PEEK LEMMON VALLEY

HYDROLOGY CLOMR

PYRAMID Engineers & Land Surveyors

City of Reno

Inter-Office Memo

Date: June 11, 1996

To: Steve Varela, City Engineer/Maintenance Director

From: Glen Daily, Associate Civil Engineer

Via: Gary Stockhoff, Principal Engineer

Re: **Peek Properties, Lemmon Valley - FEMA Letter of Map Revision**

I have reviewed the attached reports which appear to be of proper method and adequate detail to model stormwater runoff generated from tributary areas which would traverse the study area. I would recommend City acknowledgement of the Conditional Letter Of Map Revision (CLOMR) for present conditions, with the caveat the study is based upon existing conditions for the 22-square mile tributary area, and as such flow rates could change appreciably with future development within same. My comments are as follows:

The subject property of the study is traversed by a strip generally following a wide wash area from southwest to northeast currently designated within FEMA Flood Hazard Zone A. Zone A is defined as special flood hazard areas inundated by a 100-year flood with no base flood elevations determined. The current 100-year delineation has been established through approximate methods. Origins of potential flood waters would be primarily from the eastern slopes of Peavine Mountain. Surrounding property within the study area is currently designated within FEMA Flood Hazard Zone X defined as areas determined to be outside the 500-year floodplain.

The purpose of the attached CLOMR is to establish 100-year discharges from local runoff recognized by FEMA. These flows will be used as the basis of drainage requirements to be further detailed within hydrology reports specific to future development projects within the property as required through the development review process. Requirements for drainage reports per Chapter II of the Public Works Design Manual requires detailed analysis of the existing conditions, and impacts of the proposed development to existing conditions. Future development within the 22-square mile tributary area could vary considerably, and there will probably be a need to further update the FEMA flood delineations several years in the future.

If possible I would like these reports returned as they may provide useful data for future analysis of drainage problems in the north valleys.

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
173-C N. Morrison Ave.
San Jose, CA 95126
(408) 297-4848
FAX:408-297-4855

March 29, 1996

Federal Emergency Management Agency
Natural and Technological Hazards Division
Building 105
Presidio of San Francisco
San Francisco, California 94129-1250

Subject: Conditional Letter of Map Revision
Peek Lemmon Valley, Washoe County, Nevada
(320019 32031C-2825E, 2977E; effective 9/30/94)

Dear Sir or Madam:

Enclosed is a request for a Conditional Letter of Map Revision for an within Lemmon Valley in Washoe County, Nevada (Community No. 320019). The area bound by Military Road, Lemmon Drive and Lemmon Lake Playa is subject to shallow flooding during extreme storm events. Prior to the preparation of detailed development plans, the owner of these properties would like to have FEMA certify new estimates of 100-year discharges from local runoff. As such this CLOMR application is for a *review of revised hydrology only.*

Effective flood insurance rate mapping for this area indicates Zone A through approximate methods, but there is no estimate of 100-year discharge anywhere in the vicinity. Shallow flooding can occur when runoff from ephemeral streams overtops both Military Road and Lemmon Drive. Existing drainage basin conditions have been used for the hydrologic analyses.

An initial processing fee of $280 is enclosed for the review of the detailed hydrology. Technical questions regarding the CLOMR request may be directed to myself at this office. Please do not hesitate to call me with any questions.

Very Truly Yours,

SCHAAF & WHEELER

Charles D. Anderson

Charles D. Anderson, P.E.
Senior Engineer

REQUEST FOR A CONDITIONAL LETTER OF MAP REVISION (CLOMR)

Hydrology Only

Peek Lemmon Valley Property

Washoe County, Nevada
(Community No. 320019)

Submitted to

Federal Emergency Management Agency

Prepared

March 28, 1996

By

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
173-C N. Morrison Ave.
San Jose, CA 95126
(408) 297-4848
FAX:408-297-4855

Request for a Conditional Letter of Map Revision
(Hydrology Only)

Lemmon Valley

Washoe County, Nevada: Community No. 320019

Project Name / Identifier: Peek Lemmon Valley

Introduction. Lemmon Valley is a terminal drainage basin near the Reno-Stead area of Washoe County, Nevada north of downtown Reno. Runoff from the north and east flanks of Peavine Peek flows in ephemeral streams across U.S. Highway 395 through Lemmon Valley into a playa known locally as Lemmon Lake. There is no outlet for this drainage. Approximately 22 square miles drains through the Peek Lemmon Valley Property. Flood discharge rates have not been established by FEMA. An approximate Flood Insurance Study for this area was adopted by FEMA in September 1994.

Effective Floodplain. The approximate floodplain is shown in a hydrologic report enclosed with this CLOMR request. Flooding on the Peek property is generally broad, shallow, and due to the alluvial nature of the floodplain deposits, unpredictable. Effective FIRM maps show a 100-year lake elevation of 4920. Eventually more detailed hydraulic information will be needed, but the owner would like to obtain FEMA approval for discharge estimates. To our knowledge, this is the first detailed hydrologic analysis for this area of Lemmon Valley.

Hydrologic Analysis. Nearby stream gages are found on Peavine Creek in Reno and Upper Long Valley just across the California border. However, neither gage has a period of record greater than about five years, which is insufficient to perform a reliable flood flow frequency analysis. Therefore, flood discharge estimates are accomplished using a rainfall-runoff model (HEC-1). To enhance model performance, curve numbers are calibrated to a gaged watershed (South Willow Creek near Gerlach), which although 200 miles away, has similar hydrologic characteristics in terms of rainfall, soil types, and land use. The accompanying hydrologic report fully describes the frequency analysis and calibration, and the development of the local hydrologic model.

Existing basin conditions have been used to develop the model. Also, the effects of culvert routing through the Western Pacific Railroad, North Virginia Street, and U.S. Highway 395 have been included. There are many culverts with upstream storage capacity in deep ravines, and this tends to attenuate peak runoff somewhat. Local experience indicates that sedimentation within channels on the Lemmon Valley floor plays a role in the distribution of flood overflows once they reach the property, but there is no significant effect on flood discharge at the property itself.

FORM 1

REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM**	*O.M.B. Burden No 3067-0148* *Expires July 31, 1994*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

1. OVERVIEW

1. The basis for this revision request is (are): *(check all that apply)*
   - ☐ Physical change
     - ☐ Existing
     - ☐ Proposed
   - ☐ Improved methodology
   - ☐ Improved data
   - ☐ Floodway revision
   - ■ Other Detailed Hydrologic Analysis
     Explain First detailed hydrologic analysis in area.
2. Flooding Source: Local Runoff (No permanent creeks in area.)
3. Project Name/Identifier: Peek Lemmon Valley
4. FEMA zone designations affected: A
   (example: A, AH, AO, A1-A30, A99, AE, V, V1-30, VE, B, C, D, X)
5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	County	State	Map No.	Panel No.	Effective Date
EX: 480301	Katy, City	Harris, Fort Bend	TX	480301	0005D	02/08/83
480287	Harris County	Harris	TX	48201C	0220G	09/28/90
320019	Washoe County	Washoe	NV	32031C	2825E	09/30/94
320019	"	"	"	32031C	2977E	09/30/94

6. The area of revision encompasses the following types of flooding, structures, and associated disciplines: *(check all that apply)*

Types of Flooding
- ■ Riverine
- ☐ Coastal
- ☐ Alluvial Fan
- ■ Shallow Flooding *(e.g. Zones AO and AH)*
- ☐ Lakes

Affected by wind/wave action
- ☐ Yes
- ☐ No

Structures
- ☐ Channelization
- ☐ Levee/Floodwall
- ☐ Bridge/Culvert
- ☐ Dam
- ☐ Coastal
- ☐ Fill
- ☐ Pump Station
- ■ None
- ☐ Channel Relocation
- ☐ Excavation
- ☐ Other *(describe)*

Disciplines*
- ■ Water Resources
  - ■ Hydrology
  - ☐ Hydraulics
  - ☐ Sediment Transport
  - ☐ Interior Drainage
- ☐ Structural
- ☐ Geotechnical
- ☐ Land Surveying
- ☐ Other *(describe)*

☐ Other(describe)__________

* **Attach completed "Certification by Registered Professional Engineer and/or Land Surveyor" Form for each discipline checked. (Form 2)**

2. FLOODWAY INFORMATION

7. Does the affected flooding source have a floodway designated on the effective FIRM or FBFM? ☐ Yes ■ No
8. Does the revised floodway delineation differ from that shown on the effective FIRM or FBFM ☐ Yes ☐ No
   If yes, give reason: __________

Attach copy of either a public notice distributed by the community stating the community's intent to revise the floodway or a statement by the community that it has notified all affected property owners and affected adjacent jurisdictions.

9. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP? ☐ Yes ☐ No

If yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

3. PROPOSED ENCROACHMENTS

10. With floodways:

1A. Does the revision request involve fill, new construction, substantial improvement, or other development in the floodway? ☐ Yes ☐ No

1B. If yes, does the development cause the 100-year water surface elevation to increase at any location by more than 0.000 feet? ☐ Yes ☐ No

11. Without floodways:

2A. Does the revision request involve fill, new construction, substantial improvement, or other development in the 100-year floodplain? ☐ Yes ■ No

2B. If yes, does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the 100-year water surface elevation to increase at any location by more than one foot (*or other surcharge limit if community or state has adopted more stringent criteria*)? ☐ Yes ☐ No

If the answer to either Items 1B or 2B is yes, please provide documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

4. REVISION REQUESTOR ACKNOWLEDGMENT

12. Having read NFIP Regulations, 44 CFR Ch. I, parts 59, 60, 61, and 72, I believe that the proposed revision ■ is ☐ is not in compliance with the requirements of the aforementioned NFIP Regulations.

5. COMMUNITY OFFICIAL ACKNOWLEDGMENT

13. Was this revision request reviewed by the community for compliance with the community's adopted floodplain management ordinances? ■ Yes ☐ No

14. Does this revision request have the endorsement of the community? ■ Yes ☐ No

If no to either of the above questions, please explain: ______________________________

Please note that community acknowledgment and /or notification is required for all requests as outlined in Section 65.4 (b) of the NFIP Regulations.

6. OPERATION AND MAINTENANCE

15. Does the physical change involve a flood control structure (e.g., levees, floodwalls, channelization, basins, dams)? ☐ Yes ■ No

If yes, please provide the following information for each of the new flood control structures:

A. Inspection of the flood control project will be conducted periodically by ______________________________ (entity)

______________ with a maximum interval of ______________ months between inspections.

B. Based on the results of scheduled periodic inspections, appropriate maintenance of the flood control facilities will be conducted by ______________________________ (entity)

to ensure the integrity and degree of flood protection of the structure.

C. A formal plan of operation, including documentation of the flood warning system, specific actions and assignments of responsibility by individual name or title, and provisions for testing the plan at intervals not less than one year, ☐ has ☐ has not been prepared for the flood control structure.

D. The community is willing to assume responsibility for ☐ performing ☐ overseeing compliance with the maintenance and operation plans of the ______________________ (Name)

flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Attach operation and maintenance plans

7. REQUESTED RESPONSE FROM FEMA

16. After examining the pertinent NFIP regulations and reviewing the document entitled "Appeals, Revisions, and Amendments to Flood Insurance Maps: A guide for Community Officials," dated January 1990, this request is for a:

__✓__ a. CLOMR — A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision *(LOMR or PMR)*, or proposed hydrology changes *(see 44 CFR Ch. I, Parts 60, 65, and 72)*.

_____ b. LOMR — A letter from FEMA officially revising the current NFIP map to show changes to floodplains, floodways, or flood elevations. LOMRs typically depict decreased flood hazards. *(See 44 CFR Ch. I Parts 60 and 65.)*

_____ c. PMR — A reprinted NFIP map incorporating changes to floodplains, floodways, or flood elevations. Because of the time and cost involved to change, reprint, and redistribute an NFIP map, a PMR is usually processed when a revision reflects increased flood hazards or large-scope changes. *(See 44 CFR Ch. I, Parts 60 and 65.)*

_____ d. Other: Describe ______________________

8. FORMS INCLUDED

17. Form 2 entitled, "Certification By Registered Professional Engineer and/or Land Surveyor" must be submitted.

The following forms should be included with this request if (check the included forms):

• Hydrologic analysis for flooding source differs from that used to develop FIRM	■ Hydrologic Analysis Form (Form 3)
• Hydraulic analysis for riverine flooding differs from that used to develop FIRM	☐ Riverine Hydraulic Analysis Form (Form 4)
• The request is based on updated topographic information or a revised floodplain or floodway delineation is requested	☐ Riverine /Coastal Mapping Form (Form 5)
• The request involves any type of channel modification	☐ Channelization Form (Form 6)
• The request involves new bridge or culvert or revised analysis of an existing bridge or culvert	☐ Bridge/Culvert Form (Form 7)
• The request involves a new revised levee/floodwall system	☐ Levee/Floodwall System Analysis Form (Form 8)
• The request involves analysis of coastal flooding	☐ Coastal Analysis Form (Form 9)
• The request involves coastal structures credited as providing protection from the 100-year flood	☐ Coastal Structures (Form 10)
• The request involves an existing, proposed, or modified dam	☐ Dam Form (Form 11)
• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	☐ Alluvial Fan Flooding Form (Form 12)

18. The minimum initial review fee for the appropriate request category has been included. ■ Yes ☐ No

Initial fee amount: $ 280

METHOD OF PAYMENT (Check one box)

☐ PAYMENT ENCLOSED
Check or money order only.
Make payable to
National Flood Insurance Program

☐ VISA ☐ MASTERCARD

CARD NUMBER

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Signature

EXP. Date

or

19. This request is for a project that is for public benefit and is intended to reduce the flood hazard to existing development in identified flood hazard areas as opposed to planned floodplain development. ☐ Yes ■ No

or

20. This request is to correct an error or to include the effects of natural changes within the areas of special flood hazards. ☐ Yes ■ No

Note: I understand that my signature indicates that all information submitted in support of this request is correct.

Signature of Revision Requester

Printed Name and Title of Revision Requester

Company Name

Date

Note: Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.

Signature of Community Official

Printed Name and Title of Community Official

Community Name

Date

Does this request impact any other communities? ☐ Yes ■ No

If yes, attach letters from all affected jurisdictions acknowledging revision request and approving changes to floodway, if applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

D. The community is willing to assume responsibility for ☐ performing ☐ overseeing compliance with the maintenance and operation plans of the ______________________________ *(Name)*

flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Attach operation and maintenance plans

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_____ d. Other: Describe ______________________________

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• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	☐ Alluvial Fan Flooding Form (Form 12)

18. The minimum initial review fee for the appropriate request category has been included. ■ Yes ☐ No

Initial fee amount: $ 280

METHOD OF PAYMENT (Check one box)

☐ PAYMENT ENCLOSED
Check or money order only.
Make payable to
National Flood Insurance Program

☐ VISA ☐ MASTERCARD

CARD NUMBER

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Signature

EXP. Date

or

19. This request is for a project that is for public benefit and is intended to reduce the flood hazard to existing development in identified flood hazard areas as opposed to planned floodplain development. ☐ Yes ■ No

or

20. This request is to correct an error or to include the effects of natural changes within the areas of special flood hazards. ☐ Yes ■ No

Note: I understand that my signature indicates that all information submitted in support of this request is correct.

Signature of Revision Requester

Printed Name and Title of Revision Requester

Company Name

Date

Note: Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.

Signature of Community Official

Printed Name and Title of Community Official

Community Name

Date

Does this request impact any other communities? ☐ Yes ■ No

If yes, attach letters from all affected jurisdictions acknowledging revision request and approving changes to floodway, if applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY
CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM

O.M.B. Burden No. 3067-0148
Expires July 31, 1994

FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average . 23 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067- 0148), Washington, DC 20503.

1. This certification is in accordance with 44 CFR Ch. I, Section 65.2
2. I am licensed with an expertise in Water Resources (hydrology
[example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)** structural, geotechnical, land surveying.]
3. I have 10 years experience in the expertise listed above.
4. I have ☒ prepared ☐ reviewed the attached supporting data and analyses related to my expertise.
5. I ☒ have ☐ have not visited and physically viewed the project.
6. In my opinion, the following analyses and /or designs, is/are being certified:
Hydrology
7. Base upon the following review, the modifications in place have been constructed in general accordance with plans and specifications. N/A
Basis for above statement: (check all that apply)
a. ☐ Viewed all phases of actual construction.
b. ☐ Compared plans and specifications with as-built survey information.
c. ☐ Examined plans and specifications and compared with completed projects.
d. ☐ Other
8. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Charles D. Anderson
(please print or type)

Title: Senior Engineer
(please print or type)

Registration No. 11518

Expiration Date: 12-31-96

State Nevada

Type of License Civil

Charles D Anderson
Signature

March 28, 1996
Date

PROFESSIONAL ENGINEER · STATE OF NEVADA · CHARLES D. ANDERSON · CIVIL · No. 11518
Charles D. Anderson
3-28-96

Seal
(Optional)

*Specify Subdiscipline

Note: Insert not applicable (N/A) when statement does not apply.

FORM 3

HYDROLOGIC ANALYSIS FORM

FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS FORM**	*O.M.B. Burden No. 3067-0148 Expires July 31, 1994*	*FEMA USE ONLY*

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.67 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden, to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

Community Name: Washoe County

Flooding Source: Local Runoff
(One form for each flooding source)

Project Name/Identifier: Peek Lemmon Valley

1. HYDROLOGIC ANALYSIS IN FIS

☒ Approximate study stream (Zone A)
☐ Detailed study stream (briefly explain methodology) ____________

2. REASON FOR NEW HYDROLOGIC ANALYSIS

☒ No existing analysis
☐ Improved data *(see data revision on page 3)*
☐ Changed physical conditions of watershed *(explain)* ____________
☐ Alternative methodology *(justify why the revised model is better than model used in the effective FIS)* ____________
☐ Evaluation of proposed conditions (CLOMRs only) (explain) ____________
☐ Other ____________

If a computer program/model was used in revising the hydrologic analysis, please provide a diskette with the input files for the 10-, 50-, 100 - and 500-year recurrence intervals.

Only the 100-year recurrence interval need be included for SFHAs designated as Zone A.

3. APPROVAL OF ANALYSIS

☐ Approval of hydrologic analysis, including the resulting peak discharge value (s) has been provided by the appropriate local, state, or Federal Agency. (i.e., ____________)
Attach evidence of approval.
☐ Approval of the hydrologic analysis is not required by any local, State, or Federal Agency.

Stream: Local Runoff

Comparison of 100-year Discharges

Location:*	Drainage area (Sq mi.)	FIS (cfs):	Revised (cfs):
Military Road (M1)	0.25		20
Military Road (M2)	4.32		890
Military Road (M3)	0.82		160
Military Road (M4)	3.17		1,070
Military Road (M5)	0.28		50
Lemmon Drive (L1)	9.50		1,480

Note: When revised discharges are not significantly different than FIS discharges, FEMA may require a confidence limits analysis on attachment D at a later date to complete the review.

As is often the case with revision requests, only a portion of a stream may actually be revised or be affected by a revision. Therefore, transition to the unrevised portion is important to maintain the continuity of the study. NFIP regulations stipulate that such a transition must be assured. What is the transition from the proposed discharges to the effective discharges? Please explain how the transition was made *(attach separate sheet if necessary)*

No Effective Discharges

ATTACH A COMPLETED REVIEW OF RESULTS PAGE FOR EACH FLOODING SOURCE.

* See Figure 3 of accompanying hydrology report for locations.

Is the new hydrologic analysis being developed solely to revise the flow values presented in the FIS *(i.e. no changed hydraulic conditions)*? ■ Yes ☐ No

If yes, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No N/A

FEMA does not normally revise NFIP maps solely due to insignificant flow changes where changes in 100-year water surface elevation are less than 1.0 foot.

5. HISTORICAL FLOODING INFORMATION

Is historical data available for the flooding source? ☐ Yes ■ No

If yes, provide the following:

Location along flooding source: ____________________

Maximum peak discharge: ____________________ cfs

Second highest peak discharge: ____________________ cfs

Source of information: ____________________

6. GAGE RECORD INFORMATION

Location of nearest gage to project site *(along flooding source or similar watershed; specify)*
Similar Watershed 260 miles northeast.

Gaging Station: South Willow Creek Near Gerlach (USGS 10353770)

Drainage area at gage: 31.0 mi²

Number of years of data: 32

7. DATA REVISION

Please use the following table to list all the data and/or parameters affected by this request and identify them as new data (*New*) or as revising existing data (*Revised*). *(If necessary, attach a separate sheet.)*

Data Parameter	New	Revised	Data Source
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

- Data source can be from a Federal, State, or local government agency, or from a private source. Some State and local governments may have less strict data requirements than Federal agencies, in which case the hydrologic data may not be accepted by FEMA unless it is demonstrated that the data give a better estimate of the flood discharge.
- Attach documentation corroborating each data source *(i.e., certified statement, report, bibliographical reference to a published document)*. In the case of a published document or a government report, providing copies of the cover and pertinent pages may be helpful.

8. METHODOLOGY FOR NEW ANALYSIS

■ Statistical Analysis of Gage Records *(use Attachment A)* Calibration of 100-year AMC

☐ Regional Regression Equations *(use Attachment B)*

■ Precipitation/Runoff Model *(use Attachment C)*

☐ Other *(specify; attach backup computations and supporting data)* ____________________

ATTACHMENT A: STATISTICAL ANALYSIS OF GAGE RECORDS

Gaging Station: South Willow Creek Near Gerlach (10353770)

Gage Location (latitude and longitude): N41:01:00 W119:21:00

	FIS:	Revised:
1. Number of years of data		
Systematic		32
Historical		33
2. Homogeneous data	☐ Yes ☐ No	☒ Yes ☐ No
3. Data adjustments	☐ Yes ☐ No	☐ Yes ☒ No
4. Number of high outliers		Ø
Low outliers		Ø
Zero events		1
5. Generalized skew		0.0
6. Station skew		-0.320
7. Adopted skew		-0.197
8. Probability distribution used (justify if log-Pearson III was not used)		LP III
9. Transfer equations to ungaged sites		☐ Yes ☒ No

If yes, specify method

10. Expected probability*		☐ Yes ☒ No
11. Comparison of results with other analyses		☐ Yes ☒ No

If yes, describe comparison

*FEMA does not accept expected probability analyses for the purpose of reflecting flood hazard information in a FIS.

If any data is not available, indicate by N/A.

Attach analysis including plot of flood frequency curve. See Accompanying Hydrologic Report

1. Bibliographical Reference:

____

____

____

(Attach a copy of title page, table of contents, and pertinent pages including equations.)

2. Gaged or ungaged stream: ______________________________

3. Hydrologic region(s): ______________________________
Attach backup map.

4. Provide parameters, values, and source of data used to define parameters.

____

____

____

	FIS:		Revised:	
5. Urbanized conditions calculations	☐ Yes	☐ No	☐ Yes	☐ No
6 Percent of watershed urbanization	______		______	
7. Is the watershed controlled?	☐ Yes	☐ No	☐ Yes	☐ No
8. Comparison with other analyses	☐ Yes	☐ No	☐ Yes	☐ No

If the answer to 5, 7, or 8 is yes, explain methodology in Comments.

If data is not available, indicate by N/A.

Comments

____

____

____

____

Attach computation and supporting maps, delineating the watershed boundary and drainage area divides.

ATTACHMENT C: PRECIPITATION/RUNOFF MODEL

		FIS:	Revised
1.	Method or model used:		HEC-1
	Version:		4.0
	Date:		Sept. 1990
2.	Source of rainfall depth:		NOAA
3.	Source of rainfall distribution:		Balanced - SCS Type II
4.	Rainfall duration:		24 hour
5.	Areal adjustment to precipitation (%):		—
6.	Hydrograph development method:		SCS UH
7.	Loss rate method:		SCS Curve No.
	Source of soils information:		SCS
	Source of land use information		City of Reno
8.	Channel routing method:		Muskingham
9.	Reservoir routing:	☐ Yes ☐ No	☐ Yes ☒ No
10.	Baseflow considerations:	☐ Yes ☐ No	☒ Yes ☐ No

If yes, explain how baseflow was determined:

Baseflow calibrated at 4 cfs per square mile to match 100-year 24 hour volume determined from gage data for South Willow Creek Near Gerlach

		FIS:	Revised
11.	Snowmelt considerations:	☐ Yes ☐ No	☐ Yes ☒ No
12.	Model calibration:	☐ Yes ☐ No	☒ Yes ☐ No

If yes, explain how calibration was performed Antecedent Moisture Condition and base flow were calibrated to 100-year frequency analysis for South Willow Creek, using the same storm distribution.

13. Future land use condition: ☐ Yes ☒ No
If yes, explain why

NOTE: FEMA policy is to base flooding on existing conditions.
If data is not available, indicate by N/A.

Attach precipitation/runoff model, hydrologic model schematic, curve number calculations, time of concentration calculations, and supporting maps, delineating the watershed boundary and drainage area divides.

