FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
PHOENIX, ARIZONA

FOUNTAIN HILLS NORTH FLOODPLAIN DELINEATION STUDY

FCD 92-04

TECHNICAL DATA NOTEBOOK HYDROLOGY

Existing Condition

Book 1 of 3

George V. Sabol Consulting Engineers, Inc.

Scottsdale, Arizona

OCTOBER 1994

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PHOENIX, ARIZONA

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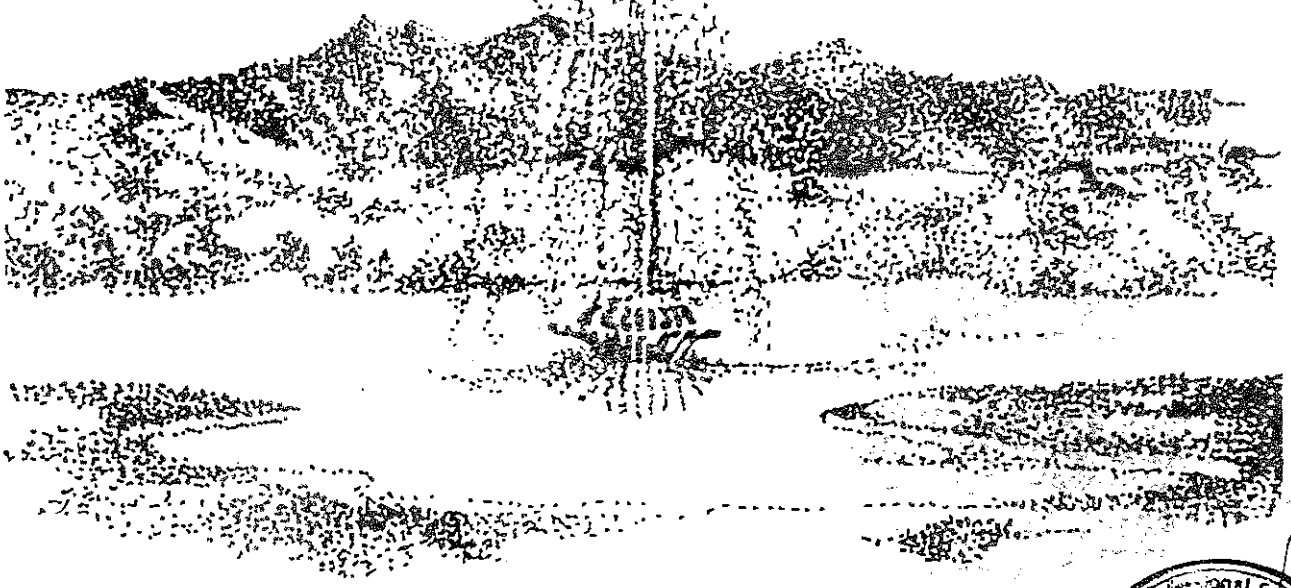
FOUNTAIN HILLS NORTH FLOODPLAIN DELINEATION STUDY

FCD 92-04

TECHNICAL DATA NOTEBOOK HYDROLOGY

Existing Condition

Book 1 of 3



George V. Sabol Consulting Engineers, Inc.

Scottsdale, Arizona

OCTOBER 1994

Registered Professional Engineer (Civil)
CERTIFICATE NO.
12739
THOMAS R.
LOOMIS
Date Signed 10/10/94
ARIZONA, U.S.A.

PREFACE

The Fountain Hills North Floodplain Delineation Study (Contract No. FCD 92-04) was performed for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602)506-1501 FAX (602)506-4601

Floodplain Management Branch
Branch Manager: Mr. Pedro Calza
Project Manager: Mr. Timothy M. Murphy

Watershed Management Branch
Branch Manager: Mr. Amir Motamedi
Project Manager: Ms. Sandy Story

By:

George V. Sabol Consulting Engineers, Inc.
7950 E. Acoma Dr, Suite 211
Scottsdale, Arizona 85260-6962
(602)483-3368
FAX (602)483-3990

Project Manager: George V. Sabol, PhD, PE
Project Engineer: Mr. Thomas R. Loomis, PE, RLS

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B Flow Split Hydraulic Calculations
C Reach Route Cross Section Plots
D 100-Year, 6-Hour Storm Existing Condition HEC-1 Output
E 100-Year, 24-Hour Storm Existing Condition HEC-1 Output

Registered Professional Engineer (Civil)
CERTIFICATE NO.
12739
THOMAS R.
LOOMIS
Date Signed 10/10/94
ARIZONA, U.S.A.

LIST OF EXHIBITS
Book 3 OF 3

A Drainage Basin Map and Sheet Index for Exhibit D
B Hydrology soils map
C Hydrology land use map
D Hydrology subbasin, time of concentration and flood routing map
E HEC-1 Routing Diagram

INTRODUCTION

The following report is a comprehensive document which contains the results and supporting computations for the hydrology portion of the Fountain Hills (North) Floodplain Delineation Study located in Maricopa County, Arizona. Our sincere appreciation is extended to the following agencies for their help and perspective while studying this watershed:

- Arizona Department of Water Resources
- Arizona State Land Department
- Flood Control District of Maricopa County
- Maricopa County Department of Transportation
- Maricopa County Parks and Recreation Department
- Town of Fountain Hills.

The purpose of this study is to provide estimates of peak discharges from the 100-year storm at key locations on the watershed. Those discharges are then used to estimate the horizontal limits of flooding in designated study reaches, and to define floodway limits. The study was ordered by the Flood Control District of Maricopa County (District). The hydraulics portion of this study is contained under separate cover. The hydrology portion of this study is done using the methodology contained in the Drainage Design Manual for Maricopa County, Arizona (Design Manual) [6.5:11], prepared by the Special Projects Branch, Hydrology Division, of the District. Hydrologic modeling is accomplished using the US Army Corps of Engineers (COE) HEC-1 computer program [6.5:8]. There are no existing floodplains in the study area which have been defined in previous studies by the Federal Emergency Management Agency (FEMA). The hydraulics portion of this study defines floodplains and floodways on the following washes:

Arrow Wash	Ashbrook Wash
Balboa Wash	Caliente Wash
Escalante Wash	Hesperus Wash
Legend Wash	Oxford Wash
Tulip Wash.	

The study limits for each wash are identified in Exhibit A.

Special problems which were encountered are flow splits caused by physical obstructions to flow as a result of urbanization. There are five significant flood retarding structures existing on the watershed. Those structures cause significant attenuation of peak discharges from the upper watershed and required special attention in the modeling effort. The only significant hydrology study of record for the watershed is the study done by Trico, Inc. [6.6:] for the design of those structures.

The study watershed is approximately 16.5 square miles in area. Refer to Exhibit A. The Town of Fountain Hills is a small community with a population of approximately 20,000 people. The historical flooding problems have thus far been minor. The community has only been in existence since the early 1970's, and because of the arid desert environment, has not experienced many significant rainfall events. Flooding consists of street flooding at wash crossings and the potential for flooding of homes situated near the major watercourses. Drainage channels in the area are well defined and typically have significant hydraulic capacity. Existing flood protection measures are the five major flood retarding structures and a policy of protection of the existing pre-development drainage channels. The typical rainfall cycle consists of short duration, high intensity thunder storms during the summer months, and general storms of longer duration during the winter months. Refer to the hydraulics report for a Community fact sheet.

STUDY DOCUMENTATION ABSTRACT							
INITIAL STUDY	X	RESTUDY		LOMR		OTHER	

SECTION 1: GENERAL INFORMATION

1A	COMMUNITY	Town of Fountain Hills
1B	COMMUNITY NUMBER	
1C	COUNTY	Maricopa
1D	STATE	Arizona
1E	DATE STUDY ACCEPTED	
1F	STUDY CONTRACTOR	George V. Sabol Consulting Engineers, Inc.
	CONTACTS	Thomas R. Loomis, PE, RLS George V. Sabol, PhD, PE
	ADDRESS	7950 E. Acoma Dr, Suite 211 Scottsdale, Arizona 85260-6962
	PHONE	(602)483-3368 (602)483-3990(FAX)
	SUBCONSULTANTS	McLaughlin Kmetty Engineers, Ltd.
1G	TECH. REVIEWER (FEMA)	
	PHONE	
1H	FEMA REGIONAL REVIEWER	
	PHONE	
1I	STATE REVIEWER	Arizona Department of Water Resources
	PHONE	
1J	LOCAL REVIEWER	Flood Control District of Maricopa County Mrs. Sandra Story, Mr. Tim Murphy
	PHONE	(602)506-1501
1K	RIVER OR STREAM NAME	Ashbrook Wash and tributaries, misc.
1L	REACH DESCRIPTION	Refer to Exhibit A
1M	STUDY TYPE	Floodplain/Floodway Delineations

SECTION 2: MAPPING INFORMATION

2A	USGS QUAD SHEETS	Granite Reef Dam
		McDowell Peak
		Sawik Mountain
		Fort McDowell
2B	MAPPING FOR HYDROLOGIC STUDY TYPE/SOURCE	2-foot contour interval in ACAD Format Flood Control District of Maricopa County
	SCALE	1 inch = 200 feet
	DATE	August 1991
2C	MAPPING FOR HYDRAULIC STUDY TYPE/SOURCE	Same as 2B
	SCALE	
	DATE	

SECTION 3: HYDROLOGY

3A	MODEL OR METHOD USED (Including vendor and version description)	HEC-1 version 4.0.1E dated May 1991 Dodson & Associates, Inc.
3B	STORM DURATION	6-hour, 24-hour
3C	HYETOGRAPH TYPE	In accordance with Design Manual
3D	FREQUENCIES DETERMINED	100-year
3E	LIST OF GAGES USED IN FREQUENCY ANALYSIS OR CALIBRATION (Location, Years of Record, Gage Ownership)	None available.
3F	RAINFALL AMOUNTS AND REFERENCE	100-year, 6-hour = 3.3 inches 100-year, 24-hour = 4.2 inches NOAA Atlas II
3G	UNIQUE CONDITIONS AND PROBLEMS	5 Flood Retarding Structures Flow diversions
3H	COORDINATION OF Q'S (Agency, date, comments)	

STUDY DOCUMENTATION ABSTRACT (continued)		

SECTION 4: HYDRAULICS

4A	MODEL OR METHOD USED (including vendor and version description)	HEC-2 version 4.6.2 dated May 1991 Dodson & Associates, Inc.
4B	REGIME	Subcritical, with supercritical reaches
4C	FREQUENCIES FOR WHICH PROFILES WERE COMPUTED	100-year
4D	METHOD OF FLOODWAY CALCULATION	Method 1
4E	UNIQUE CONDITIONS AND PROBLEMS	Flow splits at some streets. Some buildings in Zone X.

George V. Sabol Consulting Engineers, Inc.

TELEPHONE LOG

PROJECT: 35 **TO/FROM:** Gary Finnie

DATE: 16 Dec 93 **ORGANIZATION:** Kenny Aerial Mappings

TOPICS: Extended Cross Section GR Data for HEC-2

CITY: **PHONE NO.:** 258-6471

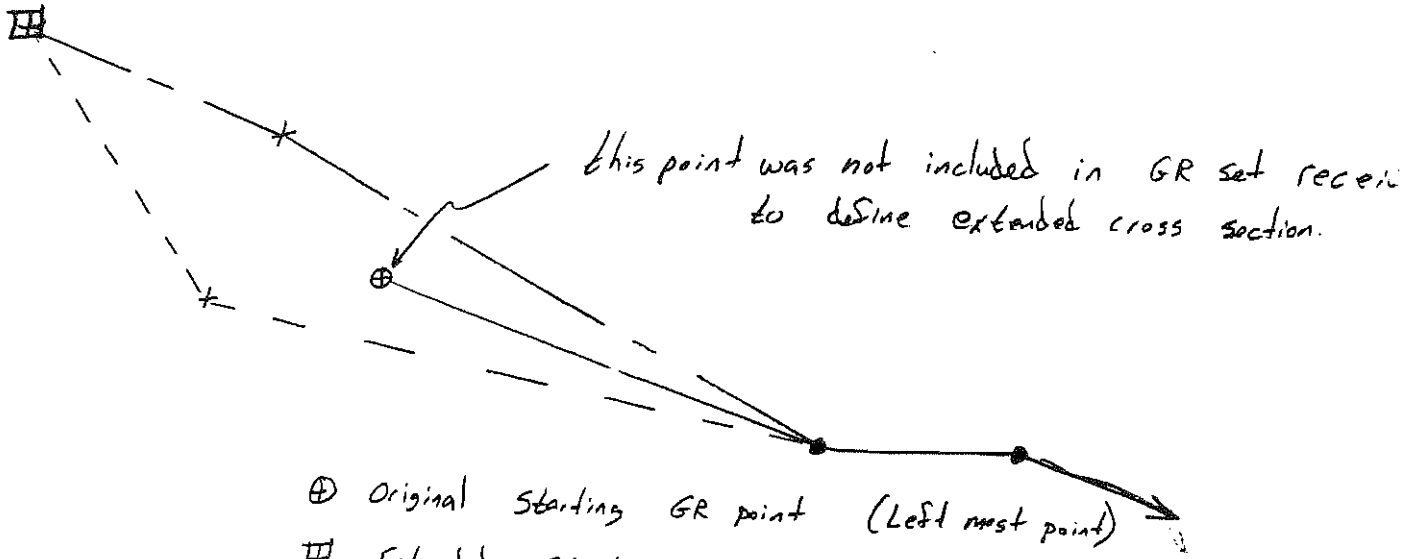
ITEMS DISCUSSED:

Deletion of 1st GR point from previous GR set when extending cross section (See back for better explaniation)

Garry said " they didn't Doubble up on points and there shouldn't be overlap" infering we may need to edit the new GR set: add the point they left out.

Appearantly their software reads points moving in one direction only. Thus the operator may have intentionally left a gap ie told machine to start at specified elevation an continue Reading data untill it is close to orriginal first GR point.

FURTHER ACTIONS REQUIRED: Do not edit GR set - Kenny supplied us with a section that is supposed to physically represent the ground at each cross section location.



⊕ Original Starting GR point (Left most point)

⊞ Extended Starting GR point

● Points common to both GR sets

MKE McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 2-4-94 TIME: 10:25 AM JOB NO. F Hills

TO: F Brown LOCATION:

FROM: T. Rooms LOCATION:

SUBJECT/DISCUSSION:

has mapping ready - on disks - MKE wants load input plot w/ X-S. use for plot HEC-2 f.plains
redo / redo as affects the f.p. lines

SUMMARY/ACTION ITEMS: 1. Tom will mail disks with new topo, MKE is to plot ASAP for GVS to continue its check of new mapping. I promised a draftsman would be available to do the work

COPY TO:

George V. Sabol Consulting Engineers, Inc.

TELEPHONE LOG RECEIVED MAR 29 1994

PROJECT: Etn. Hills ~~TO~~/FROM: Tim Murphy

DATE: 21 March 94 (approx.) ORGANIZATION: FCDMC

TOPICS: mapping

CITY: PHONE NO.:

ITEMS DISCUSSED: Kenney Aerial Mapping (KAM) is going to revise the strip maps (again) because of the problem with the contour lines along the trim lines. (The contours do not match the contours for the large area maps. The error is beyond the fuzzy tolerance limits for convergence of the 2 files.) We discussed this and agreed that we will use the strip map files that were merged into the work sheet drawings by MKE. (I did not want to re-do those work sheets because of the problems that MKE had in producing those sheets.) The work sheet maps will have notes indicating the inaccuracy of the contours near the trim lines. The report will also address this issue. The revised strip maps will be provided to us (by the District) and these will be merged into the area maps, and then these merged files will undergo GIS conversion.

FURTHER ACTIONS REQUIRED:

Copy - Geza Kmetty, MKE
Lari Spire, GCA

G V Sabol
28 March 94

Note: This needs to be documented in the next Progress Report to the District.

George V. Sabol Consulting Engineers, Inc.

TELEPHONE LOG

PROJECT: 35 Fountain Hills

TO/FROM: Hal Marron

DATE: 1/6/93 11:45

ORGANIZATION:

TOPICS: Mapping

CITY: Phx.

PHONE NO.: 244-2566

ITEMS DISCUSSED: Told Hal about the mapping problems I have encountered so far. We also discussed coordination of hydrology parameters; we agreed on the following:

Major Basins will be numbered (AGK = 100-199)
(GVS = 200-299)

Minor Basins will be letters.

Concentration points will be numbered: (AGK = 1-499)
(GVS = 500-999).

Start numbering at the top of a watershed.

FURTHER ACTIONS REQUIRED: Get together on zoning names and the common watershed boundary.

George V. Sabol Consulting Engineers, Inc.

TELEPHONE LOG

PROJECT: 35 Fountain Hills

TO/FROM: Tim Murphy

DATE: 1/6/93 11:29

ORGANIZATION: FCD

TOPICS: Mapping

CITY: Phx

PHONE NO.: 506-1501

ITEMS DISCUSSED: I let Tim know that the mapping does not match along the sheet boundaries. The problem appears to be random. The worst spot is between sections 8 and 5. He will try to verify this on their system. I also asked for a Results of Survey map or report that details the location of control points and section corners.

FURTHER ACTIONS REQUIRED:

George V. Sabol Consulting Engineers, Inc.

Memo To File

~~TELEPHONE LOG~~

PROJECT: 35 Fountain Hills

TO/FROM: File

DATE: 1/6/93

ORGANIZATION:

TOPICS:

CITY:

PHONE NO.:

ITEMS DISCUSSED: I met with Randy Harrel at Fountain Hills yesterday, while researching the Town records. We discussed the proposed Sunridge Canyon development, and how to model it for the future condition. This project will encompass approximately 1000 acres. The average density will be one unit per acre. Since the density will vary at any given area, and we don't know what the development plan will be, we agreed to use a low density residential classification. The RTIMP parameter is to be used.

Tom Morris

FURTHER ACTIONS REQUIRED: Implement in future condition model.

George V. Sabol Consulting Engineers, Inc.

TELEPHONE LOG

PROJECT: 35 Fountain Hills

TO/FROM: File

DATE: 3/10/93

ORGANIZATION: GVSCE

TOPICS: Field Trip on 3/8/93

CITY:

PHONE NO.:

ITEMS DISCUSSED: George and I visited all 5 dams the morning of 3/8/93. We placed painted lath at high water lines on both the upstream and downstream sides of each dam. Richard Alvocer is to obtain elevations at these locations, and a cross section on the downstream side. I did not mark a downstream location at Dam #6.

We identified high water marks in the principal spillways of Dams 7 and 11 at the outlet ends. The depth from flowline was measured:

Dam #7: 37.8" = 3.15'

Dam #11: 25" and 35.4" = 2.08' & 2.95'

Tom Jones

FURTHER ACTIONS REQUIRED:

MKE

McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 5-3-93 TIME: 8:40 Am JOB NO. Fountain Hills
TO: Tim Murphy LOCATION: FCD of MC
FROM: Frank Brown LOCATION: MKE

SUBJECT/DISCUSSION:
Arrow Wash & Cavern - Randy to take a look, Tim to call on Mon PM. OK for Randy interested on upstream side of road. - @ 3 locations

SUMMARY/ACTION ITEMS: 1. Tim will call Randy Horrell on 5-3-93 afternoon to see if Randy had a chance to look at Arrow Wash and Cavern Drive. Leave it in report as not to be modeled until I hear how to change it.

2. Add cross sections to upstream side of road for 3 locations
a. Arrow Wash at Cavern Drive
b. Tulip Wash at Boulder Drive
c. Caliente Wash at McDowell Mtn Road.

COPY TO:

MKE **McLaughlin Kmetty Engineers, Ltd.**

TELEPHONE COMMUNICATION REPORT

Ftn Hills

DATE: 6-9-93 TIME: 8:25 AM msg JOB NO.

TO: Hal Marron LOCATION: Willdan Assoc. (formerly w/ AGK)

FROM: Frank Brown LOCATION: MKE

SUBJECT/DISCUSSION:

1. Does Fig A4-3 from FEMA 37 apply to the Ftn Hills Study?

Summary of discussion I had with Hal:

1. Fig A4-3 - Hal has KAM get the break points and then he checks it against the verification cross-sections. If the section is wrong vertically then it won't matter if there are lots of data pts. Cross-sections are considered as spot elevations with XYZ coords.
We meet those specs because FCD uses 2' CI for work maps, and 4' CI for final maps.

His contract with Kenney References FEMA 37 and they won't be paid within 30 days.

2. Hal's bigger concern is the mapping - his personal opinion is the mapping is not good enough. Cited 4' difference at culverts between ground survey and aerial survey.
Says control should be at 1000' from ctrl point, actual is >600'

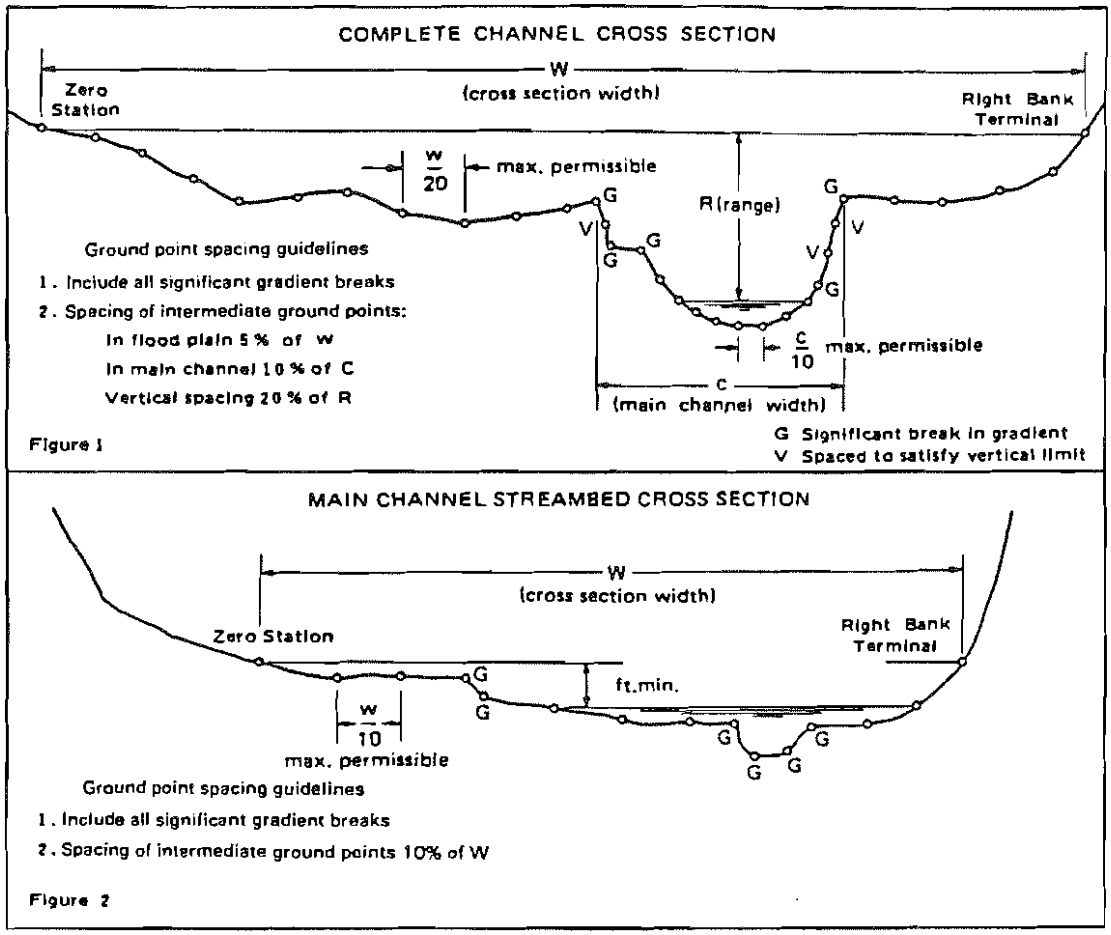
SUMMARY/ACTION ITEMS: I discussed above with my client GVS, Tom Loomis: 1. Tom says to proceed first with the same scale plot of the verification cross-sections, but don't send anyone home if cross-section plots can be done.

2. Tom's opinion is the mapping is OK and some field survey will be needed, like along Ashbrook (due to all the vegetation).

We decided not to send a FAX of Fig A4-3 to Ellis Hyde.

COPY TO:

FIGURE A4-3.
EXAMPLES OF CROSS SECTION GROUND POINT SPACING



MKE

McLaughlin Knetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 7-15-93 TIME: 8:30-8:50 JOB NO. Fth Hills
TO: Tom Lomis LOCATION: GVS Scottsdale
FROM: F. Brown LOCATION: MKE Phx

SUBJECT/DISCUSSION:
1. need AutoCad from KAM still - revised x-s locations
2. He will modify us the KAM check sec - AutoCad file.
3. revise 2A x-s after get item 1.

DTP 8:55 -

1. Item 5 below discussed.
2. Also ALS needs change 110 culvert pipe 2-54" CMP's. one was squished on side. Was 2-60".

SUMMARY/ACTION ITEMS: 1. Kenney will deliver here the revised AutoCad file.

2. GVS will modify the KAM check sections on AutoCad file

3. Wait for ALS rewritten survey notes to plot the ALS chk sections will be Monday at the latest.

4. FB to revise Tabulating + x-s orientation on Zapata

5. Found ALS road-crossing field notes. Need to make sure if -0.18 was done or not. Was to have done on Monday Tues found has nothing to do. No sloppy notes - needs all Benchmarks.

COPY TO: Write in Philly or Leader rod. call first before FAX first. this second priority - 1st priority is chk sections. I gave a note to Richard Alcocer on these items.

MKE

McLaughlin Knetly Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 7-19-93 TIME: 3PM JOB NO. Fm Hills
TO: F Brown LOCATION: MKE
FROM: T. Loomis LOCATION: GVS

SUBJECT/DISCUSSION:

move 3 X-S down to where mapping is
move AS 76 that way, Tom needs new length
from Conc. Points ~~the path~~ + Routing Path (two
different lengths) Tc Path ends @ conc, breaks off +
goes with alignment

Did Dave give out trimmed ~~[illegible]~~ topo? (NO)
GCA has translated all topo

move X-S inside if yes. by phone to KAM topo changed
we forgot to move X-S
they should've told me earlier.

SUMMARY/ACTION ITEMS: 1. Cross Section AS 76 was revised to match edge of mapping. I will call KAM to explain. KAM will get a new disk with those revisions. AS 76 AR 3, AR 4 (extended due to digitizing error)

2. The trimmed topo was given to GCA

3. Dave Bottler to develop the new TC Path and Routing Path lengths to give to Tom + David.

COPY TO:

MKE McLaughlin Knetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 7-20-93 TIME: 2:15 PM JOB NO. Fountain Hills

TO: Tim Murphy LOCATION: FCDMC

FROM: E. Brown LOCATION: MKE

SUBJECT/DISCUSSION:

1. Flow rates are required to be placed on the floodplain maps for Fountain Hills. The reason is that flow rates will probably change quickly on some washes, so this would be helpful information to appear on the floodplain maps.

2. Tim will send samples to me.

SUMMARY/ACTION ITEMS: 1. When double-checking the floodplain maps, ensure that the flow rate appears.

2. See samples to be mailed.

COPY TO: Tom Loomis

MKE McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 7-22-93 TIME: 2:15PM JOB NO. Fth Hills

TO: Tim Murphy LOCATION: FCDMC

FROM: F Brown LOCATION: MKE

SUBJECT/DISCUSSION: 1. Difference between actual low-point and thalweg per HEC-2 AutoCad file

Tim does not think it'll be too big of a deal. Would like to look at.

n value report - Randy Harnell has looked at, has had no comments. Tim has now forwarded to AGK as a sample of an acceptable n value study.

SUMMARY/ACTION ITEMS:

COPY TO:

MKE McLaughlin Kmetty Engineers, Ltd

TELEPHONE COMMUNICATION REPORT

DATE: 4-7-93 TIME: 11:45 AM JOB NO. Fth Hills
TO: Tim Murphy LOCATION: FCDMC
FROM: Frank Brown LOCATION: MKE

SUBJECT/DISCUSSION: Setting Back Stations

Told him set low

Tim has had many set low per elevation - not unusual

Says back sts could be looked at individually - I said

ET's individual so he agreed won't need to

Tim says this is common, probably will not have to revise

because this sounds OK to him. He was aware of back

station setting when we were in the field.

SUMMARY/ACTION ITEMS: 1. I called Tom Loomis - explained the above notes to him, & that is ok with Tom.

COPY TO:

MEMORANDUM

To: Meeting No. 6 Attendees:
Tim Murphy, PE, FCDMC
Sandy Story, FCDMC
Randy Harrel, PE, Town of Fountain Hills
Tom Ward, Town of Fountain Hills
Frank Brown, MKE

From: T.R. Loomis, GVSCE

Subject: Fountain Hills North Floodplain Delineation Study

Date: 12 September 1994

Meeting Notes for Meeting No. 6

The meeting commenced at 2:30 pm at the Town of Fountain Hills in Mr. Harrel's office. The purpose of the meeting was to present the work study floodplain maps to the Town of Fountain Hills for discussion. The hydrology exhibits and HEC-1 summary tables were also given to the Town. There was no agenda for this meeting.

These notes are our understanding of the major items of interest that were discussed at the meeting. Please inform GVSCE if corrections or additions are appropriate. The following are the items discussed:

1. Each floodplain and potential problem area was discussed to the satisfaction of Mr. Harrel.

2. Oxford Wash downstream of Fountain Hills Boulevard: The condominium/townhome residents still desire the footbridge across the wash. Since it would be in the floodplain, it is not recommended.

3. There are no structures within the preliminary 100-year floodplain.

4. Mr. Harrel, the FEMA Floodplain Administrator for the Town of Fountain Hills, agrees that the floodway should be set at the floodplain, except for those areas listed in action item 1 below.

5. It is acceptable for future projects to use the Letter of Map Revision (LOMR) process to add floodways, if a floodway is desired.

6. Proposed culverts for Ashbrook Wash at Fountain Hills Boulevard: It is the District's intention that Stanley Consultants submit the revised HEC-2 analysis and revised floodplain prior to FEMA submittal. This current Flood Delineation Study is unaffected by the proposed culverts.

7. The Town's goal is to protect structures from the ultimate (future conditions) 100-year flow rate. The ultimate flow rate is approximately 30% higher than that used for the Flood Delineation Study.

The meeting adjourned at 5:15 p.m.

The following is a list of action items that GVSCE/MKE are to address:

1. Investigate floodways at:
   a. AR: Fountain Hills Blvd. to 0.338 to 0.441 (Sheet 9). (This is a reservoir storage area.) Reason: New plat "Tolopaya".
   b. AS: 3.554 on left side.
   c. AR: Mountainside Drive to 0.645 (Sheet 8).
   d. AR: Mimosa Drive to 0.756 (Sheet 8).
   e. BA & HE: 2.238 to 2.332 (Sheet 3). Reason: New homes with walk-out basements currently here.
   f. OX: 0.235 to 0.397 (Sheet 6). Property owners asking for fence permits.

2. Check culvert overtopping at BA & HE 2.198 (Boulder Drive, Sheet 3). It was verified by the Town that this culvert has been overtopped once in the past by a very significant debris blocking problem. Culvert was 70% blocked by debris.

3. Verify berm is high enough: At Fire Station (Sheet 1, AS Wash). Verify that the berm is high enough to force flow back to street low point. Zone A is currently proposed here; Plat 516 subdivision is proposed in this location. Note that an asphalt speed bump has been added here for flood protection.

4. Remove Zone A, use Zone AE for street flooding for Caliente Wash at EL Pueblo Blvd (Sheet 7).

5. a. AS Wash at Dam 4: A new chain link fence has been added in emergency spillway. Per Tim Murphy, try a HEC-1 reservoir route with no emergency spillway flows (100% blockage on fence) and report to Tim Murphy the new water surface elevation.

   b. AS Wash at Dam 4: Revise the Zone A limits to match curved brick wall. (Tom Loomis to check new topography, provide to MKE and decide if it should be placed into floodplain maps.)

6. Add Zone X on AS Wash, right side, Saguaro Blvd. to Bayfield Drive (Sheet 9). Keep Zone A for street flow on Hamilton Drive.

7. Send Randy Harrel a copy of other communities' building set back requirements---Yavapai County, Pima County. There are no set backs currently set by the Town for buildings near washes. (This may be an ADMS action item.)

8. Reduce line thickness for thalwegs - it is too similar to floodplain line.

9. Per prior discussion with Tim Murphy, use dashed line where floodway = floodplain.

10. AS Wash at Dam 4: (Sheet 5). Where AS floodplain extends through the Cloudburst Culvert and the Bristol Wash Culvert under Golden Eagle Blvd., stop at road and state, "Limit of Study".

MEMORANDUM

To: Meeting No. 5 Attendees:
Tim Murphy, PE, FCDMC
Sandy Story, FCDMC
Frank Brown, MKE

From: T.R. Loomis, GVSCE

Subject: Fountain Hills North Floodplain Delineation Study
Contract 92-04

Date: 12 September 1994

Meeting Notes for Meeting No. 5

The meeting commenced at 11:00 am within the Fountain Hills North study area on 6 September 1994. Several areas were checked in order to verify the preliminary work study floodplain maps. Photographs were taken at most of these areas.

These notes are our understanding of the items of interest that were reviewed at this meeting. Please inform GVSCE if corrections or additions are appropriate. The following are the items discussed. A list of action items follows the meeting minutes for Meeting Number 6 which occurred immediately after this meeting.

1. Caliente Wash at El Pueblo Boulevard (Sheet 7): see Action Item 4.

2. Ashbrook Wash downstream of EL Pueblo Boulevard (Sheet 10): The fill added last year appears to be stable, while it is noted that significant runoff has not occurred since placement.

3. Ashbrook Wash at Bayfield Drive (Sheet 9): see Action Item 6.

4. Arrow Wash at Arrow Drive (Sheet 9): See Action Item 11.

5. Arrow Wash at Fountain Hills Boulevard: The Zone A for street flow is appropriate.

6. Ashbrook Wash at Cross-Section 2.200, Lot 25 on Aloe Drive Cul-de-Sac (Sheet 10): The flow depth is 4.8 feet. An informal survey performed using a hand level and tape measure shows the flood plain to be accurate. The finished floor of the adjacent house appears to be above the floodplain.

7. Balboa/Hesperus Wash and Oxford Wash at Fountain Hills Boulevard: See Action Item 13.

8. Ashbrook Wash at Golden Eagle Boulevard: The berm appears to be high enough to force the street overflow back to the street low point. Also see Action Item 3.

9. Ashbrook Wash at Dam 4: See Action Item 5.

The field review was completed at 2:30 p.m.

MEMORANDUM

To: Meeting No. 4 Attendees:
Tim Murphy, PE, FCDMC
Jan Opstein, FCDMC
Frank Brown, MKE
Thomas R. Loomis, PE, GVSCE

From: T.R. Loomis, GVSCE Tom Loomis

Subject: Fountain Hills North Floodplain Delineation Study
Contract 92-04

Date: 7 September 1994

Meeting Notes for Meeting No. 4

The meeting commenced at 9:30 am at the Flood Control District of Maricopa County on 31 August 1994. The meeting was held to discuss the District's review comments on the 100-year floodplain delineation maps and HEC-2 models. There was no agenda for this meeting.

These notes are our understanding of the major items of interest that were discussed at the meeting. Please inform GVSCE if corrections or additions are appropriate. The following notes are organized according to the District's review comments:

General Comments

1. The mapped floodplain limits frequently do not match the HEC-2 output because of the difference in accuracy between the mapping and the photogrammetrically digitized cross sections used in the HEC-2 models. It was agreed that a general note would be added to the report and each HEC-2 file. The floodplain limits are plotted on the study work maps using the contours.

2. It was agreed to add a general comment to the T records regarding storm duration. Comment records where the discharge is changed in the Ashbrook Wash file should reflect the storm duration since the 6-hour storm does not control for all of Ashbrook Wash.

3. An appropriate comment will be added.

4. This will be done.

5. The section lines and corners will be added. One-quarter corners are not available.

6. A general comment at the start of each file is sufficient except for any special uses.

7. This will be done.

8. The bank stations were set at the channel bottom on each side of the culvert inlet or outlet. These locations differ from the locations originally set in the n-value report. NH records are therefore necessary to define the changes in roughness previously defined by the bank stations and a standard NC record.

Ashbrook Wash

1. See note 1 under General Comments.

2. It was agreed to setup a field reconnaissance meeting to examine this area and others.

3. It was agreed to check the upstream and downstream cross sections and discuss this area with Randy Harrel.

4. There is a number transposition here. It will be corrected.

Arrow Wash

1. Flow does overtop Mountain Side Drive. This will be shown and labeled Zone AE (typical for shallow flow overtopping a road).

Balboa/Hesperus Wash

1. Comment cards will be added stating why the floodway limits are set at the floodplain limits.

2. This will be done.

3. This will be verified. It appears to be ineffective area.

Caliente Wash

1. See note 1 of General Notes.

2. This will be done.

Legend/Tulip Wash

1. The line appears to be one of the old mapping stream lines. It will be removed.

Oxford Wash

1. Zone A will be used.

Notes on other items of discussion are:

1. Ashbrook section AS 1.636. The reason the thalweg station is not set at 10000 is because the town placed fill in the left overbank after the photo date of the mapping. The cross section was subsequently field surveyed but the thalweg and contours on the study work maps do not reflect the fill. Comment records will be added to describe this.

2. Designate the impoundment areas upstream of the Dams and road ponding areas with an AE zone.

3. A meeting will be held with Randy Harrel to discuss the zone designation for the Dam 4 spillway and the left overbank of Ashbrook Wash downstream of Golden Eagle Boulevard. Other items of discussion will include setting the floodway limits at the floodplain limits for most wash reaches.

4. The contour lines on the study work maps are fuzzy. A different screen should be used.

5. Add HEC-2 thalwegs to the small sheet index schematic on each sheet, with stream labels if readable.

6. Add comment cards regarding the three cross sections used to start the Ashbrook Wash HEC-2 model.

7. Tom Loomis is to review the revised topography of the Dam 4 spillway area.

8. Revise Ashbrook Wash AS 5.563 BT records and add comment cards.

9. Setup a field reconnaissance meeting for the week of September 5.

10. Add a text label to the existing dirt road shown on sheet 4.

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

TO: MEETING NO. 1 ATTENDEES

TIM MURPHY
Flood Control District
of Maricopa County (FCDMC)

SANDY STORY
FCDMC

GEORGE V. SABOL
George V. Sabol Consulting
Engineers (GVSCE)

TOM LOOMIS
GVSCE

GEZA E. KMETTY
McLaughlin Kmetty Engineers (MKE)

FRANK EDWARD BROWN
MKE

FROM: TOM LOOMIS
Project Engineer
GVSCE

DATE: 11 December, 1992

SUBJECT: Fountain Hills Floodplain Delineation Study (North)
Contract FCD 92-04

RECORDER: George Sabol/Tom Loomis Tom Loomis

Meeting Notes for Meeting No. 1

1. The meeting commenced at 10:30 at the GVSCE/MKE office on 10 December 1992. In attendance were:

   Mr. Tim Murphy, FCDMC
   Ms. Sandy Story, FCDMC
   Dr. George V. Sabol, GVSCE
   Mr. Thomas R. Loomis, GVSCE
   Mr. David T. Phelps, GVSCE
   Mr. Geza E. Kmetty, MKE
   Mr. Frank Brown, MKE

   The FCDMC and GVSCE agendae are shown in Attachment A.

   The following is our understanding of the major items of interest that were discussed at the meeting. Please inform GVSCE if corrections or additions are appropriate.

2. George Sabol provided opening comments and an introduction of David Phelps to Tim Murphy and Sandy Story.

3. Tim Murphy explained that he is the Project Manager, and as such, all official communication on the project to the District will be directed to Tim. Sandy

Story will be providing hydrologic review. Advising and technical issues concerning hydrology should be addressed to Sandy directly. Tim will be providing hydraulic review. Advising and technical issues concerning hydraulics should be addressed to Tim.

4. Tom Loomis provided a report of the activities that will be undertaken over the next one to two month time period. He used a project bar chart for that purpose.

5. A copy of the project schedule bar chart will be revised to agree with the start of project date (8 December 1992). A copy of that chart (on 8½" x 11" paper) will be provided to the District within two weeks.

6. Meeting No. 2 will be a field trip. That meeting will be scheduled at the appropriate time.

7. Meeting No. 3 will be held in about 2 months for the purpose of reviewing subbasin delineation.

8. Tom Loomis provided an update of the offsite map that was prepared by GCA. This map may be used by the District at the Public Meeting.

9. Tim Murphy provided an update of the onsite mapping that is being provided by the Town of Fountain Hills. The mapping is being prepared by Kenney Aerial Mapping Company for Anderson-Nelson under contract to the Town of Fountain Hills. The completed mapping is to be delivered by Kenney Aerial Mapping Company to Anderson-Nelson today (10 December 1992). Tim Murphy will provide the data files and sets of map reproducibles on mylar and a print of the maps to GVSCE next week. Tom Loomis requested a list of map symbols. Tim responded that the list is supposed to be on the data files. Tom described that mapping (ground survey by GVSCE) of the high school and Club Mirage areas will be prepared and spliced into the onsite maps. A map symbol line will be used to depict the limits of map revision for those two areas. George Sabol noted that any problem areas with the onsite maps, if any, that are discovered in using those maps for this project will be conveyed to the District for resolution.

10. Tim Murphy stated that the first Public Meeting will be 17 December 1992, from 5:00 p.m. to 8:00 p.m. A copy of the meeting announcement is shown in Attachment B. The District will be represented by Tim Murphy, Sandy Story, and Jim Phipps. Tom Loomis will attend the meeting but is not expected to make a presentation. Geza Kmetty will attend, if his schedule permits.

11. Tim Murphy provided an example of a legal advertisement (Attachment C). This is to be placed in the Fountain Hills and Arizona Republic newspapers. The consultant is to proceed with that advertisement.

12. Tim Murphy provided an example of a Rights of Entry letter (Attachment D). This is to be sent to any property owners that may be significantly affected by entry for surveying. Tim noted that the high school, Club Mirage, and MCO Properties should receive the letters. Frank Brown will work with Richard Alcocer, the project surveyor, to identify property owners that should receive the letter.

13. Tim Murphy provided copies of three progress reports that can be used as examples (Attachment E). The progress report (1 copy) is to be sent to Tim and received at least 5 days prior to the monthly invoice.

14, Tim Murphy provided a copy of an example invoice (Attachment F). Charges will be shown for each major task heading and for the prime consultant and subcontractor. Invoices are to be addressed to Tim but mailed to the attention of Ms. Terri Bolligar, Account Receivable at the District.

15. Tim Murphy provided a reference list for the consultant's information (Attachment G).

16. Tim Murphy noted that a new FEMA checklist for floodplain delineation submittals dated October 1992 will be provided by the District when they become available.

17. Tim Murphy provided an example of an excellent data summary report (Attachment G).

18. Tim Murphy noted that ADWR is to be informed of progress with this study because of the floodplain delineation and the dam safety considerations. There should be appropriate communication with David Creighton (floodplain) and Bill Jenkins (dam safety). Formal submittals, if any, to ADWR will be by the District.

19. Tom Loomis will borrow full size prints of engineering plans for the dams from ADWR. These will be delivered to the District and the District will provide copies of those plans for the consultant's use.

20. Tom Loomis will arrange a meeting with ADWR. Tim Murphy requested that he be notified so that he can attend.

21. The meeting adjourned at 11:30.

FCD 92-04
FOUNTAIN HILLS NORTH
FLOODPLAIN DELINEATION STUDY
KICKOFF MEETING

December 14, 1992

AGENDA

✓1. Personnel Assignments
✓2. Monthly Report — Address to Tim M. (1 copy)
✓3. Billing Procedure — Address to Tim M., 2 copies Terry
✓4. Newspaper Ad
✓5. Right of Entry Letter
✓6. Publications current List
✓7. FEMA Checklist 10/92 date on list. Provided by District
✓8. Bar Chart (Project Schedule)
✓9. Mapping
✓10. Public Meeting
11. ADWR Sub-Basin (Prelim.) submit to ADWR.

Rights of Entry: Club Mirage.
High School
Chuck sections

Tim to go meet with ADWR on Dana.
Check out plans of structures.
District to reproduce.

MEETING NO. 1
ATTACHMENT A

GVSCE

MEETING AGENDA

Meeting:	Number 1
Project:	Fountain Hills (North) Floodplain Delineation Study
Date:	December 10, 1992
Time:	10:30 a.m.
Location:	Office of George V. Sabol Consulting Engineers

Time	Duration (Min.)	Topic	Presenter
10:30	5	Introduction, Opening Comments	Dr. Sabol
10:35	15	Project Schedule, Months 1 and 2	Tom Loomis
10:50	5	Mapping Status Update, Offsite Discuss Patching in Topo	Tom Loomis
10:55	10	Mapping Status, Onsite	Tim Murphy
11:05	15	Procedures Public Meeting Monthly Progress Reports Legal Advertisement Rights of Entry	Tim Murphy
11:20	10	Miscellaneous HNTB High School Grading Plan Open Discussion	Tim Murphy
11:30	5	Closing Remarks	Dr. Sabol
11:35		Adjourn	

92491-00\12-10Agn.035

MEETING No. 1
ATTACHMENT A

FLOOD CONTROL DIST. CT
of
Maricopa County
2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TDD (602) 506-5897

BOARD OF DIRECTORS
P. Ben Arredondo
Betsey Bayless
James D. Bruner
Carole Carpenter
Tom Freestone

Flood Control District

FOUNTAIN HILLS FLOODPLAIN DELINEATION STUDY

An open house to inform Fountain Hills residents of floodplain delineation studies being performed in the Town by the Flood Control District of Maricopa County will be conducted from 5 - 8 p.m., Thursday, December 17, 1992, in the Town Hall Conference Room, 16836 E. Palisades.

The public is invited to come by the Town Hall anytime between the hours of 5 - 8 p.m. to meet with District representatives to discuss the study.

A total of 39 linear miles of washes within the Town will be studied over the next 12 months. The study will involve mapping and hydraulic analysis of the washes and the delineation of the 100-year floodplain.

Technical and other information relevant to the study will be accepted for review and consideration during the study. Such information should be submitted to Mr. Tim Murphy, Flood Control District of Maricopa County, 2801 West Durango Street, Phoenix, Arizona, 85009, telephone 602-506-1501.

MEETING NO. 1
ATTACHMENT B

OCT 2 3 1992
CH. HILL/PHOENIX

TOTAL PRICE: $26.51

ISSUED TO: AFFIDAVIT OF PUBLICATION
CH2M Hill

STATE OF ARIZONA

County of Maricopa

Kevin Cloe, being duly sworn, upon oath, deposes and says: That he is the Publisher of

The Wickenburg Sun

A newspaper of general circulation in the County of Maricopa, State of Arizona, published in Wickenburg, Arizona, and that the copy hereto attached is a true copy of the advertisement as published weekly in The Wickenburg Sun on the dates following:
October 14 and 21, 1992

KEVIN CLOE
PUBLISHER

Sworn to before me this 21st day of

October A.D. 19 92

Notary Public

OFFICIAL SEAL
BRENDA M. FORNOFF
NOTARY PUBLIC - ARIZONA
MARICOPA COUNTY
My Comm. Expires April 15, 1994

MEETING NO. 1
ATTACHMENT C

PUBLIC NOTICE - Your Right To Know

ANNOUNCEMENT OF FLOOD HAZARD STUDY.
The Flood Control District of Maricopa County, under authority of the National Flood Insurance Act of 1968 (P.L. 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L. 93-234), is funding a detailed study of flood havard areas in western Maricopa County as follows: [illegible] Iona Wash from the confluence with Trilby Wash, T4N, R3W, Section 25 to State Route 89 (Grand Avenue) in T6N, R5W, Section 29. [illegible]
The study is being performed for the Flood Control District by CH2M HILL of Tempe, Arizona.
The purpose of this study is to examine and evaluate flood hazard areas which are developed or which are likely to be developed and to determine flood elevations for those areas. Flood elevations will be used by Maricopa County to carry out floodplain management objectives of the National Flood Insurance Program. They will also be used as the basis for determining appropriate flood insurance premium rates applicable for buildings and their contents.
This announcement is intended to notify all interested persons of the commencement of this study so that they may have an opportunity to bring any relevant facts and technical data concerning local flood hazards to the attention of the Flood Control District for consideration in the course of this study. Such information should be addressed to Mr. Pedro Calza or Ms. Sandy Story, Flood Control District of Maricopa County, 2801 W. Durango Street, Phoenix, AZ 85009, telephone (602) 506-1501 for CH2M HILL'S use in performing the study.

Published in The Wickenburg Sun on October 14 and 21, 1992.

MKE ASAP 2°

McLaughlin Kmetty Engineers, Ltd.

3030 North Central Avenue, Suite 402 Phoenix, Arizona 85012 (602) 248-7702 FAX (602) 248-7951

September 27, 1991

Club Mirage + High School reg'd don't really do many homes. Do still point for survey. Talk w/ Tim on this.

GEZA E. KMETTY
RONALD C. McLAUGHLIN
HALFORD E. ERICKSON
DOUGLAS T. SOVERN
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON
DONALD L. ZIEMEA

Eddie Miller
12000 W. Northern
Peoria, AZ 85345

Parcel No.: 401-11-035

Re: Right of entry for surveying purposes

Dear Property Owners:

The Flood Control District of Maricopa County has contracted with McLaughlin Kmetty Engineers, Ltd., to perform a flood insurance study for the Buckeye Area. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcels of land within the limits of the study area.

The intent of this letter is to notify you of the commencement of surveying activities in support of the above mentioned study. In order to perform these surveys it may be necessary to enter your property. This activity should not result in any inconvenience or damage to property. If you have any objections to the entry onto your property, you must notify Mr. Tim Murphy of the Flood Control District at 262-1501. Otherwise it will be assumed that you consent to the entry onto your property.

The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revisions of Flood Insurance Rate Maps. This study should be available to the public in about 12 to 18 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Mr. Tim Murphy of the Flood Control District or Mr. Geza Kmetty of McLaughlin Kmetty Engineers.

Mr. Tim Murphy, Hydrologist, Flood Control District, (602) 262-1501.

Mr. Geza Kmetty, Principal, McLaughlin Kmetty Engineers, Ltd. (602) 248-7702.

Geza E. Kmetty, P.E.
Principal

MEETING NO. 1
ATTACHMENT D

89407-00\Entry.002

BURGESS & NIPLE

ENGINEERS
ARCHITECTS

Ms. Leanna Cumberland
Flood Control District
of Maricopa County
3335 West Durango
Phoenix, AZ 85009

Re: FCD 90-67 Gila Bend Area

October 25, 1991

Dear Ms. Cumberland:

Burgess & Niple, Inc.
5025 East Washington Street
Suite 212
Phoenix, AZ 85034
602 244-8100
Fax 602 244-1915

Progress on the Gila Bend FIS through September 28, 1991 includes:

- Data Collection: Public notice, collection of data, and preparation of a schedule. Activity 90% complete.
- Mapping: Area flown, photomylars (Exhibit 2) made, proceeding on 1" = 200' scale mapping. Activity 80% complete.
- Hydrology: Preliminary subbasins and soils delineated and digitized, field investigation and parameter estimation nearly completed. Activity 25% complete.
- Ground Survey: Activity 100% complete.
- Coordination 10% complete. Met with District and ADWR.

Should you have any questions, please call.

Very truly yours,

BURGESS & NIPLE, INC.

James E Mischler

James E. Mischler, P.E.
Project Manager

JEM:pr

FLOOD CONTROL DISTRICT
RECEIVED
OCT

RECEIVED
OCT 28 1991

MEETING NO. 1
ATTACHMENT E

HNTB HOWARD NEEDLES TAMMEN & BERGE OFF
ARCHITECTS ENGINEERS PLANNERS
Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

March 12, 1992

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

RECEIVED
MAR 17 1992

FLOOD CONTROL DIS... RECEIVED MAR 17 1992

In Account With

HOWARD NEELDLES TAMMEN & BERGENDOFF

Invoice No. #6-15081-11

RE: Professional Services Rendered Regarding:
Deadman Wash Flood Insurance Study
FCD 90-65

Task	% Complete	Contract Amount	Previous Earnings	Current Earnings	Total
Data Collection	100%	4,044.00			
Topographic Mapping	84%	30,200.00			
Hydrology	75%	30,666.00			
Field Surveys	99%	45,050.00			
Floodplain & Floodway Delin.	30%	31,257.00			
GIS Preparation	55%	15,358.00			
Coordination & Study Mgmt.	68%	14,325.00			
	73%	170,900.00			

MEETING NO. 1
ATTACHMENT F

ADD
1. EXPENSES
2. SUBS.

Invoice Summary:

Total Earned this Period	
Amount Previously Earned	
Total Earned to Date	
Less: 10% Retention	(
Previously Invoiced	(
Amount Due This Invoice	$

Partners Charles T. Hennigan PE, Daniel J. Salgar PE, John L. Cassan PE, Robert S. Como PE, Donald A. Dubies PE, James L. Tuttle, Jr. PE, Hugh E. Sims PE, Gary C. Goodman AIA, Gordon H. Haney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Goodbrod PE, John W. Wight, Jr. PE, Richard C. Backman PE, Richard L. Ramsey AIA, Douglas S. Prescott PE, Donald L. Hartle PE
Associates Kendall T. Lindsin CPA, Roberta W. Sinclair PE, Harry D. Bentzoss PE, Robin E. Rodeck PE, Walter Shonka PE, Kevin T. Lynch PE, [illegible] PE, Wayne Baker PE, Blake W. Carmena PE, Michael R. Ingordia PE, Bernard L. Prince PE, Stephen B. Quinn PE, Saul A. [illegible] PE, Ewing [illegible] AIA, Douglas C. Moore PE, Carl J. Meiss PE, Carol F. Becker PE, Donald P. Kaup PE, Thomas L. Williams AIA, John E. Kuzke PE, Robert F. Pirtu PE, Steven V. Ross AIA, Robert A. [illegible] PE, Gerald D. Sautbeer PE, Benjamin A. Whisler PE, Roger S. Austin PE, John D. Brockway PE, Charles L. Dilk [illegible] PE, Robert V. Sauer PE, Douglas A. Duvu AIA, Raymond J. McCoop PE, Thomas A. Skinner PE, Raul A. Yordasi PE, F. Christopher Clinging AIA, A. A. [illegible] PE, [illegible] AIA, James T. Kelly AIA, Terry K. Miller AIA, Roger C. Ward PE, Maurice C. Miller PE, Robert L. Wagoner AIA, James R. [illegible] PE, Robert A. Diaz PE, Bahram [illegible] PE
Offices Atlanta, GA, Atlanta, GA, Boston, MA, Chattanooga, TN, Chicago, IL, Cleveland, OH, Dallas, TX, Denver, CO, Fort [illegible]

HNTB HOWARD NEEDLES TAMMEN & BERGEDOFF
ARCHITECTS ENGINEERS PLANNERS
Two Renaissance Square
Suite 1100
40 North Central
Phoenix, Arizona 85004
(602) 528-4300

FLOOD CONTROL DISTRICT
RECEIVED
NOV 26 1991
CH ENG | P & FM
DCP | HYDRO
ADMIN | LMGT
FINANCE | FILE
D & C | 1 | 7 AM
PERS
RETURN
AM

November 25, 1991

Mr. Timothy M. Murphy
Project Manager
FLOOD CONTROL DISTRICT OF
MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

RE: Contract FCD 90-65
Deadman Wash Flood Insurance Study
Monthly Progress Report

Dear Mr. Murphy:

1. In this letter, we are reporting progress on the Deadman Wash Flood Insurance Study through November 25, 1991.

2. Our estimated percentage completion by task is as follows:

Data Collection	90%
Topographic Mapping	27%
Hydrology	14%
Field Survey	89%
Floodplain and Floodway Delineation	0%
GIS Preparation	18%
Coordination and Study Management	38%
Total Study	38%

3. Progress on individual tasks is outlined below:

a. Data Collection

(1) During the past month, we have collected the following items:

(a) The floodplain mapping of New River from the confluence with Deadman Wash to I-17.

(b) A LOTUS 123 spreadsheet program for calculation of subbasin loss parameters.

(2) We are in the process of obtaining from the FCDMC a copy of the Manning's "n" value determination report by the USGS.

b. Topographic Mapping. Final field control values have been delivered to Aerial Mapping Company (AMCI), and analytical aerotriangulation has been completed. The results of the

MEETING NO. 1
ATTACHMENT E

Partners Charles T. Henrigan PE, Daniel J. Spiegel PE, John L. Dobson PE, Robert S. Coma PE, Donald A. Dukes PE, James L. Tuttle, Jr. PE, Hugh B. Scholl PE, Gary C. Gossman AIA, Gordon H. Slaney, Jr. PE, Harvey K. Hammond, Jr. PE, Stephen G. Gobbato PE, John W. Nightingale PE, Richard D. Beckman PE, Richard L. Fannon AIA, Douglas E. Prescott PE, Ronald L. Hartle PE
Associates Kenneth T. Lincoln CPA, Roberta W. Simonsen PE, Harry C. Bartosek PE, Roger E. Robson PE, Walter Shanks PE, Frank T. Lamm PE, H. Jerome Butler PE, Blaise M. Carrera PE, Michael P. Ingoglia PE, Bernard L. Rinne PE, Stephen B. Quinn PE, Saul A. Jaegers PE, Bruce H. Miller FAIA, Douglas C. Moore PE, Carl L. Vega PE, Carole F. Becker PE, Donald P. Kautz PE, Thomas L. Williams AIA, John E. Hudson PE, Rodney P. Reis PE, Steven M. Reiss AIA, Robert A. Leick PE, Clyde D. Bazzell PE, Benjamin A. Wilson PE, Roger S. Austin PE, John C. Brockway PE, Charles L. O'Reilly, Jr. PE, Robert N. Brown PE, Douglas A. Bates AIA, Raymond J. McCabe PE, Thomas A. Bruner PE, Earl A. Hansen PE, F. Christopher Dunne AE&A AICP, Richard W. Blanking AIA, James T. Kirkham AIA, Terry K. Mann AIA, Robert C. Alvord PE, Maurice D. Vivian PE, Robert L. Wilson AIA, James P. Ritz PE, Robert A. Drake PE, Beth Harmon Anderson PE
Offices Anchorage AK, Atlanta GA, Baton Rouge LA, Boston MA, Chicago IL, Cleveland OH, Columbia SC, Dallas TX, Denver CO, Fairfax VA

analytics were within acceptable limits. Mapping layout has been completed. Mapping is being performed first for the south end of the project area and will be delivered as soon as it is completed.

c. Hydrology.

(1) We submitted the preliminary drainage area delineation map to FCDMC for review on October 31.

(2) We are in the process of completing a draft precipitation calculation summary.

d. Field Survey.

(1) All control work for aerial mapping has been completed.

(2) All level work for Elevation Reference Marks (ERMs) is complete.

e. Floodplain and Floodway Delineation. No work has been accomplished to date.

f. GIS Preparation. No additional work was completed during the report period. Final soils ARC/INFO coverage coding will be accomplished when watershed boundaries are approved.

g. Coordination and Study Management.

(1) Routine coordination activities have continued.

(2) Additional questions raised by property owners are being responded to as they arise.

(3) A progress meeting was held on October 31 and the next meeting is scheduled for November 27.

4. Please call me if you have any questions or need additional information.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF

Richard M. Wells, P.E.
Project Manager

15081.13
RMW/kjt

A+

FLOOD INSURANCE STUDY
for
THE BUCKEYE AREA
FCD CONTRACT NO. 90-69

SUMMARY REPORT FOR
PHASE I, TASK 1 DATA COLLECTION

As part of the Scope of Work for the Flood Insurance Study for the Buckeye Area, data collection was performed. Appropriate reference sources were consulted in order to obtain the results of previous studies and other data to supplement study area understanding. The following is a brief summary of that information.

Summary of Data Collection

1. Soil Conservation Service:

   a. Watershed Work Plan, Buckeye Watershed, Maricopa County, Arizona, October 1963, with Supplemental Watershed Work Plan Agreement No. 1, 1972. This SCS watershed workplan report for the Buckeye watershed contained some useful historic information. It indicated that damages from stormwater runoff, to some degree, occurred approximately once every three years. The effect of a 1951 storm was discussed. The objective of the report was to provide the preliminary justification and analysis for construction of the Buckeye Flood Retarding Structures.

   b. Buckeye Watershed, Study of Emergency Spillway Adequacy As Related to Dam Safety Examination (Site 1), December 1979. A complete copy of the text and calculations was obtained. The cover sheet of the TR-20 computer output was photocopied. The main results of this report were incorporated into the FCDMC Buckeye FRS Dam Break Study (Items 11A and 11B)

   c. Other SCS Documents: The FRS Record Drawings were obtained from FCDMC. The complete SCS file was reviewed. For the most part, no other documentation was photocopied as it generally dealt with runoff coming into the FRS. Some portions of these files were copied: A map showing Structures I, II and III; a letter referencing 1970 aerial photographs; and a watershed boundary map.

MEETING NO. 1
ATTACHMENT G

The available final hydrology report and Record Drawings ("As Builts") for the Buckeye Flood Retarding Structures prepared by the SCS indicate that the structures will contain runoff from the 100-year event, and direct this runoff to the Hassayampa River and not to the Study Area.

2. Arizona Department of Transportation:

   a. Record Drawings (As-Builts) for Interstate 10 from the Hassayampa River to Dean Road. These drawings show culvert locations, Design flow rate (Q_{50}) at each culvert and the design headwater.

   b. The Hydrology Reports for I-10 were not obtained due to the flow rate information contained in the Record Drawings.

3. FCDMC Hydrology Study for the White Tanks ADMS, prepared by WLB Group, will be reviewed at the offices of the District.

4. & 5. Design and Operations Information on the Roosevelt Canal. A map of the Roosevelt Canal shows storm sewer entering the canal, stormwater siphons under the canal and stormwater inlet points. Mr. Gary Colvin, Manger, was contacted.

Design and Operations Information on the Buckeye Canal. A map of the Buckeye Canal shows storm sewer entering the canal, stormwater siphons under the canal and stormwater inlet points. Mr. Stan Ashby, Manager, was contacted.

The design and operation of the Roosevelt Canal and the Buckeye Canal was obtained from these maps and conversations with the Irrigation District managers. The Roosevelt Irrigation District (RID) and Buckeye Irrigations (BID) cover approximately 38,000 and 18,000 acres, respectively. The major crops are cotton and alfalfa. The Buckeye Canal conveys 350 cfs under normal operations. At any one time approximately 85% of the total acreage is under irrigation. The RID is entirely supplied by groundwater and the BID gets some from the Gila River and groundwater.

6. A meeting is planned for sometime in October, 1991, with Mr. Fred Carpenter, Town of Buckeye Manager, and Mr. Greg Schuelke, Town of Buckeye Engineer.

7. Bond copies of the USGS topographic maps, at 1:24,000 scale. These maps are presently not available in GIS format.

8. Aerial Photographs, from Landiscor, at 1:14,400 scale. Photographs taken March 31, 1991 (current publication) were reviewed. For hydrologic purposes, little change has occurred in the study area, thus photos taken February 22, 1990 (last year's publication) will be utilized for the hydrology.

9. SCS Soil Survey of Maricopa County Central Part, September 1977. The 1:20,000 maps were reduced to 1:24,000 for overlay use with the watershed map. There are approximately 30 different soil symbols in the study area.

10. FCDMC Flooding Reports. The Flood Control District has gathered newspaper articles and photos of past flooding events throughout the County. A review of this valuable information includes articles from the Buckeye town paper discussing flooding that occurred along the Gila River. The most significant flooding event in the study area happened on August 15, 1990. Information gathered by the FCDMC indicates that most of the damage from this event took place along Dean Road at the RID Canal. Flood waters were restricted by improvements to Dean Road and resulted in the overtopping of the RID Canal. A number of claims for damages were filed against the MCHD by local residents.

11. a. Phase I Report Hydrologic Analysis, Buckeye Floodwater Retarding Structures #1, #2, and #3 for Flood Control District of Maricopa County, FCD Project 88-63, prepared by Dames & Moore, January 23, 1990. This report states that each Flood Retarding Structure (FRS) is capable of fully detaining the 100-year runoff. Information concerning the Probable Maximum Precipitation (PMP) and resulting Probable Maximum Flood (PMF) are presented.

    b. Phase II Report, Volume I, Dam-Break Analysis, Buckeye Floodwater Retarding Structure #1, #2 and #3, for the Flood Control District of Maricopa County, FCD Project 86-63, prepared by Dames & Moore, June 28, 1990.

    Discussions of seepage-induced breaches of the FRS embankments during a PMP event conclude there are probably no embankment sections more susceptible to

a breach than another. A similar conclusion is reached for PMF overtopping failure. There is every indication that the Buckeye FRS would operate as designed during the 100-year event. The information on PMF inundation downstream of the FRS does not apply to this Buckeye Area Flood Insurance Study.

12. A separate hydrology report for the Hassayampa River was apparently not prepared as that information is contained in the Maricopa County Flood Insurance Study. An attempt will be made to obtain the following reference to verify this: Cella Barr Associates, 1975, FEMA Flood Insurance Re-Study of Maricopa County, Hassayampa River, Phoenix, Arizona.

13. Flood Insurance Study, Flood Boundary and Floodway Maps, and Flood Insurance Rate Maps for Maricopa County, Unincorporated and Incorporated Areas, Revised September 4, 1991.

    The most recent FEMA publication of an FIS for Maricopa County is dated September 4, 1991. An approximate study using TR-55 designated several Zone A areas along the north sides of the Roosevelt and Buckeye Canals. The following FIRM panels cover the study area: 2000, 2015, 2025, 2040, 2050, 2485, 2480, and 2505.

14. Mr. Harry Millsaps, Hydraulic Engineer, Soil Conservation Service. Mr. Millsaps was made aware on September 11, 1991, that MKE is performing a Buckeye Area FIS. He provided access to SCS's file on the Buckeye FRS.

15. Mr. Dave Creighton, Project Engineer, Flood Management, Arizona Department of Water Resources. A meeting was held with Mr. Creighton on September 26, 1991. Separately published meeting minute notes were sent to FCDMC.

DISTRICT PUBLICATIONS

Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology, June 1, 1992

Drainage Design Manual for Maricopa County, Arizona: Volume II - Hydraulics, September 1, 1992

Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991

Data Delivery Specifications: The Hydrologic Information System (HIS), Revision 01.1

FEMA PUBLICATIONS

FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, March 1991

FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, January 1990

ADWR PUBLICATIONS

State Standard Attachment 1-90, Instructions for Organizing and Submitting Technical Documentation for Flood Studies, September 1991

MEETING NO. 1
ATTACHMENT G

Onsite Maps

Kenny - to Anderson-Nelson today
maps - mylar & paper copy to GVSCE
mapping problems identified to FCD
TRL - requested list of map symbols
Tim - next week delivery to GVSCE

Public Meeting - 17 Dec. 5:00 - 8:00
TRL will be there
Geya may attend

Legal Ad - example from Tim to Frank
ad will Ftn. Hills + Republic papers
proceed w/ this.

