HYDROLOGIC ANALYSIS OF THE CITY OF RENO'S MAJOR DRAINAGE BASINS

PREPARED FOR

THE CITY OF RENO PUBLIC WORKS DEPARTMENT

PREPARED BY

SUMMIT ENGINEERING CORPORATION

OCTOBER 1985

A HYDROLOGIC ANALYSIS OF THE CITY OF RENO'S MAJOR DRAINAGE BASINS

City of Reno, Washoe County, Nevada

PREPARED FOR

The City of Reno
Public Works Department

PREPARED BY

SUMMIT Engineering Corporation
248 Winter Street, Suite 1
Reno, Nevada 89503

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HYDROLOGIC ANALYSIS OF THE CITY OF RENO'S MAJOR DRAINAGE BASINS

City of Reno, Washoe County, Nevada

INTRODUCTION

The purpose of this hydrologic analysis of the City of Reno's major drainage basins is to provide the City of Reno Engineering Department with the following:

1. Background information on how the major drainage basins are arranged and their function within the total watershed area.

2. The analysis methodology of developing the hydrographs, and determining the storm drainage discharge values.

3. Conclusions for the computed storm drainage discharge values at various spots or points determined by the City staff within the watershed area.

4. Recommendations on the priority of future detailed basin analyses; the required construction of facilities that are definitely deficient, and criteria for master plan implementation.

The scope of work for the project consisted of (1) project research and collection of existing data, (2) collection of field data, (3) data evaluation with City staff, (4) analysis of rainfall data provided by City staff, (5) development of the computer model and modeling data, (6) generation of storm hydrographs for each point, (7) a summary of the conclusions determined from the hydrographs, and (8) provide recommendations for future basin analyses.

BACKGROUND INFORMATION

The City of Reno, Washoe County, Nevada, lies at the base of the eastern slope of the Sierra Nevada Mountains. The Truckee River, which begins at Lake Tahoe to the west, flows easterly through the City of Reno, eventually terminating at Pyramid Lake, northeast of Reno. The Truckee River has caused significant damage in the past due to periodical flooding, mainly in the early 1900's. The threat of flooding from the Truckee River has been significantly reduced by flood control projects completed by the U.S. Army Corps of Engineers and the U.S. Department of Agriculture Soil Conservation Service (SCS).

Other flooding still occurs in parts of the City due to the inadequacy of existing drainage facilities. These existing storm drainage problems have become more severe as development continues beyond originally conceived limits. There have been numerous storm drainage studies done within the City of Reno area in the past, some of which are listed in Table 1. In addition to these studies, there have been numerous individual, limited scope reports completed for various development projects throughout the City.

TABLE 1

STORM DRAINAGE STUDIES

1. A Report on Storm Drainage and Sanitary Sewage, October 1957, Engineering Office of Clyde C. Kennedy.

2. An addendum Report on Storm Drainage, August 1963, Kennedy Engineers.

3. Southwest Reno Watershed Investigation Report, dated November 1972, United States Department of Agriculture-Forest Service, Soil Conservation Service.

4. Flood Insurance Study, July 5, 1983, Federal Emergency Management Agency.

5. Watershed Work Plan Peavine Mountain Watershed, March 1958, Prepared By City of Reno, with assistance by U.S. Department of Agriculture, Soil Conservation Service.

6. Reno Drainage Study Preliminary Report: Analysis of Drainage Deficiency Areas Within the City Limits, December 1984, Winzler and Kelly.

7. Flood Plain Information, Southwest Foothill Streams, Reno, Nevada, June 1974, Army Corps of Engineers.

8. Reno Drainage Study, Analysis of the Stead Drainage Deficiency Area, March 1985, Winzler and Kelly Consulting Engineers.

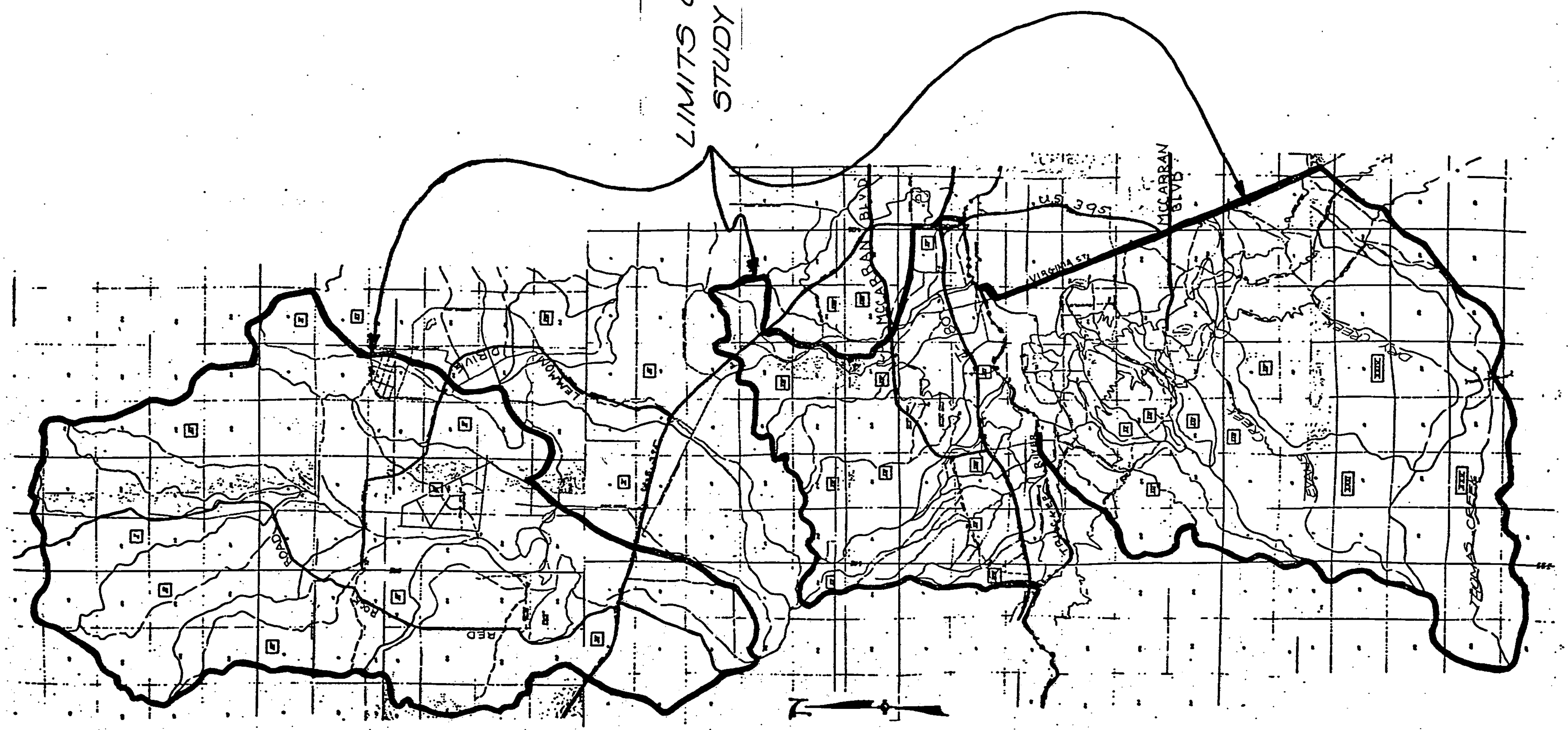
9. A Hydrological Analysis of the Paradise Pond Watershed, July 1985, SUMMIT Engineering Corporation.

10. Reno Drainage Study, Analysis of the Evans Creek Drainage Deficiency Area, May 1985, Winzler and Kelly Consulting Engineers.

This storm drainage study covers a wide area, with many diverse hydrologic features; elevations varying from less than 4,500 feet to over 10,000 feet above sea level, slopes ranging from near vertical cliffs of solid rock to virtually flat valley floors with soil types of high and low permeability, and various ground covers ranging from dense forests to open sagebrush hills to impervious pavements and buildings.

The climate of the Reno area varies considerably. It is semi-arid with an average annual precipitation amount of seven inches. It is not uncommon to experience a daily temperature swing of over 45 degrees fahrenheit, between night and day. While the temperature over a majority of the area climbs above freezing on most days in the winter, the higher elevations usually have a light snowpack during the winter months. Naturally, the mountainous areas also receive a greater overall precipitation than the lower lying areas. Most of the precipitation falling over the area during the winter season is snow in the higher elevations, and is mixed rain and snow in the lower elevations. These winter storms are usually of a frontal type and move from west to east dropping the majority of their precipitation on the western side of the Sierra Nevada Mountains, while the summer precipitation comes mainly as brief thunderstorms in the middle and late afternoons.

All of Reno's drainage basins flow to the Truckee River or



THE CITY OF RENO'S MAJOR DRAINAGE BASIN WATERSHED BOUNDARY

FIG. 1

various lakes by natural drainage channels and storm drainage systems (reference Figure 1 for the area analyzed by this storm drainage study).

ANALYSIS METHODLOGY

This study encompasses the City of Reno's major drainage basins, from Stead to the Thomas Creek drainage basin, just north of the Mt. Rose Highway. This total area will be divided into three regions: (1) The Stead Region, which is the area that drains into Silver Lake and the other dry lakes in the area; (2) North of the Truckee River Region, which is the area north of the Truckee River that drains into the Truckee River; and (3) South of the Truckee River Region, which is the area south of the Truckee River that drains into the Truckee River.

The Stead region consists of Drainage Basins I, II, III, IV, V, VI, VII, VIII, IX, X, and XI, containing Computation Points 1 through 8 (reference Figure 2 and Appendix "A" for locations of each drainage basin and computation point). Appendix "A" maps are drawn at 1-inch equals 2000-feet (1"=2000') for ease of overlay purposes on U.S.G.S. 7 1/2 minute series quadrangle maps. Drainage Basins VI, VII, VIII, IX, and X are outside the Reno City corporate limits, and City staff decided not to have any storm drainage discharges computed for any point within these drainage basins. Therefore, they were not analyzed in this study.

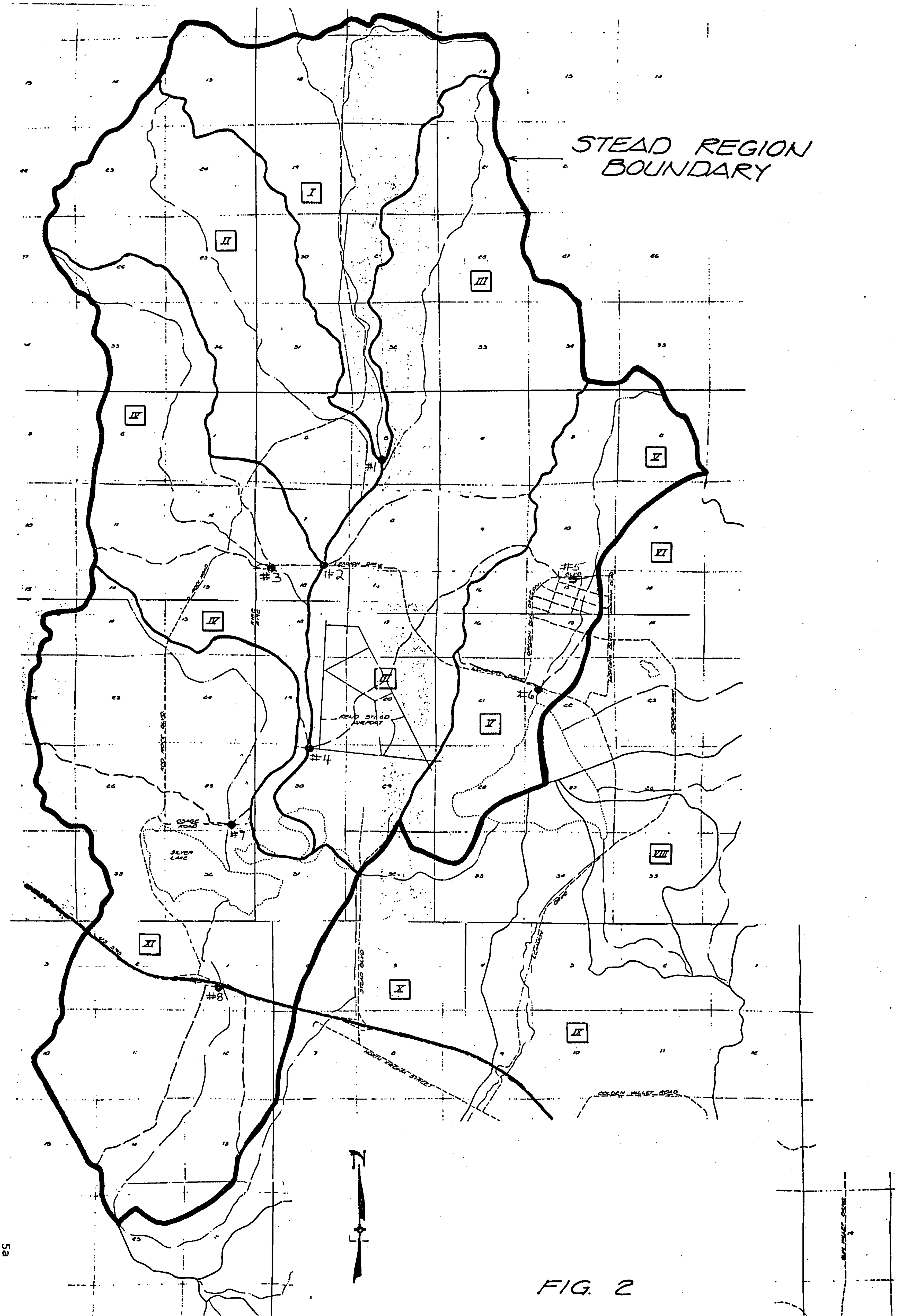

STEAD REGION BOUNDARY
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
#1
#2
#3
#4
#5
#6
#7
#8

FIG. 2

The north of the Truckee River region consists of Drainage Basins XII, XIII, XIV, XV, XVI, XVII, and XVIII, containing Computation Points 9 through 26 (reference Figure 3 and Appendix "A" for the locations of each drainage basin compuation point). The Paradise Pond drainage basin was not analyzed in this report, since a detailed hydrologic study was recently completed for the City of Reno, by SUMMIT Engineering Corporation, in July 1985. This report compiles storm drainage discharges at numerous points.

The south of the Truckee River region consists of Drainage Basins XIX, XX, XXI, XXII, XXIII, XXIV, and XXV, containing Computation Points 27 through 44. A separate section was additionally developed in this region for the computation of various storm drainage discharges located on the proposed Southwest McCarran Boulevard Extension, Computation Points M-1 through M-4 (reference Figure 4 and Appendix "A" for locations of each drainage basin and computation point).

In each drainage basin, one to four computation points were chosen by the City staff for analysis and determination of peak storm drainage discharges. The computation points chosen, were typically where runoff crosses a structure, a road, an irrigation ditch, or an outlet from a detention area.

The computation points were analyzed using a computer program similar to the SCS program outlined in TR20. This program, as well as the Army Corps of Engineer's hydrology computer

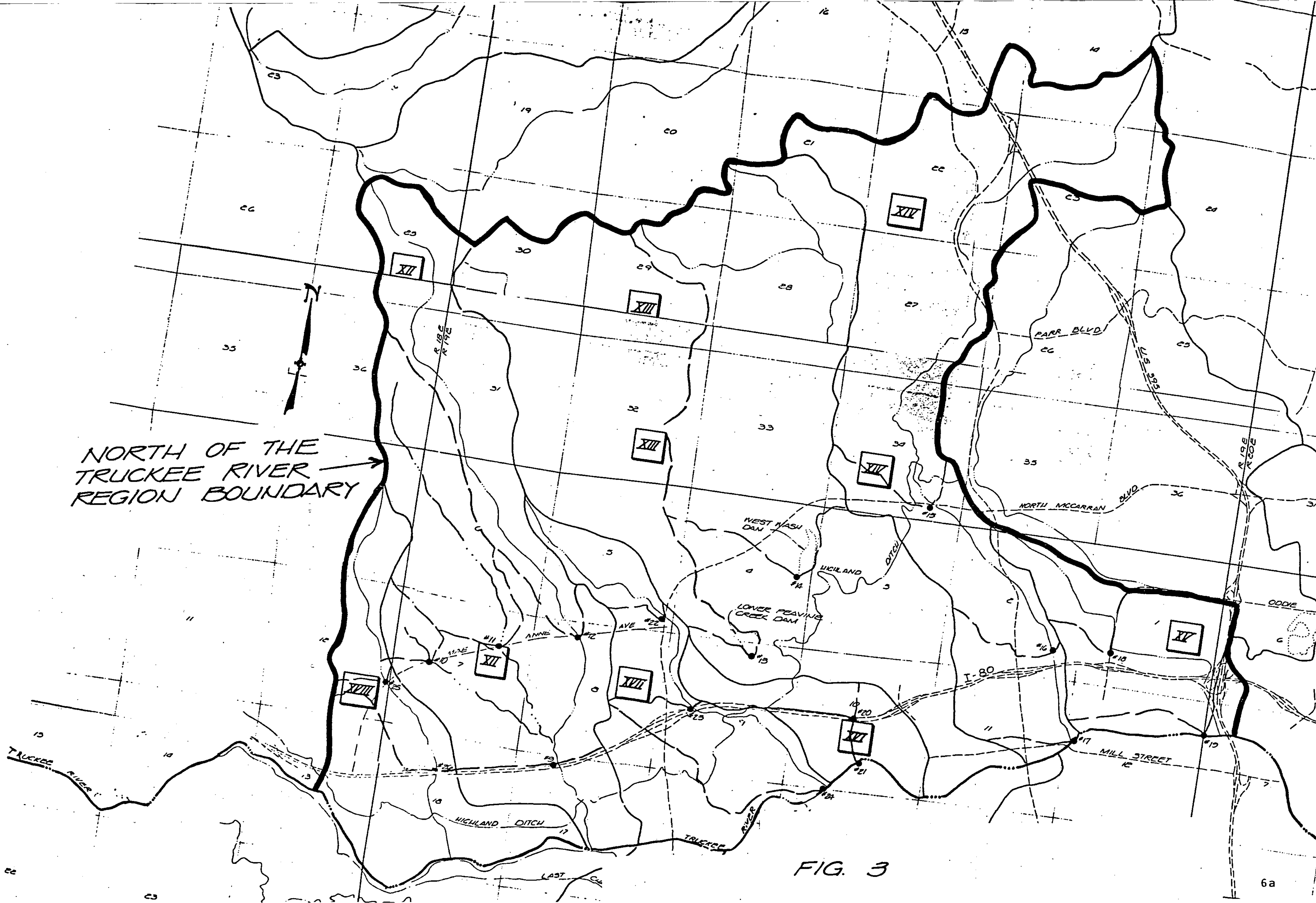
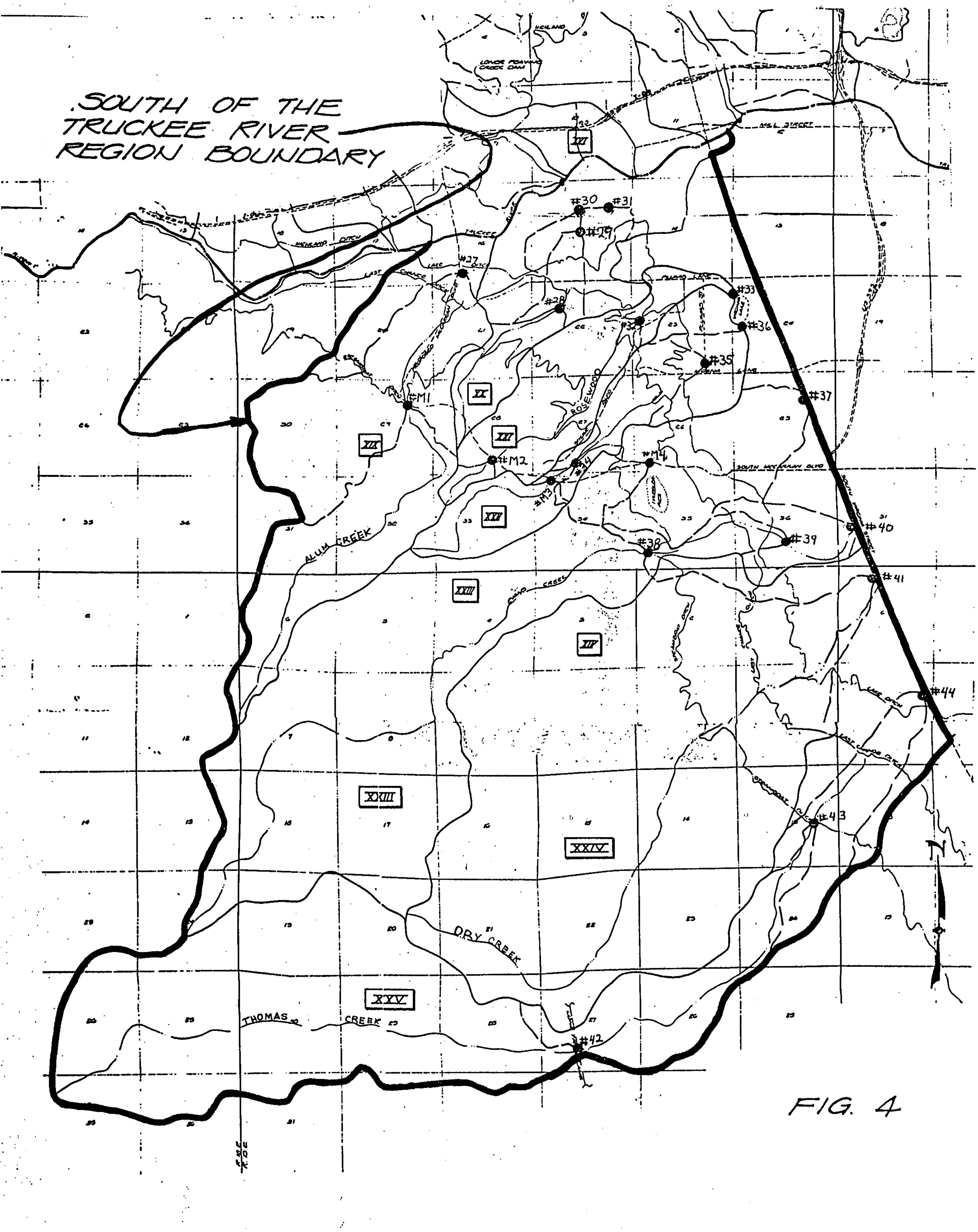

NORTH OF THE
TRUCKEE RIVER
REGION BOUNDARY
XII
XIII
XIV
XV
XVII
XVIII
PARR BLVD.
U.S. 395
NORTH MCCARRAN BLVD.
ODDIE
WEST WASH DAM
HIGHLAND DITCH
LOWER PEAVINE CREEK DAM
ANNE AVE
I-80
MILL STREET
TRUCKEE RIVER
R18E
R19E
R19E
R20E

FIG. 3



SOUTH OF THE
TRUCKEE RIVER
REGION BOUNDARY
#30
#31
#29
#27
#28
#32
#33
#36
#35
#37
#M1
#M2
#M3
#4
#M4
#38
#39
#40
#41
#44
#43
#42
XX
XXI
XXII
XXIII
XXIV
XXV
ROSEWOOD
ALUM CREEK
DRY CREEK
THOMAS CREEK
SOUTH McCARRAN BLVD
MILL STREET

FIG. 4

program HEC-1, utilizes the unit hydrograph concept. The unit hydrograph represents one (1) unit (1-inch) of direct runoff from a rainfall excess of some unit duration and specific area distribution. Rainfall excess is the precipitation minus interception, depression storage and infiltration. The utilization of the unit hydrograph concept requires two major assumptions: (1) For a given basin similar types of storms will produce runoff hydrographs of similar shapes, and (2) that the hydrologic system described by the unit hydrograph is a linear system. Another assumption is that the storm precipitation falls uniformly over the basin for its duration unless an areal distribution reduction (depth-area ratios) is applied to the point rainfall.

The unit hydrograph developed by SCS is based on empirical data. They have evaluated numerous actual watersheds and developed hydrographs, which were then made dimensionless and an average unit hydrograph was developed. This average unit hydrograph is the best available representation of the hydrographs developed by typical storms in the Reno area.

There are several conditions to be resolved before the actual drainage basin or sub-basin data can be used. They are as follows:

1. Determine the antecedent soil moisture condition.
   An antecedent soil moisture Condition II was used in this report because it represents the normal

condition of the watersheds. The different conditions are shown in the following:

Condition I - soils that are dry, but the vegetation is not to the wilting point.

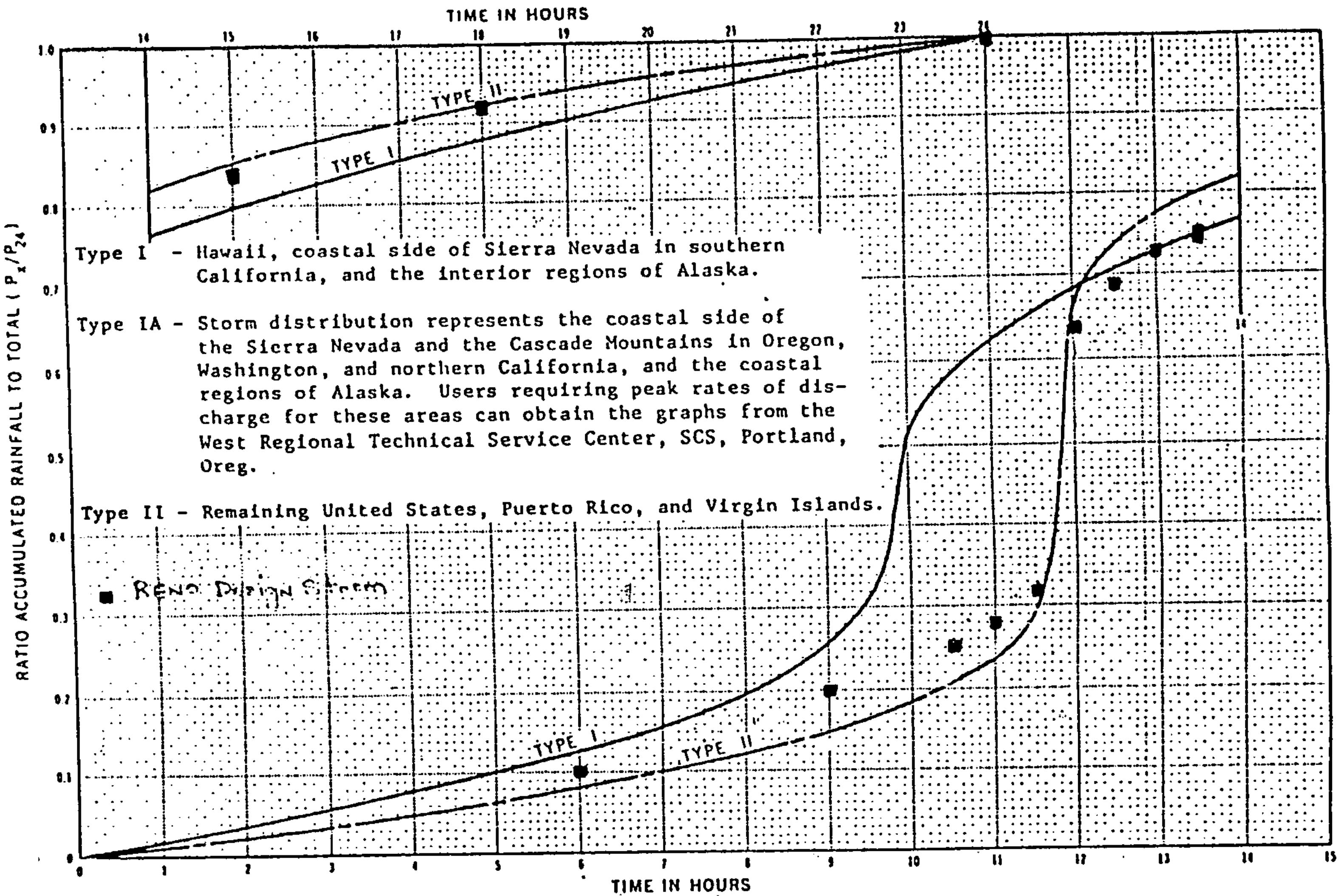
Condition II - average conditions.

Condition III - heavy rainfall or light rainfall, with low temperatures occuring within the last five days - saturated soil.

A Condition III may exist in the higher drainage basins during the course of the year, and a greater discharge would result with a major storm event. This report will use the average watershed condition, rather than a particular hydrological condition.

2. <u>Determine the rainfall distribution.</u> A Type II rainfall distribution was used for this report since the shape of the Reno design storm follows the SCS Type II design storm (reference Figure 5 for a comparison of the Reno Design Storm to the SCS design storms). The different types are as follows:

   Type I - Hawaii, Alaska, and the coastal side of the Sierra Nevada and Cascade mountain ranges. Defined as areas where intense short duration



SOURCE: SCS-TP-149

SCS TYPE I & II DESIGN STORM

FIGURE 5
A COMPARISON OF THE RENO DESIGN STORM TO THE SCS DESIGN STORMS

storms are not prevalent.

Type II - the remainder of the United States. Defined as areas which are subject to both short duration summer thunderstorms and long duration frontal passages.

3. Determine the areal distribution reduction factors for the point rainfall data. Areal reduction factors were used from the National Oceanic and Atmospheric Administration (NOAA) Atlas 2, Volume VII for Nevada. Extensive research developed one other source for areal reduction factors near the Reno area. The source is NOAA technical memorandum NWS Hydro-40 "Depth-area Ratios in the Semi-arid Southwest United States", dated August 1984. The depth-area ratios are based on data obtained from Arizona and New Mexico. Las Vegas has used this report for its areal reduction factors in the past, but it was determined that Reno's weather is quite different from those areas. A comparison of the different areal reduction factors from the two sources are given in Table 2. The factors are considered to be independent of the return period of the precipitation.

4. Determine the rainfall values for the 5-, 25-, 50-, and 100-year storms with durations of 3-, 6-, and 24-hours. The City of Reno staff requested that

TABLE 2

A COMPARISON OF AREAL REDUCTION FACTORS FROM THE NOAA ATLAS 2 AND THE NOAA TECHNICAL MEMORANDUM NWS HYDRO-40

DRAINAGE AREA SQ.MI.	PRECIPITATION DURATION-HRS	FROM NOAA ATLAS 2	FROM HYDRO-40
5	3	99%	86%
	6	99%	93%
	24	99%	98%
10	3	97%	80%
	6	98%	86%
	24	99%	95%
20	3	95%	74%
	6	96%	80%
	24	98%	92%
30	3	93%	69%
	6	95%	75%
	24	97%	90%
40	3	92%	66%
	6	94%	72%
	24	96%	89%
50	3	90%	65%
	6	93%	81%
	24	95%	88%

their newly approved Rainfall Intensity-Duration-Frequency Curves (IDF), with the corresponding rainfall isopleth maps, developed for the City of Reno, by Winzler and Kelly Consulting Engineers in the report entitled, Reno Drainage Study, Preliminary Report: Analysis of Drainage Deficiency Areas Within the City Limits, dated December 1984, be utilized to compute storm discharges in this report. There is a substantial difference in rainfall amounts developed by this new report and the NOAA Atlas 2. A comparison is given in Table 3 between the 5-year, 24-hour Winzler and Kelly rainfall and the 100-year, 24-hour NOAA Atlas 2 rainfall for each drainage basin. The storm discharges were also computed using the NOAA Atlas 2 rainfall data. This was done to provide a comparison with the storm discharges computed with the Winzler and Kelly rainfall data.

The City staff was informed of the differences and decided again, that this report should compute the storm drainage peak discharges using the rainfall data developed by Winzler and Kelly (reference the next section of this report for a more detailed discussion of the differences between the Winzler and Kelly rainfall data and the NOAA Atlas 2 rainfall data).

TABLE 3

COMPARISON OF RAINFALL DATA BETWEEN
WINZLER & KELLY AND NOAA ATLAS 2

DRAINAGE BASIN	WINZLER & KELLY 5-YR, 24-Hr STORM RAINFALL VALUE - INCHES	NOAA 100-YR, 24-HR STORM RAINFALL VALUE - INCHES
I	3.29	2.65
II	3.49	2.75
III	2.92	2.50
IV	3.52	2.70
V	2.67	2.50
VI	2.53	2.45
VII	2.64	2.50
VIII	2.78	2.50
IX	3.38	2.65
X	3.60	2.70
XI	4.23	2.80
XII	3.64	2.80
XIII	3.32	2.70
XIV	2.61	2.50
XV	1.89	2.55
XVI	2.34	2.65
XVII	2.67	2.70
XVIII	3.16	2.80
XIX	3.77	3.00
XX	2.35	2.67
XXI	2.56	2.70
XXII	2.54	2.80
XXIII	4.04	3.90
XXIV	3.18	3.50
XXV	5.09	4.10

The remaining hydrologic data required to compute a particular storm discharge at a given computation point is the **surface area**, the **runoff curve number (CN)**, the **lag time**, and the **average point rainfall**.

The **surface area** is the area that contributes storm drainage runoff to a computation point. The watershed area was divided into 25 drainage basins, which was further divided up into 44 sub-basins to determine the peak storm drainage discharges at the particular points chosen by City staff. The sub-basin surface area was delineated and measured with a digital planimeter from a 7.5 minute series U.S.G.S. quadrangle map (1"=2000') (reference Appendix "A" for the delineated drainage basin and sub-basins for overlaying the 7.5 minute series U.S.G.S). quadrangle maps.

The **runoff curve number (CN)** is a number between 0 and 100 to represent the hydrological effect of the soil, the land use, and the hydrologic condition. Each sub-basin's curve number had to be established independently. The different soil types were determined from the SCS's Soil Survey of Washoe County, Nevada, South Part, while the hydrologic effects were determined from the U.S.G.S. quadrangle maps. The land use and future land uses were based on the City of Reno's Land Use/Transportation Guide, dated September 10, 1984, and the Washoe County, North Valley Land Use Guide, dated January 1984. The weighted runoff curve number was determined by taking an average of all the different curve numbers within each sub-basin. A curve number was developed for an existing land use condition and for a projected developed future land use condition.

The sub-basin **lag time** was calculated using the modified curve number method. The lag time is a function of the average slope of the basin, the hydraulic length, and the maximum retention of the runoff. The equation for the modified curve number method is:

$$L.T. = \frac{(L)^{0.8}}{1900} \frac{[(1000/CN) - 9]^{0.7}}{y^{0.5}}$$

where L.T. is the lag time in hours, L is the distance the water travels in feet, CN is the weighted curve number and y is the slope in percent. "L and y" were measured from the 7.5 minute series U.S.G.S. quadrangle maps. The curve number method was chosen for its ability to work with large sub-basin drainage areas and to estimate the future developed state of the drainage basin (reference Table 4 and the appendices for the sub-basin hydrologic data).

The **average point rainfall** was developed from rainfall data, extrapolated from the newly approved IDF curves and isopleth maps, by averaging this data for the entire sub-basin. The wet season isopleth map was used for determining the 24-hour duration storm, which is a winter-frontal type storm; the dry season isopleth maps were used for the 3- and 6-hour duration storms, which are summer-thundershower type storms.

Areal reduction factors were applied to the averaged rainfall data for each sub-basin over five (5) square miles in area. The area of five (5) square miles was used as the dividing point strictly because areal reduction factors for basins smaller than five (5) square miles produce an areal reduction factor between 99 percent and 100 percent, which do not significantly reduce the storm drainage peak discharges. The areal reduction factors were based on fixed areas; meaning the geographical area is fixed and the storm is either centered over it, or is displaced so that only a portion of the storm effects the area (reference Tables 10, 27, and 44 for the areal reduction factors used for the Winzler and Kelly rainfall data).

In the Stead region the correction factors using the dry season isopleth maps were much greater than the correction factors using the wet season isopleth maps. This caused the cumulative rainfall for the 6-hour duration storm to be greater than the 24-hour duration storm for Computation Points 1 through 7. For the remainder of the computation points in this study, Points 8 through 44, the 24-hour duration storm produced the highest peak discharges.

The hydrographs were routed through channels or reservoirs by the Muskingum Method and the Modified Puls Method, respectively. The Modified Puls Method requires the storage discharge data for each reservoir. The Muskingum Method requires an "X" factor and a "K" factor. The "X" factor is a measure of the effect of inflow and outflow on the channel reach. An "X" value of .25 was used in this report. The "K" factor is the time of concentration as displayed in Table 6. The Modified Puls Method requires the storage discharge data for each reservoir. This data is contained in Table 5.

The existing pipe or channel capacities were computed with inlet control equations by determining the slope, size and specific material of the pipe, the inlet condition, and the amount of head available before the storm water would overtop the road or dike.

CONCLUSIONS OF THE HYDROLOGIC ANALYSIS

STEAD REGION

The Stead region analyzed by this study covers 44.7 square miles. This region includes Drainage Basins I through XI and Computation Points 1 through 8. The area within the actual City of Reno corporate limits is only a small part of this region. This region is characterized by sandy, silty soils, and is covered predominately by sagebrush. Elevations range from a high point of 8266 feet on Peavine Peak to a low point of about 4950 feet in the vicinity of Silver Lake. Runoff flows in fairly well defined channels in the steeper areas and converts to sheet flow in the flatter areas around the lakes. The storm water runoff drains into Silver Lake and several other playas, where a small percentage of the water percolates into the groundwater system, while the majority of the runoff is lost to evaporation. There are no man-made detention areas used within this region (reference Figure 2 and the maps in Appendix "A", (Sheets 1 and 2) for the location of computation points in the Stead region). Tables 7, 8, and 9 summarize the rainfall data used for each compuation point (reference Appendix "B" for the hydrographs and computed discharges for the Stead Region). A hydrograph is provided for each computation point's largest peak discharge.

The following is a summary of each computation point describing the location, the condition of the drainage facilities at the computation point location, existing and future land uses, and how the discharge flow was developed:

Computation Point No. 1

Computation Point No. 1 is located where the runoff from Drainage Basin I crosses a dirt road, just south of Red Rock Road in Section 5 Township 21 North, Range 19 East, M.D.B.&M.

There is virtually no existing development in this area, and there are no drainage facilities crossing the road. The existing area is sagebrush-covered land, but the future land use is designated as a combination of rural and limited development areas. Runoff from a significant storm would flow across the dirt road, resulting in erosion and damage to the road structure. The maximum discharge occurred during the 100-year, 6-hour storm with 3647 cfs for future land use conditions. The 5-year, 6-hour storm with existing land use conditions was computed as 1165 cfs.

Computation Point No. 2

Computation Point No. 2 is located at the eastern end of the old Stead drag strip. There is no existing development or drainage structure at this point. Runoff from Drainage Basin II, and a portion of Drainage Basin III plus the routed flow from Computation Point No. 1, contributes flow to Computation Point No. 2. The future land use is designated as a combination of suburban, rural, and limited development areas. Flooding at this point would probably not be a significant problem, except for possible erosion problems due to surface soil types which are very susceptible to erosion. The maximum discharge occurred during a 100-year, 6-hour storm with 10,818 cfs for future land use conditions. A 5-year, 6-hour storm with existing land use conditions was computed as 3448 cfs.

Computation Point No. 3

Computation Point No. 3 is located at the western end of the old Stead drag strip where runoff from Drainage Basin IV flows into the drag strip. There is no existing development or drainage structure at this point. The future land use is designated as a combination of rural and limited development areas. Damage from flooding at this point would be mainly from erosion. The maximum discharge occurs during a 100-year, 6-hour storm with 3044 cfs for future land use conditions. The 5-year, 6-hour storm was 1008 cfs with existing land use conditions.

Computation Point No. 4

Computation Point No. 4 is located on the western side of the Reno-Stead Airport. The runway is crowned and thus will divert the flows around the west end of the runway at this point. There is runoff from Drainage Basins III and IV, and routed flow from Computation Points 2 and 3 contributing to Computation Point No. 4. The future land use is designated as a combination of suburban, rural, and limited development areas. Minimal damage will probably result from a major storm event. The maximum discharge occurred during a 100-year, 6-hour storm with 12,917 cfs for future land use conditions. Under existing land use conditions, the 5-year, 6-hour storm a discharge of 4148 cfs was computed.

Computation Point No. 5

Computation Point No. 5 is located at Oregon Boulevard, just above the existing residential development. This sub-basin has a designated future land use as suburban area. The runoff comes from Drainage Basin V. There is a 36-inch corrugated metal pipe (CMP) under Oregon Boulevard at this point. The entrance to the pipe is blocked by brush, and the pipe is partially filled with silt and is collapsing. If the pipe were cleared and straightened, it would have a capacity of approximately 45 cfs. The peak flow from a 5-year, 6-hour storm for existing land use conditions will be 560 cfs. This will cause approximately 515 cfs to flow over Oregon Boulevard and down a small defined channel, which is not capable of handling this flow. The overflow from a 100-year, 6-hour storm will be 1861 cfs under future land use conditions.

Computation Point No. 6

Computation Point No. 6 is located at Lemmon Drive, just below the preceding residential developments. There is runoff from Sub-basin V, along with the routed flow from Computation Point No. 5 contributing to Computation Point No. 6. The future and existing land use is designated as suburban. There is a 36-inch corrugated metal pipe (CMP) under Lemmon Drive at this point. The entrance to this pipe is blocked by brush and the pipe is partially filled with silt. If this pipe were cleared, it would have a capacity of approximately 45 cfs. The flow at this point during a 5-year, 6-hour storm for existing land use conditions will be 985 cfs. This will cause approximately 940 cfs to flow over Lemmon Drive. The overflow from a 100-year, 6-hour storm will be 3321 cfs under future land use conditions.

Computation Point No. 7

Computation Point No. 7 is located at Osage Road, just east of Wagon Ho Trail above Silver Knolls Subdivision. The runoff comes from Drainage Basin XI. The existing land use is large lot, single-family dwellings on sagebrush-covered hills. The future land use is designated as a combination of surburban, rural, urban, and limited development area. There is a 36-inch corrugated metal pipe (CMP) with a concrete headwall under Osage Road at this point. There is a small amount of silt in the pipe. If this were cleaned out, the pipe would have a capacity of approximately 62 cfs. The flow at this point during a 5-year, 6-hour storm will be 804 cfs for existing land use conditions. This will cause approximately 742 cfs to flow over Osage Road at this point.

The overflow during a 100-year, 6-hour storm will be 2629 cfs under future land use conditions.

Computation Point No. 8

Computation Point No. 8 is located at U.S. 395, east of the Red Rock Road Interchange. The runoff occurs from Drainage Basin XI from sagebrush-covered hills with no present development. The proposed land use is designated as suburban, rural, and limited development area.

There is a 24-inch reinforced concrete pipe (RCP) under U.S. 395 at this point. This pipe has a capacity of approximately 29 cfs. The flow at this point during a 5-year, 24-hour storm will be 1318 cfs for existing land use conditions. A total of 29 cfs will flow in the pipe and the rest will flow along Red Rock Road under U.S. 395. The flow from the 100-year, 24-hour storm will be 4655 cfs under future land use conditions. This flow will also pass beneath U.S. 395 on Red Rock Road.

NORTH OF THE TRUCKEE RIVER REGION

The north of the Truckee River region extends from Panther Valley to the Truckee River covering 24.7 square miles. This region encompasses Drainage Basins XII through XVIII and Computation Point No. 9 through Computation Point No. 26. For delineation of the sub-basins and location of the computation points see Figure 3 and Appendix "A" (Sheets 2 and 3). The elevation in this region ranges from 4440 feet to 7122 feet above sea level. There is dense development near the Truckee River, while farther from the river there are undeveloped hills and mountains. No detention structures were estimated or used within this region except Upper and Lower Peavine and East and West Wash detention dams. The soils, for the most part, in this region are clayey with sagebrush growing on the undeveloped areas. The slopes in the higher elevations tend to be very steep. All the runoff from this region drains into the Truckee River (reference Appendix "C" for the hydrographs, and computed discharges of the different computation points). The rainfall data for this region is summarized in Tables 24, 25, and 26. A hydrograph is provided for each computation point's largest peak discharge.

The following is a summary of each computation point describing the location, the condition of the drainage facilities at the computation point location, the existing and future land uses, and how the discharge flow is developed.

Computation Point No. 9

Computation Point No. 9 is located at Interstate 80 approximately .9 miles west of West McCarran inside Drainage Basin XII. The routed flow from Computation Points 10, 11, and 12, along with the runoff from the area between these computation points, contribute to the flow at Computation Point No. 9.

Part of the area draining into Computation Point No. 9 is currently under residential construction, while most of the remaining land area is covered by sagebrush. There are two 102-inch corrugated metal pipes (CMP) under Interstate 80 at this point. One pipe is clear and the other is half-blocked by silt. If this were cleared, the two pipes would have a combined capacity of approximately 3400 cfs. The 25-year, 24-hour storm discharge for future land use conditions would be 2764 cfs, if no storm water detention occurs. This can all be carried in the two pipes. The 100-year, 24-hour storm flow with existing land use conditions will be 3986 cfs, resulting in approximately 586 cfs to flow over Interstate 80 at this point. The overflow from the 100-year, 24-hour storm under future land use conditions will increase to approximately 729 cfs, if detention structures are not constructed as development progresses.

Computation Point No. 10

Computation Point No. 10 is located where a minor drainage channel crosses Mae Anne Avenue inside Drainage Basin XII. The land area draining into this point, is mainly sagebrush-covered hills for the existing land use condition, with the future land use proposed as single-family residential and rural.

There is a 36-inch reinforced concrete pipe (RCP) crossing under Mae Anne Avenue at this point. The pipe is clear and clean, and has a capacity of approximately 160 cfs. During a 5-year, 24-hour storm, the flow for existing land use conditions will be 144 cfs. This will all be carried by the 36-inch pipe. The 5-year, 24-hour storm flow under future land use conditions with no detentions will be 215 cfs. This would result in approximately 55 cfs to flow over Mae Anne Avenue. The 100-year, 24-hour flow will increase to 541 cfs under future land use conditions, if detention structures are not constructed, overflowing Mae Anne Avenue by approximately 381 cfs.

Computation Point No. 11

Computation Point No. 11 is located where a major drainage channel crosses Mae Anne Avenue, east of Computation Point No. 10. The land area draining into this point, is again predominately sagebrush-covered hills, with some single-family residential dwellings.

There is a 54-inch reinforced concrete pipe (RCP) under Mae Anne Avenue at this point. A small amount of brush blocks the entrance to this pipe. If this were cleared, the pipe would have a capacity of approximately 425 cfs. During a 5-year, 24-hour storm the flow for existing land use conditions will be 478 cfs. This will cause approximately 53 cfs to flow over Mae Anne Avenue. This overflow will be increased to approximately 122 cfs for a 5-year, 24-hour storm under future land use conditions. The flow from a 100-year, 24-hour storm under future land use conditions will be 1522 cfs, causing a flow over Mae Anne Avenue of approximately 1097 cfs.

Computation Point No. 12

Compuation Point No. 12 is located where another major drainage channel crosses Mae Anne Avenue, east of Computation Point No. 11 within Drainage Basin XII. The land area is predominately sagebrush-covered hills, with a limited number of improved roads. The future land uses are proposed to be a combination of single and multi-family residential, and distribution with warehousing.

There are three 60-inch reinforced concrete pipes (RCP) under Mae Anne Avenue at this point. The combined capacity of these pipes is approximately 630 cfs. During a 5-year, 24-hour storm the flow for existing land use conditions will be 676 cfs. This will cause approximately 46 cfs to flow over Mae Anne Avenue. The 5-year, 24-hour storm overflow across Mae Anne Avenue will be increased to approximately 90 cfs under future land use conditions and no detention facilities. The flow from a 100-year, 24-hour storm for existing land use conditions will be 1881 cfs, thus causing approximately 1251 cfs to flow over Mae Anne Avenue. The 100-year, 24-hour storm flow will be increased to 1959 cfs under future land use conditions, increasing the overflow to approximately 1329 cfs across Mae Anne Avenue.

Computation Point No. 13

Computation Point No. 13 is located at the outlet from Lower Peavine detention basin in Drainage Basin XIII. The surface area runoff draining into this point is mostly sagebrush-covered hills, with a few sparsely developed areas. The future condition is proposed to be single and multi-family residential. The outflow from Upper Peavine detention drains into the Lower Peavine detention basin. To compute the discharge at Computation Point No. 13, the following steps had to be accomplished. First, the discharge draining into the Upper Peavine detention was calculated. Second, the flow was level-pool routed by the Modified Puls Method through Upper Peavine detention basin. This outflow is then channel-routed using the Muskingum Method, to the Lower Peavine detention basin along with the surface drainage between Upper and Lower Peavine detention basins and added together. The total inflow is then level-pool routed through the Lower Peavine detention basin. The storage-outflow data for each detention basin is shown in Table 6 and the channel routing data is shown in Table 5.

The SCS designed the principal outlets for Upper and Lower Peavine detention basins to carry the 100-year storm. The SCS used three inches (3") of rainfall in two hours as their 100-year design storm. The emergency spillways were designed to carry two (2) to five (5) times this storm. The principal spillway of Lower Peavine detention has a capacity of 88 cfs. As can be seen from the data in Appendix "C" this was exceeded during the 25-, 50-, and 100-year, 24-hour storms. This is because the 5-year, 24-hour storm developed from the new City of Reno IDF curves, with the isopleth maps is greater than the 100-year storm used by the SCS. The 100-year, 24-hour storm in existing land use conditions shows 2530 cfs flowing over the emergency spillway. This leaves 4.9 feet of freeboard to the crest of the dam.

Computation Point No. 14

Computation Point No. 14 is located at the outlet of the West Wash detention basin in Drainage Basin XIII. Again, the land area draining into this point, is covered mainly by sagebrush. All the flow from the East Wash detention basin, except 33 cfs, is diverted to the West Wash detention basin. To compute the discharge at Computation Point No. 14, five steps had to be accomplished. First, compute the discharge draining into the East Wash detention basin. Secondly, this flow is level-pool routed through the East Wash detention basin. Next, a maximum of 33 cfs is subtracted out for the 18-inch diameter outlet drain. Fourth, the remaining flow is channel routed to the West Wash detention, while adding the additional surface area runoff. And fifth, the total inflow is then level-pool routed through the West Wash detention basin. The storage-outflow data for each detention basin is referenced in Table 6.

The SCS designed the principal spillway of the East and West Wash detention basins to carry the 100-year storm flow. The SCS used three inches (3") of rainfall in two hours as their 100-year design storm. The emergency spillways of the East and West Wash detention basins were designed for two and one-half times this storm. The principal spillway of the West Wash detention has a capacity of 74 cfs. As can be seen, from the data in Appendix "C", this was exceeded during the 25-, 50-, and 100-year, 24-hour storms. This is because even the 5-year, 24-hour storm determined from the City of Reno new IDF curves with the isopleth maps, is greater than the 100-year storm used by the SCS. The 100-year, 24-hour storm shows 1408 cfs flowing over the emergency spillway for existing land use conditions and 1580 cfs flowing over the emergency spillway under future land use conditions. This leaves 6.5 feet of freeboard for existing land use conditions and 6.4 feet of freeboard under future land use conditions.

Computation Point No. 15

Computation Point No. 15 is located approximately 0.4 miles west of North Virginia Street and North McCarran Boulevard Intersection, where a natural drainage crosses North McCarran Boulevard. This computation point lies within Drainage Basin XIV as shown on Figure 3. The existing land use consists of some single-family residences, a commercial area, and a distribution/warehousing area. At ultimate planned build-out, the conditions and land uses will remain the same.

There is a 10- by 8-foot concrete box under McCarran Boulevard at this point with a small amount of mud at the entrance. If this were cleared, the box would have a capacity of 1850 cfs. This is sufficient to carry the 100-year, 24-hour storm of 1754 cfs under future land use conditions.

Computation Point No. 16

Computation Point No. 16 is located at the southeast corner of the University of Nevada-Reno Campus. The routed flow from Computation Point No. 15, along with the runoff from the surface area between Computation Point No. 15 and Computation Point No. 16, contributes to the flow at this point. This point lies within Drainage Basin XIV. The sub-basin area is fairly well developed, and land use conditions were assumed to remain the same for future conditions.

The City of Reno storm drain plans show a 48-inch storm drain pipe through the University Of Nevada-Reno Campus to carry this discharge. This pipe will not be capable of carrying the 5-year, 24-hour storm flow for existing land use conditions, which will develop a flow of 405 cfs. The 48-inch reinforced concrete pipe (RCP) has a capacity of approximately 120 cfs. The overflow discharge, approximately 285 cfs for existing land use conditions, will be carried above the ground. The 100-year, 24-hour flow under future land use conditions is 1808 cfs.

Computation Point No. 17

Computation Point No. 17 is located at the Truckee River approximately 2000 feet downstream of Virginia Street. The routed flow from Computation Point No. 16, along with the surface runoff from the area between Computation Point No. 16 and Computation Point No. 17, contributes to the flow at this computation point lying within Drainage Basin XIV. The sub-basin area is well developed in the existing state, and no substantial changes are anticipated for future land use conditions.

The City of Reno storm drain plans show a 60- and a 24-inch pipe entering the Truckee river at this point. The combination of these existing pipes cannot carry the existing 5-year, 24-hour storm which was computed to be 407 cfs. The existing pipes can carry approximately 260 cfs together, therefore, approximately 147 cfs will be overflow. The 100-year, 24-hour storm under future land use conditions is 1816 cfs.

Computation Point No. 18

Computation Point No. 18 is located at the intersection of Wells Avenue and East Ninth Street. The area draining into this point is almost all developed. Therefore, future development should have minimal effect on this drainage basin. Computation Point No. 18 is in Drainage Basin XV.

The City of Reno storm drain plans show a 24-inch diameter storm drain pipe with a capacity of approximately 26 cfs running down East Ninth Street. The storm water runoff of 50 cfs for a 5-year, 24-hour storm, will result in 24 cfs to overflow down East Ninth Street with existing land use conditions. The 100-year, 24-hour storm was computed as 205 cfs under future conditions.

Computation Point No. 19

Computation Point No. 19 is located at the Interstate 80 Bridge over Kietzke Lane. The discharge at Computation Point No. 19 consists of the routed flow from Computation Point No. 18, along with the runoff from the surface area between Computation Point No. 18 and Computation Point No. 19. The surface area is virtually all developed land offering no substantial change for future land use conditions.

There is a 66-inch reinforced concrete pipe (RCP) emptying into the Truckee River at this point. This pipe has an approximate capacity of 100 cfs. This means that approximately 9 cfs will flow overland during a 5-year, 24-hour storm, since existing land use conditions create 109 cfs. The 100-year, 24-hour storm has a computed discharge of 468 cfs for existing land use conditions. Future land use conditions will provide similar results.

Computation Point No. 20

Computation Point No. 20 is located where Interstate 80 passes over Stoker Avenue. The drainage area that contributes to this point is completely developed with single-family residences, and lies within Drainage Basin XVI. The 5-year, 24-hour storm discharge for existing land use conditions was calculated to be 84 cfs. The 18-inch diameter storm drain will not be able to carry this flow. The 100-year, 24-hour storm discharge was 269 cfs. The 18-inch diameter storm drain has a capacity of approximately 24 cfs, therefore 60 cfs will overflow into the streets during a 5-year, 24-hour storm.

Computation Point No. 21

Computation Point No. 21 is located at the Truckee River across from Idlewild Park. The routed flow from Computation Point No. 20, and the contributing surface area runoff, adds to the flow at Computation Point No. 21. This point lies within Drainage Basin XVI, as shown on Figure 3. The area is not yet fully developed with land uses designated as multi-residential and commercial.

The City of Reno storm drain plans show a 36-inch storm drain emptying into the Truckee River at this point. The computed 5-year, 24-hour discharge was 129 cfs for existing land use conditions. A 36-inch pipe will not handle this flow, or the 100-year, 24-hour storm discharge of 444 cfs under future land use conditions. The 36-inch pipe has the capacity to carry approximately 70 cfs, leaving approximately 59 cfs to flow on the surface.

Computation Point No. 22

Computation Point No. 22 is located just north of Mae Anne Avenue and North McCarran Boulevard Intersection, where a natural drainage channel crosses North McCarran Boulevard. The land area contributing flow to this point from Drainage Basin XVII, is sagebrush-covered hills. The future land use is planned to be single and multi-family residential.

There is an existing 54-inch diameter CMP under McCarran Boulevard at this point, which is partially filled with silt. If this were cleared, the pipe would have a capacity of approximately 300 cfs. Under existing conditions, the 25-year, 24-hour storm flow will be 293 cfs. This discharge can all flow in the 54-inch CMP. During a 100-year, 24-hour storm approximately 158 cfs will flow over McCarran Boulevard based on existing land use conditions. Under future land use conditions, the 5-year, 24-hour storm flow will be 224 cfs. This flow can be carried by the 54-inch CMP. Without detention basins, the 100-year, 24-hour storm under future land use conditions will be 594 cfs, with 294 cfs flowing over McCarran Boulevard.

Computation Point No. 23

Computation Point No. 23 is located approximately 0.4 miles east of the Interstate 80 and West McCarran Boulevard Interchange, where a natural drainage channel crosses Interstate 80. The routed flow from Computation Point No. 22, and the runoff from the area between Computation Points 22 and 23, contributes to the flow at this point. This area is mostly sagebrush-covered slopes with a future land use designation of multi-residential and community commercial. The computation point lies within Drainage Basin XVII.

A 96-inch CMP culvert passes under Interstate 80 at this point. There is a small amount of silt and trash in the entrance to this pipe. If this were cleared, the pipe would have a capacity of approximately 1250 cfs. For future land use conditions, the flow during a 100-year, 24-hour storm will be 777 cfs. This flow can all be carried by the existing pipe.

Computation Point No. 24

Computation Point No. 24 is located at the Truckee River across from the west end of Idlewild Park. Flow to Computation Point No. 24 consists of the routed flow from Computation Point No. 23 and its contributing surface area. The existing area is not fully developed, and future land use is established as a combination of single and multi-family residential, and commercial. This area all lies within Drainage Basin XVII.

No major storm drainage structure could be located at this point. The storm water runoff at this point will flow overland into the Truckee River. The computed discharge at Computation Point No. 24 for a 5-year, 24-hour storm will be 257 cfs for existing land use conditions. The 100-year, 24-hour storm will be 933 cfs under future land use conditions.

Computation Point No. 25

Computation Point No. 25 is located where a natural drainage channel crosses Mae Anne Avenue, southwest of Computation Point No. 10. The area draining into this point is mainly sagebrush-covered hills with future planned development as single-family residential. This area is within Drainage Basin XVIII.

There is an 84-inch reinforced concrete pipe (RCP) under Mae Anne Avenue at this point. This pipe has a capacity of approximately 850 cfs. The 100-year, 24-hour storm flow under future conditions will be 759 cfs. This flow will all be carried by the existing pipe.

Computation Point No. 26

Computation Point No. 26 is located where a natural drainage channel crosses Interstate 80 approximately 2.8 miles west of the West McCarran Boulevard Interchange. The routed flow from Computation Point No. 25, and the runoff from the area between Computation Points 25 and 26, contributes to the flow at this point. This area is mainly sagebrush-covered hills with future development as single and multi-family residential. This area again lies in Sub-basin XVIII.

There is a 78-inch corrugated metal pipe (CMP) under Interstate 80 at this point with a capacity of approximately 875 cfs. The 50-year, 24-hour storm flow under future land use conditions will be 820 cfs. This total flow will be carried by the existing pipe. The 100-year, 24-hour storm will be approximately 927 cfs under future land use conditions, which will cause 52 cfs to overflow Interstate 80.

SOUTH OF THE TRUCKEE RIVER REGION

The south of the Truckee River region is a large area extending from the Thomas Creek drainage basin to the Truckee River encompassing 45.9 square miles. Only the drainage basins west of Virginia Street were analyzed in this report. This region encompasses Drainage Basins XIX through XXV and Computation Points 27 through 44. A separate section was developed for various computation points along the southwest quadrant of the McCarran Boulevard Extension, even though these computation points lie within this region. For delineation of these sub-basins and locations of these computation points see Figure 4 and Appendix "A".

The elevation in this region varies from 4,450 feet to 10,000 feet above sea level. There are steep, forested and sagebrush-covered slopes in the higher elevations transitioning to flatter, densely-developed areas closer to the Truckee River. The soil types vary considerably, being more porous in the higher elevations; with clayey soils in the lower elevations. All runoff from this region eventually drains into the Truckee River (reference Tables 7, 8, and 9 for the rainfall data, and Appendix "D" for the hydrographs and discharge data for this area [south of the Truckee River region], and a hydrograph for each computation point's largest peak discharge).

The following is a summary of each computation point describing the location, the condition of the drainage facilities at the computation point location, the existing and future land uses, and how the discharge flow is developed.

Computation Point No. 27

Computation Point No. 27 is located where a natural drainage channel crosses Mayberry Drive, east of Roy Gomm School in Drainage Basin XIX. This natural drainage channel includes Alum Creek. The upper area of the basin draining into this point consists of sparsely-forested slopes, with the lower portion partially developed with single-family residences. The future land use proposed for this area is single-family residential.

There are two 3 1/2- by 7-foot box culverts under Mayberry Drive at this point. These boxes have a combined capacity of approximately 518 cfs. The 5-year, 24-hour storm flow at this point will be 1195 cfs for existing land use conditions. This will cause approximately 677 cfs to flow over Mayberry Drive. During a 100-year, 24-hour storm under future land use conditions approximately 3177 cfs will flow over Mayberry Drive.

Computation Point No. 28

Computation Point No. 28 is located near the intersection of Thomas Jefferson Drive and Sagittarius. The drainage area contributing to this point consists of sagebrush and lightly forest-covered slopes with some residential development in the lower areas. Future land uses for the undeveloped areas is proposed to be rural and single-family residential. This computation point is in Drainage Basin XX.

There are two 8-foot long catch basins and a 30-inch diameter pipe at this point. The computed discharge for a 5-year, 24-hour storm for existing land use conditions is 143 cfs, while the 100-year, 24-hour storm under future land use conditions is 631 cfs. The 30-inch diameter pipe has a capacity of approximately 100 cfs, if cleared. This results in 43 cfs flowing down the streets for a 5-year, 24-hour storm for existing land use conditions.

Computation Point No. 29

Computation Point No. 29 is located near the intersection of Hunter Lake Drive and California Avenue. The flow routed from Computation Point No. 28, and the runoff from the area between Computation Points 28 and 29, contributes to the flow. This area is virtually all developed.

The runoff at this point flows in a 30-inch storm drain pipe, which carries approximately 70 cfs and overflows onto Hunter Lake Drive and California Avenue. The 5-year, 24-hour storm developes a peak discharge of 199 cfs for existing land use conditions and 829 cfs for a 100-year, 24-hour storm under future land use conditions. The overflow discharges will be 129 cfs and 759 cfs for the 5-year, 24-hour storm for existing land use conditions, and the 100-year, 24-hour storm under future land use conditions, respectively.

<u>Computation Point No. 30</u>

Computation Point No. 30 is located at the intersection of Foster Drive and Hunter Lake Drive within Drainage Basin XX. The existing area is fully developed with single-family residences. The flow routed from Computation Point No. 29, and the runoff from the surrounding area, contributes to the flow at Computation Point No. 30.

