	5404.7	78	8	70	5405.2	62	8	54	3368	5404.8
	238+83	238+83	5396.9	1007	5404.4	1881	5405.6	2308	5406.0	100	6.8	341	5406.4	60	43	17	5406.8	45	32	13	3368	5407.0
	240+11	240+11	5398.8	1007	5405.1	1881	5406.6	2308	5407.1	216	2.9	803	5407.6	145	120	25	5408.1	145	120	25	3368	5408.3
	240+23	240+23	5398.8	1007	5405.2	1881	5406.7	2308	5407.2	279	2.2	1037	5407.7	145	124	21	5408.2	145	124	21	3368	5408.4
	241+66	241+66	5400.0	1007	5405.4	1881	5406.8	2308	5407.4	385	1.8	1291	5407.9	185	144	41	5408.2	145	104	41	3368	5408.5
	246+20	246+20	5400.6	1007	5406.1	1881	5406.5	2308	5407.3	42	12.4	185	5409.1	41	17	24	5409.7	41	17	24	3368	5409.6
	246+40	246+40	5401.9	1007	5406.3	1881	5407.9	2308	5408.8	97	8.4	276	5409.6	96	55	41	5410.3	77	55	22	3368	5410.7
	247+02	247+02	5404.6	1007	5408.9	1881	5410.8	2308	5411.6	52	8.1	284	5411.6	52	20	32	5411.6	52	20	32	3368	5414.4
	248+08	248+08	5404.9	1007	5412.0	1881	5416.2	2308	5416.8	298	3.9	593	5416.7	86	36	50	5416.7	86	36	50	3368	5417.0
	249+01	249+01	5404.9	1007	5413.1	1881	5417.1	2308	5417.8	461	0.7	3106	5417.8	175	120	55	5417.8	175	120	55	3368	5418.9
	252+08	252+08	5404.9	1007	5413.1	1881	5417.1	2308	5417.8	348	1.3	1748	5417.6	38	14	24	5417.6	38	14	24	3368	5418.9
	254+32	254+32	5404.9	1007	5413.4	1881	5417.1	2308	5417.8	418	1.2	1911	5418.2	89	38	51	5418.2	62	38	24	3368	5418.9
	255+28	255+28	5405.2	1007	5413.4	1881	5417.0	2308	5417.7	181	3.5	664	5418.2	158	50	108	5418.2	71	34	37	3368	5418.8
	256+30	256+30	5406.6	1007	5413.9	1881	5417.8	2308	5418.2	265	4.2	549	5418.9	253	39	214	5419.3	71	31	40	3368	5418.7
	256+82	256+82	5406.6	1007	5414.1	1881	5418.0	2308	5418.5	59	5.7	408	5418.9	61	23	38	5419.4	64	24	40	3368	5419.0
	259+28	259+28	5407.6	1007	5415.1	1881	5418.6	2308	5419.3	264	3.1	740	5419.6	77	43	34	5420.0	78	43	35	3368	5420.3
	263+70	263+70	5409.4	1007	5416.6	1881	5419.5	2308	5420.1	183	3.6	644	5420.5	116	33	83	5420.7	72	33	39	3368	5421.1
	268+78	268+78	5413.1	1007	5419.8	1881	5420.8	2308	5421.3	330	2.8	814	5421.8	204	92	112	5422.3	190	84	106	3368	5422.2
	274+04	274+04	5413.7	1007	5421.5	1881	5422.3	2308	5422.4	66	10.4	222	5422.8	60	21	39	5422.9	60	21	39	3368	5424.1
	278+26	278+26	5416.0	1007	5423.3	1881	5425.6	2308	5426.4	122	5.3	439	5426.5	43	17	26	5426.6	41	15	26	3368	5427.2
	282+30	282+30	5417.3	1007	5425.0	1881	5427.1	2308	5427.8	110	5.5	421	5428.4	108	51	57	5428.8	46	20	26	3368	5428.9
	287+25	287+25	5421.0	1007	5427.0	1881	5429.0	2308	5429.7	91	7.3	318	5429.8	90	34	56	5430.6	41	26	15	3368	5431.0
	293+66	293+66	5425.1	1007	5431.9	1881	5433.7	2308	5434.3	70	7.6	304	5434.4	45	23	22	5435.0	43	23	20	3368	5435.5
	298+10	298+10	5426.9	1007	5433.9	1881	5435.8	2308	5436.5	114	4.2	544	5437.0	89	38	51	5437.4	76	25	51	3368	5437.6
	303+37	303+37	5429.1	998	5435.3	1758	5437.0	2109	5437.7	97	5.4	388	5438.0	59	16	43	5438.3	47	16	31	3058	5439.0
	307+71	307+71	5432.0	998	5438.6	1758	5439.6	2109	5439.9	63	10.4	203	5440.5	52	15	37	5440.9	52	15	37	3058	5440.9
	312+17	312+17	5434.5	998	5441.7	1758	5443.6	2109	5444.3	82	5.9	357	5444.1	53	18	35	5444.1	33	18	15	3058	5445.6
	315+97	315+97	5437.1	998	5443.4	1758	5445.1	2109	5445.7	80	5.2	402	5445.9	79	67	12	5446.5	62	50	12	3058	5447.0
	321+07	321+07	5439.5	998	5445.7	1758	5447.3	2109	5447.9	66	9.3	228	5447.6	36	23	13	5447.6	28	16	13	3058	5448.9
	325+22	325+22	5442.9	998	5449.5	1758	5451.1	2109	5451.6	104	5.4	387	5452.2	74	22	52	5452.7	61	22	39	3058	5452.9
	331+09	331+09	5445.8	998	5451.9	1758	5453.4	2109	5453.8	181	4.8	436	5454.1	64	50	14	5454.4	50	35	15	3058	5454.9
	332+50	332+50	5446.1	998	5452.7	1758	5454.0	2109	5454.4	62	7.0	301	5454.9	61	48	13	5455.5	61	48	13	3058	5455.1
	333+41	333+41	5447.0	998	5453.0	1758	5454.3	2109	5454.7	51	8.0	265	5455.2	51	25	26	5455.6	51	25	26	3058	5455.5
	333+85	333+85	5449.0	998	5453.6	1758	5455.4	2109	5456.1	39	10.0	211	5456.1	39	14	25	5456.0	39	14	25	3058	5460.8
	334+39	334+39	5449.0	998	5454.9	1758	5457.1	2109	5458.0	99	3.9	535	5458.0	98	27	71	5457.9	98	27	71	3058	5461.7
	335+91	335+91	5449.1	998	5455.2	1758	5457.3	2109	5458.1	106	4.9	428	5457.9	50	25	25	5457.4	28	11	17	3058	5461.7
	339+12	339+12	5450.9	998	5457.0	1758	5458.5	2109	5459.1	61	7.8	270	5459.5	46	25	21	5460.4	46	25	21	3058	5461.9
	342+35	342+35	5455.2	998	5459.4	1758	5460.9	2109	5461.5	70	7.4	284	5461.7	44	19	25	5461.9	36	19	17	3058	5463.2
	348+43	348+43	5457.7	998	5463.4	1758	5464.6	2109	5465.0	101	5.3	395	5465.6	81	32	49	5466.1	69	27	42	3058	5466.2
	351+91	351+91	5458.2	998	5464.7	1758	5466.0	2109	5466.4	52	8.8	239	5466.6	33	13	20	5466.8	27	13	14	3058	5467.4
	354+52	354+52	5462.9	998	5467.2	1758	5469.1	2109	5469.8	28	13.5	156	5470.0	28	15	13	5470.4	28	15	13	3058	5471.5
	354+84	354+84	5463.3	998	5469.1	1758	5471.7	2109	5472.7	47	7.1	298	5472.6	47	23	24	5472.6	47	23	24	3058	5475.3
	355+57	355+57	5463.3	998	5469.9	1758	5472.4	2109	5473.4	67	5.1	412	5473.4	67	24	43	5473.3	67	24	43	3058	5476.0
	356+75	356+75	5463.3	998	5470.4	1758	5472.8	2109	5473.8	111	3.9	543	5473.7	63	29	34	5473.6	63	29	34	3058	5476.3
	360+44	360+44	5463.9	998	5471.2	1758	5473.4	2109	5474.3	94	3.7	563	5474.4	64	35	29	5474.4	64	35	29	3058	5476.7
	363+92	363+92	5464.2	998	5471.7	1758	5473.8	2109	5474.7	62	5.0	421	5474.9	62	31	31	5474.8	62	31	31	3058	5477.0
	366+91	366+91	5466.1	998	5472.4	1758	5474.6	2109	5475.4	67	7.1	296	5475.5	56	34	22	5475.5	56	34	22	3058	5477.6
	367+24	367+24	5468.8	998	5474.0	1758	5475.4	2109	5476.0	59	10.5	201	5475.8	42	22	20	5475.8	42	22	20	3058	5477.2
	368+92	368+92	5469.5	998	5476.7	1758	5478.3	2109	5478.8	74	6.9	306	5479.0	48	31	17	5479.0	48	31	17	3058	5480.0
	371+36	371+36	5469.5	998	5477.4	1758	5479.3	2109	5479.9	83	3.0	696	5480.2	83	40	43	5480.2	83	40	43	3058	5481.3
	371+82	371+82	5478.6	942	5481.9	1572	5482.9	1682	5483.0	57	9.5	177	5483.1	40	21	19	5483.3	34	15	19	2558	5484.1
	372+64	372+64	5478.7	942	5483.6	1572	5484.8	1682	5484.9	144	5.1	332	5485.4	85	57	28	5485.7	60	33	27	2558	5486.

Table V - 1
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Floodplain Table

