City ENGINEERING
check-out Copy #3

MESA DRAINAGE STUDY

CITY of COLORADO SPRINGS, COLORADO

June 1976

prepared by · parker & associates denver
· engineering · planning · architecture · photogrammetry ·

CITY OF COLORADO SPRINGS
COLORADO

INTEROFFICE MEMORANDUM

DATE: August 10, 1989

TO: Chris Smith, Subdivision Administrator

FROM: Gary R. Haynes, City Engineer

SUBJECT: MESA DRAINAGE BASIN - SONDERMAN PARK EXCLUSION FROM THE BASIN

The Mesa Drainage Basin Master Plan was revised in 1986 and approved by City Council on March 31, 1986. Recently, a question has risen about the status of Sonderman Park and the payment of drainage fees. In reviewing the fee computation section of the master report, I find it somewhat vague as to the exclusion of the land for Sonderman Park, approximately 95 acres. The intent of the master plan was to exclude Sonderman Park from the drainage basin fee computation due to the fact that it is a natural area and development in the park would be minimal plus the Park and Recreation Department has agreed to maintain the drainage system through the park as it presently exists and improvements will not be necessary to the drainage system through the park.

In summary, the 785 acres used in the fee calculation do not include the acreage for Sonderman Park. Therefore, Sonderman Park land is not subject to drainage fees. Please alert your staff and file this memorandum conspicuously in all files and reports for the Mesa Drainage Basin Master Plan.

Gary R. Haynes
City Engineer

GRH/njh

cc: DeWitt Miller, Director of Public Works
Nancy Lewis, Director of Park and Recreation
Bruce A. Thorson, Assistant City Engineer
Bev Dustin, Land Development Specialist
Bill Ruskin, Park and Recreation Superintendent of Planning

b:gary14.94

PARKER & ASSOCIATES CONSULTING ENGINEERS

255 YUMA STREET DENVER, COLORADO 80223 PHONE 744-1401

June 16, 1976

Mr. Donell Jeffries
City Engineer
City of Colorado Springs
P.O. Box 1575
Municipal Building
Colorado Springs, Colo. 80901

Dear Sir:

We are pleased to submit, herewith, our final report pertinent to drainage improvements in the Mesa Basin. This work has been completed in accordance with our authorization from the City of Colorado Springs.

During the course of the work, field investigations and studies were carried out regarding existing situations. Numerous consultations were held with state and local officials regarding all aspects of the Project. Several design alternatives were considered before arriving at a final solution.

Based upon the foregoing, final designs and evaluations were prepared to establish a sound program of proposed improvements. Estimated costs for the improvements were computed on a per acre basis for the undevelopes areas.

The recommendations shown on the report represent appropriate courses of action based upon the facts presented. There are, however, numerous variations which may be considered by city officials.

We would like to express our appreciation to the City of Colorado Springs for their assistance during the preparation of this report.

Respectfully submitted,

Parker & Associates

William F. Parker, Jr.
President

David A. Henney
Project Engineer

MESA DRAINAGE STUDY

PREPARED FOR:

COLORADO SPRINGS, COLORADO

PREPARED BY:

PARKER & ASSOCIATES, INC.
CONSULTING ENGINEERS
255 YUMA STREET
DENVER, COLORADO 80223

June, 1976

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SECTION I

GENERAL INFORMATION

PURPOSE AND SCOPE

The Mesa Drainage area is a sparsely developed portion of Colorado Springs. Much of the area consists of steep slopes and numerous natural drainage channels. Due to many unique features of the area, major future growth is certain to occur.

Appropriate zoning has been provided for the area to insure proper land use in conformance with the area's natural features. The provision of proper drainage planning and facilities will materially assist in sound development of the area.

It is the basic purpose of this report to provide a "Master Plan" for required future drainage facilities for the area. Further, the report has determined cost data and economic analysis pertinent to future required drainage facilities.

There are currently some drainage facilities within the area. They are, for the most part, culverts and short sections of drainage conduit used to transport drainage flows under major facilities such as highways, railroads, etc. As such, they were designed to solve a specific and isolated drainage problem.

Ultimate drainage of the area must be accomplished through maximum utilization of natural drainage patterns. Future land use, ground slopes, geological conditions and numerous other factors effect the ultimate drainage problem. This report has attempted to properly analyze all of these factors and to develop an economically sound and adequate "Master Plan" of drainage improvements.

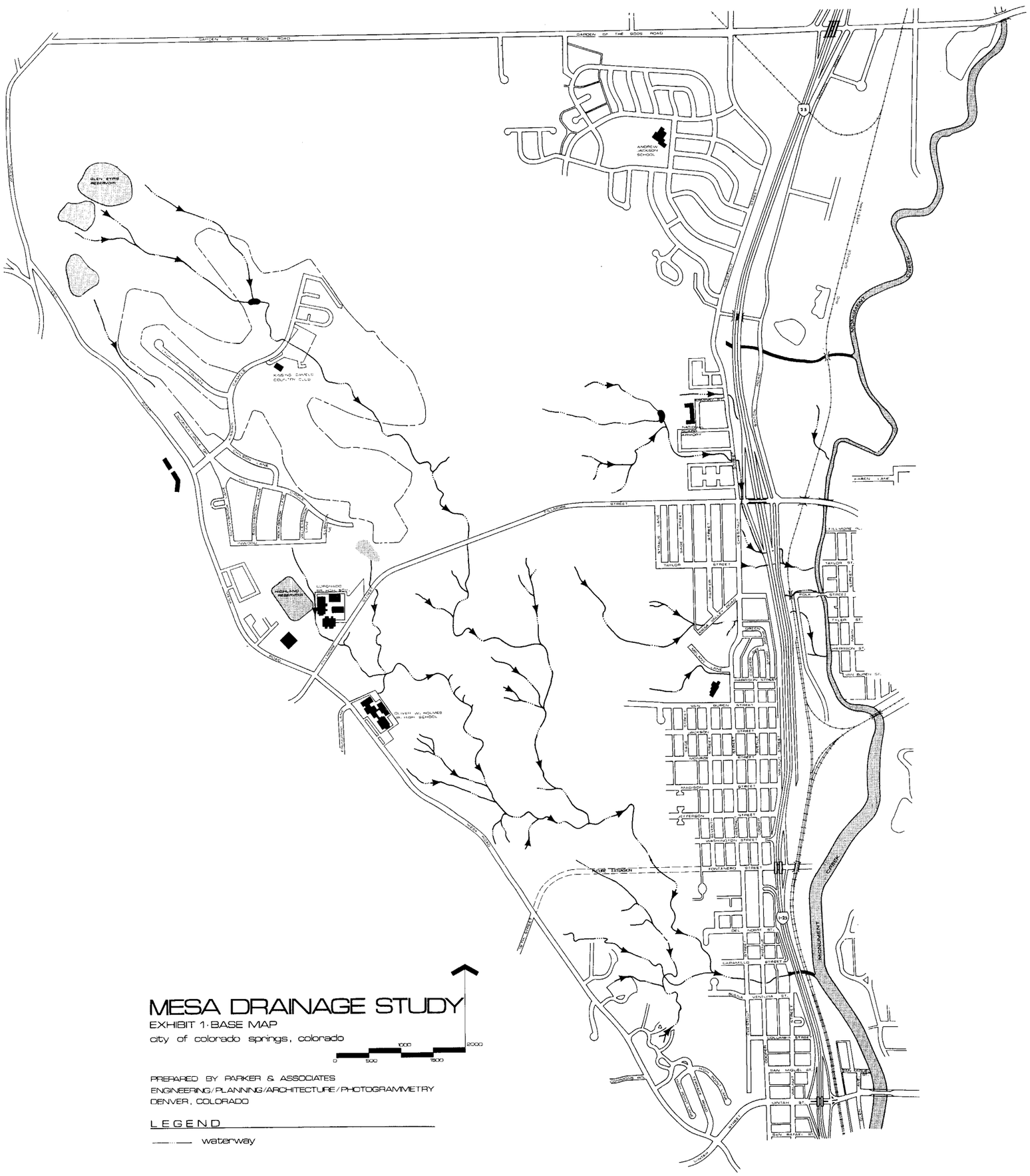
BASIN DESCRIPTION

The Mesa drainage basin consists of approximately 2,100 acres of land lying in the northwestern portion of Colorado Springs. All drainage from the area ultimately enters Monument Creek. Interstate Highway 25 lies immediately adjacent to Monument Creek and all drainage flows from the Mesa area must be conveyed under the highway.

The drainage basin lies within the area bounded on the north by Garden of the Gods Road, on the west by Mesa Road, on the south by Uintah Street, and on the east by Monument Creek. More particularly, it includes portions of Sections 25, 26, 27, 34, and 36, Township 13 South, Range 67 West; Sections 1, 2, and 12, Township 14 South, Range 67 West; Section 31, Township 13 South, Range 66 West; and Sections 6 and 7, Township 14 South, Range 66 West.

Current development within the area is sparse. In the lower areas, well established development has occurred. This development has been provided primarily in rectangular block patterns without regard to natural drainage features. The developed area is primarily adjacent to Interstate Highway 25.

The Kissing Camels Golf Course is located in the upper reaches of the basin. In the areas adjacent to the Golf Course some residential development has occurred. Other development is currently planned and certain to materialize in the near future.



MESA DRAINAGE STUDY

EXHIBIT 1-BASE MAP

city of colorado springs, colorado

0 500 1000 2000

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DENVER, COLORADO

LEGEND

waterway

The land areas in between the Golf Course and Interstate Highway 25 have undergone limited development. With the development of a sound drainage program, the need for available land will lead to increased development of this area. Exhibit No. 1, Base Map, shows the basic configuration of natural drainage channels in the area. The main channel of the basin forms a type of "Y" configuration. Reconnaissance of the area reveals that the creek bed has cut deep "gullies" in many areas. The worst conditions are on the easterly leg of the "Y" just before the two upper reaches join and in the main channel below the junction of the upper channels.

The well-defined channel has water flowing in it all year. The year-round flow originates from two primary sources. A series of springs located adjacent to Fillmore Street is the largest contributor. The easterly reach of the "Y" derives all of its flow by spring water. A sizeable bed of springs surfaces in the upper reaches of the ditch on the south side of Fillmore Street.

The westerly branch of the "Y" derives its water from two different sources. Some spring water feeds into this branch from springs that surface on the southeast side of Fillmore Street in the Coronado High School area. The other source of water is the Mesa Water Filtration Plant owned by the City. The concrete reservoirs at the Mesa Plant leak to some extent. This leakage water converges into a stream and flows under Fillmore Street into the southern branch of the "Y".

Much of the creek basin has been abused by the general public in using the area as a dumping ground. Numerous old car bodies, stoves, washing machines, etc. litter the creek and surrounding area.

In some areas, serious erosion has occurred due to the numerous bike and jeep trails that traverse the area. When use of these trails wears off the existing vegetation, they form natural drainage ways for further erosion.

The native vegetation in the area is sparse. Special care will have to be taken in the development of the area in order to maintain the steep slopes common to the area. If these slopes are denuded of native vegetation, or use as fill areas, severe erosion will result.

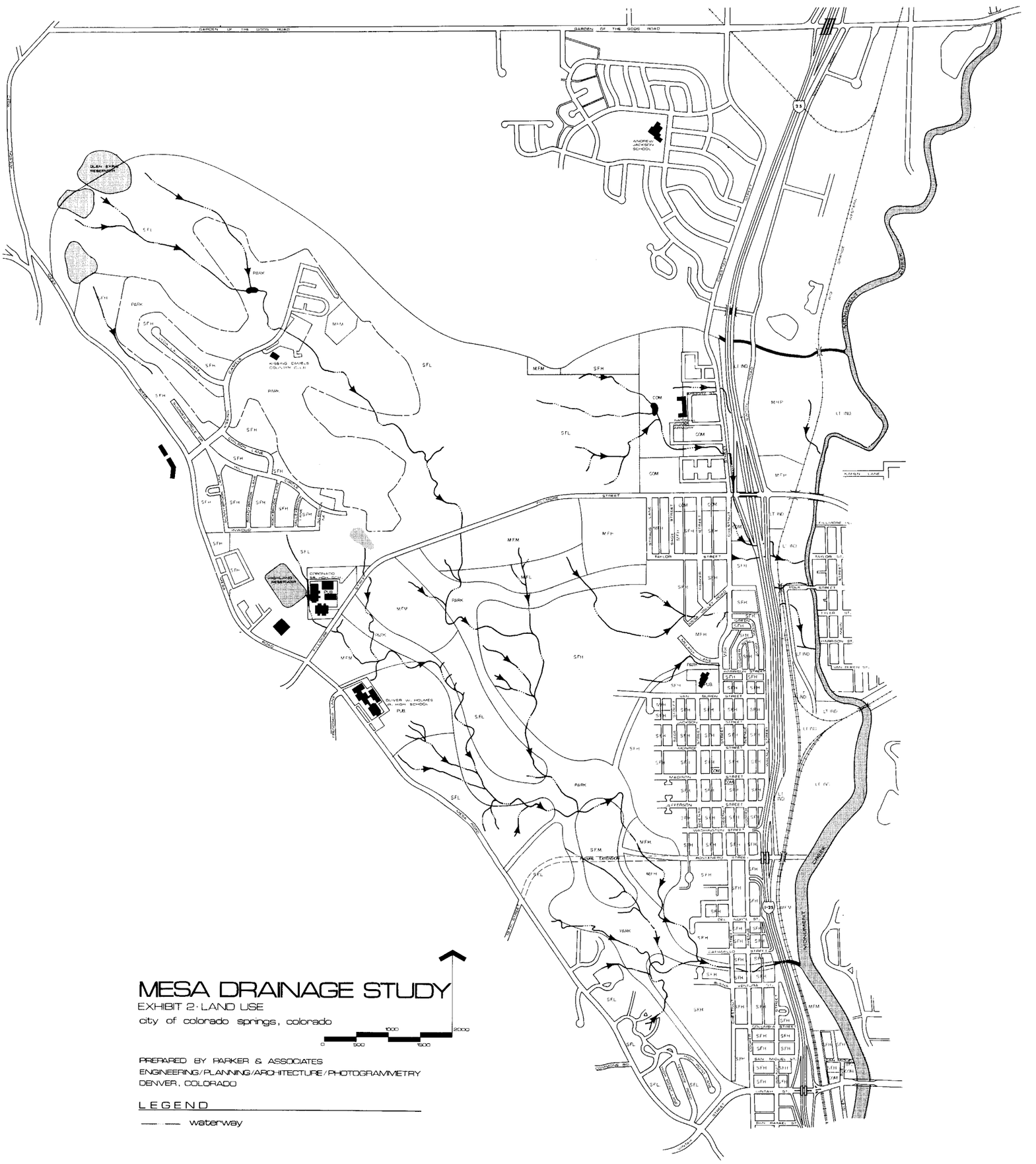
LAND USE

The actual land use of an area has a major effect on the drainage problems to be encountered. Land use for the Mesa Drainage Study has been determined from data provided by the City of Colorado Springs Planning Department.

The land use information provides basic ground cover information and relationships as to the percent of pervious or impervious areas. This data, when coordinated with soil types, provides design information for storm water runoff calculations.

Exhibit No. 2, Land Use, is shown on page 6 of this report. This data reflects anticipated future land use conditions. A tabulation of the acreage in each land use classification is shown in Table No. 1 on page 7.

Storm water runoff determinations are based upon land use, land cover, and other related factors. This data has been classified for use in subsequent calculations as shown in Table No. 1.


GARDEN OF THE GODS ROAD
ANDREW JACKSON SCHOOL
SFL
PARK
SFH
MFM
MFH
COM
LT IND
KISSING CAMELS COUNTRY CLUB
HIGHLAND RESERVOIR
CORONADO SENIOR HIGH SCHOOL
OLIVER W. HOLMES JR. HIGH SCHOOL
PUB
TAYLOR STREET
MADISON STREET
JEFFERSON STREET
WASHINGTON STREET
KIOWA CREEK
MONUMENT CREEK
MESA DRAINAGE STUDY
EXHIBIT 2: LAND USE
city of colorado springs, colorado
0
500
1000
2000
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ENGINEERING/PLANNING/ARCHITECTURE/PHOTOGRAMMETRY
DENVER, COLORADO
LEGEND
waterway

TABLE NO. 1

LAND USE AREAS

	AREA ACRES	PER CENT
SINGLE FAMILY RESIDENTIAL		
Low Density (1-2 units/acre)	653	31.2
Medium Density (2-3 units/acre)	25	1.2
High Density (3-6 units/acre)	472	22.5
MULTI-FAMILY RESIDENTIAL		
Low Density (2-10 units/acre)	19	0.9
Medium Density (6-15 units/acre)	90	4.3
High Density (6-25 units/acre)	113	5.4
COMMERCIAL	130	6.2
PARK	368	17.6
SCHOOL	54	2.6
LIGHT INDUSTRIAL	136	6.5
MOBILE HOME PARK	34	1.6
MESA BASIN	2,094	100.0

SOILS DATA

Soil types within a drainage area have a marked effect on the quantity of runoff waters. The more impervious the soil, the greater the quantity of runoff.

Mesa Basin soil classification was secured with major assistance from the Soil Conservation Service. Soil types were classified by Hydrologic Groups for design purposes.

The soils identified in the Mesa Basin are as follows:

RB-2: Hilly, gravelly land and Samsil soils. The RB-2 land type is an association of Samsil soils and gravelly, cobbly material over shale. The Samsil series consists of light colored, calcareous, clayey soils over shale at a depth of 20 inches or less. The gravelly, cobbly material is 30% to 70% coarse fragments and may extend to a depth of 1 foot to 30 feet over shale.

I4-C: Unnamed Series

This is a well drained, deep, loamy soil formed in sandy alluvium. Slopes range from 3% to 8%. The surface layer is a loam with thickness varying from 4 to 10 inches. The subsoil, 20 to 35 inches thick, is a clay loam or sandy clay loam. The underlying material is a sandy loam. In some places material ranging from gravel to shale may occur below 40".

XA1-AB: Loamy Alluvial

Loamy Alluvial land consists of deep soils on slightly raised flood plains. Stratification is common throughout the soil profile. Textures range from sandy loam to clay loam in the top 20 to 40 inches. The underlying material ranges from loamy sand to clay loam. Among some of the larger drainages, gravel and cobble may occur at lower depths. Ground water tables are usually below five (5) feet.

A7-B: Heldt Series

The Heldt series consists of deep, light colored, calcareous, clayey soils on alluvial fans and valley side slopes. The profile ranges from silty clay loam to clay. The surface layer is 2 to 6 inches thick. The material underlying the subsoil extends to 60 inches or more. Cracks are common in this soil when dry.

S9-C: Keith Series

The Keith series consists of deep, well drained, loamy soils on the uplands. The loam or silt loam surface layer ranges from 4 to 8 inches thick. The subsoil is about 24 to 54 inches thick and is a clay loam or silty clay loam. The loamy material underlying the subsoil extends to a depth of 60 inches or more.