Rights of Entry
FEB will work w/ ALS to identify
Tim → letters to Club Mirage & High school
whatever we feel is significant → from Tim

Progress Reports
Tim provided examples
(1) copy
addressed to Tim

Bills (2) copies
Terri Bolligar
addressed to Tim

Publication list from Tim

FEMA checklist
Oct 1992 → will be provided by District

Data summary example from Tim (Buckeye)

ADWR
↳ FCD can submit directly to FEMA
dam safety considerations
FCD will submit any ~~submitta~~ info. to ADWR
coord w/ Bill Jenkins
Dave Creighton
informal work w/ ADWR
formal submittal by FCD

~~Tim will provide copies of~~

TRL will get full size copies of dam
to FCD → copies back to us

TRL coord ADWR meeting w/ Tim ↳ wants to go

DISTRICT PUBLICATIONS

Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology, June 1, 1992

Drainage Design Manual for Maricopa County, Arizona: Volume II - Hydraulics, September 1, 1992

Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991

Data Delivery Specifications: The Hydrologic Information System (HIS), Revision 01.1

FEMA PUBLICATIONS

FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, March 1991

FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, January 1990

ADWR PUBLICATIONS

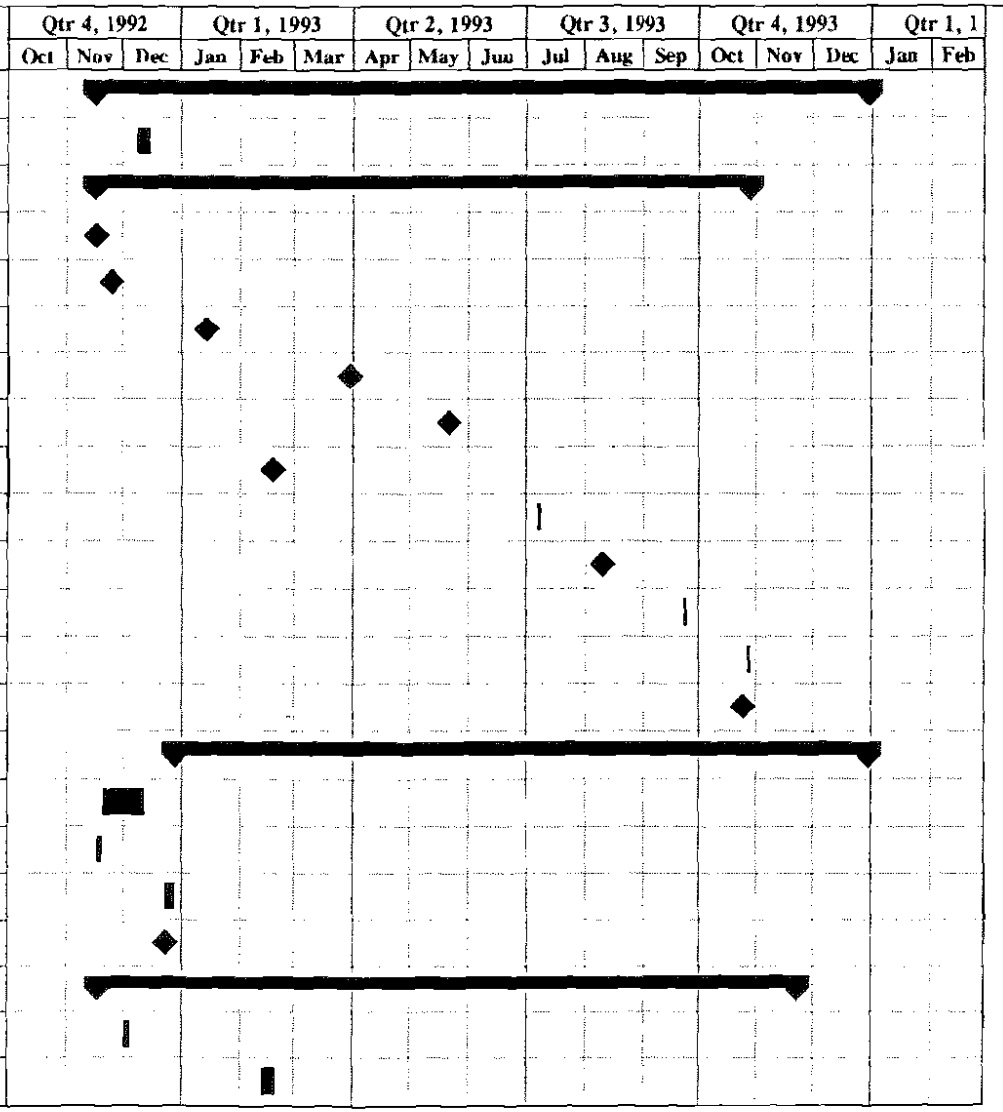
State Standard Attachment 1-90, Instructions for Organizing and Submitting Technical Documentation for Flood Studies, September 1991

Fountain Hills North Fl. Jplain Delineation Study

Project Schedule

George V. Sabol Consulting Engineers, Inc.

ID	Name	Work	Cost
1	1 COORDINATION	292h	$17,952.97
2	1.1 Project Schedule	40h	$2,196.40
3	1.2 Coordination Meetings	97h	$6,914.95
4	1.2.1 Field Trip #1	33h	$2,184.45
5	1.2.2 Public Meeting No. 1	2h	$109.82
6	1.2.3 Hydrology Mtg.: Sub-Basin Delin.	3h	$134.95
7	1.2.4 Hydrology Mtg. : Parameters	5h	$293.35
8	1.2.5 Hydrology Mtg.: Exist. HEC-1 Model	3h	$134.95
9	1.2.6 Hydraulics Mtg.: Prop. C/S Locations	7h	$402.51
10	1.2.7 Coordination Meeting #1	3h	$134.95
11	1.2.8 Field Trip #2 and Hydraulics Prelim. Report	33h	$3,140.25
12	1.2.9 Coordination Meeting #2	3h	$134.95
13	1.2.10 Coordination Meeting #3	3h	$134.95
14	1.2.11 Public Meeting No. 2	2h	$109.82
15	1.3 Monthly Progress Reports	99h	$5,408.14
29	1.4 Advertising	8h	$1,019.40
30	1.5 Rights of Entry	36h	$1,734.32
31	1.6 Town of Fountain Hills	12h	$679.76
32	2 DATA COLLECTION	28h	$1,431.86
33	3 TOPOGRAPHIC MAPPING	763h	$39,530.68
34	3.1 DTM Conversion	48h	$2,296.56
35	3.2 Work Study Drawings	130h	$5,717.70



Project: Fountain Hills North
Date: 9/23/92

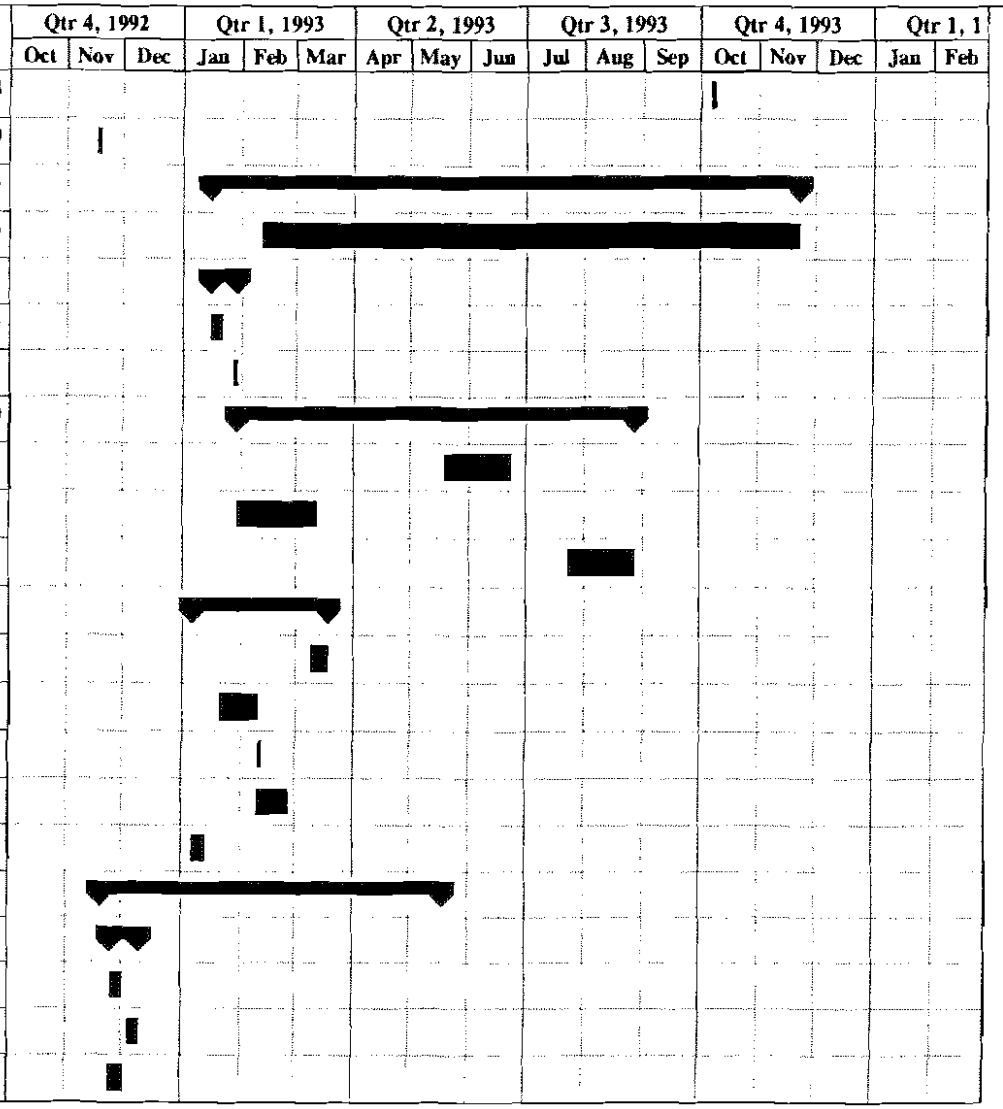
Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

Fountain Hills North Floodplain Delineation Study

Project Schedule

George V. Sabol Consulting Engineers, Inc.

ID	Name	Work	Cost
36	3.3 Non-Erasable Mylars and Reduced Scale Maps	24h	$1,313.28
37	3.4 Hydrologic Base Maps	60h	$3,179.40
38	3.5 GIS Conversion	501h	$27,023.74
39	3.5.1 Coordination	62h	$3,546.36
40	3.5.2 Hydrology Parameters	76h	$3,807.38
41	3.5.2.1 Existing Condition	55h	$2,740.04
42	3.5.2.2 Future Condition	21h	$1,067.34
43	3.5.3 Final Conversion	363h	$19,670.00
44	3.5.3.1 Hydrology Conversion	112h	$6,225.00
45	3.5.3.2 Survey and Mapping Conversion	128h	$6,775.00
46	3.5.3.3 Floodplain and Floodway Conversion	123h	$6,670.00
47	**4 FIELD SURVEY**	**452h**	**$30,084.40**
48	4.1 Elevation Reference Marks	82h	$5,564.52
49	4.2 Cross Section Verification	166h	$11,070.28
50	4.3 Plot Check Sections	24h	$1,046.08
51	4.4 As-Built Structures	128h	$8,835.88
52	4.5 Supplemental Topography	52h	$3,567.64
53	**5 HYDROLOGY**	**1358h**	**$58,604.86**
54	5.1 Base Maps	136h	$5,388.04
55	5.1.1 Digitize Soil Boundaries	18h	$762.30
56	5.1.2 Land Use Bound. - Existing	52h	$2,031.48
57	5.1.3 Land Use Bound. - Future	52h	$2,031.48



Project: Fountain Hills North
Date: 9/23/92

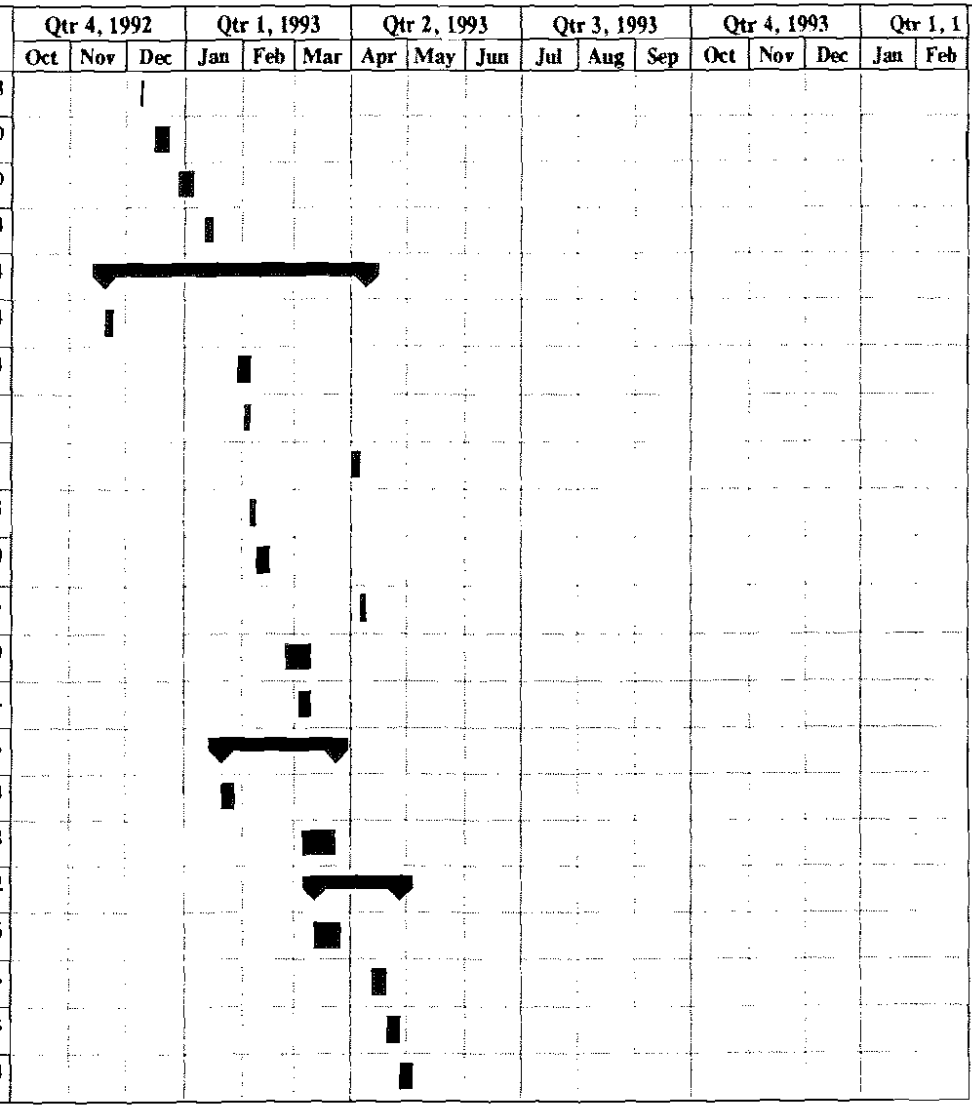
Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

Fountain Hills North Floodplain Delineation Study

Project Schedule

George V. Sabol Consulting Engineers, Inc.

ID	Name	Work	Cost
58	5.1.4 Terrain Class Boundaries	14h	$562.78
59	5.2 Preliminary Sub-Basin Delineation	144h	$6,082.00
60	5.3 Field Reconnaissance	40h	$2,761.40
61	5.4 Final Sub-Basin Delineation	40h	$1,744.24
62	5.5 Parameter Estimations	522h	$20,844.54
63	5.5.1 Re-Write MCUHP1	24h	$1,317.84
64	5.5.2 Soils	80h	$3,306.64
65	5.5.3 Land Use - Existing Condition	33h	$1,168.21
66	5.5.4 Land Use - Future Condition	33h	$1,168.21
67	5.5.5 Terrain Class	12h	$473.08
68	5.5.6 Tc - Existing Condition	66h	$2,630.40
69	5.5.7 Tc - Future Condition	42h	$1,684.24
70	5.5.8 Channel Routing	136h	$5,084.40
71	5.5.9 Reservoir Routing	96h	$4,011.52
72	5.6 HEC-1 Diagram	148h	$6,713.68
73	5.6.1 Create Diagram	40h	$2,196.40
74	5.6.2 Draft Diagram	108h	$4,517.28
75	5.7 HEC-1 Computer Models	248h	$11,218.72
76	5.7.1 100-Year Existing Condition Model	120h	$6,040.16
77	5.7.2 100-Year Future Condition Model	80h	$3,472.08
78	5.7.3 10-Year Future Condition Model	48h	$1,706.48
79	5.8 HEC-1 Computer Model Calibration	80h	$3,852.24



Project: Fountain Hills North
Date: 9/23/92

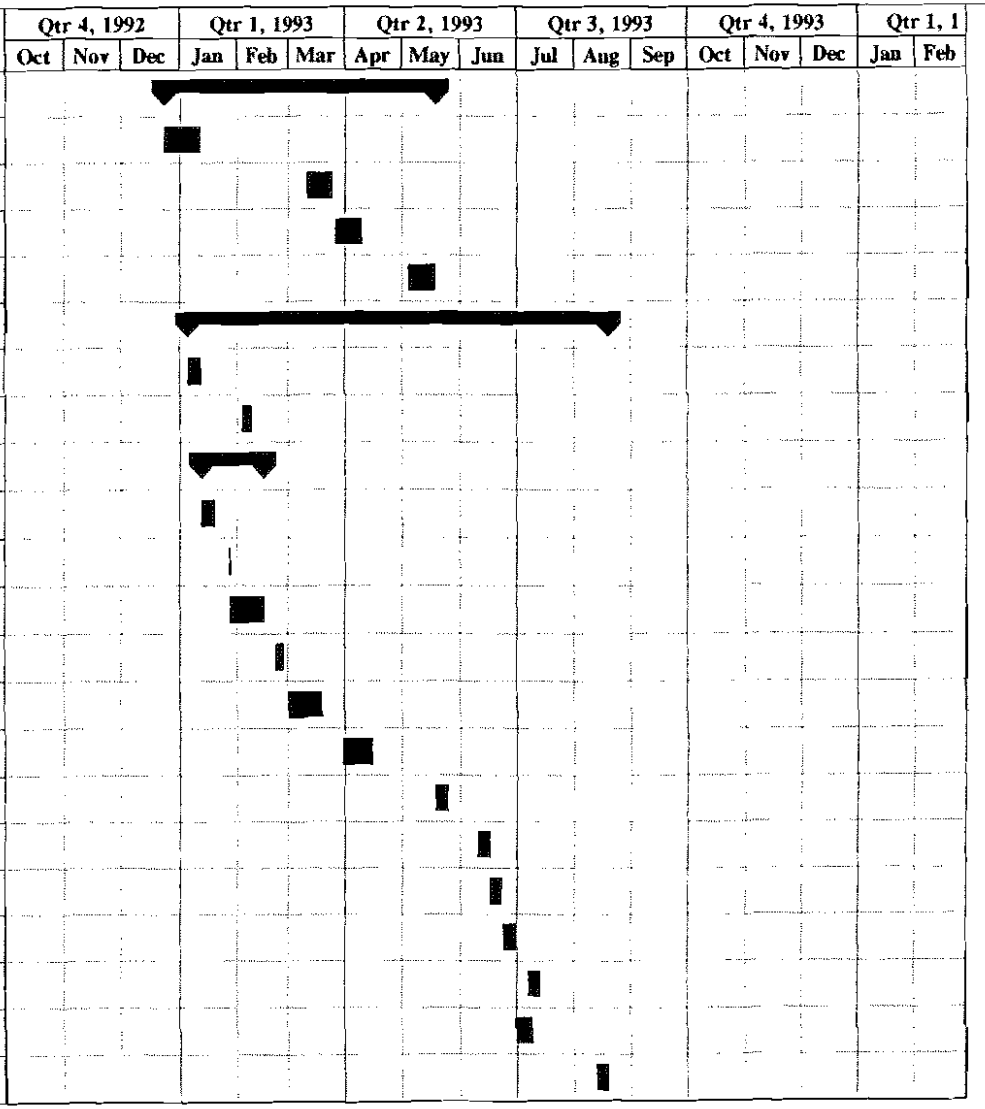
Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

Fountain Hills North Floodplain Delineation Study

Project Schedule

George V. Sabol Consulting Engineers, Inc.

ID	Name	Work	Cost
80	5.9 FCD Hydrology Review	0h	$0.00
81	5.9.1 Review Sub-Basin Delineation	0h	$0.00
82	5.9.2 Review Parameters	0h	$0.00
83	5.9.3 Review Diagram and Input Files	0h	$0.00
84	5.9.4 Review HEC-1 Results	0h	$0.00
85	6 FLOODPLAIN AND FLOODWAY DELINEATION	1438h	$67,689.40
86	6.1 Field Reconnaissance	44h	$2,843.44
87	6.2 "n" Value Report	62h	$2,749.74
88	6.3 Cross Section Locations	120h	$10,903.26
89	6.3.1 Cross Section Locations	98h	$4,700.36
90	6.3.2 Identify & Locate Check C/S	12h	$705.70
91	6.3.3 Photo. Digitized X-Sections	10h	$5,497.20
92	6.4 Cross Section Plotting	64h	$2,611.80
93	6.5 HEC-2 Computer Models (12)	192h	$8,700.00
94	6.6 Modeling of Structures	152h	$6,912.00
95	6.7 Floodplain Delineation (natural)	152h	$6,065.76
96	6.8 Floodway Delin. - Method 4 Subcritical	132h	$5,236.04
97	6.9 Floodway Delin. - Method 6 Supercritical	108h	$4,373.40
98	6.10 Floodway Delin. - Method 1 Subcritical	132h	$5,236.04
99	6.11 Floodway Delin. - Method 1 Supercritical	108h	$4,240.68
100	6.12 HEC-2 Model Calibration	98h	$4,325.18
101	6.13 Flood Zone Determination	74h	$3,492.06



Project: Fountain Hills North
Date: 9/23/92

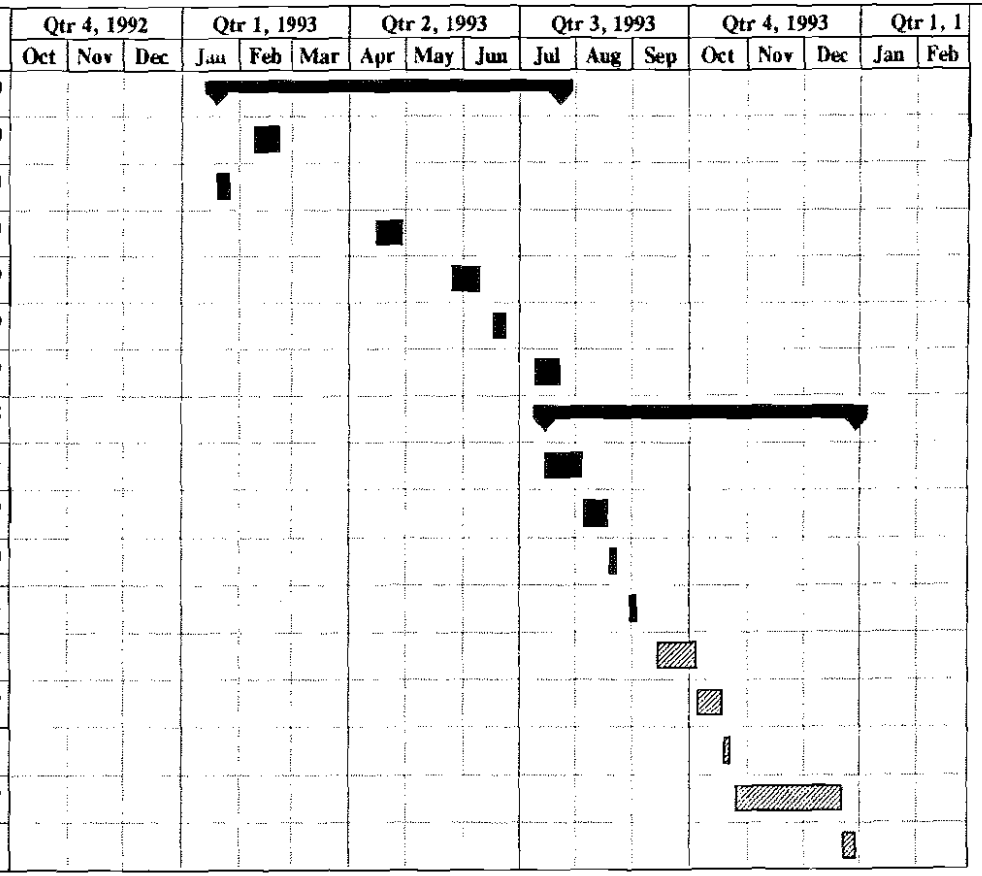
Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

Fountain Hills North Floodplain Delineation Study

Project Schedule

George V. Sabol Consulting Engineers, Inc.

ID	Name	Work	Cost
102	6.14 FCD Hydraulics Review	0h	$0.00
103	6.14.1 Review "n" Value Report	0h	$0.00
104	6.14.2 Proposed Cross Section Locations	0h	$0.00
105	6.14.3 Review HEC-2 Models w/structures	0h	$0.00
106	6.14.4 Floodplain Delin. (natural)	0h	$0.00
107	6.14.5 Floodway Delin. (equal convey.)	0h	$0.00
108	6.14.6 Floodway Delin. (method 1)	0h	$0.00
109	7 FINAL PRODUCTS	1112h	$55,087.58
110	7.1 Preliminary Hydrology Report	328h	$15,482.24
111	7.2 FCD and ADWR Review	0h	$0.00
112	7.3 HEC1- ADWR and Agency Revisions	64h	$2,242.00
113	7.4 Final Hydrology Report	148h	$8,029.12
114	7.5 Preliminary Hydraulics Report	368h	$18,032.04
115	7.6 HEC2- FCD and ADWR Review	0h	$0.00
116	7.7 Final Hydraulics Report	112h	$7,510.22
117	7.8 FEMA Review	0h	$0.00
118	7.9 HEC2- FEMA & Public Mtg. Revisions	92h	$3,791.96



Project: Fountain Hills North
Date: 9/23/92

Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

TO: MEETING NO. 2 ATTENDEES

TIM MURPHY
Flood Control District
of Maricopa County (FCDMC)

SANDY STORY
FCDMC

TOM LOOMIS
George V. Sabol Consulting
Engineers (GVSCE)

Randy Harrel, P.E.
Town of Fountain Hills (TOFH)

FROM: TOM LOOMIS
Project Engineer
GVSCE

DATE: 23 December, 1992

SUBJECT: Fountain Hills Floodplain Delineation Study (North)
Contract FCD 92-04

RECORDER: Tom Loomis Tom Loomis

Meeting Notes for Meeting No. 2

1. The meeting commenced at 3:30 at the Town of Fountain Hills on 23 December 1992. In attendance were:

   Mr. Randy Harrel, (TOFH)
   Mr. Tim Murphy, FCDMC
   Ms. Sandy Story, FCDMC
   Mr. Thomas R. Loomis, GVSCE

   There was no agenda for this meeting.

   The following is our understanding of the major items of interest that were discussed at the meeting. Please inform GVSCE if corrections or additions are appropriate.

2. Mr. Harrel showed the materials he has gathered together so far. These consisted of drainage improvement plans for Palisades Blvd. drainage channel, Dam #4 as-builts, and miscellaneous sewer plans. The following is a list of materials, which came up at various points during the meeting, which Mr. Harrel agreed to provide copies of:

   a. The Town of Fountain Hills proposed new zoning code.
   b. Palisade Blvd. Improvement Plans, and storm drain in Golden Eagle Blvd.
   c. Addendums, revisions, and additions to the 1992 improvement district plans.

d. Plans and plat for a proposed subdivision on Hampstead Drive.
e. Plans for Zapata Wash at Montezuma Boulevard.

3. Mr. Harrel provided a copy of the newspaper article (**The Times**, 23 December, 1992) about Public Meeting No. 1 (Attachment A).

4. Mr. Loomis presented the existing and future condition land use maps (preliminary redlines) and asked for comments. Everyone agreed the approach was acceptable.

5. Mr. Loomis presented a copy of the Town zoning map on which tentative watershed concentration points were marked. Each location was discussed. Mr. Harrel pointed out locations where culverts were incorrectly located and where new culverts were placed as a part of the 1992 improvement districts. Mr. Harrel added several concentration points. These were added to the work map.

6. Mr. Loomis asked Mr. Harrel for copies of subdivision plats in order to verify the dedicated function of large open tracts. Mr. Harrel agreed to let Mr. Loomis research the plats in the Town offices. A work area is open on Tuesday and Thursdays.

7. Mr. Harrel requested that a separate sub-basin be delineated for flow in Golden Eagle Boulevard east of the crossing of Ashbrook Wash. This crossing was flooded last year. Flow overtopped the roadway. The culvert was not clogged with debris.

8. The proposed Sunridge Canyon subdivision will be master planned in the next two months. Mr. Harrel agreed to set up a meeting with MCO Properties to determine the average density of development and the boundary. A tentative date of 31 December, 1992 was selected. Mr. Harrel and Mr. Loomis will attend the meeting.

9. Mr. Loomis asked Mr. Harrel if local precipitation data is kept. Mr. said to contact the Chaparral Water Company or **The Times** newspaper.

The Times
Dec. 2 1992

Flood control study will take one year

Maricopa County's Flood Control District is set to embark on a floodplain delineation study that will assist the town in future development and identify any problem areas.

Tim Murphy, project manager, stressed last week, however, that the Town of Fountain Hills would not be liable for correcting problems should any be found.

The study's main purpose is to identify potential flood hazard areas to safeguard life and property.

Murphy outlined the study's main benefits for the Town Council:

* Identification of flood hazards before significant development occurs.
* Identification of flood hazards caused by existing development.
* Determination of areas in need of flood protection, and structures that may require flood insurance.
* Minimize loss of life and property by regulating floodplain development.
* Development of hydrological information to address existing and future drainage problems.

Murphy said the county's study will not address the structural integrity of the earthen dams built here in the early 1970s.

He said the study will take about a year to complete, and the work will entail surveys and walk throughs on various washes in Fountain Hills.

No earth work, land disturbance or other improvement work will be done in connection with the $500,000 study.

Maricopa County has hired two consultants, George V. Sabol Consulting Engineers and AGK Engineers, to perform the study.

Fountain Hills has been divided up into two study areas for the project, with the northern half having 16 square miles of watershed area and the southern portion with eight square miles.

In addition, the north study area has 24 "river miles" to be studied, while the southern half has only 15 river miles.

"The town is not immediately obligated to do anything with the study's results," Murphy said Dec. 17. "The purpose is to identify potential problem areas" with the washes.

Results also will be forwarded to the Federal Emergency Management Agency, which ultimately will issue a "Flood Insurance Rate Map" on the basis of the study's findings.

Although the town itself would not be taking out flood insurance, the study could identify any homeowners who may want to consider taking out flood insurance.

Town Manager Paul Nordin said the town will benefit in one area by having data available for future developments.

"We'll be able to tell developers what they will have to put in for culverts and that type of thing for future subdivisions and developments," he said.

Town Engineer Randy Harrel said results will be particularly helpful to the town for studying possible storm-drainage improvements on Saguaro Boulevard by Fountain Park and the Ashbrook Wash, which has major crossings on Fountain Hills and El Pueblo boulevards and Del Cambre Avenue.

MEMORANDUM TO FILE

DATE: 14 January 1993

FROM: Tom Loomis

PROJECT: Fountain Hill North Floodplain Delineation Study
FCD 92-04

SUBJECT: Meeting at Anderson-Nelson, Inc. (A-N)

Attendees:

Tom Loomis, GVSCE
Hal Marron, AGK
Don Anderson, A-N
George Nelson, A-N

The meeting was held on 11 January 1993. The purpose was to discuss the survey control, done by A-N, used to prepare the 200 scale topographic mapping. George Nelson provided the following:

1. A written description of the method used to rotate the Fountain Hills Local Coordinate System to NAD 1983 State Plane Coordinate System.

2. A written monument description of the high altitude aerial control panel points.

We discussed the method used. Hal Marron expressed his concern that the two monuments used for the rotation/translation were very close to a north-south alignment, that the distance between them is only 1 mile, and that the points are located at the southeast corner of Fountain Hills. This could potentially result in a rotational distortion with propagational error being worst at the northwest corner of the town.

I supported his concern. George Nelson then called his surveyor, Larry James. I discussed our concern with him. He agreed that this is a potential problem. He said that there are other monuments along the south and east town boundaries that were surveyed by SRP using GPS techniques. They (A-N) did not use these monuments because they have not been tied into the Fountain Hills Local Coordinate System.

We then discussed other information that is in A-N records. Don Anderson had prints made of the items I requested. Refer to the Reference Information List for items obtained from A-N.

Thomas R. Loomis

92491-00\1-14-93.035

George V. Sabol Consulting Engineers, Inc.
1331 17th Street, Suite 700, Denver, Colorado 80202
(303) 295-7016 FAX (303) 292-2415

25 January 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 1

Dear Mr. Murphy:

The following progress is reported for the period 8 December 1992 through 15 January 1993:

TASK 1 - COORDINATION

a. The Kick-off meeting was held on 10 December.
b. The Project Schedule was completed and submitted to FCDMC.
c. Public Meeting No. 1 was held on 17 December.
d. Meeting No. 2 was held on 23 December to discuss land-use assumptions, concentration point locations and data collection.

TASK 2 - DATA COLLECTION

a. Meet with Bill Jenkins at ADWR on 16 December.
b. Performed a data search with the Town of Fountain Hills.
c. Initiated data compilation with the State Lands Office, County Highway Dept., County Parks Dept., and Anderson-Nelson.
d. Compiled data gathered thus far.

TASK 3- MAPPING

a. Initiated work on study area maps.
b. Met with GCA on map files on 31 December.
c. Verified south boundary of watershed.
d. Reviewed coordinate data and rotation/translation parameters for maps.
e. Reviewed control layers and edge match.
f. Coordinated with FCDMC, AGK and A-N on survey control.

TASK 4 - FIELD SURVEY

(no activity)

TASK 5 - HYDROLOGY

a. Defined land use categories.
b. Delineated watershed on map.
c. Defined concentration points.
d. Initiated reservoir route data study.
e. Initiated sub-basin delineation
f. Initiated sub-basin data summary report.

TASK 6 - HYDRAULICS

a. Conducted field trip to observe drainage system.
b. Initiated work to select cross-section locations.

TASK 7 - FINAL PRODUCTS

(no activity)

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	38
2	99
3	5
4	1
5	19
6	1
7	0

Potential problems that were identified are:

1. Problems with matching map sheets has been identified and brought to the attention of FCDMC. The severity of this problem is unknown, and impact on the project, if any, has not been resolved.
2. Problems with map translation and rotation was noted. The potential impact on the project and the need to rectify is unknown.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc:

George V. Sabol, Ph.D., P.E.

MEMORANDUM TO FILE

DATE: **3 February 1993**

DATE: **Tom Loomis**

SUBJECT: **Meeting at Kenney Aerial Mapping**

TOPIC: **Fountain Hills Floodplain Delineation Study (North)**
Contract FCD 92-04

RECORDER: **Tom Loomis**

---

1. The meeting commenced at 2:00 at the office of Kenney Aerial Mapping (KAM) on 2 February 1993. In attendance were:

   Mr. Ellis Hyde (KAM)
   Mr. Frank Deal (KAM)
   Mr. Paul Khorramabbad (KAM)
   Mr. Tim Murphy, FCDMC
   Ms. Sandy Story, FCDMC
   Mr. Thomas R. Loomis, GVSCE

   There was no agenda for this meeting.

2. Mr. Loomis and Mr. Deal discussed the format to use for providing HEC-2 cross section locations to KAM. It was agreed that the cross sections could be provided in an AutoCAD drawing file format as polylines. Cross sections will be digitized into AutoCAD from left to right looking downstream.

3. The schedule for delivering HEC-2 cross section locations to KAM was discussed. Mr. Loomis will review the tentative locations and then submit them to the FCD for review and approval. The locations will then be provided to KAM. It will probably be three weeks before locations are delivered to KAM. Mr. Hyde asked how many cross section locations have been identified thus far. Mr. Loomis said about 430, but this number will probably be reduced to approximately 400.

4. The 200 scale contour mapping provided by KAM was discussed. Mr. Loomis pointed out that the edges between AutoCAD files do not match. In most cases, there is less than 0.005′ of gap or overlap. Between sheets 5 and 8 there is a triangular-shaped gap that is 22 feet wide at the west sheet edge. There is a 0.29′ gap at the southwest corner of sheet 9, between sheets 9 and 16. Mr. Murphy stated that Hal Marron of AGK Engineers has a similar problem with at least one location in his study area.

The possible cause of these problems was discussed. It was decided that the probable cause of the general sheet matching gap is related to the rotation to the State plane coordinate system. The scale factor applied to each sheet was only single precision. This could cause a rounding problem which would vary results between files. This error should not cause a problem with the GIS translation.

The second problem, which is the two locations with large gaps, is probably caused by an improper trim operation using AutoCAD. This speculation was made by Mr. Deal. Mr. Ellis stated that KAM will verify that these problems exist and make corrections as appropriate.

Tom Loomis

George V. Sabol Consulting Engineers, Inc.
1331 17th Street, Suite 700, Denver, Colorado 80202
(303) 295-7016 FAX (303) 292-2415

22 February 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 2

Dear Mr. Murphy:

The following progress is reported for the period 16 January 1993 through 15 February 1993:

TASK 1 - COORDINATION
- a. Placed newspaper ads.
- b. Coordinated mapping problems with Hal Marron at AGK.
- c. Completed Rights of Entry.

TASK 2 - DATA COLLECTION
- a. Miscellaneous data and map collection, review, compilation and reporting.
- b. Performed a data search with the Town of Fountain Hills.

TASK 3- MAPPING
- a. Completed DTM conversion.
- b. Initiated work study drawings.
- c. Initiated hydrologic base maps.
- d. Initiated GIS conversion.

TASK 4 - FIELD SURVEY
- a. ERMs are about 70% completed.
- b. Initiated as-built surveys.

TASK 5 - HYDROLOGY
- a. Prepared base maps.
- b. Initiated digitizing soil maps.
- c. Completed land-use boundaries.
- d. Sub-basin delineation is nearly completed.
- e. Initiated parameter estimation.
- f. Performed reservoir route data analyses.

TASK 6 - HYDRAULICS
- a. Field reconnaissance is nearly completed.
- b. Cross-section location is mostly completed.

TASK 7 - FINAL PRODUCTS
(no activity)

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	40
2	99
3	11
4	13
5	24
6	8
7	0

Potential problems that were identified are:

1. It has been discovered that there was not horizonal or vertical survey performed to tie the mapping control points together. Control points were located using historic (development) benchmarks. Those benchmarks may have been disturbed since their placement. However, at this time there is no reason to suspect that the mapping accuracy will not be within FEMA standards for floodplain delineation studies.
2. Field reconnaissance has located 30+ culverts. The scope-of-work was based on an estimate of 14 culverts. This has resulted in considerably more work in preparing reservoir route input for HEC-1, and will result in considerably more flow-splits than originally anticipated.

Other items of interest:

1. We located a copy of the original (1970) topographic map (1 inch = 100 feet, 10 ft. C.I.) of the west development area. This enhances our data base for watershed mapping.
2. We obtained a map of the north part of the watershed from the County Parks Department (1 inch = 400 feet, 10 ft C.I.). This will be used for sub-basin delineation in that area.
3. Routing section data will be extracted from those two maps.
4. The USGS maps will be used as base maps in the reports for consistency.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc:

George V. Sabol, Ph.D., P.E.

George V. Sabol Consulting Engineers, Inc.
1331 17th Street, Suite 700, Denver, Colorado 80202
(303) 295-7016 FAX (303) 292-2415

29 March 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 3

Dear Mr. Murphy:

The following progress is reported for the period 16 February 1993 through 15 March 1993:

TASK 1 - COORDINATION

a. Maintained coordination with the various parties concerning mapping and control problems.
b. Submitted documentation for legal advertising to FCDMC.
c. Prepared Progress Report No. 2.

TASK 2 - DATA COLLECTION

a. Miscellaneous data review, compilation and report preparation.

TASK 3- MAPPING

a. Performed checks of revised contour maps.
b. Communicated with Hal Marron (AGK) and Ken Valverde (AGK's surveyor) on map control.

TASK 4 - FIELD SURVEY

a. ERM's are about 90% completed.
b. Participated in a meeting on survey control at the District with Pedro Calza and Tim Murphy. In attendance were representatives of GVSCE, AGK, Anderson-Nelson (Town of Fountain Hills consultant), and Rangy Harrel (Town of Fountain Hills).
c. Prepared instructions for surveying of structures for the preparation of as-built drawings.
d. Met with Richard Alcocer on survey of structures and supplemental topographic survey of the dam and spillway at the high school.

TASK 5 - HYDROLOGY

a. Completed preliminary sub-basin delineation.
b. Prepared AutoCadd operator for digitizing the sub-basins.
c. Conducted a field visit of all five dams and staked high water marks (in reservoir and outlet) for January - February storms, and prepared a memorandum.
d. Began obtaining routing cross sections.
e. Sub-basins, T_c paths, and routing paths are being digitized.
f. Performed reservoir route data analyses.

TASK 6 - HYDRAULICS

a. Conducted field survey portion of n value study and prepared photo documentation.

TASK 7 - FINAL PRODUCTS

(no activity)

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	45
2	99
3	25
4	15
5	36
6	12
7	0

Other items of interest for this month:

1. It was agreed with Sandy Story and Tim Murphy to move concentration points on the east Town boundary north of Section 11, west to the crossing of McDowell Mountain Park Road.

2. The upstream end of the detailed study reach of Escalante Wash was moved upstream approximately 450 feet upstream to the confluence with a tributary wash. This was agreed upon with Tim Murphy.

3. The average slope for Clark time of concentration flow paths will not be slope averaged. The average slope will be estimated using the top and bottom elevations and the total length. Slope averaging will not be done because the watershed is being broken down into small sub-basins which will minimize the problem of a steep upper reach combined with a flat, long, lower reach. This was agreed to with Amir Motamedi, and discussed with Sandy Story.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc:

George V. Sabol, Ph.D., P.E.

TRL

George V. Sabol Consulting Engineers, Inc.
1331 17th Street, Suite 700, Denver, Colorado 80202
(303) 295-7016 FAX (303) 292-2415

30 April 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 4

Dear Mr. Murphy:

The following progress is reported for the period 16 March 1993 through 15 April 1993:

TASK 1 - COORDINATION

a. Prepared Progress Report No. 3.

TASK 2 - DATA COLLECTION

a. Data collection is essentially complete.

TASK 3- MAPPING

No activity.

TASK 4 - FIELD SURVEY

a. Completed ERM's.
b. Completed as-built structure surveys.
c. Completed supplemental topography for the high school stadium and Oxford Wash. Proceeding with map revisions.
d. Proceeding with as-built drawings of the various dams and culverts.

TASK 5 - HYDROLOGY

a. Completed routing cross section preparation for the reaches outside HEC-2 modeling areas.
b. Completed preliminary sub-basin delineation map.
c. Completed preliminary concentration point and T_c path exhibit.
d. Proceeding with CADD preparation of hydrology exhibits and routing diagram.
e. Coordinated with Hal Marron at AGK on the common watershed boundary and reached agreement on the boundary.
f. Coordinated with Hal Marron at AGK on preparation of parameter spread sheets and exhibits.
g. Proceeding with hydrology parameter spreadsheets.
h. Prepared sub-basin, land-use, and soils exhibits for review by the District.

TASK 6 - HYDRAULICS

a. Coordinated with Frank Brown at MKE on HEC-2 cross section selection and submittal to the District for review.

b. Reviewed MKE's cross section locations.
c. Met with Frank Brown and Richard Alcocer on the proposed field verification cross sections.
d. Selected verification cross sections.
e. Discussed cross section selection and upcoming submittal with Tim Murphy.

TASK 7 - FINAL PRODUCTS

a. Prepared table of contents for the Hydrology Report.
b. Prepared Exhibit A (Drainage Basin Map and Sheet Index for Exhibits B, C and D).
c. Prepared Summary Table for Exhibit A.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	49
2	99
3	25
4	46
5	45
6	14
7	5

Other items of interest for this month:

1. A letter and supporting documentation on mapping problems was prepared and submitted to the District. A procedure to be used to resolve any future mapping problems and concerns was proposed.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc:

George V. Sabol, Ph.D., P.E.

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

TO: MEETING NO. 3 ATTENDEES

TIM MURPHY
Flood Control District
of Maricopa County (FCDMC)

SANDY STORY
FCDMC

TOM LOOMIS
GEORGE SABOL
George V. Sabol Consulting
Engineers (GVSCE)

Frank Brown
McLaughlin Kmetty Engineers (MKE)

FROM: TOM LOOMIS
Project Engineer
GVSCE

DATE: 10 May 1993

SUBJECT: Fountain Hills Floodplain Delineation Study (North)
Contract FCD 92-04

Meeting Notes for Meeting No. 3

The meeting commenced at 1:00 at the Flood Control District of Maricopa County on 4 May 1993. This meeting was held to review the hydrology preliminary sub-basin delineation and the preliminary hydraulics cross section locations.

There was no agenda for this meeting.

The following is our understanding of the major items of interest that were discussed at the meeting. Please inform GVSCE if corrections or additions are appropriate.

1. Mr. Murphy and Ms. Story presented their review comments on the hydrology preliminary sub-basin delineation. The comments and agreed upon course of action are summarized as follows:

   Section 2, Sub-basin 202A - Mr. Murphy point out that the T_c path terminates below the top of the sub-basin. He asked for an explanation of why this was done. Mr. Loomis responded that the T_c path selected was representative of the majority of the sub-basin. Extending the T_c path to the top of the sub-basin would cause an increase in slope that is not representative of the majority of the sub-basin.

Section 2, Sub-basin 202B - Mr. Murphy point out that the T_c path at the upper end of the sub-basin was inconsistent with the logic used for sub-basin 202A. Mr. Loomis and Dr. Sabol agreed. A revised T_c path was agreed upon. Mr. Loomis agreed to review all of the sub-basins to locate any other such inconsistencies.

Section 32, Sub-basin 205L - Ms. Story pointed out that a T_c path had not been identified. Mr. Loomis stated that this had already been noted and a T_c path selected.

2. Mr. Loomis reviewed the sub-basin delineation corrections proposed as a result of the field reconnaissance. These were too numerous to identify in the minutes. The FCDMC personnel and GVSCE personnel agreed that the preliminary sub-basin delineation is acceptable as modified. GVSCE will finalize the sub-basin delineation.

3. Mr. Loomis distributed preliminary copies of the Routing Diagram and Exhibit "A" to Mr. Murphy and Ms. Story. He also reviewed the list of hydraulic structures prepared to show critical data for each culvert and the status for analysis purposes.

4. Mr. Loomis presented the proposed spreadsheet layouts for estimation of hydrology parameters. Ms. Story was satisfied with the proposed approach. Mr. Loomis stated that a writeup of the parameter estimation process and sample spreadsheets would be prepared and forwarded to Ms. Story for review.

5. Mr. Brown submitted the hydraulics parameter estimation (n-value) report to Mr. Murphy for review. He described the report layout.

6. The meeting was adjourned at 3:30 p.m.

c: Dr. George V. Sabol

92491-00\5-4Min.035

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3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

MEMORANDUM TO FILE

DATE: 10 May 1993

FROM: TOM LOOMIS
Project Engineer
GVSCE

DATE: 10 May 1993

SUBJECT: Meeting with Mr. Randy Harrel

PROJECT: Fountain Hills Floodplain Delineation Study (North)
Contract FCD 92-04

---

1. A meeting was held with Mr. Randy Harrel, Town of Fountain Hills (TOF). The meeting commenced at 10:00 a.m. on 6 May 1993. In attendance were:

   Mr. Randy Harrel (TOF)
   Mr. Tom Loomis (GVSCE)
   Mr. Frank Brown (MKE)

   There was no agenda for this meeting.

2. Mr. Loomis reviewed the preliminary sub-basin delineation maps with Mr. Harrel. Mr. Harrel made an adjustment to the routing path 623624. The hydrologic routing at the stock tank in Section 2 was discussed. Mr. Harrel stated that the Town had field surveyed a profile along the top of the tank embankment. He agreed to send Mr. Loomis a copy of the field notes. Mr. Harrel did not voice opposition to any proposed sub-basin boundaries.

3. Mr. Loomis reviewed the List of Hydraulic Structures table with Mr. Harrel. Mr. Harrel was given a copy of the table and the location diagram.

4. Mr. Brown reviewed the preliminary HEC-2 cross section locations with Mr. Harrel. Mr. Harrel did not voice opposition to any cross section locations. Mr. Harrel expressed an interest in reviewing the preliminary n-value report after the FCDMC has finished reviewing it.

5. Mr. Harrel agreed to forward the Town survey notes for five As-Built structures in the Improvement District projects to Mr. Loomis as soon as possible.

Tom Loomis

c: Mr. Tim Murphy
Dr. George V. Sabol

92491-00\5-10Mem.035

George V. Sabol Consulting Engineers, Inc.
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TO: MEETING NO. 3 ATTENDEES

TIM MURPHY
Flood Control District
of Maricopa County (FCDMC)

SANDY STORY
FCDMC

TOM LOOMIS
GEORGE SABOL
George V. Sabol Consulting
Engineers (GVSCE)

Frank Brown
McLaughlin Kmetty Engineers (MKE)

FROM: TOM LOOMIS
Project Engineer
GVSCE

DATE: 10 May 1993

SUBJECT: Fountain Hills Floodplain Delineation Study (North)
Contract FCD 92-04

Meeting Notes for Meeting No. 3

The meeting commenced at 1:00 at the Flood Control District of Maricopa County on 4 May 1993. This meeting was held to review the hydrology preliminary sub-basin delineation and the preliminary hydraulics cross section locations.

There was no agenda for this meeting.

The following is our understanding of the major items of interest that were discussed at the meeting. Please inform GVSCE if corrections or additions are appropriate.

1. Mr. Murphy and Ms. Story presented their review comments on the hydrology preliminary sub-basin delineation. The comments and agreed upon course of action are summarized as follows:

   Section 2, Sub-basin 202A - Mr. Murphy point out that the T_c path terminates below the top of the sub-basin. He asked for an explanation of why this was done. Mr. Loomis responded that the T_c path selected was representative of the majority of the sub-basin. Extending the T_c path to the top of the sub-basin would cause an increase in slope that is not representative of the majority of the sub-basin.

Section 2, Sub-basin 202B - Mr. Murphy point out that the T_c path at the upper end of the sub-basin was inconsistent with the logic used for sub-basin 202A. Mr. Loomis and Dr. Sabol agreed. A revised T_c path was agreed upon. Mr. Loomis agreed to review all of the sub-basins to locate any other such inconsistencies.

Section 32, Sub-basin 205L - Ms. Story pointed out that a T_c path had not been identified. Mr. Loomis stated that this had already been noted and a T_c path selected.

2. Mr. Loomis reviewed the sub-basin delineation corrections proposed as a result of the field reconnaissance. These were too numerous to identify in the minutes. The FCDMC personnel and GVSCE personnel agreed that the preliminary sub-basin delineation is acceptable as modified. GVSCE will finalize the sub-basin delineation.

3. Mr. Loomis distributed preliminary copies of the Routing Diagram and Exhibit "A" to Mr. Murphy and Ms. Story. He also reviewed the list of hydraulic structures prepared to show critical data for each culvert and the status for analysis purposes.

4. Mr. Loomis presented the proposed spreadsheet layouts for estimation of hydrology parameters. Ms. Story was satisfied with the proposed approach. Mr. Loomis stated that a writeup of the parameter estimation process and sample spreadsheets would be prepared and forwarded to Ms. Story for review.

5. Mr. Brown submitted the hydraulics parameter estimation (n-value) report to Mr. Murphy for review. He described the report layout.

6. The meeting was adjourned at 3:30 p.m.

c: Dr. George V. Sabol

92491-00\5-4Min.035

George V. Sabol Consulting Engineers, Inc.
1331 17th Street, Suite 700, Denver, Colorado 80202
(303) 295-7016 FAX (303) 292-2415

26 May 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 5

Dear Mr. Murphy:

The following progress is reported for the period 16 April 1993 through 15 May 1993:

TASK 1 - COORDINATION

a. Prepared Progress Report No. 4.
b. Meeting on 4 May at the District on Hydrology and Hydraulics to discuss FCD review comments on sub-basin delineation and HEC-2 cross section locations.

TASK 2 - DATA COLLECTION

a. Data collection is substantially complete.

TASK 3- MAPPING

a. Initiated translation of topographic maps into ArcInfo.
b. Began hydraulic base sheet layout.
c. Converted HEC-2 cross sections and thalwegs to ArcInfo. Calculated stations for cross sections along the thalweg.
d. Submitted hydrologic AutoCad drawings to GCA for conversion to ArcInfo and calculation of areas.

TASK 4 - FIELD SURVEY

a. Proceeding with map revisions of high school stadium.
b. Proceeding with as-built drawings of the various dams and culverts.
c. Proceeding with HEC-2 check cross sections.

TASK 5 - HYDROLOGY

a. Conducted field reconnaissance to verify sub-basin boundaries and flow diversion cross-sections.
b. Surveyed flow splits, culverts, and routing reaches.
c. Compiled photographs of field reconnaissance.
d. Finalized sub-basin delineation.
e. Proceeding with parameter estimation spreadsheets.
f. Proceeding with CADD exhibits.
g. Prepared hydraulics of dam emergency spillways for routing operations.

TASK 6 - HYDRAULICS

a. Prepared n-value report and submitted to District on 4 May.
b. Prepared culvert photograph documentation.
c. Coordinated with Tim Murphy on HEC-2 cross-section comments, and reviewed these with Frank Brown.
d. Reviewed HEC-2 cross-section selection.
e. Began work on special culvert option of HEC-2.
f. Prepared cross-section information and delivered to Kenney Aerial Mapping and GIS Consultants of Arizona for digitizing and ArcInfo conversion.

TASK 7 - FINAL PRODUCTS

a. Prepared hydrology Exhibit "A" and an outline of the preliminary hydrology report.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	51
2	99
3	27
4	55
5	53
6	20
7	7

Other items of interest for this month:

1. Tom's horse needs his sheath cleaned.
2. Pedro Calza caught a 15 lb. catfish on a fly rod.
3. Joyce didn't send Tom any "You screwed up" notes!

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc

George V. Sabol, Ph.D., P.E.

George V. Sabol Consulting Engineers, Inc.
1331 17th Street, Suite 700, Denver, Colorado 80202
(303) 295-7016 FAX (303) 292-2415

23 June 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 6

Dear Mr. Murphy:

The following progress is reported for the period 16 May 1993 through 20 June 1993:

TASK 1 - COORDINATION
a. Prepared Progress Report No. 5.

TASK 2 - DATA COLLECTION
a. Data collection is substantially complete.

TASK 3- MAPPING
a. GIS Consultants of Arizona is calculating hydrologic parameter areas and is developing a data base for parameters.

TASK 4 - FIELD SURVEY
a. Performed field verification surveys of HEC-2 sections.
b. Compared survey data to the sections that were obtained from Kenney Aerial Mapping, and coordinated corrective actions with MKE, Alcocer, and Kenney Aerial Mapping.
c. Performed miscellaneous surveys for culvert as-built drawings and the Oxford Wash topography.

TASK 5 - HYDROLOGY
a. Performed flow-split analyses and developed rating curves.
b. Performed reservoir routing analyses and developed rating curves.
c. Finalized sub-basin delineation.
d. Evaluated the effects of Golden Eagle Park on Dam 4 detention volumes. Informed FCDMC by letter. Coordinated with ADWR.
e. Completed photographic documentation of the watershed.

TASK 6 - HYDRAULICS
a. Received cross-section information (digitizing and conversion) from Kenney Aerial Mapping and GIS Consultants of Arizona.
b. Progressed with HEC-2 model development.
c. Progressed with modeling structures.
d. Evaluated field verification of channel cross-section data.

TASK 7 - FINAL PRODUCTS

No activity on this Task.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	51
2	99
3	52
4	88
5	60
6	29
7	8

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc

George V. Sabol, Ph.D., P.E.

Fountain Hills FIS
Monthly Billing Summary

#6

Billing Period 16 May - 20 June 93

Invoice No. _____

	Budget	Time Billed: Current Period	Time Billed: Cummulative	Time Billed: Balance	Time Charged: Current Period	Time Charged: Cummulative
GVSCE						
GVS	132	4	66	66	4	70
TRL	850	57	440	410	58 1/2	620 1/2
DTP	560	22	370	190	118	777
Eg.Tech.(2)	828	128	505	323	128	362
Word Proc.	277	41	90	187	41 1/2	89 1/2
Adm. Asst.	46	4	24	22	4	24
Direct Expenses	$11,647.00	4,957.14	6,946.85	4,700.15		
Sub-Total	$125,170.00	14,489.25	69,664.07	55,505.93		
			56%			
MKE						
GEK	60	8	22	38		
FEB	590	72 1/2	273	317		
CADD oPER.	690	101	493	197		
Draftsman	185	0	3	182		
Direct Expenses	$1,114.00	130.36	681.16	432.84		
Sub-Total	$73,340.00	8,848.82	37,577.97	35,762.03		
			51%			
Alcocer Land Surveyors	$26,631.00	0	17,968.04	8,662.96		
GCA	$24,675.00	0	10,123.75	14,537.25		
Total	$249,816.00	23,338.07	135,333.83	114,482.17		
			54%			

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23 August 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 7

Dear Mr. Murphy:

The following progress is reported for the period 21 June 1993 through 15 August 1993:

TASK 1 - COORDINATION

a. Prepared Progress Report No. 6.

TASK 2 - DATA COLLECTION

a. Data collection is substantially complete.

TASK 3- MAPPING

a. Coordinated with GCA on the preparation of hydrology parameters and submittals to the District.
b. Completed conversion of topographic maps and hydrology mapping to ARC-INFO. Made preliminary submittal to the District.

TASK 4 - FIELD SURVEY

a. Reviewed as-built drawings of structures that were field surveyed.
b. Sent a letter to the Town of Fountain Hills on drainage structures.
c. Completed field verification of HEC-2 cross-sections.
d. Completed comparisons of field verifications against photodigitized cross-sections that were received from Kenney Aerial Mapping (KAM).

TASK 5 - HYDROLOGY

a. Completed soils parameter spreadsheet, and submitted to the District.
b. Completed HEC-1 routing section definition.
c. Completed T_C data spreadsheet.
d. Completed land-use parameter spreadsheet, and submitted to the District.
e. Prepared routing parameter spreadsheet.

TASK 6 - HYDRAULICS

a. Received photodigitized cross-section data from Kenney Aerial Mapping. This is about 90 percent complete. (See comments under other items of interest.)
b. Compared photodigitized cross-section data with cross-sections from contour maps for randomly selected sections. (See comments under other items of interest.)
c. Prepared DXF files of photodigitized cross-sections.
d. Coordinated photodigitizing problems between KAM and the District, MKE and AGK. Scheduled a meeting with the District to present discrepancies that are arising between photodigitized data and the contour maps.
e. Progressed with HEC-2 model development.

TASK 7 - FINAL PRODUCTS

a. Prepared report table of contents and mapping sections.
b. Began preparation of HEC-1 exhibit maps.
c. Reviewed GCA AutoCAD files to be used as a basis for HEC-1 Exhibit maps.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	55
2	100
3	80
4	95
5	70
6	38
7	10

Other items of interest and potential problems are:

1. Significant problems were encountered in receiving correctly photodigitized HEC-2 cross-section data from KAM. We have received seven submittals from KAM and all have had a variety of errors. Sources of error are a result of KAM software problems, operator mistakes, and deficiencies in contours maps resulting in revisions in section end point definition by GVSCE and MKE. This has resulted in a tremendous effort on our part to perform quality control checking of the KAM submittals and wasted effort on the part of GVSCE and MKE in reproducing work products numerous times. Presently, many of KAM's problems have

been identified and rectified; however, due to deficiencies with the contour maps, we still do not have all of the photodigitized data to meet HEC-2 modeling requirements.

2. As a result of comparing photodigitized cross-sections with cross-sections from the contour maps (for about 10 locations) it is evident that the contour maps are not adequate to accurately map floodplains on the contour maps. This problem has been identified to the District and other involved firms.
3. The photodigitized cross-sections compare favorably with the field verified cross-sections to satisfy HEC-2 modeling requirements.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc

George V. Sabol, Ph.D., P.E.

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

MEMORANDUM

To: Meeting Attendees:
Mr. Dave Johnson, FCDMC
Mr. Tim Murphy, FCDMC
Dr. Sam Kao, AGK
Mr. Hernan Aristizabal, AGK
Mr. Geza Kmetty, MKE
Mr. Frank Brown, MKE
Dr. George V. Sabol, GVSCE
Mr. Tom Loomis, GVSCE

From: Tom Loomis TRL

Subject: Meeting to discuss mapping accuracy

Project: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04

Date: 23 August 1993

The meeting was held on 16 August 1993 at 1:00 p.m. at the office of McLaughlin Kmetty Engineers, Ltd. There was not an agenda for this meeting. Mr. Loomis explained that the purpose of the meeting was for GVSCE and AGK to notify the FCDMC of concerns regarding the accuracy of the 200 scale mapping prepared by Kenney Aerial Mapping (KAM) and provided by the FCDMC. GVSCE has completed field verification check sections, and obtained photogrammetric HEC-2 cross sections from KAM. Mr. Loomis covered the following in regard to the accuracy of the mapping:

1. The mapping was prepared by KAM under a sub-contract with Anderson-Nelson, who had a contract with the Town of Fountain Hills. The purpose in preparing the mapping was to provide the Town with a planning tool. The mapping was never intended to be used for floodplain delineation purposes.

2. The mapping was prepared using a digital terrain model (DTM). The model was based on a 75-foot grid spacing and break line data. The grid spacing does not appear to be tight enough, and there apparently is insufficient break line data to adequately model the terrain, particularly in the channel area.

3. Six cross sections, picked at random by GVSCE by examining areas of the contour mapping which did not appear reasonable, were presented for support of statement 2 above. Each cross section plot depicts a comparison between the photogrammetric cross section and one extracted from the contours. Vertical errors of as much as 10 feet are apparent, assuming the photogrammetric cross sections are correct. The vertical errors result in a horizontal error of contour location which is very significant for plotted cross sections (errors of as much as 100 feet).

4. Dr. Kao presented four cross section comparisons from the Fountain Hills (South) area which depict similar differences, and an apparent horizontal shift which has yet to be explained.

Mr. Loomis then discussed the accuracy of the photogrammetric HEC-2 cross sections. Cross section plots of the field check sections against the photogrammetric sections were presented. The accuracy is significantly better with most differences occurring in heavily vegetated ares. There is also an, as yet, unexplained horizontal shift apparent in these plots. The photogrammetric cross sections appear to be sufficiently accurate to meet FEMA specifications.

Mr. Loomis described the following problems which are now apparent:

1. The contour mapping provided by the District does not meet FEMA specifications in certain areas and there is not enough data available to isolate these areas, as they are random, but appear most often in the channels.

2. The hydraulic model, based on the photogrammetric cross sections, will meet required accuracy. Floodplain boundaries that are to be plotted on the contour mapping will not be accurate in all areas.

3. The photogrammetric cross sections will not all have sufficient hydraulic capacity to convey the 100-year peak discharge because the cross section lengths were determined using the contour maps. The inaccuracy in the contour mapping resulted in photogrammetric cross sections that do not always extend far enough to adequately depict the floodplain.

Mr. Loomis presented the following recommendation to correct the problems:

1. The existing contour mapping is accurate enough to be used for the hydrology, but should not be used for the hydraulic analysis.

2. The stereo photography and control are apparently accurate enough to meet FEMA specifications. The stereo model should be used to create enhanced contour strip maps along each wash to be delineated, using conventional stereoscopic techniques, not a DTM. This could be done after the hydraulic modeling is completed and actual floodplain limits are known.

3. Photogrammetric extensions of the existing cross sections will be necessary in some areas.

Both Dr. Sabol and Dr. Kao requested that the District provide GVSCE amd AGK with financial relief for the costs incurred thus far which are not covered by the contract scope of work. The change order should also cover costs associated with the additional work to assist in the preparation of the enhanced mapping.

There was considerable discussion regarding the proposed solution and the change orders. Both Mr. Johnson and Mr. Murphy agreed that the proposed solution is acceptable and that a change order is appropriate. The following course of action was agreed upon:

1. Mr. Murphy will schedule a meeting with KAM to present this problem. Wednesday, 18 August 1993 was tentatively agreed upon. All parties are to attend.

2. Both AGK and GVSCE are to itemize costs incurred to date that are in excess of the agreed upon scope of work that is due to the mapping problems and attempts to resolve the problems.

3. The District will contract, or otherwise deal, directly with KAM to obtain acceptable mapping.

4. AGK and GVSCE are to prepare a statement of required effort and cost estimate for the extra work necessary to complete the project using the revised mapping.

Mr. Loomis discussed why it has taken so long to get to the point where this determination regarding mapping accuracy could be made. Seven iterations of submittal and checking of the photogrammetric cross sections was required because of errors found in KAM's submittals to GVSCE. This process took 2 months. The problems encountered included incorrect stationing, missing end points, erroneous data, sections out of order, incomplete X1 records, and missing data when cross sections contained horizontal angle points. It was pointed out by Mr. Murphy that this was a problem between GVSCE and its sub-contractor, KAM, and not the Districts' responsibility. However, Mr. Kmetty noted that this was a problem that the consultants inherited as a result of the District's decision to accept the existing mapping from KAM. The consultants had little choice as a result of that decision.

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16 September 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 8

Dear Mr. Murphy:

The following progress is reported for the period 16 August 1993 through 12 September 1993:

TASK 1 - COORDINATION
a. Prepared Progress Report No. 7

TASK 2 - DATA COLLECTION
a. Data collection is substantially complete.

TASK 3- MAPPING
a. Met with the District, MKE and AGK on 16 August to define mapping problems and to develop a strategy for resolution.
b. Met with the District, MKE, AGK and Kenney Aerial Mapping (KAM) on 18 August to present the problems to KAM and to agree upon a solution.
c. Coordinated with sub-consultants (MKE, ALS and GCA) in preparing a change order request as a result of the meeting of 18 August.
d. Prepared and submitted a change order request to the District.

TASK 4 - FIELD SURVEY
a. Field surveying is completed.

TASK 5 - HYDROLOGY
a. Revised parameter spreadsheets. Submitted to District for review.
b. Completed channel routing data.
c. Progressed with HEC-1 model development.
d. Plotted and red-lined hydrology exhibit drawings.

TASK 6 - HYDRAULICS
a. Progressed with special culvert input for HEC-2 model.
b. Progressed with HEC-2 model development.

TASK 7 - FINAL PRODUCTS

a. Progressed with Hydrology Report; Chapter 3, exhibit drawings, Survey and Mapping, Land-use and Soils Parameters.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	65
2	100
3	80
4	100
5	77
6	55
7	23

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, Ph.D., P.E.