The flow at this point is initially carried by a 42-inch storm drain under Hunter Lake Drive. When the capacity of this pipe (approximately 120 cfs) is reached, the additional water will begin to flow into a 30-inch storm drain under Foster Drive. When the capacity of this pipe (approximately 42 cfs) is reached, the water will flow down Hunter Lake Drive to the river. For existing land use conditions, the 5-year, 24-hour storm will discharge 234 cfs, causing approximately 72 cfs to flow down Hunter Lake Drive. During a 5-year, 24-hour storm under future land use conditions approximately 159 cfs will overflow down Hunter Lake Drive. The flow down Hunter Lake Drive will be approximately 591 cfs during a 100-year, 24-hour storm for existing land use conditions, and 768 cfs under future land use conditions.

Computation Point No. 31

Computation Point No. 31 is located on Foster Drive, near Reno High School in Drainage Basin XX. The flow from the 30-inch pipe under Foster Drive, and the runoff from the fully developed area, contributes to the flow at Computation Point No. 31. This flow is diverted into the old Indian Flat drain, which runs to the Truckee River in a 60-inch diameter pipe. This 60-inch diameter pipe has a capacity of approximately 200 cfs.

A valley gutter exists through the Reno High School parking lot to carry additional flow at this point. The computed flow for a 5-year, 24-hour storm for existing land use conditions is 172 cfs, and the 100-year, 24-hour storm under future land use conditions is 442 cfs. The 60-inch diameter pipe will carry the 5-year, 24-hour storm for existing land use conditions, while 242 cfs will overflow during the 100-year, 24-hour under future land use conditions.

Computation Point No. 32

Computation Point No. 32 is located near the intersection of Sharon Way and Belford Drive and is called the Rosewood Wash or Skyline Wash. The area draining into this point, Drainage Basin XXI, is partially developed with a future land use designated as rural and single-family residential. The undeveloped area is covered by sagebrush and light forest. The developed area is covered by single and multi-family residential dwellings. The proposed future land use will be the same.

There is an 84-inch culvert with a concrete headwall under Sharon Way. This pipe has a capacity of approximately 570 cfs. The flow at this point for existing land use conditions during a 5-year, 24-hour storm will be 320 cfs. This flow will all be carried by the 84-inch culvert. During a 100-year, 24-hour storm there will be 1186 cfs at this point under future land use conditions, causing 616 cfs to flow over Sharon Way. For comparison, the Army Corps of Engineers computed a storm drainage discharge at this point, of 700 cfs for a 100-year storm (reference Table 1, Item 7 for the report information).

Computation Point No. 33

Computation Point No. 33 is located near the north end of Virginia Lake. The runoff from the residential area below Computation Point No. 32, with the routed flow from Computation Point No. 32, contributes to this point. The area is virtually all developed with single and multi-family residential units.

There are two 3 1/2- by 7-foot box culverts going into Virginia Lake at this point. They are partially silted and choked with branches and debris. If these boxes were cleared and cleaned, they would have a combined capacity of approximately 151 cfs. The flow from a 5-year, 24-hour storm at this point would be [Q_5 =] 346 cfs for existing land use conditions. This will cause approximately 195 cfs to overflow the box culverts. The overflow during a 100-year, 24-hour storm will be 944 cfs for existing land use [Q_{100} = 1,095 cfs] conditions. The 5-year flow under future land use conditions will be [Q_5 =] 442 cfs, thus increasing the overflow to approximately 291 cfs. The overflow during the 100-year storm will increase to 1127 cfs under future land use [Q_{100} = 1,278 cfs] conditions.

Computation Point No. 34

Computation Point No. 34 is located where a natural drainage channel crosses the Steamboat Ditch, southeast of the Skyline Boulevard and El Cerro View Intersection in Drainage Basin XXII. The drainage area contributing to this point is mostly undeveloped with sagebrush and forest cover. The future land use is designated as a combination of rural, single and multi-family residential.

There is no drainage structure at this point. The storm water enters Steamboat Ditch until the ditch overflows. The 5-year, 24-hour storm discharge is 254 cfs for existing land use conditions, while the 100-year, 24-hour storm discharge under future land use conditions is 868 cfs. With the Steamboat Ditch being at the existing ground elevation the storm water runoff, even from a 5-year, 24-hour storm, will flow across the ditch and continue on downhill toward Virginia Lake.

Computation Point No. 35

Computation Point No. 35 is located near the intersection of Glenda Way and Plumas Street. Computation Point No. 35 contains the routed flow from Computation Point No. 34 and the runoff from the area between Computation Points 34 and 35. This area is partly developed with single-family residences and a golf course. The future land uses are the same as the existing uses.

There is a 36-inch CMP under Plumas Street at this point. The pipe is completely filled with silt, with only eight inches (8") of pipe visible. If this pipe were cleared, it would have a capacity of approximately 70 cfs. The 5-year, 24-hour storm flow is 323 cfs for existing land use conditions. Even with the pipe cleared there will be approximately 253 cfs overflowing onto Plumas Street. The overflow will increase to approximately 1019 cfs under future land use conditions for a 100-year, 24-hour storm.

Computation Point No. 36

Computation Point No. 36 is located at the south end of Virginia Lake within Drainage Basin XXII. This Computation Point is developed by the routed flow from Computation Point No. 35 and the runoff occurring above this point. The area is considered as fully developed.

There are three 27-inch pipes with a combined capacity of approximately 90 cfs at this point. This capacity will be exceeded by 321 cfs during a 5-year, 24-hour storm for existing land use conditions, and by 1122 cfs for a 100-year, 24-hour storm under future land use conditions.

Computation Point No. 37

Computation Point No. 37 is located near the intersection of South Virginia Street and Peckham Lane. The drainage area contributing to this point is partially developed with single and multi-family residential with the proposed uses being the same. This area is in Drainage Basin XXIII.

There is a 4 1/2- by 6 1/2-foot box culvert under Virginia Street at this point. This box has a capacity of approximately 110 cfs. This will be exceeded by 92 cfs during a 5-year, 24-hour storm for existing land use conditions, and by 224 cfs under future land use conditions.

Computation Point No. 38

Computation Point No. 38 is located where Evans Creek crosses Steamboat Ditch in Drainage Basin XXIII. The drainage area contributing flow into this point is covered with sagebrush and forest. Most of this area is in the Toiyabe National Forest and is planned as open space.

Evans Creek passes under Steamboat Ditch, which is carried in a flume. A total of approximately 370 cfs could flow under the flume. Flows larger than this will overtop the flume and possibly damage it. The 5-year, 24-hour storm flow for existing land use conditions is 1617 cfs. The 100-year, 24-hour storm flow under future land use conditions will be 4619 cfs. For comparisons, the Army Corps of Engineers computed 100-year discharges at this point of 2600 cfs (reference Table 1, Item 7 for the report information).

Computation Point No. 39

Computation Point No. 39 is located where Evans Creek crosses Del Monte Lane. The flow at this point consists of the routed flow from Computation Point No. 38 and the runoff from the area between Computation Points 38 and 39. This area is mostly developed with large single-family residential units and has basically the same future land use.

There is a bridge with a 3- by 6-foot opening at this point. The opening has a capacity of approximately 78 cfs. Any flow greater than this, will flow over the bridge. During a 5-year, 24-hour storm for existing land use conditions, approximately 1541 cfs will flow over the bridge. During a 100-year, 24-hour storm under future conditions approximately 4554 cfs will flow over the bridge. For comparisons, Winzler and Kelly Consulting Engineers computed a storm discharge at this point for a 5- and 100-year storm of 1335 cfs and 3110 cfs, respectively, under future land use conditions. The existing land use condition discharges were 1280 cfs and 2990 cfs for the 5- and 100-year storms, respectively (Reference Table 1, Item 10 for the report information).

Computation Point No. 40

Computation Point No. 40 is located near the intersection of Del Monte Lane and South Virginia Street. The routed flow from Computation Point No. 39, and the runoff from the area between Computation Points 39 and 40, contributes to the flow at this point. The area is developed with large single-family residential lots.

There is a 3- by 9-foot box culvert under Virginia Street at this point. This box has a capacity of approximately 176 cfs. During a 5-year, 24-hour storm for existing land use conditions approximately 1447 cfs would overflow the box. During a 100-year, 24-hour storm under future land use conditions approximately 4470 cfs would overflow the box. For comparisons, the Army Corps of Engineers computed a 100-year discharge at this point of 2600 cfs. Winzler and Kelly Consulting Engineers computed a future land use condition storm discharge of 1225 cfs and 2775 cfs for the 5-and 100-year storms, respectively. The existing land use condition storm discharge was 1135 cfs and 2570 cfs for the 5- and 100-year storms, respectively (reference Table 1, Item 7 for information on the Army Corps of Engineer's report; Table 1, Item 10 for the Winzler and Kelly Consulting Engineer's report).

Computation Point No. 41

Computation Point No. 41 is located where Dry Creek crosses South Virginia Street in Drainage Basin XXIV. The drainage area contributing flow into this point is partially developed with single-family residences; with a future land use of rural. The area in the higher elevations is covered with light forest, while the area in the lower elevations is covered with sagebrush.

There is a 20- by 6-foot arch under Virginia Street at this point. This arch has an estimated capacity of approximately 1000 cfs. During a 5-year, 24-hour storm for existing land use conditions the capacity is exceeded by 218 cfs. During a 100-year, 24-hour storm under future land use conditions the capacity is exceeded by approximately 2852 cfs. For comparisons, the Army Corps of Engineers computed a 100-year storm discharge of 4300 cfs at this point (reference Table 1, Item 7 for the report information).

Computation Point No. 42

Computation Point No. 42 is located where Thomas Creek crosses Lone Tree Lane in Drainage Basin XXV. The area draining into this point is undeveloped and mostly covered by forest. There is no development planned for this area, since it lies within the Toiyabe National Forest.

There is a bridge over Thomas Creek at this point. The bridge is about 6-feet high and the channel under the bridge is about 15-feet wide. The capacity is approximately 690 cfs. During a 5-year, 24-hour storm the capacity of the bridge will be exceeded by approximately 1122 cfs. During a 100-year, 24-hour storm the capacity will be exceeded by approximately 4665 cfs. For comparisons, the Army Corps of Engineers computed a 100-year storm discharge of 3200 cfs at this point (reference Table 1, Item 7 for the report information).

Computation Point No. 43

Computation Point No. 43 is located where Thomas Creek crosses Steamboat Ditch. Computation Point No. 43 consists of the routed flow from Computation Point No. 42 and the runoff from the area between Computation Points 42 and 43. This area is mostly covered by sagebrush and light forest, with future development proposed as rural.

There is a 5- by 12-foot box culvert under the flume carrying the Steamboat Ditch at this point. The capacity of this box is approximately 672 cfs. This is exceeded by approximately 1222 cfs during a 5-year, 24-hour storm for existing land use conditions. During a 100-year, 24-hour storm the capacity will be exceeded by approximately 4889 cfs under future land use conditions. For comparisons, the Army Corps of Engineers computed a 100-year storm discharge of 3500 cfs at this point (reference Table 1, Item 7 for the report information).

Computation Point No. 44

Computation Point No. 44 is located where Thomas Creek crosses South Virginia Street. The routed flow from Computation Point No. 43, along with runoff from the surrounding area, contributes to Computation Point No. 44. This area is part pasture and partly covered with sagebrush, and is planned to be developed as rural and single-family residential.

There is a 3- by 7 1/2-foot box culvert under Virginia Street at this point. The approximate capacity of this box is 180 cfs. During a 5-year, 24-hour storm for existing land use conditions, this will be exceeded by 1732 cfs. The 100-year, 24-hour storm flow under future land use conditions will exceed the capacity of the box by approximately 5445 cfs. For comparisons, the Army Corps of Engineers computed a discharge at this point of 3900 cfs (reference Table 1, Item 7 for the report information).

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION

The proposed Southwest McCarran Boulevard Extension will link the western section (currently terminating at West Fourth Street) with the southern section currently terminating at Plumas Drive. The new extension will run through the proposed Caughlin Ranch development within the southwest region of Reno. Currently, the area is for the most part, undeveloped and generates flow from drainage basins originating on the lower slopes of the Sierras. The existing vegetation is predominately sagebrush and light-forested areas. The future land use is designated as a combination of rural, single and multi-family residential. The storm drainage peak discharges will be computed using the future land uses (reference Appendix "E" for the hydrographs and discharge data for this area). Tables 58, 59, and 60 show the rainfall data used from the Winzler and Kelly report.

Computation Point M-1

Computation Point M-1 is located where the McCarran Extension intersects Alum Creek (reference Appendix "A" and Figure 4 for delineation of these sub-basins and locations of these computation points). This sub-basin within Drainage Basin XIX is predominately forest area, with sagebrush covering the lower areas. This area has a proposed future land use of rural.

Since the area produces its own flows, and no other basins feed into this area, no routing was necessary. For a 5-year, 24-hour storm, a peak flow of 673 cfs was realized. The peak values for the 25-, 50-, and 100-year return periods are 1265 cfs, 1698 cfs, and 1747 cfs, respectively.

Alum creek flows uninterrupted in the current condition, but with further development a proper drainage structure would have to be built in order to protect the McCarran Extension and allow uninterrupted flow of Alum Creek.

Computation Point M-2

Computation Point M-2 is located just to the south of Computation Point M-1, where the Rosewood Wash intersects the proposed McCarran Extension. This sub-basin within Drainage Basin XXI, when future proposed development is complete, will contain a large number of single and multi-family residences. Currently, the basin is sagebrush covered with some forested areas is the upper reaches of the basin. For the 5-year, 24-hour storm a peak flow of 158 cfs was calculated. The peak values for the 25-, 50-, and 100-year storms are 257 cfs, 327 cfs, and 363 cfs, respectively.

Computation Point M-3

Computation Point M-3 is located to the southeast of Computation Point M-2, where a natural drainage channel intersects the McCarran Extension near Skyline Boulevard.

This sub-basin within Drainage Basin XXII is mainly covered with sagebrush, with minor forested areas. The future land use is designated as rural. The 5-year, 24-hour storm has a peak flow of 318 cfs. The peak values for the 25-, 50-, and 100-year storms are 615 cfs, 834 cfs, and 946 cfs, respectively.

<u>Computation Point M-4</u>

Computation Point M-4 is the eastern most point of the four computation points, located just to the west of Lake Stanley. This sub-basin within Drainage Basin XXIII is predominately open ground with sagebrush cover, and there is some development on the eastern side of the basin. The proposed future land use is rural. For the 5-year, 24-hour storm a peak flow of 179 cfs, was computed. For the 25-, 50-, and 100-year, 24-hour storms the peak flows were computed as 332 cfs, 444 cfs, and 501 cfs, respectively.

TABLE 4

SUB-BASIN HYDROLOGIC DATA FOR EACH COMPUTATION POINT

COMPUTATION POINT	AREA (S.M.)	EXISTING CN NUMBER	FUTURE CN NUMBER	EXISTING LAG TIME HOURS	FUTURE LAG TIME HOURS	CUMULATIVE SUB-BASIN AREA(S.M.)
1	6.54	74	74	4.51	4.51	6.54
2						
II	7.78	76	77	4.95	4.81	
III	7.79	75	75	5.12	5.12	22.11
3	4.45	76	76	3.66	3.66	4.45
4						
III	3.45	75	76	4.34	4.22	
IV	2.80	76	78	4.01	3.78	32.81
5	2.08	75	75	1.89	1.89	2.08
6	2.27	75	77	2.78	2.62	4.35
7	5.20	78	80	5.52	5.19	5.20
8	2.36	78	80	1.15	1.08	2.36
9	1.33	81	88	1.06	0.83	4.24
10	0.18	81	88	0.30	0.24	.18
11	1.17	81	83	1.20	1.12	1.17
12	1.56	81	82	1.50	1.45	1.56
13 Above Upper Peavine	2.40	82	83	0.99	.96	
13 Above Lower Peavine	0.69	82	84	1.10	1.03	3.09
14 Above East Wash	2.10	82	83	1.20	1.16	
14 Above West Wash	1.10	82	84	0.76	0.71	3.20
15	3.73	82	89	4.33	3.37	3.73
16	0.88	84	88	1.33	1.15	4.61
17	5.81	86	92	1.10	0.87	10.42
18	0.35	81	81	0.91	0.91	.35
19	0.87	81	81	1.69	1.69	1.22
20	0.28	84	84	0.79	0.79	.28
21	0.18	84	89	0.40	0.33	.46
22	0.33	81	87	0.67	0.55	.33
23	0.34	81	88	0.93	0.73	.67
24	0.66	81	89	1.02	0.77	1.33
25	0.45	81	82	0.72	0.70	.45
26	0.28	81	86	0.71	0.60	.73
27	5.15	80	81	2.61	2.53	5.15
28	0.66	82	87	1.12	0.95	.66
29	0.33	87	87	0.77	0.77	.99

TABLE 4 - CONTINUED

COMPUTATION POINT	AREA (S.M.)	EXISTING CN NUMBER	FUTURE CN NUMBER	EXISTING LAG TIME HOURS	FUTURE LAG TIME HOURS	CUMULATIVE SUB-BASIN AREA(S.M.)
30	0.16	87	87	1.24	1.24	1.15
31	0.52	87	87	1.02	1.02	.52
32	1.70	84	87	1.62	1.46	1.70
33	0.35	87	87	1.13	1.13	2.05
34	0.83	81	83	1.20	1.13	.83
35	0.78	83	87	1.31	1.14	1.61
36	0.53	85	87	1.50	1.40	2.14
37	2.15	82	87	2.07	1.74	2.15
38	8.30	78	78	4.61	4.61	8.30
39	0.46	80	80	1.42	1.42	8.76
40	0.45	80	80	1.32	1.32	9.21
41	13.35	82	82	4.87	4.87	13.35
42	7.34	73	73	4.01	4.01	7.34
43	1.63	78	78	2.71	2.71	8.97
44	1.21	79	79	2.16	2.16	10.18
M-1	0.24	-	80	-	2.47	2.47
M-2	0.12	-	92	-	0.27	.27
M-3	0.80	-	82	-	0.99	.99
M-4	0.32	-	87	-	0.49	.49

Total area analyzed by this study is 115 square miles.

TABLE 5

CHANNEL ROUTING DATA

	K Factor in Hours
C.P. No. 1 - C.P. No. 2	2.35
C.P. No. 2 - C.P. No. 4	4.44
C.P. No. 3 - C.P. No. 4	4.44
C.P. No. 5 - C.P. No. 6	1.71
C.P. No. 10 - C.P. No. 9	.98
C.P. No. 11 - C.P. No. 9	.78
C.P. No. 12 - C.P. No. 9	.55
Upper - Lower Peavine	.83
East - West Wash	.22
C.P. No. 15 - C.P. No. 16	1.55
C.P. No. 16 - C.P. No. 17	.48
C.P. No. 18 - C.P. No. 19	.87
C.P. No. 20 - C.P. No. 21	.088
C.P. No. 22 - C.P. No. 23	.83
C.P. No. 23 - C.P. No. 24	.94
C.P. No. 25 - C.P. No. 26	.62
C.P. No. 28 - C.P. No. 29	.376
C.P. No. 29 - C.P. No. 30	.188
C.P. No. 30 - C.P. No. 31	.22
C.P. No. 32 - C.P. No. 33	.645
C.P. No. 34 - C.P. No. 35	1.227
C.P. No. 35 - C.P. No. 36	.466
C.P. No. 38 - C.P. No. 39	1.133
C.P. No. 39 - C.P. No. 40	.422
C.P. No. 42 - C.P. No. 43	1.69
C.P. No. 43 - C.P. No. 44	.95

TABLE 6

STORAGE OUTFLOW DATA

UPPER PEAVINE CREEK DETENTION

Water Surface Elevation	Storage Ac.Ft.	Discharge cfs
94	50	0
95	55	20
96	60	67
120	285	79
122	300	579
128	360	4600
130	crest of dam	

LOWER PEAVINE CREEK DETENTION

Water Surface Elevation	Storage Ac.Ft.	Discharge cfs
50	25	0
52	30	72
65	100	88
66	110	338
67	120	788
73	185	6088
74	crest of dam	

EAST WASH DETENTION

Water Surface Elevation	Storage Ac.Ft.	Discharge cfs
48	48	0
49	55	33
50	60	34
51	66	284
54	80	1834
56	92	3000
58	crest of dam	

WEST WASH DETENTION

Water Surface Elevation	Storage Ac.Ft.	Discharge cfs
54	71	0
54.5	72	57
79	375	74
80	390	350
82	412	1474
85	467	3800
86	487	4900
88.5	crest of dam	

ANALYSIS OF RESULTS FOUND BY USING WINZLER AND KELLY RAINFALL DATA

The Rainfall Intensity-Duration-Frequency (IDF) Curves developed by Winzler and Kelly in December 1984, for the City of Reno, from rainfall data at the Reno-Cannon International Airport Rain-gauging Station are nearly the same as the rainfall IDF curves based on the NOAA Atlas 2 (1972). Winzler and Kelly also developed isopleth maps for use with their IDF curves. These maps utilize a correction factor when an area outside the Reno-Cannon International Airport is analyzed. The intensities of the IDF curves at the Reno-Cannon International Airport are multiplied by the correction factor appropriate for the area being analyzed. These correction factors increase as one proceeds west from the Reno-Cannon International Airport, and thus increases the rainfall values substantially. The rainfall values on the NOAA isopluvial maps also increase as one proceeds west and gains elevation. However, the NOAA rainfall values do not increase as much as the Winzler and Kelly values. As shown in Table 3, the rainfall values for the 5-year storm (using Winzler and Kelly) exceeds the 100-year storm values using the 1972 NOAA Atlas 2 for all drainage basins, except Drainage Basins XV, XVI, XVII, XX, XXI, XXII, and XXIV. These drainage basins are all relatively close to the Reno-Cannon International Airport, and thus have small correction factors which are similar to the NOAA factors.

The Winzler and Kelly isopleth maps were developed by Dr. Yeou-Koung Tung, Department of Civil Engineering, University of Nevada-Reno. These maps are based on nine unofficial rain-gauging stations. To develop his maps, a rainfall ratio between these stations and the official rain-gauging station at the Reno-Cannon International Airport was developed. The ratios of "monthly maximum daily rainfall" and "monthly total rainfall" between the unofficial stations and the Reno-Cannon International Airport Station were taken and averaged to obtain the final ratio used. The standard deviation for the ratio at each unofficial station is quite substantial, and at some stations the standard deviation is even larger than the ratio.

The isopleth lines were plotted using these ratios, and 1-inch equals 2000-foot (1"=2000') scale overlays of these isopleth maps were utilized to determine the correction factors used in this report. The position of the Reno-Cannon International Airport Rain-gauging Station differs from the wet season isopleth to the dry season isopleth. By definition, the correction factor at the Reno-Cannon International Airport should be one (1). On the isopleth overlays the Reno-Cannon International Airport Station is closer to the 1.2 correction factor line, than the .9 correction factor line.

These discrepancies in the overlays, along with the differences between the standard deviation and the ratios, significantly reduce the reliability of the correction factors.

It is recommended that the isopleth overlays be checked and corrected, since historic flows within the designated basins do not seem to reflect the flows developed utilizing these overlays.

The majority of the existing drainage structures were designed using the rainfall data in the NOAA Atlas. Since the rainfall values used in this report are much greater than the NOAA values, most of the drainage structures analyzed were found to be undersized. Generally, the results show that the further a structure is from the Reno-Cannon International Airport, the more undersized it will be. If these values are utilized, it will be necessary to perform detailed drainage basin analyses to develop recommendations for the control of storm water runoff. Based on the results found in this report it will be necessary to reconstruct existing drainage structures and to construct additional facilities to control the increased runoff, with data obtained from these new isopleth maps.

RECOMMENDATIONS

Based on the results obtained at the points analyzed in this report, it is recommended, that further review and study and possibly changes to the isopleth maps are necessary, to better reflect actual historic conditions, especially with the large discrepancies between the standard deviations and the ratios.

Also, based on the results of this report, the high values of storm water runoff obtained can cause major erosion problems and property damage due to water and carried soils. Therefore, there are many major drainage basins within the watershed that need a detailed drainage basin analysis for the control of storm water runoff.

The following is a general analysis of deficiencies by region:

Stead Region

In the Stead region future development will need to provide adequate channelization of the storm water discharges. Currently, runoff in the undeveloped flatter areas experience sheet flow, meaning that large discharges are spread out over a large surface area. Where the size of the required channels become extremely large, a detention dam may prove necessary to decrease the peak discharge. These problems should be addressed as the development proceeds.

North of the Truckee River Region

Within the north of the Truckee River region the storm water runoff is more controlled. Storm drainage needs in Drainage Basins XII and XVIII are being addressed as development proceeds in the Northgate area. Use of rainfall values derived from the Winzler and Kelly isopleths would probably show a need for an increased number of drainage structures.

Storm drainage needs in Drainage Basin XIII were addressed by construction of Lower Peavine, Upper Peavine, and the East and West Wash Detention dams. The Winzler and Kelly rainfall values show these dams now to be undersized.

A detention dam (proposed by the SCS for Evans Creek [Block "N"] in January 1970) will be required in Drainage Basin XIV.

Drainage Basins XV, XVI, and XVII will require upsizing of the existing drainage facilities in light of the new rainfall data used in this study.

South of the Truckee River Region

In order to protect the south of the Truckee River region from flooding, the storm discharges from Thomas Creek, Dry Creek, Evans Creek, Alum Creek, Hunter Creek, and the other small unnamed drainage basins will need to be controlled by several storm drainage facilities. Such facilities could consist of earth channels, detention dams or basins, and the upsizing of deficient pipes. Drainage basins XIX through XXV all flow to the Truckee River via existing storm drainage systems. Drainage basins south of the Truckee River region show high storm water discharges and small capacity storm drainage systems. Thus, detailed drainage basin analyses are needed to provide the actual information necessary to determine the solutions to the problems.

Drainage Basin Priorities and Deficiencies

In order to determine a priority listing, the following conditions were used to assess the drainage basins: (1) Future estimated growth or development within the drainage basin, (2) quantity of the storm water discharge, and (3) lack of storm drainage facilities capable of carrying the peak discharges, whether existing or proposed.

The drainage basins with the highest priority are: Drainage Basin XXIII, the Evans Creek Basin; Drainage Basin XXV, the Thomas Creek Basin; Drainage Basin XIX, the Alum Creek Basin; and Drainage Basin XXII, the basin just south of the Rosewood Wash.

The group of drainage basins with second priority are: Drainage Basins XX, the basin just south of the Alum Creek Basin; Drainage Basin XIV, the Panther Valley Basin; Drainage Basin XV, the basin just south of the Paradise Pond drainage basin; and Drainage Basins III and IV combined, the basins in North Stead.

This report developed a number of points that were deficient in carrying the computed peak discharges. The following points listed are definitely undersized or deficient within their particular drainage basin.

Computation Point No. 5: a 36-inch CMP with an estimated capacity of 45 cfs to carry a computed discharge of 560 cfs for a 5-year storm.

Computation Point No. 6: a 36-inch CMP with an estimated capacity of 45 cfs to carry a computed discharge of 985 cfs for a 5-year storm.

Computation Point No. 7: a 36-inch CMP with an estimated capacity of 62 cfs to carry a computed discharge of 804 cfs for a 5-year storm.

Computation Point No. 8: a 24-inch RCP with an estimated capacity of 29 cfs to carry a computed discharge of 1300 cfs for a 5-year storm.

Computation Point No. 24: no major storm drainage system to carry 257 cfs, 5-year storm traversing through it.

Computation Point No. 27: two 3.5- by 7-foot box culverts with an estimated capacity of 518 cfs to carry a computed discharge of 1195 cfs for a 5-year storm.

Computation Point No. 38: a flume under Steamboat Ditch with an estimated capacity of 370 cfs to carry a computed discharge of 1617 cfs for a 5-year storm.

Computation Point No. 39: a 3- by 6-foot channel under a bridge with an estimated capacity of 78 cfs to carry a computed discharge of 1541 cfs for a 5-year storm.

Computation Point No. 40: a 3- by 9-foot box culvert with an estimated capacity of 176 cfs to carry a computed discharge of 1447 cfs for a 5-year storm.

Computation Point No. 42: a 6- by 15-foot channel under a bridge with an estimated capacity of 690 cfs to carry a computed discharge of 1812 cfs for a 5-year storm.

Computation Point No. 43: a 5- by 12-foot box culvert with an estimated capacity of 672 cfs to carry a computed discharge of 1894 cfs for a 5-year storm.

Computation Point No. 44: a 3- by 7.5-foot box culvert with an estimated capacity of 180 cfs to carry a computed discharge of 1912 cfs for a 5-year storm.

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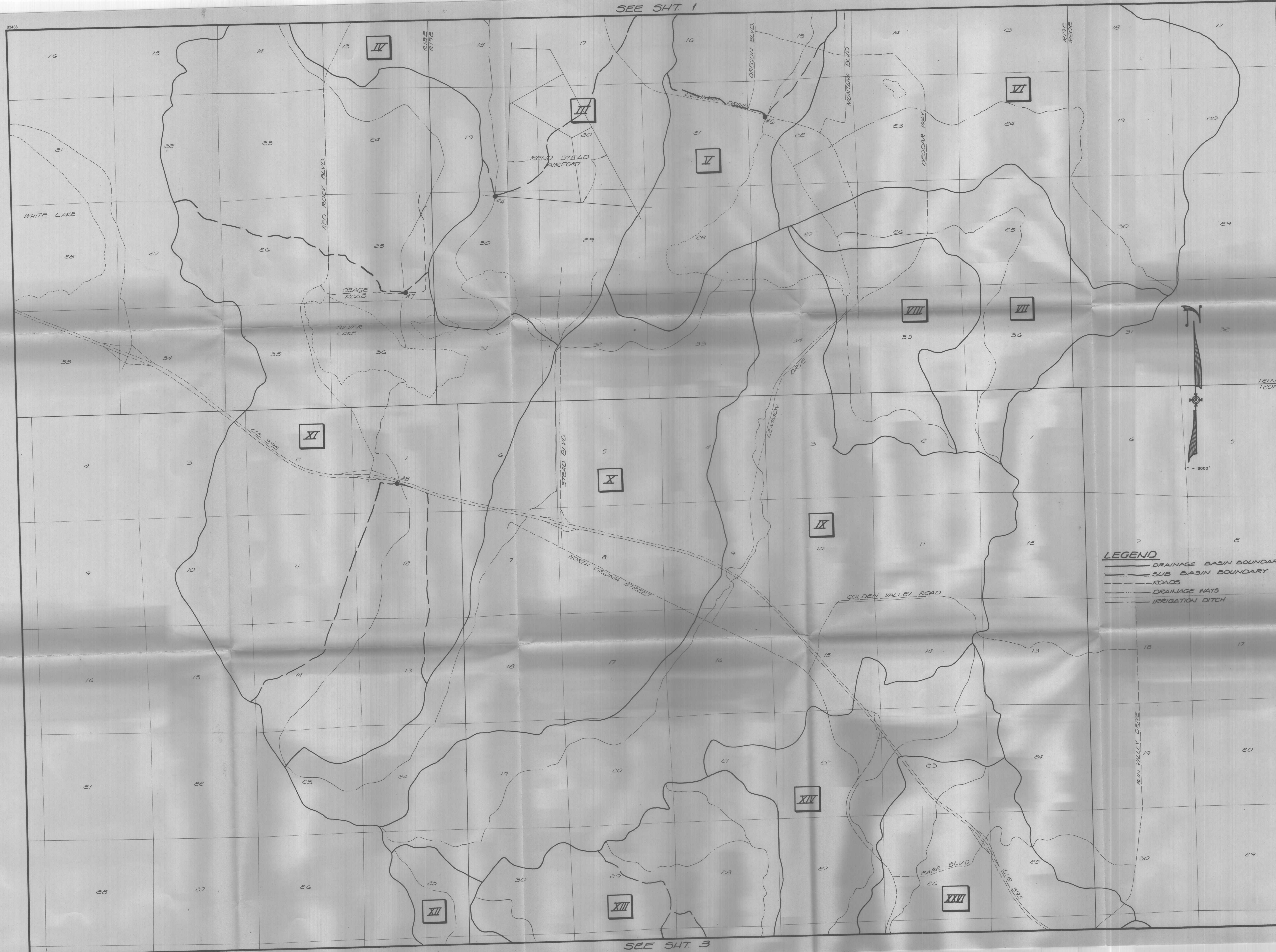
APPENDIX "A"



SHEET 2 OF 4

SUMMIT ENGINEERING CORPORATION
CONSULTING ENGINEERS AND SURVEYORS
248 WINTER STREET, SUITE 1, RENO, NEVADA 89503
572 FIFTH STREET, ELKO, NEVADA 89801
PHONE: RENO (702) 329-1867 ELKO (702) 738-8058

SCALE HORIZ. 1"=2000' VERT. ____
JOB No. 2058
DRAWING No. ____

CITY OF RENO HYDROLOGY STUDY
MASTER STORM DRAINAGE
RENO, WASHOE COUNTY, NEVADA

REV.	DATE	DESCRIPTION	BY	APP'D

DESIGNED BY: DDW
DRAWN BY: EDM
CHECKED BY: DDW
DATE: JUNE 1985

RED ROCK ROAD
R18E
R19E
T23N
T22N
R19E
R20E
T22N
T21N
I
II
III
IV
V
VI
#1
#2
#3
#5
LEMMON DRIVE
RED ROCK ROAD
OREGON
BLVD
MONTANA BLVD
1" = 2000'
LEGEND
DRAINAGE BASIN BOUNDARY
SUB BASIN BOUNDARY
ROADS
DRAINAGE WAYS
IRRIGATION DITCH
SEE SHT. 2
SUMMIT ENGINEERING CORPORATION
CONSULTING ENGINEERS AND SURVEYORS
248 WINTER STREET, SUITE 4, RENO, NEVADA 89503
572 FIFTH STREET, ELKO, NEVADA 89801
PHONE: RENO (702) 329-1867 ELKO (702) 738-8058
SHEET 1 OF 4
SCALE HORIZ. 1"=2000'
VERT.
JOB No. 2056
DRAWING No.
CITY OF RENO HYDROLOGY STUDY
MASTER STORM DRAINAGE
RENO, WASHOE COUNTY, NEVADA
REV. DATE DESCRIPTION BY APP'D
DESIGNED BY: DDW
DRAWN BY: EDM
CHECKED BY: DDW
DATE: JUNE 1985
14-4

SEE SHT. 2

SEE SHT. 4

CITY OF RENO HYDROLOGY STUDY

MASTER STORM DRAINAGE

RENO, WASHOE COUNTY, NEVADA

SUMMIT ENGINEERING CORPORATION

CONSULTING ENGINEERS AND SURVEYORS
248 WINTER STREET, SUITE 1, RENO, NEVADA 89503
572 FIFTH STREET, ELKO, NEVADA 89801
PHONE: RENO (702) 329-1887 ELKO (702) 738-8058

SCALE HORIZ. 1"=2000' VERT. ____
JOB No. 2056
DRAWING No. ____

SHEET 4 OF 4

REV.	DATE	DESCRIPTION	BY	APP'D

DESIGNED BY: DDW
DRAWN BY: EDM
CHECKED BY: DDW
DATE: JUNE 1985

14-4

APPENDIX "B"

TABLE 7

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

24-Hour Cumulative Rainfall
(Source: Winzler and Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
1	3.29	5.00	6.21	6.83
2				
*D.B. II	3.49	5.30	6.58	7.23
*D.B. III	2.78	4.22	5.24	5.76
3	3.61	5.49	6.81	7.49
4				
*D.B. IV	3.48	5.28	6.55	7.20
*D.B. III	2.99	4.54	5.63	6.19
5	2.50	3.80	4.72	5.18
6	2.65	4.12	5.11	5.62
7	3.99	5.91	7.34	8.06
8	4.80	7.28	9.04	9.94

* Drainage Basin

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 8

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

6-Hour Cumulative Rainfall
(Source: Winzler and Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
1	4.45	6.21	7.24	9.23
2				
*D.B. II	4.45	6.21	7.24	9.23
*D.B. III	4.37	6.10	7.11	9.07
3	4.45	6.21	7.24	9.23
4				
*D.B. IV	4.06	5.67	6.60	8.42
*D.B. III	3.98	5.56	6.48	8.26
5	4.06	5.67	6.60	8.42
6	3.82	5.34	6.22	7.94
7	4.06	5.67	6.60	8.42
8	3.43	4.88	5.59	7.13

* Drainage Basin

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 10

STEAD REGION

RAINFALL DATA WITH AREAL DISTRIBUTION REDUCTION FACTORS
BASED ON WINZLER AND KELLY

COMPUTATION POINT	STORM DURATION HOURS	AREAL RED. FACTOR	AFFECTED COMPUTATION POINT NO.	5-YEAR STORM IN	25-YEAR STORM IN	50-YEAR STORM IN	100-YEAR STORM IN
1	24	99%	1	3.26	4.95	6.15	6.76
1	6	99%	1	4.41	6.15	7.17	9.14
1	3	98%	1	3.35	4.86	5.81	7.10
2	24	97%	1	3.19	4.85	6.02	6.63
		97%	2 DBII	3.39	5.14	6.38	7.01
		97%	2 DBIII	2.70	4.09	5.08	5.59
2	6	96%	1	4.27	5.96	6.95	8.86
		96%	2 DBII	4.27	5.96	6.95	8.86
		96%	2 DBIII	4.20	5.86	6.83	8.71
2	3	95%	1	3.25	4.71	5.63	6.77
		95%	2 DBII	3.25	4.71	5.63	6.77
		95%	2 DBIII	3.19	4.63	5.53	6.65
4	24	96%	1	3.16	4.80	5.96	6.56
		96%	2 DBII	3.35	5.09	6.32	6.94
		96%	2 DBIII	2.67	4.05	5.03	5.53
		96%	3	3.47	5.27	6.54	7.19
		96%	4 DBIV	3.34	5.07	6.29	6.91
		96%	4 DBIII	2.87	4.36	5.40	5.94
4	6	95%	1	4.23	5.90	6.88	8.77
		95%	2 DBII	4.23	5.90	6.88	8.77
		95%	2 DBIII	4.15	5.80	6.75	8.62
		95%	3	4.23	5.90	6.88	8.77
		95%	4 DBIV	3.86	5.39	6.27	8.00
		95%	4 DBIII	3.78	5.28	6.16	7.85
4	3	93%	1	3.18	4.61	5.51	6.63
		93%	2 DBII	3.18	4.61	5.51	6.63
		93%	2 DBIII	3.12	4.53	5.41	6.51
		93%	3	3.18	4.61	5.51	6.63
		93%	4 DBIV	2.90	4.20	5.03	6.05
		93%	4 DVIII	2.85	4.13	4.93	5.93

TABLE 9

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

3-Hour Cumulative Rainfall
(Source: Winzler & Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
1	3.42	4.96	5.93	7.13
2				
*D.B. II	3.42	4.96	5.93	7.13
*D.B. III	3.36	4.87	5.82	7.00
3	3.42	4.96	5.93	7.13
4				
*D.B. IV	3.12	4.52	5.41	6.50
*D.B. III	3.06	4.44	5.30	6.38
5	3.12	4.52	5.41	6.50
6	2.94	4.26	5.10	6.13
7	3.12	4.52	5.41	6.50
8	2.64	3.83	4.58	5.50

* Drainage Basin

NOTE: These values were derived from the Winzler & Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 11

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

24-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	516	1167	1684	1956
2	1510	3357	4813	5590
3	571	1201	1683	1936
4	1966	4313	6154	7125
5	182	464	695	820
6	341	863	1283	1507
7	639	1199	1637	1864
8	1318	2478	3323	3756

TABLE 12

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

6-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	1165	2027	2565	3647
2	3448	5988	7569	10743
3	1008	1721	2162	3044
4	4101	7122	8997	12777
5	560	1008	1288	1861
6	985	1767	2253	3249
7	804	1367	1710	2402
8	703	1297	1670	2428

TABLE 13

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

3-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	753	1491	2002	2668
2	2187	4303	5765	7668
3	591	1155	1548	2053
4	2509	4957	6647	8859
5	419	834	1127	1505
6	702	1409	1907	2554
7	533	1012	1343	1764
8	514	1048	1424	1918

TABLE 14

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

24-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	516	1167	1684	1956
2	1549	3415	4883	5664
3	570	1202	1683	1936
4	2010	4372	6219	7193
5	181	464	696	819
6	366	905	1331	1557
7	700	1339	1810	2050
8	1482	2713	3600	4655

TABLE 15

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

6-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	1165	2027	2565	3647
2	3496	6048	7636	10818
3	1008	1721	2162	3044
4	4174	7223	9112	12917
5	559	1008	1288	1861
6	1026	1822	2315	3321
7	914	1522	1890	2629
8	813	1460	1858	2665

TABLE 16

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

3-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	753	1491	2002	2668
2	2235	4373	5846	7763
3	704	1347	1786	2353
4	2551	5013	6711	8929
5	419	834	1127	1505
6	735	1455	1962	2616
7	622	1150	1509	1965
8	597	1180	1590	2118

TABLE 17

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

24-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
1	1.5	2.1	2.4	2.65
2				
*D.B.II	1.55	2.15	2.5	2.7
*D.B.III	1.45	2.05	2.3	2.55
3	1.55	2.15	2.45	2.7
4				
*D.B.IV	1.55	2.15	2.45	2.65
*D.B.III	1.45	2.1	2.4	2.6
5	1.4	2.0	2.3	2.5
6	1.4	2.0	2.3	2.5
7	1.6	2.2	2.5	2.7
8	1.8	2.4	2.8	2.9

* Drainage Basin

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 18

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

6-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
1	0.95	1.35	1.5	1.7
2				
*D.B.II	0.97	1.35	1.55	1.75
*D.B.III	0.95	1.35	1.45	1.65
3	0.97	1.35	1.55	1.75
4				
*D.B.IV	0.97	1.35	1.5	1.75
*D.B.III	0.95	1.35	1.5	1.65
5	0.91	1.3	1.4	1.6
6	0.92	1.3	1.4	1.6
7	1.0	1.4	1.55	1.75
8	1.1	1.5	1.7	2.0

* Drainage Basin

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 19

STEAD REGION
COMPUTATION POINTS 1 THROUGH 8

3-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
1	.85	1.11	1.25	1.43
2				
*D.B.II	.85	1.11	1.25	1.46
*D.B.III	.85	1.11	1.25	1.39
3	.85	1.12	1.25	1.46
4				
*D.B.IV	.81	1.10	1.25	1.46
*D.B.III	.81	1.09	1.21	1.39
5	.80	1.08	1.20	1.36
6	.80	1.08	1.20	1.36
7	.82	1.11	1.26	1.46
8	.83	1.01	1.10	1.23

* Drainage Basin

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 20

STEAD REGION

RAINFALL DATA WITH AREAL DISTRIBUTION REDUCTION FACTORS
BASED ON NOAA ATLAS 2

COMPUTATION POINT	STORM DURATION HOURS	AREAL RED. FACTOR	AFFECTED COMPUTATION POINT NO.	5-YEAR STORM IN	25-YEAR STORM IN	50-YEAR STORM IN	100-YEAR STORM IN
1	24	99%	1	1.49	2.08	2.38	2.62
1	6	99%	1	0.95	1.34	1.49	1.68
1	3	98%	1	0.83	1.09	1.23	1.40
2	24	97%	1	1.46	2.04	2.33	2.57
		97%	2 DBII	1.50	2.09	2.43	2.62
		97%	2 DBIII	1.41	1.99	2.23	2.47
2	6	96%	1	0.91	1.30	1.44	1.63
		96%	2 DBII	0.93	1.30	1.49	1.68
		96%	2 DBIII	0.91	1.30	1.39	1.58
2	3	95%	1	0.81	1.05	1.19	1.36
		95%	2 DBII	0.81	1.05	1.19	1.39
		95%	2 DBIII	0.81	1.05	1.19	1.32
4	24	96%	1	1.44	2.02	2.30	2.54
		96%	2 DBII	1.49	2.06	2.40	2.59
		96%	2 DBIII	1.39	1.97	2.21	2.45
		96%	3	1.49	2.06	2.35	2.59
		96%	4 DBIV	1.49	2.06	2.35	2.59
		96%	4 DBIII	1.39	2.02	2.30	2.50
4	6	95%	1	0.90	1.28	1.43	1.62
		95%	2 DBII	0.92	1.28	1.47	1.66
		95%	2 DBIII	0.90	1.28	1.38	1.57
		95%	3	0.92	1.28	1.47	1.66
		95%	4 DBIV	0.92	1.28	1.43	1.66
		95%	4 DBIII	0.90	1.28	1.43	1.57
4	3	93%	1	0.79	1.03	1.16	1.33
		93%	2 DBII	0.79	1.03	1.16	1.36
		93%	2 DBIII	0.79	1.03	1.16	1.29
		93%	3	0.79	1.04	1.16	1.36
		93%	4 DBIV	0.75	1.02	1.16	1.36
		93%	4 DVIII	0.75	1.01	1.13	1.29

TABLE 21

STEAD REGION
COMPUTATION POINTS 1 - 8

24-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	56	170	245	312
2	202	571	807	1003
3	67	178	246	309
4	267	730	1023	1271
5	27	97	145	181
6	58	190	278	342
7	108	234	307	359
8	206	416	575	617

TABLE 22

STEAD REGION
COMPUTATION POINTS 1 - 8

6-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

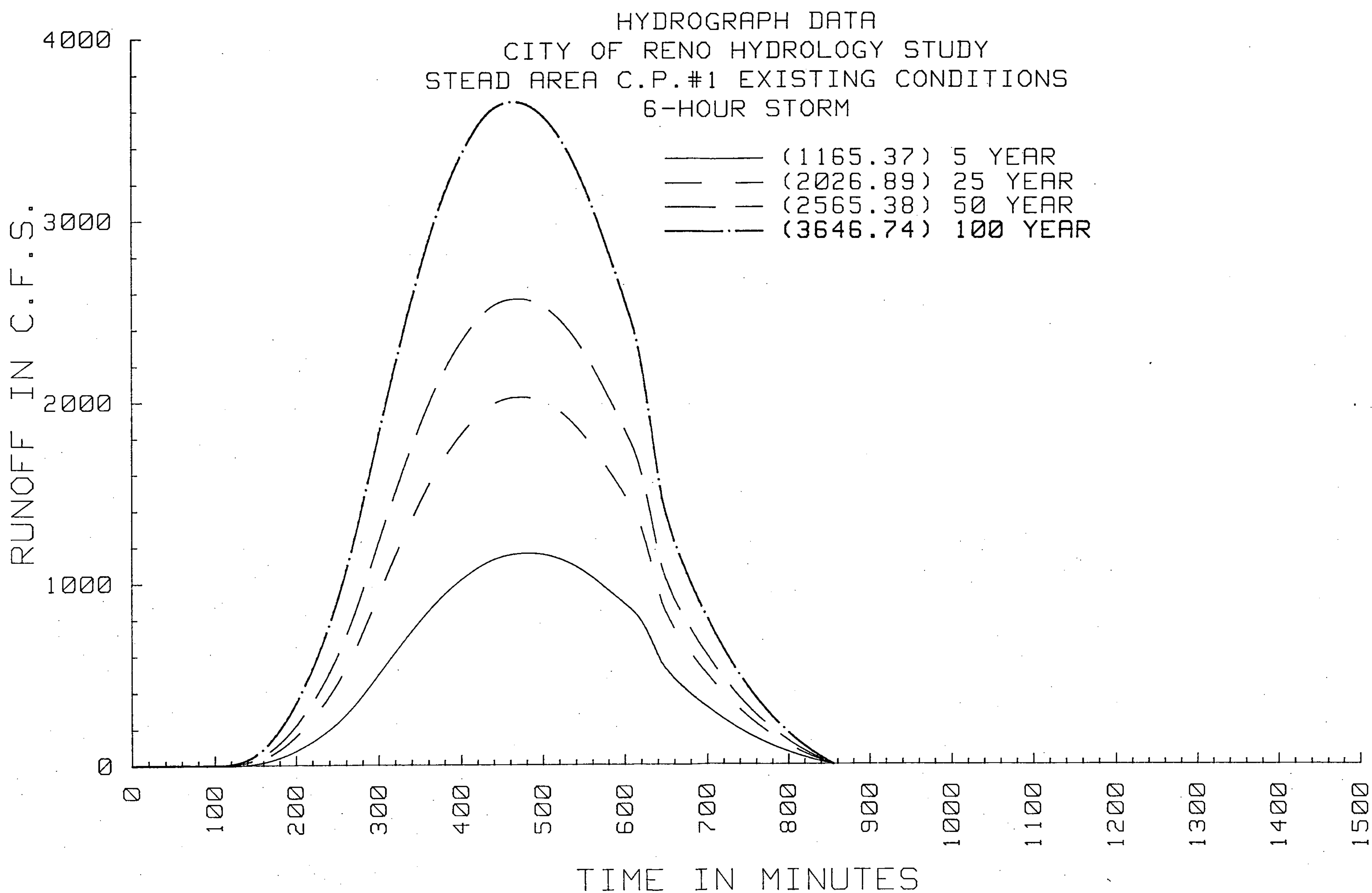
COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	11	62	91	133
2	41	204	291	425
3	17	66	102	143
4	48	235	350	511
5	7	33	42	63
6	16	70	89	133
7	37	105	137	183
8	46	120	171	258

TABLE 23

STEAD REGION
COMPUTATION POINTS 1 - 8

3-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
1	3	26	46	77
2	16	88	152	250
3	8	36	56	94
4	16	97	165	283
5	2.5	20	31	50
6	7	40	62	97
7	17	56	83	124
8	25	52	69	97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STEAD AREA C.P.#1 EXISTING CONDITIONS
6-HOUR STORM
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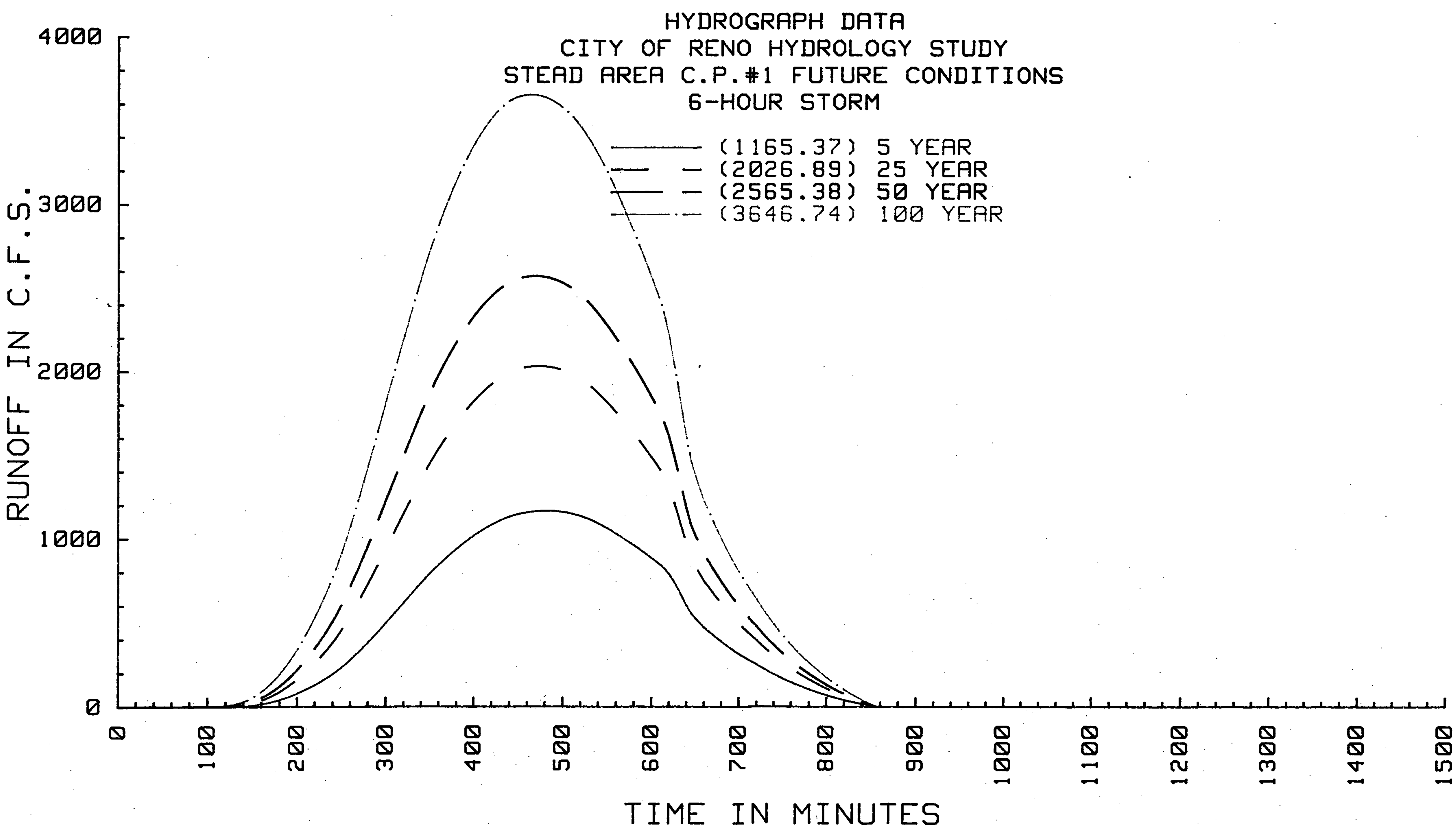
(2026.89) 25 YEAR
(2565.38) 50 YEAR
(3646.74) 100 YEAR
RUNOFF IN C.F.S.
0
1000
2000
3000
4000
TIME IN MINUTES
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500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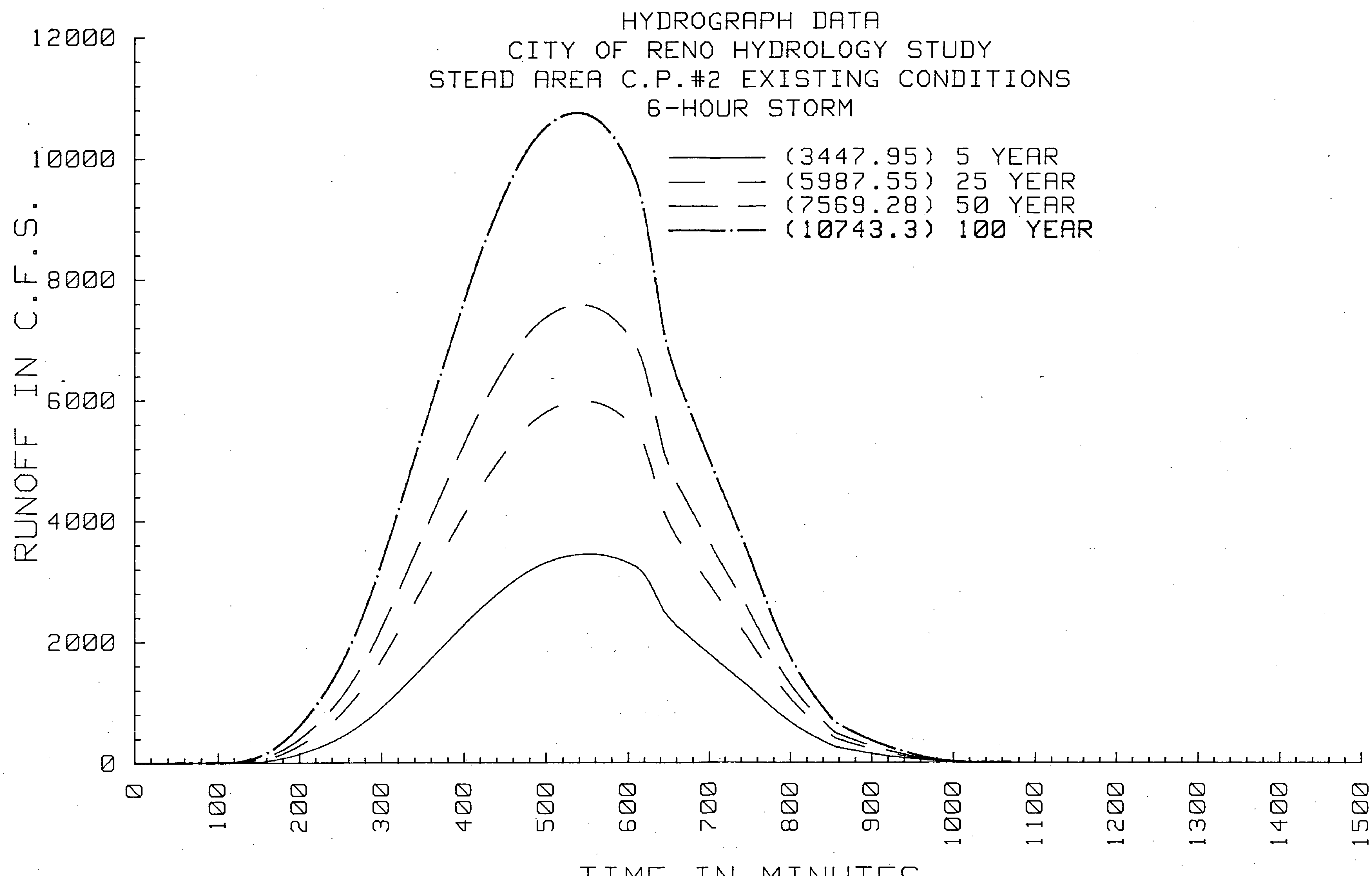
STEAD AREA C.P.#1 FUTURE CONDITIONS
6-HOUR STORM
(1165.37) 5 YEAR
(2026.89) 25 YEAR
(2565.38) 50 YEAR
(3646.74) 100 YEAR
RUNOFF IN C.F.S.
4000
3000
2000
1000
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES



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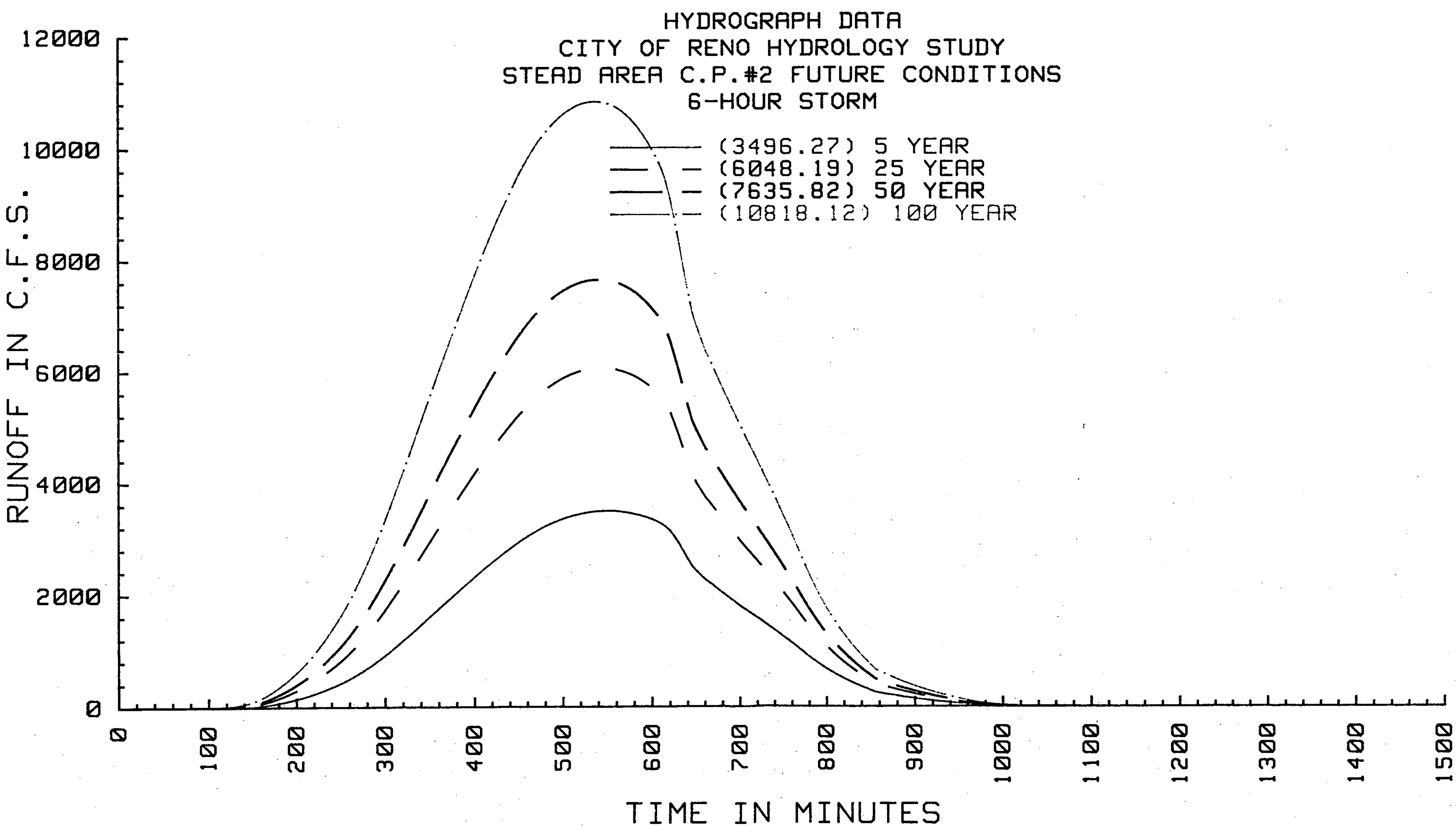
CITY OF RENO HYDROLOGY STUDY
STEAD AREA C.P.#2 EXISTING CONDITIONS
6-HOUR STORM
(3447.95) 5 YEAR
(5987.55) 25 YEAR
(7569.28) 50 YEAR
(10743.3) 100 YEAR
RUNOFF IN C.F.S.
0
2000
4000
6000
8000
10000
12000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES



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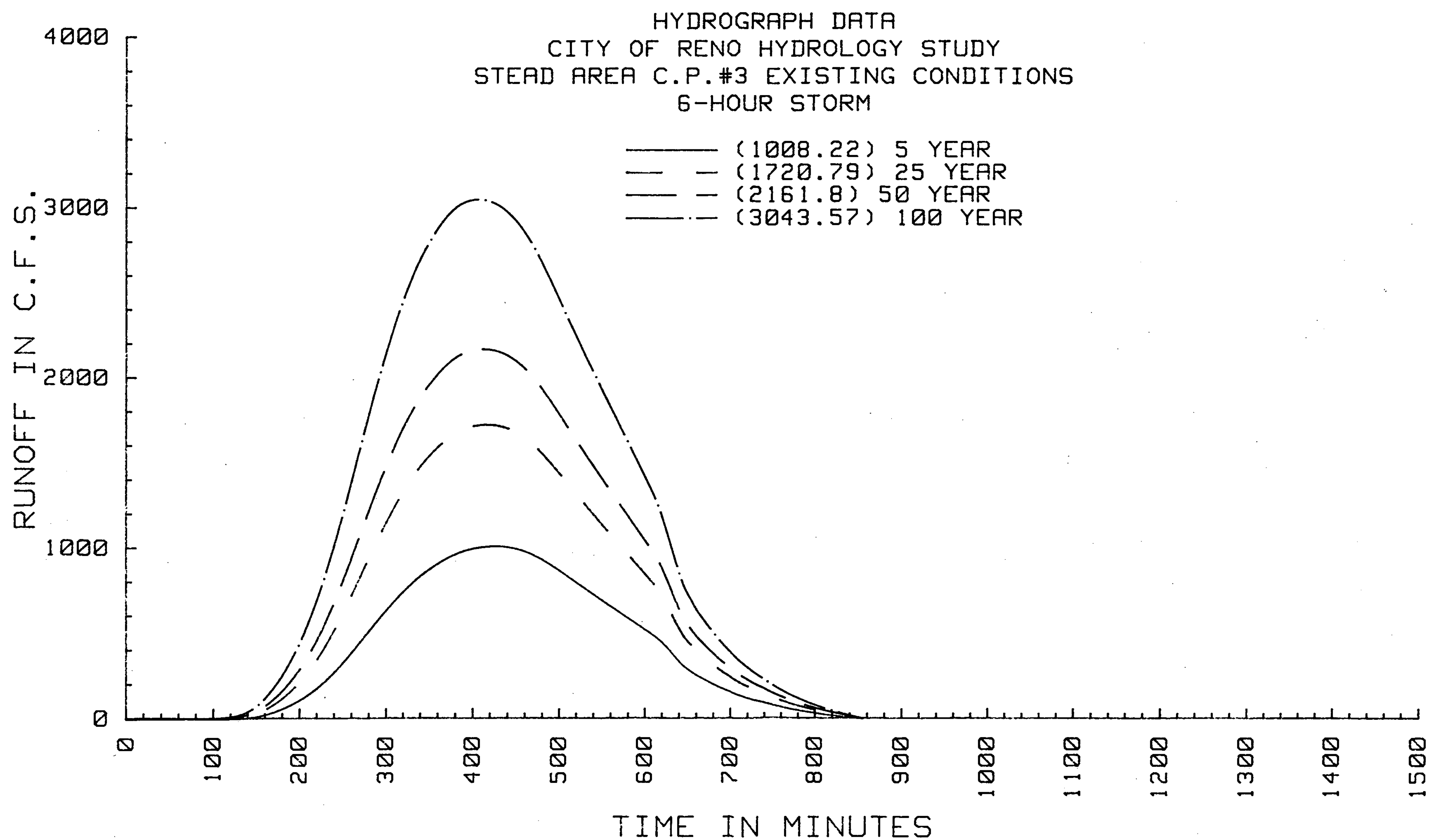
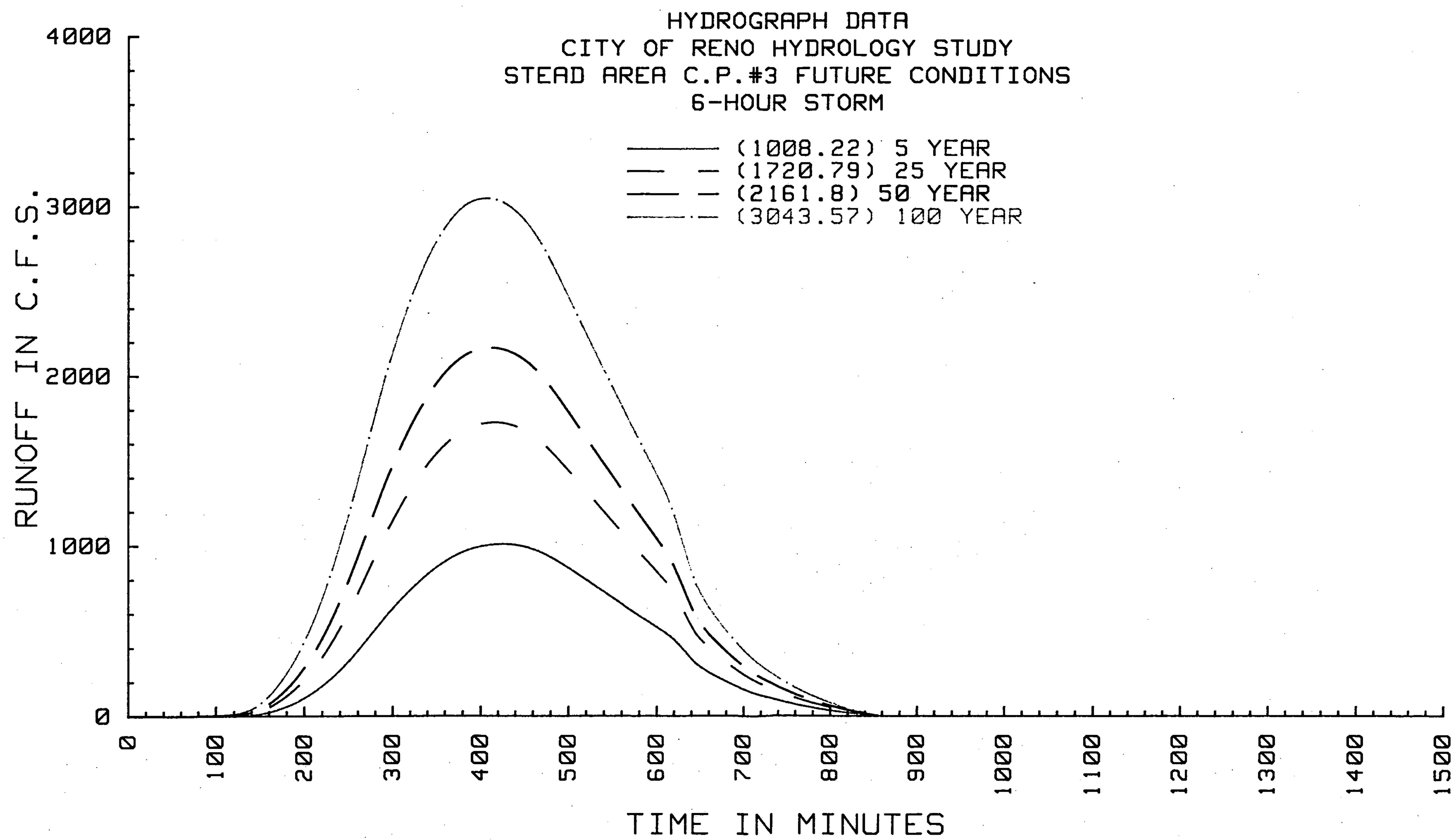
STEAD AREA C.P.#2 FUTURE CONDITIONS
6-HOUR STORM
(3496.27) 5 YEAR
(6048.19) 25 YEAR
(7635.82) 50 YEAR
(10818.12) 100 YEAR
RUNOFF IN C.F.S.
0
2000
4000
6000
8000
10000
12000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
STEAD AREA C.P.#3 EXISTING CONDITIONS
6-HOUR STORM
(1008.22) 5 YEAR
(1720.79) 25 YEAR
(2161.8) 50 YEAR
(3043.57) 100 YEAR
RUNOFF IN C.F.S.
0
1000
2000
3000
4000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES



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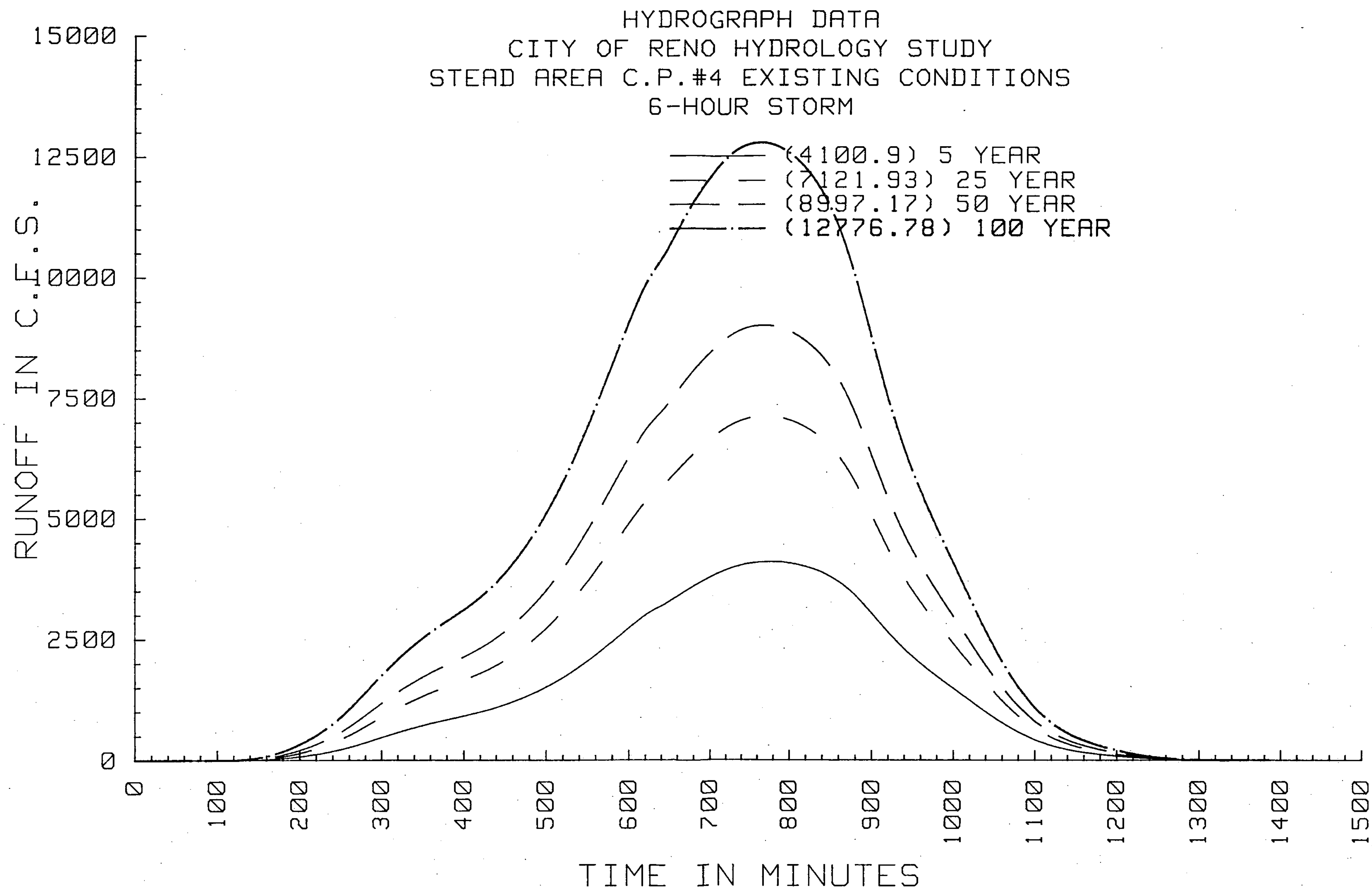
CITY OF RENO HYDROLOGY STUDY
STEAD AREA C.P.#3 FUTURE CONDITIONS
6-HOUR STORM
(1008.22) 5 YEAR
(1720.79) 25 YEAR
(2161.8) 50 YEAR
(3043.57) 100 YEAR
RUNOFF IN C.F.S.
4000
3000
2000
1000
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES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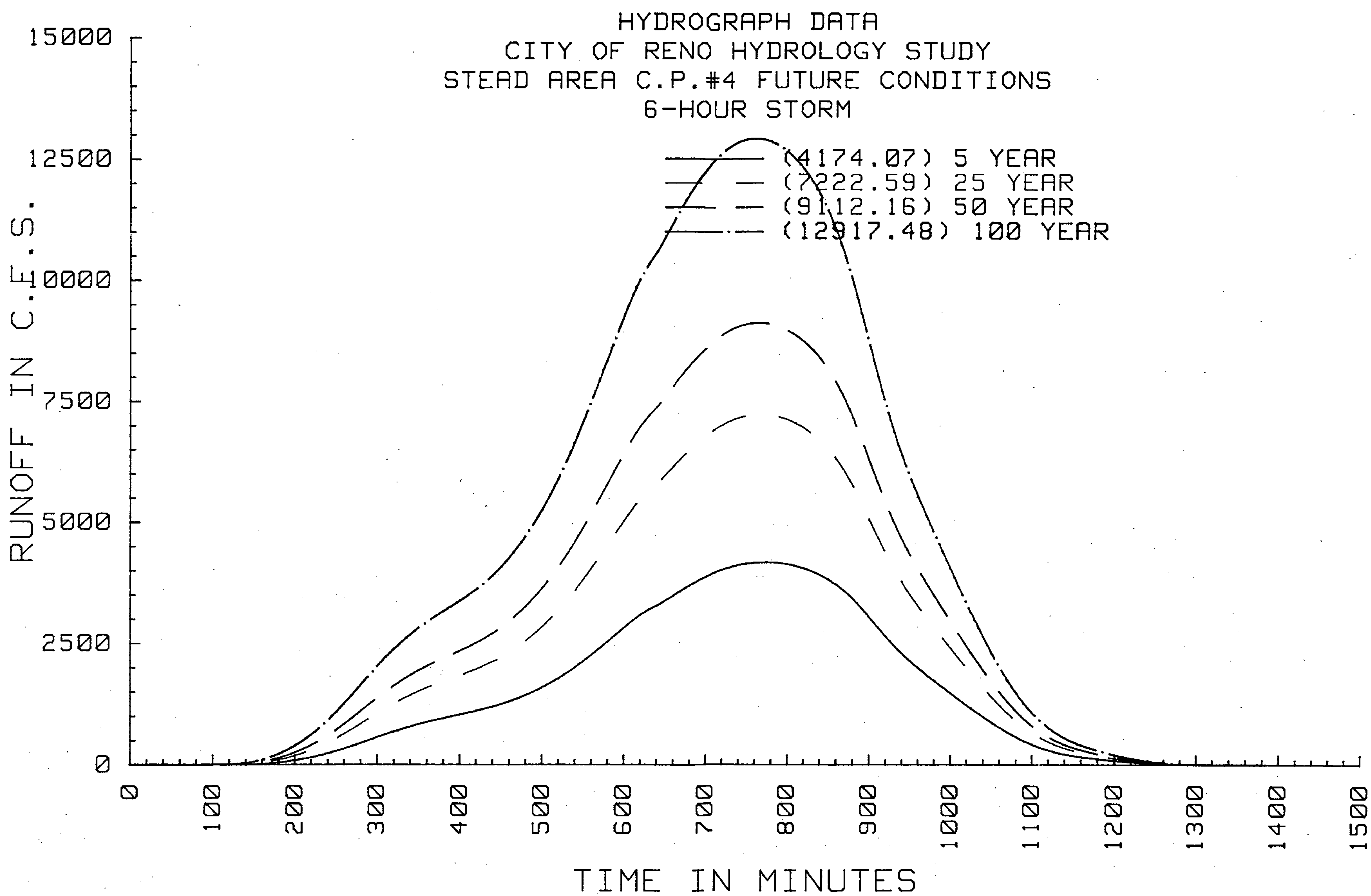
STEAD AREA C.P.#4 EXISTING CONDITIONS
6-HOUR STORM
(4100.9) 5 YEAR
(7121.93) 25 YEAR
(8997.17) 50 YEAR
(12776.78) 100 YEAR
RUNOFF IN C.F.S.
15000
12500
10000
7500
5000
2500
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES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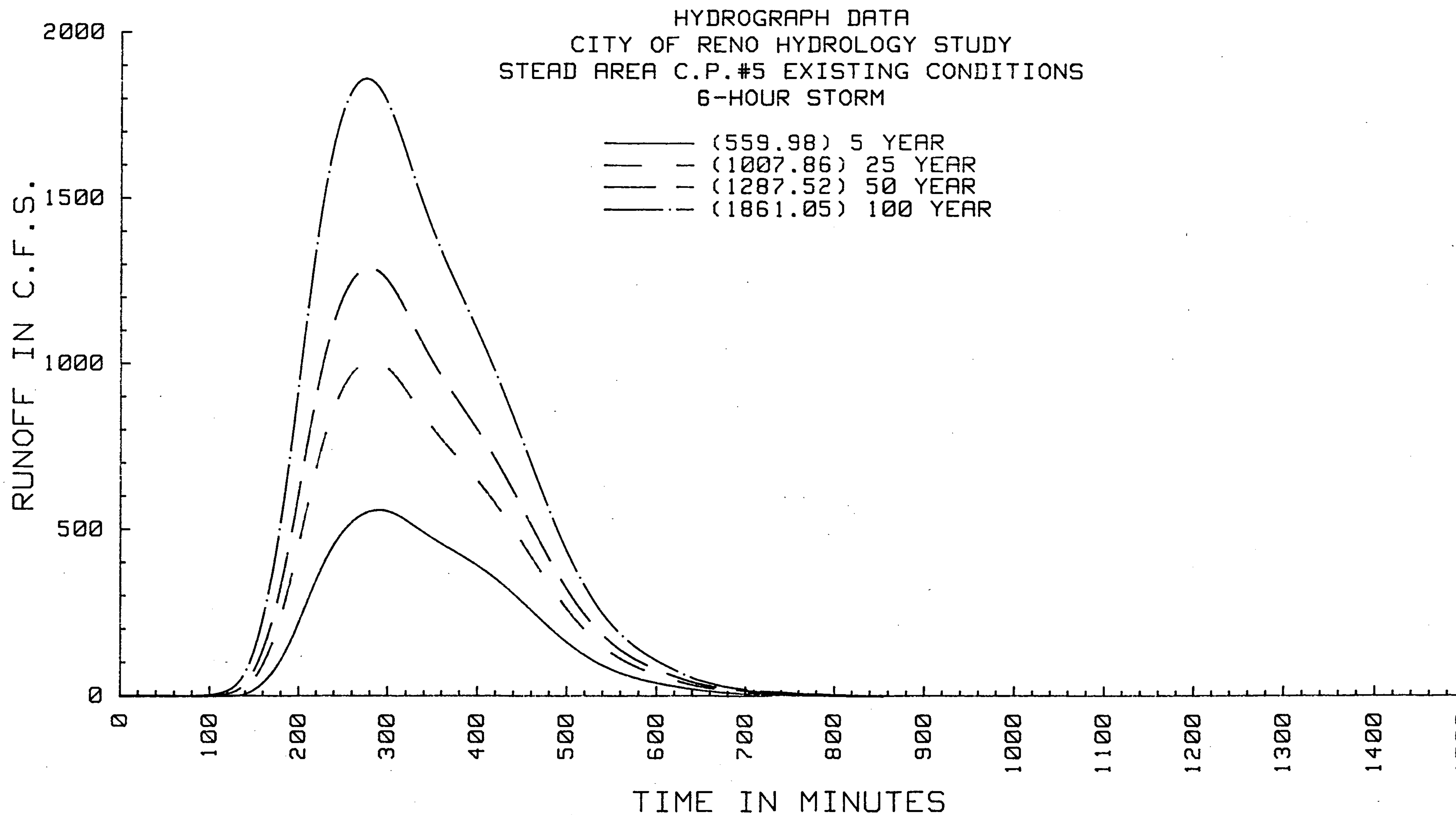
CITY OF RENO HYDROLOGY STUDY
STEAD AREA C.P.#4 FUTURE CONDITIONS
6-HOUR STORM
(4174.07) 5 YEAR
(7222.59) 25 YEAR
(9112.16) 50 YEAR
(12917.48) 100 YEAR
RUNOFF IN C.F.S.
15000
12500
10000
7500
5000
2500
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES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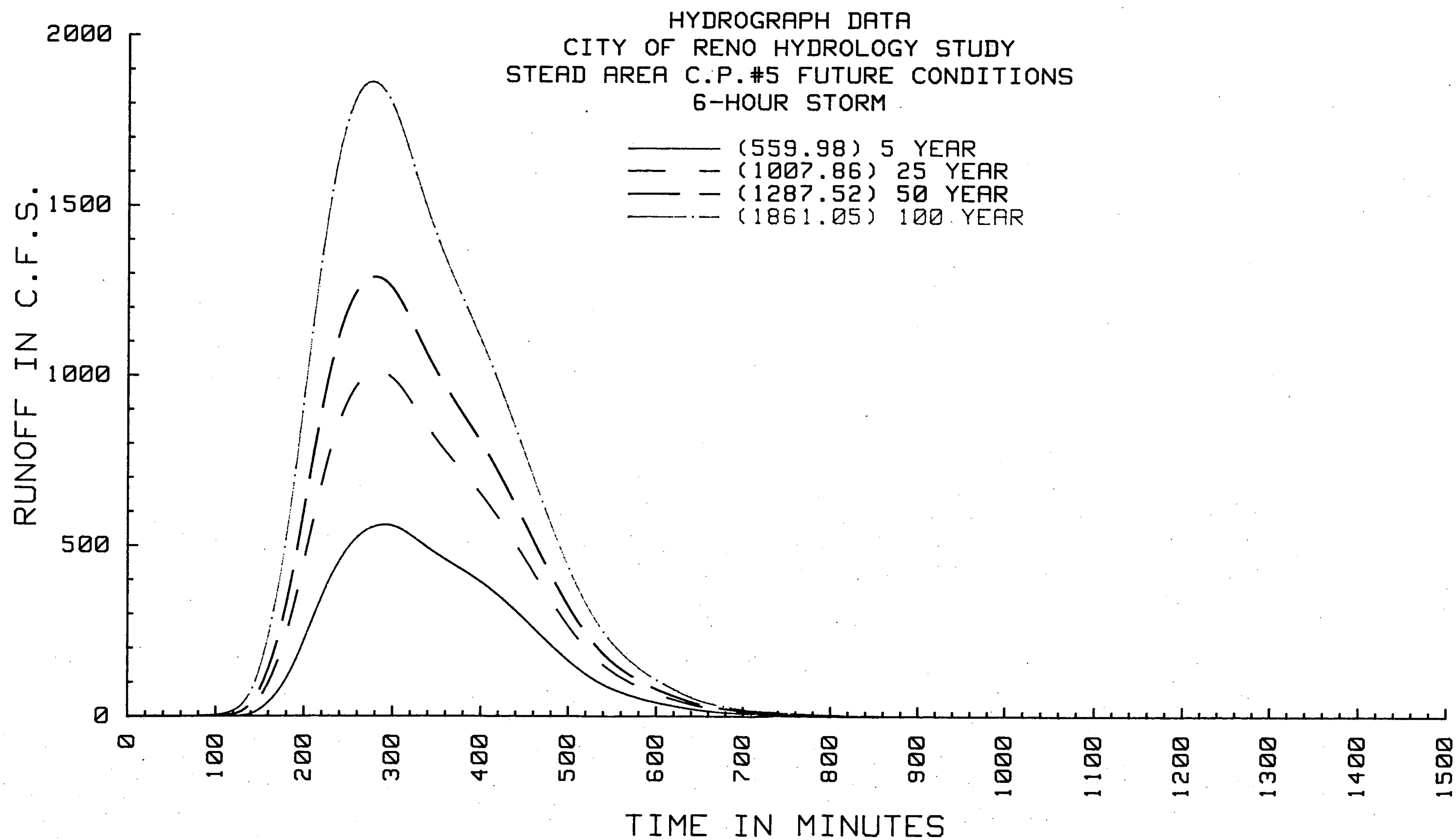
CITY OF RENO HYDROLOGY STUDY
STEAD AREA C.P.#5 EXISTING CONDITIONS
6-HOUR STORM
(559.98) 5 YEAR
(1007.86) 25 YEAR
(1287.52) 50 YEAR
(1861.05) 100 YEAR
RUNOFF IN C.F.S.
2000
1500
1000
500
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES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STEAD AREA C.P.#5 FUTURE CONDITIONS
6-HOUR STORM
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(1007.86) 25 YEAR
(1287.52) 50 YEAR
(1861.05) 100 YEAR
RUNOFF IN C.F.S.
2000
1500
1000
500
0
0
100
200
300
400
500
600
700
800
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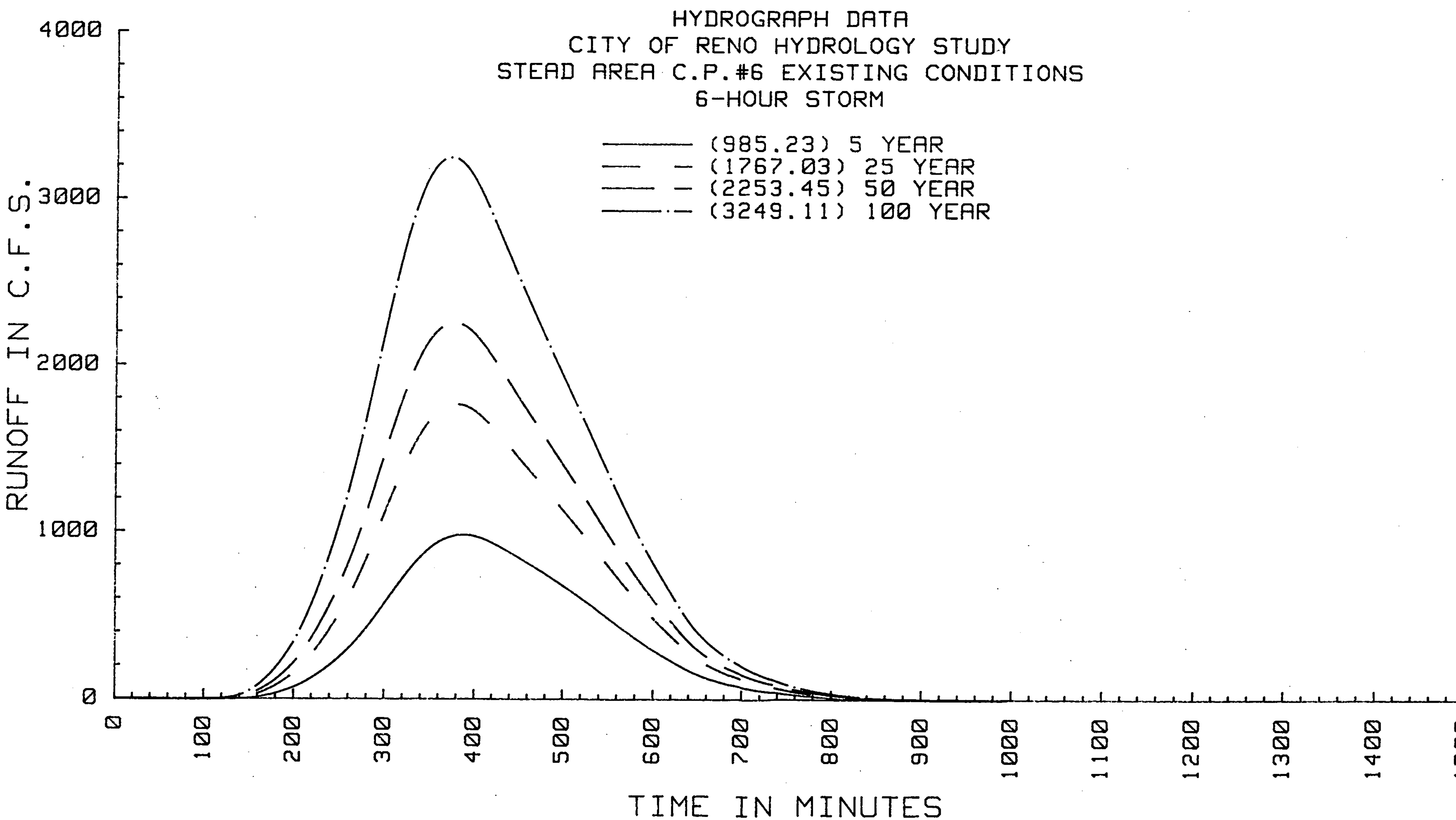
1100
1200
1300
1400
1500
TIME IN MINUTES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STEAD AREA C.P.#6 EXISTING CONDITIONS
6-HOUR STORM
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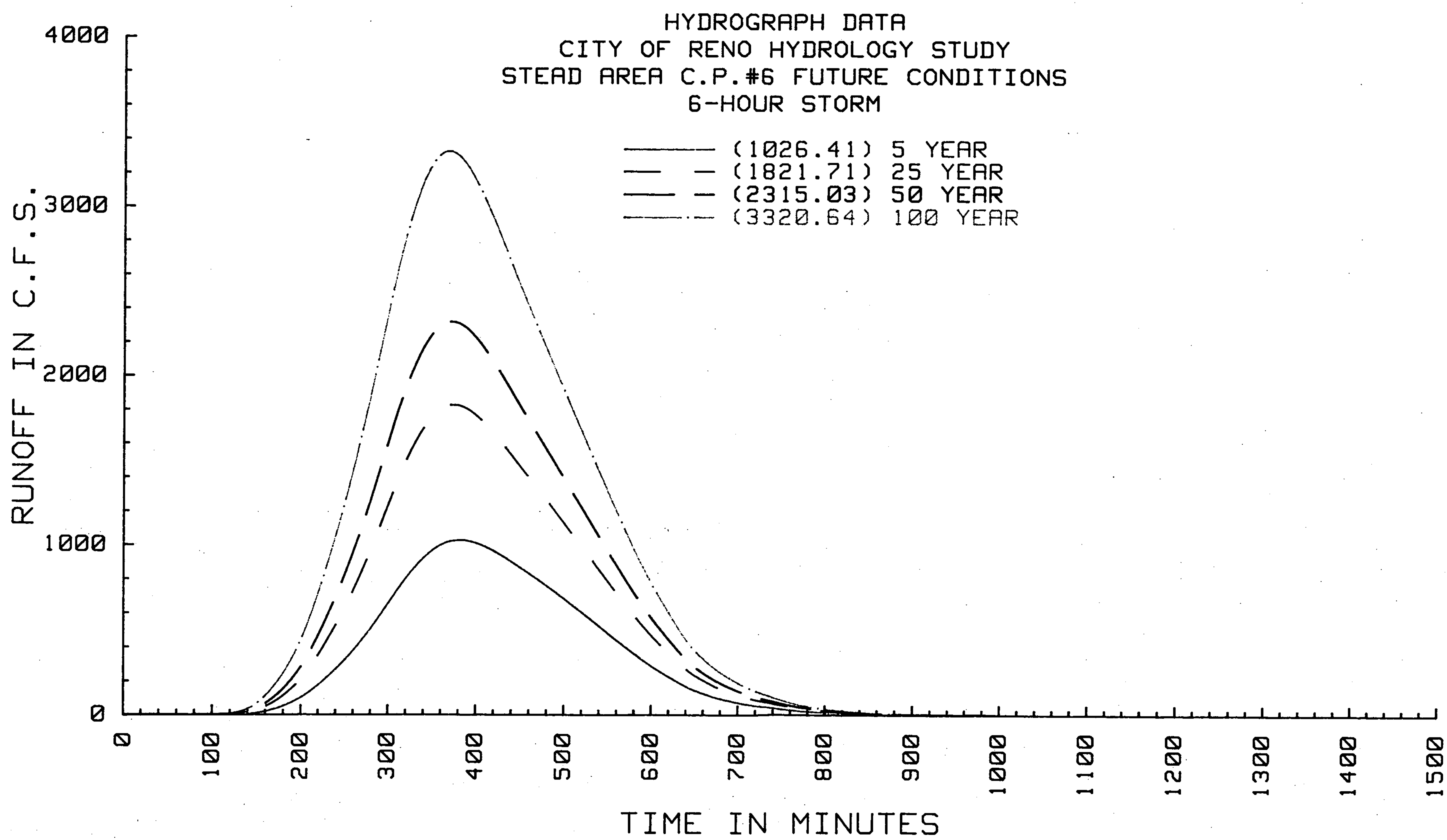
(1767.03) 25 YEAR
(2253.45) 50 YEAR
(3249.11) 100 YEAR
RUNOFF IN C.F.S.
0
1000
2000
3000
4000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES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STEAD AREA C.P.#6 FUTURE CONDITIONS
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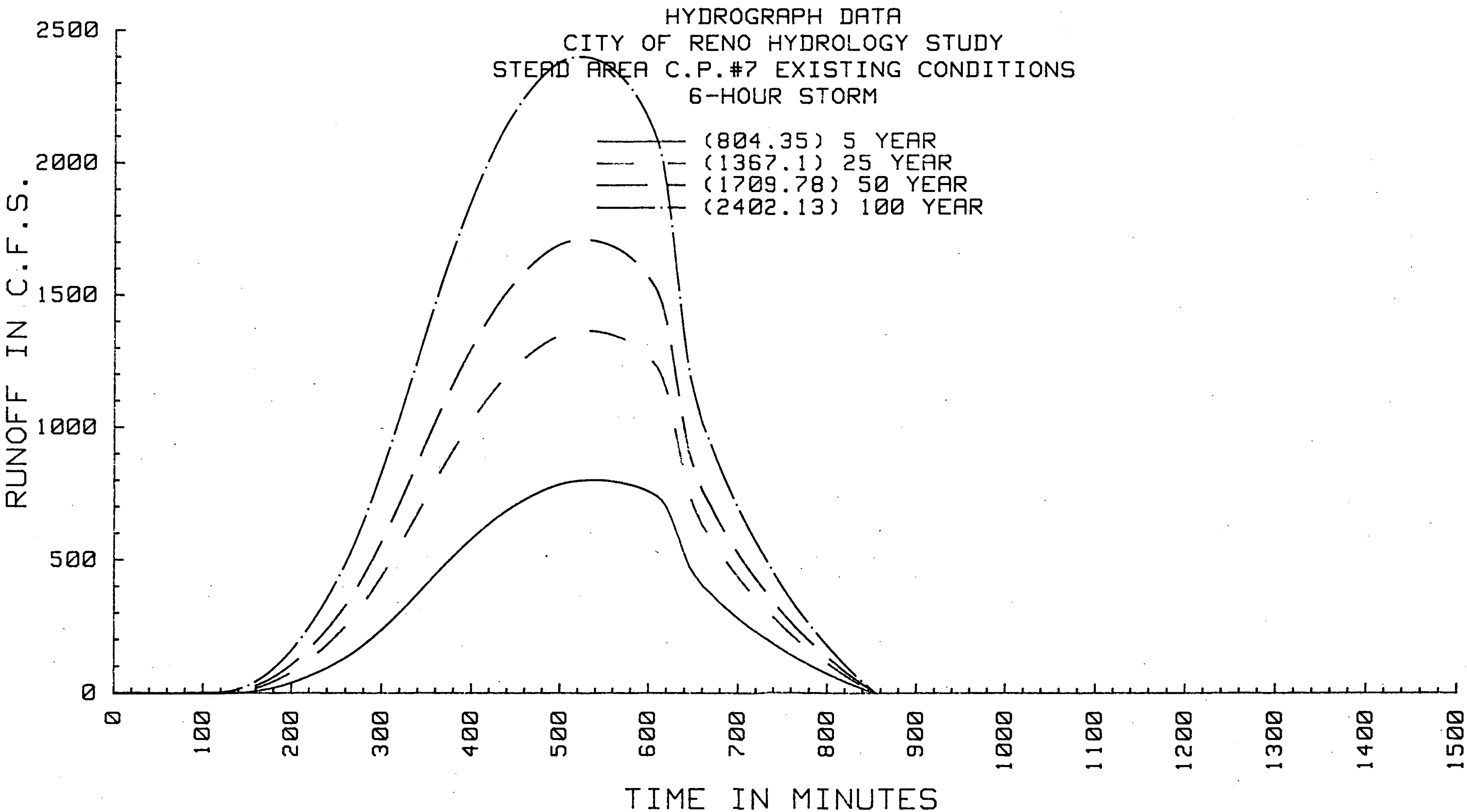
(1821.71) 25 YEAR
(2315.03) 50 YEAR
(3320.64) 100 YEAR
RUNOFF IN C.F.S.
4000
3000
2000
1000
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES


HYDROGRAPH DATA
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STEAD AREA C.P.#7 EXISTING CONDITIONS
6-HOUR STORM
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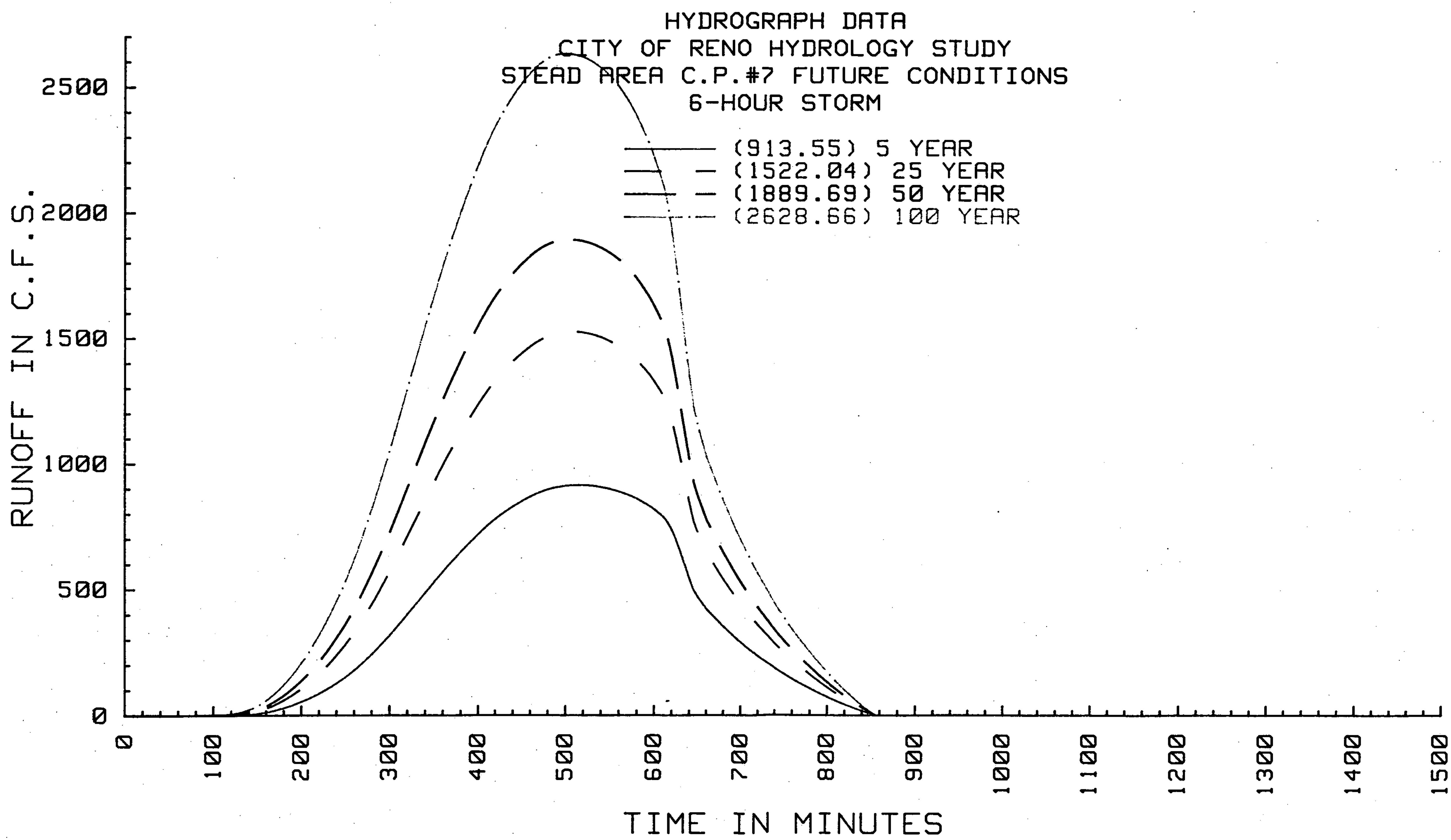
(1367.1) 25 YEAR
(1709.78) 50 YEAR
(2402.13) 100 YEAR
RUNOFF IN C.F.S.
0
500
1000
1500
2000
2500
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES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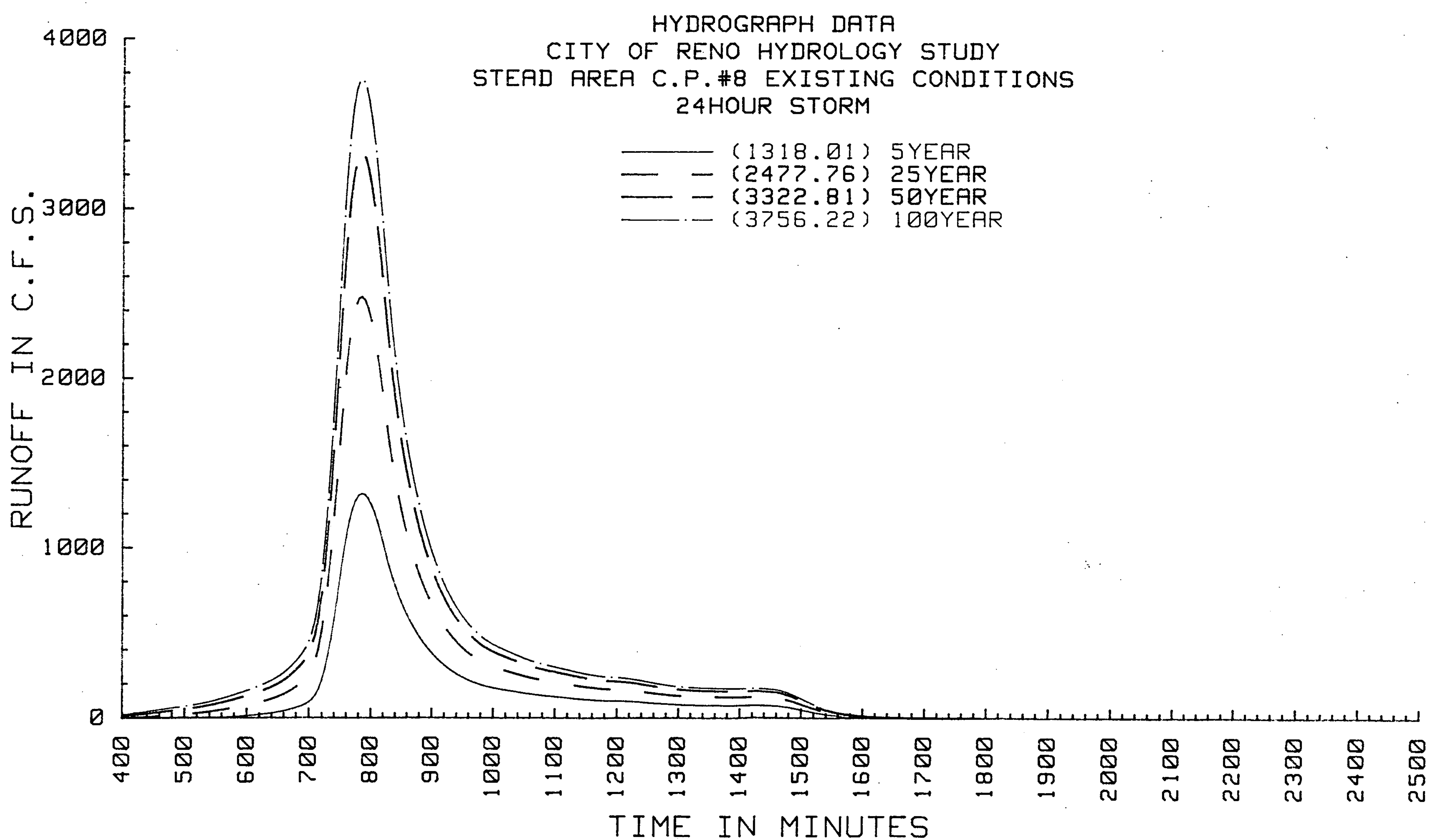
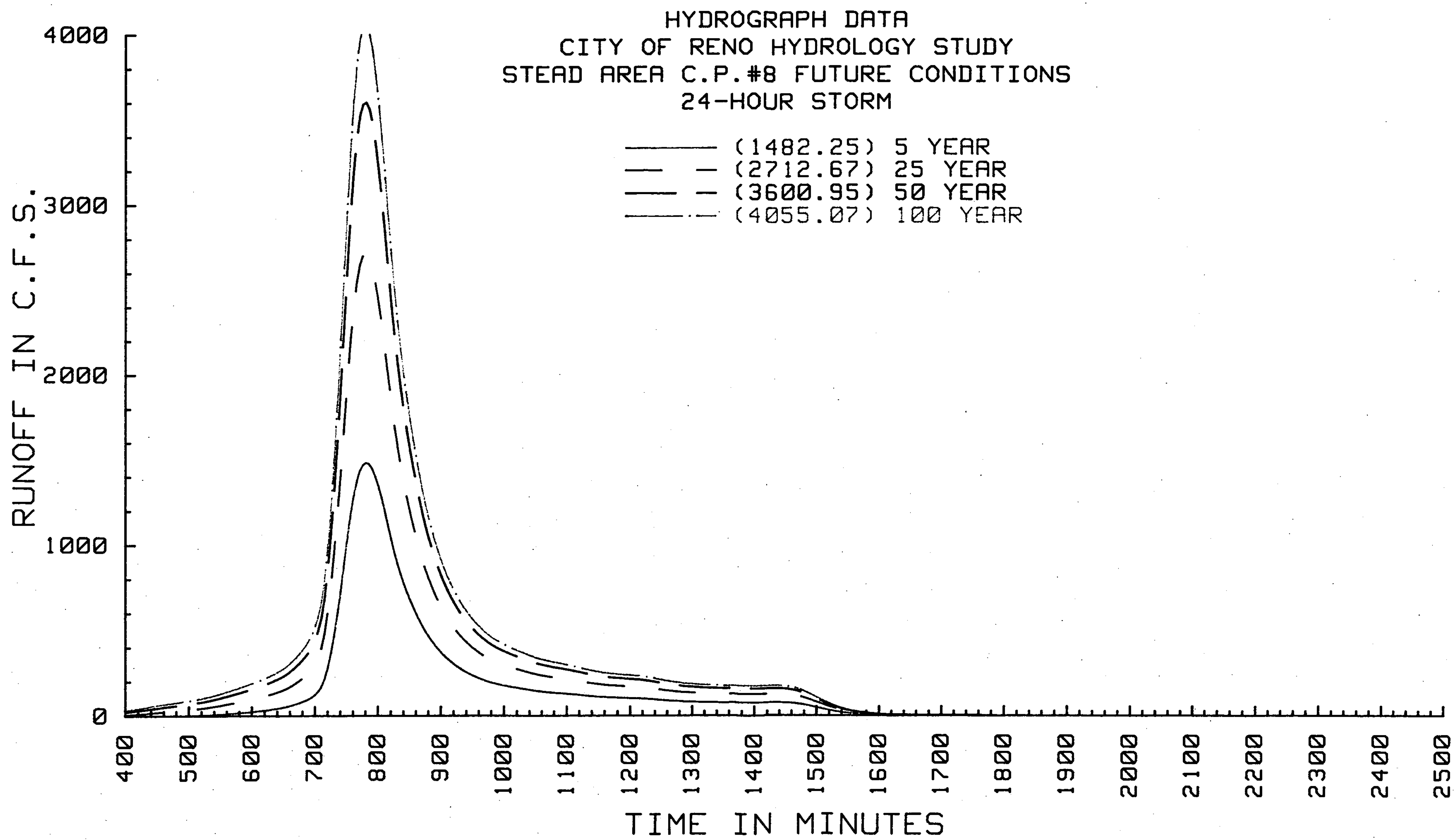
STEAD AREA C.P.#7 FUTURE CONDITIONS
6-HOUR STORM
(913.55) 5 YEAR
(1522.04) 25 YEAR
(1889.69) 50 YEAR
(2628.66) 100 YEAR
RUNOFF IN C.F.S.
0
500
1000
1500
2000
2500
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
STEAD AREA C.P.#8 EXISTING CONDITIONS
24HOUR STORM
(1318.01) 5YEAR
(2477.76) 25YEAR
(3322.81) 50YEAR
(3756.22) 100YEAR
RUNOFF IN C.F.S.
4000
3000
2000
1000
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
STEAD AREA C.P.#8 FUTURE CONDITIONS
24-HOUR STORM
(1482.25) 5 YEAR
(2712.67) 25 YEAR
(3600.95) 50 YEAR
(4055.07) 100 YEAR
RUNOFF IN C.F.S.
4000
3000
2000
1000
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES

APPENDIX "C"

TABLE 24

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

24-Hour Cumulative Rainfall
(Source: Winzler and Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
9	2.85	4.33	5.37	5.90
10	3.34	5.06	6.29	6.91
11	3.75	5.70	7.07	7.78
12	4.31	6.54	8.12	8.93
13 Above Upper Peavine	4.03	6.12	7.60	8.35
13 Above Lower Peavine	3.34	5.06	6.29	6.91
14 Above East Wash	3.48	5.28	6.55	7.20
14 Above West Wash	3.20	4.85	6.03	6.62
15	2.92	4.43	5.50	6.05
16	2.22	3.38	4.19	4.61
17	1.95	2.95	3.67	4.03
18	2.02	3.06	3.80	4.18
19	1.81	2.74	3.41	3.74
20	2.43	3.69	4.58	5.04
21	2.29	3.48	4.32	4.75
22	3.13	4.75	5.90	6.48
23	2.78	4.22	5.24	5.76
24	2.43	3.69	4.58	5.04
25	3.61	5.49	6.81	7.49
26	3.13	4.75	5.90	6.48

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas for five (5) square miles.

TABLE 25

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

6-Hour Storm Cumulative Rainfall
(Source: Winzler & Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
9	1.64	2.29	2.67	3.40
10	1.79	2.51	2.92	3.73
11	2.18	3.05	3.56	4.54
12	2.50	3.49	4.06	5.18
13 Above Upper Peavine	2.42	3.38	3.94	5.02
13 Above Lower Peavine	1.95	2.73	3.18	4.05
14 Above East Wash	2.26	3.16	3.68	4.70
14 Above West Wash	2.03	2.83	3.30	4.21
15	2.11	2.94	3.43	4.37
16	1.56	2.18	2.54	3.24
17	1.33	1.85	2.16	2.75
18	1.48	2.07	2.41	3.08
19	1.37	1.91	2.22	2.84
20	1.52	2.13	2.48	3.16
21	1.37	1.91	2.22	2.84
22	1.87	2.62	3.05	3.89
23	1.64	2.29	2.67	3.40
24	1.44	2.02	2.35	3.00
25	1.95	2.73	3.18	4.05
26	1.64	2.29	2.67	3.40

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 26

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

3-Hour Cumulative Rainfall
(Source: Winzler & Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
9	1.26	1.83	2.18	2.63
10	1.38	2.00	2.39	2.88
11	1.68	2.44	2.91	3.50
12	1.92	2.78	3.33	4.00
13 Above Upper Peavine	1.86	2.70	3.22	3.88
13 Above Lower Peavine	1.50	2.18	2.60	3.13
14 Above East Wash	1.74	2.52	3.02	3.63
14 Above West Wash	1.56	2.26	2.70	3.25
15	1.62	2.35	2.81	3.38
16	1.20	1.74	2.08	2.50
17	1.02	1.48	1.77	2.13
18	1.14	1.65	1.98	2.38
19	1.05	1.52	1.82	2.19
20	1.17	1.70	2.03	2.44
21	1.05	1.52	1.82	2.19
22	1.44	2.09	2.50	3.00
23	1.26	1.83	2.18	2.63
24	1.11	1.61	1.92	2.31
25	1.50	2.18	2.60	3.13
26	1.26	1.83	2.18	2.63

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 27

NORTH OF THE TRUCKEE RIVER REGION

RAINFALL DATA WITH AREAL DISTRIBUTION REDUCTION FACTORS
BASED ON WINZLER AND KELLY

COMPUTATION POINT	STORM DURATION HOURS	AREAL RED. FACTOR	AFFECTED COMPUTATION POINT NO.	5-YEAR STORM IN	25-YEAR STORM IN	50-YEAR STORM IN	100-YEAR STORM IN
17	24	99%	15	2.89	4.39	5.45	5.99
		99%	16	2.20	3.35	4.15	4.56
		99%	17	1.93	2.92	3.63	3.99
17	6	98%	15	2.07	2.88	3.36	4.28
		98%	16	1.53	2.14	2.49	3.18
		98%	17	1.30	1.81	2.12	2.70
17	3	97%	15	1.57	2.28	2.73	3.28
		97%	16	1.16	1.66	2.02	2.43
		97%	17	.99	1.44	1.72	2.07

TABLE 28

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

24-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	1373	2609	3518	3986
10	144	281	382	433
11	478	911	1230	1394
12	676	1249	1667	1881
13	78	724	2013	2626
14	61	81	907	1482
15	387	776	1068	1219
16	405	808	1111	1267
17	407	814	1118	1276
18	50	120	176	205
19	109	270	399	468
20	84	170	235	269
21	129	264	367	421
22	147	293	402	458
23	207	418	575	657
24	257	521	721	824
25	247	475	643	729
26	307	594	806	915

TABLE 29

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

6-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	509	987	1296	1940
10	29	65	89	140
11	162	323	429	648
12	258	484	628	926
13	72	75	78	524
14	58	67	73	1374
15	260	479	621	908
16	261	482	624	913
17	251	465	603	885
18	20	49	69	114
19	52	121	170	280
20	27	58	79	124
21	39	85	117	184
22	42	92	125	196
23	64	138	188	294
24	91	194	263	408
25	62	132	179	277
26	80	171	231	359

TABLE 30

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

3-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	367	800	1111	1530
10	15	40	60	89
11	116	260	361	500
12	189	394	543	737
13	26	73	74	78
14	0	60	66	73
15	162	348	482	659
16	162	348	481	658
17	150	328	456	625
18	14	37	56	82
19	34	93	141	208
20	18	43	63	89
21	27	65	94	135
22	27	61	96	138
23	43	101	153	219
24	61	145	217	310
25	40	97	139	199
26	54	131	188	268

TABLE 31

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

24-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	1517	2764	3668	4129
10	215	372	484	541
11	547	1011	1349	1522
12	720	1312	1740	1959
13	79	755	2018	2620
14	62	149	1072	1654
15	674	1192	1564	1754
16	696	1229	1613	1808
17	698	1235	1620	1816
18	50	120	176	205
19	109	270	399	468
20	84	170	235	269
21	151	290	392	444
22	224	402	529	594
23	294	526	693	777
24	354	632	832	933
25	264	499	671	759
26	328	613	820	927

TABLE 32

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

6-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	616	1135	1463	2134
10	62	113	144	206
11	197	377	494	731
12	280	518	669	979
13	72	76	79	544
14	59	68	211	1495
15	479	791	983	1362
16	484	802	999	1386
17	469	779	972	1351
18	20	49	69	114
19	20	121	170	280
20	27	58	79	124
21	47	96	128	197
22	82	152	196	285
23	120	220	283	408
24	168	301	383	549
25	69	144	193	294
26	97	194	257	387

TABLE 33

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

3-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	455	932	1266	1709
10	37	78	109	150
11	142	304	415	568
12	207	423	579	782
13	36	73	75	78
14	0	61	67	171
15	349	639	835	1085
16	348	638	833	1083
17	328	607	797	1036
18	14	37	56	82
19	34	93	141	80
20	18	43	63	89
21	32	73	103	145
22	53	105	154	210
23	86	170	240	324
24	124	241	333	445
25	45	105	150	212
26	67	151	213	297

TABLE 34

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

24-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
9	1.55	2.15	2.55	2.75
10	1.6	2.2	2.6	2.8
11	1.6	2.2	2.6	2.8
12	1.6	2.2	2.6	2.8
13 Above Upper Peavine	1.55	2.15	2.55	2.7
13 Above Lower Peavine	1.55	2.15	2.55	2.7
14 Above East Wash	1.5	2.1	2.5	2.65
14 Above West Wash	1.5	2.1	2.5	2.65
15	1.4	2.0	2.2	2.5
16	1.45	2.05	2.3	2.5
17	1.45	2.05	2.4	2.55
18	1.5	2.1	2.4	2.5
19	1.5	2.1	2.4	2.5
20	1.5	2.1	2.5	2.65
21	1.5	2.1	2.5	2.65
22	1.5	2.15	2.5	2.7
23	1.5	2.15	2.5	2.7
24	1.5	2.15	2.5	2.7
25	1.6	2.2	2.6	2.8
26	1.6	2.2	2.6	2.8

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 35

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

6-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
9	.98	1.37	1.55	1.75
10	1.0	1.4	1.6	1.8
11	1.0	1.4	1.6	1.8
12	1.0	1.4	1.6	1.8
13 Above Upper Peavine	.98	1.37	1.5	1.75
13 Above Lower Peavine	.98	1.37	1.5	1.75
14 Above East Wash	.96	1.35	1.5	1.7
14 Above West Wash	.96	1.35	1.5	1.7
15	.97	1.3	1.4	1.6
16	.95	1.32	1.45	1.6
17	.95	1.35	1.45	1.55
18	.95	1.35	1.5	1.7
19	.95	1.35	1.5	1.7
20	.96	1.35	1.5	1.7
21	.96	1.35	1.5	1.7
22	.97	1.37	1.5	1.7
23	.97	1.37	1.5	1.7
24	.97	1.37	1.5	1.7
25	.99	1.4	1.55	1.75
26	.99	1.4	1.55	1.75

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 36

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

3-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
9	.82	1.11	1.26	1.46
10	.85	1.15	1.30	1.49
11	.85	1.15	1.30	1.49
12	.85	1.15	1.30	1.49
13 Above Upper Peavine	.81	1.10	1.25	1.46
13 Above Lower Peavine	.81	1.10	1.25	1.46
14 Above East Wash	.81	1.09	1.23	1.42
14 Above West Wash	.81	1.09	1.23	1.42
15	.80	1.08	1.20	1.36
16	.80	1.08	1.20	1.35
17	.80	1.06	1.18	1.31
18	.81	1.10	1.24	1.44
19	.81	1.10	1.25	1.42
20	.81	1.10	1.25	1.42
21	.81	1.10	1.25	1.42
22	.81	1.10	1.25	1.42
23	.81	1.10	1.25	1.42
24	.81	1.10	1.25	1.42
25	.82	1.11	1.27	1.45
26	.82	1.11	1.27	1.45

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 37

NORTH OF THE TRUCKEE RIVER REGION

RAINFALL DATA WITH AREAL DISTRIBUTION REDUCTION FACTORS
BASED ON WINZLER AND KELLY

COMPUTATION POINT	STORM DURATION HOURS	AREAL RED. FACTOR	AFFECTED COMPUTATION POINT NO.	5-YEAR STORM IN	25-YEAR STORM IN	50-YEAR STORM IN	100-YEAR STORM IN
17	24	99%	15	1.39	1.98	2.18	2.48
		99%	16	1.44	2.03	2.28	2.48
		99%	17	1.44	2.03	2.38	2.52
17	6	98%	15	0.95	1.27	1.37	1.57
		98%	16	0.93	1.29	1.42	1.57
		98%	17	0.93	1.32	1.42	1.52
17	3	97%	15	0.78	1.05	1.16	1.32
		97%	16	0.78	1.05	1.16	1.31
		97%	17	0.78	1.03	1.14	1.27

TABLE 38

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

24-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	309	603	825	940
10	66	116	150	168
11	101	210	291	334
12	100	214	301	346
13	0	72	74	75
14	0	45	59	60
15	196	374	438	535
16	208	395	462	562
17	215	402	472	573
18	23	55	74	81
19	59	141	189	206
20	29	63	88	98
21	66	126	169	186
22	61	122	157	178
23	88	173	222	251
24	126	243	311	351
25	48	104	146	168
26	70	143	198	227

TABLE 39

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

6-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

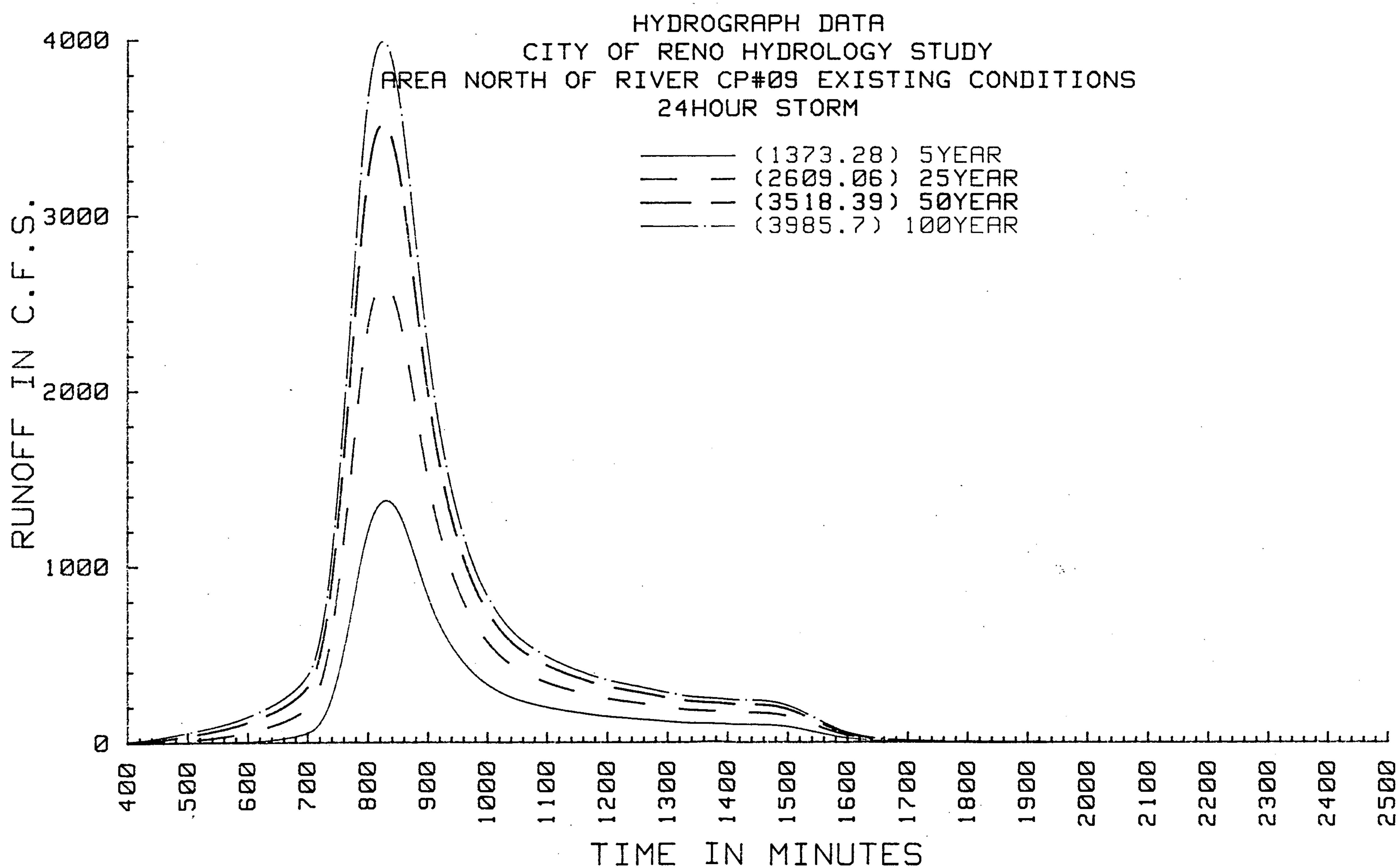
COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	102	243	328	424
10	16	37	49	62
11	26	69	98	129
12	28	74	105	139
13	0	0	0	23
14	0	0	0	0
15	114	206	237	301
16	115	210	241	307
17	110	201	232	297
18	5	16	21	30
19	16	47	62	86
20	7	20	26	35
21	17	42	53	70
22	17	42	52	68
23	30	70	85	110
24	54	116	139	176
25	9	29	38	53
26	18	49	63	85