Stream: ______________________________

Select one location for Confidence Limits Evaluation *(describe location)*: ______________________________

____

Discharges for selected location:

Exceedance Probability		FIS	Revised
10%	(10-year)	________ cfs	________ cfs
2%	(50-year)	________ cfs	________ cfs
1%	(100-year)	________ cfs	________ cfs
0.2%	(500-year)	________ cfs	________ cfs

1% (100-year) Flood Confidence Intervals

90% Confidence Interval:	5% limit	________	cfs
	95% limit	________	cfs
50% Confidence Interval:	25% limit	________	cfs
	75% limit	________	cfs

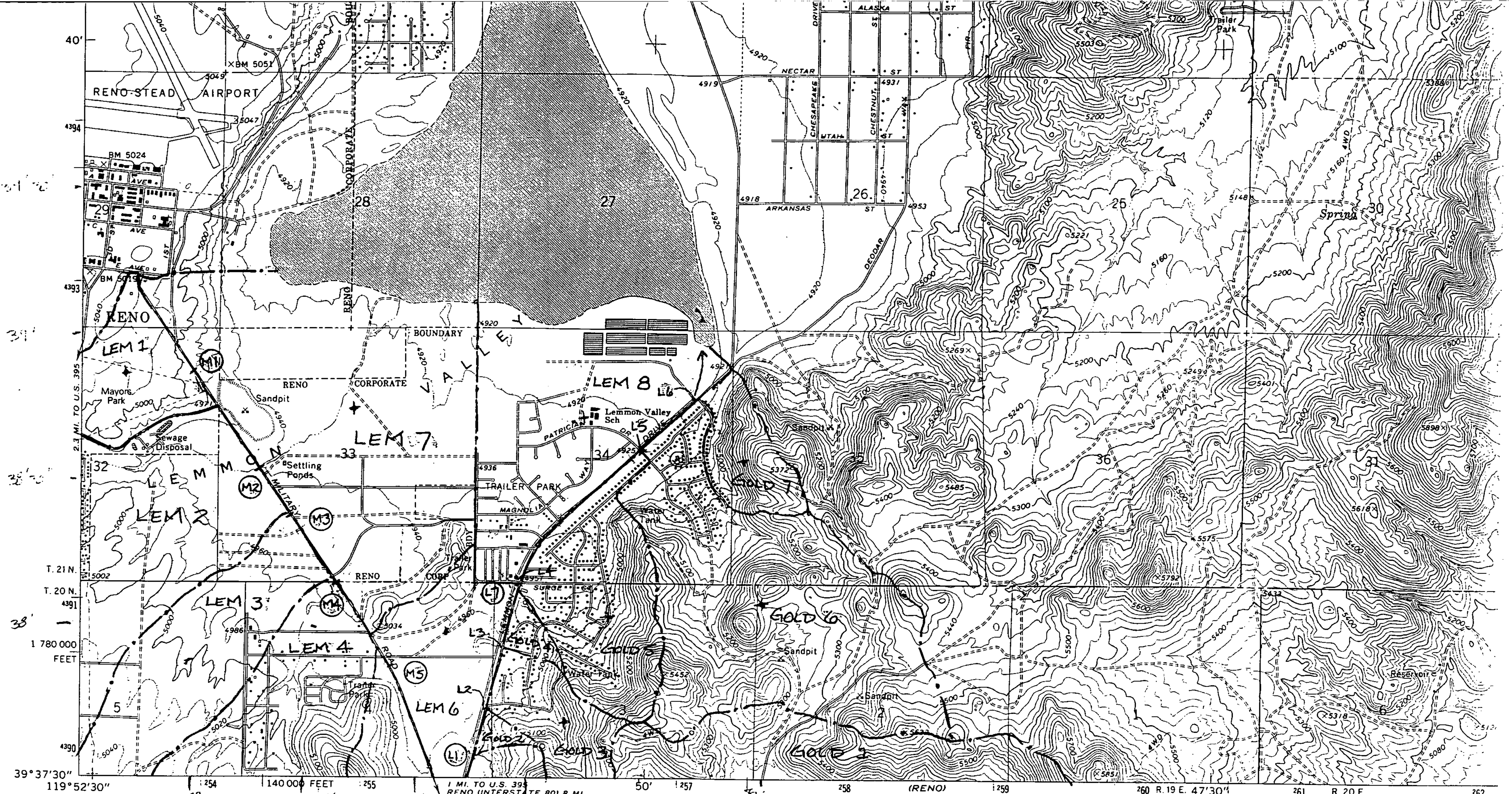
If the value of the 100-year frequency flood in the FIS is beyond the 50% confidence interval but within the 90% confidence interval, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No

An example of confidence limits analysis can be found in Appendix 9 of Bulletin 17B.

Attach Confidence Limits Analysis.

APPENDIX 3.A

DRAINAGE AREA



Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1966. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grid based on Nevada coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue
To place on the predicted North American Datum 1983 move the projection lines 14 meters north and 87 meters east as shown by dashed corner ticks
Fine red dashed lines indicate selected fence lines

GN MN
1°48' 32 MILS
16½° 293 MILS

UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

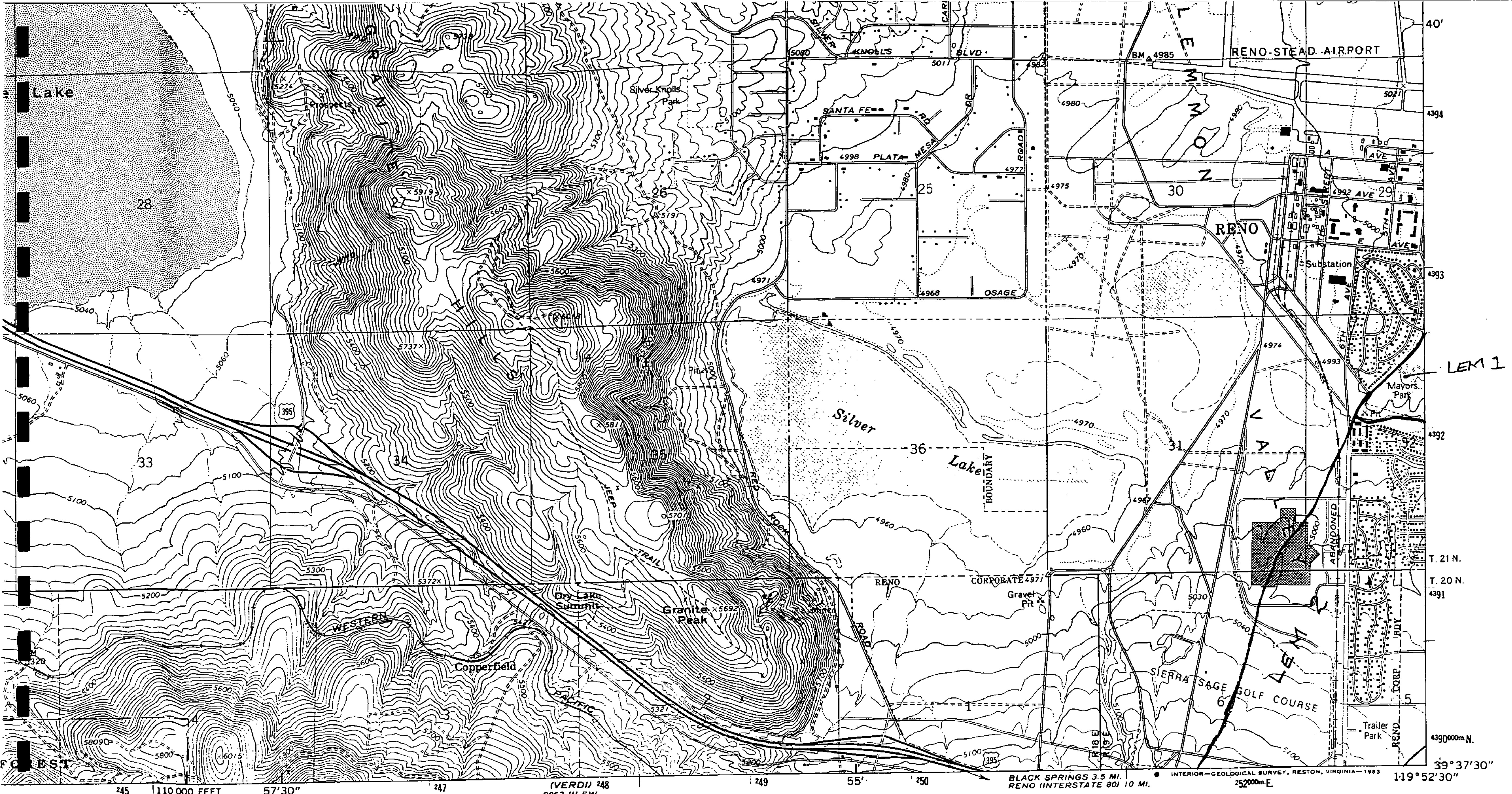
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

NEVADA
QUADRANGLE LOCATION

Revisions shown in purple compiled from aerial photographs taken 1978 and other source data. This information not field checked. Map edited 1982

RENO NE



SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GN MN 16½° 1°52' 33 MILS 293 MILS

UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

NEVADA
QUADRANGLE LOCATION

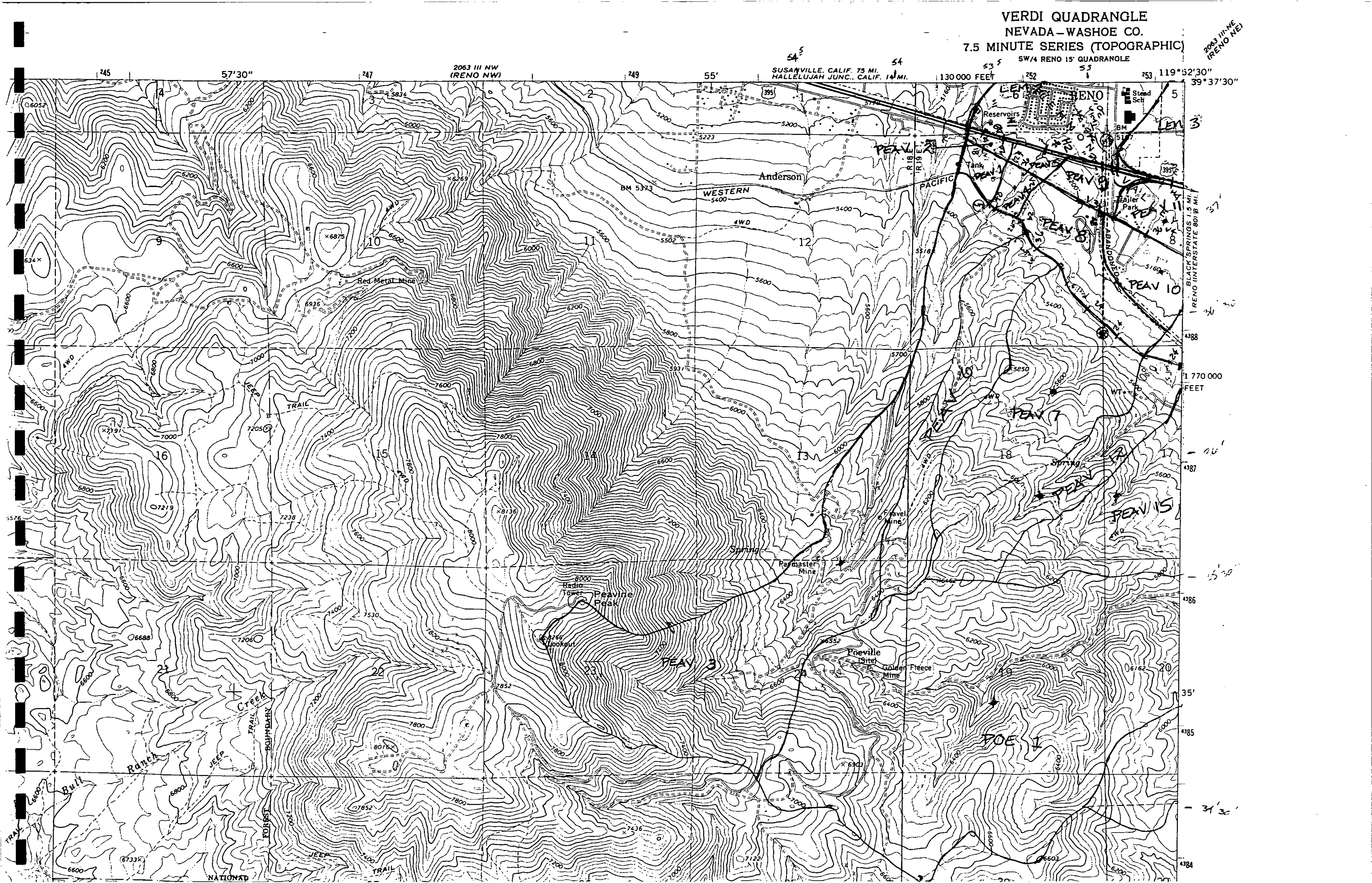
Revisions shown in purple compiled from aerial photographs taken 1978 and other source data. This information not field checked. Map edited 1982

ROAD CLASSIFICATION

Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
U. S. Route

RENO NW, NEV.
NW/4 RENO 15' QUADRANGLE
N3937.5—W11952.5/7.5

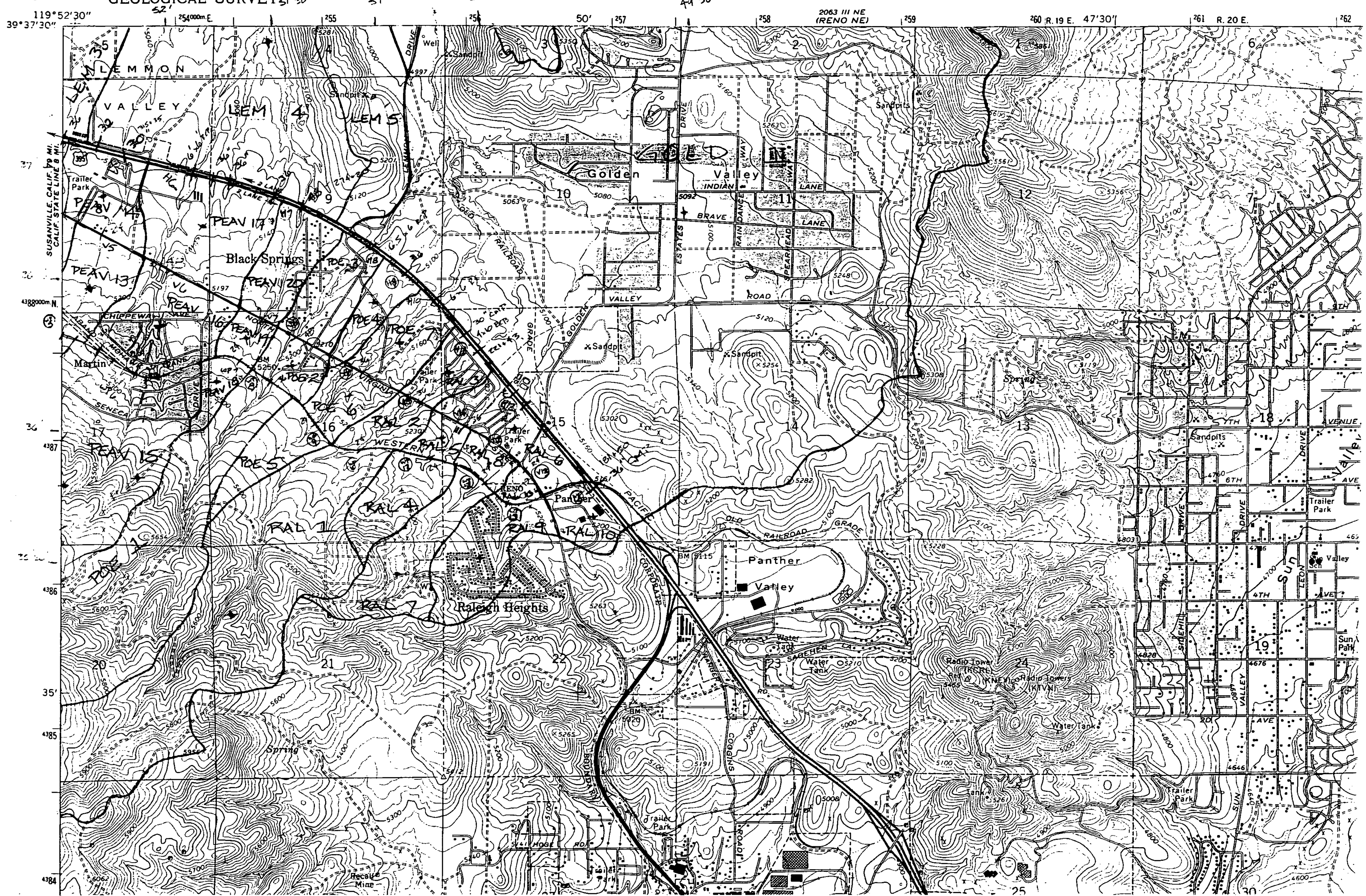
1967
PHOTOREVISED 1982
DMA 2063 III NW—SERIES V896



VERDI QUADRANGLE
NEVADA–WASHOE CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 RENO 15' QUADRANGLE
2063 III NE (RENO NE)
2063 III NW (RENO NW)
SUSANVILLE, CALIF. 75 MI.
HALLELUJAH JUNC., CALIF. 14 MI.
130 000 FEET
1 770 000 FEET
119°52'30"
39°37'30"
57'30"
55'
35'
BLACK SPRINGS 1.5 MI.
RENO (INTERSTATE 80) 8 MI.
Stead Sch
Reservoirs
Tank
Trailer Park
ABANDONED
Anderson
WESTERN PACIFIC
BM 5373
Red Metal Mine
Gravel Mine
Paymaster Mine
Spring
Peavine Peak
Radio Tower
Lookout
Poeville (Site)
Golden Fleece Mine
JEEP TRAIL
Bull Ranch Creek
FOREST BOUNDARY
NATIONAL

RENO

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



PEEK'S LEMMON VALLEY PROPERTY

HYDROLOGIC ANALYSES

March 1996

Prepared For:

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Engineers & Land Surveyors
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INTRODUCTION

Flood discharge information is desired for property located between Military Road and Lemmon Valley Road in Reno-Stead, Nevada. As shown on Figure 1, current Flood Insurance Rate Maps classify the area as flood prone in the 100-year event with a Zone A designation based on approximate methods. The intent of present work is to establish 100-year flow rates at the subject property.

HYDROLOGIC ANALYSES

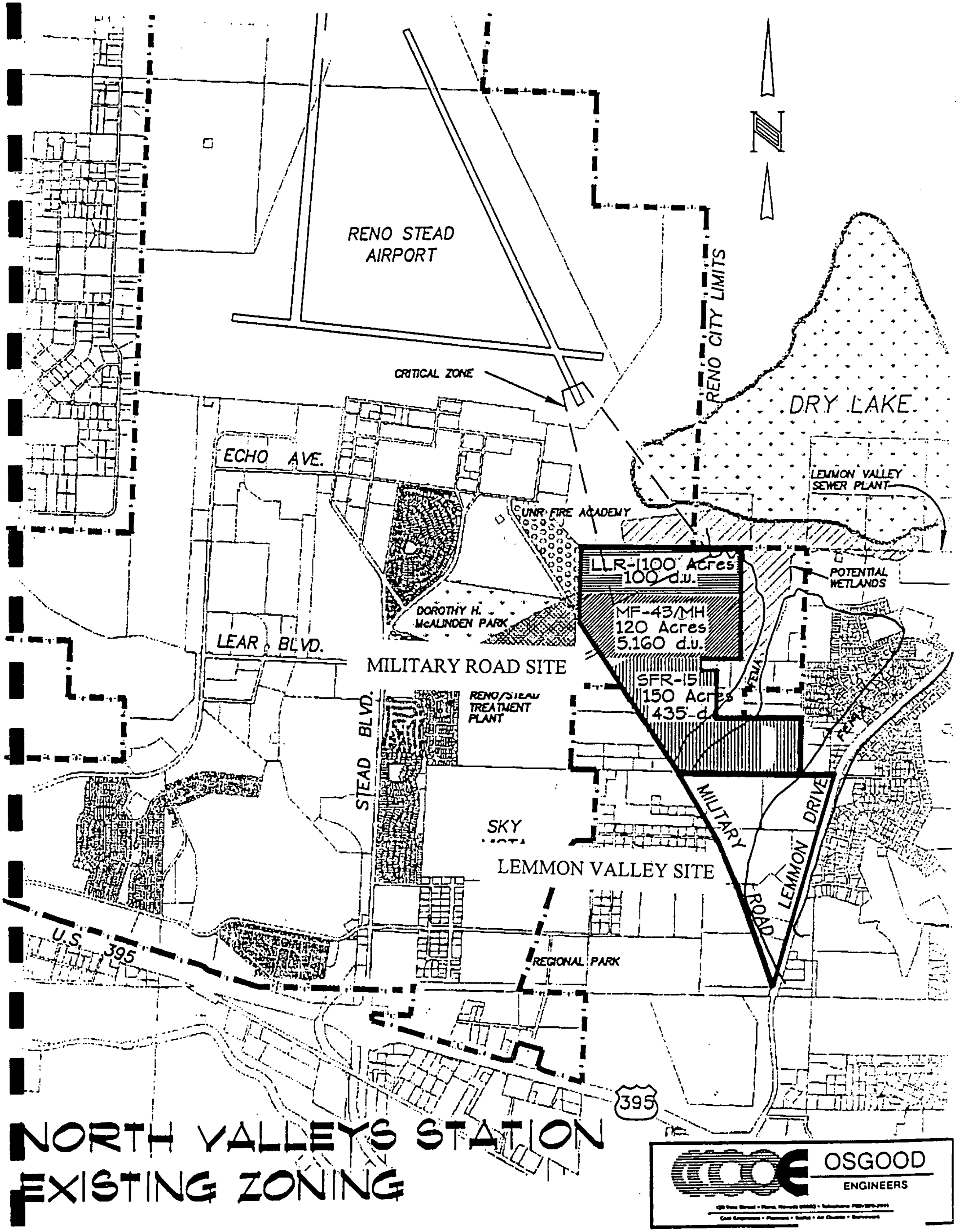
Since hydrologic data for the immediate Lemmon Lake area is limited, discharge must be estimated using a hydrologic model.

Estimates of runoff to the Peek property are based on the Soil Conservation Service (SCS) Unit Hydrograph model. Software employed to perform the computational work is the U.S. Army Corps of Engineers' HEC-1 program, which is accepted by FEMA. The SCS model is basically a lumped-parameter type of model which uses a rainfall pattern and depth of rainfall as basic input. The rainfall-runoff relationship is established using the SCS Curve Number (CN) technique, which models the retention of excess precipitation as a function of land use, soil type, ground cover, and antecedent moisture conditions (i.e. soil saturation resulting from previous rainfall).

Each watershed's response to excess precipitation (runoff) is defined by the SCS non-dimensional unit hydrograph, whose parameters are developed through estimates of geomorphological and hydraulic characteristics of the watershed in question. These are detailed below.

Watershed characteristics that influence the unit hydrograph are generally measurable in the field (or more precisely, from quadrangle mapping). Precipitation information may be found from the NOAA water atlas for Nevada, and previously determined intensity-duration-frequency relationships for the Reno area. The remaining parameter is the curve number, which is estimated using SCS guidelines and published soil surveys.

To improve model reliability, curve numbers (actually antecedent moisture conditions) are calibrated to nearby, similar watersheds with gaged streamflow records. It is important to note that this calibration applies *only to the particular rainfall distribution* used in the model. Other distributions would require their own calibration. Since hydrologic and hydraulic data for this part of Nevada is fairly limited, the definition of a nearby watershed has been extended to northeastern Washoe County. The nearest watershed of similar elevation, slope, land use, basic soil type and ground cover with a sufficiently long period of record to perform a discharge frequency analysis (more than nine years of record) is South Willow Creek located approximately 30 miles north of Gerlach, or 260 miles northeast of Lemmon Lake. This gage has a systematic record of 32 years (1963-1995, with 1979 missing). A gage on Galena Creek near Steamboat (25 miles south of Lemmon Lake) is used to calibrate antecedent moisture conditions typical of the more alpine (characterized by groves of Ponderosa and Aspen) areas at the upper reaches of Peavine Creek.



N
RENO STEAD AIRPORT
CRITICAL ZONE
RENO CITY LIMITS
DRY LAKE
LEMMON VALLEY SEWER PLANT
UNR FIRE ACADEMY
ECHO AVE.
LLR-1100 Acres
100 d.u.
POTENTIAL WETLANDS
MF-43/MH
120 Acres
5,160 d.u.
DOROTHY H. McALINDEN PARK
LEAR BLVD.
MILITARY ROAD SITE
SFR-15
150 Acres
435 d
FEMA
RENO/STEAD TREATMENT PLANT
STEAD BLVD.
SKY
MILITARY ROAD
LEMMON DRIVE
LEMMON VALLEY SITE
REGIONAL PARK
U.S. 395
395
NORTH VALLEYS STATION
EXISTING ZONING
OSGOOD
ENGINEERS

FIGURE 1

Precipitation. An SCS Type II storm pattern has been adopted as the rainfall distribution, since the project site is located east of the Sierra Nevada crest. (ref. SCS, *Urban Hydrology for Small Watersheds*, Technical Release 55, June 1986) A 24-hour, 100-year precipitation event is used to estimate peak 100-year runoff. Coincident snowmelt is not factored into peak discharge estimates. Twenty four hour precipitation depths are obtained from NOAA's draft isopluvial maps for western Nevada. Washoe County has indicated that they will adopt these maps upon publication. Total precipitation at the centroid of each calibration watershed is given below.

S. Willow Creek Near Gerlach	2.5 inches
Galena Creek Near Steamboat	6.5 inches

Frequency and depth information have been merged so that the rainfall pattern used in runoff computations is the Type II SCS distribution, but the maximum depth of rainfall for any duration reflects Reno area statistics. A normalized 15 minute precipitation pattern based on the 100-year rainfall intensity - duration - frequency curve for the general Reno area is included as Appendix A.

To obtain this pattern, rainfall intensities (inches per hour) for durations in 15 minute intervals are taken from the Reno 100-year IDF curve and converted into depth, which is normalized by dividing the 24-hour depth from the IDF curve. Incremental normalized precipitation is then found by taking the difference in the depth ratio. Each interval of this normalized distribution pattern is then ranked in descending order so that it can be made to fit a standard SCS Type II normalized distribution. The "balanced" distribution reflecting local statistics is found by matching each local normalized precipitation increment to its corresponding Type II rank. Thus the basic Type II pattern is followed, but local precipitation statistics are preserved.

Unit Hydrograph. A unit hydrograph models the response of a watershed to one inch of excess precipitation. For calibration and prediction, the SCS dimensionless unit hydrograph is used (ref. SCS, *National Engineering Handbook, Section 4: Hydrology*, March 1985). Basin lag is the only required parameter to define the unit hydrograph. Watershed characteristics are summarized in Table 1. Curve numbers are for desert regions from the Arizona Department of Water Resources (Appendix B). Watershed lag is from the *National Engineering Handbook:*

$$Lag = \frac{l^{0.8} (S + 1)^{0.7}}{1900 \; Y^{0.5}}$$

$$S = \frac{1000}{CN} - 10$$

Where Lag = time (hours) from the center of mass of rainfall excess to the peak discharge.
l = hydraulic length of watershed (divide to outlet) in feet.
Y = average basin slope in percent.
CN = Curve Number = f(antecedent moisture condition).