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

14 October 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 9

Dear Mr. Murphy:

The following progress is reported for the period 13 September 1993 through 10 October 1993:

TASK 1 - COORDINATION

a. Prepared Progress Report No. 8

TASK 2 - DATA COLLECTION

a. Data collection is substantially complete.

TASK 3- MAPPING

No activity, except as noted under items of interest and special problems.

TASK 4 - FIELD SURVEY

a. Field surveying is completed.

TASK 5 - HYDROLOGY

a. HEC-1 model for the 6-hr storm is nearly complete.
b. HEC-1 logic diagram is nearly complete.
c. Initiated work on future condition model parameters.
d. Initiated work on the 24-hr storm model.

TASK 6 - HYDRAULICS

HEC-2 models have been developed, including special culvert options, for all 16 reaches requiring floodplain delineation. These models are essentially complete for existing conditions (December 1992). The models have not been subjected to final review, nor have they been used for floodplain and floodway analyses. Some cross sections will need modifications when the new photodigitized data is received from Kenney Aerial Mapping.

TASK 7 - FINAL PRODUCTS

a. The exhibits for the Hydrology Report have been prepared (AutoCAD) and corrections to those exhibits are being produced.
b. Tables of hydrology parameters are completed.
c. A draft of the 100-year, 6-hour hydrology report section has been prepared.
d. The 100-year, 6-hour hydrology with supporting exhibits, tables, and draft of report will be submitted to the District within the next reporting period.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	77
2	100
3	80
4	100
5	85
6	63
7	36

The following items of interest and special problems are noted:

1. The project was placed on-hold, except for selected hydrology tasks, by the consultant as of 11 October 1993. This is for the purpose of redefining the remaining scope-of-work and agreeing upon the necessary change order to address problems that exist with the DTM.
2. Kenney Aerial Mapping (KAM), during the meeting at the District on 18 August 1993, agreed to revise the DTM by adding break lines and other input, and to extend certain photodigitized section data. KAM estimated that the revised DTM would be available in 30 days, and that the extensions of the photodigitized sections would be provided "very quickly." Eight weeks have passed since that meeting and neither the revised DTM nor the extended photodigitized section data have been received. Therefore, we have not been able to finalize the HEC-2 models of the washes.

3. A recommended redefinition of the scope-of-work and a change order is being prepared by the consultant to address completion of the project upon delivery of the revised DTM by Kenney Aerial Mapping. This is to be available for discussion with the District by 22 October 1993.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, PhD, PE

SUMMARY MINUTES
SUNRIDGE CANYON - FOUNTAIN HILLS
DRAINAGE SCOPE
CVL 50-0002-01
November 1, 1993

Attendees:

Tim Murphy, Flood Control of Maricopa County (FCDMC)
Randy Harrel, Town of Fountain Hills (TofFH)
George Sabol, George V. Sabol Consulting Engineers, Inc. (GVS)
Tom Loomis, George V. Sabol Consulting Engineers, Inc. (GVS)
Jack Moody, Coe & Van Loo Consultants, Inc. (CVL)
Rick Jones, Coe & Van Loo Consultants, Inc. (CVL)

The purpose of the meeting was to discuss the Sunridge Canyon project, and to gather drainage information for the area. GVS is in the process of preparing a Flood Insurance Study for the Northern Fountain Hills area. As a part of the study, GVS will be preparing hydrology for the area, and delineating numerous floodplains within the Town of Fountain Hills.

In connection with this development the following was agreed upon:

1. GVS would not perform floodplain delineations on Bristol Wash or Cloudburst wash within the Sunridge Canyon area.

2. Analysis of these washes will be performed by CVL in connection with the development of the site.

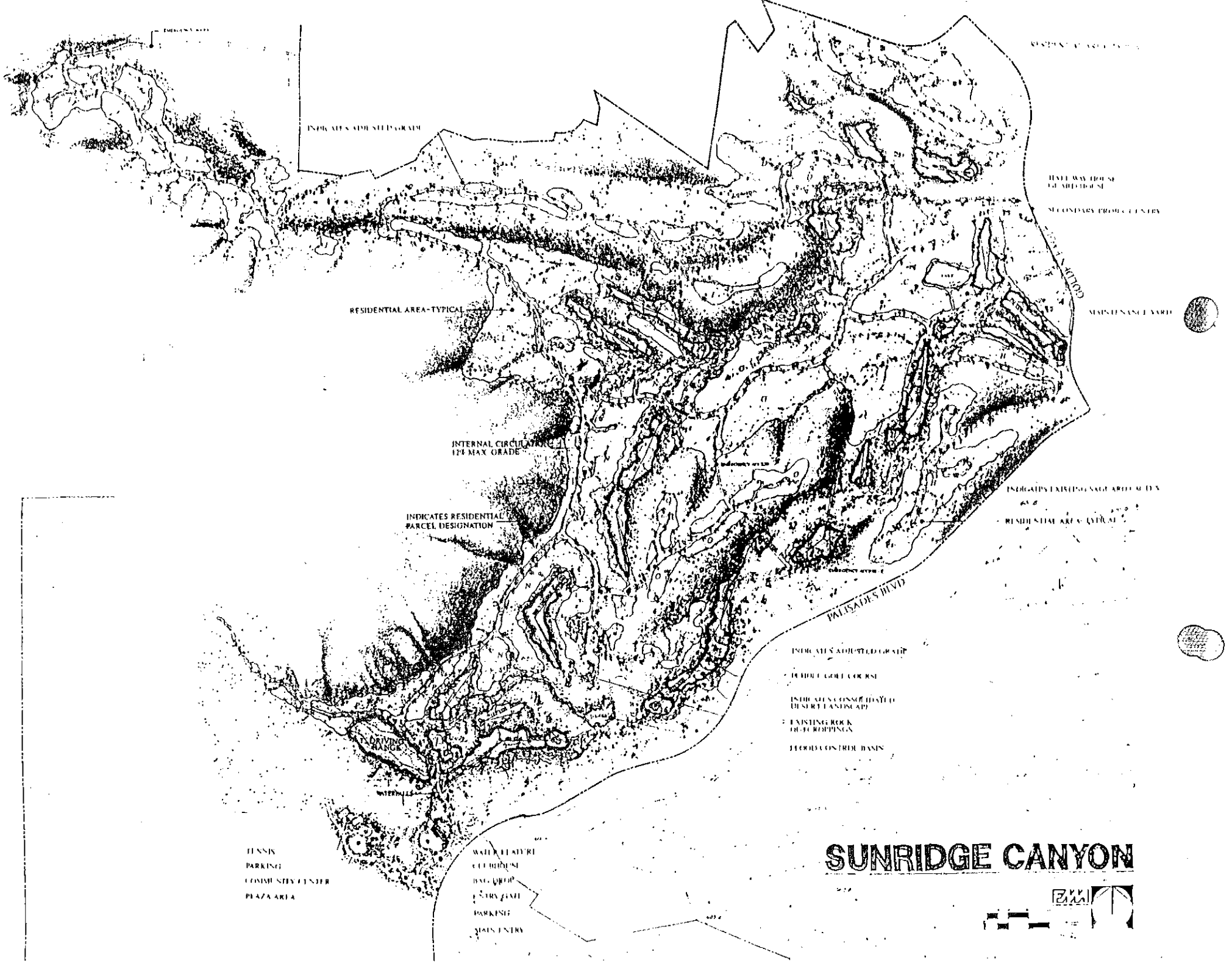
3. GVS has preliminary HEC-2 models on several washes within the Sunridge Canyon area that CVL would be able to utilize to facilitate the analysis.

4. GVS will continue preparing their Area Wide Hydrology Study. Approval of their preliminary report is anticipated to occur in or before January 1994, with approval of their final report estimated to be the middle of 1994.

5. TofFH will allow CVL to use the information established for the GVS hydrology prior to its approval, in order to expedite the preparation of final plans for Sunridge Canyon.

6. TofFH will require CVL to modify the GVS preliminary hydrology to account for future condition land use.

Circulation will be made to all attendees. If your understanding of what was discussed during the meeting in connection with this project should differ from the above, please contact Rick Jones at (602) 264-6831.


INDICATES ADJUSTED GRADE
RESIDENTIAL AREA-TYPICAL
INTERNAL CIRCULATION
12% MAX GRADE
INDICATES RESIDENTIAL
PARCEL DESIGNATION
HALF WAY HOUSE
GUARD HOUSE
SECONDARY PROJ. ENTRY
COLLEGE
MAINTENANCE YARD
INDICATES EXISTING SAGE ARTEMISIA
RESIDENTIAL AREA-TYPICAL
PALISADES BLVD
INDICATES ADJUSTED GRADE
PUBLIC GOLF COURSE
INDICATES CONSOLIDATED
DESERT LANDSCAPE
EXISTING ROCK
OUTCROPPINGS
FLOOD CONTROL BASIN
DRIVING
RANGE
WATERFALLS
TENNIS
PARKING
COMMUNITY CENTER
PLAZA AREA
WATER FEATURE
CLUBHOUSE
BAG DROP
ENTRY GATE
PARKING
MAIN ENTRY
SUNRIDGE CANYON

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12 November 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 10

Dear Mr. Murphy:

The following progress is reported for the period 11 October 1993 through 7 November 1993:

TASK 1 - COORDINATION
a. Prepared Progress Report No. 9

TASK 2 - DATA COLLECTION
a. Data collection is substantially complete.

TASK 3- MAPPING
No activity.

TASK 4 - FIELD SURVEY
a. Field surveying is completed.

TASK 5 - HYDROLOGY
a. The 100-year existing condition model (without reservoir routing and flow split operations) was submitted to the FCDMC for review.
b. Reservoir route and flow split tables are added to the 100-year, 6-hour existing condition model. Substantiating hydraulic calculations are complete and ready for submittal to the FCDMC for review.

TASK 6 - HYDRAULICS
No activity.

TASK 7 - FINAL PRODUCTS
No activity.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	80
2	100
3	80
4	100
5	90
6	63
7	36

The following items of interest and special problems are noted:

1. The project remains on-hold, except for completion of work on the 100-year, 6-hour, existing condition hydrology model, as per letter to the District dated 11 October 1993.
2. A revised Scope-of-Work/Budget recommendation was submitted to the District on 5 November 1993.
3. A meeting was held on 27 October with the District and Coe & Van Loo Consultants concerning the Sunridge Canyon development.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, PhD, PE

George V. Sabol Consulting Engineers, Inc.
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14 December 1993

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 11

Dear Mr. Murphy:

The following progress is reported for the period 8 November 1993 through 5 December 1993:

TASK 1 - COORDINATION
a. Prepared Progress Report No. 10

TASK 2 - DATA COLLECTION
a. Data collection is substantially complete.

TASK 3- MAPPING
No activity.

TASK 4 - FIELD SURVEY
a. Field surveying is completed.

TASK 5 - HYDROLOGY
a. Completed 100-year, 6-hour, existing condition model.
b. Submitted preliminary hydrology report to the District, short chapters on routing and final results.
c. Performed 100-year, 24-hour, existing condition model (without routing optimization), and compared the peak discharges for the subbasins.
Note: The 6-hour model produces larger peak discharges for all subbasins than the 24-hour model produces.
d. Plotted selected hydrographs (for dams).

TASK 6 - HYDRAULICS
No activity.

TASK 7 - FINAL PRODUCTS
The Hydrology Report is in preparation and is approximately 75 percent complete.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	80
2	100
3	80
4	100
5	95
6	63
7	40

The following items of interest and special problems are noted:

1. The project remains on-hold, except for completion of work on the 100-year, 6-hour, existing condition hydrology model, as per letter to the District dated 11 October 1993.
2. A revised Scope-of-Work/Budget recommendation was submitted to the District on 5 November 1993.
3. GVSCE was informed by the District in a phone call with Mr. Tim Murphy that the change order has received preliminary approval. Change order authorization can be expected by the end of December.
4. Verbal notice was provided by GVSCE to MKE that the project was no longer on-hold for hydraulic analyses. GVSCE and MKE will be finalizing the HEC-2 models of the washes for which floodplain delineations are to be performed.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, PhD, PE

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

1 March 1994

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 12

Dear Mr. Murphy:

The following progress is reported for the period 6 December 1993 through 27 February 1994:

TASK 1 - COORDINATION

a. Prepared Progress Report No. 11

TASK 2 - DATA COLLECTION

a. Data collection is substantially complete.

TASK 3- MAPPING

a. Revised DTM mapping was received from the District as a result of Kenney Aerial Mapping Company's agreement to remap the identified watercourses.
b. The revised mapping was loaded in AutoCAD, and work map sheets were produced that include the contour maps of the watercourse strips (the new DTM), street and building overlays, the thalweg and cross section locations, and control grids. This was a major effort because of the manner in which the DTM files were provided by Kenney Aerial Mapping Company. Nonetheless, worksheet maps are presently available that show features as described above, and these will be used for the hydraulic analyses.
c. The new mapping was "verified" by plotting and comparing previously selected cross sections. Three sets of cross sections are plotted for each location; 1) photodigitized data, 2) field survey data, and 3) cross section data obtained from the new DTM contour maps. That comparison, which was agreed upon to "verify" the new mapping, indicates that acceptable mapping is now available. Those comparison plots are available for inspection at our office. Upon inspection of those plots by Mr. Tim Murphy, we will prepare a letter of transmittal and summary conclusion along with copies of the plots to the District.
d. Upon review of the new DTM mapping, it was observed by both the District and GVSCE that the contours in the new mapping do not merge into the contours for the old mapping at the trim lines. This will present a problem for

GIS conversion of the mapping since the new strip maps must be merged with the old base maps of the study area. The deviations at the trim lines are beyond the "fuzzy" limit capabilities for merging those files. GVSCE advised the District that the problem as described was not within the GIS subcontractors scope-of-work or responsibility. Therefore, the mapping was rejected in regard to GIS conversion. The District is to coordinate with Kenney Aerial Mapping Company in resolving that problem.

TASK 4 - FIELD SURVEY

a. Field surveying is completed.

TASK 5 - HYDROLOGY

a. GVSCE addressed the hydrology review comments that were received from the District concerning the 100-year, 6-hour HEC-1 modeling.
b. Channel routings were reoptimized for better simulation of flow conditions.
c. Storage routing behind the dams were reviewed and revised to eliminate routing instabilities on the low-flow recession limb of the hydrographs.
d. HEC-1 modeling is completed for the following:
    1.) 10-year and 100-year, 6-hour, existing condition.
    2.) 100-year, 24-hour existing condition.
    3.) 10-year and 100-year, 6-hour, future condition.
e. Parameter summary tables for all 6-hour models were prepared. As noted in Progress Report No. 11, the 6-hour models produce larger peak discharges for all subbasins than the 24-hour models and therefore only 6-hour parameter tables are necessary. These summary tables were submitted to the District for review.
f. Inflow and outflow hydrographs were plotted for each of the five dams. These were produced to verify the HEC-1 model results and performance. Copies of these were submitted to the District.
g. Hydrographs at other critical locations were plotted for internal review.

TASK 6 - HYDRAULICS

a. The HEC-2 culvert routines are being checked against analytic calculations using HY8.
b. Floodplain and floodway analyses are progressing using the HEC-2 models that have been developed for all watercourses.
c. A diskette copy of HEC-2 input files for watercourses that are being eliminated from the scope-of-work were provided to the District.

TASK 7 - FINAL PRODUCTS

The Hydrology Report is in preparation and is approximately 80 percent complete.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	90
2	100
3	90
4	100
5	95
6	70
7	45

The following items of interest and special problems are noted:

a. Contract Change Order No. 2 was received from the District in January 1994. The contractual budget was increased to $262,000. Future invoices will reflect that change.
b. Notice on Contract Change Order No. 3 is pending at the District. We are progressing in anticipation of receiving that authorization.
c. A file of the corrected DTM (trim line fuzzy tolerance problem) will need to be received from the District before the GIS conversion of the mapping can be undertaken.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, PhD, PE

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

30 March 1994

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 13

Dear Mr. Murphy:

The following progress is reported for the period 28 February through 27 March 1994:

TASK 1 - COORDINATION

a. Prepared Progress Report No. 12

TASK 2 - DATA COLLECTION

a. Data collection is substantially complete.

TASK 3- MAPPING

a. In regard to Task 3, Mapping, item d of the last Progress Report (No. 12, dated 1 March 1994), GVSCE was advised by Mr. Tim Murphy that Kenney Aerial Mapping Company (KAM) is going to revise the strip mapping (again). The revision to those maps is to bring the contour lines into conformation with the old mapping at the trim lines. GVSCE and the District agreed that the strip maps that were previously received by KAM (through the District) and incorporated into work map sheets (see Task 3, item b of Progress Report No. 12) will be used for the floodplain delineation maps even though they will not be the same as the strip maps that will again be revised by KAM. The reason for this is the extensive time that it would take to once again produce work map sheets from the revised strip maps. Notes will be added to all work map sheets indicating that some of the contour lines are in error along the trim lines, and that the overall maps (GIS converted) must be used for elevation information outside the limits of the floodplain delineation. The report will discuss this situation and clearly identify the limitations of the work map sheets. The newly revised strip maps will be provided by the District to GVSCE. They will be delivered to GCA for

incorporation of the new strip maps into the previously supplied overall mapping of the study area. The strip mapping will replace the old, faulty mapping up to the trim lines. The mapping files, as described above, will then undergo GIS conversion. It is expected that KAM will provide strip map files to the District that can be incorporated into the overall maps without further problems (fuzzy tolerances, etc.) and can undergo successful GIS conversion.

TASK 4 - FIELD SURVEY

a. Field surveying is completed.

TASK 5 - HYDROLOGY

a. The project hydrology was reviewed in regard to preparation of the hydrology report.

TASK 6 - HYDRAULICS

a. Additional culvert hydraulic analyses were performed in regard to checking HEC-2 results.
b. Floodplain and floodway analyses are progressing using the HEC-2 models that were developed.

TASK 7 - FINAL PRODUCTS

The Hydrology Report is in preparation and is approximately 85 percent complete.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	94
2	100
3	95
4	100
5	95
6	80
7	50

The following items of interest and special problems are noted:

a. Contract Change Order No. 3 was received from the District in March 1994. The contractual budget was increased to $269,827. Future invoices will reflect that change.

b. A file of the corrected DTM (trim line fuzzy tolerance problem) will need to be received from the District before GIS conversion of the mapping can be incorporated.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, PhD, PE

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

25 April 1994

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 14

Dear Mr. Murphy:

The following progress is reported for the period 28 March through 24 April 1994:

TASK 1 - COORDINATION
a. Prepared Progress Report No. 13

TASK 2 - DATA COLLECTION
a. Data collection is substantially complete.

TASK 3- MAPPING
a. No activity.

TASK 4 - FIELD SURVEY
a. Field surveying is complete.

TASK 5 - HYDROLOGY
a. Hydrology is complete.

TASK 6 - HYDRAULICS
a. Floodplain and floodway analyses are progressing using the HEC-2 models that were developed.

TASK 7 - FINAL PRODUCTS
a. The Hydrology Report is in preparation and is approximately 85 percent complete. The Hydraulics Report is underway.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	95
2	100
3	95
4	100
5	100
6	85
7	55

The following items of interest and special problems are noted:

a. A file of the corrected DTM (trim line fuzzy tolerance problem) will need to be received from the District before GIS conversion of the mapping can be incorporated.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, PhD, PE

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

19 July 1994

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 West Durango St.
Phoenix, Arizona 85009

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04
Monthly Progress Report No. 15

Dear Mr. Murphy:

The following progress is reported for the period 25 April through 17 July 1994:

TASK 1 - COORDINATION

a. Prepared Progress Report No. 14

TASK 2 - DATA COLLECTION

a. Data collection is substantially complete.

TASK 3- MAPPING

a. No activity.

TASK 4 - FIELD SURVEY

a. Field surveying is completed.

TASK 5 - HYDROLOGY

a. Hydrology is complete.

TASK 6 - HYDRAULICS

a. Preliminary floodplain analyses were submitted to the District, and review comments were received back from the District.
b. Comments from the District are about 75 percent resolved. This includes selected HEC-2 reanalyses, replotting of selected cross sections, and replotting the profiles.
c. Completed digitizing floodplains for all watercourses.

TASK 7 - FINAL PRODUCTS

a. The Hydrology Report is 90 percent complete.
b. The Hydraulics Report is about 40 percent complete.
c. The Hydrology Report and the Hydraulics Report are scheduled to be submitted to the District in August.

The estimated percent completion by tasks are as follows:

Task No.	Percent Completed
1	95
2	100
3	95
4	100
5	100
6	90
7	75

The following items of interest and special problems are noted:

a. Final mapping has not been received as of this report period.

b. The final review of hydrology indicates that the 24-hour storm (10-yr and 100-yr) produces the largest discharges in Ashbrook Wash below Dam 4. The 6-hour storm produces higher discharges for other locations.

Please call me if you have any questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, PhD, PE

1.3.1 COMMUNITY

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 506-1501
Fax (602) 506-4601
TDD (602) 506-5897

D. E. Sagramoso, P.E., Chief Engineer and General Manager

BOARD OF DIRECTORS
P. Ben Arredondo
Betsey Bayless
James D. Bruner
Carole Carpenter
Tom Freestone

JUN 25 1992

George V. Sabol, Ph.D., P.E.
Project Manager
George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street
Phoenix, Arizona 85016-6419

SUBJECT: Notice of Selection for Contract FCD 92-04

Dear Dr. Sabol:

Your firm has been selected for performing the work in the Fountain Hills North Floodplain Delineation Study.

Additional information will be forthcoming regarding Schedule, Scope of Work, and Fee Negotiations.

Sincerely,

Leanna Cumberland
Chief, Contracting Branch

RECEIVED DEC 2 8 1993

George V. Sabol Consulting Engineers, Inc.
1331 17th Street, Suite 700, Denver, Colorado 80202
(303) 295-7016 FAX (303) 292-2415

28 December 1992

Mr. Geza E. Kmetty, P.E.
McLaughlin Kmetty Engineers, Ltd.
3501 N. 16th Street, Suite A
Phoenix, Arizona 85016

Subject: Fountain Hills (North) Floodplain Delineation Study
Contract FCD 92-04

Dear Geza:

George V. Sabol Consulting Engineers, Inc. (GVSCE) received verbal notice to proceed with the referenced project on 8 December 1992. We anticipate receiving written notice to proceed shortly from the Flood Control District of Maricopa County (FCDMC). I will be submitting copies of agreements/contracts between GVSCE and its subconsultants to FCDMC along with other documents that FCDMC will be requesting of GVSCE. As such, I am submitting this letter of agreement to you for your review and approval.

The final negotiated fee proposal to FCDMC is dated 12 October 1992. Copies of pages from that fee proposal related to work to be performed by McLaughlin Kmetty Engineers, Ltd. (MKE) are shown in Attachment 1. A breakdown of the scope-of-work and related MKE personnel man-hours is shown in Attachment 2.

The MKE responsibilities for the Fountain Hills project are as follows:

1. The required hydraulic analyses (HEC-2 modeling), as specified in Attachment 2, are to be performed by MKE under the direct supervision of a MKE senior engineer. GVSCE will provide an engineer and an engineering technician to assist the MKE senior engineer in performing those hydraulic analyses and the preparation of the floodplain delineation maps. The Project Engineer (Thomas R. Loomis) of GVSCE will have overall supervision of the hydraulic analyses and preparation of the floodplain delineation maps.

   Note: Senior engineer is defined as an Arizona registered professional engineer (civil) with experience in hydraulic analyses of floodplains. Engineer is defined as a graduate engineer with EIT certification or better. Engineering technician is defined as a person with education and/or experience in engineering practice.

2. MKE is responsible for all computer-aided design/drafting (CADD) and manual drafting services as specified in Attachment 2.

3. MKE is responsible for the preparation of the Hydraulics Report as required under Contract FCD 92-04. The report will be reviewed by GVSCE prior to submittal to FCDMC.

Contract FCD 92-04 is a Fixed/Lump Sum contract, and as such, MKE will be reimbursed according to the fee proposal amount shown in Attachment 1, unless written authorization from GVSCE is provided for services over and above those designated herein. Monthly progress payments will be made upon receipt of monthly invoices by MKE and payment of invoices by FCDMC.

If this agreement is satisfactory to you, please sign the original and the copy. Return the original to me. Please call me if you have questions.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc.

George V. Sabol, Ph.D., P.E.

Enclosures:
Attachment 1 - Pages of Fee Proposal to FCDMC dated 12 October 1992 related to fee and man-hours for MKE.
Attachment 2 - Itemized MKE man-hour schedule.

Agreement Accepted
McLaughlin Kmetty Engineers, Ltd.

by: _____
Geza E. Kmetty, P.E.
Title: Principal
Date: 12/28/92

Meeting on flood plain plan

Find out where flood waters go on Dec. 17

An open house to inform Fountain Hills residents of floodplain delineation studies being performed on over 30 washes flowing through the community will be held on Thursday, Dec. 17.

The meeting will be held from 5 to 8 p.m. at the Town Hall Conference Room, 16836 E. Palisades Blvd.

The public is invited to come by the Town Hall anytime during the three-hour open house to share their experience and observations of local flooding and hear details about the studies.

Details will include how the study is conducted, what kind of information is being gathered and how the information will be used.

Mapping floodplains involves developing detailed topographic maps to determine where water goes and studying rainfall patterns to determine typical amounts of runoff. The studies and resulting maps will be used to better manage the floodplain so as to reduce or prevent flood damage and maintain the integrity of the floodplains.

Extensive surveying and aerial mapping is involved in the studies, but other factors influencing drainage also must be considered, including soil composition, slope and vegetation and land use.

The Fountain Hills studies are expected to take 12 months to complete, after which time a second open house will be held to inform residents of the results of the studies.

Questions or additional information regarding the studies can be obtained by writing or calling Jim Phipps or Tim Murphy of the Flood Control District of Maricopa County, 2801 W. Durango Street, Phoenix, AZ 85009, telephone 506-1501, or Randy Harrel, town engineer, Town of Fountain Hills, 16836 E. Palisades Blvd, Fountain Hills, AZ 85268, telephone 837-2003.

Audit tops Sanitary agenda

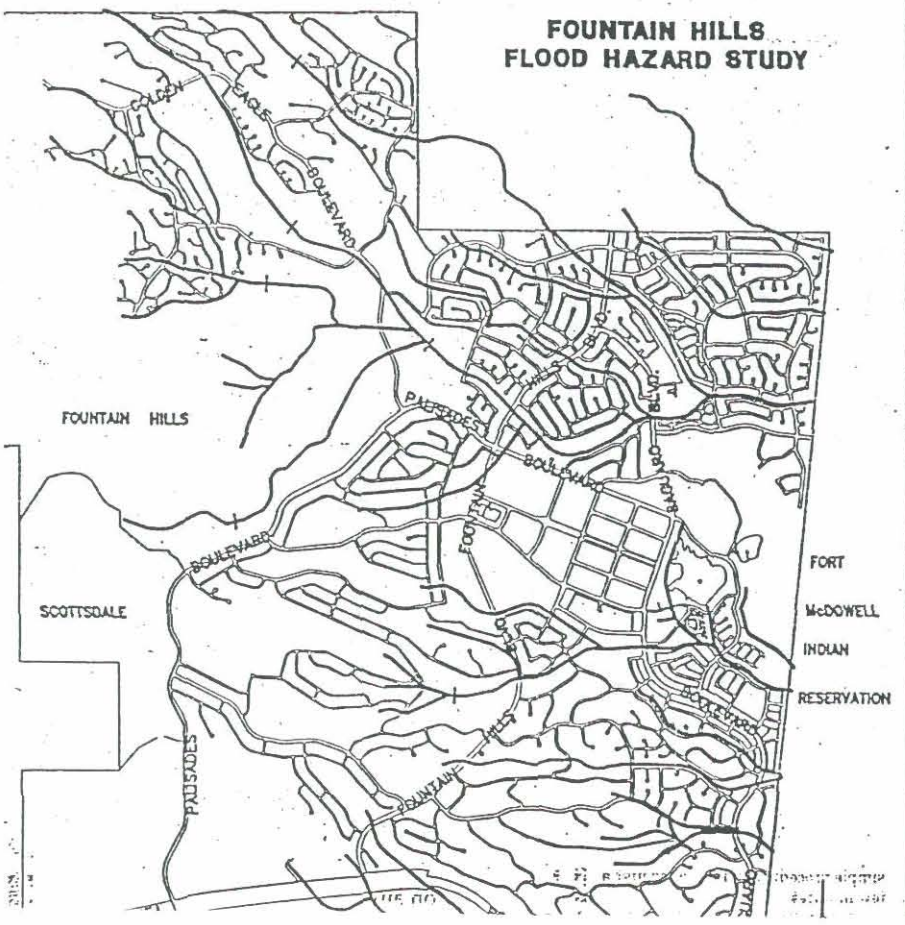
The annual audit report will be the major topic on the agenda for the Sanitary District board of directors when it meets Thursday, Dec. 10.

The report is a routine document prepared each year, according to District Manager Ron Huber.

The board will also select a new chairman for the coming calendar year.

The job of chairman has simply rotated under the current board, and that being the case Director Dennis Regeski will be leading the board for the next year. Director Bruce Hansen is the outgoing chairman.

Huber said monthly staff reports will also be presented at the meeting, and he has a few carryover items to update the board on.



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are WORKING FOR YOU!
Transaction Specialist
Larraine LaGiglia.....
daily monitors the progress of each of my ESCROWS and LISTINGS. She is in constant contact with my LISTERS & concentrates on finding BUYERS for my listings.

Systems Specialists
Dana West.....
Implements the unique MARKETING SYSTEMS designed to get my LISTINGS SOLD quickly! She keeps my LISTERS advised of the progress on their property.
Administration Specialist

TCL [illegible]
92-464.001

AGK ENGINEERS, INC.
2255 N. 44th St. Suite 330 • Phoenix, AZ 85008 • Phone (602) 244-2566 • FAX:(602) 244-8947

RECEIVED JAN 0 7 1993

PRINCIPALS
Edward A. Adair, P.E.
R. Gerald Green, P.E.
Samuel E. Kao, Ph.D., P.E.

ASSOCIATES
Michael J. Bonar, P.E.
Denis L. Howe, P.E.
Hal E. Marron, P.E.
Patrice M. Miller

January 4, 1993

Mr. Frank Brown, P.E.
MKE
3501 North 16th Street
Phoenix, AZ 85016-6419

Reference: Local Advertisement
Fountain Hills Flood Insurance Studies

Dear Mr. Brown:

Per our telephone conversation today regarding the shared publication of the legal advertisement for the Fountain Hills Flood Insurance Study, AGK's understanding is as follows:

1. MKE will proceed with advertisement preparation and placement in the Arizona Republic and Times of Fountain Hills.

2. AGK will be sent a copy of the advertisement to review prior to publication.

3. Tim Murphy, Flood Control District of Maricopa County, will be sent a copy of the advertisement prior to publication to review and approve.

4. Two (2) Affidavits of Publication will be issued for each advertisement. One will name MKE (or Sabol) and the other will name AGK Engineers, Inc. as the party the affidavit was issued to.

5. MKE will submit an invoice to AGK for AGK's share of the publication cost along with a copy of the original invoices from the publications. AGK will pay 50% of the original invoice cost of publication to MKE.

Sincerely,

AGK ENGINEERS, INC.

Hal Marron

Hal E. Marron, P.E.
Project Manager

HEM/kp

Town Road Department crew members Greg Capaldi and George Roth clear debris from runoff on Fountain Hills Boulevard at Ashbrook Wash just north of Palisades Boulevard last Saturday morning. Barricades were installed to prevent motorists from attempting to drive through the flooded street. A total of 2.12 inches of rain fell on the community that morning. *(Photo by Arnold Dworkis)*

THE TIMES Aug. 26, 1992

Cooler Temperatures, too

Heavy rains hit town

With a Sunday high of only 71 degrees (it didn't feel like August) and a torrential downpour early Saturday morning, the year's wacky weather trend continues.

The remains of Hurricane Lester brought plenty of moisture into Arizona last weekend, and Fountain Hills got its share in an early morning storm on Saturday, Aug. 22.

A total of 2.12 inches of rain fell that day, with most of it falling in an early morning deluge. The runoff quickly filled the town's washes, and the road crews were out putting up barricades where the water was flowing across the roads.

There were reports of water in some offices, but no major damage. Water did get into the north fire station on Golden Eagle Boulevard. (See story, this page.)

The storm broke the humid, heat wave that had been plaguing the area in recent weeks. Sunday's high was only 71, and it was in the mid-60s at night as many residents were able to turn off their air conditioners and open doors and windows.

Another .34 inches fell on Sunday, as a light drizzle came down most of the day.

The weekend rainfall raised the month's total to 3.85 inches and the total to date for the year an amazing 17.11 inches.

Mostly sunny skies are expected the remainder of the week. For a complete log of the week's temperatures and rainfall, see the weather box at the top of Page A-1.

Raging wash inundates fire station

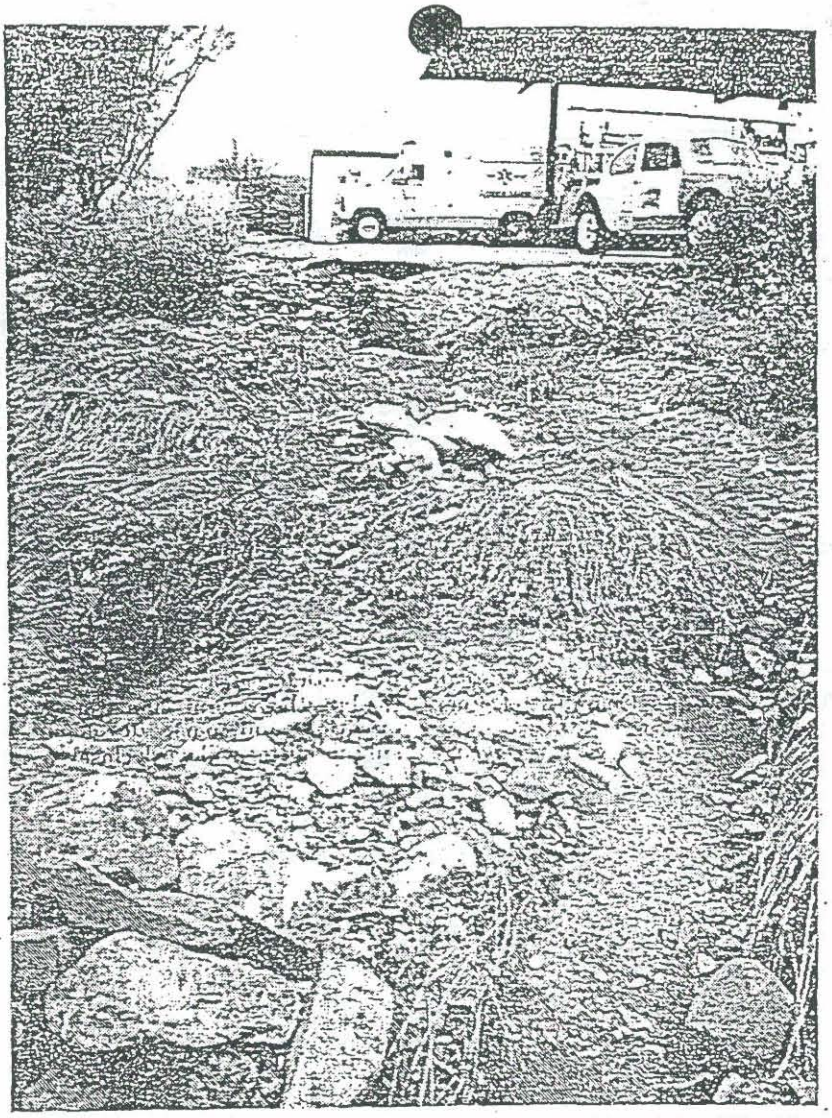
Rushing water spilling from the banks of an overburdened wash seeped into Fire Station 23 on Golden Eagle Boulevard early Saturday morning causing slight damage and a large clean-up.

Heavy rains Friday night and early Saturday morning sent high water rolling down Ashbrook Wash from high in the McDowell Mountains. The fire station lies in a low spot about 100 yards from the edge of the wash.

Apparently, a culvert which carries water under Golden Eagle Boulevard, became clogged with debris sending the water over the roadway

(cont. on page A-7)

THE TIMES Aug. 26, 1992



Rocks and debris were washed around the Fountain Hills Fire Department station on Golden Eagle Boulevard early Saturday morning. The station was flooded when a culvert under Golden Eagle became clogged.

Station

(cont. from page A-1)

and down the driveway of the fire station.

Firefighters on duty at the station were aware of the heavy rain coming down, but not the rising wash until a colleague arrived and found water about to come through the door.

Firefighter John Dooley said when he arrived for duty a short time later mud and water had seeped under the door into the building. There was about two inches of water in the bathroom and hallway of the station.

Monday morning, the path of the floodwater could be seen as small bushes and grass lay over under the force of the stream. A fan was being used to help dry the crawlspace under the trailer which serves the fire station.

The mud and water were removed from the building and the carpet and flooring were cleaned up.

To the rear of the fire station, a rain gauge was anchored in the asphalt of the parking area and was washed away by the flooding. Dooley said there was no reading taken before the gauge disappeared, but when it was found down the wash it had about two inches of mud covered with another 1.5 inches of water.

a-10
A-1

The Ti

OF FOUNTAIN HILLS AND RIO VERDE, ARIZONA

Also serving the Fort McDowell Indian Community

Wednesday
February 10, 1993

Vol. 20, No. 6

Your hometown weekly newspaper

32 Pages - 2 Sections

50 Cents

RECEIVED FEB 12 1993

Weather

	HIGH	LOW	PREC.
Tues., February 2	69	36	--
Wed., February 3	73	39	--
Thurs., February 4	76	45	--
Fri., February 5	74	50	--
Sat., February 6	78	47	--
Sun., February 7	77	50	.08
Mon., February 8	57	52	1.70

The resolution further states the

(cont. on page A-10)

Rains bring total to 8.44 inches for year

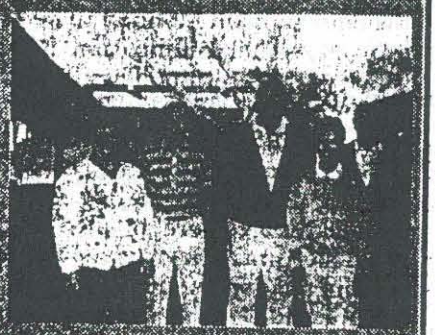
The rainy days of the winter of '93 are continuing as another Pacific storm dropped 1.78 inches of rain on the community Monday and early Tuesday morning.

The total was as of 7:30 a.m. Tuesday, and the skies were still threatening and more rain was predicted for that day.

The showers Monday, including a heavy downfall around 9 p.m. that night, brings the annual total to 8.44 inches . . . in just a little over five weeks!

Partly cloudy skies are forecast for the remainder of the week, and there is a chance for more showers by the weekend.

eek:



y has concerns

areas change must be made by operations, she has questions utilizing financial concerns. See

ter room dedicated

the Community Center's new dedicated last weekend. It was n Hills. See Page B-1

ect 300 game

owled a perfect 300 game in a Via Linda Lanes. The 23-year three years. See Page B-1.

Fire District:
Citizens Advisory Committee: Wednesday, 6 p.m., Fire Station 1

Sanitary District:
Board of Directors: Regular meeting, Thursday, 6 p.m., at district office on Pepperwood Circle

School:
School Board: Thursday, 7 p.m.

ices

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At Ashbrook Wash crossing

Crews try to keep FH Blvd. dry

By Michael Scharnow

Town officials are hopeful nuisance flows on Fountain Hills Boulevard at the Ashbrook Wash crossing will no longer be a problem.

The large wash itself is still running, but the town's street crew last week finished up a major "repair job" in an attempt to make the area presentable.

There were two problems at that location which resulted from the heavy rains Fountain Hills experienced in December and particularly in January:

* An underground drain pipe became clogged, forcing the excess or nuisance water to run over the street.

* The groundwater table is so low at the crossing that excess water was literally being forced through pavement cracks up to 15 feet away from the concrete "dip."

"That's why we were experiencing so much tearing up of the pavement and potholes at that location," said Street Superintendent Pat Harvey.

Town Engineer Randy Harrel said the town is pursuing "disaster assistance" funds from two sources in an attempt to recoup money spent for the recent fixes.

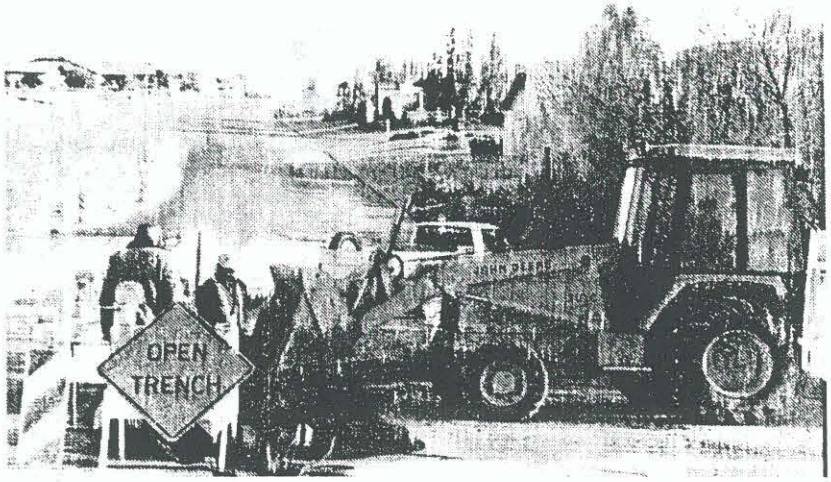
"We actually made application for eight different locations for disaster assistance," Harrel said.

"We suffered quite a bit of damage as a result of those storms."

Assistance funds could come from the Federal Emergency Management Agency or the national Department of Transportation.

"We had Fountain Hills Boulevard under control last summer," Harrel said. "The pipe was clean, and the pavement was in much better shape."

Because of the excess groundwater found so far away from the actual wash crossing, the street crew installed an underground "drain" pipe, designed to divert the water and channel it into the wash rather than up through pavement cracks.



The street crew backfills a small trench containing a drain pipe that will help keep Fountain Hills Blvd. dry at Ashbrook Wash.

"The road is basically setting on a layer of clay at that point, and the water runs right on top of that under the road," the engineer added.

Final patches for cracks and potholes were put on last week Thursday, Feb. 4, and a smooth layer of hot patch asphalt may be added soon near the crossing.

Long-term help

Harrel said both nuisance and storm water problems won't be solved for the Ashbrook Wash at Fountain Hills Boulevard until a permanent box culvert is built.

He estimates that will cost more than $250,000.

"That's our long-term plan," Harrel said. "We are planning to secure federal aid funds to finance most of its construction, so we're probably looking at two to three years for completion."

The box culvert would be large enough to handle large storm flows underneath the roadway and accommodate pedestrian traffic should a pathway ever be built in the wash.

The roadway itself would have to be raised as well "over" the culvert, adding significantly to the project's estimated cost.

Man arrested for assaulting two women

William Schreck of Fountain Hills was arrested for assault early Sunday morning, Feb. 7, after allegedly pushing and throwing two women at a home on Boxwood Lane.

Sheriff deputies arrested Schreck at approximately 4 a.m., said Sheriff's Sgt. Dave Toporek.

Apparently, Shreck pushed one woman into a bookcase then grabbed and threw a second woman to the ground, Toporek said.

In other matters, the Sheriff's Office reported:

* At approximately 12:40 a.m. on Jan. 31, four juveniles were arrested for possession of alcohol near the intersection of Palisades and Fountain Hills boulevards.

* Vandals apparently dam. electrical conduit and a drain pipe on the roof of Four Peaks School on the weekend of Jan. 30 and 31. At 8:15 a.m. on Monday, Feb. 1, school personnel discovered and reported the damage to sheriff deputies.

DESIERTO ROSE
LANDSCAPE SERVICES
DESIGN, INSTALLATION, MAINTENANCE
Landscape Tip: Through transpiration, a living ground cover cools the

35 homes cut off

Floods draw attention to safety routes

Recent heavy rains brought to the attention of Rio Verde Fire District officials the need to prepare an emergency access plan for the extreme northwest section of the community.

Flash flooding in the wash across Avenida Del Ray between Arroyo Way and Horseshoe Bend blocked all access to about 35 homes north of the wash during a recent storm.

Fire District Board Chairman Al Hill said the wash was running at at depth of four feet for a couple of hours, making it impossible for emergency equipment to reach those living in the area.

Fortunately there were no emergency calls into the area while the road was closed, he added.

Addressing the problem will be one of the first issues to face the new Fire District board.

Hill said flash flooding in the wash from summer monsoon and winter storms has been a problem for a long time. However, the recent flooding created the most acute problem in memory and increased awareness of a need for an emergency access plan.

At its first meeting last week the board asked Rural/Metro Chief Bob Oden what the legal problems of such a situation was for the district.

Oden said he could not give a legal opinion, but he said firefighters must make every effort to reach a victim in an emergency situation.

Solutions

The board has decided to pursue two short-term approaches and one long-term solution to the access problem, according to Hill.

Residents near the wash on the north side will be asked to store emergency equipment and a golf cart.

Emergency personnel would then cross the wash on foot, pick up the equipment and golf cart and go to the scene.

Hill also said that an emergency evacuation plan will be established for the neighborhood. During stormy weather the wash will be monitored and if there appears to be a danger of flash flooding the fire department will ask residents to evacuate the area.

One potential long-term solution to the problem is to access the area through the new Tonto Verde development.

Hill said the developer will be asked to provide an emergency route to Avenida Del Ray from the Tonto Verde side.

He added that the route would be designated for emergency only and provide only limited passage.

Hill estimated that it would be at least a year before such a route would be available, and it would only be used if the Avenida Del Ray route were closed. Using an access route through Tonto Verde would likely result in a slight delay in response time.

The Fire District board will be communicating its concern to the Rio Verde Community Association board of directors and the residents of the area so they are fully aware of the potential problem.

According to Hill, both the Community Association streets committee, and the Rio Verde Country Club are considering solutions to the problem of flooding which occurs at the wash.

The high water usually causes the closure of the sixth hole on the Quail Run Golf Course and creates a significant clean-up operation for the streets committee.

Rio Verde Review

Monthly hikes for February are scheduled for next week. On Thursday, Feb. 11, Bob Mason will be leading a group to Needle Rock north of Rio Verde along the river. On Friday, Feb. 12, Bob Brooke will lead a group to Fat Man's Pass in South Mountain Park. Good shoes are needed for the South Mountain trek.

* * *

A Ladies' Day Away is planned for Rio Verde residents on Friday, March 5. The outing will begin with a one-hour Coffee Concert conducted by James Sedares, conductor of the Phoenix Symphony Orchestra. Also performing will be R. Carlos Nakai with the Native American Flute and Cherry Rhodes at the organ. Following there will be a shopping trip and optional lunch at the Arizona Center. The cost of the concert is $11. The group will leave Rio Verde in car pools at 9:15 a.m. Those interested may sign up in the post office.

* * *

Income tax forms are available on the table in the Rio Verde Post Office.

* * *

The second annual Rio Verde Tennis Club Championships are scheduled for Monday, Feb. 22, through Sunday, Feb. 28. The event is "handicapped" to even out the competition.

* * *

The library committee is ready to accept more books for the Oasis Library. Books need to be current and in good condition. Also, a dictionary is needed. Call Millicent Harris, 471-2407.

Beeline

(cont. from page A-15)

the county.

Other opponents felt it is premature to complete the study if there are no plans for construction of the road.

Birthstone of the Month

9-1.
A-1

The Fil

OF FOUNTAIN HILLS AND RIO VERDE, ARIZONA

Also serving the Fort McDowell Indian Community

Wednesday
February 17, 1993

Vol. 20, No. 7

Your hometown weekly newspaper

32 Pages • 2 Sections

50 Cents

RECEIVED FEB 19 1993

FRANK BROWN
PHOENIX, AZ
SCOTTSDALE, AZ
KNOLL, ENG 5 TO 8026

Weather

	HIGH	LOW	PREC.
Tues., February 9	63	49	--
Wed., February 10	61	46	.41
Thurs., February 11	65	38	.06
Fri., February 12	69	39	--
Sat., February 13	66	41	--
Sun., February 14	52	45	.10
Mon., February 15	62	45	.43

and they would be constructed much faster than if they were phased in at

(cont. on page A-9)

Rain keeps on coming

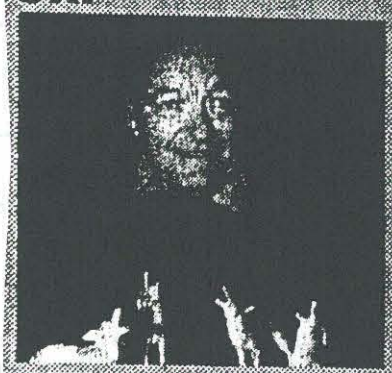
And the rains just keep on coming.

The comunity received another drenching this past weekend. Total rainfall for the week was 1.01 inches bringing the monthly total to 2.79 inches and the annual total to 9.45 inches.

That's about equal to the average annual rainfall, but it has been achieved in just six weeks. A total of 13.9 inches has fallen since Dec. 4, when the current wet cycle began.

Forecasters are calling for continuing rain Wednesday through Friday and possibly into the weekend as several more Pacific storms are scheduled to pass through. Highs are predicted to be in the low to mid-60s.

eek:



request

g and Zoning Commission ap-
uest for a rezoning of 46 acres
atholic churches. See Page A-

are renewed, 3-2

ee School District principals'
the coming year. See Page A-

te education reform

am's plan to reform school law
in Hills School Board. The bill
ay schools are governed. See

m Michael Jackson

a touching call from enter-
e died. See Page B-1.

Fire District:

Citizens Advisory Committee:
Wednesday, 5 p.m., Fire Station 1

School:

School Board - Wednesday, 7 p.m.
School Admininstration Bldg.

AGK ENGINEERS, INC.
2255 N. 44th St. Suite 330 • Phoenix, AZ 85008 • Phone (602) 244-2563 • FAX:(602) 244-8947

PRINCIPALS
Edward A. Adair, P.E.
R. Gerald Green, P.E.
Samuel E. Kao, Ph.D., P.E.

ASSOCIATES
Michael J. Bonar, P.E.
Denis L. Howe, P.E.
Hal E. Marron, P.E.
Patrice M. Miller

February 17, 1993

Mr. Tim Murphy
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, AZ 85009

Reference: Fountain Hills Flood Insurance Study
Survey Control - Update
AGK Project No. 310.43

Dear Mr. Murphy:

Since the writing of our letter of February 11, 1993, AGK has been able to obtain copies of the vertical and horizontal control survey notes used for the aerial mapping supplied by the District to AGK for the above referenced project. Based upon our review of these notes and our research, we wish to refine our request for information from that expressed in our February 11, 1993 letter. The information requested is as follows:

1. A comprehensive listing of all panel points, brass caps, and other control points that are either shown on or used to establish the control for the mapping. The comprehensive listing should include the following:

   - point number or name
   - 1983 NAD State Plane Coordinates
   - local coordinates
   - 1929 NGVD ground elevation
   - 1929 NGVD monument elevation (if different)
   - local datum elevation (indicate ground or monument)
   - description of point —
   - alternate descriptions or names for same point

   This listing should be complete for all low altitude and high altitude map panels, all control brass caps, and all the named points contained in the horizontal control survey. A partial list of these point names would include:

DEB	SWEAT	JUD
ALLEN (AKA AL)	NEW BAKER (N.B.)	NEW ROBERT (N.R.)
LOUIE	JULIE	PADUC (AKA P.D. & PADUKE)
NEW MICK (N.M.)	MF	PAT
RENA	TEEPEE	G.L.
RW		

The request for alternate names is made due to naming convention inconsistencies found within the survey notes. Two examples are as follows:

Page 52 Horizontal Control

Panel 1100 - ECC 32-1 (F.H. original control)
Record 41559.110 N 17484.740 E
Also is BM #328
Record Elev. = 2039.74 0.35 above ground

(Editors note: From the Town of Fountain Hills Benchmark 328 is described as a PC located at coordinates 23807.998 N, 21801.806 E)

Page 44 Vertical Control

BM #16 - GLO BR Cap - angle point S.R.I.R.
Elev. 1536.12 0.55' above N.G.

This is the same description given to point number 153 in the August 24, 1992 letter from Anderson-Nelson and to panel point 1153.

2. Copies of the available documentation of the 1970 triangulation survey for Fountain Hills. It is our understanding that points established as a part of that survey were used as the basis for this new aerial control survey and that no new overall control closure was performed. This requested documentation could include the original survey notes and/or Math Plats or Records of Survey created from these notes.

3. A more comprehensive description of the method used to convert the elevations on the mapping from local datum to 1929 NGVD. The method described in Anderson-Nelson's letter of August 24, 1992 cannot be confirmed in the field. ADOT's recent construction of the Beeline Highway has destroyed the monument at the northwest corner of its intersection with Shea Boulevard. Other than the August 24 letter, AGK has been provided no record information showing that monument as part of the vertical control survey for Fountain Hills. AGK is currently conducting a control survey that will include ADOT control points and the two Indian boundary points identified as points 123 and 153. We will keep you advised of the progress of this survey and its impact on the 1.26 feet adjustment factor used in the mapping conversion.

We thank you for your prompt action on this request.

Sincerely,

AGK ENGINEERS, INC.

Hal Marron

Hal E. Marron, P.E.
Project Manager

HEM/kp

cc: Tom Loomis, George Sabol & Associates
Randy Harrell, Town of Fountain Hills
Don Anderson, Anderson-Nelson

TRANSMITTAL

TO: Tim Murphy
Flood Control District of Maricopa Co.
2801 Durango Street
Phoenix, AZ 85009

FROM: George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

DATE: Feb. 25, 1993

PROJECT No./Name: 35 Fountain Hills Floodplain Delineation Study

SUBJECT: Legal Advertisement

ENCLOSED ARE THE FOLLOWING

Original affidant of Publication from the Times of Fountain Hills.

REMARKS

COPIES AGK

S' 'ED Thomas R. Lomis

PHOENIX

TRANSMITTAL

TO: Joyce Sabol

FROM: *George V. Sabol Consulting Engineers, Inc.*
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

DATE: 25 Feb 1993

PROJECT No./Name: 35 Fountain Hills

SUBJECT: Legal Advertisements

ENCLOSED ARE THE FOLLOWING

AZ Republic Invoice
AZ Republic Affidavit - Original for AGK
Times Invoice
Times Affidavit - Original for AGK

REMARKS

Joyce: We owe the Republic $43.56 & the Times $0.00. Send Hal Marron at AGK copies of invoices & original affidavits plus our invoice for 50%. I already sent original affidavits to the FCD (see copies of Transmittals for AGK).

COPIES

SIGNED Tom Loomis

PHOENIX

Rcvd. 3-4-93

Job file
92-404.001

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501

FAX # 506-4601

COVER SHEET

TO: FRANK BROWN

COMPANY OR DEPT: McLAUGHLIN KMETTY FAX # 248-7851

FROM: TIM MURPHY

NUMBER OF PAGES BEING SENT INCLUDING COVER SHEET: 2

IF THERE ARE ANY PROBLEMS, PLEASE CALL (602) 506-1501.

COMMENTS: EXAMPLE OF N VALUE DETERMINATION.

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC'S METHOD

Project : Deadman Wash Floodplain Delineation Study
Stream : Deadman Wash
Location : Just upstream of I–17 bridges
Photo No : 10
Section Description : Bed material is cobbles, boulders, and large rock with weeds and brush. Floodplain has a dense cover of trees and brush.

Channel Conditions		Manning's	n Value	Left Overflow	Channel	Right Overflow
Channel Material	Coarse Gravel	nb	.028			
	Cobble		.030 – .050	0.045	0.045	0.045
	Boulder		.040 – .070			
Degree of Irregularity	Smooth	n1	.000			
	Minor		.001 – .005		0.005	
	Moderate		.006 – .010	0.010		0.010
	Severe		.011 – .020			
Effects of Obstruction	Negligible	n2	.000 – .004			
	Minor		.005 – .015	0.015	0.010	0.015
	Appreciable		.020 – .030			
	Severe		.040 – .060			
Vegetation	Small	n3	.002 – .010			
	Medium		.010 – .025	0.025	0.015	0.025
	Large		.025 – .050			
	Very Large		.050 – .100			
Variations in Channel Cross Section	Gradual	n4	.000			
	Alternating		.001 – .005			
	Alternating		.010 – .015			
Degree of Meandering	Minor	m	1.00			
	Appreciable		1.15			
	Severe		1.30			
n = (nb + n1 + n2 + n3 + n4) m				0.095	0.075	0.095

NVALUE10.WK3

HAPPY ST. PATRICK'S DAY!

The Times

OF FOUNTAIN HILLS AND RIO VERDE, ARIZONA

Also serving the Fort McDowell Indian Community

RECEIVED MAR 18 1993

FRANK BROWN
MCLAUGHLIN, KMELTY, ENG 5 823324
3501 N 16TH ST
PHOENIX, AZ 85016

Leprechauns will turn Fountain **Green** at noon

Weather

	HIGH	LOW	PREC.
Tues., March 9	82	49	--
Wed., March 10	82	47	--
Thurs., March 11	81	46	--
Fri., March 12	83	53	--
Sat., March 13	81	49	--
Sun., March 14	71	51	--
Mon., March 15	83	49	--

Wednesday March 17, 1993

Vol. 20, No. 11

Your hometown weekly newspaper

30 Pages - 2 Sections

50 Cents

the identity of the gas were still unknown at press time.

Lions will be collecting for White Cane Days

Members of the Fountain Hills Lions Club will be accepting donations for White Cane Days, March 19 and 20.

Club members will be accepting donations to support Lions activities at four local locations.

They will be stationed at Bashas', Safeway, McDonald's and the Fountain Hills Post Office.

The Lions supply glasses for school age children whose families need help in providing glasses, and the club contributes to the Arizona Eye Bank.

3-17-93 A-1

FH population estimate now at 11,000

The town population has probably topped the 11,000 mark.

The official 1990 census was 10,030, and recently released population estimates from the state have set the town's population at 10,790 as of July 1, 1992.

The Arizona Department of Economic Security recently released population estimates for Arizona, its counties and all incorporated municipalities.

The state and county estimates are developed by DES, while the subcounty estimates are developed by DES and the six regional Councils of Government. Their draft estimates are reviewed by the Population Technical Advisory Committee (POPTAC), established by Governor's Executive Order.

Once recommended by POPTAC, the population estimates are sent to the DES director for approval and then forwarded to the Economic Estimates Commission (EEC) where they are used in the determination of local government expenditure limitations.

Since the estimate was made last July, Fountain Hills has seen an upturn in new home construction, home resales activity and move-ins as evidenced by increases in the local school enrollments.

Conservative estimates now place the population at approximately 11,000.

The Times
OF FOUNTAIN HILLS AND RIO VERDE, ARIZONA
Wednesday, March 31, 1993

B Section

- Clubs
- Business News
- Religion
- Classifieds
- Sports
- Fountain Spouts

A check for $2300 has been presented to kick off the Kiwanis Park Fund.

The money was raised from a jointly-sponsored High Tea the three Kiwanis Clubs held recently at the Rio Verde Country Club. Co-chairing the event were Joan McGivern of the Noon Kiwanis and Shirley Wright of Sunrise Kiwanis.

The High Tea featured women's apparel from Fountain Fashions and jewelry from Designs By Sami.

"We want to thank Kay Kinder of Fountain Fashions and Sami Jack of Designs by Sami for their efforts and contributions to making this a big success," said McGivern.

"Kay not only brought in her fashions, but donated the use of her models, a guitarist for background music and an ice sculpture that made the event all that much more special. She even paid for the advanced promotion. The Kiwanis Clubs really thank her."

Kiwanis Park is a long-term project that is being planned as a joint project by the three clubs. It will likely be located along Kiwanis Dive adjacent to the clubhouse just south of Fountain Park and Lakeside Resort Casitas.

The clubhouse and property were recently renamed the "Fountain Hills Kiwanis Park Activity Center."

It is envisioned that the property will be developed into a youth-oriented area. There is a wash bordering the property on the south that may also be developed.

Representatives of the three local clubs will be meeting in coming months to develop a plan for the property. Serving on that study group are Dr. Paul Kolwaite from Sunrise Kiwanis, Frank Clark from Noon Kiwanis and Bob Travis from Sunset Kiwanis.

Organizers of the High Tea said another is planned for next March based on the success of this year's event.

High Tea co-chai
McGivern prese
Kiwanis Preside

Boy Scout Ryan B
plant life on camp

We now have a year's rainfall in just 3 months

And the rains just keep on coming.

Now having more than our average annual rainfall, last weekend's rains bring the annual total to 12.73 inches -- in just three months!

The heaviest rains occurred Friday night and early Saturday morning with 1.85 inches in the rain gauge as of 7:30 a.m. that day. Another .11 fell during the day, and another .28 was logged Sunday night and early Monday morning.

Another week weather disturbance is expected Friday, but forecasters are calling for a nice weekend.

Ryan
trail a

Ryan Boese, a
member of Troop 3
work on a community
that will create a
Fountain Hills High

The project is in
his completing requi
highest rank in Boy
Eagle.

The son of Ric a
he is a freshman at
school.

Guiding Boese w
Bob Treloar, a biolog
school. The scout
research on three
plant life systems, So
and Chihuahuan. T
plant life are repr

File

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

14 April 1993

Mr. Tim Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Subject: Fountain Hills Floodplain Delineation Study (North)
Preliminary Sub-Basin Delineation and HEC-2 Cross Section Locations
Contract FCD 92-04

Dear Tim:

We have completed the preliminary sub-basin delineation and HEC-2 cross section locations. I have enclosed the following information for your review and comments:

1. Preliminary hydrology Exhibits B, C, and D at a scale of 1"=400' (soils, land use, and T_c/routing, respectively).
2. Original pencil work maps used for sub-basin delineation, including:

    a. 1"=200' Fountain Hills detailed mapping;
    b. 1"=400' McDowell Mountain Park mapping covering the area north of the 200 scale maps; and
    c. 1"=100' original Fountain Hills development mapping covering most of the area west of the 200 scale maps.

3. An overall land use map at a scale of 1"=800'.
4. Town of Fountain Hills Zoning Map at a scale of 1"=800'.
5. An overall soils map at a scale of 1"=2000'.
6. Original pencil work maps used for location of HEC-2 cross sections and FEMA check sections, at a scale of 1"=200'.

Please return the original pencil work maps to me when you have completed your review. After we have agreed on cross section locations and sub-basin boundaries, I will forward a revised set to Randy Harrel at the Town of Fountain Hills.

I will be submitting draft copies of the following information by 4 May 1993 for your review:

1. Preliminary Hydrology Report Table of Contents.
2. Preliminary Hydrology Report Section 2: Mapping and Survey Information.
3. Preliminary Hydrology Report Section 3: Hydrologic Analysis
    3.1 Hydrologic Method Description
    3.2 Parameter Estimation
        3.2.2.1 Watershed Sub-Basin Parameters

I plan to spend next week in the field verifying sub-basin boundaries, checking land use, and obtaining routing cross sections in the areas outside the detailed mapping. As always, feel free to accompany me on the field inspection. I hope Sandy can make it out there for a day or two.

George will be in town on 4 May 1993 for a meeting with the Drainage Manual Steering Committee. We would like to schedule a coordination meeting for the afternoon of 4 May 1993 to discuss your review comments, the results of my field reconnaissance, the hydrology parameter estimation procedures, and progress on hydraulics. Please check with Sandy and establish a time for the meeting. We could also meet on 5 May 1993 if the 4th is inconvenient. Feel free to give me a call if you have any questions regarding this letter.

Sincerely,

Thomas R. Loomis

Thomas R. Loomis, P.E.

cc: Sandy Story, Frank Brown, George Sabol

Enclosure: Referenced maps.

LAND USE IDENTIFIER LEGEND FOR EXHIBIT C

Map Symbol	Land Use Description	Town of Fountain Hills Zoning Classifications	RTIMP
VLDR	Very Low Density Residential	Rural-43, Rural-190	15
LDR	Low Density Residential	R1-18, R1-35	25
MDR	Medium Density Residential	R1-6, R1-7, R1-8, R1-10	45
MFR	Multiple Family Residential	R-2, R-3, R-4, R-5	65
C	Commercial	C-S, C-O, C-1, C-2, C-3	90
IND	Industrial	IND-1, IND-2, IND-3	75
ND	Natural Desert	N/A	0
SCH	School	N/A	25
DE	Dedicated Drainage Easement	Dedicated by recorded plat (width > = 100').	0

Each map symbol may have one of the following qualifiers:

N Natural (no development, zero percent impervious for the existing condition).

P( ) Partially developed (< 50% built out). The value in parenthesis after the P represents the estimated existing condition percent impervious. All of these will be changed to F for the future condition.

F Fully developed (> = 50% built out). Used for the existing condition if the polygon is greater than 50% built out.

RECEIVED MAY 1 3 1993

...ntain Hills Times

AND RIO VERDE, ARIZONA

...so serving the Fort McDowell Indian Community

Wednesday
May 12, 1993

Vol. 20, No. 19
Your hometown
weekly newspaper

26 Pages - 2 Sections

50 Cents

Weather

	HIGH	LOW	PREC.
...ues., May 4	92	60	--
Wed., May 5	85	55	--
Thurs., May 6	91	53	--
Fri., May 7	90	55	--
Sat., May 8	93	56	--
Sun., May 9	97	60	--
Mon., May 10	99	64	--

Bulldozers moving into FH washes next week

By Michael Scharnow

The town appears unable to prevent some Maricopa County-mandated grading in two area washes.

MCO Properties will likely begin bulldozing work next week in Ashbrook Wash from Saguaro Boulevard east to the Indian reservation and in the wash just north of Morningside at Lakeside Village.

A meandering swath ranging anywhere from 10 feet to 50 feet or more in width will be cut in by MCO, which still owns the washes.

The county's Department of Environmental Management notified MCO the access is required so personnel can spray the areas for mosquito control.

Tom Engelthaler, the county's vector control manager, told the Town Council May 6 that the two sections have become so heavily vegetated that access is virtually impossible.

Engelthaler said there are a "multitude" of mosquito problems in Fountain Hills and his office is in charge of controlling outbreaks.

The major worry is to prevent the transmission of diseases, particularly encephalitis (sleeping sickness).

Modifications

Engelthaler said the two target washes are "heavy breeding" areas and need to be modified for access and control.

The county wants a clear channel cut into the two stretches so running water has no chance to "pool" along the way and offer breeding habitats for mosquitoes. In addition, an access lane is needed for personnel and equipment along the defined channel.

Engelthaler said the best form of prevention is elimination of possible breeding sites.

Although there have only been 12 verified cases of encephalitis in the county during the past 18 years, Engelthaler attributed that to an aggressive control of mosquito breeding.

"We prioritize mosquito control on a year-round basis and eliminate mosquito sources as we find them," he said.

Jim Rush, a local developer who is finishing out the Cottonwoods, a subdivision that adjoins the Ash-

(cont. on page A-10)

will be getting a substantial increase in pay. I don't think she could have turned the offer down."

Hansen said a search committee is being formed to find a new executive director. The committee will consist of four Chamber board members and one outside person.

The committee will consider all resumes received, but will keep its solicitation within Arizona.

Yet another trial date in Fox case

Another trial date has been set in the case involving Town Councilman Charlie Fox.