Reach	Station Number	Stream Number	Thalweg Elevation (ft)	10 Year		50 year		100 Year					100 Year 0.5' EGL				100 Year 1.0' EGL				500 Year	
				Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Total Width (ft)	Velocity (ft/sec)	Area (sq. ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	Flow (cfs)	CWSEL (ft)
Little Dry Creek	373+49	373+49	5478.7	942	5484.3	1572	5485.2	1682	5485.3	94	5.5	305	5485.8	60	32	28	5486.2	48	20	28	2558	5486.4
	374+44	374+44	5479.8	942	5484.6	1572	5485.5	1682	5485.7	68	6.6	255	5486.1	41	26	15	5486.6	38	23	15	2558	5486.7
	374+78	374+78	5478.7	942	5485.1	1572	5486.3	1682	5486.5	80	4.3	392	5486.8	43	18	25	5487.3	43	18	25	2558	5487.7
	376+33	376+33	5478.7	942	5485.3	1572	5486.5	1682	5486.7	55	6.7	252	5487.3	47	19	28	5487.7	42	14	28	2558	5487.9
	377+59	377+59	5479.3	942	5485.8	1572	5487.1	1682	5487.3	36	7.9	213	5487.8	36	14	22	5488.2	36	14	22	2558	5488.7
	377+72	377+72	5479.7	942	5485.8	1572	5487.2	1682	5487.5	40	7.8	215	5487.9	39	19	20	5488.3	39	19	20	2558	5489.0
	383+48	383+48	5484.8	942	5489.5	1572	5491.3	1682	5491.5	62	6.2	270	5491.4	60	20	40	5491.4	60	20	40	2558	5493.2
	387+50	387+50	5489.3	942	5493.2	1572	5494.2	1682	5494.4	62	8.0	210	5494.4	62	31	31	5494.4	62	31	31	2558	5495.6
	391+66	391+66	5496.8	942	5500.9	1572	5502.4	1682	5502.6	26	12.2	138	5502.6	26	16	10	5502.6	26	16	10	2558	5504.4
	392+37	392+37	5497.1	942	5503.2	1572	5505.5	1682	5505.9	49	5.6	298	5505.9	49	19	30	5505.9	49	19	30	2558	5509.0
	392+98	392+98	5497.1	942	5503.7	1572	5506.1	1682	5506.5	82	3.6	469	5506.5	80	34	46	5506.5	80	34	46	2558	5509.0
	394+26	394+26	5497.1	942	5503.9	1572	5506.3	1682	5506.7	98	2.8	602	5506.7	98	65	33	5506.7	98	65	33	2558	5509.0
	395+99	395+99	5498.2	942	5504.1	1572	5506.5	1682	5506.8	276	1.6	1062	5506.8	90	39	51	5506.8	90	39	51	2558	5509.1
	396+13	396+13	5498.7	942	5504.1	1572	5506.5	1682	5506.9	277	1.5	1101	5506.8	110	52	58	5506.8	110	52	58	2558	5509.1
	398+80	398+80	5498.7	942	5504.4	1572	5506.4	1682	5506.8	77	5.0	339	5506.9	76	47	29	5506.9	76	47	29	2558	5509.0
	402+39	402+39	5501.3	942	5506.5	1572	5508.0	1682	5508.2	63	7.1	236	5508.2	62	26	36	5508.2	62	26	36	2558	5509.8
	406+54	406+54	5504.1	942	5509.6	1572	5511.1	1682	5511.3	74	5.9	286	5511.3	74	23	51	5511.3	74	23	51	2558	5512.5
	409+98	409+98	5508.3	942	5512.7	1572	5514.0	1682	5514.1	43	10.8	155	5514.1	43	22	21	5514.1	43	22	21	2558	5515.4
	410+13	410+13	5508.3	942	5513.7	1572	5515.0	1682	5515.2	46	8.0	210	5515.2	46	21	25	5515.2	46	21	25	2558	5516.5
	414+02	414+02	5511.6	942	5516.4	1572	5517.8	1682	5518.0	57	8.4	200	5518.0	57	31	26	5518.0	57	31	26	2558	5519.5
	418+67	418+67	5519.4	942	5523.2	1572	5524.1	1682	5524.2	86	8.4	200	5524.3	70	14	56	5524.3	70	14	56	2558	5525.1
	418+77	418+77	5519.3	942	5523.8	1572	5524.7	1682	5524.8	89	7.9	212	5524.7	50	15	35	5525.0	41	11	30	2558	5525.6
	421+43	421+43	5519.8	942	5525.8	1572	5526.8	1682	5527.0	150	4.8	351	5527.4	69	23	46	5527.9	57	19	38	2558	5527.9
	423+65	423+65	5520.9	531	5526.6	874	5527.6	874	5527.8	63	3.8	233	5528.2	62	28	34	5528.7	62	28	34	1316	5528.6
	423+97	423+97	5522.1	531	5526.6	874	5527.7	874	5527.8	56	4.2	206	5528.2	50	23	27	5528.7	50	23	27	1316	5528.7
	424+92	424+92	5522.6	531	5531.3	874	5532.3	874	5532.3	330	0.8	1033	5532.6	150	63	87	5532.6	150	63	87	1316	5532.9
	426+10	426+10	5522.6	531	5531.3	874	5532.3	874	5532.3	255	1.0	887	5532.6	100	52	48	5532.6	100	52	48	1316	5532.9
	428+45	428+45	5522.7	531	5531.3	874	5532.3	874	5532.3	104	1.7	502	5532.6	104	51	53	5532.7	104	51	53	1316	5532.9
	432+89	432+89	5529.2	531	5531.8	874	5532.4	874	5532.4	69	7.4	117	5532.3	68	44	24	5532.4	68	44	24	1316	5533.1
	432+99	432+99	5530.2	531	5532.2	874	5532.9	874	5532.9	107	6.7	131	5532.8	58	35	23	5532.8	58	35	23	1316	5533.5
	434+78	434+78	5529.7	531	5534.4	874	5535.0	874	5535.0	50	7.4	117	5535.1	36	16	20	5535.1	36	16	20	1316	5536.2
	437+57	437+57	5532.3	160	5536.4	170	5537.7	240	5537.7	12	5.2	47	5537.7	12	4	8	5537.7	12	4	8	600	5537.9
	439+21	439+21	5534.8	160	5538.5	170	5538.7	240	5539.6	27	4.3	55	5539.6	27	16	11	5539.6	27	16	11	600	5545.4
	441+80	441+80	5535.1	160	5539.1	170	5539.3	240	5540.2	54	2.2	110	5540.3	28	14	14	5540.3	28	14	14	600	5545.4
	443+67	443+67	5535.4	160	5539.4	170	5539.6	240	5540.4	58	1.7	143	5540.5	57	24	33	5540.5	57	24	33	600	5545.4
Willow Creek	01+23	01+23	5533.0	476	5536.3	773	5537.3	752	5537.3	30	7.7	98	5537.4	30	21	9	5537.4	30	21	9	1193	5537.8
	02+10	02+10	5533.2	410	5539.8	560	5541.6	560	5541.6	72	1.8	309	5541.6	72	36	36	5541.6	72	36	36	780	5543.5
	05+06	05+06	5533.2	410	5540.1	560	5541.7	560	5541.7	82	1.6	352	5541.7	81	54	27	5541.7	81	54	27	780	5543.5
	07+51	07+51	5534.4	410	5540.2	560	5541.8	560	5541.8	97	1.6	354	5541.8	97	61	36	5541.8	97	61	36	780	5543.6
	10+36	10+36	5535.7	410	5540.5	560	5542.0	560	5542.0	64	2.4	238	5542.0	63	36	27	5542.0	63	36	27	780	5543.7
	10+53	10+53	5535.7	410	5539.9	560	5541.0	560	5541.0	30	11.6	48	5541.0	30	13	17	5541.0	30	13	17	780	5542.6
	11+76	11+76	5537.4	410	5542.8	560	5547.5	560	5547.5	144	5.8	96	5547.5	144	120	24	5547.5	144	120	24	780	5550.4
	12+01	12+01	5537.4	410	5544.2	560	5548.2	560	5548.2	141	0.6	927	5548.2	118	103	15	5548.2	113	98	15	780	5550.4
	13+03	13+03	5537.4	410	5544.2	560	5548.2	560	5548.2	160	0.6	867	5548.2	129	117	12	5548.2	99	87	12	780	5550.4
	15+02	15+02	5537.4	410	5544.3	560	5548.2	560	5548.2	200	1.0	570	5548.2	190	128	62	5548.2	190	128	62	780	5550.4
	17+32	17+32	5537.9	410	5544.5	560	5548.2	560	5548.2	118	1.2	473	5548.2	47	19	28	5548.2	47	19	28	780	5550.4
	17+57	17+57	5539.6	410	5544.4	560	5548.2	560	5548.2	71	3.4	166	5548.2	35	12	23	5548.2	35	12	23	780	5550.4
	19+07	19+07	5540.5	410	5545.2	560	5550.0	560	5550.0	34	2.6	216	5550.0	31	17	14	5550.0	31	17	14	780	5553.9
	19+32	19+32	5540.5	410	5545.3	560	5550.1	560	5550.1	68	1.6	359	5550.0	35	27	8	5550.0	30	22	8	780	5554.0
	20+88	20+88	5542.4	410	5545.9	560	5550.1	560	5550.1	59	2.4	235	5550.1	59	31	28	5550.1	59	31	28	780	5554.1
	23+71	23+71	5544.2	410	5548.9	560	5550.4	560	5550.4	46	3.2	173	5550.5	46	23	23	5550.5	46	23	23	780	5554.1
	27+24	27+24	5546.1	410	5550.6	560	5551.5	560	5551.5	38	4.6	121	5551.5	38	20	18	5551.5	38	20	18	780	5554.3
	30+18	30+18	5549.5	410	5553.1	560	5553.7	560	5553.7	37	6.1	92	5553.7	37	23	14	5553.7	37	23	14	780	5554.9
	35+15	35+15	5550.4	410	5555.3	560	5556.0	560	5556.0	54	2.9	191	5556.1	39	15	24	5556.1	39	15	24	780	5556.9
	40+92	40+92	5555.9	410	5558.4	560	5558.9	560	5558.9	26	8.8	63	5558.9	26	13	13	5558.9	26	13	13	780	5559.6

Table V - 1
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Floodplain Table

Reach	Station Number	Stream Number	Thalweg Elevation (ft)	10 Year		50 year		100 Year					100 Year 0.5' EGL				100 Year 1.0' EGL				500 Year	
				Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Total Width (ft)	Velocity (ft/sec)	Area (sq. ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	Flow (cfs)	CWSEL (ft)
Blackmer Gulch	01+23	01+23	5406.0	644	5406.8	1307	5407.2	1587	5407.3	287	5.7	281	5407.5	175	105	70	5407.5	175	105	70	2442	5407.7
	04+84	04+84	5407.2	644	5409.7	1307	5410.3	1587	5410.5	298	3.5	458	5410.7	185	160	25	5410.7	185	160	25	2442	5410.9
	09+24	09+24	5411.4	437	5412.2	839	5412.6	985	5412.7	328	3.8	259	5412.8	213	133	80	5412.8	213	133	80	1523	5413.1
	10+61	10+61	5410.3	437	5413.3	839	5413.7	985	5413.7	198	3.9	254	5413.8	150	145	5	5413.8	150	145	5	1523	5414.0
	13+78	13+78	5413.0	437	5415.8	839	5415.8	985	5415.8	281	3.1	320	5415.8	180	12	168	5416.2	144	12	132	1523	5415.8
	14+18	14+18	5413.6	437	5416.1	839	5416.4	985	5416.5	348	1.5	640	5417.0	181	24	157	5417.2	145	24	121	1523	5416.8
	17+92	17+92	5419.1	437	5420.3	839	5420.8	985	5420.9	144	6.1	162	5420.9	130	73	57	5420.9	130	73	57	1523	5421.4
	23+12	23+12	5423.4	437	5425.5	839	5426.3	985	5426.5	78	4.7	210	5426.5	70	35	35	5426.5	70	35	35	1523	5427.3
	27+98	27+98	5427.2	437	5429.3	839	5430.2	985	5430.5	58	7.3	135	5430.5	50	41	9	5430.5	50	41	9	1523	5431.5
	31+61	31+61	5433.9	437	5436.6	839	5437.0	985	5437.1	184	5.1	193	5437.1	179	164	15	5437.2	140	125	15	1523	5437.5
	32+00	32+00	5438.0	437	5440.6	839	5440.9	945	5441.0	337	1.1	900	5441.2	235	174	61	5441.4	190	129	61	1505	5441.3
	35+29	35+29	5438.0	437	5440.6	839	5440.9	945	5441.0	157	2.3	406	5441.3	156	86	70	5441.5	137	86	51	1505	5441.4
	39+00	39+00	5438.0	437	5440.7	839	5441.1	945	5441.2	71	4.4	217	5441.5	70	39	31	5441.6	70	39	31	1505	5441.7
	42+64	42+64	5438.0	437	5441.2	839	5442.8	945	5443.1	19	11.7	81	5443.1	19	10	9	5443.1	19	10	9	1505	5444.8
	43+25	43+25	5457.2	437	5459.5	839	5459.9	945	5460.0	482	0.7	1290	5460.0	482	150	332	5460.0	482	150	332	1505	5460.4
	45+62	45+62	5457.2	437	5459.5	839	5459.9	945	5460.0	450	0.8	1185	5460.0	275	97	178	5460.0	225	47	178	1505	5460.4
	49+82	49+82	5457.2	437	5459.5	839	5459.9	945	5460.0	416	1.0	910	5460.1	200	145	55	5460.1	165	120	45	1505	5460.5
	52+95	52+95	5457.2	437	5459.5	839	5459.9	945	5459.9	132	4.4	217	5460.1	70	46	24	5460.0	50	36	14	1505	5460.3
	56+68	56+68	5458.0	204	5459.9	381	5460.7	397	5460.8	69	2.3	175	5460.9	69	38	31	5461.3	69	38	31	671	5461.6
	58+60	58+60	5467.0	204	5467.8	381	5468.1	397	5468.1	231	3.7	108	5468.1	120	75	45	5468.1	85	50	35	671	5468.3
	60+82	60+82	5464.1	204	5468.5	381	5469.1	397	5469.1	66	2.6	152	5469.2	66	35	31	5469.3	66	35	31	671	5469.7
	63+46	63+46	5469.4	204	5470.8	381	5471.3	397	5471.4	41	6.8	58	5471.4	41	26	15	5471.4	41	26	15	671	5472.0
	65+51	65+51	5490.2	204	5490.8	381	5491.0	397	5491.0	263	3.7	109	5491.0	210	171	39	5491.0	180	161	19	671	5491.2
	68+03	68+03	5487.8	204	5491.0	381	5491.2	397	5491.3	191	0.8	516	5491.3	110	80	30	5491.4	70	60	10	671	5491.6
Quincy Gulch	03+82*	03+82	5412.9	280	5415.6	538	5416.0	642	5416.1	276	5.3	122	5416.1	221	151	70	5416.1	221	151	70	986	5416.5
	07+99*	07+99	5420.3	0	5420.4	24	5421.2	30	5421.3	758	4.0	8	5421.3	758	743	15	5421.3	758	743	15	37	5421.4
	09+19*	09+19	5424.4	0	5423.2	24	5423.5	30	5423.6	777	2.6	12	5423.6	777	748	29	5423.6	777	748	29	37	5423.6
	09+37*	09+37	5425.4	1	5425.4	24	5425.6	30	5425.6	805	1.8	17	5425.6	805	749	56	5425.6	805	749	56	38	5425.6
	12+73**	12+73	5425.1	96	5426.8	131	5427.0	151	5427.1	122	2.2	70	5427.1	122	13	109	5427.1	122	13	109	215	5427.2
	12+98**	12+98	5427.0	106	5427.4	145	5427.5	166	5427.6	110	3.6	46	5427.6	110	25	85	5427.6	110	25	85	241	5427.7
	15+91**	15+91	5427.5	280	5428.9	525	5429.2	615	5429.3	217	3.3	187	5429.3	217	42	175	5429.3	217	42	175	900	5429.5
	16+16**	16+16	5429.2	280	5430.0	528	5430.2	622	5430.3	189	4.6	136	5430.3	189	49	140	5430.3	189	49	140	922	5430.6
	17+48	17+48	5429.9	280	5430.5	538	5430.8	642	5430.9	261	2.7	241	5430.9	168	2	166	5430.9	168	2	166	986	5431.2
	20+88	20+88	5433.8	280	5435.1	538	5435.4	642	5435.6	132	5.3	121	5435.8	70	43	27	5436.1	50	23	27	986	5435.9
	23+58	23+58	5438.0	280	5440.2	538	5440.6	642	5440.7	160	4.0	162	5440.9	80	43	37	5441.2	60	33	27	986	5441.0
	24+14	24+14	5444.6	280	5448.3	538	5448.6	642	5448.7	484	0.6	1163	5448.8	80	40	40	5448.5	40	20	20	986	5449.0
	27+71	27+71	5444.6	280	5448.3	538	5448.6	642	5448.7	427	0.7	957	5448.9	60	31	29	5449.1	40	21	19	986	5449.0
	30+12	30+12	5447.7	280	5448.9	538	5449.3	642	5449.5	111	5.7	112	5449.4	85	9	76	5449.6	65	9	56	986	5449.8
	32+78	32+78	5452.5	280	5455.9	538	5456.7	642	5457.0	36	7.6	84	5457.0	35	13	22	5457.0	35	13	22	986	5460.5
	33+69	33+69	5453.4	280	5456.8	538	5457.6	642	5457.8	143	3.3	194	5457.8	143	16	127	5457.8	143	16	127	986	5460.6
	34+95	34+95	5454.3	280	5458.2	538	5458.5	642	5458.8	33	8.7	74	5458.8	32	14	18	5458.8	32	14	18	986	5459.9
	36+55	36+55	5455.4	280	5459.9	538	5461.3	642	5461.7	47	4.4	146	5461.7	47	23	24	5461.7	47	23	24	986	5462.6
	39+38	39+38	5459.3	280	5462.9	538	5463.8	642	5464.1	49	6.3	101	5464.1	49	33	16	5464.1	49	33	16	986	5464.9
	40+18	40+18	5461.2	280	5465.7	538	5466.3	642	5466.5	119	2.2	298	5466.5	70	29	41	5466.5	70	29	41	986	5467.0
	41+43	41+43	5461.8	280	5465.8	538	5466.4	642	5466.6	97	3.8	171	5466.8	55	23	32	5466.8	55	23	32	986	5467.1
	42+61	42+61	5461.9	280	5466.4	538	5467.1	642	5467.8	51	5.4	100	5467.6	51	11	40	5467.6	51	11	40	986	5468.2
	43+10	43+10	5462.1	280	5467.3	538	5468.5	642	5468.7	92	3.8	167	5468.9	54	26	28	5468.9	54	26	28	986	5469.3