TABLE 40

NORTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 9 THROUGH 26

3-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
9	87	198	267	365
10	11	24	32	43
11	23	57	78	108
12	23	61	84	117
13	0	0	0	0
14	0	0	0	0
15	83	162	201	255
16	83	162	200	255
17	78	153	187	240
18	4	12	17	26
19	12	36	52	74
20	6	15	21	29
21	14	31	41	55
22	13	29	39	52
23	25	54	72	94
24	46	92	120	154
25	7	20	29	41
26	14	36	51	71


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#09 EXISTING CONDITIONS
24HOUR STORM
(1373.28) 5YEAR
(2609.06) 25YEAR
(3518.39) 50YEAR
(3985.7) 100YEAR
RUNOFF IN C.F.S.
0
1000
2000
3000
4000
400
500
600
700
800
900
1000
1100
1200
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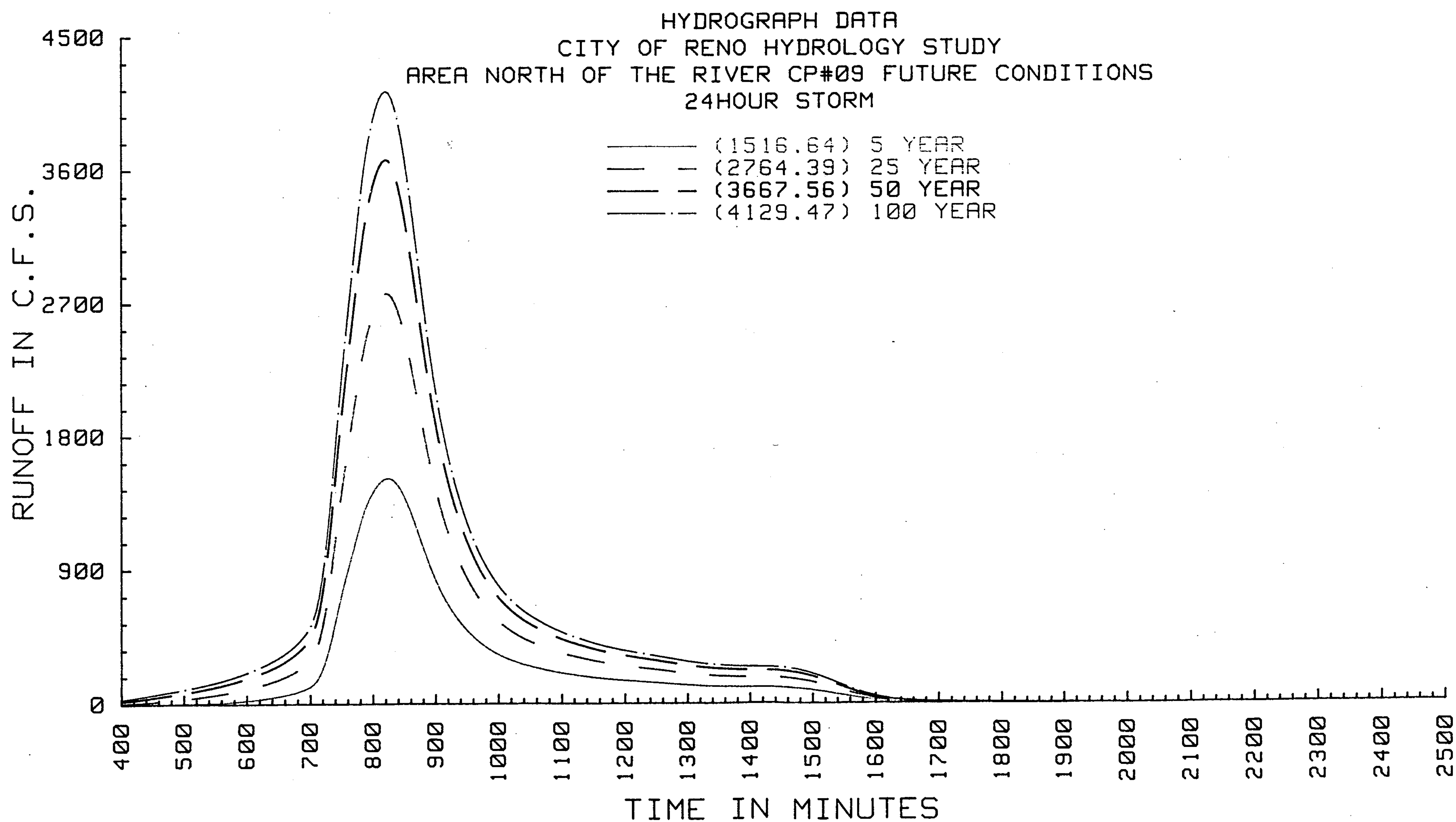
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#09 FUTURE CONDITIONS
24HOUR STORM
(1516.64) 5 YEAR
(2764.39) 25 YEAR
(3667.56) 50 YEAR
(4129.47) 100 YEAR
RUNOFF IN C.F.S.
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3600
2700
1800
900
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500
600
700
800
900
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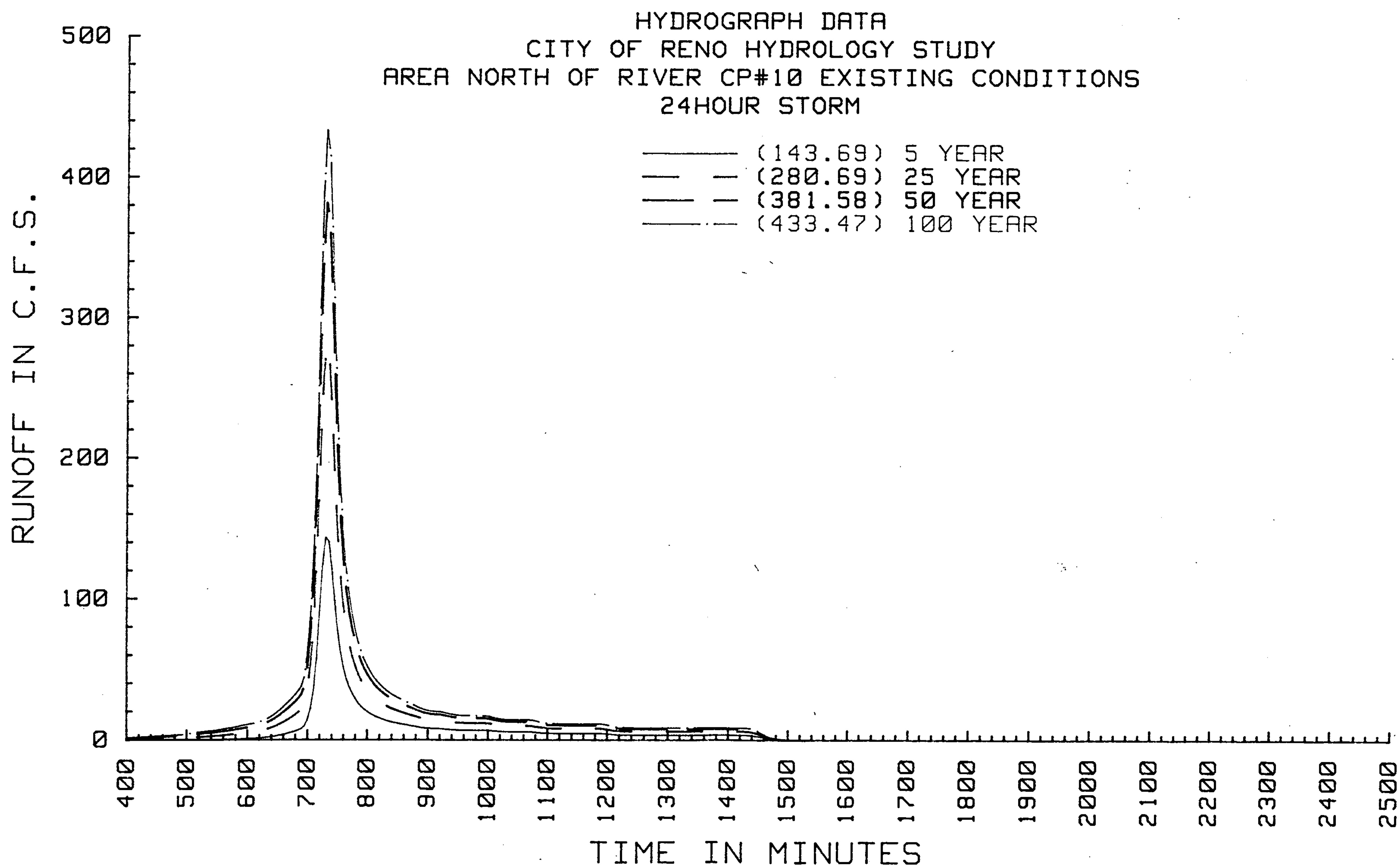
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#10 EXISTING CONDITIONS
24HOUR STORM
(143.69) 5 YEAR
(280.69) 25 YEAR
(381.58) 50 YEAR
(433.47) 100 YEAR
RUNOFF IN C.F.S.
0
100
200
300
400
500
400
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700
800
900
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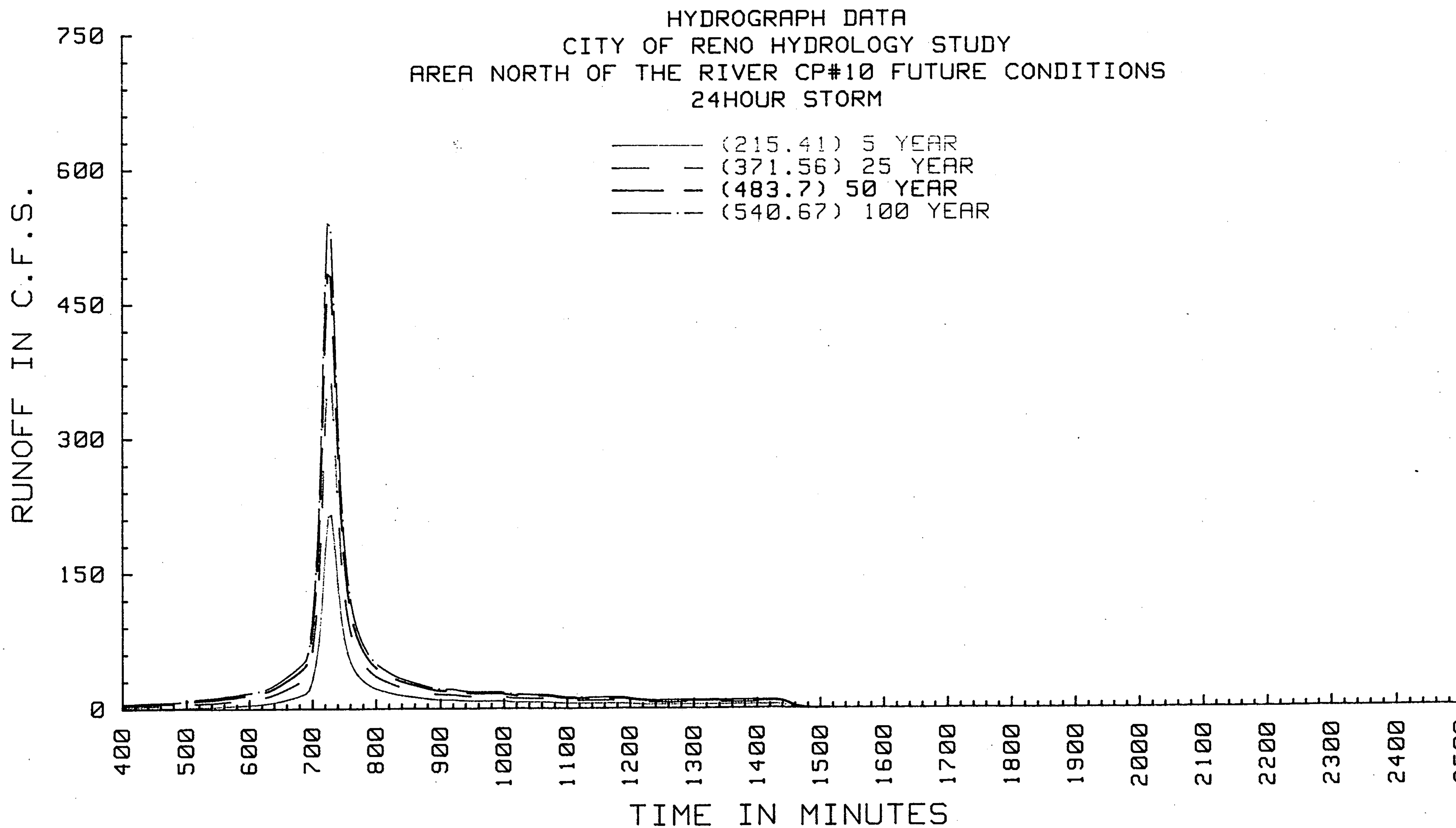
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#10 FUTURE CONDITIONS
24HOUR STORM
(215.41) 5 YEAR
(371.56) 25 YEAR
(483.7) 50 YEAR
(540.67) 100 YEAR
RUNOFF IN C.F.S.
750
600
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300
150
0
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600
700
800
900
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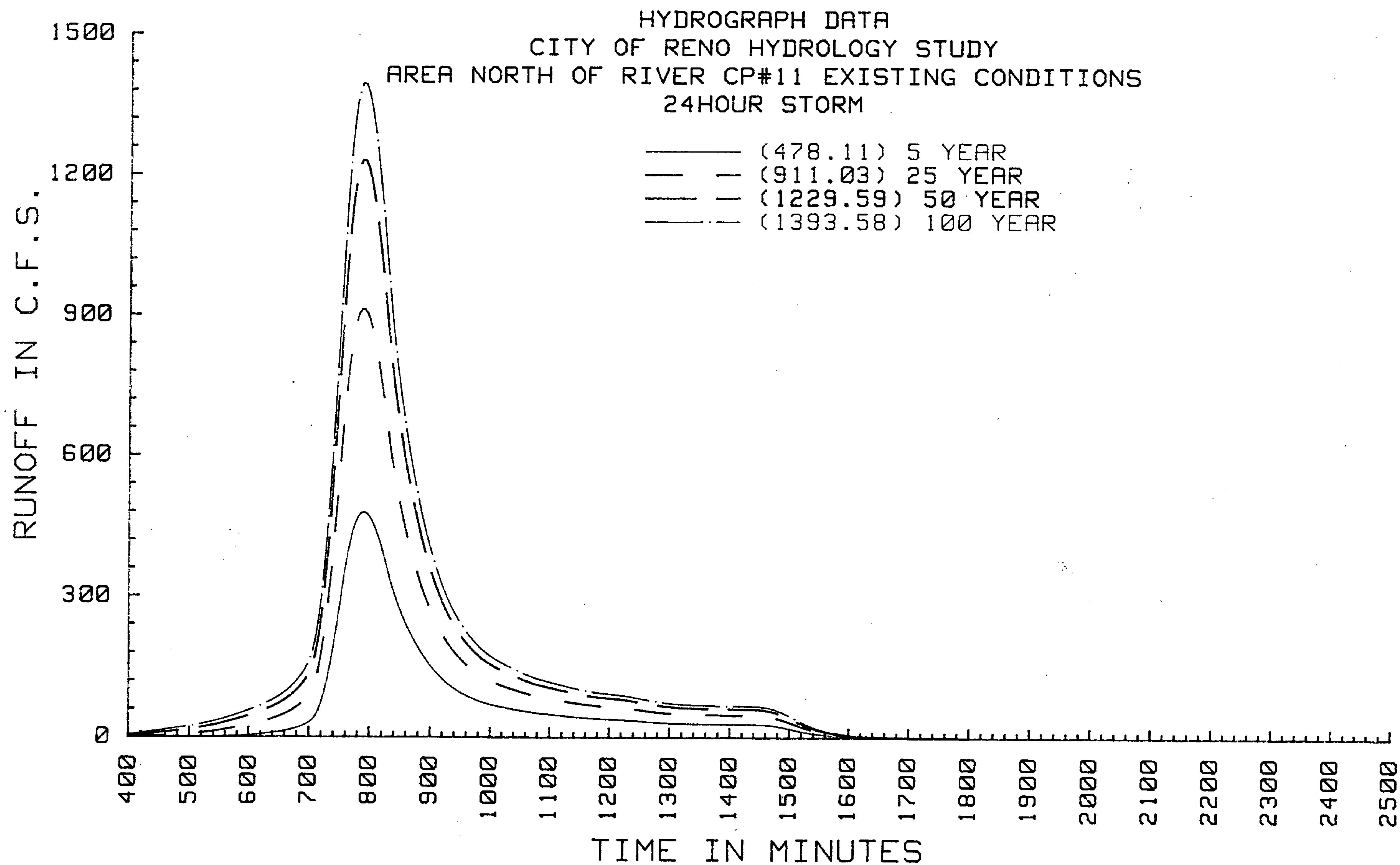
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#11 EXISTING CONDITIONS
24HOUR STORM
(478.11) 5 YEAR
(911.03) 25 YEAR
(1229.59) 50 YEAR
(1393.58) 100 YEAR
RUNOFF IN C.F.S.
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1200
900
600
300
0
400
500
600
700
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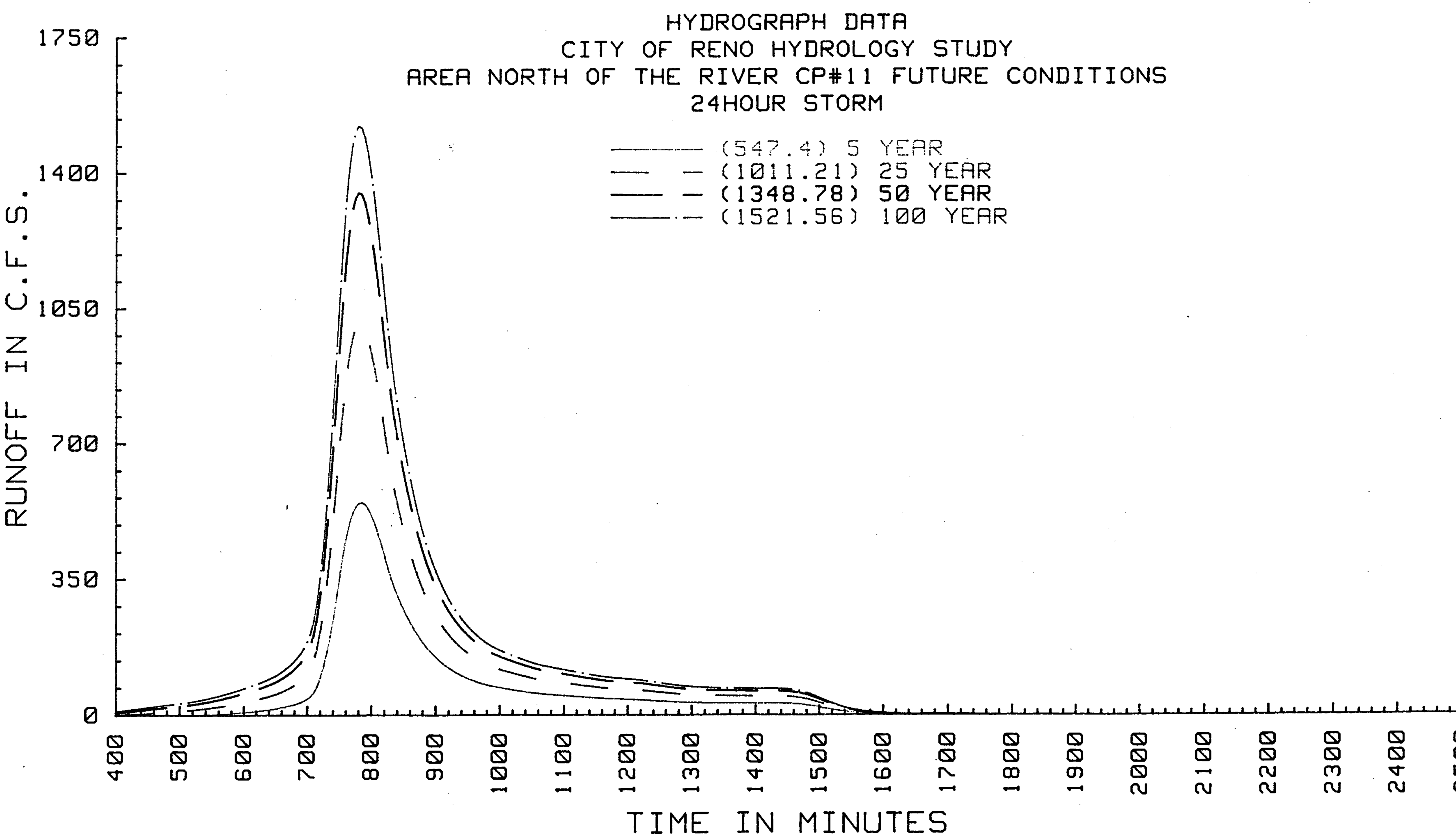
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#11 FUTURE CONDITIONS
24HOUR STORM
(547.4) 5 YEAR
(1011.21) 25 YEAR
(1348.78) 50 YEAR
(1521.56) 100 YEAR
RUNOFF IN C.F.S.
0
350
700
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1400
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400
500
600
700
800
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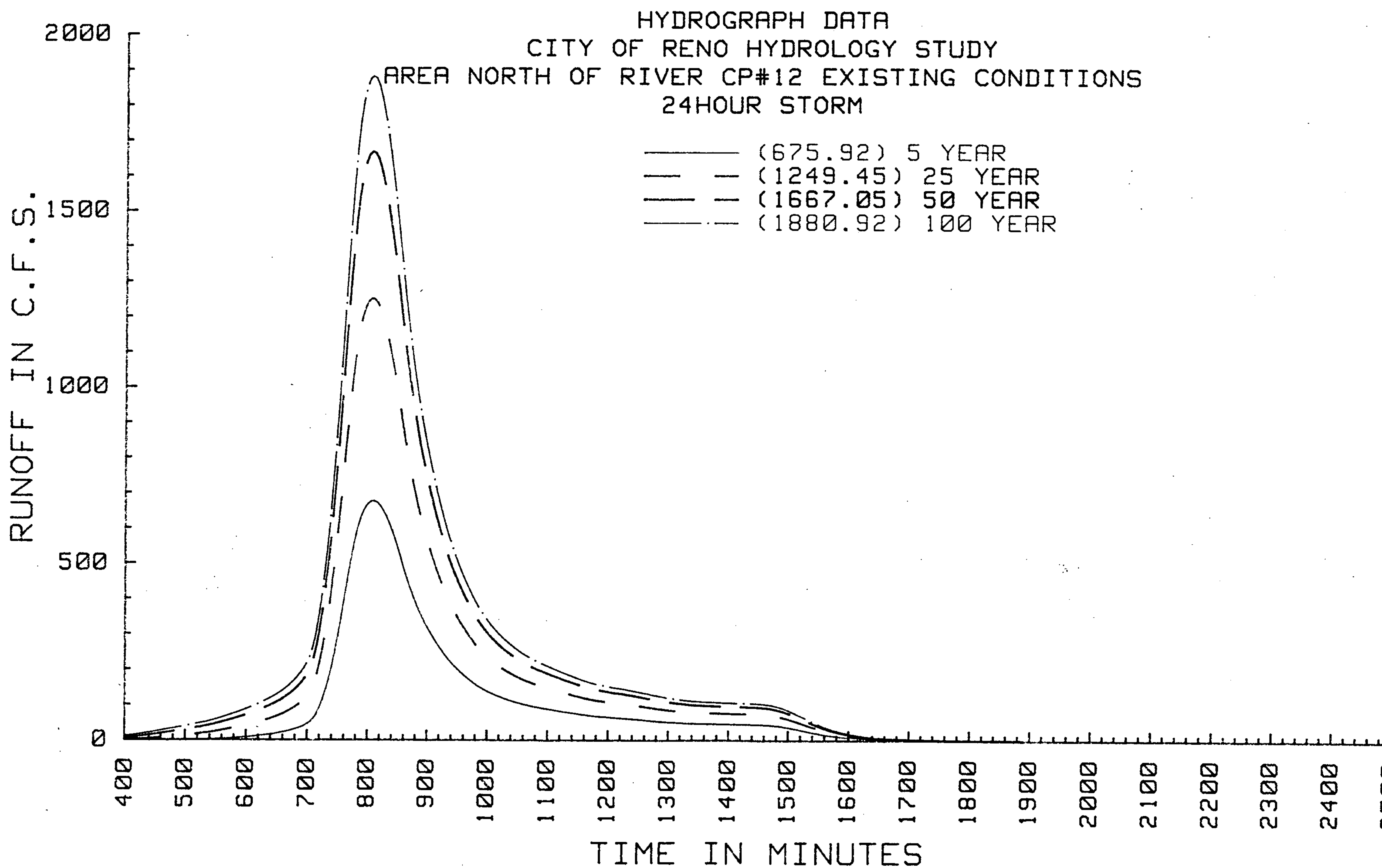
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#12 EXISTING CONDITIONS
24HOUR STORM
(675.92) 5 YEAR
(1249.45) 25 YEAR
(1667.05) 50 YEAR
(1880.92) 100 YEAR
RUNOFF IN C.F.S.
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1500
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500
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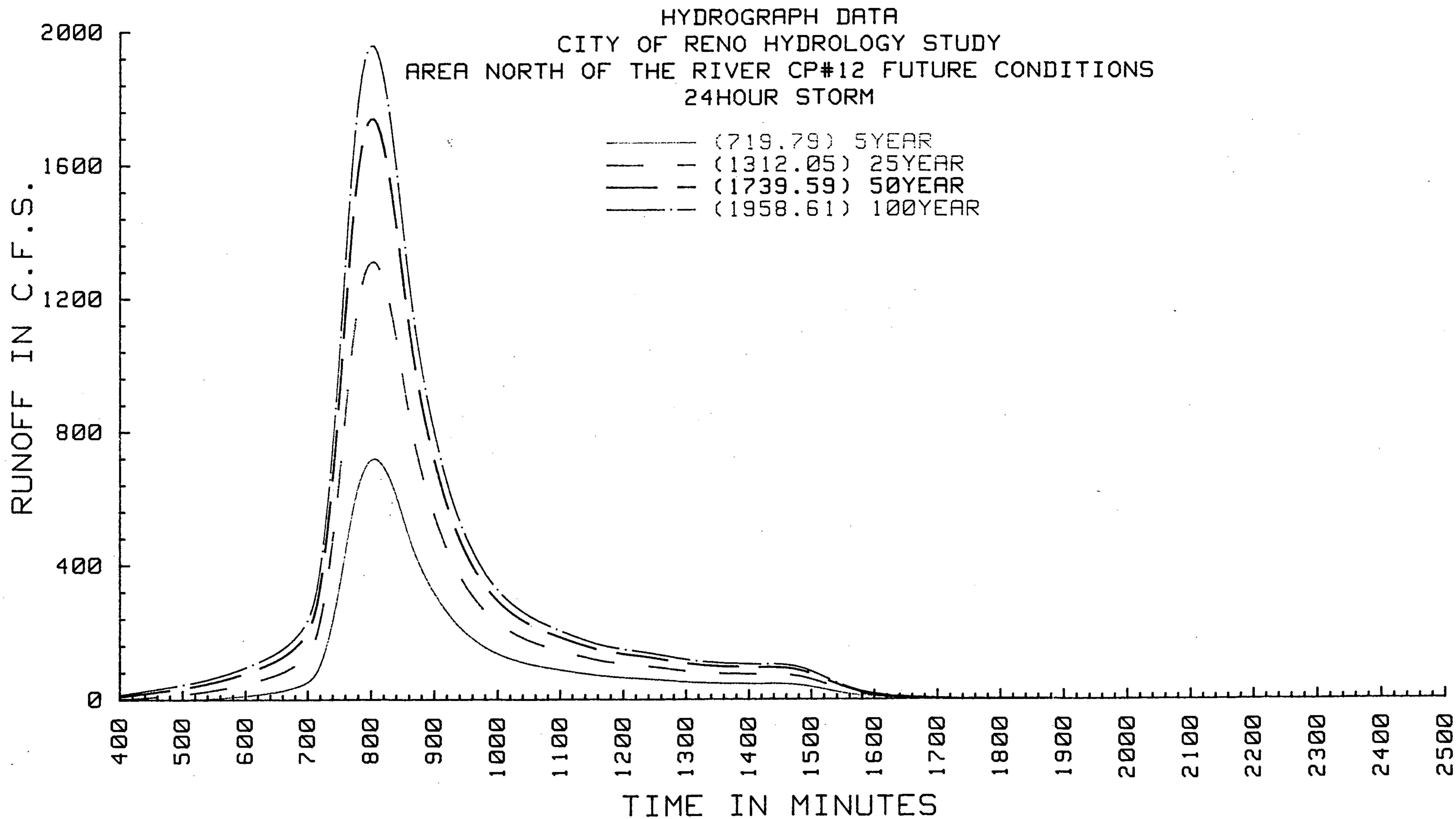
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#12 FUTURE CONDITIONS
24HOUR STORM
(719.79) 5YEAR
(1312.05) 25YEAR
(1739.59) 50YEAR
(1958.61) 100YEAR
RUNOFF IN C.F.S.
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400
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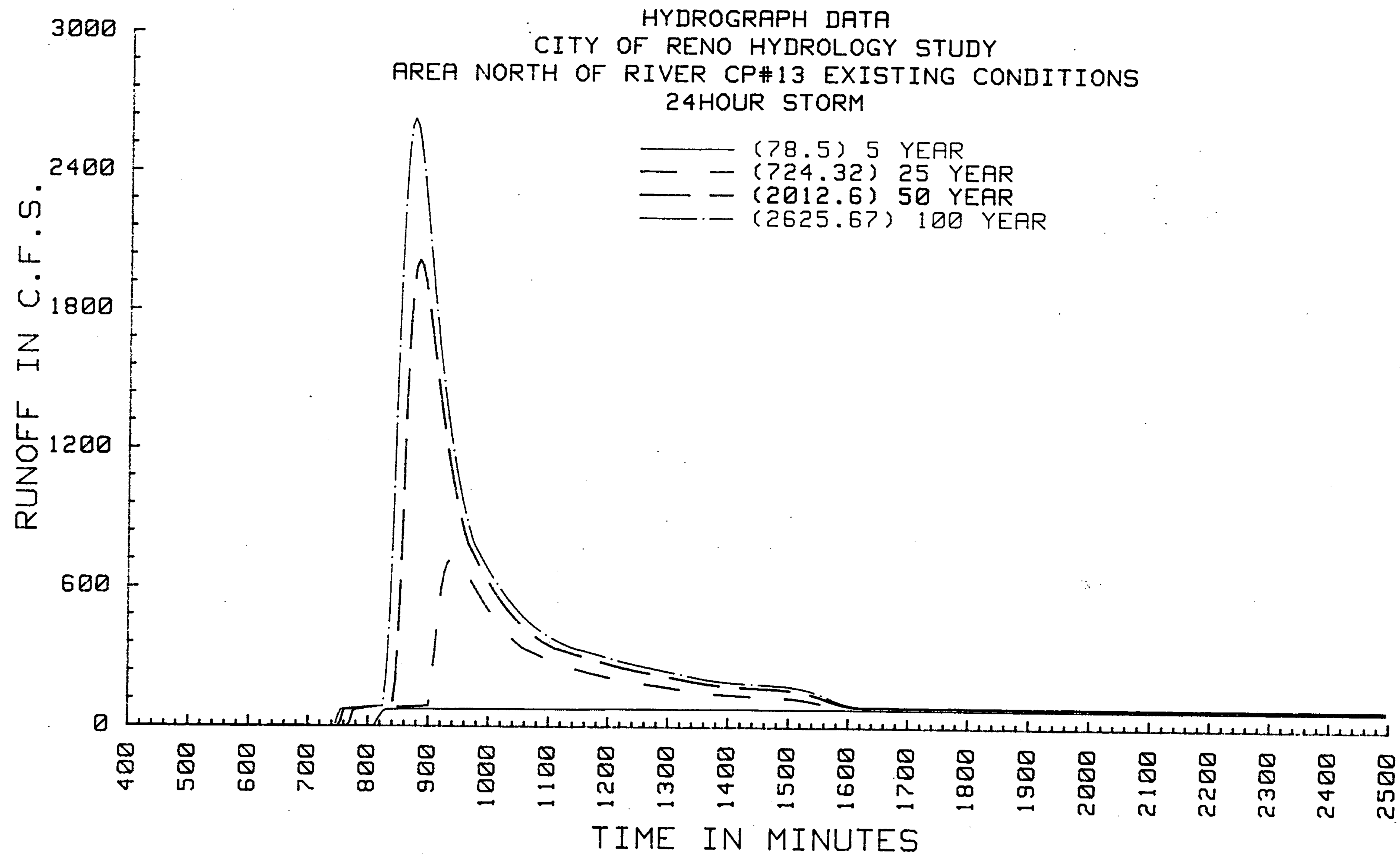
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#13 EXISTING CONDITIONS
24HOUR STORM
(78.5) 5 YEAR
(724.32) 25 YEAR
(2012.6) 50 YEAR
(2625.67) 100 YEAR
RUNOFF IN C.F.S.
3000
2400
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1200
600
0
400
500
600
700
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900
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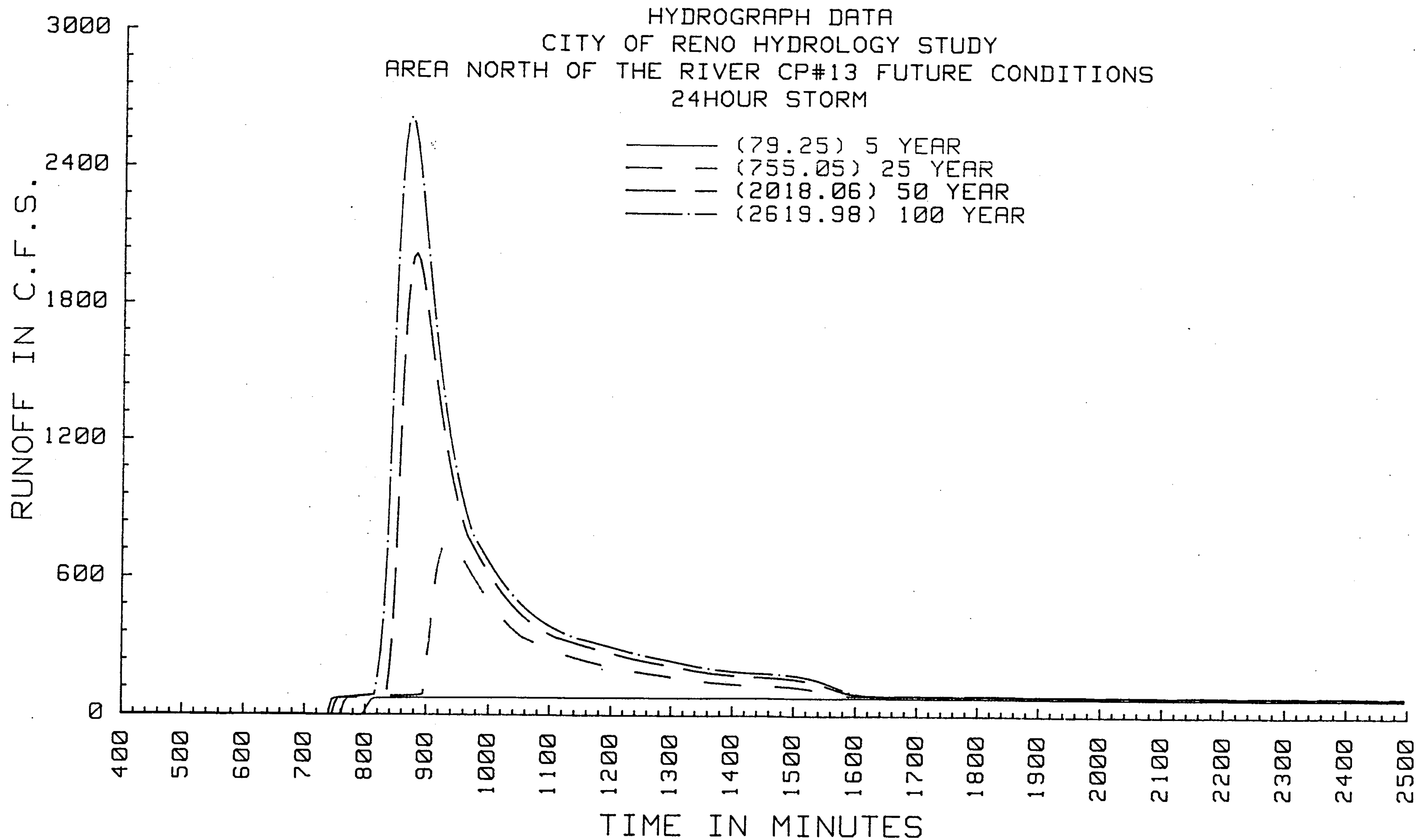
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#13 FUTURE CONDITIONS
24HOUR STORM
(79.25) 5 YEAR
(755.05) 25 YEAR
(2018.06) 50 YEAR
(2619.98) 100 YEAR
RUNOFF IN C.F.S.
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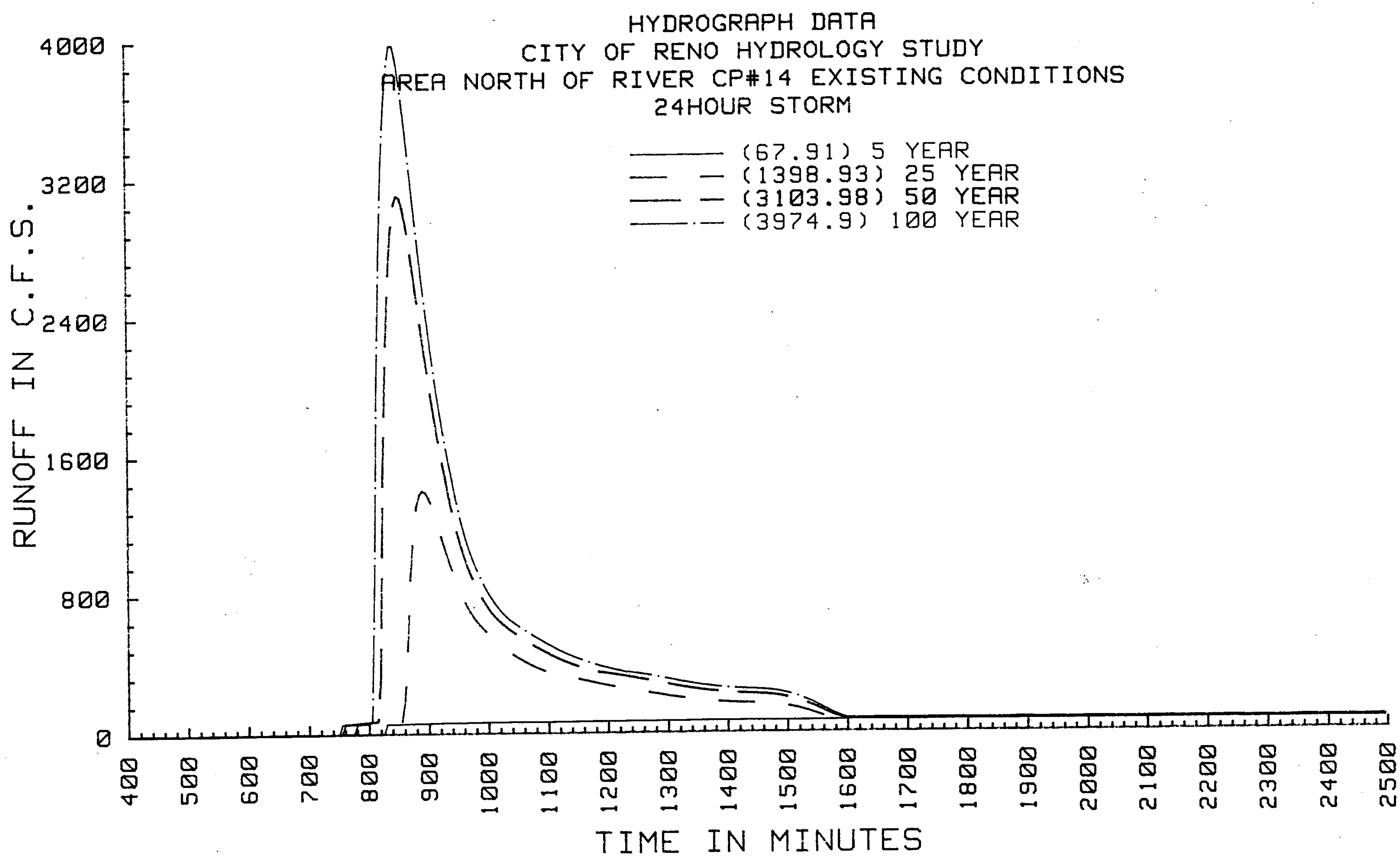
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#14 EXISTING CONDITIONS
24HOUR STORM
(67.91) 5 YEAR
(1398.93) 25 YEAR
(3103.98) 50 YEAR
(3974.9) 100 YEAR
RUNOFF IN C.F.S.
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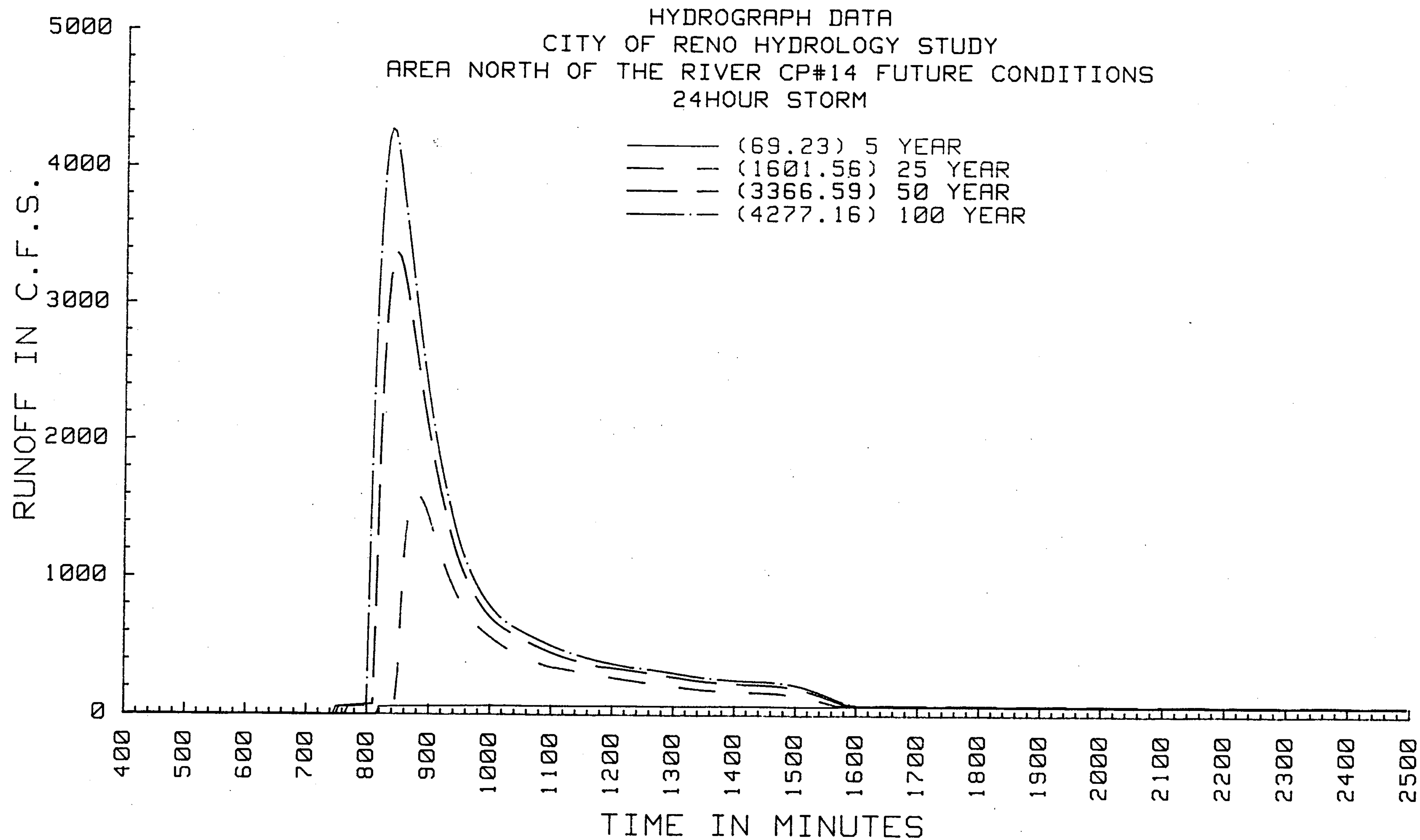
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#14 FUTURE CONDITIONS
24HOUR STORM
(69.23) 5 YEAR
(1601.56) 25 YEAR
(3366.59) 50 YEAR
(4277.16) 100 YEAR
RUNOFF IN C.F.S.
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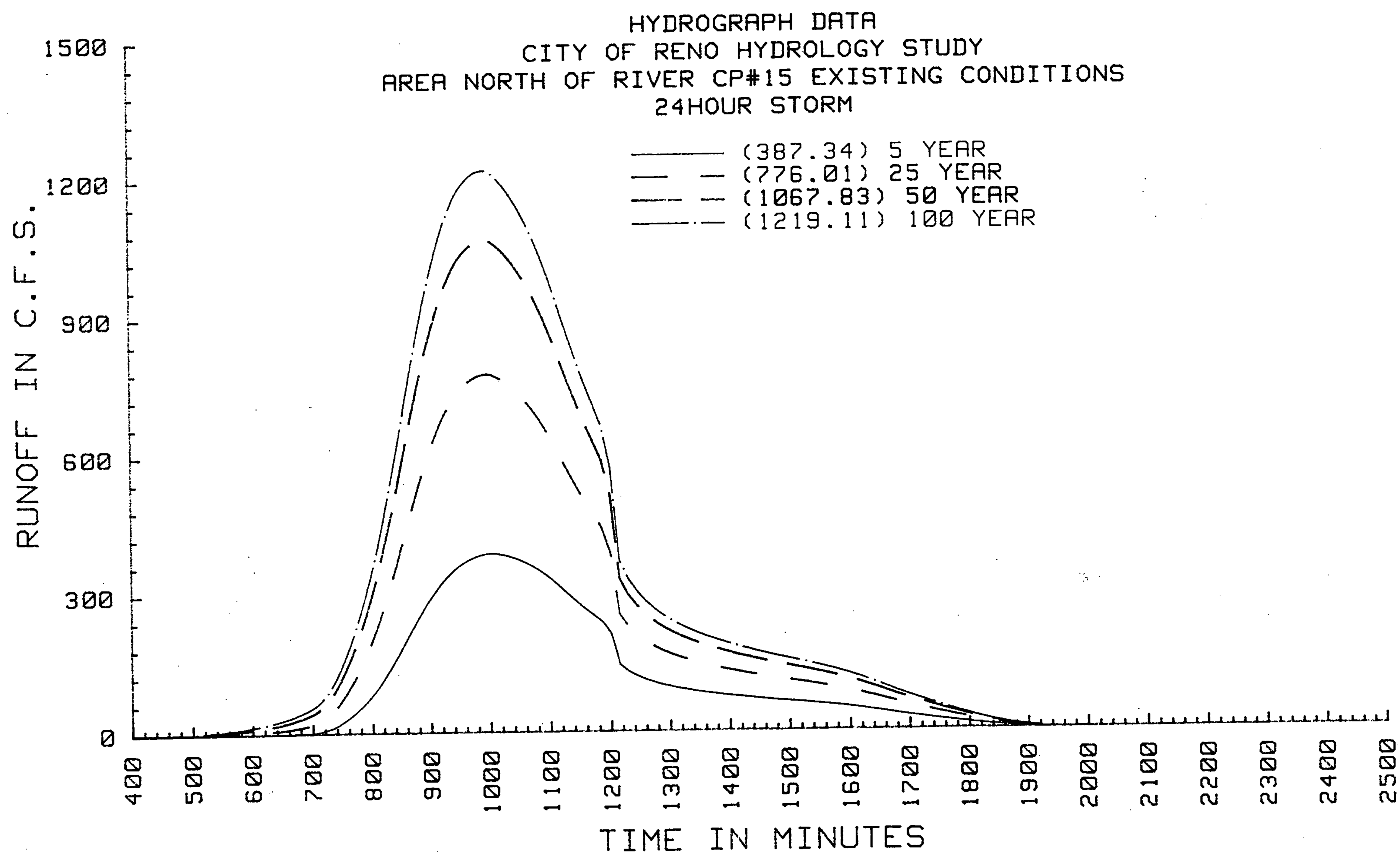
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#15 EXISTING CONDITIONS
24HOUR STORM
(387.34) 5 YEAR
(776.01) 25 YEAR
(1067.83) 50 YEAR