Q-9: Chaseveille Series

The Chaseveille series consists of somewhat excessively drained

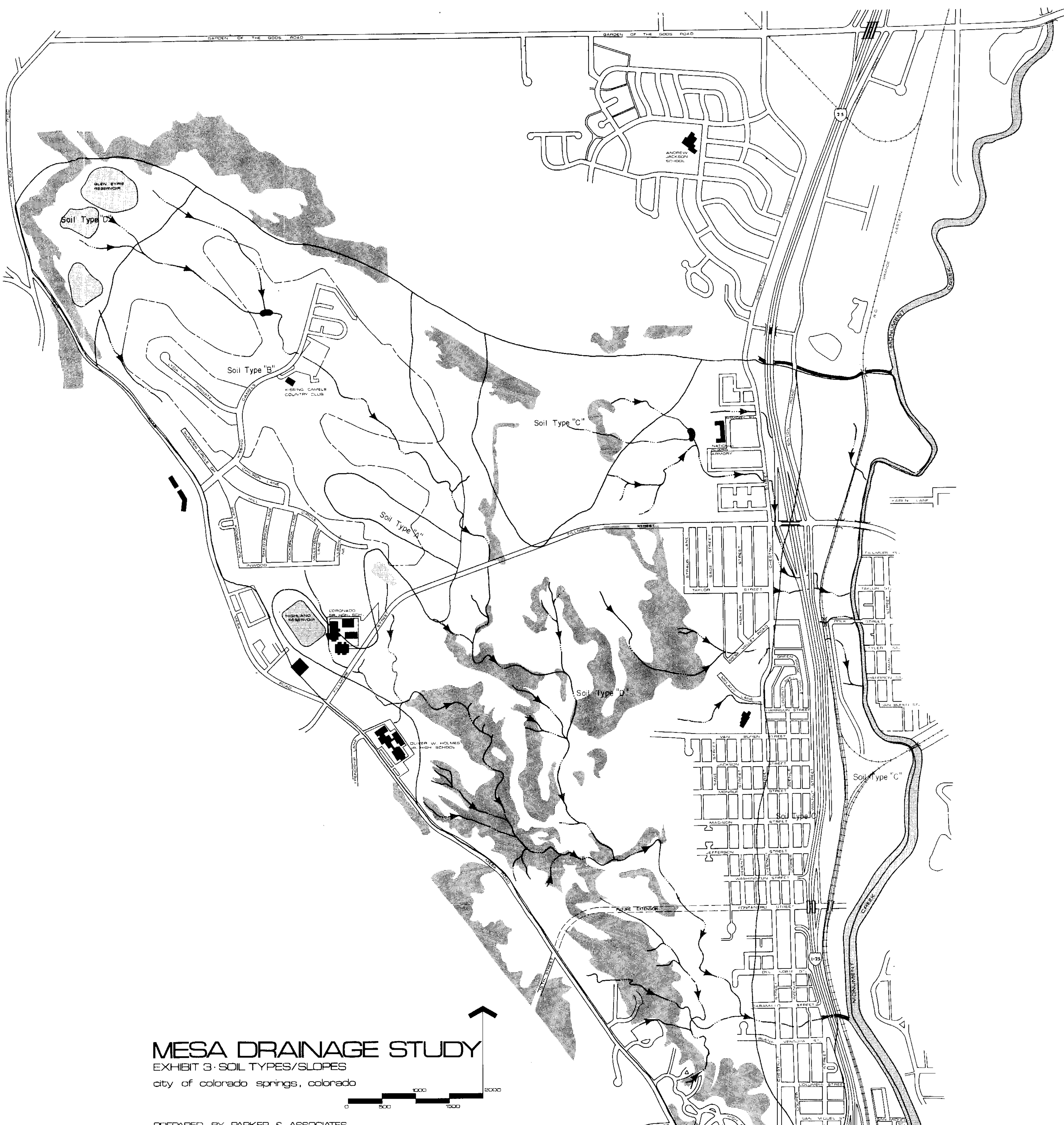
soils formed in sandy alluvial materials. Slopes range from 0 to 3%. The surface layer, ranging about 6 to 20 inches thick, is a sandy loam to gravelly sandy loam. The material underlying the surface layer is a gravelly light sandy loam to very gravelly loamy sand extending to 60 inches or more.

The Soil Conservation classification data has been converted into hydrologic groups and is shown in Table No. 2 below.

Table No. 2
Hydrologic Soil Groups

Soil Conservation Classification	Hydrologic Soil Group
Q9	"A"
I4-C	"B"
S9-C	"B"
A7-B	"C"
XA1-AB	"C"
RB-2	"D"

Exhibit No. 3, Soil Types/Slopes, following page 10, shows the hydrologic soil groups for the Mesa Basin. The area for each group is shown in Table No. 3 on page 12.



MESA DRAINAGE STUDY

EXHIBIT 3 · SOIL TYPES/SLOPES

city of colorado springs, colorado

0 500 1000 1500 2000

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DENVER, COLORADO

LEGEND

waterway

min. 30% slope

Table No. 3
Area and Percentage of
Hydrologic Soil Groups

Hydrologic Soil Group	Acres	Percent of Acre
A	24	1.13
B	633	30.25
C	414	19.77
D	1023	48.85

FUTURE PLANNING

Consultation was held with personnel from the City of Colorado Springs Planning Department and Parks and Recreation Department. This consultation was held to determine the desired future plans for the Mesa area. In so doing, the drainage "Master Plan" can be tailored to the extent possible to fit planning, parks and recreation needs.

The planning department desires to place the lower drainage areas into park property. The Mesa contains a significant amount of land with slopes in excess of 30 percent. The City wishes to have no building of any type placed on these slopes. Exhibit No. 3 shows the location and general size of all slopes exceeding 30 percent.

It is suggested that development criteria will prohibit any dumping of

fill or debris in the area. The "leveling" of hills to increase land usage should be avoided.

A major concern of all parties contacted was the preservation of the Mesa basin in a state of optimum balance between natural conditions and adequate erosion control measures. Where it was determined that erosion control was necessary, primary consideration was given to channel protection which altered natural conditions minimally.

Parks and recreation personnel hope to have a large park and recreation area along the drainage channel immediately west of the existing housing area. This area could be used for ball fields and similar recreation interests.

Green belts could be provided along the drainage channels extending to the northwest. These areas could be used as access routes and could accomodate "bike paths".

ELEVATION DATA

In order to secure adequate planimetric and elevation data for design analysis, aerial mapping was developed for the Mesa Basin. This mapping consisted of 100 scale, 2' contour maps for the area. In areas of steep slopes, contour intervals were varied to fit the situation required.

SECTION II

DESIGN INFORMATION

SUB-BASIN CONFIGURATION

The drainage from the Mesa Basin occurs through numerous drainage channels. This results from numerous "man made" drainage paths due to culvert locations, existing residential development, the Interstate Highway and other factors. As a result, the area has been divided into one hundred (100) drainage sub-basins for analysis. The major drainage area is along the westerly side of the Mesa Basin and includes thirty-eight (38) sub-basins. (See Exhibit 5)

Exhibit No's. 9, 10, and 11, provide a schematic flow pattern for all sub-basin flows. These Exhibits are shown following page 52. Basic information on each sub-basin is provided in Table No. 4.

The information shown in Table No. 4 includes the area of each sub-basin, the length of drainage channel and the elevation differential of the sub-basin. Also shown is the Curve Number (CN) used in determining the direct runoff from each sub-basin. The procedure for determining Curve Numbers will be explained under the section on Design Criteria.

EXISTING DRAINAGE FACILITIES

There are many existing drainage facilities located within the Mesa Basin. Where possible, all existing drainage facilities were field checked to determine dimensions and to determine their physical condition for incorporation in the required facilities. Exhibit No. 4, Existing Drainage

Structures, following page 34, shows the location and size of the existing units. Table No. 5, Existing Drainage Structures, shows the size, location, and capacity of all existing drainage units. In some cases, capacities could not be determined due to inability to determine either size or slope of the existing unit.

DESIGN CRITERIA

Design criteria used for this study was in basic conformance with the standards established by the City of Colorado Springs.

A modified synthetic hydrograph method was used to determine flows in most sub basins which were then summed to develop composite hydrographs for combined basin flow. The rational method was limited in use to very small basins and evaluation of storm sewers in some developed areas.

The Unit Hydrograph used herein conforms to the following:

$$q_p = \frac{484\ AQ}{T_p}$$

$$T_c = \left(\frac{11.9L^3}{H}\right) 0.385$$

$$T_p = \frac{D}{2} = 0.6\ T_c$$

$$T_b = 2.67\ T_p$$

In the above formula, the following definitions apply:

q_p = peak flow in cfs

A = basin area in square miles

Q = basin runoff in inches

T_p = peak time of the hydrograph

D = time of excess tainfall

Tc = time of concentration

T_b = time to end of runoff

Criteria for Storm Intensity is taken from the City of Colorado Springs, Criteria for Drainage Reports and Storm Sewer Systems, Section 4 (A), "Storm Intensity". The values given here define the intensity of a 50 year storm as two inches (2") in one (1) hour, and the intensity of a 100 year storm as three inches (3") in one (1) hour. The storm distribution has been taken from "Typical Storm Distribution Curves for Convective Storms".

The determination of Curve Numbers has been based on data provided by the Bureau of Reclamation's book, "Design of Small Dams".

In determining the overall sub-basin curve number, the percentage of each soil type in the sub-basin was determined. This percentage was then multiplied by the applicable Curve Number to obtain the sub-basin Curve Number.

The Time of Concentration was obtained from the Soil Conservation Service, "Nomograph to Determine Time of Concentration in Colorado".

HYDROGRAPHS

A tabulation of Synthetic Hydrograph Calculations is shown in Table No. 6. These values are provided for all sub-basins with areas in excess of twenty (20) acres.

Table No. 4
Sub-Basin Characteristics

Sub-Basin Number	Area In Square Miles	Channel Length In Feet	Elevation Difference In Feet	Curve Number
1	0.0577	2700	96	85
2	0.1108	2200	55	87
3	0.0559	1140	24	79
4	0.204	4645	112	83
5	0.0855	1630	64	84
6	0.1470	4905	177	78
7	0.0348	1900	53	84
8	0.0667	3830	120	90
9	0.134	3900	96	89
10	0.0334	1190	30	87
11	0.0382	1590	46	89
12	0.0326	600	9	89
13	0.110	3630	223	90
14	0.0242	1520	104	90
15	0.0492	1740	100	95
16	0.0815	1210	52	92
17	0.0717	2715	66	88
18	0.0399	1700	72	88

Table No. 4 con't

Sub-Basin Number	Area In Square Miles	Channel Length In Feet	Elevation Difference In Feet	Curve Number
19	0.769	2830	95	84
20	0.0611	2692	145	79
21	0.0238	1250	135	92
22	0.0465	1900	131	86
23	0.0784	1750	164	91
24	0.0505	2750	172	92
25	0.1082	1330	166	92
26	0.0226	1040	65	89
27	0.0178	630	50	87
28	0.0028	480	165	78
29	0.0682	2400	60	83
30	0.0533	1660	48	89
31	0.0881	1135	55	92
32	0.0766	2570	91	94
33	0.0769	3760	182	84
34	0.0584	3230	170	87
35	0.0963	2710	40	89
36	0.130	2160	23	96
37	0.0434	1590	157	87
38	0.0039	630	1	77

Table No. 4 con't

Sub-Basin Number	Area In Square Miles	Channel Length in Feet	Elevation Difference in Feet	Curve Number
39	0.0253	1970	45	92
40	0.0370	2270	95	91
41	0.0274	1410	129	93
42	0.0374	1410	129	89
43	0.0088	230	13	93
44	0.0350	1610	108	96
45	0.0488	750	13	95
46	0.0184	150	2	95
47	0.0200	170	1	95
48	0.0155	620	20	95
49	0.00178	730	7	95
50	0.00121	450	7	95
51	0.00075	310	8	95
52	0.00545	1360	24	92
53	0.00409	830	23	92
**54	0.00034			
55	0.00085	330	12	95
56	0.00164	100	5	93
57	0.00167	1070	3	93
58	0.01270	1070	12	92

Table No. 4 con't

Sub-Basin Number	Area In Square Miles	Channel Length in Feet	Elevation Difference in Feet	Curve Number
59	0.01270	1070	12	91
60	0.00280	250	2	95
61	0.00199	150	3	92
62	0.00136	410	8	95
63	0.00170	700	6	95
64	0.00162	500	4	95
65	0.02520	2850	38	92
66A	0.02230	870	10	95
66B	0.01230	830	10	86
66C	0.01200	850	13	83
66D	0.00340	500	8	83
**68	0.0117			
69	0.00177	100	0.5	89
70	0.00160	100	1	93
71	0.00202	400	4	93
72	0.00541	1100	13	93
73	0.0374	790	16	93
74	0.00275	860	20	90
75	0.00835	1230	37	91
76	0.00129	100	1	91

Table No. 4 con't.

Sub-Basin Number	Area In Square Miles	Channel Length in Feet	Elevation Difference in Feet	Curve Number
77	0.00206	200	1	93
78	0.00409	250	2	90
79	0.00136	50	2	89
80	0.00165	50	3	90
81	0.00721	800	16	88
** 82	0.0223			
** 83	0.00467			
** 84	0.02244			
85	0.00577	720	18	95
86	0.00137	450	3	94
87	0.00321	250	8	95
88	0.00142	300	8	95
89	0.01705	200	2	87
90	0.00341	500	5	95
91	0.00239	170	2	92
** 92	0.01123			
93	0.00760	140	2	90
94	0.0552	1550	35	90
** 95	0.0072			
** 96	0.0052			

Table No. 4 con't

Sub-Basin Number	Area In Square Miles	Channel Length in Feet	Elevation Difference in Feet	Curve Number
**97	0.01278			
**98	0.02207			
99	0.00294	630	20	95
100	0.00186	500	12	94

*See Exhibits No's. 9, 10 or 11.

**Flow in some basins is determined using the rational method.

TABLE 5

EXISTING DRAINAGE STRUCTURES

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
3	Drain under parking lot	460 ft. of 36" cmp	.013	4.0	outlet control	sub-basin 3	36.2	
4	Drain under Fillmore St.	150 ft. of 13" x 22" cmpa	.08	24.0	outlet control	sub-basin 4	18.0	
5	Drain under Kissing Camels Dr.	100 ft. of 18" x 29" cmpa	.04	2.0	inlet control	sub-basin 5	13.0	
6	Culvert appx. 100' above pond	80' of 36" cmp	.05	4.0	inlet control	sub-basin 6	44.0	
7	Drain under Kissing Camels Dr.	100 ft. of 18" x 29" cmpa	.03	2.0	outlet control	sub-basin 7	12.6	
8	Entrance to Kissing Camels Dr.	110 ft.of 18" cmp	.02	2.5	outlet control	Mesa Rd. along sub-basin 8	8.2	
8	Drain under Kissing Camels Dr.	100 ft. of 18" x 29" cmpa	.02	2.0	outlet control	sub-basin 8	12.1	

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth(ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
9	Along Mesa Rd. W. of Inwood Rd.	30 ft. of 18" cmp	.02	2.0	outlet control	Mesa Rd. along sub-basin 9	7.5	
9	Under Mesa Rd. at filtration plant	40 ft. of 18" cmp	.02	2.0	outlet control	Mesa Rd. along sub-basin 9	7.4	
9	Along Mesa Rd.	50 ft. of 30" cmp	.02	4.0	inlet control	Mesa Rd. along sub-basin 9	33.0	
9	Under drive near baseball diamond	50 ft. of 19" steel	.02	2.0	inlet control	part of sub-basin 9	11.0	
9	Drain under Inwood Rd.	50 ft. of 18" cmp	.02	2.0	outlet control	part of sub-basin 9	7.3	
9	Drain under Inwood Rd.	50 ft. of 18" cmp	.02	2.0	outlet control	part of sub-basin 9	7.3	
9	Drain under Inwood Rd.	50 ft. of 18" cmp	.02	2.0	outlet control	part of sub-basin 9	7.3	
9	Drain under Illbrook Rd.	50 ft. of 18" cmp	.02	2.0	outlet control	part of sub-basin 9	7.3	

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
10	Drain under Fillmore St.	120 ft. of 13" x 22" cmp	.04	5.0	inlet control	curbs & median on Fillmore St.	14.4 each half	1/2 of pipe drain north, & 1/2 of pipe drains south
10	Drain under Fillmore St.	150 ft. of 48" cmp	.05	16.0	outlet control	sub-basin 10	196	
10	Coronado High School	600 ft. of 48" cmp	.026	7.0	outlet control	sub-basin 10	110	partially plugged with sand.
10	Coronado High School	50 ft. of 30" cmp	.02	4.0	outlet control	sub-basin 10	36	
10	Coronado High School	100 ft. of 54" cmp	.026	6.0	inlet control	sub-basin 10	140	
11	Drain under road near Fillmore St.	50 ft. of 20" steel	.02	2.5	inlet control	part of sub-basin 11	15	entrance projecting from fill.
11	Drain under Fillmore St.	150 ft. of 18" cmp	.05	16.0	outlet control	sub-basin 11	20	entrance projecting from fill.
11	Drain from Coronado H. S. parking lot	110 ft. of 18" rcp	.02	5.0	inlet control	Coronado H.S. parking lot	19.5	inlet box entrance (headwall).

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
16	Drain under Chestnut St.	70 ft. of 6" cmp	.02	2.0	outlet control	sub-basin 16	0.5	entrance projecting from fill
16	Drain under freeway off-ramp	330 ft. of 48" rcp	.0085	6.0	inlet control	part of sub-basin 16	127.0	headwall entrance
16	Drain under intersection of Fillmore St. & Chestnut St.	152 ft. of 24" rcp	.015	3.0	inlet control	sub-basin 16	22.5	headwall entrance
22	Drain along Fillmore St.	1400 ft. of 30" rcp	.093	-	flowing full	sub-basins 16 & 22	125.0	
25	Drain under freeway on-ramp	530 ft. of 48" rcp	.049	6.0	inlet control	sub-basin 25	127.0	headwall entrance
25	Drain under freeway	382 ft. of 60" rcp	.055	7.0	inlet control	sub-basin 25	209.0	headwall entrance
32	Drain under freeway	270 ft. of 60" rcp	.058	7.0	inlet control	sub-basin 32	209.0	headwall entrance
36	Drain under freeway	190 ft. of 48" rcp	.034	6.0	inlet control	sub-basin 36	127.0	headwall entrance

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
36	Drain lowest street nest to freeway	36 ft. of 15" rcp	.028	5.0	inlet control	part of sub-basin 36	13.8	inlet box entrance (headwall)
39	Basin drain under Chestnut Street	80 ft. of 10" x 10" cbc	.005	13.0	inlet control	sub-basin 39	1260	30° to 75° wingwall flare
43	Drain under freeway	186 ft. of 36 " rcp	.018	5.0	inlet control	sub-basin 43	68	headwall entrance
44	Drain under Chestnut St.	2-22" x 36" cmpa 50 ft. long ea.	.02	4.0	inlet control	part of sub-basin 44	75.6	inlet box entrance (headwall)
44	Drain along Chestnut St.	30 ft. of 13" x 22" cmpa	.02	2.0	inlet control	ditch along Chestnut St.	8.0	entrance projecting from fill
45	Drain under freeway	148 ft. of 24" rcp	.007	5.0	outlet control	part of sub-basin 45	33.0	headwall entrance
47	Drain under freeway	90 ft. of 24" rcp	.039	5.0	inlet control	part of sub-basin 45	33.5	headwall entrance
48	Drain under freeway	163 ft. of 10' x 14' cbc	.005	15.0	inlet control	sub-basin 48	1400	30° to 75° wingwall flare

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
49	Drain under north-bound freeway lanes	80 ft of 15" rcp	.008	5 0	outlet control	sub-basin 49	11.8	inlet box entrance (headwall)
50	Drain under north-bound freeway lanes	78 ft. of 15" rcp	.015	5.0	outlet control	sub-basin 50	13.3	inlet box entrance (headwall)
51	Drain under north-bound freeway lanes	90 ft. of 15" rcp	.011	5.0	outlet control	sub-basin 51	12.2	inlet box entrance (headwall)
53	Drain under street	60 ft. of 66" cmp	.02	8.0	inlet control	sub-basin 53	250	headwall entrance
55	Drain under north-bound freeway lanes	164 ft. of 15" rcp	.008	5.0	outlet control	sub-basin 55	9.8	inlet box entrance (headwall)
59	Drain to Monument Creek in lower end	430 ft. of 55" x 65" elliptical pipe	.025	8.0	outlet control	sub-basin 59	200	inlet box entrance headwall
60	Drain under north-bound freeway lane	130 ft. of 30" rcp	.017	5.0	inlet control	sub-basin 60	50	headwall entrance