* Widths include shallow flooding area due to roadway / embankment overtopping with reduced flow due to lateral weir analysis at E. Quincy Avenue

** Reduced flow due to lateral weir analysis at E. Quincy Avenue

Table V - 1
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Floodplain Table

Reach	Station Number	Stream Number	Thalweg Elevation (ft)	10 Year		50 year		100 Year					100 Year 0.5' EGL				100 Year 1.0' EGL				500 Year	
				Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Total Width (ft)	Velocity (ft/sec)	Area (sq. ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	Flow (cfs)	CWSEL (ft)
Quincy Gulch	43+58	43+58	5462.2	280	5467.5	538	5468.7	642	5468.9	80	3.4	188	5469.1	57	26	31	5469.1	57	26	31	986	5469.5
	44+09	44+09	5462.4	280	5467.6	538	5468.8	642	5469.0	51	3.7	174	5469.2	51	21	30	5469.2	51	21	30	986	5469.6
	45+71	45+71	5465.2	280	5472.6	538	5473.5	642	5473.8	89	2.0	329	5473.8	89	47	42	5473.8	89	47	42	986	5474.4
	47+30	47+30	5465.3	280	5472.7	538	5473.6	642	5473.9	88	1.3	496	5473.9	88	39	49	5473.9	88	39	49	986	5474.5
	48+91	48+91	5487.8	280	5488.8	538	5489.1	642	5489.2	155	5.2	124	Not Applicable - Denver High Line Canal Embankment								986	5489.5
	52+22	52+22	5491.7	280	5493.5	538	5494.0	642	5494.1	89	5.0	128	5494.5	89	77	12	5494.5	89	77	12	986	5494.5
Greenwood Gulch Bypass	00+00	00+00	5342.3	649	5343.2	1284	5343.7	1609	5343.9	324	3.7	429	5343.9	324	129	195	5343.9	324	129	195	2330	5344.3
	00+25	00+25	5341.0	649	5343.3	1284	5343.7	1609	5343.9	307	3.6	442	5343.9	307	68	239	5343.9	307	68	239	2330	5344.3
	03+05	03+05	5334.0	649	5343.4	1284	5344.0	1609	5344.2	434	0.7	2428	5344.2	434	261	173	5344.2	434	261	173	2330	5344.7
	06+35	06+35	5337.0	649	5343.4	1284	5344.0	1609	5344.2	537	0.7	2223	5344.2	537	355	182	5344.2	537	355	182	2330	5344.7
	10+05	10+05	5340.0	1034	5343.4	2164	5344.0	2813	5344.3	577	1.8	1589	5344.3	577	498	79	5344.3	577	498	79	4308	5344.8
	14+15	14+15	5340.5	1034	5344.1	2164	5344.7	2813	5344.9	389	5.5	509	5345.3	262	235	27	5345.6	194	167	27	4308	5345.3
Greenwood Gulch	10+79	10+79	5340.5	1034	5344.0	2164	5344.7	2813	5344.9	388	5.6	504	5345.3	262	235	27	5345.6	194	167	27	4308	5345.3
	19+24	19+24	5343.5	1034	5347.5	2164	5348.8	2813	5349.3	246	5.5	507	5349.5	125	33	92	5349.9	60	33	27	4308	5350.0
	28+83	28+83	5348.7	1034	5352.4	2164	5353.3	2813	5353.7	305	5.8	485	5353.9	159	20	139	5354.3	129	20	109	4308	5354.4
	38+98	38+98	5352.8	1034	5357.7	2164	5358.4	2813	5358.7	260	5.1	553	5359.1	145	71	74	5359.2	125	61	64	4308	5359.2
	44+41	44+41	5356.7	1034	5360.0	2164	5361.2	2813	5361.7	143	6.6	424	5361.9	120	96	24	5362.1	120	96	24	4308	5362.4
	49+84	49+84	5360.9	1034	5364.5	2164	5365.3	2813	5365.7	308	4.5	621	5366.0	169	149	20	5366.2	116	96	20	4308	5366.2
	52+87	52+87	5361.5	1034	5365.8	2164	5366.6	2813	5366.9	450	3.2	888	5367.4	241	231	10	5367.9	206	196	10	4308	5367.6
	59+32	59+32	5365.7	1034	5369.8	2164	5370.5	2813	5370.8	290	6.3	447	5371.0	158	113	45	5371.0	158	113	45	4308	5371.3
	60+77*	60+77	5372.0	1256	5372.9	2557	5373.5	3291	5373.8	620	5.5	597	5373.8	592	577	15	5373.8	592	577	15	5014	5374.1
	61+31*	61+31	5375.9	1256	5374.4	2557	5374.8	3291	5375.0	820	5.9	561	5375.1	633	617	16	5375.1	633	617	16	5014	5375.3
	65+53*	65+53	5375.9	1256	5377.6	2557	5378.2	3291	5378.5	730	4.4	747	5378.5	580	404	176	5378.5	580	404	176	5014	5378.3
	69+14	69+14	5375.9	1256	5379.3	2557	5380.0	3291	5379.9	500	2.6	1288	5379.9	377	294	83	5379.9	377	294	83	5014	5380.1
	71+60	71+60	5375.9	1256	5379.9	2557	5380.1	3291	5380.0	270	4.5	731	5380.2	270	12	258	5380.2	270	12	258	5014	5380.3
	77+45	77+45	5384.4	1256	5385.9	2557	5386.5	3291	5386.7	572	7.1	462	5387.1	170	126	44	5387.1	170	126	44	5014	5387.4
	78+52	78+52	5383.8	1256	5387.1	2557	5387.9	3291	5388.2	745	2.7	1220	5388.7	290	225	65	5388.9	220	175	45	5014	5388.8
	80+99	80+99	5383.1	1256	5387.2	2557	5388.1	3291	5388.4	622	2.2	1508	5388.9	350	120	230	5388.9	175	35	140	5014	5389.1
	82+79	82+79	5384.1	1256	5387.1	2557	5387.8	3291	5388.2	277	7.0	472	5388.9	200	135	65	5389.6	175	115	60	5014	5388.9
	83+17	83+17	5384.1	1256	5387.6	2557	5388.7	3291	5389.1	420	3.9	845	5389.3	180	130	50	5389.8	180	130	50	5014	5389.7
	87+04	87+04	5386.1	1256	5388.7	2557	5389.5	3291	5389.9	669	3.0	1105	5390.2	300	173	127	5390.5	235	108	127	5014	5390.5
	90+73	90+73	5390.2	1256	5390.8	2557	5391.1	3291	5391.2	719	5.3	626	5391.5	450	210	240	5391.8	360	120	240	5014	5391.5
	94+23	94+23	5389.1	1256	5392.0	2557	5392.6	3291	5392.8	572	3.3	1004	5393.1	275	38	237	5393.2	225	13	212	5014	5393.2
	95+63	95+63	5389.3	1256	5393.6	2557	5394.1	3291	5394.3	331	6.7	493	5394.5	215	51	164	5394.5	215	51	164	5014	5394.9
	98+84	98+84	5390.4	1256	5394.2	2557	5395.0	3291	5395.4	261	2.7	1223	5395.8	190	79	111	5395.8	190	79	111	5014	5396.1
	103+87	103+87	5393.0	1256	5395.7	2557	5397.2	3291	5397.6	198	7.7	430	5397.6	140	71	69	5397.6	140	71	69	5014	5398.3
	108+35	108+35	5396.6	1256	5401.0	2557	5401.6	3291	5402.0	358	4.7	705	5402.3	225	158	67	5402.4	205	158	47	5014	5402.7
	112+99	112+99	5400.0	1256	5403.0	2557	5403.8	3291	5404.1	322	4.0	818	5404.4	300	264	36	5404.4	300	264	36	5014	5404.8
	116+42	116+42	5399.6	1256	5403.4	2557	5404.3	3291	5404.7	401	3.8	860	5404.9	279	216	63	5404.9	279	216	63	5014	5405.5
	117+43	117+43	5404.5	1156	5405.5	2191	5406.0	2640	5406.1	308	6.3	417	5406.4	216	191	25	5406.8	161	136	25	3959	5406.5
	123+49	123+49	5407.9	1156	5409.5	2191	5410.0	2640	5410.2	541	2.9	912	5410.7	342	308	34	5411.2	286	252	34	3959	5410.7
	127+98	127+98	5408.2	1156	5411.8	2191	5412.3	2640	5412.4	361	5.8	459	5412.6	202	185	17	5412.7	118	102	17	3959	5412.7
	131+33	131+33	5414.5	1156	5416.2	2191	5416.7	2640	5416.9	262	6.6	401	5417.3	175	46	129	5417.7	150	46	104	3959	5417.4
	134+96	134+96	5416.2	1156	5417.9	2191	5418.6	2640	5418.8	465	3.1	860	5419.2	232	100	132	5419.5	215	100	115	3959	5419.4
	138+14	138+14	5416.2	1156	5418.5	2191	5419.1	2640	5419.2	98	9.3	283	5419.7	97	41	56	5419.9	97	41	56	3959	5420.1
	138+66	138+66	5416.2	1156	5419.0	2191	5420.2	2640	5420.7	105	6.2	425	5420.7	105	56	49	5420.7	105	56	49	3959	5421.9
	138+83	138+83	5424.2	1156	5426.0	2191	5426.8	2640	5427.1	111	9.2	288	5427.1	111	63	48	5427.1	111	63	48	3959	5427.9
	141+41	141+41	5422.0	1156	5426.8	2191	5428.1	2640	5428.6	503	1.0	2621	5428.6	175	50	125	5428.6	125	25	100	3959	5429.8
	144+43	144+43	5423.2	1156	5426.8	2191	5428.1	2640	5428.6	444	1.6	1652	5428.7	250	104	146	5428.8	150	54	96	3959	5429.8
	147+29	147+29	5422.0	1156	5426.9	2191	5428.1	2640	5428.6	467	1.1	2443	5428.8	250	86	164	5429.0	190	76	114	3959	5429.8
	149+95	149+95	5423.7	1156	5426.8	2191	5428.0	2640	5428.5	178	4.3	614	5428.7	177	84	93	5429.0	159	76	83	3959	5429.7