Table 1
Watershed Characteristics

	S. Willow Creek Nr Gerlach	Galena Creek Nr Steamboat
Drainage Area (mi^2)	31	8.5
24-hr 100-yr Precipitation (in.)	2.5	6.5
Hydraulic Length, *l* (feet)	56,200	35,000
Average Basin Slope, *Y* (%)	15.6	16.0
Basic Ground Cover	Mountain Brush (50% cover)	Ponderosa Pine (50% Cover)
Soil Group, HSG, CN, %	Newlands, B, 57, 6%	Tallac, B, 58, 10%
	Hopgood/Hartig, B, 57, 8%	Oest, B, 58, 10%
	Simon, B, 57, 7%	Apmat, B, 58, 5%
	Home Camp, C, 70, 14%	Surprise, B, 58, 5%
	Bucklake, C, 70, 13%	Fraval, C, 72, 40%
	Mosquet, D, 82, 2%	Temo, C, 72, 20%
	Singatse, D, 82, 40%	Meiss, D, 79, 5%
	Outcrop, D, 95, 10%	
Weighted CN (AMC II)	75	65

Calibration to Gaged Watersheds. Antecedent moisture conditions within two gaged watersheds have been calibrated so that estimated peak discharge is validated by the results of statistical analyses of recorded annual peak discharge. Contributing base flow for each basin has also been adjusted so that the peak 24 hour runoff volume is also consistent with stream gage data.

Calibration is based on statistical analyses of streamflow data for South Willow Creek and Galena Creek. Stream gages at Peavine Creek and Long Valley Creek (CA) are closer to Lemmon Lake, but do not have sufficiently long periods of record to justify statistical analyses. Peak discharges for the creeks at gaged locations are estimated by fitting recorded annual peak discharges to a Log-Pearson III distribution following guidelines prepared by the USGS Office of Water Data Collection (*Guidelines for Determining Flood Flow Frequency*, Bulletin #17B, Rev. September 1981). Flood frequency calculations are included as Appendix C, and summarized in Table 2. Statistics for the Galena gage have been adjusted to reflect a historic flood that occurred in 1956, before the start of the systematic record. Note that the watershed draining through the Peek property drains approximately 22 square miles, ranging in elevation from 4920 to 8266.

A HEC-1 model that includes each gaged basin is presented as Appendix D. Curve numbers and base flow (in cfs per square mile) have been adjusted so that the statistically estimated 100-year peak discharge is matched and the 100-year maximum 24-hour volume (as measured by the 24-hour average discharge in cfs) is preserved. Calibration results for each basin are shown in Table 3; for the purposes of hydrologic modeling, the following parameters are adopted:

Antecedent Moisture Condition	II½ (basic), II¼ (alpine)
Base Flow Contribution	4 cfs/mi^2

Table 2 Stream Gage Information		
	South Willow Creek	Galena Creek
Gage Name	S. Willow C Nr Gerlach, NV	Galena C Nr Steamboat, NV
USGS Station Identification	10353770	10348900
Latitude	N41:01:00	N39:21:43
Longitude	W119:21:00	W119:49:37
Systematic Record	1963-1978, 1980-1995	1962-1995
Number of Years	32	34
Historic Record	1963-1995	1956-1995
Historic Peaks	N/A	1956
Low Outlier/Zero Flow	1968	N/A
Regional Skew Coefficient	0.0	0.0
100-yr Discharge (cfs)	3,575	2,982
24-hr average flow (cfs)	945	360
Drainage Area (mi^2)	31.0	8.5
Gage Elevation	4500	5592
Divide Elevation	8533	10776

Table 3 Calibration		
	South Willow Creek	Galena Creek
LPIII 100-yr Peak Q (cfs)	3,575	2,982
CN at AMC II	75	65
CN to Match Peak Q	81.7	69.2
Equivalent AMC	II½	II¼
Calibrated Peak Q (cfs)	3,580	3,113
LPIII Max 24 hr Avg Q (cfs)	945	360
Base Flow to Match 24 hr Q (cfs/mi^2)	4.0	0.0
Calibrated 24 hr Avg Q (cfs)	942	715

Lemmon Valley Hydrology. The eastern quadrant of Peavine Peek, Golden Valley, and parts of Lemmon Valley drain through the Peek Property into Lemmon Lake, a terminal playa in a closed basin. The nature of the playa means that *all* runoff tributary to the playa accumulates in the playa. According to the SCS Soil Survey for southern Washoe County, soil materials underlying the playa are mostly clay, silty clay, and silty clay loam with slow or very slow permeability. Essentially the only outflow from the playa is through evaporation, which has implications discussed in the hydraulics section.

Basin Characteristics. Watersheds draining to Military Road and Lemmon Drive are shown on Figure 2. Parameters including drainage area, hydraulic length, slope, precipitation at the basin centroid, weighted curve number, basin lag and urbanization are summarized in Table 5.

The watershed has been broken into sub-basins for a higher level of detail regarding basin characteristics. Rainfall distribution is identical to that used in the stream gage calibration, while depth is taken from the same NOAA draft isopluvial mapping. Curve number estimation utilizes the same chart as the calibration for the South Willow Creek gage with a calibrated antecedent moisture condition of II½. Hydrologic soil groups are taken from SCS mapping for Washoe County. Appendix B presents curve number estimation based on the categories given above for each soil group. Basic ground covers within the watershed fall under the categories summarized in Table 4.

Table 4
Curve Numbers Based on Ground Cover

Cover	Description	Hydrologic Soil Group B	Hydrologic Soil Group C	Hydrologic Soil Group D
Mountain Brush	Mixtures of oak, aspen, mountain mahogany, bitter brush, and other brush w/ some grass.	66	77	87
Juniper/Brush	Juniper w/ an understory of brush.	64	79	89
Sage/Brush	Sage with an understory of brush.	62	76	87

Urbanization. To model the effect of existing development in the watershed, base curve numbers are used in conjunction with the percentage of impervious area in the sub-basin. Impervious areas refer to pavement (e.g. roads and parking lots), driveways, sidewalks, and building footprints that eliminate the surface infiltration of runoff into the ground. Urbanization tends to increase the peak rate and volume of runoff, all other factors (such as rainfall) being equal.

Urbanization is estimated from aerial photographs and quadrangle mapping by computing the percentage of a given basin covered by impervious surfaces. Low density residential areas are assumed to have an impervious area of one-third the gross acreage; high density development and commercial or industrial areas are assumed to be 70 percent impervious. Special areas such as large parking lots or lakes are assumed to be 100 percent impervious.

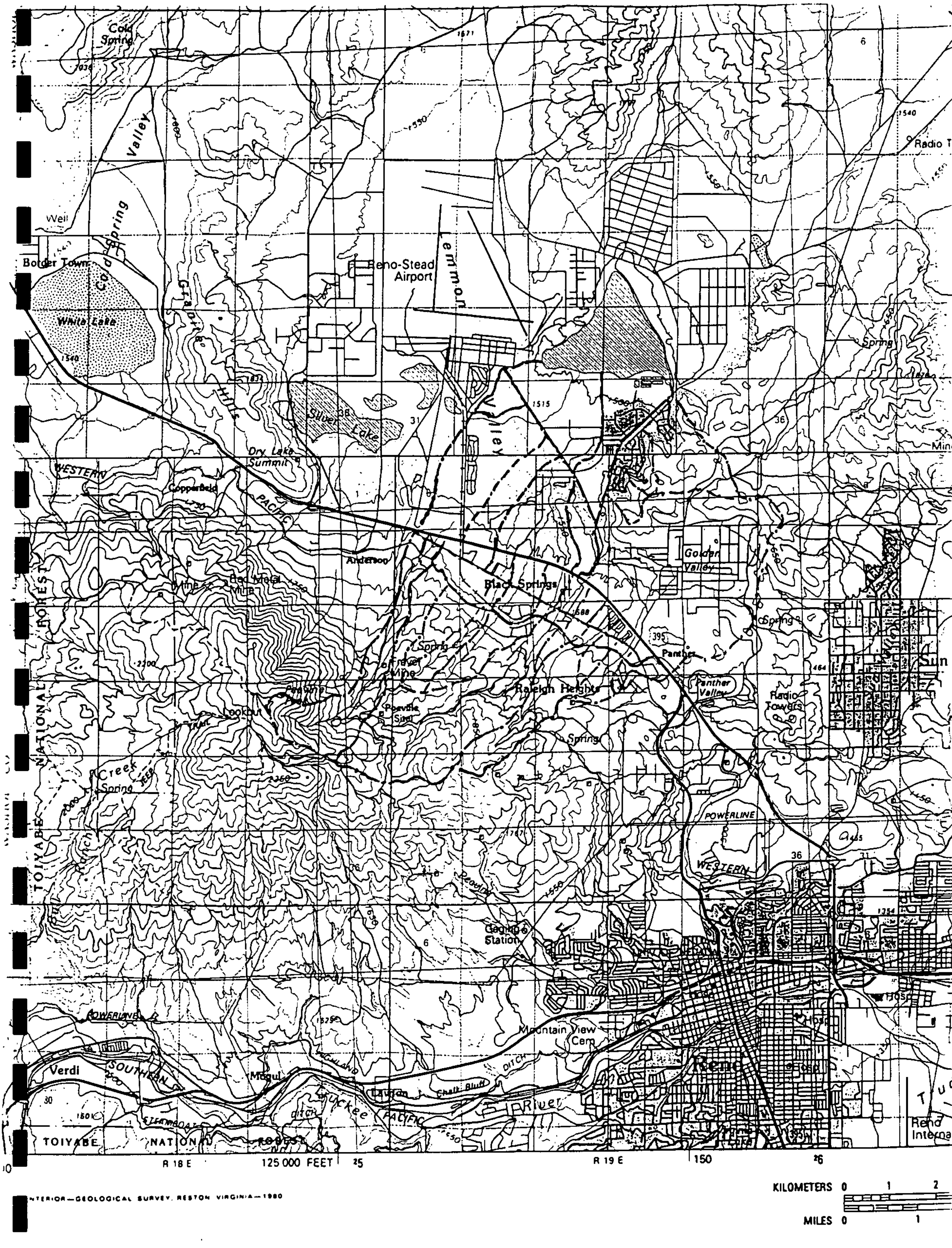

Cold Spring
Valley
Cold Spring
Well
Border Town
White Lake
Granite Hills
Reno-Stead Airport
Lemmon Valley
Silver Lake
Dry Lake Summit
WESTERN PACIFIC
Copperfield
Anderson
Red Metal Mine
Mine
Black Springs
Golden Valley
Spring
Panther
Panther Valley
Radio Towers
Sun
Radio To
Mine
Raleigh Heights
Peavine Peak
Lookout
Peavine Sta
Spring
Creek
Spring
TRAIL
JEEP
TOIYABE NATIONAL FOREST
POWERLINE
WESTERN
Peavine
Gaging Station
Mountain View Cem
Reno
Hosp
Verdi
SOUTHERN PACIFIC
Mogul
HIGHLAND DITCH
Chalk Bluff
Truckee River
ditch
STEAMBOAT
TOIYABE NATIONAL FOREST
Reno Interna
R 18 E
125 000 FEET
R 19 E
150
INTERIOR—GEOLOGICAL SURVEY, RESTON VIRGINIA—1980
KILOMETERS 0 1 2
MILES 0 1

FIGURE 2

PYRAMID ENGINEERS AND LAND SURVEYORS
PEEK PROPERTY HYDROLOGY
Watershed Parameters
Table 5

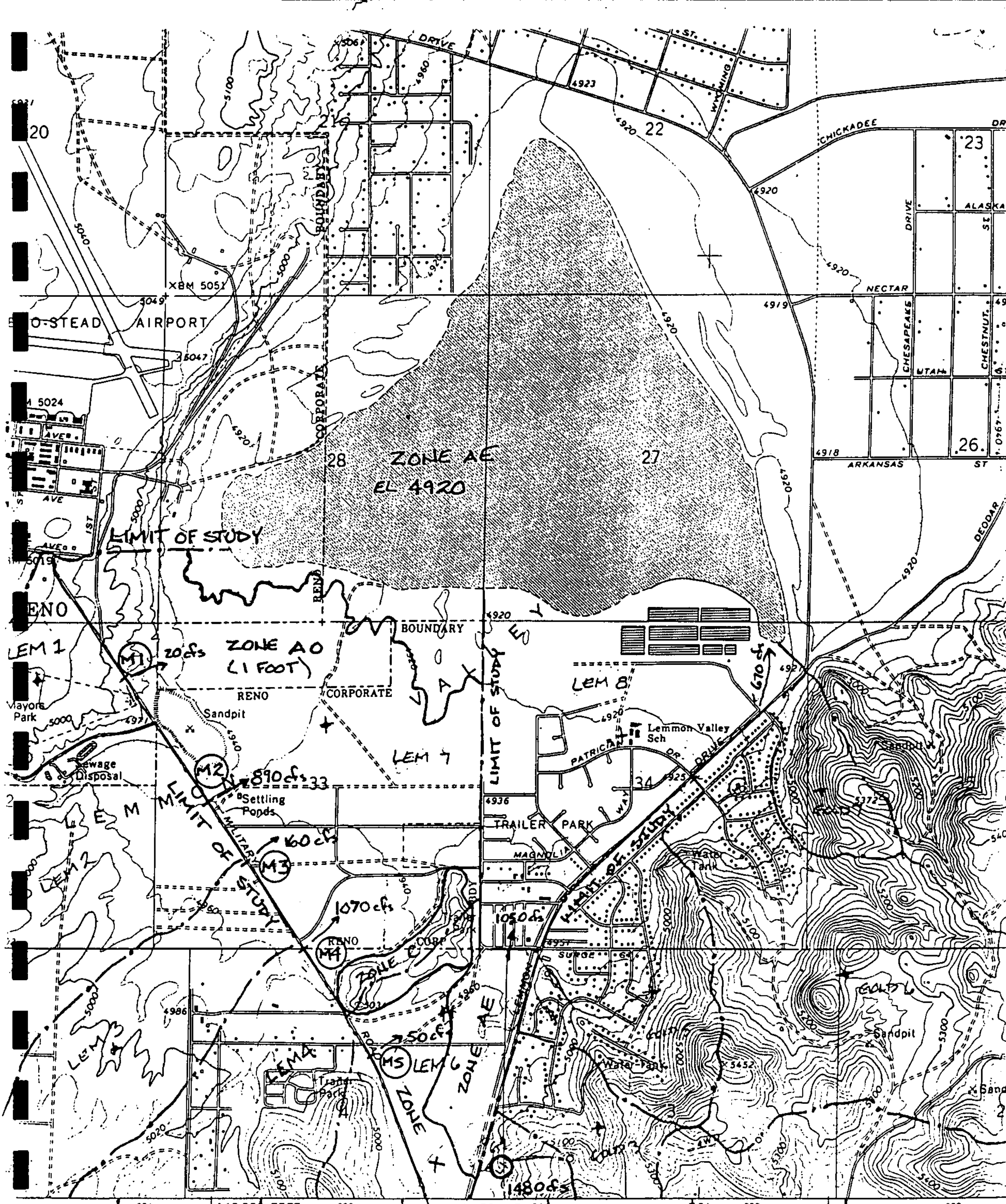
Basin Designation	Basin Area (sq. mi.)	Length (feet)	Avg. Slope (percent)	Basin Centroid Latitude	Basin Centroid Longitude	Precip. (inches)	Ground Cover	Soil Groups (sq. mi.) B	Soil Groups (sq. mi.) C	Soil Groups (sq. mi.) D	Weighted CN	Basin Lag (hours)	Urbanization (sq. mi.) LD (33%)	Urbanization (sq. mi.) HD (70%)	Urbanization (sq. mi.) (100%)	Net Percent Impervious
PEAV1	0.05	1,500	7	N 39 37 10	W 119 53 30	3.60	Mountain Brush		0.05		77.0	0.18				
PEAV2	0.02	1,000	4	N 39 37 15	W 119 53 30	3.60	"		0.02		77.0	0.17				
PEAV3	1.35	19,000	15	N 39 35 40	W 119 54 15	3.75	Juniper/Brush	0.23	0.78	0.34	79.3	0.88				
PEAV4	0.03	1,200	8	N 39 37 00	W 119 53 30	3.50	Mountain Brush		0.03		77.0	0.14				
PEAV5	0.02	1,000	8	N 39 37 10	W 119 53 15	3.50	"		0.02		77.0	0.12				
PEAV6	0.39	10,000	12	N 39 36 10	W 119 53 45	3.50	"		0.26	0.13	80.3	0.57				
PEAV7	0.58	7,000	16	N 39 36 15	W 119 53 10	3.47	"	0.01	0.39	0.18	79.9	0.38				
PEAV8	0.18	2,100	2	N 39 37 15	W 119 53 20	3.48	"		0.18		77.0	0.45				
PEAV9	0.10	1,500	8	N 39 37 05	W 119 52 50	3.45	"		0.10		77.0	0.17				
PEAV10	0.10	2,500	6	N 39 36 43	W 119 52 40	3.55	"		0.10		77.0	0.30				
PEAV11	0.07	2,000	1	N 39 37 00	W 119 52 35	3.46	"		0.07		77.0	0.61				
PEAV12	0.36	8,600	14	N 39 35 50	W 119 53 10	3.55	"		0.22	0.14	80.9	0.46				
PEAV13	0.14	3,000	4	N 39 36 28	W 119 52 20	3.40	"		0.14		77.0	0.42				
PEAV14	0.14	2,800	3	N 39 36 50	W 119 52 20	3.45	"		0.13	0.01	77.7	0.45	0.01			2
PEAV15	0.76	7,800	14	N 39 35 47	W 119 52 45	3.50	"		0.30	0.46	83.1	0.40	0.07			3
PEAV16	0.20	2,500	4	N 39 36 20	W 119 52 00	3.40	"		0.20		77.0	0.36	0.08			13
PEAV17	0.24	3,500	5	N 39 36 42	W 119 51 47	3.35	"		0.15	0.09	80.8	0.38	0.01			1
PEAV18	0.04	1,800	5	N 39 36 10	W 119 51 45	3.20	"		0.03	0.01	79.5	0.23	0.01			10
PEAV19	0.04	1,200	6	N 39 36 17	W 119 51 35	3.15	"		0.035	0.005	78.3	0.16				
PEAV20	0.12	4,000	3	N 39 36 35	W 119 51 25	3.25	"		0.08	0.04	80.3	0.55	0.05			14
POE1	2.52	21,000	9	N 39 34 55	W 119 53 30	3.50	Juniper/Brush	0.25	0.95	1.32	82.8	1.11				
POE2	0.05	1,700	5	N 39 36 10	W 119 51 20	3.15	Mountain Brush		0.05		77.0	0.24	0.01			7
POE3	0.11	2,700	4	N 39 36 25	W 119 51 15	3.25	"		0.11		77.0	0.39	0.06			18
POE4	0.07	2,500	9	N 39 36 25	W 119 51 00	3.15	"		0.07		77.0	0.24				0.5
POE5	0.09	3,250	8	N 39 35 55	W 119 51 30	3.30	"		0.03	0.06	83.7	0.26				
POE6	0.07	1,700	6	N 39 36 05	W 119 51 05	3.25	"		0.07		77.0	0.22				
POE7	0.10	2,500	7	N 39 36 20	W 119 50 50	3.35	"		0.10		77.0	0.27				0.5
RAL1	1.00	13,000	9	N 39 35 20	W 119 51 40	3.30	"	0.00	0.23	0.77	84.8	0.70				
RAL2	0.07	2,300	10	N 39 36 00	W 119 50 50	3.10	"		0.06	0.01	78.4	0.21				
RAL3	0.08	1,800	7	N 39 36 10	W 119 50 35	3.20	"		0.08		77.0	0.21		0.05		44
RAL4	0.12	3,200	9	N 39 35 45	W 119 50 50	3.20	"		0.07	0.05	81.2	0.26				
RAL5	0.04	1,500	5	N 39 35 55	W 119 50 40	3.10	"		0.03	0.01	79.5	0.20	0.01			5
RAL6	0.14	2,000	4	N 39 36 05	W 119 50 20	3.01	"	0.03	0.02	0.09	81.1	0.27		0.04		20
RAL7	0.20	5,800	8	N 39 35 25	W 119 50 50	3.13	"		0.11	0.09	81.5	0.44				
RAL8	0.03	1,500	5	N 39 35 20	W 119 50 30	3.02	"		0.01	0.02	83.7	0.17	0.00			5
RAL9	0.17	3,800	6	N 39 35 30	W 119 50 25	3.13	"			0.17	87.0	0.30	0.13			25
RAL10	0.01	700	4	N 39 35 50	W 119 50 15	3.15	"			0.01	87.0	0.09				2
RAL11	0.08	2,000	6	N 39 35 35	W 119 50 00	3.02	"			0.08	87.0	0.18				5
LEM1	0.25	4,000	1	N 39 38 50	W 119 52 20	3.50	Sage/Brush	0.12	0.13		69.3	1.31				
LEM2	1.67	14,000	2.5	N 39 38 10	W 119 52 45	3.45	Sage/Golf Course	0.21	1.07	0.18	74.5	1.96	0.45	0.05	0.02	12
LEM3	0.65	9,000	2	N 39 37 50	W 119 52 00	3.38	Sage/Brush	0.13	0.43	0.09	74.7	1.53	0.03			2
LEM4	1.13	10,100	2	N 39 37 25	W 119 51 30	3.25	"	0.13	0.59	0.41	78.4	1.50	0.08			2
LEM5	0.28	6,500	2	N 39 37 15	W 119 51 00	3.25	"	0.03	0.25		74.5	1.18				
LEM6	0.39	6,200	0.7	N 39 38 00	W 119 50 50	3.25	"	0.26	0.13		66.7	2.38				0.5
LEM7	1.08	6,000	0.7	N 39 38 42	W 119 51 18	3.30	"	0.72	0.13	0.23	69.0	2.18				
LEM8	0.69	5,500	0.8	N 39 38 40	W 119 50 17	3.20	"	0.49	0.20		66.1	2.06		0.29	0.06	38
GOLD1	4.55	20,000	4	N 39 36 45	W 119 49 30	3.00	"	0.66	2.63	1.26	77.0	1.91	2.02			15
GOLD2	0.02	1,300	18	N 39 37 40	W 119 50 37	3.20	"	0.00	0.02		73.9	0.11				
GOLD3	0.19	4,500	10	N 39 37 42	W 119 50 20	3.15	"	0.05	0.14		72.3	0.42	0.03			5
GOLD4	0.03	1,800	8	N 39 38 00	W 119 50 30	3.02	"	0.01	0.03		73.7	0.22	0.02			20
GOLD5	0.36	7,000	14	N 39 38 05	W 119 50 10	3.08	"	0.17	0.19		69.4	0.55	0.24			22
GOLD6	0.93	9,400	7	N 39 38 08	W 119 49 30	3.00	"	0.20	0.60	0.13	74.5	0.85	0.14			5
GOLD7	0.13	4,000	9	N 39 38 32	W 119 49 32	3.02	"	0.03	0.10		72.8	0.40	0.01			1

Peak Flow Attenuation. Sub-basins have been delineated to reflect the Western Pacific Railroad, North Virginia Street, and U.S. Highway 395 which form barriers to runoff from Peavine Peak to the southwest. Creeks and swales are carried through these impediments in culverts. Since the ravines carrying runoff tend to be fairly deep (twenty feet of cover over a culvert is not uncommon), and the culverts fairly small (24-inch or 36-inch diameter is typical), there is significant detention storage behind the railroad, street and highway, and runoff is attenuated (i.e. peak runoff rates are reduced). Based on topographic information obtained in the field by PYRAMID Engineers and Land Surveyors, and Highway 395 record drawings prepared by Nevada Dept. of Transportation, these culverts have been modeled.

Runoff will pond behind each culvert depending upon its capacity. If the flow rate is high enough, the railroad, street or highway could be overtopped. Since the railroad, street and highway are all constructed above the natural grade, there is a ditch along the upstream side of each, and some runoff can be diverted, generally to the southeast. Eventually these diversions are intercepted by a northeasterly flowing creek, and will either be carried through the railroad or highway or diverted further to the east depending upon individual culvert capacities at each creek. These diversions also tend to delay the arrival of peak runoff at Military Road and Lemmon Drive, and also tend to attenuate the peak flowrate.

Flood Routing. Culvert detention and diversions are is described in the HEC-1 model for Lemmon Valley, which is included as Appendix E. Runoff is routed through culverts by the Modified Puls method and in creeks and channels using the Muskingum method to move hydrographs toward the watershed outlet. Storage-discharge relationships are based on the field survey and topographic information from USGS quadrangle mapping, and the NDOT plans. Routing lengths are taken from quadrangle maps; Muskingum's "K" parameter is estimated as the travel time in hours based on an average velocity within the routing reach. Muskingum's "x" value, which weighs the amount of pure translation versus attenuation of the flood wave, has been set between 0.2 and 0.3 for natural channels (depending upon relative steepness), and 0.4 for man-made channels. An "x" value of 0.5 represents pure translation with no storage; a value of 0.0 represents a reservoir.

Peak 100-year Discharge. Table 6 summarizes estimated peak 100-year discharge rates at Military Road and Lemmon Drive, referenced to points shown on Figure 3. Flowrate estimates are given at discrete points along each road at major drainage facilities. The hydraulic analyses section discusses how this flow moves across Military Road and Lemmon Drive, and through the subject property.



..., edited, and published by the Geological Survey

...rol by USGS and NOS/NOAA

...graphy by photogrammetric methods from aerial ...graphs taken 1966. Field checked 1967

...onic projection. 1927 North American datum
...00-foot grid based on Nevada coordinate system,

FIGURE 3

CONTOU...

Table 6 Estimated 100-Year Discharge	
Location	100-Year Discharge (cfs)
Military Road	
M1	20
M2	890
M3	160
M4	1070
M5	50
Lemmon Lake	1940
Lemmon Drive	
L1 (East Side of Lemmon Drive)	1480
Channel Flow at Surge Street	460
Overflow at Surge Street	1050
Lemmon Lake	1450

Future Development. Estimated discharge from Table 6 is predicated upon existing conditions as of November 1995 (based on available information). As more of the watershed develops, peak discharges could increase, as could the volume of runoff passing through the site to Lemmon Lake. The increase in both peak rate and volume could be very significant and cause tremendous flooding. Since the Lemmon Valley is a closed basin with no outlet for flood runoff other than evaporation, increased impervious areas *anywhere* in the valley can cause the amount of water entering the playa, and thus the level of the playa to increase.

It is not clear at this time how the hydrologic impact of future development within the watershed will be regulated, but in any event FEMA mapping must be based on existing conditions.

HYDRAULIC ANALYSES

Hydraulic analyses are concerned with the distribution of peak flowrates from Table 6 through the property toward Lemmon Lake. Figure 3 shows resulting flood plain designations based on the analyses of Appendix F. More detailed mapping is enclosed separately. Detailed analyses have been broken into two areas of concern: (1) Peek property between Lemmon Drive, Military Road and the boundary between Townships 20N and 21N (**Lemmon Valley Site**); and (2) property between the Township 20N/21N boundary and Lemmon Lake to the east of Military Road (**Military Road Site**).