The trial will begin in Scottsdale Justice Court June 14, more than seven months after the alleged crime occurred.

Fox and a close friend, Street Department maintenance worker Danny Tancredi, were pulled over Nov. 2 by Sheriff's Office deputies after a report went out on missing campaign signs.

Deputies found 19 "John Vardian for Fire Board" signs in the back of Fox's white van, and the Maricopa County Attorney's Office later filed misdemeanor charges of theft and tampering with political signs.

In statements given to authorities, Fox and Tancredi said a woman called the Fox residence to complain about campaign signs littering a local street, and they were merely picking up those signs that were down or damaged.

The highly-publicized case has been through a number of continu-

and threatened three homes.

According to Fountain Hills Fire Chief Tom Knapp, that blaze, pushed by a strong wind, jumped across Mohave Road a short distance east of Fountain Hills.

However, quick action by firefighters stopped the fire as it burned downhill into a wash.

If the fire had burned to the bottom of the wash, the wind would

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Construction on a new Salt River tribal landfill started earlier this month, raising concerns among Fountain Hills residents about dust and traffic problems.

It was announced by *The Times* in March that the new landfill site would be located northeast of Gilbert Road along the Beeline Highway just south of the Arizona Canal

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Bonds

(cont. from page A-1)

district currently owns.

The board asked for the tour because the Facilities Committee had asked for permission to explore the market for the land.

The group visited three larger sites and two smaller sites adjacent to the existing elementary schools.

Those included a 17.5-acre parcel at Hawk and Arroyo Vista drives, a 32-acre site on El Lago Boulevard near Cavern Drive and 19 acres along Aspen Drive near Eagle's Nest Drive.

The tour was conducted mostly to familiarize the board members with the property.

There was discussion about the fact that the Aspen site may be within a flood plain, but that will not be known until later in the summer when Maricopa County releases its new flood study of the area.

Also, the sites adjacent to the existing schools were talked about for potential expansion of those schools.

It was also agreed that any discussion about the El Lago site be done with open communication with neighbors in the area.

Higgins said she would like to see the district retain ownership of that parcel, but not necessarily use it as a school site.

The property is not considered ideal for school construction.

Crystal

(cont. from page A-1)

Farrell said the Community Development Department is responsible for initial interpretation of the Zoning Ordinance and the commission is free to vote against its findings and recommendations.

"So long as the individual commission members do not render a decision that results in the property owner being totally unable to develop the property, their decision will not be the subject of litigation that would be difficult, if not impossible, to defend by the town," Farrell wrote.

Community Development Director Gary Jeppson said MCO Properties has not changed the subdivision's configuration nor its proposed grading plan.

The public is invited to attend Thursday night's open meeting.

The Vet's Corner

...ies will be increased.

The district will be hiring about a dozen new teachers for the next school year.

One of the key options discussed for cutting the budget was the reduction or elimination of classroom aides.

Dunne said Friday that is being

Washes

(cont. from page A-1)

brook Wash, charged the problem is excessive effluent dumping by MCO that is causing the washes to flow with water on an almost constant basis.

Rush said years ago, before heavy effluent irrigation was initiated by MCO, the Ashbrook Wash was normally dry, except for wet periods during winter months.

Rush, a former head of the local MCO Properties office, further charged that running water in the Morningside wash is from a leak in the Fountain Park lake bottom or the dam at the park.

"Before we tear out the wash, let's check the water and the source of water in the washes," Rush said.

"I think the water is induced by man, and I think we can control the water flow and then at the same time control the mosquitoes by eliminating the water source . . .

"We'd by dry today if there were no irrigation."

A combination

Town Engineer Randy Harrel said there is no direct runoff of effluent from turfed areas into the washes, but he said using "common sense" might lead one to conclude some of the running water is recharged effluent from irrigation.

"We also know there is a high water table in those areas between the rock and clay layers, and there is still some surface water coming from the mountains," Harrel said.

"A combination of effects are probably resulting in the current situation."

Mayor John Cutillo said he would like to see the effluent option examined, rather than tearing up the washes, but Engelthaler said it would be difficult to determine how long it would take for the washes to dry up, if ever, should effluent irrigation be stopped.

Town staff has examined some preliminary grading plans submitted by MCO, and it appears that a grading permit will be issued to allow the scraping.

MCO Vice President Ray Baldwin said he hopes to begin the work next week, depending on when the permit is issued by the town.

The idea is to promote international understanding through homestay experiences for students, increasing cultural awareness and acceptance.

It also is a good way to promote study of foreign languages in our schools and stimulate interest in other cultures.

All students who participate in the program have full medical coverage and chaperons and coordinators are available to assist the host family.

Students provide their own transportation and pocket money.

This summer, the program needs to place French students who will visit from July 8 to Aug. 3, and from July 30 to Aug. 22.

A group of Spanish students will need host families from July 2 to 28.

Residents who are interested in hosing a young person or having their children participate in the program in Europe should call Torrilhon at 837-1591.

Summer program for young teens

Touchstone Community, Inc., the Phoenix-based social service agency which operates after school child care programs at McDowell Mountain School, is holding a summer program for junior high school students.

Robin Keiner, an artist who has worked in the prevention and latchkey programs in the Phoenix area, is directing the high school leadership program called Teen Power.

The program is open to seventh and eighth grade students. It will operate 2 1/2 hours each weekday afternoon for seven weeks, Keiner said.

The goal of the program is to get the kids involved and allow them to learn about decision making.

The students will have input on the subjects for discussion groups. Topics for discussion will include drugs and sexuality, according to Keiner.

"This is not a classroom setting," she said. "The kids will be discussing how and why they make specific decisions."

Some of the methods for student interaction will include crafts, sports, making a video, community service and social action.

Keiner said she has already talked to the students, and they are aware the program is available.

Further information about fees for the program and registration may be obtained by calling Karol Harris at 953-3001.

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LET US
RE-FASHION
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THE REDKEN CONSULTATION

Town of FOUNTAIN HILLS

May 17, 1993

Maricopa County Flood Control District
2801 W. Durango
Phoenix, AZ 85009

Attention: Tim Murphy

Gentlemen:

We have attached recent correspondence and plan of work for MCO Properties in Ashbrook Wash, and the unnamed wash east of Panorama and north of Morningside. This correspondence is for information only. We would recommend that you do not change your N-Values for the streams, nor any cross section data, to reflect possible lowflow channel grading. Although the work will be occurring this summer, future maintenance of this lowflow channel and cleared area is questionable. If you have any further concerns, or need further clarification, feel free to call.

Sincerely,

Randy L. Harrel

Randy L. Harrel, P.E., L.S.
Town Engineer

RLH:jn
cc: Tom Loomis - w/att.
Hal Marron, Jr. - w/att.

ASHBWASH.RLH

16836 East Palisades Boulevard - P.O. Box 17958 - Fountain Hills, Arizona 85269 - (602) 837-2003 - FAX: (602) 837-3145

APPLICATION — ZONING CLEARANCE/BUILDING PERMIT

TOWN OF FOUNTAIN HILLS DEPARTM OF COMMUNITY DEVELOPMENT
16836 E. PALISADES BLVD. BUILDING C P.O. BOX 17958 FOUNTAIN HILLS, ARIZONA 85269
PHONE (602) 837-2003 FAX 837-3145

BUILDING PERMIT NUMBER: 93-0273

APPLICANT: COMPLETE NUMBERED SPACES BELOW. PRESS HARD TO MAKE 4 COPIES.

1. CONSTRUCTION ADDRESS / LOCALITY: See attached map
2. NEAREST INTERSECTION OR DIRECTIONS TO JOB SITE. DRAW MAP IF NECESSARY.: Saguaro & Del Cambre - Panorama & El Lago
3. LEGAL LOT/SPACE | BLOCK | SUB DIV. / MOB. HOME PARK:
4. LEGAL DESCRIPTION (RECORDED): Ashbrook Wash & Morningside Wash
5. OWNER OR TENANT: MCO Properties Inc. — PHONE: 837-9660
6. MAILING ADDRESS: P.O. Box 17795 Fountain Hills, AZ. — ZIP: 85268
7. CONTRACTOR: Hard Rock Construction Co. — LIC. #: 075314 — PHONE: 492-0510
8. ADDRESS: 1910 W. Deer Valley Rd. Phx. AZ. — PRIV. TAX LIC. #: — ZIP: 85027
9. LIST YOUR UTILITIES: GAS CO. | ELEC. CO.: SRP | WATER CO.: CCWC | WELL | SEWER | CITY: Ftn. Hills | SEPTIC (ISDS)
10. TEMPORARY ELEC. POWER? YES__ NO__ ON POLE__ ON BLDG __ ELEC. CO. AGREEMENT? YES__ NO__ | OWNER BLDR CONTRACTOR STATEMENT? YES NO | VALUATION $
11. LIST ALL WORK TO BE DONE ON THIS PERMIT. OTHER PERMITS MAY BE TAKEN OUT LATER.: Channelization of washes to allow continuous flow of water. Moving approximately 2000 Cu. Yds. of dirt

ZONE DIST.	PARCEL NO.	DEVLP. CODE / CENSUS
OPEN —	M&B	

ZONING CASE # | B.A. CASE # | PRIOR ZONING PERMITS

F. YD. | R. YD. | S. YD. 1 | S. YD. 2 | FRONTAGE | BLDG. HT. | LOT COVERAGE %

REMARKS

HGWY

HEALTH

FLOOD — APPVD. BY — DATE

FLOOD CONTROL INSP. REQ'D. — APPVD. BY — DATE

CONST. TYPE | OCCUPANCY | # STORY | BSMT. | BLDG. HT. | # BR | # BATH

TOTAL AREA | NEW | EXIST | REMODEL | HANDICAPPED | FIRE DIST. | ST. FIRE MAR. | FIRE SPRINKLERS ☐ REQ. ☐ OPT. ☐ 1 HR SUBST. ☐ AREA INCREASE

EST. VALUE $ | % AREA INCREASE SEP. | OCC. LOAD | SPECIAL INSPECTION REQ'D. ☐ CONC. ☐ STEEL ☐ OTHER

WHAT IS INCLUDED IN THIS PERMIT?

WHEN NUMBERED, APPROVED AND MACHINE VALIDATED BELOW; THIS BECOMES A PERMIT TO BUILD AS NOTED.

Grading

REVIEWED BY: R.H. — DATE: 5/11/93 — PERMIT ISSUED BY: L. Bratcher — DATE: 5/13/93

PROVISIONS: The applicant is advised that issuance of this permit will not relieve responsibility of the owner or owner's agents to comply with the provisions of all laws and ordinances, including federal, state and local jurisdictions, which regulate construction and performance of construction, or with any private deed restrictions or requirements of the applicable fire district. This permit becomes null and void if the construction work is not begun within 180 days from date of issue or if at any time prior to final inspection and approval the work is suspended or abandoned for a period of 180 days.

Should a permit be allowed to expire prior to final inspection, electrical service to the project may be discontinued.

I hereby certify that I am the owner or duly authorized owner's agent, that I have read this application and that all information is correct. I further certify that I have read, understand and will comply with all of the provisions outlined hereon. I also certify that the plot plan submitted is a complete and accurate plan showing any and all existing and proposed structures on the subject property.

DATE 5/10/93 SIGNATURE Ray Baldwin V.P.

PRINT NAME Ray Baldwin

TO KEEP YOUR PERMIT ACTIVE AND AVOID UNNECESSARY EXPIRATION IT IS IMPORTANT THAT YOU CALL FOR INSPECTION AT LEAST EVERY 180 DAYS.

FOR INSPECTION CALL 837-2003

1.	SINGLE PERMIT FEE SQ. FT. BASIS STD ☐ SQ. FT.	$
2.	SINGLE PERMIT VALUE TABLE BASIS (VAL)	$ 126.00
3.	PLAN CHECK SQ. FT.	$
4.	PLAN CHECK VALUE	$ 30.00
5.	PLAN CHECK STD.	$
6.	M.P.E. (SPECIFY)	$
7.	ZONING	$
8.	COPY	$
9.	OTHER (SPECIFY)	$
10.	TOTAL	$ 156.00
11.	ADJUSTMENT:	

SPECIAL FEE COMMENTS: Ck #5402 5/13/93 $156.00

ORIGINAL

MCO Properties Inc.
16838 East Palisades Boulevard. P.O. Box 17795
Fountain Hills. Arizona 85269
Telephone (602) 837-9660

May 10, 1993

Town of Fountain Hills
16836 East Palisades Blvd.
Fountain Hills, AZ 85268

To Whom It May Concern:

In an attempt to clarify this grading permit application, I have discussed the work which we are proposing to do with Randy Harrel. As per his request, I am submitting the following:

1. A copy of aerial photos of the area of work, outlining the approximate limits of construction.
2. A "typical section" diagram which shows the section which we will attempt to provide, depending on field conditions.
3. A map showing the general area of construction.
4. A copy of the letter which we received from Maricopa County Department of Environmental Management, requiring us to perform this work.
5. We have guessed that we will move 2000 cubic yards of dirt. We will not know the actual amount until we complete construction.

In conversations with the Army Corp of Engineers approximately 2 years ago, they indicated to us that we would not need a 404 permit in "Existing" Fountain Hills, meaning the developed portion of Fountain Hills.

If you have any further questions concerning this matter, please feel free to contact me.

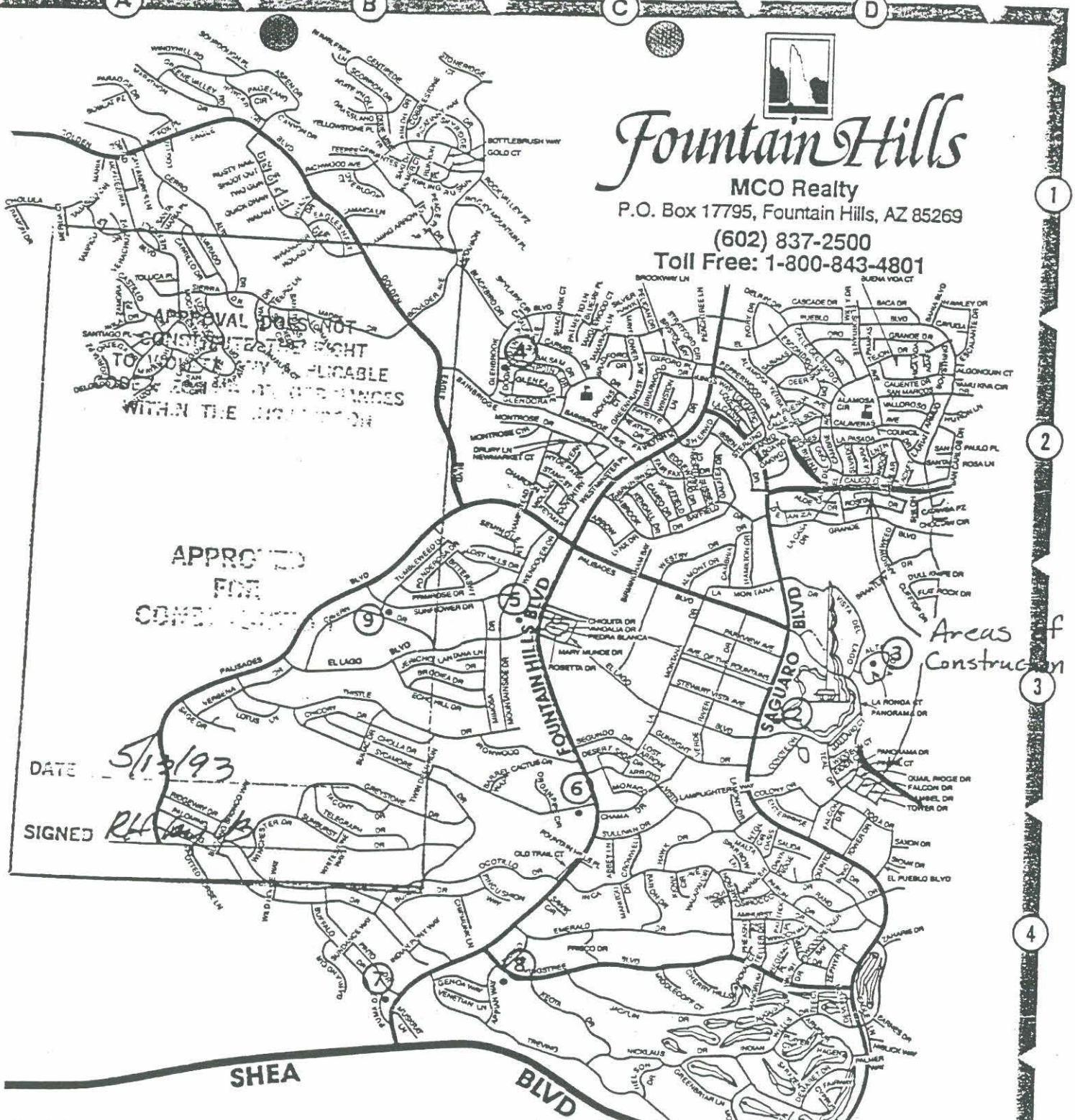
Sincerely,

Ray Baldwin

Ray Baldwin
Vice President

Fountain Hills

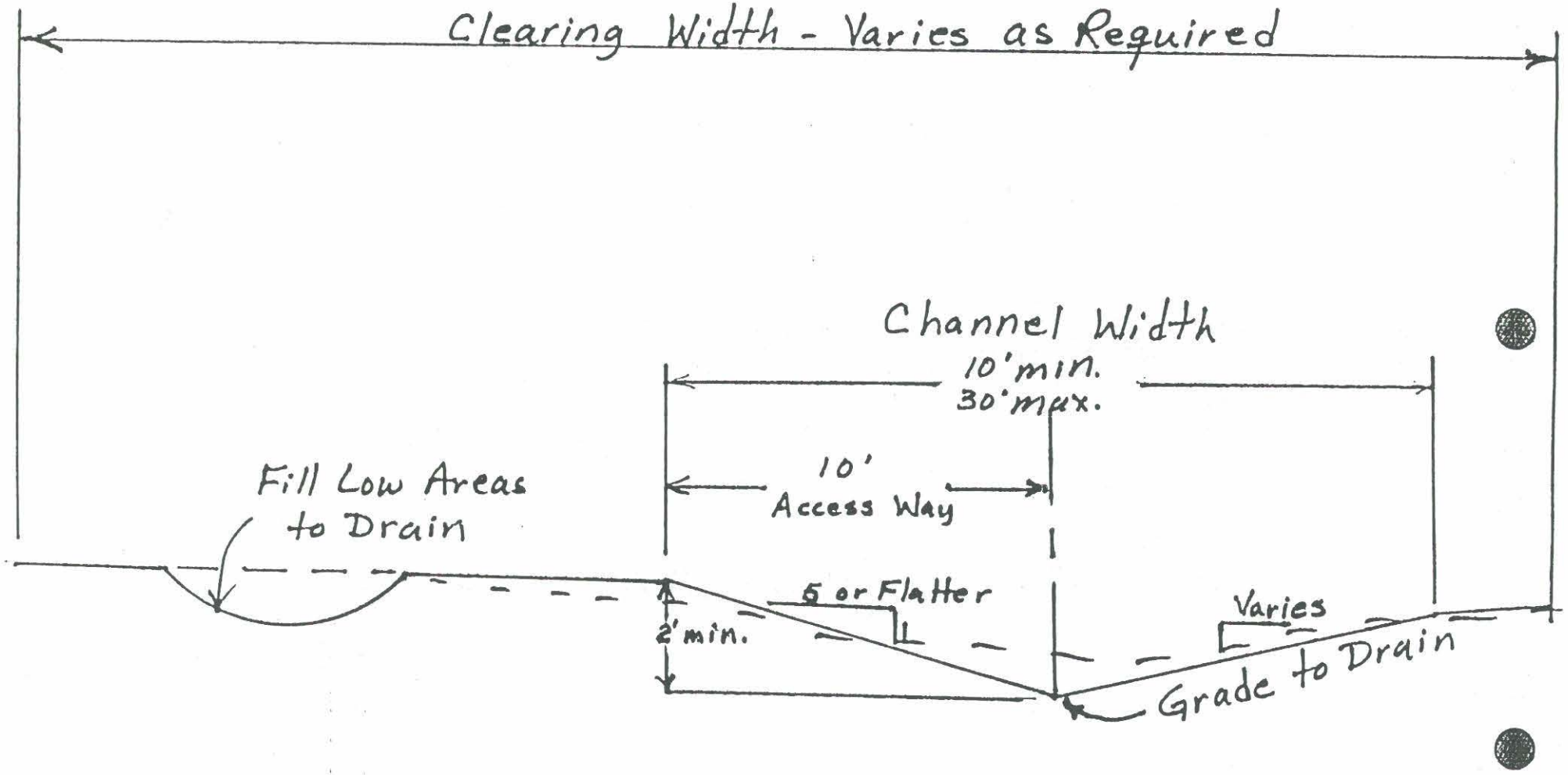
MCO Realty
P.O. Box 17795, Fountain Hills, AZ 85269
(602) 837-2500
Toll Free: 1-800-843-4801



1. MCO REALTY & VISITOR CENTER 837-2500
2. MCO REALTY FOUNTAIN OFFICE 837-7107

——————MODEL HOMES——————

3. ARRIBA DEL LAGO 837-9885
4. GLENBROOK HOMES 837-2721
5. VILLA D' ESTE 837-8557
6. YODER-BUILT HOMES 837-8886
7. McDONALD HOMES 837-0733
8. NEW AMERICAN HOMES/CIMBER PT 837-1005
9. MYERS CUSTOM HOMES 837-2500



Typical Section
N. T. S.

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

24 May 1993

Mr. Tim Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Subject: Supplemental Hydraulic Analyses
Contract FCD 92-04
Fountain Hills Floodplain Delineation Study (North)

Dear Tim:

The Fountain Hills project has a number of existing culverts which must be analyzed as a part of the hydraulic calculations for floodplain delineation and hydrologic routing. The HEC-2 Special Culvert routine will be used for those culverts which lie in floodplain delineation study reaches. Our contract calls for verification of the HEC-2 results by use of external methods. I am proposing use of the HY8 Culvert Analysis Microcomputer Program Version 4.0 dated 30 April 1992 for this purpose. This version of the software, and the supporting documentation, was obtained from the Center for Microcomputers in Transportation, University of Florida. The program automates the procedures set forth in the U.S. Department of Transportation, Federal Highway Administration, *Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (HDS-5)*, dated September 1985. This program is also proposed for development of culvert rating curves for hydrologic routing for the following:

1. The Principal Spillways for Dams 4, 6, 7, 11, and 36; and
2. Culverts which do not lie in floodplain delineation study reaches.

There is a storm drain system on Arrow Wash and Sunflower Wash which lies in the floodplain delineation study area. The storm drain conveys flows from both washes under the Palisades Plaza development located at the southeast corner of the intersection of Palisades Boulevard and Fountain Hills Boulevard. This system cannot be modeled effectively using the HEC-2 computer program or HY8. I am proposing use of the Texas Hydraulic System (THYSYS) microcomputer program, version 2.4.2 dated 31 January 1992, for modeling of this storm drain system. THYSYS was created by the Texas Department of Transportation and is maintained and supported by that agency. The program has modules for the following:

1. Hydrology using the Rational method;
2. Water Surface Profiles using the step backwater method;
3. Bridge and culvert hydraulics;
4. Storm sewer networks with either open channel or pressure flow; and
5. Pump stations.

Only the storm sewer network module would be used for this study. The program allows entry of a controlling tailwater elevation, which would be estimated using HEC-2. Flow rates can be estimated

using the hydrology module or input directly. Flow rates would be input directly. The program estimates friction losses using the Manning equation. Minor losses at junctions are estimated externally and then input at the proper location. The program output lists computed water surface elevations, hydraulic gradeline elevations, velocities, and depths of flow. I have used this program for design projects and drainage master plans over the last eight years and have satisfied myself that the calculations are performed in an acceptable manner. This is the same program which Dr. Mays referenced last week at the HEC-2 class during his culvert discussion. Enclosed is a copy of the introduction section of the manual for your review.

Please let know if you have any concerns over our use of these programs for verification of the HEC-2 culvert modeling, or analysis of the Palisades Plaza storm drain system.

Sincerely,

Thomas R. Loomis

Thomas R. Loomis, P.E., R.L.S.

Enclosure: THYSYS User's Manual introduction.

cc: Dr. George V. Sabol
Mr. Frank Brown

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

24 May 1993

Mr. Tim Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Subject: Golden Eagle Park (Phase 1) Grading Plans
Contract FCD 92-04
Fountain Hills Floodplain Delineation Study (North)

Dear Tim:

Thank you for providing a copy of the plans for the proposed Golden Eagle Park last week. I have reviewed the plans with the goal of determining if the proposed park will have any detrimental effects on the function of Dam Number 4 as a flood control reservoir. The effects of the proposed grading changes are summarized in Table 1.

TABLE 1

Effects of Golden Eagle Park on Dam 4 Storage Capacity

Contour [1]	Surface Area (acres) Existing [2]	Surface Area (acres) Proposed [3]	Cumulative Volume (acre-feet) Existing [4]	Cumulative Volume (acre-feet) Proposed [5]	Cumulative Difference [5]-[4] [6]	Dam 4 Existing Volume [7]	% Change [8]
1702.74	0.00	0	---	---	---	---	
1704.74	0.01	0.17	0.1	0.4	0.3	4.2	7.1
1706.74	0.94	1.14	1.3	2.0	0.7	10.9	6.4
1708.74	2.67	2.96	5.0	6.1	1.1	22.3	4.9
1710.74	5.12	5.45	12.1	13.6	1.5	39.4	3.8
1712.74	7.79	7.53	23.1	24.7	1.6	63.1	2.5
1714.74	10.15	9.87	37.9	39.1	1.2	93.9	1.3
1716.74	11.52	11.24	55.4	56.2	0.8	131.0	0.6
1718.74	12.10	11.93	74.4	74.9	0.5	172.7	0.3

Keep in mind that the emergency spillway crest elevation is 1715. The surface areas listed are representative of only the areas affected by grading for the park improvements. The contour elevations listed in Table 1 are the grading plan elevations after adjustment to the NGVD 1929 datum. The grading as proposed will cause a net increase in storage volume of 0.5 acre-feet at elevation 1718.74. The earthwork for the site is close to balanced without consideration to shrink and swell. The grading, if constructed per the plans, will actually have a positive effect on the storage characteristics of the reservoir. We are proceeding with our work as planned. I will use the existing condition storage curve for hydrologic routing through Dam 4.

Please feel free to contact me if you have any questions regarding this information.

Sincerely,

Thomas R. Loomis

Thomas R. Loomis, P.E., R.L.S.

cc: Dr. George V. Sabol
Mr. Randy Harrel

GEORGE V. SAUL CONSULTING ENGINEERS, INC.

CLIENT Flood Control District of Maricopa Co.
PROJECT Fountain Hills North F.P.D.S.
SUBJECT Dam & Grading Changes - Proposed

SHEET 1 OF 1
DATE 5/24/93
BY
PROJECT NO. 35

Golden Eagle Park Grading Changes

Contour	Area (areas)		
	Existing	Proposed	Difference
06	0.007	0.17	- 0.16
08	0.94	1.14	- 0.20
10	2.67	2.96	- 0.29
12	5.12	5.45	- 0.33
14	7.79	7.53	0.26
16	10.15	9.87	0.28
18	11.52	11.24	0.28
20	12.10	11.93	0.17

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

3 June 1993

Mr. Tim Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Subject: Golden Eagle Park (Phase 1) Grading Plans
Contract FCD 92-04
Fountain Hills Floodplain Delineation Study (North)

Dear Tim:

I talked with Mr. Jim Johnson of ADWR this morning concerning my letter to you dated 24 May 1993. The letter was regarding Golden Eagle Park Phase 1 and its possible effects on Dam 4. Jim found an error in my table. I had a typographical error in my spreadsheet formula to calculate volumes. This has been corrected and a revised table follows.

TABLE 1

Effects of Golden Eagle Park on Dam 4 Storage Capacity

Contour [1]	Area (acres)		Cumulative Volume (acre-feet)		Cumulative Difference [5]-[4] [6]	Dam 4 Existing Total Volume [7]	% Change ([6]/[7])*100 [8]
	Existing [2]	Proposed [3]	Existing [4]	Proposed [5]			
1702.74	0.00	0.00	---	---	---	---	---
1704.74	0.01	0.17	0.0	0.1	0.1	4.2	2.6
1706.74	0.94	1.14	0.7	1.3	0.6	10.9	5.4
1708.74	2.67	2.96	4.2	5.2	1.1	22.3	4.9
1710.74	5.12	5.45	11.8	13.5	1.7	39.4	4.3
1712.74	7.79	7.53	24.6	26.4	1.8	63.1	2.9
1714.74	10.15	9.87	42.5	43.8	1.3	93.9	1.4
1716.74	11.52	11.24	64.2	64.9	0.7	131.0	0.5
1718.74	12.10	11.93	87.8	88.1	0.3	172.7	0.2

The following paragraph is a repeat from my previous letter, revised to reflect the changes noted in the new table:

Keep in mind that the emergency spillway crest elevation is 1715. The surface areas listed are representative of only the areas affected by grading for the park improvements. The contour elevations listed in Table 1 are the grading plan elevations after adjustment to the NGVD 1929 datum, which is a -1.26 feet adjustment from the historical Fountain Hills datum. The grading as proposed will cause a net increase in storage volume of approximately 1.2 acre-feet at the emergency spillway crest elevation of 1715. The earthwork for the site is close to balanced without consideration to shrink and swell. The grading, if constructed per the plans, will have a slight positive effect on the storage characteristics of the reservoir. However, the net effect is probably less than the error associated with the mapping. We are proceeding with our work as planned. I will use the existing condition storage curve for hydrologic routing through Dam 4.

Please feel free to contact me if you have any questions regarding this information.

Sincerely,

Thomas R. Loomis

Thomas R. Loomis, P.E., R.L.S.

cc: Dr. George V. Sabol
Mr. Randy Harrel
Mr. Jim Johnson

TABLE 1
Effects of Golden Eagle Park on Dam 4 Storage Volume

Contour [1]	Area (acres) Existing [2]	Proposed [3]	Cumulative Volume (acre-feet) Existing [4]	Proposed [5]	Cumulative Difference [5]-[4] [6]	Dam 4 Existing Total Volume [7]	% Change ([6]/[7])*100 [8]
1702.74	0.00	0	—	—	—	—	
1704.74	0.01	0.17	0.0	0.1	0.1	4.2	2.6
1706.74	0.94	1.14	0.7	1.3	0.6	10.9	5.4
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1712.74	7.79	7.53	24.6	26.4	1.8	63.1	2.9
1714.74	10.15	9.87	42.5	43.8	1.3	93.9	1.4
1716.74	11.52	11.24	64.2	64.9	0.7	131.0	0.5
1718.74	12.10	11.93	87.8	88.1	0.3	172.7	0.2

Town of FOUNTAIN HILLS

June 9, 1993

Mr. William C. Jenkins, P.E.
Chief, Safety of Dams
Engineering Division
Department of Water Resources
State of Arizona
15 South 15th Avenue
Phoenix, AZ 85007

Attention: Jim Johnson

Re: Golden Eagle Park, Phase I Construction

Dear Mr. Jenkins:

This letter summarizes the discussion and resolution reached at our meeting this morning concerning Dam #4.

- Golden Eagle Park is planned for construction in the drainage basin upstream from Dam #4. It is intended that the park construction yield balanced earth work, i.e., no decrease in the storage capacity behind the dam.

- The Flood Control District of Maricopa County has a floodplain delineation study of Ashbrook Wash, including the Dam #4 area, ongoing at the present time. Preliminary hydrology including the dam stage/storage/discharge is anticipated to be available later this summer, with hydraulics available next winter. Tom Loomis from Sabol & Associates, their design consultant, has indicated that the Phase I construction plans for Golden Eagle Park are basically balanced, and in fact, yield a small increase in the storage capacity upstream from the dam.

- The storage capacity calculated by Tom Loomis is less than the storage capacity originally calculated for the dam. ADWR is concerned that this could result in a higher water surface pool elevation and/or a higher outflow from the dam.

- However, other factors in the watershed area including rainfall intensity changes and runoff coefficient (curve) changes may cause the pool elevation in peak outflow to either increase or decrease.

- The Town of Fountain Hills is constructing the park primarily with Heritage Grant funding. After receiving a Heritage Grant fund in 1991, the Town's application was denied in 1992, primarily because no construction has been done and no grant funds

16836 East Palisades Boulevard - P.O. Box 17958 - Fountain Hills, Arizona 85269 - (602) 837-2003 - FAX: (602) 837-3145

had yet been spent. The Town is currently re-submitting an application for additional grant funding for 1993, and needs to get Phase I construction underway and completed. Because of this, it is highly undesirable to wait until new hydrology information is available to proceed with Phase I of the park construction.

- Golden Eagle Park, Phase I construction will grade only 13 of the 25 acres in the park, and areas west of Golden Eagle Boulevard owned by MCO Properties and within the basin area will not be disturbed by the park construction.

- The Town will provide ADWR with a hydrologic model which will route the one half probable maximum flood through Fountain Hills Dam #4 and spillway.

The consensus of the meeting was to allow the Town to proceed with construction of Golden Eagle Park, Phase I. There is adequate room within the basin that is not being graded during Phase I to allow a future modification if necessary. The dam itself and spillway are also not within the limits of Phase I construction.

The Town recognizes that if the water surface pool elevation or the peak outflow increases detrimentally over the original calculated values, that modifications to the dam structure, spillway, or basin may be necessary in future phases of the park construction. The Town also recognizes its responsibility to the health and safety of the public as the part owner and designated operator of Dam #4. We look forward to reviewing the floodplain delineation data with you when it is available.

Attached to this letter for your use are copies of the Town's 1991 contour mapping (1991 photogrammetry), including the dam structures and basins for the seven Fountain Hills detention dams. Please note that the contour maps are on Fountain Hills (USGS) datum, and that the Flood Control District's floodplain delineation study is all based on NGVD datum.

Sincerely,

Randy L. Harrel

Randy L. Harrel, P.E., L.S.
Town Engineer

RLH:jn

cc: Ray Baldwin
Lenny Allsbrooks
Tom Loomis
Tim Murphy
Jack Moody
Robin Goodman
Paul Nordin

GEPPHASI.RHL

TKL - Tim gave this to me on 3 March 94. Return for my files.

Town of FOUNTAIN HILLS

FLOOD CONTROL DISTRICT
RECEIVED
FEB 17 '94

CHENG	P&PM
DEP	HYDRO
ADMIN	MGT
FINANCE	FILE
C&O	TMM
ENGR	
REMARKS	

February 15, 1994

Mr. James E. Rydeen, AIA, President
Armstrong, Torseth, Skold and Rydeen Inc.
4901 Olson Memorial Highway
Minneapolis, MN 55422

Re: Rerouting Legend Wash for the Proposed Addition to McDowell Mountain Elementary School

Dear Mr. Rydeen:

Per our discussions and your letter of February 7, 1994, we understand that should the May school bond issue pass, an eight classroom addition to McDowell Mountain Elementary School will be made, and Legend Wash rerouted to the south on your property.

As you are aware, this wash is part of the Flood Plain Delineation Study currently being performed by the Maricopa County Flood Control District and their consultant--George Sabol & Associates. Substantial completion of the Flood Plain Delineation Study is currently expected in June 1994.

Several review/approval processes are possible, depending on the relative timing of the final phases of the Flood Plain Delineation Study, and of the site work plans for the school addition:

- Our preference would be to include the wash modifications as a "Committed Project Within 18 Months of Completion" in accordance with FEMA requirements, modify the Flood Plain Delineation and submit the modified delineation to FEMA initially.

- Other less desirable alternatives include delaying the FEMA submittal of Tulip/Legend Washes, omitting the school site from the initial Delineation Study, or requesting a Conditional Letter of Map Revision from FEMA after approval of the delineation.

The length of the review process will, of course, depend on which one of these review procedures is taken. Obviously the modifications to the Flood Plain Delineation will be the financial responsibility of the School District, like any other developer in the flood plain. The most expeditious procedure to follow would probably be to contract directly with George Sabol & Associates for these modifications. The Flood Control District would have to approve this, but as of this time, see no objection to doing so, per Tim Murphy.

16836 East Palisades Boulevard - P.O. Box 17958 - Fountain Hills, Arizona 85269 - (602) 837-2003 - FAX: (602) 837-3145

In addition to the School's rerouting of Legend Wash, the following additional upcoming flood plain modifications appear likely to be under way in the near future:

- The Town of Fountain Hills has a federal aid project slated for Fountain Hills Blvd. at Ashbrook Wash (upgrading the existing dip crossing to a double barrel concrete box culvert) which is currently scheduled to advertise for bid in May 1995.

- Paradise Ridge, a subdivision lying on the west side of Fountain Hills Blvd. between Colony Wash and El Lago Blvd., has been submitted to the Town for preliminary plat review. This project contemplates rerouting an unnamed wash (Colony Wash North?) which is currently dammed up and retained, into Colony Wash, and the culvert under Fountain Hills Blvd. at Colony Wash enlarged.

- A HURF bond issue for the reconstruction of Fountain Hills Blvd. (Shea Blvd. to Palisades Blvd.) is slated for March 8. Should this bond issue pass, it is anticipated that several additional culverts under Fountain Hills Blvd. will be enlarged, but the construction would probably not be completed for 3-4 years, and so would not quality for the FEMA "Committed Project".

We hope this letter has been a help to you in your planning process, as well as to those organizations receiving information copies of this letter. We have attached your letter and school addition drawing, together with those informational copies for their reference.

Sincerely,

Randy L. Harrel

Randy L. Harrel, P.E., L.S.
Town Engineer

RLH:jn

cc: Tim Murphy/MCFCD
Cathy Walker/MDFDC
Walt Dunne/F.H. School Dist.
Paul Nordin
Gary Jeppson

FR

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

7 March 1994

RECEIVED MAR 1 8 1994

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Subject: Fountain Hills (North) FIS
Contract FCD 92-04

Dear Mr. Murphy:

Enclosed are copies of the plotted cross sections for "verification" of the revised DTM that was recently completed by Kenney Aerial Mapping Company. We have reviewed these, and you reviewed these in our office on 3 March 1994. It is our opinion, based on the enclosed plots, that the new mapping is adequate for floodplain analysis and mapping for the referenced project. Consequently, we will be proceeding with the hydraulic analysis and floodplain/floodway delineations using that mapping.

Please call me if you have questions or wish to discuss this.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc:

George V. Sabol, PhD, PE

Enclosure: Verification plots (17) sheets

Copies: Mr. Geza Kmetty, MKE w/enclosures
Dr. Sam Kao, AGK w/enclosures

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

RECEIVED MAR 1 6 1994

7 March 1994

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Subject: Fountain Hills (North) FIS
Contract FCD 92-04

Dear Mr. Murphy:

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We are reviewing these maps and will be performing some editorial refinement We will evaluate using less screening on the contour lines so that they are more clearly shown. Please review these maps and provide comments and suggestions as you feel appropriate.

I am sending copies of these maps to Mr. Randy Harrel at your request. Mr. Harrel should also provide comments and suggestions as he feels appropriate.

Sincerely yours,
George V. Sabol Consulting Engineers, Inc:

George V. Sabol, PhD, PE

Enclosure: Sheets 8, 9 and 10 of draft work sheet maps

Copies: Mr. Randy Harrel, Town of Fountain Hills w/enclosure
Mr. Geza Kmetty, MKE w/o enclosure

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 6-2-94 Job No.: 92-404.001

To: Flood Control District of Maricopa County

Attention: Mr. Tim Murphy

Re: Fountain Hills North.

WE ARE SENDING YOU X ATTACHED ___ VIA deliver

Original:	Copies	Date	Description
	1	6-2-94	Escalante Wash Cross-Sections
	1	6-2-94	Caliente Wash Cross-Sections
	1	—	1 Legend sheet - applies to all cross-sections.

Remarks: Tim,

this completes the submittal on May 31, 1994.

Please throw away the previous cross-sections, since they are outdated.

COPY TO GVSCE, Inc including cross-sections

SIGNED Frank Edward Brown

JOB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 6/29/98 Job No.: 92-404.01

To: Stanley Consultants

Attention: Jeff Minz

Re: Fountain Hills North

Ashbrook Wash @ Ftn Hills Blvd.

WE ARE SENDING YOU ✓ ATTACHED ___ VIA pickup

Original:	Copies	Date	Description
	1	2-21-98	Sheet 9 of 10 bond photo copy with floodplain
	1	4/27/98	Disk with HEC2 input + output
	1ea	unk	FTHILLS4.EXE + FTHILLS7.ZIP 1of2 and 2of2
	1ea	unk	FTHILLS1.EXE, FTHILLS2.EXE, FTHILLS3.EXE

Remarks: Jeff,

here are 6 disks that contain the HEC-2 data and all of the AutoCad drawings/ref files needed to generate Sheet 9 of 10. The flood plain is preliminary and needs to go through in-house and FCDMC quality control procedures.

Call me with any HEC-2 questions and call Pat Kastler with AutoCad questions.

COPY TO Mr. Tim Murphy, FCDMC
Dr. George Sabol, GVSCE Inc
no enclosures

SIGNED Frank Edward Brown

RECEIVED JUL 0 7 1994

TO: File

FROM: Tim Murphy

FILE: Fountain Hills - North FCD 92-04

DATE: July 7, 1994

SUBJECT: Review comments on Escalante and Calante Washes to discuss with Frank Brown of McLaughlin Kmetty Engineers

Escalante Wash

1. For cross section 2.555 why isn't the thalweg located within the main channel as defined in the HEC-2 model? Why is the channel width only 9.8 feet at this cross section? The channel appears to be much wider than this in the aerial photos and is 27 feet wide on the next downstream cross section.

2. On cross section 2.764 you need to check the lengths of the left and right overbank reaches.

3. Cross section 2.695 isn't indicated on the profile plot.

Calante Wash

4. Why doesn't the thalweg go through culvert number 527 (cross section 1.093)? The plot of this cross section doesn't show the culvert.

5. Check the channel reach lengths for cross section 1.778, 1.789 and 1.805. The distances specified in the HEC-2 model don't agree with the distances scaled off of sheet 7.

6. On cross section 2.072 consider blocking out a portion of the right overbank for ineffective flow.

Profile Plots

7. Change the horizontal scale so that more cross sections can be shown on each page.

8. Show the town limits and road crossings.

9. The profiles need to conform with the requirements shown in chapter 9, section B, of FEMA 37.

ID Num.	ELEV (ft)	DESCRIPTION
1-A	1544.63	Top of Brass Cap set by G.L.O., near the intersection of Grande Boulevard and El Pueblo Boulevard, being the Southeast corner of Section 11, Township 3 North, Range 6 East.
1-B	1556.30	Top of Brass Cap, at a point of curvature of center line of La Casa Drive, approximately 80 feet West of Del Cambre Avenue, being in the Southwest 1/4 of Section 11, Township 3 North, Range 6 East.
1-C	1603.59	Top of Brass Cap on centerline of Deerskin Drive, approximately 190 feet Northeast from the intersection of Deerskin Drive and Escondido Drive, being in the Northwest 1/4 of Section 11, Township 3 North, Range 6 East.
1-D	1655.56	Top of Brass Cap, at point of curvature of centerline of McDowell Mountain Road, approximately 80 feet North of the South line of Section 3, Township 3 North, Range 6 East.
1-E	1551.77	Top of Brass Cap, at Station 41 + 33 on McDowell Mountain Road, approximately 185 feet East of Escalante Wash, being in the Southeast 1/4 of Section 2, Township 3 North, Range 6 East.
1-F	1521.64	Top of Brass Cap set by G.L.O., stamped 1/16 Section 1 and 12, located approximately 36 feet East of the Southwest corner of Section 1, Township 3 North, Range 6 East.
1-G	1537.66	Brass Cap in concrete at center of Northeast curb return at Southeast corner of intersection of San Marcus and El Pueblo Boulevard, being in the Northeast 1/4 of Section 11, Township 3 North, Rang 6 East.
1-H	1529.73	Top of Brass Cap at intersection of Vallecito Drive and Rosita Drive, being in the Southeast 1/4 of Section 11, Township 3 North, Range 6 East.
2-A	1630.62	Top of Brass Cap in concrete at the middle of Northeast curb return at intersection of Fountain Hills Boulevard and Kings Way, being in the Northeast 1/4 of Section 10, Township 3 North, Range 6 East.
2-B	1619.45	Top of Brass Cap at the intersection of Saguaro Boulevard and Sterling Way, being in the Southwest 1/4 of Section 11, Township 3 North, Range 6 East.

ID Num.	ELEV (ft)	DESCRIPTION
2-C	1581.56	Top of Brass Cap at the center of the cul-de-sac at the West end of De Anza Drive, being in the Southwest 1/4 of Section 11, Township 3 north, Range 6 east.
3-A	1644.18	Top of Brass Cap at center of cul-de-sac at the South end of Arrow Drive, near the Southwest corner of Southeast 1/4 of Section 10, Township 3 North, Range 6 East.
3-B	1636.82	Top of Brass Cap in concrete at middle of Southeast curb return at the intersection of Fountain Hills Boulevard and Edgeworth Drive, being in the Southeast 1/4 of Section 10, Township 3 North, Range 6 East.
4-A	1700.67	Top of Brass Cap at the intersection of Hampstead Drive and Bainbridge Avenue, being in the Northwest 1/4 of Section 10, Township 3 North, Range 6 East.
5-A	1684.27	Top of Brass Cap at the intersection of Glenbrook Boulevard and Tanglewood Court, being in the Northwest 1/4 of Section 10, Township 3 North, Range 6 East.
6-A	1707.36	Top of Brass Cap at the intersection of Mountainside Drive and Lost Hills Drive, being in the Northwest 1/4 of Section 15, Township 3 North, Range 6 East.
6-B	1813.51	Top of Brass Cap at a point of tangency on Cavern Drive approximately 430 feet Northeast of the intersection of El Lago Boulevard and Cavern Drive, being in the Northeast 1/4 of Section 16, Township 3 North, Range 6 East.
6-C	1869.71	Top of Brass Cap at a point of tangency on Sunflower Drive, approximately 80 feet Southeast of the intersection of Palisades Boulevard and Sunflower Drive, being in the Northeast 1/4 of Section 16, Township 3 North, Range 6 East.
6-D	1730.12	Top of Brass Cap at the intersection of Palisades Boulevard and Golden Eagle Boulevard, being in the Southeast 1/4 of Section 9, Township 3 North, Range 6 East.

TRANSMITTAL

TO: Flood Control District of Maricopa Co.

Attn: Mr. Tim Murphy

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: July 22, 1994

PROJECT No./Name: 35 Fountain Hills FIS FCD 92-04

SUBJECT: ERM's

ENCLOSED ARE THE FOLLOWING

1- ERM List

REMARKS

Tim: For your review. A copy has been sent to Stanley Consultants for use in design of the structure at Ashbrook Wash + Fountain Hills Blvd.

COPIES Frank Brown

SIGNED Thomas R Loomis

ID Num.	ELEV (ft)	DESCRIPTION
7-A	1830.08	Top of Brass Cap at the intersection of Blackbird Drive and Audubon Place, being in the Southeast 1/4 of Section 4, Township 3 North, Range 6 East.
7-B	1750.17	Top of Brass Cap at the intersection of Golden Eagle Boulevard and Bainbridge Avenue, being in the Northeast 1/4 of Section 9, Township 3 North, Range 6 East.
8-A	1876.03	Top of Brass Cap at the intersection of Golden Eagle Boulevard and Aspen Drive, being in the Southeast 1/4 of Section 4, Township 3 North, Range 6 East.
8-B	1925.49	Top of Brass Cap at the intersection of Golden Eagle Boulevard and Nyack Drive, being in the Southwest 1/4 of Section 4, Township 3 North, Range 6 East.
8-C	1809.90	Top of Brass Cap at the intersection of Kipling Drive and Runyon Place, being in the Southeast 1/4 of Section 4, Township 3 North, Range 6 East.
9-A	1924.94	Top of Brass Cap at the intersection of Marathon Drive and Greene Valley Drive, being in the Northeast 1/4 of Section 5, Township 3 North, Range 6 East.
9-B	1980.84	Top of Brass Cap at the North end of Marathon Drive cul-de-sac, being in the Northeast 1/4 of Section 5, Township 3 North, Range 6 East.
9-C	1893.64	Top of Brass Cap at a point of tangency on the centerline of Aspen Drive, approximately 400 feet Northwest of the intersection of Aspen Drive and Rusty Nail Court, being in the Northwest 1/4 of Section 4, Township 3 North, Range 6 East.
9-D	1856.71	Top of Brass Cap at the West end of Grassland Drive cul-de-sac, being in the Northwest 1/4 of Section 4, Township 3 North, Range 6 East.
10-A	1982.50	Top of Brass Cap at the intersection of El Lago Boulevard and Palisades Boulevard, being in the Northwest 1/4 of Section 16, Township 3 North, Range 6 East.

ID Num.	ELEV (ft)	DESCRIPTION
11-A	1772.83	Top of Brass Cap set in concrete on the East side of Longmont Wash approximately 30 feet South of Fountain Hills bench mark #295, being near the Southwest corner of Northeast 1/4 of Section 9, Township 3 North, Range 6 East.
12-A	2025.18	Top of Brass Cap set by G.L.O., stamped elev = 2026.82 (Fountain Hills bench mark #240) and located approximately 300 feet West of the intersection of Thistle Drive and Palisades Boulevard and approximately 40 feet North of Palisades Boulevard, being the West 1/4 corner of Section 16, Township 3 North, Range 6 East.
12-B	2015.48	Top of Brass Cap set in concrete located S 89°52'21" W 1618.00 feet of bench mark 12-A, being in the Northeast 1/4 of Section 17, Township 3 North, Range 6 East.
12-C	1894.76	Top of Brass Cap set by G.L.O., (Fountain Hills bench mark #252), being the Common corner of Sections 8, 9, 16 and 17, Township 3 North, Range 6 East.
12-D	1929.94	Top of Brass Cap set by G.L.O. (Fountain Hills bench mark #299) being the West 1/4 corner of Section 9, Township 3 North, Range 6 East.
12-E	1869.37	Top of Brass Cap set by G.L.O. (Fountain Hills bench mark #302) at the intersection of Sierra Madre Drive and Zapata Drive, being in the Southeast 1/4 of Section 5, Township 3 North, Range 6 East.
12-F	1822.68	Top of Brass Cap at the intersection of Sierra Madre Drive and Lorma Lane, being in the Northwest 1/4 of Section 9, Township 3 North, Range 6 East.
13-A	1873.28	Top of Brass Cap in concrete at North end of East headwall of box culvert in Zapata Wash at Montezuma Boulevard, being in the Northeast 1/4 of Section 8, Township 3 North, Range 6 East.
13-B	1954.42	Top of Brass Cap in concrete in rock outcrop on West side of Montezuma Boulevard and North side of Montezuma Wash, being in the Northeast 1/4 of Section 8, Township 3 North, Range 6 East.

ID Num.	ELEV (ft)	DESCRIPTION
14-A	2091.39	Top of Brass Cap (Fountain Hills panel point #203 elev = 2092.98) at the intersection of Golden Eagle Boulevard and Cierro Alto Drive, being in the Northeast 1/4 of Section 5, Township 3 North, Range 6 East.
14-B	2119.31	Top of Brass Cap located on the South side of Golden Eagle Boulevard, approximately 2300 feet Easterly from the intersection of Montezuma Boulevard and Golden Eagle Boulevard, being in the Northwest 1/4 of Section 5, Township 3 North, Range 6 East.
14-C	1996.54	Top of Brass Cap in concrete on parcel 36, approximately 350 feet Northwesterly of intersection of Montezuma Boulevard and Cholula Drive, being in the Southwest 1/4 of Section 5, Township 3 North, Range 6 East.
15-A	2051.40	Top of Brass Cap in concrete located on the Southwest side of Ramon Drive, approximately 210 feet Southeast of the intersection of Cholula Drive and Ramon Drive, being in the Southwest 1/4 of Section 5, Township 3 North, Range 6 East.

TRANSMITTAL

TO: Flood Control District of Maricopa County

Attn: Tim Murphy

FROM: *George V. Sabol Consulting Engineers, Inc.*

7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 8/15/94

PROJECT No./Name: 35 Fountain Hills FCD 92-04

SUBJECT: ERM List

ENCLOSED ARE THE FOLLOWING

1. Revised ERM list.

REMARKS

Tim: ERM 116-A was added and the description of 1-E was revised.

COPIES

SIGNED Tom Francis

TRL Tim gave this to me on 3 March 94. Return for my files.

Town of FOUNTAIN HILLS

FLOOD CONTROL DISTRICT RECEIVED
FEB 17 '94
CHENG | P&PM
DEP | HYDRO
ADMIN | LMGT
FINANCE | FPE
C&O | TMM
ENGR
REMARKS

February 15, 1994

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16836 East Palisades Boulevard - P.O. Box 17958 - Fountain Hills, Arizona 85269 - (602) 837-2003 - FAX: (602) 837-3145

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Randy L. Harrel, P.E., L.S.
Town Engineer

RLH:jn

cc: Tim Murphy/MCFCD
Cathy Walker/MDFDC
Walt Dunne/F.H. School Dist.
Paul Nordin
Gary Jeppson

E:\MCDOMTNS.RLH

FB

George V. Sabol Consulting Engineers, Inc.
7950 East Acoma Drive, Suite 211, Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

7 March 1994

RECEIVED MAR 1 8 1994

Mr. Timothy M. Murphy
Project Manager
Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Subject: Fountain Hills (North) FIS
Contract FCD 92-04

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Appl
92-404.001

RECEIVED MAR 16 1994

7 March 1994

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Project Manager
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2801 W. Durango Street
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JOE

MKE

McLaughlin Kmetty Engineers, Ltd.

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LETTER OF TRANSMITTAL

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Attention: Mr. Tim Murphy

Re: Fountain Hills North.

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	1	6-2-94	Escalante Wash Cross-Sections
	1	6-2-94	Caliente Wash Cross-Sections
	1	—	1 Legend Sheet - applies to all cross-sections.

Remarks: Tim,

this completes the submittal on May 31, 1994.

Please throw away the previous cross-sections, since they are outdated.

COPY TO GVSCE, Inc including cross-sections

SIGNED Frank Edward Brown

JOB

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

LETTER OF TRANSMITTAL

Date: 6/29/98 Job No.: 92-404.01

To: Stanley Consultants

Attention: Jeff Minz

Re: Fountain Hills North

Ashbrook Wash @ Ftn Hills Blvd.

WE ARE SENDING YOU ✓ ATTACHED ___ VIA pickup

Original:	Copies	Date	Description
	1	2-21-98	Sheet 9 of 10 bond photo copy with floodplain
	1	4/27/98	Disk with HEC2 input + output
	1ea	unk	FTHILLS4.EXE + FTHILLS7.ZIP 1of2 and 2of2
	1ea	unk	FTHILLS1.EXE, FTHILLS2.EXE, FTHILLS3.EXE

Remarks: Jeff,

here are 6 disks that contain the HEC-2 data and all of the AutoCad drawing/ref files needed to generate Sheet 9 of 10. The flood plain is preliminary and needs to go through in-house and FCDMC quality control procedures.

Call me with any HEC-2 questions and call Pat Kastler with AutoCad questions.

COPY TO Mr. Tim Murphy, FCDMC
Dr. George Sabol, GVSCE Inc
no enclosures

SIGNED Frank Edward Brown

RECEIVED JUL 0 7 1994

TO: File

FROM: Tim Murphy

FILE: Fountain Hills - North FCD 92-04

DATE: July 7, 1994

SUBJECT: Review comments on Escalante and Calante Washes to discuss with Frank Brown of McLaughlin Kmetty Engineers

Escalante Wash

1. For cross section 2.555 why isn't the thalweg located within the main channel as defined in the HEC-2 model? Why is the channel width only 9.8 feet at this cross section? The channel appears to be much wider than this in the aerial photos and is 27 feet wide on the next downstream cross section.

2. On cross section 2.764 you need to check the lengths of the left and right overbank reaches.

3. Cross section 2.695 isn't indicated on the profile plot.

Calante Wash

4. Why doesn't the thalweg go through culvert number 527 (cross section 1.093)? The plot of this cross section doesn't show the culvert.

5. Check the channel reach lengths for cross section 1.778, 1.789 and 1.805. The distances specified in the HEC-2 model don't agree with the distances scaled off of sheet 7.

6. On cross section 2.072 consider blocking out a portion of the right overbank for ineffective flow.

Profile Plots

7. Change the horizontal scale so that more cross sections can be shown on each page.

8. Show the town limits and road crossings.

9. The profiles need to conform with the requirements shown in chapter 9, section B, of FEMA 37.

TRANSMITTAL

TO: Flood Control District of Maricopa Co.

Attn: Mr. Tim Murphy

FROM: *George V. Sabol Consulting Engineers, Inc.*
7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: July 22, 1994

PROJECT No./Name: 35 Fountain Hills FIS FCD 92-04

SUBJECT: ERM's

ENCLOSED ARE THE FOLLOWING

1- ERM List

REMARKS

Tim: For your review. A copy has been sent to Stanley Consultants for use in design of the structure at Ashbrook Wash + Fountain Hills Blvd.

COPIES Frank Brown

SIGNED Thomas R Jennis

ID Num.	ELEV (ft)	DESCRIPTION
1-A	1544.63	Top of Brass Cap set by G.L.O., near the intersection of Grande Boulevard and El Pueblo Boulevard, being the Southeast corner of Section 11, Township 3 North, Range 6 East.
1-B	1556.30	Top of Brass Cap, at a point of curvature of center line of La Casa Drive, approximately 80 feet West of Del Cambre Avenue, being in the Southwest 1/4 of Section 11, Township 3 North, Range 6 East.
1-C	1603.59	Top of Brass Cap on centerline of Deerskin Drive, approximately 190 feet Northeast from the intersection of Deerskin Drive and Escondido Drive, being in the Northwest 1/4 of Section 11, Township 3 North, Range 6 East.
1-D	1655.56	Top of Brass Cap, at point of curvature of centerline of McDowell Mountain Road, approximately 80 feet North of the South line of Section 3, Township 3 North, Range 6 East.
1-E	1551.77	Top of Brass Cap, at Station 41 + 33 on McDowell Mountain Road, approximately 185 feet East of Escalante Wash, being in the Southeast 1/4 of Section 2, Township 3 North, Range 6 East.
1-F	1521.64	Top of Brass Cap set by G.L.O., stamped 1/16 Section 1 and 12, located approximately 36 feet East of the Southwest corner of Section 1, Township 3 North, Range 6 East.
1-G	1537.66	Brass Cap in concrete at center of Northeast curb return at Southeast corner of intersection of San Marcus and El Pueblo Boulevard, being in the Northeast 1/4 of Section 11, Township 3 North, Rang 6 East.
1-H	1529.73	Top of Brass Cap at intersection of Vallecito Drive and Rosita Drive, being in the Southeast 1/4 of Section 11, Township 3 North, Range 6 East.
2-A	1630.62	Top of Brass Cap in concrete at the middle of Northeast curb return at intersection of Fountain Hills Boulevard and Kings Way, being in the Northeast 1/4 of Section 10, Township 3 North, Range 6 East.
2-B	1619.45	Top of Brass Cap at the intersection of Saguaro Boulevard and Sterling Way, being in the Southwest 1/4 of Section 11, Township 3 North, Range 6 East.

ID Num.	ELEV (ft)	DESCRIPTION
2-C	1581.56	Top of Brass Cap at the center of the cul-de-sac at the West end of De Anza Drive, being in the Southwest 1/4 of Section 11, Township 3 north, Range 6 east.
3-A	1644.18	Top of Brass Cap at center of cul-de-sac at the South end of Arrow Drive, near the Southwest corner of Southeast 1/4 of Section 10, Township 3 North, Range 6 East.
3-B	1636.82	Top of Brass Cap in concrete at middle of Southeast curb return at the intersection of Fountain Hills Boulevard and Edgeworth Drive, being in the Southeast 1/4 of Section 10, Township 3 North, Range 6 East.
4-A	1700.67	Top of Brass Cap at the intersection of Hampstead Drive and Bainbridge Avenue, being in the Northwest 1/4 of Section 10, Township 3 North, Range 6 East.
5-A	1684.27	Top of Brass Cap at the intersection of Glenbrook Boulevard and Tanglewood Court, being in the Northwest 1/4 of Section 10, Township 3 North, Range 6 East.
6-A	1707.36	Top of Brass Cap at the intersection of Mountainside Drive and Lost Hills Drive, being in the Northwest 1/4 of Section 15, Township 3 North, Range 6 East.
6-B	1813.51	Top of Brass Cap at a point of tangency on Cavern Drive approximately 430 feet Northeast of the intersection of El Lago Boulevard and Cavern Drive, being in the Northeast 1/4 of Section 16, Township 3 North, Range 6 East.
6-C	1869.71	Top of Brass Cap at a point of tangency on Sunflower Drive, approximately 80 feet Southeast of the intersection of Palisades Boulevard and Sunflower Drive, being in the Northeast 1/4 of Section 16, Township 3 North, Range 6 East.
6-D	1730.12	Top of Brass Cap at the intersection of Palisades Boulevard and Golden Eagle Boulevard, being in the Southeast 1/4 of Section 9, Township 3 North, Range 6 East.

ID Num.	ELEV (ft)	DESCRIPTION
7-A	1830.08	Top of Brass Cap at the intersection of Blackbird Drive and Audubon Place, being in the Southeast 1/4 of Section 4, Township 3 North, Range 6 East.
7-B	1750.17	Top of Brass Cap at the intersection of Golden Eagle Boulevard and Bainbridge Avenue, being in the Northeast 1/4 of Section 9, Township 3 North, Range 6 East.
8-A	1876.03	Top of Brass Cap at the intersection of Golden Eagle Boulevard and Aspen Drive, being in the Southeast 1/4 of Section 4, Township 3 North, Range 6 East.
8-B	1925.49	Top of Brass Cap at the intersection of Golden Eagle Boulevard and Nyack Drive, being in the Southwest 1/4 of Section 4, Township 3 North, Range 6 East.
8-C	1809.90	Top of Brass Cap at the intersection of Kipling Drive and Runyon Place, being in the Southeast 1/4 of Section 4, Township 3 North, Range 6 East.
9-A	1924.94	Top of Brass Cap at the intersection of Marathon Drive and Greene Valley Drive, being in the Northeast 1/4 of Section 5, Township 3 North, Range 6 East.
9-B	1980.84	Top of Brass Cap at the North end of Marathon Drive cul-de-sac, being in the Northeast 1/4 of Section 5, Township 3 North, Range 6 East.
9-C	1893.64	Top of Brass Cap at a point of tangency on the centerline of Aspen Drive, approximately 400 feet Northwest of the intersection of Aspen Drive and Rusty Nail Court, being in the Northwest 1/4 of Section 4, Township 3 North, Range 6 East.
9-D	1856.71	Top of Brass Cap at the West end of Grassland Drive cul-de-sac, being in the Northwest 1/4 of Section 4, Township 3 North, Range 6 East.
10-A	1982.50	Top of Brass Cap at the intersection of El Lago Boulevard and Palisades Boulevard, being in the Northwest 1/4 of Section 16, Township 3 North, Range 6 East.

ID Num.	ELEV (ft)	DESCRIPTION
11-A	1772.83	Top of Brass Cap set in concrete on the East side of Longmont Wash approximately 30 feet South of Fountain Hills bench mark #295, being near the Southwest corner of Northeast 1/4 of Section 9, Township 3 North, Range 6 East.
12-A	2025.18	Top of Brass Cap set by G.L.O., stamped elev = 2026.82 (Fountain Hills bench mark #240) and located approximately 300 feet West of the intersection of Thistle Drive and Palisades Boulevard and approximately 40 feet North of Palisades Boulevard, being the West 1/4 corner of Section 16, Township 3 North, Range 6 East.
12-B	2015.48	Top of Brass Cap set in concrete located S 89°52'21" W 1618.00 feet of bench mark 12-A, being in the Northeast 1/4 of Section 17, Township 3 North, Range 6 East.
12-C	1894.76	Top of Brass Cap set by G.L.O., (Fountain Hills bench mark #252), being the Common corner of Sections 8, 9, 16 and 17, Township 3 North, Range 6 East.
12-D	1929.94	Top of Brass Cap set by G.L.O. (Fountain Hills bench mark #299) being the West 1/4 corner of Section 9, Township 3 North, Range 6 East.
12-E	1869.37	Top of Brass Cap set by G.L.O. (Fountain Hills bench mark #302) at the intersection of Sierra Madre Drive and Zapata Drive, being in the Southeast 1/4 of Section 5, Township 3 North, Range 6 East.
12-F	1822.68	Top of Brass Cap at the intersection of Sierra Madre Drive and Lorma Lane, being in the Northwest 1/4 of Section 9, Township 3 North, Range 6 East.
13-A	1873.28	Top of Brass Cap in concrete at North end of East headwall of box culvert in Zapata Wash at Montezuma Boulevard, being in the Northeast 1/4 of Section 8, Township 3 North, Range 6 East.
13-B	1954.42	Top of Brass Cap in concrete in rock outcrop on West side of Montezuma Boulevard and North side of Montezuma Wash, being in the Northeast 1/4 of Section 8, Township 3 North, Range 6 East.

ID Num.	ELEV (ft)	DESCRIPTION
14-A	2091.39	Top of Brass Cap (Fountain Hills panel point #203 elev = 2092.98) at the intersection of Golden Eagle Boulevard and Cierro Alto Drive, being in the Northeast 1/4 of Section 5, Township 3 North, Range 6 East.
14-B	2119.31	Top of Brass Cap located on the South side of Golden Eagle Boulevard, approximately 2300 feet Easterly from the intersection of Montezuma Boulevard and Golden Eagle Boulevard, being in the Northwest 1/4 of Section 5, Township 3 North, Range 6 East.
14-C	1996.54	Top of Brass Cap in concrete on parcel 36, approximately 350 feet Northwesterly of intersection of Montezuma Boulevard and Cholula Drive, being in the Southwest 1/4 of Section 5, Township 3 North, Range 6 East.
15-A	2051.40	Top of Brass Cap in concrete located on the Southwest side of Ramon Drive, approximately 210 feet Southeast of the intersection of Cholula Drive and Ramon Drive, being in the Southwest 1/4 of Section 5, Township 3 North, Range 6 East.

TRANSMITTAL

TO: Flood Control District of Maricopa County

Attn: Tim Murphy

FROM: *George V. Sabol Consulting Engineers, Inc.*

7950 East Acoma Drive, Suite 211
Scottsdale, Arizona 85260-6962
(602) 483-3368 FAX (602) 483-3990

DATE: 8/15/94

PROJECT No./Name: 35 Fountain Hills FCD 92-04

SUBJECT: ERM List

ENCLOSED ARE THE FOLLOWING

1. Revised ERM list.

REMARKS

Tim: ERM 116-A was added and the description of 1-E was revised.

COPIES

SIGNED Tom Francis

1.3.2 STATE COORDINATION

Town of FOUNTAIN HILLS

January 11, 1993

Mr. William C. Jenkins, P.E.
Arizona Department of Water Resources
15 South 15th Avenue
Phoenix, AZ 85007

Attention: Jim Johnson

Re: Fountain Hills No. 4 Dam (07.33)

Gentlemen:

This letter is in response to your letter of October 7, 1992. The Town of Fountain Hills is now the owner of the property upstream from the crest of Dam No. 4, and is the responsible party for the dam.

