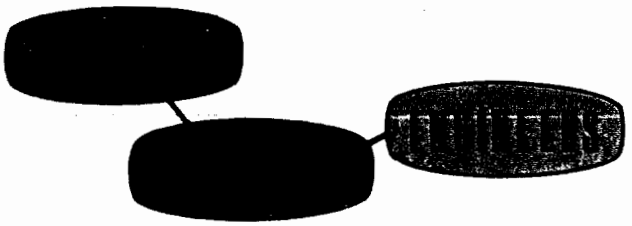

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HYDROLOGIC ENGINEERING STUDY
OF THE

ROCKRIMMON NORTH DRAINAGE BASIN

COLORADO SPRINGS COLORADO
MARCH, 1973

C- Springs Copy

planners · consultants · engineers

Suite 200
4525 Northpark Drive
Colorado Springs, Colo. 80907

(303) 598-3222

March 20, 1973

Director of Public Works
City of Colorado Springs
Colorado Springs, Colorado

Dear Sir:

Transmitted herewith is the Hydrologic Engineering Study of the Rockrimmon North Drainage Basin in Colorado Springs, Colorado.

This report includes a study of the rainfall runoff characteristics and makes recommendations regarding the structures to accomodate this runoff. This is the Master Drainage Plan to accomodate all proposed development within the basin.

The plan has been prepared at the request of the Golden Cycle Land Corporation to conform to their recently approved Master Development Plan of the Rockrimmon Area.

We remain available at any time to answer questions or provide specific information relative to this study.

Respectfully submitted,

UNITED WESTERN ENGINEERS

Allan D. Miller

Allan D. Miller
President

/dst

Enclosure

Approved:

Nelson Kamuf
President, Golden Cycle Land Corporation

HYDROLOGIC ENGINEERING STUDY

OF THE

ROCKRIMMON NORTH DRAINAGE BASIN

Prepared for

THE GOLDEN CYCLE LAND CORPORATION

AND

THE CITY OF COLORADO SPRINGS, COLORADO

CITY COUNCIL MEMBERS

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GOLDEN CYCLE LAND CORPORATION

W. T. Wells	Chairman
N. C. Kamuf	President
B. S. Clark	Secretary

March, 1973

I, Oliver E. Watts, a registered engineer in the State of Colorado, hereby certify that the attached drainage plan and report of the Rockrimmon North Drainage Basin were prepared under my direction and supervision and are correct to the best of my knowledge and belief. I further certify that said drainage report is in accordance with all City of Colorado Springs Ordinances and specifications and criteria; and the criteria, rules and regulations of the State Engineer of Colorado.

Registered Professional Engineer
and Land Surveyor, Number 9853

INDEX

HYDROLOGIC ENGINEERING STUDY

ROCKRIMMON NORTH DRAINAGE BASIN

SECTION I. INTRODUCTION

A. PURPOSE AND SCOPE

1. Purpose: The purpose of this study is twofold:

a. To provide a Master plan which will best protect the proposed developments within the basin and downstream areas from the runoff of severe storms, in accordance with sound engineering practice and current ordinances, laws, regulations and criteria applicable to the City of Colorado Springs.

b. To provide a legal means of enforcement to the City of Colorado Springs whereby land developers will be obligated to provide required storm drainage facilities and structures and whereby the costs related to these facilities and structures will be equitably distributed among the basin developers in accordance with ordinances of the City of Colorado Springs.

2. Scope: This study specifically prescribes the major storm drainage conveyances and generally describes the secondary, or collection, storm systems required to accomodate the runoff. These secondary systems are subject to considerable change, based on specific development plans of respective developers, however, the major outfall or greenbelt, systems should be considered fixed. It is intended that the facilities recommended herein may be replaced with alternatives based on detailed information presented with future drainage reports.

The study is intended to replace that portion of the study prepared by Karcich and Weber in March, 1967, which pertains to the Rockrimmon North Drainage Basin. Also incorporated into the proposed revised basin limits is a minor basin which was previously included in the study of the Dry Creek Drainage Basin by R. Keith Hook & Associates, dated November, 1966. Also incorporated is the Monument Creek area previously not studied in the form of a master basin report.

The revised study is prepared at the request of the Golden Cycle Land Corporation based on the decisions of the City Engineer and the City Drainage Board. This study is required because of the recently revised and approved Master Land Use Plan of the Rockrimmon Development and a number of proposed drainage revisions by the developer. The study also encompasses a number of updated and revised drainage criteria of the City. Opinions of the City attorney and proposed bills now before the State Legislature that the outflow after full development be held equal to or less that of the basin in its natural state are fully complied with.

All proposed developments within the basin are incorporated into this study.

B. DESCRIPTION OF BASIN

1. Location: The Rockrimmon North Drainage Basin lies in the Northwestern portion of Colorado Springs, as shown on Plate A in the appendix. It occupies portions of Section 11, 12, 13, 14 and 24 of Township 13 South, Range 67 West, and portions of Sections 7, 18 and 19 of Township 13 South, Range 66 West of the 6th P.M. The upper limit of the basin lies approximately three-fourths mile Southeast of the Mount Saint Francis Academy on Woodmen Road. The basin is oriented in a Southeasterly direction to the outfall points along Monument Creek near the Pikeview and Woodmen Road Interchanges on Interstate Highway 25.

The total basin comprises 1401.20 acres, of which 1385.45 acres is within the existing Colorado Springs City limits. The remaining 15.75 acres is located in the far Northwestern tip and is owned by the Mount Saint Francis Academy.

The basin is bounded on the South and West by the Rockrimmon South Basin, on the Northwest by the Douglas Creek Basin, on the North by an unstudied basin and on the East by the right-of-way of Interstate Highway 25. The Dry Creek and Cottonwood Creek Basins protrude into the basin, which includes all of Monument Creek from the Woodmen Road Bridge to the Interstate Bridge.

2. Terrain: The upper limits of the basin consist of steep rolling hills and well defined natural valleys. The slopes are covered by a good growth of Ponderosa and Pinon Pine, Scrub Oak and a variety of shrubs and grasses. The central portion consists of gently rolling terrain covered by a variety of shrubs and grasses, with isolated patches of Scrub Oak and Pinon Pine. The Eastern and Southern portions consist of moderately sloping hills and well defined channels, lightly timbered with small Ponderosa and Pinon Pine, Scrub Oak and various shrubs and grasses. All streams within the basin have intermittent flows with the exception of Monument Creek.

3. Soils: The various soil types are deliniated on Plates B and B1 in the appendix and are characterized as follows. Mapping and interpretations are by soil scientists of the USDA - Soil Conservation Service.

a. Mapping Unit C3: Razor series of well drained, light colored, clayey soils. The surface layer, 3 to 6 inches thick is a clay loam. Subsoil is a clay 12 to 24 inches thick overlying a calcarious clay extending to 20 to 40 inches in depth, where a calcarious shale occurs. This soil is of high plasticity, has a high shrink swell potential and falls within hydrologic group "D".

b. Mapping Unit C7: Cushman series of well drained, loamy soils over interbedded sandstone and shale. The surface layer ranges from loam to clay loam and and a sandy clay loam 4 to 10 inches thick. The subsoil is 15 to 30 inches of clay loam overlying a calcarious loam. Sandstone and shale occurs at 20 to 40 inches. These soils have low plasticity and permiability and fall within hydrologic group "C".

c. Mapping Unit RB-1: Stoney steep land of slopes from six percent to vertical cliffs. The surface soil is loamy sand or sandy loam of a depth of from 10 to 30 inches over sandstone or shale, with 20 to 30 percent of the area in rock outcrop. This soil is within hydrologic group "D".

d. Mapping Unit RB-2: Samsil soils and gravelly, cobbly material over shale. The samsil series consists of light colored, calcarious, clayey soils of high shrink swell capacity overlying shale at a depth of 20 inches or less. The gravelly, cobbly material is 30 to 70 percent coarse fragments overlying shale at depths of one to thirty feet, and was the source of several worked out gravel pits in the area. This soil is in hydrologic group "D".

e. Mapping Unit R5: Tructon series of deep, dark soils which are sandy loam in texture throughout the profile. The surface layer is 5 to 8 inches thick, the subsoil 10 to 26 inches thick and the light colored underlying soil usually extends to a depth of 60 inches or more. This soil is moderately permiable, has low plasticity and falls within hydrologic group "B".

f. Bedrock: The sandstone and shale outcroppings and bedrock are commonly found in the Southern portions of the basin and are of the Laramie and Fox Hills Sandstone formations which are exposed on Popes Bluff. The Laramie formation consists of black shale and seams of lignite interbedded with irregular layers of sandstone and is the primary source for the coal mines underlying the area. The Fox Hills formation is a massive white fine grained sandstone in the upper part; underlain by greenish and brown fine-grained sandstone; interbedded with shale in the lower part.

In the Northern portions of the basin are exposed outcroppings of the Dawson Arkose formation, a coarse varicolored conglomeratic sandstone with lenses of clay in the upper part; arkosic sand and shale containing lignite, in the lower part.

4. Existing Developments: Very few drainage structures exist within the basin. A few small culverts have been installed along the existing private roads, however, several major culverts exist along the railroad, Cascade Avenue, and Interstate 25 near the outfall points of the basin. These facilities are shown on Plates C and C1 in the appendix and will be utilized to the maximum extent possible in this study.

In the late 1950's and early 1960's the owner initiated two great plains improvement programs in cooperation with the Soil Conservation Service to conserve and restore the range land within the majority of the basin. In these programs several diversion ditches, erosion control dams, grassed waterways and seeding protects were constructed. The erosion control dams do not fall under the jurisdiction of the State Engineer, although a bill is now before the legislature which will require a filing similar to that of stockwater ponds. A stockwater pond was installed on the main greenbelt in the Northwest one-quarter, Section 18 which was filed with and approved by the State Engineer (Number 6868). These facilities are felt to be serving a useful purpose and will be utilized to the maximum extent in this study.

5. Condition of Range: At the request of the Engineer, the Soil Conservation Service has made a range study of the basin. As shown on Plate B, the upper portions of the basin is considered to be in poor to fair range condition, the lower portion to be in poor condition. The dominant range plants are the little Bluestem, Mountain Muhly, Junegrass, Bluegramma, Three-awn, Squirrel Tail, Mountain Mahogany, Ryus, Sand Drop, Oak and Western Wheat. The range has been invaded by Sleepygrass, Sand Lilly, Vetch, Cactus, Fringe sage, Yucca, Indian Paintbruch, Kinnikinnick, Pinque, Sleepytoes and Weeds.

The natural drainage channels were classified in accordance with Colorado State SCS advisory notice No. 836 as follows:

Case I - Well grassed; wide, stable swale.
Case II - Fairly well stabilized, well defined channel.
Case III- Heavily choked with brush.
Case IV - Active erosion in progress.
Case V - Large stream, well vegitated with meanders.

C. Proposed Development

Three major developments exist within the basin which have been proposed by respective developers. The Master Plans for these areas have been used in this report and are shown on the enclosed plates.

The Rockrimmon Development is the major one, for which the Master Development Plan has been previously approved by the City Council, occupying the majority of the basin and including the outfall points on Monument Creek.

The Westerly portion of the basin is the Paradise Valley Development, as proposed by the Vrooman Construction Company.

On the Northern edge of the basin is the 'Discovery' Development, as proposed by David Sellon and Associates.

Portions of the far upstream limits of the basin are not now proposed for a development. In these minor areas, the planners of this firm have determined the approximate best use of the land and have shown it on the enclosed plan, which is the basis of the drainage analysis. A portion of this area is now owned by the Mount Saint Francis Academy and realistically will remain in its existing state. However, in order to provide a conservative study and avoid potential future problems, this area is considered to be developed.

HYDROLOGIC ENGINEERING STUDY
OF THE
ROCKRIMMON NORTH DRAINAGE BASIN
SECTION II
METHOD OF ANALYSIS

A. REFERENCES

1. City of Colorado Springs:

a. Existing Ordinances, rules, regulations and criteria.

b. Dry Creek Drainage Study, R. Keith Hook and Associates, Inc., November, 1966.

c. Hydrologic Engineering Study of the Rockrimmon North and Rockrimmon South Drainage Basins, Karcich & Weber, Inc., March, 1967.

2. USDA - Soil Conservation Service:

a. Soil Mapping and interpretations and Range Studies of the Rockrimmon North Drainage Basin, November, 1972.

b. National Engineering Handbook.
   1. Section 4, Hydrology, January, 1971.
   2. Section 5, Hydraulics.
   3. Section 14, Chute Spillways.

c. Technical Release No. 16, Rainfall-Runoff Charts for selected curve numbers.

d. Precipitation-Frequency Maps for Colorado, prepared by the U.S. Weather Bureau, October, 1967.

3. USDI - Bureau of Reclamation:

a. Design of small dams, 1965.

b. Design Standards Number 3, Canals and Related Structures.

c. Hydraulic and Excavation Tables, 1957.

4. USA - Corps of Engineers:

a. Hydraulic Design Criteria.

b. Flood Plain Information, Monument Creek, January, 1971.

c. Special Hazard Study, Monument Creek, Rockrimmon Area, December, 1972.

5. Denver Regional Council of Governments, Drainage Criteria Manual,March, 1969.

6. L. A. County Flood Control District, Hydrology and Hydraulic Design Manual, 1964.

7. State of Colorado, Division of Highways, Roadway Design Manual, May, 1972.

8. State of Colorado, State Engineer, applicable laws, rules and regulations pertaining to the design, operation and maintenance of dams.

9. State of California, Division of Highways.

a. Planning Manual, Part 7, Design.

b. Bank and Shore Protection, November, 1960.

c. California Culvert Practice.

10. Linsley, Kohler and Paulhus, Hydrology for Engineers, McGraw-Hill, 1958.

11. Linsley & Franzini, Water-Resources Engineering, McGraw-Hill, 1964.

12. Albertson, Barton & Simons, Fluid Mechanics for Engineers, Prentice Hall, 1960.

13. King & Brater, Handbook of Hydraulics, McGraw-Hill, 1963.

14. Handbook of Steel Drainage and Highway Construction Products, American Iron and Steel Institute, 1971.

15. Handbook of Concrete Culvert Pipe Hydraulics, Portland Cement Association, 1964.

16. Concrete Pipe Design Manual, American Concrete Pipe Association, 1970.

B. CRITERIA:

This study is prepared under the following hydrologic criteria, as prescribed by the City of Colorado Springs, and as discussed in detail in a later section. The major greenbelts are designed to accomodate the 100 year storm runoff, having rainfall intensity of 3.42 inches per hour for a duration of one hour. The interior collection systems and minor greenbelts are designed to accomodate the 50 year storm runoff, having a rainfall intensity of 2.0 inches per hour for a duration of one hour.

The spillways of the small flood control dams are designed to accomodate the runoff of a storm having a return period of 100 years and a duration of 6 hours without over topping of the dam crests. This criteria is

assessed in consideration of downstream channel characteristics and is found to exceed the spillway requirements of the State Engineer for stockwater ponds.

The spillway of the major dam is designed to accomodate the runoff of the "maximum probable flood" under the criteria of the State Engineer without overtopping the dam crest.

In the Monument Creek Flood Plain the "Intermediate Regional Flood" (100 year) is delineated and land uses are proposed which are in keeping with the proposed flood plain ordinance of the City.

C. HYDROLOGY:

Two separate methods of hydrologic analysis were utilized in this study, each of which is a variation of the USDA - SCS synthetic hydrograph method.

1. Collection system: Hydrologic analysis for the design of the interior collection system has been commonly used for a number of years within the City. The area in question is divided into a series of small drainage basins, as defined by the topography and anticipated grading plans, to such an extent to fully predict the storm runoff at selected points of interest.

The time of concentration of particular basins is computed from the formula:

$$Tc=\left(\frac{11.9L^3}{H}\right)^{0.385}$$ in hours for overland flow

Where: L=length of longest water course, in miles.
H=elevation difference in feet.

For other than overland flow conditions, the time of concentration is computed from the velocities of flows in respective drainage structures.

The time of concentration for an area involving a large body of water is defined as the time required for the travel of a wave across the water surface, defined by the equation:

$$Vw=5.67(Dm)^{0.5}$$

Where: Vw=wave velocity in feet per second.
Dm=mean depth of reservoir in feet.

The time of peak runoff is computed by the formula:

$$Tpo=D/2 + 0.6\ Tc$$, in hours.

Where D=Duration of rainfall (one hour).

The peak runoff quantity, in cubic feet per second, in computed by the formula:

$$q_p=\frac{484\ AQ}{Tpo}$$ Where A=area of the basin, in square miles
Q=runoff corresponding to the rainfall amount and curve number, as defined in

SCS technical release number 16. Curve numbers are computed as described in a later section.

The base time, or the time at which all runoff theoretically ceases is computed by the formula:

$T_b = 2.67\ T_{po}$, in hours.

2. Greenbelt: The hydrologic procedures in developing the design runoff flows for the greenbelt system are defined in Chapter 21 of the SCS Engineering Handbook, Section 4. Major points of analysis are selected at critical locations and hydrographs are computed for each of these points by the following procedures, as they apply to this study.

a. The rainfall amounts and duration are selected from the appropriate criteria.

b. The composite curve number is computed from the data in paragraph 3 of this section.

c. The direct runoff is taken from SCS technical release number 16.

d. The time of concentration is computed in the same manner as that for the collection system.

e. The hydrograph family is classified (Fig.21.3)

f. The duration of excess rainfall, t_o, is determined (Fig. 21.4)

g. Initial peak time is computed from $T_p = 0.7tc$.

h. To/Tp ratio is computed.

i. Revised To/Tp ratio is selected (Table 21.16)

j. Revised Tp is computed from $T_p = \frac{T_o}{T_o/T_p}$.

k. Compute qp from $q_p = 484\ A/T_p$.

l. Compute Qqp from $Q_{qp} = q_p \times Q$.

m. Compute hydrograph times from table 21.17, adjusting to rainfall duration if time is other than 6 hours.

n. Compute hydrograph rates from Table 21.17.

Consideration must be given to all reservoir staging within the basin and the hydrographs adjusted accordingly. These are adjusted either by adjusting the 'un-staged' hydrograph by the storage rates, or by developing incremental hydrographs for reaches of the basin and numerically summing them with reservoir outflows. Either method must consider travel times along the greenbelt which create lags in increments of storage as applied downstream.

3. Curve Numbers: Curve numbers corresponding to the various types of development and soils encountered are defined as follows, as they pertain to this study.

Type of Ground Cover	Soil Type Hydrologic Grouping B	C	D
Range Land, Poor Condition	79	86	89
Range Land, Fair Condition	69	79	84
Single Family Residential(1)	94	96	97
Multi Family(10 units/acre)	95	97	97
Multi Family(15 units/acre)	97	97	97
PBC/school	97	97	97

(1)A density of 4.0 units per acre will result in the listed curve numbers. For lower densities, the undeveloped portions of the lots are to remain either in the natural state or fully landscaped, resulting in lower curve numbers for these portions of the development. No higher densities are proposed.

D. HYDRAULICS:

1. General Formulas: All hydraulic computations are performed using the following variations of Manning's Fornula.

$$Q=\frac{1.486}{n} R^{2/3}S^{1/2} \quad \text{for open channels}$$

$$Q=\frac{0.463}{n} D^{8/3}S^{1/2} \quad \text{for pipes}$$

Where Q=discharge in CFS.
n=Mannings roughness coefficient
A=Area of the hydraulic section
R=Hydraulic radius, being the area of the hydraulic section divided by the wetted perimiter.
S=Slope of the hydraulic gradient.
D=Diameter of conduit.

2. Roughness coefficients: The following roughness coefficients are utilized.

n	Type of Structure
0.013	Formed concrete or concrete pipe
0.015	Trowelled concrete pavement
0.016	Plant mixed bituminous pavement
0.024	2-2/3"x3/4" corrugated metal pipe
0.026	3"x1" CMP and Pipe-Arch.
	Unlined, unvegitated channels:
0.023	Clay Loam
0.020	Sand
0.030	Gravel
0.040	Rock

Vegitated channels are assessed individually.

3. Freeboard requirements: All pipe storm drains are designed to flow full, corresponding to the suitable nominal size, keeping the hydraulic gradient below finished ground surface.