Hydraulic Analyses have been made using the HEC-2 backwater program and hand calculations as appropriate. Effective Flood Insurance Rate Maps (September 30, 1994) show a 100-year flood zone determined by approximate methods (Zone A) on almost the entire Lemmon Valley Site, and another Zone A covering the middle quarter of the Military Road Site. The 100-year elevation of Lemmon Lake has been established by detailed methods as 4920.

Sedimentation. One characteristic of alluvial streams in arid regions is that they transport large amounts of loose, cohesionless material such as sand and gravel during storms. Sediment is eroded from the upper watershed where streams are relatively steep and flow velocity high, and deposited in milder areas along the valley floor, where backwater or ponding conditions prevail and velocities are lower. This may occur at culvert entrances, which can trap sediments. Local experience suggests that Military Road culverts become clogged while Lemmon Drive crossing culverts remain clear. In 1986, culverts along Military Road filled with sediment causing the roads to be overtopped with storm runoff and several road washouts that have since been repaired. However, the basic cause of the washouts (deposition within culverts and channels) will continue in the future since the sediment transport capacity of culverts and channels was not changed. Annual maintenance along Lemmon Drive is apparently sufficient to keep the channel free of debris and sediment. Also the area east of Lemmon Drive above the most upstream culvert appears to act as a natural sediment trap. Analyses reflect this local experience (i.e. the Military Road culverts are considered plugged, while Lemmon Drive culverts are considered to be clear.)

Lemmon Valley Site. Lemmon Drive traverses the eastern edge of Lemmon Valley, against the base of hills to the east. The creek draining Golden Valley and areas above Highway 395 crosses under Lemmon Drive in a ten-foot by four-foot reinforced box culvert which leads to a trapezoidal drainage channel between the north- and south-bound lanes of the road. As Lemmon Drive intersects cross streets, culverts carry the channelized water.

A drainage channel located between the north bound and south bound lanes can carry roughly 750 cfs. Triple 5' by 4' culverts however limit the net capacity of this drainage facility to about 450 cfs. Flow in excess of this capacity will overtop Lemmon Drive to the west enter the Lemmon Valley Site. This flow will follow a drainage swale across the site to the north where it leaves the site through a residential area at Surge Street. Buildings and fences effectively block the flow, so water surface elevations on the Lemmon Valley Site are controlled by the energy it takes to force the runoff (about 1,050 cfs) through the gap between the residences and a pair of hills that trend across the north end of the Lemmon Valley Site from the southwest to northeast. The resulting flood plain has been mapped as an AE Zone with base flood elevations shown at two foot intervals.

About 50 cfs from a culvert at Military Road and Tholl Drive crosses across the site just to the south of the hills at a very shallow depth (0.1 foot). Areas outside of the Zone AE within the Lemmon Valley Site are identified as Zone X, which indicates areas of shallow flooding less than one foot deep. Flooding within this area is that typical to alluvial fan areas, with unpredictable flow paths since new channels may be scoured during individual storms, since much of the sediment load is taken out at upstream culverts.

Military Road Site. Runoff from the hills flows into a ditch along the west side of Military Road. As with Lemmon Drive, there are several culverts parallel to Military Road at individual cross streets. An easterly ditch along the road also drains runoff, but there are only four places where a culvert crosses beneath Military Road from the western ditch into the site.

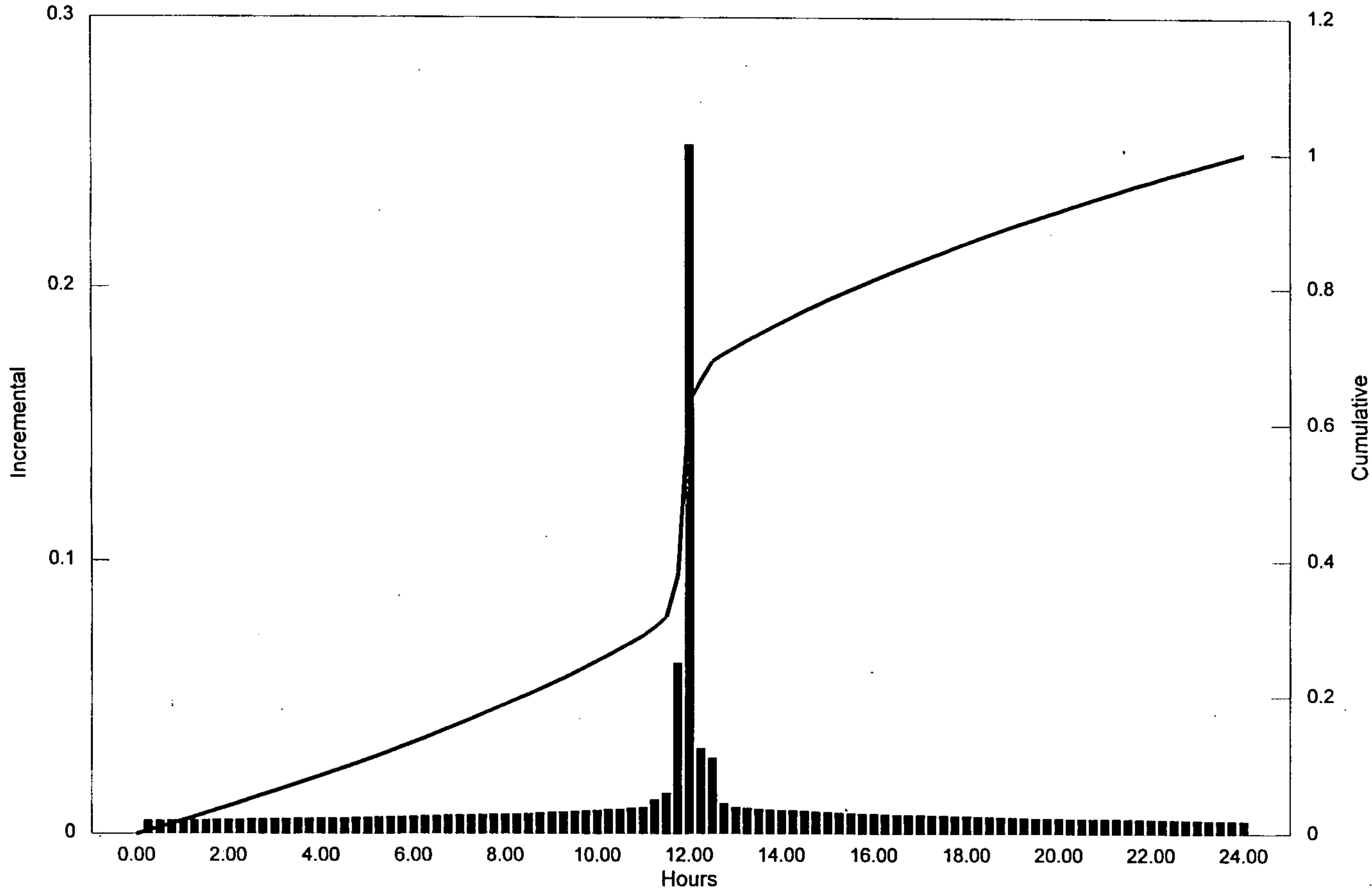
With culvert sedimentation, this runoff overflows the road to the northeast, as in 1986. Once storm water has crossed the road, it will flow toward Lemmon Lake, although the water may take unpredictable paths. Average depth has been estimated by assuming that road overflow would occur mainly at each culvert location. Hand calculations (Appendix G) show that average depths would range from 0.4 foot to 0.8 foot downstream of individual culverts. Based on discussion with FEMA Region IX, shallow flood depths in excess of 0.7 foot should be mapped as Zone AO with a depth equal to one foot.

As shown on Figure 2, just about all of the Military Road Site is mapped as an AO1 zone, although average depth is less than one foot. Actual road overtopping and flow paths will be fairly unpredictable and new channels may be randomly scoured. If the roadside channels and culverts do not fill will sediment, about 200 cfs can flow along Military Road to a low spot at a triple 4' by 10.5' box culvert. Road overflow to the south would be reduced and flow across the site from the triple box culvert would increase from 900 cfs to roughly 1,200 cfs. However average depths downstream of Military Road would still be about one foot, and the mapping would be no different.

APPENDIX A

Precipitation

100-year Precipitation Pattern
Reno, Nevada



APPENDIX A

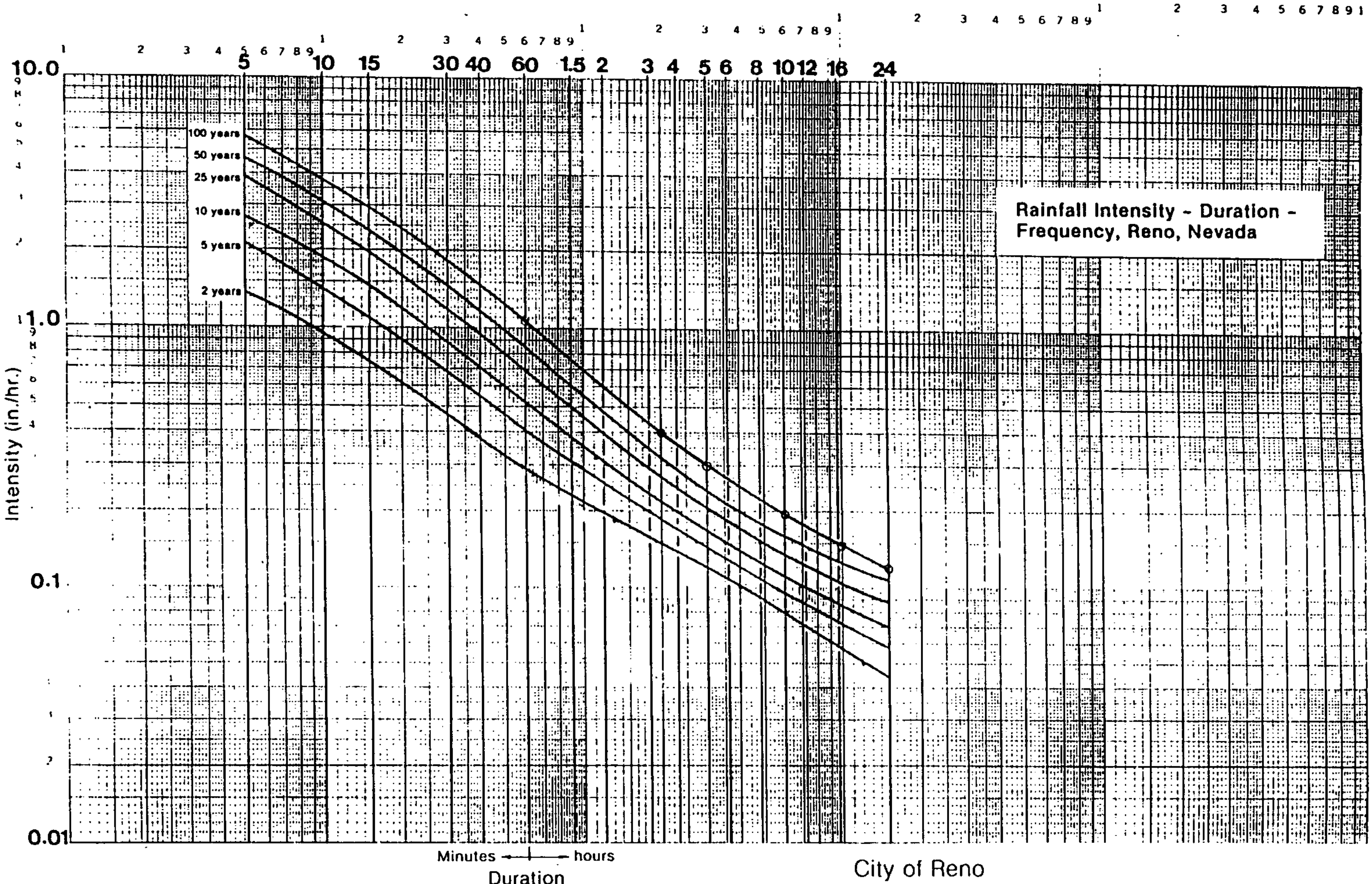
APPENDIX A

100-year Precipitation Pattern for Reno, Nevada

Time (hours)	Time (minutes)	IDF Depth (inches)	Depth Ratio	Incremental Precip	Rank	Type II Distribution	Type II Incremental	Rank	Balanced Incremental	Balanced Cumulative
0.25	15	0.73	0.25348	0.25348	1	0.0027	0.00265	95	0.00486	0.00486
0.50	30	0.91	0.31598	0.06250	2	0.0053	0.00265	93	0.00491	0.00977
0.75	45	1.00	0.34723	0.03125	3	0.0081	0.00275	91	0.00497	0.01474
1.00	60	1.08	0.37501	0.02778	4	0.0108	0.00275	89	0.00503	0.01977
1.25	75	1.12	0.38994	0.01493	5	0.0136	0.00280	87	0.00509	0.02486
1.50	90	1.16	0.40259	0.01264	6	0.0164	0.00280	85	0.00516	0.03001
1.75	105	1.19	0.41359	0.01101	7	0.0194	0.00295	83	0.00522	0.03524
2.00	120	1.22	0.42337	0.00978	8	0.0223	0.00295	81	0.00529	0.04053
2.25	135	1.24	0.43219	0.00882	15	0.0254	0.00305	78	0.00540	0.04593
2.50	150	1.27	0.44024	0.00804	23	0.0284	0.00305	77	0.00544	0.05137
2.75	165	1.29	0.44764	0.00741	30	0.0316	0.00315	76	0.00548	0.05685
3.00	180	1.31	0.45451	0.00687	40	0.0347	0.00315	75	0.00552	0.06237
3.25	195	1.33	0.46092	0.00641	51	0.0381	0.00335	70	0.00560	0.06796
3.50	210	1.35	0.46959	0.00866	18	0.0414	0.00335	69	0.00564	0.07361
3.75	225	1.38	0.47909	0.00951	10	0.0449	0.00345	67	0.00568	0.07929
4.00	240	1.41	0.48816	0.00907	13	0.0483	0.00345	65	0.00573	0.08502
4.25	255	1.43	0.49683	0.00867	17	0.0519	0.00360	64	0.00575	0.09077
4.50	270	1.45	0.50515	0.00832	20	0.0555	0.00360	63	0.00577	0.09654
4.75	285	1.48	0.51315	0.00800	24	0.0594	0.00385	58	0.00597	0.10251
5.00	300	1.50	0.52085	0.00770	27	0.0632	0.00385	57	0.00603	0.10855
5.25	315	1.53	0.53055	0.00970	9	0.0672	0.00400	55	0.00616	0.11471
5.50	330	1.56	0.53997	0.00942	11	0.0712	0.00400	53	0.00629	0.12100
5.75	345	1.58	0.54914	0.00916	12	0.0755	0.00425	51	0.00641	0.12741
6.00	360	1.61	0.55805	0.00892	14	0.0797	0.00425	49	0.00646	0.13387
6.25	375	1.63	0.56674	0.00869	16	0.0842	0.00450	48	0.00650	0.14037
6.50	390	1.66	0.57522	0.00848	19	0.0887	0.00450	47	0.00656	0.14693
6.75	405	1.68	0.58350	0.00828	21	0.0936	0.00485	42	0.00678	0.15371
7.00	420	1.70	0.59158	0.00809	22	0.0984	0.00485	41	0.00682	0.16054
7.25	435	1.73	0.59949	0.00791	25	0.1037	0.00525	39	0.00690	0.16744
7.50	450	1.75	0.60724	0.00774	26	0.1089	0.00525	37	0.00700	0.17443
7.75	465	1.77	0.61482	0.00758	28	0.1146	0.00570	34	0.00715	0.18159
8.00	480	1.79	0.62225	0.00743	29	0.1203	0.00570	33	0.00719	0.18877
8.25	495	1.81	0.62954	0.00729	31	0.1266	0.00625	31	0.00729	0.19606
8.50	510	1.83	0.63670	0.00715	34	0.1328	0.00625	29	0.00743	0.20350
8.75	525	1.85	0.64372	0.00702	36	0.1398	0.00695	26	0.00774	0.21124
9.00	540	1.87	0.65062	0.00690	39	0.1467	0.00695	25	0.00791	0.21915
9.25	555	1.89	0.65740	0.00678	42	0.1546	0.00790	23	0.00804	0.22719
9.50	570	1.91	0.66407	0.00667	44	0.1625	0.00790	21	0.00828	0.23547
9.75	585	1.93	0.67063	0.00656	47	0.1717	0.00915	19	0.00848	0.24395
10.00	600	1.95	0.67709	0.00646	49	0.1808	0.00915	17	0.00867	0.25262
10.25	615	1.97	0.68438	0.00729	32	0.1925	0.01170	14	0.00892	0.26154
10.50	630	1.99	0.69157	0.00719	33	0.2042	0.01170	13	0.00907	0.27060
10.75	645	2.01	0.69866	0.00709	35	0.2197	0.01545	10	0.00951	0.28011
11.00	660	2.03	0.70566	0.00700	37	0.2351	0.01545	9	0.00970	0.28981
11.25	675	2.05	0.71257	0.00691	38	0.2592	0.02410	6	0.01264	0.30245
11.50	690	2.07	0.71939	0.00682	41	0.2833	0.02410	5	0.01493	0.31739
11.75	705	2.09	0.72613	0.00674	43	0.4733	0.18995	2	0.06250	0.37989
12.00	720	2.11	0.73278	0.00666	45	0.6632	0.18995	1	0.25348	0.63336

100-year Precipitation Pattern for Reno, Nevada

Time (hours)	Time (minutes)	IDF Depth (inches)	Depth Ratio	Incremental Precip	Rank	Type II Distribution	Type II Incremental	Rank	Balanced Incremental	Balanced Cumulative
12.25	735	2.13	0.73936	0.00658	46	0.6992	0.03595	3	0.03125	0.66462
12.50	750	2.15	0.74587	0.00650	48	0.7351	0.03595	4	0.02778	0.69239
12.75	765	2.17	0.75230	0.00643	50	0.7538	0.01865	7	0.01101	0.70340
13.00	780	2.18	0.75865	0.00636	52	0.7724	0.01865	8	0.00978	0.71318
13.25	795	2.20	0.76494	0.00629	53	0.7857	0.01325	11	0.00942	0.72261
13.50	810	2.22	0.77117	0.00622	54	0.7989	0.01325	12	0.00916	0.73177
13.75	825	2.24	0.77733	0.00616	55	0.8093	0.01040	15	0.00882	0.74059
14.00	840	2.26	0.78342	0.00610	56	0.8197	0.01040	16	0.00869	0.74928
14.25	855	2.27	0.78946	0.00603	57	0.8289	0.00915	18	0.00866	0.75794
14.50	870	2.29	0.79543	0.00597	58	0.8380	0.00915	20	0.00832	0.76626
14.75	885	2.31	0.80135	0.00592	59	0.8459	0.00790	22	0.00809	0.77435
15.00	900	2.32	0.80721	0.00586	60	0.8538	0.00790	24	0.00800	0.78234
15.25	915	2.34	0.81301	0.00580	62	0.8607	0.00690	27	0.00770	0.79005
15.50	930	2.36	0.81876	0.00575	64	0.8676	0.00690	28	0.00758	0.79763
15.75	945	2.37	0.82446	0.00570	66	0.8739	0.00625	30	0.00741	0.80503
16.00	960	2.39	0.83011	0.00565	68	0.8801	0.00625	32	0.00729	0.81233
16.25	975	2.41	0.83570	0.00560	70	0.8858	0.00565	35	0.00709	0.81942
16.50	990	2.42	0.84125	0.00555	74	0.8914	0.00565	36	0.00702	0.82644
16.75	1005	2.44	0.84686	0.00560	71	0.8967	0.00525	38	0.00691	0.83335
17.00	1020	2.46	0.85268	0.00582	61	0.9019	0.00525	40	0.00687	0.84022
17.25	1035	2.47	0.85845	0.00577	63	0.9067	0.00480	43	0.00674	0.84696
17.50	1050	2.49	0.86418	0.00573	65	0.9115	0.00480	44	0.00667	0.85363
17.75	1065	2.51	0.86986	0.00568	67	0.9161	0.00455	45	0.00666	0.86028
18.00	1080	2.52	0.87550	0.00564	69	0.9206	0.00455	46	0.00658	0.86686
18.25	1095	2.54	0.88110	0.00560	72	0.9249	0.00425	50	0.00643	0.87329
18.50	1110	2.55	0.88666	0.00556	73	0.9291	0.00425	52	0.00636	0.87965
18.75	1125	2.57	0.89218	0.00552	75	0.9331	0.00400	54	0.00622	0.88587
19.00	1140	2.59	0.89765	0.00548	76	0.9371	0.00400	56	0.00610	0.89197
19.25	1155	2.60	0.90309	0.00544	77	0.9409	0.00375	59	0.00592	0.89789
19.50	1170	2.62	0.90850	0.00540	78	0.9446	0.00375	60	0.00586	0.90375
19.75	1185	2.63	0.91386	0.00536	79	0.9483	0.00365	61	0.00582	0.90956
20.00	1200	2.65	0.91919	0.00533	80	0.9519	0.00365	62	0.00580	0.91537
20.25	1215	2.66	0.92448	0.00529	81	0.9554	0.00345	66	0.00570	0.92107
20.50	1230	2.68	0.92974	0.00526	82	0.9588	0.00345	68	0.00565	0.92671
20.75	1245	2.69	0.93496	0.00522	83	0.9621	0.00325	71	0.00560	0.93232
21.00	1260	2.71	0.94015	0.00519	84	0.9653	0.00325	72	0.00560	0.93792
21.25	1275	2.72	0.94531	0.00516	85	0.9685	0.00320	73	0.00556	0.94348
21.50	1290	2.74	0.95043	0.00512	86	0.9717	0.00320	74	0.00555	0.94903
21.75	1305	2.75	0.95552	0.00509	87	0.9747	0.00300	79	0.00536	0.95439
22.00	1320	2.77	0.96058	0.00506	88	0.9777	0.00300	80	0.00533	0.95972
22.25	1335	2.78	0.96561	0.00503	89	0.9807	0.00295	82	0.00526	0.96498
22.50	1350	2.80	0.97061	0.00500	90	0.9836	0.00295	84	0.00519	0.97017
22.75	1365	2.81	0.97558	0.00497	91	0.9864	0.00280	86	0.00512	0.97529
23.00	1380	2.82	0.98052	0.00494	92	0.9892	0.00280	88	0.00506	0.98035
23.25	1395	2.84	0.98543	0.00491	93	0.9920	0.00275	90	0.00500	0.98535
23.50	1410	2.85	0.99032	0.00488	94	0.9947	0.00275	92	0.00494	0.99029
23.75	1425	2.87	0.99517	0.00486	95	0.9974	0.00265	94	0.00488	0.99517
24.00	1440	2.88	1.00000	0.00483	96	1.0000	0.00265	96	0.00483	1.00000



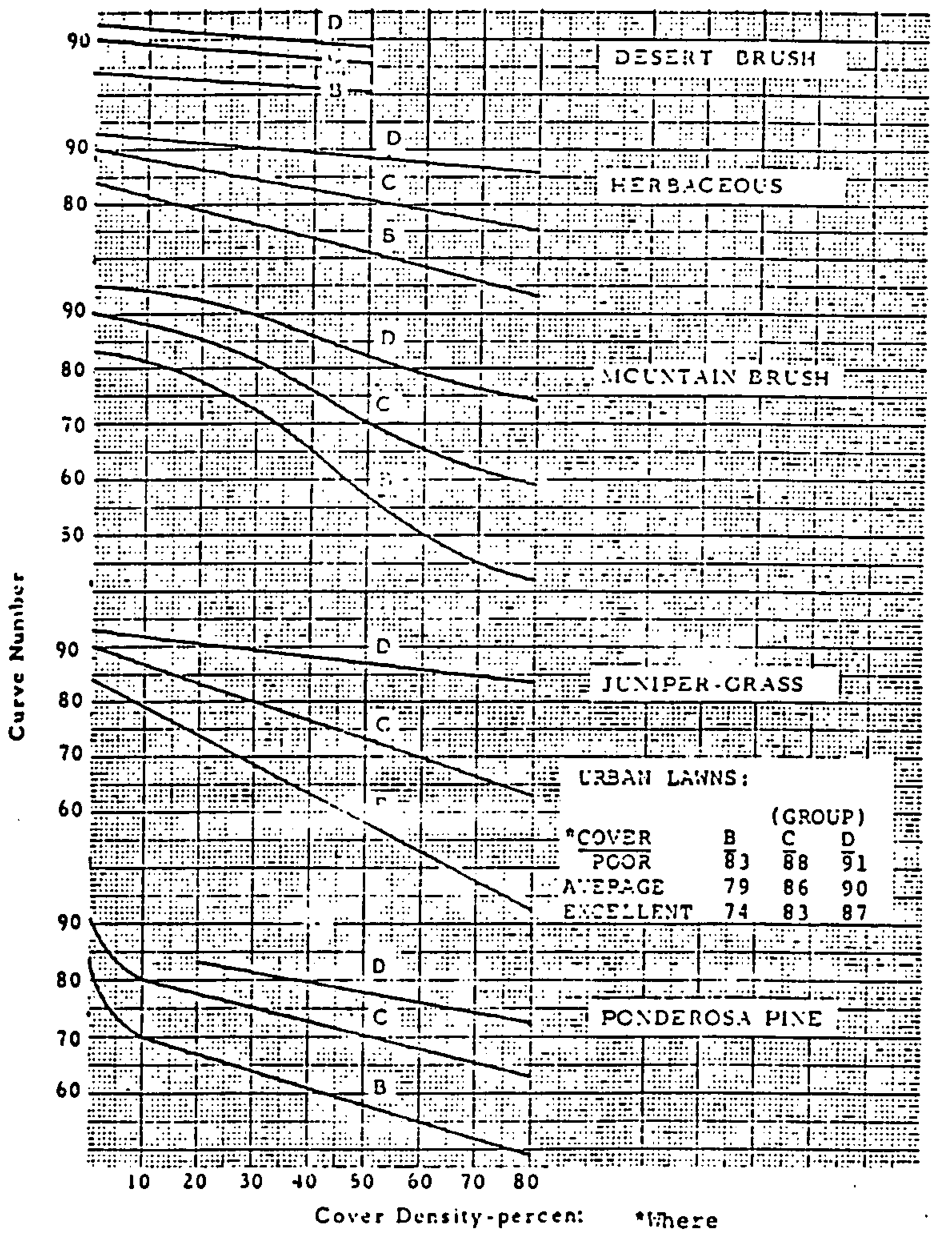
City of Reno
Rainfall Intensity - Duration - Frequency Curves for General Reno Area
Based on Rainfall Data from Cannon Airport Gauging Station

APPENDIX A

Figure 4

APPENDIX B

Curve Numbers



*Where
Poor = Less than 1/3.
Average = 1/3 to 2/3.
Excellent = more than 2/3.