(1219.11) 100 YEAR
RUNOFF IN C.F.S.
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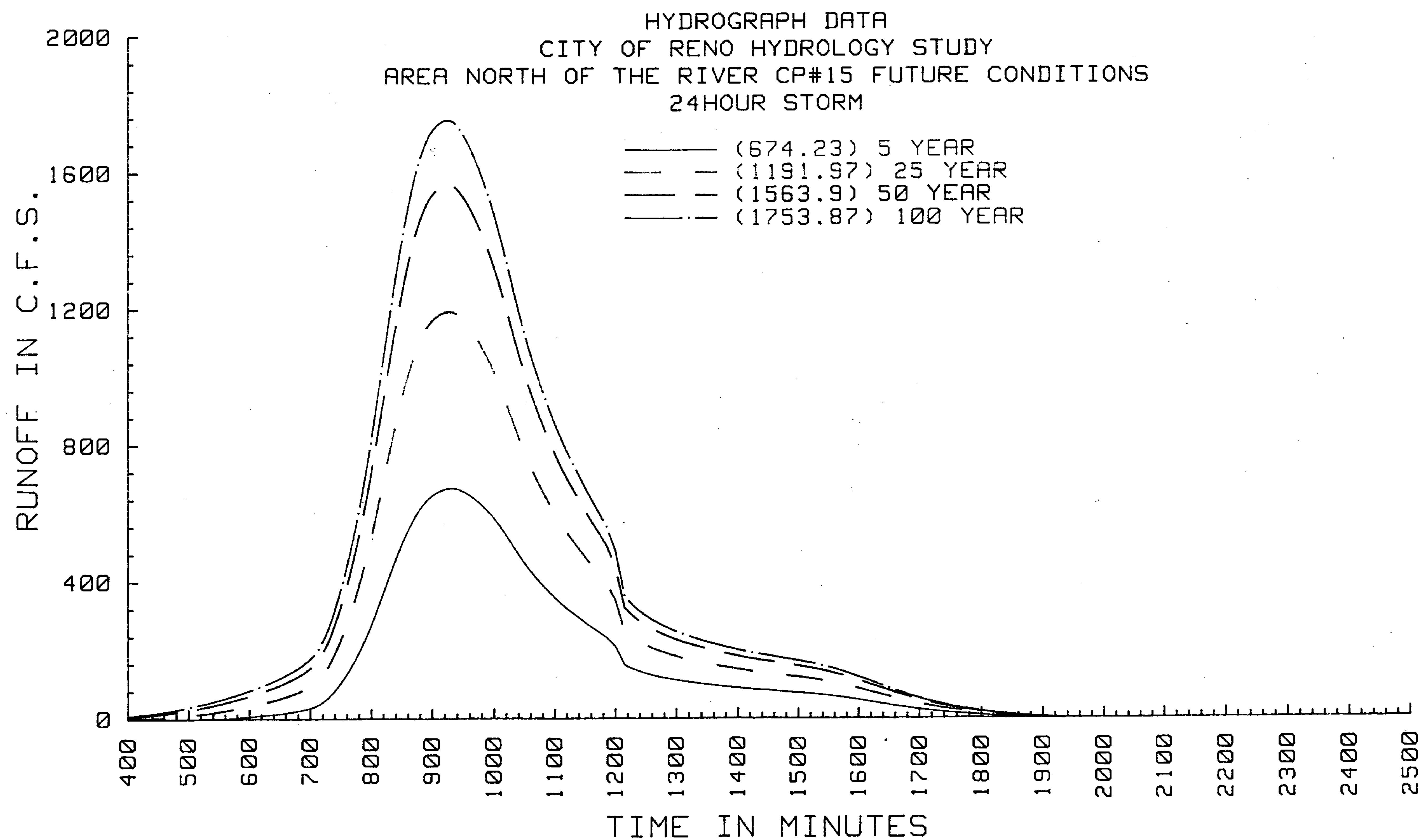
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#15 FUTURE CONDITIONS
24HOUR STORM
(674.23) 5 YEAR
(1191.97) 25 YEAR
(1563.9) 50 YEAR
(1753.87) 100 YEAR
RUNOFF IN C.F.S.
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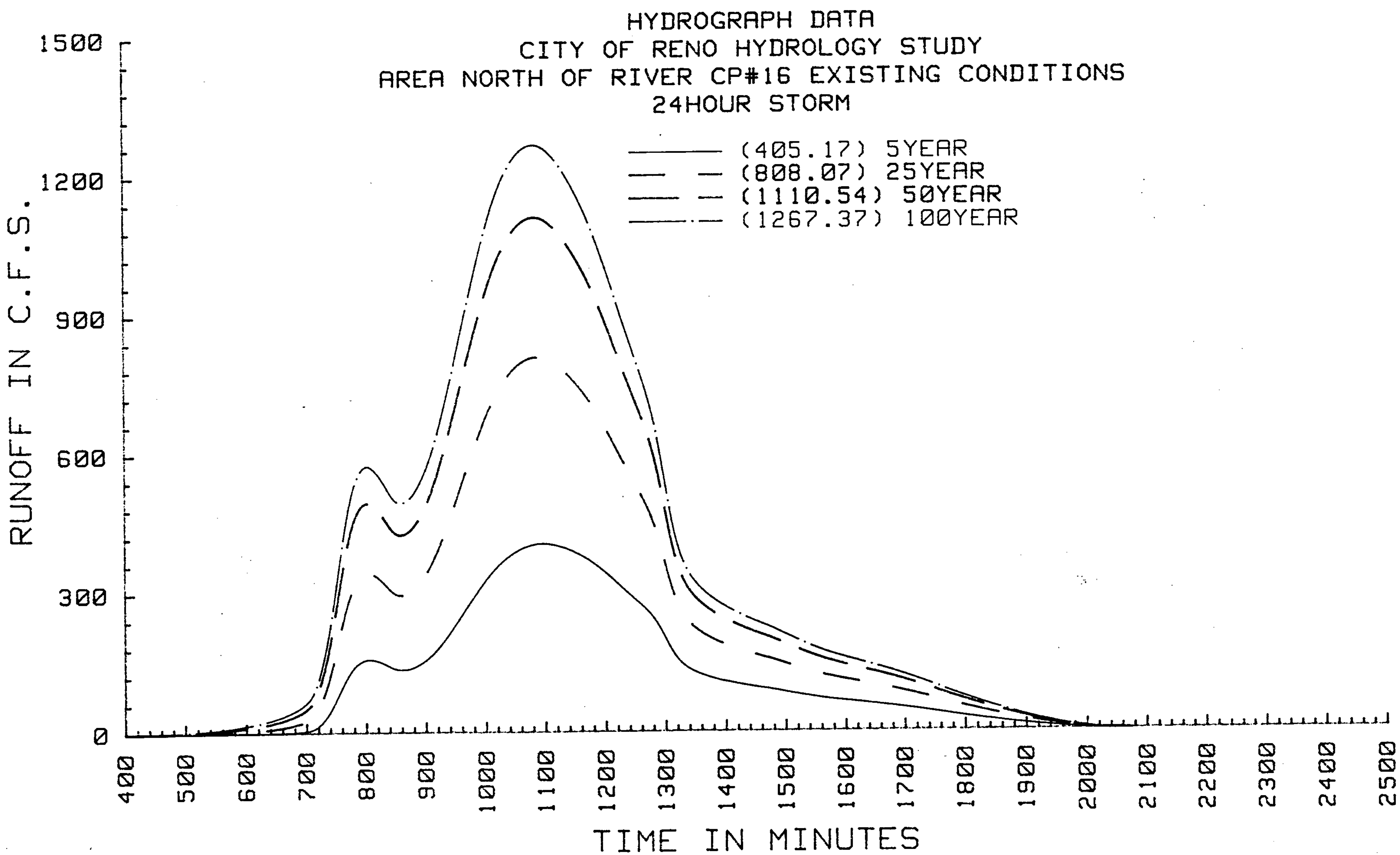
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#16 EXISTING CONDITIONS
24HOUR STORM
(405.17) 5YEAR
(808.07) 25YEAR
(1110.54) 50YEAR
(1267.37) 100YEAR
RUNOFF IN C.F.S.
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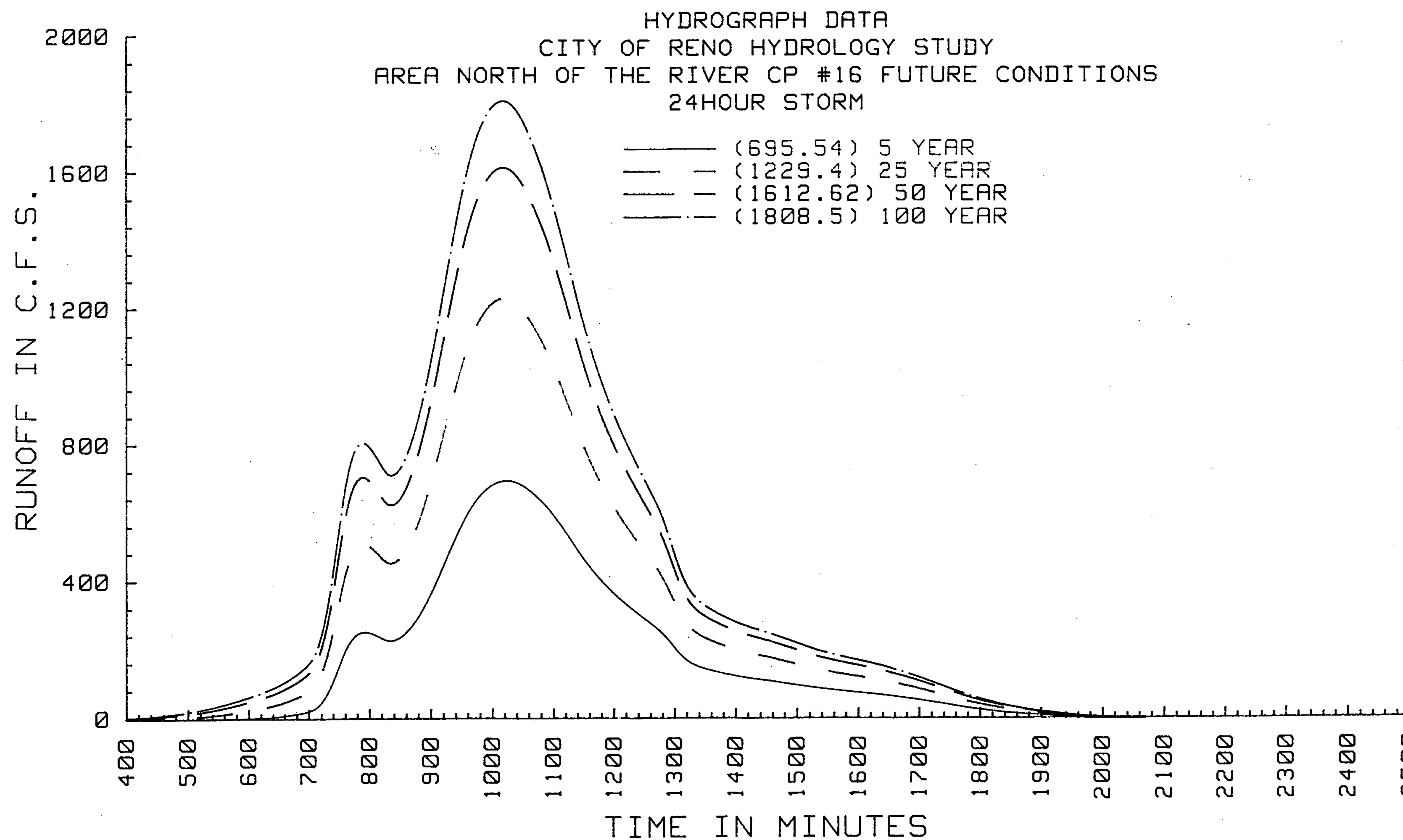
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP #16 FUTURE CONDITIONS
24HOUR STORM
(695.54) 5 YEAR
(1229.4) 25 YEAR
(1612.62) 50 YEAR
(1808.5) 100 YEAR
RUNOFF IN C.F.S.
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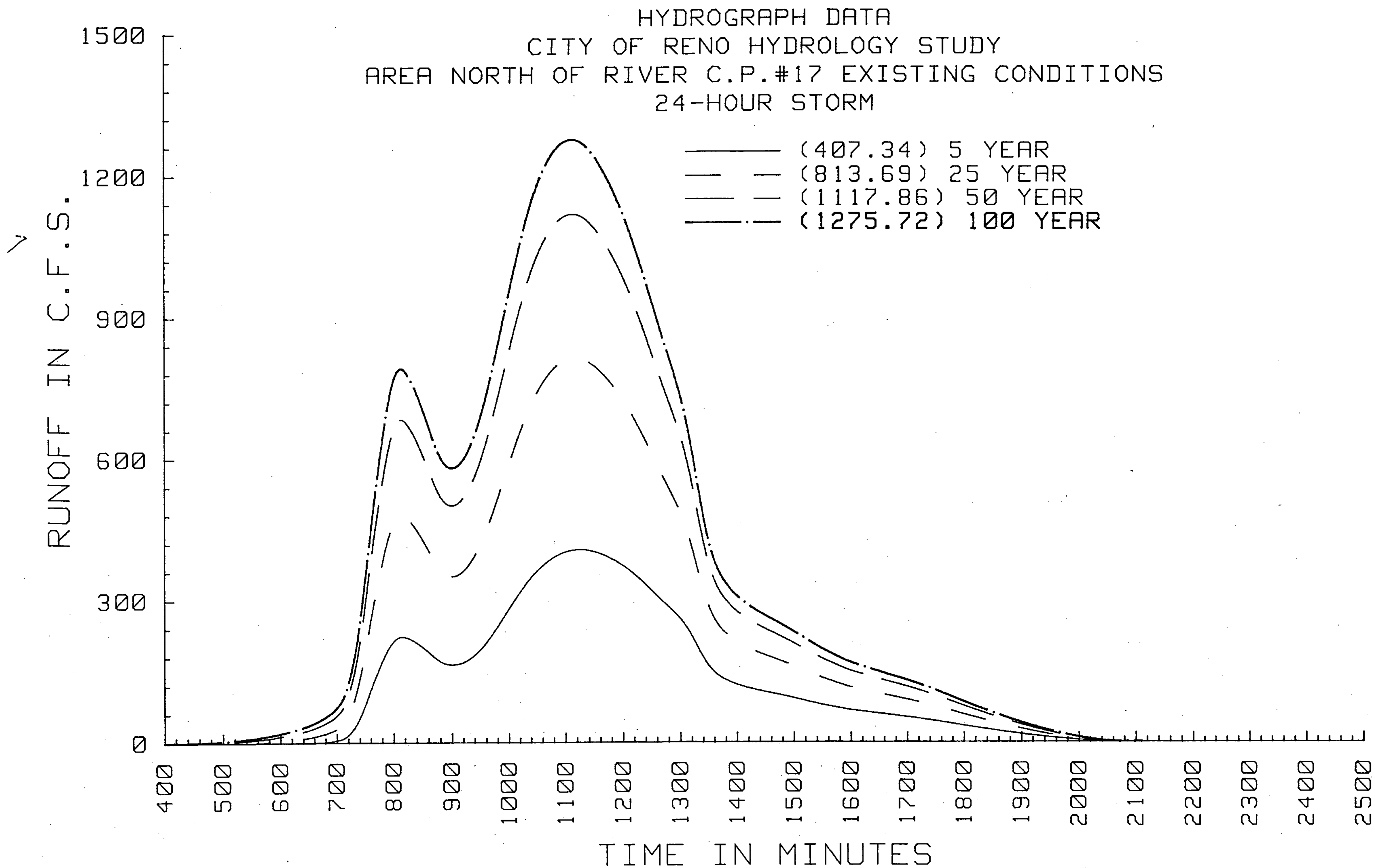
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER C.P.#17 EXISTING CONDITIONS
24-HOUR STORM
(407.34) 5 YEAR
(813.69) 25 YEAR
(1117.86) 50 YEAR
(1275.72) 100 YEAR
RUNOFF IN C.F.S.
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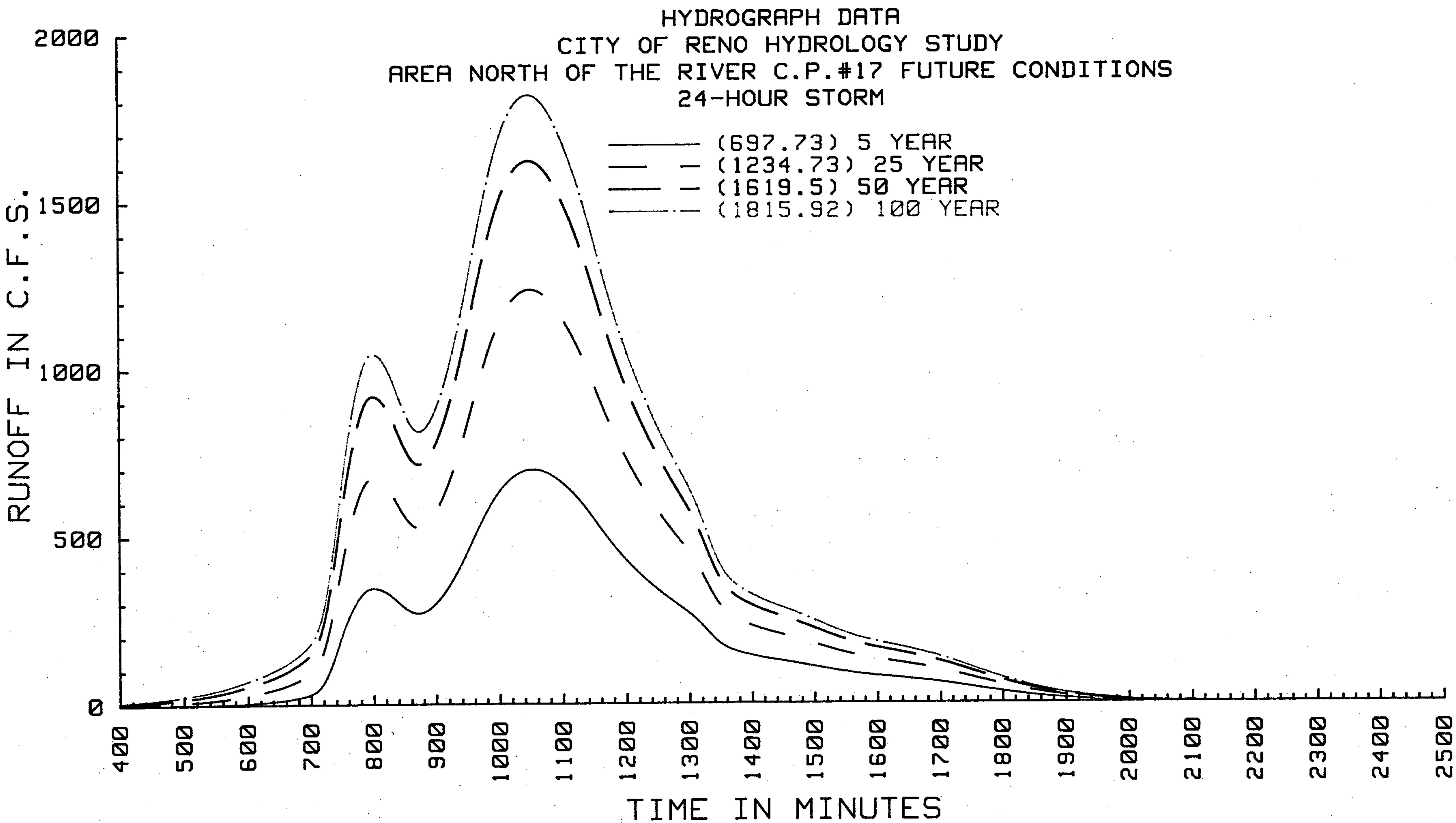
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER C.P.#17 FUTURE CONDITIONS
24-HOUR STORM
(697.73) 5 YEAR
(1234.73) 25 YEAR
(1619.5) 50 YEAR
(1815.92) 100 YEAR
RUNOFF IN C.F.S.
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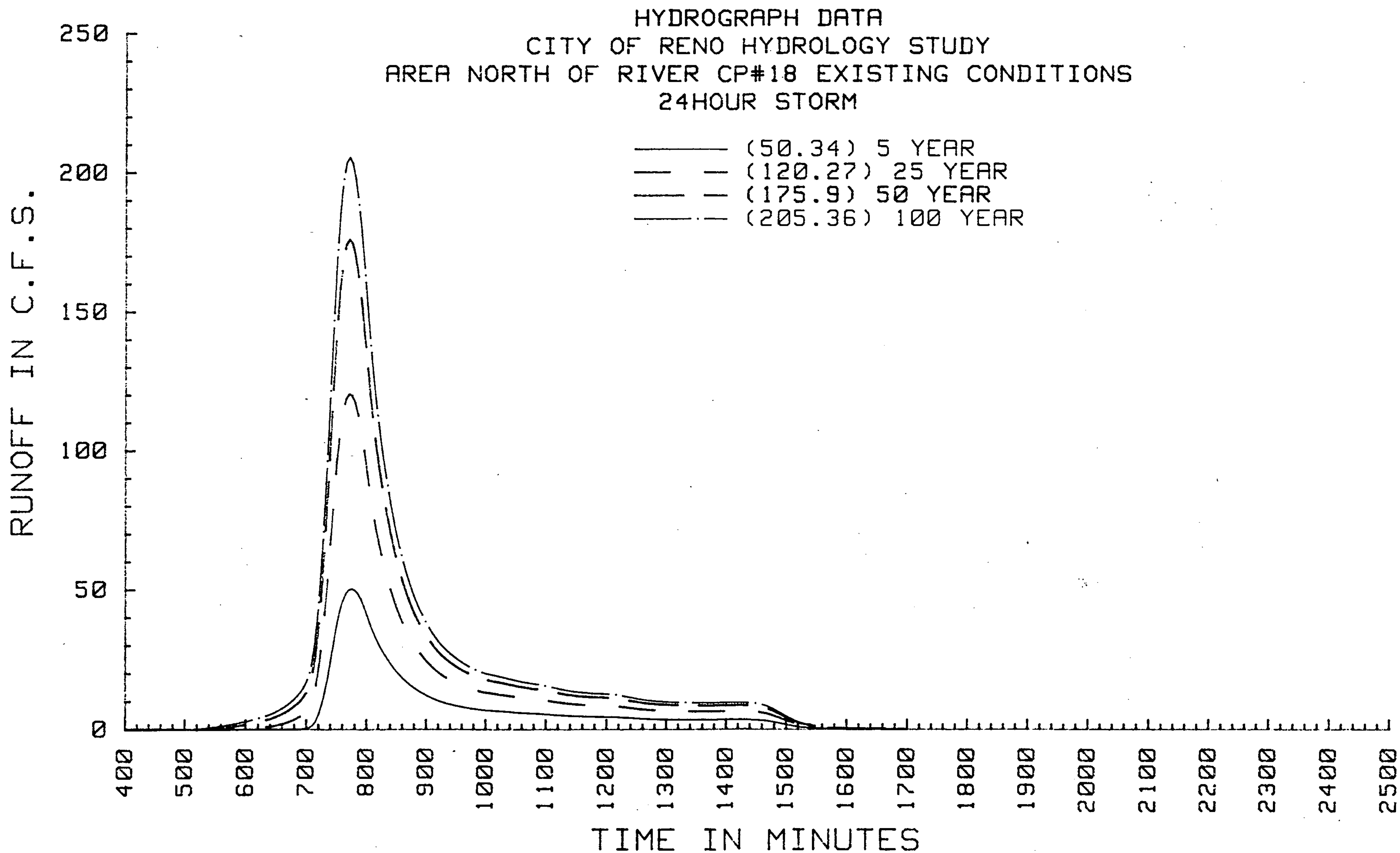
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#18 EXISTING CONDITIONS
24HOUR STORM
(50.34) 5 YEAR
(120.27) 25 YEAR
(175.9) 50 YEAR
(205.36) 100 YEAR
RUNOFF IN C.F.S.
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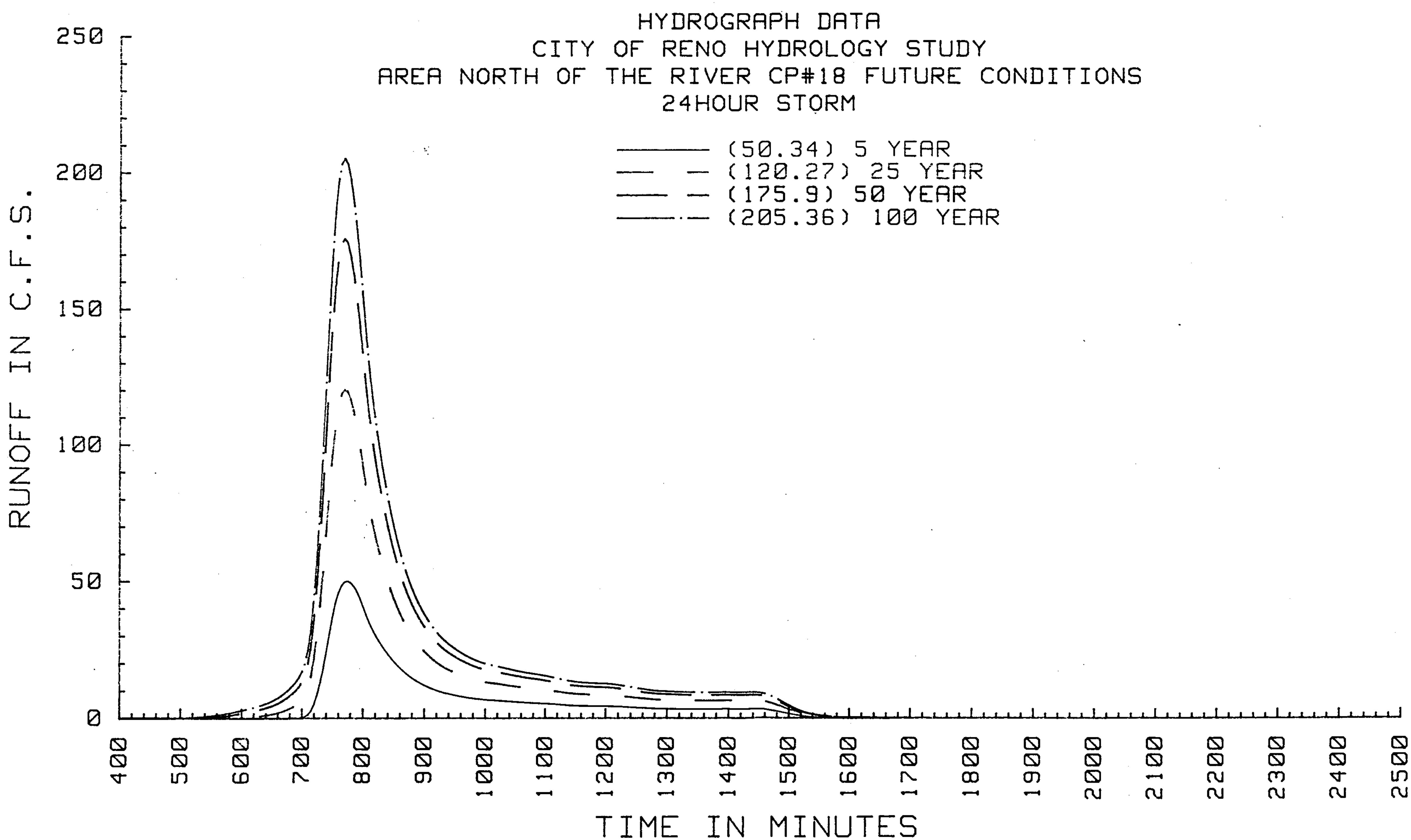
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#18 FUTURE CONDITIONS
24HOUR STORM
(50.34) 5 YEAR
(120.27) 25 YEAR
(175.9) 50 YEAR
(205.36) 100 YEAR
RUNOFF IN C.F.S.
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100
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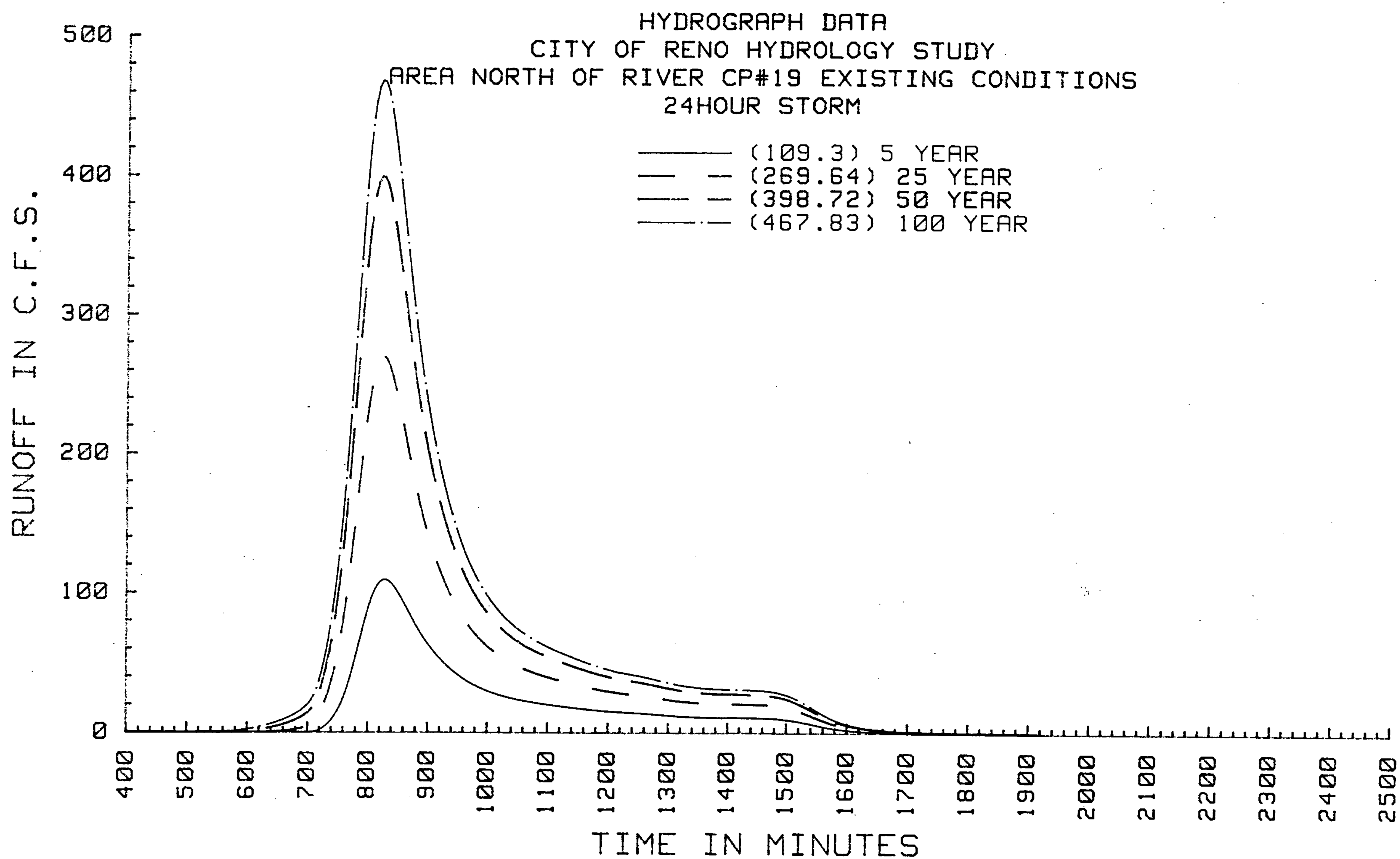
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#19 EXISTING CONDITIONS
24HOUR STORM
(109.3) 5 YEAR
(269.64) 25 YEAR
(398.72) 50 YEAR
(467.83) 100 YEAR
RUNOFF IN C.F.S.
TIME IN MINUTES
0
100
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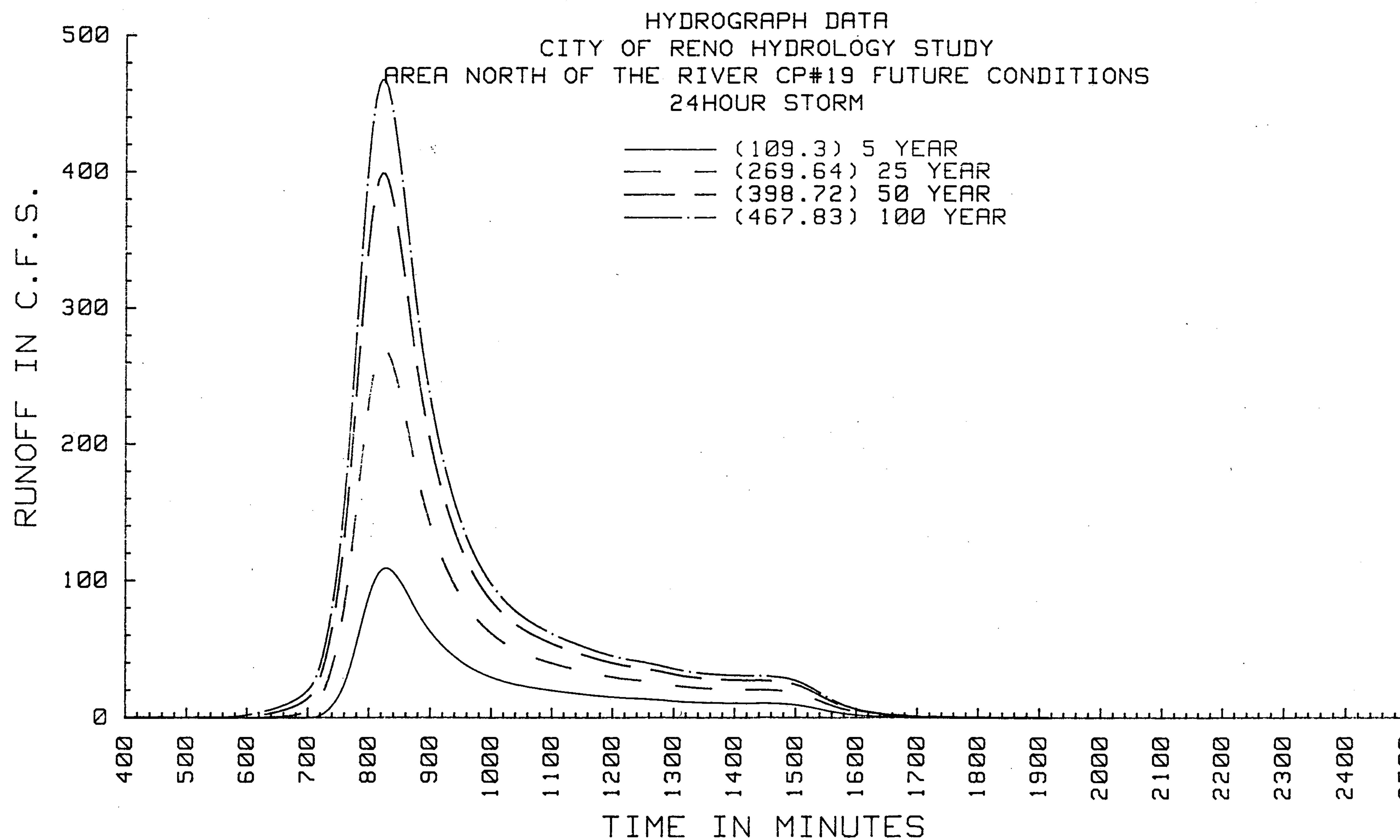
HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#19 FUTURE CONDITIONS
24HOUR STORM
(109.3) 5 YEAR
(269.64) 25 YEAR
(398.72) 50 YEAR
(467.83) 100 YEAR
RUNOFF IN C.F.S.
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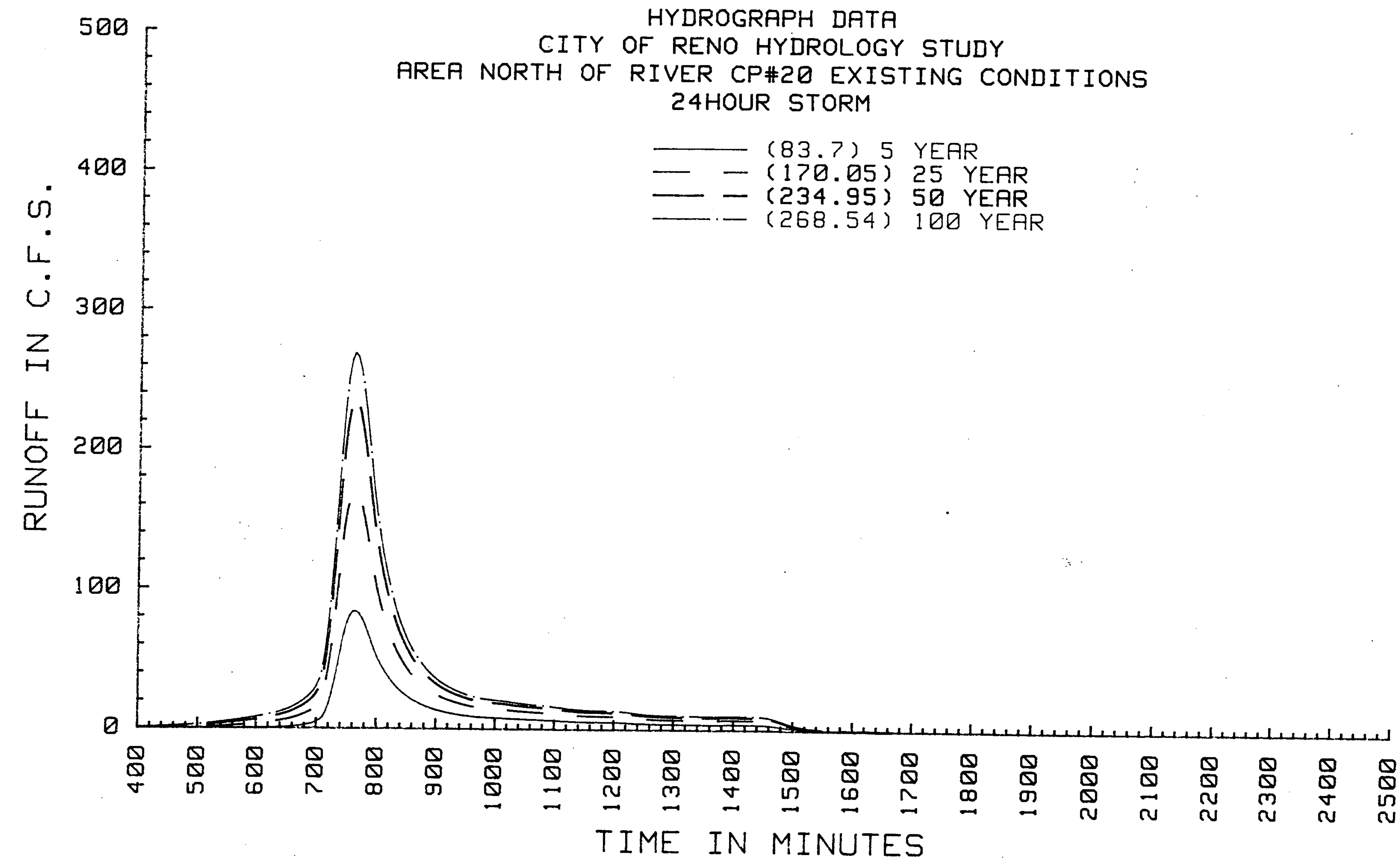
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#20 EXISTING CONDITIONS
24HOUR STORM
(83.7) 5 YEAR
(170.05) 25 YEAR
(234.95) 50 YEAR
(268.54) 100 YEAR
RUNOFF IN C.F.S.
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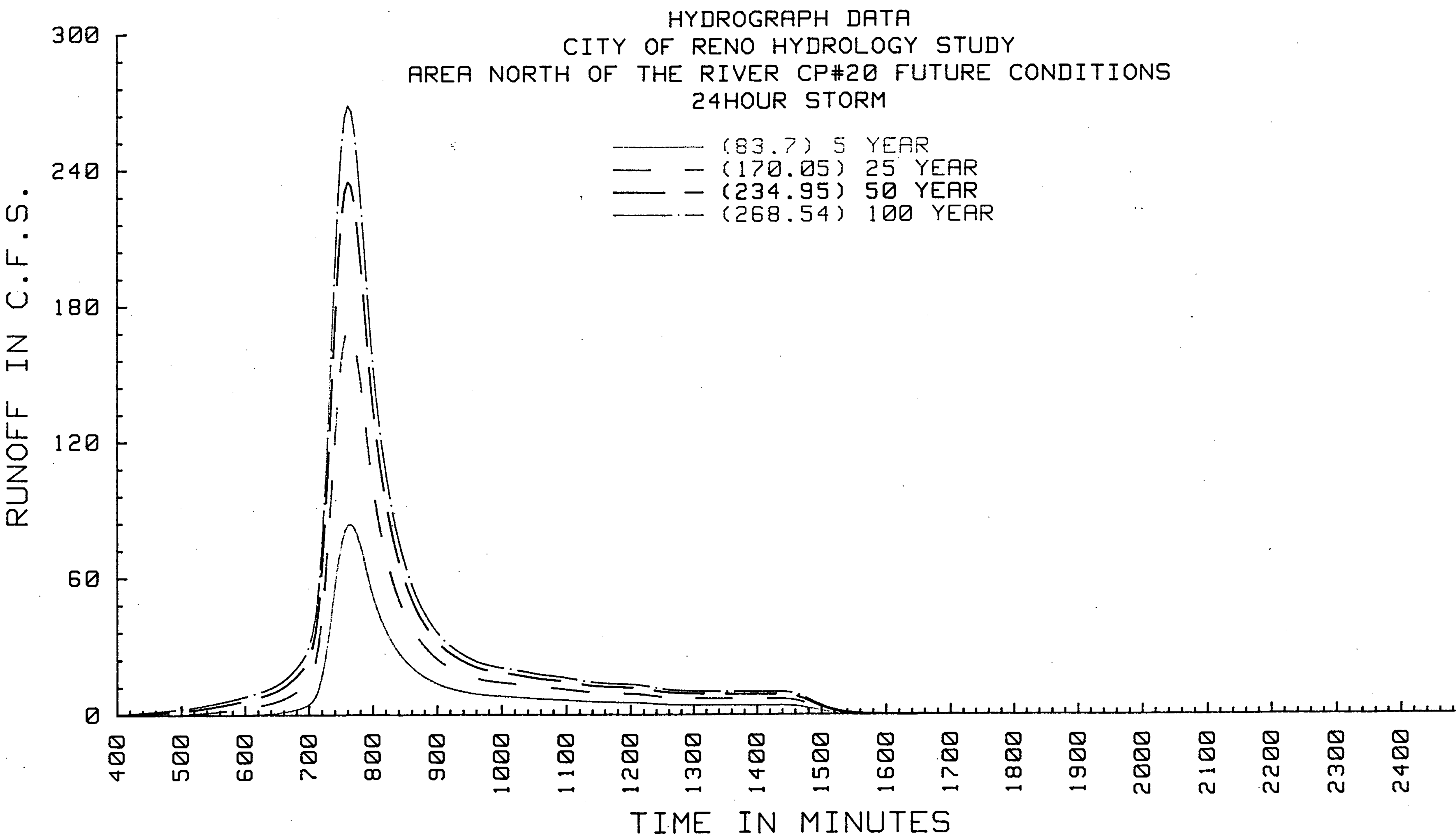
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#20 FUTURE CONDITIONS
24HOUR STORM
(83.7) 5 YEAR
(170.05) 25 YEAR
(234.95) 50 YEAR
(268.54) 100 YEAR
RUNOFF IN C.F.S.
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180
120
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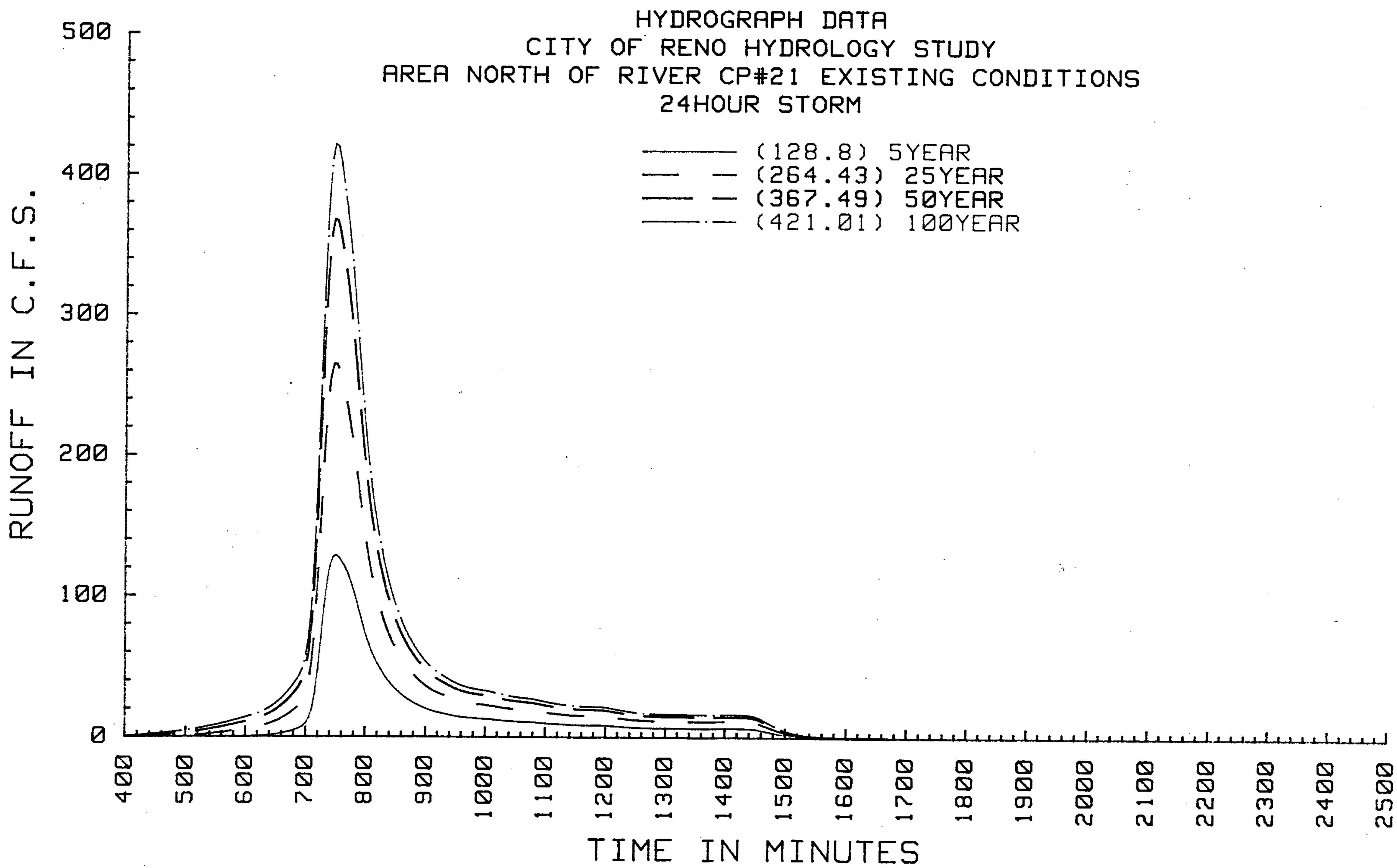
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#21 EXISTING CONDITIONS
24HOUR STORM
(128.8) 5YEAR
(264.43) 25YEAR
(367.49) 50YEAR
(421.01) 100YEAR
RUNOFF IN C.F.S.
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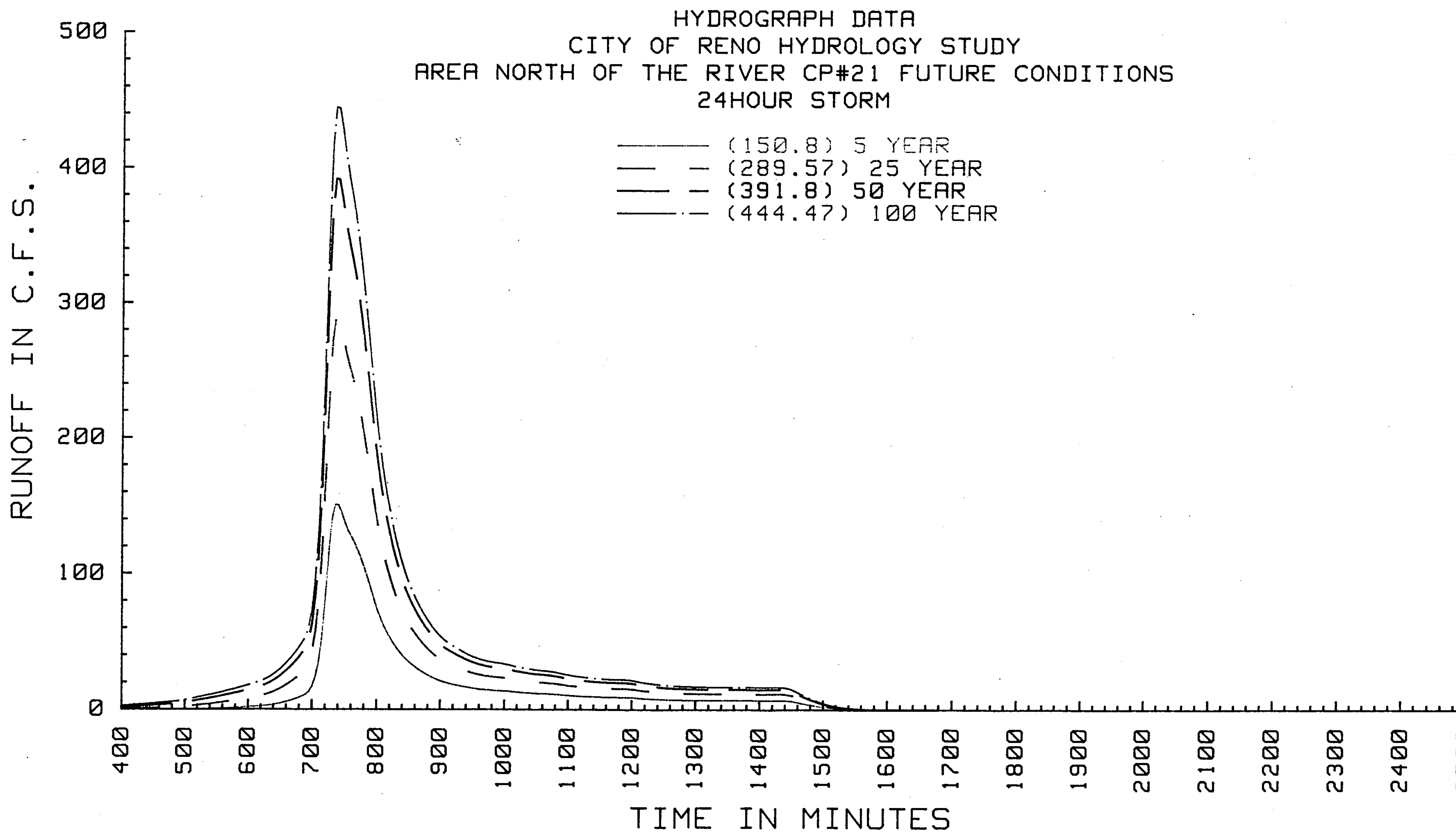
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#21 FUTURE CONDITIONS
24HOUR STORM
(150.8) 5 YEAR
(289.57) 25 YEAR
(391.8) 50 YEAR
(444.47) 100 YEAR
RUNOFF IN C.F.S.
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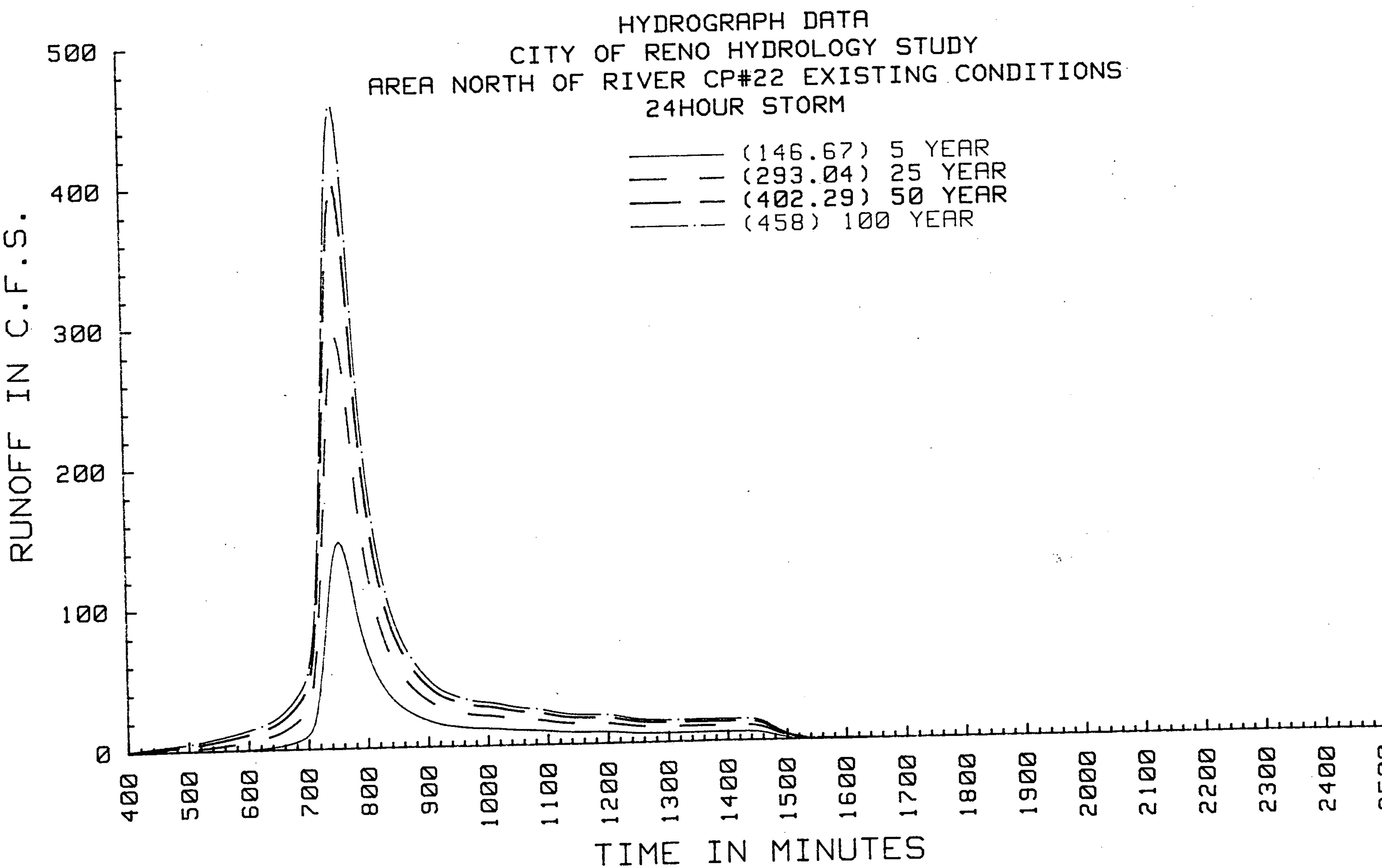
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#22 EXISTING CONDITIONS
24HOUR STORM
(146.67) 5 YEAR
(293.04) 25 YEAR
(402.29) 50 YEAR
(458) 100 YEAR
RUNOFF IN C.F.S.
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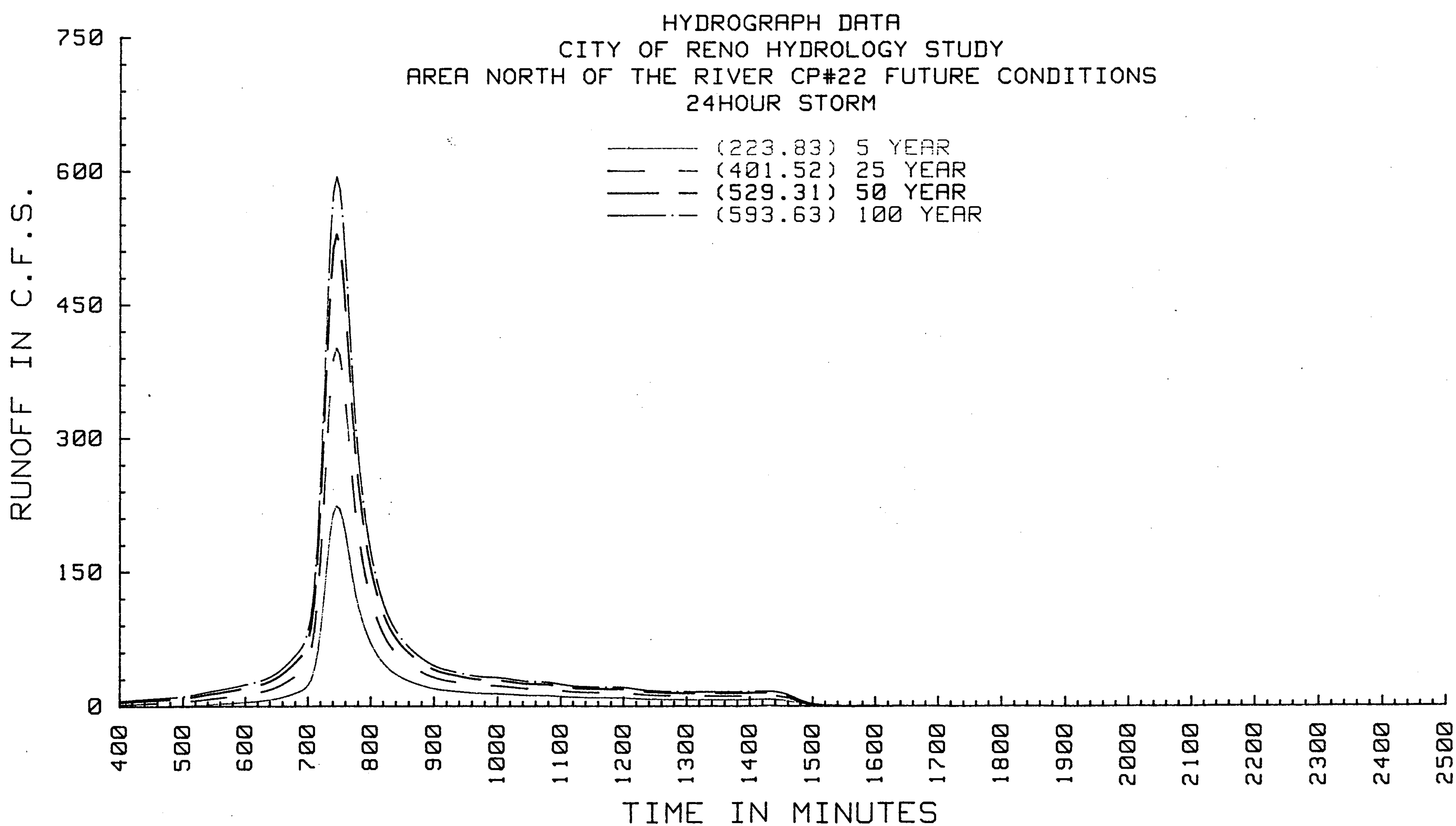
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#22 FUTURE CONDITIONS
24HOUR STORM
(223.83) 5 YEAR
(401.52) 25 YEAR
(529.31) 50 YEAR
(593.63) 100 YEAR
RUNOFF IN C.F.S.
750
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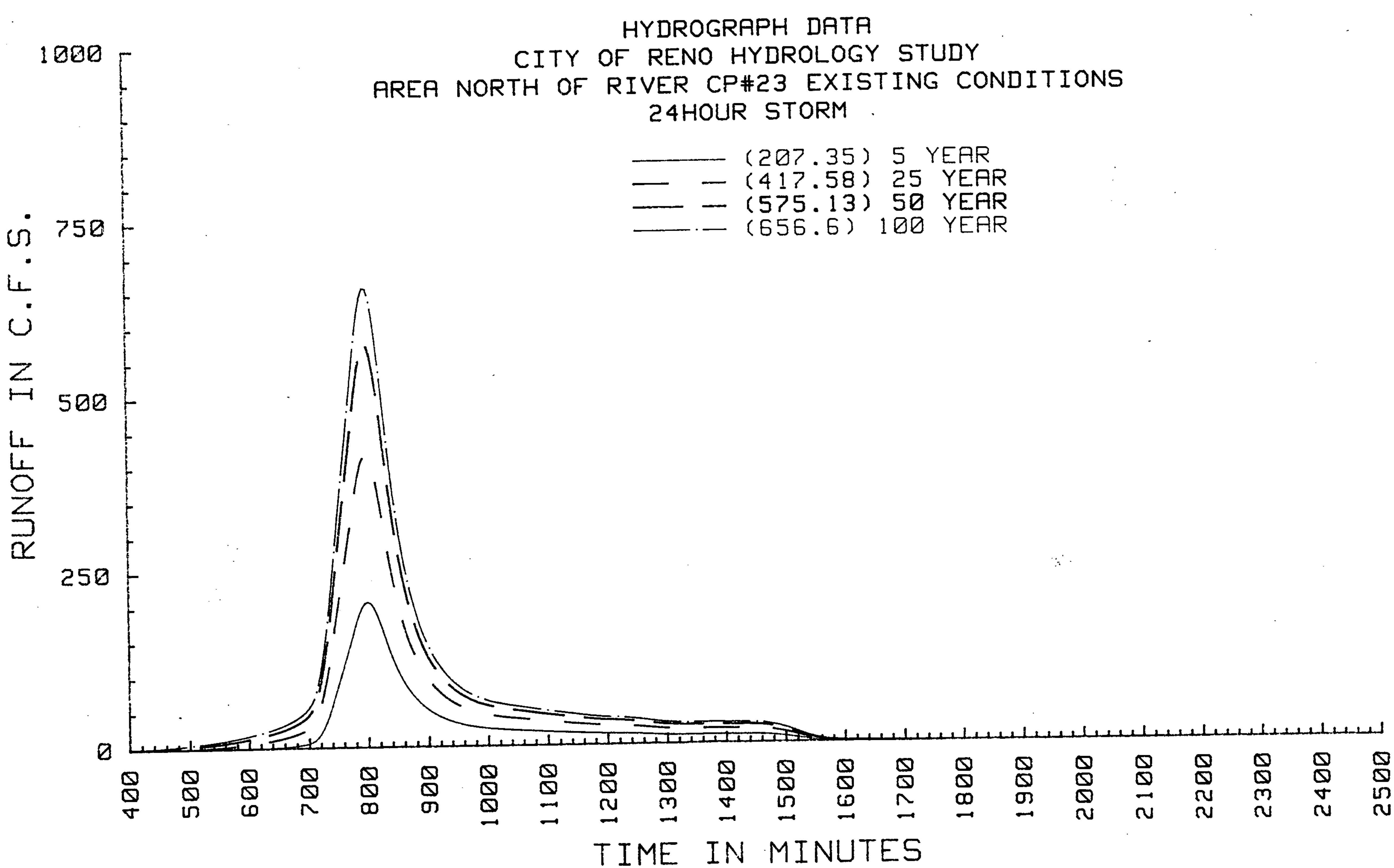
2400
2500
TIME IN MINUTES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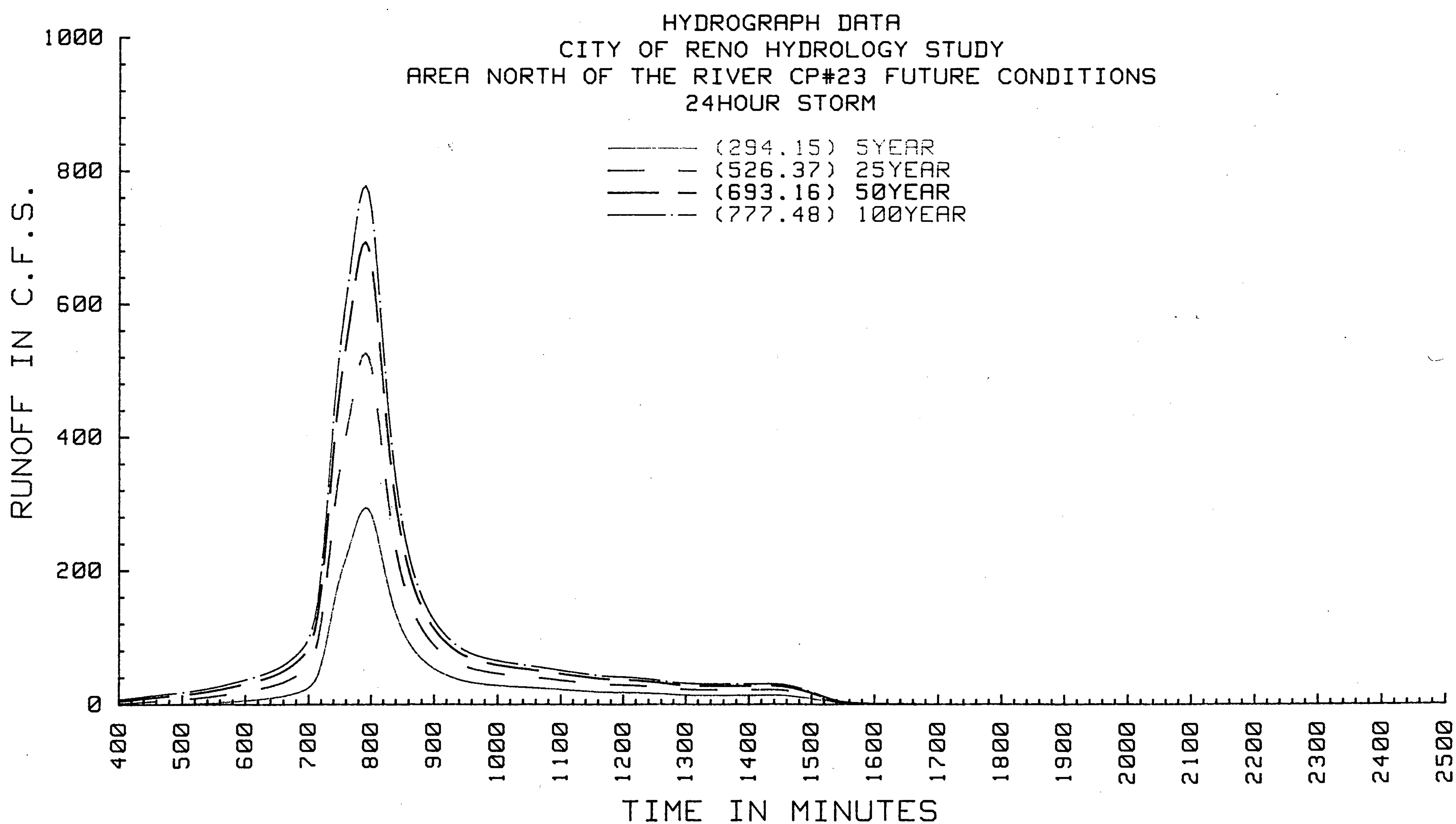
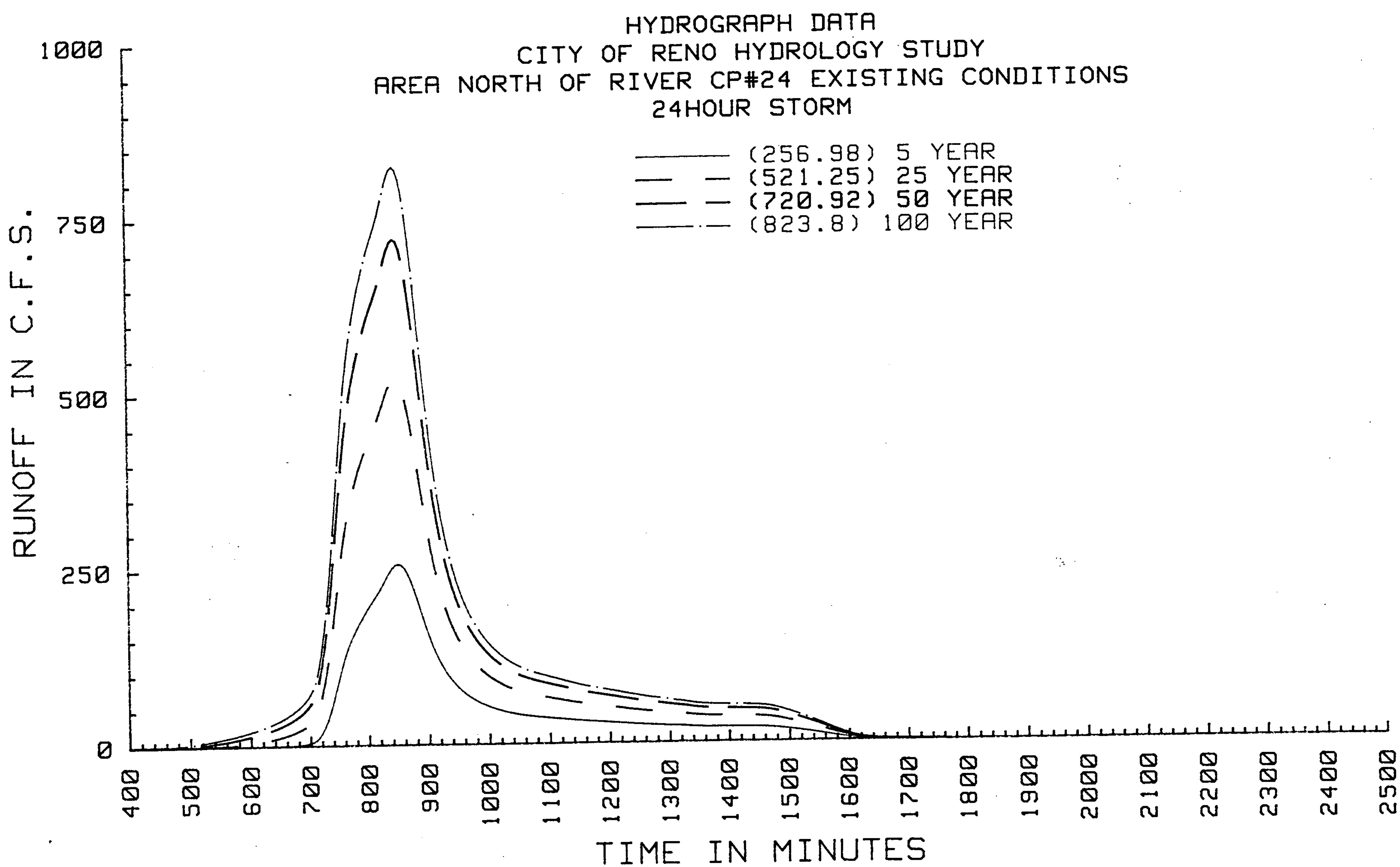
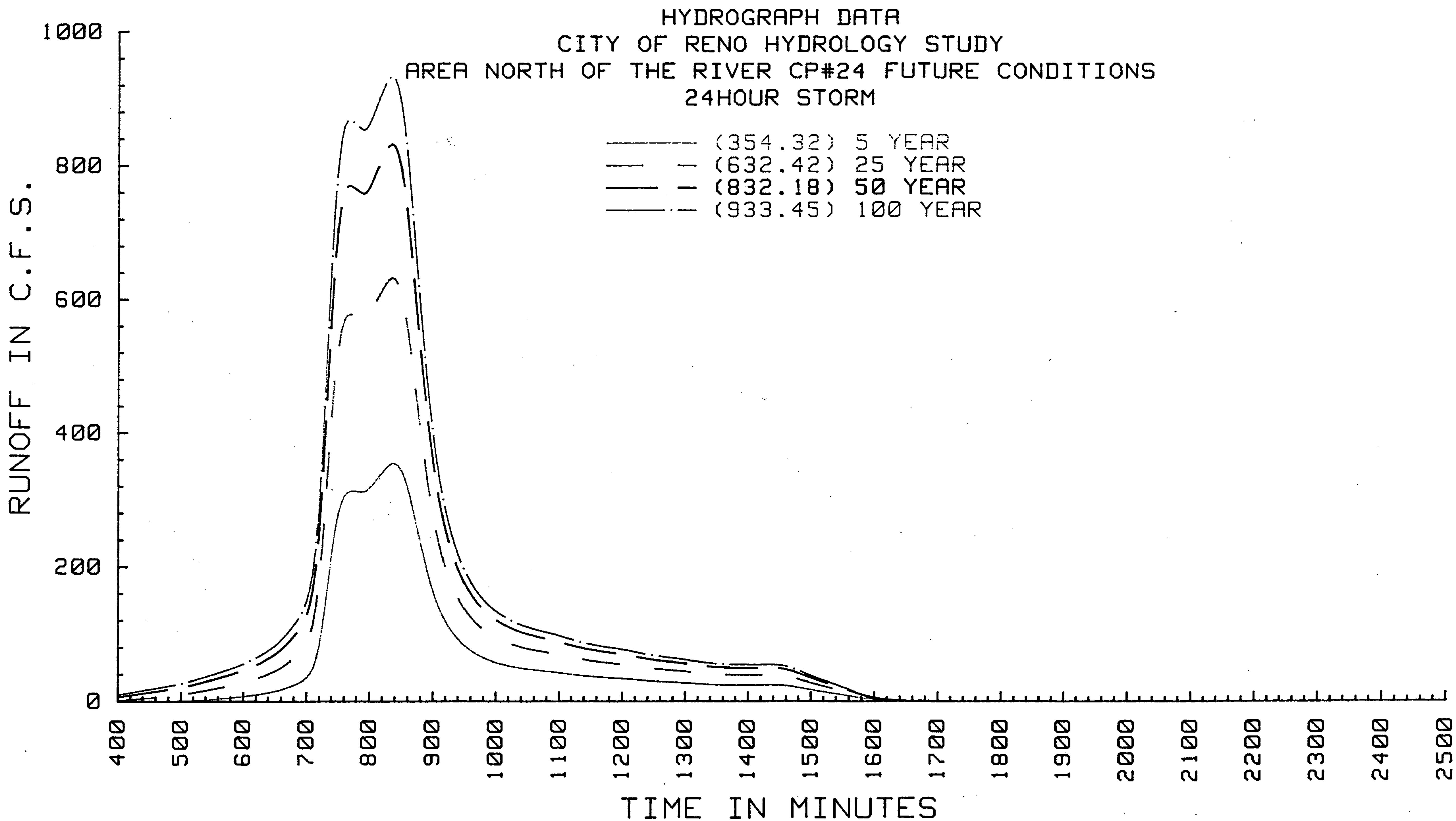
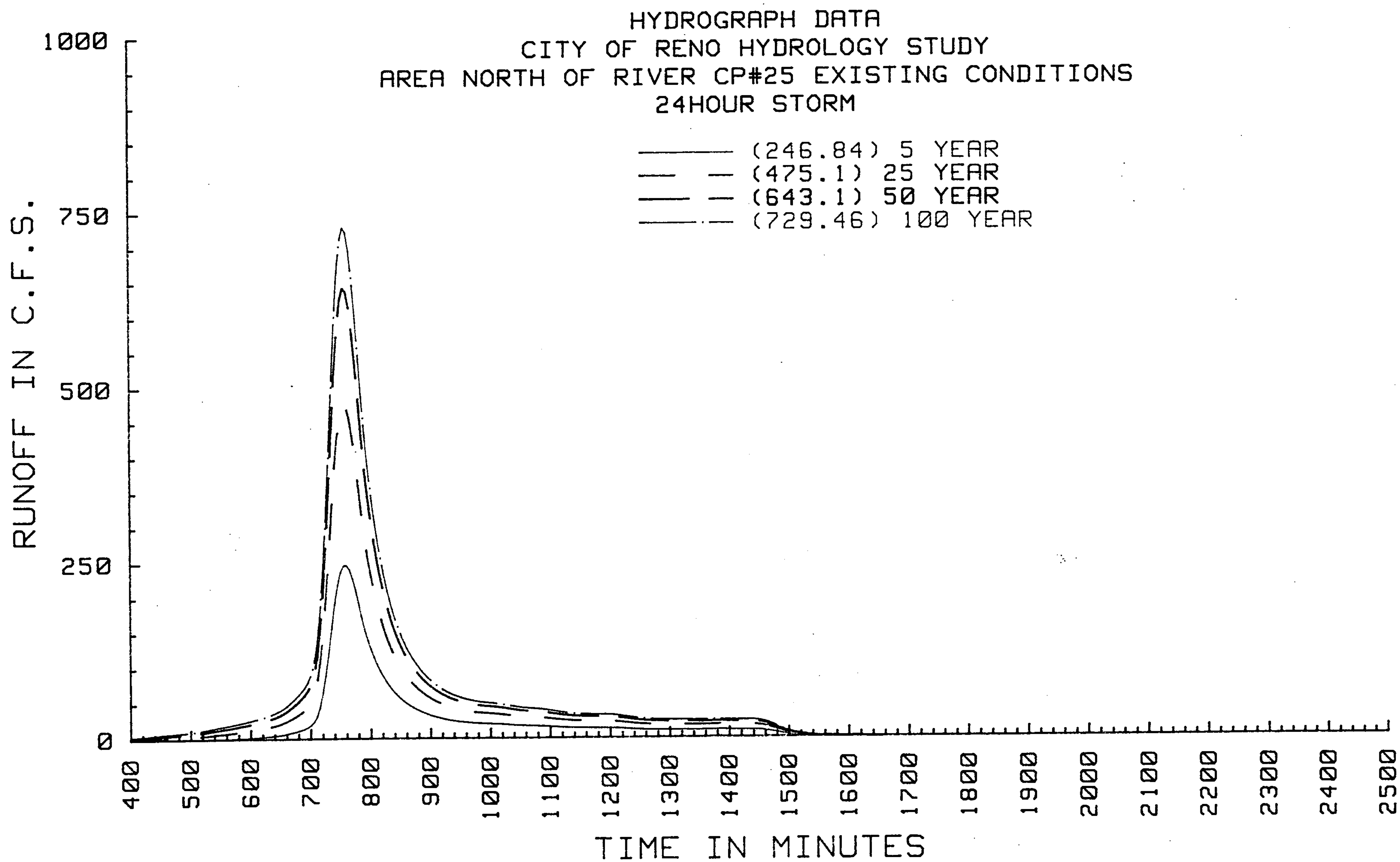
AREA NORTH OF RIVER CP#23 EXISTING CONDITIONS
24HOUR STORM
(207.35) 5 YEAR
(417.58) 25 YEAR
(575.13) 50 YEAR
(656.6) 100 YEAR
RUNOFF IN C.F.S.
1000
750
500
250
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES

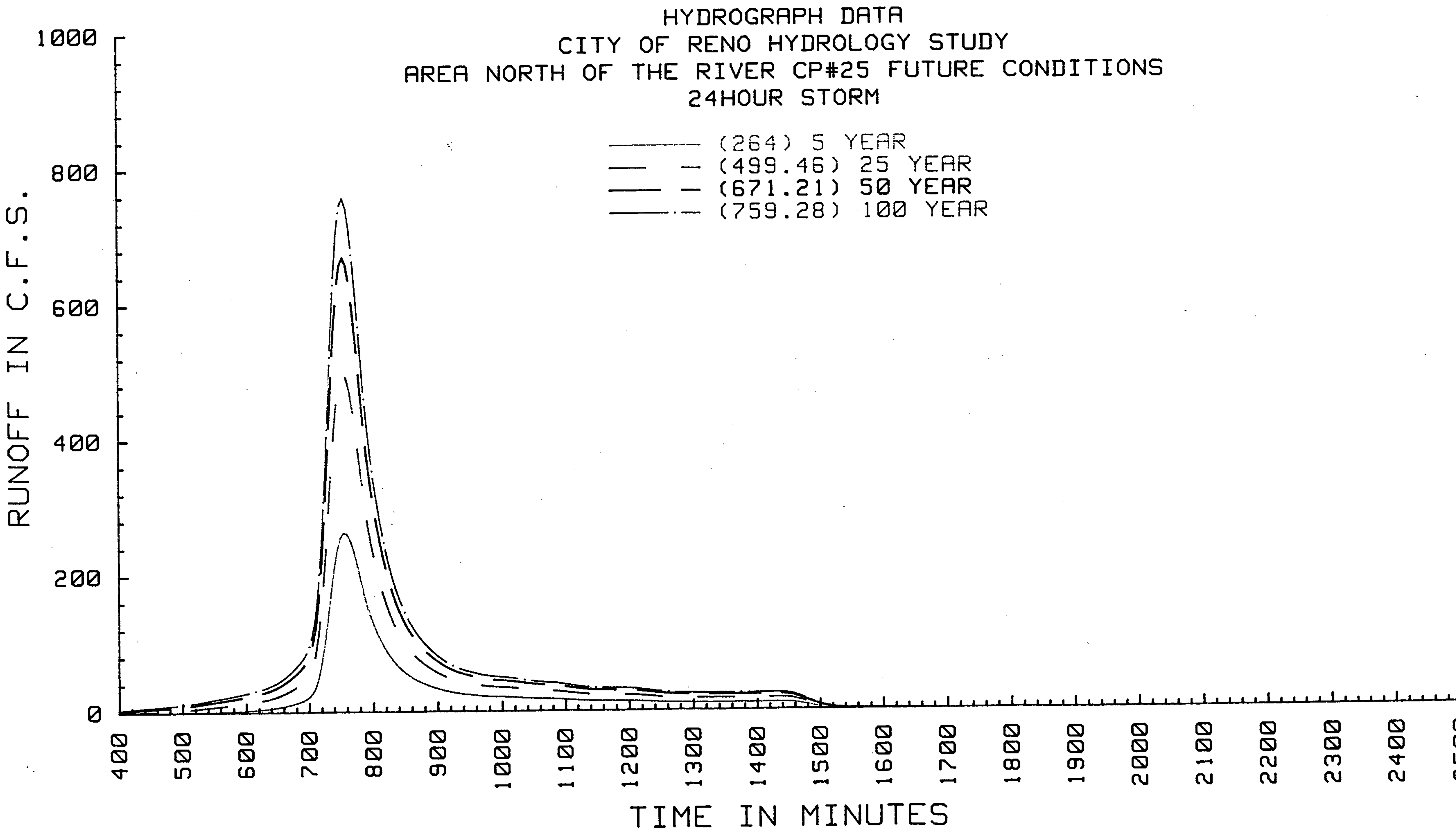


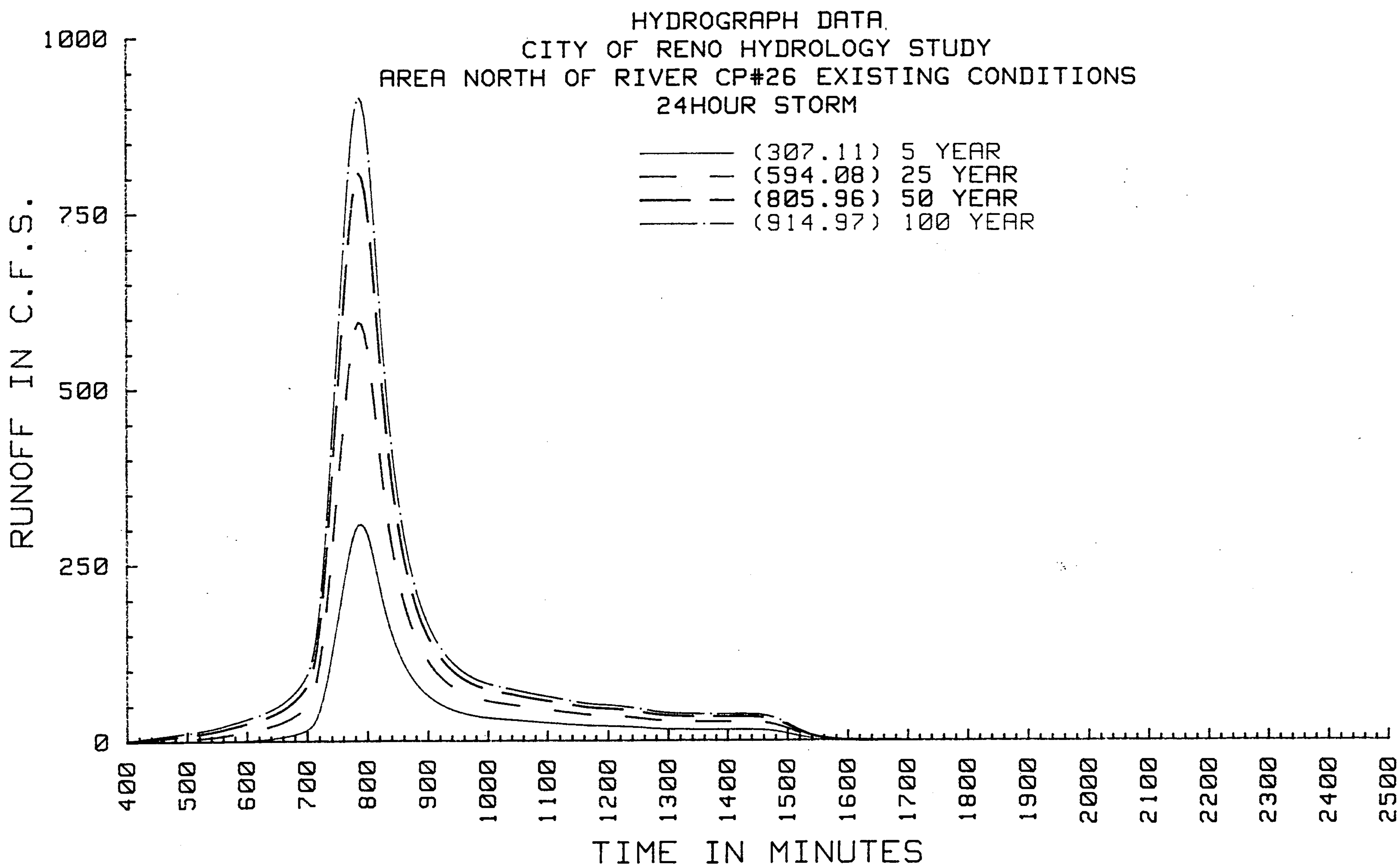
HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#23 FUTURE CONDITIONS
24HOUR STORM
(294.15) 5YEAR
(526.37) 25YEAR
(693.16) 50YEAR
(777.48) 100YEAR
RUNOFF IN C.F.S.
1000
800
600
400
200
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES

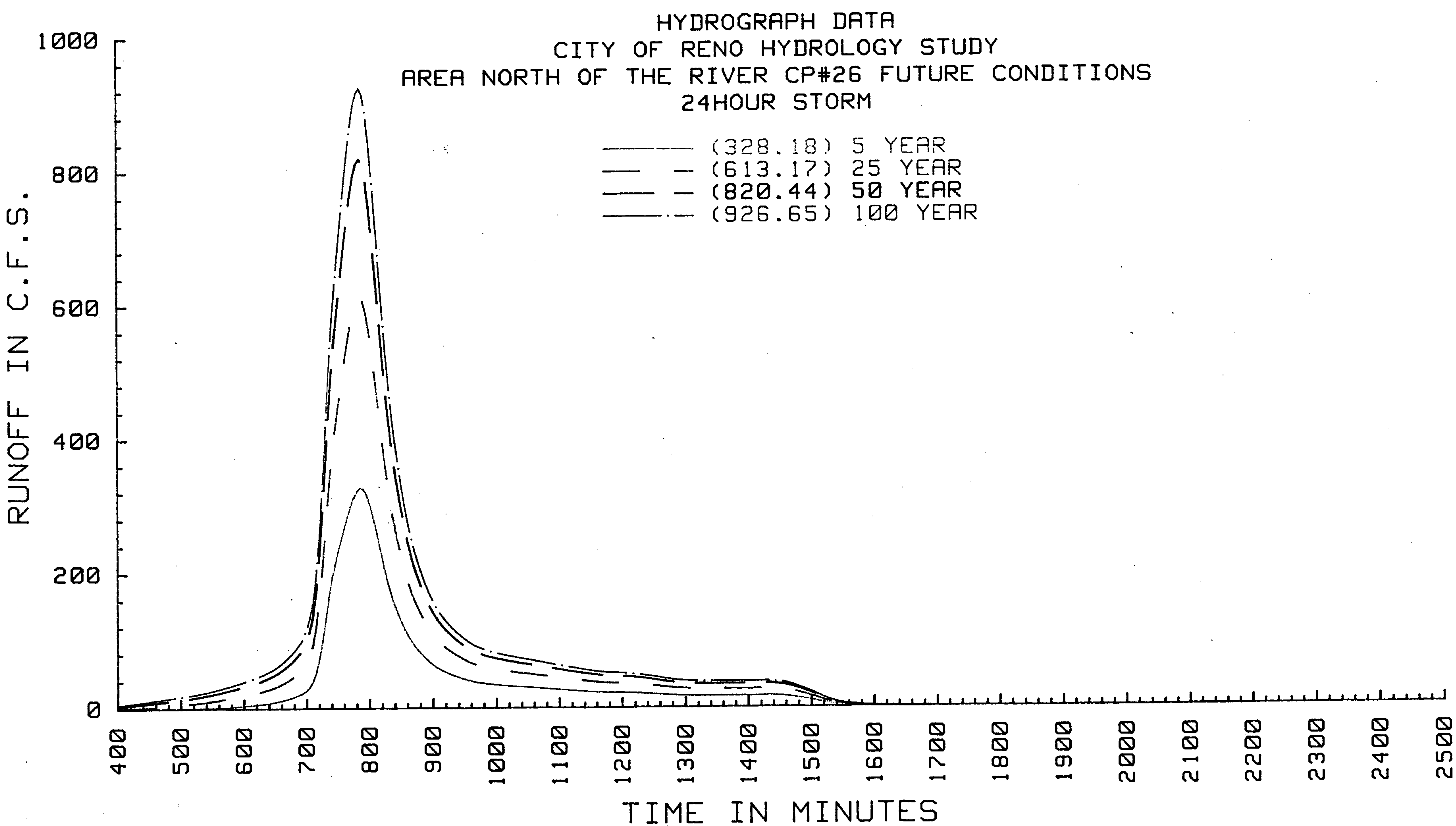

HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#24 EXISTING CONDITIONS
24HOUR STORM
(256.98) 5 YEAR
(521.25) 25 YEAR
(720.92) 50 YEAR
(823.8) 100 YEAR
RUNOFF IN C.F.S.
1000
750
500
250
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#24 FUTURE CONDITIONS
24HOUR STORM
(354.32) 5 YEAR
(632.42) 25 YEAR
(832.18) 50 YEAR
(933.45) 100 YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#25 EXISTING CONDITIONS
24HOUR STORM
(246.84) 5 YEAR
(475.1) 25 YEAR
(643.1) 50 YEAR
(729.46) 100 YEAR
RUNOFF IN C.F.S.
0
250
500
750
1000
TIME IN MINUTES
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#25 FUTURE CONDITIONS
24HOUR STORM
(264) 5 YEAR
(499.46) 25 YEAR
(671.21) 50 YEAR
(759.28) 100 YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF RIVER CP#26 EXISTING CONDITIONS
24HOUR STORM
(307.11) 5 YEAR
(594.08) 25 YEAR
(805.96) 50 YEAR
(914.97) 100 YEAR
RUNOFF IN C.F.S.
0
250
500
750
1000
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA NORTH OF THE RIVER CP#26 FUTURE CONDITIONS
24HOUR STORM
(328.18) 5 YEAR
(613.17) 25 YEAR
(820.44) 50 YEAR
(926.65) 100 YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES

APPENDIX "D"

TABLE 41

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

24-Hour Cumulative Rainfall
(Source: Winzler and Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
27	3.89	5.91	7.34	8.06
28	2.50	3.80	4.72	5.18
29	2.29	3.48	4.32	4.75
30	2.29	3.48	4.32	4.75
31	2.22	3.38	4.19	4.61
32	2.50	3.80	4.72	5.18
33	1.95	2.54	3.67	4.03
34	3.20	4.85	6.03	6.62
35	2.29	3.48	4.32	4.75
36	1.95	2.54	3.67	4.03
37	2.09	3.17	3.93	4.32
38	4.86	7.39	9.17	10.08
39	2.22	3.38	4.19	4.61
40	1.88	2.85	3.54	3.89
41	2.92	4.43	5.50	6.05
42	5.84	8.86	11.00	12.10
43	3.06	4.64	5.76	6.34
44	2.09	3.16	3.93	4.32

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 42

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

6-Hour Cumulative Rainfall
(Source: Winzler and Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
27	1.64	2.29	2.67	3.40
28	1.29	1.80	2.10	2.67
29	1.25	1.74	2.03	2.59
30	1.29	1.80	2.10	2.67
31	1.17	1.64	1.91	2.43
32	1.17	1.64	1.91	2.43
33	1.09	1.53	1.78	2.27
34	1.29	1.80	2.10	2.67
35	1.09	1.53	1.78	2.27
36	1.01	1.42	1.65	2.11
37	.94	1.31	1.52	1.94
38	1.95	2.73	3.18	4.04
39	.86	1.20	1.40	1.78
40	.78	1.09	1.27	1.62
41	1.25	1.74	2.03	2.59
42	2.57	3.60	4.19	5.35
43	.94	1.31	1.52	1.94
44	.62	.87	1.02	1.30

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 43

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

3-Hour Cumulative Rainfall
(Source: Winzler and Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
27	1.26	1.83	2.18	2.63
28	.99	1.44	1.72	2.06
29	.96	1.39	1.66	2.00
30	.99	1.44	1.72	2.06
31	.90	1.31	1.56	1.88
32	.90	1.31	1.56	1.88
33	.84	1.22	1.46	1.75
34	.99	1.44	1.72	2.06
35	.84	1.22	1.46	1.75
36	.78	1.13	1.35	1.63
37	.72	1.04	1.25	1.50
38	1.50	2.18	2.60	3.13
39	.66	.96	1.14	1.38
40	.60	.87	1.04	1.25
41	.96	1.39	1.66	2.00
42	1.98	2.87	3.43	4.13
43	.72	1.04	1.25	1.50
44	.48	.70	.83	1.56

NOTE: These values were derived from the Winzler and Kelly report. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 44

SOUTH OF THE TRUCKEE RIVER REGION

RAINFALL DATA WITH AREAL DISTRIBUTION REDUCTION FACTORS
BASED ON WINZLER AND KELLY

COMPUTATION POINT	STORM DURATION HOURS	AREAL RED. FACTOR	AFFECTED COMPUTATION POINT NO.	5-YEAR STORM IN	25-YEAR STORM IN	50-YEAR STORM IN	100-YEAR STORM IN
38-44	24	99%	38	4.81	7.32	9.08	9.98
		99%	39	2.20	3.35	4.15	4.56
		99%	40	1.86	2.82	3.54	3.85
		98%	41	2.86	4.34	5.39	5.93
		99%	42	5.78	8.77	10.89	11.98
		99%	43	3.03	4.59	5.70	6.28
		99%	44	2.09	3.13	3.89	4.28
38-44	6	98%	38	1.91	2.68	3.12	3.96
		98%	39	0.84	1.18	1.37	1.74
		98%	40	0.76	1.07	1.24	1.59
		98%	41	1.23	1.71	1.99	2.54
		98%	42	2.52	3.53	4.11	5.24
		98%	43	0.92	1.28	1.49	1.90
		98%	44	0.61	0.85	1.00	1.27
38-43	3	98%	38	1.47	2.14	2.55	3.07
		98%	39	0.65	0.94	1.12	1.35
		98%	40	0.59	0.85	1.02	1.23
		97%	41	0.93	1.35	1.61	1.94
		98%	42	1.94	2.81	3.36	4.05
		98%	43	0.71	1.02	1.23	1.47
44	3	97%	42	1.92	2.78	3.33	4.01
		97%	43	0.70	1.01	1.21	1.46
		97%	44	0.48	0.68	0.81	1.51

TABLE 45

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

24-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	1195	2299	3117	3538
28	143	302	423	486
29	199	409	567	649
30	234	476	658	753
31	172	301	394	442
32	320	641	887	1014
33	346	682	959	1095
34	254	506	694	791
35	323	649	892	1019
36	411	772	1070	1215
37	202	457	658	764
38	1617	3046	4084	4619
39	1619	3053	4095	4632
40	1623	3062	4107	4646
41	1218	2445	3369	3852
42	1812	3479	4713	5355
43	1894	3648	4949	5561
44	1912	3688	5005	5625

TABLE 46

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

6-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	241	505	684	1064
28	28	67	95	156
29	47	105	145	232
30	58	126	175	277
31	33	71	127	191
32	61	140	194	311
33	74	164	226	360
34	30	73	105	175
35	49	117	165	271
36	63	146	205	333
37	30	76	110	191
38	335	695	930	1419
39	334	693	928	1417
40	333	693	927	1416
41	250	552	759	1213
42	436	899	1203	1848
43	438	910	1221	1884
44	436	908	1220	1884

TABLE 47

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

3-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Existing Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	146	376	548	794
28	18	51	78	114
29	32	82	147	176
30	39	100	147	210
31	23	55	91	151
32	41	109	161	237
33	47	127	187	273
34	19	56	86	129
35	30	88	134	199
36	37	108	164	243
37	14	52	87	137
38	183	466	677	972
39	182	465	674	968
40	182	464	673	967
41	114	338	515	770
42	244	613	895	1287
43	243	615	900	1298
44	235	598	881	1274

TABLE 48

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

24-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	1277	2422	3262	3695
28	220	415	558	631
29	287	544	732	829
30	321	610	821	930
31	174	301	394	442
32	413	778	1048	1186
33	442	821	1129	1278
34	295	566	765	868
35	374	712	961	1089
36	414	773	1069	1212
37	334	662	906	1033
38	1617	3046	4084	4619
39	1619	3053	4095	4632
40	1623	3062	4107	4646
41	1218	2445	3369	3852
42	1812	3479	4713	5355
43	1894	3648	4949	5561
44	1912	3688	5005	5625

TABLE 49

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

6-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	266	547	736	1135
28	56	115	154	236
29	78	158	212	324
30	89	180	242	369
31	33	106	136	191
32	93	193	259	399
33	106	219	294	452
34	39	91	128	207
35	69	150	205	323
36	86	184	251	392
37	63	139	190	306
38	335	695	930	1419
39	334	693	928	1417
40	334	693	927	1416
41	250	552	759	1213
42	436	899	1203	1848
43	438	910	1221	1884
44	436	908	1220	1884

TABLE 50

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

3-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	168	415	598	858
28	38	88	126	176
29	54	125	177	247
30	62	143	202	282
31	23	70	118	153
32	65	154	219	310
33	74	174	248	350
34	26	70	105	153
35	45	115	169	242
36	56	141	207	295
37	41	107	161	233
38	183	466	677	972
39	182	465	674	968
40	182	464	673	967
41	114	338	515	770
42	244	613	895	1287
43	243	615	900	1298
44	235	598	881	1274

TABLE 51

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

24-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
27	1.8	2.6	3.0	3.3
28	1.5	2.2	2.5	2.7
29	1.5	2.2	2.5	2.7
30	1.5	2.2	2.5	2.7
31	1.5	2.2	2.5	2.7
32	1.55	2.3	2.55	2.7
33	1.55	2.3	2.5	2.7
34	1.7	2.5	2.8	2.9
35	1.6	2.4	2.7	2.8
36	1.55	2.3	2.6	2.7
37	1.7	2.4	2.6	2.7
38	2.4	3.3	3.8	3.9
39	1.8	2.5	2.7	2.8
40	1.7	2.4	2.6	2.7
41	2.0	2.8	3.3	3.4
42	2.9	3.5	4.4	4.6
43	2.0	2.7	3.3	3.5
44	1.8	2.4	2.6	2.8

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 52

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

6-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
27	1.2	1.6	1.9	2.1
28	1.0	1.4	1.55	1.75
29	1.0	1.4	1.55	1.75
30	1.0	1.4	1.55	1.75
31	1.0	1.4	1.55	1.75
32	1.08	1.47	1.6	1.8
33	1.02	1.42	1.6	1.8
34	1.15	1.5	1.7	2.0
35	1.07	1.47	1.65	1.9
36	1.02	1.42	1.6	1.8
37	1.08	1.5	1.7	1.9
38	1.45	1.8	2.3	2.6
39	1.1	1.5	1.7	2.0
40	1.05	1.45	1.6	1.8
41	1.2	1.55	2.0	2.2
42	1.6	1.9	2.6	2.9
43	1.2	1.55	1.8	2.2
44	1.1	1.4	1.6	1.8

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 53

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

3-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
27	.91	1.25	1.40	1.63
28	.82	1.11	1.27	1.46
29	.82	1.11	1.27	1.46
30	.82	1.11	1.27	1.46
31	.82	1.11	1.27	1.46
32	.88	1.17	1.31	1.50
33	.88	1.17	1.31	1.50
34	.94	1.26	1.41	1.65
35	.92	1.25	1.40	1.63
36	.88	1.17	1.31	1.50
37	.91	1.21	1.38	1.59
38	1.19	1.59	1.75	2.05
39	.98	1.29	1.43	1.66
40	.91	1.19	1.33	1.50
41	1.05	1.40	1.58	1.76
42	1.32	1.71	1.91	2.23
43	1.06	1.40	1.58	1.76
44	.91	1.19	1.33	1.49

NOTE: These values were derived from the NOAA Atlas 2. An areal distribution reduction factor has been applied to this rainfall data for sub-basins with cumulative areas over five (5) square miles.

TABLE 54

SOUTH OF THE TRUCKEE RIVER REGION

RAINFALL DATA WITH AREAL DISTRIBUTION REDUCTION FACTORS
BASED ON NOAA ATLAS 2

COMPUTATION POINT	STORM DURATION HOURS	AREAL RED. FACTOR	AFFECTED COMPUTATION POINT NO.	5-YEAR STORM IN	25-YEAR STORM IN	50-YEAR STORM IN	100-YEAR STORM IN
38-44	24	99%	38	2.38	3.27	3.76	3.86
		99%	39	1.78	2.48	2.67	2.77
		99%	40	1.68	2.38	2.57	2.67
		98%	41	1.96	2.74	3.23	3.33
		99%	42	2.87	3.47	4.36	4.55
		99%	43	1.98	2.67	3.27	3.47
		99%	44	1.78	2.38	2.57	2.77
38-44	6	98%	38	1.42	1.76	2.25	2.55
		98%	39	1.08	1.47	1.67	1.96
		98%	40	1.03	1.42	1.57	1.76
		98%	41	1.18	1.52	1.96	2.16
		98%	42	1.57	1.86	2.55	2.84
		98%	43	1.18	1.52	1.76	2.16
		98%	44	1.08	1.37	1.57	1.76
38-43	3	98%	38	1.17	1.56	1.72	2.01
		98%	39	0.96	1.26	1.40	1.63
		98%	40	0.89	1.17	1.30	1.47
		97%	41	1.02	1.36	1.53	1.71
		98%	42	1.29	1.68	1.87	2.19
		98%	43	1.04	1.37	1.55	1.72
44	3	97%	42	1.28	1.66	1.85	2.16
		97%	43	1.03	1.36	1.53	1.71
		97%	44	0.88	1.15	1.29	1.45

TABLE 55

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

24-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	270	614	809	962
28	85	177	220	249
29	115	240	298	338
30	131	273	338	383
31	63	170	204	225
32	170	358	426	467
33	191	400	473	521
34	83	189	234	249
35	128	281	344	365
36	161	347	425	452
37	228	427	487	518
38	419	816	1059	1111
39	424	824	1067	1119
40	429	832	1077	1129
41	572	1125	1512	1594
42	444	684	1089	1182
43	480	753	1189	1292
44	496	781	1221	1329

TABLE 56

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

6-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

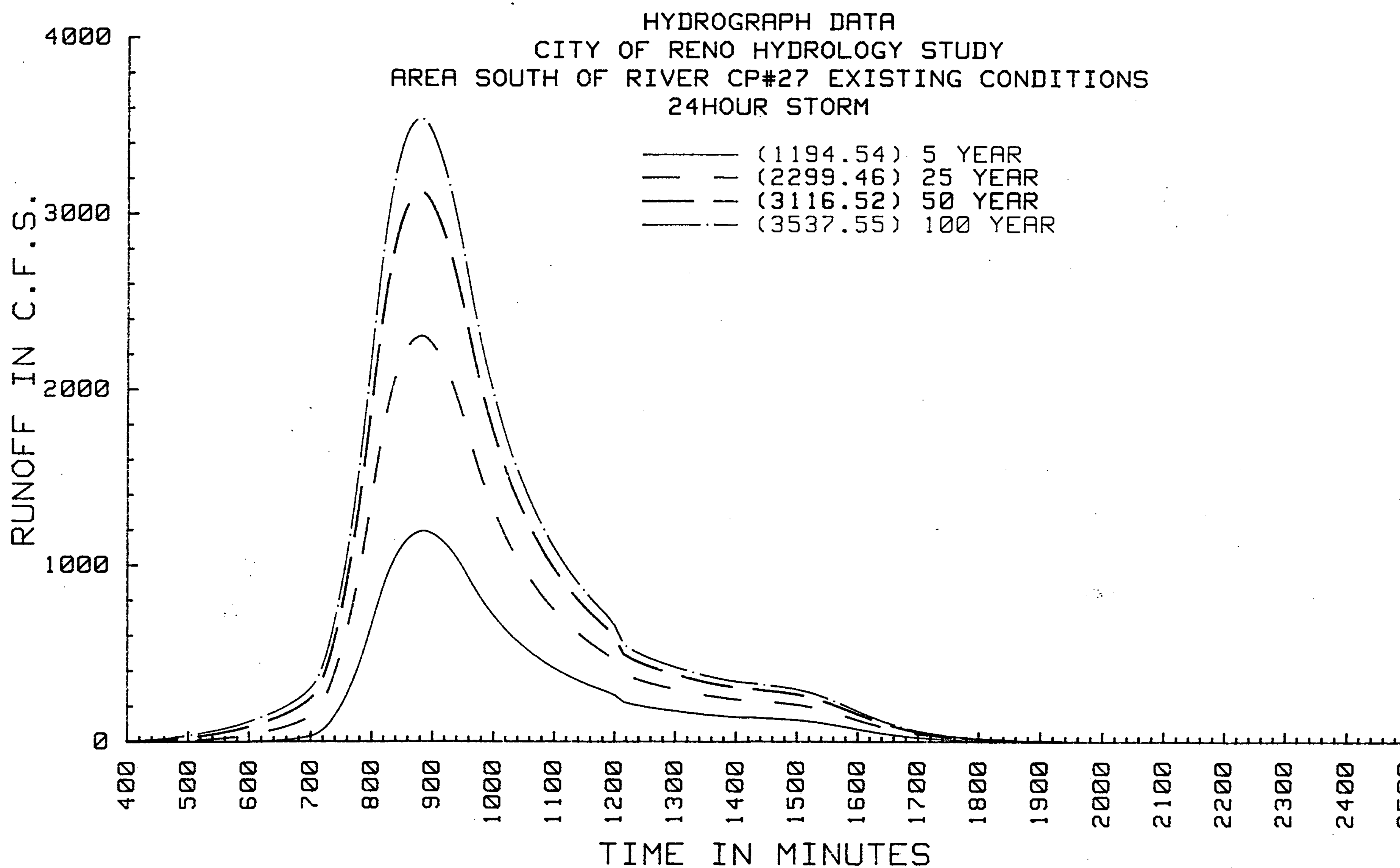
COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	120	251	371	458
28	29	67	84	108
29	42	95	119	152
30	48	109	135	174
31	22	50	68	114
32	76	154	183	232
33	88	177	212	267
34	28	58	79	115
35	57	114	148	202
36	74	149	192	256
37	89	185	238	294
38	155	274	484	629
39	154	274	484	629
40	154	274	484	629
41	223	423	736	893
42	118	199	448	571
43	126	217	477	619
44	128	221	482	627