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
62	Drain under north-bound freeway lane	80 ft. of 15" rcp	.038	5.0	inlet control	sub-basin 62	13.8	inlet box entrance (headwall)
63	Drain under north-bound freeway lane	72 ft. of 15" rcp	.058	5.0	inlet control	sub-basin 63	13.8	inlet box entrance (headwall)
64	Drain under north-bound freeway lane	58 ft. of 15" rcp	.031	5.0	inlet control	sub-basin 64	13.8	inlet box entrance (headwall)
65	Drain to Monument Creek	510 ft. of 48" cmp	.03	6.0	outlet control	sub-basin 65	100	headwall entrance
66	northeast corner of sub-basin	100 ft. of 30" steel	.05	5.0	inlet control	sub-basin 66	57	entrance projecting from fill
66	northeast corner of sub-basin	40 ft. of 31" x 50" cmpa	.01	4.0	inlet control	sub-basin 66	60	entrance projecting from fill
66	east side of sub-basin	70 ft. of 18" x 29" cmpa	.02	5.0	outlet control	sub-basin 66	25	inlet box entrance (headwall)

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
66	east side of sub-basin	70 ft. of 18" x 29" cmpa	.02	5.0	outlet control	sub-basin 66	25	inlet box entrance (headwall)
66	east side of sub-basin	70 ft. of 36" cmp	.02	5.0	outlet control	sub-basin 66	58	inlet box entrance (headwall)
66	southeast corner of sub-basin	70 ft. of 22" x 36" cmpa	.02	5.0	outlet control	sub-basin 66	43	inlet box entrance (headwall)
69	Drain to Monument Creek	50 ft. of 18" cmp	.02	3.0	outlet control	sub-basin 69	10	entrance projecting from fill
70	north & south sides of Fontanero St.	2-24" cmp (60 ft. ea.)	.01	5.0	outlet control	sub-basin 70	25	inlet box entrance (headwall)
71	Drain under northbound freeway lane	64 ft. of 15" rcp	.006	5.0	outlet control	sub-basin 71	13	inlet box entrance (headwall)
72	Drain under northbound freeway lane & Sinton Rd.	152 ft. of 24" rcp	.106	5.0	inlet control	sub-basin 72	33.5	inlet box entrance (headwall)

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
75	Drain under Sinton Rd.	42 ft. of 18" rcp	.017	5.0	inlet control	sub-basin 75	19.5	inlet box entrance (headwall)
77	Drain under Sinton Rd.	50 ft. of 24" rcp	.028	5.0	inlet control	sub-basin 77	33.5	inlet box entrance (headwall)
78	Drain under railroad lines	85 ft. of 72" cmp	.0235	10.0	inlet control	sub-basin 78	352	headwall entrance
79	Drain under railroad lines	35 ft of 5' x 13' stone box culvert	.01	7.5	inlet control	sub-basin 79	150	headwall entrance
80	Drain under railroad lines	75 ft. of 48" cmp	.013	13.0	outlet control	sub-basin 80	200	headwall entrance
81	Drain under railroad lines	50 ft. of 72" cip	.054	15.6	inlet control	sub-basin 81	530	partially plug with sand, he wall entrance
82	Drain to Monument Creek	15 ft. of 60" cmp	.02	7.0	inlet control	sub-basin 82	190	headwall entrance
86	Drain under freeway off-ramp	36 ft. of 18" rcp	.147	5.0	inlet control	sub-basin 86	19.5	inlet box entrance (headwall)

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
88	Drain under Sinton Rd.	98 ft. of 24" cmp	.03	5.0	outlet control	sub-basin 88	25	entrance pro-jecting from fil
89	Drain under railroad line	320 ft. of 54" cmp	.037	8.0	outlet control	sub-basin 89	175	partially full of sand. headwal entrance
89	Drain along west sub-basin boundary	790 ft. of 48" rcp	.05	8.0	flowing full	culverts from sub-basins 87 & 100	347.9	
91	Drain under frontage rd.	60 ft. of 36" rcp	.018	5.0	inlet control	sub-basin 91	68	headwall entrance
94	Cross-street drain, E. end of north loop	22 ft. of 18" rcp	.064	5.0	inlet control	sub-basin 94	19.5	inlet box entran (headwall)
94	North loop drain	90 ft. of 36" cmp	.0056	5.0	outlet control	sub-basin 94	49.0	inlet box entran (headwall)
94	Cross-street drain, E. end of south loop	23 ft. of 18" rcp	.022	5.0	inlet control	sub-basin 94	19.5	inlet box entran (headwall)

TABLE 5

Continued

Sub-basin No.	Location	Description	Slope feet/foot	Headwater Depth (ft)	Flow Condition	Service Area	Capacity C.F.S.	Comments
94	South loop drain	149 ft. of	.006	5.0	outlet control	sub-basin 94	45.0	inlet box entran (headwall)
94	Drain under railroad line	40 ft. of 72" cmp	.0275	8.0	inlet control	sub-basin 94	290	headwall entrance
99	Drain under frontage rd.	80 ft. of 48" rcp	.0085	5.0	flowing full	sub-basin 99	143	headwall entrance
100	Drain along frontage rd.	310 ft. of 36" rcp	.02	5.0	inlet control	sub-basin 100	68	headwall entrance

TABLE NO. 6
MESA BASIN
SYNTHETIC HYDROGRAPHIC CALCULATIONS

BASIN NUMBER	AREA SQUARE MILES	LENGTH OF CHANNEL	ELEVATION DIFFERENCE	Tc HOURS	Tp HOURS	INCHES 50 Yr.	INCHES 100 Yr.	(cfs) 50 Yr.	(cfs) 100 Yr.	DESIGN Q (cfs)
1	0.0577	2700	96	0.20	0.62	.80	1.59	36.0	71.5	36.0
2	0.1108	2200	55	0.20	0.62	.91	1.74	78.7	150.5	78.7
3	0.0559	1140	24	0.125	0.57	.52	1.19	24.5	56.1	134.0
4	0.2040	4645	112	0.36	0.72	.69	1.45	94.7	198.9	410.0
5	0.0855	1630	64	0.140	0.584	.75	1.52	53.1	107.5	53.1
6	0.1470	4905	177	0.32	0.692	.48	1.13	49.4	116.0	90.0
7	0.0348	1900	53	0.17	0.602	.75	1.52	20.9	42.3	65.0
8	0.0667	3830	120	0.285	0.671	1.09	1.98	52.3	95.2	52.3
9	0.1340	3900	96	0.31	0.686	1.03	1.90	97.4	179.7	132.0
10	0.0334	1190	30	0.125	0.575	.91	1.74	25.6	49.0	260.0
11	0.0382	1590	46	0.15	0.590	1.03	1.90	32.8	60.5	210.0
12	0.0326	600	09	0.09	0.554	1.03	1.90	29.3	54.0	29.3
13	0.1100	3630	223	0.205	0.623	1.09	1.98	93.2	169.3	93.2
14	0.0242	1520	104	0.100	0.560	1.09	1.98	22.8	41.4	22.8
15	0.0492	1740	100	0.12	0.572	1.48	2.45	60.0	99.3	60.0
16	0.0815	1210	52	0.10	0.560	1.24	2.16	87.4	152.2	233.0
17	0.0717	2715	66	0.235	0.641	.97	1.82	52.5	98.7	208.0
18	0.0399	1700	72	0.14	0.584	1.16	2.07	32.1	60.2	130.0
19	0.0769	2830	95	0.22	0.632	1.16	2.07	44.2	89.5	356.0
20	0.0611	2692	145	0.175	0.605	1.09	1.98	25.4	58.2	125.0

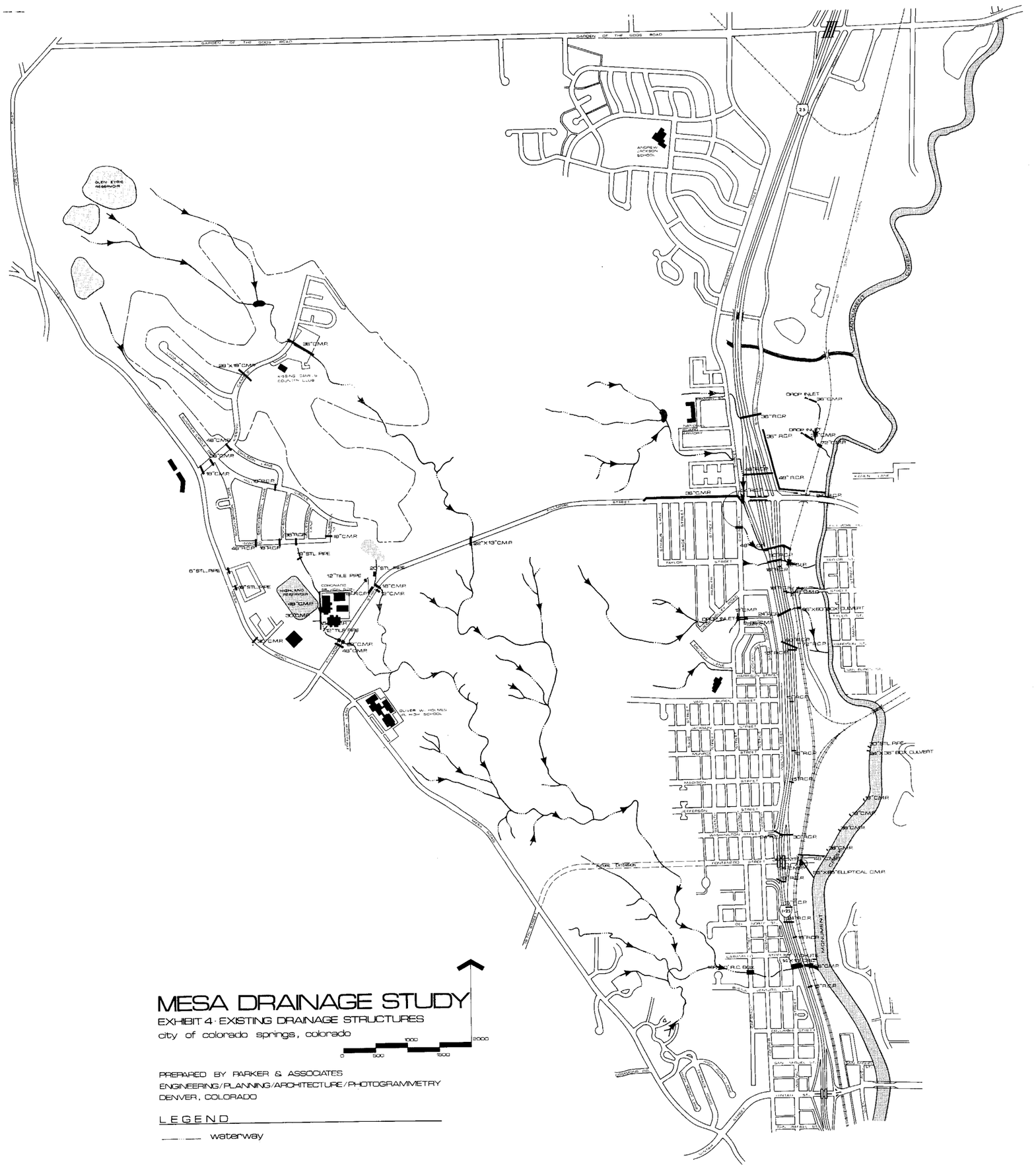
BASIN NUMBER	AREA SQUARE MILES	LENGTH OF CHANNEL	ELEVATION DIFFERENCE	Tc HOURS	Tp HOURS	INCHES 50 Yr.	INCHES 100 Yr.	(cfs) 50 Yr.	(cfs) 100 Yr.	DESIGN Q (cfs)
21	0.0238	1250	135	0.077	0.546	1.16	2.07	26.2	45.6	45.6
22	0.0465	1900	131	0.120	0.572	1.31	2.25	33.4	65.3	33.4
23	0.0784	1750	164	0.10	0.560	1.24	2.16	78.6	140.2	300.0
24	0.0505	2750	172	0.165	0.599	1.24	2.16	50.6	88.1	50.6
25	0.1082	1330	166	0.075	0.545	1.40	2.35	119.2	207.6	119.2
26	0.0226	1040	65	0.080	0.548	1.03	1.90	20.6	38.0	20.6
27	0.0178	630	50	0.042	0.525	.97	1.82	14.9	28.5	14.9
28	0.0028	480	165	0.0125	0.508	0.91	1.74	1.3	3.0	21.5
29	0.0682	2400	60	0.215	0.629	0.91	1.74	36.2	76.2	450.0
30	0.0533	1600	48	0.155	0.593	1.16	2.07	44.8	82.7	410.0
31	0.0881	1135	55	0.095	0.557	1.16	2.07	94.8	165.1	452.0
32	0.0766	2570	91	0.20	0.620	1.48	2.45	83.7	140.5	229.0
33	0.0769	3760	182	0.225	0.635	.97	1.82	44.0	89.2	44.0
34	0.0581	3230	170	0.20	0.620	1.09	1.98	41.0	78.4	41.0
35	0.0963	2710	40	0.29	0.674	1.16	2.07	71.2	131.3	1145.0
36	0.130	2160	23	0.26	0.66	1.24	2.16	149.7	243.0	149.7
37	0.0434	1590	157	0.092	0.56	.97	1.82	34.1	65.3	34.1
38	0.0039	630	1		0.56					4.7
39	0.0253	1970	45	0.195	0.62	1.57	2.55	24.5	42.7	1165.0
40	0.0370	2270	95	0.185	0.61	1.48	2.45	33.9	60.6	272.0
41	0.0274	1410	129	0.09	0.55	1.48	2.45	31.4	54.0	31.4
42	0.0374	1410	129	0.085	0.55	1.03	1.90	33.8	62.4	33.8
43	0.0088	230	13	0.03	0.52	1.31	2.25	10.7	18.4	70.0
44	0.0350	1610	108	0.10	0.56	1.40	2.35	47.3	76.8	197.0
45	0.0488	750	13	0.10	0.56	1.48	2.45	62.4	103.3	62.4

BASIN NUMBER	AREA SQUARE MILES	LENGTH OF CHANNEL	ELEVATION DIFFERENCE	Tc HOURS	Tp HOURS	INCHES 50 Yr.	INCHES 100 Yr.	(cfs) 50 Yr.	(cfs) 100 Yr.	DESIGN Q (cfs)
46	0.0184	150	2	0.163	0.60	--	--	--	--	41.8
47	0.0200	170	1	0.50	0.80	--	--	--	--	44.7
48	0.0155	620	20	0.07	0.54	1.48	2.45	20.6	34.6	1250.0
49	0.001785	730	7	0.125	0.58	1.48	2.45	2.3	3.9	2.3
50	0.00121	450	7	0.071	0.54	1.48	2.45	1.5	2.5	1.5
51	0.000753	310	8	0.0437	0.53	1.48	2.45	1.0	1.7	1.0
52	0.00545	1360	24	0.150	0.59	1.24	2.16	5.6	9.7	5.6
53	0.00409	830	23	0.090	0.55	1.24	2.16	4.5	7.8	4.5
54	0. 00034					1.48	2.45			1.3
55	0.000848	330	12	0.04	0.52	1.48	2.45	1.2	2.0	1.2
56	0.00164	100	5	0.02	0.51	1.31	2.25	2.0	3.4	2.0
57	0.00167	1070	3	0.02	0.51	1.31	2.25	2.0	3.6	2.0
58	0.01270	1070	12	0.165	0.60	1.24	2.16	12.8	22.3	12.8
59	0.01270	1070	12	0.165	0.60	1.16	2.07	11.9	21.2	14.7
60	0.00281	250	2	0.05	0.53	1.48	2.45	3.8	6.4	3.8
61	0.00199	150	3	0.03	0.52	1.24	2.16	2.3	4.0	2.3
62	0.00136	410	8	0.07	0.54	1.48	2.45	1.7	2.8	1.7
63	0.00170	700	6	0.13	0.58	1.48	2.45	2.1	3.5	2.1
64	0.00162	500	4	0.10	0.56	1.48	2.45	2.1	3.5	2.1
65	0.0252	2850	38	0.30	0.68	1.24	2.16	22.3	38.8	104.9
66A	0.0223	870	10	0.13	0.58	1.48	2.45	27.6	46.3	27.6
66B	0.0123	830	10	0.12	0.57	.85	1.66	8.8	17.2	8.8
66C	0.0120	850	13	0.26	0.656					39.0
66D	0.0034	500	8	0.11	0.566					12.6

BASIN NUMBER	AREA SQUARE MILES	LENGTH OF CHANNEL	ELEVATION DIFFERENCE	Tc HOURS	Tp HOURS	INCHES 50 Yr.	INCHES 100 Yr.	(cfs) 50 Yr.	(cfs) 100 Yr.	DESIGN Q (cfs)
67	0.00897									21.6
68	0.0117									31.2
69	0.00177	100	0.5	0.035	0.52	1.03	1.90	1.64	4.9	1.64
70	0.00160	100	1	0.025	0.52	1.31	2.25	2.0	3.4	2.0
71	0.00202	400	4	0.075	0.55	1.31	2.25	2.3	3.9	2.3
72	0.00541	1100	13	0.16	0.60	1.31	2.25	5.73	9.8	21.5
73	0.0374	790	16	0.10	0.56	1.31	2.25	4.23	7.3	12.2
74	0.00275	860	20	0.095	0.56	1.09	1.98	2.62	4.8	2.6
75	0.00835	1230	37	0.12	0.57	1.16	2.06	8.26	14.7	13.8
76	0.00129	100	1	0.023	0.51	1.16	2.06	1.45	2.6	6.5
77	0.00206	200	1	0.06	0.54	1.31	2.25	2.46	4.2	4.76
78	0.00409	250	2	0.506	0.80	1.09	1.98	2.76	5.0	235.0
79	0.00136	50	2					5.01		11.0
80A	0.00165	50	3					5.07		5.1
80B	0.00165	50	3					5.07		5.1
81	0.00721	800	16	0.10	0.56					182.0
82	0.0223									205.0
83	0.00467							16.5		32.0
84	0.02244									289.0
85	0.00577	720	18	0.080	0.55	1.48	2.45	7.52	12.6	7.5
86	0.00137	450	3	0.208	0.625			1.4		1.4
87	0.00321	250	8	0.048	0.53	1.48	2.45	4.35	7.3	8.8
88	0.00142	300	8	0.045	0.53	1.48	2.45	1.95	3.2	1.95
89	0.01705	200	2	0.045	0.53	.91	1.74	14.1	26.9	219.70
90	0.00341	500	5	0.09	0.55	1.48	2.45	4.44	7.3	4.5

BASIN NUMBER	AREA SQUARE MILES	LENGTH OF CHANNEL	ELEVATION DIFFERENCE	Tc HOURS	Tp HOURS	INCHES 50 Yr.	INCHES 100 Yr.	(cfs) 50 Yr.	(cfs) 100 Yr.	DESIGN Q (cfs)
91	0.00239	170	2	0.04	0.52	1.24	2.16	2.69	4.7	2.7
92	0.01123									44.8
93	0.00760	140	2	0.03	0.52	1.09	1.98	7.66	13.9	7.7
94	0.0552	1550	35	0.17	0.60	1.09	1.98	48.5	88.0	48.5
95	0.0072									27.2
96	0.0052									21.8
97	0.01278									51.5
98	0.02207									75.9
99	0.00294	630	20	0.070	0.54	1.48	2.45	3.83	6.34	6.8
100	0.00186	500	12	0.07	0.54	1.40	2.35	2.27	3.8	57.0

NOTE: Some of the "Design Q's" are determined using the Rational Method.