HYDROLOGIC SOIL - COVER COMPLEXES
AND ASSOCIATED CURVE NUMBERS

Source: Soil Conservation Service
(Except Urban Lawns)

Figure 17 - Curve Numbers as a function of soil hydrologic group, cover and density of cover. (Arizona Department of Water Resources.)

Table I-A-5 Curve Numbers (CN) and Constants for the Case $I_a = 0.2$ S

1	2	3	4	5	1	2	3	4	5
CN for condition II	CN for conditions I	III	S Values*	Curve* starts where P =	CN for condition II	CN for conditions I	III	S Values*	Curve* starts where P =
			(inches)	(inches)				(inches)	(inches)
100	100	100	0	0	60	40	78	6.67	1.33
99	97	100	.101	.02	59	39	77	9.95	1.39
98	94	99	.204	.04	58	38	76	7.24	1.45
97	91	99	.309	.06	57	37	75	7.54	1.51
96	89	99	.417	.08	57	36	75	7.86	1.57
95	87	98	.526	.11	55	35	74	8.88	1.64
94	85	98	.638	.13	54	34	73	8.52	1.70
93	83	98	.753	.15	53	33	72	8.87	1.77
92	81	97	.870	.17	52	32	71	9.23	1.85
91	80	97	.989	.20	51	31	70	9.61	1.92
90	78	96	1.11	.22	50	31	70	10.0	2.00
89	76	96	1.24	.25	49	30	69	10.4	2.08
88	75	95	1.36	.27	48	29	68	10.8	2.16
87	73	95	1.49	.30	47	28	67	11.3	2.26
86	72	94	1.36	.33	46	27	66	11.7	2.34
85	70	94	1.76	.35	45	26	65	12.2	2.44
84	68	93	1.90	.38	44	25	64	12.7	2.54
83	67	93	2.05	.41	43	25	63	13.2	2.64
82	66	92	2.20	.44	42	24	62	13.8	2.76
81	64	92	2.34	.47	41	23	61	14.4	2.88
80	63	92	2.50	.50	40	22	60	15.0	3.00
79	62	91	2.66	.53	39	21	59	15.6	3.12
78	60	90	2.82	.56	38	21	58	16.3	3.26
77	59	89	2.99	.60	37	20	57	17.0	3.40
76	58	89	3.16	.63	36	19	56	17.8	3.56
75	57	88	3.33	.67	35	18	55	18.6	3.72
74	55	88	3.51	.70	34	18	54	19.4	3.88
73	54	87	3.70	.74	33	17	53	20.3	4.06
72	53	86	3.89	.78	32	16	52	21.2	4.24
71	52	86	4.09	.82	31	16	51	22.2	4.44
70	51	85	4.28	.86	30	15	50	23.3	4.66
69	50	84	4.49	.90					
68	48	84	4.70	.90	25	12	43	30.0	6.00
67	47	83	4.92	.98	20	9	37	40.0	8.00
66	46	82	5.15	1.03	15	6	30	56.7	11.34
65	45	82	5.38	1.08	10	4	22	90.0	18.00
64	44	81	5.62	1.12	5	2	13	190.0	38.00
63	43	80	5.87	1.17	0	0	0	infinity	infinity
62	42	79	6.13	1.23					
61	41	78	6.39	1.28					

*For CN in Column 1.

APPENDIX C

Flood Flow Frequency Calculations

Name: S WILLOW C NR GERLACH, NV
ID: 10353770
PO Code: NV
Gage Datum: 4500.0
Base Discharge: ---
Annuals: 30 (N)
Partials: 37 (N)
Years: 1963-1993

Mo/ Day	Water Year	-Annual Peak- Discharge	Code	---Stage--- at Peak	Code	Highest Since	-Superior Stage- Height	M/Day	Code	#Prtl Peaks
01/31	1963	1730.00	---	7.30	---	---	---	---	---	37
---	1964	0.50	---	---	---	---	---	---	---	37
06/23	1965	171.00	---	1.88	---	---	---	---	---	37
11/00	1966	9.00	---	0.73	---	---	---	---	---	37
---	1967	40.00	---	1.35	---	---	---	---	---	37
---	1968	0.00	---	---	---	---	---	---	---	37
01/23	1969	302.00	---	2.18	---	---	---	---	---	37
---	1970	22.00	---	0.98	---	---	---	---	---	37
12/02	1971	19.00	---	0.94	---	---	---	---	---	37
01/27	1972	4.00	---	0.61	---	---	---	---	---	37
---	1973	27.00	---	1.07	---	---	---	---	---	37
03/14	1974	4.00	---	0.66	---	---	---	---	---	37
---	1975	50.00	---	1.72	---	---	---	---	---	37
07/17	1976	8.20	---	1.18	---	---	---	---	---	37
06/08	1977	109.00	---	2.30	---	---	---	---	---	37
03/05	1978	113.00	---	2.46	---	---	---	---	---	37
02/18	1980	400.00	---	3.98	---	---	---	---	---	37
02/15	1981	0.59	---	0.55	---	---	---	---	---	37
02/16	1982	53.00	---	1.61	---	---	---	---	---	37
03/01	1983	476.00	---	4.31	---	---	---	---	---	37
12/14	1984	31.00	---	1.36	---	---	---	---	---	37
03/18	1985	38.00	---	1.49	---	---	---	---	---	37
02/17	1986	780.00	---	4.64	---	---	---	---	---	37
05/16	1987	13.00	---	1.07	---	---	---	---	---	37
02/13	1988	1.50	---	0.69	---	---	---	---	---	---
02/25	1989	21.00	---	1.26	---	---	---	---	---	---
07/18	1990	6.00	---	0.87	---	---	---	---	---	---
03/26	1991	4.00	---	0.79	---	---	---	---	---	---
03/06	1992	0.24	---	0.66	---	---	---	---	---	---
03/14	1993	62.00	---	1.88	---	---	---	---	---	---

1994 0.24 Feb/March

1995 120-150 May 5 → provisionally

Lat N41:01:00

Long W119:21:00

Drainage Area = 31 mi^2

Gage Datum = 4500

TWO STATION CORRELATION PROGRAM
FROM
WRC BULLETIN NO.17B

S WILLOW C NR GERLACH, NV (10353770) W/O 68 (ZERO FLOW YEAR)

YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)
63	1730.0	64	.5	65	171.0	66	9.0
67	40.0	69	302.0	70	22.0	71	19.0
72	4.0	73	27.0	74	4.0	75	50.0
76	8.2	77	109.0	78	113.0	80	400.0
81	.6	82	53.0	83	476.0	84	31.0
85	38.0	86	780.0	87	13.0	88	1.5
89	21.0	90	6.0	91	4.0	92	.2
93	62.0	94	.2	95	150.0		

N = 31 MEAN = 1.33789 S.D. = 1.01587
STATION SKEW = -.320 REGIONAL SKEW = .000
ADOPTED SKEW = -.197

BASED ON 31 YEARS OF RECORD
THE LOW AND HIGH OUTLIER CRITERIA ARE: .05 9032.14 CFS

BASIC DATA

YEAR	Q(CFS)	RANK	YEAR	Q(CFS)	MEDIAN PLOTTING POSITION
63	1730.0	1	63	1730.0	.0223
64	.5	2	86	780.0	.0541
65	171.0	3	83	476.0	.0860
66	9.0	4	80	400.0	.1178
67	40.0	5	69	302.0	.1497
69	302.0	6	65	171.0	.1815
70	22.0	7	95	150.0	.2134
71	19.0	8	78	113.0	.2452
72	4.0	9	77	109.0	.2771
73	27.0	10	93	62.0	.3089
74	4.0	11	82	53.0	.3408
75	50.0	12	75	50.0	.3726
76	8.2	13	67	40.0	.4045
77	109.0	14	85	38.0	.4363
78	113.0	15	84	31.0	.4682
80	400.0	16	73	27.0	.5000
81	.6	17	70	22.0	.5318
82	53.0	18	89	21.0	.5637
83	476.0	19	71	19.0	.5955
84	31.0	20	87	13.0	.6274
85	38.0	21	66	9.0	.6592
86	780.0	22	76	8.2	.6911
87	13.0	23	90	6.0	.7229
88	1.5	24	91	4.0	.7548
89	21.0	25	74	4.0	.7866

BASIC DATA (CONTD.)

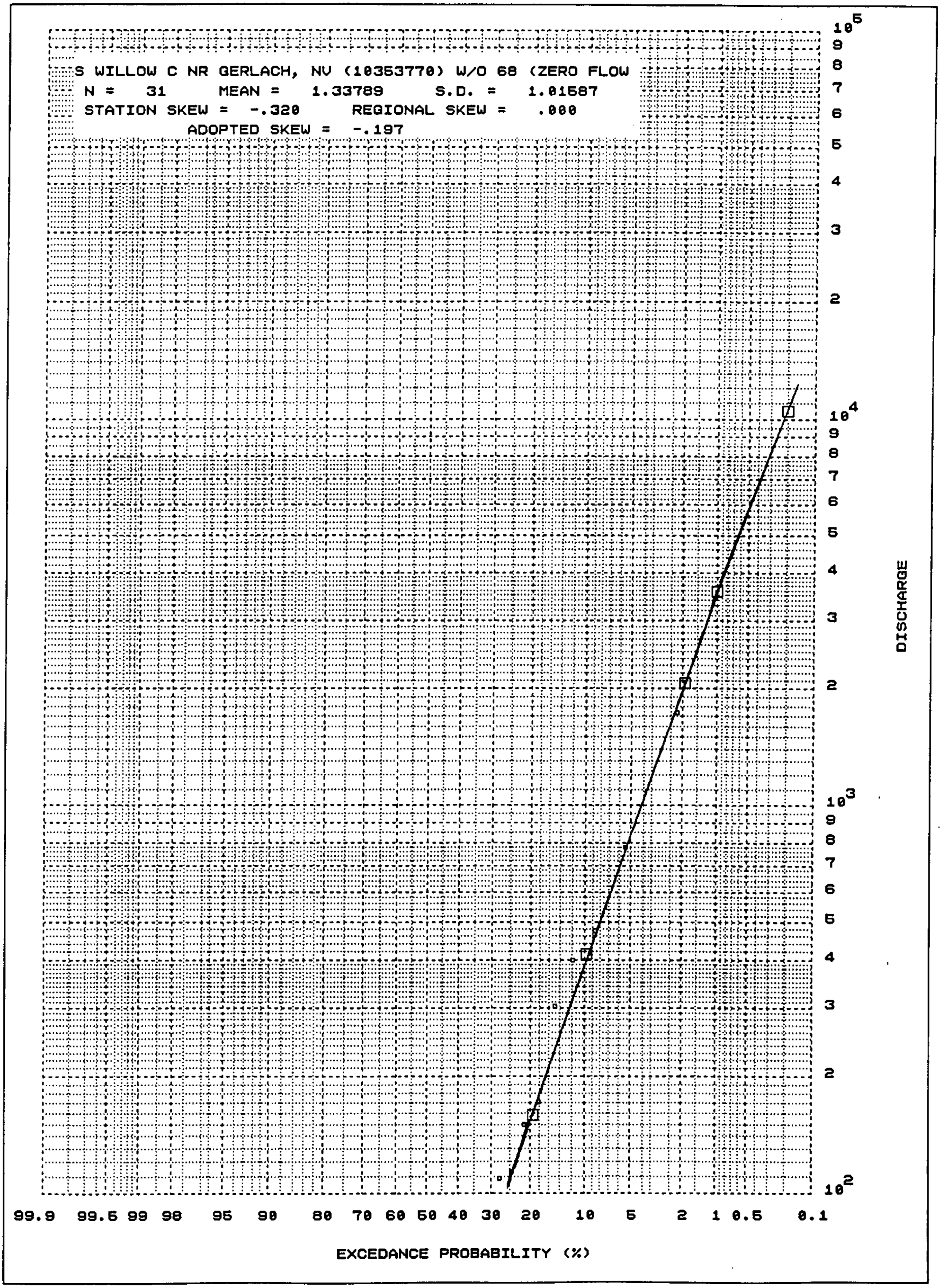
YEAR	Q(CFS)	RANK	YEAR	Q(CFS)	MEDIAN PLOTTING POSITION
90	6.0	26	72	4.0	.8185
91	4.0	27	88	1.5	.8503
92	.2	28	81	.6	.8822
93	62.0	29	64	.5	.9140
94	.2	30	94	.2	.9459
95	150.0	31	92	.2	.9777

S WILLOW C NR GERLACH, NV (10353770) W/O 68 (ZERO FLOW YEAR)

FREQUENCY CURVE PLOTTING POINTS

N = 31 MEAN = 1.33789 S.D. = 1.01587
STATION SKEW = -.320 REGIONAL SKEW = .000
ADOPTED SKEW = -.197

n/N = 31/32	EXCEEDANCE PROBABILITY	KGwP Gw=-.197	Q(CFS)
.949	.980	-2.15771	.1
.872	.900	-1.30076	1.0
.775	.800	-.83063	3.1
.484	.500	.03273	23.5
.194	.200	.84974	158.9
.097	.100	1.25862	413.5
.019	.020	1.94670	2067.7
.010	.010	2.18072	3574.5
.002	.002	2.64048	10478.0


S WILLOW C NR GERLACH, NV (10353770) W/O 68 (ZERO FLOW
N = 31 MEAN = 1.33789 S.D. = 1.01587
STATION SKEW = -.320 REGIONAL SKEW = .000
ADOPTED SKEW = -.197
10^5
9
8
7
6
5
4
3
2
10^4
9
8
7
6
5
4
3
2
10^3
9
8
7
6
5
4
3
2
10^2
DISCHARGE
99.9 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.1
EXCEDANCE PROBABILITY (%)

TWO STATION CORRELATION PROGRAM
FROM
WRC BULLETIN NO.17B

S WILLOW C NR GERLACH, NV 24 HR AVG (STA 10353770)

YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)
74	1.3	75	12.0	76	.1	77	4.7
78	63.0	79	2.0	80	125.0	81	45.0
82	14.0	83	152.0	84	20.0	85	22.0
86	279.0	87	11.0	88	1.2	89	9.4
90	1.6	91	2.0	92	.2	93	47.0

N = 20 MEAN = .93524 S.D. = .93467
STATION SKEW = -.374 REGIONAL SKEW = .000
ADOPTED SKEW = -.194

BASED ON 20 YEARS OF RECORD
THE LOW AND HIGH OUTLIER CRITERIA ARE: .05 1460.27 CFS

BASIC DATA

YEAR	Q(CFS)	RANK	YEAR	Q(CFS)	MEDIAN PLOTTING POSITION
74	1.3	1	86	279.0	.0343
75	12.0	2	83	152.0	.0833
76	.1	3	80	125.0	.1324
77	4.7	4	78	63.0	.1814
78	63.0	5	93	47.0	.2304
79	2.0	6	81	45.0	.2794
80	125.0	7	85	22.0	.3284
81	45.0	8	84	20.0	.3775
82	14.0	9	82	14.0	.4265
83	152.0	10	75	12.0	.4755
84	20.0	11	87	11.0	.5245
85	22.0	12	89	9.4	.5735
86	279.0	13	77	4.7	.6225
87	11.0	14	91	2.0	.6716
88	1.2	15	79	2.0	.7206
89	9.4	16	90	1.6	.7696
90	1.6	17	74	1.3	.8186
91	2.0	18	88	1.2	.8676
92	.2	19	92	.2	.9167
93	47.0	20	76	.1	.9657

APPENDIX C

S WILLOW C NR GERLACH, NV 24 HR AVG (STA 10353770)

FREQUENCY CURVE PLOTTING POINTS

N = 20 MEAN = .93524 S.D. = .93467
STATION SKEW = -.374 REGIONAL SKEW = .000
ADOPTED SKEW = -.194

EXCEEDANCE PROBABILITY	KGwP Gw=-.194	Q(CFS)
.980	-2.15625	.1
.900	-1.30050	.5
.800	-.83079	1.4
.500	.03227	9.2
.200	.84964	53.6
.100	1.25896	129.4
.020	1.94823	570.4
.010	2.18279	945.0
.002	2.64384	2549.0

APPENDIX C

Name: GALENA C NR STEAMBOAT, NV
ID: 10348900
PO Code: NV

Gage Datum: 5592.0
Base Discharge: 30.00

Annuals: 33 (N)
Partials: 109 (N)
Years:1956-1993

Mo/ Day	Water Year	-Annual Peak- Discharge	Code	---Stage--- at Peak	Code	Highest Since	-Superior Stage- Height	M/Day	Code	#Prtl Peaks
07/20	1956	4730.00	5 *	---	---	---	---	---	---	109
06/10	1962	80.00	4	1.64	---	---	---	---	---	109
01/31	1963	472.00	4	2.26	---	---	---	---	---	109
05/19	1964	38.00	4	1.67	---	---	---	---	---	109
08/15	1965	3670.00	4	---	---	---	---	---	---	109
08/02	1966	292.00	4	3.67	---	---	---	---	---	109
06/21	1967	400.00	4	---	---	---	---	---	---	109
10/02	1968	47.00	4	2.88	32	---	3.07	12/15	64	109
06/16	1969	80.00	4	2.98	32	---	3.28	01/26	64	109
06/14	1970	81.00	4	3.04	32	---	3.18	01/06	64	109
06/26	1971	114.00	4	3.18	---	---	---	---	---	109
06/07	1972	99.00	4	3.14	---	---	---	---	---	109
05/14	1973	84.00	4	3.17	---	---	---	---	---	109
05/14	1974	87.00	4	3.06	---	---	---	---	---	109
06/15	1975	100.00	4	---	---	---	---	---	---	109
09/11	1976	32.00	4	2.77	---	---	---	---	---	109
06/09	1977	34.00	4	2.77	---	---	---	---	---	109
06/04	1978	56.00	4	2.87	---	---	---	---	---	109
05/21	1979	43.00	4	2.75	32	---	3.15	01/11	64	109
01/13	1980	80.00	4	3.02	---	---	---	---	---	109
04/23	1981	29.00	4	2.65	---	---	---	---	---	109
06/19	1982	247.00	4	3.95	---	---	---	---	---	109
05/29	1983	143.00	4	3.62	---	---	---	---	---	109
05/31	1984	72.00	4	3.26	---	---	---	---	---	109
10/12	1985	36.00	4	3.09	---	---	---	---	---	109
02/18	1986	94.00	4	3.43	---	---	---	---	---	109
05/16	1987	33.00	---	3.07	---	---	3.39	01/20	64	109
05/12	1988	12.00	---	3.09	---	---	3.33	12/15	64	---
05/08	1989	37.00	---	3.44	---	---	---	---	---	---
07/12	1990	21.00	---	3.15	---	---	3.41	02/17	64	---
06/09	1991	35.00	---	3.30	---	---	3.58	12/31	64	---
04/29	1992	13.00	4	3.04	---	---	3.13	01/19	64	---
06/14	1993	78.00	4	3.60	---	---	---	---	---	---
6/06	1994	37.00								
6/04	1995	351.00								

Lat N39:21:43

Lon W119:49:37

8.5 mi^2 D.A.

* HISTORIC PEAK

TWO STATION CORRELATION PROGRAM
FROM
WRC BULLETIN NO.17B

GALENA C NR STEAMBOAT, NV (10348900) 56 IS HISTORIC

YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)
62	80.0	63	472.0	64	38.0	65	3670.0
66	292.0	67	400.0	68	47.0	69	80.0
70	81.0	71	114.0	72	99.0	73	84.0
74	87.0	75	100.0	76	32.0	77	34.0
78	56.0	79	43.0	80	80.0	81	29.0
82	247.0	83	143.0	84	72.0	85	36.0
86	94.0	87	33.0	88	12.0	89	37.0
90	21.0	91	35.0	92	13.0	93	78.0
94	37.0	95	351.0				

N = 34 MEAN = 1.88410 S.D. = .48988
STATION SKEW = 1.283 REGIONAL SKEW = .000
ADOPTED SKEW = .595

BASED ON 34 YEARS OF RECORD
THE LOW AND HIGH OUTLIER CRITERIA ARE: 4.00 1464.27 CFS

BASIC DATA

YEAR	Q(CFS)	RANK	YEAR	Q(CFS)	MEDIAN PLOTTING POSITION
62	80.0	1	65	3670.0	.0203
63	472.0	2	63	472.0	.0494
64	38.0	3	67	400.0	.0785
65	3670.0	4	95	351.0	.1076
66	292.0	5	66	292.0	.1366
67	400.0	6	82	247.0	.1657
68	47.0	7	83	143.0	.1948
69	80.0	8	71	114.0	.2238
70	81.0	9	75	100.0	.2529
71	114.0	10	72	99.0	.2820
72	99.0	11	86	94.0	.3110
73	84.0	12	74	87.0	.3401
74	87.0	13	73	84.0	.3692
75	100.0	14	70	81.0	.3983
76	32.0	15	62	80.0	.4273
77	34.0	16	69	80.0	.4564
78	56.0	17	80	80.0	.4855
79	43.0	18	93	78.0	.5145
80	80.0	19	84	72.0	.5436
81	29.0	20	78	56.0	.5727
82	247.0	21	68	47.0	.6017
83	143.0	22	79	43.0	.6308
84	72.0	23	64	38.0	.6599

BASIC DATA (CONTD.)

YEAR	Q(CFS)	RANK	YEAR	Q(CFS)	MEDIAN PLOTTING POSITION
85	36.0	24	94	37.0	.6890
86	94.0	25	89	37.0	.7180
87	33.0	26	85	36.0	.7471
88	12.0	27	91	35.0	.7762
89	37.0	28	77	34.0	.8052
90	21.0	29	87	33.0	.8343
91	35.0	30	76	32.0	.8634
92	13.0	31	81	29.0	.8924
93	78.0	32	90	21.0	.9215
94	37.0	33	92	13.0	.9506
95	351.0	34	88	12.0	.9797

GALENA C NR STEAMBOAT, NV (10348900)

FREQUENCY CURVE PLOTTING POINTS

N = 34 MEAN = 1.88410 S.D. = .48988
STATION SKEW = 1.283 REGIONAL SKEW = .000
ADOPTED SKEW = .595

EXCEEDANCE PROBABILITY	KGwP Gw= .595	Q(CFS)
.980	-1.72299	11.0
.900	-1.20102	19.8
.800	-.85715	29.1
.500	-.09868	68.5
.200	.79991	188.8
.100	1.32825	342.6
.020	2.35704	1093.4
.010	2.75190	1706.8
.002	3.60305	4458.2

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
173-C N. Morrison Ave.
SAN JOSE, CA 95126
(408) 297-4848
FAX (408) 297-4855

JOB PYRA-05-95
SHEET NO. 1 OF 4
CALCULATED BY CDA DATE 10-04-95
CHECKED BY ______ DATE ______
SCALE ______

Galena Creek Near Steamboat (10348900)

Weigh Historic Data (1956) following:
WRC, Bulletin 17B Appendix 6

Length of Systematic Record, $N = 34$
Mean of Logarithms, $M = 1.88410$
Standard Deviation, $S = 0.48988$
$S^2 = 0.23988$
$S^3 = 0.11756$
Coefficient of Skew, $G = 1.283$

HISTORIC ADJUSTMENT

No. of Historic Peaks, $Z = 1$ (1956)
No. of Years in Historic Record, $H = 40$ (1956-1995)
No. of Low Values (e.g. 0), $L = 0$
Systematic Record Weight,

$$W = \frac{H - Z}{N + L} = \frac{40 - 1}{34} = 1.147059$$

Historically Adjusted Mean,

$$\tilde{M} = \frac{WNM + \Sigma X_z}{H - WL}$$

where $X_z = \log(Y_{1956}) = \log(4{,}730) = 3.67486$

$$\therefore \tilde{M} = \frac{(1.147059)(34)(1.88410) + 3.67486}{40}$$

$$= 1.92887$$

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FAX (408) 297-4855

JOB PYRA-05-95

CALCULATED BY CDA DATE 10-04-95

CHECKED BY DATE

SCALE

	Y_z (cfs)	$\text{Log } Y_z = X_z$	$X_z - \tilde{M}$	$(X_z - \tilde{M})^2$	$(X_z - \tilde{M})^3$
1956	4,730	3.67486	1.74599	3.04849	5.32263

$M - \tilde{M} = 1.88410 - 1.92887 = -0.04477$

$(M - \tilde{M})^2 = 0.002004$

$(M - \tilde{M})^3 = -0.0000897$

Historically Adjusted Standard Deviation,

$$\tilde{S}^2 = \frac{W(N-1)S^2 + WN(M-\tilde{M})^2 + \Sigma(X_z - \tilde{M})^2}{(H - WL - 1)}$$

$$= \frac{(1.147059)(34-1)(0.23998) + (1.147059)(34)(.002004) + 3.04849}{40 - 1}$$

$$= 0.31309$$

$\tilde{S} = 0.55955 \qquad \tilde{S}^3 = 0.17519$

Historically Adjusted Skew,

$$\tilde{G} = \frac{H - WL}{(H-WL-1)(H-WL-2)\tilde{S}^3}\left[\frac{W(N-1)(N-2)S^3G}{N} + 3W(N-1)(M-\tilde{M})S^2 + WN(M-\tilde{M})^3 + \Sigma(X_z - \tilde{M})^3\right]$$

$$= \frac{40}{(40-1)(40-2)(.17519)}\left[(1.147059)(34-1)(34-2)(0.11756)(1.283)/34 + 3(1.147059)(34-1)(-0.04477)(0.23988) + (1.147059)(34)(-0.0000897) + 5.32263\right]$$

$$= 1.45946$$

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Weight Adjusted Skew w/ Regional Skew per Bull. 17B

$$\tilde{G}_W = \frac{MSE_{\bar{G}}(\tilde{G}) + MSE_{\tilde{G}}(\bar{G})}{MSE_{\bar{G}} + MSE_{\tilde{G}}}$$

where $MSE_{\tilde{G}}$ = mean square error of adjusted skew

$$\approx 10^{[A - B \log(N/10)]}$$

for $|\tilde{G}| = 1.45946 > 0.90$

$$A = -0.52 + 0.30|\tilde{G}| = -0.08216$$

for $|\tilde{G}| = 1.46 < 1.50$

$$B = 0.94 - 0.26|\tilde{G}| = 0.56$$

$$MSE_{\tilde{G}} = 10^{[-0.08216 - (0.56)\log(34/10)]} = 0.41707$$

Use Bull. 17B Plate 1 for generalized skew, $\bar{G} = 0.$

$\therefore MSE_{\bar{G}} = 0.302$ per Bull. 17B

$$\tilde{G}_W = \frac{(0.302)(1.45946) + (0.41707)(0.)}{.302 + .41707} = 0.61295$$