TABLE 57

SOUTH OF THE TRUCKEE RIVER REGION
COMPUTATION POINTS 27 THROUGH 44

3-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
27	60	164	221	320
28	23	50	68	91
29	34	73	98	131
30	39	83	112	149
31	18	38	51	88
32	62	121	154	203
33	71	74	178	233
34	22	51	67	96
35	46	98	127	176
36	62	128	164	223
37	78	150	198	261
38	89	215	278	405
39	89	215	277	404
40	89	215	277	404
41	155	345	458	589
42	60	159	220	338
43	65	172	238	362
44	63	167	233	354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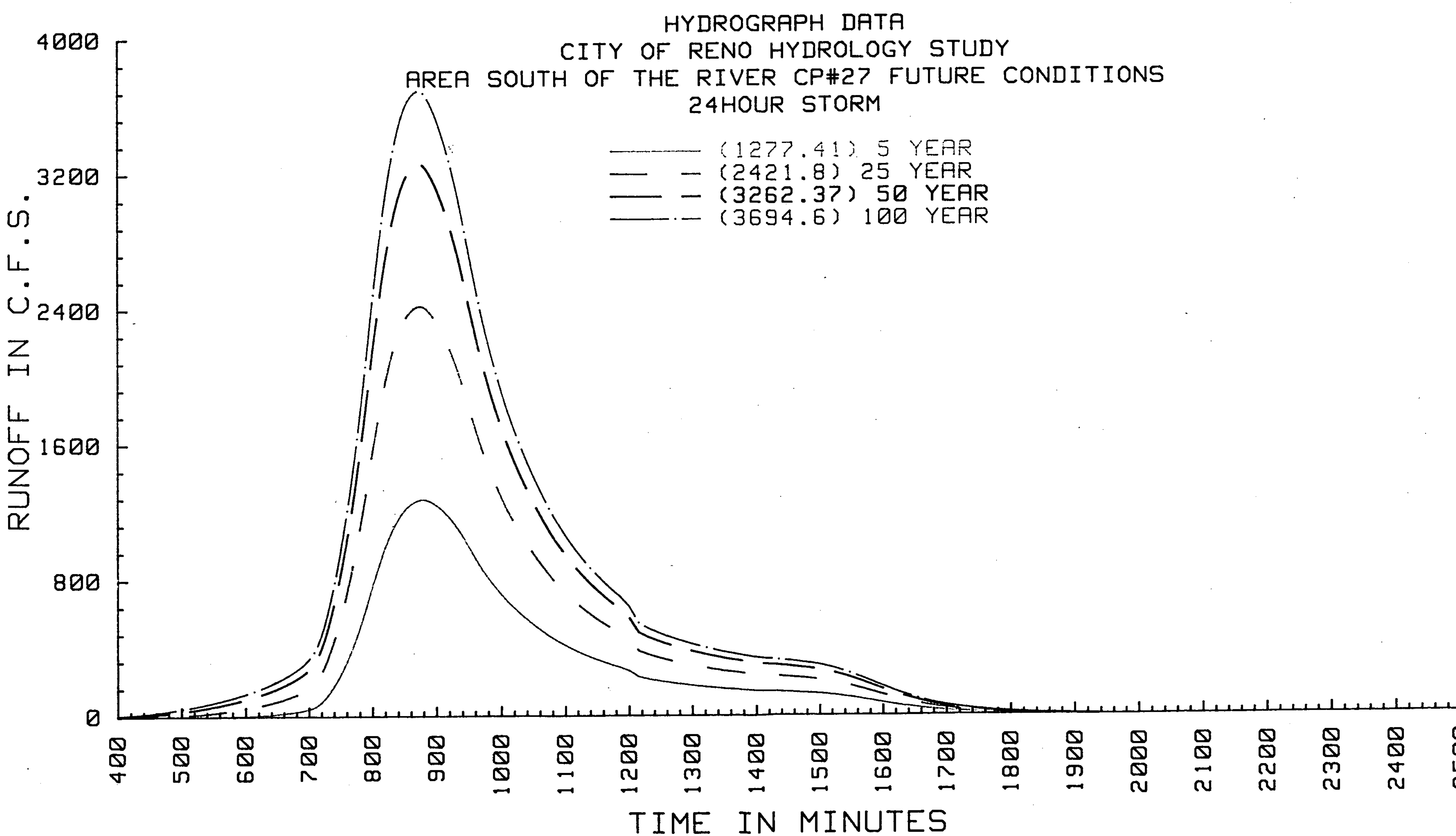
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#27 EXISTING CONDITIONS
24HOUR STORM
(1194.54) 5 YEAR
(2299.46) 25 YEAR
(3116.52) 50 YEAR
(3537.55) 100 YEAR
RUNOFF IN C.F.S.
4000
3000
2000
1000
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#27 FUTURE CONDITIONS
24HOUR STORM
(1277.41) 5 YEAR
(2421.8) 25 YEAR
(3262.37) 50 YEAR
(3694.6) 100 YEAR
RUNOFF IN C.F.S.
4000
3200
2400
1600
800
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
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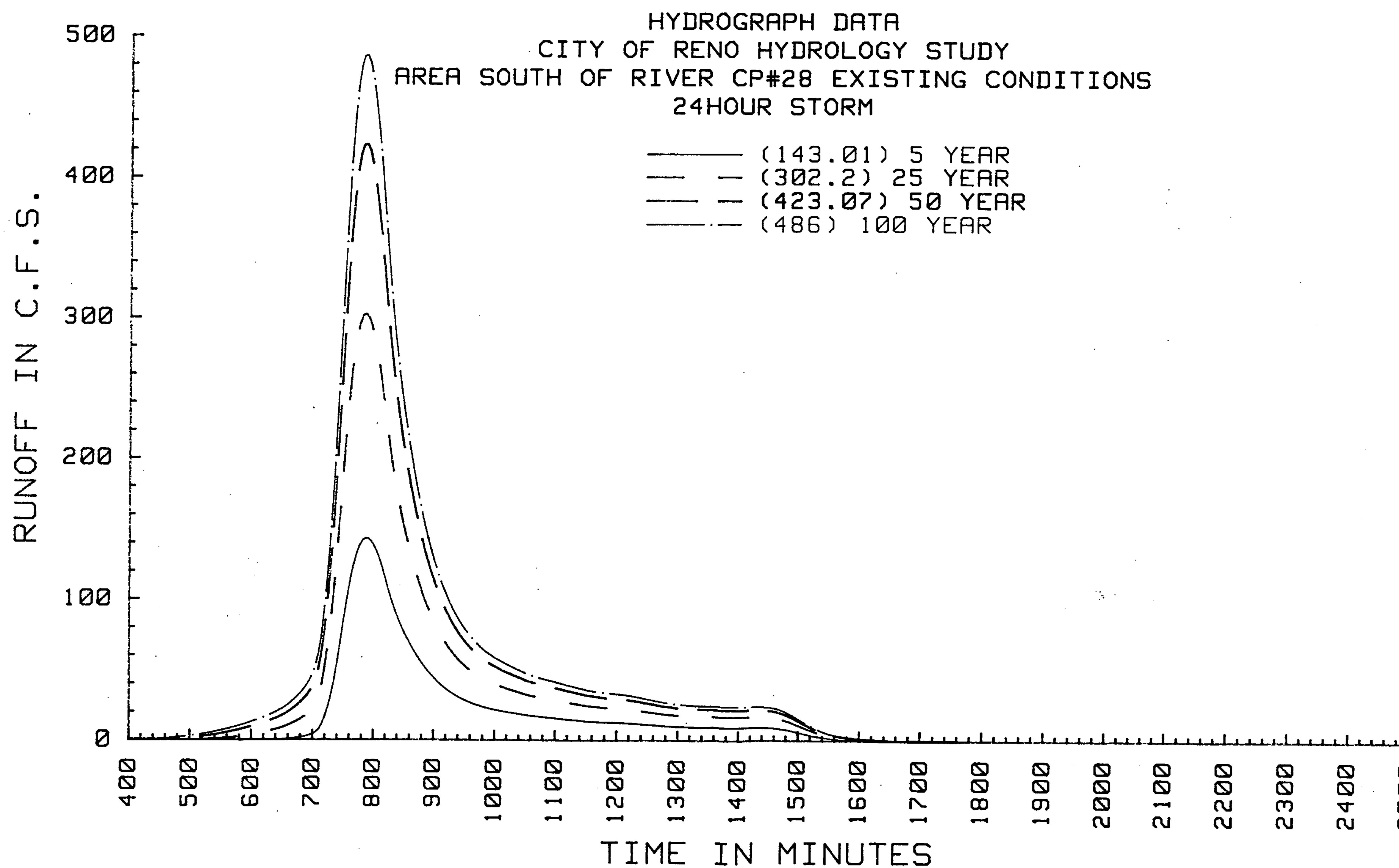
2100
2200
2300
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#28 EXISTING CONDITIONS
24HOUR STORM
(143.01) 5 YEAR
(302.2) 25 YEAR
(423.07) 50 YEAR
(486) 100 YEAR
RUNOFF IN C.F.S.
0
100
200
300
400
500
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
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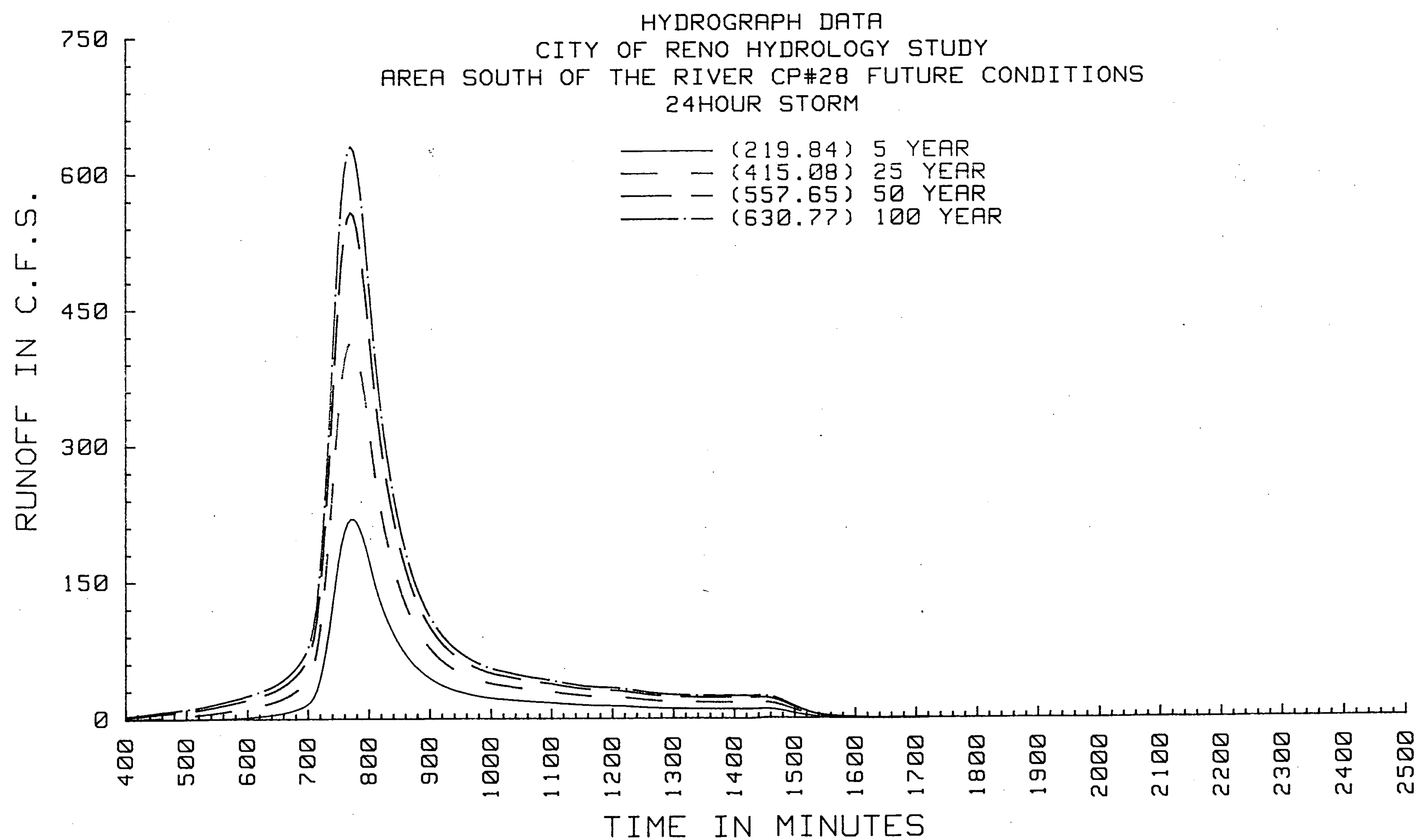
2100
2200
2300
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#28 FUTURE CONDITIONS
24HOUR STORM
(219.84) 5 YEAR
(415.08) 25 YEAR
(557.65) 50 YEAR
(630.77) 100 YEAR
RUNOFF IN C.F.S.
0
150
300
450
600
750
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
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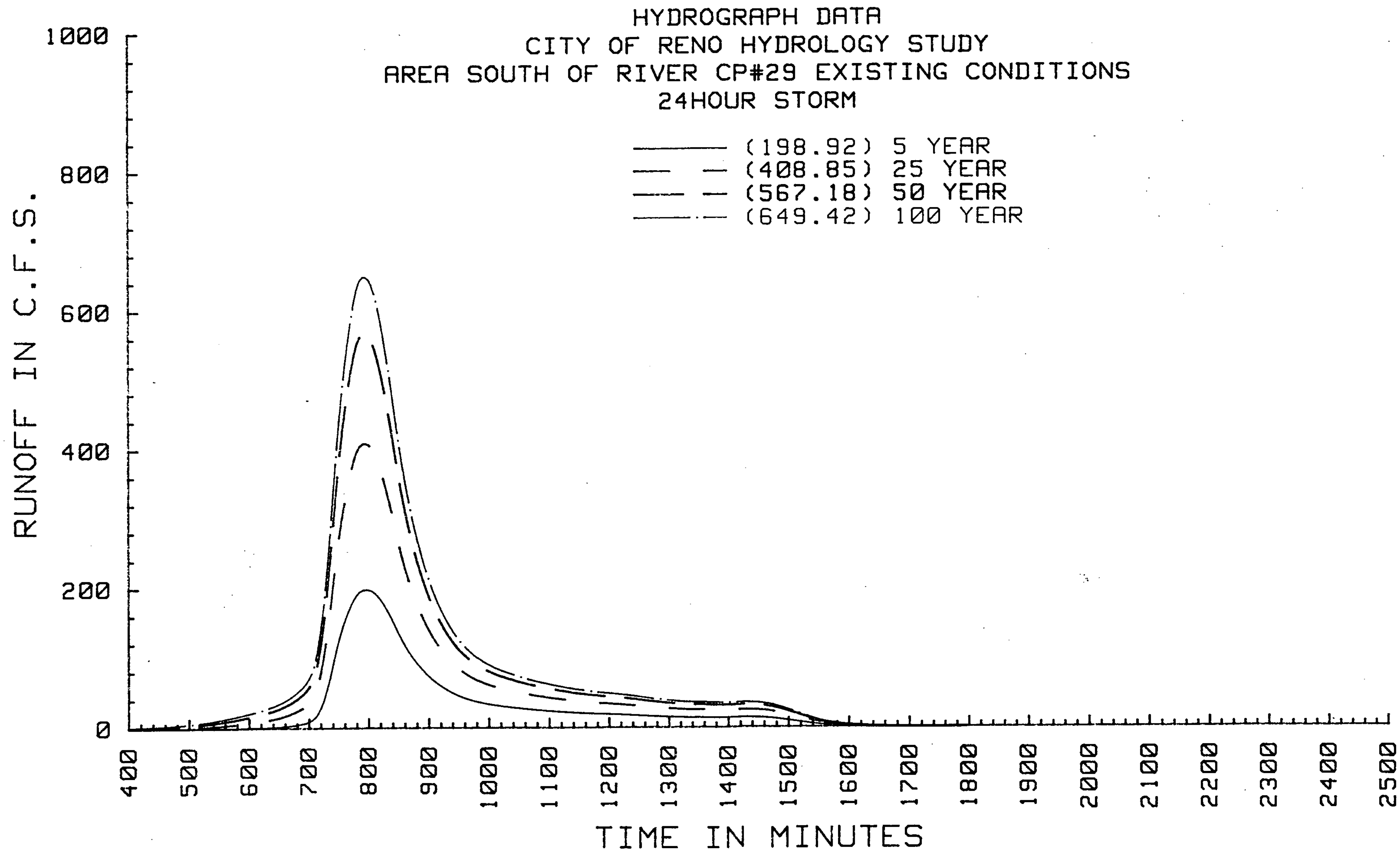
2100
2200
2300
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#29 EXISTING CONDITIONS
24HOUR STORM
(198.92) 5 YEAR
(408.85) 25 YEAR
(567.18) 50 YEAR
(649.42) 100 YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
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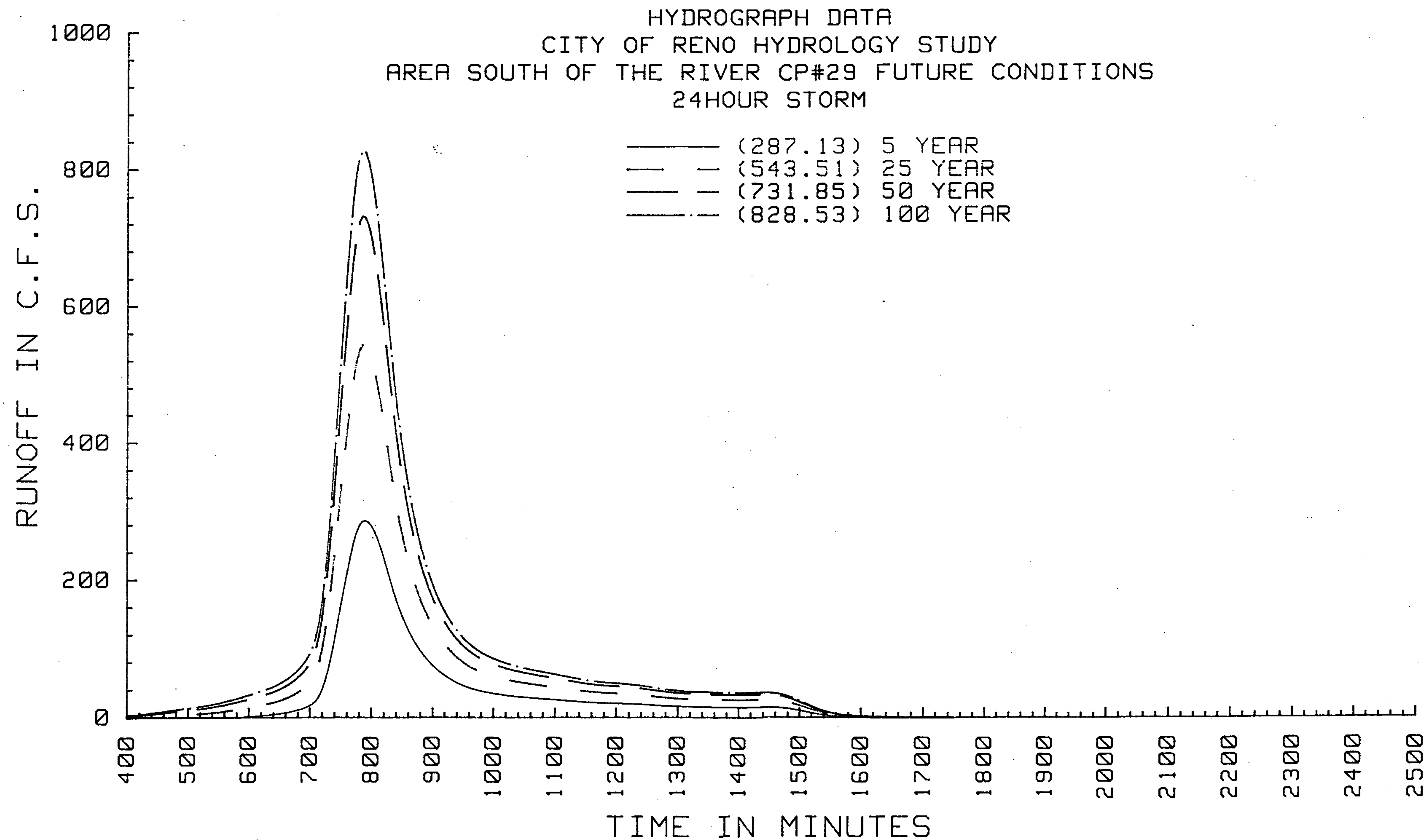
2100
2200
2300
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#29 FUTURE CONDITIONS
24HOUR STORM
(287.13) 5 YEAR
(543.51) 25 YEAR
(731.85) 50 YEAR
(828.53) 100 YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
400
500
600
700
800
900
1000
1100
1200
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1500
1600
1700
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1900
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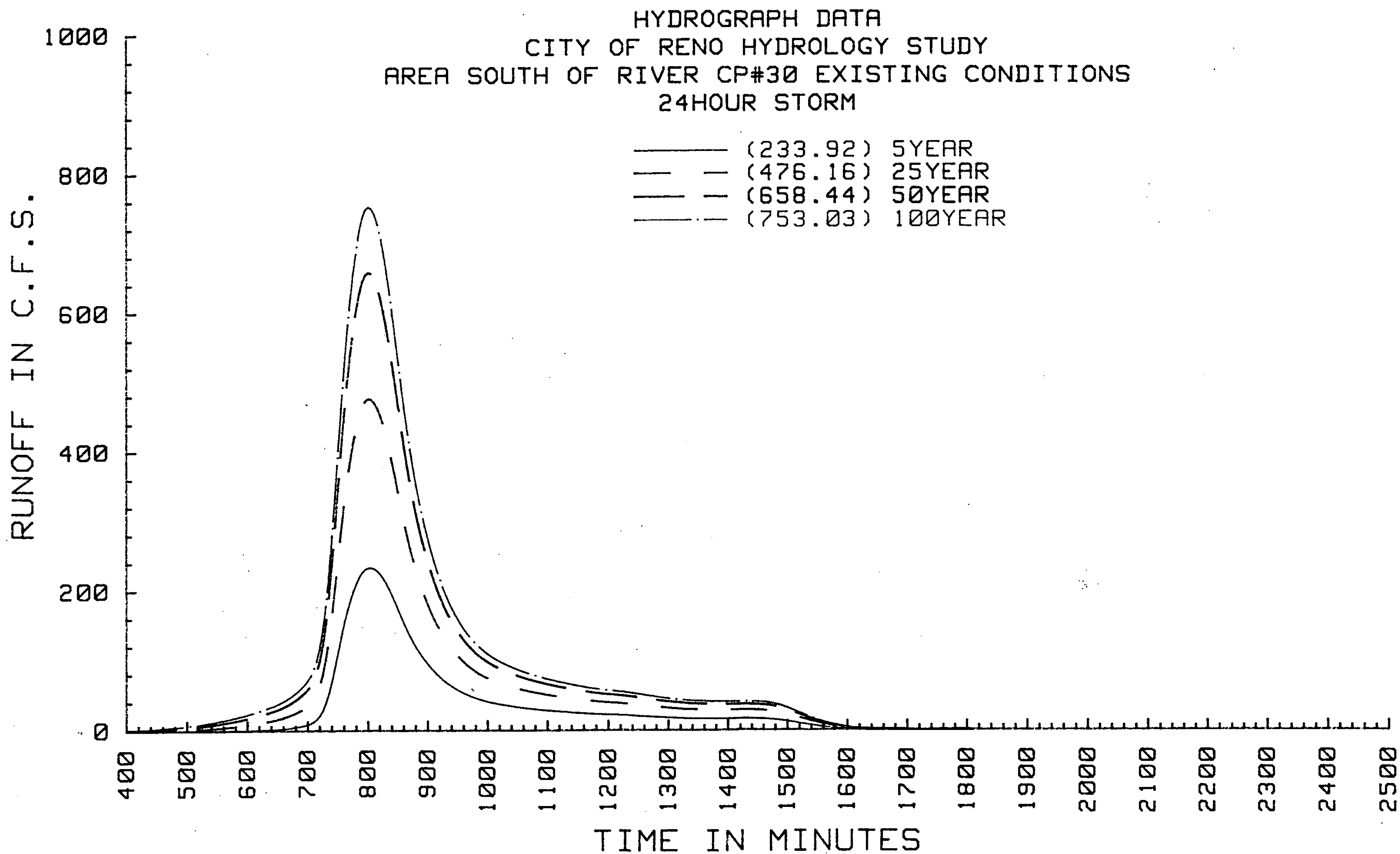
2200
2300
2400
2500
TIME IN MINUTES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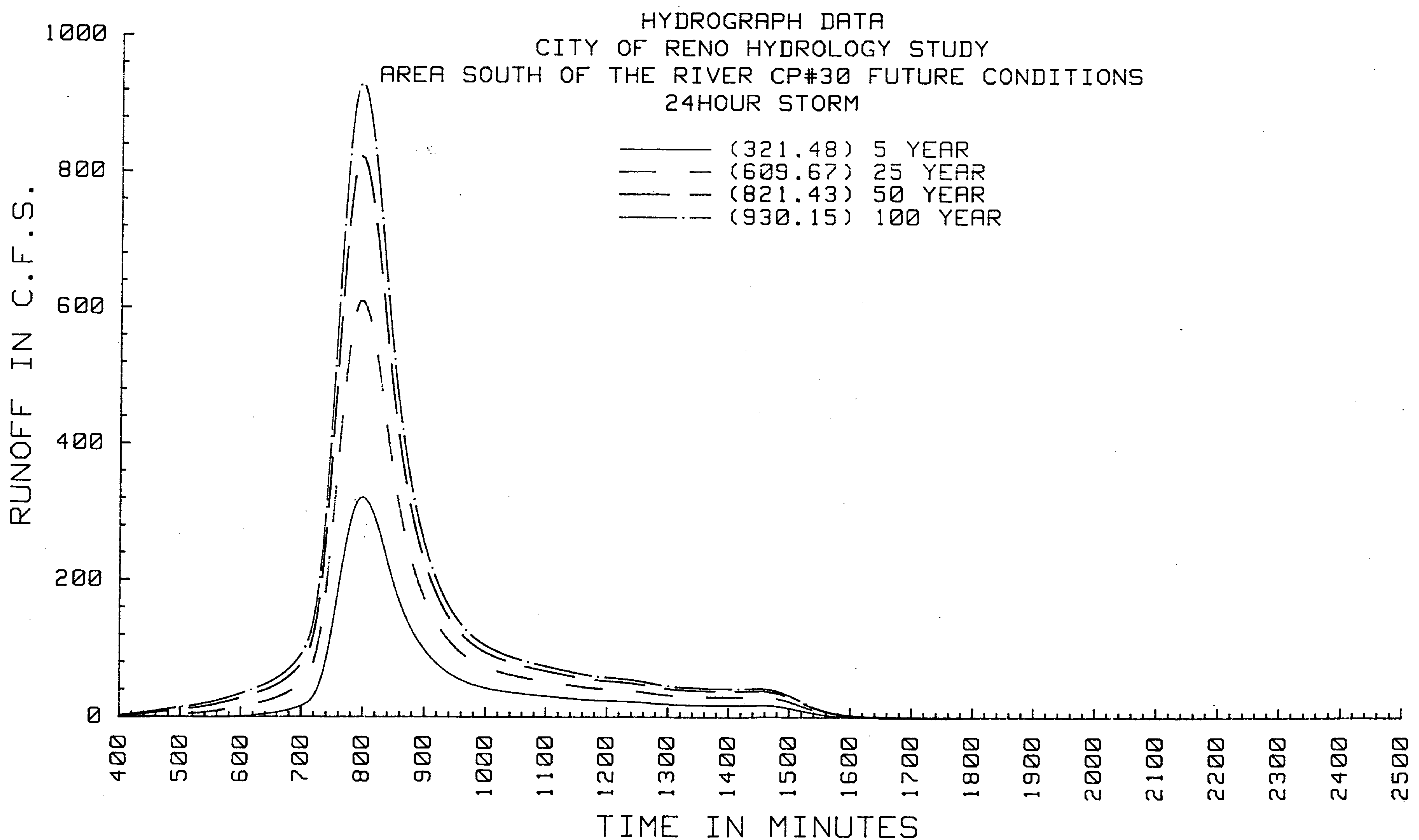
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#30 EXISTING CONDITIONS
24HOUR STORM
(233.92) 5YEAR
(476.16) 25YEAR
(658.44) 50YEAR
(753.03) 100YEAR
RUNOFF IN C.F.S.
1000
800
600
400
200
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#30 FUTURE CONDITIONS
24HOUR STORM
(321.48) 5 YEAR
(609.67) 25 YEAR
(821.43) 50 YEAR
(930.15) 100 YEAR
RUNOFF IN C.F.S.
1000
800
600
400
200
0
400
500
600
700
800
900
1000
1100
1200
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1500
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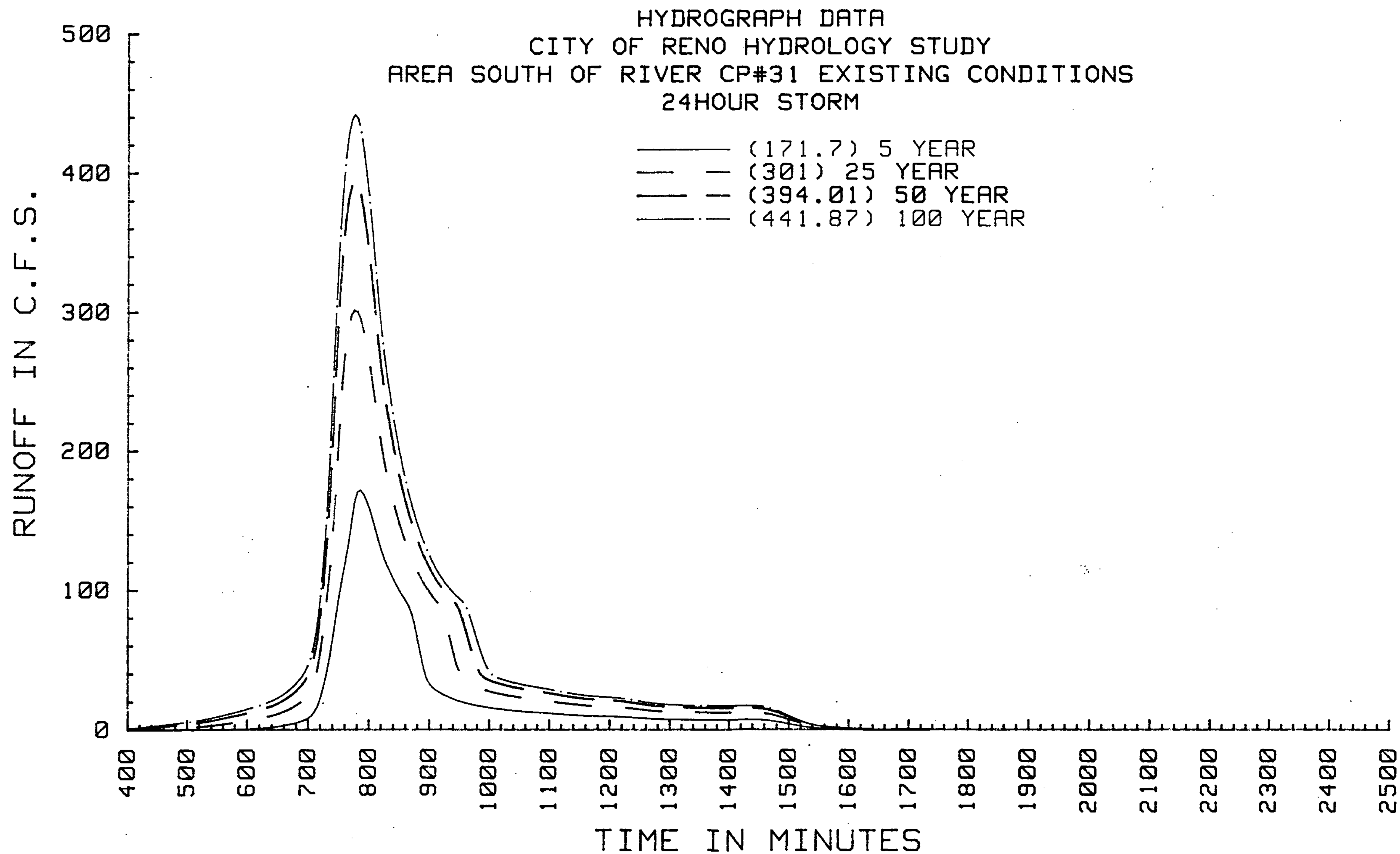
2300
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#31 EXISTING CONDITIONS
24HOUR STORM
(171.7) 5 YEAR
(301) 25 YEAR
(394.01) 50 YEAR
(441.87) 100 YEAR
RUNOFF IN C.F.S.
0
100
200
300
400
500
400
500
600
700
800
900
1000
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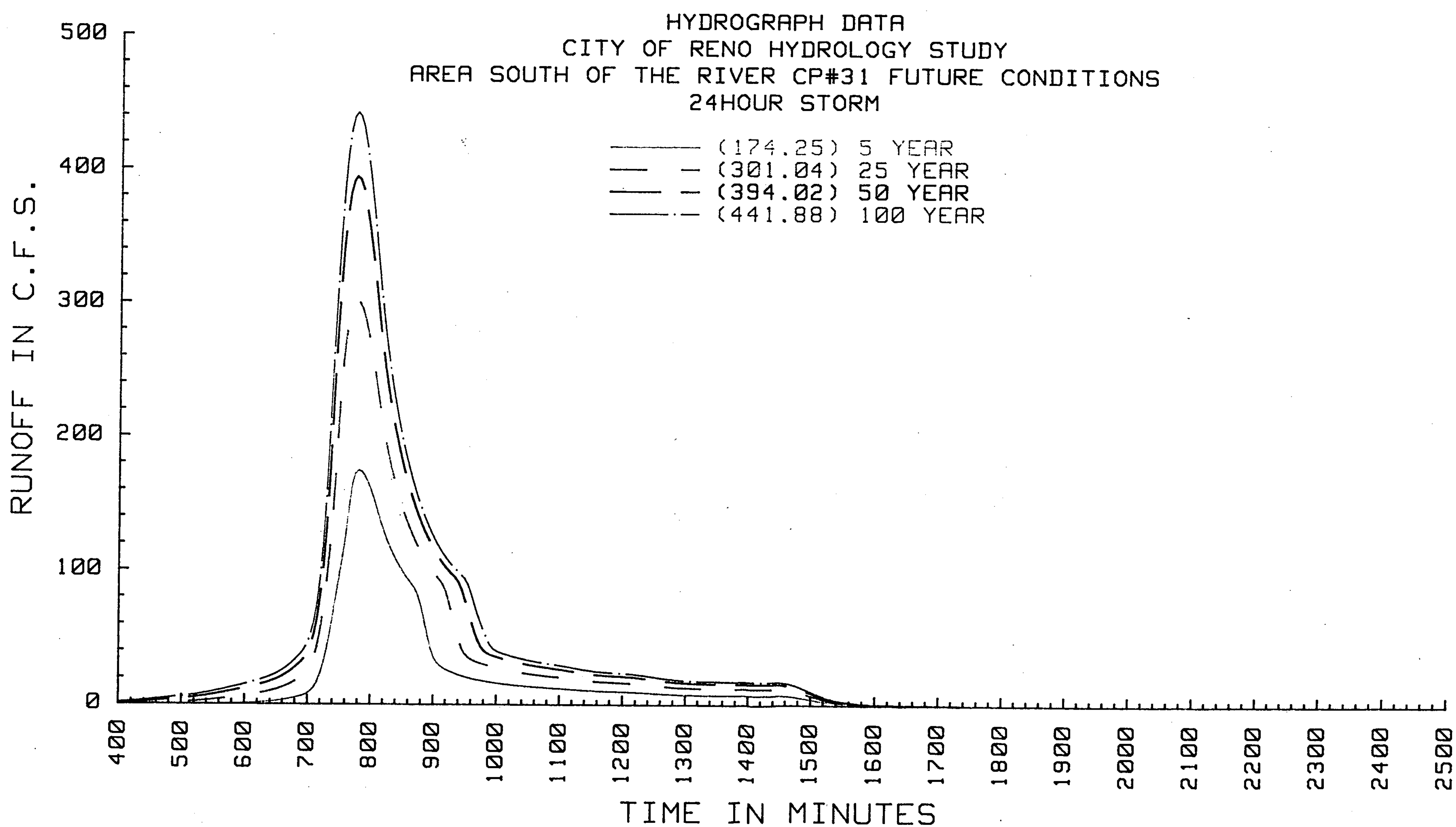
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#31 FUTURE CONDITIONS
24HOUR STORM
(174.25) 5 YEAR
(301.04) 25 YEAR
(394.02) 50 YEAR
(441.88) 100 YEAR
RUNOFF IN C.F.S.
0
100
200
300
400
500
400
500
600
700
800
900
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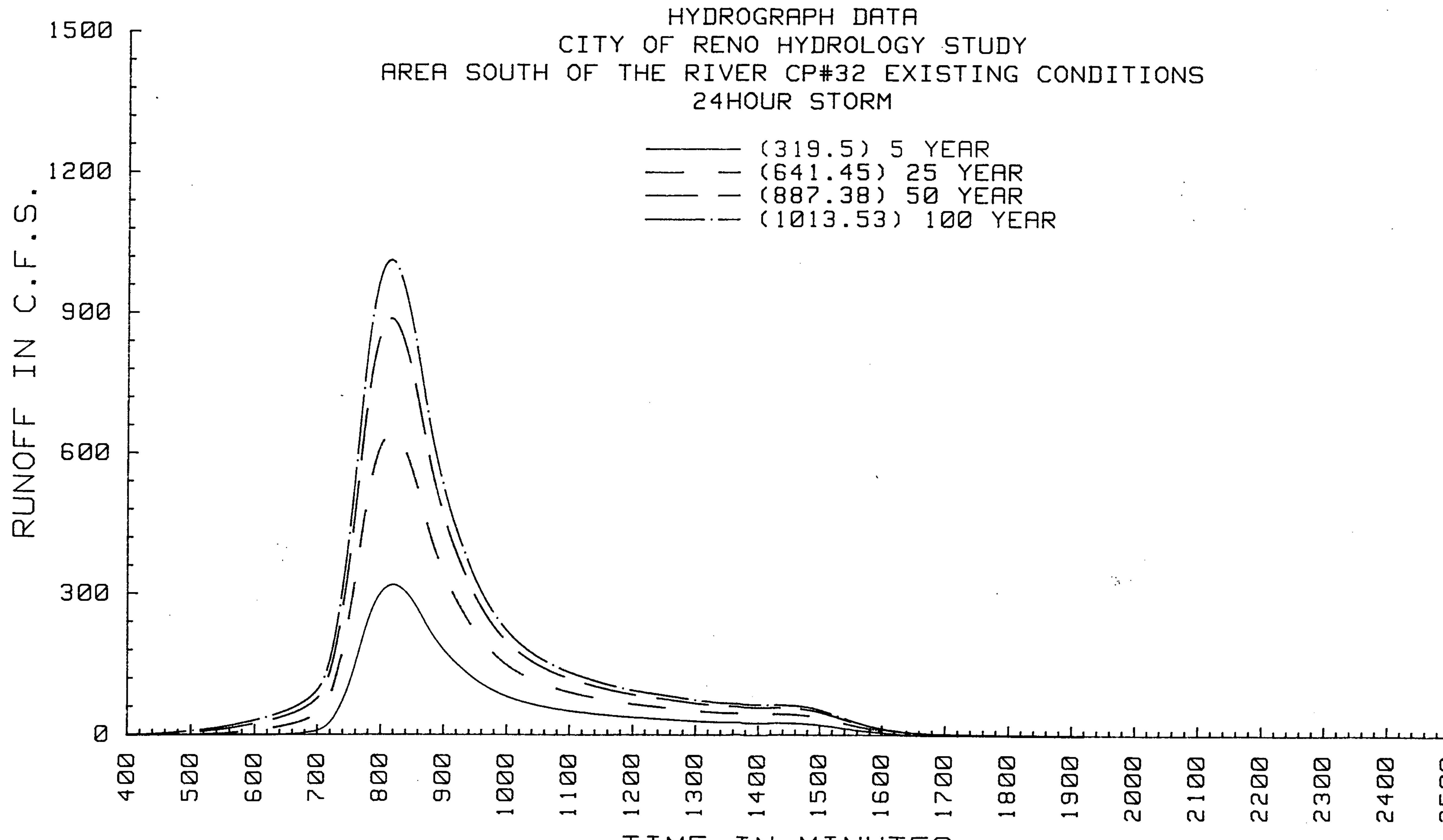
TIME IN MINUTES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AREA SOUTH OF THE RIVER CP#32 EXISTING CONDITIONS
24HOUR STORM
(319.5) 5 YEAR
(641.45) 25 YEAR
(887.38) 50 YEAR
(1013.53) 100 YEAR
RUNOFF IN C.F.S.
1500
1200
900
600
300
0
400
500
600
700
800
900
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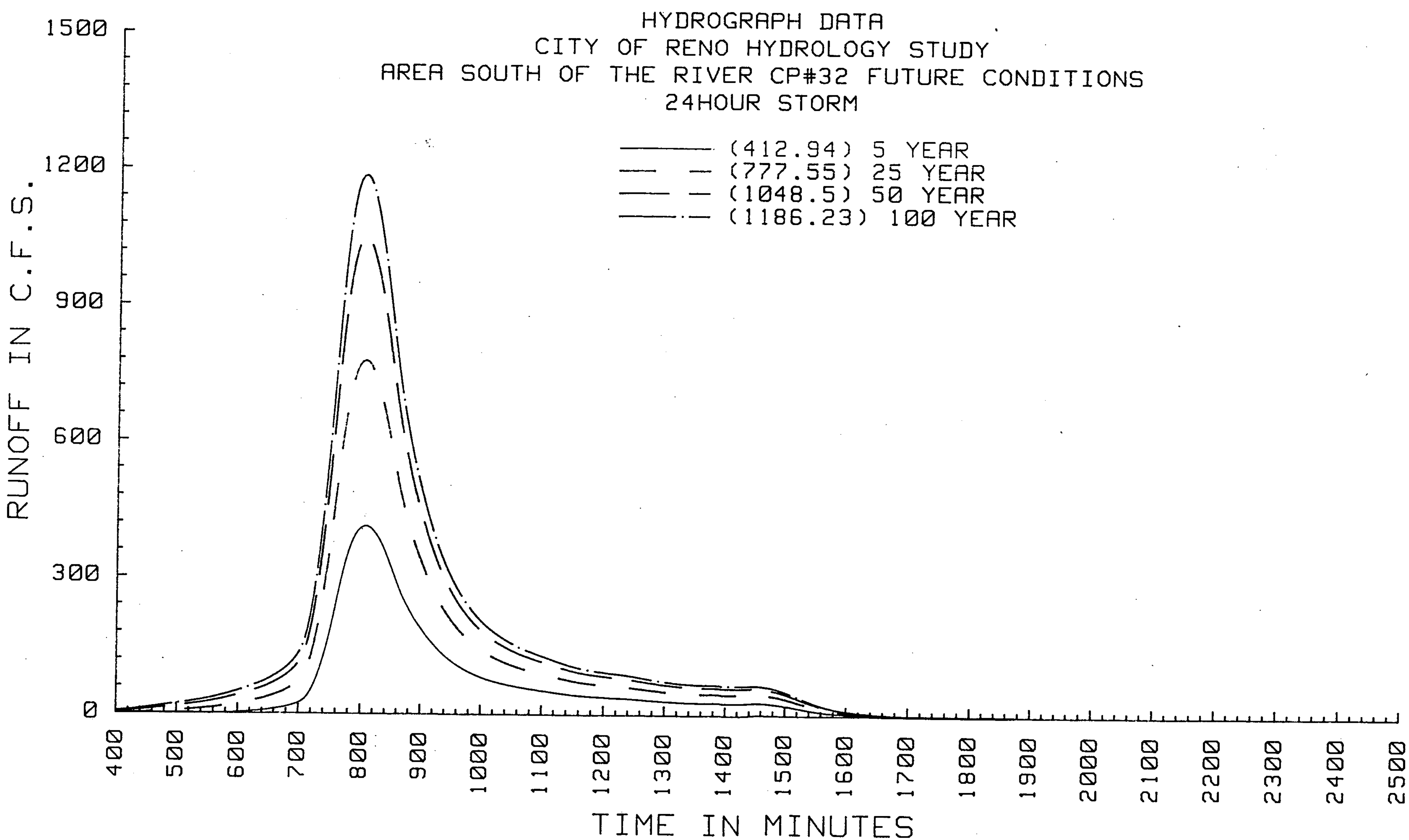
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#32 FUTURE CONDITIONS
24HOUR STORM
(412.94) 5 YEAR
(777.55) 25 YEAR
(1048.5) 50 YEAR
(1186.23) 100 YEAR
RUNOFF IN C.F.S.
0
300
600
900
1200
1500
400
500
600
700
800
900
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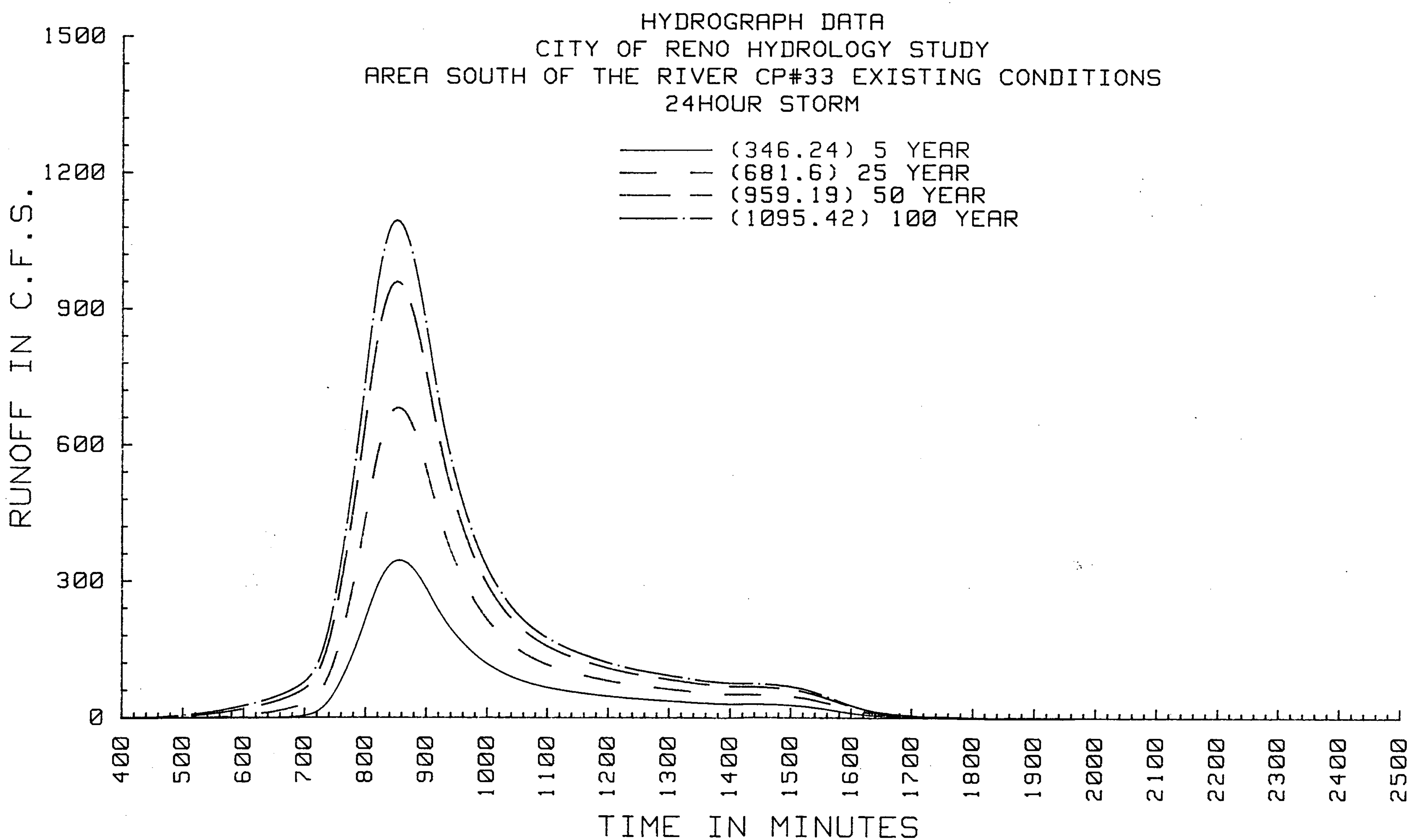
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#33 EXISTING CONDITIONS
24HOUR STORM
(346.24) 5 YEAR
(681.6) 25 YEAR
(959.19) 50 YEAR
(1095.42) 100 YEAR
RUNOFF IN C.F.S.
1500
1200
900
600
300
0
400
500
600
700
800
900
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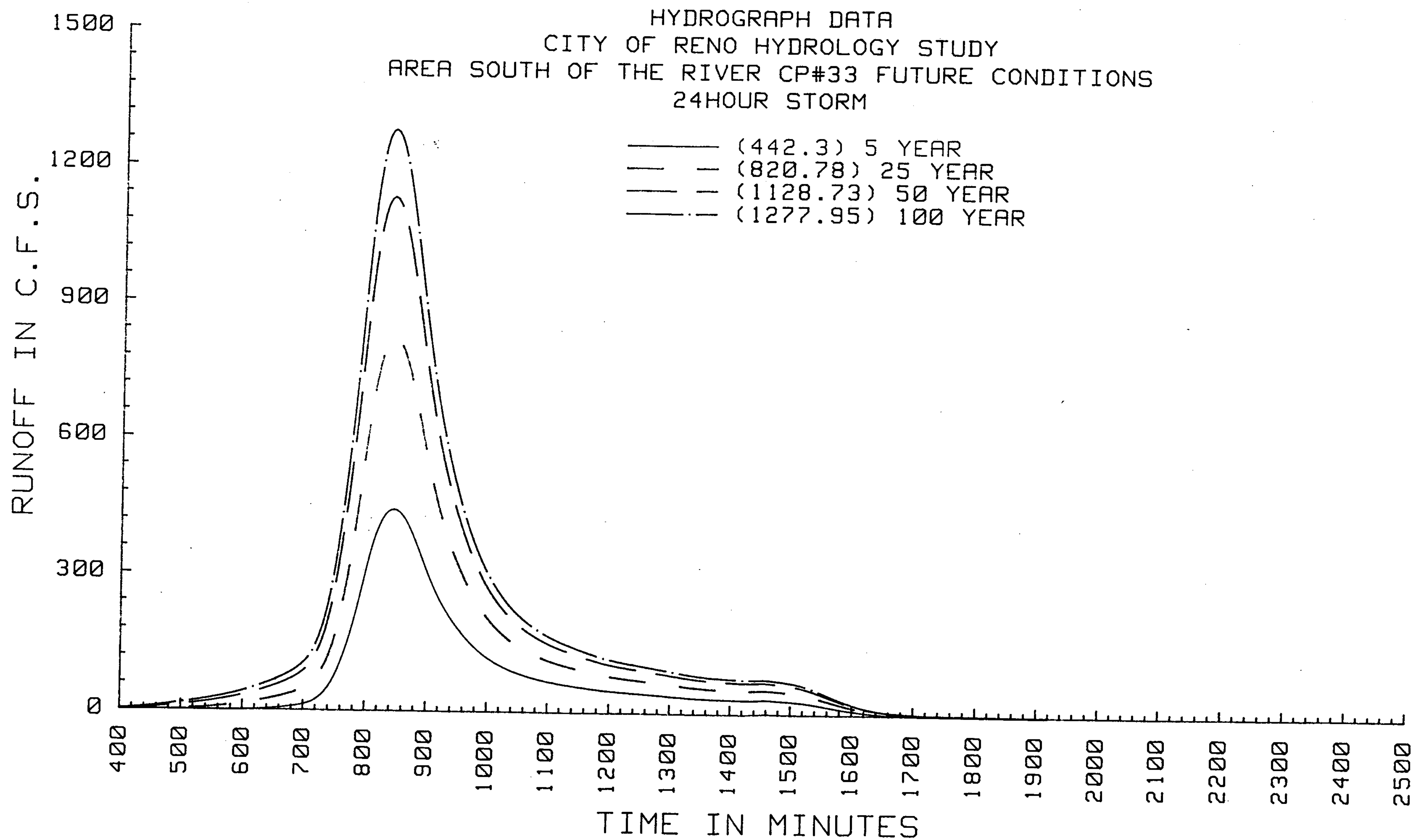
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#33 FUTURE CONDITIONS
24HOUR STORM
(442.3) 5 YEAR
(820.78) 25 YEAR
(1128.73) 50 YEAR
(1277.95) 100 YEAR
RUNOFF IN C.F.S.
1500
1200
900
600
300
0
400
500
600
700
800
900
1000
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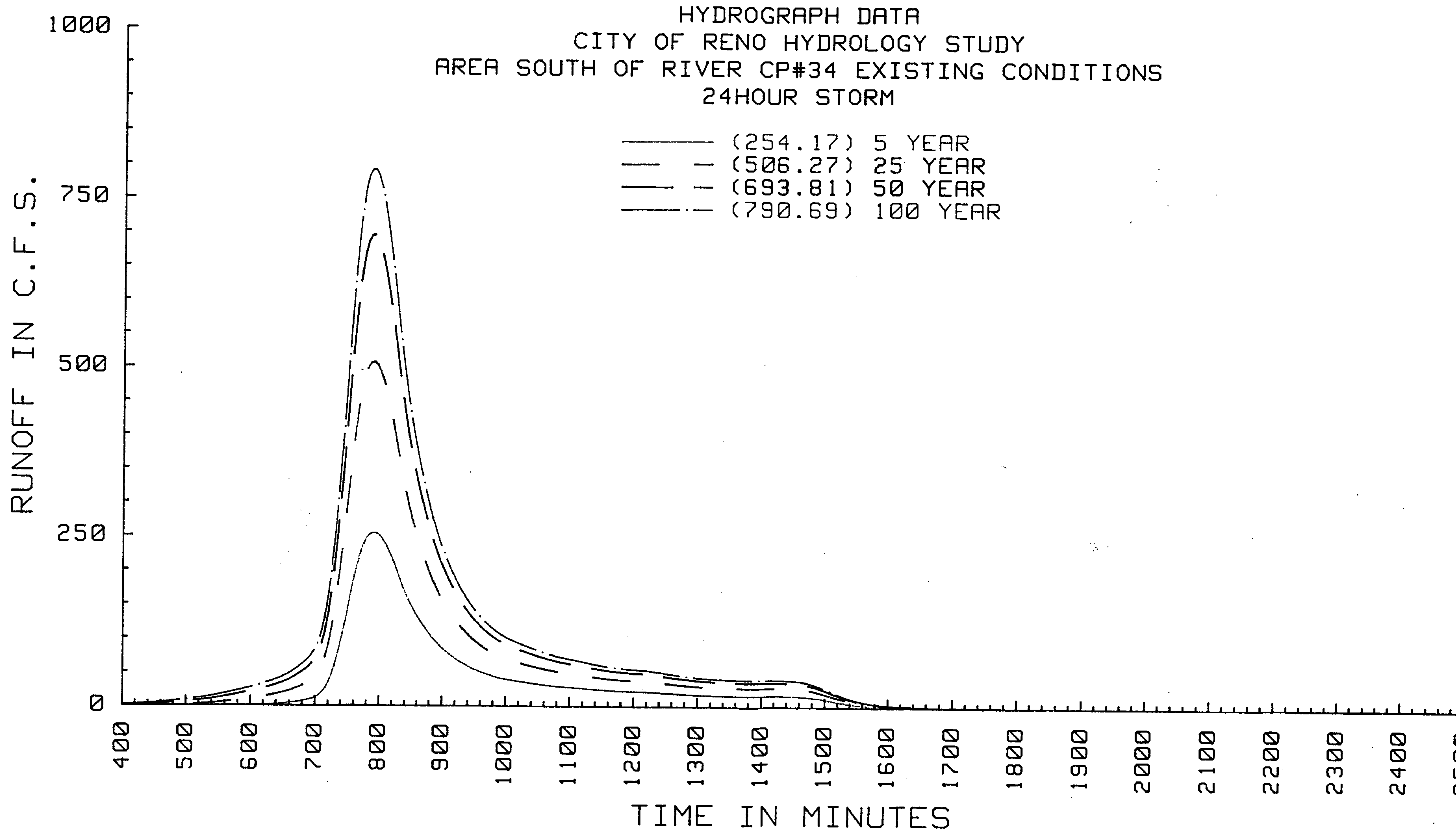
2400
2500
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#34 EXISTING CONDITIONS
24HOUR STORM
(254.17) 5 YEAR
(506.27) 25 YEAR
(693.81) 50 YEAR
(790.69) 100 YEAR
RUNOFF IN C.F.S.
1000
750
500
250
0
400
500
600
700
800
900
1000
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1200
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2200
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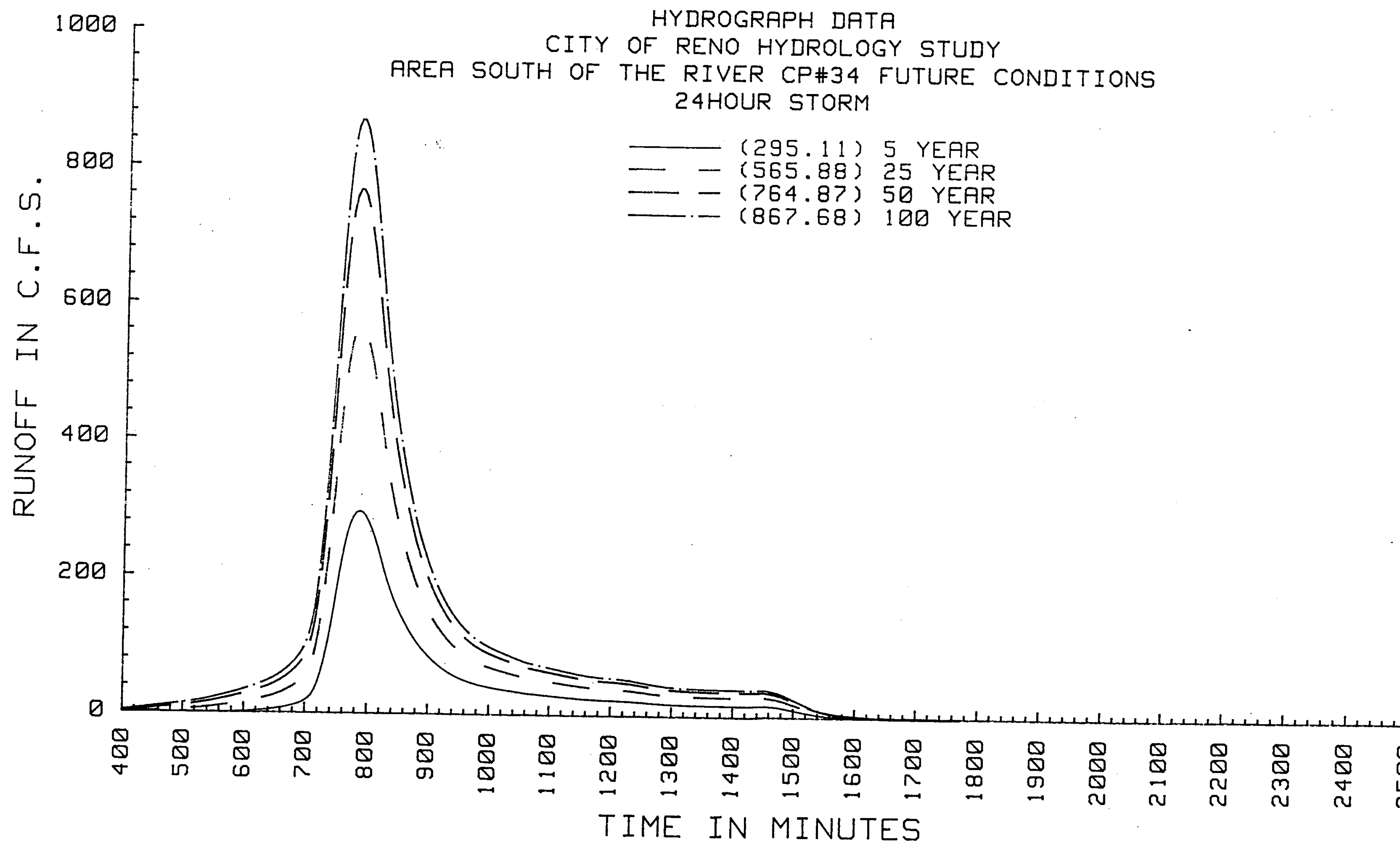
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#34 FUTURE CONDITIONS
24HOUR STORM
(295.11) 5 YEAR
(565.88) 25 YEAR
(764.87) 50 YEAR
(867.68) 100 YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
400
500
600
700
800
900
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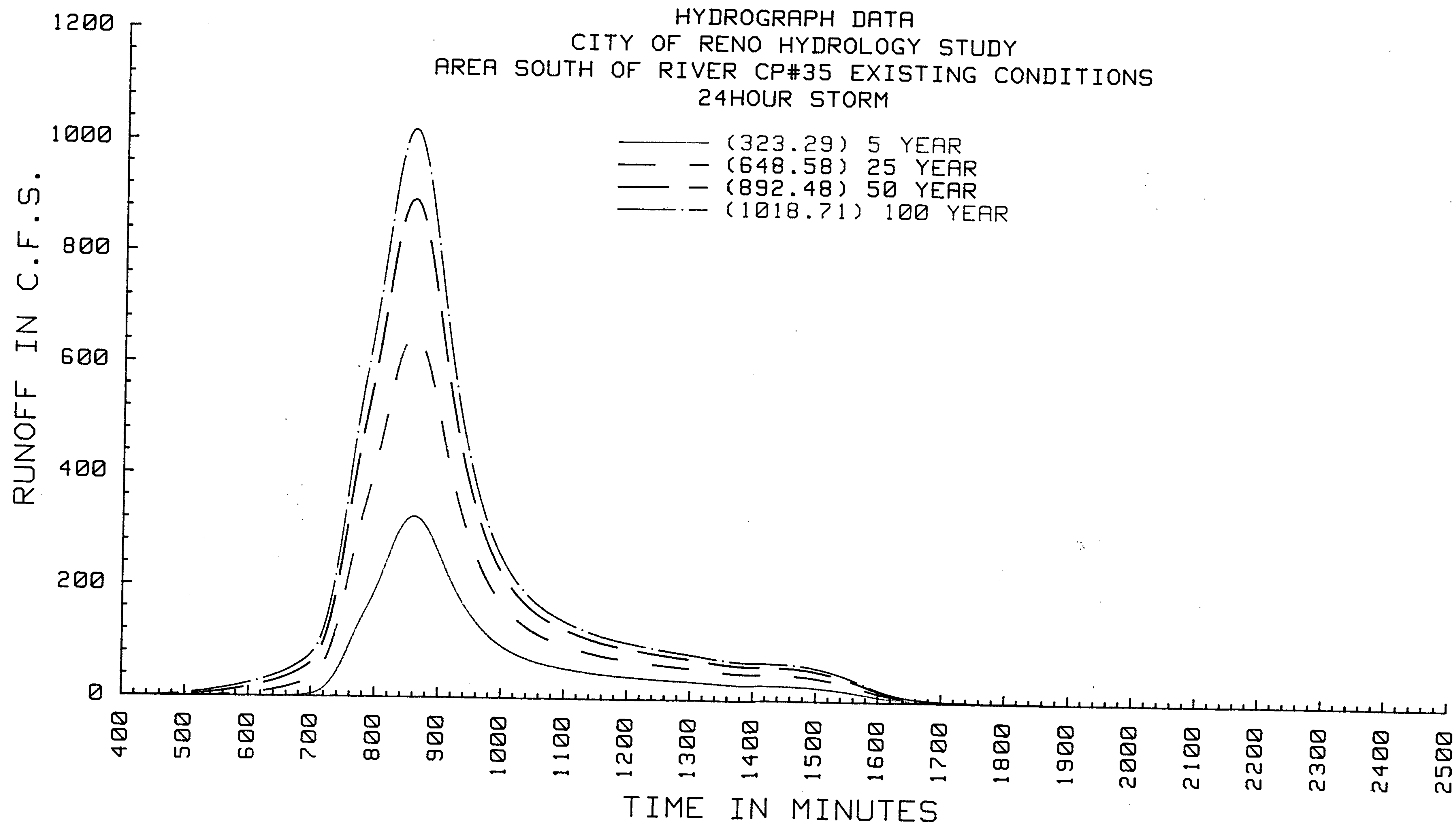
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#35 EXISTING CONDITIONS
24HOUR STORM
(323.29) 5 YEAR
(648.58) 25 YEAR
(892.48) 50 YEAR
(1018.71) 100 YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
1200
TIME IN MINUTES
400
500
600
700
800
900
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1200
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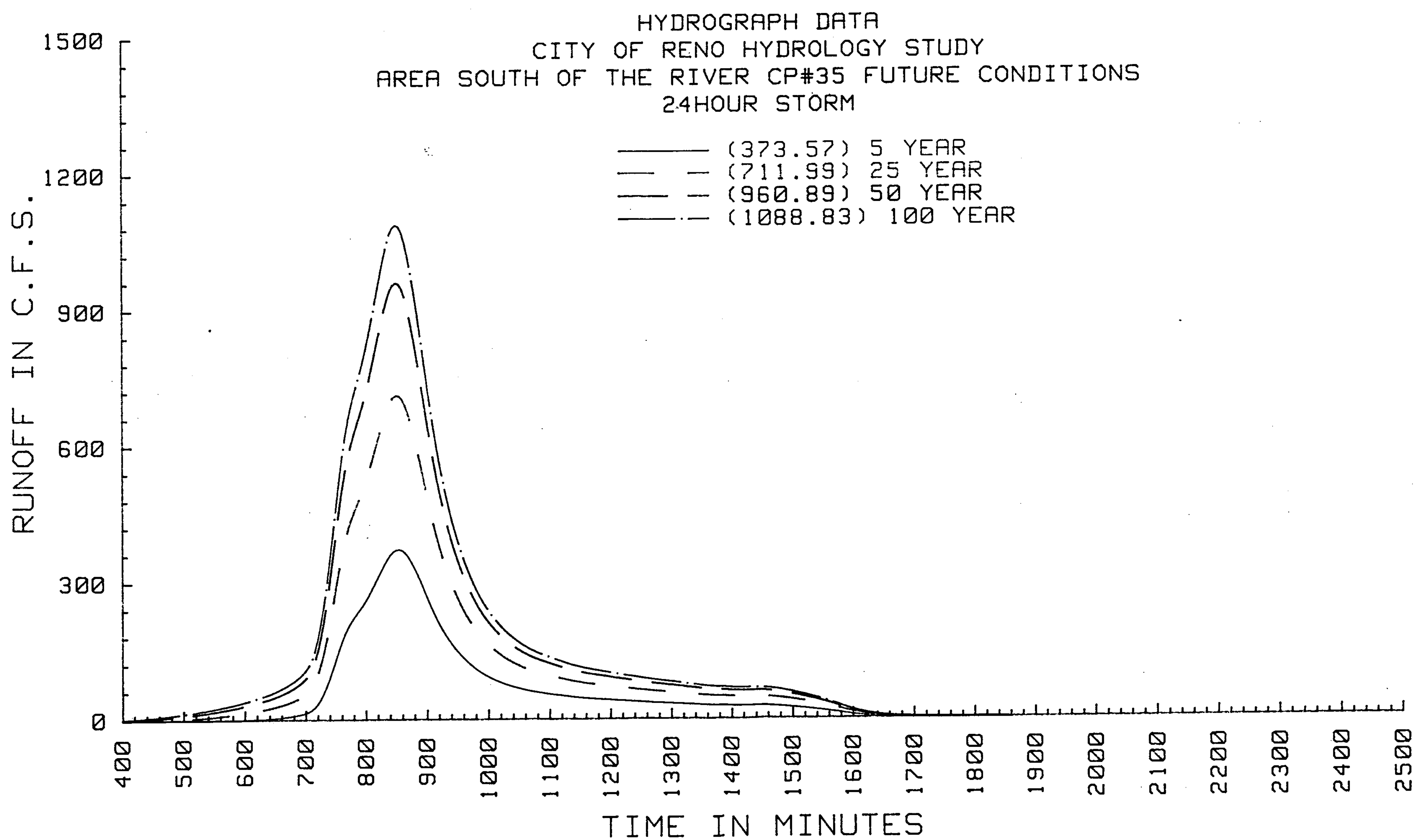
2200
2300
2400
2500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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#35 FUTURE CONDITIONS
24HOUR STORM
(373.57) 5 YEAR
(711.99) 25 YEAR
(960.89) 50 YEAR
(1088.83) 100 YEAR
RUNOFF IN C.F.S.
1500
1200
900
600
300
0
400
500
600
700
800
900
1000
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1200
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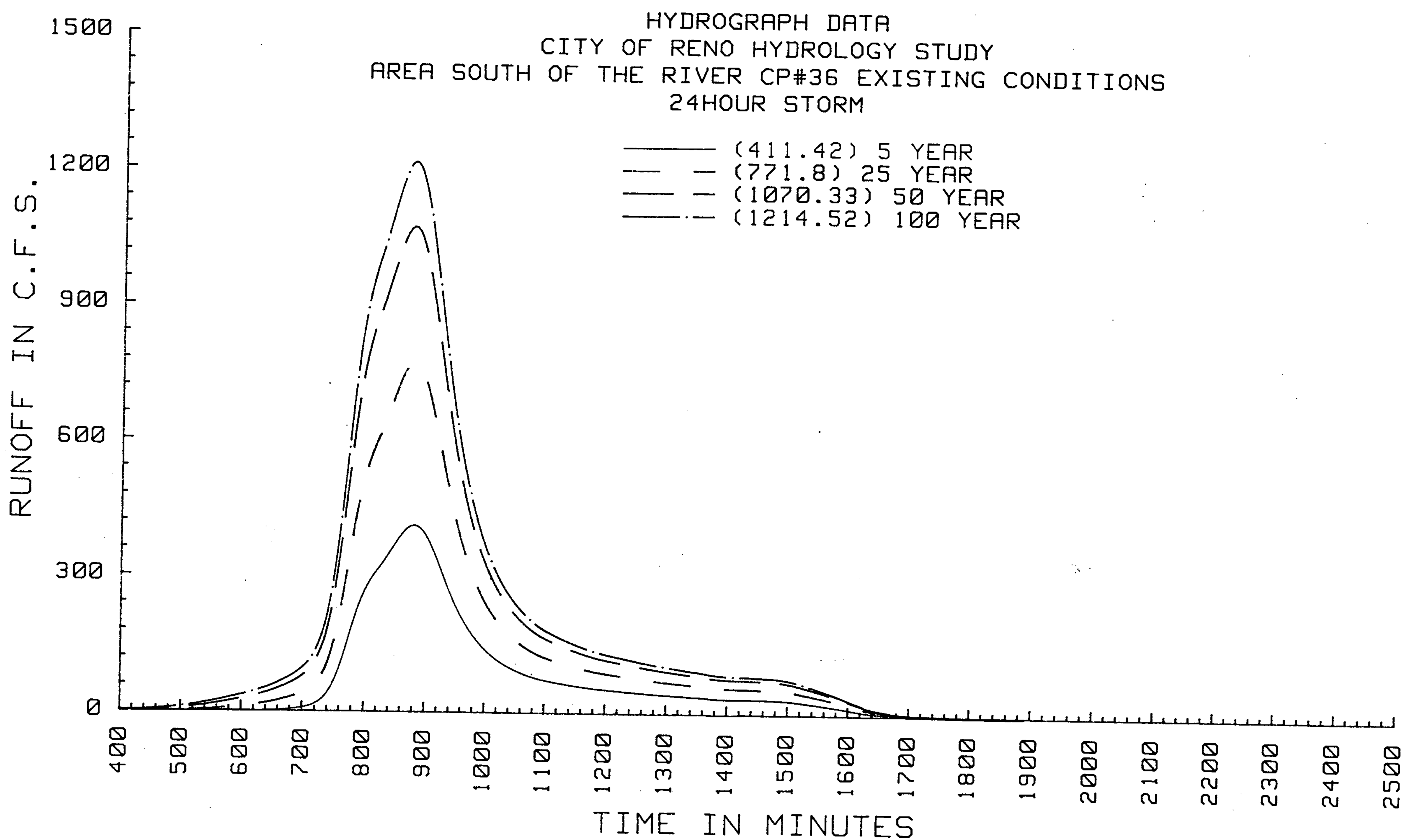
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#36 EXISTING CONDITIONS
24HOUR STORM
(411.42) 5 YEAR
(771.8) 25 YEAR
(1070.33) 50 YEAR
(1214.52) 100 YEAR
RUNOFF IN C.F.S.
1500
1200
900
600
300
0
400
500
600
700
800
900
1000
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1200
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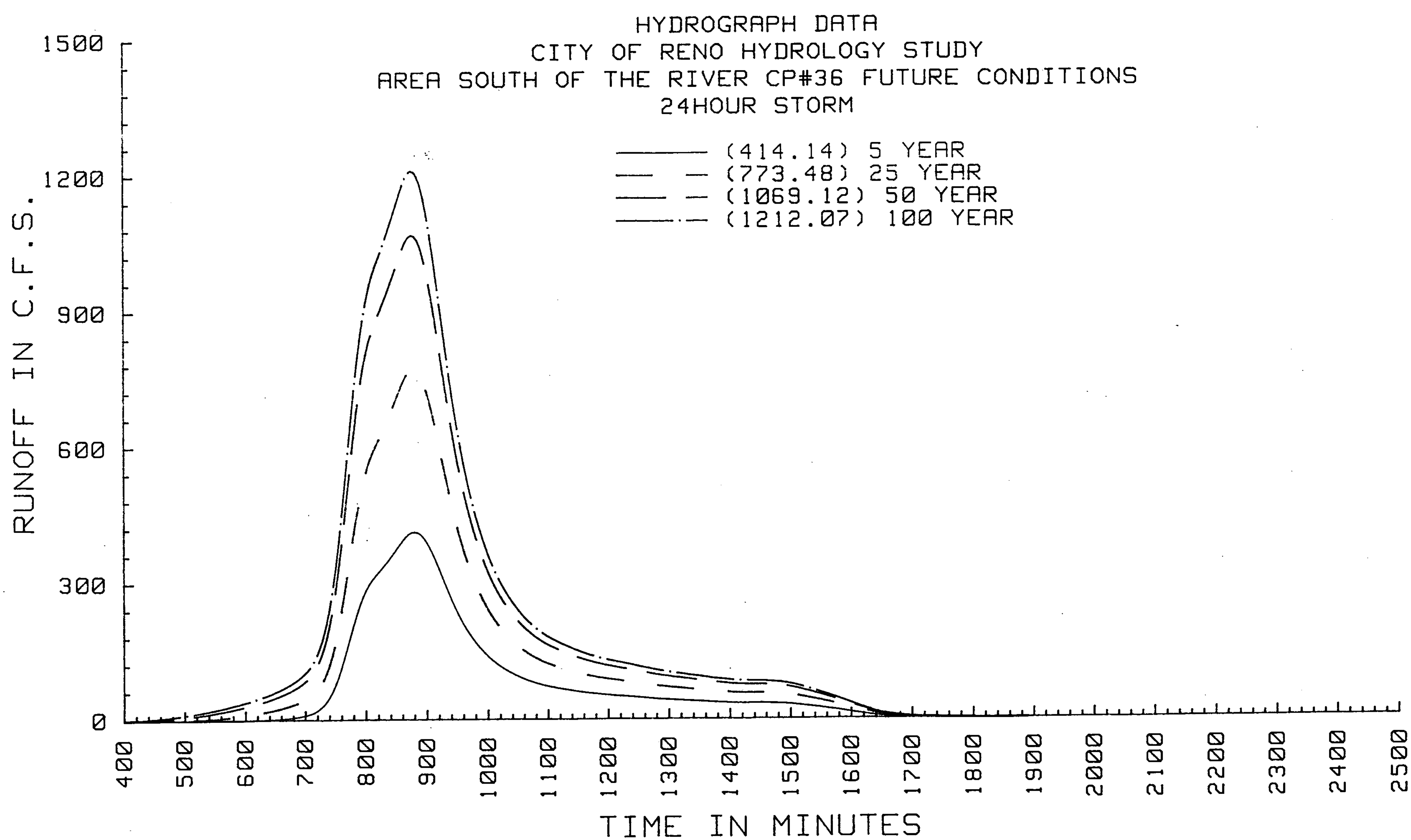
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP#36 FUTURE CONDITIONS
24HOUR STORM
(414.14) 5 YEAR
(773.48) 25 YEAR
(1069.12) 50 YEAR
(1212.07) 100 YEAR
RUNOFF IN C.F.S.
0
300
600
900
1200
1500
400
500
600
700
800
900
1000
1100
1200
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1500
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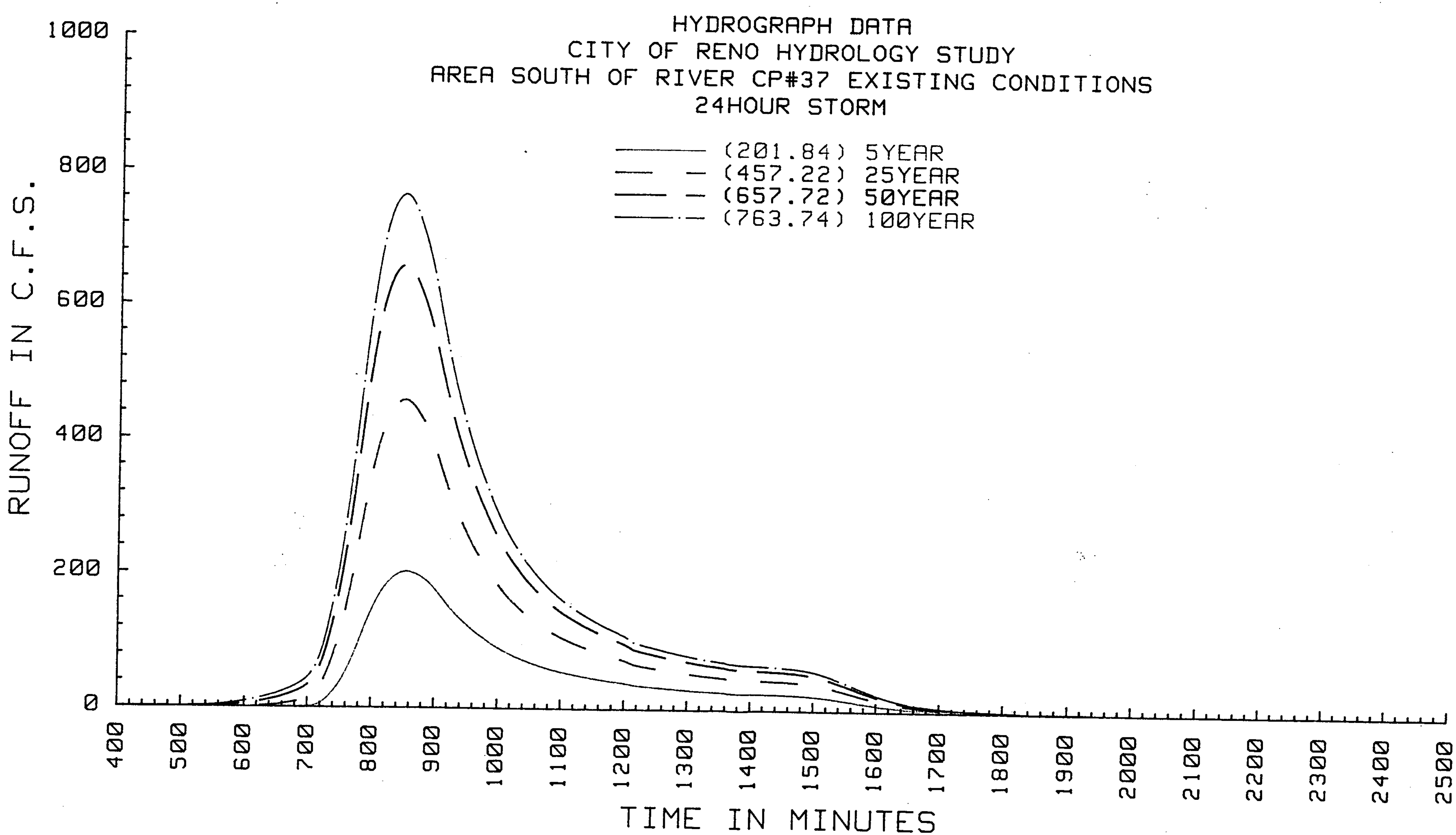
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER CP#37 EXISTING CONDITIONS
24HOUR STORM
(201.84) 5YEAR
(457.22) 25YEAR
(657.72) 50YEAR
(763.74) 100YEAR
RUNOFF IN C.F.S.
0
200
400
600
800
1000
400
500
600
700
800
900
1000
1100
1200
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1400
1500
1600
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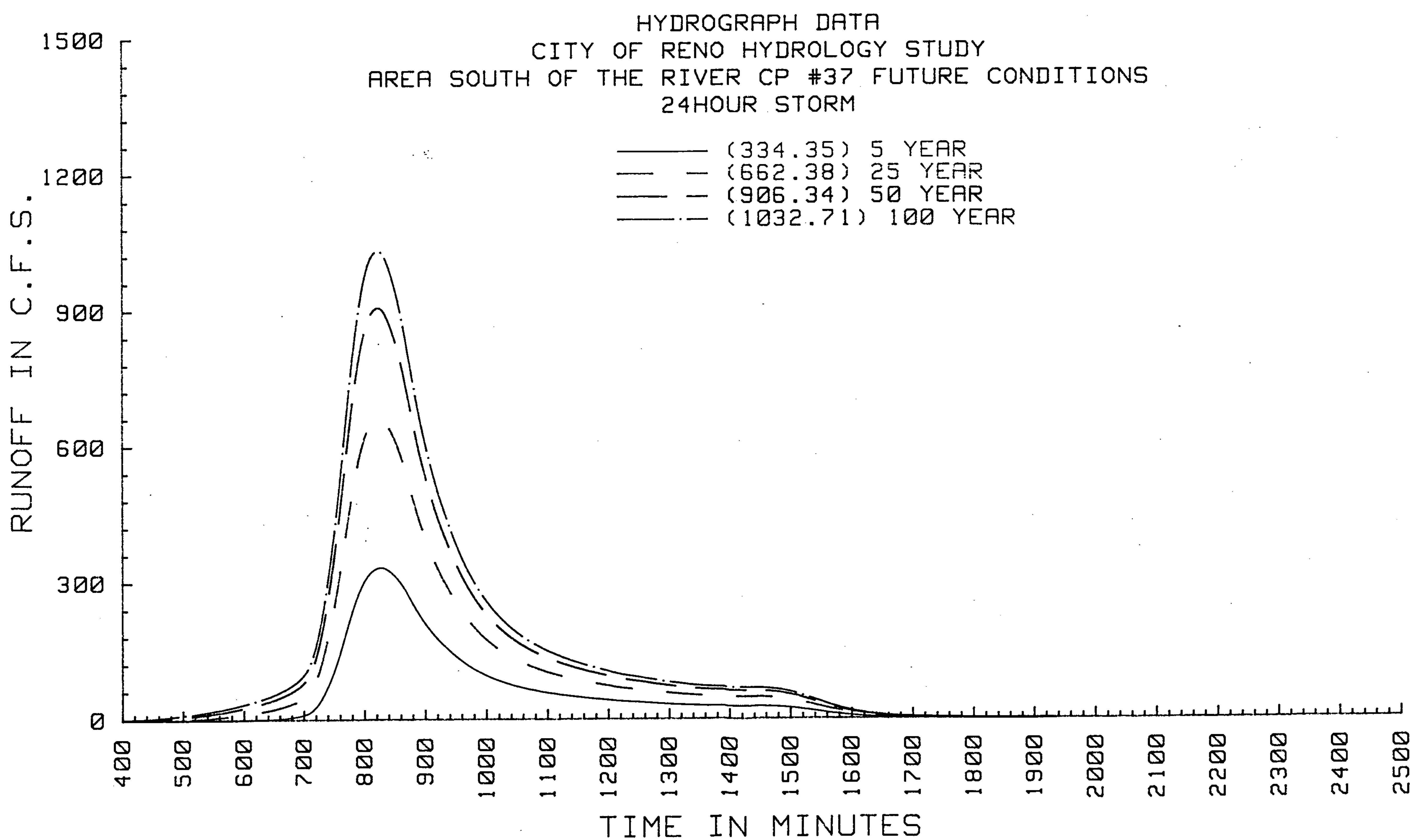
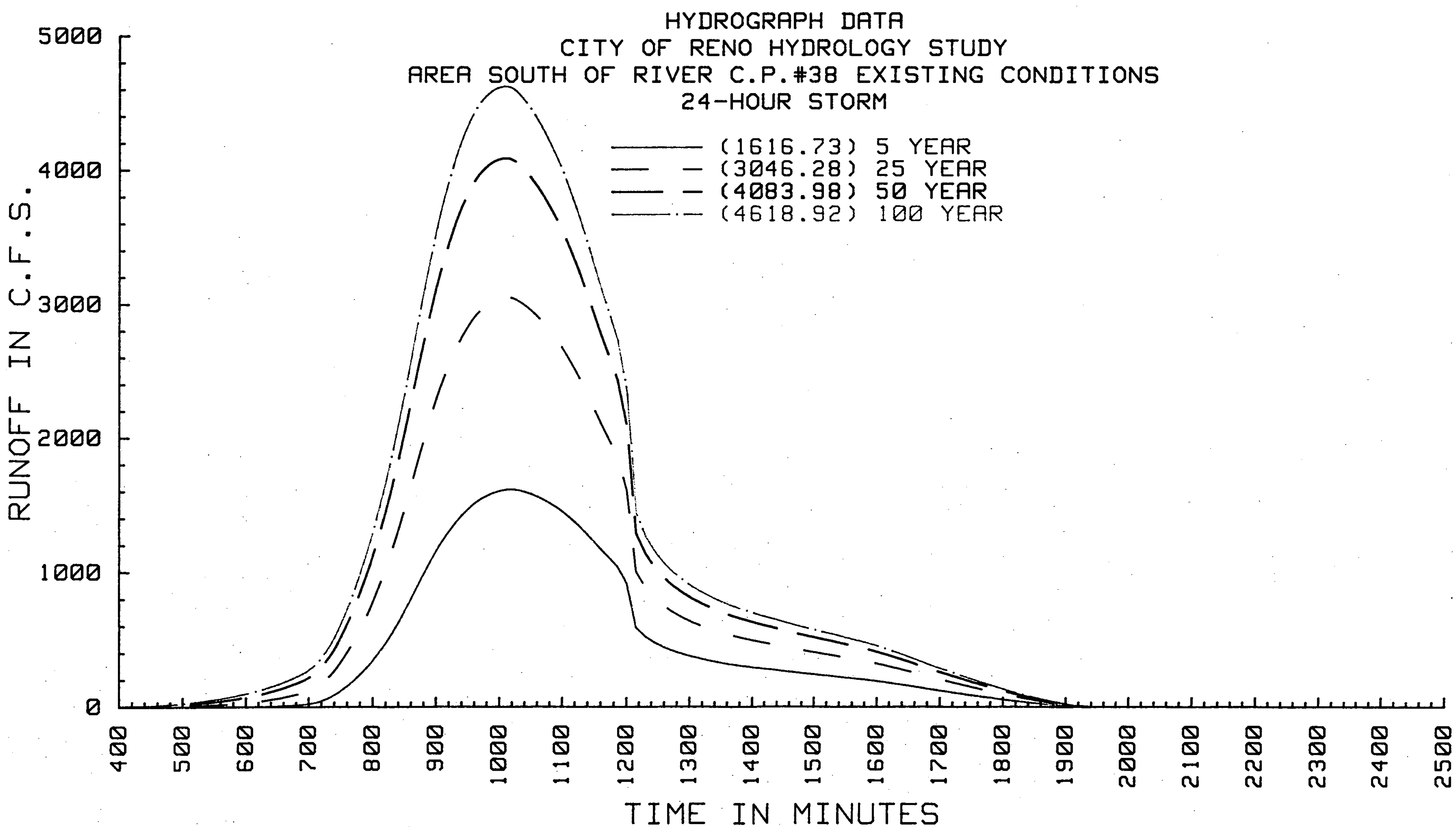
2200
2300
2400
2500
TIME IN MINUTES


HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF THE RIVER CP #37 FUTURE CONDITIONS
24HOUR STORM
(334.35) 5 YEAR
(662.38) 25 YEAR
(906.34) 50 YEAR
(1032.71) 100 YEAR
RUNOFF IN C.F.S.
1500
1200
900
600
300
0
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER C.P.#38 EXISTING CONDITIONS
24-HOUR STORM
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(4083.98) 50 YEAR
(4618.92) 100 YEAR
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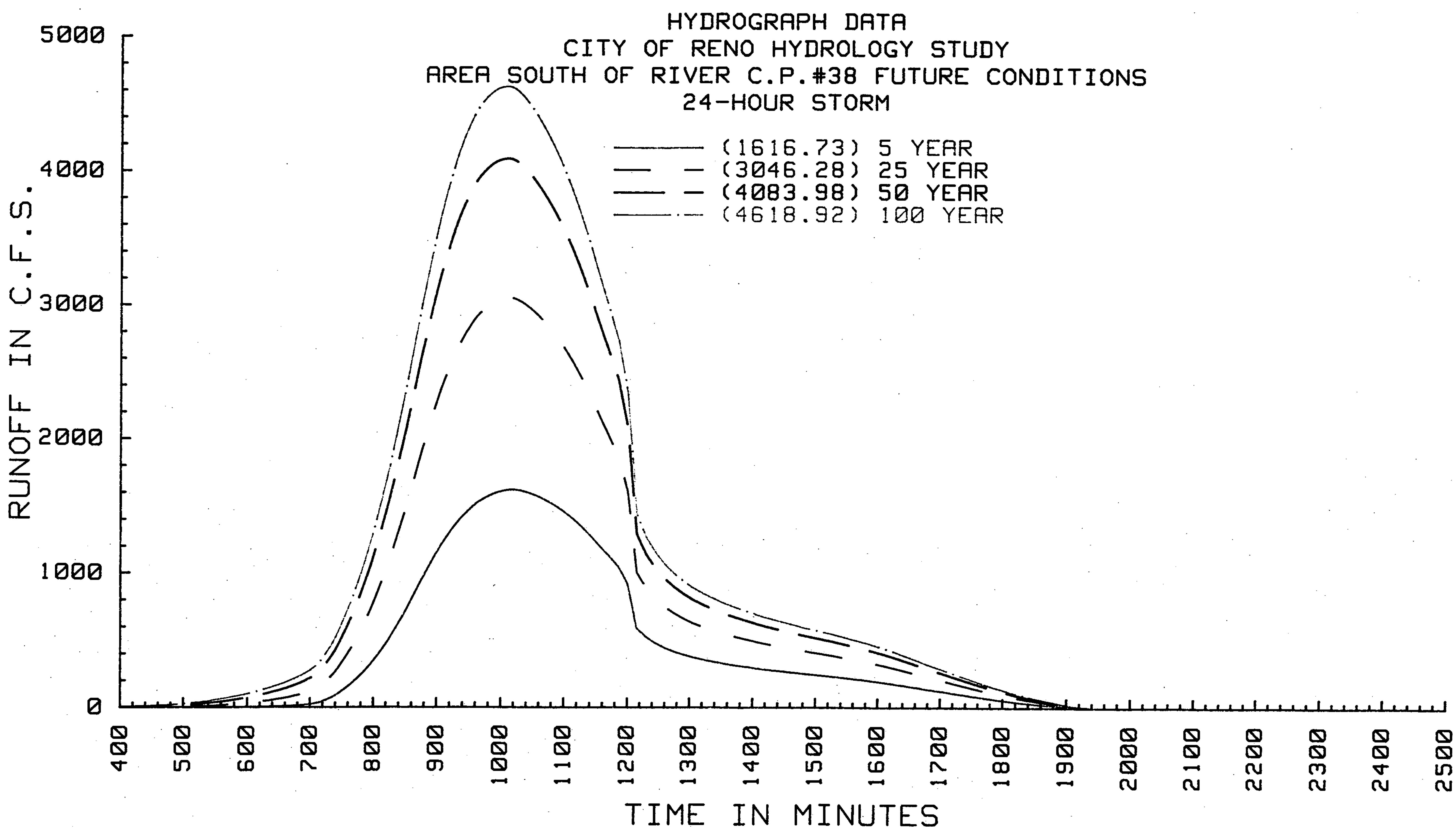
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AREA SOUTH OF RIVER C.P.#38 FUTURE CONDITIONS
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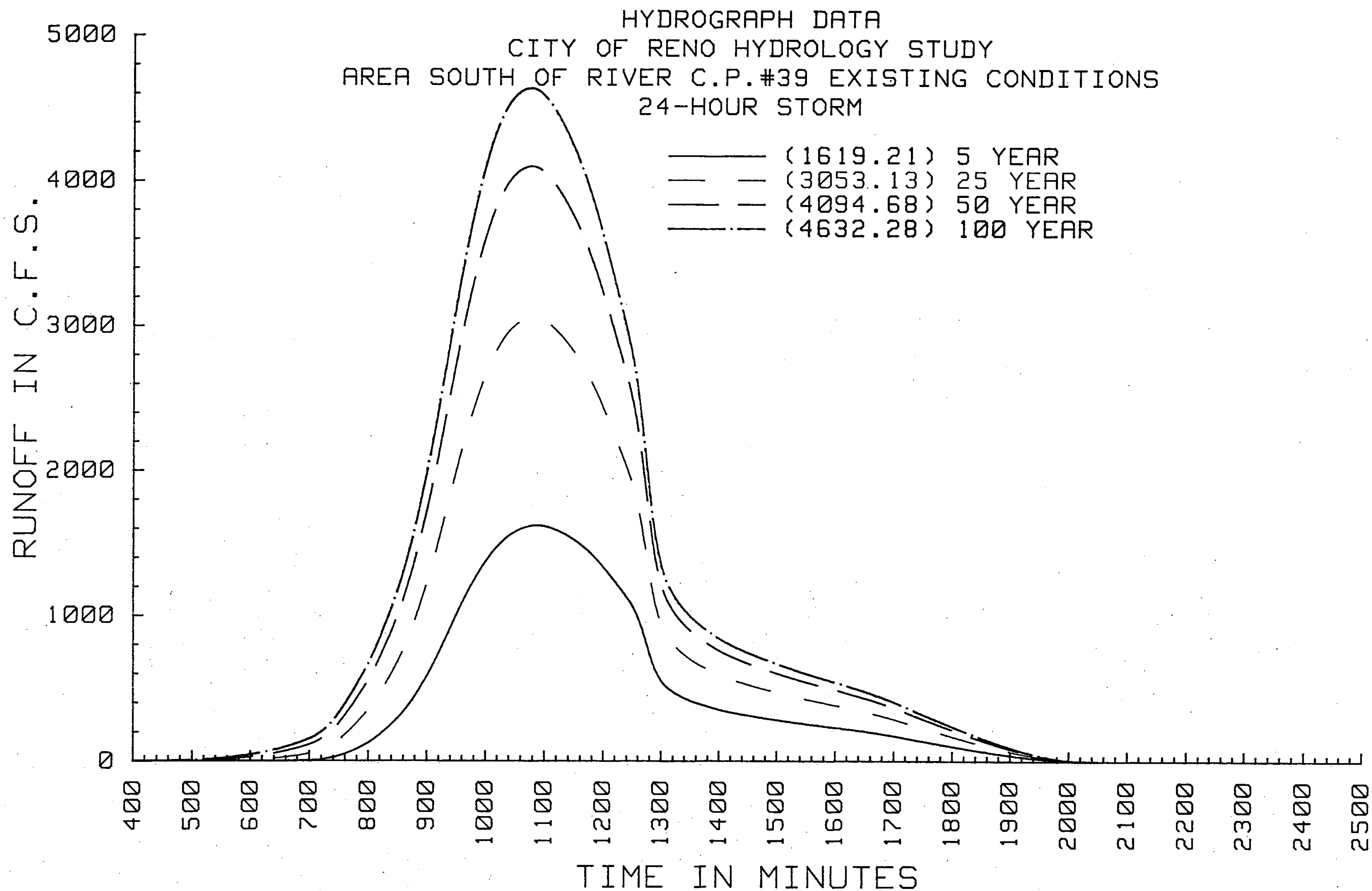