MESA DRAINAGE STUDY

EXHIBIT 4 · EXISTING DRAINAGE STRUCTURES

city of colorado springs, colorado

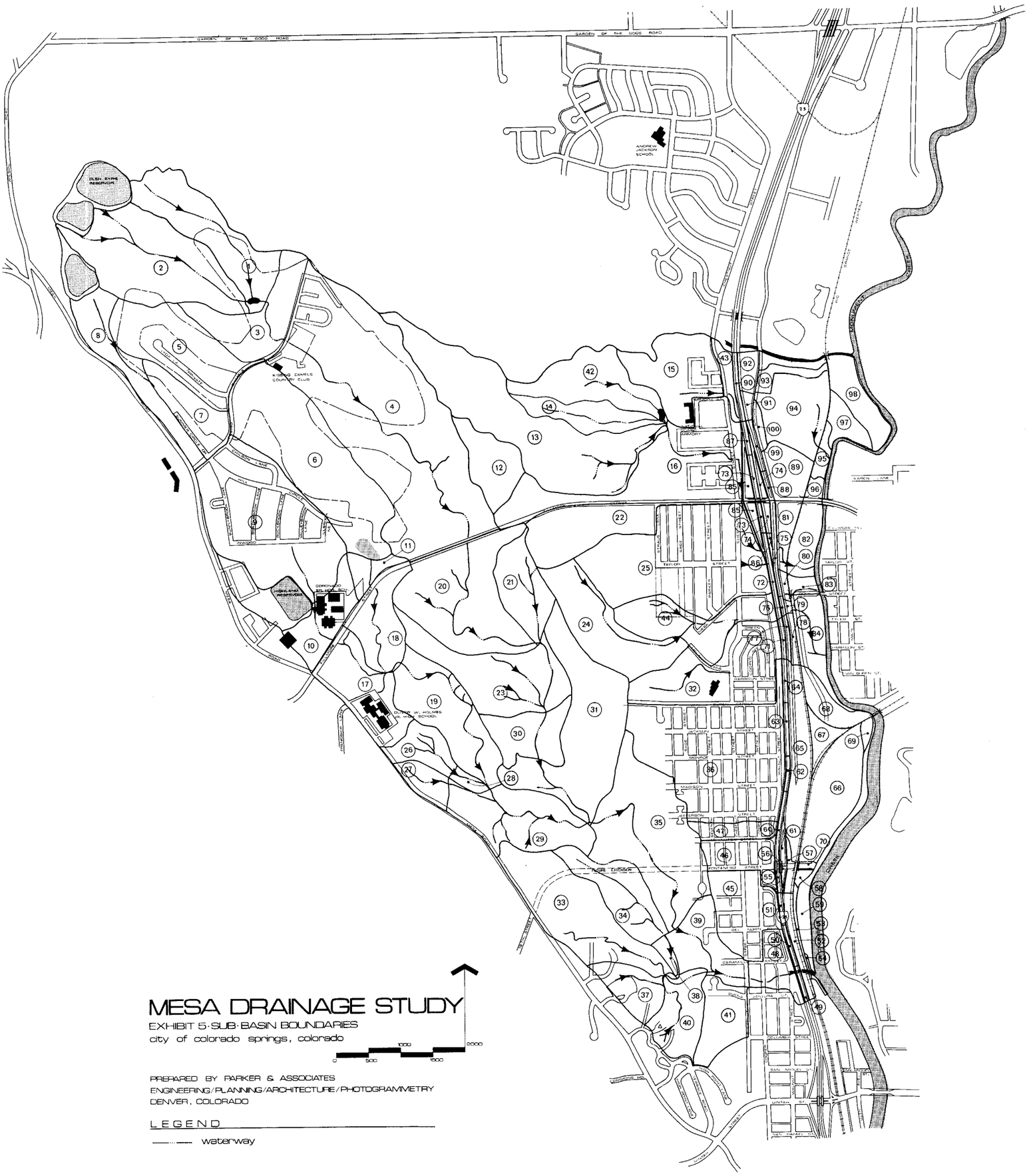
0 500 1000 2000

PREPARED BY PARKER & ASSOCIATES
ENGINEERING/PLANNING/ARCHITECTURE/PHOTOGRAMMETRY
DENVER, COLORADO

LEGEND

waterway

existing drainage structure



MESA DRAINAGE STUDY

EXHIBIT 5-SUB-BASIN BOUNDARIES

city of colorado springs, colorado

0 500 1000 2000

PREPARED BY PARKER & ASSOCIATES
ENGINEERING/PLANNING/ARCHITECTURE/PHOTOGRAMMETRY
DENVER, COLORADO

LEGEND

—·—·— waterway

SECTION III

FINAL DESIGN

DESIGN CONCEPT

A detailed analysis of the physical characteristics of the Mesa channels was made to determine what the limiting velocities should be for flow in these channels during major storms. The primary consideration for this study was that there must be an optimum level of protection in the channels which will allow them to remain as natural as possible and still insure against property damage resulting from eroded channel sections.

An analysis made with the cooperation of soils and hydraulic engineers from the Soil Conservation Service resulted in choosing a velocity of three (3) feet per second as the average velocity which would cause no scour in the Mesa Basin. If it is necessary to prevent all scour of natural channels, then this velocity must be the maximum allowable during storms meeting the 100 year criteria.

Since, as stated previously, it is the wish of public officials and area residents that the channels stay as natural as possible, a limiting velocity for channels without bottom and bank protection has been set at eight (8) feet per second. Grouted rip-rap lining has been specified for areas subjected to flow velocities greater than 15 feet per second. Details of natural channels as well as sections with channel protection are shown in Exhibits 12 and 13.

The widths of flow for the drainage tributaries ranged from 60 feet to one hundred ten feet with no proposed bank and bottom protection. The greenbelt right-of-way width should be established for various reaches

according to the guidelines shown in Exhibits 12 and 13. Those reaches which remain in their existing condition will use the guidelines of Exhibit 12. Where channel protection is required, the greenbelt width will be 20 feet wider than the top of the channel on both sides as shown in Exhibit 13.

Some protection is needed in minor tributaries which are located almost exclusively in those regions we have delineated having slopes greater than 30%. These channels carry small flows, but due to the steepness of slopes, they will have high velocities. It is recommended that these areas be protected with small check dams placed intermittently in the channels to slow velocities. The costs of these structures have been included in the category of Unclassified Structure Costs in Tables No. 7 and 8. Details for these structures are shown in Exhibit 14.

The basins which are below Fillmore Street and contribute flow to the main channel, which flows into Monument Creek near Caramillo Street, have been analyzed using one-hundred year storm flow quantities because flows here are at, or above 500 cubic feet per second. All other basins are analyzed using the fifty-year criteria, because the tributaries they contribute to generate less than 500 cfs under the 100 year criteria.

Temporary storage areas are anticipated in three basins north of Fillmore Street. These ponding areas have been investigated for storm recurrence intervals of fifty and one hundred years. The

hundred-year outflow from these areas was prevented from overtopping Fillmore Street and was used to evaluate peak flows in the downstream sub-basins.

Drainage patterns in existing developments were studied to determine the capacity of existing drainage facilities and the need for new facilities.

Included in this Addendum is a copy of a letter from the State Division of Water Resources which concludes that the temporary run-off storage structures proposed in this report are not subject to review by that Office.

All proposed facilities can be seen by referring to Exhibits No. 6, Green Belt/Channel Protection, and No. 7, Proposed Storm Sewer Improvements.

Exhibit No. 8 reflects the "Master Plan" recommended for the Mesa Basin. In the next portion of the report, Routing and Improvements, a brief description has been provided regarding each sub-basin and its drainage requirements.

ROUTING AND IMPROVEMENTS

Sub-basins 1 and 2 are located mostly within the Kissing Camels Country Club grounds, and are covered partly by the golf course. Both sub-basins drain towards the existing pond in the lower part of sub-basin 1. Due to the location and the relatively low flow developed, no new structures have been proposed. The combined flow developed at the confluence of the two sub-basins is 114.7 cubic feet per second.

Sub-basin 3 is largely within the limits of the golf course. The existing drainage culvert under Kissing Camels Drive is a 36 inch CMP, which is inadequate for the design flow of 134 cubic feet per second. A 48 inch CMP at 1.5 per cent is proposed in addition.

Sub-basin 4 has an existing detention reservoir north of Fillmore Street. The existing 22 inch by 12 inch CMP arch is inadequate to carry the design flow of 410 CFS without overtopping and flowing into Fillmore Street. The addition of a proposed 42 inch CMP 10 feet above the existing pipe will prevent the overtopping condition. A maximum of 36 acre feet of temporary storage is generated behind the highway fill. The resulting outflow from the two pipes will be 115 CFS. The slope below the outlet end of the 42 inch CMP should be

protected with grouted rip-rap to prevent erosion.

Sub-basins 5 and 6 are on the higher ground, within the country club boundaries. The area lacks defined drainage ways. Sub-basin 5 carries 53.1 CFS across Kissing Camels Drive through an existing oval pipe, 18 inch by 29 inch CMP. This pipe is inadequate for the design flow. An additional 30 inch CMP is needed to carry the full design flow. Sub-basin 6 carries its own runoff and that from sub-basin 5, generally easterly and downhill towards the existing pond in the low end of the sub-basin. This pond is a permanent storage facility and will not function as a detention pond during a 100 year storm. A 100 year flow of 180 CFS will flow into basin 11.

Sub-basin 11 has an existing detention reservoir above Fillmore Street. The existing 18 inch CMP under Fillmore Street is inadequate to accomodate the 100 year peak inflow of 210 CFS without overtopping into Fillmore Street. An additional 30 inch CMP at 5 per cent is needed 8 feet above the existing pipe. A maximum temporary storage of 31 acre feet is generated behind the highway fill. The maximum outflow from the two pipes is 73 CFS. Rip-rap is needed below the 30 inch CMP on the south slope of Fillmore Street.

Sub-basins 7 and 8 drain into sub-basin 9. The existing culverts under Kissing Camels Drive should be abandoned in favor of a new storm sewer system. A 50 year flow of 20.9 CFS from basin 7 can be carried down Chilson Lane in a 21 inch RCP at 1.7 per cent. At Hill

Circle and Chilson Lane the fifty year flow is 30.6 CFS. It can be carried down Hill Circle in a 30 inch RCP at 0.5 per cent. At Hill Circle and Rockbrook Lane, the flow of 35.4 CFS can be carried south to Inwood Drive in a 30 inch RCP at 1 per cent. The 50 year flow from sub-basin 8 of 52.3 CFS can be carried down Sunnybrook Lane in a 30 inch RCP at 2 per cent. At Sunnybrook Lane and Inwood Dirve, the flow of 62 CFS can be carried east in a 36 inch RCP at 1 per cent. At Inwood Drive and Shadybrook Lane, the flow of 71.7 CFS can be carried east in a 36 inch RCP at 2 per cent. At Inwood Drive and Rockbrook Lane, the combined flow of 98 CFS can be carried in a 42 inch RCP at 1 per cent, east 210 feet, where it will discharge into a ditch carrying runoff toward Coronado High School and an existing 48 inch CMP. The ditch will have a maximum 1 foot flow depth and a maximum velocity of 10 feet per second. Rip-rap should be provided the full length of the ditch.

The existing 48" CMP at Coronado High School is adequate to carry flow from the storm, meeting 50-year criteria. The 100-year runoff will cause 88 CFS to overflow into the school parking lot. To correct this situation, an additional 48" CMP is needed next to the existing pipe.

A temporary storage area is planned northwest of Fillmore Street and south of Coronado High School. The existing 48 inch CMP under Fillmore Street is adequate to carry both the 100-year and 50-year

flows without overtopping Fillmore Street. The 100-year flow into this area is 252 CFS. The maximum temporary storage of 41 acre feet is generated behind Fillmore Street. The maximum outlfow during the 100-year storm will be 191 CFS.

Along and under Mesa Road, adjacent to sub-basin 9, are culverts which are inadequate for the design flow imposed. These pipes should be replaced with 18 inch and 30 inch CMP. These costs are not reflected in the drainage fees in this basin.

The outflow from sub-basins 10 and 11, together with flows from sub-basins 17 through 19, and 26 through 29, reach a 100 year peak flow of 450 CFS at the bottom of sub-basin 29. The maximum velocity achieved in any stream reach from Fillmore Street to the bottom of sub-basin 29 is 9 feet per second. This magnitude of velocity will cause some undesirable scouring effects, which will create a need for rip-rap protection for some reaches within these basins.

The outflow from sub-basin 4 will be carried through sub-basin 20, at times achieving a velocity in excess of 12 feet per second. Approximately 80 to 90 per cent of this channel, as well as the other major channels south of Fillmore Street, will require rip-rap protection.

In sub-basin 21, a 100 year flow of 46 CFS generates a velocity of 16.7 feet per second at the lower end of the sub-basin. The channel here should be protected with grouted rip-rap from a point 175 feet from the lower limit of the basin to a point 240 feet from the lower limit of the basin.

The maximum flow at the bottom of sub-basin 31 is the sum of flow from sub-basins 1, 2, 3, 4, 20, 21, 23, 30 and 31. The peak flow here

during the 100 year storm is 452 CFS.

The existing residence at the bottom of sub-basin 35 will be subject to flooding during a 100 year storm. The top width of the channel through this area will reach a point 110 feet wide ~~from the center of the channel~~. The elevation of the water surface in this area is at 6,097 feet.

A flow of 78 CFS in sub-basin 34 can be carried through the sub-basin with no need of further protection. This flow combines with the flow from sub-basins 33, 37, 38, 39 and 40, to reach a peak 100 year flow of 1,165 CFS. The channel bottom from the junction where this peak is reached to Monument Creek must be protected with rip-rap due to high velocities. The existing 10 foot by 10 foot reinforced concrete box at the bottom of sub-basin 39 is adequate to carry flow from the 100 year storm.

Sub-basins 13, 14 and 42 all contribute runoff to a channel going through sub-basin 16. The peak flow from these basins, as well as sub-basin 12 is 233 CFS. This flow is picked up in sub-basin 16, 350 feet west of Chestnut Street in a 48 inch RCP at 2.7 per cent. An existing 48 inch RCP at 0.85 per cent at the bottom of sub-basin 16 will carry 127 CFS. The remaining 106 CFS will flow south toward an existing 24 inch RCP at 1.5 per cent. The capacity of this pipe is 30 CFS, so an additional 42 inch RCP needs to be installed at 1.5 per cent to carry the additional flow of 76 CFS.

In sub-basin 15, a 50 year flow of 60 CFS can be carried under Chestnut Street in a 42 inch CMP. This flow combines with flow from sub-basin 43 to produce a peak of 70 CFS. An existing 36 inch RCP

will pick up with 2 feet of head and the remaining 15 CFS will overflow into sub-basin 16.

In sub-basin 100, a peak flow of 57 CFS will be picked up in an existing 36 inch RCP.

Flow from sub-basin 99 will combine with the pipe flow from sub-basin 16 to produce a peak of 133.5 CFS. This flow combines with the flow from sub-basins 15, 43 and 100 to produce a peak flow of 191.0 CFS. An existing 48 inch RCP in sub-basin 89 will carry this flow to the top of sub-basin 96. An existing 54 inch RCP will carry this flow, along with flows from sub-basins 88 and 89 to Monument Creek.

The existing 72 inch CMP is adequate to carry this combined flow. After passing through sub-basin 95, this flow will enter Monument Creek.

In sub-basin 22 a peak flow of 33.4 CFS is carried down Fillmore Street in an existing 30 inch RCP at 9.3 per cent. At the intersection of Fillmore Street and Chestnut Street the flows from sub-basins 22 and 16 combine to form a peak flow of 132 CFS. An existing 48 inch RCP at 4.9 per cent will carry this flow combined with the flow from sub-basins 73, 74 and 85, and overflow from sub-basins 87 and 90 into sub-basin 81.

In sub-basin 25 the peak flow of 119.2 CFS is divided so that 60.6 CFS flows to basin 44, and 58.6 CFS flows through an existing 60 inch RCP into sub-basin 81. The combined flow of 182 CFS in sub-basin 81 will flow into an existing 72 inch cast iron pipe, and from there into an existing 60 inch CMP, which will carry the peak flow with 7.0

feet of headwater depth. The ditch below the 60 inch CMP should be grassed with 2 to 1 side slopes, a bottom width of 8 feet, a slope of 5 per cent, and a depth of 2.9 feet. This ditch will carry flow to Monument Creek.

Flow from sub-basins 86 and 75 will reach a peak of 16 CFS and will flow into sub-basin 80 through an existing 18 inch RCP at 1.7 per cent. From this point, they will be carried through sub-basin 83 to Monument Creek in an existing ditch.

Flow from sub-basin 72 and 76 combine and flow in a 24 inch RCP at 10.6 per cent. Flow then passes through a 3 foot by 5 foot concrete box, and from there, flows into Monument Creek in an existing ditch.

In sub-basin 32, 60 per cent of the area is above Chestnut Street. This area generates a peak flow of 50.2 CFS which is picked up at the intersection of Melany Drive and Chestnut Street in three proposed 10' curb inlets. A 24" RCP proceeds north from this point at 1.5 per cent. Sub-basins 24, 25 and 44 contribute 150 CFS to this flow, and the peak flow of 197 CFS flows east in a 42 inch RCP at 3.3 per cent. An existing 60 inch RCP at 5.8 per cent at the bottom of basin 32 will carry 229 CFS out of the area, allowing for 7.8 feet of headwater depth. An existing 72 inch CMP at 2.4 per cent will carry this flow along with flow from sub-basin 71 and 77 underneath railroad tracks and into Monument Creek.

Run-off from sub-basins 64, 63 and 62 are all carried underneath the frontage road into sub-basin 65.

Street drainage for the existing developments east of I-25 were investigated to determine if new storm sewers were needed or if existing storm sewers were of sufficient capacity. Eight inch curb and gutter was assumed for all streets with a 30 CFS flow limit on all arterial streets. Those streets where additional storm sewers are proposed are described below.

At the intersection of Taylor Street and Chestnut Street, the peak flow of 37.5 CFS should be picked up in three six foot curb inlets and carried in a 24 inch RCP at 2.3 per cent. This pipe will connect to the existing 60 inch RCP at 5.5 per cent at the bottom of basin 25. From here the flow will continue into sub-basin 82, under the railroad in a 72 inch CIP, and finally into Monument Creek.

One hundred fifty feet north of the intersection of Chestnut and Monroe Street, a four foot and a ten foot curb inlet will pick up a total of 18.6 CFS, leaving 31.4 CFS to flow in both sides of Chestnut Street. From this point, a 21 inch RCP should be installed south to the intersection of Chestnut and Madison Street.

An eight foot and four foot inlet will pick up 25.4 CFS at Chestnut and Monroe Street, to be carried south in a 30 inch RCP.

At the intersection of Chestnut Street and Washington Street, two eight foot inlets will pick up 16.2 CFS to be carried south in a 36 inch RCP to Fontanero Street and east to an existing manhole under I-25 where flow is to be carried to Monument Creek in an existing 55 inch

x 65 inch Elliptical CMP.