Drainage channels in the collector systems are designed with one-foot minimum freeboard.

Drainage channels in the primary greenbelt are designed with one-foot minimum freeboard, adjusted for curvature and sediment.

Curvature freeboard is defined by the formula:

$$d_2 - d_1 = \frac{V^2 B}{gR}$$

Where V=velocity, fps.
B=top width, feet.
g=32.2
R=radius of centerline, in feet.

4. Headwater requirements: Minimum headwater for culverts is defined by the formulas:

$hi=0.022\ V_2^2$ for CMP
$hi=0.017\ V^2$ for others

Culverts under roadways are designed in accordance with California Culvert Practice, i.e., to flow full under the maximum head permitted by the roadway fill, as limited by channel area or development limits.

5. Channel Computations: The optimum shape of channel is assumed, i.e., where depth equals bottom width (b) with side slopes of one on one. The channel size becomes, therefore, a function of runoff and slope where $b = \frac{8/3\ Qn}{1.93\ S^{1/2}}$

6. Spillway Capacities: Critical depth is assumed at the point of break in grade from tranquil to super-critical slopes. The water surface profiles are computed

for various flows and backwater curves run to the beginning of the spillway in developing spillway capacity curves in accordance with SCS Engineering Manual, Part 5. The depth at the beginning of the spillway plus the velocity head is the water surface corresponding to respective assumed discharges.

E. RESERVOIR STAGING:

The storage curve and the inflow hydrograph are computed for each reservoir site. The spillway is designed to accomodate the designated storm without overtopping the dam. The spillway capacity curve is computed as described in a previous section and the design storm is 'staged' through the reservoir as follows.

The outflow is assumed for respective inflows, corresponding to the incremental times computed on the inflow hydrograph. The resulting water level elevation is computed and compared with the level corresponding to the assumed outflow. The outflow is then adjusted until the water surface elevations obtained from the storage curve and spillway capacity curve agree.

HYDROLOGIC ENGINEERING STUDY

OF THE

ROCKRIMMON NORTH DRAINAGE BASIN

SECTION III - COMPUTATIONS

A. HYDROLOGY

1. Summary: Computations and hydrographs are enclosed in this section.

The following is a summary of hydrologic computations. The"developed state" computations conservatively consider velocity in fully lined conditions, resulting in maximum peak runoffs.

Hydrograph Point	Area of Basin Acres	Undeveloped State		Developed State		
		Curve No.	Runoff-CFS	Curve No.	Unstaged Runoff	Runoff* (staging)
1(2)	128	86	212.5	88	225.9	225.9/158.4
2(2)	178	87	256.0	88	264.1	167.4/107.0
3(2)	201	87	289.6	90	524.9	313.5
4(2)	428	87	616.1	90	667.2	401.1
5(2)	511	87	604.2	91	732.3	640.4
6(1)	134	89	105.8	93	128.2	128.2/105.0
7(1)	24	87	18.5	92	27.2	27.2/7.0
8(1)	310	88	183.3	94	336.0	265.8
9(1)	27	89	21.8	95	33.9	33.9
10(2)	966	88	1169.9	92	1353.8	1386.8/150.0
11(2)	1122	88	1039.7	92	1562.3	358.6
12(1)	102	88	60.7	92	60.6**	
13(2)***	2172	Unk	Unk	82	1245(1)	979.0(3)
14(2)***	17	Unk	Unk	94	44.1	
15(2)***	111	Unk	Unk	94	278.7	
16(2)***	636	Unk	Unk	93	1200	
17(1)	73	89	60.0	95	92.6	92.6/55.0

* Inflow/Outflow - Developed state runoff includes all reservoir staging.
** Includes only the area below trans-basin diversion point
***Outfall points of previously studied basins
(1) 50 year minor greenbelt criteria.
(2) 100 year major greenbelt criteria.
(3) Includes staging effects of the reservoir approved in the Rockrimmon Neighborhood Center Number One Subdivision, 100 year criteria.

2. GENERAL RUNOFF COMPUTATIONS --

DEVELOPED STATE

(50 YEAR CRITERIA)

MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	N/ C	TPO	FLOW Q	FLOW qp	Tb
I	A	33.26	.0477	2380	176	0.133			87	.580	0.91	36.3	
	B	49.08	.0704	2880	240	0.146			87	.587	0.91	52.8	
	C	32.95	.0472	1880	211	0.095			87	.557	0.91	37.3	
	D	14.96	0.214	1260	169	0.066			92	.539	1.24	23.8	
	E	4.64	.0066	530	140	0.026			87	.515	0.91	5.6	
	F	5.23	.0075	715	170	0.033			87	.519	0.91	6.4	
II	A	15.67	.0225	1755	182	0.092			86	.555	0.85	16.7	
	B	19.55	.0280	1570	169	0.085			88	.551	0.97	23.9	
	C	36.40	.0522	1770	189	0.090			90	.554	1.09	49.7	
	D	29.78	.0427	2110	194	0.111			90	.566	1.09	39.8	
	E	20.61	.0296	1775	189	0.091			92	.554	1.24	32.1	
III	A	33.91	.0486	2270	240	0.110			89	.566	1.03	42.8	
	B	6.22	.0089	900	147	0.047			90	.528	1.09	8.9	
	C	4.82	.0069	835	100	0.037			91	.522	1.16	7.4	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N.H.Patel

Date: 10-4-72

UNITED WESTERN ENGINEERS
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MAJOR BASIN	SUB BASIN	AREA Planim. Read.	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	W/C	TPO	FLOW Q	FLOW qp	Tb
III	D	6.99	.0100	890	94	0.056			93	.533	1.31	11.9	
	E	6.83	.0098	1120	55	0.087			88	.552	0.97	8.3	
	F	9.47	.0136	1350	82	0.092			92	.555	1.24	14.7	
	G	10.93	.0157	1260	55	0.102			88	.561	0.97	13.1	
	H	12.98	.0186	1230	57	0.096			88	.557	0.97	15.7	
	I	4.49	.0064	350	105	0.018			93	.510	1.31	8.0	
	J	5.18	.0074	1120	59	0.087			91	.552	1.16	7.5	
	K	4.46	.0064	560	31	0.051			95	.530	1.48	8.6	
	L	25.86	.0371	2410	214	0.126			92	.575	1.24	38.7	
	M	8.02	.0115	865	156	0.038			89	.522	1.03	11.0	
	N	4.25	.0061	440	60	0.030			89	.518	1.03	5.9	
IV	A	15.67	.0225	1425	252	0.064			92	.538	1.24	25.1	
	B	7.18	.0103	675	53	0.050			93	.530	1.31	12.3	
	C	4.78	.0068	640	56	0.047			93	.528	1.31	8.2	
	D	2.65	.0038	570	53	0.041			94	.524	1.40	4.9	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N.H. Patel

Date: 10-4-72

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Suite 200
4525 Northpark Drive
Colorado Springs, Colo. 80907

MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	X/C	TPO	FLOW Q	FLOW qp	Tb
IV	E	11.09	.0159	680	88	0.041			94	.524	1.40	20.6	
	F	2.27	.0032	475	36	0.040			94	.524	1.40	4.1	
	G	21.13	.0303	2380	123	0.154			94	.592	1.40	34.7	
	H	9.70	.0139	1240	90	0.081			97	.548	1.67	20.5	
	I	7.47	.0107	860	242	0.037			92	.522	1.24	12.3	
	J	13.02	.0187	1205	249	0.053			93	.531	1.31	22.3	
	K	11.79	.0169	1275	170	0.067			93	.540	1.31	19.8	
	L	14.38	.0206	1320	152	0.072			92	.543	1.24	22.8	
	M	4.23	.0061	775	117	0.043			93	.525	1.31	7.4	
	N	4.38	.0063	925	53	0.072			97	.543	1.67	9.4	
	O	17.13	.0246	2000	201	0.102			93	.561	1.31	27.8	
V	A	2.53	.0036	690	60	0.050			94	.530	1.40	4.6	
	B	15.48	.0222	1240	105	0.078			93	.546	1.31	25.8	
	C	3.65	.0052	720	31	0.067			94	.540	1.40	6.5	
	D	9.68	.0139	2220	107	0.149			94	.589	1.40	16.0	

HYDROLOGIC COMPUTATION — BASIC DATA

PROJ: Rockrimmon North

By: N.H.Patel
Date: 10-4-72

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MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	/V/ C	TPO	FLOW Q	FLOW qp	Tb
V	E	16.17	.0232	1905	123	0.140			96	.584	1.57	30.2	
	F	9.32	.0134	890	38	0.080			97	0.548	1.67	19.8	
	G	3.95	.0057	340	29	0.029			97	0.517	1.67	8.9	
	H	2.56	.0037	630	57	0.046			93	0.527	1.31	4.4	
	I	6.74	.0097	650	51	0.049			96	0.529	1.57	13.9	
	J	2.07	.0030	535	52	0.039			93	0.523	1.31	3.6	
	K	5.04	.0072	1060	93	0.067			94	0.540	1.40	9.0	
	L	4.85	.0070	880	80	0.058			97	0.534	1.67	10.6	
	M	4.36	.0062	990	46	0.082			95	0.549	1.48	8.1	
	N	6.54	.0094	1210	61	0.092			94	0.555	1.40	11.5	
	O	1.87	.0027	440	27	0.041			95	0.524	1.48	3.7	
	P	13.87	.0199	940	157	0.048			91	0.528	1.16	21.2	
	Q	12.39	.0178	1050	56	0.082			93	0.549	1.31	20.6	
	R	9.48	.0136	1030	76	0.071			94	0.542	1.40	17.0	
	S	2.58	.0037	520	53	0.037			97	0.522	1.67	5.7	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N.H.Patel

Date: 10-5-72

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MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	/Y C	TPO	FLOW Q	FLOW qp	Tb
VI	A	1.10	.0016	360	26	0.033			90	0.519	1.09	1.6	
	B	3.95	.0057	960	151	0.050			90	0.530	1.09	5.7	
	C	12.42	.0178	1085	68	0.077			94	0.546	1.40	22.1	
	D	5.76	.0082	1250	69	0.091			94	0.554	1.40	10.0	
	E	2.54	.0036	520	45	0.040			95	0.524	1.48	4.9	
	F	48.60	.0697	4180	62	0.380			97	0.728	1.67	77.4	
VII	A	3.28	.0047	505	34	0.043			96	0.525	1.57	6.8	
	B	6.32	.0091	850	53	0.066			95	0.539	1.48	12.1	
	C	1.68	.0024	410	35	0.034			95	0.520	1.48	3.3	
	D	3.19	.0046	810	51	0.063			95	0.537	1.48	6.1	
	E	3.45	.0049	1330	48	0.113			92	0.567	1.24	5.2	
	F	7.40	.0106	760	80	0.049			95	0.529	1.48	14.4	
	G	6.99	.0100	1400	50	0.120			96	0.572	1.57	13.3	
	H	5.94	.0085	685	84	0.056			97	0.533	1.67	12.9	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N. H. Patel

Date: 10-5-72

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4525 Northpark Drive
Colorado Springs, Colo. 80907

MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	N C#	TPO	FLOW Q	FLOW qp	Tb
VII	I	8.99	.0129	920	82	0.061			97	0.536	1.67	19.5	
	J	3.28	.0047	510	90	0.030			97	0.518	1.67	7.3	
	K	10.60	.0152	1300	55	0.103			100	0.561	2.00	26.2	
VIII	A	7.87	.0113	750	153	0.038			90	0.522	1.09	11.4	
	B	11.77	0.0169	1210	127	0.070			91	0.542	1.16	17.5	
	C	7.13	.0102	800	139	0.042			87	0.525	0.91	8.6	
	D	3.53	.0051	635	115	0.035			85	0.521	0.80	3.8	
	E	8.03	.0115	855	134	0.046			85	0.527	0.80	8.4	
	F	4.52	.0065	1310	45	0.116			87	0.569	0.91	5.0	
	G	4.17	.0060	1010	24	0.110			86	0.566	0.85	4.4	
	H	13.10	.0188	1155	161	0.060			92	0.536	1.24	21.0	
IX	A	19.57	.0281	1440	60	0.116			95	0.569	1.48	35.4	
	B	7.36	.0106	1040	42	0.090			91	0.554	1.16	10.7	
	C	11.93	.0171	1200	4	0.101			95	0.560	1.48	21.9	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N.H. Patel

Date: 10-5-72

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MAJOR BASIN	SUB BASIN	AREA Planim. Read.	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	$\sqrt{C}$	TPO	FLOW Q	FLOW qp	Tb
IX	D	4.18	.0060	400	32	0.035			93	0.521	1.31	7.3	
	E	22.88	.0328	2035	67	0.160			95	0.596	1.48	39.4	
	F	18.07	.0259	2400	75	0.188			92	0.612	1.24	25.4	
	G	6.35	.0091	1350	62	0.103			87	0.561	0.91	7.1	
	H	7.50	.0108	1460	67	0.112			95	0.567	1.48	13.6	
	I	7.31	.0105	1080	44	0.091			92	0.554	1.24	11.4	
	J	5.41	.0078	730	30	0.070			93	0.542	1.31	9.1	
	K	12.73	.0182	1040	48	0.085			94	0.551	1.40	22.4	
	L	6.34	.0091	960	33	0.090			94	0.554	1.40	11.1	
X	A	3.70	0.0053	400	10	0.055			97	0.533	1.70	8.2	
	B	12.13	.0174	650	75	0.042			96	0.525	1.57	25.2	
	C	11.50	.0165	800	85	0.050			95	0.530	1.48	22.3	
	D	5.88	.0084	780	78	0.051			90	0.530	1.09	8.4	
	E	5.49	.0079	950	24	0.101			89	0.560	1.03	7.0	
	F	9.16	.0131	740	78	0.048			90	0.528	1.09	13.1	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N.H.Patel

Date: 10-5-72

UNITED WESTERN ENGINEERS
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Colorado Springs, Colo. 80907

MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	X C#	TPO	FLOW Q	FLOW qp	Tb
XI	A	8.96	.0128	660	83	0.042			90	0.525	1.09	12.9	
	B	6.46	.0093	550	86	0.034			92	0.520	1.24	10.7	
	C	6.90	.0099	500	43	0.038			90	0.522	1.09	10.0	
	D	12.18	.0175	870	56	0.067			92	9.540	1.24	19.4	
	E	10.26	0.01472	1630	76	0.120			92	0.572	1.24	15.4	
	F	9.50	0.01363	1680	77	0.124			93	0.574	1.31	15.1	
XII	A	12.77	.0183	485	71	0.032			92	0.519	1.24	21.2	
	B	10.80	.0155	550	42	0.044			94	0.526	1.40	20.0	
	C	14.89	.0214	1290	74	0.091			97	0.554	1.67	31.2	
	D	10.06	.0144	1480	60	0.120			97	0.572	1.67	20.3	
XIII	A	7.36	.0106	1050	76	0.072			91	0.543	1.16	11.0	
	B	14.03	.0201	710	151	0.037			96	0.522	1.57	29.3	
	C	18.69	.0268	1435	181	0.074			98	0.544	1.77	42.2	
	D	10.89	.0156	1060	136	0.058			95	0.534	1.48	20.9	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N.H.Patel

Date: 10-6-72

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MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	N/C#	TPO	FLOW Q	FLOW qp	Tb
XIII	E	10.78	.0154	640	181	0.029			91	0.517	1.16	16.7	
	F	10.54	.0151	1150	133	0.063			92	0.537	1.24	16.9	
	G	11.97	.0172	1690	84	0.121			92	0.572	1.24	18.0	
	H	6.50	.0093	1770	77	0.140			95	0.584	1.48	11.4	
XIV	A	12.35	.0177	1270	118	0.076			94	0.545	1.40	22.0	
	B	6.85	.0098	920	98	0.058			91	0.534	1.16	10.3	
	C	7.75	.0111	715	106	0.041			87	0.524	0.91	9.3	
	D	10.63	.0152	1200	79	0.083			94	0.549	1.40	18.8	
	E	3.98	.0057	720	70	0.048			93	0.528	1.31	6.8	
XV	A	4.23	0.00607	700	36	0.061			97	0.537	1.67	9.1	
	B	4.16	0.00597	690	48	0.054			95	0.532	1.48	8.0	
	C	2.62	0.00377	550	34	0.048			97	0.529	1.67	5.8	
	D	1.11	0.00159	380	30	0.044			97	0.526	1.67	2.4	
	E	8.13	0.01166	1120	18	0.140			97	0.584	1.67	16.1	

HYDROLOGIC COMPUTATION — BASIC DATA

PROJ: Rockrimmon North

By: N.H.Patel

Date: 12-26-72

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MAJOR BASIN	SUB BASIN	AREA Planim. Read.	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	N/C#	TPO	FLOW Q	FLOW qp	Tb
XV	F	5.07	0.00727	1080	30	0.110			97	0.566	1.67	10.4	
	G	3.51	0.00503	570	16	0.068			97	0.541	1.67	7.5	
	H	2.51	0.00360	430	22	0.044			97	0.526	1.67	5.5	
	I	10.90	0.01563	1020	32	0.100			97	0.560	1.67	22.6	
	J	6.95	0.00997	1040	22	0.119			97	0.571	1.67	14.1	
	K	5.37	0.00770	570	34	0.052			97	0.531	1.67	11.7	
	L	9.09	0.01304	580	52	0.043			97	0.526	1.67	20.0	

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

By: N.H.Patel

Date: 12-26-72

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MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	CURVE	TPO	FLOW Q	FLOW qp	Tb
XVI	A	5.35	.00768	440	54	.030			95	.482	1.48	11.41	1.29
	B	8.28	.01188	850	60	.063			95	.538	1.48	15.82	1.44
	C	4.10	.00588	500	23	.049			95	.529	1.48	7.96	1.41
	D	11.07	.01588	1020	24	.112			95	.567	1.48	20.06	1.51
	E	4.62	.00663	650	24	.065			95	.539	1.48	8.81	1.44
	F	3.93	.00564	580	30	.053			95	.532	1.48	7.59	1.42
	G	3.29	0.00472	510	16	0.059			97	0.535	1.67	7.1	1.43
	H	3.47	0.00498	600	40	0.050			97	0.530	1.67	7.8	1.42
	I	1.65	0.00237	949	49	0.077			97	0.546	1.67	3.5	1.46
	J	1.23	0.00176	300	32	0.024			97	0.514	1.67	2.8	1.37
	K	3.14	0.00450	610	26	0.060			97	0.536	1.67	6.8	1.43
	L	17.99	0.02581	1280	55	0.100			97	0.560	1.67	37.3	1.50
	M	6.07	0.00871	1010	46	0.085			97	0.551	1.67	12.8	1.47

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ: Rockrimmon North

O.E.W.
B. B.E.J.
Date: 1-24-73
3-8-73

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MAJOR BASIN	SUB BASIN	AREA Planim. Read	AREA MILE	BASIN LENGTH	BASIN HEIGHT	Tc	DITCH LENGTH	DITCH SLOPE	CURVE	TPO	FLOW Q	FLOW qp	Tb
XVII	A	2.00	0.00287	200	39	0.015			95	0.509	1.48	4.04	1.36
	B	2.25	0.00323	630	29	0.060			95	0.536	1.48	4.32	1.43
	C	10.00	0.01435	1550	57	0.128			95	0.577	1.48	17.81	1.54
	D	4.88	0.00700	1500	61	0.120			95	0.572	1.48	8.77	1.53
XVIII	A	2.51	0.00360	1060	50	0.087			95	0.552	1.48	4.67	1.47
	B	6.58	0.00944	690	52	0.052			95	0.531	1.48	12.73	1.42
	C	3.88	0.00557	620	48	0.048			95	0.529	1.48	7.54	1.41
	D	3.28	0.00471	390	52	0.027			95	0.516	1.48	6.54	1.38
	E	2.23	0.00320	340	45	0.025			95	0.515	1.48	4.45	1.37
	F	6.00	0.00861	960	54	0.076			95	0.546	1.48	11.30	1.46
	G	3.17	0.00455	800	6	0.146			95	0.588	1.48	5.54	1.57

HYDROLOGIC COMPUTATION — BASIC DATA

PROJ: Rockrimmon North

By N.H.Patel

Date: 3-16-73

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3. HYDROGRAPH COMPUTATIONS --
UNDEVELOPED STATE

UNITED WESTERN ENGINEERS
Colorado Springs, Colorado

U.S. Department of Agriculture
Soil Conservation Service

HYDROGRAPH COMPUTATION
Pt. #1 - Undeveloped State

Subdivision Rockrimmon North Gov't City-Colo.Spgs

Location City of Colorado Springs, Colorado

Return Period 100 Yrs. Calc'd by C.E.A.
L=6420'
H=352'
Date 10-20-72

Dr. Area 0.2010 Sq. Mi. T_C 0.310 Hr. Runoff Curve No. 86

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.03 In. Computed T_p $\frac{0.217}{7\ Tc}$ Hr. T_o 4.88 Hr.