We are awaiting establishment of the routine inspection date for this dam and the other dams within the town limits of Fountain Hills.

We have begun maintenance operations by cleaning brush and debris from the inlet trash rack and the approach to the inlet.

We have no information at this time indicating how to prepare an Emergency Action Plan for the dam, and would request that you send us any materials necessary to accomplish this. The Flood Control District of Maricopa County is currently preparing a Flood Plain Delineation Study of Fountain Hills; completion is anticipated in December 1993. We believe that it would be prudent to have the data from the Flood Plain Delineation Study available prior to completing the Emergency Action Plan.

We did not see any errors on the dam identification fact sheet.

We have engaged the consulting firm of Coe & Van Loo to provide master planning for Golden Eagle Park, which encompasses the upstream face and reservoir pool of Dam No. 4. We would anticipate that Mr. Jack Moody from that firm will be contacting you in the near future to discuss, among other things, the following items:

- Effluent re-use in the reservoir pool and on the dam face.
- Landscape material selection for use on the dam face and toe.

16836 East Palisades Boulevard - P.O. Box 17958 - Fountain Hills, Arizona 85269 - (602) 837-2003 - FAX: (602) 837-3145

- Restrictions on usage of the reservoir pool (e.g., requirements for minimum flow channels through the pool area; extent of restrictions on fencing on the spillway approach).

Thank you for your assistance. We will await notification of the next dam inspection date.

Sincerely,

Randy L. Harrel

Randy L. Harrel, P.E., L.S.
Town Engineer

RLH:jn

cc: Jack Moody / CVL
Ray Baldwin / MCO
Paul Nordin
Robin Goodman
Pat Harvey
Tim Murphy / MCFCD
Ton Loomis / George Sabol & Asso.

AZDEPTOF.RLH

Received 4/19/93
GRSCE

cc: Tom Loomis / Sabal
Hallmark / ACK

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue, Phoenix, Arizona 85007
Telephone (602) 542-1541
Fax (602) 542-3383

April 12, 1993

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

Mr. Ray Baldwin
MCO Properties, Inc.
16838 East Palisades Blvd
Fountain Hills, Arizona 85286

Subject: Fountain Hills Dam (07.31)
Fountain Hills #7 Dam (07.32)
Fountain Hills #36 Dam (07.38)
Fountain Hills #6 Dam (07.39)
Fountain Hills #11 Dam (07.40)
Fountain Hills #19 Dam (07.41)

Dear Mr. Baldwin:

Enclosed for your information and action are copies of the reports of the most recent safety inspections of the subject dams. An invoice for the inspection fees in the amount of $500.00 will soon follow by separate mail.

It is Department policy to review the License of Approval of each operating dam within state jurisdiction following its safety inspection. Based on the findings of the inspections and a review of our files, Fountain Hills, Fountain Hills #7, Fountain Hills #36, Fountain Hills #6, Fountain Hills #11, and Fountain Hills #19 Dams appear to be in satisfactory condition to operate as indicated on their current Licenses, issued December 6, 1984, respectively. The Licenses require no changes and remain in full force and effect.

While the dams appear to be in satisfactory condition to impound water, some operation and/or maintenance deficiencies were noted that require your timely attention. The deficiencies are detailed in the respective inspection reports. Briefly, they include:

<u>Fountain Hills Dam (07.31)</u>

1. Dam needs an Emergency Action Plan.

MSS20160

Fountain Hills #7 Dam (07.32)

1. Remove trees and vegetation (taller than two feet) on both the upstream and downstream face of dam.

2. Remove trees in approach channel.

3. Remove trees and bushes around the outlet works inlet structure.

4. Replace missing bolts on trash rack.

5. Remove debris from trash rack.

6. Remove bushes around trash rack.

7. Outlet conduit is 1/3 full of sediment, this needs to be cleaned out.

8. Remove trees in emergency spillway approach channel.

9. Dam needs and Emergency Action Plan.

10. Remove sediment in spillway basin.

Fountain Hills #36 DAM (07.38)

1. Remove trees and bushes (taller than two feet) from the upstream and downstream face of dam.

2. Remove vegetation in and around trash rack.

3. Remove debris on trash rack. Remove debris and vegetation in and around trash rack.

4. Patch cracks on wing walls in stilling basin.

5. Remove trees and vegetation in emergency spillway approach channel.

6. Dam needs an Emergency Action Plan.

7. Remove sediment from inlet slab.

8. Remove trees and desert broom around inlet structure.

9. Remove sand and dirt in stilling basin slab.

Fountain Hills #6 Dam (07.39)

1. Remove trees and vegetation (taller than two feet) from both the upstream and downstream face of dam.

2. Remove debris from trash racks.

3. Remove vegetation above out works intake structure wing walls.

4. Remove silt/dirt and rocks from stilling basin. Also remove rocks from drain slot.

5. Remove vegetation from emergency spillway training walls.

6. Dam needs an Emergency Action Plan.

7. Remove trees from spillway approach channel.

Fountain Hills #11 Dam (07.39)

1. Remove trees and vegetation (taller than two feet) from both the upstream and downstream face of dam.

2. Remove debris from trash rack.

3. Remove tree above trash rack.

4. Remove silt from stilling basin.

5. Remove trees above stilling basin wing walls.

6. Remove vegetation taller than two feet from emergency spillway channel.

7. Dam needs an Emergency Action Plan.

8. Patch the left wing wall (front face) of the outlet works inlet structure.

Fountain Hills #19 Dam (07.41)

1. Remove trees and vegetation (taller than two feet) from both faces of the dam.

2. Remove trees and vegetation from outlet works inlet structure.

3. Remove debris on and around trash rack.

4. Remove trees and vegetation above inlet wing walls.

5. Remove sediment in conduit, also clean concrete slab.

6. Dam needs an Emergency Action Plan.

Please advise us when this work has been completed.

We tentatively plan to make our next regularly scheduled inspection of all dams during the month of December, 1995, with the exception of Fountain Hills Dam (07.31) which will be inspected during December, 1994, and will contact you in advance to arrange a mutually convenient inspection date and time. In the interim, please notify the Department promptly of any unusual or alarming conditions which may occur at the dams.

You may contact Jim Johnson of the Safety of Dams and Flood Engineering Section at (602) 542-1541 if you have any questions.

Sincerely,

William C. Jenkins, P.E.
Chief
Safety of Dams & Flood Engineering

Enclosure(s)

cc: Randy L. Harrel, P.E., L.S.

WCJ/JLJ/mja

MSS20160

1.3.3 OTHER AGENCIES

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

January 18, 1993

GEZA E. KMETTY
RONALD C. McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON

Mr. Ray Baldwin
MCO Properties, Inc.
P.O. Box 17795
Fountain Hills, Arizona 85269

Re: Right of entry for surveying purposes

Dear Property Owners:

The Flood Control District of Maricopa County has contracted with George V. Sabol Consulting Engineers, Inc. (GVSCE), and their subcontractor McLaughlin Kmetty Engineers, Ltd.(MKE), to perform a Flood Delineation Study for the northern portion of the Town of Fountain Hills. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a "100-year flood" event. According to records at the Maricopa County Assessor's office, you own one or more parcels of land within the limits of the study area.

The intent of this letter is to notify you of the commencement of surveying activities in support of the above mentioned study. In order to perform these surveys it may be necessary to enter your property. This activity should not result in any inconvenience or damage to property. If you have any objections to the entry onto your property, you must notify Mr. Tim Murphy of the Flood Control District at 506-1501. Otherwise it will be assumed that you consent to the entry onto your property.

The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency for flood insurance information and revisions of Flood Insurance Rate Maps. This study should be available to the public in about 12 to 18 months.

The Flood Control District and its representatives appreciate your help in assuring the accuracy of this study by allowing access to your property for the surveyors and by providing any information you may have regarding past flooding or related problems.

If you have any questions regarding this study or the right of entry, please contact Mr. Tim Murphy of the Flood Control District, Mr. Tom Loomis of George V. Sabol Consulting Engineers, or Mr. Frank Brown of McLaughlin Kmetty Engineers.

Mr. Tim Murphy, Hydrologist, Flood Control District, (602) 506-1501.
Mr. Tom Loomis, Project Manager, GVSCE, (602) 234-3321
Mr. Frank Brown, Project Engineer, McLaughlin Kmetty Engineers, Ltd. (602) 248-7702.

Frank Edward Brown

Frank Edward Brown, P.E.
Project Engineer

92491-00\Entry.035

TOWN OF FOUNTAIN HILLS FLOOD DELINEATION STUDY

RIGHT OF ENTRY FOR SURVEYING PURPOSES

List of Property Owners Notified

Mr. Walter Dunne, Superintendent
Fountain Hills Unified School District
14605 North Del Cambre
Fountain Hills, Arizona 85268

Mr. Ray Baldwin
MCO Properties, Inc.
P.O. Box 17795
Fountain Hills, Arizona 85269
Phone: 837-9660

Mr. Gary Martinson
Mirage Real Estate/Club Mirage
14815 North Fountain Hills Blvd.
Fountain Hills, Arizona 85268]
Phone: 837-8700

MKE

LETTER OF TRANSMITTAL

McLaughlin Kmetty Engineers, Ltd.
3501 North 16th Street, Phoenix AZ 85016-6419
248-7702 FAX 248-7851

O Flood Control District of Maricopa County

DATE 3-8-93 JOB NO. 92-404.001

ATTENTION Mr. Tim Murphy

RE: Fountain Hills North

ENTLEMEN:

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via mail the following items:

☐ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐

OPIES	DATE	DESCRIPTION
12a	—	Photocopy of overlay onto 9"x 9" aerial photograph #480, with and without photo.

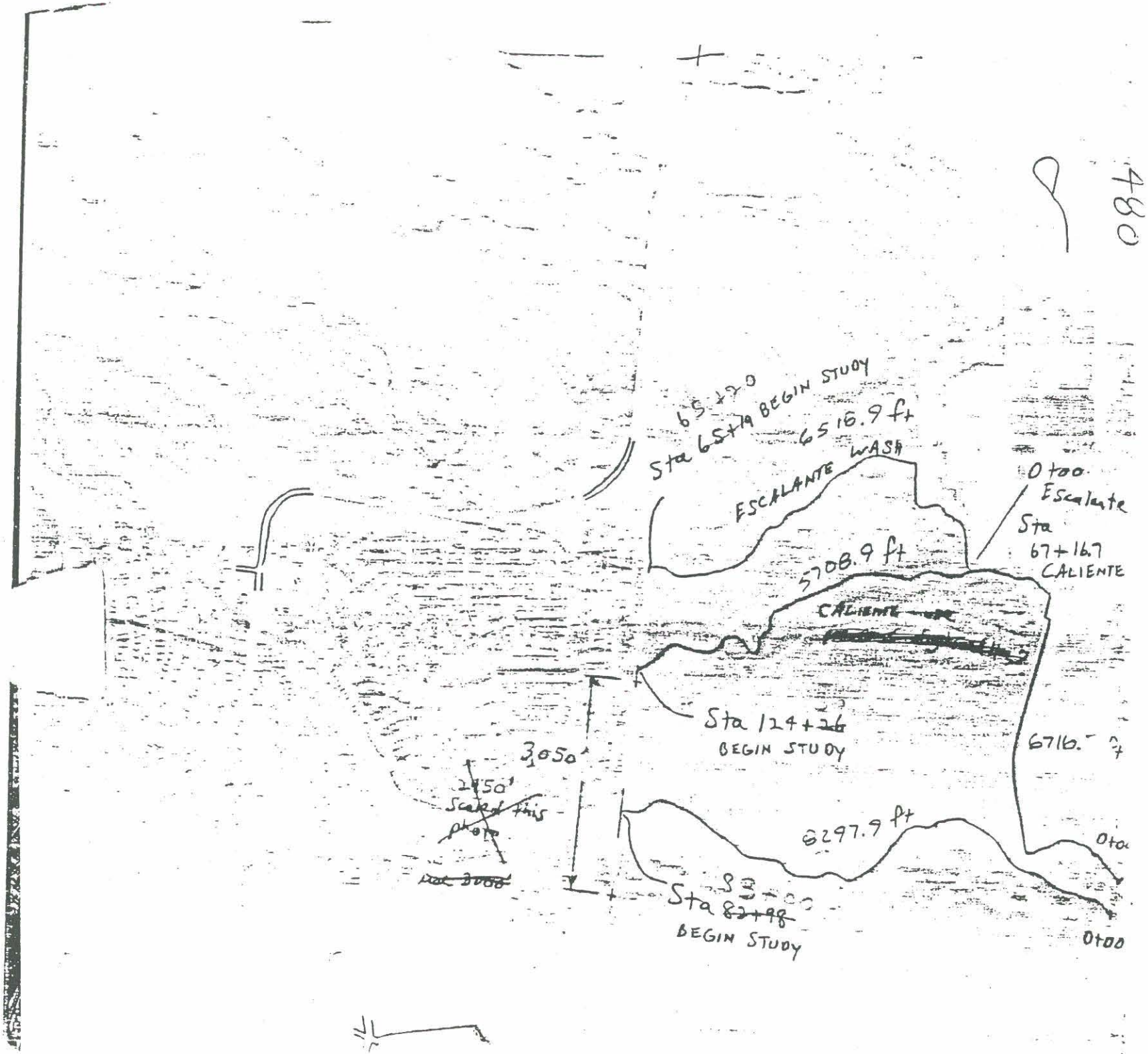
EMARKS Tim,

please review and approve our Stationing for the 3 washes that exit the Study Area. This is based on the site visit we had with you on January 12th. The distances were digitized from the aerial photo overlay and are accurate to the best of our knowledge and ability.

COPY TO Mr. Tom Loomis

SIGNED: Frank Edward Brown

If enclosures are not as noted, kindly notify us at once.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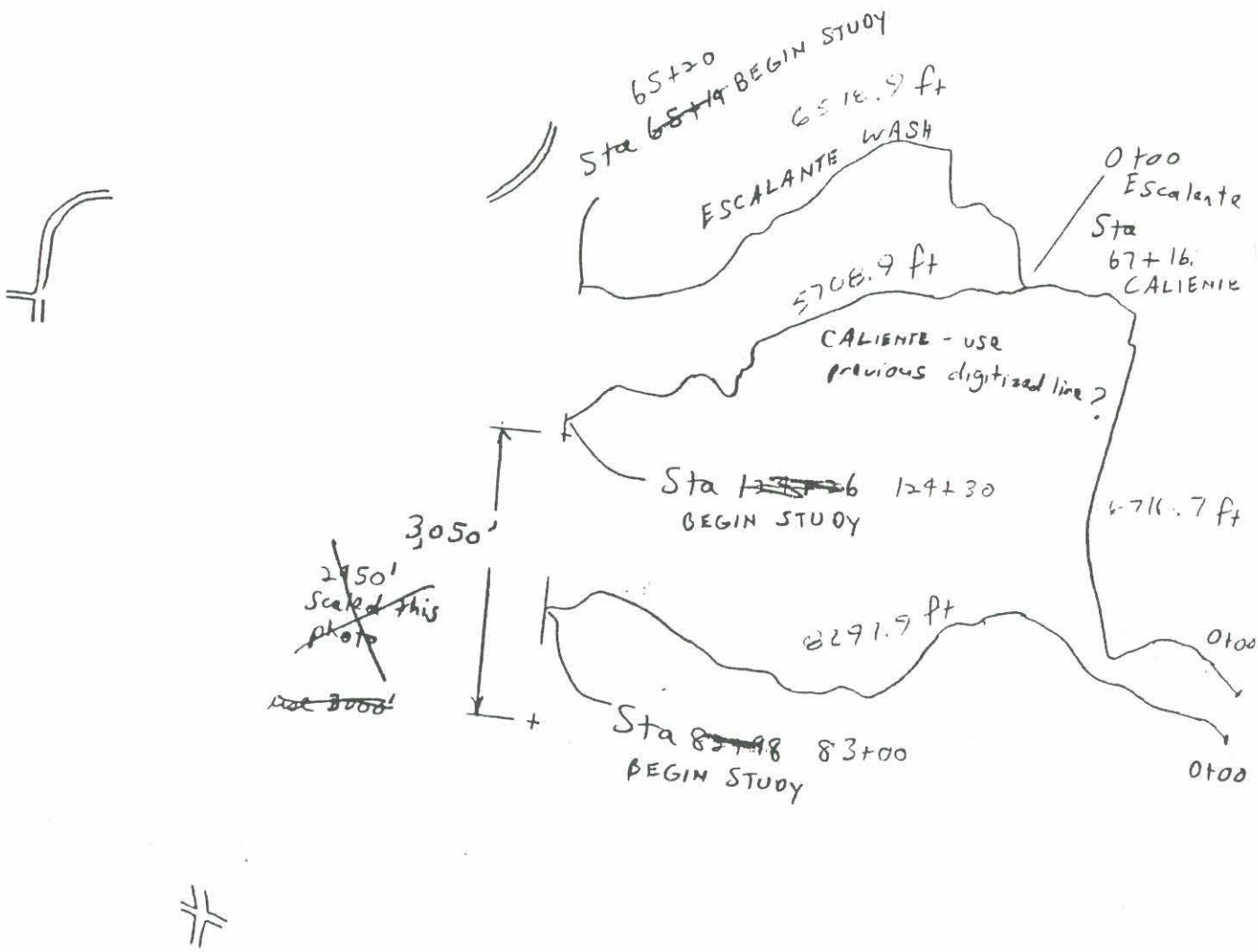
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~~Scaled this~~
~~photo~~
~~not 3000'~~
6716.7 ft
8291.9 ft
0+00
Sta ~~83+18~~ 83+00
BEGIN STUDY
0+00

TRANSMITTAL

TO: AGK Engineers, Inc.
2255 N. 44th Street
Suite 330
Phoenix, AZ 85008 Attn: Hal Marron

FROM: *George V. Sabol Consulting Engineers, Inc.*
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

DATE: April 7, 1993

PROJECT No./Name: 35 Fountain Hills

SUBJECT: Common watershed boundary between North and South study areas.

ENCLOSED ARE THE FOLLOWING

1 - 3.5" diskette with major basin boundaries for north area.

REMARKS

Hal: Please check our common watershed boundary to see where we may disagree. Also, please send your surveyed elevation for point 123 as soon as possible.

Thanks!
Tom

COPIES

SIGNED Thomas R. Jones

PHOENIX

CC: Jim Murphy / MCFCD
Tom Loomis / Sabo / [illegible]
Pat H[illegible]

ARIZONA DEPARTMENT OF WATER RESOURCES

15 South 15th Avenue, Phoenix, Arizona 85007
Telephone (602) 542-1541
Fax (602) 542-3383

April 21, 1993

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

Mr. Randy L. Harrel, P.E., L.S.
Town Engineer
Town of Fountain Hills
16838 East Palisades Blvd
Post Office Box 17958
Fountain Hills, Arizona 85269

Subject: Fountain Hills #4 Dam (07.33)

Dear Mr. Harrel:

Enclosed for your information and action is a copy of the report of the most recent safety inspection of the subject dam. An invoice for the inspection fees in the amount of $70.00 will soon follow by separate mail.

It is Department policy to review the License of Approval of each operating dam within state jurisdiction following its safety inspection. Based on the findings of the inspection and a review of our files, Fountain Hills #4 Dam appears to be in satisfactory condition to operate as indicated on the enclosed License of Approval. The License recognizes known or suspected deficiencies present at the dam and outlines the conditions under which the Department permits continued operation. This License supersedes all previous Licenses or other operating consents issued for this dam.

While the dam appears to be in satisfactory condition to impound water, some operation and/or maintenance deficiencies were noted that require your timely attention. The deficiencies are detailed in the respective inspection reports. Briefly, they include:

1. Remove trees and vegetation (taller than two feet high) from upstream face of dam.

2. Repair erosion, located midway on dam downstream face.

MSS20165

3. Remove trees and bushes above wing walls at stilling basin.

4. Remove sediment from stilling basin slab.

5. Emergency Action Plan is needed for dam. Enclosed is information on how to develop emergency action plans.

Please advise us when this work has been completed.

We tentatively plan to make our next regularly scheduled inspection of Fountain Hills #4 Dam during December 1994, and will contact you in advance to arrange a mutually convenient inspection date and time. In the interim, please notify the Department promptly of any unusual or alarming conditions which may occur at the dam.

We received a letter, dated March 10, 1993, in which you approved the Park Master Plan, submitted by Coe and Van Loo for the reservoir area. As we have discussed, because the project could impact the safety of the dam, it is essential that we be given the opportunity to review the construction drawings before construction begins. Review comments may necessitate revisions, but since you have been coordinating with us already on this project, a requirement for significant revisions is considered unlikely.

You may contact Jim Johnson of the Safety of Dams and Flood Engineering Section if you have any questions.

Sincerely,

William C. Jenkins, P.E.
Chief
Safety of Dams & Flood Engineering

WCJ/JLJ/mja

Enclosures

MSS20165

State of Arizona

DEPARTMENT OF WATER RESOURCES

LICENSE OF APPROVAL

Pursuant to Title 45-Waters, Chapter 6, Article 1, of the Arizona Revised Statutes, the DIRECTOR, Department of Water Resources issues this License of Approval to: TOWN OF FOUNTAIN HILLS

Authorizing the use of: FOUNTAIN HILLS #4 *Dam and Reservoir, File Number:* 07.33

Located in Section 10 *, Twp.* 3N *, Rge.* 6E *, G. & S.R. B. & M.,* MARICOPA *County, State of Arizona,*

to impound water in accordance with and subject to the following terms and conditions:

Use shall be only as a flood retarding structure, limited to temporary storage during periods of flood and for such additional time as may be required to completely evacuate the floodwaters through the outlet conduits

This License of Approval supersedes every previous consent for use issued by the State of Arizona relative to said dam and reservoir.

Witness my hand and seal of the Arizona Department of Water Resources

this 20th *day of* April , 1993

C. Laurence Linser, P.E. No. 9528
Deputy Director, Engineering

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

Instructions for Photogrametrically Digitized Cross Sections

TO: FRANK DEAL
Kenney Aerial Mapping

FROM: TOM LOOMIS
George V. Sabol Consulting
Engineers (GVSCE)

DATE: May 11, 1993

REFERENCE: August 28, 1992, proposal letter for Fountain Hills North

1. Using the stereoscopic map model prepare GR records for approximately 400 cross sections (384 counted on computer file), using the GR data pairs (elevation, station) format of HEC-2. Provide a disk and a hard-copy printout of all records.

   a. Use both the blue layer (labelled XS-1, cyan) and the red layer (labelled XS-2, white) to prepare GR data pairs. The green layer should be ignored for your purposes.

2. Insert X1 record identifiers between each set of GR records. Only Field 1(stream station) of X1 record needs to be filled out. Use stream stationing provided from GCA.

3. GR record stationing will be from left to right looking downstream with the thalweg as station 10,000. Note: left is on the left while looking downstream.

4. The elevation data are to be spaced no more than one-fourth of a contour interval, which in this case is 0.5 feet. This vertical tolerance applies across the entire cross-section width.

   a. A maximum of 100 data pairs are to be provided for each set of GR records.

Please provide this information within 12 working days from the date of receipt, in accordance with your current contract with us, or let me know if there is a scheduling problem.

Tom Loomis

92491-00\Photgram.035

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF WATER AND WASTE MANAGEMENT
2406 South 24 Street, Suite E204
Phoenix, Az 85034
(602) 506-6667

December 15, 1992

RECEIVED
JAN 19 1993

CERTIFIED MAIL

Mr. Ray Baldwin
MCO Properties, Inc.
16838 East Palisades Blvd
P. O. Box 17795
Fountain Hills, Az 85268

Dear Mr. Baldwin:

Our Vector Control staff has determined that extensive mosquito breeding has been occurring along several washes in Fountain Hills. These heavily overgrown washes provide excellent mosquito habitat due to the continued discharge of water into them which has artificially created marsh like conditions. With no clearly defined channel to carry this almost constant flow of water, and the dense vegetation which has subsequently developed, not only have a multitude of mosquito breeding sites occurred, but most of the breeding areas are not accessible for treatment with vehicle mounted or hand carried equipment.

These washes no longer are subject to heavy flows, caused by rainstorms, which would scour out vegetation and keep a clear flow channel along the length of the wash. This natural cleaning of the washes is prevented by flood control structures which have limited such flows. The two worst problem areas are:

- Ashbrook Wash, especially east of Saguaro Blvd. to El Pueblo Blvd.
- The wash east of the fountain which runs between Palisades Blvd. and the Ft. McDowell Reservation boundary.

Reducing the irrigation of the "park" area west of the High School may decrease the flow of water into Ashbrook Wash. It appears, however, that other sources, associated with the development of the area, will continue to feed water into the washes maintaining the heavy vegetative growth and subsequent mosquito breeding. These areas are also attractive to wild birds which may be reservoirs of the viruses which cause encephalitis. This, along with the populations of *Culex Sp.* mosquitos breeding in the water, poses a significant danger of transmission of either St. Louis Encephalitis or Western Equine Encephalitis to nearby residents.

In order to eliminate this danger and prevent its recurrence, you are therefore instructed to clear a low flow channel in the washes, where necessary, to prevent water from spreading and ponding. Such channels are to be maintained free of emergent and overhanging vegetation which could provide protective cover for mosquito breeding. We recommend that this work be undertaken as soon as possible and completed prior to the onset of warm weather next spring. If you are not able to make the physical corrections necessary to eliminate all of the mosquito breeding in the washes, you will need to develop and implement an alternative plan to eliminate this dangerous (and illegal) situation.

If you have any questions on this matter, please call our Vector Control Manager, Tom Engelthaler, at 273-0895.

Sincerely,

John A. Power, P.E.
Division Manager

cc. Tom Engelthaler
Dale Bodiya
Gene Bond, Legal Liaison

cc: Tim Murphy/ M
Tom Loomis/ Sabol

FOUNTAIN HILLS SANITARY DISTRICT
16941 E. Pepperwood Circle
Fountain Hills, Arizona 85268
(602) 837-8444

June 4, 1993

Mr. Randy Harrel, P.E.
Town Engineer
Town of Fountain Hills
P.O. Box 17958
Fountain Hills AZ 85269

Re: EPA Stormwater Regulations Compliance

Dear Randy:

Some weeks ago, you asked me what the Sanitary District was doing to comply with EPA's stormwater regulations.

Very little area of the District's wastewater treatment plant drains off-site. Since the District does not want to procure a stormwater discharge permit, money has been allocated in our budget to regrade or berm whatever area is necessary to force site drainage into our emergency storage pond. This work is scheduled for completion by the end of 1993.

Should you have any questions concerning this matter, do not hesitate to call.

Sincerely,

Ron

Ronald D. Huber, P.E.
District Manager

RDH/rm

MKE McLaughlin Kmetty Engineers, Ltd.

TELEPHONE COMMUNICATION REPORT

DATE: 7-20-93 TIME: 2:15 PM JOB NO. Fountain Hills

TO: Tim Murphy LOCATION: FCDMC

FROM: E. Brown LOCATION: MKE

SUBJECT/DISCUSSION:

1. Flow rates are required to be placed on the floodplain maps for Fountain Hills. The reason is that flow rates will probably change quickly on some washes, so this would be helpful information to appear on the floodplain maps.

2. Tim will send samples to me.

SUMMARY/ACTION ITEMS: 1. When double-checking the floodplain maps, ensure that the flow rate appears.

2. See samples to be mailed.

COPY TO: Tom Loomis

ANDERSON-NELSON, INC.
4441 East McDowell Road
PHOENIX, ARIZONA 85008

(602) 273-1850

LETTER OF TRANSMITTAL

DATE	JOB NO.
9-14-93	5293

ATTENTION: Thomas Loomis

RE: Golden Eagle Estates
Fountain Hills

TO George V. Sabal Consult. Eng., Inc.
7950 E. Acoma Dr., Suite 211
Scottsdale, AZ 85260-6962

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☒ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
1			Paving Plans, shts 1 - 14 Culvert Details sht 12 of 14

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19 _____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO _____

SIGNED: Don Prior

If enclosures are not as noted, kindly notify us at once.

Don Prior

1.3.4 FEMA REGIONAL OFFICE

1.3.5 FEMA WASHINGTON

Federal Emergency Management Agency

Washington, D.C. 20472

FLOOD CONTROL DISTRICT
RECEIVED
OCT 23 1997
CH ENG | C & FM
DEP
ADM
FIN
1 RGN

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 97-09-534P

The Honorable Don Stapley
Chairperson, Maricopa County Board
of Supervisors
301 West Jefferson Street
Phoenix, Arizona 85003

Community: Maricopa County, Arizona
Community No.: 040037
Panels Affected: 04013C1270 D, 1300 E, and 1750 E
Effective Date of This Revision: OCT 21 1997

102-I-C

Dear Mr. Stapley:

This responds to a request that the Federal Emergency Management Agency (FEMA) revise the effective Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas (the effective FIRM for your community), in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated February 10, 1997, Mr. Ron Nevitt, Program Manager, NFIP, Flood Control District of Maricopa County, requested that FEMA revise the FIRM to show the effects of detailed studies along the following flooding sources: Arrow Wash, Ashbrook Wash, Balboa Wash, Caliente Wash, Cereus Wash, Chukar Wash, Colony Wash, Cyprus Point Wash, Emerald Wash, Escalante Wash, Fountain Channel, Greystone Wash, Hesperus Wash, Jacklin Wash, Kingstree Wash, Laser Drain, Legend Wash, Logan Wash, Malta Drain, Mangrum Drain, North Colony Wash, Oxford Wash, Powder Wash, Sunburst Wash, Sycamore Wash, and Tulip Wash.

All data required to complete our review of this request were submitted with letters from Mr. Nevitt. Because this Letter of Map Revision (LOMR) is based on a detailed hydrologic or hydraulic study conducted by a Federal, State, or local agency to replace an approximate study conducted by FEMA, fees were not assessed for the review.

We have completed our review of the submitted data. We have revised the FIRM to add floodplain boundary delineations and zone designations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) along Arrow Wash, Ashbrook Wash, Balboa Wash, Caliente Wash, Cereus Wash, Chukar Wash, Colony Wash, Cyprus Point Wash, Emerald Wash, Escalante Wash, Fountain Channel, Greystone Wash, Hesperus Wash, Jacklin Wash, Kingstree Wash, Laser Drain, Legend Wash, Logan Wash, Malta Drain, Mangrum Drain, North Colony Wash, Oxford Wash, Powder Wash, Sunburst Wash, Sycamore Wash, and Tulip Wash. The modifications are shown on the enclosed annotated copies of FIRM Panel(s) 04013C1270 D, dated April 15, 1988, and 04013C1300 E and 04013C1750 E, both dated September 4, 1991. This LOMR hereby revises the above-referenced panel(s) of the effective FIRM.

Because this revision request also affects the Town of Fountain Hills, a separate LOMR for that community was issued on the same date as this LOMR.

The modifications are effective as of the date shown above. The map panel(s) as listed above and as modified by this letter will be used for all flood insurance policies and renewals issued for your community.

A review of the determination made by this LOMR and any requests to alter this determination should be made within 30 days. Any request to alter the determination must be based on scientific or technical data.

We are preparing a revised FIRM and Flood Insurance Study (FIS) report for Maricopa County, Arizona and Incorporated Areas; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the FIRM and FIS report will be distributed for review in fall 1997. For informational purposes, detailed flood hazard data for the above-mentioned flooding sources have been shown on the enclosed annotated copies of the Summary of Discharges Table, Floodway Data Table, and Flood Profile Panel(s). Please note that corporate limits for the Town of Fountain Hills are not shown on the effective FIRM. We will incorporate the modifications made by this LOMR, the detailed flood hazard data, and the corporate limits for the Town of Fountain Hills into the preliminary FIRM and FIS report before they are distributed, and the modifications will be included when the FIRM and FIS report become effective.

This revision affects effective FIRM Panels 04013C1270 D, 04013C1300 E, and 04013C1750 E. Effective FIRM Panels 04013C1300 E and 04013C1750 E are currently shown at a scale of 2,000 feet per inch. When the preliminary copies of the FIRM are distributed, portions of FIRM Panel 04013C1300 E will be replaced by FIRM Panels 04013C1288 F and 04013C1289 F, and portions of FIRM Panel 04013C1750 E will be replaced by FIRM Panels 04013C1726 F, 04013C1727 F, 04013C1728 F, and 04013C1729 F. The new FIRM panels will be shown at a scale of 500 feet per inch.

This LOMR is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development, and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

Because this LOMR will not be printed and distributed to primary users, such as local insurance agents and mortgage lenders, your community will serve as a repository for these new data. We encourage you to disseminate the information reflected by this LOMR throughout the community, so that interested persons, such as property owners, local insurance agents, and mortgage lenders, may benefit from the information. We also encourage you to prepare a related article for publication in your community's local newspaper. This article should describe the assistance that officials of your community will give to interested persons by providing these data and interpreting the NFIP maps.

This determination has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and is in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed minimum NFIP criteria. These criteria are the minimum and do not supersede any State or local requirements of a more stringent nature. This includes adoption of the effective FIRM to which the regulations apply and the modifications described in this LOMR. Our records show that your community has met this requirement.

A Consultation Coordination Officer (CCO) has been designated to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Dorothy M. Lacey
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
The Presidio of San Francisco, Building 105
San Francisco, California 94129-1250
(415) 923-7177

If you have any questions regarding floodplain management regulations for your community or the NFIP in general, please contact the CCO for your community at the telephone number cited above. If you have any technical questions regarding this LOMR, please contact Mr. John Magnotti of our staff in Washington, DC, either by telephone at (202) 646-3932 or by facsimile at (202) 646-4596.

Sincerely,

Frederick H. Sharrocks, Jr., Chief
Hazard Identification Branch
Mitigation Directorate

Enclosure(s)

cc: The Honorable Jerry Miles
Mayor, Town of Fountain Hills

Mr. Randy L. Harrel
Town Engineer
Town of Fountain Hills

Mr. Ron Nevitt
Program Manager
NFIP
Flood Control District of Maricopa County

1.3.6 FEMA TECHNICAL CONSULTANT

1.3.7 COPY OF PUBLIC NOTICES

42-464.161

AGK ENGINEERS, INC.
2255 N. 44th St. Suite 330 • Phoenix, AZ 85008 • Phone (602) 244-2566 • FAX:(602) 244-8947

RECEIVED JAN 0 7 1993

PRINCIPALS
Edward A. Adair, P.E.
R. Gerald Green, P.E.
Samuel E. Kao, Ph.D., P.E.

ASSOCIATES
Michael J. Bonar, P.E.
Denis L. Howe, P.E.
Hal E. Marron, P.E.
Patrice M. Miller

January 4, 1993

Mr. Frank Brown, P.E.
MKE
3501 North 16th Street
Phoenix, AZ 85016-6419

Reference: Local Advertisement
Fountain Hills Flood Insurance Studies

Dear Mr. Brown:

Per our telephone conversation today regarding the shared publication of the legal advertisement for the Fountain Hills Flood Insurance Study, AGK's understanding is as follows:

1. MKE will proceed with advertisement preparation and placement in the Arizona Republic and Times of Fountain Hills.

2. AGK will be sent a copy of the advertisement to review prior to publication.

3. Tim Murphy, Flood Control District of Maricopa County, will be sent a copy of the advertisement prior to publication to review and approve.

4. Two (2) Affidavits of Publication will be issued for each advertisement. One will name MKE (or Sabol) and the other will name AGK Engineers, Inc. as the party the affidavit was issued to.

5. MKE will submit an invoice to AGK for AGK's share of the publication cost along with a copy of the original invoices from the publications. AGK will pay 50% of the original invoice cost of publication to MKE.

Sincerely,

AGK ENGINEERS, INC.

Hal Marron

Hal E. Marron, P.E.
Project Manager

HEM/kp

PUBLIC NOTICE
YOUR RIGHT TO KNOW

ANNOUNCEMENT OF FLOOD HAZARD STUDY

The Flood Control District of Maricopa County, under authority of the National Flood Insurance Act of 1968 (P.L. 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L. 93-234), is funding a detailed study of flood hazard areas in The Town of Fountain Hills, Arizona.

The study is being performed for the Flood Control District by AGK Engineers and George V. Sabol Consulting Engineers.

The purpose of this study is to examine and evaluate flood hazard areas which are developed or which are likely to be developed and to determine flood elevations for those areas. Flood elevations will be used by Maricopa County to carry out floodplain management objectives of the National Flood Insurance Program. They will also be used as the basis for determining appropriate flood insurance premium rates applicable for buildings and their contents.

This announcement is intended to notify all interested persons of the commencement of this study so that they may have an opportunity to bring any relevant facts and technical data concerning local flood hazards to the attention of the Flood Control District for consideration in the course of this study. Such information should be addressed to Mr. Tim Murphy or Ms. Sandy Story, Flood Control District of Maricopa County, 2801 W. Durango Street, Phoenix, AZ 85009, telephone (602) 506-1501.

Published in _____ on _____.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7

GEZA E. KMETTY
RONALD C. McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON

DONALD L. ZIEMBA

Date 1-5-93

PAGE 1 of 1
INCL. this page

From Frank Brown

Transmitted to Fax Number 244-8947

To Mr. Hal Marron

Company AGK Engineers

Comments Hal,

please review and approve (by phone) this legal ad. I sent a copy to Tim Murphy.

JOB # 92-404.001

Complete @ 2'11

PUBLIC NOTICE
YOUR RIGHT TO KNOW

ANNOUNCEMENT OF FLOOD HAZARD STUDY

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The Town of Fountain Hills, Arizona.

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Published in _____ on _____.

NOTE: If this transmission is incomplete, please call (602) 248-7702.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C. McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON

DONALD L. ZIEMBA

Date 1-5-93

PAGE 1 of 1
INCL. this page

From Frank Brown

Transmitted to Fax Number 506-4601

To FCD of MC, Mr. Tim Murphy

Company

Comments Please review and call with your approval of this legal ad. We will place in AZ Republic and the Times of Fountain Hills.

JOB # 92-404.001

Complete @ 9:10

NOTE: If this transmission (602) 248-7702.

PUBLIC NOTICE
YOUR RIGHT TO KNOW

ANNOUNCEMENT OF FLOOD HAZARD STUDY

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Published in _____ on _____.

yerpee

MKE McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C. McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TOREN
TERRENCE P. KENYON

DONALD L. ZIEMBA

Date 1-5-93

PAGE 1 of 2
INCL. this page

From Frank Brown

Transmitted to Fax Number 271-7364

To Debbie Wilson, Legal Advertising

Company The Arizona Republic Newspaper

Comments Please publish this ad a total of two times, one week apart. Let us know the amount to prepay. We will need two separate Affidavits of Publication: one made out to AGK Engineers, and the other to George V. Sabol Consulting Engineers

JOB # 92-404.001

[illegible] @ 4:47

NOTE: If this transmission is incomplete, please call (602) 248-7702.

MKE

McLaughlin Kmetty Engineers, Ltd.

3501 North 16th Street Phoenix, Arizona 85016-6419 (602) 248-7702 FAX (602) 248-7851

GEZA E. KMETTY
RONALD C. McLAUGHLIN
HALFORD E. ERICKSON
WILLIAM R. KENDALL
RALPH L. TORÉN
TERRENCE P. KENYON

DONALD L. ZIEMBA

Date 1-5-93

PAGE 1 of 2
INCL. this page

From Frank Brown

Transmitted to Fax Number 837-1951

To Kip, in legal advertising dept.

Company The Times of Fountain Hills Newspaper

Comments Please publish this ad a total of two times, one week apart. Let me know if we need to prepay. We will need two separate affidavits of Publication: one made out to AGK Engineers, and the other to George V. Sabol Consulting Engineers.

JOB # 92-404.001

George 4/115

NOTE: If this transmission is incomplete, please call (602) 248-7702.

ASPEN, CO (303) 925-1920 | TULSA, OK (918) 664-2741 | DENVER, CO (303) 458-5550 | SUMMIT COUNTY, CO (303) 468-2141

LETE ENGINEERING SERVICES IN: TRANSPORTATION MUNICIPAL ENGINEERING CIVIL ENGINEERING STORM DRAINAGE AND FLOOD CONTROL
WATER RESOURCES TREATMENT AND DISTRIBUTION CONSTRUCTION MANAGEMENT SPECIALTY HYDRAULICS RATE STUDIES AND UTILITIES ECONOMICS

PUBLIC NOTICE
YOUR RIGHT TO KNOW

ANNOUNCEMENT OF FLOOD HAZARD STUDY

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Published in _____ on _____.

Corres

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

January 7, 1993

The Arizona Republic
c/o The Arizona Business Gazette
P.O. Box 1950
Phoenix, Arizona 85001

Attention: Tom, Legal Advertising

Dear Tom:

Enclosed is a legal ad to be published two separate times, one week apart. Please publish on any day of the week other than Monday or Tuesday.

According to your estimate, we are pre-paying $789.60, by Check #2105. The Arizona Republic/Business Gazette will provide two originals of the Affidavit of Publication.

Very truly yours,

GEORGE V. SABOL CONSULTING ENGINEERS, Inc.

Thomas Robert Loomis

Thomas Robert Loomis, P.E.
Project Engineer

c: Tim Murphy, Flood Control District of Maricopa County
Frank Brown, McLaughlin Kmetty Engineers
Hal Marron, AGK Engineers

92491-00\AZBusGaz.035

Corr.

PUBLIC NOTICE
YOUR RIGHT TO KNOW

ANNOUNCEMENT OF FLOOD HAZARD STUDY

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Published in _____ on _____.

George V. Sabol Consulting Engineers, Inc.
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

January 12, 1993

The Times of Fountain Hills
P.O. Box 17869
Fountain Hills, Arizona 85269

Attention: Kip, Legal Advertising

Dear Kip:

Enclosed is a legal ad to be published two separate times, one week apart. Please publish on two consecutive Wednesdays.

According to your estimate, we are pre-paying $45.00, by Check #2113. The Times of Fountain Hills will provide two originals of the Affidavit of Publication.

Very truly yours,

GEORGE V. SABOL CONSULTING ENGINEERS, Inc.

Parker Kmetty

for Thomas Robert Loomis, P.E.
Project Engineer

c: Tim Murphy, Flood Control District of Maricopa County
Frank Brown, McLaughlin Kmetty Engineers, Ltd.
Hal Marron, AGK Engineers

92491-00\TimesFtH.035

TRANSMITTAL

TO: Tim Murphy
Flood Control District of Maricopa County

FROM: *George V. Sabol Consulting Engineers, Inc.*
3501 North 16th Street, Suite B, Phoenix, Arizona 85016
(602) 234-3321 FAX (602) 248-7851

DATE: 1/28/93

PROJECT No./Name: FCD 92-04 Mountain Hills

SUBJECT: Legal Advertisement

ENCLOSED ARE THE FOLLOWING

Original Affidavit of Publication from The Arizona Republic.

REMARKS

COPIES AGK

SIGNED Esther Kmetty

PHOENIX

THE ARIZONA REPUBLIC / *The Phoenix Gazette*

P.O. BOX 200 PHOENIX, AZ 85001-0200

3 INVOICE NUMBER	PAGE	4 DATE
D400[illegible]0376459	1	01-31-93

BILLED ACCOUNT NAME

RECEIVED FEB 0 2 1993

MCLAUGHLIN KMETTY ENGRS
FRANK BROWN
3501 N 16TH ST
PHOENIX AZ 85016

5 BILLING PERIOD: 01-01-93 TO 01-31-93

6 TERMS OF PAYMENT	TYPE ADVERTISING
DUE ON PRESENTATION	DISPLAY

7 BILLED ACCOUNT NO.	8 ADV./CLIENT NO.
D400010	

ADVERTISER/CLIENT NAME

PLEASE RETURN COPY WITH PAYMENT

FOR BILLING INFORMATION CALL: 271-8558

DATE	11 REF.	CODE	12 13 14 DESCRIPTION	CLASS	15 LINES/SAU DIMENSIONS	16 TMS	17 BILLED UNITS	18 RATE	19 GROSS AMOUNT	20 NET AMOUNT
-28			PAYMENT 2105							789.60CR
			CHARGES							
-29		150	93008/FLOOD HAZA		1X 2.81					833.16
			SUB TOTAL CHGS. &	CRDTS.						833.16

ONTRACT PERFORMANCE
RACT TYPE: NONE
ENT MO. LINES/INCHES
TO DATE LINES/INCHES
VERSARY/EXPIRE DATE

DESCRIPTION OF CODES

150-LEGAL AD

REPEAT YOUR AD IN "BONUS WEEKLY". REACH OVER 340,000 NON-SUBSCRIBER HOUSEHOLDS VALLEYWIDE FOR AS LOW AS 22.50 PER INCH. CALL 271-8447 FOR INFO

CURRENT GROSS	22 CURRENT NET
	43.56

24 AGING		
PAST DUE 30 DAYS	PAST DUE 60 DAYS	PAST DUE 90 DAYS

25 PLEASE PAY THIS AMOUNT

$43.56

D 000400010400010 0000004356

30-0359

The Arizona Republic/The Phoenix Gazette

P.O. BOX 200
PHOENIX, AZ 85001-0200

Invoice Number 93008

DO NOT PAY
FROM THIS INVOICE
Pay from End-Of-Month
Statement. Account No. 400010

RECEIVED 27 1993

RECEIVED 27 1993

McLaughlin Kmetty Engineers, Ltd.
Frank Brown
3501 N. 16th St.
Phoenix, AZ. 85016-6419

THIS IS YOUR INVOICE FOR THE FOLLOWING LEGAL ADVERTISING:

CATCH LINE 93008/FLOOD HAZARD STUDY (invoice #) Class No. 98

Runs:	Republic	Gazette
1.	Wed. Jan. 13, 1993 B4	
2.	Wed. Jan. 20, 1993 B7	
3.		
4.		
5.		
6.		
7.		
8.		
9.		

Purchase Order No.

Ad Size 1 X 2.81

$ 296.50 Rate

$ 833.16 Total

Pre-Payment $789.60
chk #2105

Please deduct pre-payment and pay the balance

LGL-007 (4-16,92)

WESTERN STATES PUBLISHERS
DBA THE TIMES OF FOUNTAIN HILLS
PO BOX 17869
Fountain Hills, AZ 85269

STATEMENT

ACCOUNT NO. DATE

George V.Sabol
3501 N. 16th St
Suite B
Phoenix, AZ 85016

$
AMOUNT REMITTED

PLEASE DETACH AND RETURN WITH YOUR PAYMENT

DATE	INVOICE NO.	DESCRIPTION	CHARGES	PAYMENTS	BALANCE
'13/93 '20/93		Publication PAID IN FULL Ch #2113			$45.00

CURRENT	30 DAYS	60 DAYS	90 + DAYS	TOTAL AMOUNT DUE

Thank You

INVOICE NO. 93008

ANNOUNCEMENT OF FLOOD HAZARD STUDY

The Flood Control District of Maricopa County, under authority of the National Flood Insurance Act of 1968 (P.L. 90-448), as amended, and the Flood Disaster Protection Act of 1973 (P.L. 93-234), is funding a detailed study of flood hazard areas in The Town of Fountain Hills, Arizona.

The study is being performed for the Flood Control District by AGK Engineers and George V. Sebol Consulting Engineers.

The purpose of this study is to examine and evaluate flood hazard areas which are developed or which are likely to be developed and to determine flood elevations for those areas. Flood elevations will be used by Maricopa County to carry out floodplain management objectives of the National Flood Insurance Program. They will also be used as the basis for determining appropriate flood insurance premium rates applicable for buildings and their contents.

This announcement is intended to notify all interested persons of the commencement of this study so that they may have an opportunity to bring any relevant facts and technical data concerning local flood hazards to the attention of the Flood Control District for consideration in the course of this study. Such information should be addressed to Mr. Tim Murphy or Ms. Sandy Story, Flood Control District of Maricopa County, 2801 W. Durango Street, Phoenix, AZ 85009, telephone (602) 506-1501.

Published: Arizona Republic, January 13, 20, 1993.

The Arizona Republic/The Phoenix Gazette

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

JOAN LOHR, being first duly sworn, upon oath deposes and says: That she is the legal advertising manager of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic and The Phoenix Gazette, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

~~The Arizona Republic~~
The Phoenix Gazette

JANUARY 13, 20, 1993

Joan Lohr

Sworn to before me this

25TH day of

JANUARY 93 A.D. 19

OFFICIAL SEAL
MARY LEE BOOHER
NOTARY PUBLIC STATE OF ARIZONA
MARICOPA COUNTY
My Comm. Expires March 17, 1995

Mary Lee Booher
Notary Pub

PUBLIC NOTICE
OUR RIGHT TO KNOW

NOUNCEMENT OF FLOOD HAZARD STUDY

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and the Flood Disaster Protection Act of 1973 (P.L. 93-
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Street, Phoenix, AZ 85009, telephone (602) 506-1501.

FH Times 1/13,1/20/93

AFFIDAVIT OF PUBLICATION

The Times
OF FOUNTAIN HILLS AND RIO VERDE, ARIZONA

A publication of Western States Publishers, Inc.

STATE OF ARIZONA
COUNTY OF MARICOPA } ss.

L. ALAN CRUIKSHANK, being first duly sworn, upon oath deposes and says: That he is the publisher of

THE TIMES OF FOUNTAIN HILLS AND RIO VERDE

a newspaper of general circulation in the County of Maricopa and the State of Arizona, published at Fountain Hills, Arizona, and that the copy hereto attached is a true copy of the advertisement as published weekly in The Times of Fountain Hills and Rio Verde on the following dates:

Jan 13, 1993
Jan 20, 1993

Sworn to before me this

23 day of

February A.D. 19 93

Karen Kirkendoll
Notary Public

OFFICIAL SEAL
KAREN KIRKENDOLL
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My comm. expires May 14, 1993

INVOICE NO. 93008

ANNOUNCEMENT OF FLOOD HAZARD STUDY

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~~The Arizona Republic~~
The Phoenix Gazette

JANUARY 13, 20, 1993

Joan Lohr

Sworn to before me this

25TH day of

JANUARY 93 A.D. 19

OFFICIAL SEAL
MARY LEE BOOHER
NOTARY PUBLIC STATE OF ARIZONA
MARICOPA COUNTY
My Comm. Expires March 17, 1995

Mary Lee Booher
Notary Public

CONTRACT FOR CONSULTANT SERVICES

CONTRACT FCD 92-04

Pursuant to the provisions of the Arizona Revised Statutes (A.R.S.), 48-3603, the Board of Directors has the authority to enter into contracts.

The Flood Control District of Maricopa County, Arizona, hereinafter called the "DISTRICT", is desirous of having certain professional services performed in connection with the Fountain Hills Floodplain Delineation Study (North), hereinafter called the "PROJECT" and as more fully described in Exhibit "A", Scope of Work, attached; and,

GEORGE V. SABOL CONSULTING ENGINEERS, INC., hereinafter called "CONSULTANT", is desirous of performing said services;

THEREFORE, the parties hereto mutually agree as follows:

SECTION I - SERVICES OF THE CONSULTANT

The CONSULTANT, under the general supervision of the Chief, Hydrologist of the District's Hydrology Division shall prepare studies, reports, surveys, plans, drawings, specifications and cost estimates as are necessary for the PROJECT and according to the directions and designated standards of the DISTRICT and in accordance with Exhibit A. It is understood and agreed that the DISTRICT's authorized representative shall be the Chief, Planning and Project Management Division or his duly authorized representative, hereinafter called the "AGENT" and that he/she shall be the sole contact for administering this contract.

The CONSULTANT shall meet periodically with the AGENT so as to keep the DISTRICT informed of the progress of the work in accordance with the schedule defined in Exhibit A.

The CONSULTANT shall promptly advise the AGENT of any factors, which may develop during the PROJECT, that would likely result in contract costs in excess of budgetary constraints.

SECTION II - PERIOD OF SERVICE

The CONSULTANT shall complete all work per the schedule provided in Exhibit "A", Scope of Work within 360 calendar days after receipt of the Notice to Proceed, inclusive of DISTRICT review time. Should extension of this contract period be necessary, and any such extension(s) continue the date of contract expiration for a time period of more than one year from the date of contract execution, adjustment(s) of the consultant's fee(s) may, upon agreement by both the DISTRICT and the CONSULTANT, be made in accordance with the Consumer Price Index for Urban Consumers, Western Division published by the U.S. Department of Labor, Bureau of Labor Statistics, using the published edition coinciding with the initial contract expiration date. Any such fee adjustment shall only apply to the extended contract time period.

SECTION III - PAYMENTS TO THE CONSULTANT

The CONSULTANT shall be paid for work under this Contract a lump sum fee of $249,847.00 plus any adjustments that have been approved in writing in accordance with the Maricopa County Procurement Code.

The DISTRICT shall pay the CONSULTANT upon completion of the work as accepted by the DISTRICT, except that progress payments may be made as billed by the CONSULTANT based on approved monthly progress reports subject to the limitations set forth in Exhibit "A", Scope of Work. Ten percent of all contract payments made on an interim basis shall be retained by the DISTRICT as insurance of proper performance of the contract or, at the option of the CONSULTANT, a substitute security may be provided by the CONSULTANT in an authorized form pursuant to procedures established by the DISTRICT. The CONSULTANT is entitled to all interest from any such substitute security.

When the contract is fifty percent (50%) completed, one-half (1/2) of the amount retained will be paid to the CONSULTANT provided the CONSULTANT is making satisfactory progress on the contract and there is no specific cause or claim requiring a greater amount to be retained. After the contract is fifty percent (50%) completed, no more than five percent (5%) of the amount of any subsequent progress payments shall be retained providing the CONSULTANT is making satisfactory progress on the project, except if at any time the DISTRICT determines satisfactory progress is not being made, ten percent (10%) retention shall be reinstated for all progress payments made under the contract subsequent to the determination.

If the CONSULTANT desires a partial payment in accordance with the provisions above, the CONSULTANT will complete and forward, a DISTRICT provided form, indicating payment distribution to MBE/WBE firms.

Any retention shall be paid or substitute security returned or released, as applicable, to the CONSULTANT within forty-five (45) calendar days after: (1) final completion of all work per Exhibit A, (2) acceptance of work under the contract, (3) receipt of a completed "Certificate of Performance" form, (4) the CONSULTANT'S statement that no project disputes exist, (5) invoicing for any retained monies has been received by the DISTRICT, and (6) a document stating the total payments received by the prime as well as total payments the prime has made to MBE and WBE subcontractors, vendors, and suppliers.

SECTION IV - THE DISTRICT'S RESPONSIBILITIES

The DISTRICT shall furnish the CONSULTANT, at no cost to the CONSULTANT, the following information or services for this PROJECT:

A. The copy of on-hand maps, records, survey ties, bench marks or other data pertinent to the PROJECT. This does not, however, relieve the CONSULTANT of the responsibility of searching records for additional information, for requesting specific information or for verification of that information provided. The DISTRICT does not warrant the accuracy or comprehensiveness of any such information.

B. All available information and data relative to policies, standards, criteria, and studies, etc. impacting the PROJECT as identified by the CONSULTANT.

C. Availability of staff for consultation with the CONSULTANT during the performance of studies and plan development in order to identify the problems, needs, and other functional aspects of the PROJECT.

D. Examination of documents submitted by the CONSULTANT and rendering of decisions pertaining thereto promptly, to avoid unreasonable delay in the progress of the work by the CONSULTANT. The DISTRICT will keep the CONSULTANT advised concerning the progress of the DISTRICT's review of work.

SECTION V - ALTERATION IN SCOPE OF WORK

Any alteration in the scope of work that will result in a substantial change in the nature of the PROJECT so as to materially increase or decrease the contract fee will require negotiation of an amendment to the contract to be executed by the DISTRICT and the CONSULTANT. No work shall commence on the change until the contract amendment has been approved by the DISTRICT and the CONSULTANT has been notified to proceed by the AGENT. It is distinctly understood and agreed that no claim for extra work done or

materials furnished by the CONSULTANT will be allowed by the DISTRICT except as provided herein, nor shall the CONSULTANT do any work or furnish any materials not covered by this agreement unless such work is first authorized in writing in accordance with the Maricopa County Procurement Code. Any such work or materials furnished by the CONSULTANT without such written authorization first being given shall be at his own risk, cost, and expense, and he hereby agrees that without such written authorization he will make no claim for compensation for such work or materials furnished.

SECTION VI - RECORDS

Records of the CONSULTANT's payroll expense pertaining to this PROJECT and records of accounts between the DISTRICT and the CONSULTANT shall be kept on a generally recognized accounting basis and shall be available upon request to the DISTRICT or its authorized representative for audit during normal business hours. The records shall be subject to audit by appropriate grantor agency if the PROJECT is funded all or in part by a grant.

SECTION VII - PROJECT COMPLETION

If during the course of this contract situations arise which prevent completion within the allotted time, an extension may be granted by the AGENT.

SECTION VIII - TERMINATION

The DISTRICT may terminate this contract at any time upon reimbursement to the CONSULTANT of expenses which include reasonable charges for time and material for the percentage of work satisfactorily completed and turned over to the DISTRICT.

The DISTRICT reserves the right to postpone, terminate or abandon this PROJECT for the CONSULTANT's failure to complete the PROJECT on time, or failure to comply with the provisions of the contract. The DISTRICT also reserves the right to terminate any or all parts of this contract for its own convenience as the DISTRICT may determine at its sole discretion.

The DISTRICT hereby gives notice that pursuant to A.R.S. Section 38-511 "A" this contract may be cancelled without penalty or further obligation within three years after execution if any person significantly involved in initiation, negotiation, securing, drafting, or

creating a contract on behalf of the DISTRICT is, at anytime while the contract or any extension of the contract is in effect, an employer, agent, or any other party to the contract in any capacity or a consultant to any other party of the contract with respect to the subject matter of the contract. Cancellation under this section shall be effective when written notice from the Chief Engineer and General Manager is received by all of the parties of the contract. In addition, the DISTRICT may recoup any fee for commission paid or due to any person significantly involved in initiation, negotiation, securing, drafting, or creating the contract on behalf of the DISTRICT from any other party to the contract arising as a result of the contract.

The CONSULTANT may terminate this contract in the event of nonpayment of fees as specified in Section III, PAYMENTS TO THE CONSULTANT.

SECTION IX - OWNERSHIP OF DOCUMENTS

All original documents including, but not limited to studies, reports, tracings, drawings, physical and computer models, estimates, field notes, investigations, design analyses, calculations, computer software, and specifications, prepared in the performance of this Contract are to be and remain the property of the DISTRICT and are to be delivered to the AGENT before final payment is made to the CONSULTANT. The DISTRICT reserves the right to reuse the documents as it sees fit. However, the DISTRICT will not reuse, alter, or modify these documents without noting such alterations, modifications, or intent of their reuse, and will hold the CONSULTANT harmless from any claims arising from the reuse, alteration, or modification of the documents. The CONSULTANT may retain reproducible copies of all such documents delivered to the DISTRICT.

SECTION X - COMPLIANCE WITH LAWS

The CONSULTANT is required to comply with all Federal, State and local laws, local ordinances and regulations. The CONSULTANT's signature on this contract certifies compliance with the provisions of the I-9 requirements of the Immigration Reform and Control Act of 1986 for all personnel that the CONSULTANT and any subconsultants employ to complete this PROJECT. It is understood that the DISTRICT shall conduct itself in accordance with the provisions of the Maricopa County Procurement Code.

SECTION XI - GENERAL CONSIDERATIONS

A. Prior to beginning the work, the CONSULTANT shall furnish the DISTRICT for approval the names of its key employees, and of its sub-consultants and their key employees to be used on this PROJECT. Any subsequent changes are subject to the written approval of the DISTRICT.

The CONSULTANT in replacing a MBE/WBE subcontractor should attempt to contract with another MBE/WBE.

B. The failure of either party to enforce any of the provisions of this Contract or to require performance of the other party of any of the provisions hereof shall not be construed to be a waiver of such provisions, nor shall it affect the validity of this Contract or any part thereof, or the right of either party to thereafter enforce each and every provision.

C. The CONSULTANT shall be responsible for the cost of any additional design, field layout, testing, construction and supervision necessary to correct those errors or omissions attributable to the CONSULTANT and for any damage incurred by the DISTRICT as a result of additional construction costs caused by such CONSULTANT errors or omissions.

D. The fact that the DISTRICT has accepted or approved the CONSULTANT's work shall in no way relieve the CONSULTANT's responsibility.

E. It is mutually understood and agreed that this Contract shall be governed by the laws of the State of Arizona, both as to interpretation and performance. Any action at law, suit in equity, or judicial proceeding for the enforcement of this Contract, or any provision thereof, shall be instituted only in the courts of the State of Arizona.

SECTION XII - SUCCESSORS AND ASSIGNS

This Contract shall not be assigned by either party without prior written approval of the other except that the CONSULTANT may use in the performance of this Contract without prior approval of the DISTRICT, personnel or services of its related entities and affiliated companies as if they were an integral part of the CONSULTANT; and it shall extend to and be binding upon the heirs, executors, administrators, successors and assigns of the parties hereto.

SECTION XIII - NO KICK-BACK CERTIFICATION

The CONSULTANT warrants that no person has been employed or retained to solicit or secure this Contract upon any agreement or understanding for a commission, percentage, brokerage, or contingent fee; and that no member of the Board of Directors/Supervisors or any employee of the DISTRICT has any interest, financially or otherwise, in the CONSULTANT firm.

For breach or violation of this warranty, the DISTRICT shall have the right to annul this Contract without liability, or at its discretion to deduct from the Contract price or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

SECTION XIV - ANTI-DISCRIMINATION PROVISION

The Flood Control District of Maricopa County will endeavor to ensure in every way possible that minority and women-owned business enterprises shall have every opportunity to participate in providing professional services, purchased goods, and contractual services to the Flood Control District of Maricopa County without being discriminated against on the grounds of race, religion, sex, age, or national origin.

The CONSULTANT agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, or handicap and further agrees not to engage in any unlawful employment practices. The CONSULTANT further agrees to insert the foregoing provisions in all subcontracts hereunder.

SECTION XV - AMENDMENTS

This Contract may be amended by mutual written agreement of the DISTRICT and the CONSULTANT.

SECTION XVI - INDEMNIFICATION AND INSURANCE

A. The CONSULTANT shall provide and maintain the following minimum insurance requirements:

1. Professional Liability. The CONSULTANT shall show evidence of maintaining continuous insurance for the past three (3) years with a minimum coverage limit of $1,000,000.00 each claim and/or in the aggregate.

The CONSULTANT shall provide and maintain Professional Liability Insurance with a minimum single limit of $1,000,000.00 for each claim made and an aggregate limit of $1,000,000.00 for all claims made through this contract's completion date or the policy's life, whichever is longer.

2. Commercial General Liability. Commercial general liability insurance with a minimum single limit of $1,000,000.00 for each coverage/occurrence. The policy shall include coverage for bodily injury and personal injury, broad form property damage and blanket contractual coverage.

3. Automobile Liability. Automobile liability insurance, with an individual single limit for bodily injury and property damage of no less than $1,000,000.00, each occurrence, with respects to CONSULTANT's vehicles (whether owned, hired, non-owned), assigned to or used in the performance of this contract.

4. Workers' Compensation Insurance. This insurance shall be maintained during the life of the contract.

5. Additional Insured. The policies, except professional liability and workers' compensation, required by
this section shall name the DISTRICT as Additional Insured, and shall specify that insurance afforded the CONSULTANT shall be primary insurance, and that any insurance coverage carried by the DISTRICT or its employees shall be excess coverage, and not contributory coverage to that provided by the CONSULTANT. No policy issued under this contract shall lapse, be cancelled, allowed to expire, or be materially changed to affect the coverage available to the DISTRICT without thirty (30) days written notice to the DISTRICT.

6. DISTRICT approved documentation outlining the coverages specified in this section shall be filed with the DISTRICT prior to issuance of the Notice to Proceed.

B. The CONSULTANT agrees to indemnify and save harmless the DISTRICT, any of its departments, agencies, officers, or employees from all suits, including attorney's fees and costs of litigation, actions, loss, damage, expense, cost or claims, of any character or any nature arising out of the CONSULTANT's wanton, willful or negligent acts, errors or omissions in the performance of work under this Contract, and any wanton, willful or negligent acts, errors or omissions by any subconsultant or other agent used by the CONSULTANT in the performance of work under this Contract.

IN WITNESS WHEREOF, the parties herein have executed this Contract.

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

Geo V Sabol
Principal

George V. Sabol
Printed Name

President
Title

84-1110255
Tax Identification Number

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY:

Stanley G. Smith
Acting Chief Engineer/General Manager

ACCEPTED AND APPROVED:

Betsey Bayless
Chairman, Board of Director

ATTEST:

Fran McCarroll
Clerk of the Board

Date: 12.7.92

LEGAL REVIEW

Approved as to form and within the powers and authority granted under the laws of the State of Arizona to the Flood Control District of Maricopa County.

Julie M. Lemmon
General Counsel, District

Date: 10/29/92

Scope of Work FCD 92-04
Flood Control District of Maricopa County
Floodplain Delineation and Topographic Mapping
For the Town of Fountain Hills (North)

GENERAL

The project consists of approximately 24 river miles of floodplain and floodway delineations for the northern portion of the Town of Fountain Hills (Town) as shown on Exhibit 1. This will require the development of the surface water hydrology for a 16 square mile watershed. Five (5) major retention structures and numerous road crossings are anticipated to have significant impacts on the floodplain delineations and development of the watershed hydrology.

The consultant will develop the hydrology using the U.S. Army Corps of Engineer's HEC-1 computer model and the floodplain and floodway delineations using the HEC-2 computer model. The consultant must use sound engineering judgement in the development of the hydrologic and hydraulic models. The results of the models must be analyzed carefully and refinements made to the input parameters in order to obtain the most realistic results.

The results of this study must be reviewed and approved by the District, the Town, and by the Arizona Department of Water Resources (ADWR) prior to submittal to the Federal Emergency Management Agency (FEMA). The study must then be reviewed and accepted by the Federal Emergency Management Agency (FEMA) prior to the finalization of this contract. As a part of this requirement, the consultant is responsible for all Public Notification regarding this study.

Work under this Scope will be completed within 360 days from the date of Notice to Proceed, including District and ADWR reviews.

TASK 1 COORDINATION

1.1 The consultant will submit a project schedule showing coordination meetings and completion dates for each of the tasks and major sub-tasks in the Scope of Work. The schedule will be submitted within 14 days of the Notice To Proceed and shall be updated as needed.

1.2 The consultant shall participate in regular coordination meetings (approximately every three weeks) with the District's Project Manager and in milestone coordination meetings during the development of the hydrologic and hydraulic analyses. Coordination and milestone meetings will be combined to the maximum extent possible and will normally be held at the consultant's office. The consultant is responsible for the minutes of any meetings.

1.3 The consultant shall submit monthly progress reports at least 5 days before submittal of monthly invoices. The report shall be brief and should be no longer than two typed pages. At a minimum, the monthly report shall contain the following:

a. A description of the work accomplished, by task during the reporting month.

b. Percent (%) completed for the month and percent (%) cumulative completed for each task.

c. A brief description of the work to be accomplished the following month.

d. A description of any problems encountered.