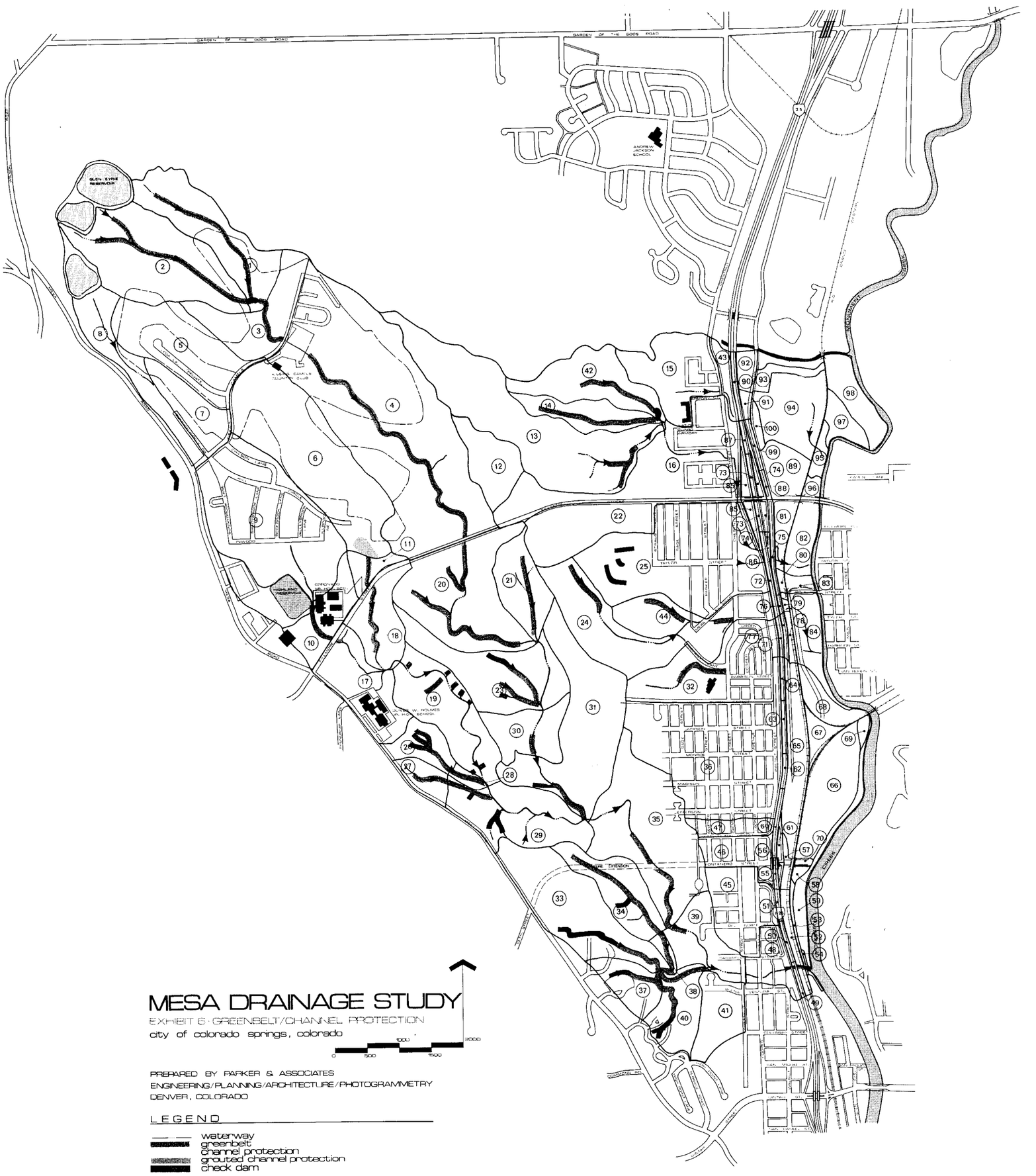
A flow of 62.4 CFS generated in sub-basin 45 can be carried in the streets and no additional pipes will be needed. Any flow which does not enter the existing 24 inch RCP under I-25 will flow south and enter the main drainage channel coming out of the Mesa Basin.

Sub-basin 46 has a peak flow of 6 CFS which enters an existing 15 inch RCP at 4.8 per cent. This flow combined with the flow from sub-basin 55 enters a 15 inch RCP at 0.8 per cent and flows into sub-basin 52. This flow combines with the flow from sub-basins 52, 51, 50 and 49 and enters the main Mesa drainage channel just above the entrance to Monument Creek.

A peak flow of 13.8 CFS from the lower half of basin 47 enters an existing 24 inch RCP at 3.9 per cent. It combines with the flow from sub-basin 60 and enters a 30 inch RCP at 1.7 per cent. This same pipe picks up the peak flow from sub-basin 61 before it discharges into sub-basin 65. The peak flow from sub-basins 65, 64, 63, 62, 61, 60, 47 and the lower part of sub-basin 36 combine to generate a peak flow of 104.9 CFS, which is carried in an existing 48 inch CMP at 2 per cent. This flow is then directly carried to Monument Creek.

SUMMARY OF IMPROVEMENTS

The improvements required have been shown in preceeding portions of this report and can be seen by reference to Exhibits Number 6, 7, and 8. They have been summarized in the following tables.



MESA DRAINAGE STUDY

EXHIBIT 6 - GREENBELT/CHANNEL PROTECTION

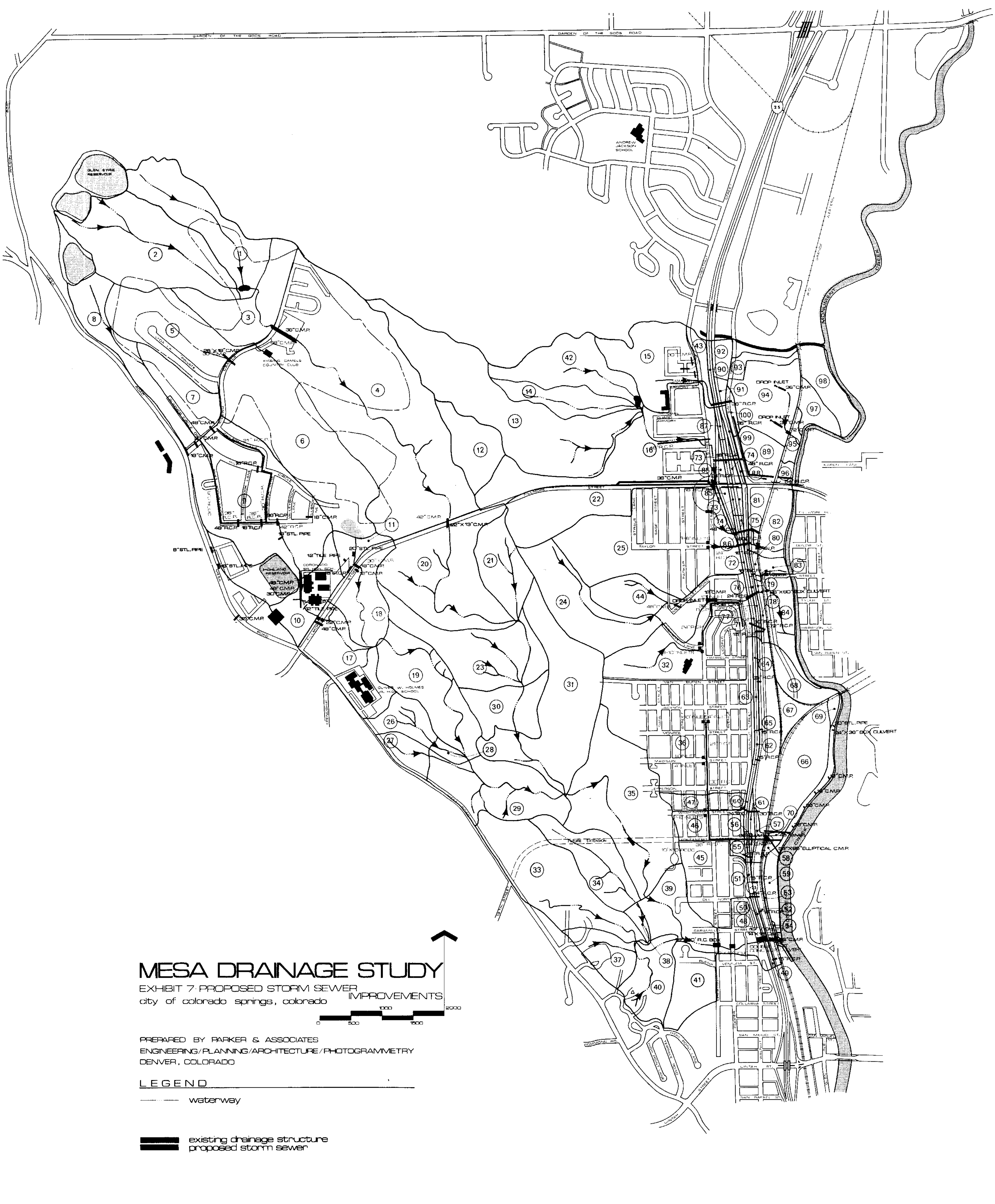
city of colorado springs, colorado

0 500 1000 1500 2000

PREPARED BY PARKER & ASSOCIATES
ENGINEERING/PLANNING/ARCHITECTURE/PHOTOGRAMMETRY
DENVER, COLORADO

LEGEND

- waterway
- greenbelt
- channel protection
- grouted channel protection
- check dam


MESA DRAINAGE STUDY
EXHIBIT 7 PROPOSED STORM SEWER IMPROVEMENTS
city of colorado springs, colorado
0 500 1000 1500 2000
PREPARED BY PARKER & ASSOCIATES
ENGINEERING/PLANNING/ARCHITECTURE/PHOTOGRAMMETRY
DENVER, COLORADO
LEGEND
waterway
existing drainage structure
proposed storm sewer
GARDEN OF THE GODS ROAD
ANDREW JACKSON SCHOOL
GLEN EYRIE RESERVOIR
OLIVER W. HOLMES JR. HIGH SCHOOL
DROP INLET

MESA DRAINAGE STUDY

EXHIBIT 8 · MASTER PLAN

city of colorado springs, colorado

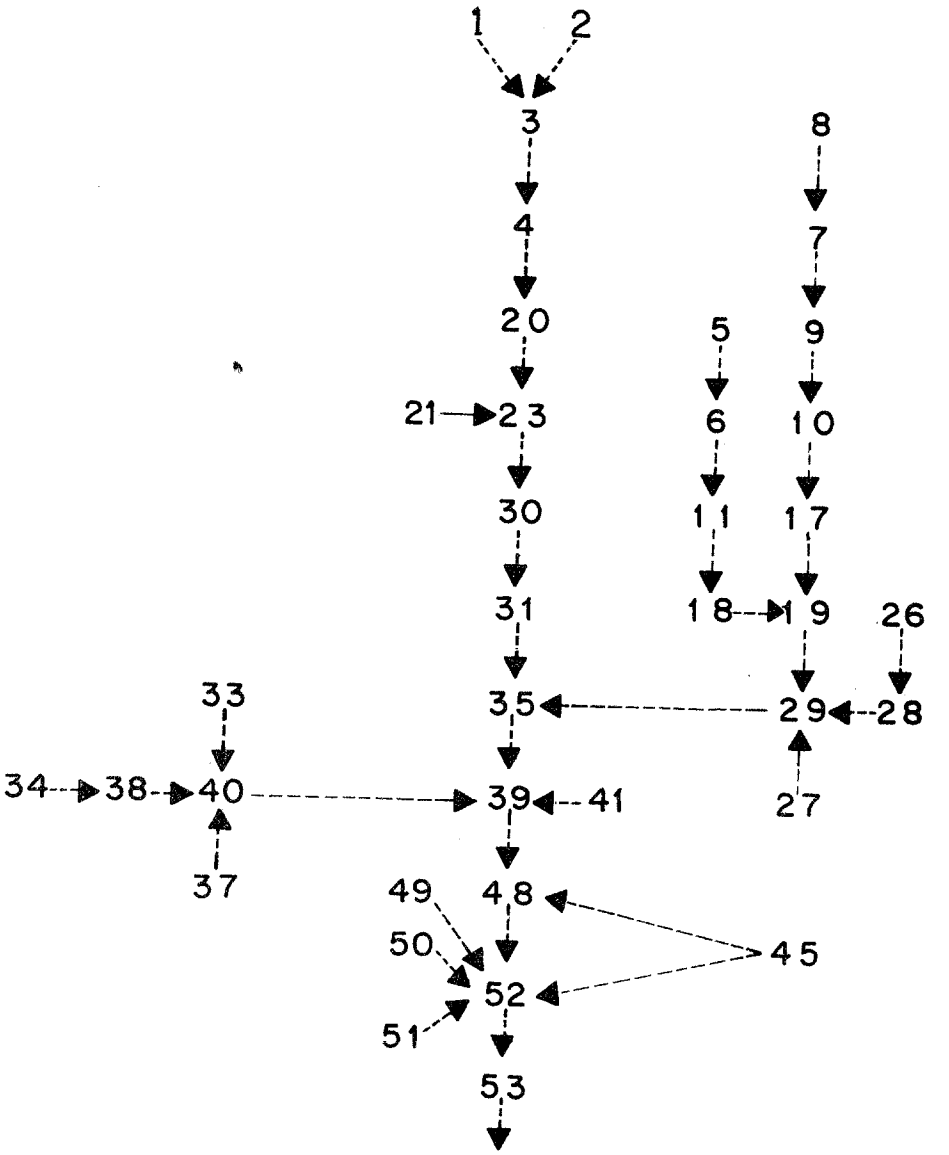
0 500 1000 1500 2000

PREPARED BY PARKER & ASSOCIATES
ENGINEERING/PLANNING/ARCHITECTURE/PHOTOGRAMMETRY
DENVER, COLORADO

LEGEND

- waterway
- greenbelt
- channel protection
- grouted channel protection
- check dam
- existing drainage structure
- proposed storm sewer

EXHIBIT NO. 9
SUB-BASIN-SCHEMATIC
BY BASIN NUMBERS



monument creek

EXHIBIT NO. 10
SUB-BASIN-SCHEMATIC
BY BASIN NUMBERS

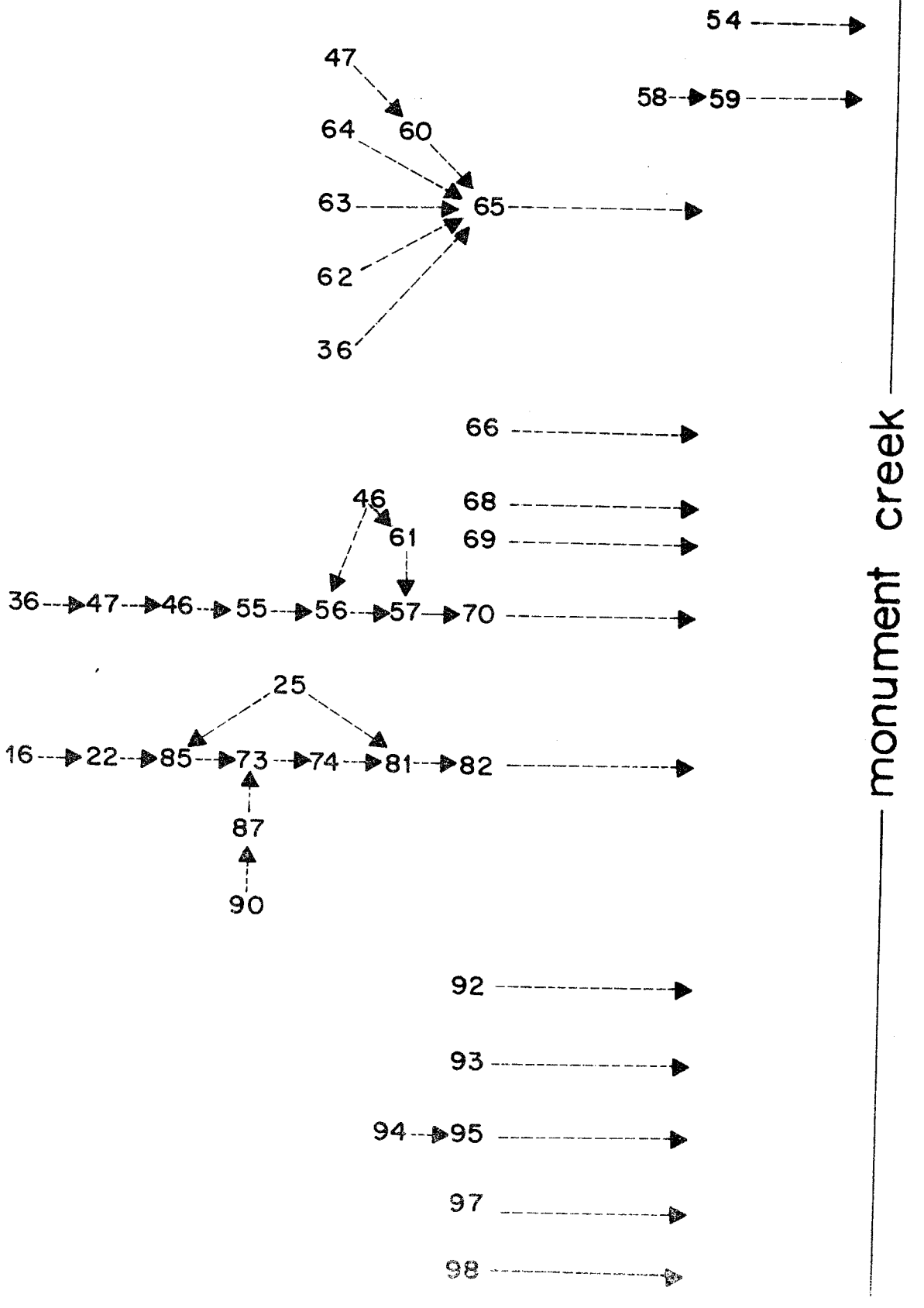
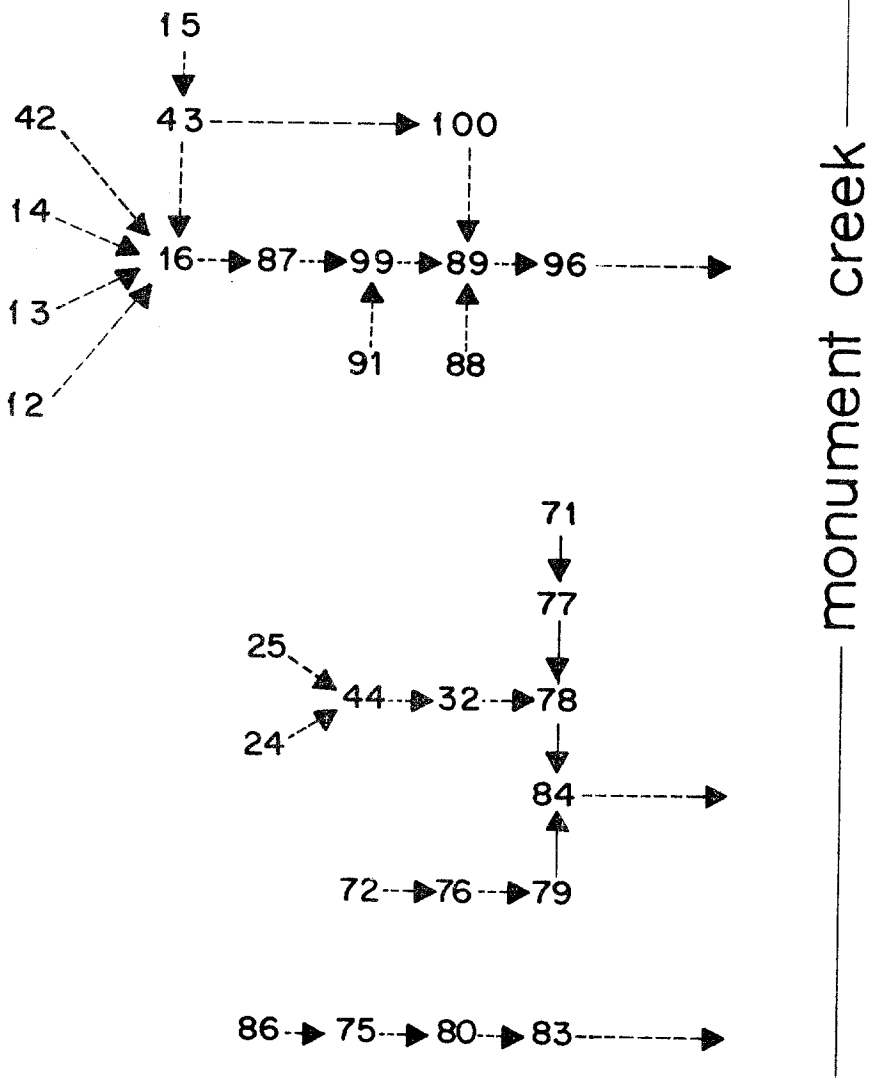


EXHIBIT NO. 11
SUB-BASIN-SCHEMATIC
BY BASIN NUMBERS



SECTION IV

COST FACTORS

GENERAL

An estimate of cost has been provided for all proposed improvements. This estimate is shown in Table No. 8.

Estimated costs have been based on current construction cost figures. Appropriate escalation factors will be required for construction done in future years.

The total estimated cost for all improvements is $2,066,608.50.

A further breakdown of costs shows that a total of $1,841,702.50 =(),674,275x or $1,048.81 per acre is the cost for improvements in presently undeveloped areas. ~~An additional bridge fee of $26.06 per acre has been determined for proposed bridges within the Mesa Basin.~~

These basins are classified with regard to City responsibility or developer responsibility for the proposed drainage improvements.