* Widths include shallow flooding area due to roadway / embankment overtopping

Table V - 1
FHAD for Little Dry Creek (ARAPCO) and Tributaries
Floodplain Table

Reach	Station Number	Stream Number	Thalweg Elevation (ft)	10 Year		50 year		100 Year					100 Year 0.5' EGL				100 Year 1.0' EGL				500 Year	
				Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Flow (cfs)	CWSEL (ft)	Total Width (ft)	Velocity (ft/sec)	Area (sq. ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	CWSEL (ft)	Total Width (ft)	Dist. Left (ft)	Dist. Right (ft)	Flow (cfs)	CWSEL (ft)
Prentice Gulch	150+57	150+57	5426.3	1156	5428.2	2191	5428.9	2640	5429.1	162	8.1	325	5429.2	135	61	74	5429.2	125	51	74	3959	5429.8
	157+08	157+08	5430.9	1156	5434.2	2191	5434.8	2640	5435.0	419	3.7	713	5435.4	252	66	186	5435.9	198	66	132	3959	5435.6
	160+08	160+08	5434.1	1156	5436.3	2191	5436.9	2640	5437.1	200	6.5	408	5437.6	151	58	93	5437.9	151	58	93	3959	5437.5
	162+22	162+22	5440.3	1156	5442.1	2191	5442.7	2640	5443.0	229	7.1	370	5442.9	174	97	77	5443.0	150	98	52	3959	5443.6
	166+70	166+70	5440.8	1156	5443.5	2191	5444.4	2640	5444.7	336	2.8	930	5445.0	156	115	41	5445.3	103	62	41	3959	5445.4
	169+57	169+57	5440.8	1156	5443.7	2191	5444.6	2640	5444.9	239	4.5	588	5445.4	139	80	59	5445.9	119	73	46	3959	5445.6
	173+89	173+89	5446.3	1156	5447.7	2191	5448.1	2640	5448.3	403	5.7	460	5448.5	198	95	103	5448.5	192	89	103	3959	5448.7
	177+21	177+21	5446.7	1156	5450.1	2191	5451.0	2640	5451.2	232	4.9	541	5451.5	226	181	45	5451.5	225	180	45	3959	5451.6
	178+52	178+52	5451.8	1156	5451.7	2191	5452.7	2640	5453.1	620	6.5	405	5453.1	503	480	23	5453.1	503	480	23	3959	5453.8
	179+79	179+79	5449.8	1156	5454.3	2191	5455.2	2640	5455.4	846	1.1	2355	5455.7	504	477	27	5455.7	504	477	27	3959	5455.9
	184+03	184+03	5454.4	1435	5456.5	2553	5457.0	2922	5457.1	391	6.3	466	5457.4	228	39	189	5457.7	166	39	127	4389	5457.6
	187+59	187+59	5457.7	1435	5460.4	2553	5461.1	2922	5461.3	412	4.1	706	5461.7	192	137	55	5461.9	184	129	55	4389	5461.7
	190+49	190+49	5459.3	1435	5461.5	2553	5462.2	2922	5462.4	368	4.3	679	5462.8	213	78	135	5463.1	138	35	103	4389	5462.9
	195+58	195+58	5462.8	1435	5466.0	2553	5466.8	2922	5467.0	407	5.7	515	5466.9	134	87	47	5467.0	103	66	37	4389	5467.5
	198+82	198+82	5464.5	1435	5467.7	2553	5468.6	2922	5468.7	129	6.0	484	5469.3	120	73	47	5469.6	90	58	32	4389	5469.4
	201+08	201+08	5464.5	1435	5468.1	2553	5469.2	2922	5469.5	188	4.1	709	5469.8	185	113	72	5470.4	185	113	72	4389	5470.4
	201+49	201+49	5474.4	1435	5475.7	2553	5476.0	2922	5476.2	412	6.0	483	5476.4	250	118	132	5476.6	200	118	82	4389	5476.5
	205+24	205+24	5473.9	1435	5477.1	2553	5477.8	2922	5478.0	303	3.8	769	5478.4	150	95	55	5478.7	135	80	55	4389	5478.6
	209+92	209+92	5480.5	1435	5482.6	2553	5483.1	2922	5483.2	373	6.4	457	5483.6	240	150	90	5483.8	210	110	100	4389	5483.7
	215+03	215+03	5484.8	1435	5487.1	2553	5487.8	2922	5488.0	612	2.3	1285	5488.2	350	93	257	5488.8	250	43	207	4389	5488.6
	219+15	219+15	5487.2	1435	5489.2	2553	5489.8	2922	5490.0	481	3.5	837	5490.4	300	93	207	5490.8	220	78	142	4389	5490.5
	222+85**	222+85	5493.0	1058	5494.1	1842	5494.8	2112	5495.1	155	7.3	289	5495.3	108	-33	141	5495.3	108	-33	141	3225	5495.7
	223+57	223+57	5488.1	1058	5495.0	1842	5495.9	2112	5496.1	461	1.5	1449	5496.6	320	116	204	5496.6	133	113	20	3225	5497.0
	227+54	227+54	5495.5	1058	5498.4	1842	5498.8	2112	5499.0	330	6.0	354	5499.4	301	232	69	5499.7	256	187	69	3225	5499.4
	233+01	233+01	5499.5	1058	5502.9	1842	5503.4	2112	5503.5	559	2.0	1058	5504.0	345	220	125	5504.2	275	175	100	3225	5504.1
	237+53	237+53	5503.9	1058	5505.8	1842	5506.2	2112	5506.3	363	5.0	421	5506.6	200	126	74	5506.9	160	106	54	3225	5506.8
	242+78	242+78	5506.0	1058	5510.2	1842	5510.9	2112	5511.0	305	3.1	674	5511.4	200	165	35	5511.8	135	100	35	3225	5511.7
	247+66	247+66	5508.5	1058	5512.1	1842	5513.0	2112	5513.3	164	4.4	477	5513.7	100	46	54	5514.0	90	41	49	3225	5514.1
	253+29	253+29	5514.2	1058	5519.7	1842	5520.2	2112	5520.4	465	7.2	293	5520.6	189	5	184	5521.0	166	6	160	3225	5521.0
	253+44*	253+44	5513.8	1058	5519.8	1842	5520.8	2112	5521.2	500	11.6	182	5521.2	205	10	195	5521.1	170	10	160	3225	5523.3
	254+02*	254+02	5513.8	1058	5521.1	1842	5522.9	2112	5523.5	429	5.5	386	5523.5	229	24	205	5523.5	184	24	160	3225	5523.5
	254+45	254+45	5513.9	1058	5521.2	1842	5524.3	2112	5524.7	429	3.1	692	5525.1	230	12	218	5525.5	159	12	147	3225	5526.1
	255+28	255+28	5514.4	1058	5521.6	1842	5524.4	2112	5524.7	142	4.4	476	5525.1	61	25	36	5525.5	44	14	30	3225	5526.1
	01+72	01+72	5494.4	377	5495.1	712	5495.3	811	5495.4	378	4.0	202	5495.4	276	37	239	5495.4	276	37	239	1163	5495.5
	03+23	03+23	5488.1	377	5495.5	712	5495.9	811	5496.0	149	1.9	416	5496.2	55	29	26	5496.3	45	19	26	1163	5496.4
	05+74	05+74	5493.6	377	5495.7	712	5496.4	811	5496.6	161	3.0	274	5497.0	88	65	23	5497.1	68	45	23	1163	5497.1
	08+49	08+49	5494.1	377	5497.5	712	5498.0	811	5498.2	133	3.7	220	5498.6	61	36	25	5499.1	48	28	19	1163	5498.6
	08+62	08+62	5495.3	377	5497.5	712	5498.1	811	5498.3	138	3.8	212	5498.8	83	45	38	5499.3	83	45	38	1163	5498.7
	11+11	11+11	5497.0	377	5499.4	712	5500.1	811	5500.3	92	4.3	190	5500.4	54	20	34	5500.4	54	20	34	1163	5500.7
	12+17	12+17	5497.1	377	5500.4	712	5501.2	811	5501.3	82	6.0	135	5501.5	58	21	37	5501.5	58	21	37	1163	5501.9
	14+71	14+71	5500.1	377	5504.4	712	5504.9	811	5505.1	112	4.5	182	5505.4	50	36	15	5505.7	34	19	15	1163	5505.5
	18+61	18+61	5506.1	377	5508.6	712	5509.3	811	5509.4	96	6.1	132	5509.9	47	22	25	5510.3	40	15	25	1163	5509.9
	19+82	19+82	5506.4	377	5510.3	712	5510.9	811	5511.0	116	4.1	197	5511.4	55	16	39	5511.5	55	16	39	1163	5511.5
	22+11	22+11	5511.4	377	5513.3	712	5513.8	811	5513.9	97	6.4	127	5514.1	74	20	54	5514.0	74	20	54	1163	5514.3
	25+24	25+24	5516.7	377	5521.3	712	5521.9	811	5522.0	79	6.3	130	5522.0	72	24	48	5522.1	72	24	48	1163	5522.4
	26+16	26+16	5517.3	377	5521.8	712	5524.3	811	5525.0	195	1.8	456	5525.0	123	66	57	5525.0	72	30	42	1163	5525.7
	27+34	27+34	5521.0	377	5523.1	712	5524.5	811	5525.1	139	2.6	309	5525.1	139	55	84	5525.2	139	55	84	1163	5525.8

* Widths include shallow flooding area due to roadway / embankment overtopping

** Denver High Line Canal Embankment

APPENDIX A
SUMMARY OF HYDROLOGIC INFORMATION FROM REFERENCE 9 (MWE 1986 STUDY)

Table 1
Subbasin Data for CUHP

Subbasin	DA (Mile ²)	L (Mile)	Lca (Mile)	So (Ft./Ft.)	Ia(%)	PDET (inch)	IDET (inch)
Little Dry Creek							
1	0.73	1.35	0.48	.0142	79	.35	.1
2	0.87	1.38	0.5	.0141	56	.35	.1
3	0.37	0.95	0.46	.0052	9	.4	.1
4	0.7	2.31	0.8	.0096	10	.4	.1
5	1.05	1.67	0.53	.017	5	.4	.1
6	1.0	1.48	0.68	.015	18	.4	.1
7	1.15	2.22	0.85	.0157	35	.35	.1
Willow Creek							
8	0.37	1.38	0.81	.0201	63	.35	.1
Greenwood Gulch							
9	0.57	1.59	0.95	.0116	8	.4	.1
10	0.76	1.48	0.49	.0132	13	.4	.1
11	0.54	1.25	0.64	.0162	11	.4	.1
12	0.59	1.33	0.46	.0189	12	.4	.1
13	0.68	1.35	0.52	.0184	21	.4	.1
14	0.68	1.19	0.44	.0256	37	.35	.1
15	0.48	0.85	0.32	.033	75	.35	.1
Prentice Gulch							
16	0.16	0.8	0.46	.0263	15	.4	.1
17	0.68	1.1	0.66	.0251	27	.4	.1
Blackmer Gulch							
18	0.28	0.87	0.55	.0201	3	.4	.1
19	0.79	1.71	0.51	.0216	10	.4	.1
20	0.43	1.00	0.49	.0274	15	.4	.1
Quincy Gulch							
21	0.43	1.21	0.52	.0202	14	.4	.1
22	0.39	0.9	0.42	.0294	25	.4	.1

DA: Drainage Area in Square Miles
L: Basin Length in Miles
Lca: Centroid Length in Miles
So: Basin Slope in Ft./Ft.