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AREA SOUTH OF RIVER C.P.#39 EXISTING CONDITIONS
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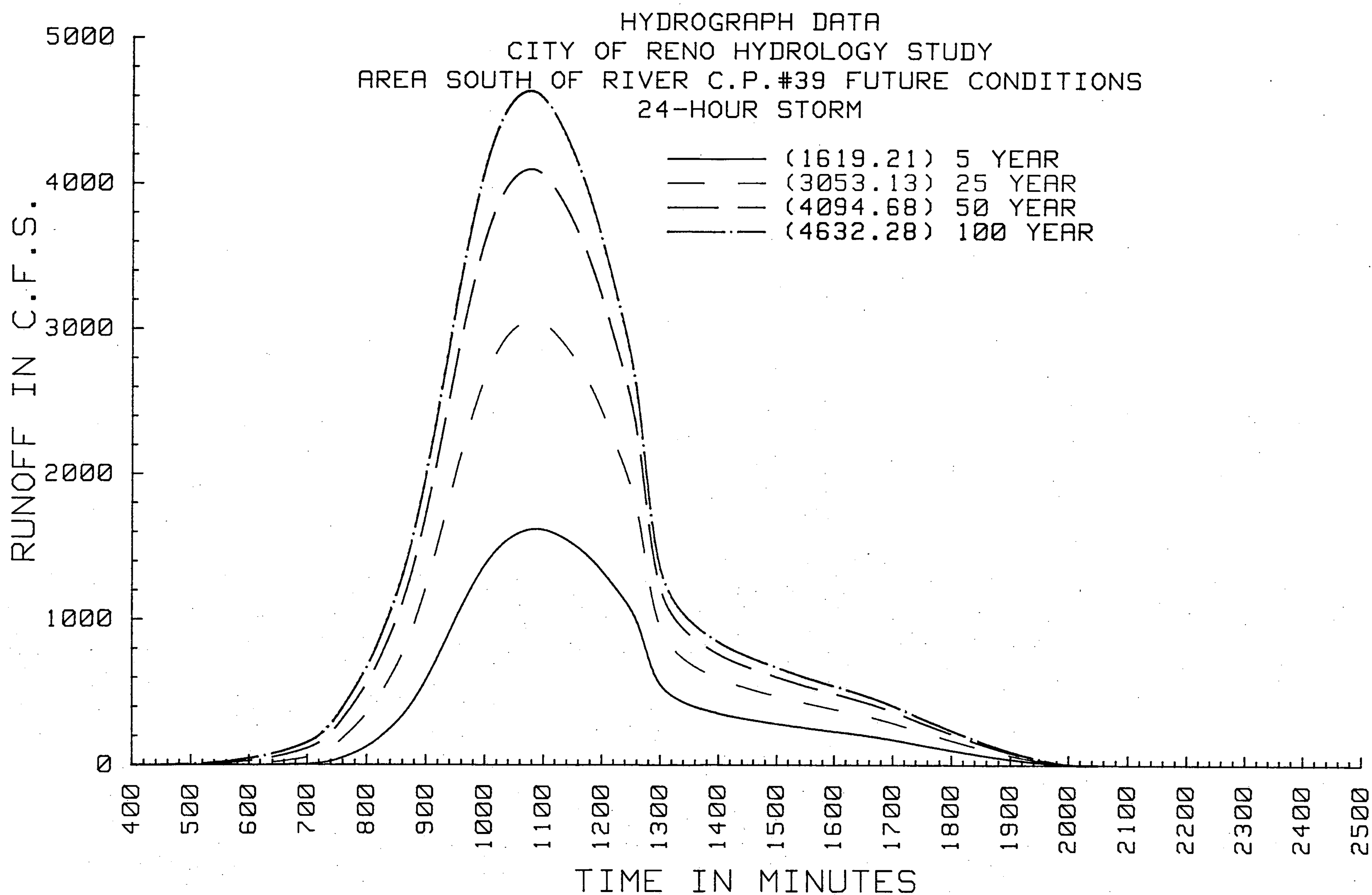
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AREA SOUTH OF RIVER C.P.#39 FUTURE CONDITIONS
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(4094.68) 50 YEAR
(4632.28) 100 YEAR
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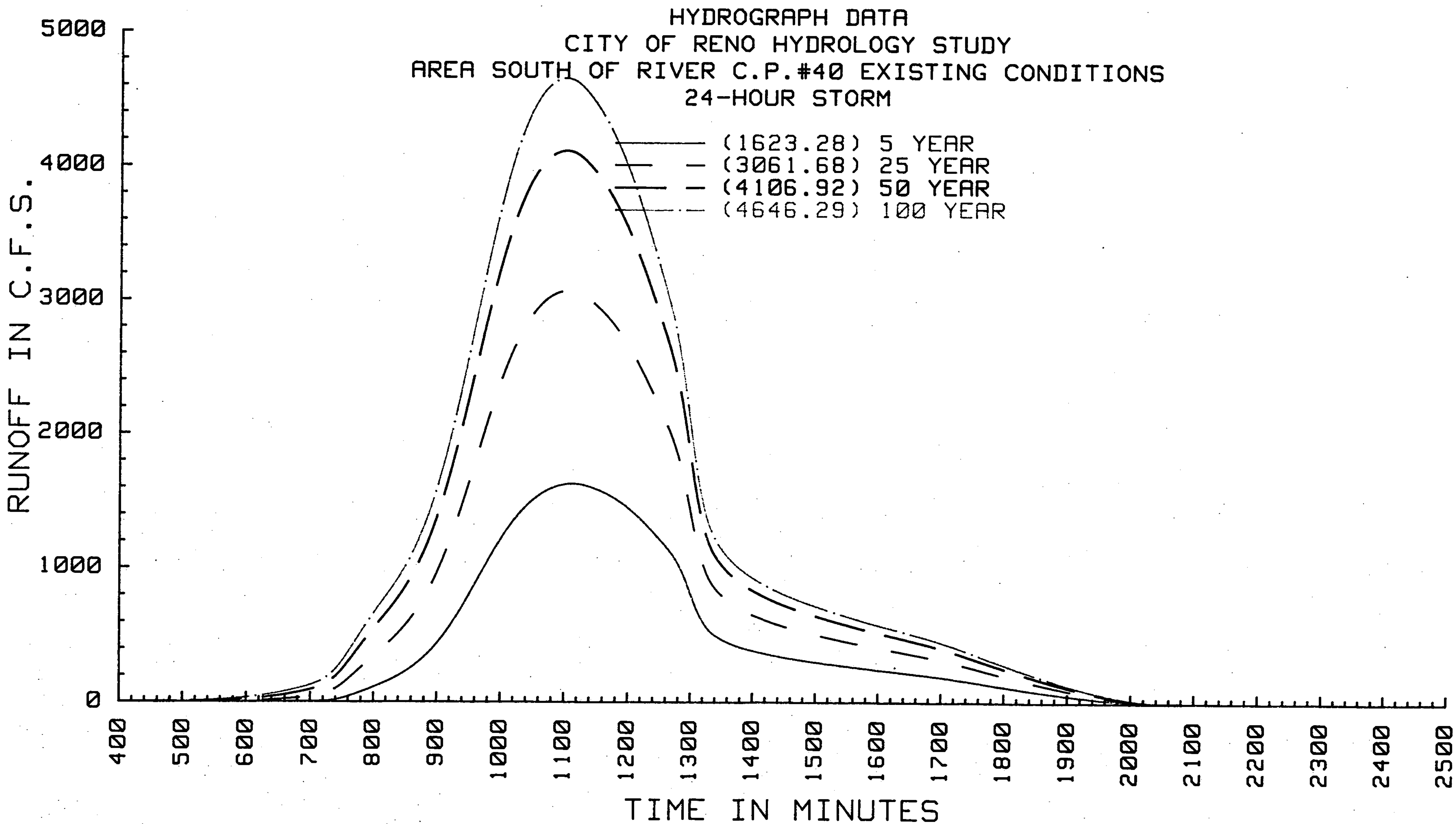
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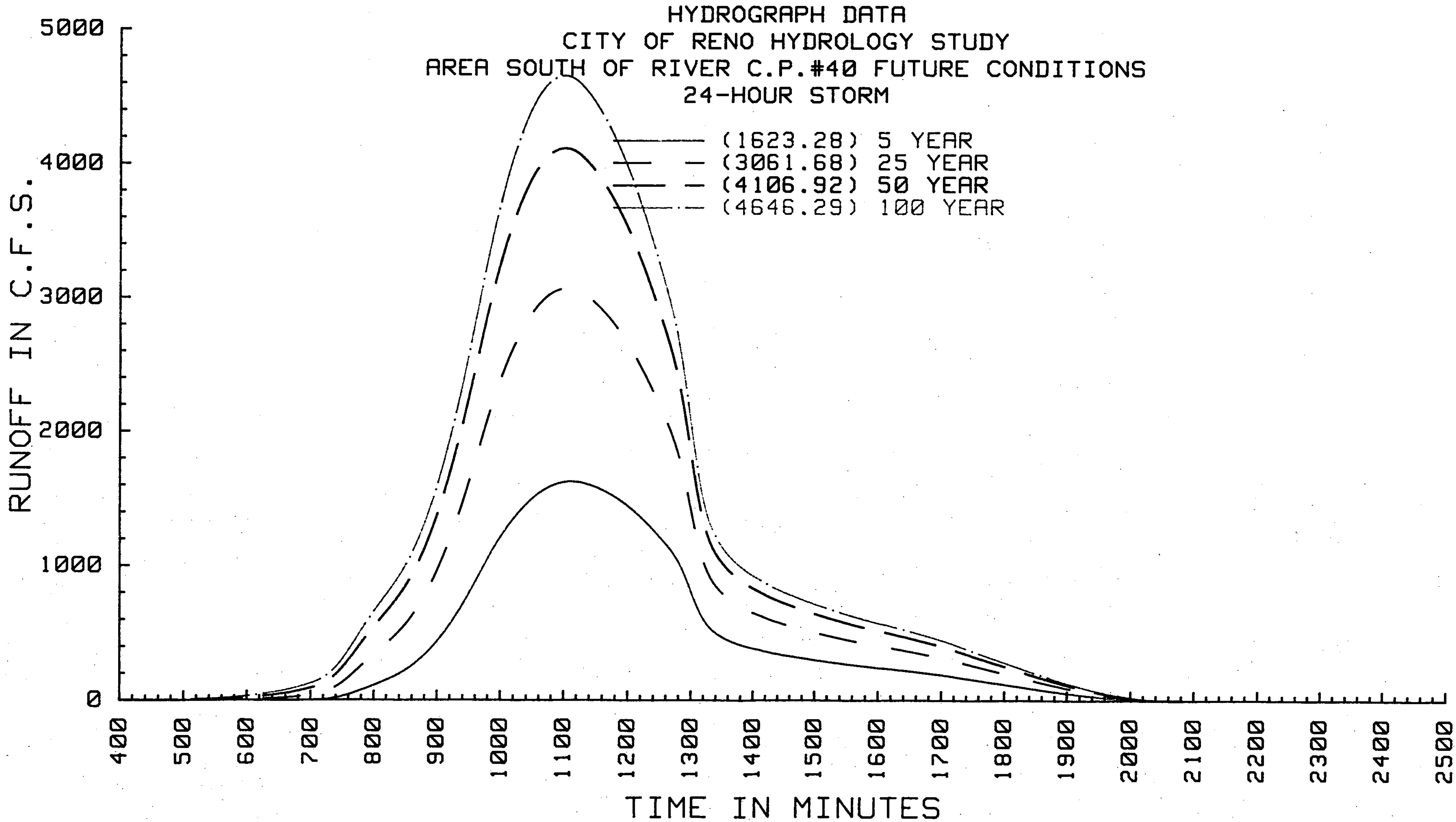
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(4106.92) 50 YEAR
(4646.29) 100 YEAR
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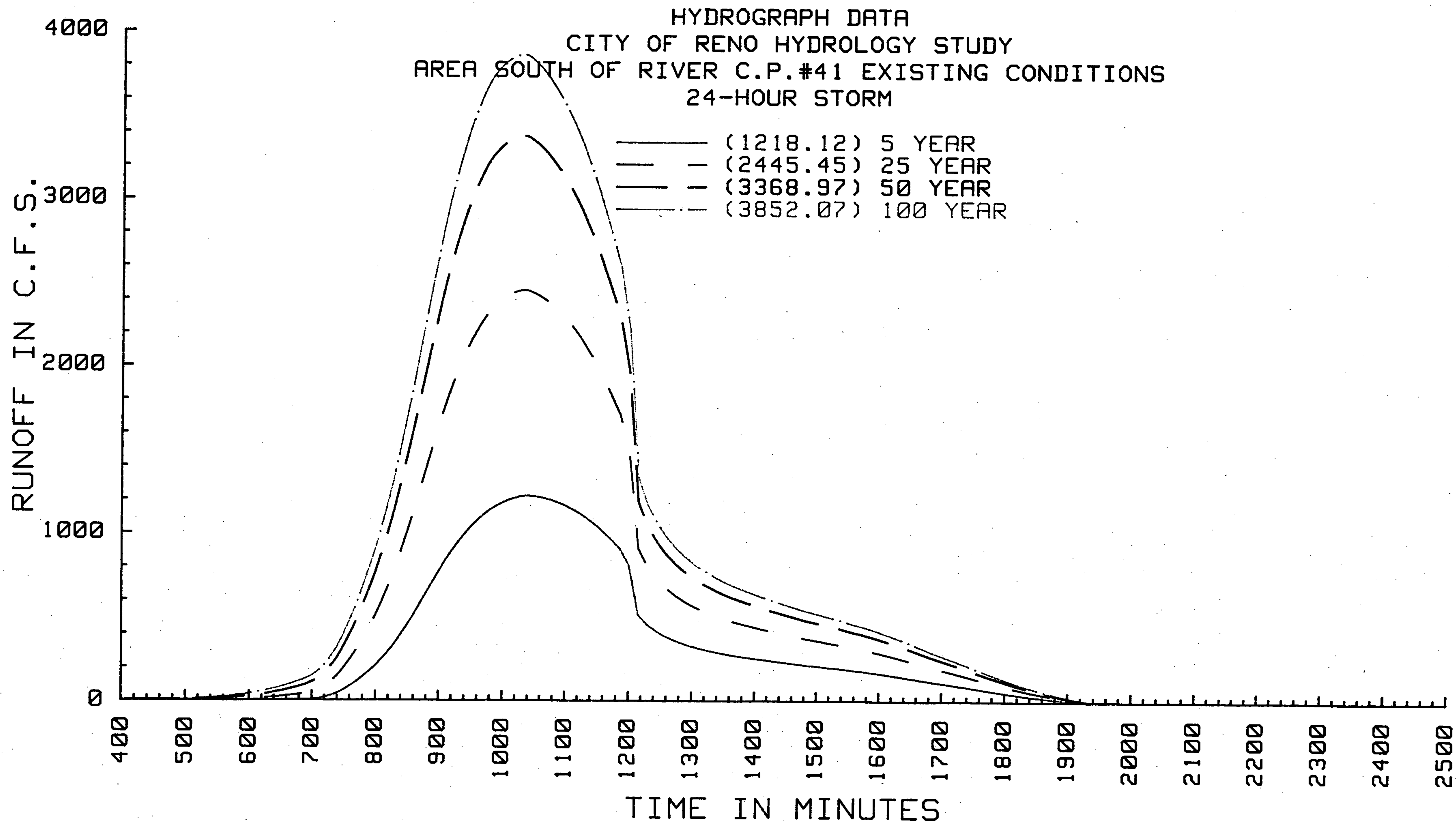
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AREA SOUTH OF RIVER C.P.#41 EXISTING CONDITIONS
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(2445.45) 25 YEAR
(3368.97) 50 YEAR
(3852.07) 100 YEAR
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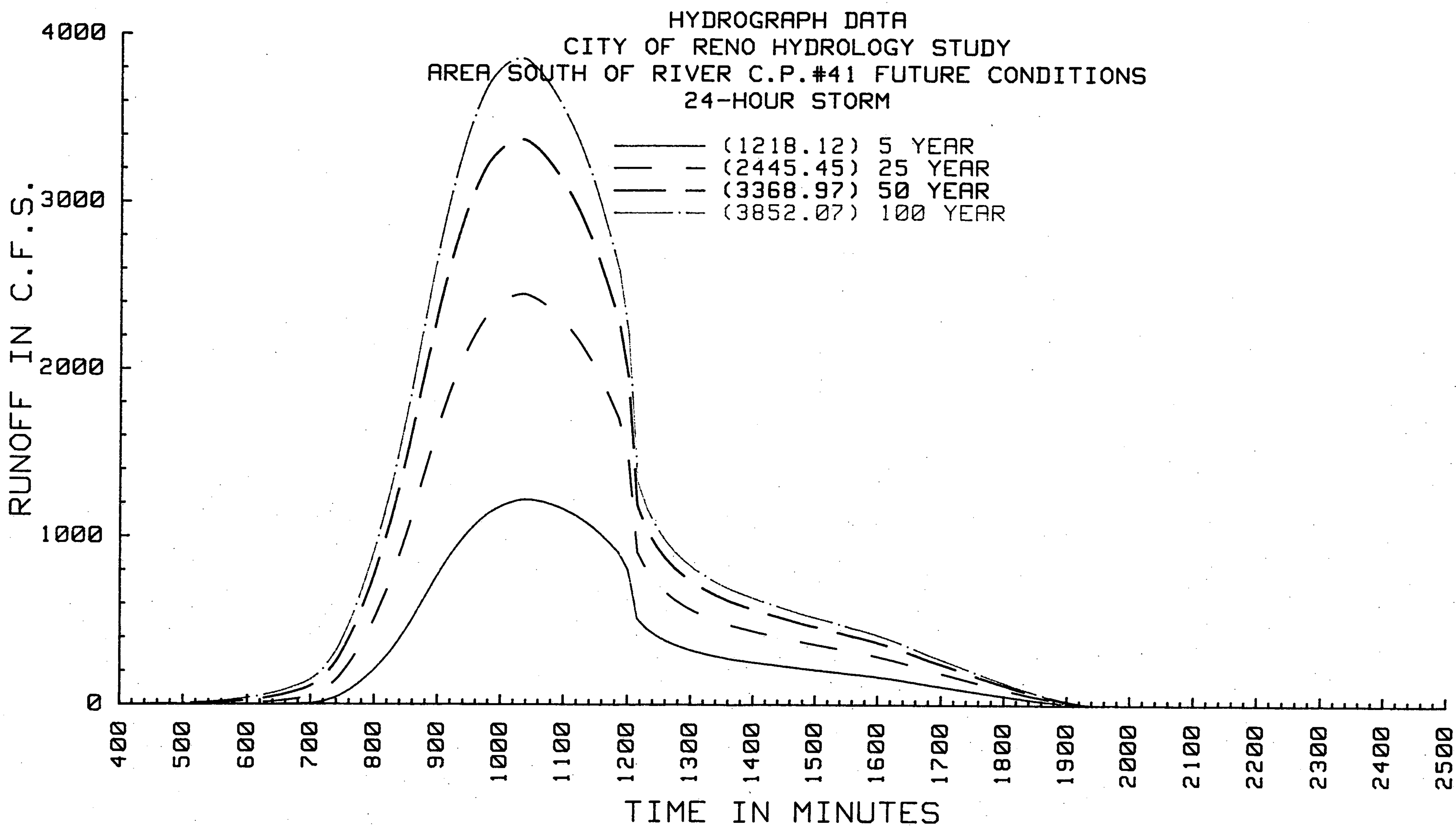
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AREA SOUTH OF RIVER C.P.#41 FUTURE CONDITIONS
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(3368.97) 50 YEAR
(3852.07) 100 YEAR
RUNOFF IN C.F.S.
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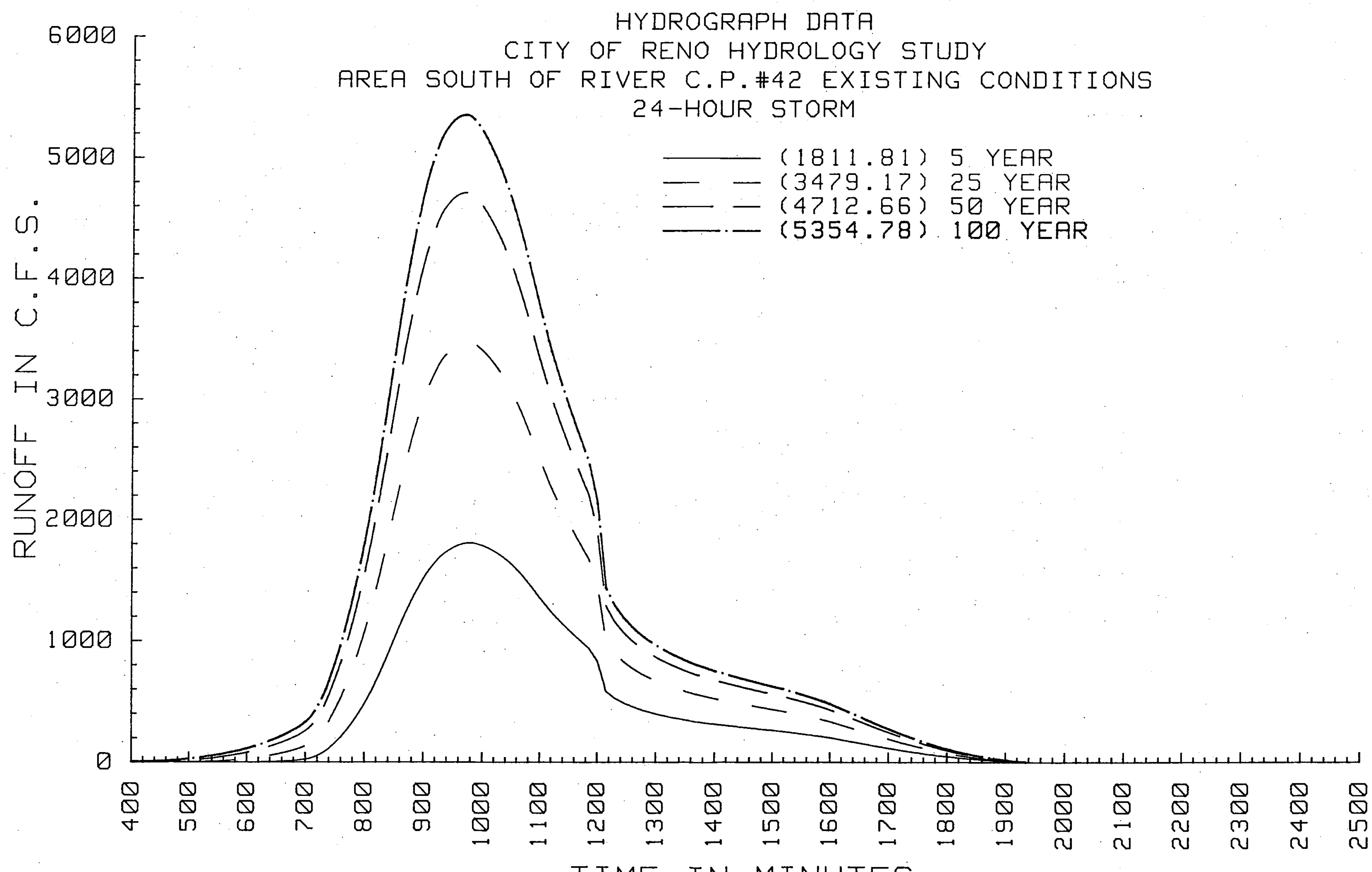
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AREA SOUTH OF RIVER C.P.#42 EXISTING CONDITIONS
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(4712.66) 50 YEAR
(5354.78) 100 YEAR
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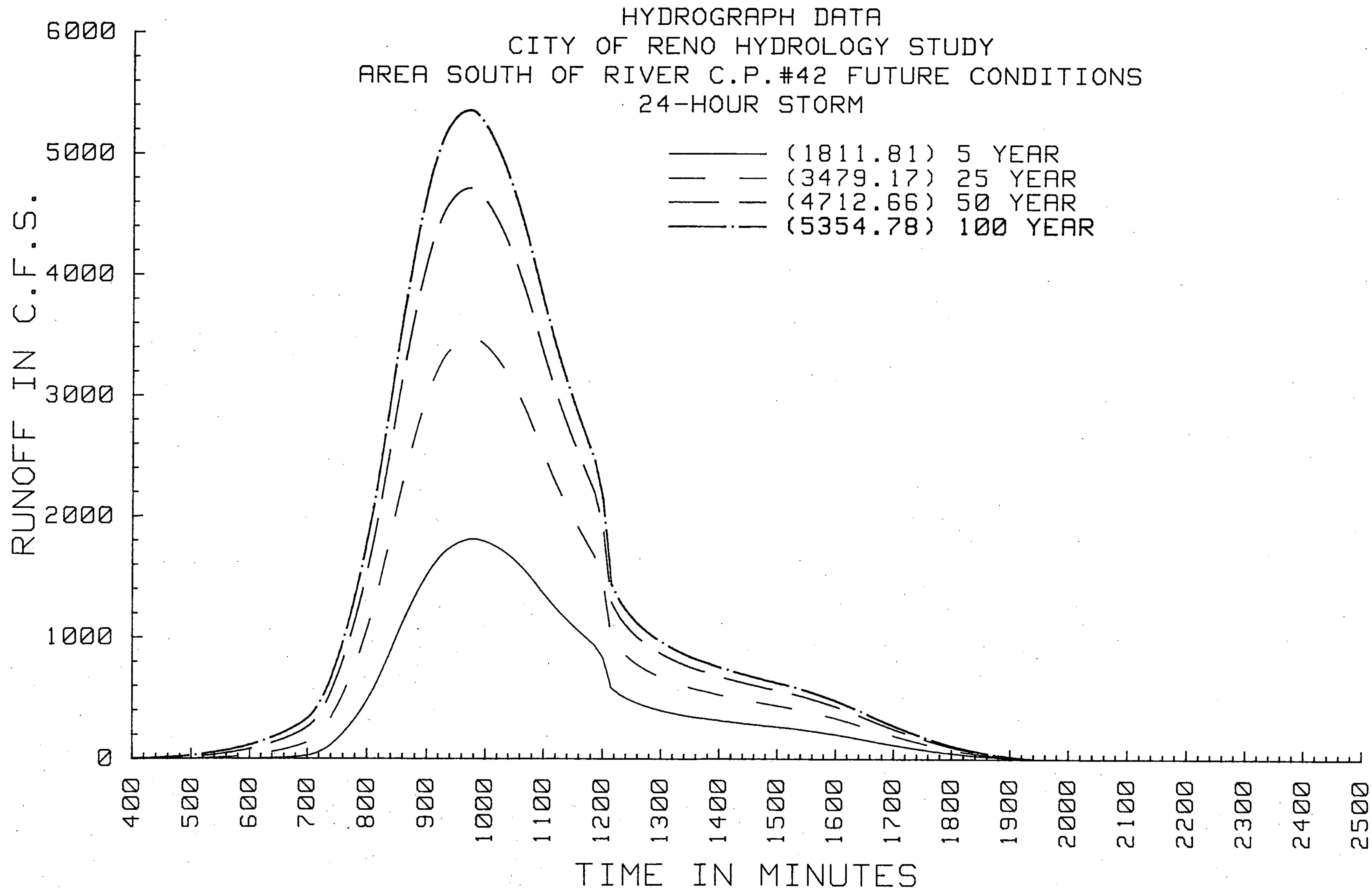

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AREA SOUTH OF RIVER C.P.#42 FUTURE CONDITIONS
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(3479.17) 25 YEAR
(4712.66) 50 YEAR
(5354.78) 100 YEAR
RUNOFF IN C.F.S.
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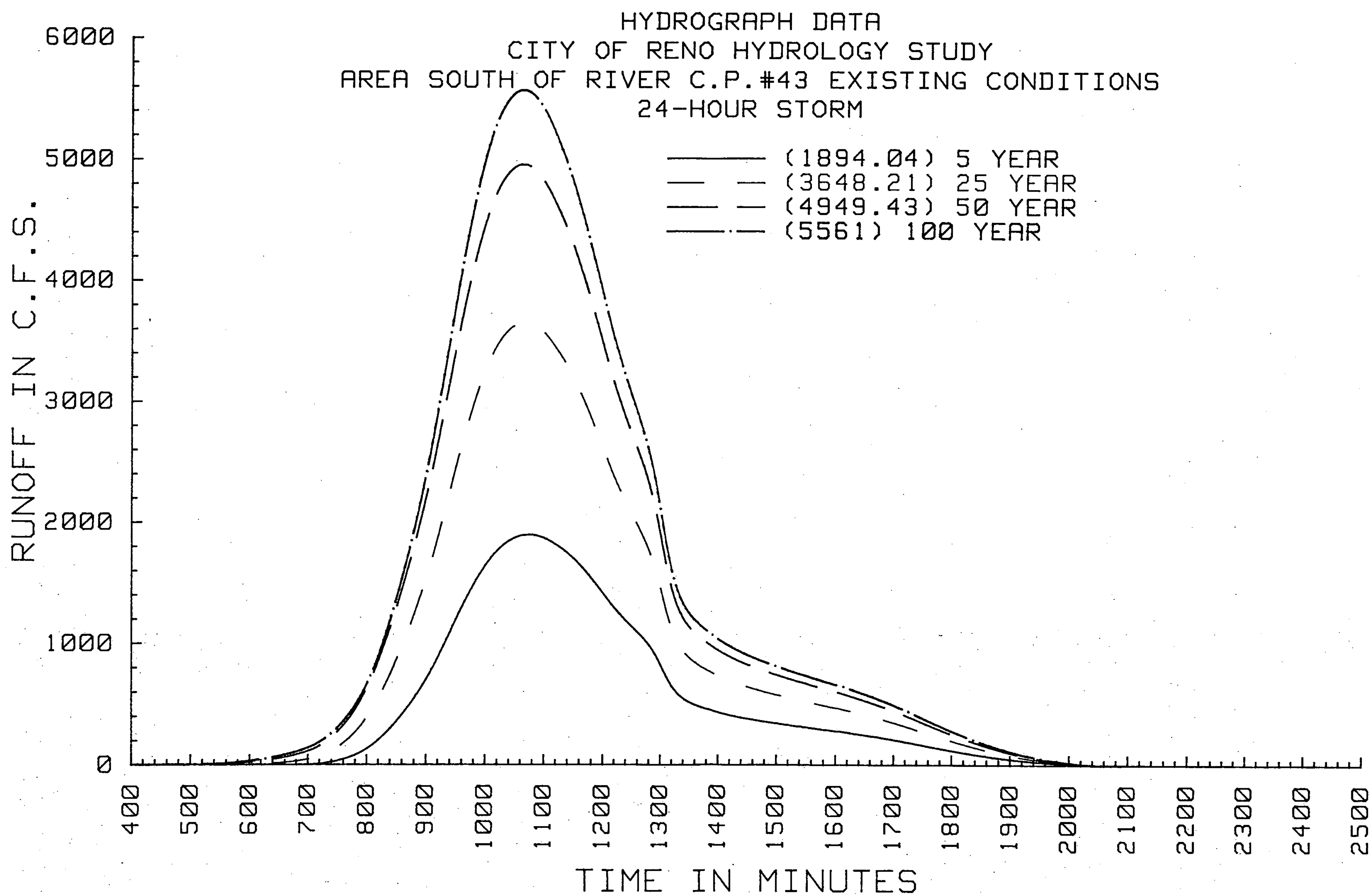
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AREA SOUTH OF RIVER C.P.#43 EXISTING CONDITIONS
24-HOUR STORM
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(3648.21) 25 YEAR
(4949.43) 50 YEAR
(5561) 100 YEAR
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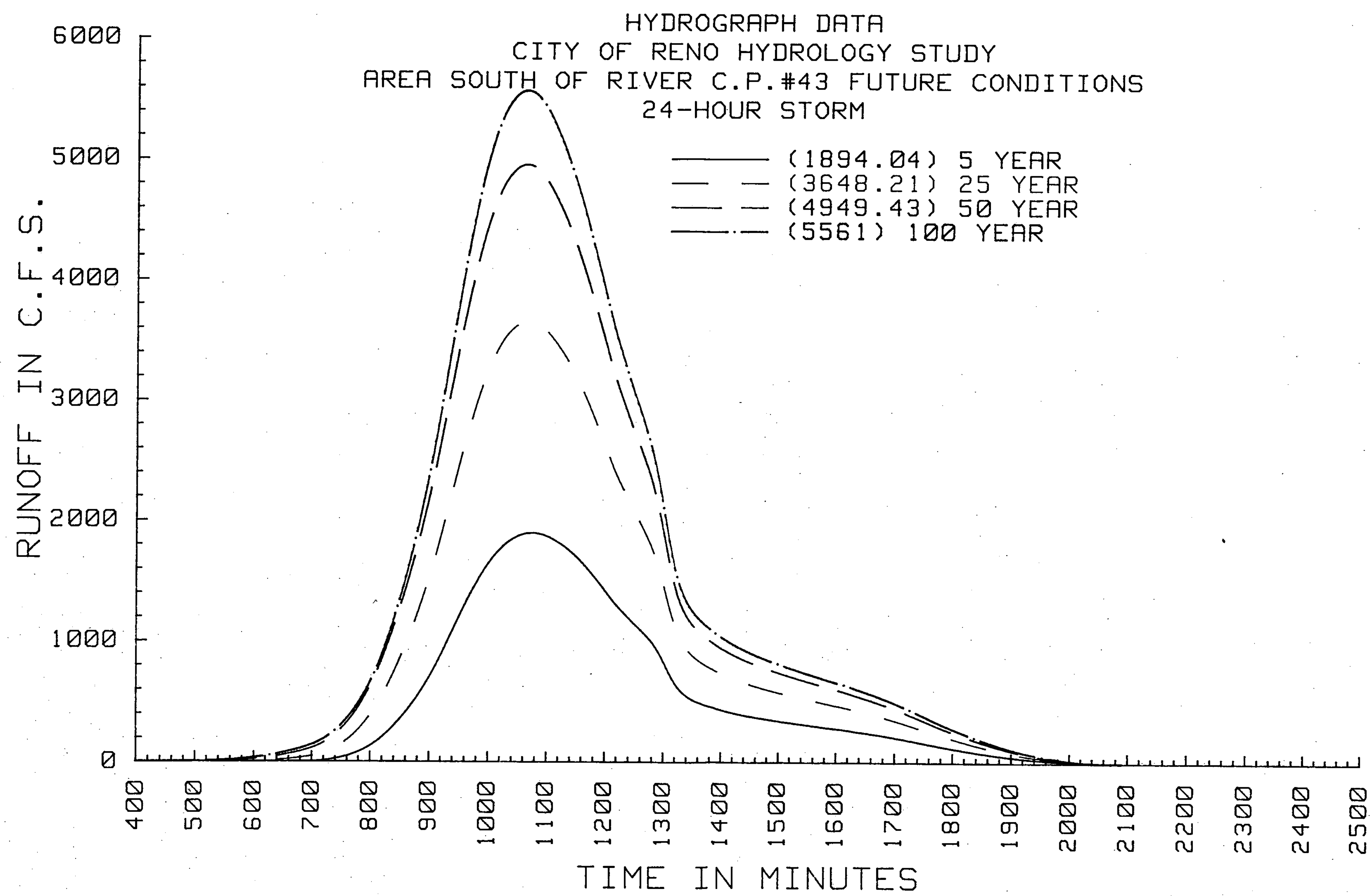
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER C.P.#43 FUTURE CONDITIONS
24-HOUR STORM
(1894.04) 5 YEAR
(3648.21) 25 YEAR
(4949.43) 50 YEAR
(5561) 100 YEAR
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RUNOFF IN C.F.S.
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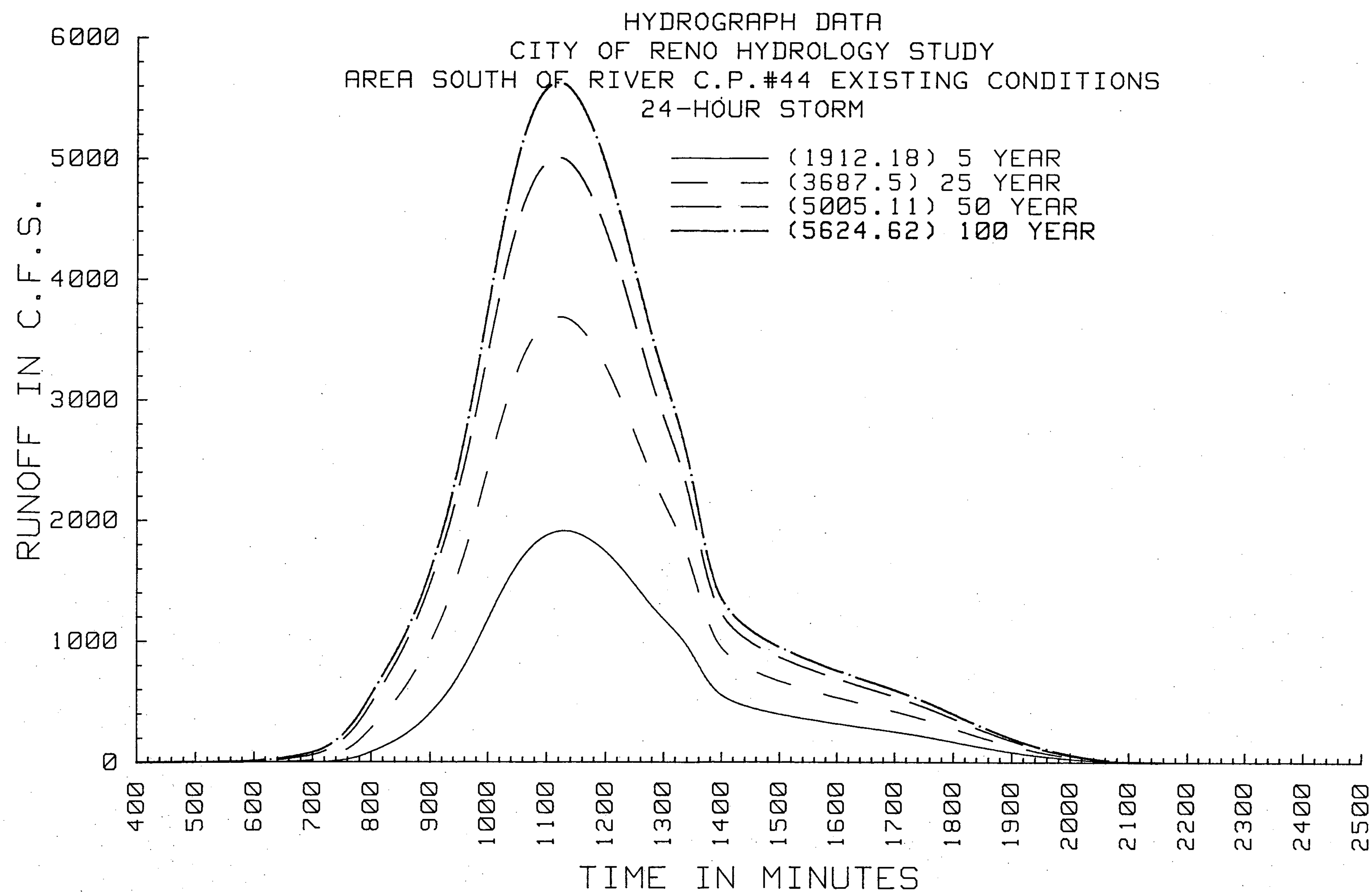
TIME IN MINUTES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CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER C.P.#44 EXISTING CONDITIONS
24-HOUR STORM
(1912.18) 5 YEAR
(3687.5) 25 YEAR
(5005.11) 50 YEAR
(5624.62) 100 YEAR
RUNOFF IN C.F.S.
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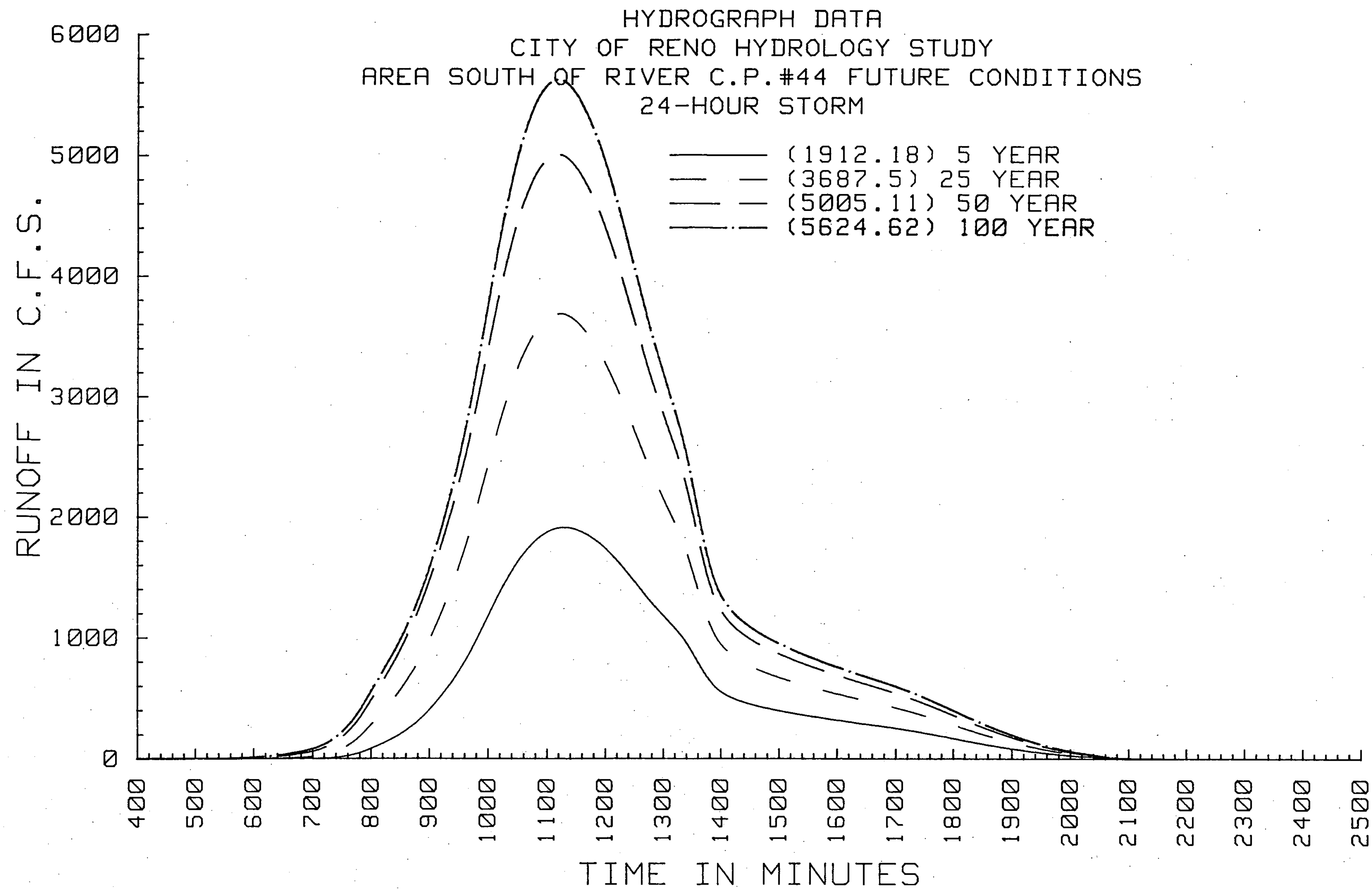
TIME IN MINUTES



HYDROGRAPH DATA
CITY OF RENO HYDROLOGY STUDY
AREA SOUTH OF RIVER C.P.#44 FUTURE CONDITIONS
24-HOUR STORM
(1912.18) 5 YEAR
(3687.5) 25 YEAR
(5005.11) 50 YEAR
(5624.62) 100 YEAR
RUNOFF IN C.F.S.
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TIME IN MINUTES

APPENDIX "E"

TABLE 58

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

24-Hour Cumulative Rainfall
(Source: Winzler and Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
M-1	4.31	6.54	8.12	8.30
M-2	3.34	5.06	6.29	6.91
M-3	3.34	5.06	6.29	6.91
M-4	2.64	4.01	4.98	5.47

TABLE 59

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

6-Hour Cumulative Rainfall
(Source: Winzler & Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
M-1	1.79	2.51	2.92	3.73
M-2	1.33	1.85	2.16	2.75
M-3	1.29	1.80	2.10	2.67
M-4	1.09	1.53	1.78	2.27

TABLE 60

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

3-Hour Cumulative Rainfall
(Source: Winzler & Kelly, December 1984)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
M-1	1.38	2.00	2.39	2.88
M-2	1.02	1.48	1.77	2.13
M-3	.99	1.44	1.72	2.06
M-4	.84	1.22	1.46	1.75

TABLE 61

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

24-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
M-1	673	1265	1698	1747
M-2	158	257	327	363
M-3	318	615	834	946
M-4	179	332	444	501

TABLE 62

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

6-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
M-1	138	284	380	587
M-2	33	57	73	102
M-3	34	85	121	200
M-4	24	55	76	121

TABLE 63

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

3-Hour Storm Drainage Peak Discharges
Based on Winzler & Kelly - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
M-1	89	217	313	446
M-2	21	42	57	77
M-3	23	64	98	144
M-4	14	37	55	80

TABLE 64

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

24-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
M-1	1.9	2.8	3.4	3.7
M-2	1.6	2.4	2.6	2.7
M-3	1.7	2.5	2.8	2.9
M-4	1.8	2.5	2.6	2.7

TABLE 65

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

6-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
M-1	1.35	1.7	2.0	2.3
M-2	1.1	1.48	1.65	2.0
M-3	1.15	1.5	1.7	2.0
M-4	1.1	1.55	1.75	2.0

TABLE 66

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

3-Hour Cumulative Rainfall
(Source: NOAA Atlas 2)

COMPUTATION POINT NO.	5-YEAR STORM (in)	25-YEAR STORM (in)	50-YEAR STORM (in)	100-YEAR STORM (in)
M-1	1.09	1.50	1.70	1.92
M-2	1.01	1.31	1.50	1.69
M-3	.94	1.26	1.41	1.65
M-4	.94	1.26	1.42	1.67

TABLE 67

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

24-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
M-1	131	310	448	521
M-2	58	103	115	121
M-3	78	187	232	248
M-4	92	163	174	185

TABLE 68

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

6-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

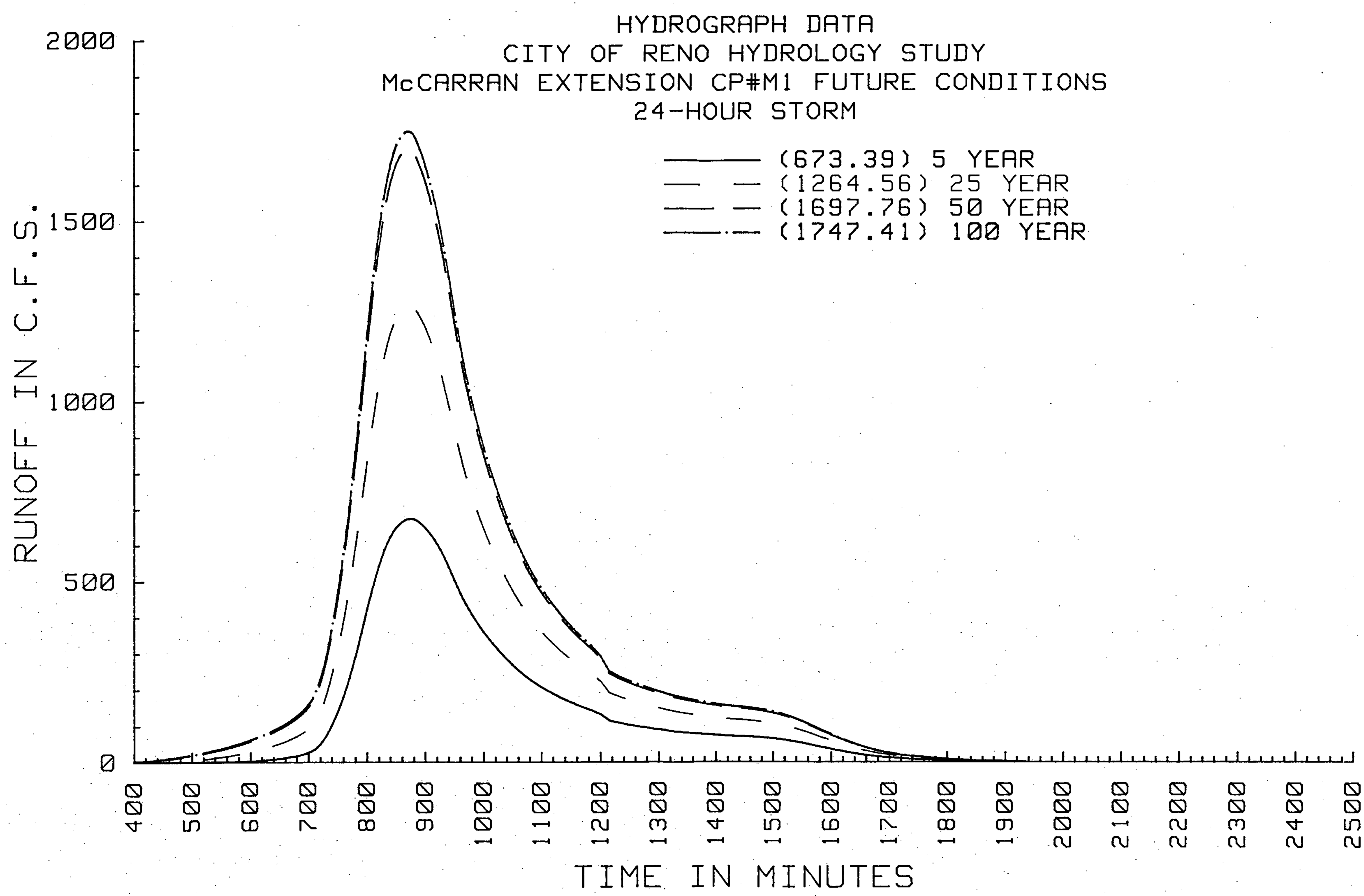
COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
M-1	68	122	177	238
M-2	23	40	48	65
M-3	24	53	73	108
M-4	24	57	73	96

TABLE 69

PROPOSED SOUTHWEST MCCARRAN BOULEVARD EXTENSION
COMPUTATION POINTS M-1 THROUGH M-4

3-Hour Storm Drainage Peak Discharges
Based on NOAA Atlas 2 - Rainfall Data
(Future Conditions)

COMPUTATION POINT NO.	5-YEAR STORM (cfs)	25-YEAR STORM (cfs)	50-YEAR STORM (cfs)	100-YEAR STORM (cfs)
M-1	45	111	150	198
M-2	20	34	43	53
M-3	19	46	61	89
M-4	19	39	52	73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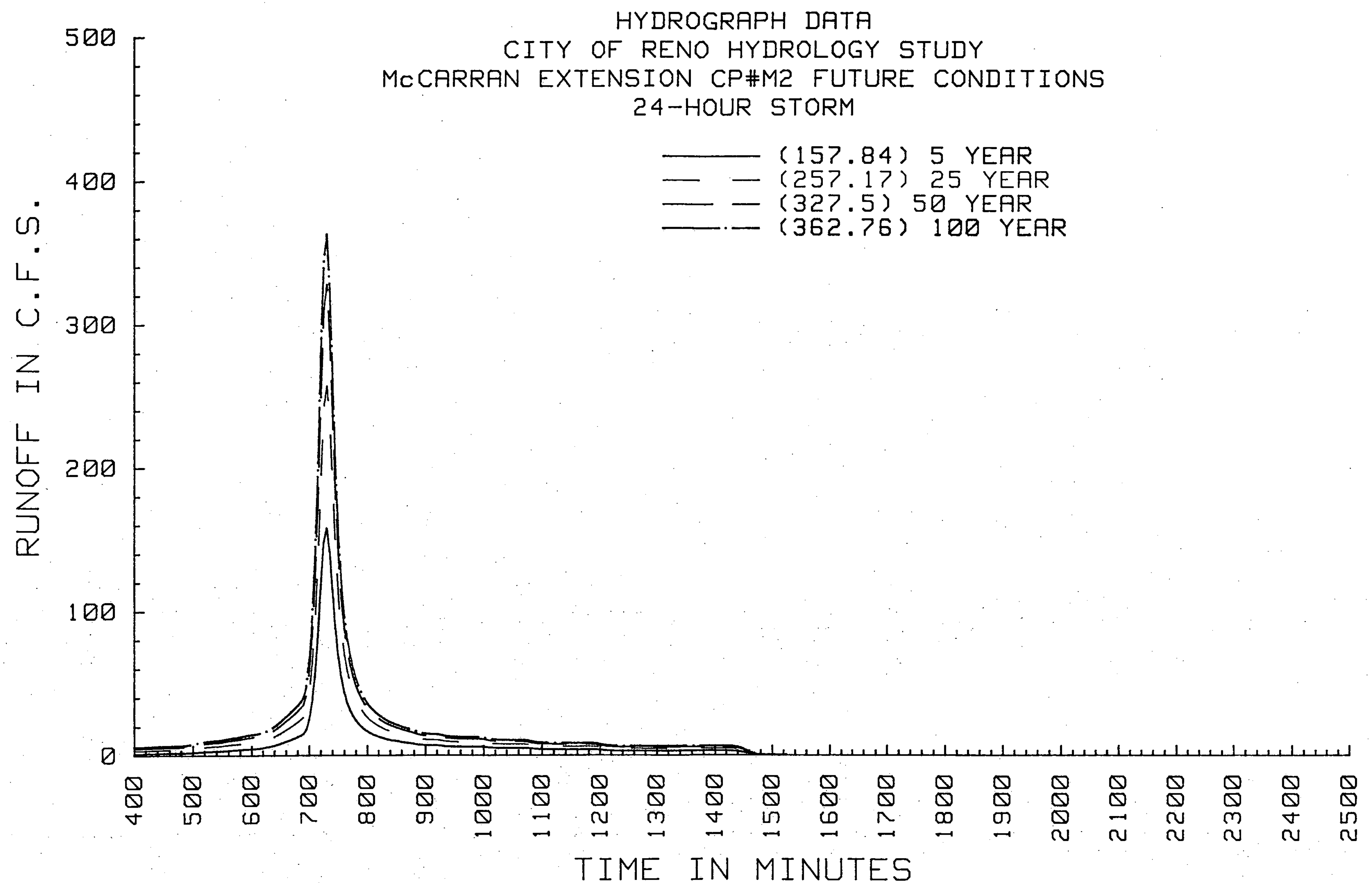
TIME IN MINUTES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McCARRAN EXTENSION CP#M2 FUTURE CONDITIONS
24-HOUR STORM
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(257.17) 25 YEAR
(327.5) 50 YEAR
(362.76) 100 YEAR
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TIME IN MINUTES
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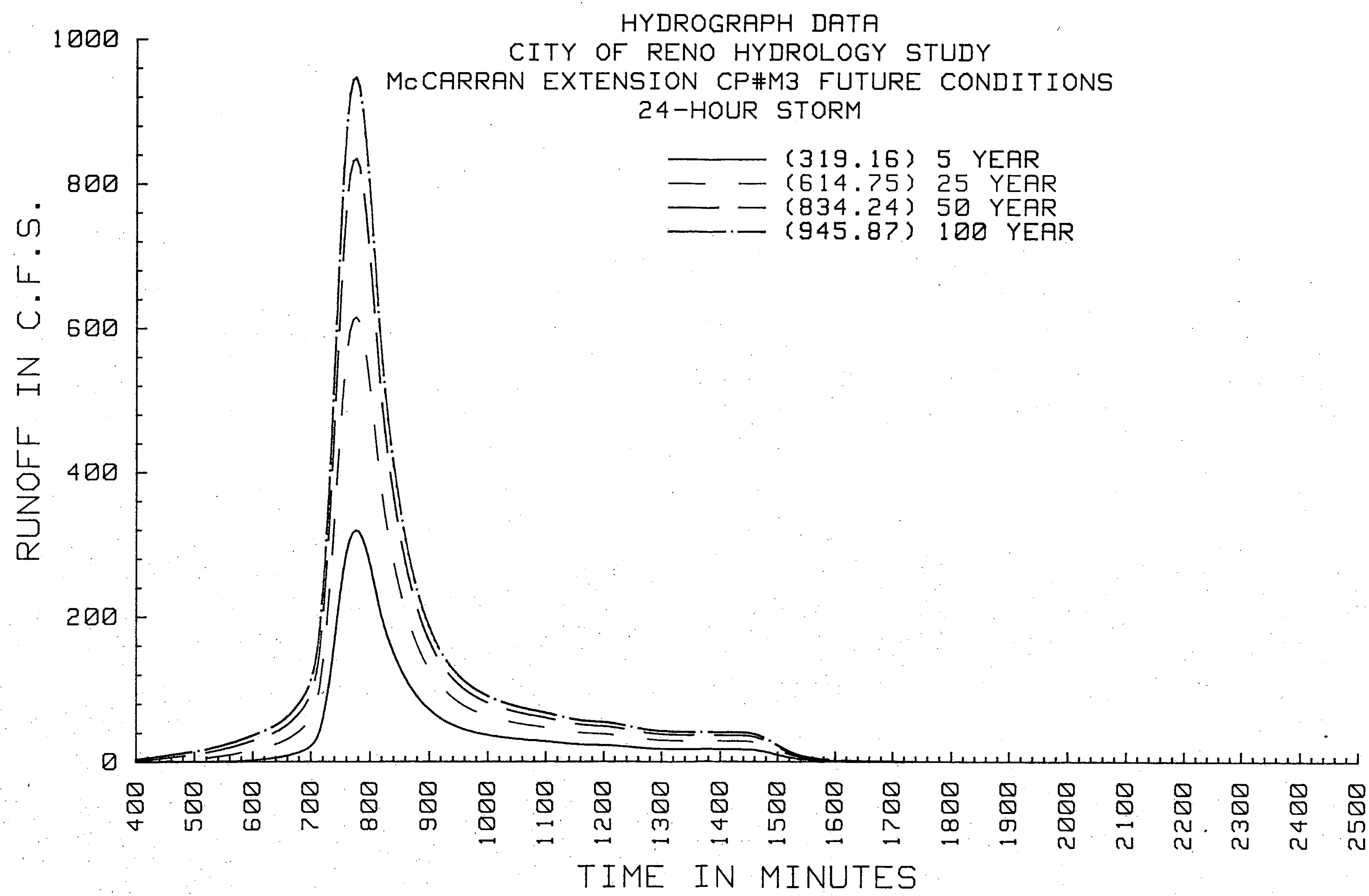
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McCARRAN EXTENSION CP#M3 FUTURE CONDITIONS
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(614.75) 25 YEAR
(834.24) 50 YEAR
(945.87) 100 YEAR
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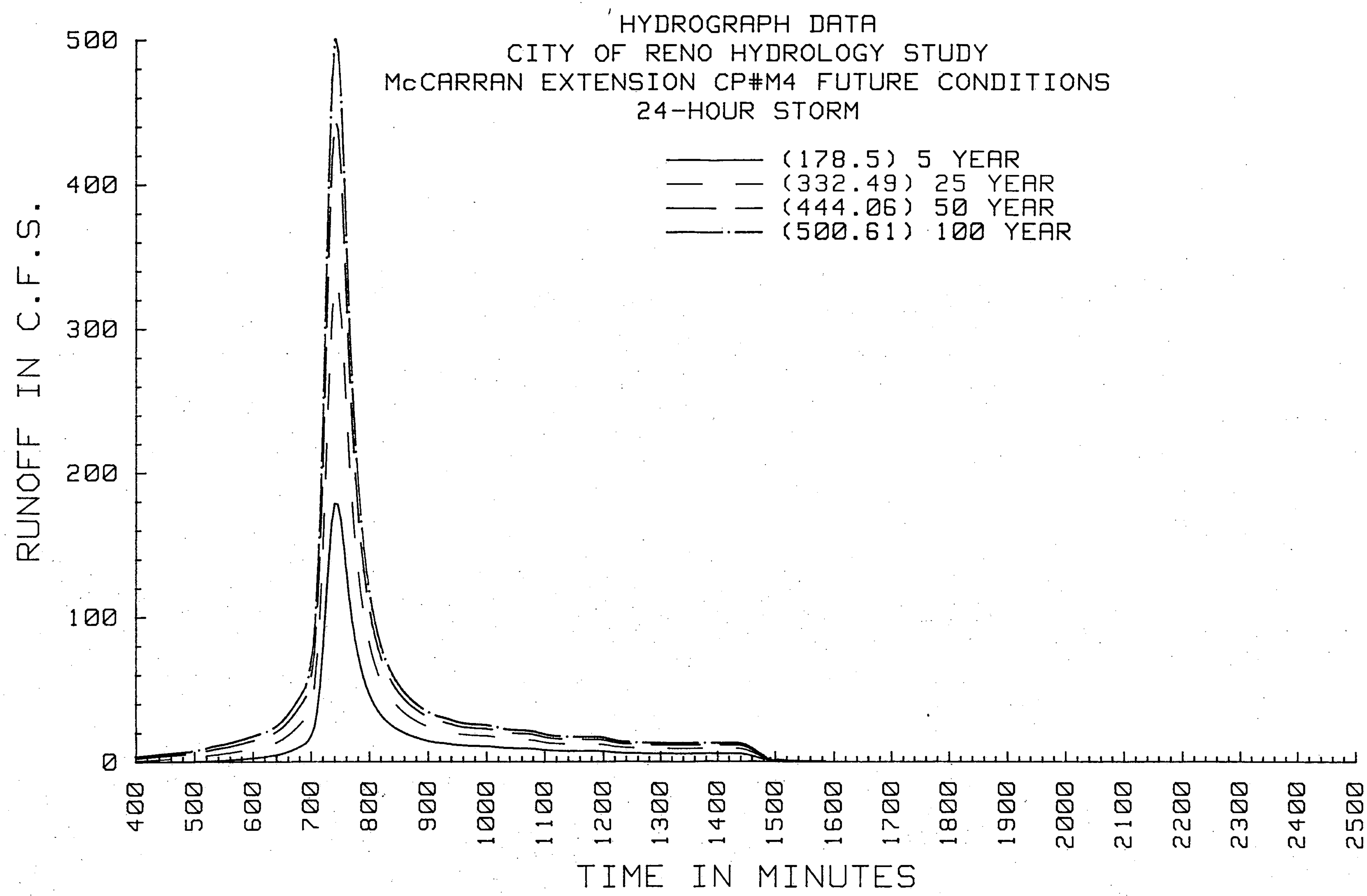
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McCARRAN EXTENSION CP#M4 FUTURE CONDITIONS
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(444.06) 50 YEAR
(500.61) 100 YEAR
RUNOFF IN C.F.S.
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TIME IN MINUTES