City Costs	Developer Costs
15, easterly portion of 16, easterly portion of 25, easterly portion of 36, 43, 45, 46, 47, 48, 49, 50, 51, 52, 53, 55, 56, 57, 60, 61, 62, 63, 64, 71, 72, 73, 74, 75, 76, 77, 84, 85, 86, 87, 88, 89, 90, 91, 93, 94, 99.	All of basins 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, westerly portion of 16, 17, 18, 19, 20, 21, 22, 23, 24, westerly portion of 25, 26, 27, 28 29, 30, 31, 32, 33, 34, 35, westerly portion of 36, 37, 38, 39, 40, 41, 42, 44, 54, 58, 59, 65, 66, 67, 68, 69, 70, 78, 79, 80, 81, 82, 83, 92, 95, 96, 97, 98, 100.
Total Acreage = 338 Acres	Total Acreage = 1,756 Acres

TABLE 7

QUANTITIES OF PROPOSED IMPROVEMENTS

Sub-Basin No.	Description	City Cost	Developer Cost	Total	Bridges Description	Bridges Cost
1	Unclassified Structures		2,000.00	2,000.00		
2	Unclassified Structures		2,000.00	2,000.00		
3	460 L.F. 48" CMP		14,720.00			
	Unclassified Structures		2,000.00	16,720.00		
4	120 L.F. 42" CMP		3,000.00			
	Unclassified Structures		20,000.00	23,000.00		
5	100 L.F. 30" CMP		2,100.00			
	Unclassified Structures		5,000.00	7,100.00		
6	Unclassified Structures		20,000.00	20,000.00		
7	50 L.F. 21" RCP		850.00			
	1 Headwall		100.00			
	1 Manhole		1,000.00			
	Unclassified Structures		2,000.00	3,950.00		

TABLE 7

Continued

Sub-Basin No.	Description	City Cost	Developer Cost	Total	Bridges Description	Bridges Cost
8	50 L.F. 30" RCP		1,050.00			
	1 Headwall		150.00			
	1 Manhole		1,000.00			
	Unclassified Structures		5,000.00	7,200.00		
9	310 L.F. 18" CMP		4,960.00			
	150 L.F. 30" CMP		3,150.00			
	390 L.F. 48" CMP		12,480.00			
	150 L.F. 18" RCP		2,250.00			
	1230 L.F. 21" RCP		20,910.00			
	2360 L.F. 30" RCP		49,560.00			
	730 L.F. 36" RCP		18,250.00			
	250 L.F. 42" RCP		7,750.00			
	1 Headwall		250.00			
	5 - 18" Flared End Sections		675.00			
	13 Manholes		13,000.00			
	750 C.Y. Rip-Rap		11,250.00	144,485.00		
10	310 L.F. 48" CMP		9,920.00	9,920.00		
11	120 L.F. 30" CMP		2,520.00	2,520.00		
12	Unclassified Structures		3,000.00	3,000.00		
13	3,500 C.Y. Rip-Rap		52,500.00			
	Unclassified Structures		15,000.00	67,500.00		

TABLE 7

Continued

Sub-Basin No.	Description	City Cost	Developer Cost	Total	Bridges Description	Bridges Cost
14	Unclassified Structures		2,000.00	2,000.00		
15	90 L.F. 30" CMP	1,890.00				
	60 L.F. 42" CMP	1,500.00				
	Unclassified Structures		5,000.00	8,390.00		
16	150 L.F. 42" RCP	4,650.00				
	350 L.F. 48" RCP	12,950.00				
	2 Headwalls	300.00				
	1050 C.Y. Rip-Rap		15,750.00			
	Unclassified Structures		5,000.00	38,650.00		
17	6250 C.Y. Rip-Rap		93,750.00			
	350 C.Y. Grouted Rip-Rap		8,750.00			
	Unclassified Structures		5,000.00	107,500.00		
18	2120 C.Y. Rip-Rap		31,800.00			
	350 C.Y. Grouted Rip-Rap		8,750.00			
	Unclassified Structures		5,000.00	45,550.00		

TABLE 7

Continued

Sub-Basin No.	Description	City Cost	Developer Cost	Total	Bridges Description	Bridges Cost
19	8000 C.Y. Rip-Rap		120,000.00			
	Unclassified Structures		20,000.00	140,000.00		
20	2150 C.Y. Rip-Rap		32,250.00			
	350 C.Y. Grouted Rip-Rap		8,750.00			
	Unclassified Structures		15,000.00	56,000.00		
21	250 C.Y. Grouted Rip-Rap		6,250.00			
	Unclassified Structures		5,000.00	11,250.00		
22	Unclassified Structures		5,000.00	5,000.00		
23	3370 C.Y. Rip-Rap		50,550.00			
	Unclassified Structures		20,000.00	70,550.00		
24	3500 C.Y. Rip-Rap		52,500.00			
	Unclassified Structures		4,000.00	56,500.00		

TABLE 7

Continued

Sub-Basin No.	Description	City Cost	Developer Cost	Total	Bridges Description	Bridges Cost
25	60 L.F. 18" RCP	900.00				
	330 L.F. 24" RCP	6,270.00				
	80 L.F. 48" CMP		2,560.00			
	3 Ea. 6' Curb Inlet	2,550.00				
	2 Manholes	2,000.00				
	Unclassified Structures	5,000.00	19,280.00			
26	Unclassified Structures		9,000.00	9,000.00		
28	Unclassified Structures		10,000.00	10,000.00		
29	10040 C.Y. Rip-Rap		150,600.00			
	Unclassified Structures		35,000.00	185,600.00		
30	3600 C.Y. Rip-Rap		54,000.00			
	Unclassified Structures		26,000.00	80,000.00		
31	1250 C.Y. Rip-Rap		18,750.00			
	Unclassified Structures		26,000.00	44,750.00		

TABLE 7

Continued

Sub-Basin No.	Description	City Cost	Developer Cost	Total	Bridges Description	Bridges Cost
32	620 L.F. 24" RCP		11,780.00			
	890 L.F. 42" RCP		27,590.00			
	3 Ea. 10' Curb Inlet		3,600.00			
	1 Ea. 12' Curb Inlet		1,400.00			
	6 Manholes		6,000.00			
	850 C.Y. Rip-Rap		12,750.00	63,120.00		
33	Unclassified Structures		12,000.00	12,000.00		
34	Unclassified Structures		7,000.00	7,000.00		
35	11800 C.Y. Rip-Rap		177,000.00			
	Unclassified Structures		20,000.00	197,000.00	10' x 10' RCBC	18,000.00
36	180 L.F. 18" RCP	2,700.00				
	600 L.F. 21" RCP	10,200.00				
	500 L.F. 30" RCP	10,500.00				
	3 Manholes	3,000.00				
	2 Ea. 4' Curb Inlet	1,400.00				
	1 Ea. 8' Curb Inlet	1,000.00				
	1 Ea. 10' Curb Inlet	12,00.00		30,000.00		

TABLE 7

Continued

Sub-Basin No.	Description	City Cost	Developer Cost	Total	Bridge Description	Bridge Cost
37	Unclassified Structures		11,000.00	11,000.00		
39	8000 C.Y. Rip-Rap		120,000.00			
	Unclassified Structures		30,000.00	150,000.00		
40	Unclassified Structures		9,000.00	9,000.00		
41	Unclassified Structures		6,000.00	6,000.00		
42	Unclassified Structures		5,000.00	5,000.00		
44	1 Ea. Headwall		250.00			
	40 L.F. 36" RCP		1,000.00			
	1500 C.Y. Rip-Rap		22,500.00			
	Unclassified Structures		5,000.00	28,750.00		
46	1450 L.F. 36" RCP	36,250.00				
	3 Manholes	3,000.00		39,250.00		

TABLE 7

Continued

Sub-Basin No.	Description	City Cost	Deverloper Cost	Total	Bridges Description	Bridges Cost
47	350 L.F. 30" RCP 1 Manhole 2 Ea. 8' Curb Inlet	7,350.00 1,000.00 2,000.00		10,350.00		
48	2350 C.Y. Rip-Rap 10' x 12' RCBC	35,250.00	19,000.00	54,250.00		
52	250 C.Y. Rip-Rap	3,750.00		3,750.00		
53	250 C.Y. Rip-Rap	3,750.00		3,750.00	Double 7' x 10' RCBC (Railroad)	23,600.00 *
54	500 C.Y. Rip-Rap	7,500.00		7,500.00		
		$162,860.00	$1,674,275.00	~~$1,810,135.00~~ $1,837,135.00		~~$41,600.00~~ 18,000

Drainage Fee:
(including 10% contingency) $\frac{\text{dollars cost}}{\text{developmental area}}$ = $1,048.81

Bridge Fee:
(including 10% contingency) $\frac{\text{dollars cost}}{\text{developmental area}}$ = $ ~~26.06~~ 11.00

* Not included in Bridge Fee

TABLE 8

COST ESTIMATES OF PROPOSED IMPROVEMENTS

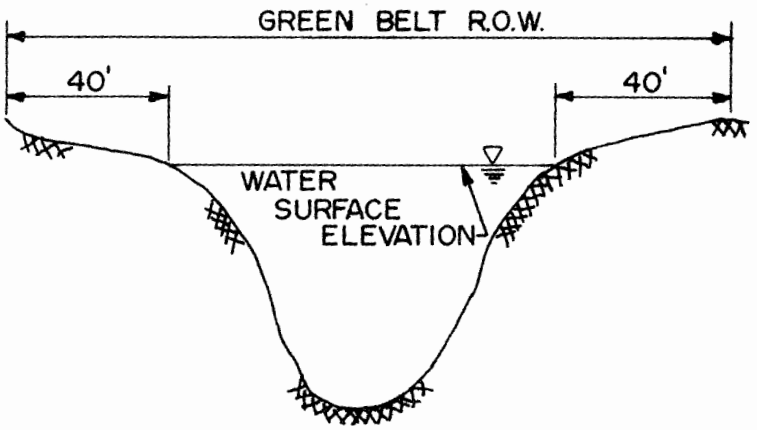
No.	Item	Unit	Quantity	Unit Price	Cost
1.	18" RCP	L.F.	390	15.00	5,850.00
2.	21" RCP	L.F.	1880	17.00	31,960.00
3.	24" RCP	L.F.	950	19.00	18,050.00
4.	30" RCP	L.F.	3260	21.00	68,460.00
5.	36" RCP	L.F.	2220	25.00	55,500.00
6.	42" RCP	L.F.	1290	31.00	39,990.00
7.	48" RCP	L.F.	350	37.00	12,950.00
7.5	18" concrete flared end section	EA.	5	135.00	675.00
8.	Double 7' x 10' RCBC	L.F.	40	590.00	23,600.00
9.	10' x 10' RCBC	L.F.	50	360.00	18,000.00
10.	10' x 12' RCBC	L.F.	50	380.00	19,000.00
11.	4' Curb Inlet	EA.	2	700.00	1,400.00
12.	6' Curb Inlet	EA.	3	850.00	2,550.00
13.	8' Curb Inlet	EA.	3	1000.00	3,000.00
14.	10' Curb Inlet	EA.	4	1200.00	4,800.00

TABLE 8

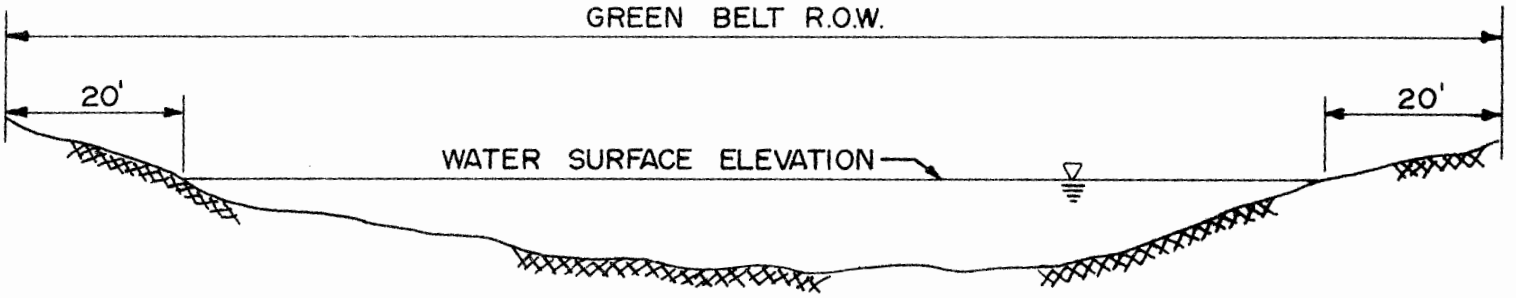
Continued

No.	Item	Unit	Quantity	Unit Price	Cost
15.	12' Curb Inlet	EA.	1	1400.00	1,400.00
16.	Manholes	EA.	30	1000.00 (ave.)	30,000.00
17.	18" CMP	L.F.	310	16.00	4,960.00
18.	30" CMP	L.F.	460	21.00	9,660.00
19.	42" CMP	L.F.	180	25.00	4,500.00
20.	48" CMP	L.F.	1240	32.00	39,680.00
21.	Headwalls	EA.	6	175.00 (ave.)	1,050.00
22.	Rip-Rap	C.Y.	71080	15.00	1,066,200.00
23.	Grouted Rip-Rap	C.Y.	1300	25.00	32,500.00
24.	Unclassified Structures				383,000.00
				Sub-Total	1,878,735.00
				10% Contingencies	187,873.50
				Total	2,066,608.50

MESA DETAILS
NATURAL CHANNELS
EXHIBIT NO. 12

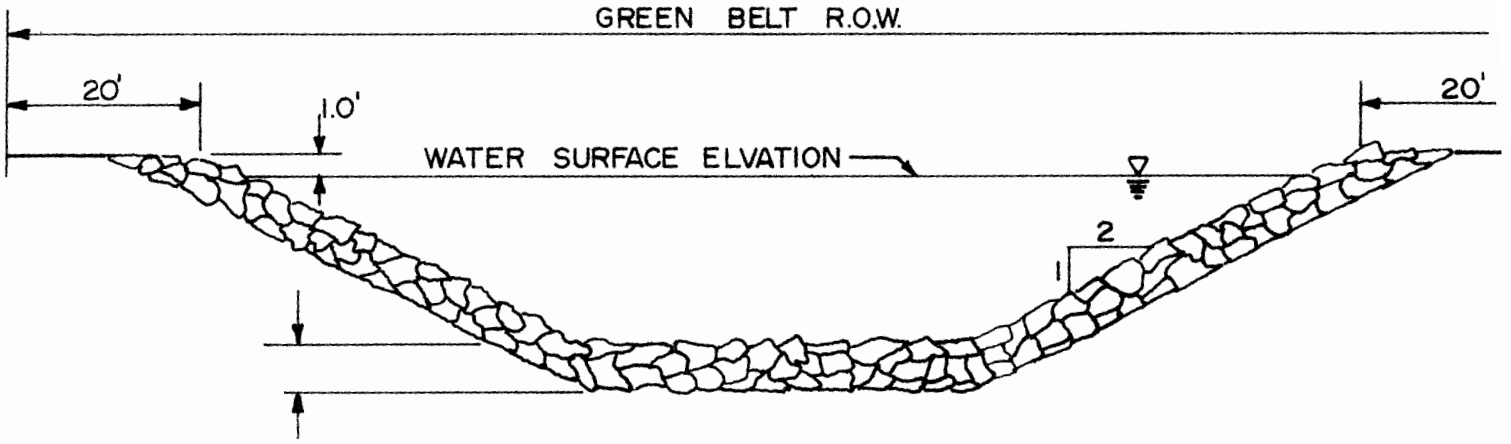


TYPICAL NATURAL CHANNEL SECTION WITH
VELOCITIES BETWEEN 3.0 AND 8.0 FEET PER SECOND



TYPICAL NATURAL CHANNEL SECTION WITH
VELOCITIES LESS THAN 3.0' FEET PER SECOND

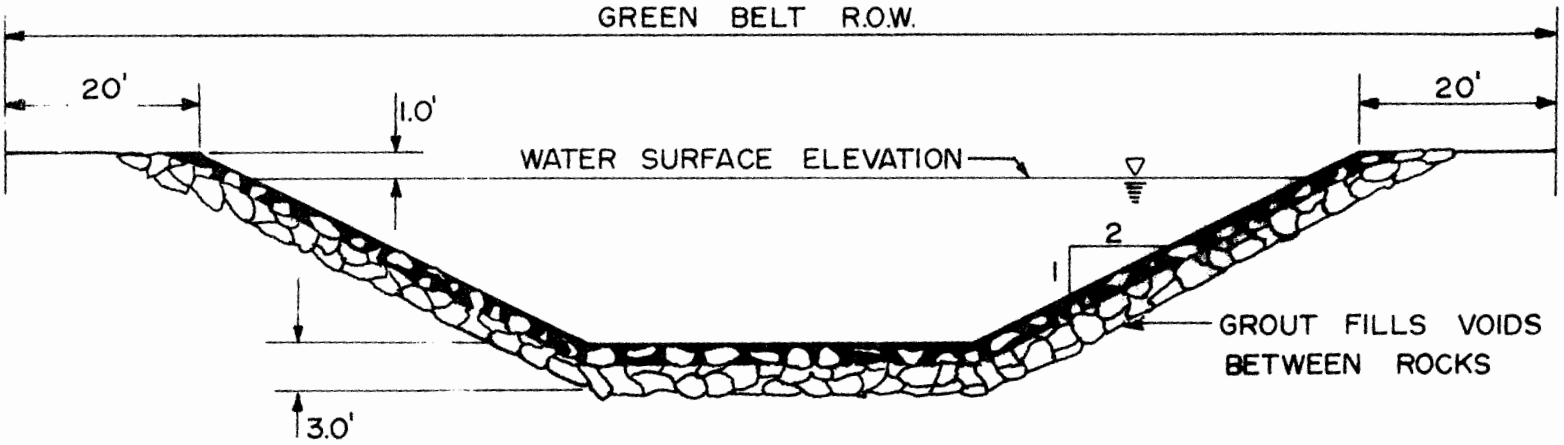
MESA DETAILS
RIP RAP & GROUTED RIP RAP
EXHIBIT NO. 13



LAYER THICKNESS IS 1.5 TIMES THE DIAMETER OF ROCK

NOTE: DIAMETER OF ROCK WILL BE SIZED WITH REGARD TO CHANNEL VELOCITIES.