Ia: % Imperviousness
PDET: Depression for Pervious Area
IDET: Depression for Impervious Area

Table 2
Stream Data for SWMM

Stream Element	Length (ft.)	Slope (Ft./Ft.)	Manning's n	Shape
1 Low Flow	5,000	.007	.025	Rectangular 18' x 12'
Overflow	5,000	.007	.06	Trapezoid 60' wide 25:1 side slope
2 Low Flow	4,400	.0025	.035	Trapezoid 25' wide 5:1 side slope 10' deep
3 Low Flow	5,600	.005	.05	Trapezoid 8' wide 12:1 & 4:1 side slopes 6' deep
Overflow	5,600	.005	.06	Trapezoid 250' wide 50:1 & 15:1 side slopes
4 Low Flow	9,200	.006	.06	Trapezoid 8' wide 4:1 & 3:1 side slopes 7' deep
Overflow	9,200	.006	.065	Trapezoid 200' wide 4:1 side slope
5 Low Flow	4,800	.005	.05	Trapezoid 1' wide 5:1 & 3.5:1 side slopes 5' deep
Overflow	4,800	.005	.055	Trapezoid 75' wide 20:1 side slope
6 Low Flow	6,900	.008	.055	Trapezoid 1' wide 2.6:1 & 4.3:1 side slopes 11' deep
7 Low Flow	6,800	.007	.055	Trapezoid 1' wide 3:1 & 7.5:1 side slopes 4' deep
Overflow	6,800	.007	.06	Trapezoid 60' wide 3:1 & 20:1 side slopes
8 Low Flow	5,700	.009	.06	Trapezoid 20' wide 2:1 side slope 4' deep
Overflow	5,700	.009	.065	Trapezoid 70' wide 12:1 & 3:1 side slopes
9 Low Flow	6,000	.008	.06	Trapezoid 1' wide 5:1 side slope 3.5' deep
Overflow	6,000	.008	.065	Trapezoid 200' wide 25:1 side slope
10 Low Flow	6,000	.005	.06	Trapezoid 8' wide 3:1 side slope 2' deep
Overflow	6,000	.005	.065	Trapezoid 300' wide 70:1 side slope
11 Low Flow	6,700	.008	.06	Trapezoid 5' wide 3:1 side slope 2' deep
Overflow	6,700	.008	.065	Trapezoid 300' wide 25:1 side slope
12 Low Flow	4,300	.01	.065	Trapezoid 1' wide 10:1 side slope 3' deep
Overflow	4,300	.01	.07	Trapezoid 300' wide 40:1 side slope
13 Low Flow	5,400	.009	.06	Trapezoid 1' wide 10:1 side slope 3' deep
Overflow	5,400	.009	.06	Trapezoid 150' wide 30:1 side slope
14 Low Flow	4,000	.019	.065	Trapezoid 1' wide 6:1 & 4:1 side slopes 4.5' deep
Overflow	4,000	.019	.08	Trapezoid 70' wide 22:1 side slope
16 Low Flow	3,300	.014	.065	Trapezoid 1' wide 13:1 & 16:1 side slopes 3.5' deep
Overflow	3,300	.014	.07	Trapezoid 200' wide 17:1 side slope
18 Low Flow	4,600	.012	.065	Trapezoid 40' wide 7.5:1 side slope 4' deep
Overflow	4,600	.012	.07	Trapezoid 350' wide 55:1 side slope
19 Low Flow	2,400	.013	.055	Trapezoid 40' wide 75:1 side slope 4' deep
Overflow	2,400	.013	.06	Trapezoid 350' wide 55:1 side slope
21 Low Flow	4,900	.017	.065	Trapezoid 1' wide 6:1 & 80:1 side slopes 3' deep
Overflow	4,900	.017	.075	Trapezoid 40:1 side slope

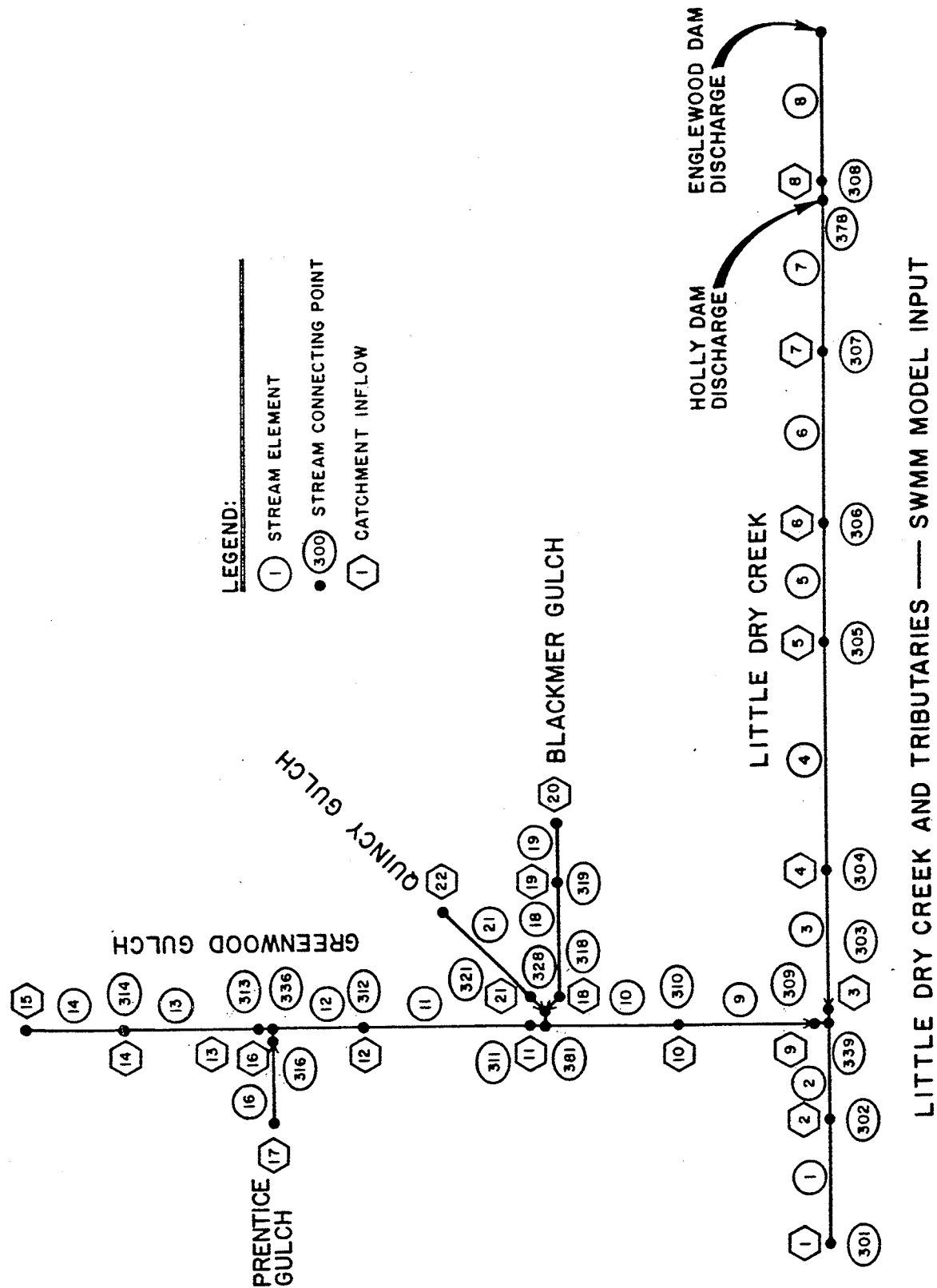


FIGURE -1
McLAUGHLIN WATER ENGINEERS, LTD.

Table 3 presents the incremental rainfall in each study, as well as the 100-year 3-hour duration storm recommended by current Arapahoe County Drainage Criteria. This is shown for reasonable comparison. Basically, all newer values reflect NOAA rainfall. The S&G values reflect the actual location on the Isohyetal mapping and are more accurate.

Table 3
100-Year 3-Hour Design Storm
(Incremental values in inches)

Time Minutes	1974 ME&M	1981 S&G	1986 MWE	Arap. Co. Drainage Criteria
0	0	0	0	0
10		.06	.06	.11
20	.21	.19	.19	.33
30		.24	.24	.93
40	1.65	1.02	1.02	.54
50		.41	.41	.30
60	.79	.36	.36	.22
70		.20	.20	.16
80	.33	.07	.07	.08
90		.07	.07	.06
100	.20	.06	.06	.06
110		.05	.05	.06
120	.11	.05	.05	.06
130		.04	.04	.02
140	.07	.04	.04	.02
150		.04	.04	.02
160	.03	.04	.04	.02
170		.03	.03	.02
180	.01			.01
Total	3.4	2.97	2.97	3.02

Infiltration and Depression Losses

The Horton infiltration method was selected for modeling infiltration losses in CUHPE/PC. Soils in the study area are mixed B and C types with majority of type C soil. Therefore, soil type C Horton infiltration losses were used for this study. Depression losses for pervious areas are 0.35" - 0.4" while depression losses for impervious areas are 0.1" as presented in Table 1.

Constant infiltration losses of 0.5"/hr. were used for the S&G Study in 1981 with pervious depression losses of 0.45" and impervious depression losses of 0.1".

Table 5

Little Dry Creek Hydrologic Investigation Summary

Location Study	LDC* above Highline Canal			LDC above GWG**			LDC below GWG			GWG @ LDC			LDC @ Mouth		
	MWE	S&G	ME&M	MWE	S&G	ME&M	MWE	S&G	ME&M	MWE	S&G	ME&M	MWE	S&G	ME&M
Drainage Area (mile ²)	1.52	-	3.61	4.64	-	6.73	12.1	12.2	14.1	7.46	-	7.46	13.7	13.5	15.8
% Imp.	42	-	-	21	-	33	21	20	29	21	-	-	26	24	32
Total Rainfall (Cum. In.)	2.97	-	3.4	2.97	-	3.7	2.97	2.97	3.4	2.97	-	-	2.97	2.92	3.4
(Ac. Ft.)	240.8	-	654.6	735	-	1,328	1,917	1,932	2,557	1,182	-	-	2,170	2,102	2,865
Infiltration Losses	80.8	-	139.6	319	-	428	833	815	817	514	-	-	890	843	965
(Ac. Ft.)															
Total	160	-	515	416	-	900	1,084	1,117	1,740	668	-	890	1,280	1,259	1,900
Runoff Volume (Ac.Ft.)															
Englewood Dam Dis-	193	-	0***	193	-	0***	193	190	0***	193	-	0***	193	190	0***
charge (cfs)															
Holly Dam Discharge	253	-	Not in	253	-	Not in	253	250	Not in	253	-	Not in	253	253	Not in
(cfs)			operation			operation			operation			operation			operation
Qp (cfs)	1,682	-	2,900	1,856	-	3,700	4,581	4,383	6,900	2,725	-	4,400	4,572	4,551	7,100

Methodology: MWE (1986) CUHPE/PC version generates hydrographs for 22 subbasin in the entire watershed. UDSWM2/PC version is used for stream routing to route these 22 hydrographs to the South Platte River. Utilized NOAA Rainfall.

S&G (1981) CUHP generates hydrographs at design point. All areas upstream of design point was modeled as singular cumulative basin at points of interest. No tributary channel routing. Utilized NOAA Rainfall.

ME&M (1974) CUHP generates hydrographs at design points. All area upstream of design point was modeled as singular cumulative basin at points of interest. No tributary channel routing. No discharge flow from Englewood Dam. Utilized DRCOG Rainfall.