(T_o/ T_p): Computed 22.49 : Used 25 Revised T_p 0.1952

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 498.4 CFS. Qq_p = 1011.71 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.8459	14.2	41		
2	0.0423	2.0	22	0.8882	4.0	42		
3	0.0846	6.1	23	0.9304	1.0	43		
4	0.1269	14.2	24	0.9727	0	44		
5	0.1692	24.3	25			45		
6	0.2115	89.0	26			46		
7	0.2538	212.5	27			47		
8	0.2961	147.7	28			48		
9	0.3383	98.1	29			49		
10	0.3806	72.8	30			50		
11	0.4229	57.7	31			51		
12	0.4652	49.6	32			52		
13	0.5075	44.5	33			53		
14	0.5498	39.5	34			54		
15	0.5921	35.4	35			55		
16	0.6344	33.4	36			56		
17	0.6767	31.4	37			57		
18	0.7190	29.3	38			58		
19	0.7613	28.3	39			59		
20	0.8036	27.3	40			60		

UNITED WESTERN ENGINEERS
Colorado Springs, Colorado

U.S. Department of Agriculture
Soil Conservation Service

HYDROGRAPH COMPUTATION
Undeveloped State

Subdivision Rockrimmon North Gov't City-Co.Spgs.

Location Pt.#2, City of Colorado Springs, Colorado

Return Period 100 Yrs. Calc'd by N.H.Patel
L=7570'
H=390' Date 11-6-72

Dr. Area 0.2781 Sq. Mi. T_C 0.37 Hr. Runoff Curve No. 87

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.12 In. Computed T_p 0.259 Hr. T_o 4.94 Hr.

(T_o/ T_p): Computed 19.07 : Used 16 Revised T_p 0.3088

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 435.88 CFS. Qq_p = 924.07 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(q_c/q_p) Qq_p

Page 21.66

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.926	5.54	41		
2	0.046	1.85	22	0.973	2.77	42		
3	0.093	6.47	23	1.019	0.92	43		
4	0.139	18.48	24	1.065	0.0	44		
5	0.185	34.19	25			45		
6	0.232	136.76	26			46		
7	0.278	255.97	27			47		
8	0.324	197.75	28			48		
9	0.371	137.69	29			49		
10	0.417	103.50	30			50		
11	0.463	81.32	31			51		
12	0.510	67.46	32			52		
13	0.556	58.22	33			53		
14	0.602	51.75	34			54		
15	0.648	48.05	35			55		
16	0.695	44.36	36			56		
17	0.741	41.58	37			57		
18	0.787	40.66	38			58		
19	0.834	38.81	39			59		
20	0.880	21.25	40			60		

Peak

UNITED WESTERN ENGINEERS
Colorado Springs, Colorado

U.S. Department of Agriculture
Soil Conservation Service

HYDROGRAPH COMPUTATION

Undeveloped State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #3, City of Colorado Springs

Return Period 100 Yrs. Calc'd by N.H. Patel
L=8650' Date 11-10-72
H=433'

Dr. Area 0.3146 Sq. Mi. T_C 0.412 Hr. Runoff Curve No. 87

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.12 In. Computed T_p 0.2884 Hr. T_o 4.94 Hr.

(T_o/ T_p): Computed 17.13 : Used 16 Revised T_p 0.3088

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 493.09 CFS. Qq_p = 1045.35 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Qq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.926	6.27	41		
2	0.046	2.09	22	0.973	3.14	42		
3	0.093	7.32	23	1.019	1.05	43		
4	0.139	20.91	24	1.065	0	44		
5	0.185	38.68	25			45		
6	0.232	154.71	26			46		
7	0.278	289.56	27			47		
8	0.324	223.70	28			48		
9	0.371	155.76	29			49		
10	0.417	117.08	30			50		
11	0.463	91.99	31			51		
12	0.510	76.31	32			52		
13	0.556	65.86	33			53		
14	0.602	58.54	34			54		
15	0.648	54.36	35			55		
16	0.695	50.18	36			56		
17	0.741	47.04	37			57		
18	0.787	46.00	38			58		
19	0.834	43.90	39			59		
20	0.880	24.04	40			60		

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HYDROGRAPH COMPUTATION

Undeveloped State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #4, City of Colorado Springs

Return Period 100 Yrs. Calc'd by N.H. Patel
L=10520'
H=485'
Date 11-8-72

Dr. Area 0.6694 Sq. Mi. T_C 0.492 Hr. Runoff Curve No. 87

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.12 In. Computed T_p 0.3444 Hr. T_o 4.94 Hr.

(T_o/ T_p): Computed 14.34 : Used 16 Revised T_p 0.3088

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 1049.19 CFS. Qq_p = 2224.28 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

Page 21.66

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.926	13.35	41		
2	0.046	4.45	22	0.973	6.67	42		
3	0.093	15.57	23	1.019	2.22	43		
4	0.139	44.49	24	1.065	0	44		
5	0.185	82.30	25			45		
6	0.232	329.19	26			46		
7	0.278	616.13	27			47		
8	0.324	476.00	28			48		
9	0.371	331.42	29			49		
10	0.417	249.12	30			50		
11	0.463	195.74	31			51		
12	0.510	162.37	32			52		
13	0.556	140.13	33			53		
14	0.602	124.56	34			54		
15	0.648	115.66	35			55		
16	0.695	106.77	36			56		
17	0.741	100.09	37			57		
18	0.787	97.87	38			58		
19	0.834	93.42	39			59		
20	0.880	51.16	40			60		

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HYDROGRAPH COMPUTATION

Pt. #5 Undeveloped State

Subdivision Rockrimmon North Gov't Colo. Spgs.

Location City of Colorado Springs

Return Period 100 Yrs. Calc'd by N. H. Patel
Date 10-27-72

Dr. Area 0.7992 Sq. Mi. T_C 0.533 Hr. Runoff Curve No. 87

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.12 In. Computed T_p 0.3728 Hr. T_o 4.94 Hr.

(T_o/ T_p): Computed 13.25 : Used 16 Revised T_p 0.3088

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 1252.63 CFS. Qq_p = 2655.58 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Qq_p

Pg 21.66

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0.0	21	0.926	15.93	41		
2	0.046	5.31	22	0.973	79.67	42		
3	0.093	18.59	23	1.019	2.66	43		
4	0.139	53.11	24	1.065	0.0	44		
5	0.185	98.26	25			45		
6	0.232	393.03	26			46		
7	0.278	735.60	27			47		
8	0.324	568.29	28			48		
9	0.371	395.68	29			49		
10	0.417	297.42	30			50		
11	0.463	233.69	31			51		
12	0.510	193.86	32			52		
13	0.556	167.30	33			53		
14	0.602	148.71	34			54		
15	0.648	138.09	35			55		
16	0.695	127.46	36			56		
17	0.741	119.50	37			57		
18	0.787	116.85	38			58		
19	0.834	111.53	39			59		
20	0.880	61.08	40			60		

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HYDROGRAPH COMPUTATION

Pt. #6-Undeveloped State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Colorado Springs, Colorado

Return Period 50 Yrs. Calc'd by C.E.A./N.H.P.
Date 10-18-72/1-2-73

Dr. Area 0.2100 Sq. Mi. T_C 0.192 Hr. Runoff Curve No. 89

Hydrograph Family No. 3 Storm Duration 1 Hr.

Rainfall: 2.0 Point 2.0 In. Areal 2.0 In.

Q 1.03 In. Computed T_p .1344 Hr. T_o 4.63 Hr.

(T_o/ T_p): Computed 34.44 : Used 36 Revised T_p .1286

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 790.36 CFS. Qq_p = 814.07 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.694	18.72	41		
2	0.035	1.63	22	0.729	18.72	42		
3	0.069	4.88	23	0.764	18.72	43		
4	0.104	38.26	24	0.799	5.70	44		
Peak 5	0.139	105.83	25	0.833	2.44	45		
6	0.174	78.96	26	0.868	0	46		
7	0.208	56.17	27			47		
8	0.243	42.33	28			48		
9	0.278	36.63	29			49		
10	0.312	33.38	30			50		
11	0.347	30.12	31			51		
12	0.382	27.68	32			52		
13	0.417	25.24	33			53		
14	0.451	22.79	34			54		
15	0.486	20.35	35			55		
16	0.521	19.54	36			56		
17	0.556	19.54	37			57		
18	0.590	19.54	38			58		
19	0.625	19.54	39			59		
20	0.660	18.72	40			60		

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HYDROGRAPH COMPUTATION

Pt. #7 Undeveloped State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location City of Colorado Springs, Colorado

Return Period 50 Yrs. Calc'd by C.E.A./N.H.P.
L=1830'
H=213'
Date 10-19-72/1-2-73

Dr. Area .0377 Sq. Mi. T_C .090 Hr. Runoff Curve No. 87

Hydrograph Family No. 3 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 0.91 In. Computed T_p .063 Hr. T_o 4.48 Hr.

(T_o/ T_p): Computed 71.11 : Used 75 Revised T_p 0.0597

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 305.49 CFS. Qq_p = 277.99 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

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LINE NO.	t /6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.647	2.86	41		
2	0.032	0.25	22	0.679	2.81	42		
3	0.065	1.58	23	0.712	2.75	43		
4	0.097	8.03	24	0.744	2.70	44		
Peak 5	0.129	18.54	25	0.777	0.08	45		
6	0.162	12.37	26	0.809	0	46		
7	0.194	8.81	27			47		
8	0.226	7.14	28			48		
9	0.259	6.09	29			49		
10	0.291	5.42	30			50		
11	0.323	4.89	31			51		
12	0.356	4.45	32			52		
13	0.388	4.09	33			53		
14	0.421	3.78	34			54		
15	0.453	3.53	35			55		
16	0.485	3.28	36			56		
17	0.518	3.14	37			57		
18	0.550	3.03	38			58		
19	0.582	2.97	39			59		
20	0.615	2.92	40			60		

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HYDROGRAPH COMPUTATION

Pt. #8 Undeveloped State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location City of Colorado Springs, Colorado

Return Period 50 Yrs. Calc'd by C.E.A./N.H.P.
L=7420'
H=453'
Dr. Area .4838 Sq. Mi. T_C 0.335 Hr. Runoff Curve No. 88

Hydrograph Family No. 3 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 0.97 In. Computed T_p 0.2345 Hr. T_o 4.56 Hr.

(T_o/ T_p): Computed 19.446 : Used 16 Revised T_p 0.285

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 821.61 CFS. Qq_p = 796.96 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

Pg 21.70

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.855	4.78	41		
2	0.043	1.59	22	0.898	3.19	42		
3	0.086	12.75	23	0.941	1.59	43		
4	0.128	97.23	24	0.983	0	44		
5	0.171	183.30	25			45		
6	0.214	147.44	26			46		
7	0.257	110.78	27			47		
8	0.299	90.06	28			48		
9	0.342	74.91	29			49		
10	0.385	64.55	30			50		
11	0.428	57.38	31			51		
12	0.470	51.00	32			52		
13	0.513	45.43	33			53		
14	0.556	42.24	34			54		
15	0.599	39.85	35			55		
16	0.641	39.05	36			56		
17	0.684	38.25	37			57		
18	0.727	37.46	38			58		
19	0.770	36.66	39			59		
20	0.812	19.13	40			60		

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HYDROGRAPH COMPUTATION

Pt. #9 Undeveloped State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location City of Colorado Springs, Colorado

Return Period 50 Yrs. Calc'd by C.E.A./N.H.P.
L=1800'
H=118'
Date 10-19-72/1-3-73

Dr. Area 0.0417 Sq. Mi. T_C 0.112 Hr. Runoff Curve No. 89

Hydrograph Family No. 3 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 1.03 In. Computed T_p .0784 Hr. T_o 4.63 Hr.

(T_o/ T_p): Computed 59.06 : Used 50 Revised T_p 0.0926

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 217.96 CFS. Qq_p = 224.50 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(q_c/q_p) Qq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.694	3.43	41		
2	0.035	0.18	22	0.729	3.37	42		
3	0.069	1.57	23	0.764	3.30	43		
4	0.104	10.64	24	0.799	0.63	44		
5	0.139	21.82	25	0.833	0	45		
6	0.174	14.41	26			46		
7	0.208	10.33	27			47		
8	0.243	8.42	28			48		
9	0.278	7.23	29			49		
10	0.313	6.40	30			50		
11	0.347	5.79	31			51		
12	0.382	5.37	32			52		
13	0.417	4.92	33			53		
14	0.451	4.51	34			54		
15	0.486	4.15	35			55		
16	0.521	3.88	36			56		
17	0.556	3.70	37			57		
18	0.590	3.64	38			58		
19	0.625	3.57	39			59		
20	0.660	3.50	40			60		

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HYDROGRAPH COMPUTATION

Pt. #10 Undeveloped State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location City of Colorado Springs, Colorado

Return Period 100 Yrs. Calc'd by N.H.Patel
L=16600'
H=650'
Date 10-20-72

Dr. Area 1.5092 Sq. Mi. T_C 0.72 Hr. Runoff Curve No. 88

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.20 In. Computed T_p 0.504 Hr. T_o 5.00 Hr.

(T_o/ T_p): Computed 9.92 : Used 10 Revised T_p 0.50

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 1460.91 CFS. Qq_p = 3213.99 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(q_c/q_p) Qq_p

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	1.050	12.86	41		
2	0.052	6.43	22	1.102	6.43	42		
3	0.105	28.93	23	1.155	3.21	43		
4	0,157	86.78	24	1.207	0	44		
5	0.210	202.48	25			45		
6	0.262	758.50	26			46		
7	0.315	1169.89	27			47		
8	0.367	986.70	28			48		
9	0.420	726.36	29			49		
10	0.472	552.81	30			50		
11	0.525	437.10	31			51		
12	0.577	363.18	32			52		
13	0.630	311.76	33			53		
14	0.682	273.19	34			54		
15	0.735	250.69	35			55		
16	0.787	237.84	36			56		
17	0.840	221.77	37			57		
18	0.892	170.34	38			58		
19	0.945	80.35	39			59		
20	0.997	28.93	40			60		

Peak

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HYDROGRAPH COMPUTATION
Undeveloped State

Subdivision Rockrimmon North Gov't City of Colo. Spgs.

Location Pt. #11, Colorado Springs

Return Period 100 Yrs. Calc'd by N.H.Patel
L=20400' Date 1-3-73
H=714'
Dr. Area 1.75357 Sq. Mi. T_C 0.91 Hr. Runoff Curve No. 88

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.20 In. Computed T_p 0.637 Hr. T_o 5.00 Hr.

(T_o/ T_p): Computed 7.85 : Used 6 Revised T_p 0.8333

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 1018.48 CFS. Qq_p = 2240.65 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(q_c/q_p) Qq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.944	190.46	41		
2	0.047	2.24	22	0.992	123.24	42		
3	0.094	11.20	23	1.039	78.42	43		
4	0.142	33.61	24	1.086	44.81	44		
5	0.186	82.90	25	1.133	26.89	45		
6	0.236	219.58	26	1.181	17.93	46		
7	0.283	546.72	27	1.228	11.20	47		
8	0.331	911.94	28	1.275	8.96	48		
9	0.378	1039.66	29	1.322	6.72	49		
10	0.425	961.24	30	1.369	4.48	50		
11	0.472	822.32	31	1.417	2.24	51		
12	0.519	692.36	32	1.464	0	52		
13	0.567	584.81	33			53		
14	0.614	501.91	34			54		
15	0.661	432.45	35			55		
16	0.708	378.67	36			56		
17	0.756	340.58	37			57		
18	0.803	311.45	38			58		
19	0.850	289.04	39			59		
20	0.897	253.19	40			60		

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HYDROGRAPH COMPUTATION
Undeveloped State

Subdivision Rickrimmon North Gov't City Colo. Spgs.

Location Pt. #12, Colorado Springs

Return Period 50 Yrs. Calc'd by N.H.Patel
L=5850' Date 1-3-73
△H=198'

Dr. Area 0.16028 Sq. Mi. T_C 0.355 Hr. Runoff Curve No. 88

Hydrograph Family No. 3 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 0.97 In. Computed T_p 0.2485 Hr. T_o 4.56 Hr.

(T_o/ T_p): Computed 18.35 : Used 16 Revised T_p 0.285

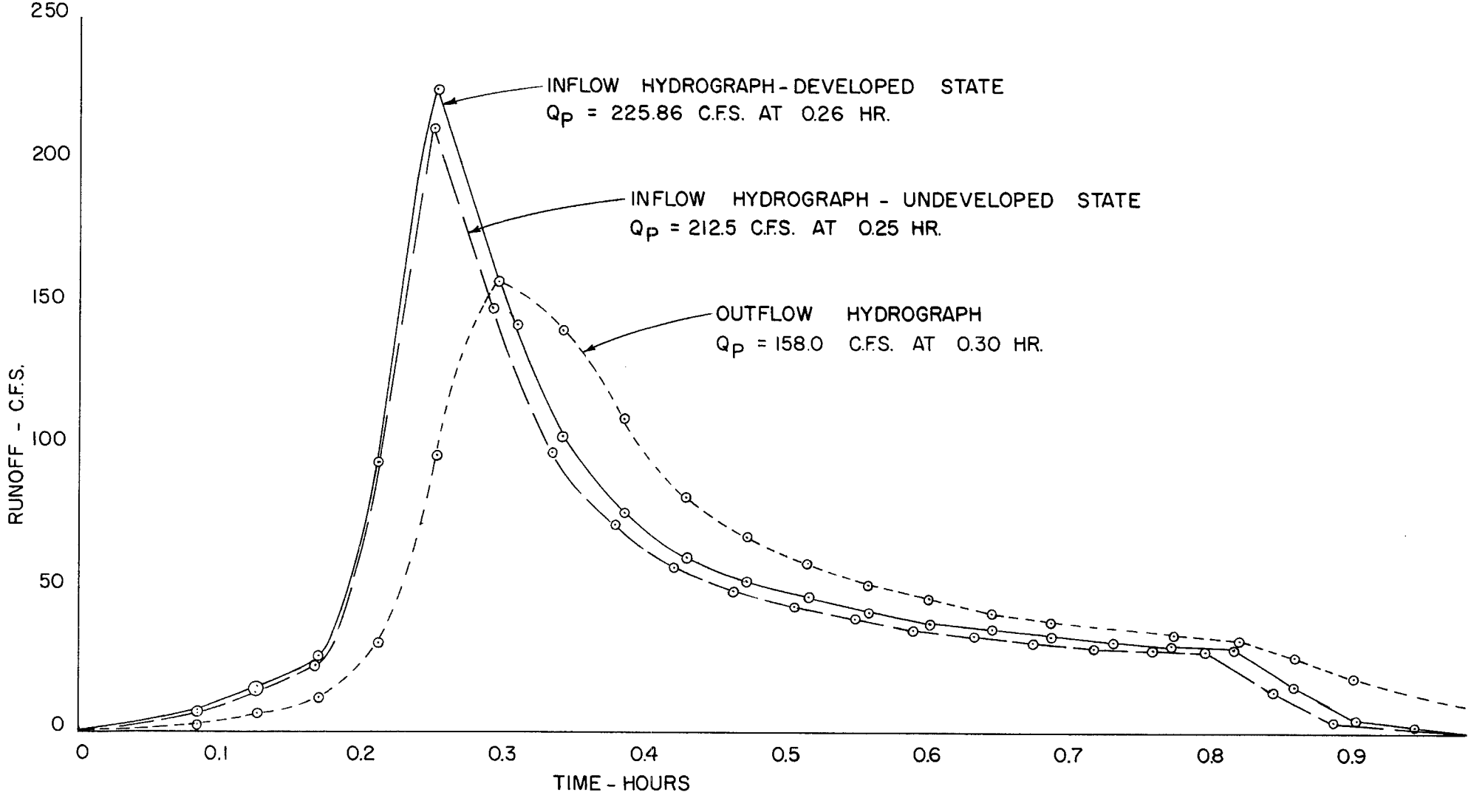
$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 272.19 CFS. Qq_p = 264.03 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(q_c/q_p) Qq_p