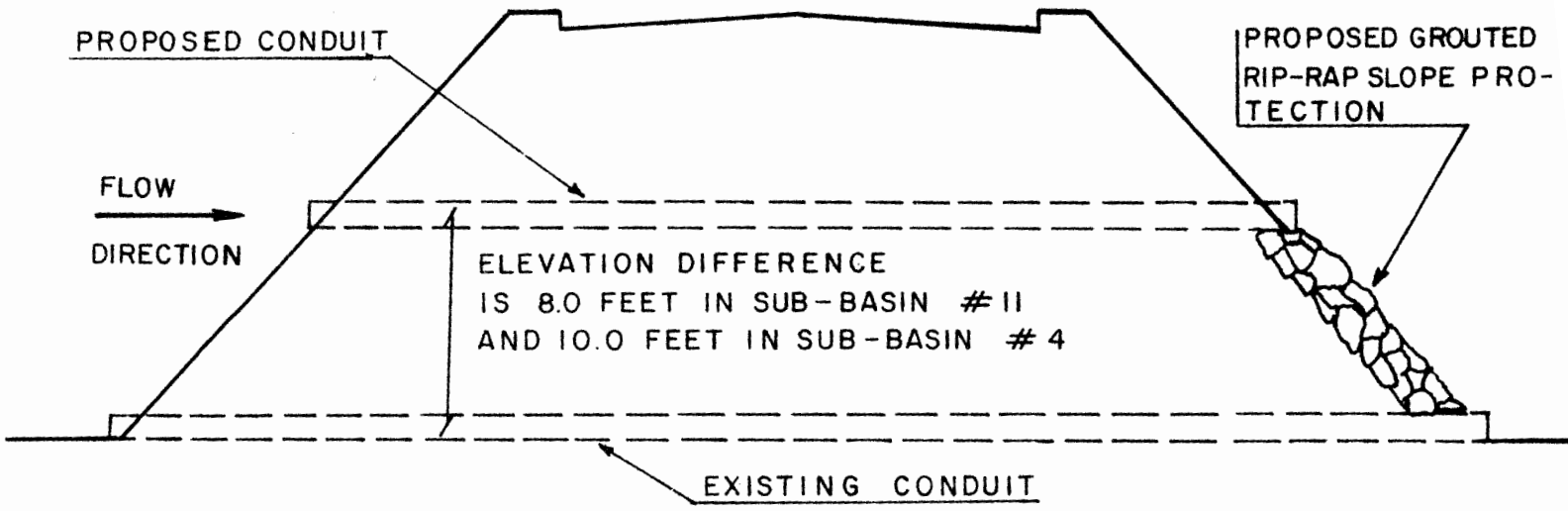
TYPICAL RIP RAP SECTION



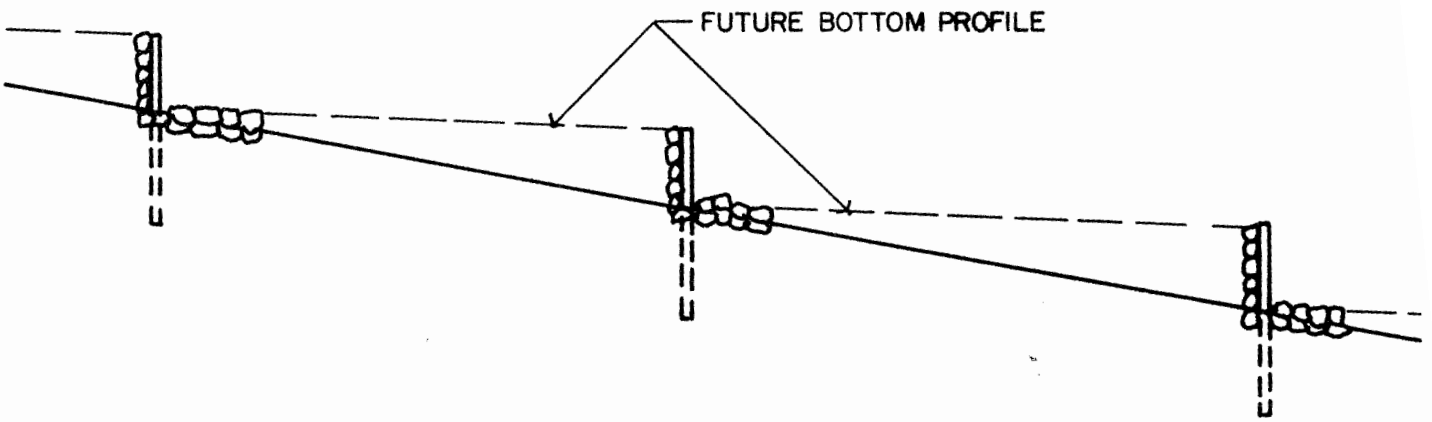
TYPICAL GROUTED RIP RAP SECTION

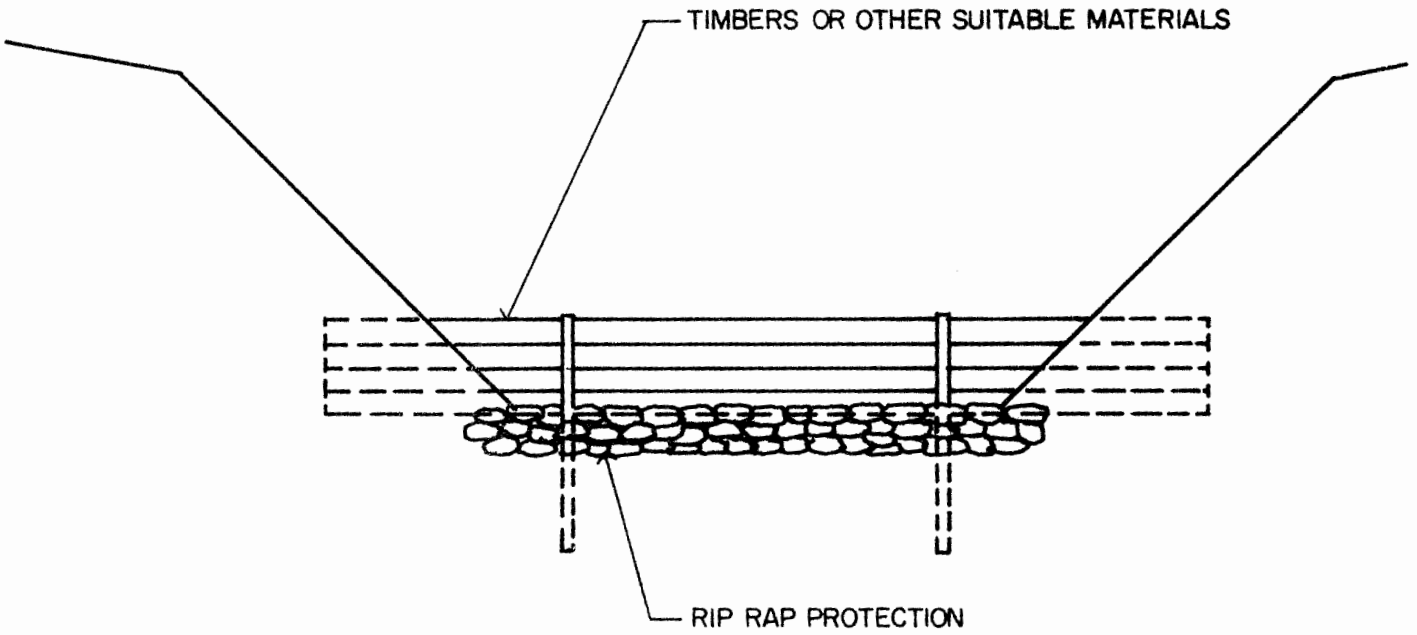
NOTE: GROUT SHALL PENETRATE RIP RAP TO A DEPTH NOT LESS THAN 6"

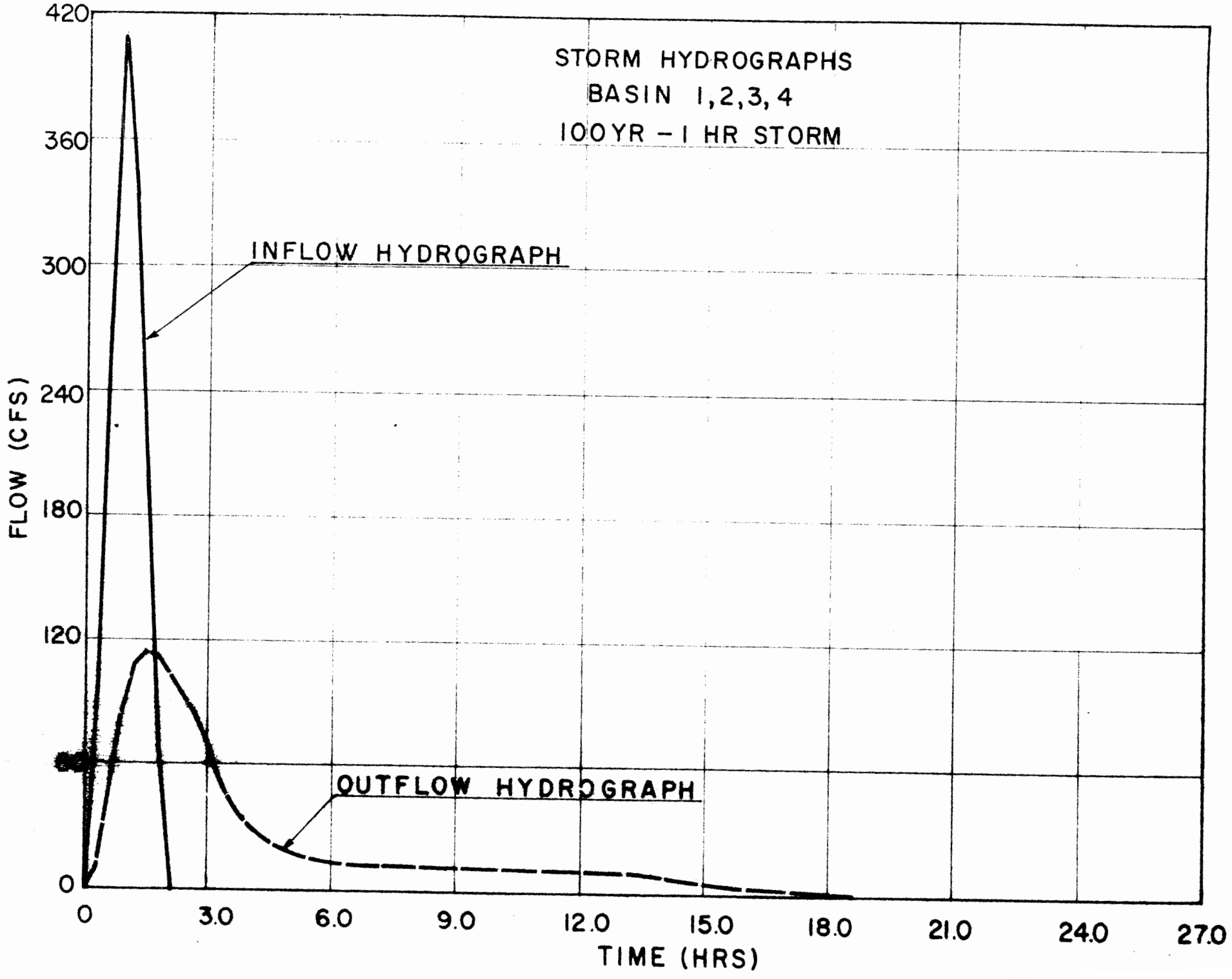
MESA DETAILS
FILLMORE ST CROSSING
IN SUB-BASINS #4 AND #11
EXHIBIT NO. 14