* LDC = Little Dry Creek

** GWG = Greenwood Gulch

*** ME&M 1974 Study assumed no discharge from Englewood Dam.

APPENDIX B
SAMPLE CUHP INPUT FILE

```

1      10-YEAR LITTLE DRY CREEK, HYDROLOGY BY MWE 1985 WRC PN 2099
1      10-YEAR0.100.110.280.710.210.110.060.050.050.040.040.040.040.030.030.03
1      10-YEAR0.03

```

80	10.SUB101001 BASIN	1
0.73	1.35 0.48	79.0142
80	10.SUB103002 BASIN	2
0.87	1.38 0.50	56.0141
80	10.SUB105003 BASIN	3
0.37	0.95 0.46	9.0052
80	10.SUB107004 BASIN	4
0.70	2.31 0.80	10.0096
80	10.SUB109005 BASIN	5
1.05	1.67 0.53	5.0170
80	10.SUB111006 BASIN	6
1.00	1.48 0.68	18.0150
80	10.SUB113007 BASIN	7
1.15	2.22 0.85	35.0157
80	10.SUB115008 BASIN	8
0.37	1.38 0.81	63.0201
80	10.SUB300009 BASIN	9
0.57	1.59 0.95	8.0116
80	10.SUB302010 BASIN	10
0.76	1.48 0.49	13.0132
80	10.SUB304011 BASIN	11
0.54	1.25 0.64	11.0162
80	10.SUB306012 BASIN	12
0.59	1.33 0.46	12.0189
80	10.SUB308013 BASIN	13
0.68	1.35 0.52	21.0184
80	10.SUB310014 BASIN	14
0.68	1.19 0.44	37.0256
80	10.SUB312015 BASIN	15
0.48	0.85 0.32	75.0330
80	10.SUB400016 BASIN	16
0.16	0.80 0.46	15.0263
80	10.SUB402017 BASIN	17
0.68	1.10 0.66	27.0251
80	10.SUB501018 BASIN	18
0.28	0.87 0.55	3.0201
80	10.SUB502019 BASIN	19
0.79	1.71 0.51	10.0216
80	10.SUB504020 BASIN	20
0.43	1.00 0.49	15.0274
80	10.SUB602021 BASIN	21
0.43	1.21 0.52	14.0202
80	10.SUB604022 BASIN	22
0.39	0.90 0.42	25.0294

E

APPENDIX C
SAMPLE SWMM INPUT FILE

2 1 1 2
3 4

WATERSHED 1

LITTLE DRY CREEK 10-YEAR HYDROLOGY (HYDROGRAPHS GENERATED BY CUHP)

MWE 1986 - WRC PN 2099

54 10.

001 301

002 302

003 303

004 304

005 305

006 306

007 307

008 308

009 309

010 310

011 311

012 312

013 313

014 314

015 014

016 316

017 016

018 318

019 319

020 019

021 321

022 021

14 314

314 13

13 313

313 336

16 316

316 336

336 12

12 312

312 11

11 311

321 328

328 381

19 319

319 18

18 318

318 328

381 10

10 310

310 9

9 309

309 339

99 199

.17

4 1 4000 .0190 6 4 .065 4.5
70 4000 .0190 22 22 .080 6.0
0 1 .0010 0 0 .001 10.0
1 5400 .0090 10 10 .060 3.0
150 5400 .0090 30 30 .060 20.0
0 1 .0010 0 0 .001 10.0
1 3300 .0140 13 16 .065 3.5
200 3300 .0140 17 17 .070 20.0
0 1 .0010 0 0 .001 10.0
0 1 .0010 0 0 .001 10.0
1 4300 .0100 10 10 .065 3.0
300 4300 .0100 40 40 .070 20.0
0 1 .0010 0 0 .001 10.0
5 6700 .0080 3.0 3.0 .060 2.0
300 6700 .0080 25.0 25.0 .065 10.0
0 1 .0010 0.0 0.0 .001 10.0
0 1 .0010 0.0 0.0 .001 10.0
10 2400 .0130 7.5 7.5 .055 4.0
350 2400 .0130 55.0 55.0 .060 10.0
0 1 .0010 0.0 0.0 .001 10.0
40 4600 .0120 7.5 7.5 .065 4.0
350 4600 .0120 55.0 55.0 .070 10.0
0 1 .0010 0.0 0.0 .001 10.0
0 1 .0010 0.0 0.0 .001 10.0
8 6000 .0050 3.0 3.0 .060 2.0
300 6000 .0050 70.0 70.0 .065 7.0
0 1 .0010 0.0 0.0 .001 10.0
1 6000 .0080 5.0 5.0 .060 3.5
200 6000 .0080 25.0 25.0 .065 6.5
0 1 .0010 0.0 0.0 .001 10.0
0 1 .0010 0.0 0.0 .001 10.0
.5 3. .67 11. 1.0 139.

MWE10.sin

1

1.17 290. 1.33 505. 1.5 785. 1.67 1132.
1.83 1588. 2.0 2079. 2.17 2410. 2.33 2529.
2.5 2463. 2.67 2264. 2.83 2037. 3.0 1872.
3.17 1717. 3.33 1563. 3.5 1421. 4.0 1061.
4.5 756. 5.0 519. 5.5 355. 6.0 243.
7.0 113. 8.0 53. 9.0 25. 10.0 11.
199 8 9 2 0 1 .0010 0.0 .001 10.0
0.0 0.0 0.0 116.0 100. 138. 260.0 157.
500.0 174. 710.0 189.0 1120. 204. 1600. 217.
1710. 222.
8 308 4 20 5700 .0090 2.0 2.0 .060 4.0
70 5700 .0090 12.0 3.0 .065 0.0
308 378 3 0 1 .0010 0.0 0.0 .001 10.0
98 198 16 3 0 1 .0010 0.0 0.0 .001 10.0
.17 .0 .5 19. .67 70. 1.0 565.
1.17 979. 1.33 1179. 1.5 1101. 1.67 928.
1.83 777. 2.0 656. 2.5 424. 3.0 292.
3.5 184. 4.0 93. 5.0 22. 6.0 3.
198 378 9 2 0 1 .0010 0.0 0.0 .001 10.0
0.0 0.0 3.0 58.0 10. 95. 24.0 121.
82.5 142. 185.0 164.0 235. 171. 250. 984.
276. 2468.
378 7 3 0 1 .0010 0.0 0.0 .001 10.0
7 307 4 1 6800 .0070 3.0 7.5 .055 4.0
60 6800 .0070 3.0 20.0 .060 5.0
307 6 3 0 1 .0010 0.0 0.0 .001 10.0
6 306 1 1 6900 .0080 2.6 4.3 .055 11.0
306 5 3 0 1 .0010 0.0 0.0 .001 10.0
5 305 4 1 4800 .0050 5.0 3.5 .050 5.0
75 4800 .0050 20.0 20.0 .055 10.0
305 4 3 0 1 .0010 0.0 0.0 .001 10.0
4 304 4 8 9200 .0060 4.0 3.0 .060 7.0
200 9200 .0060 4.0 4.0 .065 10.0
304 3 3 0 1 .0010 0.0 0.0 .001 10.0
3 303 4 8 5600 .0050 12.0 4.0 .050 6.0
250 5600 .0050 50.0 15.0 .060 9.0
303 339 3 0 1 .0010 0.0 0.0 .001 10.0
339 2 3 0 1 .0010 0.0 0.0 .001 10.0
2 302 1 25 4400 .0025 5.0 5.0 .035 20.0
302 1 3 0 1 .0010 0.0 0.0 .001 10.0
1 301 4 18 5000 .0070 0.0 0.0 .025 12.0
60 5000 .0070 25.0 25.0 .060 14.0

0

0

ENDPROGRAM

-1

APPENDIX D
SUMMARY OF SWMM OUTPUT

URBAN DRAINAGE STORM WATER MANAGEMENT MODEL - 32 BIT VERSION 1998
REVISED BY UNIVERSITY OF COLORADO AT DENVER

*** ENTRY MADE TO RUNOFF MODEL ***

LITTLE DRY CREEK 10-YEAR HYDROLOGY (HYDROGRAPHS GENERATED BY CUHP)
MWE 1986 - WRC PN 2099

ONUMBER OF TIME STEPS 54
OINTEGRATION TIME INTERVAL (MINUTES), 10.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH

1

LITTLE DRY CREEK 10-YEAR HYDROLOGY (HYDROGRAPHS GENERATED BY CUHP)
MWE 1986 - WRC PN 2099

HYDROGRAPHS FROM CUHPF MODEL ARE LISTED FOR THE FOLLOWING 22 SUBCATCHMENTS

TIME (HR/MIN)		1	2	3	4	5	6	7	8	9	10
		11	12	13	14	15	16	17	18	19	20
		21	22								
0	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
0	10.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
0	20.	44.	27.	0.	0.	0.	2.	8.	11.	0.	1.
		0.	1.	3.	21.	163.	1.	7.	0.	1.	1.
		1.	6.								
0	30.	221.	150.	1.	1.	1.	16.	45.	67.	1.	7.
		3.	6.	20.	85.	449.	3.	37.	0.	4.	9.
		6.	27.								
0	40.	648.	553.	47.	33.	111.	182.	250.	228.	31.	129.
		79.	124.	203.	483.	1414.	53.	282.	44.	123.	137.
		95.	232.								
0	50.	1035.	1107.	97.	87.	257.	354.	589.	471.	80.	249.
		157.	219.	334.	636.	679.	73.	442.	85.	243.	204.

		164.	270.								
1	0.	595. 171. 160.	726. 217. 203.	107. 307.	128. 446.	315. 311.	390. 65.	707. 371.	339. 88.	113. 264.	267. 181.
1	10.	318. 151. 136.	415. 183. 139.	95. 248.	140. 270.	288. 148.	336. 52.	590. 272.	214. 75.	120. 230.	232. 143.
1	20.	175. 130. 110.	226. 147. 93.	84. 191.	133. 158.	242. 101.	278. 40.	455. 195.	128. 61.	110. 192.	193. 109.
1	30.	119. 109. 88.	139. 118. 64.	72. 148.	119. 98.	199. 94.	225. 32.	348. 141.	83. 49.	99. 157.	158. 83.
1	40.	95. 90. 71.	99. 94. 44.	60. 115.	110. 65.	163. 78.	183. 25.	269. 103.	59. 40.	90. 129.	129. 64.
1	50.	80. 75. 58.	76. 76. 31.	51. 89.	100. 46.	135. 75.	149. 20.	209. 76.	44. 33.	81. 106.	106. 49.
2	0.	76. 63. 47.	65. 61. 22.	43. 70.	91. 36.	112. 74.	122. 16.	164. 57.	35. 27.	71. 87.	87. 38.
2	10.	75. 53. 38.	62. 49. 17.	37. 55.	81. 29.	93. 74.	100. 12.	131. 44.	33. 22.	63. 72.	72. 29.
2	20.	75. 45. 31.	61. 40. 10.	32. 44.	72. 27.	77. 74.	83. 10.	107. 35.	32. 18.	56. 59.	59. 23.
2	30.	71. 37. 25.	58. 32. 8.	27. 35.	65. 25.	64. 59.	68. 8.	89. 28.	30. 15.	50. 49.	49. 18.
2	40.	61. 31. 21.	51. 26. 6.	23. 28.	58. 22.	53. 56.	57. 6.	74. 23.	27. 12.	44. 40.	40. 14.
2	50.	57. 27. 17.	47. 21. 6.	20. 23.	53. 21.	44. 56.	47. 2.	62. 19.	25. 10.	40. 33.	33. 11.
3	0.	56. 22.	46. 17.	17. 19.	47. 20.	36. 56.	39. 0.	54. 14.	24. 8.	35. 28.	28. 9.

		14.	6.								
3	10.	44. 19. 11.	38. 14. 4.	14. 15.	43. 14.	30. 11.	32. 0.	46. 10.	21. 7.	32. 23.	23. 4.
3	20.	14. 16. 9.	16. 11. 2.	12. 11.	38. 7.	25. 2.	26. 0.	35. 7.	10. 6.	28. 19.	19. 2.
3	30.	4. 13. 7.	7. 9. 2.	10. 5.	35. 4.	21. 0.	21. 0.	25. 4.	5. 5.	25. 15.	15. 0.
3	40.	0. 11. 3.	3. 7. 0.	9. 3.	31. 2.	17. 0.	17. 0.	15. 3.	2. 0.	22. 12.	12. 0.
3	50.	0. 9. 0.	0. 2. 0.	8. 2.	28. 0.	14. 0.	13. 0.	10. 2.	0. 0.	20. 10.	10. 0.
4	0.	0. 8. 0.	0. 0. 0.	6. 2.	25. 0.	12. 0.	11. 0.	7. 0.	0. 0.	18. 8.	8. 0.
4	10.	0. 6. 0.	0. 0. 0.	5. 0.	23. 0.	10. 0.	8. 0.	5. 0.	0. 0.	16. 7.	7. 0.
4	20.	0. 2. 0.	0. 0. 0.	2. 0.	20. 0.	8. 0.	3. 0.	4. 0.	0. 0.	14. 6.	2. 0.
4	30.	0. 0. 0.	0. 0. 0.	0. 0.	18. 0.	7. 0.	2. 0.	3. 0.	0. 0.	13. 2.	0. 0.
4	40.	0. 0. 0.	0. 0. 0.	0. 0.	16. 0.	6. 0.	0. 0.	2. 0.	0. 0.	11. 0.	0. 0.
4	50.	0. 0. 0.	0. 0. 0.	0. 0.	15. 0.	2. 0.	0. 0.	0. 0.	0. 0.	10. 0.	0. 0.
5	0.	0. 0. 0.	0. 0. 0.	0. 0.	13. 0.	0. 0.	0. 0.	0. 0.	0. 0.	9. 0.	0. 0.
5	10.	0. 0.	0. 0.	0. 0.	12. 0.	0. 0.	0. 0.	0. 0.	0. 0.	8. 0.	0. 0.