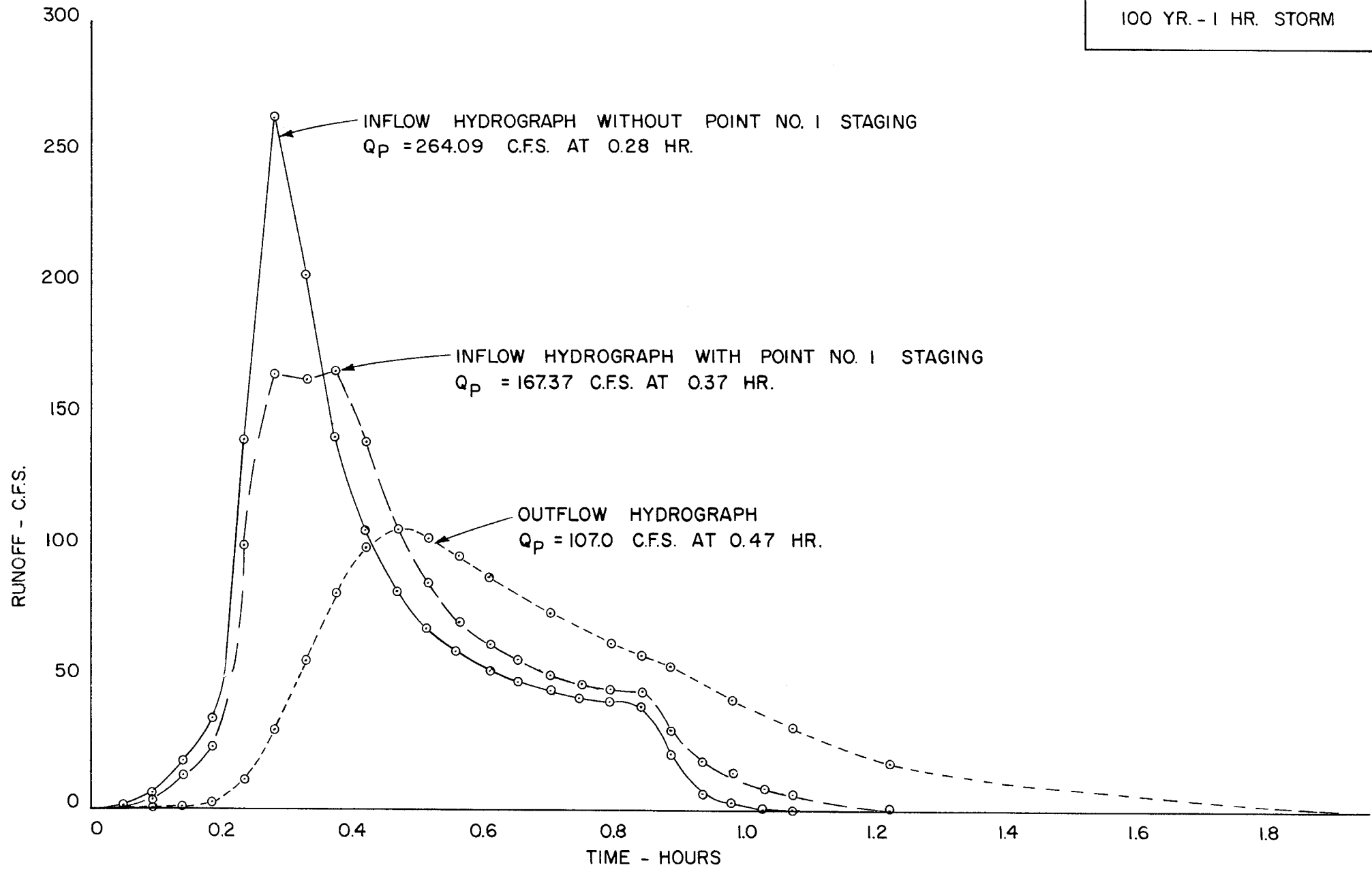
LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.0	0	21	0.855	1.58	41		
2	0.043	0.53	22	0.898	1.05	42		
3	0.085	4.22	23	0.940	0.53	43		
4	0.128	32.21	24	0.983	0	44		
Peak 5	0.171	60.73	25			45		
6	0.214	48.85	26			46		
7	0.256	36.70	27			47		
8	0.299	29.84	28			48		
9	0.342	24.82	29			49		
10	0.385	21.39	30			50		
11	0.428	19.01	31			51		
12	0.470	16.90	32			52		
13	0.513	15.05	33			53		
14	0.556	13.99	34			54		
15	0.598	13.20	35			55		
16	0.641	12.94	36			56		
17	0.684	12.67	37			57		
18	0.727	12.41	38			58		
19	0.770	12.15	39			59		
20	0.812	6.34	40			60		

4. HYDROGRAPH COMPUTATIONS -- DEVELOPED STATE

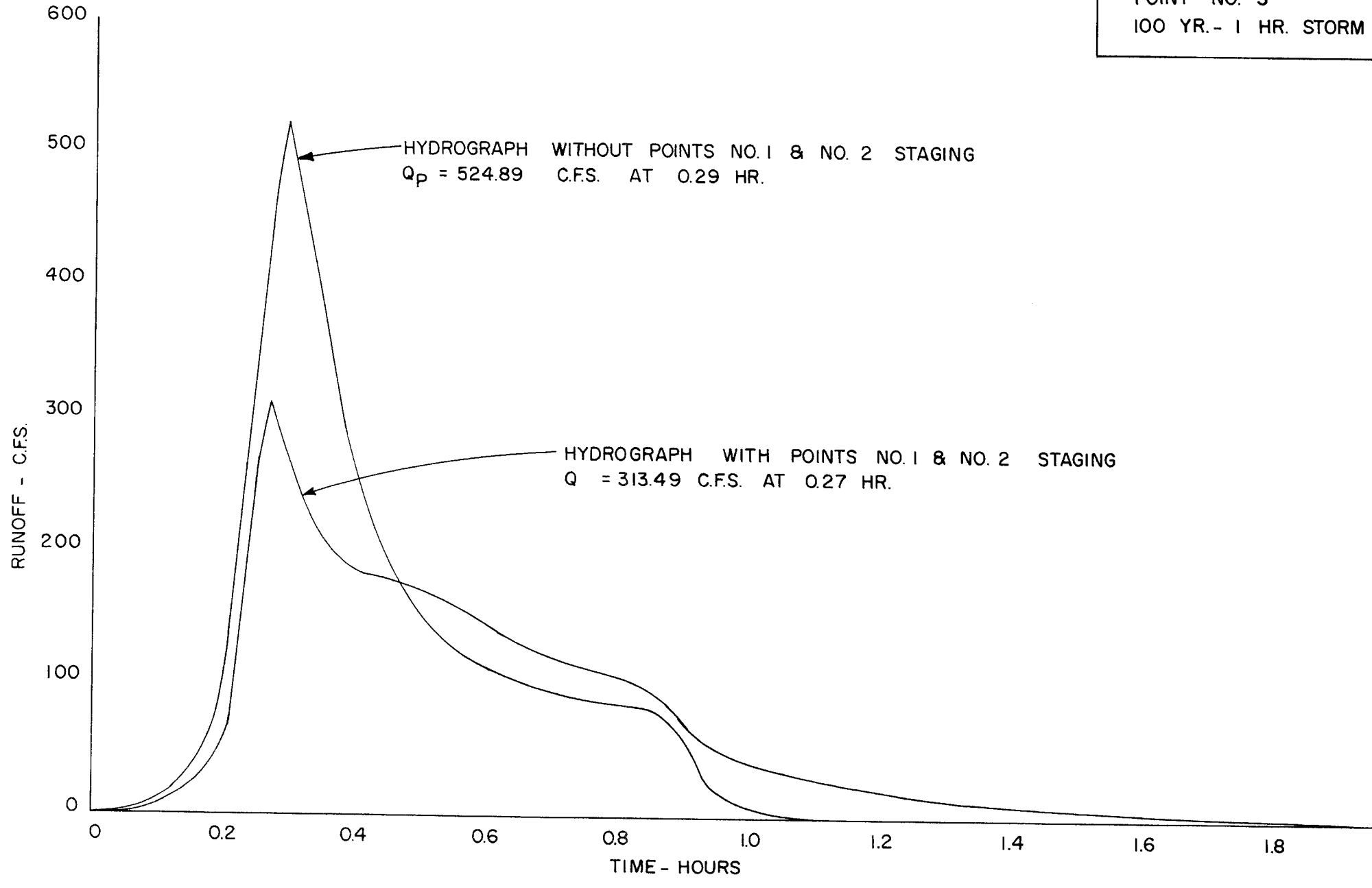
ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 1
100 YR. - 1 HR. STORM

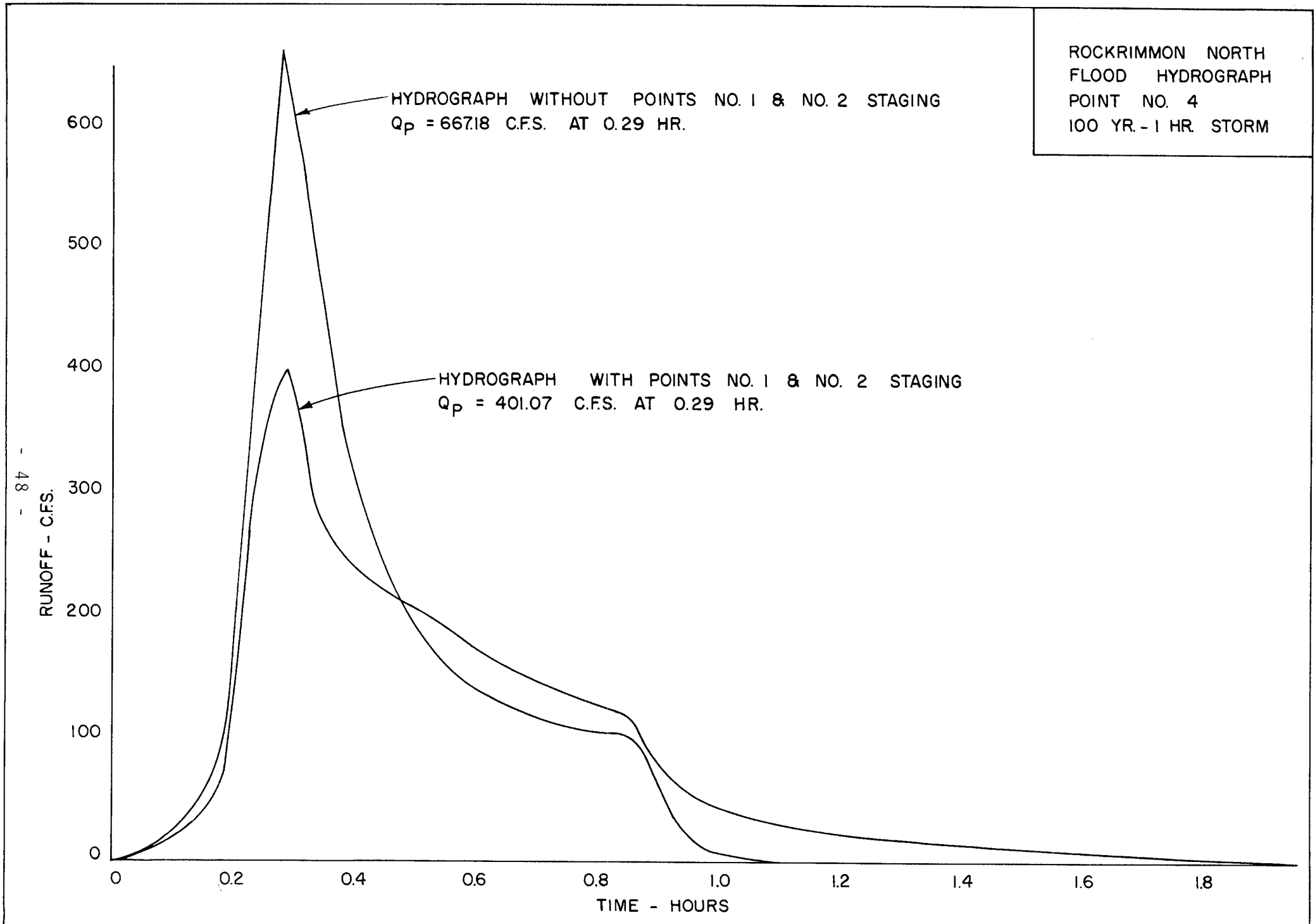


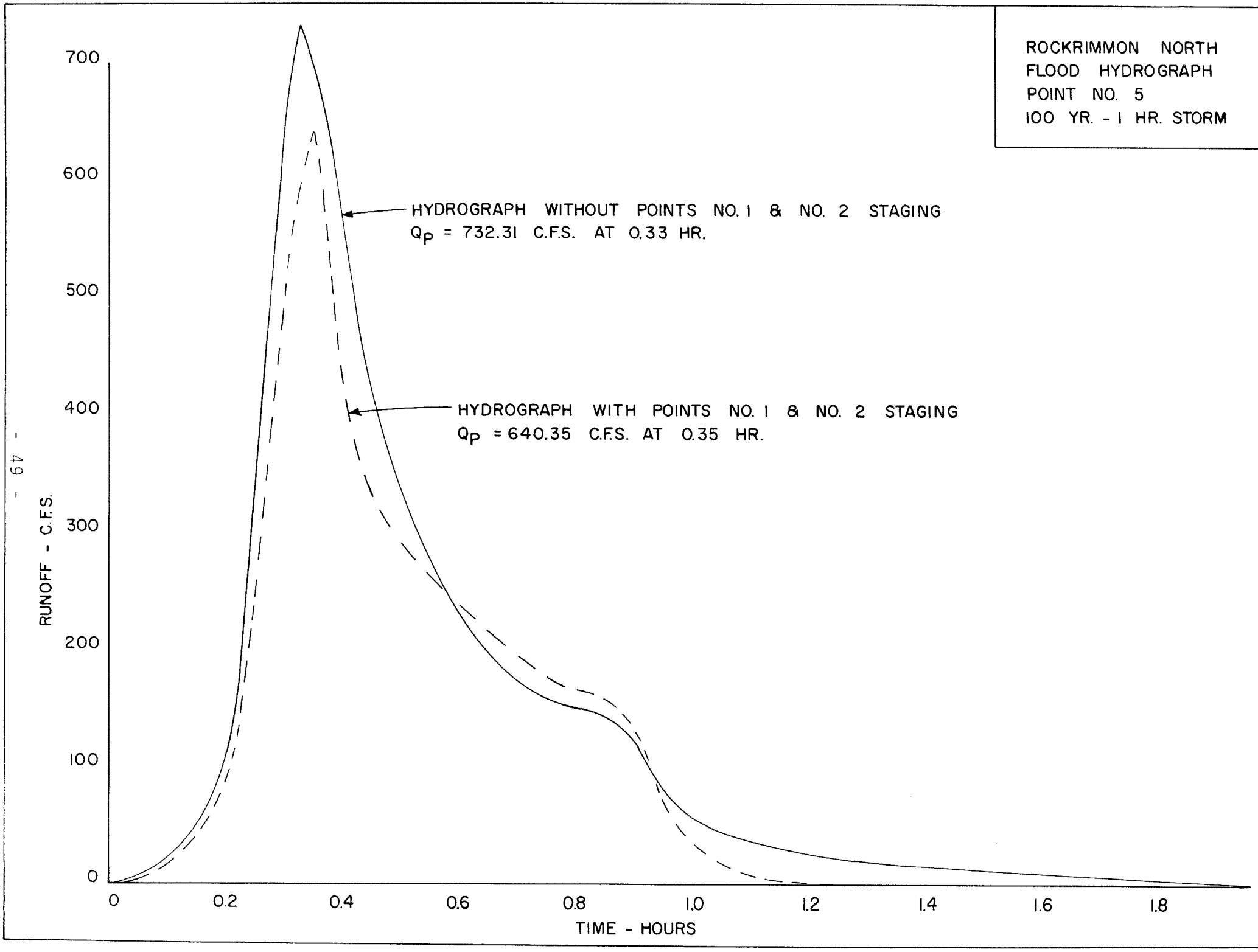
ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 2
100 YR. - 1 HR. STORM