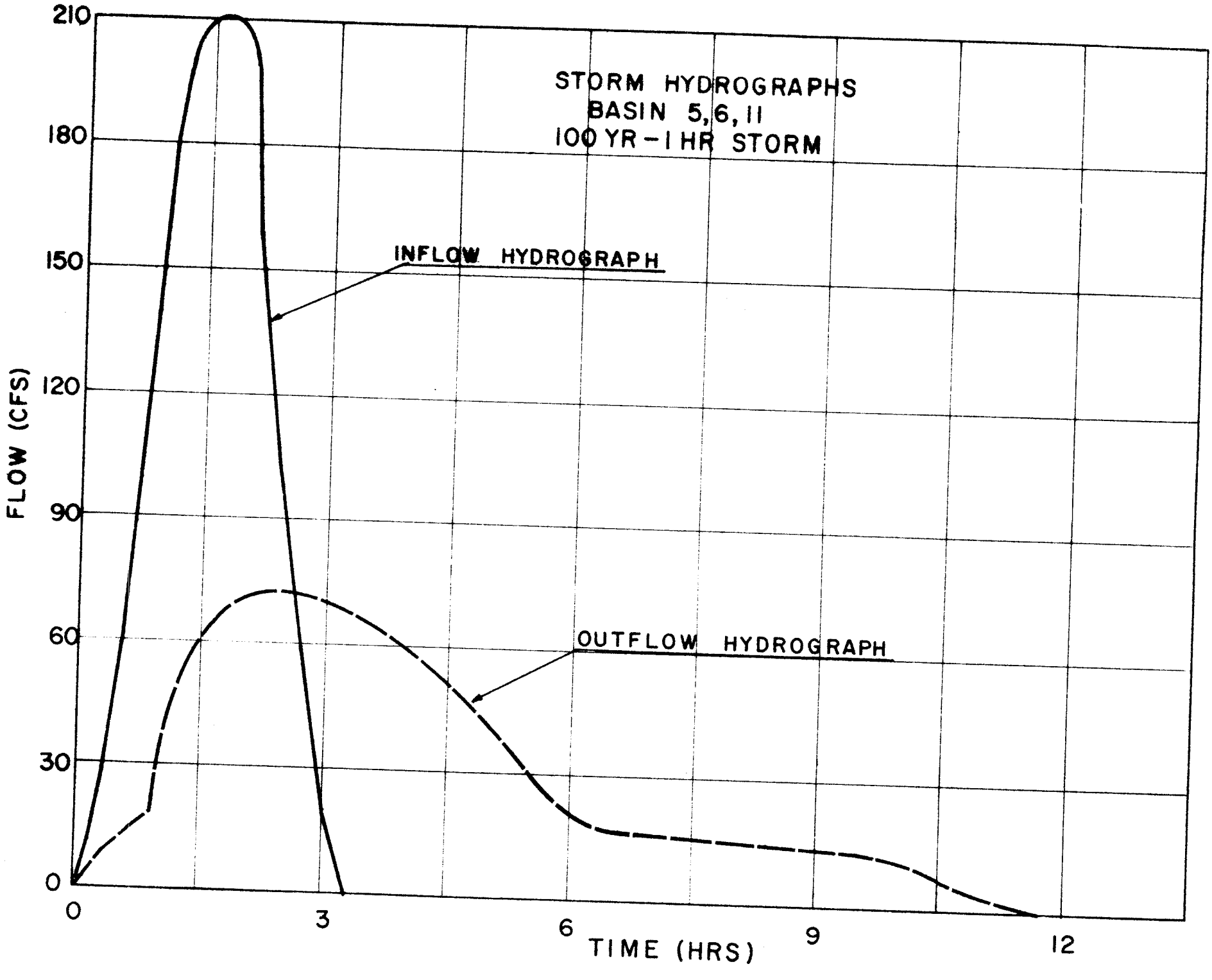


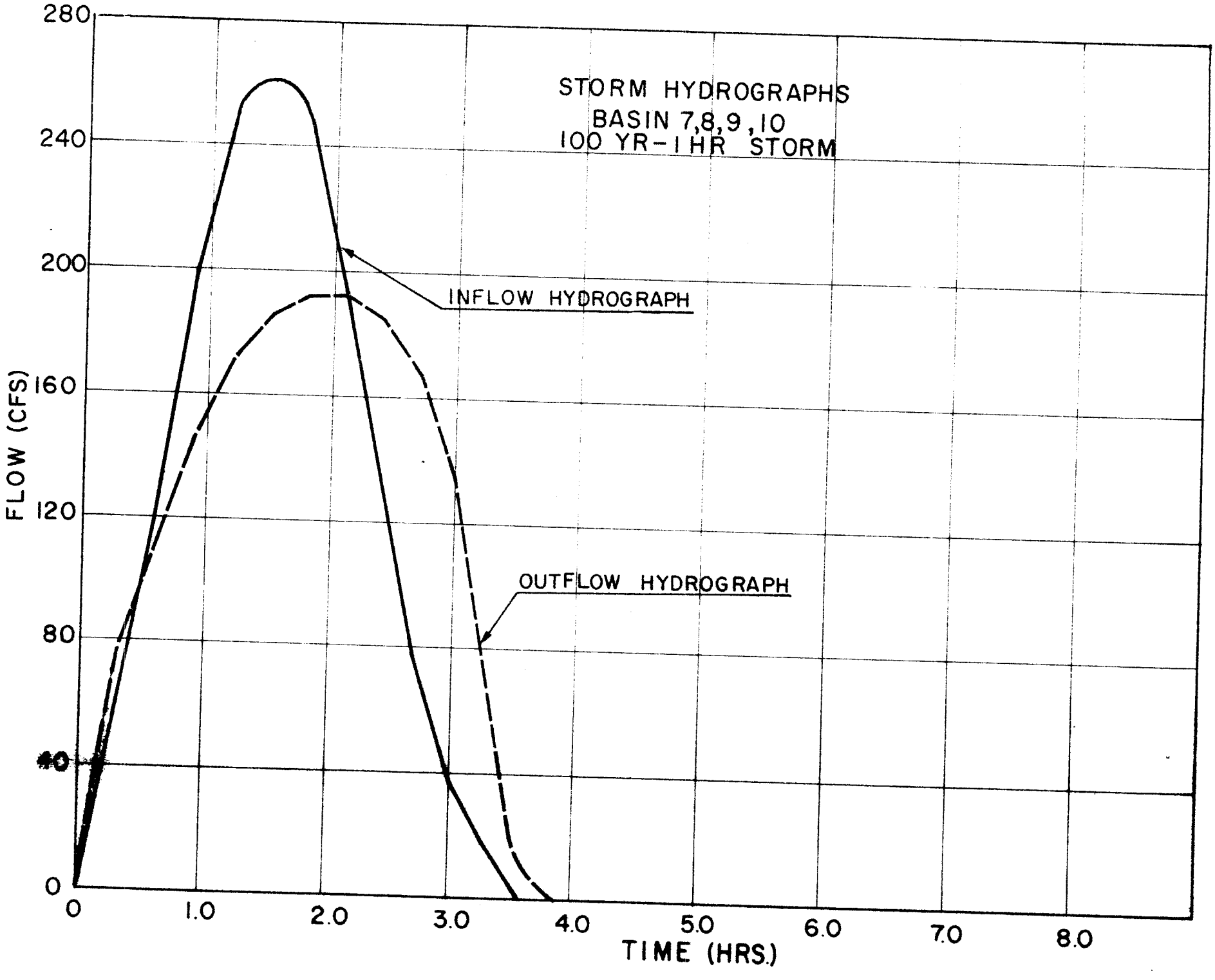
MESA DETAILS
CHECK DAMS
EXHIBIT NO. 15

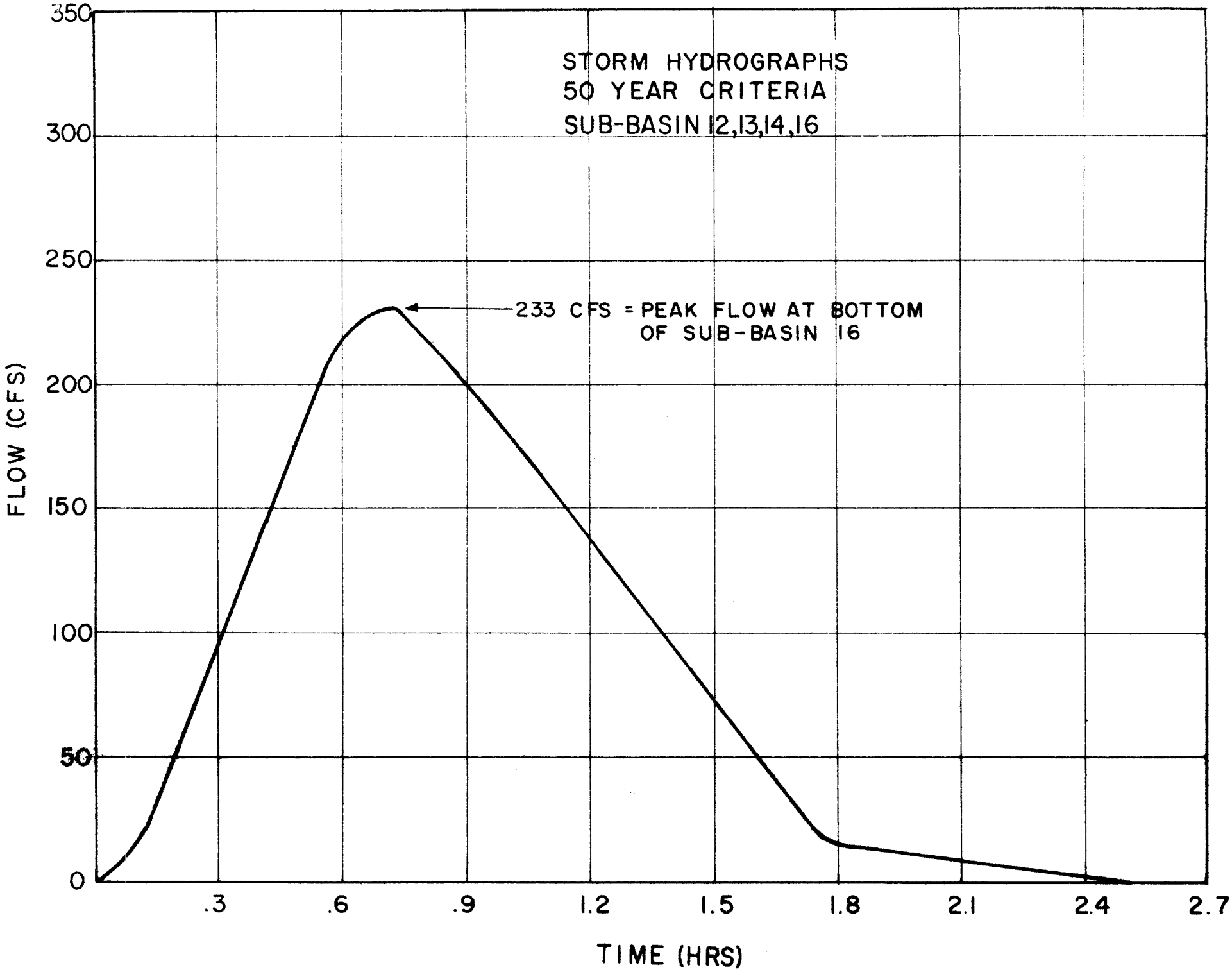


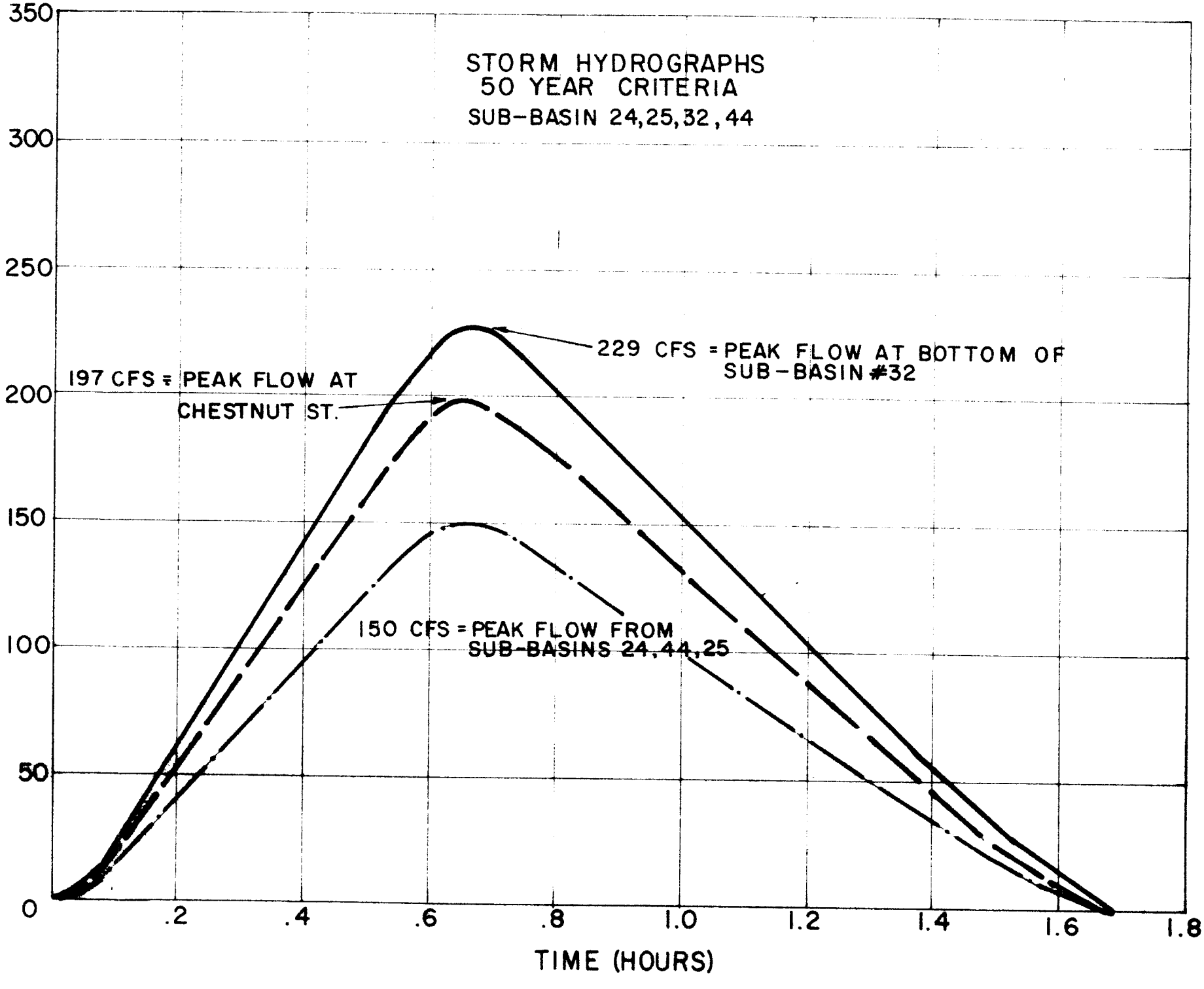


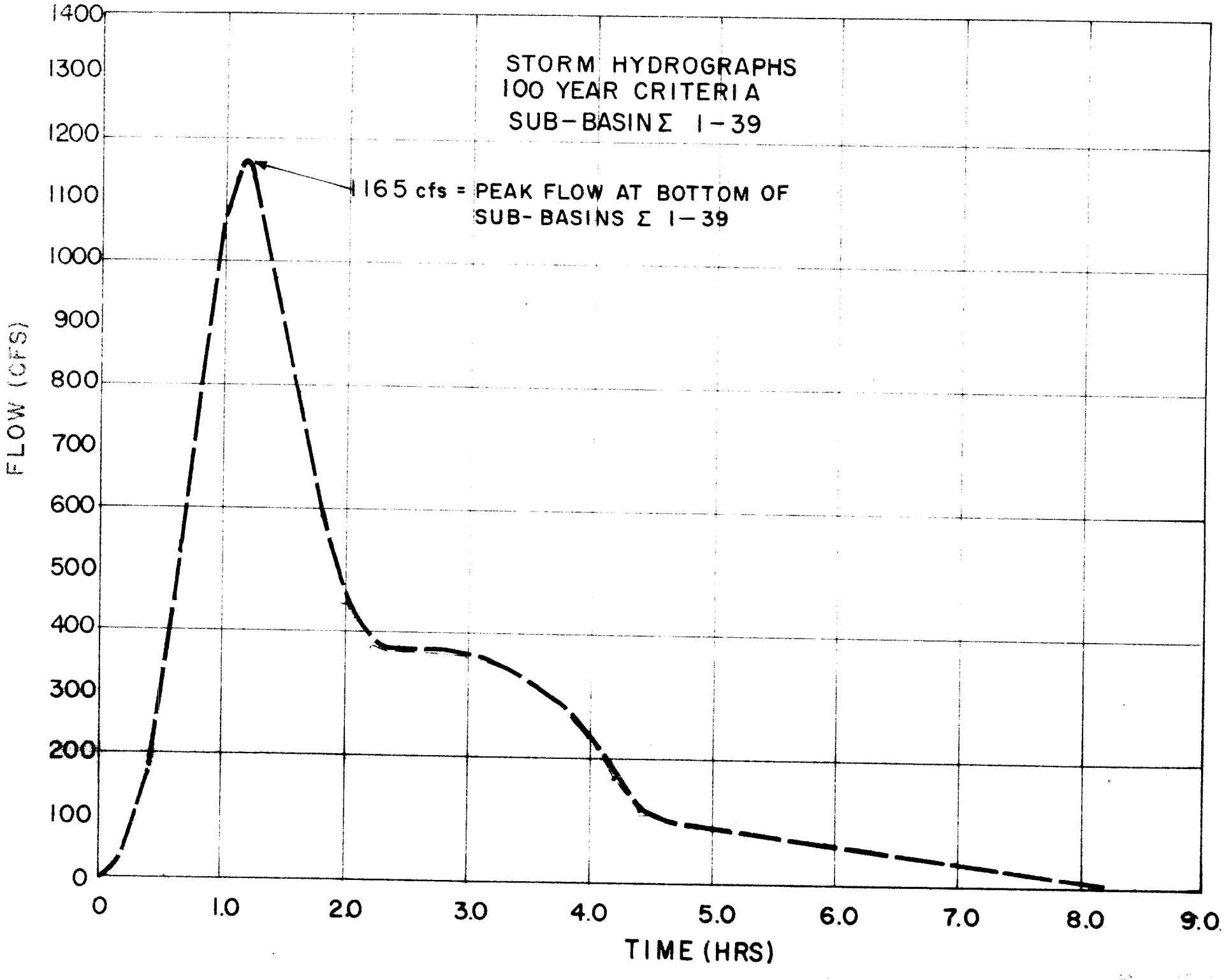

STORM HYDROGRAPHS
BASIN 1,2,3,4
100YR - 1 HR STORM
INFLOW HYDROGRAPH
OUTFLOW HYDROGRAPH
FLOW (CFS)
TIME (HRS)
420
360
300
240
180
120
0
0
3.0
6.0
9.0
12.0
15.0
18.0
21.0
24.0
27.0

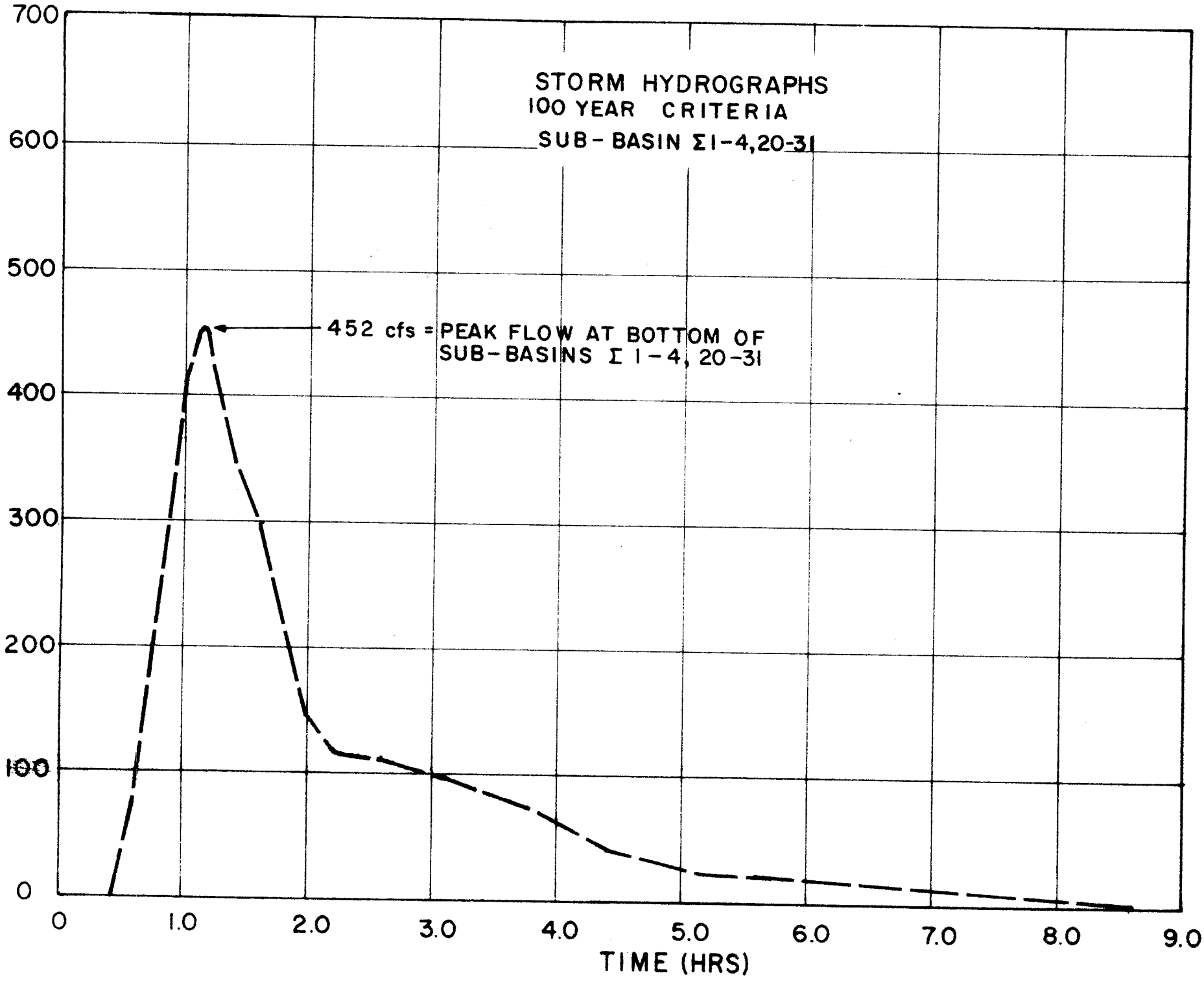

STORM HYDROGRAPHS
BASIN 5, 6, 11
100 YR - 1 HR STORM
INFLOW HYDROGRAPH
OUTFLOW HYDROGRAPH
FLOW (CFS)
210
180
150
120
90
60
30
0
0
3
6
9
12
TIME (HRS)

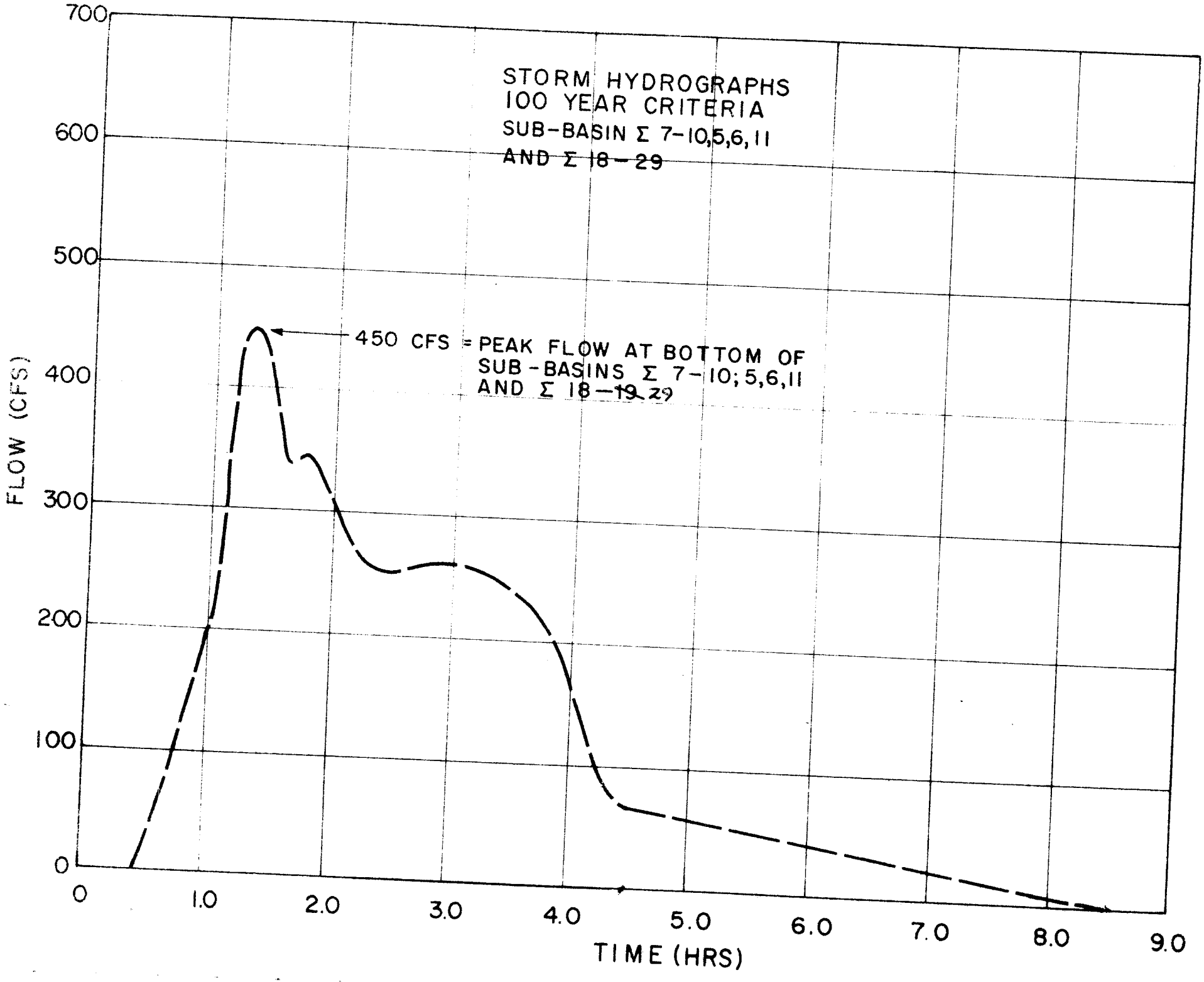

STORM HYDROGRAPHS
BASIN 7,8,9,10
100 YR-1 HR STORM
INFLOW HYDROGRAPH
OUTFLOW HYDROGRAPH
FLOW (CFS)
TIME (HRS.)
280
240
200
160
120
80
40
0
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0


STORM HYDROGRAPHS
50 YEAR CRITERIA
SUB-BASIN 12,13,14,16
233 CFS = PEAK FLOW AT BOTTOM OF SUB-BASIN 16
FLOW (CFS)
350
300
250
200
150
100
50
0
.3
.6
.9
1.2
1.5
1.8
2.1
2.4
2.7
TIME (HRS)


STORM HYDROGRAPHS
50 YEAR CRITERIA
SUB-BASIN 24,25,32,44
350
300
250
200
150
100
50
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
TIME (HOURS)
229 CFS = PEAK FLOW AT BOTTOM OF SUB-BASIN #32
197 CFS = PEAK FLOW AT CHESTNUT ST.
150 CFS = PEAK FLOW FROM SUB-BASINS 24,44,25


STORM HYDROGRAPHS
100 YEAR CRITERIA
SUB-BASIN Σ 1-39
1165 cfs = PEAK FLOW AT BOTTOM OF SUB-BASINS Σ 1-39
FLOW (CFS)
TIME (HRS)
0
100
200
300
400
500
600
700
800
900
1100
1200
1300
1400
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0


STORM HYDROGRAPHS
100 YEAR CRITERIA
SUB-BASIN Σ1-4,20-31
452 cfs = PEAK FLOW AT BOTTOM OF SUB-BASINS Σ 1-4, 20-31
700
600
500
400
300
200
100
0
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
TIME (HRS)


STORM HYDROGRAPHS
100 YEAR CRITERIA
SUB-BASIN Σ 7-10,5,6,11
AND Σ 18-29
450 CFS = PEAK FLOW AT BOTTOM OF
SUB-BASINS Σ 7-10; 5,6,11
AND Σ 18-19, 29
FLOW (CFS)
700
600
500
400
300
200
100
0
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
TIME (HRS)

RICHARD D. LAMM
Governor

C.J. KUIPER
State Engineer

DIVISION OF WATER RESOURCES

Department of Natural Resources
300 Columbine Building
1845 Sherman Street
Denver, Colorado 80203
Administration (303) 892-3581
Ground Water (303) 892-3587

MAR 24 1976

March 22, 1976

Mr. Donald Jeffries
City Engineer
P.O. Box 1575
Municipal Building
Colorado Springs, CO 80901

Re: Mesa Basin Drainage Improvements
W. Div. 2 W. Dist. 10

Dear Mr. Jeffries:

Mr. David A. Henny of Parker & Associates requested that we review their study of the subject basin.

We have determined that none of the proposed works comes under our jurisdiction in accordance with CRS 1973, 37-87-105 -- Approval of Plans for Reservoir.

It appears that the proposed plan, under the auspices of the City of Colorado Springs, will provide the appropriate protection which the populace is entitled.

If you have any further questions, please contact our Dams and Reservoirs Branch.

Very truly yours,

Alan E. Pearson, P.E.
Chief, New Plans & Specifications
Dams and Reservoirs Branch

AEP:cam

cc: David Henny