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CALCULATED BY CDA DATE 10-04-95
CHECKED BY DATE
SCALE

Log Pearson III Distribution

$$\log Q = \tilde{M} + K\tilde{S}$$

where $K = f(\tilde{G}_w)$ from Bull 17B

($\tilde{G}_w = .613$) ($\tilde{S} = .55955$) ($\tilde{M} = 1.92794$)

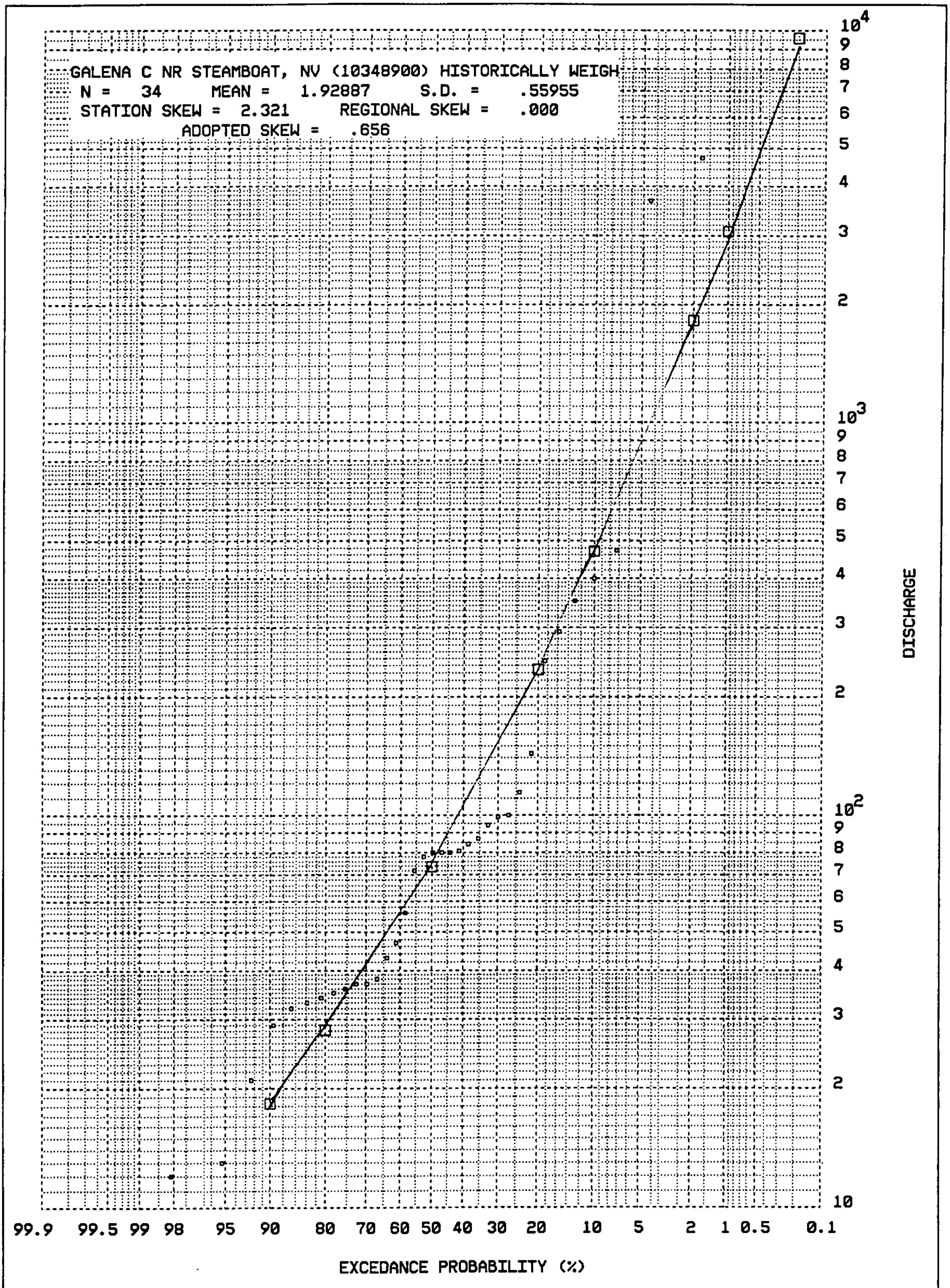
Percentile	K	$K\tilde{S}$	$\log Q = \tilde{M} + K\tilde{S}$	Q(cfs)
98	-1.71291	-0.95846	0.96948	9
90	-1.19809	-0.67039	1.25755	18
80	-0.85716	-0.47962	1.44832	28
50	-0.10157	-0.05684	1.87110	74
20	0.79827	0.44667	2.37461	237
10	1.32908	0.74369	2.67163	469
2	2.36547	1.32360	3.25154	1,785
1	2.76404	1.54662	3.47456	2,982 ←
0.2	3.62443	2.02805	3.95599	9,036

APPENDIX C

Station 10348900 Galena Creek Near Steamboat, NV (8.5 sq. mi.)
Historically Weighted LP III Analysis
Record: 1956, 1962 - 1995 (34 years)
Historical Period: 1956 - 1995 (40 years)

n = 34 Z = 1 H = 40
W = 1.147059 M = 1.927944

Year	Discharge	Log Q = X	x = (X - M)	Event	Weighted Order	Median Plotting Position
1956	4730	3.67486	1.74692	1	1.00	0.0173
1965	3670	3.56467	1.63672	2	2.07	0.0439
1963	472	2.67394	0.74600	3	3.22	0.0723
1967	400	2.60206	0.67412	4	4.37	0.1007
1995	326	2.51322	0.58527	5	5.51	0.1291
1966	292	2.46538	0.53744	6	6.66	0.1575
1982	247	2.39270	0.46475	7	7.81	0.1859
1983	143	2.15534	0.22739	8	8.96	0.2143
1971	114	2.05690	0.12896	9	10.10	0.2426
1975	100	2.00000	0.07206	10	11.25	0.2710
1972	99	1.99564	0.06769	11	12.40	0.2994
1986	94	1.97313	0.04518	12	13.54	0.3278
1974	87	1.93952	0.01158	13	14.69	0.3562
1973	84	1.92428	-0.00366	14	15.84	0.3846
1970	81	1.90849	-0.01946	15	16.99	0.4130
1962	80	1.90309	-0.02485	16	18.13	0.4414
1969	80	1.90309	-0.02485	17	19.28	0.4698
1980	80	1.90309	-0.02485	18	20.43	0.4982
1993	78	1.89209	-0.03585	19	21.57	0.5266
1984	72	1.85733	-0.07061	20	22.72	0.5550
1978	56	1.74819	-0.17976	21	23.87	0.5834
1968	47	1.67210	-0.25585	22	25.01	0.6118
1979	43	1.63347	-0.29448	23	26.16	0.6401
1964	38	1.57978	-0.34816	24	27.31	0.6685
1994	37	1.56820	-0.35974	25	28.46	0.6969
1989	37	1.56820	-0.35974	26	29.60	0.7253
1985	36	1.55630	-0.37164	27	30.75	0.7537
1991	35	1.54407	-0.38388	28	31.90	0.7821
1977	34	1.53148	-0.39647	29	33.04	0.8105
1987	33	1.51851	-0.40943	30	34.19	0.8389
1976	32	1.50515	-0.42279	31	35.34	0.8673
1981	29	1.46240	-0.46555	32	36.49	0.8957
1990	21	1.32222	-0.60572	33	37.63	0.9241
1992	13	1.11394	-0.81400	34	38.78	0.9525
1988	12	1.07918	-0.84876	35	39.93	0.9809
		64.02715				


GALENA C NR STEAMBOAT, NV (10348900) HISTORICALLY WEIGH
N = 34 MEAN = 1.92887 S.D. = .55955
STATION SKEW = 2.321 REGIONAL SKEW = .000
ADOPTED SKEW = .656
DISCHARGE
EXCEDANCE PROBABILITY (%)
99.9 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.1
10
10^2
10^3
10^4

APPENDIX C

TWO STATION CORRELATION PROGRAM
FROM
WRC BULLETIN NO.17B

GALENA C NR STEAMBOAT, NV (10348900) 24 HR AVG

YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)	YEAR	Q(X)
62	49.0	63	130.0	64	26.0	65	250.0
66	24.0	67	230.0	68	26.0	69	69.0
70	61.0	71	49.0	72	59.0	73	53.0
74	53.0	75	80.0	76	19.0	77	21.0
78	38.0	79	32.0	80	49.0	81	25.0
82	155.0	83	91.0	84	63.0	85	20.0
86	125.0	87	19.0	88	10.0	89	28.0
90	10.0	91	25.0	92	11.0	93	53.0
94	16.0	95	163.0				

N = 34 MEAN = 1.63639 S.D. = .37542
STATION SKEW = .257 REGIONAL SKEW = .000
ADOPTED SKEW = .165

BASED ON 34 YEARS OF RECORD
THE LOW AND HIGH OUTLIER CRITERIA ARE: 4.51 415.42 CFS

BASIC DATA

YEAR	Q(CFS)	RANK	YEAR	Q(CFS)	MEDIAN PLOTTING POSITION
62	49.0	1	65	250.0	.0203
63	130.0	2	67	230.0	.0494
64	26.0	3	95	163.0	.0785
65	250.0	4	82	155.0	.1076
66	24.0	5	63	130.0	.1366
67	230.0	6	86	125.0	.1657
68	26.0	7	83	91.0	.1948
69	69.0	8	75	80.0	.2238
70	61.0	9	69	69.0	.2529
71	49.0	10	84	63.0	.2820
72	59.0	11	70	61.0	.3110
73	53.0	12	72	59.0	.3401
74	53.0	13	93	53.0	.3692
75	80.0	14	74	53.0	.3983
76	19.0	15	73	53.0	.4273
77	21.0	16	71	49.0	.4564
78	38.0	17	80	49.0	.4855
79	32.0	18	62	49.0	.5145
80	49.0	19	78	38.0	.5436
81	25.0	20	79	32.0	.5727
82	155.0	21	89	28.0	.6017
83	91.0	22	68	26.0	.6308
84	63.0	23	64	26.0	.6599
85	20.0	24	91	25.0	.6890

BASIC DATA (CONT.)

YEAR	Q(CFS)	RANK	YEAR	Q(CFS)	MEDIAN PLOTTING POSITION
86	125.0	25	81	25.0	.7180
87	19.0	26	66	24.0	.7471
88	10.0	27	77	21.0	.7762
89	28.0	28	85	20.0	.8052
90	10.0	29	76	19.0	.8343
91	25.0	30	87	19.0	.8634
92	11.0	31	94	16.0	.8924
93	53.0	32	92	11.0	.9215
94	16.0	33	88	10.0	.9506
95	163.0	34	90	10.0	.9797

GALENA C NR STEAMBOAT, NV (10348900) 24 HR AVG

FREQUENCY CURVE PLOTTING POINTS

N = 34 MEAN = 1.63639 S.D. = .37542
STATION SKEW = .257 REGIONAL SKEW = .000
ADOPTED SKEW = .165

EXCEEDANCE PROBABILITY	KGwP Gw= .165	Q(CFS)
.980	-1.96420	7.9
.900	-1.26250	14.5
.800	-.84854	20.8
.500	-.02743	42.3
.200	.83253	88.9
.100	1.29780	132.9
.020	2.14097	275.5
.010	2.44677	358.9
.002	3.07891	619.8

APPENDIX D

Calibration

Schaaf & Wheeler
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FAX (408) 297-4855

JOB PYRA-05-95
SHEET NO. 1 OF
CALCULATED BY CDA DATE Rev. 2-29-96
CHECKED BY DATE
SCALE

CALIBRATION

S. Willow C Nr. Gerlach

$\hat{Q}_{100}$ = 3575 cfs

(BF = 4 cfs/mi²)

AMC	CN	Lag	Peak	24-hr Avg
II	75	2.35 hr	1872 cfs	
III	88	1.53	6128	
→ II ½	81.5	1.93	3511	932
II ¾	84.8	1.72	4696	

(Actual CN = 81.7, Q = 3582 cfs ; 942 cfs 24-hr Avg.)

Galena C Nr. Steamboat

$\hat{Q}_{100}$ = 2982 cfs

(BF = Φ)

AMC	CN	Lag	Peak	24-hr Avg
II	65	2.15 h	2455 cfs	
III	82	1.32	5940	
II ½	73.5	1.71	3922	
→ II ¼	69.2	1.92	3113	715 cfs > 360 ok

```
*******************************************
*                                         *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
*             SEPTEMBER 1990              *
*               VERSION 4.0               *
*                                         *
*  RUN DATE  03/04/1996  TIME  12:17:14   *
*                                         *
*******************************************
```

```
*******************************************
*                                         *
*     U.S. ARMY CORPS OF ENGINEERS        *
*     HYDROLOGIC ENGINEERING CENTER       *
*           609 SECOND STREET             *
*        DAVIS, CALIFORNIA 95616          *
*            (916) 756-1104               *
*                                         *
*******************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

ID   PEEK HYDROLOGY (PELS
ID   AMC CALIBRATION
IT      15 01OCT95    2400     300
IO       3
* **********

KK  WILLOW
KM   Basin runoff calculation for   S WILLOW C NR GERLACH
BA    31.0
BF     -4.     0.1     1.0
PB    2.50
PC  .00486  .00977  .01474  .01977  .02486  .03001  .03524  .04053  .04593  .05137
PC  .05685  .06237  .06796  .07361  .07929  .08502  .09077  .09654  .10251  .10855
PC  .11471  .12100  .12741  .13387  .14307  .14693  .15371  .16054  .16744  .17443
PC  .18159  .18877  .19606  .20350  .21124  .21915  .22719  .23547  .24395  .25262
PC  .26154  .27060  .28011  .28981  .30245  .31739  .37989  .63336  .66462  .69239
PC  .70340  .71318  .72261  .73177  .74059  .74928  .75794  .76626  .77435  .78234
PC  .79005  .79763  .80503  .81233  .81942  .82644  .83335  .84022  .84696  .85363
PC  .86028  .86686  .87329  .87965  .88587  .89197  .89789  .90375  .90956  .91537
PC  .92107  .92671  .93232  .93792  .94348  .94903  .95439  .95972  .96498  .97017
PC  .97529  .98035  .98535  .99029  .99517 1.00000
LS            81.7
UD    1.91
* **********

KK  GALENA
KM   Basin runoff calculation for  GALENA C NR STEAMBOAT
BA     8.5
BF      0.      0.      1.
PB     6.5
LS            69.2
UD    1.92
* **********

ZZ
```

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*****************************************                         ***************************************
*                                       *                         *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                         *   U.S. ARMY CORPS OF ENGINEERS
*             SEPTEMBER 1990            *                         *   HYDROLOGIC ENGINEERING CENTER
*              VERSION 4.0              *                         *         609 SECOND STREET
*                                       *                         *      DAVIS, CALIFORNIA 95616
*  RUN DATE  03/04/1996  TIME  12:17:14 *                         *          (916) 756-1104
*                                       *                         *
*****************************************                         ***************************************



                         PEEK HYDROLOGY (PELS
                         AMC CALIBRATION

   4 IO          OUTPUT CONTROL VARIABLES
                       IPRNT           3  PRINT CONTROL
                       IPLOT           0  PLOT CONTROL
                       QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          15  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1OCT95  STARTING DATE
                       ITIME        0000  STARTING TIME
                          NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      5OCT95  ENDING DATE
                      NDTIME        0245  ENDING TIME
                       ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL     .25 HOURS
                     TOTAL TIME BASE   74.75 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
   5 KK       *   WILLOW   *
              *            *
              **************
                         Basin runoff calculation for   S WILLOW C NR GERLACH

                SUBBASIN RUNOFF DATA

   7 BA          SUBBASIN CHARACTERISTICS
                      TAREA       31.00  SUBBASIN AREA
```

```
8 BF        BASE FLOW CHARACTERISTICS
                  STRTQ      124.00  INITIAL FLOW
                  QRCSN         .10  BEGIN BASE FLOW RECESSION
                  RTIOR     1.00000  RECESSION CONSTANT

            PRECIPITATION DATA

9 PB              STORM        2.50  BASIN TOTAL PRECIPITATION

10 PI         INCREMENTAL PRECIPITATION PATTERN
                  .00      .00      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .00      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .06      .25      .03      .03      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                  .01      .00      .00      .00      .00

20 LS       SCS LOSS RATE
                  STRTL         .45  INITIAL ABSTRACTION
                 CRVNBR       81.70  CURVE NUMBER
                  RTIMP         .00  PERCENT IMPERVIOUS AREA

21 UD       SCS DIMENSIONLESS UNITGRAPH
                   TLAG        1.91  LAG

                                                  ***

                                          UNIT HYDROGRAPH
                                     40 END-OF-PERIOD ORDINATES
           339.     1039.    2004.    3359.    5027.    6337.    7111.    7349.    7263.    6700.
          6029.     5196.    4149.    3284.    2682.    2188.    1824.    1499.    1228.     998.
           817.      674.     546.     447.     366.     298.     247.     202.     166.     136.
           109.       91.      76.      65.      54.      44.      33.      24.      15.       6.

    ***          ***          ***          ***          ***

                    HYDROGRAPH AT STATION   WILLOW

  TOTAL RAINFALL =    2.50, TOTAL LOSS =    1.52, TOTAL EXCESS =     .98

 PEAK FLOW    TIME                         MAXIMUM AVERAGE FLOW
  (CFS)       (HR)                 6-HR        24-HR       72-HR     74.75-HR
  3582.      13.75       (CFS)     2178.        942.        397.        387.
                       (INCHES)     .653       1.130       1.427       1.444
                        (AC-FT)    1080.       1868.       2360.       2388.

                    CUMULATIVE AREA =   31.00 SQ MI

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          ***************
          *             *
```

```
22 KK     *    GALENA  *
          *            *
          **************
                    Basin runoff calculation for  GALENA C NR STEAMBOAT

             SUBBASIN RUNOFF DATA

24 BA         SUBBASIN CHARACTERISTICS
                    TAREA        8.50  SUBBASIN AREA

25 BF         BASE FLOW CHARACTERISTICS
                    STRTQ         .00  INITIAL FLOW
                    QRCSN         .00  BEGIN BASE FLOW RECESSION
                    RTIOR     1.00000  RECESSION CONSTANT

              PRECIPITATION DATA

26 PB               STORM        6.50  BASIN TOTAL PRECIPITATION

10 PI           INCREMENTAL PRECIPITATION PATTERN
                     .00      .00      .01      .01      .01      .01      .01      .01      .01      .01
                     .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                     .01      .01      .01      .01      .00      .01      .01      .01      .01      .01
                     .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                     .01      .01      .01      .01      .01      .06      .25      .03      .03      .01
                     .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                     .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                     .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                     .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                     .01      .00      .00      .00      .00

27 LS         SCS LOSS RATE
                    STRTL         .89  INITIAL ABSTRACTION
                   CRVNBR       69.20  CURVE NUMBER
                    RTIMP         .00  PERCENT IMPERVIOUS AREA

28 UD         SCS DIMENSIONLESS UNITGRAPH
                     TLAG        1.92  LAG

                                                        ***

                                                  UNIT HYDROGRAPH
                                             40 END-OF-PERIOD ORDINATES
             92.      281.      542.      909.     1362.     1721.     1935.     2004.     1988.     1836.
           1655.     1432.     1151.      908.      743.      607.      505.      415.      342.      277.
            228.      188.      152.      125.      102.       84.       69.       56.       47.       38.
             31.       26.       21.       18.       15.       12.       10.        7.        5.        2.

    ***             ***             ***             ***             ***

                      HYDROGRAPH AT STATION   GALENA

  TOTAL RAINFALL =    6.50, TOTAL LOSS =    3.37, TOTAL EXCESS =    3.13

PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
  (CFS)       (HR)              6-HR        24-HR       72-HR     74.75-HR
  3113.      13.75     (CFS)    1817.        715.        238.        230.
                     (INCHES)   1.988       3.127       3.128       3.128
                     (AC-FT)     901.       1418.       1418.       1418.
```

CUMULATIVE AREA =   8.50 SQ MI

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	WILLOW	3582.	13.75	2178.	942.	397.	31.00		
HYDROGRAPH AT	GALENA	3113.	13.75	1817.	715.	238.	8.50		

*** NORMAL END OF HEC-1 ***

APPENDIX E

Lemmon Valley Hydrologic Model

```
*****************************************                     ***********************************
*                                       *                     *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                     *   U.S. ARMY CORPS OF ENGINEERS
*           SEPTEMBER 1990              *                     *   HYDROLOGIC ENGINEERING CENTER
*             VERSION 4.0               *                     *        609 SECOND STREET
*                                       *                     *     DAVIS, CALIFORNIA 95616
*  RUN DATE  03/04/1996  TIME  12:25:51 *                     *         (916) 756-1104
*                                       *                     *
*****************************************                     ***********************************
```

```
X     X  XXXXXXX   XXXXX         X
X     X  X        X     X       XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID   PEEK HYDROLOGY (PELS)
   2          ID   100-YEAR DISCHARGE
   3          ID   w/ Culvert Debris Along Military Road; Lemmon Drive Clear
   4          IT       5 01OCT95    2400     300
   5          IO       5
              * **********

   6          KK   PEAV1
   7          BA    0.05
   8          BF      -4.
   9          PB    3.60
  10          IN     15. 01OCT95    2400
  11          PC  .00486  .00977  .01474  .01977  .02486  .03001  .03524  .04053  .04593  .05137
  12          PC  .05685  .06237  .06796  .07361  .07929  .08502  .09077  .09654  .10251  .10855
  13          PC  .11471  .12100  .12741  .13387  .14307  .14693  .15371  .16054  .16744  .17443
  14          PC  .18159  .18877  .19606  .20350  .21124  .21915  .22719  .23547  .24395  .25262
  15          PC  .26154  .27060  .28011  .28981  .30245  .31739  .37989  .63336  .66462  .69239
  16          PC  .70340  .71318  .72261  .73177  .74059  .74928  .75794  .76626  .77435  .78234
  17          PC  .79005  .79763  .80503  .81233  .81942  .82644  .83335  .84022  .84696  .85363
  18          PC  .86028  .86686  .87329  .87965  .88587  .89197  .89789  .90375  .90956  .91537
  19          PC  .92107  .92671  .93232  .93792  .94348  .94903  .95439  .95972  .96498  .97017
  20          PC  .97529  .98035  .98535  .99029  .99517 1.00000
  21          LS            77.0
  22          UD    0.18
              * **********

  23          KK      V1
  24          KM      Route thru 18" CMP at Virginia St; Overflow to East
  25          DT     V1D
  26          DI       0       5      13      18      22     300
  27          DQ       0       0       0       0       0     274
              * **********

  28          KK      H1
  29          KM     Route to H1
  30          RM       1    0.03     0.3
              * ***********

  31          KK   PEAV2
  32          BA    0.02
  33          PB    3.60
  34          LS            77.0
  35          UD    0.17
              * *************

  36          KK      H1  Highway 395
  37          KM      No Storage at Highway
  38          HC       2
              * *************
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 39         KK      H1
 40         KM      48" CMP Capacity = 60 cfs, Overflow to E
 41         DT     H1D
 42         DI       0      10      50      60      61     100     200     500
 43         DQ       0       0       0       0       1      40     140     440
            * *************

 44         KK      M2
 45         KM     Route to Military Road
 46         RM       5    0.83     0.2
            * ****************

 47         KK    LEM1
 48         BA    0.25
 49         PB    3.50
 50         LS            69.3
 51         UD    1.31
            * ****************

 52         KK      M1    Military Road (36" RCP)
 53         KM     Culvert Assumed Unplugged for Most Conservative Floodplain
 54         DT     M1D
 55         DI      0.      5.      7.      8.    10.6     24.     48.
 56         DQ      0.      0.      0.      0.     0.6      7.     23.
            * ****************

 57         KK    LAKE
 58         KM    Route to Lemmon Lake
 59         RM       4    0.83     0.2
            * *************

 60         KK   PEAV3
 61         BA    1.35
 62         PB    3.75
 63         LS            79.3
 64         UD    0.88
            * **************
            *    WP1  Western Pacific Railroad
            *    Storage U/S of Railroad (Assume at TOP at Beginning of Storm)
            * rs  1.    ELEV     17.   (unstable routing, so negligible attenuation)
            * sa 0.      0.2     0.4     0.6     0.7     0.9     1.2     1.4
            * se 13      15      17      19      20      22      24      26
            * sq  0      30      88     130     150     186     366    1215
            * **********

 65         KK     WP1
 66         KM     Culvert Capacity Approx. 200 cfs; Remainder Spills to East
 67         DT    WP1D
 68         DI       0      30      88     130     150     186     366    1215
 69         DQ       0       0       0       0       0      26     170     495
            * *********
```

```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  70      KK      V2
  71      KM     Route to Virginia Street
  72      RM       1    0.04      0.3
          * *********

  73      KK   PEAV4
  74      BA    0.03
  75      PB    3.50
  76      LS              77.0
  77      UD    0.14
          * **********

  78      KK      V1
  79      KM     Recall Overflow from V1
  80      DR     V1D
          * **********

  81      KK      V2
  82      KM     Route Along Virginia to V2
  83      RM       1    0.07      0.3
          * **********

  84      KK      V2  Virginia Street
  85      HC       3
          * **********
          *     V2
          *    Route thru Dual 36" CMP (Unstable Routing so Negligible Attenuation)
          * rs    1    ELEV     27.
          * sa  0.     0.09     0.18     0.26     0.35     0.39     0.44     0.48
          * se  24       26       28       30       32       33       34       36
          * sq  0.       36      100      140      160      180      562     2236
          * ***********

  86      KK      V2
  87      KM     Culvert Capacity Approx. 180 cfs; Overflow to East
  88      DT     V2D
  89      DI       0       36      100      140      160      180      562     2236
  90      DQ       0        0        0        0        0        0       87      583
          * ***********