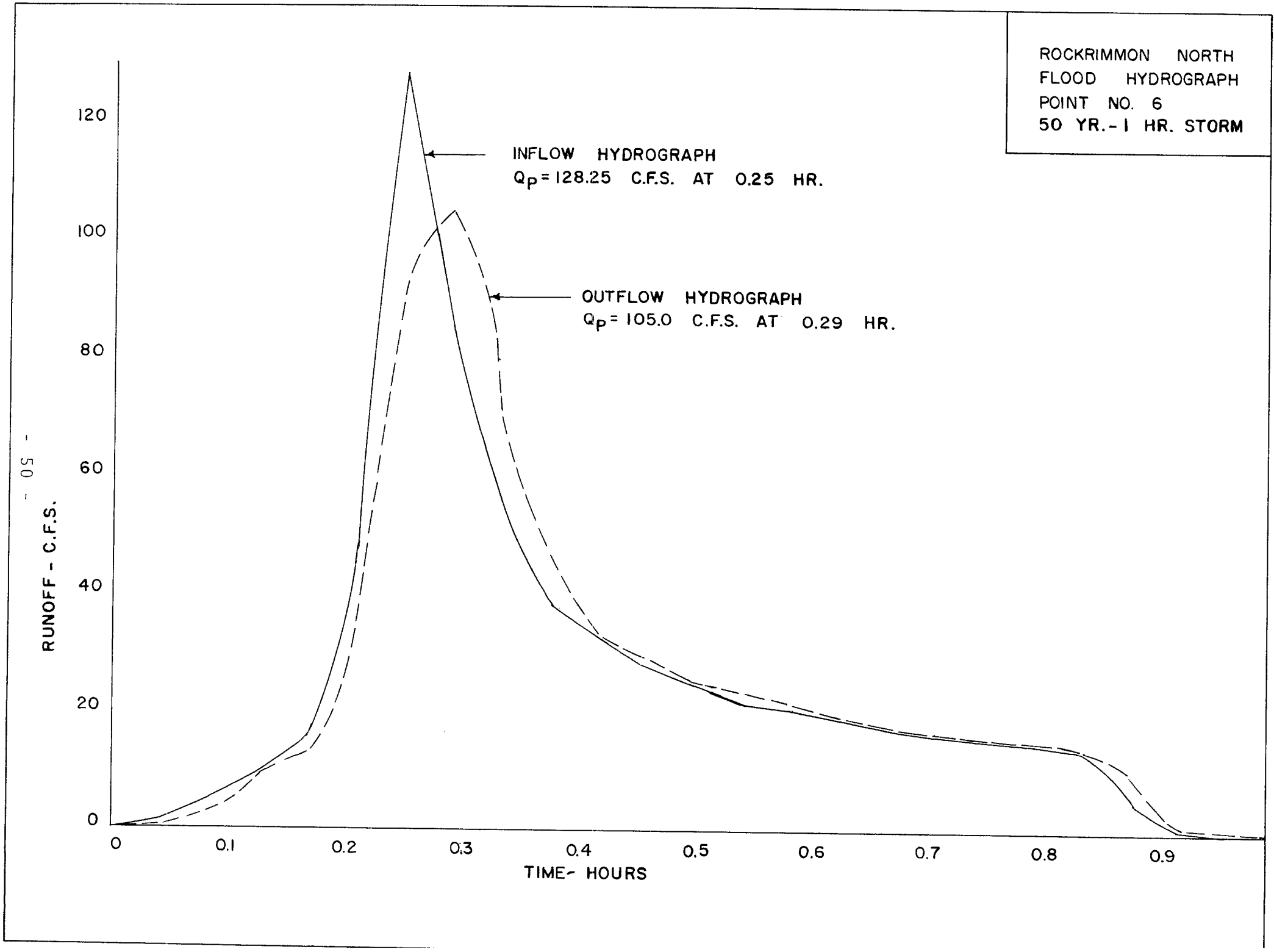


ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 3
100 YR. - 1 HR. STORM

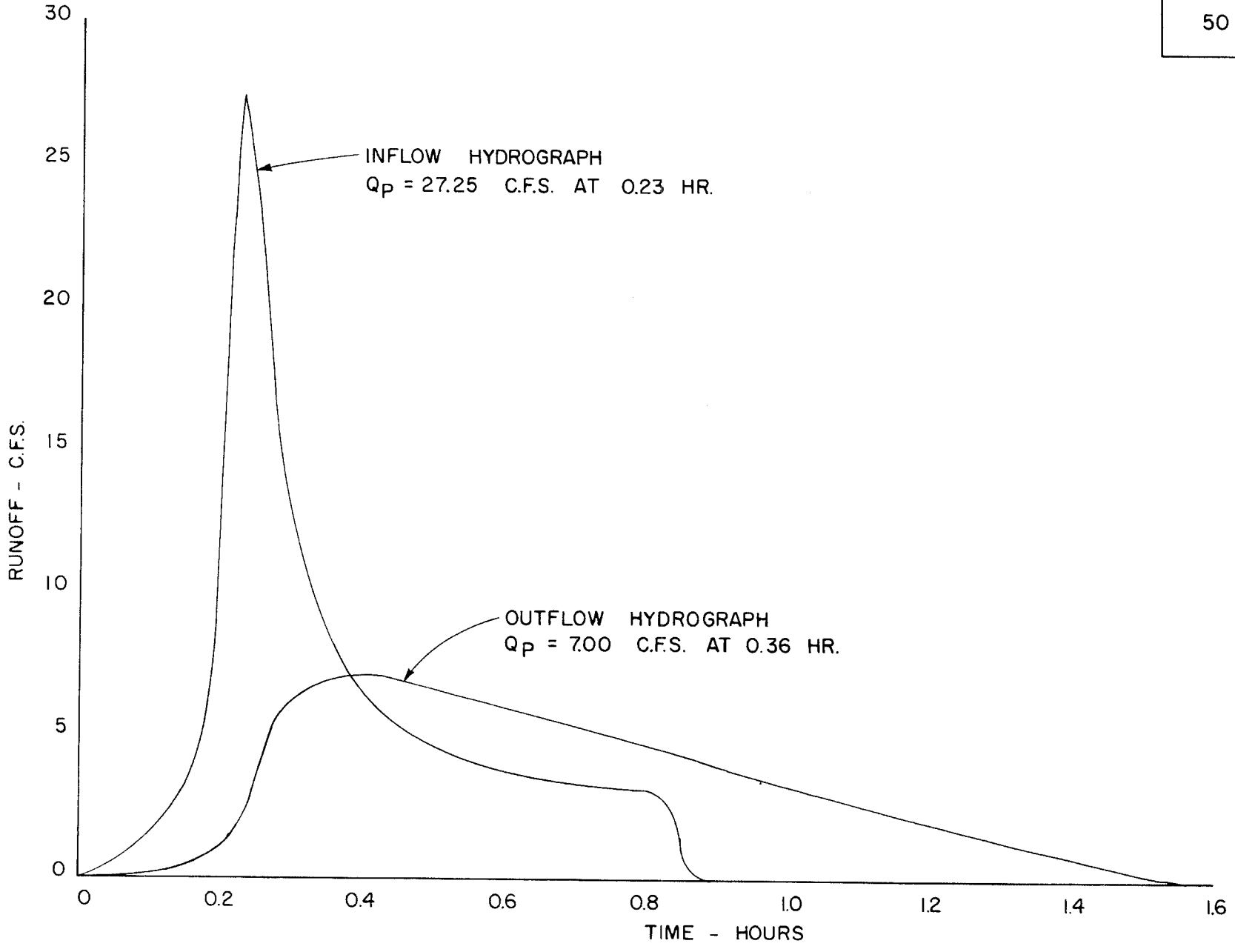



ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 4
100 YR. - 1 HR. STORM
HYDROGRAPH WITHOUT POINTS NO. 1 & NO. 2 STAGING
Q_P = 667.18 C.F.S. AT 0.29 HR.
HYDROGRAPH WITH POINTS NO. 1 & NO. 2 STAGING
Q_P = 401.07 C.F.S. AT 0.29 HR.
RUNOFF - C.F.S.
0
100
200
300
400
500
600
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
TIME - HOURS

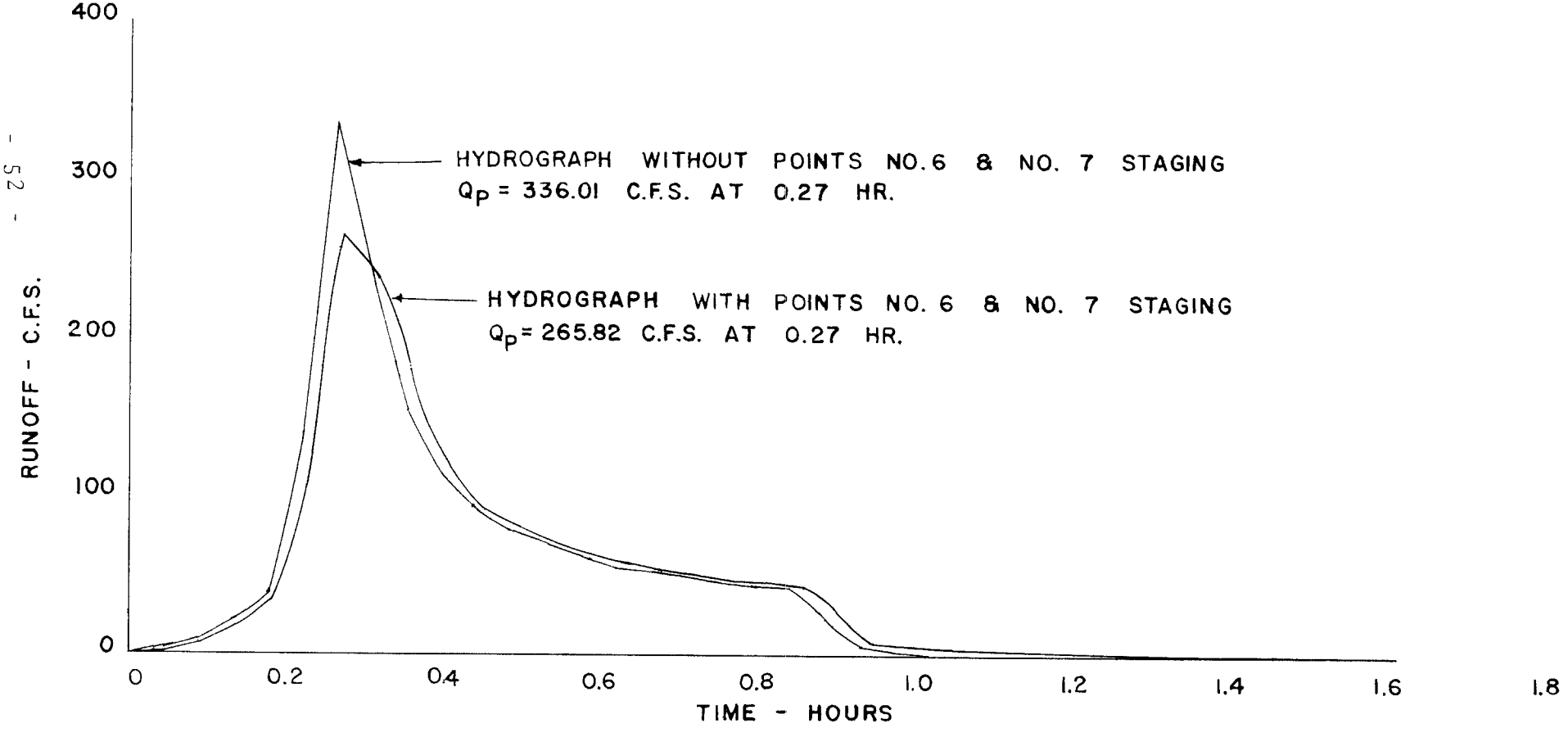

ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 5
100 YR. - 1 HR. STORM
HYDROGRAPH WITHOUT POINTS NO. 1 & NO. 2 STAGING
Q_P = 732.31 C.F.S. AT 0.33 HR.
HYDROGRAPH WITH POINTS NO. 1 & NO. 2 STAGING
Q_P = 640.35 C.F.S. AT 0.35 HR.
RUNOFF - C.F.S.
TIME - HOURS
0
100
200
300
400
500
600
700
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8

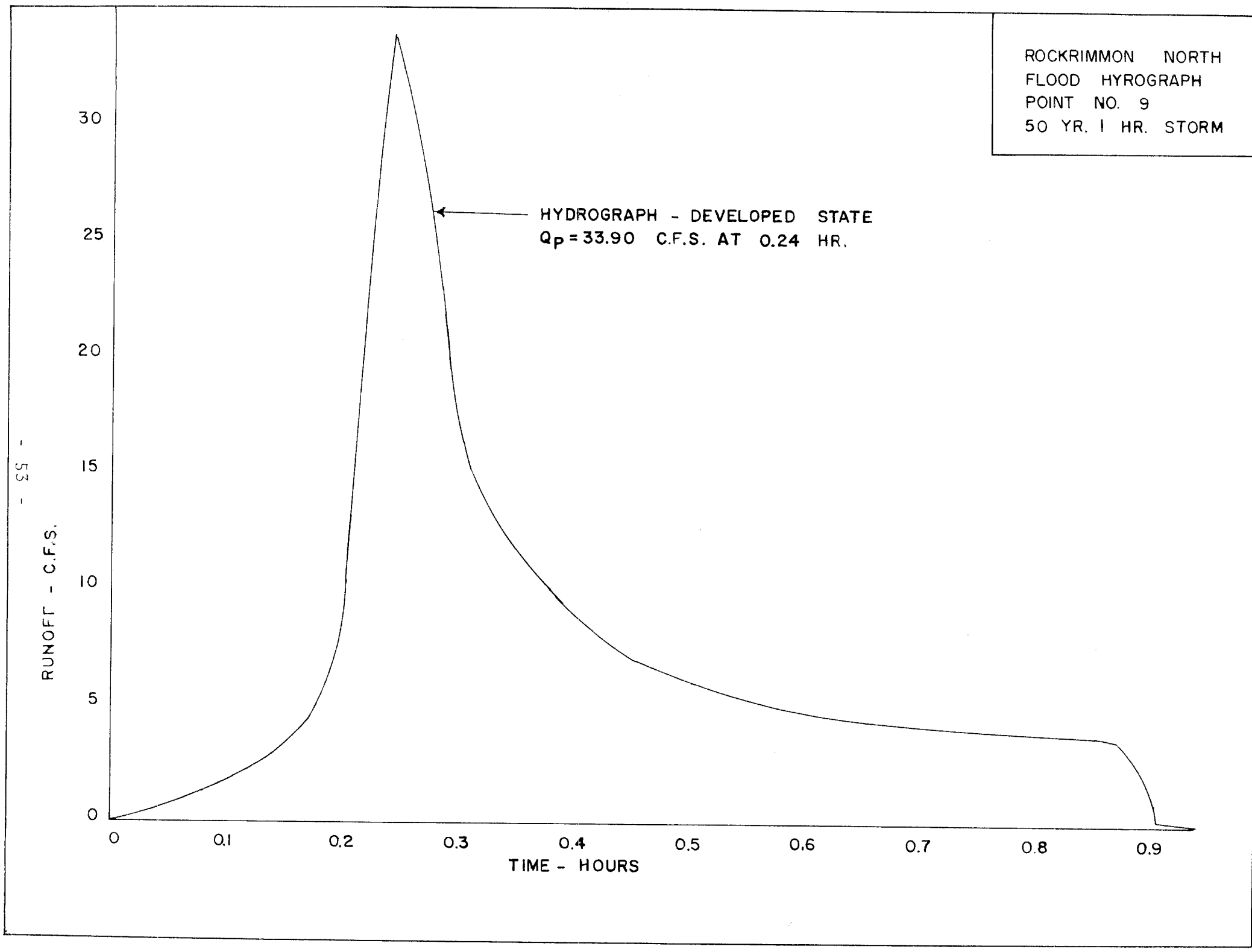

ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 6
50 YR. - 1 HR. STORM
INFLOW HYDROGRAPH
Q_P = 128.25 C.F.S. AT 0.25 HR.
OUTFLOW HYDROGRAPH
Q_P = 105.0 C.F.S. AT 0.29 HR.
RUNOFF - C.F.S.
0
20
40
60
80
100
120
TIME - HOURS
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

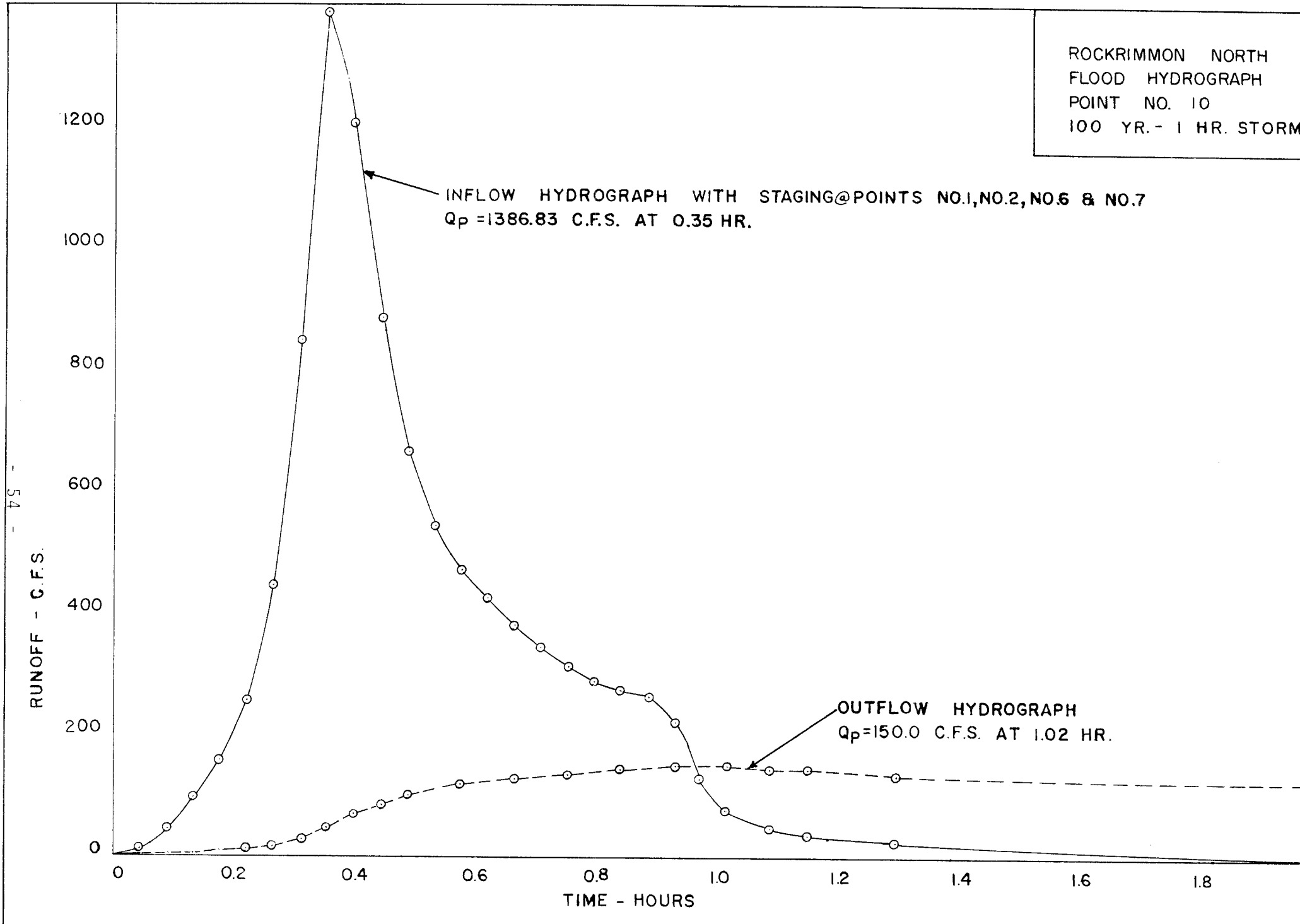
ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 7
50 YR. - 1 HR. STORM