1.4 The consultant is responsible for placing the legal advertising at the beginning of the study, notifying the public of the study. The ad will be run in a widely circulated newspaper twice, with approximately one week between runs. The ad also will be run twice in a local newspaper that serves the area being studied. After the ad is run the consultant will supply the District with original affidavits of publication from the newspaper(s) for each day that the ad ran.

1.5 The consultant will obtain the necessary Rights of Entry from the property owners where access may be required. The consultant can use the District's records as may be necessary to complete this task. The consultant will furnish the District with a list of all the property owners notified and a sample Right of Entry letter.

1.6 The consultant shall meet with officials from the Town of Fountain Hills. The purpose of this meeting is to identify local flooding problems and obtain information on current and planned public works projects, channel modifications, storm-drainage systems, development, and obtain the current corporate limits. The Town Engineer will also be contacted for input during the development of the hydrology and hydraulics model. The Town Engineer should also be contacted for updates on the street construction projects.

1.7 The District in coordination with the Town will plan and conduct two public meetings. One representative from the consultant will be required to attend each of the meetings. The first meeting will be to inform the public of the purpose and scope of the study. The second meeting will be to inform the public and obtain public comment on the study results, and shall take place prior to the submittal of the study to FEMA. The consultant will respond to the comments from the public and make revisions to the study if necessary.

1.8 Prior to finalizing of the hydrologic analysis, The consultant will submit maps, hydrology report, and HEC-1 model to the Arizona Department of Water Resources (ADWR) and any other governmental agency reviewers through the District. The consultant will respond to questions by the reviewers and make modifications to the hydrologic maps, model, and report if necessary.

1.9 The consultant will submit maps, hydraulics report, and HEC-2 model, to ADWR, FEMA for review by the Technical Evaluation Contractor (TEC), and any other governmental agency reviewers through the District. The consultant will respond to questions by the reviewers and make modifications to maps, models and report if required.

TASK 2 DATA COLLECTION

2.1 The consultant will collect and review pertinent data from the District, ADWR, the Town, and other outside sources. Data to be collected will include previous flood hazard reports and hydrology for the study area; existing topographic mapping; historical flooding information; as-built plans for existing structures; FEMA Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions and other pertinent information.

2.2 A written report summarizing the data collected will be submitted to the District for information purposes. A preliminary draft of this report is due within 90 days of Notice to Proceed.

TASK 3 TOPOGRAPHIC MAPPING

3.1 The District will supply data for use in a Digital Terrain Model (DTM) and contour mapping of the Fountain Hills area in a digital format. The data was prepared at an edited scale of 1 inch = 100 feet with a contour interval of 2 feet. Hard copy 1 inch = 200 feet scale plots of the contour mapping will also be supplied to the consultant.

The DTM data will be supplied in an ASCII data file containing grid coordinate data and break line data. The grid coordinate data is on a 75'x75' grid of spot elevations in the following format: Easting, Northing, Elevation. The break line data along washes and ridges will be in the following format: Easting, Northing, Elevation, Descriptor. The descriptor will identify each point on a specific break line.

The contour and planimetric data will be supplied in an AutoCAD Version 11.0 drawing file format.

3.2 The consultant will retain an aerial mapper to photogrammetrically determine the geometric cross section data for use in the HEC-2 models. The photogrammetrically determined cross sections must meet the accuracy requirements of FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, March 1991. In those areas where the vegetation is too dense to determine the cross sections photogrammetrically, they will be determined by field survey. The consultant may also derive some of the HEC-2 cross sections from the DTM.

3.3 The consultant will develop the hydrologic base maps using the supplied mapping and DTM data. For those areas not covered by the supplied mapping, U.S. Geological Survey (USGS) topographical quadrangle maps will be used. Additional topographic information may be available through the Town for those areas not covered by the detailed mapping.

An overall watershed drainage basin map with sheet index will be prepared at a scale of 1 inch = 2000 feet.

The off-site soils, land use, sub-basin delineation, time of concentration, and flood routing maps will be based on 1 inch = 1000 feet scale photo-enlarged copies of USGS 7.5 minute quadrangle maps.

The on-site soils, land use, sub-basin, time of concentration, and flood routing maps will be prepared on 1 inch = 400 feet scale maps using the supplied topographic mapping.

3.4 Using the supplied topographic data the consultant will prepare the work study drawings of the floodplain/floodway delineations to a scale of 1 inch = 200 feet with a contour interval of 2 feet.

3.5 The consultant shall provide permanent non-erasable topographic mylars of the floodplain/floodway delineation work study drawings. In addition to the topographic data and floodplain/floodway delineations, each drawing shall include a minimum of a north arrow, scale, section corners and quarter corners (if found), current and proposed streets and Highway names, State Plane Coordinate System, major drainage features, corporate boundaries, cross section location lines, channel station center line, Base Flood Elevations (BFEs), index map, description and elevation of control points and ERMs, and reference marks used in ground control. A cover sheet will be provided with the project title, date of topographic mapping, and a location map showing geographic range covered by each specific mapping sheet. The drawings shall be 24" X 36" in size, with a scale of 1 inch = 200 feet and a contour interval of 2 feet. See Exhibit 2 for how the drawings are to be laid out.

3.6 Sketch maps no larger than 11" x 17" for the study area must be included in the narrative report along with the flood profile maps.

3.7 Digital contour and planimetric data developed for this study shall be delivered according to the District's Hydrologic Information System (HIS) Data Delivery Specifications revision 01.1. Topographic information from USGS topographic quadrangle maps should not be part of the HIS product.

TASK 4 FIELD SURVEY

4.1 Field surveying shall be undertaken to establish permanent elevation reference marks (ERMs), verify the accuracy of the topographic mapping, and where necessary to obtain surveys of bridges and other hydraulic structures. The consultant shall coordinate all the surveying work and ensure that it meets FEMA requirements. Quality control on the surveys will be per FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, March 1991. Input from the District must be obtained regarding the proposed locations of the ERMs.

4.2 Ground Control for Field Surveying:

a. All topographic mapping and survey work shall meet or exceed Federal Emergency Management Agency (FEMA) minimum criteria as defined in FEMA Document 37. This would include, but is not limited to: the establishment of "permanent" elevation reference marks (ERMs); field control; and verification of profiles by the ground survey profile procedure.

b. Horizontal and Vertical Control: Where readily available, surveys will tie into State Plane Coordinate System 1983 NAD. Field control shall be sufficient, at least one "permanent" point per mile, such point(s) being used as Elevation Reference Marks (ERMs). Surveys will be based on National Geodetic Vertical Datum (NGVD), per FEMA guidelines. "Permanent" survey points shall consist of existing monumentation, such as brass caps or similar survey monuments. Where additional monumentation is needed, survey markers conforming to Maricopa Association of Governments (MAG) Uniform Standard Detail for Public Works Construction, detail 120-1, Type C, shall be placed 2" +/- above grade, and topped with a brass cap. Elevation Reference Marks will be labelled on available maps and described in a manner which allow them to be readily located in the field.

4.3 The consultant shall verify the accuracy of the mapping by the procedures called for in FEMA Document 37 or other methods approved by FEMA. This shall include the verification of cross sections used in the floodplain delineation. A minimum of 5% of the HEC-2 cross sections shall be verified by field surveying. The results of cross section verification will be submitted to the District prior to beginning the HEC-2 modeling.

Due to dense vegetation in some areas, the HEC-2 cross sections may have to be determined by field survey.

4.4 Field surveys or "as-built" plans (where available) of all bridges, culverts, flood retarding structures, and other hydraulic structures are to be obtained by the consultant. This information should be reduced and compiled into an 11"x 17" (maximum size) drawing for inclusion in the final report. The information presented in the drawing should be in a format appropriate for use in the HEC-2 model. Field surveys or "as-built" plans of bridges, culverts, hydraulic structures, and routing reaches must also be obtained where necessary for proper hydrologic modeling. It may be necessary to field survey some structures since the "as-built" plans may not be on 1929 NGVD.

4.5 Fountain Hills Structure numbers 4, 6, 7, 11, and 36 shall be field surveyed. The field survey shall determine the elevations of the principal and emergency spillways, the crest of each structure, and other information necessary for the development of the hydrologic and hydraulic models. Arrow and Sunflower Washes are conveyed partialy through a storm sewer system. This system should be field surveyed for the development of the hydrologic and hydraulic models.

4.6 Due to changes since completion of the aerial mapping the following areas will have to be field surveyed:

1. The area of Fountain Hills High School downstream of Structure Number 4 that lies within the floodplain.

2. Oxford Wash between Fountain Hills Boulevard and the confluence with Balboa Wash.

4.7 The consultant may have to do field surveying to improve the accuracy of the DTM in the study wash reaches. Any inconsistencies in the wash contours should be identified and visually verified during the field reconnaissance. These areas can then be field surveyed to provide supplemental break line data. The supplemental data will then be input into the DTM and new contours generated.

TASK 5 HYDROLOGY

5.1 The hydrologic study of the watershed will be delivered to the District under separate cover from the hydraulic analysis. The consultant shall use the U.S. Army Corps of Engineers computer program HEC-1, 1991 Version, to develop a hydrologic model for the area. The methods and procedures in the Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology will also be used. An appropriate time step and number of ordinates is to be selected that

allows for complete calculation of the flood hydrograph without sacrificing resolution of the flood peak. All calculations, or assumptions used in developing sub-basin and routing parameters shall be documented and made a part of the appendix for the hydrology report. Field surveys will need to be taken for hydrologic modeling purposes.

5.2 Hydrologic models shall be developed for each of the following events:

a. 100-year, 6-hour, existing condition.

b. 100-year, 24-hour, existing condition.

c. 10-year, future condition.

d. 100-year, future condition.

Work on the future condition HEC-1 models shall not begin until the existing condition models are approved.

5.3 It is required that the consultant obtain the approval of the District at each of the following steps:

a. Soil maps, watershed boundary maps, and land use maps.

b. HEC-1 parameter estimation.

c. HEC-1 flow diagram and input parameters.

d. HEC-1 results.

5.4 Four meetings associated with four tasks, and two field trips shall be held with the Flood Control District staff at the following mile stones:

a. One field trip at the start of the project to scope out the critical points of the watershed and problem areas.

b. Meeting number 1 as soon as basic data are gathered and the sub-basins have been delineated. Sample HEC-1 parameter estimations should also be presented and discussed at this meeting. A copy of the draft maps of the sub-basins must be delivered to the District at this meeting.

c. Meeting number 2 after all the parameters have been estimated. A draft copy of the parameters must be delivered to the District at least one week prior to this meeting.

d. Meeting number 3 after the preliminary HEC-1 results have been obtained and a draft report has been prepared. A copy of the draft report and the copy of the HEC-1 on a floppy disc, compatible with the Districts computer, must be delivered two weeks prior to the meeting. A second copy of each will be forwarded by the District to ADWR for their review and comment.

e. Meeting number 4 to review comments by the District and ADWR one week after the consultant has received the review comments. The District will require a minimum of two weeks to review the report and the model. A second field trip may be scheduled for the same day so the results obtained can be discussed.

5.5 The consultant will develop the hydrologic base maps using the supplied mapping and DTM data. For those areas not covered by the supplied mapping, U.S. Geological Survey (USGS) topographical quadrangle maps will be used. Additional topographic information may be available through the Town for those areas not covered by the detailed mapping.

An overall watershed drainage basin map with sheet index will be prepared at a scale of 1 inch = 2000 feet.

The off-site soils, land use, sub-basin delineation, time of concentration, and flood routing maps will be based on 1 inch = 1000 feet scale photo-enlarged copies of USGS 7.5 minute quadrangle maps.

The on-site soils, land use, sub-basin, time of concentration, and flood routing maps will be prepared on 1 inch = 400 feet scale maps using the supplied topographic mapping.

5.6 Using appropriate hydrologic judgement, sub-basins are to be identified that provide reasonable depiction of the watershed condition. The sub-basins must be as homogeneous as possible, using watershed area, watershed type (mountainous and flat lands or urban and undeveloped areas), and time of concentration as criteria. Sub-basin break-downs will be done in sufficient detail to provide peak discharges at structures, major road crossings, confluences, at the study boundary limits, and at other intermediate points. The Town's input will also be obtained on the location of concentration points.

5.7 The specific hydrologic techniques to be used in this study are:

a. Rainfall Depth: Point precipitation values will be determined using the information and procedures described in the Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology.

Rainfall Distribution: Peak discharges and peak volumes for the 100-year 6-hour storm will be estimated using the District's Distribution(s). Peak discharges and peak volumes for the 100-year 24-hour storm will be estimated using the SCS Type II rainfall distribution.

b. Areal Reduction: The point precipitation values will be areally reduced for critical concentration points. Areal reduction for the 6 hour rainfall duration will be applied using the curves in the Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology. NOAA HYDRO-40 will be used with the 24 hour rainfall reduction. Copies can be obtained from the District.

c. Rainfall Excess: The Green and Ampt methodology will be utilized for estimation of rainfall losses. The Lotus spreadsheet and procedures, provided by the District, will be used to determine composite parameter values for each sub-basin.

d. Unit Hydrograph: The Clark and S-Graph method should be used following the procedures outlined in the Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology. The choices in methodology will be to the discretion of the consultant, with consent from the District.

e. Time of Concentration and S-Graph Lag Equation: The Papadakis method should be used with the Clark unit hydrograph, along with the MCUHP1 computer program, to determine the time of concentration. If this method results in unsuitable times of concentration, other method(s) must be used and compared for the most realistic result. The S-graph lag equation, along with the MCUHP2 computer program, should be used with the appropriate S-graph (Phoenix mountain or Phoenix Valley).

f. Channel Routing: Channel routing will be accomplished using either the Muskingum-Cunge or the Normal-Depth option of HEC-1. The choice of methodology will be at the discretion of the consultant, with consent from the District. Average cross sections will be developed utilizing available mapping and field reconnaissance data. Sufficient field cross sections will be taken to ensure that routing reaches are reasonable and representative of field conditions.

   The HEC-1 routing parameters for the reaches modeled using HEC-2 will be adjusted after the HEC-2 cross sections are available. The resulting velocities and depths, for all reaches, must be assessed for realistic values.

g. Reservoir Routing: Detailed analysis of structures and ponding areas will be accomplished using the Modified Puls reservoir routing option of HEC-1. Stage versus discharge tables for hydraulic structures will be estimated using appropriate hydraulic methodology.

h. Channel Transmission Losses: Attempts should be made to estimate infiltration losses through channel bottoms based on existing field data or literature. If sufficient data is not available, the final report must acknowledge so and explain how the peaks and volumes of flow are affected by not including the transmission losses.

5.8 The District will provide appropriate references to facilitate parameter estimation.

5.9 Output of the computer model should be reviewed to see if the peak flows and volumes are realistic. Adjustments to input for obtaining the most realistic results is normal to the scope.

5.10 Every attempt must be made to recover historic stream gage data and use it to compare with the results obtained by the hydrologic model. Major differences must be discussed in the final report.

5.11.1 The final hydrologic report should include the following sections and documentation using ADWR standards (as a minimum):

a. Scope of the study.

b. Description of the watershed.

c. Previous studies and reports.

d. Methodology.

e. Assumptions.

f. Results.

g. Comparison of the results with other studies and/or stream gages.

h. Conclusion.

i. List of references and agencies contacted.

5.11.2 Tables and Figures for the main Text:

a. Location map (maximum size 11"x 17") at the appropriate scale.

b. Table showing the flow peaks and volumes at critical concentration points for different rainfall events.

c. Table showing the critical peaks and volumes for major concentration points as compared to previous studies (where available).

d. Table(s) showing the major parameters for all sub-basins (slope, area, soil loss calculations, friction, total rainfall, time of concentration or lag, major structures, etc.).

5.11.3 Tables and Figures for the appendices:

a. Topographic base map(s) showing the sub-basins, routing reaches, Tc flow paths or lag flow paths, major man-made structures, and references (i.e. street names, Township, Range, Section, etc.) at the scales defined in Task 5.5.

b. Soils map(s) at the same scale as the base map.

c. Land use map(s) at the same scale as above.

d. Schematic map for the HEC-1 showing the sub-basins (area, Tc), the flow paths, the routing reaches (length, slope, friction, width, velocities, transmission losses, etc.), order of combining the hydrographs, channel, pipe or culvert dimensions (where appropriate).

e. Pertinent data on all the structures in the watershed (such as spillway elevation, rating curves, etc.)

f. One set of study maps (i.e. sub-basin boundary maps, flow path maps, soils maps, land use maps) to be folded and delivered in a binder.

5.12 As part of the final products the consultant will supply the hydrologic data in conformance with District's HIS Data delivery Specifications revision 01.1.

Specific deviations from this hydrologic scope shall not be undertaken without the specific written concurrence from the Flood Control District.

TASK 6 FLOODPLAIN AND FLOODWAY DELINEATION

6.1 Floodplain and floodway delineations must be obtained using the U.S. Army Corps of Engineers HEC-2 Water Surface Profiles computer model, version 4.6.2, May 1991, and methodology acceptable to FEMA. This model will simulate the effects of floodplain geomorphology, flow changes, bridges, culverts, hydraulic roughness factors, effective flow limitations, split-flows, and other considerations. The consultant will prepare the study using the guidelines established in FEMA Document 37, Flood Insurance Study Guidelines and Specification for Study Contractors, March 1991, and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, January 1990.

6.2 The delineation work shall meet requirements for floodplain and floodway delineations as prescribed by FEMA and ADWR.

6.3 The consultant is to make refinements to the HEC-2 model based on review of the model results by the District, ADWR, FEMA, and the Technical Evaluation Contractor. The consultant shall review the HEC-2 model results for reasonableness. Adjustments to the input parameters for obtaining the most realistic results is normal to the scope.

6.4 The consultant will prepare working maps and models of the 100-year floodplain and floodway during the course of the hydraulic modeling analysis for review by the District at progress and milestone meetings. Floodways are to be determined using equal conveyance encroachment methods to start with, but only encroachment method 1 will be used in the final analysis. The floodway encroachment is to be as near the one foot maximum rise in elevation as possible. Before determining floodways in areas of supercritical flow District approval must be obtained.

6.5 The consultant must obtain District approval at each of the following steps:

a. Field reconnaissance report and estimation of Manning's "n" values.

b. Proposed location and alignment of the cross sections and channel centerline.

c. Floodplain (natural) delineation.

d. Floodway delineation using equal conveyance encroachment.

e. Floodway delineation using encroachment method 1.

f. Final Hydraulics Report.

6.6.1 The consultant will conduct a field reconnaissance of the full study reach. This will include observation of channel and floodplain conditions for estimation of Manning's "n" values; photographic documentation of floodplain characteristics; determination of channel bank stations; observation of possible overflow areas; inspection of levees or other flood control structures; and measurement of bridge dimensions.

6.6.2 Mannings "n" values are to be determined using the methodology in the USGS report, Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991. Copies of the report are available through the District.

6.6.3 A draft report on the field reconnaissance will be submitted to the District for review and approval prior to beginning the HEC-2 modeling. The report will present the determination of channel and overbank "n" values using captioned color photographs or color photocopies. The report will also discuss floodplain conditions affecting the delineation, describe structures and obstructions, and provide color photos or color photocopies of major hydraulic structures. Photo locations, structures, and "n" values will be displayed on reduced scale mapping included in the report. The final report will be included in the Final Hydraulics Report.

6.7.1 The cross section data for use in the HEC-2 models will be determined photogrammetrically. The location and alignment of cross sections and channel centerline will be submitted for the District's review and approval prior to digitizing the cross section data. Cross section stationing will be from left to right looking downstream with the thalweg as station 10,000. Cross sections will be spaced approximately every 500 feet, unless geographic or structural constraints dictate otherwise. Identification of cross sections will be in river miles, increasing upstream. The stationing will tie into the specified river mile of the existing FEMA studies. Cross section orientation may need to be altered after running of HEC-2 model to make sure that they are perpendicular to flow per FEMA criteria. The photogrammetrically determined cross sections can be supplemented with field cross sections and sections taken from the DTM.

6.7.2 All cross sections will be plotted at appropriate standard engineering scales. The cross section plots will show water surface elevations, ineffective flow areas, "n" values, encroachments, channel stationing, bridges, culverts, and other pertinent information. All plots are to be accompanied by a legend. Draft plots of the cross sections are to be available to be used as a check of input data and for working sections during compilation of the floodplain model. Final plots of the cross sections will be submitted as part of the Final Hydraulics Report.

6.8 Bridges and culverts must be modeled in compliance with HEC-2 modeling requirements for the selected routine. Where multiple bridges occur, each bridge will be modeled separately. The HEC-2 modeling results for bridges, culverts, and other hydraulic structures must be checked by use of an independent method approved by the District.

6.9 For floodplains identified as ponding areas, it is preferable to analyze the area by using the HEC-2 model, which will provide the District with water surface elevations. If appropriate, the consultant shall identify in the ponded floodplains a floodway.

6.10 Flood zones must be determined according to FEMA criteria and clearly labelled on the final drawings.

6.11 The total area of the floodplain and floodway must be determined for each reach in square miles and acres.

6.12 The final report for the floodplain/floodway delineation study will include, but is not limited to the following:

I. Introduction
   a. Purpose of study
   b. Authority for study
   c. Coordination and acknowledgments
   d. Public notification and contact

II. Area Studied
   a. Scope of study
   b. Community description
   c. Principal flood problems
   d. Flood protection measures

III. Engineering methods
   a. Hydrologic analyses
   b. Hydraulic analyses

IV. Floodplain Management applications
   a. Flood boundaries
   b. Floodways

V. Insurance applications and CRS summary

VI. Other studies

VII. Location of data

VIII. Bibliography

IX. Reduced Delineation Maps (11"x17")

X. ERMs

6.13 As part of the final products the consultant will supply the floodplain and floodway delineation data in conformance with the District's HIS Data Delivery Specifications revision 01.1.

TASK 7 FINAL PRODUCTS

7.1. One complete set of floodplain delineation work study drawings at 1 inch = 200 feet in reproducible form (mylar) and six blueline copies as outlined in Tasks 3 and 6.

7.2 Nine copies of the Hydrology and Hydraulics reports as outlined in Tasks 5 and 6. The consultant will incorporate the comments of the District, the Town, ADWR, FEMA and other reviewers into the reports. Hardcopy printouts of the HEC-1 and HEC-2 models will be included in the reports. The HEC-1 and HEC-2 model input and output files will be supplied in a digital format on 5-1/4", 1.2 MB diskettes compatible with an IBM-AT personal computer.

7.3 One complete set of mylars for the foldout maps (no larger than 11" x 17") used in the reports.

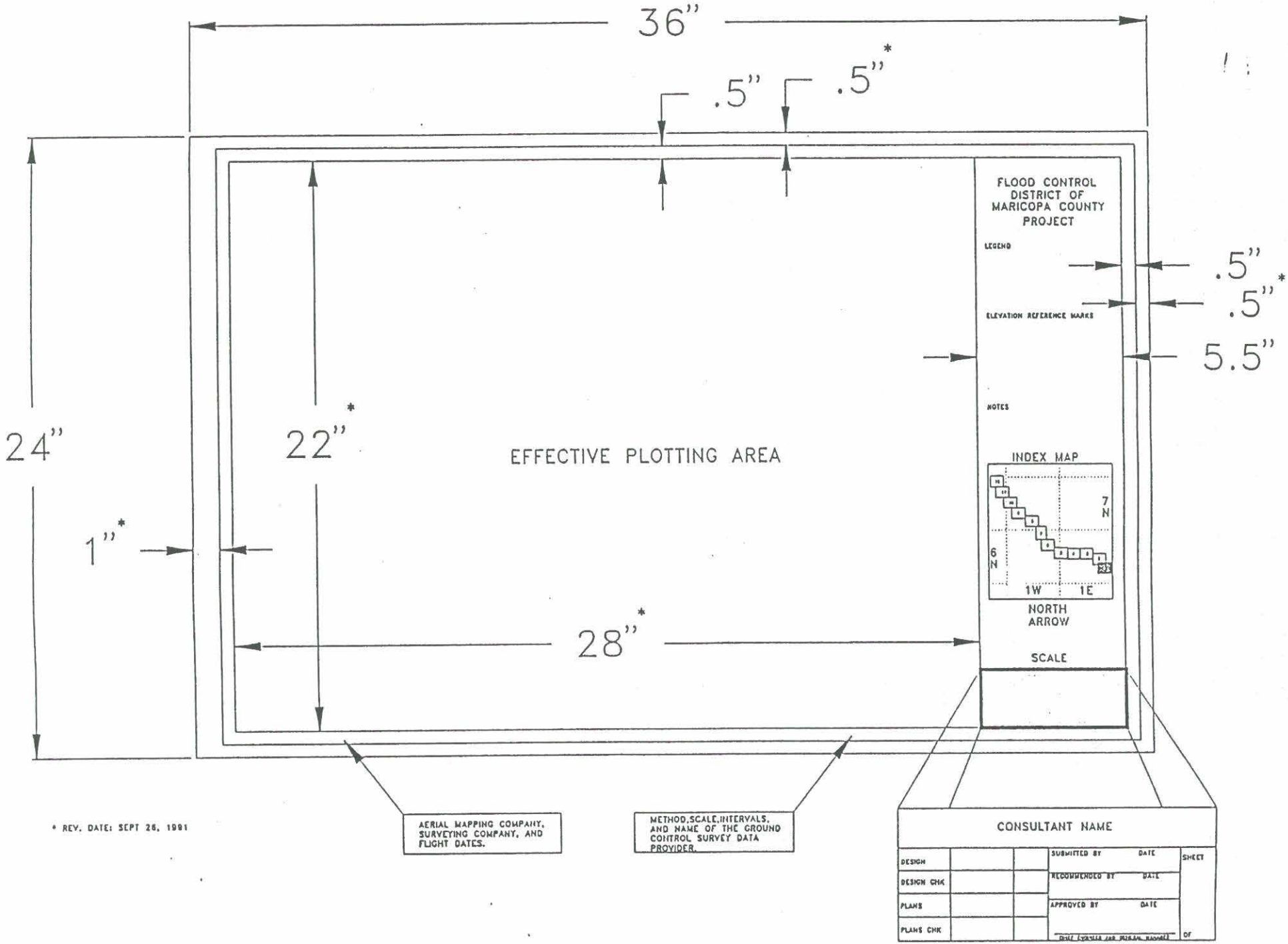
7.4 Tabular list of control points (ERMs) used with descriptions, elevations, and coordinates.

7.5 Digitized topographic data and floodplain/floodway data in conformance with the District's HIS Data Delivery Specifications revision 01.1.

7.6 Digitized hydrologic data in conformance with the District's HIS Data Delivery Specifications revision 01.1.

7.7 Documentation for this study will be as outlined in ADWR Sate Standard Attachment 1-90, Instructions for Organizing and Submitting Technical Documentation for Flood Studies, September 1991.

7.8 One copy of the current FIRM panels showing the proposed delineation.



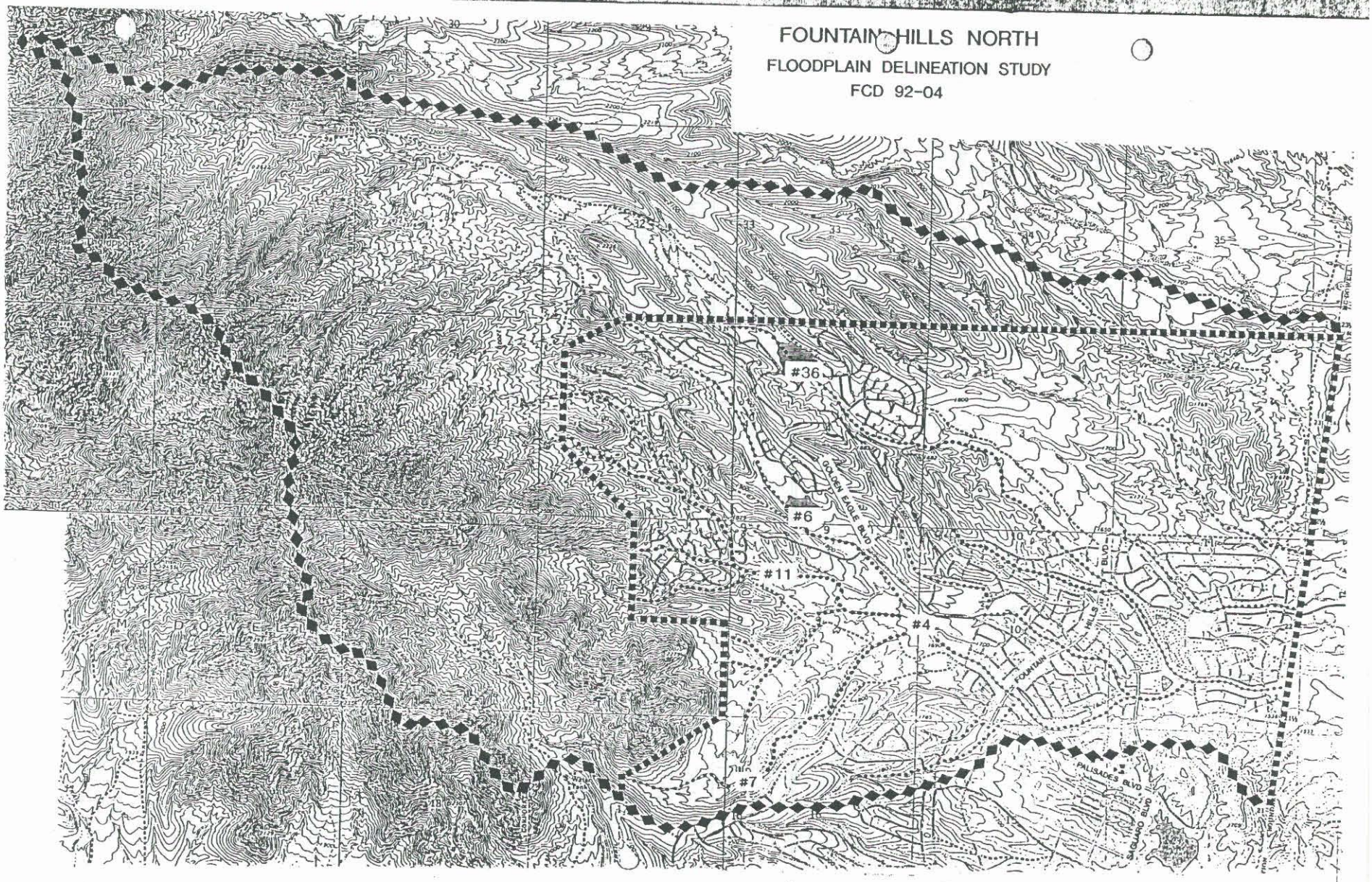
* REV. DATE: SEPT 26, 1991

Exhibit

FOUNTAIN HILLS NORTH

FLOODPLAIN DELINEATION STUDY

FCD 92-04



N

Floodplain/Floodway Delineation

Watershed Boundary

Mapping Limits

#36 Flood Retarding Structure

Exhibit 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Contract Change Order No. 1

Date: March 31, 1993 FCD Contract No./Name: 92-04, Fountain Hills (North) FIS

To: George V. Sabol Consulting Engineers, Inc. , Contractor/Consultant.

You are hereby directed to make the herein described changes from the plans and specifications or do the following described work not included in the plans and specifications on the above-mentioned project.

Changes requested by: Leanna Cumberland

Provide description of work to be done, estimate of quantities, and prices to be paid. Segregate between additional work at contract price, agreed price, and actual cost. Unless otherwise stated, rates for rental of equipment on actual cost work cover only such time as equipment is actually used and no allowance will be made for idle times.

* (1) Estimate of increases and/or decreases in contract items at contract prices.
** (2) Estimate of extra work at agreed price and/or actual cost.

Sheet No. 1 of 1

Bid Item		Estimated	As-Built	Difference	Unit	Difference
No.	Description	Quantity	Quantity	+ or -	Price	+ or -
DELETE PARAGRAPH 5 UNDER SECTION III - Payments To The Consultant and INSERT THE FOLLOWING PARAGRAPH: Any retention monies shall be paid or substitute security returned or released, as applicable, to the CONSULTANT within forty-five (45) calendar days after: (1) Completion of the work in Exhibit A through the submittal of District accepted/approved documents to FEMA, (2) receipt of a completed "Certificate of Substantial Performance" form, (3) the CONSULTANT's statement that no project disputes exist; and (4) invoicing for any retained monies has been received by the District. Upon acceptance and approval of the project by FEMA and the completion of all work required by the DISTRICT, the CONSULTANT shall submit a final Certificate of Performance and its invoice for any sums remaining due and payable under this Contract.						

We, the undersigned Contractor/Consultant, having given careful consideration to the change(s) proposed, hereby agree, if this proposal is approved, that we will provide all equipment, furnish all material (except as may otherwise be noted above), and perform all services necessary for the work above specified, and we will accept as full payment therefor the prices shown above.

By reason of this proposed change N/A days extension of time will be allowed.
Total new contract amount through this Change Order No. 1 $ 249,847.

Contractor/Consultant: George V. Sabol Engineers
1331 17th St., Ste. 700
Denver, CO 80202

By: [signature]
Title: President
Date: 14 April 1993

Recommended by: _____
Date: _____

Approved by: [signature]
Chief Engineer and General Manager
Date: May 14, 1993

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Contract Change Order No. 2

Date: 12/20/93 FCD Contract No./Name: FCD 92-04, Fountain Hills (North) FIS

To: George V. Sabol Consulting Engineers, Inc., Contractor/Consultant.

You are hereby directed to make the herein described changes from the plans and specifications or do the following described work not included in the plans and specifications on the above-mentioned project.

Changes requested by: Tim Murphy

Provide description of work to be done, estimate of quantities, and prices to be paid. Segregate between additional work at contract price, agreed price, and actual cost. Unless otherwise stated, rates for rental of equipment on actual cost work cover only such time as equipment is actually used and no allowance will be made for idle times.

* (1) Estimate of increases and/or decreases in contract items at contract prices.
** (2) Estimate of extra work at agreed price and/or actual cost.

Sheet No. 1 of 1

Bid Item		Estimated	As-Built	Difference	Unit	Difference
No.	Description	Quantity	Quantity	+ or -	Price	+ or -
There were some problems with the 1st set of mapping supplied to George V. Sabol Consulting Engineers. Additional time and effort were required by the consultant to review and use this set of mapping. The additional efforts associated with this change order are detailed in the attached letter, dated November 30, 1993, and made a part of change order #2. Change Order #2 is in the amount of $12,153.						

We, the undersigned Contractor/Consultant, having given careful consideration to the change(s) proposed, hereby agree, if this proposal is approved, that we will provide all equipment, furnish all material (except as may otherwise be noted above), and perform all services necessary for the work above specified, and we will accept as full payment therefore the prices shown above.

By reason of this proposed change --- days extension of time will be allowed.
Total new contract amount through this Change Order No. 2 $ 262,000

Contractor/Consultant: George V. Sabol Engineers
7950 E. Acoma Dr., Ste. 211
Scottsdale, AZ 85260-6962

By: Geo V Sabol
Title: President
Date: 30 Dec 1993

Recommended by: Tim Murphy
Date: 1-6-94

Approved by: [illegible]
Chief Engineers and General Manager
Date: 1/14/94

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Contract Change Order No. 3

Date: 12/27/93 FCD Contract No./Name: FCD 92-04, Fountain Hills (North) FIS

To: George V. Sabol Consulting Engineers, Inc., Contractor/Consultant.

You are hereby directed to make the herein described changes from the plans and specifications or do the following described work not included in the plans and specifications on the above-mentioned project.

Changes requested by: Tim Murphy

Provide description of work to be done, estimate of quantities, and prices to be paid. Segregate between additional work at contract price, agreed price, and actual cost. Unless otherwise stated, rates for rental of equipment on actual cost work cover only such time as equipment is actually used and no allowance will be made for idle times.

* (1) Estimate of increases and/or decreases in contract items at contract prices.
** (2) Estimate of extra work at agreed price and/or actual cost.

Sheet No. 1 of 1

Bid Item		Estimated	As-Built	Difference	Unit	Difference
No.	Description	Quantity	Quantity	+ or -	Price	+ or -

Due to the problems with the 1st set of mapping, portions of it were revised by the aerial mapper. Additional staff time will be required for the verification and transference of the revised mapping to the consultant's computer system. The additional efforts associated with this change order are detailed in the attached letter. The procedures and specifications called for in the original scope of work will be adhered to, except where noted. The additional efforts associted with this change order are detailed in the attached letter, dated November 30, 1993, and made a part of Change Order #3. For those miles of delineation eliminated from the study, the consultant will deliver to the District all of the information and data gathered so far. Change Order #3 is in the amount of $7,827.

We, the undersigned Contractor/Consultant, having given careful consideration to the change(s) proposed, hereby agree, if this proposal is approved, that we will provide all equipment, furnish all material (except as may otherwise be noted above), and perform all services necessary for the work above specified, and we will accept as full payment therefore the prices shown above.

By reason of this proposed change 300 days extension of time will be allowed.
Total new contract amount through this Change Order No. 3 $ 269,827

Contractor/Consultant: George V. Sabol Engineers
7950 E. Acoma Dr., Ste. 211
Scottsdale, AZ 85260-6962

By: [signature]
Title: President
Date: 30 Dec 1993

Recommended by: Tim Murphy
Date: 1-6-94

Approved by: [signature]
Chief Engineers and General Manager
Date: 2/2/94

SECTION 2: MAPPING AND SURVEY INFORMATION

2.1 General

The mapping and survey data used for the hydrology portion of this project is described by exhibit drawing as follows:

Exhibit A - The base mapping used for Exhibit A consists of United States Geological Survey (USGS) 7.5 minute quadrangle maps. The maps were raster scanned and converted to a vector based AutoCAD format, and merged to form a single drawing. Only the area specific to this project was scanned. The original quadrangle maps are at a scale of 1 inch = 2000 feet. The Exhibit A base mapping is plotted at a scale of 1 inch = 1500 feet. The following are the USGS quadrangle maps used for this study:

Granite Reef Dam:	1964, 1962 photo date, 1974 photorevised, 20-foot contour interval (CI), 10-foot supplementary CI (SCI). Orthophoto dated 1971.
McDowell Peak:	1965, 1962 photo date, 1982 photorevised, 10-foot CI. Orthophoto dated 1971.
Sawik Mountain:	1964, 1962 photo date, 1982 photorevised, 20-foot CI. 10-foot SCI. Orthophoto dated 1971.
Fort McDowell:	1964, 1962 photo date, 1974 photorevised, 1978 photoinspected, 20-foot CI, 10-foot SCI. Orthophoto dated 1971.

Exhibit B - Exhibit B is the hydrology soils map. The SCS Soil Map Unit boundaries shown in this exhibit are derived from the soil maps contained in the *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona* (SCS Soil Survey) [6.5:23]. The soil survey maps are at a scale of 1 inch = 2000 feet. The boundaries are digitized into AutoCAD and plotted at a scale of 1 inch = 1000 feet in combination with the Subbasin boundaries. The street planimetrics are provided by the Town of Fountain Hills in AutoCAD format.

Exhibit C - Exhibit C is the hydrology land use map. This exhibit, plotted at a scale of 1 inch = 1000 feet, contains land use boundaries, subbasin and major basin boundaries, and street planimetrics. The land use boundaries are derived from the Town of Fountain Hills Zoning Map [6.6:11] which was provided in AutoCAD format. The land use boundaries include multiple zoning categories. Refer to Section 3.2.2.1 for a description of how similar zoning classifications are generalized into land use categories.

Exhibit D - Exhibit D is the hydrology subbasin, time of concentration, and flood routing map. The exhibit contains subbasin and major basin boundaries, time of concentration flow paths and elevations, HEC-1 hydrograph flood routing flow paths and elevations, and subbasin concentration point locations. The exhibit is plotted at a scale of 1 inch = 1000 feet west of Section 32, T4N, R6E and Sections 5, 8 and 17, T3N, R6E. The easterly portion of the watershed is plotted at a scale of 1 inch = 400 feet. The 1000 scale portion of the exhibit is the majority of the undeveloped watershed. It is plotted on base topography from the USGS quadrangle maps described under Exhibit A. Only the 100-foot index contours are shown, due to the very steep terrain in this portion of the watershed.

Exhibit E - Exhibit E is a schematic hydrograph routing diagram of the hydrologic computer model.

The base mapping for the 400 scale portion of the exhibit is derived from 1 inch = 200 feet scale mapping with a 2-foot contour interval [6.6:6]. This mapping is provided by the Flood Control District of Maricopa County (District). The mapping covers Sections 2-5, 9-11, 14-16 and a portion of Sections 1, 8 and 17, all in Township 3 North, Range 6 East. The mapping was prepared by Kenney Aerial Mapping in 1991 under a subcontract with Anderson-Nelson, Inc., who was under contract with the Town of Fountain Hills. Horizontal and vertical control was done by Anderson-Nelson, Inc. The aerial photography date is 29 August 1991, and the Kenney Aerial Mapping project number is 910804-1. The mapping was prepared using a Digital Terrain Model (DTM). Reproducible

mylars and digital drawings in AutoCAD format are provided by the District. The DTM is based on grid spot elevations using a 75-foot interval, and break lines defining wash flowlines and ridges. Only the 10-foot index contours are included on this exhibit because the steep terrain causes the 2-foot intermediate contours to be indistinguishable at a scale of 1 inch = 400 feet.

2.2 Summary

There is other mapping available which is not used for the exhibit drawings but is used as supplementary information for estimating hydrologic parameters. These are included in the following summary of available mapping, and the abbreviations which will be used hereinafter.

Source	Photo Date	Horiz.[a] Scale X	Contour Interval feet	Coverage	Abbreviation
KAM	7/90	40	1	Portions of Fountain Hills	40 Scale Mapping
KAM	10/69	100	4	Secs. 2-6, 7-11 and 14-18, T3N, R6E	100 Scale Mapping
KAM	8/91	200	2	Secs. 2-5, 9-11,14-16 and Portions of 1, 8, 17, T3N, R6E	200 Scale Mapping
KAM	N/A	400	10	Secs. 31-35, T4N, R6E	400 Scale Mapping
USGS	Varies	2000	Varies	Entire Watershed	USGS Mapping

a - 1 inch = X feet

The survey control for the 40, 100, 200 and 400 scale mapping was done by Anderson-Nelson, Inc. or by Trico, Inc. However, Anderson-Nelson, Inc. owns Trico, Inc's. records for this mapping. The original survey control was done using the Town of Fountain Hills local coordinate system. The original vertical datum for the mapping is based on an Arizona Department of Transportation brass cap located at the intersection of Shea Boulevard and Arizona State Route 87. Anderson-Nelson, Inc. tied the local vertical datum into the NGVD 1929 system. All benchmarks on the local vertical datum are adjusted a minus 1.26 foot to convert to NGVD 1929.

The local coordinate system is converted to NAD 1983 by Anderson-Nelson, Inc.

The following adjustment factors are applied to rotate and translate the local coordinate system to NAD 1983:

NAD 1983 Northing = (Local Northing + 919086.5645376424)(0.9998253)
NAD 1983 Easting = (Local Easting + 729951.9067172697)(0.9998253)
Rotation: No rotation necessary.

The coordinate grid and elevations on the 200 scale mapping are on the NAD 1983 system and NGVD 1929 datum. The coordinate grid and elevations on the 40, 100 and 400 scale mapping are on the local coordinate system and datum. The coordinate grid and elevations on the USGS quadrangle maps are on the 1927 NAD system and the NGVD 1929 datum. The USGS mapping, derived from the USGS quandrangle maps by rastor scan and vectorization, are rotated and translated from NAD 1927 to NAD 1983. The rotation and translation of the USGS mapping to NAD 1983 made it possible to merge the USGS mapping AutoCAD file with the 200 scale mapping AutoCAD file. Supplementing the 200 scale mapping with the USGS mapping makes possible the base map used for Exhibit D.

Reduced copies of Exhibits A through E are provided in the following pages for convenience. Full size copies of the exhibits are provided in folders in this report.

Extreme care must be taken when using the available mapping and improvement plans. This includes verification of the coordinate system and datum upon which the maps or plans are based. Adjustments can then be made accordingly.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

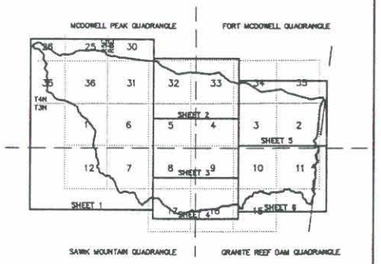
F.C.D. CONTRACT NO. FCD 92-04

LEGEND

- MAJOR BASIN NUMBER / AREA IN SQUARE MILES — 201 / 0.63
- KEY CONCENTRATION POINT
- HEC-1 IDENTIFIER AT KEY CONCENTRATION POINT 584
- HEC-1 IDENTIFIER FOR DIVERSION AT KEY CONCENTRATION POINT 523
- MAJOR DRAINAGE BASIN BOUNDARY
- HEC-2 STUDY REACH
- WASH FLOW PATH
- FORT MCDOWELL INDIAN RESERVATION BOUNDARY
- FOUNTAIN HILLS CORPORATE BOUNDARY
- RANGE AND TOWNSHIP BOUNDARY
- USGS QUADRANGLE MAP BOUNDARY
- SECTION LINE
- SHEET BOUNDARY FOR EXHIBIT "D"

NOTES

INDEX MAP



HYDROLOGY EXHIBIT "A"

DRAINAGE BASIN MAP AND SHEET INDEX FOR EXHIBIT "D"

1500 0' 1500 3000

SCALE: 1" = 1500'

CONTOUR INTERVAL = 20FEET

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	PK	7/94
PLANS CHK.	TRL	7/94

SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 1 OF 1

Drawing Name: \P\FHILLS\ACAD\EX-A.dwg
Date: REV. 17 OCT 1994 08:00am

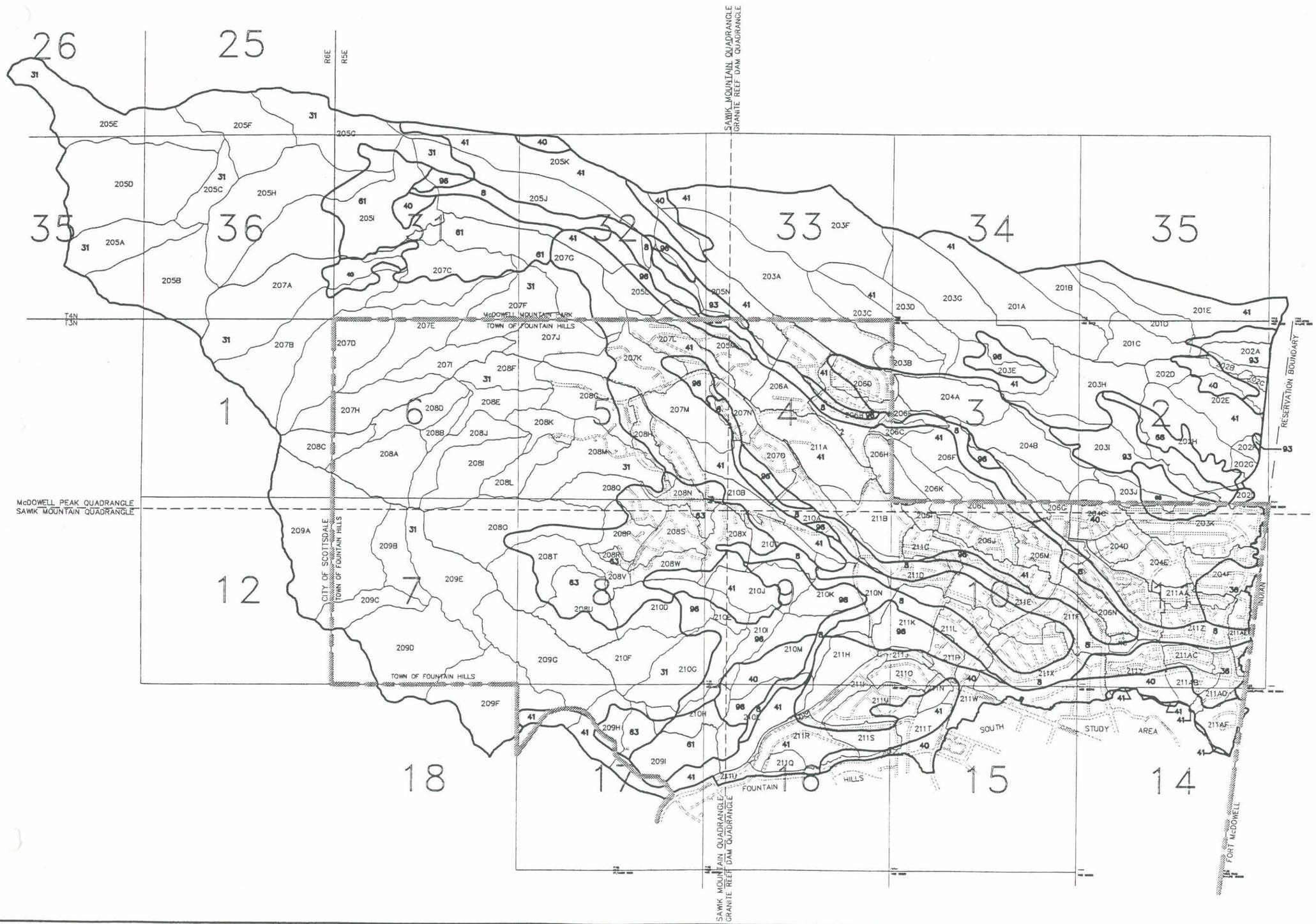
SUMMARY OF 100-YEAR PEAK DISCHARGES FOR DETAILED HYDROLOGIC ANALYSIS STUDY AREA

HEC-1 Identifier	Description	Peak Discharge (cfs)	Area (sm)
D503L	Culvert 503 flow into Ft. McDowell Indian Reservation.	323	0.63
D504L	Culvert 504 flow into Ft. McDowell Indian Reservation.	22	0.67
D505L	Culvert 505 flow into Ft. McDowell Indian Reservation.	14	0.69
D506L	Culvert 506 flow into Ft. McDowell Indian Reservation.	0	0.69
C5070	Culvert 507 on McDowell Mountain Road.	203	0.86
D508R	Culvert 508 flow into Ft. McDowell Indian Reservation.	72	0.10
C509	Culvert 509 flow at Ft. McDowell Indian Reservation.	36	0.01
C510	Culvert 510 flow at Ft. McDowell Indian Reservation.	38	0.01
D512L	Stock Tank flow into Ft. McDowell Indian Reservation.	72	0.20
C519	Escalante Wash start of Floodplain Delineation.	1406	1.59
C521	Escalante Wash at Ft. McDowell Indian Reservation.	1407	1.99
D523L	Culvert 523 flow in Caliente Wash.	266	0.23
C527	Caliente Wash at Ft. McDowell Indian Reservation (Culvert 527).	665	0.50
C535	Hesperus Wash start of Floodplain Delineation.	2520	2.62
C536I	Dam 36, inflow.	2586	2.91
C536O	Dam 36, outflow.	326	2.91
C540	End Hesperus Wash, start Balboa Wash.	560	3.24
C542	Oxford Wash, start of Floodplain Delineation.	153	0.06
C548L	Balboa Wash U/S of confluence with Oxford Wash.	721	3.72
C548R	Oxford Wash U/S of confluence with Balboa Wash.	635	0.32
C548	Confluence of Oxford and Balboa Washes.	1038	4.04
C549L	Balboa Wash U/S of confluence with Ashbrook Wash.	1128	4.19
C549R	Ashbrook Wash U/S of confluence with Balboa Wash.	2112	8.87
C549	Confluence of Balboa and Ashbrook Washes.	3095	13.06

HEC-1 Identifier	Description	Peak Discharge (cfs)	Area (sm)
C556	Ashbrook Wash, start of Floodplain Delineation.	1752	1.64
C560I	Dam 6, inflow.	1989	2.15
C560O	Dam 6, outflow.	287	2.15
C568L	Bristol Wash U/S of confluence with Cholula Wash.	961	0.61
C568R	Cholula Wash U/S of confluence with Bristol Wash.	701	0.46
C568	Confluence of Cholula and Bristol Washes.	1428	1.07
C573L	Bristol Wash U/S of confluence with Zapata Wash.	1460	1.12
C573R	Zapata Wash U/S of confluence with Bristol Wash.	772	0.46
C573	Confluence of Zapata and Bristol Washes.	1872	1.58
C577L	Bristol Wash U/S of confluence with Montezuma Wash.	1872	1.58
C577R	Montezuma Wash U/S of confluence with Bristol Wash.	800	0.34
C577	Confluence of Montezuma and Bristol Washes.	2187	1.92
C578I	Dam 11, inflow.	2231	2.00
C578O	Dam 11, outflow.	381	2.00
C584I	Dam 7, inflow.	1999	1.60
C584O	Dam 7, outflow.	469	1.60
C590L	Longmont Wash Left Branch U/S of confluence with Main Branch.	353	0.17
C590R	Longmont Wash Main Branch U/S of confluence with Main Branch	472	0.25
C590	Confluence of Left and Main Branches of Longmont Wash.	819	0.42
C593L	Longmont Wash Main Branch U/S of confluence with Right Branch.	819	0.42
C593R	Longmont Wash Right Branch U/S of confluence with Main Branch.	158	0.07

HEC-1 Identifier	Description	Peak Discharge (cfs)	Area (sm)
C593	Confluence of Right and Main Branches of Longmont Wash.	972	0.49
C595L	Bristol Wash U/S of confluence with Longmont Wash.	468	2.19
C595R	Longmont Wash U/S of confluence with Bristol Wash.	1119	0.64
C595	Confluence of Longmont and Bristol Washes.	1205	2.83
C599I	Dam 4, inflow.	1967	7.13
C599O	Dam 4, outflow.	966	7.13
C601	Tulip Wash, start of Floodplain Delineation.	462	0.25
C602	End Tulip Wash, start Legend Wash.	635	0.37
C617	Arrow Wash, start of Floodplain Delineation.	270	0.13
C620L	Sunflower Wash U/S of confluence with Arrow Wash (Culvert 611).	151	0.14
C620R	Arrow Wash U/S of confluence with Sunflower Wash (Culvert 619).	335	0.28
C620	Confluence of Sunflower and Arrow Washes.	485	0.42
C621L	Ashbrook Wash U/S of confluence with Arrow Wash.	975	7.64
C621R	Arrow Wash U/S of confluence with Ashbrook Wash.	482	0.42
C621	Confluence of Arrow and Ashbrook Washes.	1184	7.93
C622L	Legend Wash U/S of confluence with Ashbrook Wash.	1121	0.63
C622R	Ashbrook Wash U/S of confluence with Legend Wash.	1384	8.14
C622	Confluence of Legend and Ashbrook Washes.	2053	8.78
C627	Ashbrook Wash at Ft. McDowell Indian Reservation.	3187	13.32

THIS MAP WAS PREPARED USING THE USGS QUADRANGLE MAPS FOR BASE TOPOGRAPHY. REFER TO SECTION 2 OF THE HYDROLOGY REPORT.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

F.C.D. CONTRACT NO. FCD 92-04

LEGEND

MAJOR DRAINAGE BASIN BOUNDARY	
DRAINAGE SUB-BASIN BOUNDARY	
DRAINAGE SUB-BASIN IDENTIFIER	202A
SCS SOILS MAP UNIT BOUNDARY	
SCS SOILS MAP UNIT IDENTIFIER	41
SECTION LINE	
TOWNSHIP AND RANGE LINE	
USGS QUADRANGLE MAP BOUNDARY	
TOWN OF FOUNTAIN HILLS BOUNDARY	
FORT McDOWELL INDIAN RESERVATION BOUNDARY	

HYDROLOGY EXHIBIT "B"

DRAINAGE SUB-BASIN SOILS MAP

1000 0' 1000 2000

SCALE: 1" = 1000'

CONTOUR INTERVAL = NONE

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	PK	10/93
PLANS CHK.	TRL	10/93
SUBMITTED BY:		DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

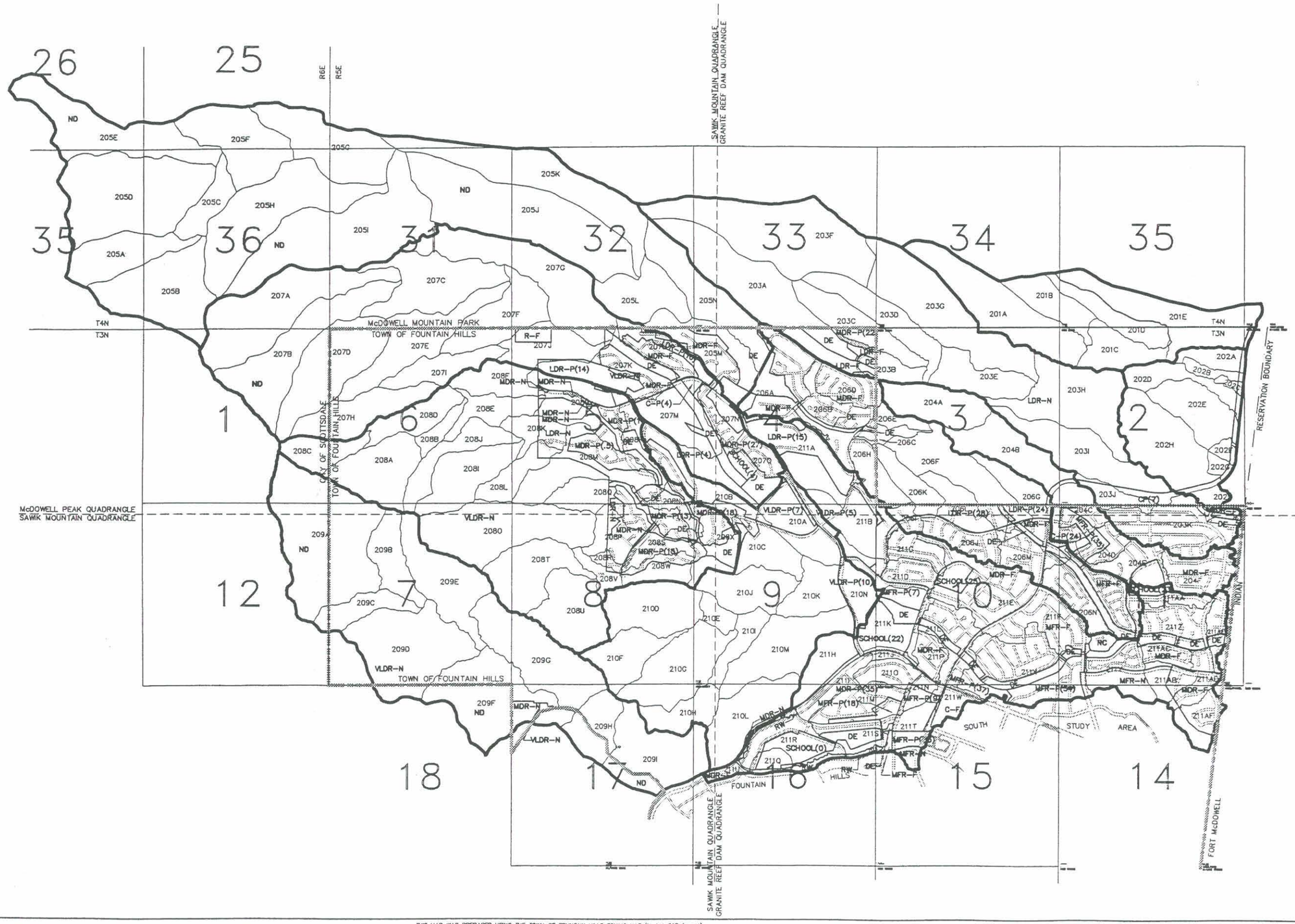
APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 1 OF 1

Dwg Name: P:\FTHILLS\ACADVEX-B.dwg
Date: Rev AUG 23 1994 09:30am

SOILS DATA PREPARED BY DIGITIZING SCS SOILS MAP UNIT BOUNDARIES FROM THE "SOIL SURVEY OF AGUILA-CAREFREE AREA, PARTS OF MARICOPA AND PINAL COUNTIES, ARIZONA"



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

F.C.D. CONTRACT NO. FCD 92-04

LEGEND

MAJOR DRAINAGE BASIN BOUNDARY	
DRAINAGE SUB-BASIN BOUNDARY	
DRAINAGE SUB-BASIN IDENTIFIER	203E
LAND USE BOUNDARY	
LAND USE IDENTIFIERS:	
Very Low Density Residential	VLDR
Light Density Residential	LDR
Medium Density Residential	MDR
Multi-Family Residential	MFR
Commercial	C
Industrial	I
Schools	School
Drainage Easement	DE
Street Right-of-Way	RW
Natural Desert	ND
Qualifers:	
Fully Developed	F
Less Than 50% Developed	P
Undeveloped	N
Value in parenthesis is estimated % impervious	(##)

Example: VLDR-P(23) indicates a partially developed VLDR land use with an estimated average percent impervious value of 23% for the entire parcel.

SECTION LINE	
RANGE AND TOWNSHIP BOUNDARY	
USGS QUADRANGLE MAP BOUNDARY	
TOWN OF FOUNTAIN HILLS BOUNDARY	
FORT McDOWELL INDIAN RESERVATION BOUNDARY	

HYDROLOGY EXHIBIT "C"

DRAINAGE SUB-BASIN LAND USE MAP

1000 0' 1000 2000

SCALE: 1" = 1000'

CONTOUR INTERVAL = NONE

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	PK	10/93
PLANS CHK.	TRL	10/93
SUBMITTED BY:		DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

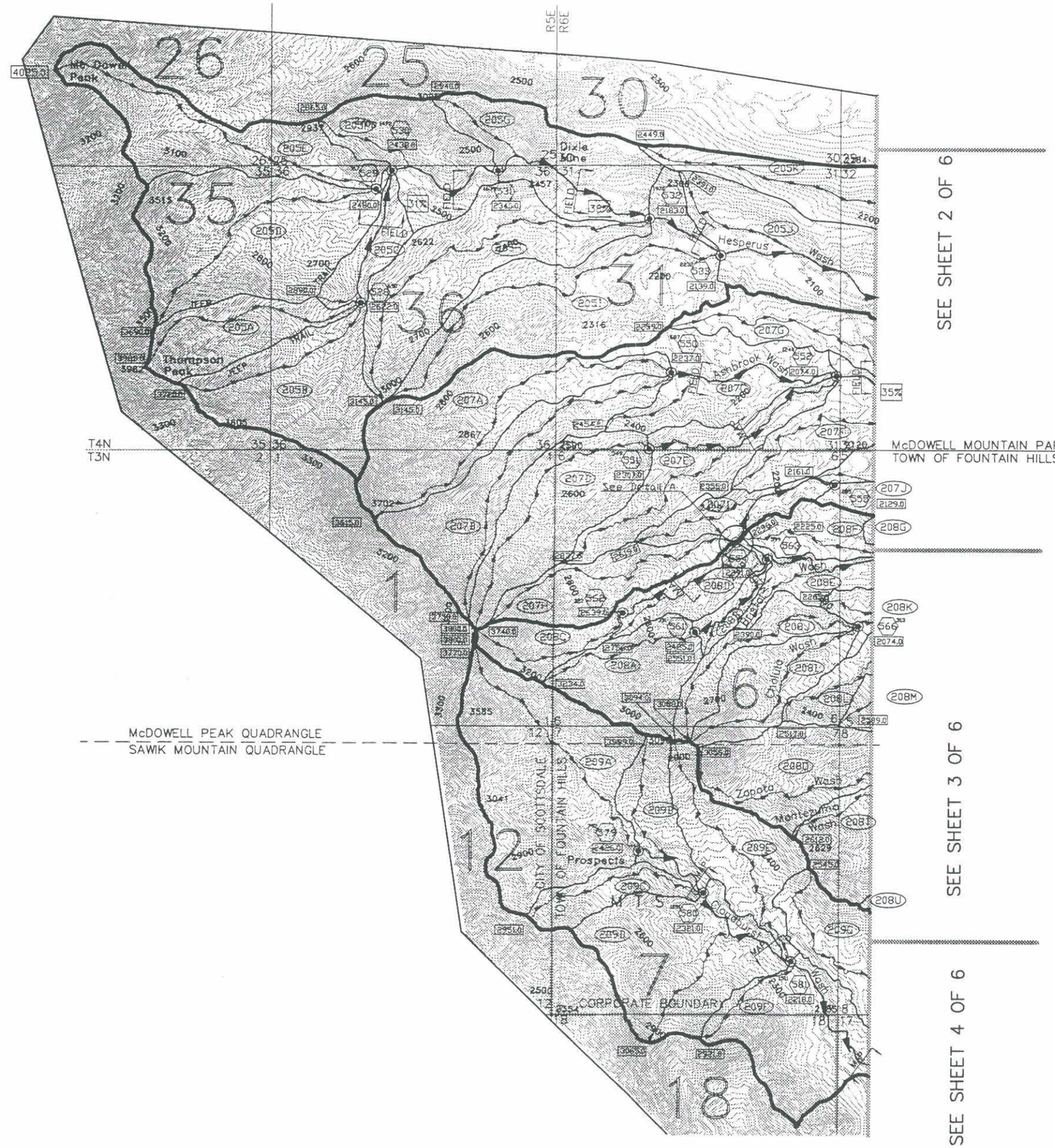
APPROVED BY: DATE

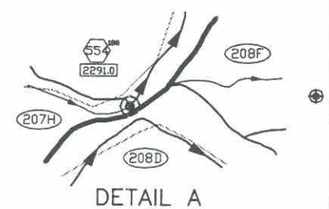
CHIEF ENGINEER AND GENERAL MANAGER

SHEET 1 OF 1

Dwg. Name: PVTHILLS\ACAD\EX-C.dwg
Date: REV. OCT. 17, 1994 08:02am

THIS MAP WAS PREPARED USING THE TOWN OF FOUNTAIN HILLS ZONING MAP (in AutoCAD format) AS A BASE. THE ZONING MAP AUTOCAD FILE IS DATED 11/92.





FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

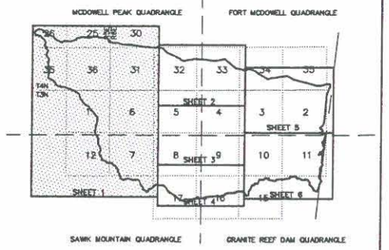
F.C.D. CONTRACT NO. FCD 92-04

LEGEND

NOTE: ALL FLOW RATES ARE FOR THE 100-YEAR PEAK DISCHARGE.