  91      KK      H2
  92      KM     Route to Highway 395
  93      RM       1    0.02      0.3
          * ***********

  94      KK   PEAV5
  95      BA    0.02
  96      PB    3.50
  97      LS              77.0
  98      UD    0.12
          * ***********
```

```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  99      KK      H1
 100      KM   Recall Overflow from H1
 101      DR     H1D
          * ***********

 102      KK      H2
 103      KM   Route along highway from H1 to H2
 104      RM       2     .14      .2
          * ***********

 105      KK      H2  Highway 395
 106      HC       3
          * ***********

 107      KK      H2
 108      KM     45 cfs Capacity in 36" Culvert thru Highway 395, Overflow to E
 109      DT     H2D
 110      DI       0      45      46      50     100     500
 111      DQ       0       0       1       5      55     455
          * ************

 112      KK      M2
 113      KM     Route to Military Road
 114      RM       5    1.11     0.2
          * ************

 115      KK     WP1
 116      KM     Recall Diverted Flow from WP1
 117      DR    WP1D
          * *************

 118      KK     WP2
 119      KM    Route to WP2
 120      RM       1     .04     0.1
          * ************

 121      KK     WP2
 122      KM    Approx. Culvert Capacity = 44 cfs; Overflow to E
 123      DT    WP2D
 124      DI       2      18      30      64     212    1325
 125      DQ       0       0       0      26     168     495
          * ************

 126      KK      V3
 127      KM     Route to Virginia St
 128      RM       1    0.10     0.3
          * ************

 129      KK   PEAV6
 130      BA    0.39
 131      PB    3.50
 132      LS            80.3
 133      UD    0.57
          * ************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 134          KK     WP2
 135          KM     Recall Overflow from WP2
 136          DR    WP2D
              * ************

 137          KK     WP3
 138          KM     Route from WP2 to WP3 Along RR
 139          RM       1    0.05     0.2
              * *************

 140          KK     WP3   WPRR (36" CMP)
 141          HC       2
              * ************

 142          KK     WP3
 143          KM     Route thru 36" CMP Culvert
 144          RS       1    ELEV      85
 145          SA       0    0.13    0.34    0.55    0.76    0.97    1.18    1.35    1.39
 146          SE      82      85      90      95     100     105     110     114     115
 147          SQ       0      35      90     110     140     162     178     346     758
              * ************

 148          KK     WP3
 149          KM     Approx. Culvert Capacity = 190 cfs; Overflow to East
 150          DT    WP3D
 151          DI       0      35      90     110     140     162     178     346     758
 152          DQ       0       0       0       0       0       0       0     156     282
              * *************

 153          KK      V3
 154          KM     Route to Virginia St
 155          RM       1    0.11     0.3
              * ************

 156          KK   PEAV7
 157          BA    0.58
 158          PB    3.47
 159          LS            79.9
 160          UD    0.38
              * ************

 161          KK     WP3
 162          KM     Recall Overflow from WP3
 163          DR    WP3D
              * ************

 164          KK     WP4
 165          KM    Route from WP3 to WP4 Along RR
 166          RM       2    0.23     0.2
              * ************
```

```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 167           KK     WP4
 168           HC       2
               * *************

 169           KK     WP4
 170           KM     (2) 24" CMP Culverts at WPRR w/ 80 cfs Capacity; Overflow to East
 171           DT    WP4D
 172           DI       0      26      52     105     236    3150
 173           DQ       0       0       0      25     156     459
               * ************

 174           KK      V3
 175           KM     Route to Virginia St
 176           RM       1    0.25     0.2
               * *************

 177           KK   PEAV8
 178           BA    0.18
 179           PB    3.48
 180           LS            77.0      1.
 181           UD    0.45
               * *************

 182           KK      V2
 183           KM   Recall Overflow from V2D
 184           DR     V2D
               * *************

 185           KK      V3
 186           KM   Route along Virginia St. from V2 to V3
 187           RM       2     .28      .2
               * *************

 188           KK      V3  Virginia St
 189           HC       5
               * *************

 190           KK      H3
 191           KM     Route to Highway 395
 192           RM       1     .06     0.3
               * **************

 193           KK   PEAV9
 194           BA    0.10
 195           PB    3.45
 196           LS            77.0
 197           UD    0.17
               * ***************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 198          KK      H2
 199          KM     Recall Overflow from H2
 200          DR     H2D
              * ***************

 201          KK      H3
 202          KM     Route to H3
 203          RM       1    0.09     0.3
              * ****************

 204          KK      H3  Highway 395 at Stead Boulevard
 205          HC       3
              * ****************

 206          KK      M2
 207          KM     Route to Military Road
 208          RM       4    0.81     0.2
              * *******************

 209          KK      M2
 210          KM     Recall Overflow from M1
 211          DR     M1D
              * *******************

 212          KK      M2
 213          KM     Route from M1 to M2
 214          RM       1    0.10     0.5
              * ************

 215          KK    LEM2
 216          BA    1.67
 217          PB    3.45
 218          LS            74.5     12.
 219          UD    1.96
              * ****************

 220          KK      M2  Triple 4 x 10.5 RCB at low point
 221          HC       4
              * ************
              *
              *   Calcs and field observation indicate that culverts completely fill w/
              *   sediment during any significant discharge.  Therefore assume no transverse
              *   culvert capacity along Lemmon Drive. All discharge assumed to overtop road
              *
              * ***********************

 222          KK    LAKE
 223          KM     Route to Lemmon Lake (V = 1 fps)
 224          RM       6    1.25     0.2
              * ******************
```

```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 225      KK   LAKE
 226      KM   COMBINE M1 AND M2 AT LAKE
 227      HC       2
          * ******************

 228      KK  PEAV10
 229      BA    0.10
 230      PB    3.85
 231      LS            77.0
 232      UD    0.30
          * ************

 233      KK      H4
 234      KM     Route to Highway 395 (No Storage at Virginia St Culvert)
 235      RM       1    0.08     0.3
          * ************

 236      KK  PEAV11
 237      BA    0.07
 238      PB    3.46
 239      LS            77.0
 240      UD    0.61
          * ************

 241      KK      H4  Highway 395
 242      HC       2
          * ************

 243      KK      H4
 244      KM     Route thru Storage Area at Highway
 245      RS       1    ELEV      94
 246      SA       0    0.12    0.24    0.55    1.40
 247      SE      91      92      94      96      98
 248      SQ       0      10      38     117    1110
          * **************

 249      KK      H4
 250      KM     Approx. Culvert Capacity = 80 cfs; Overflow to East
 251      DT     H4D
 252      DI       0      10      38     117     110
 253      DQ       0       0       0      52    1030
          * **************

 254      KK      M3
 255      KM     Route to Military Road
 256      RM       4    0.75     0.2
          * **************

 257      KK    LEM3
 258      BA    0.65
 259      PB    3.38
 260      LS            74.7      2.
 261      UD    1.53
          * **************
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 262        KK      M3  Military Road
 263        HC       2
            * ***************

 264        KK    LAKE
 265        KM     Route to Lemmon Lake
 266        RM       8    1.53     0.2
            * *****************

 267        KK  PEAV12
 268        BA    0.36
 269        PB    3.55
 270        LS            80.9
 271        UD    0.46
            * ***************

 272        KK     WP4
 273        KM     Recall Overflow from WP4
 274        DR    WP4D
            * ***************

 275        KK     WP5
 276        KM     Route Along WPRR to WP5
 277        RM       2    0.28     0.2
            * ***************

 278        KK     WP5
 279        HC       2
            * ***************

 280        KK     WP5
 281        KM     24" CMP Capacity = 45 cfs; Overflow to E Along RR
 282        DT    WP5D
 283        DI       0      21      70     377
 284        DQ       0       0      25     156
            * *****************

 285        KK      V5
 286        KM     Route to Virginia St
 287        RM       1    0.12     0.3
            * *****************

 288        KK  PEAV13
 289        BA    0.14
 290        PB    3.40
 291        LS            77.0
 292        UD    0.42
            * *****************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 293          KK      V5  Virginia St
 294          HC       2
              * ****************

 295          KK      H5
 296          KM     Route to Hwy 395
 297          RM       1    0.11     0.3
              * ****************

 298          KK  PEAV14
 299          BA    0.14
 300          PB    3.45
 301          LS            77.7      2.
 302          UD    0.45
              * ***************

 303          KK      H4
 304          KM     Recall Overflow from H4
 305          DR     H4D
              * ***************

 306          KK      H5
 307          KM     Route from H4 to H5 Along Highway 395
 308          RM       1    0.10     0.4
              * ****************

 309          KK      H5  Highway 395
 310          HC       3
              * ***************
              *     H5
              *    Route thru Two 30" CMP (Unstable Routing so Negligible Attenuation)
              * rs   1    ELEV      86
              * sa   0     0.1     0.3     2.5     2.9
              * se84.5      86      88      90      91
              * sq   0      10      35      66    2683
              * ***************

 311          KK      M4
 312          KM     Route to Military Road
 313          RM       3    0.59     0.2
              * ***************

 314          KK  PEAV15
 315          BA    0.76
 316          PB    3.50
 317          LS            83.1      3.
 318          UD    0.40
              * ***************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 319          KK     WP5
 320          KM     Recall Overflow from WP5
 321          DR    WP5D
              * ***************

 322          KK     WP6
 323          KM     Route Along RR to WP6
 324          RM       1    0.14     0.2
              * ****************

 325          KK     WP6
 326          HC       2
              * ****************

 327          KK     WP6
 328          KM     (3) 36" CMP w/ Approx Capacity = 390 cfs; Overflow to East
 329          DT    WP6D
 330          DI       0      60     170     320     385     395     705
 331          DQ       0       0       0       0       0       5      30
              * ****************

 332          KK      V6
 333          KM     Route to Virginia St
 334          RM       1    0.11     0.3
              * ****************

 335          KK  PEAV16
 336          BA    0.20
 337          PB    3.40
 338          LS            77.0     13.
 339          UD    0.36
              * ****************

 340          KK      V6  Virginia St
 341          HC       2
              * *****************

 342          KK      V6
 343          KM     Route thru Pond at Virginia St
 344          RS       1    ELEV      60
 345          SA     3.7     3.7     3.7     3.7
 346          SE      60      61      62      63
 347          SQ     260     280     290     668
              * ******************

 348          KK      H6
 349          KM     Route to Highway 395
 350          RM       1    0.11     0.3
              * ******************
```

```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 351           KK  PEAV17
 352           BA    0.24
 353           PB    3.35
 354           LS            80.8       1.
 355           UD    0.38
               * *****************

 356           KK      H6  Highway 395
 357           HC       2
               * *****************

 358           KK      H6
 359           KM     Route thru 6 x 6 RCB at Highway 395
 360           RS       1    ELEV      80
 361           SA       0    0.01    0.16    0.37    2.07    2.75
 362           SE      75      76      78      80      90      92
 363           SQ       0      24     102     210     600     660
               * *****************

 364           KK      M4
 365           KM     Route to Military Road
 366           RM       3    0.42     0.3
               * *****************

 367           KK  PEAV18
 368           BA    0.04
 369           PB    3.20
 370           LS            79.5      10.
 371           UD    0.23
               * *****************

 372           KK     WP6
 373           KM  Recall Overflow from WP6
 374           DR     WP6D
               * *****************

 375           KK     WP7
 376           KM  Route along WPRR from WP6 to WP7
 377           RM       2    .375      .2
               * *****************

 378           KK     WP7
 379           KM  Combine HG
 380           HC       2
               * *****************

 381           KK     WP7
 382           KM     Approx. 24" CMP Capacity = 30 cfs; Overflow to East
 383           DT    WP7D
 384           DI       0       2       9      19      81     159
 385           DQ       0       0       0       1      53     127
               * *****************
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 386        KK      V7
 387        KM     Route to Virginia St
 388        RM       1    0.06     0.3
            * ****************

 389        KK  PEAV19
 390        BA    0.04
 391        PB    3.15
 392        LS            78.3
 393        UD    0.16
            * ****************

 394        KK      V7  Virginia St
 395        HC       2
            * ****************

 396        KK      H7
 397        KM     Route to Highway 395
 398        RM       2    0.15     0.3
            * ****************

 399        KK  PEAV20
 400        BA    0.12
 401        PB    3.25
 402        LS            80.3     14.
 403        UD    0.55
            * ****************

 404        KK      H7  Highway 395
 405        HC       2
            * ****************

 406        KK      H7
 407        KM     Route thru 48" CMP
 408        RS       1    ELEV      91
 409        SA     .00     .06    1.06
 410        SE      88      90     100
 411        SQ       2      36     200
            * *****************

 412        KK      M4
 413        KM     Route to Military Road
 414        RM       5    0.67     0.3
            * ******************

 415        KK    LEM4
 416        BA    1.13
 417        PB    3.25
 418        LS            78.4      2.
 419        UD    1.50
            * ******************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 420          KK      M4  Military Road
 421          HC       4
              * ******************

 422          KK    LAKE
 423          KM    Route to Lemmon Lake (1 fps)
 424          RM      10    1.94     0.2
              * ******************

 425          KK    LEM7
 426          BA    1.08
 427          PB    3.30
 428          LS            69.0     0.5
 429          UD    2.18
              * *************************

 430          KK    LAKE
 431          HC       5
              * *************************

 432          KK    POE1
 433          BA    2.52
 434          PB    3.50
 435          LS            82.8
 436          UD    1.11
              * ******************

 437          KK     WP7
 438          KM   Recall Overflow from WP7
 439          DR    WP7D
              * ******************

 440          KK     WP8
 441          KM   Route along WPRR from WP7 to WP8
 442          RM       1     .11      .2
              * ******************

 443          KK     WP8
 444          KM   Combine HG
 445          HC       2
              * ******************

 446          KK     WP8
 447          KM     Route thru 36" CMP
 448          RS       1    ELEV      29
 449          SA       0     0.5     1.0     1.6     2.5     2.9     3.0
 450          SE      25      30      35      40      45      48      50
 451          SQ       0      55     100     130     150     238    1292
              * *******************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 452          KK     WP8
 453          KM     Approx Culvert Capacity = 160 cfs; Overflow to E
 454          DT    WP8D
 455          DI       0      55     100     130     160     238    1292
 456          DQ       0       0       0       0       0      78     305
              * ******************

 457          KK      V8
 458          KM     Route to Virginia St
 459          RM       1    0.06     0.3
              * ****************

 460          KK    POE2
 461          BA    0.05
 462          PB    3.15
 463          LS            77.0      7.
 464          UD    0.24
              * ****************

 465          KK      V8  Virginia St
 466          HC       2
              * *****************

 467          KK      V8
 468          KM     Route thru 48" CMP
 469          RS       1    ELEV      86
 470          SA       0    0.53    1.42    2.31    2.67    2.84     3.2
 471          SE      82      85      90      95      97      98     100
 472          SQ       0      55     150     200     220     320    1280
              * ******************

 473          KK      H8
 474          KM     Route to Highway 395
 475          RM       1    0.13     0.3
              * ******************

 476          KK    POE3
 477          BA    0.11
 478          PB    3.25
 479          LS            77.0     18.
 480          UD    0.39
              * *******************

 481          KK      H8  Highway 395
 482          HC       2
              * *******************

 483          KK      H8
 484          KM     Route thru 6 x 6 RCB
 485          RS       1    ELEV     106
 486          SA     .01     .06     .17     .35     .58     .87    1.62
 487          SE     100     102     104     106     108     110     120
 488          SQ       6      78     180     300     390     470     768
              * ********************
```

```
LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 489     KK       L1
 490     KM      Route to Lemmon Drive
 491     RM        2    0.42     0.2
         * *********************

 492     KK     POE4
 493     BA     0.07
 494     PB     3.15
 495     LS             77.0     0.5
 496     UD     0.24
         * **********************

 497     KK       H9   Highway 395
 498     KM      Route thru 36" CMP
 499     RS        1    ELEV     114
 500     SA      .15     .58     .86    1.29    1.61
 501     SE      112     114     116     118     120
 502     SQ        2      35      62      80      95
         * ***********************

 503     KK       L1
 504     KM      Route to Lemmon Drive
 505     RM        4    0.49     0.3
         * ***********************

 506     KK      WP8
 507     KM      Recall Overflow from WP8
 508     DR     WP8D
         * *****************

 509     KK      WP9
 510     KM      Route Along RR to WP9
 511     RM        2    0.21     0.3
         * ***************

 512     KK     POE5
 513     BA     0.09
 514     PB     3.30
 515     LS             83.7
 516     UD     0.26
         * ***********************

 517     KK      WP9
 518     HC        2
         * ************************

 519     KK      WP9
 520     KM      Route thru 24" CMP at WPRR
 521     RS        1    ELEV      21
 522     SA        0     .29     .58     .86     .92    1.04    1.09    1.15
 523     SE       20      25      30      35      36      38      39      40
 524     SQ        8      36      50      60      66     118     178     544
         * ***********************
```

```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          KK      WP9
          KM      Approx. Culvert Capacity = 70 cfs; Overflow to East
          DT    WP9D
          DI       8      36      50      60      66     118     178     544
          DQ       0       0       0       0       3      51     110     199
          * ************************

          KK       V9
          KM      Route to Virginia St
          RM       1    0.07     0.3
          * ************************

          KK    POE6
          BA    0.07
          PB    3.25
          LS            77.0
          UD    0.22
          * *************************

          KK       V9  Virginia St
          HC       2
          * *************************

          KK       V9
          KM      Route thru 36" CMP
          RS       1    ELEV      62
          SA       0       0    0.72    1.44    2.15    2.87
          SE      60      65      70      75      76      80
          SQ       0      65     100     130     320    4260
          * *************************

          KK      H10
          KM      Route to Highway 395
          RM       1    0.13     0.3
          * *************************

          KK    POE7
          BA    0.10
          PB    3.35
          LS            77.0     0.5
          UD    0.27
          * ***********************

          KK      H10   Highway 395
          HC       2
          * ***********************
          *     H10
          *     Route thru 6 x 6 RCB  (Unstable Routing so Neglect Storage)
          * rs    1    ELEV        6
          * sa    0    0.11     0.22     0.33     0.44     0.56
          * se    0       2        4        6        8       10
          * sq    0      51      144      252      360      432
          * *************************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 556          KK      L1
 557          KM     Route to Lemmon Drive
 558          RM       3    0.31     0.3
              * *************************

 559          KK     WP9
 560          KM     Recall Overflow from WP9
 561          DR    WP9D
              * *************************

 562          KK    WP10
 563          KM     Route Along Railroad to WP10
 564          RM       2    0.17     0.3
              * **************************

 565          KK    RAL1
 566          BA    1.00
 567          PB    3.30
 568          LS            84.8
 569          UD    0.70
              * *************************

 570          KK    WP10   WPRR
 571          HC       2
              * **************************

 572          KK    WP10
 573          KM    Approx Culvert Capacity = 60 cfs; Overflow to East
 574          DT   WP10D
 575          DI       9      39      50      55      62     145     243     759
 576          DQ       0       0       0       0       4      83     180     326
              * ****************************

 577          KK     V10
 578          KM     Route to Virginia St
 579          RM       1    0.11     0.3
              * ****************************

 580          KK    RAL2
 581          BA    0.07
 582          PB    3.10
 583          LS            78.4
 584          UD    0.21
              * ****************************

 585          KK     V10   Virginia St
 586          HC       2
              * ****************************
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 587        KK      V10
 588        KM      Route thru 36" CMP
 589        RS       1    ELEV      71
 590        SA       0    0.57    1.15    1.43    2.30    2.64    3.33    3.68
 591        SE      70      75      80      85      90      91      93      94
 592        SQ      12      78     110     140     158     162     214    1259
            * ****************************

 593        KK      V10
 594        KM      Approx. Culvert Capacity = 170 cfs; Overflow to East
 595        DT     V10D
 596        DI       0      12      78     110     140     158     162     214    1259
 597        DQ       0       0       0       0       0       0       0      45     132
            * ****************************

 598        KK      H11
 599        KM      Route to Hwy 395
 600        RM    0.72    0.10     0.3
            * ****************************

 601        KK    RAL3
 602        BA    0.08
 603        PB    3.20
 604        LS            77.0     44.
 605        UD    0.21
            * ****************************

 606        KK      H11  Highway 395
 607        KM      Negligible Storage at 4 x 10 RCB
 608        HC       2
            * ****************************

 609        KK       L1
 610        KM       Route to Lemmon Drive
 611        RM       6    0.76     0.3
            * ****************************

 612        KK    RAL4
 613        BA    0.12
 614        PB    3.20
 615        LS            81.2
 616        UD    0.26
            * ****************************