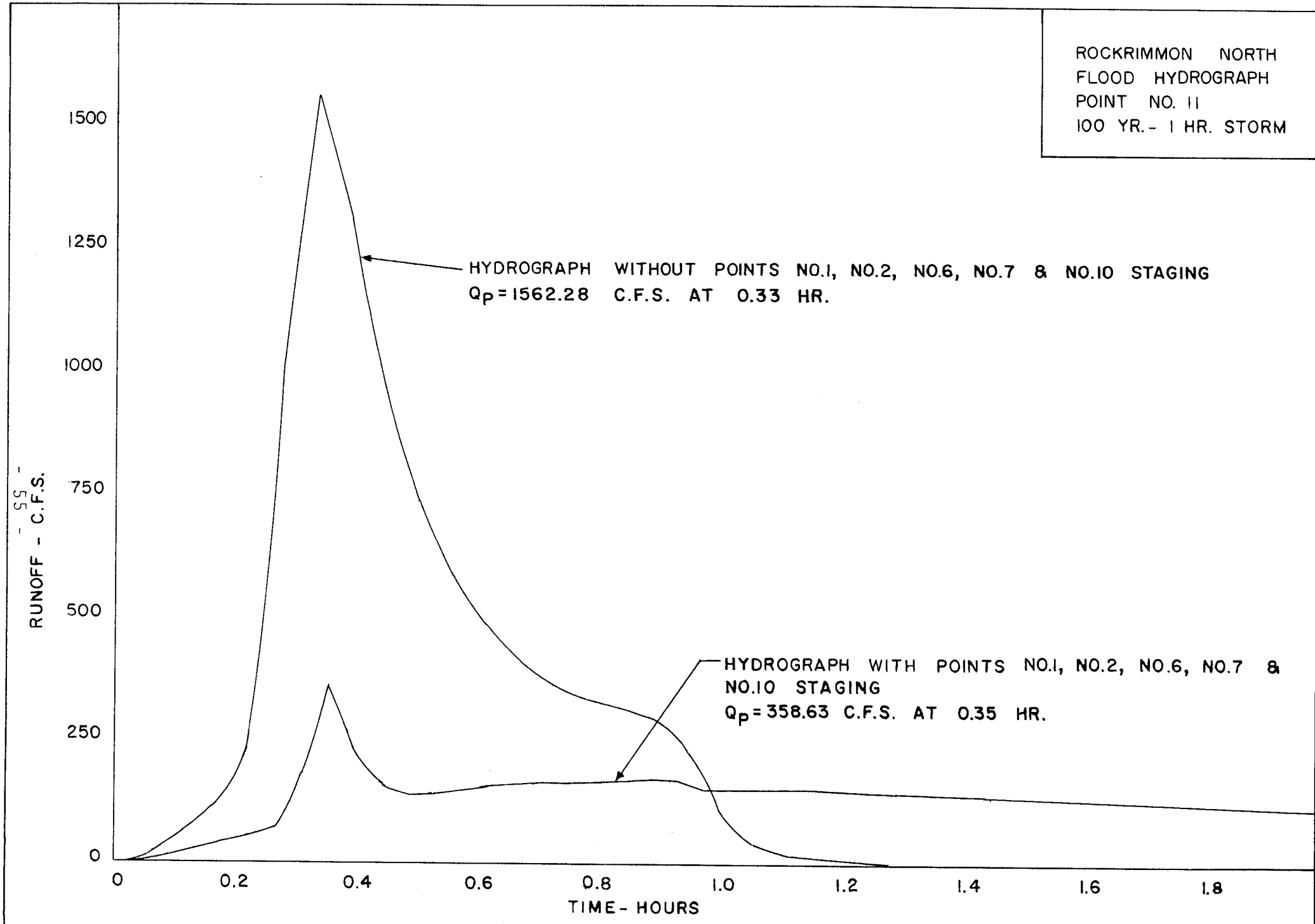


ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 8
50 YR.- 1 HR. STORM

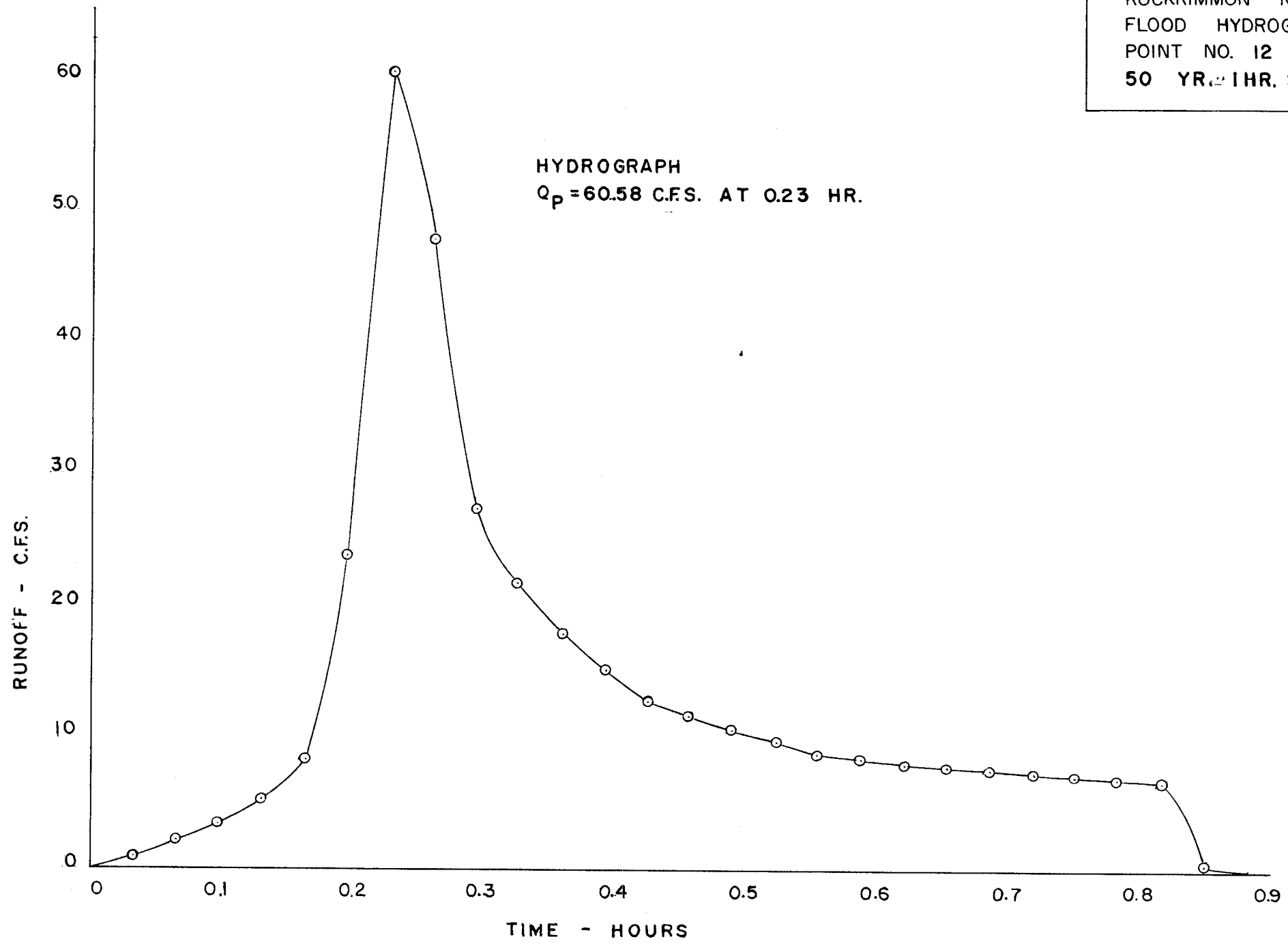


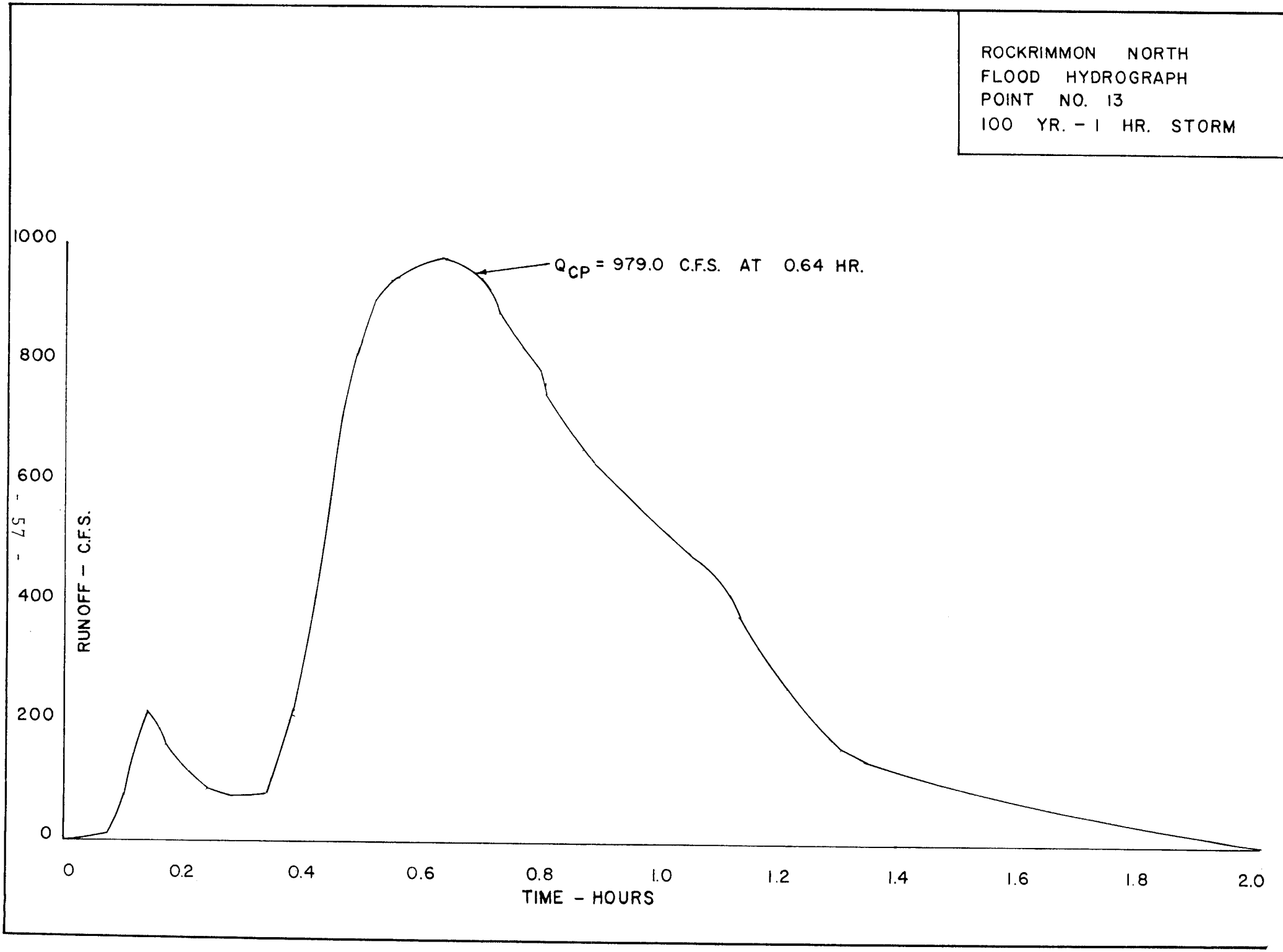

ROCKRIMMON NORTH
FLOOD HYROGRAPH
POINT NO. 9
50 YR. 1 HR. STORM
HYDROGRAPH - DEVELOPED STATE
Q_P = 33.90 C.F.S. AT 0.24 HR.
RUNOFF - C.F.S.
0
5
10
15
20
25
30
TIME - HOURS
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 10
100 YR. - 1 HR. STORM
INFLOW HYDROGRAPH WITH STAGING@POINTS NO.1,NO.2,NO.6 & NO.7
Qp =1386.83 C.F.S. AT 0.35 HR.
OUTFLOW HYDROGRAPH
Qp=150.0 C.F.S. AT 1.02 HR.
RUNOFF - C.F.S.
TIME - HOURS
0
200
400
600
800
1000
1200
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8

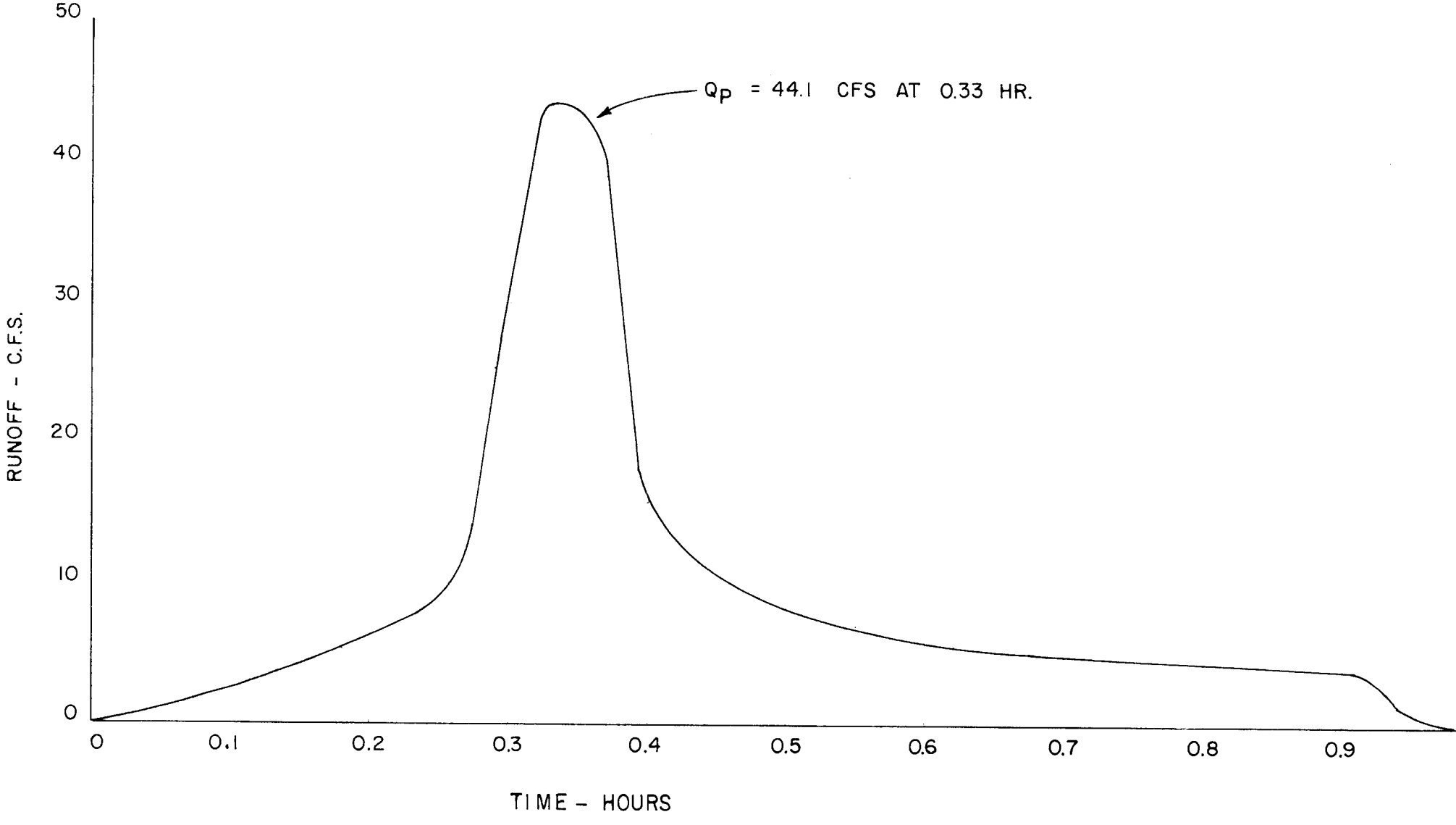

ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 11
100 YR. - 1 HR. STORM
HYDROGRAPH WITHOUT POINTS NO.1, NO.2, NO.6, NO.7 & NO.10 STAGING
Q_p = 1562.28 C.F.S. AT 0.33 HR.
HYDROGRAPH WITH POINTS NO.1, NO.2, NO.6, NO.7 & NO.10 STAGING
Q_p = 358.63 C.F.S. AT 0.35 HR.
RUNOFF - C.F.S.
TIME - HOURS
0
250
500
750
1000
1250
1500
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8

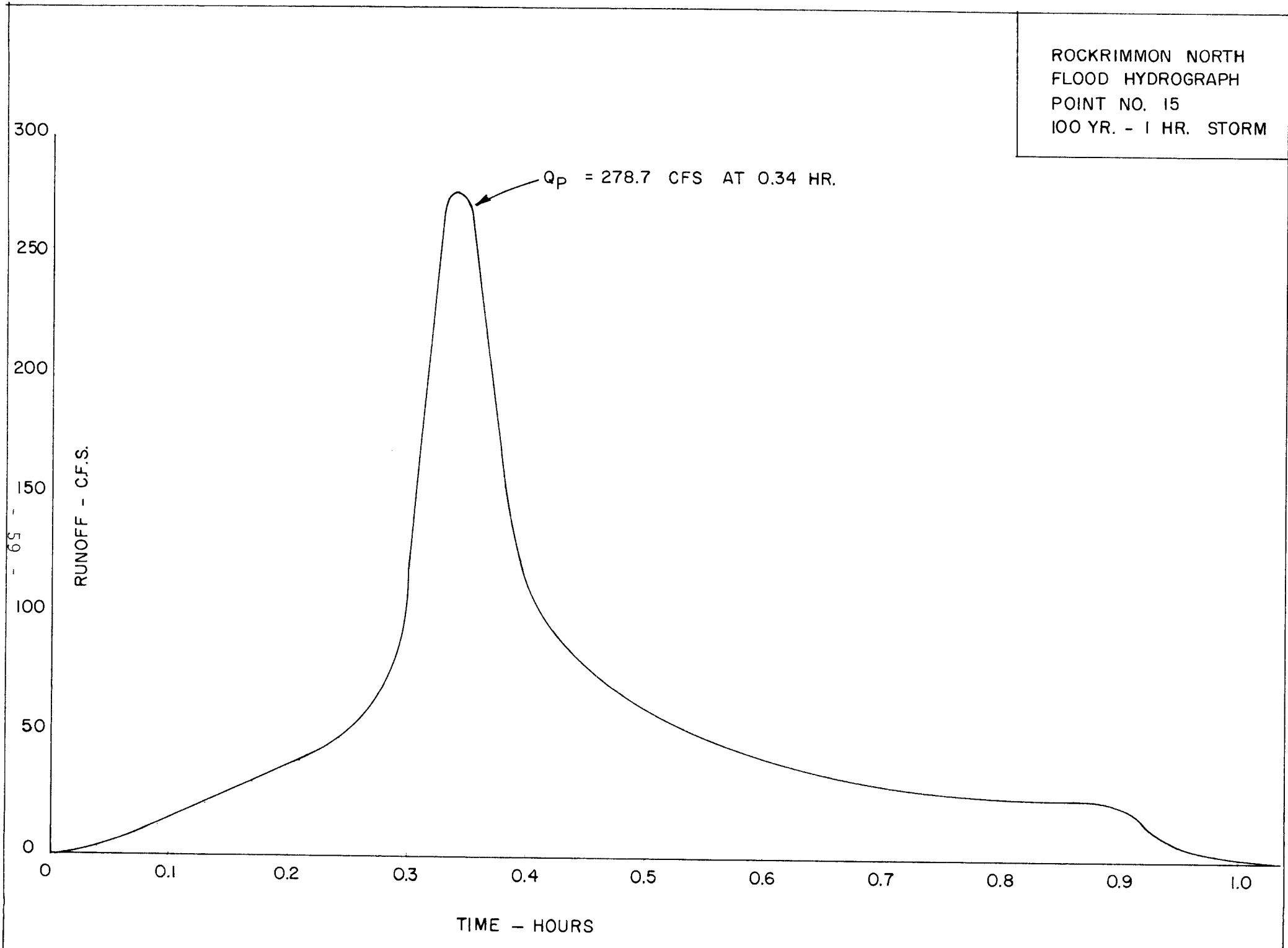
ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 12
50 YR. - 1 HR. STORM



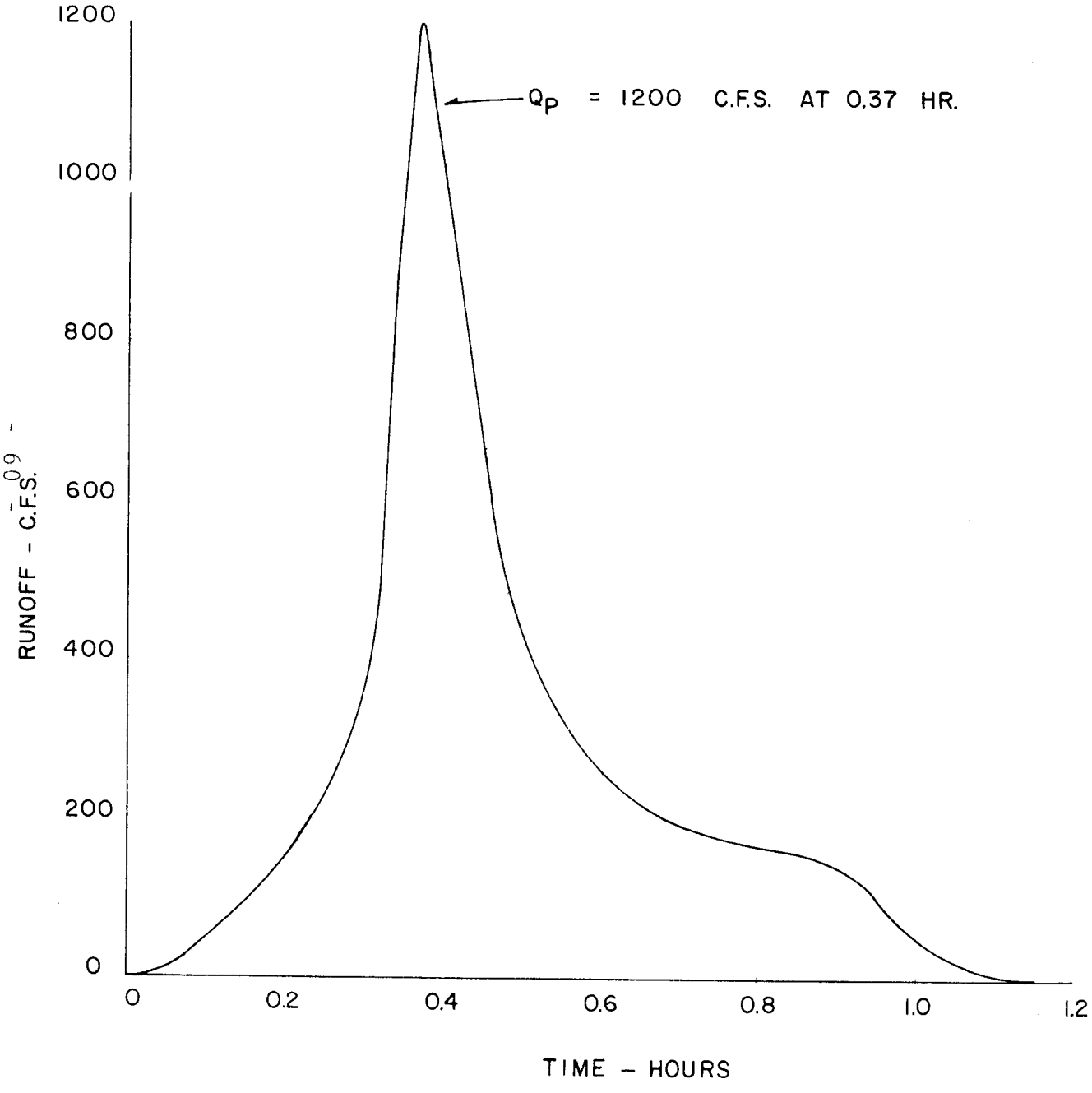

ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 13
100 YR. - 1 HR. STORM
Q_{CP} = 979.0 C.F.S. AT 0.64 HR.
1000
800
600
400
200
0
RUNOFF - C.F.S.
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
TIME - HOURS

ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 14
100 YR. - 1 HR. STORM

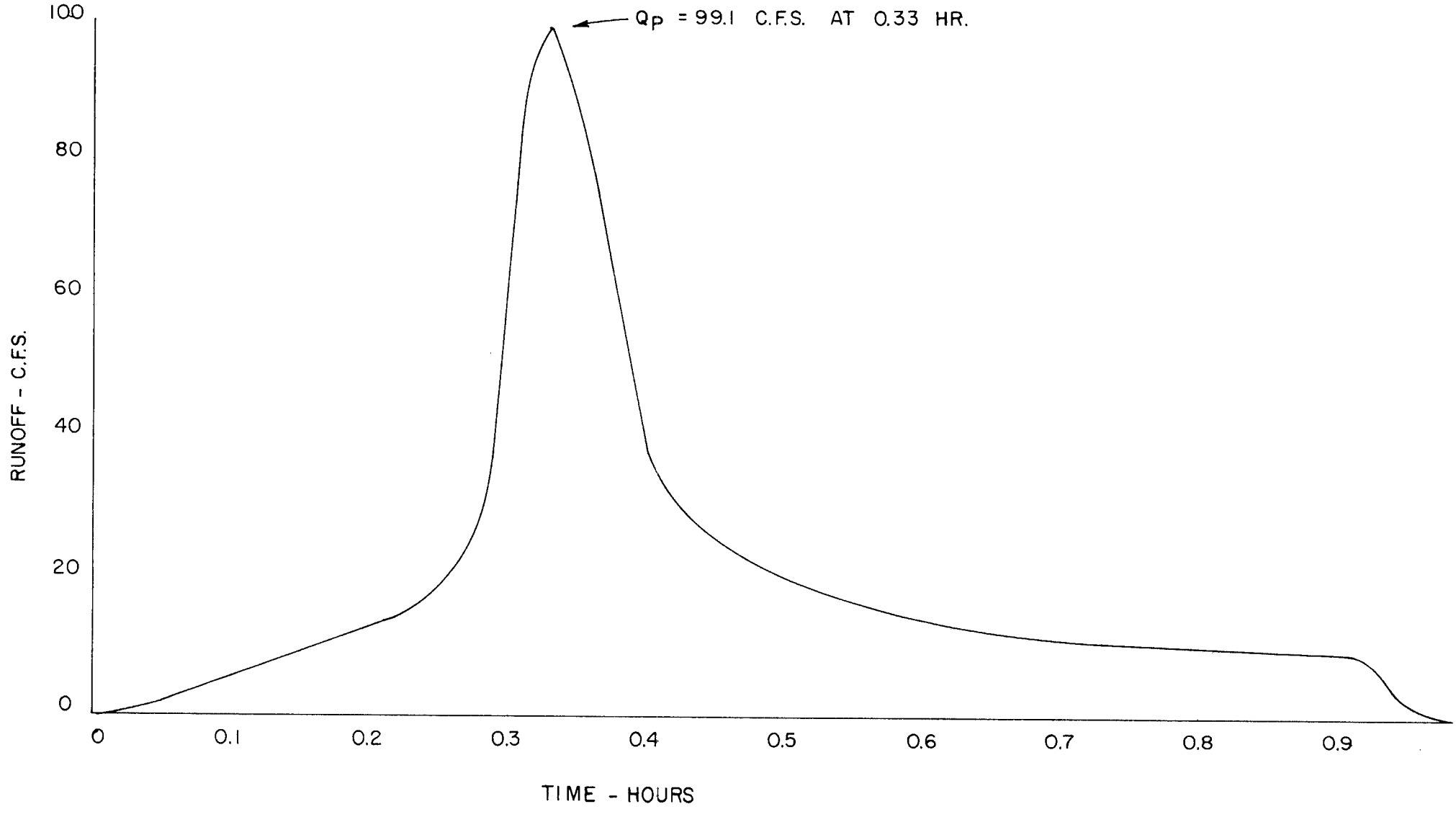



ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 15
100 YR. - 1 HR. STORM
Q_P = 278.7 CFS AT 0.34 HR.
300
250
200
150
100
50
0
RUNOFF - C.F.S.
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
TIME – HOURS

ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 16
100 YR. – 1 HR. STORM



ROCKRIMMON NORTH
FLOOD HYDROGRAPH
POINT NO. 17
100 YR. - 1 HR. STORM



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HYDROGRAPH COMPUTATION

Pt. #1 Developed State

Subdivision Rockrimmon North Gov't City of Colo. Spgs.

Location Pt. #1, City of Colorado Springs

Return Period 100 Yrs. Calc'd by N.H.Patel
L=6750'
H=352'
Date 10-30-72

Dr. Area 0.2008 Sq. Mi. T_C 0.34 Hr. Runoff Curve No. 88

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.20 In. Computed T_p 0.238 Hr. T_o 4.97 Hr.

(T_o/ T_p): Computed 20.88 : Used 25 Revised T_p 0.1988

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 488.87 CFS. Qq_p = 1075.51 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Qq_p

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.861	15.06	41		
2	0.043	2.15	22	0.904	4.30	42		
3	0.086	6.45	23	0.948	1.08	43		
4	0.129	15.06	24	0.991	0	44		
5	0.172	25.81	25			45		
6	0.215	94.64	26			46		
Peak 7	0.258	225.86	27			47		
8	0.301	157.02	28			48		
9	0.345	104.32	29			49		
10	0.388	77.44	30			50		
11	0.431	61.30	31			51		
12	0.474	52.70	32			52		
13	0.517	47.32	33			53		
14	0.560	41.94	34			54		
15	0.603	37.64	35			55		
16	0.646	35.49	36			56		
17	0.689	33.34	37			57		
18	0.732	31.19	38			58		
19	0.775	30.11	39			59		
20	0.818	29.04	40			60		

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HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #2, City of Colorado Springs, Colorado

Return Period 100 Yrs. Calc'd by N.H.Patel
L=7900'
H=390'
Date 11-6-72

Dr. Area 0.2781 Sq. Mi. T_C 0.382 Hr. Runoff Curve No. 88

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.20 In. Computed T_p 0.2674 Hr. T_o 4.97 Hr.

(T_o/ T_p): Computed 18.59 : Used 16 Revised T_p 0.3106

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 433.36 CFS. Qq_p = 953.38 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Qq_p

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.0	0.0	21	0.932	5.72	41		
2	0.047	1.91	22	0.978	2.86	42		
3	0.093	6.67	23	1.025	0.95	43		
4	0.140	19.07	24	1.071	0.0	44		
5	0.186	35.28	25			45		
6	0.233	141.10	26			46		
Peak 7	0.280	264.09	27			47		
8	0.326	204.02	28			48		
9	0.373	142.05	29			49		
10	0.419	106.78	30			50		
11	0.466	83.90	31			51		
12	0.512	69.60	32			52		
13	0.559	60.06	33			53		
14	0.606	53.39	34			54		
15	0.652	49.58	35			55		
16	0.699	45.76	36			56		
17	0.745	42.90	37			57		
18	0.792	41.95	38			58		
19	0.839	40.04	39			59		
20	0.885	21.93	40			60		

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Soil Conservation Service

HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #3, City of Colorado Springs

Return Period 100 Yrs. Calc'd by N.H.Patel
L=8980' Date 11-7-72
H=433'

Dr. Area 0.5264 Sq. Mi. T_C 0.42 Hr. Runoff Curve No. 90

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.38 In. Computed T_p 0.2940 Hr. T_o 5.12 Hr.

(T_o/ T_p): Computed 17.41 : Used 16 Revised T_p 0.320

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 796.18 CFS. Qq_p = 1894.91 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.960	11.37	41		
2	0.048	3.79	22	1.008	5.68	42		
3	0.096	13.26	23	1.056	1.89	43		
4	0.144	37.90	24	1.104	0	44		
5	0.192	70.11	25			45		
6	0.240	280.45	26			46		
Peak 7	0.288	524.89	27			47		
8	0.336	405.51	28			48		
9	0.384	282.34	29			49		
10	0.432	212.23	30			50		
11	0.480	166.75	31			51		
12	0.528	138.33	32			52		
13	0.576	119.38	33			53		
14	0.624	106.11	34			54		
15	0.672	98.54	35			55		
16	0.720	90.96	36			56		
17	0.768	85.27	37			57		
18	0.816	83.38	38			58		
19	0.864	79.59	39			59		
20	0.912	43.58	40			60		

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Soil Conservation Service

HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't Colo. Spgs.

Location Pt. #4, City of Colorado Springs

Return Period 100 Yrs. Calc'd by N.H.Patel
L=10850'
H=485' Date 11-10-72

Dr. Area 0.6691 Sq. Mi. T_C 0.50 Hr. Runoff Curve No. 90

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.38 In. Computed T_p 0.35 Hr. T_o 5.12 Hr.

(T_o/ T_p): Computed 14.63 : Used 16 Revised T_p 0.32

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 1012.01 CFS. Oq_p = 2408.59 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

Pg 21.66

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.960	14.45	41		
2	0.048	4.82	22	1.008	7.23	42		
3	0.096	16.86	23	1.056	2.41	43		
4	0.144	48.17	24	1.104	0.0	44		
5	0.192	89.12	25			45		
6	0.240	356.47	26			46		
Peak 7	0.288	667.18	27			47		
8	0.336	515.44	28			48		
9	0.384	358.88	29			49		
10	0.432	269.76	30			50		
11	0.480	211.96	31			51		
12	0.528	175.83	32			52		
13	0.576	151.74	33			53		
14	0.624	134.88	34			54		
15	0.672	125.25	35			55		
16	0.720	115.61	36			56		
17	0.768	108.39	37			57		
18	0.816	105.98	38			58		
19	0.864	101.16	39			59		
20	0.912	55.40	40			60		

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HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #5, City of Colorado Springs

Return Period 100 Yrs. Calc'd by N.H.Patel
L=14530'
H=585' Date 11-15-72

Dr. Area 0.8751 Sq. Mi. T_C 0.63 Hr. Runoff Curve No. 91

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.47 In. Computed T_p 0.469 Hr. T_o 5.20 Hr.

(T_o/ T_p): Computed 11.09 : Used 10 Revised T_p 0.52

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 814.52 CFS. Qq_p = 2011.85 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

Pg 21.66

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	1.092	8.05	41		
2	0.055	4.02	22	1.147	4.02	42		
3	0.109	18.11	23	1.201	2.01	43		
4	0.164	54.32	24	1.256	0	44		
5	0.218	126.75	25			45		
6	0.273	474.80	26			46		
Peak 7	0.328	732.31	27			47		
8	0.382	617.64	28			48		
9	0.437	454.68	29			49		
10	0.491	346.04	30			50		
11	0.546	273.61	31			51		
12	0.601	227.34	32			52		
13	0.655	195.15	33			53		
14	0.710	171.01	34			54		
15	0.764	156.92	35			55		
16	0.819	148.88	36			56		
17	0.874	138.82	37			57		
18	0.928	106.63	38			58		
19	0.983	50.30	39			59		
20	1.037	18.11	40			60		

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HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North City Gov't Colo. Spgs.

Location Pt. #6

Return Period 50 Yrs. Calc'd by N.H.Patel
L=4280' Date 12-5-72
H=380'

Dr. Area 0.1796 Sq. Mi. T_C 0.192 Hr. Runoff Curve No. 93

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 1.31 In. Computed T_p 0.1344 Hr. T_o 5.02 Hr.

(T_o/T_p): Computed 37.35 : Used 36 Revised T_p 0.1394

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 623.58 CFS. Qq_p = 816.88 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Qq_p

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.832	13.89	41		
2	0.042	1.63	22	0.873	5.71	42		
3	0.083	4.90	23	0.915	0.82	43		
4	0.125	9.80	24	0.956	0	44		
5	0.166	15.52	25			45		
6	0.208	46.56	26			46		
Peak 7	0.249	128.25	27			47		
8	0.291	84.96	28			48		
9	0.333	55.55	29			49		
10	0.374	38.39	30			50		
11	0.416	32.68	31			51		
12	0.457	27.77	32			52		
13	0.499	24.51	33			53		
14	0.541	21.24	34			54		
15	0.582	20.42	35			55		
16	0.624	18.79	36			56		
17	0.665	17.15	37			57		
18	0.707	16.34	38			58		
19	0.748	15.52	39			59		
20	0.790	14.70	40			60		

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HYDROGRAPH COMPUTATION

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #7, City of Colorado Springs

Return Period 50 Yrs. Calc'd by N.H.Patel
L=1830'
H=213' Date 11-30-72

Dr. Area 0.0377 Sq. Mi. T_C 0.090 Hr. Runoff Curve No. 92

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 1.24 In. Computed T_p 0.063 Hr. T_o 4.92 Hr.

(T_o/ T_p): Computed 78.10 : Used 75 Revised T_p 0.0656

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 278.15 CFS. Qq_p = 344.91 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

Pg 21.67

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.656	3.48	41		
2	0.033	0.41	22	0.689	3.38	42		
3	0.066	0.93	23	0.722	3.28	43		
4	0.098	1.52	24	0.754	3.17	44		
5	0.131	2.31	25	0.787	3.07	45		
6	0.164	3.73	26	0.820	2.97	46		
7	0.197	10.66	27	0.853	0.10	47		
Peak 8	0.230	27.25	28	0.886	0	48		
9	0.262	21.52	29			49		
10	0.295	12.31	30			50		
11	0.328	9.76	31			51		
12	0.361	8.07	32			52		
13	0.394	6.76	33			53		
14	0.426	5.76	34			54		
15	0.459	5.17	35			55		
16	0.492	4.73	36			56		
17	0.525	4.35	37			57		
18	0.558	3.97	38			58		
19	0.590	3.73	39			59		
20	0.623	3.59	40			60		

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HYDROGRAPH COMPUTATION

Subdivision Rockrimmon North Gov't City of Colo. Spgs.

Location Pt. #8, Disregarding staging

Return Period 50 Yrs. Calc'd by N. H. Patel
L=7420' Date 12-1-72
H=453'

Dr. Area 0.4836 Sq. Mi. T_C 0.34 Hr. Runoff Curve No. 94

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 1.40 In. Computed T_p 0.238 Hr. T_o 5.12 Hr.

(T_o/ T_p): Computed 21.51 : Used 25 Revised T_p 0.2048

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 1142.88 CFS. Qq_p = 1600.04 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

Pg 21.66

LINE NO.	t/6 HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.887	22.40	41		
2	0.044	3.20	22	0.932	6.40	42		
3	0.089	9.60	23	0.976	1.60	43		
4	0.133	22.40	24	1.021	0	44		
5	0.177	38.40	25			45		
6	0.222	140.80	26			46		
Peak 7	0.266	336.01	27			47		
8	0.311	233.61	28			48		
9	0.355	155.20	29			49		
10	0.399	115.20	30			50		
11	0.444	91.20	31			51		
12	0.488	78.40	32			52		
13	0.532	70.40	33			53		
14	0.577	62.40	34			54		
15	0.621	56.00	35			55		
16	0.666	52.80	36			56		
17	0.710	49.60	37			57		
18	0.754	46.40	38			58		
19	0.799	44.80	39			59		
20	0.843	43.20	40			60		

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HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't City Colo. Spgs

Location Pt. #9, City of Colorado Springs

Return Period 50 Yrs. Calc'd by N.H.Patel
L=1800'
H=118'
Date 12-1-72

Dr. Area 0.0417 Sq. Mi. T_C 0.112 Hr. Runoff Curve No. 95

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 1.48 In. Computed T_p 0.0784 Hr. T_o 5.22 Hr.

(T_o/ T_p): Computed 64.54 : Used 75 Revised T_p 0.0696

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 289.98 CFS. Qq_p = 429.17 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0.0	21	0.696	4.33	41		
2	0.035	0.52	22	0.731	4.21	42		
3	0.070	1.16	23	0.766	4.08	43		
4	0,104	1.89	24	0.800	3.95	44		
5	0.139	2.88	25	0.835	3.82	45		
6	0.174	4.64	26	0.870	3.69	46		
7	0.209	13.26	27	0.905	0.13	47		
Peak 8	0.244	33.90	28	0.940	0.0	48		
9	0.278	26.78	29			49		
10	0.313	15.32	30			50		
11	0.348	12.15	31			51		
12	0.383	10.04	32			52		
13	0.418	8.41	33			53		
14	0.452	7.17	34			54		
15	0.487	6.44	35			55		
16	0.522	5.88	36			56		
17	0.557	5.41	37			57		
18	0.592	4.94	38			58		
19	0.626	4.64	39			59		
20	0.661	4.46	40			60		

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HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't City of Colo. Spgs.

Location Pt. #10, Without staging

Return Period 100 Yrs. Calc'd by N.H.Patel
L=16939' Date
△H=650'
Dr. Area 1.5849 Sq. Mi. T_C 0.75 Hr. Runoff Curve No. 92

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.56 In. Computed T_p 0.525 Hr. T_o 5.28 Hr.

(T_o/ T_p): Computed 10.06 : Used 10 Revised T_p 0.528

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 1452.82 CFS. Qq_p = 3719.23 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	1.109	14.88	41		
2	0.055	7.44	22	1.164	7.44	42		
3	0.111	33.47	23	1.220	3.72	43		
4	0.166	100.42	24	1.275	0	44		
5	0.222	234.31	25			45		
6	0.277	877.74	26			46		
Peak 7	0.333	1353.80	27			47		
8	0.388	1141.80	28			48		
9	0.444	840.55	29			49		
10	0.499	639.71	30			50		
11	0.554	505.82	31			51		
12	0.610	420.27	32			52		
13	0.665	360.77	33			53		
14	0.721	316.13	34			54		
15	0.776	290.10	35			55		
16	0.832	275.22	36			56		
17	0.887	256.63	37			57		
18	0.942	197.12	38			58		
19	0.998	92.98	39			59		
20	1.053	33.47	40			60		

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HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #11, Without staging

Return Period 100 Yrs. Calc'd by N.H.Patel
L=20730'
ΔH=714'
Date 1-4-73

Dr. Area 1.82897 Sq. Mi. T_C 0.92 Hr. Runoff Curve No. 92

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 3.42 In. Areal 3.42 In.

Q 2.56 In. Computed T_p 0.644 Hr. T_o 5.28 Hr.

(T_o/ T_p): Computed 8.20 : Used 10 Revised T_p 0.528

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 1676.56 CFS. Qq_p = 4291.99 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	1.109	17.17	41		
2	0.055	8.58	22	1.164	8.58	42		
3	0.111	38.63	23	1.220	4.29	43		
4	0.166	115.88	24	1.275	0	44		
5	0.222	270.40	25			45		
6	0.277	1012.91	26			46		
Peak 7	0.333	1562.28	27			47		
8	0.388	1317.64	28			48		
9	0.444	969.99	29			49		
10	0.499	738.22	30			50		
11	0.554	583.71	31			51		
12	0.610	484.99	32			52		
13	0.665	416.32	33			53		
14	0.721	364.82	34			54		
15	0.776	334.78	35			55		
16	0.832	317.61	36			56		
17	0.887	296.15	37			57		
18	0.942	227.48	38			58		
19	0.998	107.30	39			59		
20	1.053	38.63	40			60		

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HYDROGRAPH COMPUTATION

Developed State

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Pt. #12, Basin below diversion point

Return Period 50 Yrs. Calc'd by N. H. Patel
L=1400'
ΔH=198' Date 12-29-72

Dr. Area 0.08382 Sq. Mi. T_C 0.070 Hr. Runoff Curve No. 92

Hydrograph Family No. 2 Storm Duration 1 Hr.