- DRAINAGE SUB-BASIN IDENTIFIER FOR SUBBASIN 207L — 207L
- DRAINAGE SUB-BASIN CONCENTRATION POINT 552 PEAK DISCHARGE IS 1244 cfs — 552
- HEC-1 RESERVOIR ROUTE AT CONCENTRATION POINT 513 INFLOW IS 389 cfs, OUTFLOW IS 369 cfs — 513
- DRAINAGE SUB-BASIN FLOW SPLIT CONCENTRATION POINT 505 PEAK DISCHARGE IS 32 cfs; 18 cfs SPLIT RIGHT, and 14 cfs SPLIT LEFT. — 505
- HEC-1 RESERVOIR ROUTE AND FLOW SPLIT AT CONCENTRATION POINT 523. PEAK INFLOW IS 386 cfs, OUTFLOW IS 286 cfs; 19 cfs SPLIT RIGHT, 266 cfs SPLIT LEFT. — 523
- ELEVATION AT CONCENTRATION POINT OR TOP OF Tc PATH — 1972.0
- VEGETATION COVER DENSITY (FIELD MEASURED) — 35%
- DRAINAGE SUB-BASIN CONCENTRATION POINT
- MAJOR DRAINAGE BASIN BOUNDARY
- DRAINAGE SUB-BASIN BOUNDARY
- HEC-1 ROUTING PATH
- Tc FLOW PATH
- FORT MCDOWELL INDIAN RESERVATION BOUNDARY
- CORPORATE BOUNDARY
- RANGE AND TOWNSHIP BOUNDARY
- USGS QUADRANGLE MAP BOUNDARY
- SECTION LINE
- LIMITS OF 200 SCALE MAPPING
- HEC-1 REACH ROUTE CROSS SECTION LOCATION
  - Ashbrook Wash HEC-2 Section 5.254 — AS-5.254
  - Field Survey Cross Section — FIELD
  - Cross Section From Available Mapping — MAP
- NON-CONTRIBUTING DRAINAGE AREA

INDEX MAP



HYDROLOGY EXHIBIT "D"

DRAINAGE SUB-BASIN DELINEATION TIME OF CONCENTRATION FLOW PATHS AND FLOOD ROUTING MAP

1000' 0' 1000' 2000'

SCALE: 1" = 1000'

CONTOUR INTERVAL = 20 FEET

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	P.K.	8/94
PLANS CHK.	TRL	8/94

SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

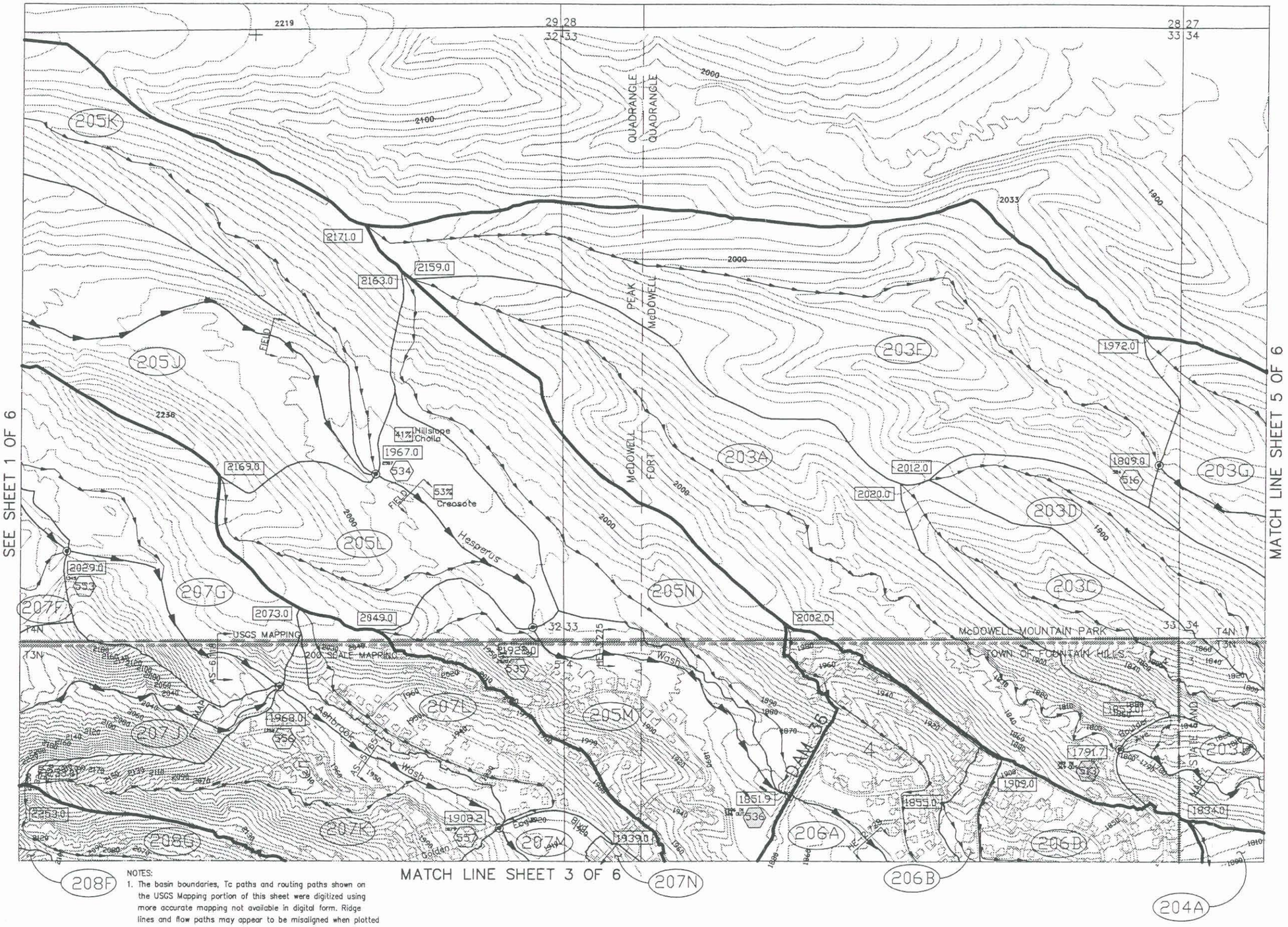
APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 1 OF 6

Dwg. Name: \P\FTHILLS\ACAD\SHEET1.dwg
Date: REV. 17 OCT 1994 8:03am

THE TOPOGRAPHY ON WHICH THIS MAP IS BASED (USGS MAPPING) CAME FROM THE REFERENCED USGS QUADRANGLE MAPS (7.5 MINUTE, 1"=2000'). ONLY 100-FOOT CONTOURS ARE SHOWN.



NOTES:

1. The basin boundaries, Tc paths and routing paths shown on the USGS Mapping portion of this sheet were digitized using more accurate mapping not available in digital form. Ridge lines and flow paths may appear to be misaligned when plotted on the USGS Mapping in some locations.

200 Scale Mapping: Kenney Aerial Mapping Flight Date = 8/91

USGS Mapping: US Geological Survey Flight Date = 1962

THE CONTOURS AND PLANIMETRICS FOR THE 200 SCALE MAPPING WERE PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS 1"=200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS AND BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY ANDERSON-NELSON, INC. THE CONTOURS FOR THE USGS MAPPING CAME FROM THE USGS QUADRANGLE MAPS(7.5 MINUTE, 1"=2000'). ONLY 10-FOOT CONTOURS ARE SHOWN FOR THE 200 SCALE MAPPING, AND 20-FOOT CONTOURS FOR THE USGS MAPPING.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

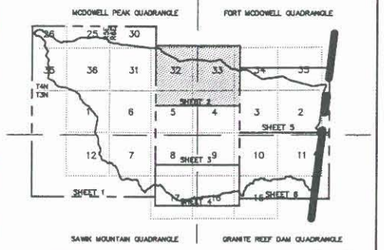
F.C.D. CONTRACT NO. FCD 92-04

LEGEND

NOTE: ALL FLOW RATES ARE FOR THE 100-YEAR PEAK DISCHARGE.

- DRAINAGE SUB-BASIN IDENTIFIER FOR SUBBASIN 207L — 207L
- DRAINAGE SUB-BASIN CONCENTRATION POINT 552 PEAK DISCHARGE IS 1244 cfs — 552
- HEC-1 RESERVOIR ROUTE AT CONCENTRATION POINT 513 INFLOW IS 389 cfs, OUTFLOW IS 369 cfs — 513
- DRAINAGE SUB-BASIN FLOW SPLIT CONCENTRATION POINT 505 PEAK DISCHARGE IS 32 cfs; 18 cfs SPLIT RIGHT, and 14 cfs SPLIT LEFT. — 505
- HEC-1 RESERVOIR ROUTE AND FLOW SPLIT AT CONCENTRATION POINT 523. PEAK INFLOW IS 386 cfs, OUTFLOW IS 286 cfs; 19 cfs SPLIT RIGHT, 266 cfs SPLIT LEFT. — 523
- ELEVATION AT CONCENTRATION POINT OR TOP OF Tc PATH — 1972.0
- VEGETATION COVER DENSITY (FIELD MEASURED) — 35%
- DRAINAGE SUB-BASIN CONCENTRATION POINT
- MAJOR DRAINAGE BASIN BOUNDARY
- DRAINAGE SUB-BASIN BOUNDARY
- HEC-1 ROUTING PATH
- Tc FLOW PATH
- FORT MCDOWELL INDIAN RESERVATION BOUNDARY
- CORPORATE BOUNDARY
- RANGE AND TOWNSHIP BOUNDARY
- USGS QUADRANGLE MAP BOUNDARY
- SECTION LINE
- LIMITS OF 200 SCALE MAPPING
- HEC-1 REACH ROUTE CROSS SECTION LOCATION Ashbrook Wash HEC-2 Section 5.254 — AS-5.254
- Field Survey Cross Section — FIELD
- Cross Section From Available Mapping — MAP
- NON-CONTRIBUTING DRAINAGE AREA

INDEX MAP



HYDROLOGY EXHIBIT "D"

DRAINAGE SUB-BASIN DELINEATION TIME OF CONCENTRATION FLOW PATHS AND FLOOD ROUTING MAP

400' 0' 400' 800'

SCALE: 1"= 400'

CONTOUR INTERVAL = VARIES

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	-
DESIGN CHK.	N/A	-
PLANS	PK	8/94
PLANS CHK.	TRL	8/94
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

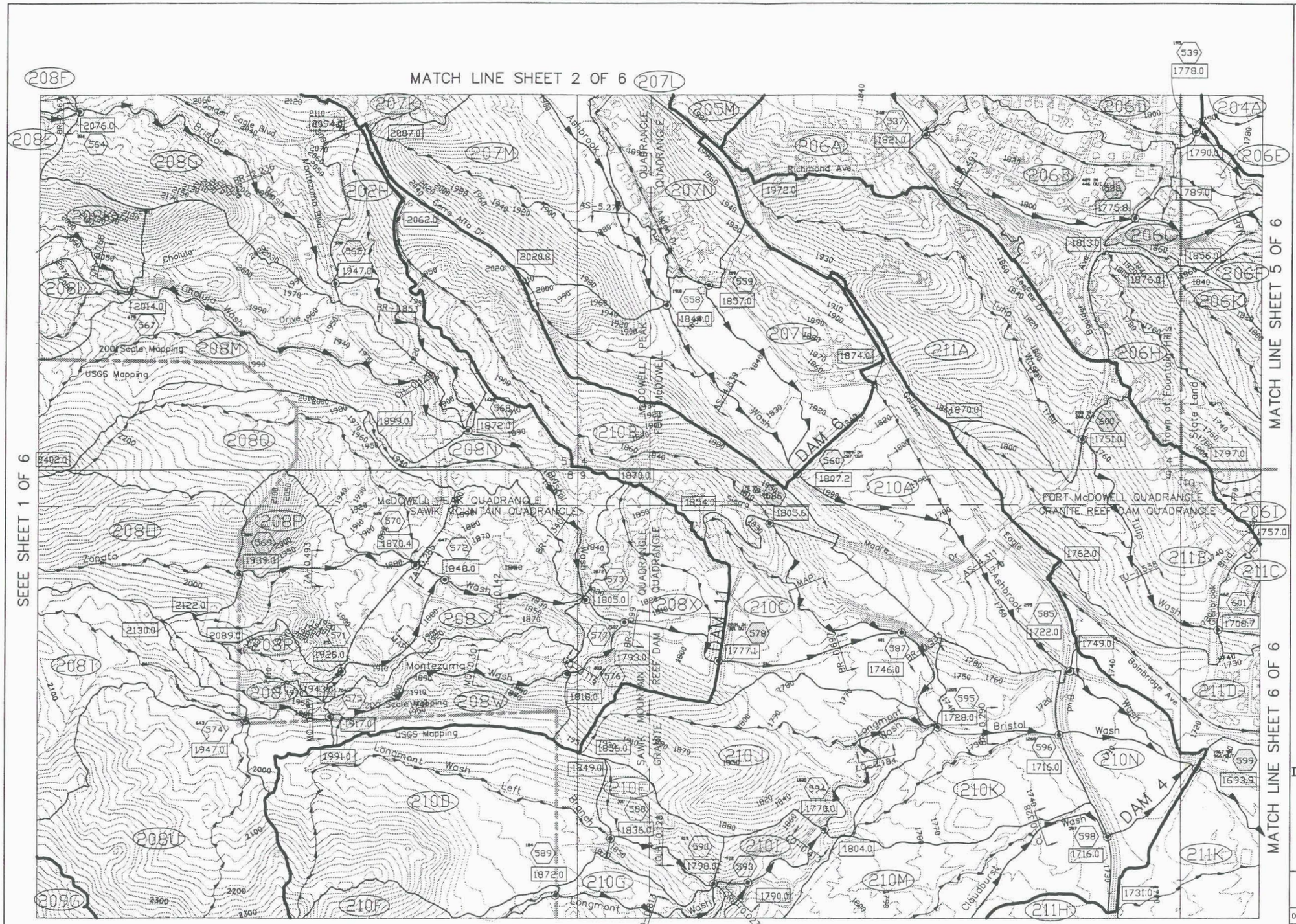
RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 2 OF 6

Dwg. Name: \P\FTHILLS\ACAD\SHEET2.dwg
Date: REV. 17 OCT 1994 8:04am



NOTES:

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200 Scale Mapping: Kenney Aerial Mapping Flight Date = 8/91

USGS Mapping: US Geological Survey Flight Date = 1962

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

F.C.D. CONTRACT NO. FCD 92-04

LEGEND

NOTE: ALL FLOW RATES ARE FOR THE 100-YEAR PEAK DISCHARGE.

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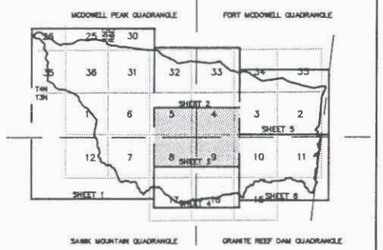
- NON-CONTRIBUTING DRAINAGE AREA

INDEX MAP



HYDROLOGY EXHIBIT "D"

DRAINAGE SUB-BASIN DELINEATION TIME OF CONCENTRATION FLOW PATHS AND FLOOD ROUTING MAP

N

400' 0' 400' 800'

SCALE: 1" = 400'

CONTOUR INTERVAL = VARIES

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	PK	8/94
PLANS CHK.	TRL	8/94
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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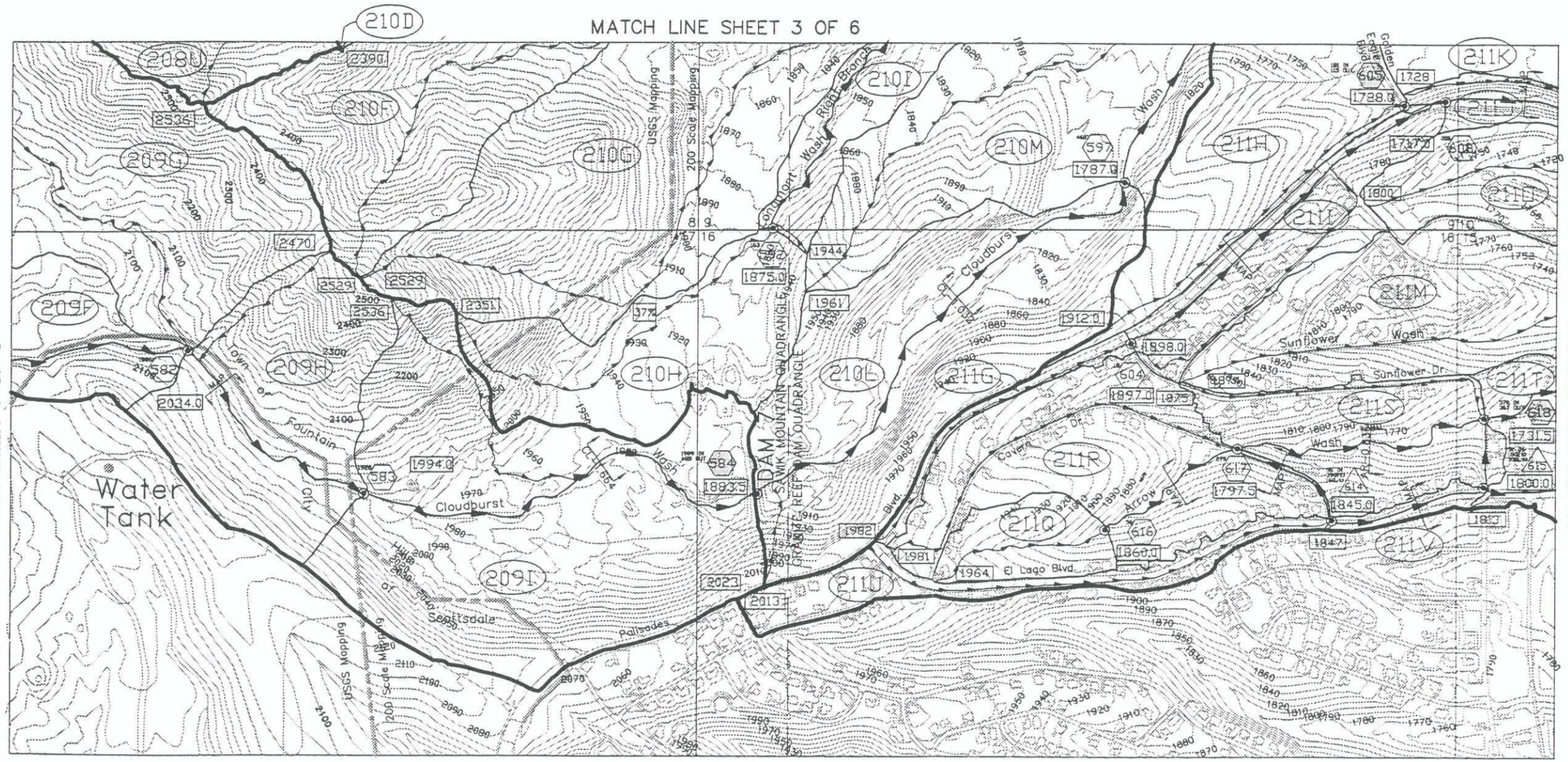
APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 3 OF 6

Dwg. Name: \P\FTHILLS\ACAD\SHEET3.dwg
Date: REV. 17 OCT 1994 08:01am



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Flight Date = 1962

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

F.C.D. CONTRACT NO. FCD 92-04

LEGEND

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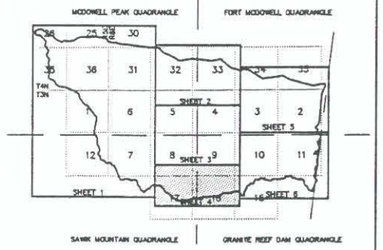
INDEX MAP



HYDROLOGY EXHIBIT "D"

DRAINAGE SUB-BASIN DELINEATION TIME OF CONCENTRATION FLOW PATHS AND FLOOD ROUTING MAP

400' 0' 400' 800'

SCALE: 1"= 400'
CONTOUR INTERVAL = VARIES

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	PK	8/94
PLANS CHK.	TRL	8/94

SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET 4 OF 6

Dwg. Name: \P\FTHILLS\ACAD\SHEET4.dwg
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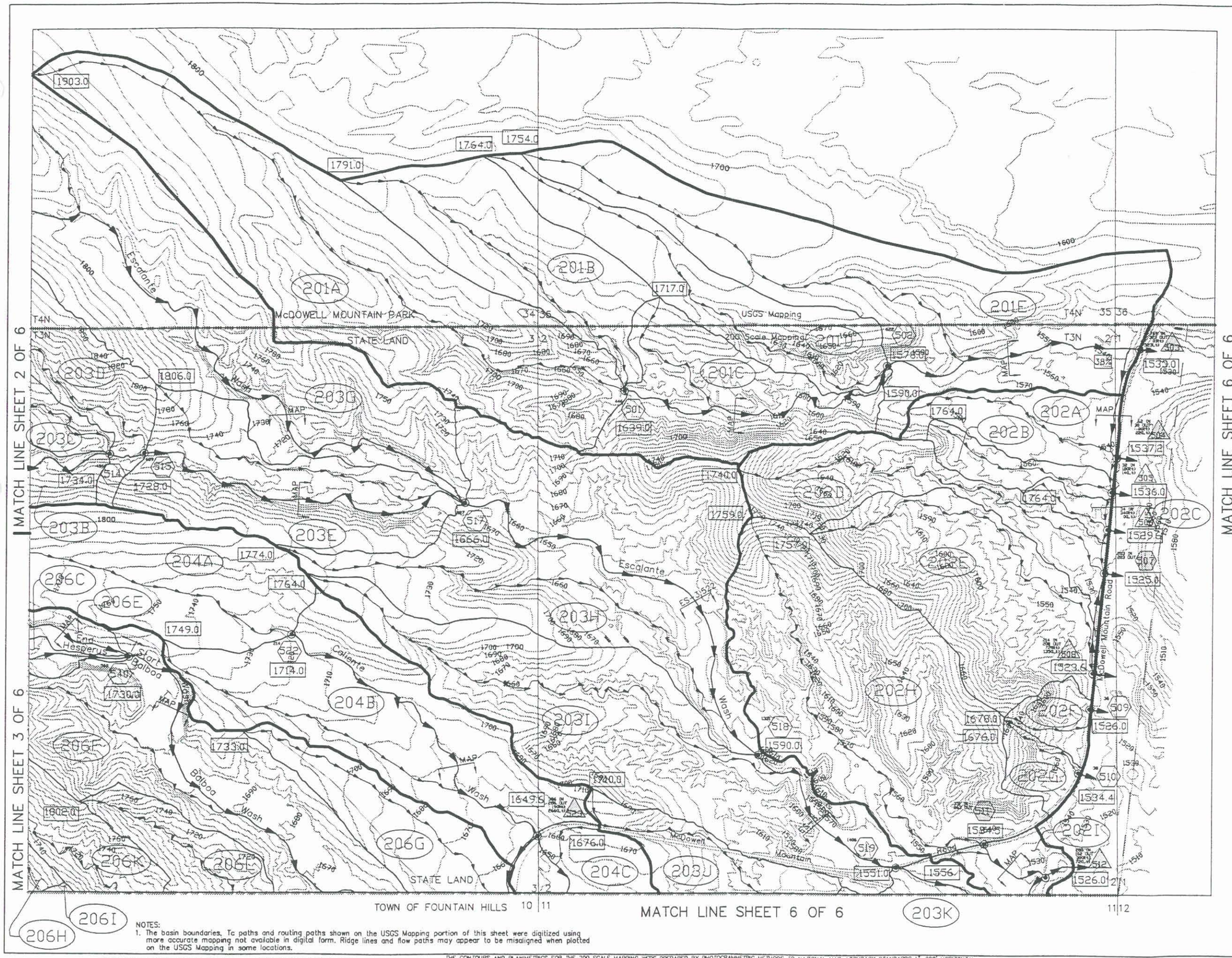

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

F.C.D. CONTRACT NO. FCD 92-04

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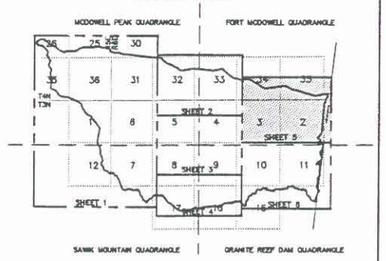
INDEX MAP



HYDROLOGY EXHIBIT "D"

DRAINAGE SUB-BASIN DELINEATION TIME OF CONCENTRATION FLOW PATHS AND FLOOD ROUTING MAP

400' 0' 400' 800'
SCALE: 1"= 400'
CONTOUR INTERVAL = VARIES

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

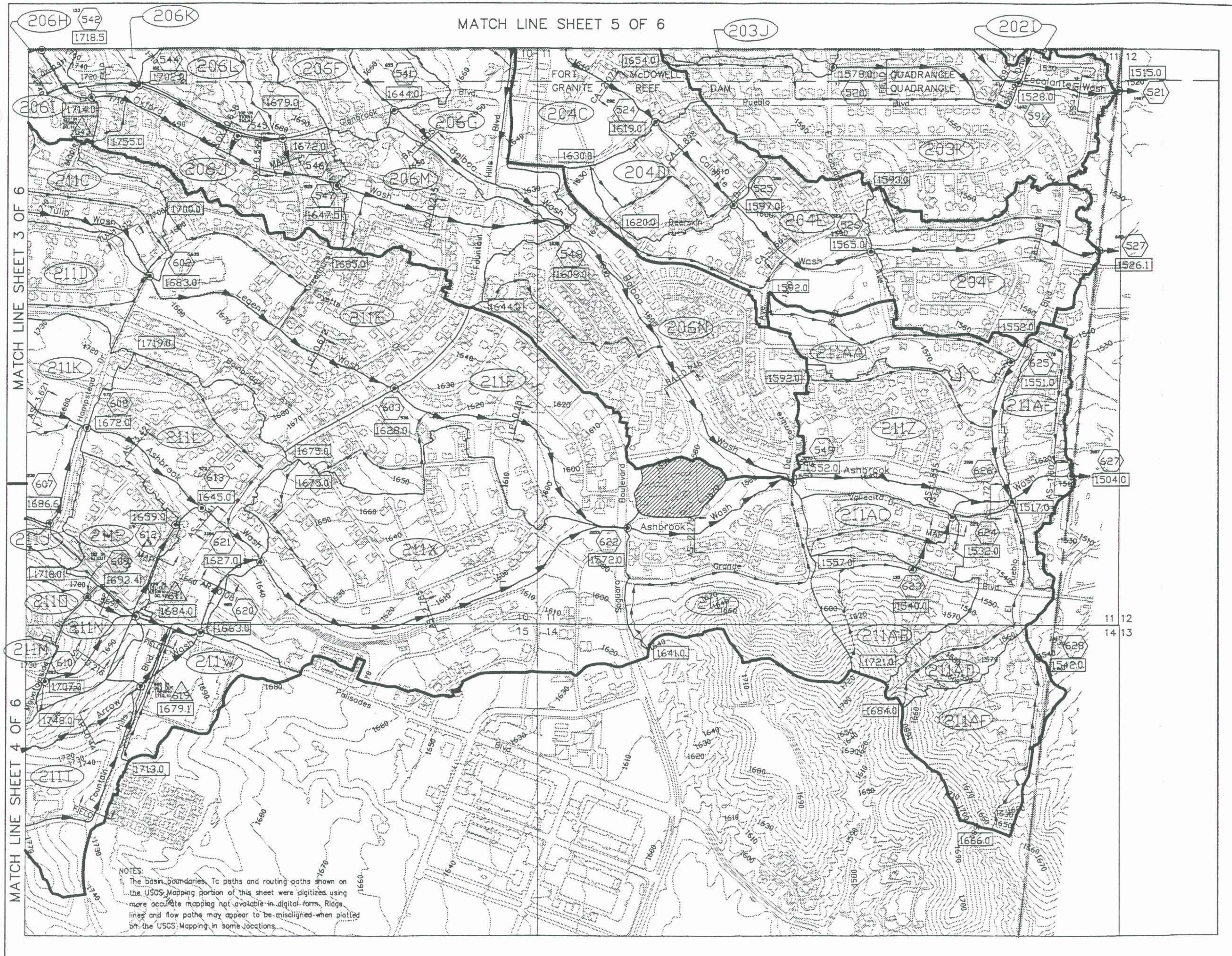
	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	PK	8/94
PLANS CHK.	TRL	8/94
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE
APPROVED BY: DATE
CHIEF ENGINEER AND GENERAL MANAGER

SHEET 5 OF 6

Dwg. Name: \P\FTHILLS\ACAD\SHEET5.dwg
Date: REV. 17 OCT 1994 09:45am



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

F.C.D. CONTRACT NO. **FCD 92-04**

LEGEND

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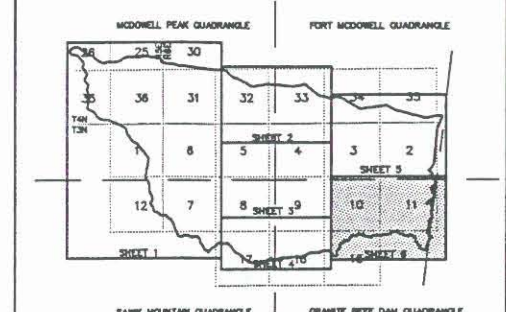

HYDROLOGY EXHIBIT "D"

DRAINAGE SUB-BASIN DELINEATION TIME OF CONCENTRATION FLOW PATHS AND FLOOD ROUTING MAP

400' 0' 400' 800'

SCALE: 1"= 400'

CONTOUR INTERVAL = 10 FEET

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	-
DESIGN CHK.	N/A	-
PLANS	PK	8/94
PLANS CHK.	TRL	8/94

SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 6 OF 6

Dwg. Name: \P\FTHILLS\ACAD\SHEET6.dwg
Date: REV. 17 OCT 1994 10:30am

200 Scale Mapping: Kenney Aerial Mapping Flight Date = 8/91

USGS Mapping: US Geological Survey Flight Date = 1962

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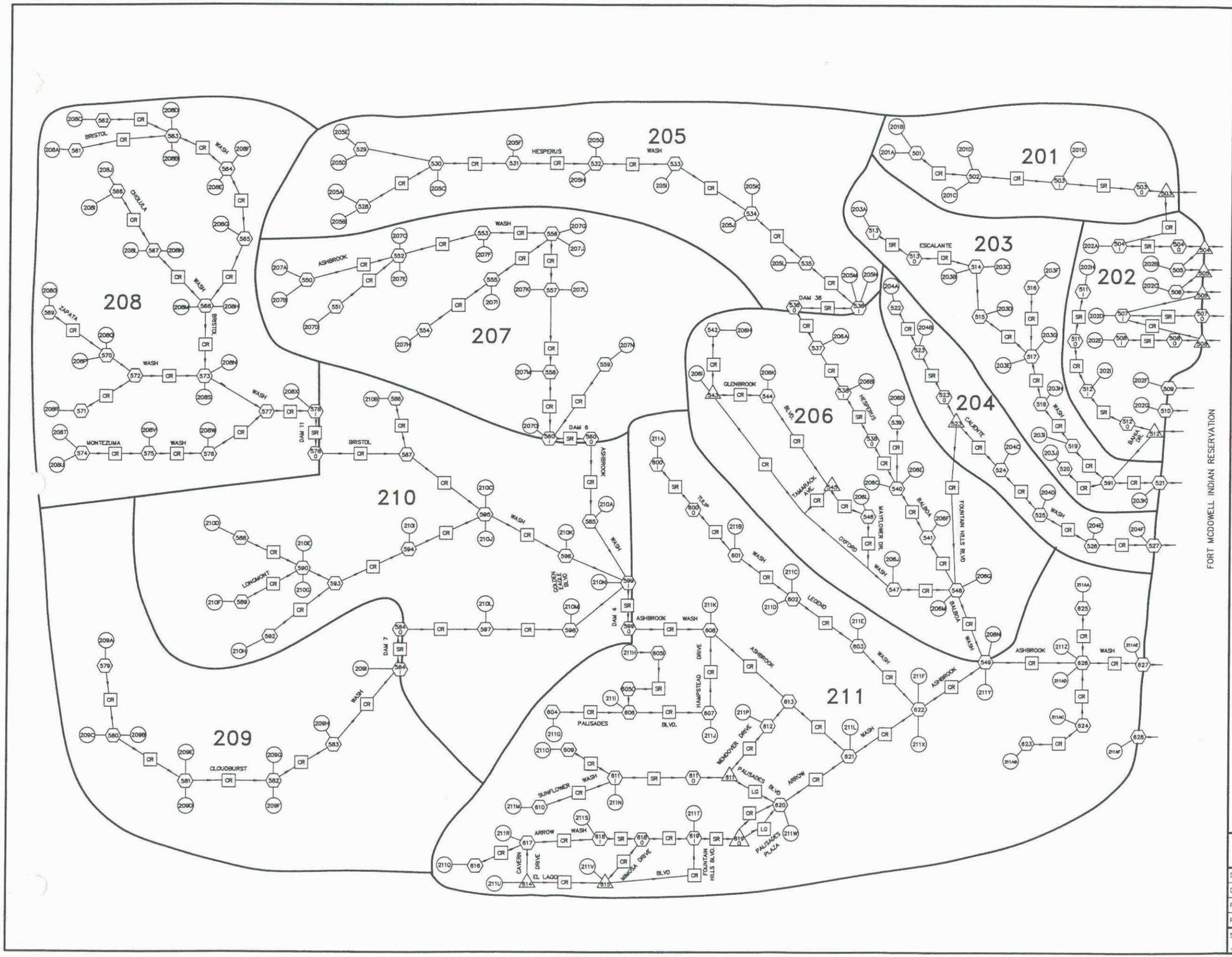


FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF FOUNTAIN HILLS NORTH

F.C.D. CONTRACT NO. 92-04

LEGEND

MAJOR BASIN BOUNDARY

DIRECTION OF FLOW

HYDROGRAPH CALCULATION FOR SUB BASIN 207L — 207L

HYDROGRAPH COMBINATION OPERATION AND/OR CONCENTRATION POINT AT NODE 544 — 544

HYDROGRAPH COMBINATION OPERATION AND/OR CONCENTRATION POINT FOR A STORAGE ROUTE OPERATION AT NODE 599 — 599 (I / O)

I FOR INFLOW TO STORAGE ROUTE OPERATION
O FOR OUTFLOW OF STORAGE ROUTE OPERATION

HYDROGRAPH ROUTING OPERATION — CR

CR = NORMAL DEPTH CHANNEL ROUTE
SR = STORAGE ROUTE
LG = LAG ROUTE

DIVERSION OPERATION TO SIMULATE FLOW SPLIT AT NODE 543 — 543

MAJOR BASIN 202 — **202**

NOTES

EXHIBIT "E"

HEC-1 FLOOD ROUTING DIAGRAM

N

GEORGE V. SABOL CONSULTING ENGINEERS, INC.

	BY	DATE
DESIGN	N/A	–
DESIGN CHK.	N/A	–
PLANS	PK	3/94
PLANS CHK.	TRL	3/94

SUBMITTED BY: DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY: DATE

APPROVED BY: DATE

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 1 OF 1

Dwg. Name: \P\FTHILLS\ACAD\EX-E.dwg
Date: REV. JUL. 24, 1994 02:45pm

SECTION 3: HYDROLOGIC ANALYSIS

3.1 Hydrologic Method Description

The watershed is modeled utilizing the methodology set forth in the *Hydrologic Design Manual for Maricopa County, Arizona* (Design Manual) [6.5:10], prepared by the Special Projects Branch, Hydrology Division, Flood Control District of Maricopa County, dated September 1990. This manual is specified for use in the Contract Scope of Work, which is contained under Section 1.5 of this report. The use of USGS regional flood flow frequency regression equations is not appropriate for this watershed because of the presence of significant flood retarding structures, flow splits caused by existing urban features and because the available regression equations do not reflect urbanized watersheds; therefore, the watershed is modeled using the unit hydrograph method. The watershed is modeled for the 10-year and 100-year, 6-hour and 24-hour duration storms for both the existing and future conditions. The future condition results and supporting documentation are contained under a separate report entitled *Fountain Hills (North) Floodplain Delineation Study, Technical Data Notebook, Future Condition Hydrology*. The two frequencies are used in order to provide the Town of Fountain Hills with peak discharges for culvert design (10-year), and peak discharges for floodplain delineation (100-year). Two storm durations are used in order to determine which storm results in the higher magnitude of discharge at various locations on the watershed. The temporal rainfall distributions used are the SCS Type II for the 24-hour duration storm, and the rainfall patterns and distributions suggested in the Design Manual for the 6-hour duration storm. The Clark unit hydrograph is used for hydrograph development. Rainfall losses are estimated using the Green-Ampt infiltration equation with an estimate for surface retention loss. Hydrographs are routed through the watershed using normal depth Modified Puls routing. Reservoir routing, where water is impounded by the flood detention structures present on the watershed, or where water ponds against roadway embankments, is accomplished using the Modified Puls method. The watershed is modeled using the U.S. Army Corps of Engineers (COE) HEC-1 Computer Program, version 4.0.1E, dated May 1991, as implemented by Dodson & Associates, Inc. [6.5:7].

The purpose in undertaking this study is to estimate peak discharges from the 10-year and 100-year recurrence storms at designated locations on the watersheds. In general, these locations are:

1. Wash confluences and street crossings mutually agreed upon between the District, Town of Fountain Hills, and George V. Sabol Consulting Engineers, Inc. (GVSCE);

2. Flood control detention structures;

3. Beginning and ending points of washes designated for floodplain delineation; and

4. Locations on the watershed where a significant flow split or diversion occurs.

The peak discharges are then used for the hydraulic analysis portion of this study for estimating floodplain and floodway limits for the washes designated for detailed study. All peak discharges estimated in this report are for the existing condition.

The study watershed in relationship to the State of Arizona is depicted on the Location Map, Figure 1. The study watershed in relationship to the City of Phoenix and Maricopa County is shown on the Vicinity Map, Figure 2.

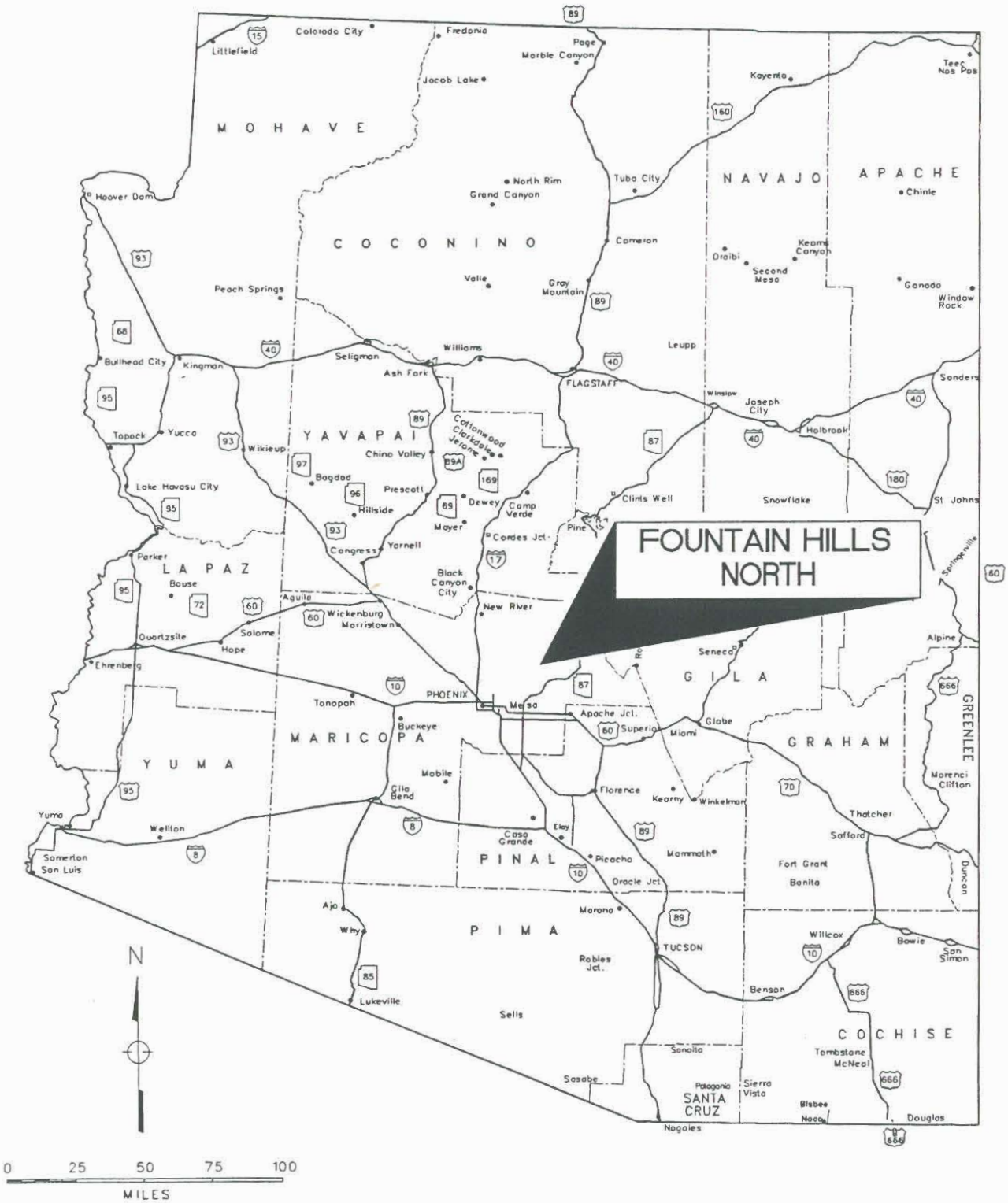


Figure 1

Location Map

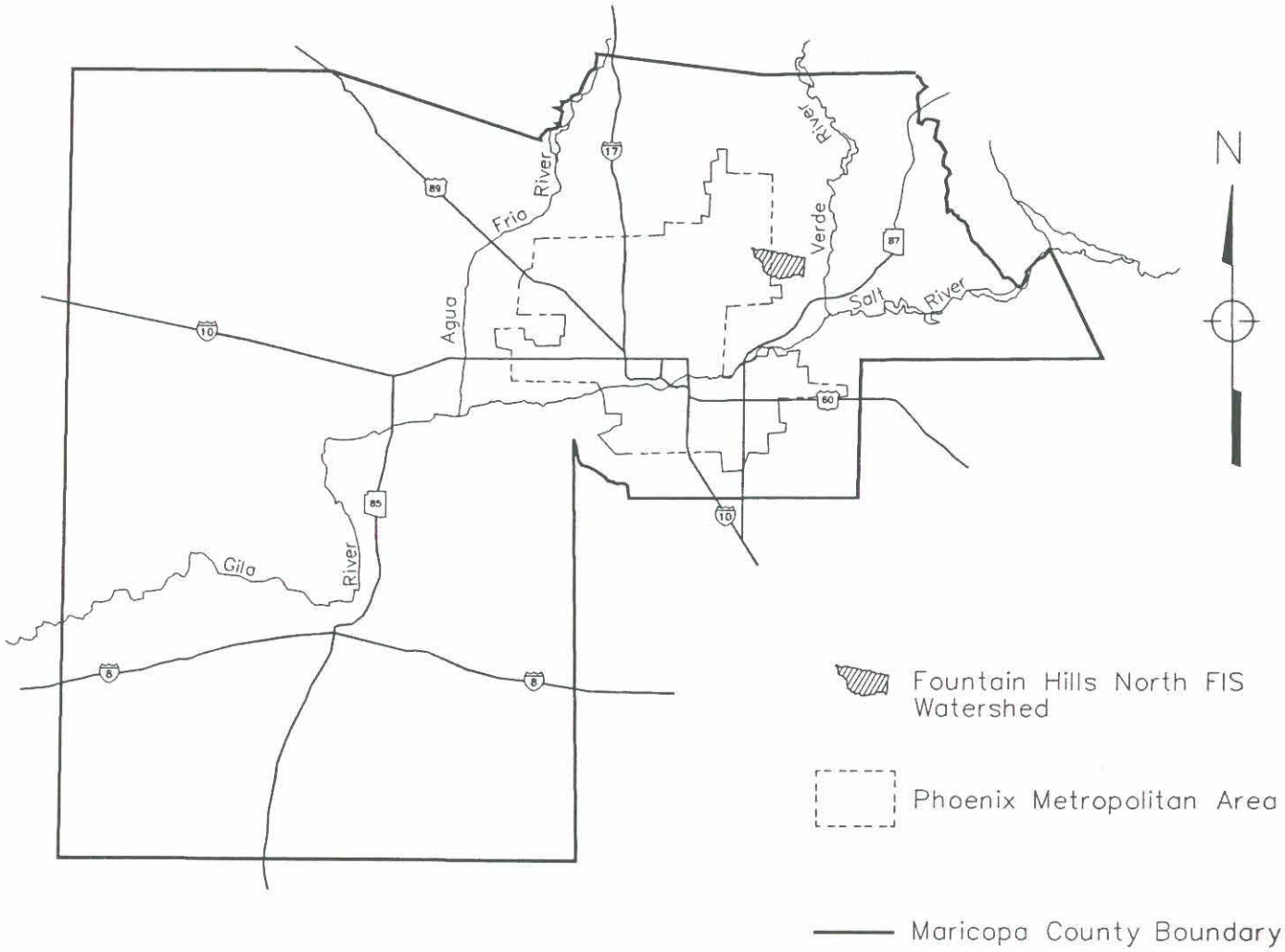


Figure 2

Vicinity Map

3.2 Parameter Estimation

3.2.1 Drainage Area Boundaries

The study watershed is approximately 16.5 square miles in area. Refer to Exhibit A in Section 2.2 for the study watershed delineation. The study area is bounded on the north by the McDowell Mountain Park and State owned land, on the east by the Fort McDowell Indian Reservation, on the south by the Fountain Hills (South) Floodplain Delineation Study area, and on the west by the City of Scottsdale and McDowell Mountain Park.

The watershed contains major washes which are designated for floodplain and floodway delineation. These are:

Arrow Wash	Ashbrook Wash
Balboa Wash	Caliente Wash
Escalante Wash	Hesperus Wash
Legend Wash	Oxford Wash
Tulip Wash.	

These washes converge into three washes at the east study boundaries. Two of these washes, Caliente and Escalante, are isolated watercourses with no major tributaries. All the other washes listed above are tributaries to Ashbrook Wash.

The watershed drains west to east, from the divide caused by the McDowell Mountains to the east boundary of the study area, and ultimately into the Verde River. There are five flood retarding structures, which are dams regulated by the ADWR, located on the watershed. Refer to Exhibit A. These dams were constructed in the early 1970s as a part of the initial phases of the Fountain Hills development. The dams were designed to reduce peak flows from the McDowell Mountains upstream of the main development area. The dam spillways and impoundment volumes are significant hydrologic features that are analyzed in detail as a part of this study.

The watershed is divided into 11 major basins to facilitate the modeling of the complex routing situations found on the watershed. This approach allows the use of naming conventions which make it easier to follow the logic of the HEC-1 model. Hydraulic flow splits created by roadways and drainage structures cause diversion of runoff from one major basin into another at various locations, particularly along McDowell Mountain Road at the northeast corner of the study area.

The watershed is a mix of undeveloped mountain and hillslope areas and urban development. Substantial areas zoned for development are still in a natural state. Many parcels in the urban area are protected from development because of steep slopes or because they were set aside as drainage easements at the time of development. The zoned urban area comprises 10.4 square miles of the 16.5 square mile study area.

The watershed is characterized by steep rugged mountainous terrain along the west side of the study area, and hillslope and wash bottom for the remainder. The watershed ranges in elevation from a low of 1,504 feet to a high of 4,025 feet in the McDowell Mountains. The typical soil type in the mountain areas is a sandy loam-rock outcrop, in the hillslope areas is a sandy loam, and in the wash bottom areas is a loamy sand. The mountainous areas therefore have a high runoff potential and the hillslopes have a moderate runoff potential.

The target criteria for delineating the watershed into subbasins was to use an average subbasin size for the hillslope areas of 0.125 square miles and an average size of 0.5 square miles for the mountain areas. The average subbasin size after the watershed delineation was approved by the District, is 0.1079 square miles. The total number of subbasins in the study is 153.

3.2.2 Physical Parameters

3.2.2.1 Watershed Subbasin Parameters

General

The watershed subbasin parameters are estimated in conformance with the Design Manual. The procedures used for estimating parameters are contained in the following sections. The descriptions only cover procedures which vary from the manual or procedures which can be done under the manual in more than one way. The parameters used for input to the HEC-1 computer program are summarized in Tables S-9 and S-10. The supporting calculations for these parameters are contained in Tables S-1 through S-8.

Subbasin naming and concentration point numbering conventions are used for the Fountain Hills North study, and the Fountain Hills South study which is being done concurrently by another study contractor. The conventions are as follows:

	South Study	North Study
Major Basin names	1-200	201 and greater
Subbasin names	A, B, C...	A, B, C...
Concentration Point numbers	1-500	501 and greater

Soils Parameters

General - Rainfall losses are estimated using the Green-Ampt infiltration equation. Soil textures are obtained from the SCS Soil Survey. The boundaries of SCS soil map units are digitized into AutoCAD using the original maps provided with the SCS Soil Survey. Section corners and quadrangle map corners are used for control to calibrate the digitizer.

Green-Ampt Parameters by SCS Soil Map Unit - The first step in determining rainfall loss values is to estimate Green-Ampt values for each SCS soil map unit present on the watershed. These are provided in Appendix A of the Design Manual, (see Table S-2). Table S-1 is an interpolation table used to determine the DTHETA and PSIF parameters given an XKSAT value. The table is derived from Figure 4.3 of the Design Manual. The PSIF values are read directly from the curve. The DTHETA values are calculated using a linear logarithmic interpolation between the angle points on the figure. Table S-2 is a listing of the Green-Ampt parameters for every SCS soil map unit present on the study watershed. It is important to note that the XKSAT values listed in column 2 of Table S-2 are composite values based on the major and minor soils described in the SCS Soil Survey. The values of PSIF and DTHETA in columns 3 through 5 are obtained by looking up the composite XKSAT value in Table S-1 and returning the corresponding PSIF and DTHETA entries. The XKSAT column in Table S-2 is listed as "unadjusted" because vegetation cover density correction factors are not applied in that table. The RTIMP values in column 6 are taken from the SCS Soil Survey. The slope ranges in column 7 are derived from the SCS Soil Survey. The terrain class designation for each soil map unit shown in column 8, is assigned based on the slope range. Refer to the "Terrain Classifications and Land Use Characteristics" section for a detailed description of the basis used to assign terrain classifications.

All of the soils listed in Table S-2 are characterized as gravelly, very gravelly, extremely gravelly, channery, or cobbly by the SCS soil survey. This means that the soils are characterized by significant percentages of broken rock up to 3 inches nominal size. The effects of large percentages of gravel on Green-Ampt parameters is unknown. The only adjustments made to account for these effects are described in Appendix A of the Design Manual.

Green-Ampt Parameters by Subbasin - The XKSAT and RTIMP parameters are estimated for each subbasin by calculating composite values based on area. The soil map unit boundaries are digitized into AutoCAD. The subbasin and major basin boundaries are also digitized into AutoCAD as a part of the subbasin delineation process. The AutoCAD drawing files are then converted to ARC/INFO format for calculation of soils and subbasin areas. The total area of all polygons for each soil

map unit is calculated. ARC/CAD, a geographic information system software package that interfaces with AutoCAD, is a more efficient tool for computing areas of multiple polygons than AutoCAD itself.

The composite values of XKSAT and RTIMP are calculated for each subbasin using a spreadsheet after the polygon areas are calculated. Refer to Table S-3. Table S-3 is the calculations summary for estimating the XKSAT, RTIMP and Terrain Classifications for each subbasin. The data in this table is sorted by subbasin. The soil map units present in each subbasin, and the corresponding area and unadjusted XKSAT values, are listed in the first three rows of each subbasin data group. The percent impervious values associated with each soil map unit are listed as "% Rock" in row 4. The composite XKSAT parameter, shown in row 6, is calculated by averaging the common logarithm of the XKSAT values from row 3 using area. This is accomplished by multiplying the total area of each soil map unit in the subbasin by the common logarithm of the associated XKSAT value. The resultant products are then totalled, the sum divided by the total area of the subbasin, and the antilogarithm calculated. The result is the composite XKSAT parameter. The RTIMP parameter, listed in row 10, is calculated by area-averaging the RTIMP values from row 4. The log-averaging method is not used for RTIMP. The log-averaged XKSAT parameter is then adjusted for the effects of vegetation cover using Figure 4.4 from the Design Manual. Refer to rows 6, 7, 8 and 9 of each subbasin group in Table S-3. The source of the Vegetation Cover Density value in row 7 is discussed under "Terrain Classifications and Land Use Characteristics".

Table S-6 is the spreadsheet used to area-weight the DTHETA and surface loss parameters. The value of PSIF for each subbasin is estimated using the log-averaged XKSAT value from Table S-3 and the lookup table in Table S-1. The DTHETA (dry) and DTHETA (normal) values for each subbasin are estimated in a similar manner. However, the final DTHETA value used for each subbasin is a composite of the dry and normal values based on area averaging using land use percentages. Refer to the "Terrain Classifications and Land Use Characteristics" section for more detail.

The lookup table values of DTHETA and PSIF are shown in columns 3, 4, and 5 of Table S-6 for each subbasin. The log-average value of XKSAT (for bare ground) is in column 2.

Watershed Delineation and Areas

The watershed delineation is accomplished using the various available mapping, aerial photographs, and field reconnaissance. The urbanized and urbanizing areas are delineated using the 200 scale mapping and the aerial photographs upon which the 200 scale mapping is based. Prints of the aerial photographs are provided by the District at a scale of 1 inch = 100 feet with each sheet covering one-quarter square mile. Improvement plans are also available for a limited number of streets in the study area. Copies of these are provided by the Town of Fountain Hills, Anderson-Nelson, Inc, HNTB, Coe and Van Loo Engineers, Kaminski-Hubbard, Inc., Stanley Franzoy-Corey, and Maricopa County. These plans are used as an aid in determining watershed divides at street intersections and where construction has occurred since the photo date of the 200 scale mapping. Areas of questionable topography, such as street intersections where subtle drainage patterns are not identifiable with 2-foot contour interval mapping, are marked for verification by field reconnaissance.

The watershed delineation in Sections 31 through 36, T4N, R6E is done using the 400 scale mapping. The watershed delineation in Sections 6, 7, 18 and the non-urbanized portions of Sections 8 and 17, T3N, R6E are done using the 100 scale mapping. The watershed delineation in Sections 1 and 12, T3N, R5E, and Sections 35 and 36, T4N, R5E, is done using the USGS mapping. The USGS orthophotographs are also used as an aid for subbasin delineation. Aerial photograph contact prints available from Aerial Mapping Company, Inc. [6.6:X] are also used. Questionable areas are identified and marked for verification by field reconnaissance. Refer to Section 3.2.2.2 for a description of the information gathered by field reconnaissance.

The coordinate basis for the 200 scale mapping and all field surveys done by GVSCE is the National Geodetic Survey North American Datum of 1983 (NAD 1983).

The vertical basis is the National Geodetic Vertical Datum of 1929 (NGVD 1929). The delineated subbasins are digitized into AutoCAD using this coordinate system. Section corners, USGS quadrangle map corners, and aerial mapping control points were used for calibration of the digitizer.

The subbasin boundaries, time of concentration flow paths and HEC-1 flood routing paths shown on Exhibit D may appear to be offset from the wash flow lines and ridges defined on the USGS base mapping. It is important to remember that the boundaries and flow paths in the areas covered by the 100 and 400 scale mapping were digitized from these maps, which provide more detailed definition of washes and ridges than the USGS mapping. The resultant digitized lines may appear inconsistent with the USGS mapping in some areas when plotted using the USGS mapping for background. However, these boundaries and flow paths are actually more accurate than if digitized using the USGS mapping.

Soils and land use polygon areas are calculated from AutoCAD drawings using Arc/CAD version 11.2. The soil map unit areas in Table S-3 are the total area of all polygons for a particular map unit within a subbasin. The land use areas in Table S-5 are the total area of all polygons for a particular land use category within a subbasin. The areas for each subbasin and major basin are summarized in Table S-9.

Terrain Classifications and Land Use Characteristics

General - The terrain classifications of the watershed are defined using the following three classifications:

1. Valley;
2. Hillslope; and
3. Mountain.

Land use characteristics are assigned using the general terms "natural" and "urban". The "natural" characteristic includes all Valley, Hillslope, and Mountain Terrain classifications that are non-urban. The "urban" characteristic includes a number of land use categories. The assignment of terrain classifications to areas of

the watershed is discussed first, followed by a description of land use assignations, initial abstraction, then a description of how vegetation cover densities are estimated, and in conclusion Table S-6 is described on a column-by-column basis.

Terrain Classification Assignment - The Valley, Hillslope and Mountain classifications are established for watershed areas by assigning a terrain class to each SCS soil map unit present on the watershed. The percentages of each land use in a given subbasin is then determined by totalling the areas of the corresponding SCS soil map units, and dividing by the total subbasin area. Refer to Tables S-2 and S-3. A terrain class is assigned to each SCS soil map unit using the following criteria:

1. The land slope range contained in the SCS Soil Survey is used in conjunction with the percent impervious for the map unit.

2. The Valley terrain class is assigned if the slope range is between 0 and 15 percent with a percent impervious value of zero.

3. The Hillslope terrain class is assigned if the slope range is between 1 and 15 percent and the soil map unit has a positive value for percent impervious. It is also assigned for slope ranges between 1 and 40 percent, regardless of the percent impervious value.

4. The Mountain terrain class is assigned to soil map units with slope ranges between 10 and 75 percent.

This selection criteria can generally be applied to all soil map units in the SCS Soil Survey. However, each terrain class assignment must be examined for reasonableness. SCS soil map unit 63 has a slope range of 10 to 65 percent. Using the assignment criteria, this soil type should be assigned a Mountain classification. According to the SCS Soil Survey, this soil occurs in both Mountain and Hillslope areas. An examination of the location of type 63 soils on this watershed indicates that it occurs on Hillslope, not Mountain, areas.

The terrain classifications shown in rows 11, 12 and 13 for each subbasin group in Table S-3 sum to 100 percent of the total subbasin. No attempt is made to separate land use characteristics at this point. The percentage of each terrain classification is calculated by totalling the areas of each soil map unit in row 2 that correspond to the appropriate terrain classification in row 5, dividing by the total subbasin area, and multiplying by 100.

Land Use Assignment - Land use characteristics are assigned to subbasins using the land use identifiers shown in Table S-4. The differentiation between urban and natural land uses is necessary for the following reasons:

1. Estimation of a composite percent impervious value for each subbasin based on impervious urban area and impervious rock outcrops in natural areas;

2. Estimation of a composite vegetation cover density for each subbasin based on urban vegetation cover and natural vegetation cover; and

3. Estimation of a composite DTHETA value for each subbasin based on use of DTHETA (dry) for natural areas and DTHETA (normal) for urban areas.

There are no agricultural land uses on the study watershed, although some natural areas are irrigated using treated wastewater effluent. These areas have been assumed to be negligible for the purposes of this study. The assignment of a land use characteristic to each land use polygon in a subbasin is done using key assumptions. The key assumptions involving percent impervious are:

1. If a land use polygon is 50 percent or more developed, it is considered fully developed. The percent impervious is assigned using the values in Table S-4. An "urban" land use characteristic is assigned in row 4 of Table S-5.

2. If a land use polygon is less than 50 percent developed, an actual percent impervious is measured and assigned. A "natural" land use characteristic is assigned in row 4 of Table S-5. By assigning the "natural" characteristic, DTHETA (dry) and the natural vegetation cover density are used for this polygon. This is a compromise to account for the effects of urbanization and still represent the dominant "natural" characteristics. It is therefore possible that a subbasin be characterized as having no urban area, but have an urban percent impervious greater than zero. An example is subbasin 208H. Refer to Table S-6, page 3.

3. If a land use polygon is undeveloped, an urban percent impervious value of zero is used. A "natural" land use characteristic is assigned.

4. The terrain classification percent impervious is applied in addition to the urban percent impervious for the above situations.

The key assumptions involving DTHETA and vegetation cover density are:

1. A land use polygon within a subbasin which is assigned an "urban" land use characteristic, based on the percent impervious assumptions, is assigned a DTHETA (normal) value and the urban vegetation cover density is used.

2. A land use polygon within a subbasin which is assigned a "natural" land use characteristic, based on the percent impervious assumptions, is assigned a DTHETA (dry) value and a natural watershed vegetation cover density.

Urban land use codes are used to name each land use polygon within a subbasin using the above assumptions. The land use codes are representative of the density of development within the polygon. Density of development is directly related to municipal zoning classifications. In order to simplify the modeling effort, similar zoning categories are lumped together. This keeps the number of land use polygons within a subbasin from becoming unmanageable, and does not adversely affect the accuracy of the model. The municipal zoning classifications lumped in each land use code are shown in Table S-4. The municipal zoning classifications are derived from the Town of Fountain Hills Zoning Ordinance [6.6:C]. The percent impervious values assigned to each land use code are taken from the county wide table of estimated values provided by the District with the Design Manual.

Initial Abstraction - Initial abstraction (IA), or surface retention loss, is estimated using Section 4.2 of the Design Manual. The values for natural terrain classes are assigned per Design Manual Table 4.1. The dominant land surface treatment in the urbanized area, outside impervious areas, is desert landscaping or native vegetation. A value of 0.10 inches is assigned for urban pervious areas. This includes an allowance for the effects of plastic liners underlying the desert landscaping. A value of 0.05 inches is assigned for urban impervious areas. The IA for natural rock outcrop areas is assumed to be the same as for the natural terrain class.

Vegetation Cover Density Assignment - The XKSAT parameter is corrected for the effects of vegetation cover. Vegetation cover density (VCD) for both the "natural" and "urban" land use characteristics are considered. The "natural" VCD assigned for each subbasin is listed in column 13 of Table S-6. The estimate of average VCD for each subbasin is assigned based on the following:

1. Observations made during the field reconnaissance;
2. Measurements made using the 1 inch = 100 feet scale aerial photographs (prints of the photography used to prepare the 200 Scale Mapping); and
3. Consideration of north and south facing slopes in the "natural" areas.

Vegetation density transects were taken at various locations on the watershed during the field reconnaissance. These locations are identified on Exhibit "D". The transects were taken using a 100-foot chain at locations selected to be representative of the average VCD in the area. These VCD values are used to assign values to subbasins where it is not practical to take transects, and small scale aerial photographs are not available. The assignment is based on interpolation between known values, engineering judgement, similarity of terrain, and consideration of slightly higher densities on north facing slopes than on south facing slopes.

The following photograph is an example of an area with an estimated vegetation cover density of 38 percent.

VCD at Location 531532

(Sheet 1 of Exhibit "D")

This photograph was taken in subbasin 205G.

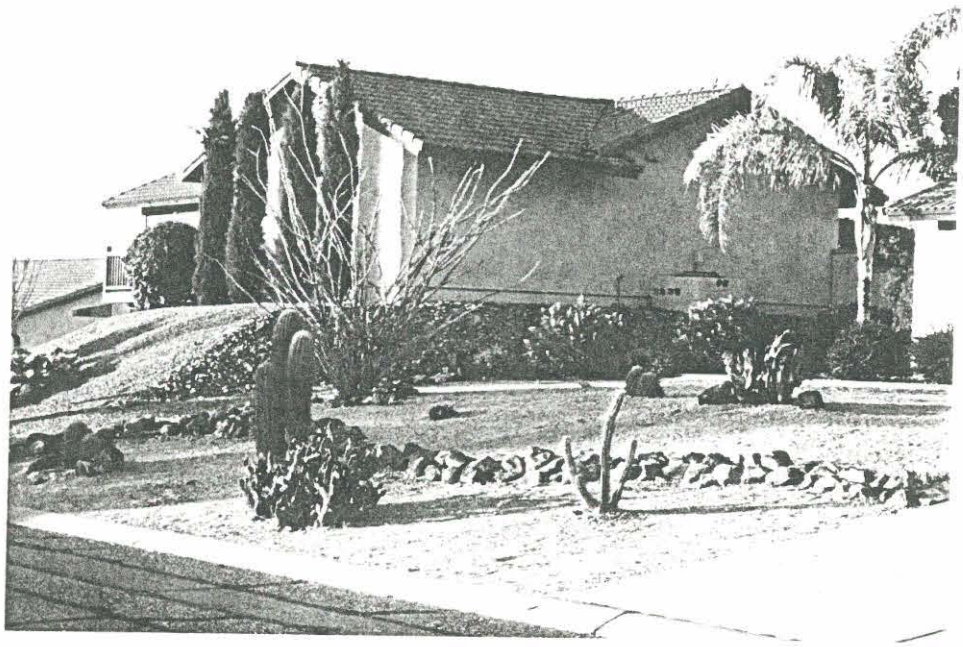
The estimated average vegetation cover density for urbanized areas is listed in column 14 of Table S-6. The majority of the landscaping in the study area consists of desert plants with very few lawns. Many areas have left the native vegetation in place. Vegetation cover in the urban setting is estimated to range from 20 percent to 30 percent (average of 25 percent of the pervious area. The average development land use in the study area is medium density residential (MDR) which has an average percent impervious of 45 percent.

The average urban VCD is therefore:

$$VCD_{urban} = \left(\frac{100 - 45}{100}\right) 25 = 14\% \text{ . A value of 15 percent is assumed.}$$

The following photograph is an example of the typical urban vegetative landscaping.

VCD near C541



This photograph was taken in subbasin 206G.

Table S-6 Description - The data in Table S-6 is generated, by column, as follows:

Column 1: Subbasin identifier.

Column 2: Bare ground logarithmic averaged XKSAT for the subbasin from row 6 of the subbasin data group in Table S-3.

Column 3: Value of DTHETA for a dry watershed condition derived from Table S-1 using the XKSAT value in column 2.

Column 4: Value of DTHETA for a normal watershed condition derived from Table S-1 using the XKSAT value in column 2.

Column 5: Value of PSIF derived from Table S-1 using the XKSAT value in column 2.

Column 6: The percentage of Valley terrain classification in the subbasin taken from row 11 of the subbasin data group in Table S-3. This percentage may include urbanized area.

Table S-6 Description - (continued)

Column 7: The percentage of Hillslope terrain classification in the subbasin taken from row 12 of the subbasin data group in Table S-3. This percentage may include urbanized area.

Column 8: The percentage of Mountain terrain classification in the subbasin taken from row 13 of the subbasin data group in Table S-3. This percentage may include urbanized area.

Column 9: The percentage of "urban" land use in the subbasin taken from row 6 of the subbasin data group in Table S-5.

Column 10: The percentage of "natural" land use in the subbasin with a Hillslope terrain classification. The value is estimated as follows:

$[10] = [7] - [9]$
where: $[7] > [9]$

$[10] = 0$
where: $[7] \leq [9]$

The number in brackets is the column number from Table S-6.

Column 11: The percentage of "natural" land use in the subbasin with a Mountain terrain classification. The value is estimated as follows:

$[11] = [8] - ([9] - [7])$
where $[8] - ([9] - [7]) \geq 0$ and $[9] - [7] > 0$

$[11] = 0$
where $[8] - ([9] - [7]) < 0$

$[11] = [8]$
where $[9] - [7] \leq 0$

Column 12: The percentage of "natural" land use in the subbasin with a Valley terrain classification. The value is estimated as follows:

$[12] = [6] - ([9] - [8] - [7])$
where $[6] - ([9] - [8] - [7]) \geq 0$
and $[9] - [8] - [7]) > 0$

$[12] = [6]$ elsewhere.

Column 13: The average vegetation cover density of the "natural" land use in the subbasin. Represents the adjusted Valley, Hillslope, and Mountain portions of the subbasin.

Table S-6 Description - (continued)

Column 14: The average vegetation cover density of the "urban" land use in the subbasin.