 617        KK    WP10
 618        KM      Recall Overflow from WP10
 619        DR   WP10D
            * ****************************
```

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 620         KK    WP11
 621         KM     Route Along Railroad to WP11
 622         RM       2    0.21     0.3
             * ******************************

 623         KK    WP11
 624         HC       2
             * ******************************

 625         KK    WP11
 626         KM     Route thru 24" CMP
 627         RS       1    ELEV      90
 628         SA       0    0.12    0.40    0.69    0.98    1.15    1.21    1.38    1.44
 629         SE      88      90      95     100     105     108     109     112     113
 630         SQ       0       0      37      50      62      67      75     313     874
             * ******************************

 631         KK    WP11
 632         KM     Approx Culvert Capacity = 75 cfs; Overflow to East
 633         DT   WP11D
 634         DI       0       0      37      50      62      67      75     313     874
 635         DQ       0       0       0       0       0       0       6     238     431
             * *******************************

 636         KK     V11
 637         KM     Route to Virginia St
 638         RM       1    0.06     0.3
             * ******************************

 639         KK    RAL5
 640         BA    0.04
 641         PB    3.10
 642         LS            79.5      5.
 643         UD    0.20
             * ******************************

 644         KK     V10
 645         KM     Recall Overflow from V10
 646         DR    V10D
             * ******************************

 647         KK     V11
 648         KM     Route Along Street to V11
 649         RM       2    0.17     0.3
             * ******************************

 650         KK     V11
 651         HC       3
             * *******************************
```

```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 652           KK      V11
 653           KM      Approx 36" CMP Capacity = 90 cfs; Overflow to East
 654           DT     V11D
 655           DI        0      22      72      85     120     338
 656           DQ        0       0       0       5      30      88
               * ********************************

 657           KK      H12
 658           KM      Route to Highway 395
 659           RM        1    0.06     0.3
               * *********************************

 660           KK     RAL6
 661           BA     0.14
 662           PB     3.01
 663           LS             81.1     20.
 664           UD     0.27
               * *********************************

 665           KK      H12
 666           HC        2
               * **********************************

 667           KK     RAL7
 668           BA     0.20
 669           PB     3.13
 670           LS             81.5
 671           UD     0.44
               * **********************************

 672           KK     WP11
 673           KM      Recall Overflow from WP11
 674           DR    WP11D
               * **********************************

 675           KK     WP12
 676           KM      Route Along WPRR to WP12
 677           RM        2    0.21     0.3
               * ***********************************

 678           KK     WP12
 679           HC        2
               * **********************************

 680           KK     WP12
 681           KM      Approx. 24" CMP Capacity = 50 cfs; Overflow to East
 682           DT    WP12D
 683           DI        0      30      40      84     329    1533
 684           DQ        0       0       0      39     279     837
               * **********
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

685           KK     V12
686           KM     Route to Virginia St
687           RM       1    0.05     0.3
              * ************

688           KK    RAL8
689           BA    0.03
690           PB    3.02
691           LS            83.7      5.
692           UD    0.17
              * ************

693           KK     V11
694           KM     Recall Overflow from V11
695           DR    V11D
              * **************

696           KK     V12
697           KM     Route Along Street from V11 to V12
698           RM       2     .15     0.3
              * ****************

699           KK     V12
700           HC       3
              * ****************

701           KK     H12
702           KM     Route to Hwy 395
703           RM       1    0.07     0.3
              * ****************

704           KK    RAL9
705           BA    0.17
706           PB    3.13
707           LS            87.0     25.
708           UD    0.30
              * ****************

709           KK    WP12
710           KM     Recall Overflow from WP12
711           DR   WP12D
              * ****************

712           KK    WP13
713           KM     Route Along RR from WP12 to WP13
714           RM       1    0.10     0.3
              * *****************

715           KK    WP13
716           HC       2
              * *****************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 717          KK    WP13
 718          KM     Route thru 24" CMP
 719          RS       1    ELEV      67
 720          SA       0    0.69    1.38    2.07    2.35
 721          SE      65      70      75      80      82
 722          SQ       0      32      47      59     674
              * *******************

 723          KK     V13
 724          KM     Route to Virginia St
 725          RM       1    0.04     0.3
              * ******************

 726          KK   RAL10
 727          BA    0.01
 728          PB    3.15
 729          LS            87.0      2.
 730          UD    0.09
              * ********************

 731          KK     V13  Virginia St
 732          HC       2
              * ********************

 733          KK     H12
 734          KM     Route to Highway 395
 735          RM       1    0.10     0.3
              * ********************

 736          KK     H12   Highway 395
 737          KM     Negligible Storage at Highway 395/Golden Valley Rd Interchange
 738          HC       3
              * ****************

 739          KK      L1
 740          KM      Route to Lemmon Drive
 741          RM       6    0.80     0.3
              * ******************

 742          KK   RAL11
 743          BA    0.08
 744          PB    3.02
 745          LS            87.0      5.
 746          UD    0.18
              * ********************

 747          KK     H13
 748          KM     Route to Lemmon Drive (No Storage at Hwy 395)
 749          RM       7    0.97     0.3
              * ********************
```

```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 750      KK   GOLD1
 751      BA    4.55
 752      PB    3.00
 753      LS             77.0     15.
 754      UD    1.91
          * *********************

 755      KK      L1  Lemmon Drive
 756      HC       7
          * *********************

 757      KK      L1
 758      KM     Channel Capacity D/S Lemmon Dr = 720 cfs; Overflow to West
 759      DT     L1D
 760      DI       0     500     700     720     721     800    1000    2000
 761      DQ       0       0       0       0       1      50     250    1250
          * **********************

 762      KK   GOLD2
 763      BA    0.02
 764      PB    3.20
 765      LS             73.9
 766      UD    0.11
          * *********************

 767      KK      L2   Bournoulli Street
 768      HC       2
          * *********************

 769      KK      L2
 770      KM     Capacity at Triple 5 x 4 RCB = 450 cfs
 771      DT     L2D
 772      DI       0     400     450     451     500     750    1000
 773      DQ       0       0       0       1      50     300     550
          * ***********************

 774      KK   GOLD3
 775      BA    0.19
 776      PB    3.15
 777      LS             72.3      5.
 778      UD    0.42
          * ***********************

 779      KK      L3   Hydraulic Street
 780      HC       2
          * ************************

 781      KK      L3
 782      KM     Capacity at Triple 5 x 4 RCB = 450 cfs
 783      DT     L3D
 784      DI       0     400     450     451     500     750    1000
 785      DQ       0       0       0       1      50     300     550
          * ************************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 786          KK   GOLD4
 787          BA    0.03
 788          PB    3.02
 789          LS             73.5      20.
 790          UD    0.22
              * ************************

 791          KK      L4   Surge Street
 792          HC       2
              * *************************

 793          KK      L4
 794          KM     Capacity at Triple 5 x 4 RCB = 470 cfs
 795          DT     L4D
 796          DI       0     400     470     471     500     750    1000
 797          DQ       0       0       0       1      30     280     530
              * **************************

 798          KK   GOLD5
 799          BA    0.36
 800          PB    3.08
 801          LS             69.4      22.
 802          UD    0.55
              * **************************

 803          KK      L5   Patrician Drive
 804          HC       2
              * **************************

 805          KK      L5
 806          KM     Capacity of Triple 5 x 4 = 450 cfs
 807          DT     L5D
 808          DI       0     400     450     451     500     750    1000
 809          DQ       0       0       0       1      50     300     550
              * ************************

 810          KK   GOLD6
 811          BA    0.93
 812          PB    3.00
 813          LS             74.5       5.
 814          UD    0.85
              * ***************************

 815          KK   GOLD7
 816          BA    0.13
 817          PB    3.02
 818          LS             72.8       1.
 819          UD    0.40
              * ***************************
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 820        KK      L6  Palace Drive
 821        HC       3
            * ****************************

 822        KK      L6
 823        KM     Channel Capacity = 980 cfs; Overflow to West
 824        DT     L6D
 825        DI       0     500     900     980     981    1000    2000
 826        DQ       0       0       0       0       1      20    1020
            * ************************

 827        KK      L1
 828        KM     Recall Overflow from L1
 829        DR     L1D
            * ***********************

 830        KK      L7
 831        KM      Route to Surge Street (V = 2 fps)
 832        RM       1    0.43     0.2
            * ***********************

 833        KK      L2
 834        KM     Recall Overflow from L2
 835        DR     L2D
            * ***********************

 836        KK      L7
 837        KM      Route to Surge Street (2 fps)
 838        RM       1    0.35     0.2
            * *********************

 839        KK      L3
 840        KM     Recall Overflow from L3
 841        DR     L3D
            * **********************

 842        KK      L7
 843        KM     Route to Surge Street (2 fps)
 844        RM       1    0.14     0.2
            * ***********************

 845        KK    LEM5
 846        BA    0.28
 847        PB    3.25
 848        LS            74.5
 849        UD    1.18
            * ************************

 850        KK      L7
 851        KM    Route to Surge Street (1 fps)
 852        RM       4    0.78     0.2
            * ************************
```

```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 853        KK    LEM6
 854        BA    0.39
 855        PB    3.25
 856        LS            66.7     0.5
 857        UD    2.38
            * ************************

 858        KK      L7   Surge Street
 859        HC       5
            * ************************

 860        KK    LAKE
 861        KM     Route to Lemmon Lake (V = 1 fps)
 862        RM       4    1.53     0.1
            * **************************

 863        KK    LEM8
 864        BA    0.69
 865        PB    3.20
 866        LS            66.1     38.
 867        UD    2.06
            * ************************

 868        KK    LAKE
 869        HC       3
            * *************************

 870        KK    LAKE   Lemmon Lake
 871        HC       2
 872        ZZ
```

```
*****************************************                         *************************************
*                                       *                         *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                         *   U.S. ARMY CORPS OF ENGINEERS
*            SEPTEMBER 1990             *                         *   HYDROLOGIC ENGINEERING CENTER
*             VERSION 4.0               *                         *          609 SECOND STREET
*                                       *                         *       DAVIS, CALIFORNIA 95616
*  RUN DATE  03/04/1996  TIME  12:25:51 *                         *           (916) 756-1104
*                                       *                         *
*****************************************                         *************************************




                              PEEK HYDROLOGY (PELS)
                              100-YEAR DISCHARGE
                              w/ Culvert Debris Along Military Road; Lemmon Drive Clear

   5 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE     1OCT95  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     3OCT95  ENDING DATE
                      NDTIME       0055  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      H1.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      V2.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      H2.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      M2.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH     WP2.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH     WP3.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      V3.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      M2.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      M4.
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      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      L1.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH     V12.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH     V13.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      L7.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
***** WARNING *****  POSSIBLE INSTABILITIES IN THE MUSKINGUM ROUTING FOR REACH      L7.
      REDUCE NSTPS OR DECREASE YOUR COMPUTATION INTERVAL (FIRST FIELD OF THE IT RECORD).
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	PEAV1	44.	11.83	6.	2.	2.	.05		
DIVERSION TO	V1D	22.	11.83	1.	0.	0.	.05		
HYDROGRAPH AT	V1	22.	11.83	5.	2.	2.	.05		
ROUTED TO	H1	24.	11.75	5.	2.	2.	.05		
HYDROGRAPH AT	PEAV2	18.	11.83	2.	1.	1.	.02		
2 COMBINED AT	H1	40.	11.83	7.	3.	3.	.07		
DIVERSION TO	H1D	0.	11.83	0.	0.	0.	.07		
HYDROGRAPH AT	H1	40.	11.83	7.	3.	3.	.07		
ROUTED TO	M2	26.	12.67	7.	3.	3.	.07		
HYDROGRAPH AT	LEM1	36.	13.08	18.	7.	7.	.25		
DIVERSION TO	M1D	15.	13.08	4.	1.	1.	.25		
HYDROGRAPH AT	M1	21.	13.08	13.	6.	6.	.25		
ROUTED TO	LAKE	20.	14.00	13.	6.	6.	.25		
HYDROGRAPH AT	PEAV3	532.	12.58	180.	70.	67.	1.35		
DIVERSION TO	WP1D	234.	12.58	47.	12.	11.	1.35		
HYDROGRAPH AT	WP1	298.	12.58	134.	58.	56.	1.35		
ROUTED TO	V2	298.	12.58	134.	58.	56.	1.35		
HYDROGRAPH AT	PEAV4	27.	11.83	3.	1.	1.	.03		
HYDROGRAPH AT	V1	22.	11.83	1.	0.	0.	.00		
ROUTED TO	V2	20.	11.92	1.	0.	0.	.00		
3 COMBINED AT	V2	301.	12.58	138.	59.	58.	1.38		
DIVERSION TO	V2D	27.	12.58	3.	1.	1.	1.38		
HYDROGRAPH AT	V2	273.	12.58	134.	59.	57.	1.38		
ROUTED TO	H2	273.	12.58	134.	59.	57.	1.38		
HYDROGRAPH AT	PEAV5	19.	11.75	2.	1.	1.	.02		
HYDROGRAPH AT	H1	0.	.08	0.	0.	0.	.00		

ROUTED TO	H2	0.	.08	0.	0.	0.	.00		
3 COMBINED AT	H2	274.	12.58	136.	59.	58.	1.40		
DIVERSION TO	H2D	229.	11.42	91.	29.	28.	1.40		
HYDROGRAPH AT	H2	45.	11.42	45.	30.	30.	1.40		
ROUTED TO	M2	45.	24.92	45.	29.	28.	1.40		
HYDROGRAPH AT	WP1	234.	12.58	47.	12.	11.	.00		
ROUTED TO	WP2	233.	12.58	47.	12.	11.	.00		
DIVERSION TO	WP2D	174.	12.58	33.	8.	8.	.00		
HYDROGRAPH AT	WP2	59.	12.58	14.	3.	3.	.00		
ROUTED TO	V3	58.	12.67	14.	3.	3.	.00		
HYDROGRAPH AT	PEAV6	193.	12.25	49.	19.	18.	.39		
HYDROGRAPH AT	WP2	174.	12.58	33.	8.	8.	.00		
ROUTED TO	WP3	174.	12.67	33.	8.	8.	.00		
2 COMBINED AT	WP3	340.	12.42	82.	27.	26.	.39		
ROUTED TO	WP3	169.	13.17	82.	27.	26.	.39	107.32	13.17
DIVERSION TO	WP3D	0.	13.17	0.	0.	0.	.39		
HYDROGRAPH AT	WP3	169.	13.17	82.	27.	26.	.39		
ROUTED TO	V3	169.	13.33	82.	27.	26.	.39		
HYDROGRAPH AT	PEAV7	362.	12.00	71.	27.	26.	.58		
HYDROGRAPH AT	WP3	0.	.08	0.	0.	0.	.00		
ROUTED TO	WP4	0.	.08	0.	0.	0.	.00		
2 COMBINED AT	WP4	362.	12.00	71.	27.	26.	.58		
DIVERSION TO	WP4D	169.	12.00	21.	5.	5.	.58		
HYDROGRAPH AT	WP4	193.	12.00	49.	22.	21.	.58		
ROUTED TO	V3	155.	12.25	49.	22.	21.	.58		
HYDROGRAPH AT	PEAV8	88.	12.08	20.	8.	7.	.18		
HYDROGRAPH AT	V2	27.	12.58	3.	1.	1.	.00		
ROUTED TO	V3	25.	12.92	3.	1.	1.	.00		
5 COMBINED AT	V3	380.	12.25	168.	61.	59.	1.15		
ROUTED TO	H3	378.	12.33	168.	61.	59.	1.15		

HYDROGRAPH AT	PEAV9	84.	11.83	11.	4.	4.	.10		
HYDROGRAPH AT	H2	229.	12.58	91.	29.	28.	.00		
ROUTED TO	H3	228.	12.67	91.	29.	28.	.00		
3 COMBINED AT	H3	592.	12.67	269.	94.	91.	1.25		
ROUTED TO	M2	553.	13.42	267.	93.	91.	1.25		
HYDROGRAPH AT	M2	15.	13.08	4.	1.	1.	.00		
ROUTED TO	M2	15.	13.17	4.	1.	1.	.00		
HYDROGRAPH AT	LEM2	284.	13.75	169.	71.	68.	1.67		
4 COMBINED AT	M2	890.	13.50	485.	194.	189.	4.32		
ROUTED TO	LAKE	825.	14.83	480.	188.	183.	4.32		
2 COMBINED AT	LAKE	842.	14.83	493.	194.	189.	4.57		
HYDROGRAPH AT	PEAV10	75.	11.92	13.	5.	5.	.10		
ROUTED TO	H4	73.	12.00	13.	5.	5.	.10		
HYDROGRAPH AT	PEAV11	27.	12.25	7.	3.	3.	.07		
2 COMBINED AT	H4	96.	12.08	20.	8.	8.	.17		
ROUTED TO	H4	87.	12.17	20.	8.	8.	.17	95.25	12.17
DIVERSION TO	H4D	32.	12.17	3.	1.	1.	.17		
HYDROGRAPH AT	H4	55.	12.17	18.	7.	7.	.17		
ROUTED TO	M3	46.	13.00	17.	8.	8.	.17		
HYDROGRAPH AT	LEM3	112.	13.25	58.	24.	23.	.65		
2 COMBINED AT	M3	156.	13.17	76.	31.	31.	.82		
ROUTED TO	LAKE	139.	14.75	75.	32.	32.	.82		
HYDROGRAPH AT	PEAV12	217.	12.08	47.	18.	18.	.36		
HYDROGRAPH AT	WP4	169.	12.00	21.	5.	5.	.00		
ROUTED TO	WP5	158.	12.33	21.	5.	5.	.00		
2 COMBINED AT	WP5	353.	12.17	69.	24.	23.	.36		
DIVERSION TO	WP5D	146.	12.17	22.	5.	5.	.36		
HYDROGRAPH AT	WP5	207.	12.17	47.	18.	18.	.36		
ROUTED TO	V5	203.	12.33	47.	18.	18.	.36		
HYDROGRAPH AT	PEAV13	68.	12.08	15.	6.	5.	.14		

2 COMBINED AT	V5	257.	12.25	62.	24.	23.	.50		
ROUTED TO	H5	251.	12.42	62.	24.	23.	.50		
HYDROGRAPH AT	PEAV14	71.	12.08	16.	6.	6.	.14		
HYDROGRAPH AT	H4	32.	12.17	3.	1.	1.	.00		
ROUTED TO	H5	31.	12.25	3.	1.	1.	.00		
3 COMBINED AT	H5	338.	12.33	80.	31.	30.	.64		
ROUTED TO	M4	278.	12.92	80.	30.	29.	.64		
HYDROGRAPH AT	PEAV15	545.	12.00	108.	42.	41.	.76		
HYDROGRAPH AT	WP5	146.	12.17	22.	5.	5.	.00		
ROUTED TO	WP6	139.	12.33	22.	5.	5.	.00		
2 COMBINED AT	WP6	644.	12.08	130.	48.	46.	.76		
DIVERSION TO	WP6D	25.	12.08	2.	0.	0.	.76		
HYDROGRAPH AT	WP6	619.	12.08	128.	47.	46.	.76		
ROUTED TO	V6	600.	12.17	128.	47.	46.	.76		
HYDROGRAPH AT	PEAV16	124.	12.00	23.	10.	9.	.20		
2 COMBINED AT	V6	704.	12.17	152.	57.	55.	.96		
ROUTED TO	V6	587.	12.42	289.	267.	267.	.96	62.79	12.42
ROUTED TO	H6	571.	12.50	289.	267.	267.	.96		
HYDROGRAPH AT	PEAV17	148.	12.00	29.	11.	11.	.24		
2 COMBINED AT	H6	634.	12.50	318.	278.	278.	1.20		
ROUTED TO	H6	527.	12.75	318.	278.	277.	1.20	88.14	12.75
ROUTED TO	M4	507.	13.17	318.	278.	276.	1.20		
HYDROGRAPH AT	PEAV18	31.	11.92	5.	2.	2.	.04		
HYDROGRAPH AT	WP6	25.	12.08	2.	0.	0.	.00		
ROUTED TO	WP7	18.	12.42	2.	0.	0.	.00		
2 COMBINED AT	WP7	31.	11.92	6.	2.	2.	.04		
DIVERSION TO	WP7D	11.	11.92	1.	0.	0.	.04		
HYDROGRAPH AT	WP7	20.	11.92	5.	2.	2.	.04		
ROUTED TO	V7	20.	11.92	5.	2.	2.	.04		
HYDROGRAPH AT	PEAV19	31.	11.83	4.	2.	1.	.04		

2 COMBINED AT	V7	50.	11.83	9.	4.	3.	.08		
ROUTED TO	H7	46.	12.00	9.	4.	3.	.08		
HYDROGRAPH AT	PEAV20	60.	12.17	15.	6.	6.	.12		
2 COMBINED AT	H7	99.	12.08	24.	10.	9.	.20		
ROUTED TO	H7	79.	12.42	24.	10.	9.	.20	92.63	12.42
ROUTED TO	M4	75.	13.08	24.	11.	11.	.20		
HYDROGRAPH AT	LEM4	225.	13.25	113.	45.	44.	1.13		
4 COMBINED AT	M4	1066.	13.08	534.	363.	360.	3.17		
ROUTED TO	LAKE	881.	15.00	531.	358.	354.	3.17		
HYDROGRAPH AT	LEM7	90.	14.08	61.	27.	26.	1.08		
5 COMBINED AT	LAKE	1937.	14.92	1160.	613.	604.	9.71		
HYDROGRAPH AT	POE1	872.	12.83	344.	133.	129.	2.52		
HYDROGRAPH AT	WP7	11.	11.92	1.	0.	0.	.00		
ROUTED TO	WP8	9.	12.00	1.	0.	0.	.00		
2 COMBINED AT	WP8	873.	12.83	345.	134.	129.	2.52		
ROUTED TO	WP8	864.	12.92	311.	129.	125.	2.52	49.19	12.92
DIVERSION TO	WP8D	213.	12.92	69.	17.	17.	2.52		
HYDROGRAPH AT	WP8	651.	12.92	242.	112.	108.	2.52		
ROUTED TO	V8	648.	13.00	242.	112.	108.	2.52		
HYDROGRAPH AT	POE2	32.	11.92	5.	2.	2.	.05		
2 COMBINED AT	V8	651.	13.00	244.	114.	110.	2.57		
ROUTED TO	V8	535.	13.42	234.	112.	109.	2.57	98.45	13.42
ROUTED TO	H8	508.	13.58	234.	111.	108.	2.57		
HYDROGRAPH AT	POE3	63.	12.00	13.	5.	5.	.11		
2 COMBINED AT	H8	515.	13.58	240.	116.	113.	2.68		
ROUTED TO	H8	467.	13.75	240.	116.	114.	2.68	109.92	13.75
ROUTED TO	L1	428.	14.17	239.	116.	117.	2.68		
HYDROGRAPH AT	POE4	41.	11.92	6.	3.	2.	.07		
ROUTED TO	H9	35.	.08	6.	4.	3.	.07	114.00	.00
ROUTED TO	L1	35.	.08	6.	4.	4.	.07		

HYDROGRAPH AT	WP8	213.	12.92	69.	17.	17.	.00		
ROUTED TO	WP9	208.	13.17	69.	17.	17.	.00		
HYDROGRAPH AT	POE5	78.	11.92	12.	5.	4.	.09		
2 COMBINED AT	WP9	214.	13.17	81.	22.	21.	.09		
ROUTED TO	WP9	148.	13.83	76.	26.	25.	.09	38.49	13.83
DIVERSION TO	WP9D	80.	13.83	18.	5.	4.	.09		
HYDROGRAPH AT	WP9	67.	13.83	58.	22.	21.	.09		
ROUTED TO	V9	67.	13.92	58.	22.	21.	.09		
HYDROGRAPH AT	POE6	44.	11.83	7.	3.	3.	.07		
2 COMBINED AT	V9	80.	11.92	63.	24.	24.	.16		
ROUTED TO	V9	70.	11.83	63.	24.	24.	.16	65.72	14.58
ROUTED TO	H10	70.	14.75	63.	24.	24.	.16		
HYDROGRAPH AT	POE7	63.	11.92	10.	4.	4.	.10		
2 COMBINED AT	H10	126.	11.92	72.	28.	28.	.26		
ROUTED TO	L1	113.	12.33	72.	28.	28.	.26		
HYDROGRAPH AT	WP9	80.	13.83	18.	5.	4.	.00		
ROUTED TO	WP10	78.	14.00	18.	5.	4.	.00		
HYDROGRAPH AT	RAL1	481.	12.33	136.	53.	51.	1.00		
2 COMBINED AT	WP10	481.	12.33	155.	58.	56.	1.00		
DIVERSION TO	WP10D	247.	12.33	77.	19.	18.	1.00		
HYDROGRAPH AT	WP10	234.	12.33	78.	38.	37.	1.00		
ROUTED TO	V10	229.	12.50	78.	38.	37.	1.00		
HYDROGRAPH AT	RAL2	46.	11.83	7.	3.	3.	.07		
2 COMBINED AT	V10	237.	12.42	85.	41.	40.	1.07		
ROUTED TO	V10	122.	12.92	84.	43.	42.	1.07	81.99	12.92
DIVERSION TO	V10D	0.	12.92	0.	0.	0.	1.07		
HYDROGRAPH AT	V10	122.	12.92	84.	43.	42.	1.07		
ROUTED TO	H11	122.	13.00	84.	43.	42.	1.07		
HYDROGRAPH AT	RAL3	82.	11.83	11.	5.	5.	.08		
2 COMBINED AT	H11	151.	11.92	95.	47.	46.	1.15		

ROUTED TO	L1	125.	13.75	94.	47.	46.	1.15		
HYDROGRAPH AT	RAL4	88.	11.92	14.	5.	5.	.12		
HYDROGRAPH AT	WP10	247.	12.33	77.	19.	18.	.00		
ROUTED TO	WP11	244.	12.58	77.	19.	18.	.00		
2 COMBINED AT	WP11	262.	12.50	90.	24.	24.	.12		
ROUTED TO	WP11	204.	13.08	85.	24.	23.	.12	110.63	13.08
DIVERSION TO	WP11D	132.	13.08	22.	6.	5.	.12		
HYDROGRAPH AT	WP11	72.	13.08	63.	19.	18.	.12		
ROUTED TO	V11	72.	13.17	63.	19.	18.	.12		
HYDROGRAPH AT	RAL5	30.	11.83	4.	2.	2.	.04		
HYDROGRAPH AT	V10	0.	.08	0.	0.	0.	.00		
ROUTED TO	V11	0.	.08	0.	0.	0.	.00		
3 COMBINED AT	V11	74.	13.08	66.	21.	20.	.16		
DIVERSION TO	V11D	1.	13.08	0.	0.	0.	.16		
HYDROGRAPH AT	V11	73.	13.08	66.	20.	20.	.16		
ROUTED TO	H12	73.	13.17	66.	20.	20.	.16		
HYDROGRAPH AT	RAL6	106.	11.92	17.	7.	7.	.14		
2 COMBINED AT	H12	161.	11.92	81.	27.	26.	.30		
HYDROGRAPH AT	RAL7	103.	12.08	22.	9.	8.	.20		
HYDROGRAPH AT	WP11	132.	13.08	22.	6.	5.	.00		
ROUTED TO	WP12	127.	13.33	22.	6.	5.	.00		
2 COMBINED AT	WP12	143.	13.25	44.	14.	14.	.20		
DIVERSION TO	WP12D	97.	13.25	16.	4.	4.	.20		
HYDROGRAPH AT	WP12	46.	13.25	28.	10.	10.	.20		
ROUTED TO	V12	46.	13.33	28.	10.	10.	.20		
HYDROGRAPH AT	RAL8	29.	11.83	4.	1.	1.	.03		
HYDROGRAPH AT	V11	1.	13.08	0.	0.	0.	.00		
ROUTED TO	V12	1.	13.25	0.	0.	0.	.00		
3 COMBINED AT	V12	70.	11.83	31.	11.	11.	.23		
ROUTED TO	H12	69.	11.92	31.	11.	11.	.23		

HYDROGRAPH AT	RAL9	160.	11.92	26.	11.	10.	.17			
HYDROGRAPH AT	WP12	97.	13.25	16.	4.	4.	.00			
ROUTED TO	WP13	95.	13.42	16.	4.	4.	.00			
2 COMBINED AT	WP13	188.	12.00	42.	15.	14.	.17			
ROUTED TO	WP13	51.	13.83	41.	15.	14.	.17	76.69	13.83
ROUTED TO	V13	51.	13.92	41.	15.	14.	.17		
HYDROGRAPH AT	RAL10	14.	11.75	1.	1.	1.	.01		
2 COMBINED AT	V13	52.	13.92	43.	15.	15.	.18		
ROUTED TO	H12	52.	14.00	43.	15.	15.	.18		
3 COMBINED AT	H12	272.	11.92	155.	54.	52.	.71		
ROUTED TO	L1	219.	12.83	154.	54.	52.	.71		
HYDROGRAPH AT	RAL11	86.	11.83	11.	4.	4.	.08		
ROUTED TO	H13	52.	12.75	11.	4.	4.	.08		
HYDROGRAPH AT	GOLD1	715.	13.67	417.	177.	171.	4.55		
7 COMBINED AT	L1	1477.	14.08	984.	428.	422.	9.50		
DIVERSION TO	L1D	727.	12.50	257.	64.	62.	9.50		
HYDROGRAPH AT	L1	750.	12.50	727.	363.	360.	9.50		
HYDROGRAPH AT	GOLD2	14.	11.75	2.	1.	1.	.02		
2 COMBINED AT	L2	751.	12.50	728.	364.	361.	9.52		
DIVERSION TO	L2D	301.	12.17	278.	76.	73.	9.52		
HYDROGRAPH AT	L2	450.	12.17	450.	288.	288.	9.52		
HYDROGRAPH AT	GOLD3	65.	12.08	15.	6.	6.	.19		
2 COMBINED AT	L3	512.	12.17	462.	294.	293.	9.71		
DIVERSION TO	L3D	62.	12.08	12.	4.	4.	9.71		
HYDROGRAPH AT	L3	450.	12.08	450.	290.	290.	9.71		
HYDROGRAPH AT	GOLD4	19.	11.83	3.	1.	1.	.03		
2 COMBINED AT	L4	461.	12.08	452.	292.	291.	9.74		
DIVERSION TO	L4D	0.	12.08	0.	0.	0.	9.74		
HYDROGRAPH AT	L4	461.	12.08	452.	292.	291.	9.74		
HYDROGRAPH AT	GOLD5	117.	12.25	30.	13.	13.	.36		

2 COMBINED AT	L5	575.	12.17	480.	305.	304.	10.10
DIVERSION TO	L5D	125.	11.92	30.	9.	9.	10.10
HYDROGRAPH AT	L5	450.	11.92	450.	296.	295.	10.10
HYDROGRAPH AT	GOLD6	201.	12.58	71.	29.	29.	.93
HYDROGRAPH AT	GOLD7	39.	12.08	9.	4.	3.	.13
3 COMBINED AT	L6	670.	12.50	529.	329.	327.	11.16
DIVERSION TO	L6D	0.	12.50	0.	0.	0.	11.16
HYDROGRAPH AT	L6	670.	12.50	529.	329.	327.	11.16
HYDROGRAPH AT	L1	727.	14.08	257.	64.	62.	.00
ROUTED TO	L7	677.	14.42	257.	64.	62.	.00
HYDROGRAPH AT	L2	301.	12.50	278.	76.	73.	.00
ROUTED TO	L7	301.	16.33	274.	76.	73.	.00
HYDROGRAPH AT	L3	62.	12.17	12.	4.	4.	.00
ROUTED TO	L7	52.	12.33	12.	4.	4.	.00
HYDROGRAPH AT	LEM5	52.	12.92	23.	9.	9.	.28
ROUTED TO	L7	48.	13.75	23.	9.	9.	.28
HYDROGRAPH AT	LEM6	24.	14.33	18.	8.	8.	.39
5 COMBINED AT	L7	1046.	14.42	581.	161.	155.	.67
ROUTED TO	LAKE	898.	15.83	563.	160.	154.	.67
HYDROGRAPH AT	LEM8	113.	13.83	68.	31.	30.	.69
3 COMBINED AT	LAKE	1446.	15.75	1112.	520.	512.	12.52
2 COMBINED AT	LAKE	3250.	15.08	2271.	1133.	1116.	22.23

*** NORMAL END OF HEC-1 ***