Rainfall: Point 2.0 In. Areal 2.0 In.

Q 1.24 In. Computed T_p 0.049 Hr. T_o 4.92 Hr.

(T_o/ T_p): Computed 100.41 : Used 75 Revised T_p 0.0656

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 618.43 CFS. Qq_p = 766.85 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Qq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	0.656	7.75	41		
2	0.033	0.92	22	0.689	7.52	42		
3	0.066	2.07	23	0.722	7.29	43		
4	0.098	3.37	24	0.754	7.06	44		
5	0.131	5.14	25	0.787	6.82	45		
6	0.164	8.28	26	0.820	6.59	46		
7	0.197	23.70	27	0.853	0.23	47		
Peak 8	0.230	60.58	28	0.886	0	48		
9	0.262	47.85	29			49		
10	0.295	27.38	30			50		
11	0.328	21.70	31			51		
12	0.361	17.94	32			52		
13	0.394	15.03	33			53		
14	0.426	12.81	34			54		
15	0.459	11.50	35			55		
16	0.492	10.51	36			56		
17	0.525	9.66	37			57		
18	0.558	8.82	38			58		
19	0.590	8.28	39			59		
20	0.623	7.98	40			60		

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HYDROGRAPH COMPUTATION

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Hyd. Pt. 13, Dry Creek D/S check Dam only

Return Period 100 Yrs. Calc'd by B.E.J.
Date 3-6-73

Dr. Area 0.250 Sq. Mi. T_C 0.217 Hr. Runoff Curve No. 82

Hydrograph Family No. 3 Storm Duration 1 Hr.

Rainfall: Point 3.50 In. Areal 3.50 In.

Q 1.78 In. Computed T_p 0.152 Hr. T_o 4.65 Hr.

(T_o/ T_p): Computed 30.6 : Used 36 Revised T_p 0.129

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 938.0 CFS. Qq_p = 1670 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
	1	0	0	21	0.70	38.4	41		
	2	0.03	3.3	22	0.73	38.4	42		
	3	0.07	10.0	23	0.77	38.4	43		
	4	0.10	78.5	24	0.80	11.7	44		
Peak	5	0.14	217.1	25	0.84	5.0	45		
	6	0.17	162.0	26	0.87	0	46		
	7	0.21	115.2	27			47		
	8	0.24	86.8	28			48		
	9	0.28	75.2	29			49		
	10	0.31	68.5	30			50		
	11	0.35	61.8	31			51		
	12	0.38	56.8	32			52		
	13	0.42	51.8	33			53		
	14	0.45	46.8	34			54		
	15	0.49	41.8	35			55		
	16	0.52	40.1	36			56		
	17	0.56	40.1	37			57		
	18	0.59	40.1	38			58		
	19	0.63	40.1	39			59		
	20	0.66	38.4	40			60		

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HYDROGRAPH COMPUTATION

Subdivision Rockrimmon North Gov't Colo. Spgs.

Location Hyd. Pt. 14

Return Period 100 Yrs. Calc'd by B.E.J.
Date 3-6-73

Dr. Area 0.026 Sq. Mi. T_C .110 Hr. Runoff Curve No. 94

Hydrograph Family No. 1 Storm Duration 1 Hr.

Rainfall: Point 3.50 In. Areal 3.50 In.

Q 2.84 In. Computed T_p .077 Hr. T_o 5.45 Hr.

(T_o/ T_p): Computed 70.8 : Used 75 Revised T_p .073

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 172.4 CFS. Qq_p = 489.6 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	.0	0	21	.73	4.7	41		
2	.04	0.8	22	.77	4.6	42		
3	.07	1.9	23	.80	4.4	43		
4	.11	2.6	24	.84	4.3	44		
5	,15	4.1	25	.88	4.1	45		
6	.18	5.2	26	.91	3.9	46		
7	.22	6.7	27	.95	0.1	47		
8	.26	9.6	28	.98	0	48		
9	.29	25.3	29			49		
Peak 10	.33	44.1	30			50		
11	.37	29.0	31			51		
12	.40	15.7	32			52		
13	.44	11.1	33			53		
14	.48	9.2	34			54		
15	.51	7.9	35			55		
16	.55	7.0	36			56		
17	.58	6.1	37			57		
18	.62	5.5	38			58		
19	.66	5.1	39			59		
20	.69	4.9	40			60		

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HYDROGRAPH COMPUTATION

Subdivision Rockrimmon North Gov't Colo. Spgs.

Location Hyd. Pt. 15

Return Period 100 Yrs. Calc'd by B.E.J.
Date 3-6-73

Dr. Area 0.173 Sq. Mi. T_C .250 Hr. Runoff Curve No. 94

Hydrograph Family No. 1 Storm Duration 1 Hr.

Rainfall: Point 3.50 In. Areal 3.50 In.

Q 2.84 In. Computed T_p .175 Hr. T_o 5.45 Hr.

(T_o/ T_p): Computed 31.1 : Used 36 Revised T_p .151

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 554.5 CFS. Qq_p = 1575 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(qc/q_p) Oq_p

	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
	1	0	0	21	.86	26.8	41		
	2	.04	3.1	22	.90	26.8	42		
	3	.09	12.6	23	.94	6.3	43		
	4	.13	22.0	24	.98	3.2	44		
	5	.17	31.5	25	1.03	0	45		
	6	.21	40.9	26			46		
	7	.26	52.0	27			47		
	8	.30	121.3	28			48		
Peak	9	.34	278.7	29			49		
	10	.38	159.0	30			50		
	11	.43	91.3	31			51		
	12	.47	69.3	32			52		
	13	.51	56.7	33			53		
	14	.56	47.2	34			54		
	15	.60	42.5	35			55		
	16	.64	37.8	36			56		
	17	.69	34.6	37			57		
	18	.73	31.5	38			58		
	19	.77	28.3	39			59		
	20	.81	26.8	40			60		

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HYDROGRAPH COMPUTATION

Subdivision Rockrimmon North City Gov't Colo. Spgs.

Location Hyd. Pt. 16

Return Period 100 Yrs. Calc'd by B.E.J.
Date 3-6-73

Dr. Area 0.993 Sq. Mi. T_C .408 Hr. Runoff Curve No. 93

Hydrograph Family No. 1 Storm Duration 1 Hr.

Rainfall: Point 3.50 In. Areal 3.50 In.

Q 2.73 In. Computed T_p .286 Hr. T_o 5.40 Hr.

(T_o/ T_p): Computed 17.5 : Used 16 Revised T_p 0.338

$q_p = \frac{484\ A}{\text{Rev. } T_p}$ = 1421.9 CFS. Qq_p = 3881.9 CFS.

T(COLUMN)=(t/T_p) Rev. T_p q(Column)=(q_c/q_p) Oq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	-0-	21	.74	182.4	41		
2	.04	3.9	22	.78	174.7	42		
3	.08	23.3	23	.82	170.8	43		
4	.11	58.2	24	.86	166.9	44		
5	.15	104.8	25	.89	155.3	45		
6	.19	143.6	26	.93	132.0	46		
7	.22	182.4	27	0.97	77.6	47		
8	.26	240.7	28	1.00	31.1	48		
9	.30	357.1	29	1.04	15.5	49		
10	.34	865.7	30	1.08	7.8	50		
Peak 11	.37	1200-	31	1.11	3.9	51		
12	.41	943.3	32	1.15	-0-	52		
13	.45	663.8	33			53		
14	.48	481.4	34			54		
15	.52	376.5	35			55		
16	.56	314.4	36			56		
17	.60	271.7	37			57		
18	.63	236.8	38			58		
19	.67	213.5	39			59		
20	.71	194.1	40			60		

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HYDROGRAPH COMPUTATION

Subdivision Rockrimmon North Gov't City Colo. Spgs.

Location Hyd. Pt. 17, 24" CIP @ D & RG RR

Return Period 100 Yrs. Calc'd by B.E.J.
Date 3-7-73

Dr. Area 0.1144 Sq. Mi. T_C 0.143 Hr. Runoff Curve No. 95

Hydrograph Family No. 1 Storm Duration 1 Hr.

Rainfall: Point 3.50 In. Areal 3.50 In.

Q 1.48 In. Computed T_p 0.100 Hr. T_o 5.54 Hr.

(T_o/ T_p): Computed 55.4 : Used 50 Revised T_p 110

$q_p = \frac{484\ A}{Rev.\ T_p}$ = 503.4 CFS. Qq_p = 745.0 CFS.

T(COLUMN) = (t/T_p) Rev. T_p q(Column) = (qc/q_p) Qq_p

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	-0-	-0-	21	.73	10.8	41		
2	.04	1.4	22	.77	10.4	42		
3	.07	3.9	23	.81	10.1	43		
4	.11	6.3	24	.84	9.7	44		
5	.15	8.8	25	.88	9.3	45		
6	.18	11.2	26	.92	9.2	46		
7	.22	14.3	27	.95	1.2	47		
8	.26	19.3	28	.99	-0-	48		
9	.29	43.1	29			49		
Peak 10	.33	99.1	30			50		
11	.37	70.1	31			51		
12	.40	37.7	32			52		
13	.44	26.6	33			53		
14	.48	22.1	34			54		
15	.51	18.9	35			55		
16	.55	16.3	36			56		
17	.59	14.3	37			57		
18	.62	12.8	38			58		
19	.66	11.8	39			59		
20	.70	11.2	40			60		

5. MAXIMUM PROBABLE FLOOD AT DAM SITE

Project Rockrimmon North

Calc. by N.H. Patel date 12-4-72

Checked by O. E. Watts date 12-5-72

Pt. #10 Dam - Maximum Probable Flood

Area = 1.5849 S. mi. curve # - 92.1

Length = 16600 ft.

Δh = 652 ft.

Tc = 0.72 hr. $\pm$ <24 hrs. ∴.24-48 hr. runoff may be neglected.

From Fig. 1 Page 29 - Design of Small Dams

Max. Probable precipitation is 22.8 in. for 6 hrs. duration-10 S.mi.area

Zone 4 - East of 105° meridian.

Fig. 2 Page 30 - Zone A

Duration-Hours	% of 10 S.mi. - 6 hr. value	Total rain inches
0 - 6	100	22.80
0 - 12	111	25.31
0 - 24	117.5	26.79

Max. (first) 6 hr. period rainfall Use Zone C Fig. 4 Page 32

Time Hours	Percentage of 6 hr. rain	Accumulative rain, inches	Incremental rain, inches	Rearranged incremental rain, inches in order 6, 4,3,1,2,5,hr.	Rearranged accumulative rain, inches
0	0	0			0
			8.21	0.91	
1/2	36	8.21			0.91
			2.96	0.91	
1	49	11.17			1.82
			1.83	1.14	
1-1/2	57	13.00			2.96
			1.59	0.91	
2	64	14.59			3.87
			1.60	1.60	
2-1/2	71	16.19			5.47
			0.91	0.91	
3	75	17.10			6.38
			1.14	8.21	
3-1/2	80	18.24			14.59
			0.91	2.96	
4	84	19.15			17.55
			0.91	1.83	
4-1/2	88	20.06			19.38
			0.92	1.59	
5	92	20.98			20.97
			0.91	0.91	
5-1/2	96	21.89	0.91	0.92	21.88
6	100	22.80	2.51	2.51	22.80
12		25.31	1.48	1.48	25.31
24		26.79			26.79

Project Rockrimmon North

Calc. by N.H. Patel date 12-4-72

Checked by O.E. Watts date 12-5-72

Composite Curve Summary:
Total Area = 1.5849 SM Comp. Curve = 92.10

Maximum Probable Flood-Pt. #10

Direct Runoff Use Fig. A-4 Pages 429, 430-Design of small dams.

Curve # is 92.1

Time Hours	Incremental rain, inches	Accumulative rain, inches	Direct Runoff, In. Accum.	Direct Runoff, In. Incremental	Incremental Loss, inches
0		0	0		
	0.91			0.38	0.53
1/2		0.91	0.38		
	0.91			0.72	0.19
1		1.82	1.10		
	1.14			1.06	0.08
1-1/2		2.96	2.16		
	0.91			0.84	0.07
2		3.87	3.00		
	1.60			1.56	0.04
2-1/2		5.47	4.56		
	0.91			0.89	0.02
3		6.38	5.45		
	8.21			8.19	0.02 *
3-1/2		14.59	13.64		
	2.96			2.93	0.03 *
4		17.55	16.57		
	1.83			1.81	0.02 *
4-1/2		19.38	18.38		
	1.59			1.56	0.03 *
5		20.97	19.94		
	0.91			0.89	0.02 *
5-1/2		21.88	20.83		
	0.92			0.89	0.03 *
6		22.80	22.2		
	2.51			2.21	0.30 *
12		25.31	24.5		
	1.48			0.88	0.60 *
24		26.79	26.15		

* Use 0.05 in/hr. loss min.
(Abandon curve)

0.025 in/1/2 hr.
0.30 in/6 hr.
0.60 in/12 hr.

UNITED WESTERN ENGINEERS

Project Rockrimmon North
Calc. by N.H. Patel date 12-4-72
Checked by O.E. Watts date 12-5-72

Maximum Probable Flood-Pt. #10

Time of Travel

Time of travel=Time of conc. from the most remote pt. to pt. #1 (=0.340)
+Time of travel from Pt. #1 to Pt. 2 (=0.017)
+Time of travel from Pt. #2 to Pt. 3 (=0.014)
+Time of travel from Pt. #3 to Pt. 4 (=0.024)
+Time of travel from Pt. #4 to Pt. 5 (=0.044)
+Time fo travel from Pt. #5 to Pt. 10 (=0.011)
TOTAL 0.450

Travel time through lake

Vw=5.67 (Dm)0.5 where Vw=Wave Velocity in fps. across the water
=5.67 x (23.61) 0.5 Dm=Mean depth of lake in ft. = 23.61'
=27.55 fps.

Length from Pt. 5 to Pt. 10=1080 ft.

∴Travel time = $\frac{1080}{3600 \times 27.55}$ = 0.011 Hr.

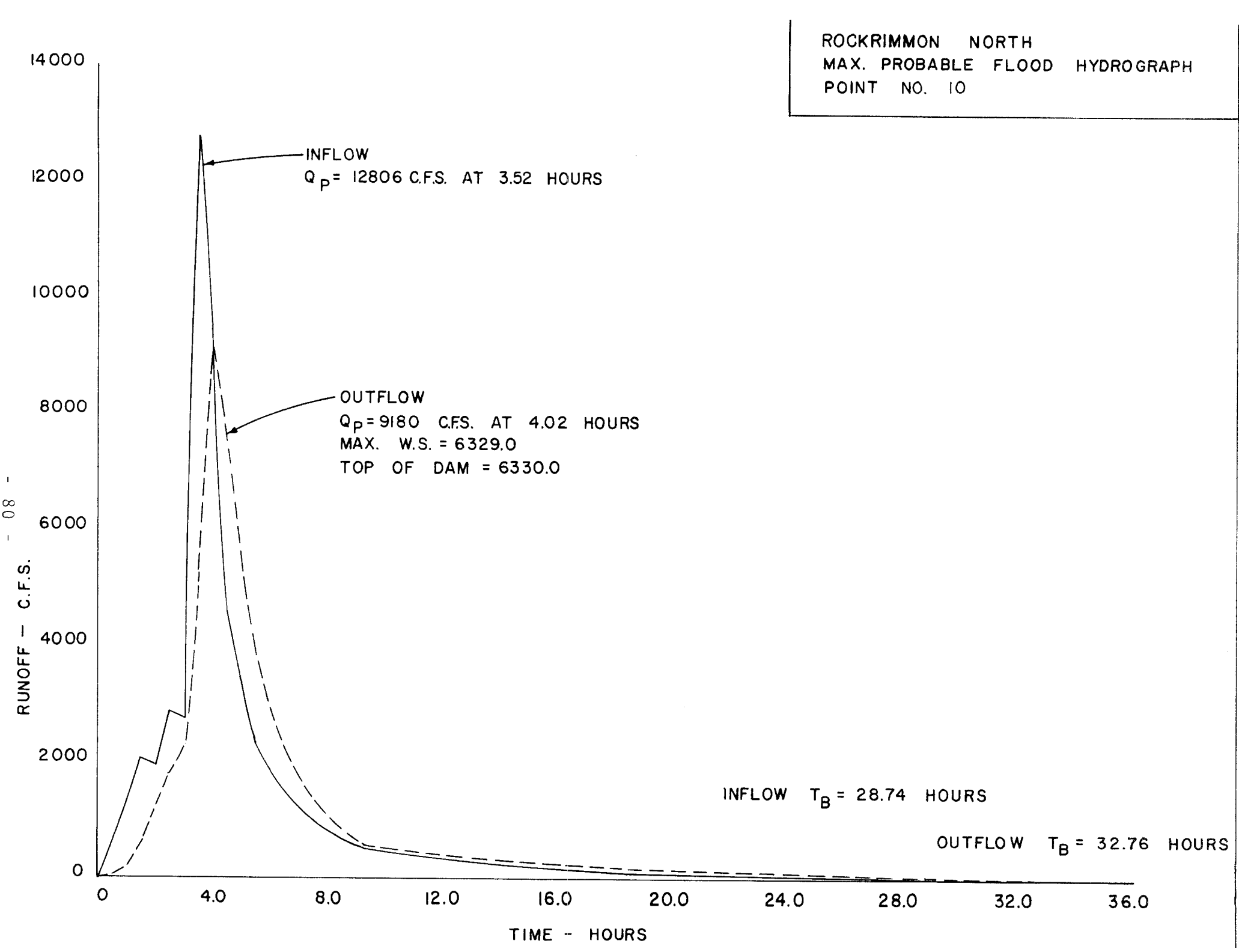
Incremental Hydrographs

Tc=0.45 Hr. Tp=D/2 + 0.6 x 0.45 = D/2 + 0.27

A=1.5849 S.Mi. $qp=\frac{484\ AQ}{TPo} = \frac{767.092\ Q}{TPo}$ Tb = 2.67 TPo

D=1/2 hr. Tp=0.52 hr. Tb=1.39 hr. qp=1475.18 Q
D=6.0 hr. Tp=3.27 hr. Tb=8.73 qp=234.58 Q
D=12.0 hr. Tp=6.27 hr. Tb=16.74 qp=122.34 Q

Time-hr.	D	Increm Q	To	Tp	Tb	qp-cfs
0	0.5	0.38	0	0.52	1.39	561
0.5	0.5	0.72	0.5	1.02	1.89	1062
1.0	0.5	1.06	1.0	1.52	2.39	1564
1.5	0.5	0.84	1.5	2.02	2.89	1239
2.0	0.5	1.56	2.0	2.52	3.39	2301
2.5	0.5	0.89	2.5	3.02	3.89	1313
3.0	0.5	8.19	3.0	3.52	4.39	12082
3.5	0.5	2.93	3.5	4.02	4.89	4322
4.0	0.5	1.81	4.0	4.52	4.39	2670
4.5	0.5	1.56	4.5	5.02	5.89	2301
5.0	0.5	0.89	5.0	5.52	6.39	1313
5.5	0.5	0.89	5.5	6.02	6.89	1313
6	6.0	2.21	6.0	9.27	14.73	518
12	12.0	0.88	12.0	18.27	28.74	108
24						


ROCKRIMMON NORTH
MAX. PROBABLE FLOOD HYDROGRAPH
POINT NO. 10
INFLOW
Q_P = 12806 C.F.S. AT 3.52 HOURS
OUTFLOW
Q_P = 9180 C.F.S. AT 4.02 HOURS
MAX. W.S. = 6329.0
TOP OF DAM = 6330.0
INFLOW T_B = 28.74 HOURS
OUTFLOW T_B = 32.76 HOURS
RUNOFF - C.F.S.
TIME - HOURS
14000
12000
10000
8000
6000
4000
2000
0
0
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
36.0
- 08 -