		0.	0.								
5	20.	0.	0.	0.	11.	0.	0.	0.	0.	7.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
5	30.	0.	0.	0.	10.	0.	0.	0.	0.	6.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
5	40.	0.	0.	0.	9.	0.	0.	0.	0.	6.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
5	50.	0.	0.	0.	8.	0.	0.	0.	0.	5.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
6	0.	0.	0.	0.	7.	0.	0.	0.	0.	1.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
6	10.	0.	0.	0.	6.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
6	20.	0.	0.	0.	6.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
6	30.	0.	0.	0.	5.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								
6	40.	0.	0.	0.	2.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.								

1

LITTLE DRY CREEK 10-YEAR HYDROLOGY (HYDROGRAPHS GENERATED BY CUHP)
MWE 1986 - WRC PN 2099

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH	LENGTH	INVERT	SIDE SLOPES		OVERBANK/SURCHARGE		JK
					OR DIAM (FT)		(FT)	SLOPE (FT/FT)	HORIZ L	TO VERT R	MANNING N	
14	314	0	4	CHANNEL	1.0	4000.	.0190	6.0	4.0	.065	4.50	0
				OVERFLOW	70.0	4000.	.0190	22.0	22.0	.080	6.00	

314	13	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
13	313	0	4	CHANNEL	1.0	5400.	.0090	10.0	10.0	.060	3.00	0	
				OVERFLOW	150.0	5400.	.0090	30.0	30.0	.060	20.00		
313	336	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
16	316	0	4	CHANNEL	1.0	3300.	.0140	13.0	16.0	.065	3.50	0	
				OVERFLOW	200.0	3300.	.0140	17.0	17.0	.070	20.00		
316	336	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
336	12	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
12	312	0	4	CHANNEL	1.0	4300.	.0100	10.0	10.0	.065	3.00	0	
				OVERFLOW	300.0	4300.	.0100	40.0	40.0	.070	20.00		
312	11	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
11	311	0	4	CHANNEL	5.0	6700.	.0080	3.0	3.0	.060	2.00	0	
				OVERFLOW	300.0	6700.	.0080	25.0	25.0	.065	10.00		
311	381	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
21	321	0	4	CHANNEL	1.0	4900.	.0170	6.0	80.0	.065	3.00	0	
				OVERFLOW	300.0	4900.	.0170	40.0	40.0	.075	10.00		
321	328	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
328	381	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
19	319	0	4	CHANNEL	10.0	2400.	.0130	7.5	7.5	.055	4.00	0	
				OVERFLOW	350.0	2400.	.0130	55.0	55.0	.060	10.00		
319	18	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
18	318	0	4	CHANNEL	40.0	4600.	.0120	7.5	7.5	.065	4.00	0	
				OVERFLOW	350.0	4600.	.0120	55.0	55.0	.070	10.00		
318	328	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
381	10	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
10	310	0	4	CHANNEL	8.0	6000.	.0050	3.0	3.0	.060	2.00	0	
				OVERFLOW	300.0	6000.	.0050	70.0	70.0	.065	7.00		
310	9	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
9	309	0	4	CHANNEL	1.0	6000.	.0080	5.0	5.0	.060	3.50	0	
				OVERFLOW	200.0	6000.	.0080	25.0	25.0	.065	6.50		
309	339	0	3		.0	1.	.0010	.0	.0	.001	10.00	0	
99	199	28	3		.0	1.	.0010	.0	.0	.001	10.00	-1	
		TIME IN HRS VS INFLOW IN CFS											
		.2	.0	.5	3.0	.7	11.0	1.0	139.0	1.2	290.0	1.3	505.0
		1.5	785.0	1.7	1132.0	1.8	1588.0	2.0	2079.0	2.2	2410.0	2.3	2529.0
		2.5	2463.0	2.7	2264.0	2.8	2037.0	3.0	1872.0	3.2	1717.0	3.3	1563.0
		3.5	1421.0	4.0	1061.0	4.5	756.0	5.0	519.0	5.5	355.0	6.0	243.0
		7.0	113.0	8.0	53.0	9.0	25.0	10.0	11.0				
199	8	9	2	PIPE	.0	1.	.0010	.0	.0	.001	10.00	0	
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	.0	116.0	100.0	138.0	260.0	157.0	500.0	174.0	710.0	

[illegible]

316	16	0	0	0.	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	537.6
318	18	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	960.0
319	19	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	780.8
321	21	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	524.8
328	321	318	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1484.8
336	313	316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1715.2
339	309	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7744.0
378	308	198	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	236.8
381	311	328	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3923.2

1
 LITTLE DRY CREEK 10-YEAR HYDROLOGY (HYDROGRAPHS GENERATED BY CUHP)
 MWE 1986 - WRC PN 2099

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENTION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
99	2537.	(DIRECT FLOW)		2 20.
199	168.	.0	415.7	6 30.
14	846.	5.0		0 50.
98	1191.	(DIRECT FLOW)		1 20.
8	168.	2.1		6 50.
314	1482.	(DIRECT FLOW)		0 50.
198	147.	.0	103.8	3 40.
308	476.	(DIRECT FLOW)		0 50.
16	317.	2.6		1 10.
13	800.	3.8		1 10.
378	531.	(DIRECT FLOW)		0 50.
316	377.	(DIRECT FLOW)		1 0.
313	1058.	(DIRECT FLOW)		1 0.
7	313.	4.0		3 20.
19	174.	2.0		1 0.
336	1435.	(DIRECT FLOW)		1 0.
307	942.	(DIRECT FLOW)		1 0.
319	437.	(DIRECT FLOW)		1 0.
12	1038.	3.8		1 30.
6	721.	6.3		1 20.
18	327.	1.9		1 20.

21	135.	1.2	1	10.
312	1156.	(DIRECT FLOW)	1	30.
306	998.	(DIRECT FLOW)	1	20.
318	389.	(DIRECT FLOW)	1	20.
321	280.	(DIRECT FLOW)	1	0.
11	796.	3.0	2	0.
5	843.	5.9	1	40.
328	644.	(DIRECT FLOW)	1	10.
311	859.	(DIRECT FLOW)	2	0.
305	1007.	(DIRECT FLOW)	1	30.
381	1256.	(DIRECT FLOW)	1	40.
4	855.	6.4	2	10.
10	981.	3.3	2	30.
304	943.	(DIRECT FLOW)	2	0.
310	1034.	(DIRECT FLOW)	2	20.
3	885.	4.8	2	20.
9	937.	4.6	3	0.
303	916.	(DIRECT FLOW)	2	20.
309	975.	(DIRECT FLOW)	2	50.
339	1845.	(DIRECT FLOW)	2	40.
2	1824.	6.2	2	50.
302	1872.	(DIRECT FLOW)	2	50.
1	1865.	8.0	2	50.
301	1922.	(DIRECT FLOW)	2	50.

APPENDIX E
TECHNICAL APPENDIX

**HOLLY DAM RESERVOIR
STORAGE-DISCHARGE RELATIONSHIP**

WATER SURFACE ELEVATION FEET	STORAGE AC.-FT.	OUTLET DISCHARGE CFS	SPILLWAY DISCHARGE CFS	TOTAL DISCHARGE CFS
5537	0.0	0.0		0.0
5540	3.0	58.0		58.0
5545	10.0	94.7		94.7
5550	24.0	120.7		120.7
5555	82.5	142.1		142.1
5561	185.0	164.1		164.1
5563	235.0	170.8		170.8
5564	250.0	174.0	810.0	984.0
5565	276.0	177.2	2291.0	2468.2
5566	302.0	180.3	4208.9	4389.2
5567	330.0	183.4	6480.0	6663.4
5568	355.0	186.5	9056.1	9242.5
5569	390.0	189.4	11904.5	12094.0
5570.2	425.0	193.0	15648.9	15841.9

VALUES BASED ON HYDROLOGIC DATA AND AREA-
CAPACITY CURVE FROM HOLLY DAM CONSTRUCTION PLANS
PREPARED BY McCALL-ELLINGSON & MORRILL, INC., JULY 1975.

Co=0.65
A=6.42 SF
OUTLET ELEV. = 5537

SPILLWAY CREST ELEV.=5563
SPILLWAY LENGTH=270'
Cw=3.0

**ENGLEWOOD DAM RESERVOIR
STORAGE-DISCHARGE RELATIONSHIP**

WATER SURFACE ELEVATION FEET	STORAGE AC.-FT.	DISCHARGE CFS
5563	0.0	0.0
5575	0.0	116.0
5580	100.0	138.1
5585	260.0	157.1
5590	500.0	174.0
5595	710.0	189.4
5600	1120.0	203.7
5605	1600.0	217.0
5607	1710.0	222.1

VALUES BASED ON HYDROLOGIC DATA AND AREA-
CAPACITY CURVE FROM ENGLEWOOD DAM CONSTRUCTION PLANS
PREPARED BY McCALL-ELLINGSON & MORRILL, INC., AUGUST 1974

Co=0.65
A=6.05 SF
OUTLET ELEV. = 5563

SPILLWAY CREST ELEV.=5607
SPILLWAY LENGTH=300'

LITTLE DRY CREEK FHAD HYDROLOGY
INFLOW HYDROGRAPH TO ENGLEWOOD DAM

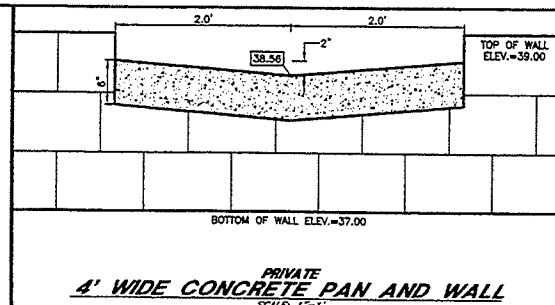
TIME (MIN.)	TIME (HR.)	Q10	Q100	Q500	Q50
10	0.2	0	0	0	0
30	0.5	3	6	11	5
40	0.7	11	22	73	19
60	1.0	139	279	578	241
70	1.2	290	583	1042	504
80	1.3	505	1015	1684	878
90	1.5	785	1579	2497	1366
100	1.7	1132	2280	3587	1972
110	1.8	1588	3199	4843	2767
120	2.0	2079	4186	5832	3621
130	2.2	2410	4848	6371	4195
140	2.3	2529	5080	6428	4396
150	2.5	2463	4931	6065	4269
160	2.7	2264	4500	5524	3901
170	2.8	2037	4011	5048	3482
180	3.0	1872	3638	4587	3165
190	3.2	1717	3293	4143	2871
200	3.3	1563	2958	3734	2584
210	3.5	1421	2655	3357	2324
240	4.0	1061	1914	2417	1685
270	4.5	756	1343	1687	1186
300	5.0	519	920	1155	813
330	5.5	355	629	790	556
360	6.0	243	430	540	380
420	7.0	113	201	253	177
480	8.0	53	94	118	83
540	9.0	25	44	55	39
600	10.0	11	20	25	18

Note: Inflow Hydrographs obtained from McLaughlin Water Engineers
1984 CLOMR. Q50 Inflow Hydrographs were not available, values
interpolated between Q10 and Q100 based on rainfall depth.
P10=2.00, P50=2.71, P100=2.97.
 $Q50=((.71/.97)*(Q100-Q10))+Q10$

LITTLE DRY CREEK FHAD HYDROLOGY
INFLOW HYDROGRAPH TO HOLLY DAM

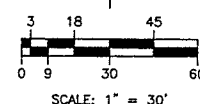
TIME (MIN.)	TIME (HR.)	Q10	Q100	Q500	Q50
10	0.2	0	0	1	0
30	0.5	19	36	69	31
40	0.7	70	125	331	110
60	1.0	565	1028	1887	904
70	1.2	979	1801	2510	1581
80	1.3	1179	2186	2565	1916
90	1.5	1101	2045	2313	1792
100	1.7	928	1717	1983	1506
110	1.8	777	1417	1664	1245
120	2.0	656	1169	1404	1031
150	2.5	424	691	862	619
180	3.0	292	435	546	397
210	3.5	184	261	316	240
240	4.0	93	131	159	121
300	5.0	22	31	31	29
360	6.0	3	4	4	4

Note: Inflow Hydrographs obtained from McLaughlin Water Engineers
1984 CLOMR. Q50 Inflow Hydrographs were not available, values
interpolated between Q10 and Q100 based on rainfall depth.
P10=2.00, P50=2.71, P100=2.97.
 $Q50=((.71/.97)*(Q100-Q10))+Q10$



1. ALL ON-SITE STORM SEWER IS PRIVATE UNLESS NOTED OTHERWISE.
2. PIPE DIMENSIONS ARE FROM CENTER TO CENTER OF MANHOLES AND THE INSIDE FACE OF INLETS.

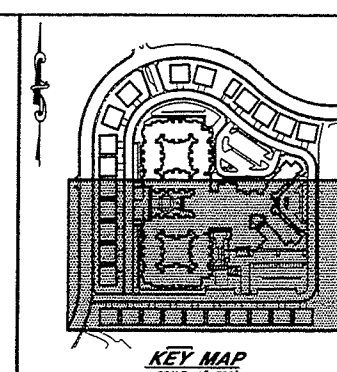
ARAPAHOE COUNTY BENCHMARK NO. 99. A CHISELED SQUARE SET ON THE TOP OF CURB ON THE NORTH SIDE OF SOUTH FOREST WAY, 27 FEET WEST OF SOUTH HOLLY STREET.
ELEVATION: 5540.94 (1929 NGVD)



LEGEND

- • • • • PROPOSED BASIN BOUNDARY
- ===== PROPOSED 2' "CATCH" CURB AND GUTTER
- ===== PROPOSED 1' "SPILL" CURB AND GUTTER
- 5500----- EXISTING CONTOUR LINE
- 5500----- PROPOSED CONTOUR LINE
- ===== PROPOSED STORM SEWER LINE
-  DESIGN POINT
-  BASIN DESIGNATION
BASIN AREA IN ACRES
-  FLOW ARROW

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	1.46	3.33
2	1.67	3.81
3	2.76	3.77
4	0.40	1.04
5	1.94	4.25
6	0.89	1.79
7	0.58	1.16
8	2.87	6.28
9	0.39	0.78
10	2.74	5.64
11	0.64	1.39
12	0.62	1.41
13	2.29	4.59
14	0.23	0.90
15	1.14	2.78
16	0.46	1.06
17	0.15	0.42
18	2.74	5.93
19	4.71	9.95
20	1.67	3.61
21	1.89	3.99
22	0.78	2.07
23	4.44	9.95
24	0.53	1.25



**BEFORE YOU DIG
CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987**

REVISIONS			
D.	DESCRIPTION	DATE	BY
1	UNFCO COMMENTS	8-07-02	RHY
2	UNFCO COMMENTS	12-13-02	RHY



Engineering Service Company
1500 South Polkman Street, Suite 128
Phone: (303) 337-1993 Fax: (303) 337-7481
engineers - surveyors

THOMAS J. TESTERMAN, ARCHITECT
architects • planners

THE CHRISTIAN LIVING CAMPUS
1000 EAST ARAPAHOE ROAD
DENVER, COLORADO 80218

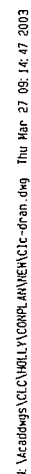
PREPARED BY: _____

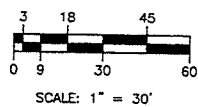
DATE: _____

ORGANIZER'S SEAL: _____

DESIGNED BY: RMY
DRAWN BY: JDP
CHECKED BY: RMY
DRAWER NUMBER: CP-193
DATE: 01-07-2002
SCALE: 1"=30'

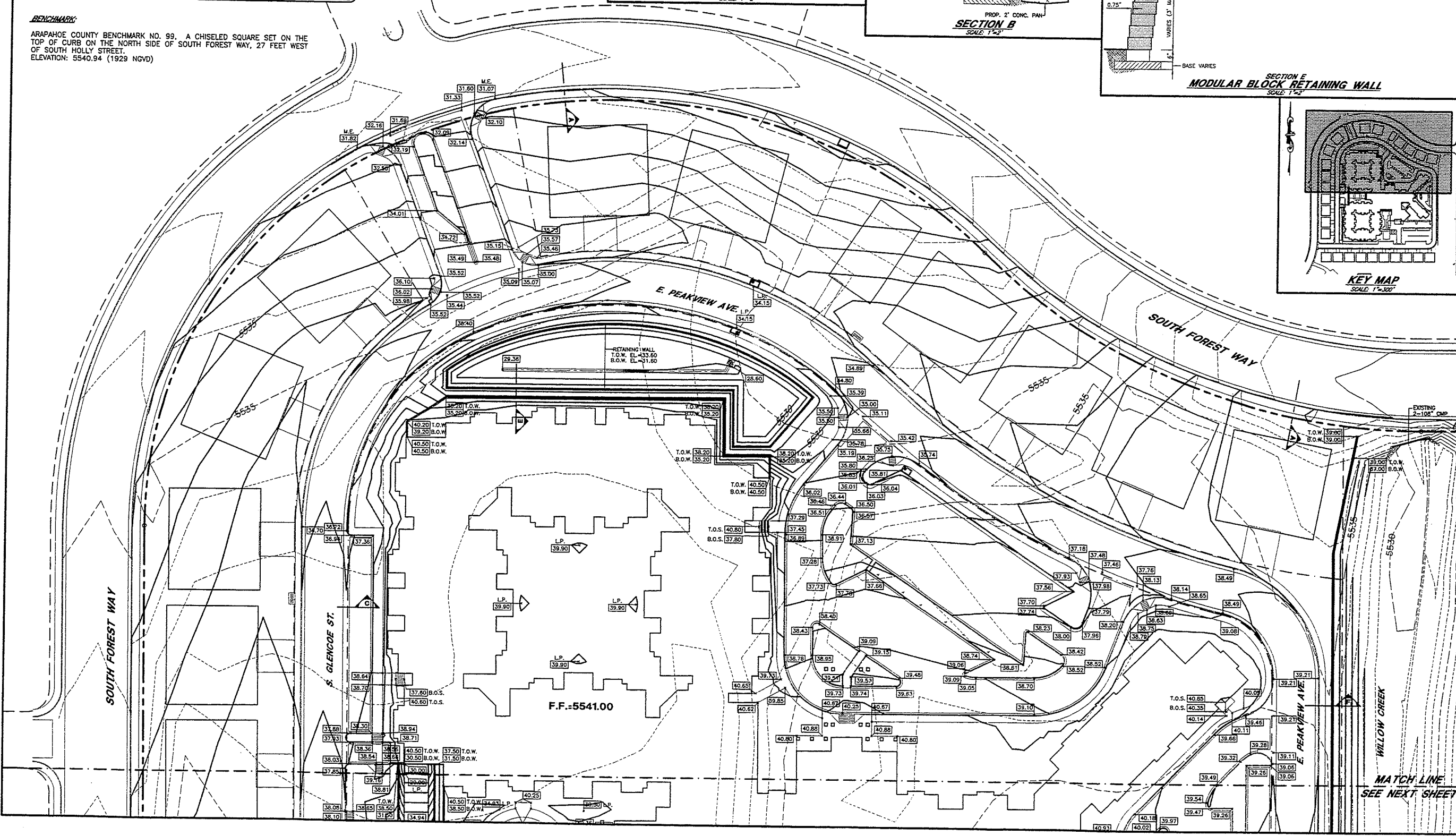
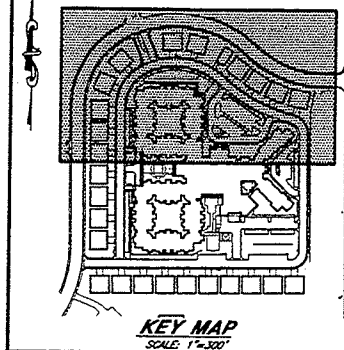
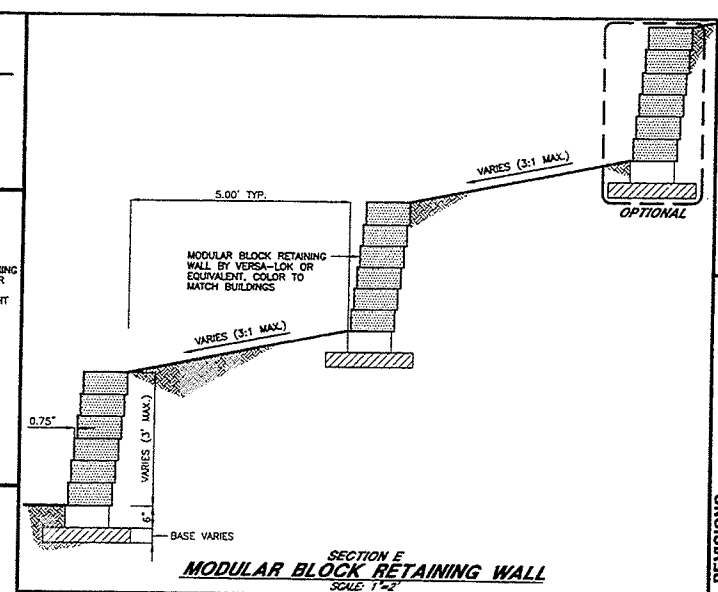
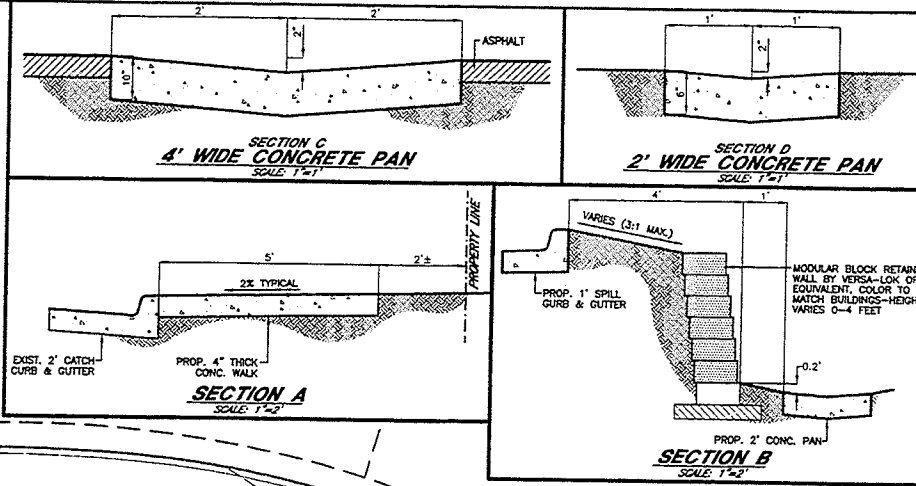
02





- LEGEND**
- PROPOSED 2'-"CATCH" CURB AND GUTTER
 - PROPOSED 1'-"SPILL" CURB AND GUTTER
 - EXISTING CONTOUR LINE
 - PROPOSED CONTOUR LINE
 - PROPOSED ELEVATION
 - B.O.S. BOTTOM OF STAIRS
 - L.P. LOW POINT
 - G.B. GRADE BREAK
 - H.P. HIGH POINT
 - M.E. MATCH EXISTING
 - B.O.W. BOTTOM OF WALL
 - T.O.W. TOP OF WALL
 - T.O.S. TOP OF STAIRS

BENCHMARK:
ARAPAHOE COUNTY BENCHMARK NO. 99. A CHISELED SQUARE SET ON THE TOP OF CURB ON THE NORTH SIDE OF SOUTH FOREST WAY, 27 FEET WEST OF SOUTH HOLLY STREET.
ELEVATION: 5540.94 (1929 NGVD)



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CENTER OF COLORADO
1-800-922-1987**

REVISIONS

NO.	DATE	DESCRIPTION
1	8-07-02	UTCD COMMENTS
2	12-13-02	UTCD COMMENTS

ENGINEER'S SEAL

DESIGNED BY: RHY
DRAWN BY: JOP
CHECKED BY: RHY
DRAWER NUMBER: CP-193
DATE: 01-07-2002
SCALE: 1"=30'
SHEET NUMBER: C4

GRADING PLAN - A CHRISTIAN LIVING CAMPUS
LOTE 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 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