Column 15: The estimated percentage of the subbasin which is impervious due to "urban" land use, taken from row 7 of the subbasin data group in Table S-5.

Column 16: The estimated percentage of the subbasin which is impervious due to hydraulically connected rock outcrops.

Column 17: The estimated total percentage of the subbasin which is impervious due to urbanization and hydraulically connected rock outcrop. The value is calculated as follows:

RTIMP (total) = [15] + [16].

Column 18: The estimated area weighted DTHETA value for the subbasin, calculated as follows:

$$\text{DTHETA (weighted)} = [3]\left(\frac{[10]+[11]+[12]}{100}\right)+\frac{[4][9]}{100}$$

Column 19: The estimated area weighted VCD for the subbasin, calculated as follows:

$$\text{VCD (weighted)} = [13]\left(\frac{[10]+[11]+[12]}{100}\right)+\frac{[14][9]}{100}$$

Table S-6 Description - (continued)

Column 20: The estimated area weighted initial abstraction (IA) value for the subbasin calculated as follows:

Terrain Class or Land Use	Initial Abstraction (inches)
Valley	0.35
Hillslope	0.15
Mountain	0.025
Urban (pervious)	0.10
Urban (impervious)	0.05

Note: The values for initial abstraction, as shown, are derived from Table 4.1 of the Design Manual

IA (weighted) =

$$\frac{0.35[12] + 0.15[10] + 0.25[11] + 0.10([9]-[15]) + 0.05[15]}{100}$$

Time of Concentration

The time of concentration for each subbasin is estimated using the Papadakis and Kazan empirical equation:

$$T_c = 11.4\ L^{0.50}\ K_b^{0.52}\ S^{-0.31}\ i^{-0.38}$$

where T_c = subbasin time of concentration in hours

L = length of the hydraulically longest flow path in miles

S = watercourse slope in feet per mile

K_b = representative watershed resistance coefficient

i = average rainfall excess intensity, during the time T_c, in inches/hour

Solution of the T_c equation is an iterative process.

The watercourse slope is adjusted per Figure 5.4 of the Design Manual if greater than 225 feet per mile. The T_c parameters for each subbasin are listed in

MCUHP1 computer program. The results are listed in Tables S-8a and S-8b for the 100-year, 6-hour and 100-year, 24-hour storms, respectively. The T_c should not be larger than the duration of the most intense period of rainfall excess, to meet the basic assumptions upon which the Clark Unit Hydrograph is based. The duration of the most intense portion of rainfall excess is defined as 90 percent of the total duration of rainfall excess for the purposes of this study. That time is listed in column 21 of Table S-8 for each subbasin. The calculated value of T_c can be compared with the 90 percent value by comparing columns 21 and 22 of Table S-8. Only 12 percent of the subbasins do not meet this criteria. Since the subbasins which do not meet the criteria are very small (less than 0.3 square miles), the Clark Unit Hydrograph is more appropriate than the alternative S-Graph method. Therefore, the Clark Unit Hydrograph is used for all subbasins. The T_c and R results are summarized for each storm duration in Table S-10.

Unit Hydrograph

The Clark Unit Hydrograph is selected for use for this study. The average subbasin size of 0.11 square miles precludes use of the S-Graph method unless guidelines for use of the Clark Unit Hydrograph cannot be met. In particular, the duration of the most intense portion of rainfall excess should not be less than the time of concentration. A check for this guideline is made for each subbasin and the results for the 100-year, 6-hour and 100-year, 24-hour storms are listed in column 17 of Table S-8a and S-8b, respectively.

Time-Area Relation

The time-area relation is a required parameter for use with the Clark Unit Hydrograph. A time-area relation is selected for each subbasin, depending on the characteristics of that subbasin. It is impractical to develop individual time-area relations for each subbasin in a model with numerous subbasins. Synthetic time-area relations are therefore used for this study. The watershed can be characterized using three categories:

1. Natural,
2. Urbanizing, and
3. Urbanized.

Three synthetic time-area relations are available for use in the Design Manual. The N-D relation on Figure 5.7 of the Design Manual is used for subbasins categorized as natural. The U-D relation on Figure 5.6 of the Design Manual is used for subbasins categorized as urban. The HEC-1 default time-area relation is used for subbasins categorized as urbanizing. An urbanizing subbasin is defined as having an urban percentage of subbasin area greater than zero and less than 50 percent. Refer to column 11 of Table S-7. An urban subbasin is defined as having an urban percentage of subbasin area greater than or equal to 50 percent.

The subbasins characterized as urbanizing using the values in Column 11 of Table S-7 were visually evaluated for reasonableness. The simplifying assumptions upon which the values in column 11 are based are the reason for performing this evaluation. Those subbasins with an urbanized drainage collection system, but are not fully developed yet, are assigned an urban time-area relation. The relation selected for each subbasin is listed in column 10 of Table S-9.

Sample Calculation of Subbasin Parameters

The following is an example of the calculation procedures for the 100-year, 6-hour storm used in preparing the data in Tables S-3 through S-9. Subbasin 207K is used for this example since all three terrain classes and a small area of urban land use are present.

Green-Ampt Parameter Calculations for Subbasin 207K -

Note: Some disparity between sample calculations and values in the tables can exist due to greater precision of spreadsheet numerics.

Step 1: *Calculate the log-average value of XKSAT.* Refer to Table S-3, page 24.

Log-Avg XKSAT = 10^a, where

$$a = \left(\frac{\log\ (0.33)\ x\ (22.6) + \log\ (0.17)\ x\ (53.9) + \log\ (0.07)\ x\ (6.4)}{82.9} \right)$$

$$= -0.7208$$

Log-Avg XKSAT = $10^{-0.7208}$ = 0.19 inches per hour

Step 2: *Calculate the average Vegetation Cover Density (VCD) for the subbasin.* Refer to Table S-6, page 3.

$$VCD_{weighted} = \frac{([10] + [11] + [12])[13] + [9][14]}{100}$$

$$= \frac{(36.2 + 27.3 + 0)(30) + (36.5)(15)}{100}$$

$$= 24.5\%$$

Use 25 percent. This value is then entered in Table S-6, page 3, column 19 and Table S-3, page 24, row 7, of the subbasin 207K data group.

Step 3: *Adjust XKSAT to reflect the effects of vegetation cover.* Refer to Table S-3, page 24.

$$C_k = 0.899 + 1.111(VCD) = 0.889 + 1.111 \left(\frac{25}{100} \right) = 1.17$$

XKSAT (adjusted) = (1.17) (0.19) = 0.22 inches per hour

Green-Ampt Parameter Calculations for Subbasin 207K - (continued)

Step 4: *Calculate the composite value of RTIMP (rock) for the subbasin.* Refer to Table S-3, page 24.

$$\text{RTIMP (composite)} = \frac{(35)(22.6) + (0)(53.9) + (0)(6.4)}{22.6 + 53.9 + 6.4} = 9.5\%$$

Use RTIMP = 9.5 percent. This value is then placed in column 16 of Table S-6.

Step 5: *Calculate the total percentages of Valley, Hillslope, and Mountain terrain classifications.* Refer to Table S-3, page 24.

$$\text{Hillslope (composite)} = \left(\frac{53.9 + 6.4}{22.6 + 53.9 + 6.4}\right)(100) = 72.7\%$$

Use 72.7 percent. The Valley and Mountain percentages are calculated in a similar manner. The resultant values are then placed in Table S-6, columns 6, 7 and 8.

Step 6: *Determine the DTHETA and PSIF parameters.* Refer to Table S-6, page 3. Use the log-averaged XKSAT value of 0.19 in column 2 to look up the values for DTHETA (dry), DTHETA (normal), and PSIF in Table S-1.

DTHETA (dry) = 0.38

DTHETA (normal) = 0.25

PSIF = 5.4 inches

These values are then placed in Table S-6, columns 3, 4 and 5, respectively. The PSIF value is also placed in Table S-9, column 7.

Step 7: *Calculate the percentage of urban area in the subbasin.* Refer to Table S-5, page 14. A land use polygon is considered "urban" if the identifier includes a "-F".

$$\text{Percent Urban} = \left(\frac{30.3}{13.6 + 32.7 + 0.8 + 0.9 + 30.3 + 0.1 + 4.7}\right) 100 = 36.5\%$$

This value is placed in Table S-6, column 9.

Green-Ampt Parameter Calculations for Subbasin 207K - (continued)

Step 8: *Calculate the urban percent impervious for the subbasin.* Refer to Table S-5, page 14. The percent impervious for each land use polygon is taken from Table S-4.

RTIMP (urban)

$$\frac{(0)(13.6)+(14)(32.7)+(16)(0.8)+(4)(0.9)+(45)(30.3)+(1)(0)+(0)(0.1)+(0)(4.7)}{13.6+32.7+0.8+0.9+30.3+0+0.1+4.7}$$

$$= 22.1\%$$

This value is placed in Table S-6, column 15.

Step 9: *Calculate the total percent impervious for the subbasin, including rock and urbanization.* Refer to Table S-6, page 3.

RTIMP (total) = [15]+[16] = 22.1 + 9.6 = 31.7%

Use RTIMP (total) = 31.7 percent. This value is placed in Table S-9, column 9.

Step 10: *Calculate the adjusted Valley, Hillslope, and Mountain percentages of the subbasin.* The adjustment is to subtract the "urban" area from the percentage of terrain class. Almost all "urban" area lies in a Hillslope terrain class. All of the Valley soils lie in wash bottoms so there should be little if any "urban" areas in the Valley terrain class. The adjustments are therefore made in the order Hillslope, Mountain, and Valley. Subbasin 207J is used for this example in order to show adjustments to both the Hillslope and Mountain percentages. Refer to Table S-6, page 3.

Hillslope = [7]-[9] = 3.0 - 16.2 = -13.2%
-13.2 < 0; therefore: Hillslope = 0 %

Mountain = [8]-([9]-[7]) = 97.0 - (16.2-3.0) = 83.8%
77.8% ≥ 0; therefore: Mountain = 83.8%

Valley = 0

These values are placed in Table S-6, columns 10, 11 and 12, respectively.

Green-Ampt Parameter Calculations for Subbasin 207K - (continued)

Step 11: *Calculate the weighted value of DTHETA, considering the "urban" and "natural" land use types.* Refer to Table S-6, page 3 (sub-basin 207K).

$$\text{DTHETA (weighted)} = \frac{[3]([10]+[11]+[12])+[4][9]}{100}$$

$$= \frac{(0.38)(36.2+27.3+0)+(0.25)(36.5)}{100}$$

$$= 0.33$$

Use DTHETA (weighted) = 0.33. This value is placed in Table S-6, page 3, column 18 and Table S-9, column 6.

Step 12: *Calculate the weighted Initial Abstraction, IA, in inches.* Refer to Table S-6, page 3.

IA (weighted)

$$= \frac{[12](0.35)+[10](0.15)+[11[(0.25)+([9]-[15])(0.10)+[15](0.05)}{100}$$

$$= \frac{(0)(0.35)+(36.2)(0.15)+(27.3)(0.25)+(36.5-22.1)(0.10)+(22.1)(0.05)}{100}$$

$$= 0.15 \text{ inches}$$

Use IA (weighted) = 0.15 inches. This value is placed in Table S-6, page 3, column 20 and Table S-9, column 5.

Time of Concentration Calculation for Subbasin 207K -

Step 1: *Estimate the average slope of the time of concentration (T_c) flow path. Refer to Table S-7, page 3.* The top and bottom elevations and the length of the T_c path are listed in columns 3, 4 and 5, respectively.

$$\text{Slope} = \frac{([3]-[4])}{[5]}$$

$$= \frac{2253.0-1908.2}{0.859}$$

$$= 401 \text{ feet per mile}$$

401 > 200, therefore the slope should be adjusted per Figure 5.4 of the Design Manual. The curve on Figure 5.4 can be simulated using the following expressions:

No adjustment for slope < 225
Slope (adjusted) = 133.800 ln (Slope) - 500.865 for
225 < slope < 400
Slope (adjusted) = 61.550 ln (Slope) - 74.683 for slope ≥ 400

The adjusted slope for subbasin 207K is therefore:

Slope (adjusted) = 61.550 ln (401) - 74.683 = 294 feet per mile

Time of Concentration Calculation for Subbasin 207K -

Step 2: *Calculate weighted K_b equation parameters m and b.* Refer to Table S-7, page 3. The weighting calculation is based on land use/terrain class percentages.

$$m(\text{weighted}) = \frac{[8](-0.01375)+[9](-0.025)+[10](-0.03)+[11](-0.00625)}{100}$$

$$= \frac{(0)(-0.01375)+(36.2)(-0.025)+(27.3)(-0.03)+(36.5)(-0.00625)}{100}$$

$$= -0.01952$$

$$b(\text{weighted}) = \frac{[8](0.08)+[9](0.15)+[10](0.20)+[11](0.04)}{100}$$

$$= \frac{(0)(0.08)+(36.2)(0.15)+(27.3)(0.20)+(36.5)(0.04)}{100}$$

$$= 0.1235$$

These values are placed in Table S-7, columns 12 and 13, respectively.

Step 3: *Calculate the value of K_b.* Refer to Table S-7, page 3.

$$K_b = m \log A + b = [12] \log [2] + [13]$$
$$= (-0.01952)(\log((0.12955)(640))) + 0.1235$$
$$= 0.086$$

Use $K_b = 0.09$. This value is placed in Table S-7, column 14.

Step 4: *Calculate the time of concentration, in hours.* The time of concentration equation in the Design Manual must be solved iteratively. This is accomplished using the MCUHP1 computer program supplied with the Design Manual. The resultant T_c value is placed in Table S-8a, column 23.

Time of Concentration Calculation for Subbasin 207K -

Step 5: *Establish a time-area relationship and calculate R.* The three synthetic dimensionless time-area relationships listed in Table 5.2 of the Design Manual are used as follows:

%Urbanized	Time-Area Curve
%Urban = 0	Natural
0% < % Urban < 50%	HEC-1 Default
% Urban ≥ 50%	Urban

Table S-7, column 11 is used to determine which curve applies to a given subbasin. The result is placed in Table S-9, column 10.

The storage coefficient, R, is calculated by MCUHP1. The result is placed in Table S-8, column 24. The duration of 90 percent of rainfall excess is placed in Table S-8, column 21 for comparison with the T_c value in column 22.

Table S-1

Green & Ampt Parameter Lookup Table
Using XKSAT

Note: The values in this table are taken from Figure 4.3 of the Drainage Design Manual.

[1] XKSAT	[2] DTHETA (Dry)	[3] DTHETA (Normal)	[4] PSIF
0.01	0.150	0.050	12.400
0.02	0.193	0.100	11.200
0.03	0.223	0.127	10.100
0.04	0.248	0.150	9.700
0.05	0.269	0.150	8.800
0.06	0.287	0.150	8.400
0.07	0.304	0.150	8.000
0.08	0.319	0.150	7.600
0.09	0.332	0.150	7.300
0.10	0.345	0.150	7.000
0.11	0.357	0.169	6.800
0.12	0.369	0.189	6.600
0.13	0.380	0.209	6.400
0.14	0.390	0.229	6.200
0.15	0.400	0.250	6.000
0.16	0.393	0.250	5.800
0.17	0.387	0.250	5.700
0.18	0.381	0.250	5.600
0.19	0.376	0.250	5.400
0.20	0.371	0.250	5.300
0.21	0.366	0.250	5.200
0.22	0.362	0.250	5.100
0.23	0.358	0.250	5.000
0.24	0.354	0.250	4.900
0.25	0.350	0.250	4.800
0.26	0.350	0.250	4.700
0.27	0.350	0.250	4.650
0.28	0.350	0.250	4.600
0.29	0.350	0.250	4.550
0.30	0.350	0.250	4.500
0.31	0.350	0.250	4.450
0.32	0.350	0.250	4.400
0.33	0.350	0.250	4.350
0.34	0.350	0.250	4.300
0.35	0.350	0.250	4.250
0.36	0.350	0.250	4.200
0.37	0.350	0.250	4.150
0.38	0.350	0.250	4.100
0.39	0.350	0.250	4.000
0.40	0.350	0.250	3.950

Table S-1

Green & Ampt Parameter Lookup Table Using XKSAT

[1] XKSAT	[2] DTHETA (Dry)	[3] DTHETA (Normal)	[4] PSIF
0.41	0.350	0.251	3.915
0.42	0.350	0.252	3.880
0.43	0.350	0.253	3.845
0.44	0.350	0.254	3.810
0.45	0.350	0.255	3.775
0.46	0.350	0.256	3.740
0.47	0.350	0.257	3.705
0.48	0.350	0.258	3.670
0.49	0.350	0.259	3.635
0.50	0.350	0.259	3.600
0.51	0.350	0.260	3.575
0.52	0.350	0.261	3.550
0.53	0.350	0.262	3.525
0.54	0.350	0.263	3.500
0.55	0.350	0.264	3.475
0.56	0.350	0.264	3.450
0.57	0.350	0.265	3.425
0.58	0.350	0.266	3.400
0.59	0.350	0.267	3.375
0.60	0.350	0.267	3.350
0.61	0.350	0.268	3.330
0.62	0.350	0.269	3.310
0.63	0.350	0.270	3.290
0.64	0.350	0.270	3.270
0.65	0.350	0.271	3.250
0.66	0.350	0.272	3.230
0.67	0.350	0.272	3.210
0.68	0.350	0.273	3.190
0.69	0.350	0.274	3.170
0.70	0.350	0.274	3.150
0.71	0.350	0.275	3.130
0.72	0.350	0.276	3.110
0.73	0.350	0.276	3.090
0.74	0.350	0.277	3.070
0.75	0.350	0.277	3.050
0.76	0.350	0.278	3.030
0.77	0.350	0.279	3.010
0.78	0.350	0.279	2.990
0.79	0.350	0.280	2.970
0.80	0.350	0.280	2.950

Table S-1

Green & Ampt Parameter Lookup Table
Using XKSAT

[1] XKSAT	[2] DTHETA (Dry)	[3] DTHETA (Normal)	[4] PSIF
0.81	0.350	0.281	2.935
0.82	0.350	0.282	2.920
0.83	0.350	0.282	2.905
0.84	0.350	0.283	2.890
0.85	0.350	0.283	2.875
0.86	0.350	0.284	2.860
0.87	0.350	0.284	2.845
0.88	0.350	0.285	2.830
0.89	0.350	0.285	2.815
0.90	0.350	0.286	2.800
0.91	0.350	0.287	2.785
0.92	0.350	0.287	2.770
0.93	0.350	0.288	2.755
0.94	0.350	0.288	2.740
0.95	0.350	0.289	2.725
0.96	0.350	0.289	2.710
0.97	0.350	0.290	2.695
0.98	0.350	0.290	2.680
0.99	0.350	0.291	2.665
1.00	0.350	0.291	2.650
1.01	0.350	0.292	2.640
1.02	0.350	0.292	2.630
1.03	0.350	0.292	2.620
1.04	0.350	0.293	2.610
1.05	0.350	0.293	2.600
1.06	0.350	0.294	2.590
1.07	0.350	0.294	2.580
1.08	0.350	0.295	2.570
1.09	0.350	0.295	2.560
1.10	0.350	0.296	2.550
1.11	0.350	0.296	2.540
1.12	0.350	0.297	2.530
1.13	0.350	0.297	2.520
1.14	0.350	0.297	2.510
1.15	0.350	0.298	2.500
1.16	0.350	0.298	2.490
1.17	0.350	0.299	2.480
1.18	0.350	0.299	2.470
1.19	0.350	0.300	2.460
1.20	0.350	0.300	2.450

Table S-2

Summary
of
Green & Ampt Parameters by SCS Map Unit

[1] SCS Soil Map Unit	[2] XKSAT (Unadj)	[3] PSIF	[4] DTHETA (Dry)	[5] DTHETA (Normal)	[6] RTIMP	[7] Slope Range (%)	[8] Terrain Class	[9] Soil Texture	[10] Runoff Characteristic
8	0.96	2.71	0.35	0.29	0%	0-3	Valley	Loamy Sand	slow
31	0.33	4.35	0.35	0.25	35%	25-65	Mountain	Sandy Loam	moderate to high
36	0.07	8.00	0.30	0.15	0%	1-8	Hillslope	Sandy Clay Loam	slow
40	0.17	5.70	0.39	0.25	0%	3-20	Hillslope	Sandy Loam/Sandy Clay Loam	medium
41	0.17	5.70	0.39	0.25	0%	20-40	Hillslope	Sandy Loam/Sandy Clay Loam	medium to rapid
61	0.15	6.00	0.40	0.25	0%	1-10	Hillslope	Clay Loam/Sandy Loam	slow to medium
63	0.14	6.20	0.39	0.23	25%	10-65	Hillslope	Clay Loam/Sandy Loam	medium to rapid
66	0.23	5.00	0.36	0.25	0%	1-7	Hillslope	Sandy Loam/Sandy Clay Loam	slow to medium
93	0.33	4.35	0.35	0.25	0%	8-30	Hillslope	Sandy Loam/Loam	medium
96	0.07	8.00	0.30	0.15	0%	1-10	Hillslope	Sandy Clay/Sandy Clay Loam	slow

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

201A

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	138.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
21% ... Vegetation Cover Density (VCD) in percent
1.12 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.19 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.217**

201B

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	51.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
25% ... Vegetation Cover Density (VCD) in percent
1.17 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.081**

201C

Soil Map Unit No. ...	40	41	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.1	49.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
33% ... Vegetation Cover Density (VCD) in percent
1.26 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.079**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

201D

Soil Map Unit No. ...	41	93	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	45.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.33	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
26% ... Vegetation Cover Density (VCD) in percent
1.18 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.071**

201E

Soil Map Unit No. ...	40	41	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.1	99.7	17.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
38% ... Vegetation Cover Density (VCD) in percent
1.31 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.25 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.183**

202A

Soil Map Unit No. ...	40	41	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.4	0.7	23.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.32 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.39 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.038**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

202B

Soil Map Unit No. ...	40	41	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	2.2	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.29 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.36 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.018**

202C

Soil Map Unit No. ...	93	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.41 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.008**

202D

Soil Map Unit No. ...	40	41	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	17.0	17.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.063**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

202E

Soil Map Unit No. ...	40	41	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	11.7	52.4	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
31% ... Vegetation Cover Density (VCD) in percent
1.23 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.22 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.104**

202F

Soil Map Unit No. ...	41	93	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	7.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.33	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
31% ... Vegetation Cover Density (VCD) in percent
1.23 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.013**

202G

Soil Map Unit No. ...	41	66	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	8.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.23	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
31% ... Vegetation Cover Density (VCD) in percent
1.23 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.013**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

202H

Soil Map Unit No. ...	41	66	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	54.9	39.5	20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.23	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.21 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.27 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.179**

202I

Soil Map Unit No. ...	40	41	66	93	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	5.3	0.6	0.8	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.23	0.33	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.23 ... XKSAT (Log averaged)
29% ... Vegetation Cover Density (VCD) in percent
1.21 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.28 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.017**

203A

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	8.4	170.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
29% ... Vegetation Cover Density (VCD) in percent
1.21 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.279**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

203B

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	2.9	25.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.044**

203C

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.103**

203D

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.3	68.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.108**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

203E

Soil Map Unit No. ...	40	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	6.3	33.2	20.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.13 ... XKSAT (Log averaged)
23% ... Vegetation Cover Density (VCD) in percent
1.14 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.14 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.093**

203F

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	5.3	208.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.333**

203G

Soil Map Unit No. ...	41	96	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	144.5	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.07	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.16 ... XKSAT (Log averaged)
27% ... Vegetation Cover Density (VCD) in percent
1.19 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.19 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.248**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

203H

Soil Map Unit No. ...	40	41	66	93	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.1	100.1	8.7	23.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.23	0.33	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.20 ... XKSAT (Log averaged)
19% ... Vegetation Cover Density (VCD) in percent
1.10 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.207**

203I

Soil Map Unit No. ...	40	41	66	93	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	15.5	15.7	20.2	57.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.23	0.33	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.26 ... XKSAT (Log averaged)
25% ... Vegetation Cover Density (VCD) in percent
1.17 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.30 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.171**

203J

Soil Map Unit No. ...	40	66	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	16.1	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.23	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
20% ... Vegetation Cover Density (VCD) in percent
1.11 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.039**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

203K

Soil Map Unit No. ...	40	66	93	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	81.8	17.4	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.23	0.33	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.18 ... XKSAT (Log averaged)
16% ... Vegetation Cover Density (VCD) in percent
1.07 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.160**

204A

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	68.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
21% ... Vegetation Cover Density (VCD) in percent
1.12 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.19 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.108**

204B

Soil Map Unit No. ...	8	40	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.5	78.8	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
29% ... Vegetation Cover Density (VCD) in percent
1.21 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.7% ... Terrain = Valley (composite)
99.3% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.126**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

204C

Soil Map Unit No. ...	40	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	49.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
24% ... Vegetation Cover Density (VCD) in percent
1.16 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.077**

204D

Soil Map Unit No. ...	40	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	28.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.044**

204E

Soil Map Unit No. ...	40	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	45.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
17% ... Vegetation Cover Density (VCD) in percent
1.08 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.071**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

204F

Soil Map Unit No. ...	36	40	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	28.2	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.07	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.10 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.11 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.077**

205A

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	75.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.118**

205B

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	135.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.211**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

205C

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	37.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
31% ... Vegetation Cover Density (VCD) in percent
1.23 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.41 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.059**

205D

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	204.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.319**

205E

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	139.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.218**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

205F

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	103.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
31% ... Vegetation Cover Density (VCD) in percent
1.23 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.41 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.161**

205G

Soil Map Unit No. ...	31	61	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	105.9	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.15	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.30 ... XKSAT (Log averaged)
38% ... Vegetation Cover Density (VCD) in percent
1.31 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
31.2% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
10.8% ... Terrain = Hillside (composite)
89.2% ... Terrain = Mountain (composite) **Total area in square miles = 0.185**

205H

Soil Map Unit No. ...	31	61	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	150.3	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.15	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.31 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.39 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
31.6% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
9.9% ... Terrain = Hillside (composite)
90.1% ... Terrain = Mountain (composite) **Total area in square miles = 0.261**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

205I

Soil Map Unit No. ...	8	31	40	61	96	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	3.0	98.2	17.4	104.2	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.33	0.17	0.15	0.07	---	---	---	---	---	---	---
% Rock ...	0%	35%	0%	0%	0%	---	---	---	---	---	---	---
Terrain Class ...	Valley	Mountain	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---

0.22 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.28 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
15.2% ... RTIMP (Composite)
1.3% ... Terrain = Valley (composite)
55.3% ... Terrain = Hillside (composite)
43.4% ... Terrain = Mountain (composite) **Total area in square miles = 0.354**

205J

Soil Map Unit No. ...	8	31	41	61	96	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	58.1	23.5	93.4	34.9	26.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.33	0.17	0.15	0.07	---	---	---	---	---	---	---
% Rock ...	0%	35%	0%	0%	0%	---	---	---	---	---	---	---
Terrain Class ...	Valley	Mountain	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---

0.25 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.30 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
3.5% ... RTIMP (Composite)
24.6% ... Terrain = Valley (composite)
65.5% ... Terrain = Hillside (composite)
9.9% ... Terrain = Mountain (composite) **Total area in square miles = 0.369**

205K

Soil Map Unit No. ...	8	31	40	41	93	96	96	0	0	0	0	0
Soil Map Unit Area(ac) ...	4.5	6.9	19.2	125.0	0.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.33	0.17	0.17	0.33	0.07	0.07	---	---	---	---	---
% Rock ...	0%	35%	0%	0%	0%	0%	0%	---	---	---	---	---
Terrain Class ...	Valley	Mountain	Hillslope	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---

0.18 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.22 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
1.5% ... RTIMP (Composite)
2.8% ... Terrain = Valley (composite)
92.7% ... Terrain = Hillside (composite)
4.4% ... Terrain = Mountain (composite) **Total area in square miles = 0.245**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

205L

Soil Map Unit No. ...	8	41	93	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	15.6	31.0	14.7	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.33	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.23 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.29 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
20.7% ... Terrain = Valley (composite)
79.3% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.118**

205M

Soil Map Unit No. ...	8	41	93	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	16.0	51.5	2.9	18.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.33	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.20 ... XKSAT (Log averaged)
21% ... Vegetation Cover Density (VCD) in percent
1.12 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.22 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
18.0% ... Terrain = Valley (composite)
82.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.139**

205N

Soil Map Unit No. ...	8	40	41	93	96	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	1.1	14.7	63.0	13.6	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.33	0.07	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	0%	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---

0.18 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
1.1% ... Terrain = Valley (composite)
98.9% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.156**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

206A

Soil Map Unit No. ...	8	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	11.2	68.1	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.21 ... XKSAT (Log averaged)
18% ... Vegetation Cover Density (VCD) in percent
1.09 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
13.7% ... Terrain = Valley (composite)
86.3% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.128**

206B

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	12.5	6.4	33.7	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.21 ... XKSAT (Log averaged)
16% ... Vegetation Cover Density (VCD) in percent
1.07 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
20.4% ... Terrain = Valley (composite)
79.6% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.095**

206C

Soil Map Unit No. ...	8	40	41	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	6.1	0.6	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.34 ... XKSAT (Log averaged)
25% ... Vegetation Cover Density (VCD) in percent
1.17 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
39.8% ... Terrain = Valley (composite)
60.2% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.024**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

206D

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	32.1	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
16% ... Vegetation Cover Density (VCD) in percent
1.07 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.062**

206E

Soil Map Unit No. ...	8	40	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	5.9	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	---	---	---	---	---	---	---	---	---	---

0.34 ... XKSAT (Log averaged)
25% ... Vegetation Cover Density (VCD) in percent
1.16 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
40.6% ... Terrain = Valley (composite)
59.4% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.023**

206F

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	34.2	10.9	48.2	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.29 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.35 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
34.0% ... Terrain = Valley (composite)
66.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.157**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

206G

Soil Map Unit No. ...	8	40	41	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	7.4	49.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.21 ... XKSAT (Log averaged)
27% ... Vegetation Cover Density (VCD) in percent
1.19 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.25 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
13.0% ... Terrain = Valley (composite)
87.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.089**

206H

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	37.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
22% ... Vegetation Cover Density (VCD) in percent
1.13 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.19 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.059**

206I

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
23% ... Vegetation Cover Density (VCD) in percent
1.14 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.19 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.021**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

206J

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.060**

206K

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	35.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
29% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.056**

206L

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	38.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.060**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

206M

Soil Map Unit No. ...	8	40	41	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	5.4	0.0	32.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.22 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
14.0% ... Terrain = Valley (composite)
86.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.060**

206N

Soil Map Unit No. ...	8	40	41	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	26.7	39.3	31.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.27 ... XKSAT (Log averaged)
16% ... Vegetation Cover Density (VCD) in percent
1.07 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.29 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
27.5% ... Terrain = Valley (composite)
72.5% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.152**

207A

Soil Map Unit No. ...	31	40	61	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	139.6	23.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.15	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.30 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.37 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
29.8% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
14.8% ... Terrain = Hillside (composite)
85.2% ... Terrain = Mountain (composite) **Total area in square miles = 0.256**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

207B

Soil Map Unit No. ...	31	40	61	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	123.5	8.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.15	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.31 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.38 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
32.4% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
7.4% ... Terrain = Hillside (composite)
92.6% ... Terrain = Mountain (composite) **Total area in square miles = 0.208**

207C

Soil Map Unit No. ...	31	40	61	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	43.3	7.5	59.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.15	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.21 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.26 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
13.7% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
60.9% ... Terrain = Hillside (composite)
39.1% ... Terrain = Mountain (composite) **Total area in square miles = 0.173**

207D

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	126.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.197**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

207E

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	100.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.42 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.157**

207F

Soil Map Unit No. ...	31	61	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	77.7	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.15	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.32 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.41 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
33.7% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
3.8% ... Terrain = Hillside (composite)
96.2% ... Terrain = Mountain (composite) **Total area in square miles = 0.126**

207G

Soil Map Unit No. ...	31	40	41	61	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	35.4	0.0	48.0	67.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.17	0.15	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
29% ... Vegetation Cover Density (VCD) in percent
1.21 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
8.2% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
76.6% ... Terrain = Hillside (composite)
23.4% ... Terrain = Mountain (composite) **Total area in square miles = 0.236**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

207H

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	79.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.124**

207I

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	46.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.073**

207J

Soil Map Unit No. ...	31	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	57.6	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.32 ... XKSAT (Log averaged)
29% ... Vegetation Cover Density (VCD) in percent
1.21 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.39 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
34.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
3.0% ... Terrain = Hillside (composite)
97.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.093**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

207K

Soil Map Unit No. ...	31	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	22.6	53.9	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
25% ... Vegetation Cover Density (VCD) in percent
1.16 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.22 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
9.6% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
72.7% ... Terrain = Hillside (composite)
27.3% ... Terrain = Mountain (composite) **Total area in square miles = 0.130**

207L

Soil Map Unit No. ...	41	96	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	45.4	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.07	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.15 ... XKSAT (Log averaged)
20% ... Vegetation Cover Density (VCD) in percent
1.11 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.17 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.080**

207M

Soil Map Unit No. ...	8	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	2.2	59.7	12.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.15 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.19 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
3.0% ... Terrain = Valley (composite)
97.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.116**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

207N

Soil Map Unit No. ...	8	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	8.3	21.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.25 ... XKSAT (Log averaged)
34% ... Vegetation Cover Density (VCD) in percent
1.27 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.32 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
26.2% ... Terrain = Valley (composite)
73.8% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.049**

207O

Soil Map Unit No. ...	8	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	12.2	57.5	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
14.6% ... Terrain = Valley (composite)
85.4% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.131**

208A

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	88.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.139**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208B

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.42 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.027**

208C

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	42.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.066**

208D

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	47.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.42 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.075**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208E

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	39.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.41 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.062**

208F

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	44.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.41 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.069**

208G

Soil Map Unit No. ...	31	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	66.1	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.29 ... XKSAT (Log averaged)
27% ... Vegetation Cover Density (VCD) in percent
1.19 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.34 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
27.9% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
20.2% ... Terrain = Hillside (composite)
79.8% ... Terrain = Mountain (composite) **Total area in square miles = 0.129**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208H

Soil Map Unit No. ...	31	41	63	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	4.9	20.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.14	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	25%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
8.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
82.2% ... Terrain = Hillside (composite)
17.8% ... Terrain = Mountain (composite) **Total area in square miles = 0.043**

208I

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	74.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.42 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.117**

208J

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.42 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.081**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208K

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	30.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
37% ... Vegetation Cover Density (VCD) in percent
1.30 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.43 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.048**

208L

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	37.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
37% ... Vegetation Cover Density (VCD) in percent
1.30 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.43 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.059**

208M

Soil Map Unit No. ...	31	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	98.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.32 ... XKSAT (Log averaged)
37% ... Vegetation Cover Density (VCD) in percent
1.30 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.42 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
34.7% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
3.5% ... Terrain = Hillside (composite)
96.5% ... Terrain = Mountain (composite) **Total area in square miles = 0.159**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208N

Soil Map Unit No. ...	31	41	63	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.2	1.6	28.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.14	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	25%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.14 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.17 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
23.7% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
99.4% ... Terrain = Hillside (composite)
0.6% ... Terrain = Mountain (composite) **Total area in square miles = 0.047**

208O

Soil Map Unit No. ...	31	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	124.9	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.29 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.37 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
33.5% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
15.1% ... Terrain = Hillside (composite)
84.9% ... Terrain = Mountain (composite) **Total area in square miles = 0.230**

208P

Soil Map Unit No. ...	31	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	9.6	27.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
27.6% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
74.3% ... Terrain = Hillside (composite)
25.7% ... Terrain = Mountain (composite) **Total area in square miles = 0.058**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208Q

Soil Map Unit No. ...	31	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	36.2	24.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.23 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.28 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
31.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
40.1% ... Terrain = Hillside (composite)
59.9% ... Terrain = Mountain (composite) **Total area in square miles = 0.094**

208R

Soil Map Unit No. ...	63	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.14	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	25%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.14 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.17 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
25.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.010**

208S

Soil Map Unit No. ...	63	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	43.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.14	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	25%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.14 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.17 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
25.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.068**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208T

Soil Map Unit No. ...	31	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	40.5	43.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.21 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.27 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
29.8% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
52.0% ... Terrain = Hillside (composite)
48.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.132**

208U

Soil Map Unit No. ...	31	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	35.8	49.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.20 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.26 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
29.2% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
58.1% ... Terrain = Hillside (composite)
41.9% ... Terrain = Mountain (composite) **Total area in square miles = 0.134**

208V

Soil Map Unit No. ...	63	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.14	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	25%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.14 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.17 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
25.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.028**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

208W

Soil Map Unit No. ...	41	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	9.4	22.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.15 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
17.7% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.050**

208X

Soil Map Unit No. ...	8	41	63	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	6.1	10.1	31.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.14	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	25%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.23 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
16.5% ... RTIMP (Composite)
12.6% ... Terrain = Valley (composite)
87.4% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.075**

209A

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	235.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.368**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

209B

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	53.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.083**

209C

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	40.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.064**

209D

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	156.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.42 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.244**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

209E

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.149**

209F

Soil Map Unit No. ...	31	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	127.7	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.31 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.39 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
30.9% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
11.6% ... Terrain = Hillside (composite)
88.4% ... Terrain = Mountain (composite) **Total area in square miles = 0.226**

209G

Soil Map Unit No. ...	31	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	130.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	---	---	---	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.40 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
35.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
0.0% ... Terrain = Hillside (composite)
100.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.204**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

209H

Soil Map Unit No. ...	31	41	63	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	14.4	20.2	18.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.14	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	25%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.19 ... XKSAT (Log averaged)
35% ... Vegetation Cover Density (VCD) in percent
1.28 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.24 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
18.3% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
73.1% ... Terrain = Hillside (composite)
26.9% ... Terrain = Mountain (composite) **Total area in square miles = 0.083**

209I

Soil Map Unit No. ...	31	41	61	63	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	2.8	34.3	58.8	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.15	0.14	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	0%	25%	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.16 ... XKSAT (Log averaged)
22% ... Vegetation Cover Density (VCD) in percent
1.13 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
5.3% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
97.6% ... Terrain = Hillside (composite)
2.4% ... Terrain = Mountain (composite) **Total area in square miles = 0.182**

210A

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	19.7	5.3	42.2	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.23 ... XKSAT (Log averaged)
26% ... Vegetation Cover Density (VCD) in percent
1.18 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.27 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
25.1% ... Terrain = Valley (composite)
74.9% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.123**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

210B

Soil Map Unit No. ...	41	63	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	56.9	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.14	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	25%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.16 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
4.2% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.107**

210C

Soil Map Unit No. ...	8	40	41	63	96	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	16.8	0.2	18.6	11.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.14	0.07	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	25%	0%	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---

0.26 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.32 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
5.3% ... RTIMP (Composite)
32.1% ... Terrain = Valley (composite)
67.9% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.082**

210D

Soil Map Unit No. ...	31	41	63	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	29.6	15.5	25.3	18.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.14	0.07	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	25%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
26% ... Vegetation Cover Density (VCD) in percent
1.18 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
18.7% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
66.9% ... Terrain = Hillside (composite)
33.1% ... Terrain = Mountain (composite) **Total area in square miles = 0.140**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

210E

Soil Map Unit No. ...	41	96	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	9.7	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.07	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.11 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.14 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.028**

210F

Soil Map Unit No. ...	31	96	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	58.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.07	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.32 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.39 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
34.4% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
1.6% ... Terrain = Hillside (composite)
98.4% ... Terrain = Mountain (composite) **Total area in square miles = 0.093**

210G

Soil Map Unit No. ...	31	96	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	71.5	31.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.07	---	---	---	---	---	---	---	---	---	---
% Rock ...	35%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	---	---	---	---	---	---	---	---	---	---

0.20 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.25 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
24.2% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
30.8% ... Terrain = Hillside (composite)
69.2% ... Terrain = Mountain (composite) **Total area in square miles = 0.162**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

210H

Soil Map Unit No. ...	31	40	61	63	96	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	6.5	6.7	20.9	2.9	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.33	0.17	0.15	0.14	0.07	---	---	---	---	---	---	---
% Rock ...	35%	0%	0%	25%	0%	---	---	---	---	---	---	---
Terrain Class ...	Mountain	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---

0.15 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.19 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
6.7% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
85.4% ... Terrain = Hillside (composite)
14.6% ... Terrain = Mountain (composite) **Total area in square miles = 0.070**

210I

Soil Map Unit No. ...	40	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	4.7	4.1	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.09 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.11 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.049**

210J

Soil Map Unit No. ...	8	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.6	39.2	26.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.12 ... XKSAT (Log averaged)
32% ... Vegetation Cover Density (VCD) in percent
1.24 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.15 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.9% ... Terrain = Valley (composite)
99.1% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.103**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

210K

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	6.5	6.6	5.7	30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.12 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.15 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
13.1% ... Terrain = Valley (composite)
86.9% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.077**

210L

Soil Map Unit No. ...	8	40	41	61	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	13.6	23.9	36.2	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.15	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.22 ... XKSAT (Log averaged)
34% ... Vegetation Cover Density (VCD) in percent
1.27 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.28 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
15.5% ... Terrain = Valley (composite)
84.5% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.137**

210M

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	16.4	50.4	0.1	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.16 ... XKSAT (Log averaged)
29% ... Vegetation Cover Density (VCD) in percent
1.21 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
15.8% ... Terrain = Valley (composite)
84.2% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.162**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

210N

Soil Map Unit No. ...	8	40	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	17.6	7.4	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.38 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.46 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
56.5% ... Terrain = Valley (composite)
43.5% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.049**

211A

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	91.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
31% ... Vegetation Cover Density (VCD) in percent
1.23 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.143**

211B

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	69.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
30% ... Vegetation Cover Density (VCD) in percent
1.22 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.109**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211C

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	2.5	0.2	20.5	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
9.1% ... Terrain = Valley (composite)
90.9% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.043**

211D

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	25.1	11.7	7.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.44 ... XKSAT (Log averaged)
21% ... Vegetation Cover Density (VCD) in percent
1.12 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.49 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
55.6% ... Terrain = Valley (composite)
44.4% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.071**

211E

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	22.6	34.3	29.6	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.22 ... XKSAT (Log averaged)
16% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.24 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
22.7% ... Terrain = Valley (composite)
77.3% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.156**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211F

Soil Map Unit No. ...	8	36	40	41	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	29.5	0.4	23.0	19.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.07	0.17	0.17	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.34 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.36 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
40.9% ... Terrain = Valley (composite)
59.1% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.113**

211G

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	1.3	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.008**

211H

Soil Map Unit No. ...	40	41	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	41.8	0.2	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.15 ... XKSAT (Log averaged)
26% ... Vegetation Cover Density (VCD) in percent
1.18 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.073**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211I

Soil Map Unit No. ...	40	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	26.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
24% ... Vegetation Cover Density (VCD) in percent
1.16 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.041**

211J

Soil Map Unit No. ...	40	96	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	8.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.07	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.15 ... XKSAT (Log averaged)
26% ... Vegetation Cover Density (VCD) in percent
1.17 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.015**

211K

Soil Map Unit No. ...	8	40	96	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	14.6	14.1	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.07	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.15 ... XKSAT (Log averaged)
26% ... Vegetation Cover Density (VCD) in percent
1.17 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
22.4% ... Terrain = Valley (composite)
77.6% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.102**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211L

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	26.7	25.0	4.2	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.33 ... XKSAT (Log averaged)
17% ... Vegetation Cover Density (VCD) in percent
1.07 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.36 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
43.6% ... Terrain = Valley (composite)
56.4% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.096**

211M

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	39.7	12.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
31% ... Vegetation Cover Density (VCD) in percent
1.23 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.21 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.081**

211N

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	3.1	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
27% ... Vegetation Cover Density (VCD) in percent
1.19 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.020**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211O

Soil Map Unit No. ...	40	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
27% ... Vegetation Cover Density (VCD) in percent
1.19 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.041**

211P

Soil Map Unit No. ...	8	40	41	96	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	0.7	6.6	0.5	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.17	0.17	0.07	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.10 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.11 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
3.3% ... Terrain = Valley (composite)
96.7% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.033**

211Q

Soil Map Unit No. ...	41	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	13.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.021**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211R

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	8.4	45.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
28% ... Vegetation Cover Density (VCD) in percent
1.20 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.084**

211S

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	10.6	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
26% ... Vegetation Cover Density (VCD) in percent
1.18 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.050**

211T

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	20.3	22.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
27% ... Vegetation Cover Density (VCD) in percent
1.18 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.20 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.066**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211U

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	3.8	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.027**

211V

Soil Map Unit No. ...	40	41	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	3.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.005**

211W

Soil Map Unit No. ...	40	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.17	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.17 ... XKSAT (Log averaged)
17% ... Vegetation Cover Density (VCD) in percent
1.08 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.030**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211X

Soil Map Unit No. ...	8	36	40	41	96	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	35.7	10.2	88.9	0.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.07	0.17	0.17	0.07	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	0%	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---

0.25 ... XKSAT (Log averaged)
18% ... Vegetation Cover Density (VCD) in percent
1.09 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.27 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
26.0% ... Terrain = Valley (composite)
74.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.214**

211Y

Soil Map Unit No. ...	8	36	40	41	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	3.0	27.2	24.1	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.07	0.17	0.17	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	0%	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---

0.12 ... XKSAT (Log averaged)
24% ... Vegetation Cover Density (VCD) in percent
1.16 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.14 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
5.2% ... Terrain = Valley (composite)
94.8% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.089**

211Z

Soil Map Unit No. ...	8	36	40	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	24.8	13.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.07	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.31 ... XKSAT (Log averaged)
19% ... Vegetation Cover Density (VCD) in percent
1.09 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.34 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
47.0% ... Terrain = Valley (composite)
53.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.083**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211AA

Soil Map Unit No. ...	36	40	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	7.8	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.07	0.17	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---	---

0.12 ... XKSAT (Log averaged)
19% ... Vegetation Cover Density (VCD) in percent
1.10 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.14 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.034**

211AB

Soil Map Unit No. ...	36	40	41	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	11.0	14.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.07	0.17	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.12 ... XKSAT (Log averaged)
22% ... Vegetation Cover Density (VCD) in percent
1.14 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.13 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.040**

211AC

Soil Map Unit No. ...	36	0	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.07	---	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	---	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	---	---	---	---	---	---	---	---	---	---	---

0.07 ... XKSAT (Log averaged)
15% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.07 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.027**

Table S-3
XKSAT and Terrain Classifications by Subbasin
Existing Condition

211AD

Soil Map Unit No. ...	36	40	41	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	23.3	3.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.07	0.17	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.08 ... XKSAT (Log averaged)
16% ... Vegetation Cover Density (VCD) in percent
1.06 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.08 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.041**

211AE

Soil Map Unit No. ...	8	36	0	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	5.5	16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.96	0.07	---	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	---	---	---	---	---	---	---	---	---	---
Terrain Class ...	Valley	Hillslope	---	---	---	---	---	---	---	---	---	---

0.14 ... XKSAT (Log averaged)
17% ... Vegetation Cover Density (VCD) in percent
1.08 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.15 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
25.1% ... Terrain = Valley (composite)
74.9% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.034**

211AF

Soil Map Unit No. ...	36	40	41	0	0	0	0	0	0	0	0	0
Soil Map Unit Area(ac) ...	1.3	30.1	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XKSAT(Unadj) ...	0.07	0.17	0.17	---	---	---	---	---	---	---	---	---
% Rock ...	0%	0%	0%	---	---	---	---	---	---	---	---	---
Terrain Class ...	Hillslope	Hillslope	Hillslope	---	---	---	---	---	---	---	---	---

0.16 ... XKSAT (Log averaged)
19% ... Vegetation Cover Density (VCD) in percent
1.10 ... Ck: 0.889+1.111*VCD - Applied EXCEPT for XKSAT>=1.2 & VCD<=10%

0.18 ... XKSAT (Adj. for VCD using Ck=XKSAT(adj)/XKSAT(unadj))
0.0% ... RTIMP (Composite)
0.0% ... Terrain = Valley (composite)
100.0% ... Terrain = Hillside (composite)
0.0% ... Terrain = Mountain (composite) **Total area in square miles = 0.053**

Table S-4

Land Use Identifiers and Percent Impervious Estimates

Landuse Code	Description	Fountain Hills Zoning Classifications	Percent Impervious
VLDR	Very Low Density Residential	Rural-190, Rural-43	15
LDR	Light Density Residential	R1-35, R1-18	25
MDR	Medium Density Residential	R1-10, R1-8, R1-6	45
MFR	Multi-Family Residential	R-2, R-3, R-4, R-5,	65
C	Commercial	C-S, C-O, C-1, C-2, C-3	75
I	Industrial	IND-1, IND-2, IND-3	90
School	Schools	C-1	varies
DE	Drainage Easement (width > 50')	N/A	0
RW	Street Right-of-Way	N/A	90
ND	Natural Desert	N/A	0

Qualifiers:

-F	Fully developed
-P	Less than 50% developed
-N	Undeveloped (natural)
(##)	Value in parenthesis is estimated % impervious

Example: VLDR-P(23) indicates a partially developed VLDR land use with an estimated average percent impervious value of 23% for the entire parcel.

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

201A	Land Use Identifier ...	LDR-N	ND	0	0	0	0	0	0
	Land Use Area(ac) ...	44.0	94.6	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2166**

201B	Land Use Identifier ...	LDR-N	ND	0	0	0	0	0	0
	Land Use Area(ac) ...	3.8	47.8	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0807**

201C	Land Use Identifier ...	LDR-N	ND	0	0	0	0	0	0
	Land Use Area(ac) ...	48.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0786**

201D	Land Use Identifier ...	LDR-N	ND	0	0	0	0	0	0
	Land Use Area(ac) ...	15.9	29.5	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0709**

201E	Land Use Identifier ...	C-P(7)	LDR-N	ND	0	0	0	0	0
	Land Use Area(ac) ...	2.0	33.2	81.9	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	7%	0%	0%	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.1% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1831**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

202A	Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	2.2	22.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	7%	7%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
7.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0378**

202B	Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	0.9	10.6	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	7%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0179**

202C	Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	1.3	3.6	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	7%	7%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
7.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0077**

202D	Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	2.4	37.6	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	7%	7%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
7.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0626**

202E	Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	2.5	64.1	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	7%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1041**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

202F

Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	2.2	6.2	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
1.8% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0131**

202G

Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	1.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
1.5% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0132**

202H

Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	4.3	110.5	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1794**

202I

Land Use Identifier ...	C-P(7)	MDR-F	0	0	0	0	0	0
Land Use Area(ac) ...	10.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	45%	—	—	—	—	—	—
Land Use Char. ...	Natural	Urban	—	—	—	—	—	—
Urban Area ...	—	0.7	—	—	—	—	—	—

6.1% ... Percent Urban — **Urban area in square miles = 0.0011**
9.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0175**

203A

Land Use Identifier ...	DE	LDR-F	MDR-F	MDR-P(22)	ND	0	0	0
Land Use Area(ac) ...	14.4	24.4	1.3	3.5	135.1	0.0	0.0	0.0
Percent Impervious ...	0%	25%	45%	22%	0%	—	—	—
Land Use Char. ...	Natural	Urban	Urban	Natural	Natural	—	—	—
Urban Area ...	—	24.4	1.3	—	—	—	—	—

14.4% ... Percent Urban — **Urban area in square miles = 0.0401**
4.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2792**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

203B	Land Use Identifier ...	DE	LDR-F	LDR-N	MDR-F	0	0	0	0
	Land Use Area(ac) ...	3.1	4.0	20.4	0.9	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	25%	0%	45%	—	—	—	—
	Land Use Char. ...	Natural	Urban	Natural	Urban	—	—	—	—
	Urban Area ...	—	4.0	—	0.9	—	—	—	—
	17.4%	**... Percent Urban**					**Urban area in square miles =**		**0.0077**
	5.0%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0445**
203C	Land Use Identifier ...	LDR-F	LDR-N	MDR-P(22)	ND	0	0	0	0
	Land Use Area(ac) ...	0.2	17.6	10.1	38.2	0.0	0.0	0.0	0.0
	Percent Impervious ...	25%	22%	22%	0%	—	—	—	—
	Land Use Char. ...	Urban	Natural	Natural	Natural	—	—	—	—
	Urban Area ...	0.2	—	—	—	—	—	—	—
	0.3%	**... Percent Urban**					**Urban area in square miles =**		**0.0003**
	9.3%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.1031**
203D	Land Use Identifier ...	LDR-N	ND	0	0	0	0	0	0
	Land Use Area(ac) ...	23.8	45.3	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0%	**... Percent Urban**					**Urban area in square miles =**		**0.0000**
	0.0%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.1080**
203E	Land Use Identifier ...	LDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	59.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0%	**... Percent Urban**					**Urban area in square miles =**		**0.0000**
	0.0%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0934**
203F	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	213.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0%	**... Percent Urban**					**Urban area in square miles =**		**0.0000**
	0.0%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.3333**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

203G

Land Use Identifier ...	LDR-N	ND	0	0	0	0	0	0
Land Use Area(ac) ...	58.5	100.3	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2482**

203H

Land Use Identifier ...	LDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	132.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2068**

203I

Land Use Identifier ...	C-P(7)	LDR-N	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	9.0	100.2	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	0%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	0.0	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0001**
0.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1707**

203J

Land Use Identifier ...	C-P(7)	LDR-N	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	18.1	2.5	4.2	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	0%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	4.2	—	—	—	—	—

16.8% ... Percent Urban — **Urban area in square miles = 0.0065**
12.7% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0389**

203K

Land Use Identifier ...	C-P(7)	DE	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	5.2	3.5	93.9	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	0%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	93.9	—	—	—	—	—

91.6% ... Percent Urban — **Urban area in square miles = 0.1467**
41.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1602**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

204A

Land Use Identifier ...	LDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	68.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1077**

204B

Land Use Identifier ...	C-P(7)	LDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	2.7	78.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	7%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1260**

204C

Land Use Identifier ...	C-P(24)	C-P(7)	MDR-F	MFR-P(35)	0	0	0	0
Land Use Area(ac) ...	12.8	15.6	10.7	10.0	0.0	0.0	0.0	0.0
Percent Impervious ...	24%	7%	45%	35%	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	Natural	—	—	—	—
Urban Area ...	—	—	10.7	—	—	—	—	—

21.8% ... Percent Urban — **Urban area in square miles = 0.0168**
25.4% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0767**

204D

Land Use Identifier ...	C-P(24)	MDR-F	MFR-P(35)	0	0	0	0	0
Land Use Area(ac) ...	2.0	16.7	9.5	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	24%	45%	35%	—	—	—	—	—
Land Use Char. ...	Natural	Urban	Natural	—	—	—	—	—
Urban Area ...	—	16.7	—	—	—	—	—	—

59.2% ... Percent Urban — **Urban area in square miles = 0.0261**
40.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0441**

204E

Land Use Identifier ...	C-P(24)	MDR-F	MFR-F	MFR-P(35)	SCHOOL(23)	0	0	0
Land Use Area(ac) ...	1.4	28.7	0.7	1.4	12.9	0.0	0.0	0.0
Percent Impervious ...	24%	45%	65%	35%	23%	—	—	—
Land Use Char. ...	Natural	Urban	Urban	Natural	Natural	—	—	—
Urban Area ...	—	28.7	0.7	—	—	—	—	—

65.2% ... Percent Urban — **Urban area in square miles = 0.0460**
38.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0705**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

204F	Land Use Identifier ...	MDR-F	0	0	0	0	0	0	0
	Land Use Area(ac) ...	49.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	45%	—	—	—	—	—	—	—
	Land Use Char. ...	Urban	—	—	—	—	—	—	—
	Urban Area ...	49.4	—	—	—	—	—	—	—
	100.0% ... Percent Urban						**Urban area in square miles =**		**0.0771**
	45.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0771**
205A	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	75.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1175**
205B	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	135.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.2112**
205C	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	37.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0588**
205D	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	204.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.3191**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

205E	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	139.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.2175**
205F	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	103.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1613**
205G	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	118.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1855**
205H	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	166.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.2605**
205I	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	226.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.3539**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

205J

Land Use Identifier ...	ND	0	0	0	0	0	0	0
Land Use Area(ac) ...	236.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.3695**

205K

Land Use Identifier ...	ND	0	0	0	0	0	0	0
Land Use Area(ac) ...	157.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2454**

205L

Land Use Identifier ...	ND	0	0	0	0	0	0	0
Land Use Area(ac) ...	75.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1176**

205M

Land Use Identifier ...	DE	LDR-P(15)	LDR-P(16)	MDR-F	ND	0	0	0
Land Use Area(ac) ...	24.3	9.2	2.8	37.4	15.1	0.0	0.0	0.0
Percent Impervious ...	0%	15%	16%	45%	0%	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Urban	Natural	—	—	—
Urban Area ...	—	—	—	37.4	—	—	—	—

42.2% ... Percent Urban — **Urban area in square miles = 0.0584**

21.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1385**

205N

Land Use Identifier ...	DE	MDR-F	ND	0	0	0	0	0
Land Use Area(ac) ...	16.9	1.8	81.2	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	45%	0%	—	—	—	—	—
Land Use Char. ...	Natural	Urban	Natural	—	—	—	—	—
Urban Area ...	—	1.8	—	—	—	—	—	—

1.8% ... Percent Urban — **Urban area in square miles = 0.0028**

0.8% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1561**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

206A

Land Use Identifier ...	DE	LDR-F	LDR-P(15)	MDR-F	ND	0	0	0
Land Use Area(ac) ...	18.2	0.0	4.7	57.9	0.9	0.0	0.0	0.0
Percent Impervious ...	0%	25%	15%	45%	0%	—	—	—
Land Use Char. ...	Natural	Urban	Natural	Urban	Natural	—	—	—
Urban Area ...	—	0.0	—	57.9	—	—	—	—

70.9% ... Percent Urban — **Urban area in square miles = 0.0906**
32.8% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1278**

206B

Land Use Identifier ...	DE	LDR-P(15)	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	4.6	0.6	55.8	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	15%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	55.8	—	—	—	—	—

91.5% ... Percent Urban — **Urban area in square miles = 0.0871**
41.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0952**

206C

Land Use Identifier ...	DE	LDR-N	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	1.2	9.8	4.2	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	4.2	—	—	—	—	—

27.5% ... Percent Urban — **Urban area in square miles = 0.0065**
12.4% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0238**

206D

Land Use Identifier ...	LDR-F	LDR-N	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	1.1	2.8	35.5	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	25%	0%	45%	—	—	—	—	—
Land Use Char. ...	Urban	Natural	Urban	—	—	—	—	—
Urban Area ...	1.1	—	35.5	—	—	—	—	—

92.9% ... Percent Urban — **Urban area in square miles = 0.0573**
41.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0616**

206E

Land Use Identifier ...	LDR-N	MDR-F	0	0	0	0	0	0
Land Use Area(ac) ...	14.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	45%	—	—	—	—	—	—
Land Use Char. ...	Natural	Urban	—	—	—	—	—	—
Urban Area ...	—	0.5	—	—	—	—	—	—

3.8% ... Percent Urban — **Urban area in square miles = 0.0009**
1.7% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0227**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

206F

Land Use Identifier ...	DE	LDR-N	LDR-P(24)	LDR-P(28)	MDR-F	0	0	0
Land Use Area(ac) ...	2.0	80.9	6.3	9.0	2.4	0.0	0.0	0.0
Percent Impervious ...	0%	0%	24%	28%	45%	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Urban	—	—	—
Urban Area ...	—	—	—	—	2.4	—	—	—

2.3% ... Percent Urban — **Urban area in square miles = 0.0037**

5.1% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1571**

206G

Land Use Identifier ...	C-P(24)	C-P(7)	DE	LDR-N	LDR-P(24)	MDR-F	MFR-F	MFR-P(35)
Land Use Area(ac) ...	2.9	0.8	5.9	30.0	6.6	9.9	0.0	1.1
Percent Impervious ...	24%	7%	0%	0%	24%	45%	65%	35%
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	Urban	Urban	Natural
Urban Area ...	—	—	—	—	—	9.9	0.0	—

17.3% ... Percent Urban — **Urban area in square miles = 0.0155**

12.5% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0895**

206H

Land Use Identifier ...	LDR-N	LDR-P(28)	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	15.4	1.0	21.3	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	28%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	21.3	—	—	—	—	—

56.5% ... Percent Urban — **Urban area in square miles = 0.0333**

26.1% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0590**

206I

Land Use Identifier ...	LDR-N	LDR-P(28)	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	0.3	6.5	6.5	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	28%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	6.5	—	—	—	—	—

48.9% ... Percent Urban — **Urban area in square miles = 0.0102**

35.7% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0208**

206J

Land Use Identifier ...	LDR-P(28)	MDR-F	0	0	0	0	0	0
Land Use Area(ac) ...	0.9	37.4	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	28%	45%	—	—	—	—	—	—
Land Use Char. ...	Natural	Urban	—	—	—	—	—	—
Urban Area ...	—	37.4	—	—	—	—	—	—

97.6% ... Percent Urban — **Urban area in square miles = 0.0585**

44.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0599**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

206K

Land Use Identifier ...	LDR-N	LDR-P(28)	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	29.4	4.9	1.4	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	28%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	1.4	—	—	—	—	—

4.0% ... Percent Urban — **Urban area in square miles = 0.0022**
5.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0558**

206L

Land Use Identifier ...	LDR-N	LDR-P(28)	MDR-F	0	0	0	0	0
Land Use Area(ac) ...	18.2	19.9	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	28%	45%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	—	—	—	—	—
Urban Area ...	—	—	0.0	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
14.7% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0595**

206M

Land Use Identifier ...	DE	LDR-P(28)	MDR-F	MFR-F	0	0	0	0
Land Use Area(ac) ...	1.1	0.0	32.3	4.7	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	28%	45%	65%	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	Urban	—	—	—	—
Urban Area ...	—	—	32.3	4.7	—	—	—	—

97.1% ... Percent Urban — **Urban area in square miles = 0.0579**
46.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0596**

206N

Land Use Identifier ...	C-P(24)	DE	MDR-F	MFR-F	MFR-P(35)	SCHOOL(23)	0	0
Land Use Area(ac) ...	0.7	15.7	8.3	69.7	2.3	0.5	0.0	0.0
Percent Impervious ...	24%	0%	45%	65%	35%	23%	—	—
Land Use Char. ...	Natural	Natural	Urban	Urban	Natural	Natural	—	—
Urban Area ...	—	—	8.3	69.7	—	—	—	—

80.3% ... Percent Urban — **Urban area in square miles = 0.1219**
51.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1518**

207A

Land Use Identifier ...	ND	0	0	0	0	0	0	0
Land Use Area(ac) ...	163.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2561**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

207B	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	133.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.2082**
207C	Land Use Identifier ...	ND	0	0	0	0	0	0	0
	Land Use Area(ac) ...	110.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1730**
207D	Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	73.2	53.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1971**
207E	Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	37.3	62.8	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1565**
207F	Land Use Identifier ...	ND	VLDR-F	VLDR-N	0	0	0	0	0
	Land Use Area(ac) ...	55.6	0.3	24.9	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	15%	0%	—	—	—	—	—
	Land Use Char. ...	Natural	Urban	Natural	—	—	—	—	—
	Urban Area ...	—	0.3	—	—	—	—	—	—
	0.4% ... Percent Urban						**Urban area in square miles =**		**0.0005**
	0.1% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1261**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

207G

Land Use Identifier ...	DE	LDR-P(16)	ND	VLDR-N	0	0	0	0
Land Use Area(ac) ...	1.5	0.7	140.9	8.1	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	16%	0%	0%	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.1% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2363**

207H

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	17.1	62.6	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1245**

207I

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	46.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0729**

207J

Land Use Identifier ...	DE	LDR-P(14)	MDR-F	ND	VLDR-F	VLDR-N	0	0
Land Use Area(ac) ...	0.5	1.7	0.3	2.7	9.3	44.9	0.0	0.0
Percent Impervious ...	0%	14%	45%	0%	15%	0%	—	—
Land Use Char. ...	Natural	Natural	Urban	Natural	Urban	Natural	—	—
Urban Area ...	—	—	0.3	—	9.3	—	—	—

16.2% ... Percent Urban — **Urban area in square miles = 0.0151**
3.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0928**

207K

Land Use Identifier ...	DE	LDR-P(14)	LDR-P(16)	LDR-P(4)	MDR-F	MDR-P(1)	ND	VLDR-N
Land Use Area(ac) ...	13.6	32.7	0.8	0.9	30.3	0.0	0.1	4.7
Percent Impervious ...	0%	14%	16%	4%	45%	1%	0%	0%
Land Use Char. ...	Natural	Natural	Natural	Natural	Urban	Natural	Natural	Natural
Urban Area ...	—	—	—	—	30.3	—	—	—

36.5% ... Percent Urban — **Urban area in square miles = 0.0473**
22.1% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1296**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

207L

Land Use Identifier ...	DE	LDR-P(15)	LDR-P(16)	MDR-F	MDR-P(27)	ND	0	0
Land Use Area(ac) ...	0.7	1.7	19.0	26.5	0.0	3.5	0.0	0.0
Percent Impervious ...	0%	15%	16%	45%	27%	0%	—	—
Land Use Char. ...	Natural	Natural	Natural	Urban	Natural	Natural	—	—
Urban Area ...	—	—	—	26.5	—	—	—	—

51.5% ... Percent Urban — **Urban area in square miles = 0.0414**

29.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0804**

207M

Land Use Identifier ...	C-P(4)	DE	LDR-P(16)	LDR-P(4)	MDR-F	MDR-P(27)	0	0
Land Use Area(ac) ...	4.1	16.7	0.1	49.9	1.4	2.0	0.0	0.0
Percent Impervious ...	4%	0%	16%	4%	45%	27%	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Urban	Natural	—	—
Urban Area ...	—	—	—	—	1.4	—	—	—

1.9% ... Percent Urban — **Urban area in square miles = 0.0022**

4.5% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1159**

207N

Land Use Identifier ...	DE	LDR-P(15)	MDR-F	MDR-P(27)	0	0	0	0
Land Use Area(ac) ...	0.9	12.3	0.1	18.2	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	15%	45%	27%	—	—	—	—
Land Use Char. ...	Natural	Natural	Urban	Natural	—	—	—	—
Urban Area ...	—	—	0.1	—	—	—	—	—

0.2% ... Percent Urban — **Urban area in square miles = 0.0001**

21.6% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0492**

207O

Land Use Identifier ...	DE	LDR-P(15)	LDR-P(4)	MDR-P(27)	SCHOOL(4)	VLDR-P(5)	VLDR-P(7)	0
Land Use Area(ac) ...	22.9	0.4	27.2	22.5	10.0	0.3	0.1	0.0
Percent Impervious ...	0%	15%	4%	27%	4%	5%	7%	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	Natural	Natural	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

9.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1305**

208A

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	0.8	87.9	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1386**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

208B	Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0269**
208C	Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	28.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0664**
208D	Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	47.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0745**
208E	Land Use Identifier ...	DE	LDR-N	VLDR-N	0	0	0	0	0
	Land Use Area(ac) ...	0.4	0.7	38.6	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	0%	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0621**
208F	Land Use Identifier ...	DE	MDR-N	VLDR-N	0	0	0	0	0
	Land Use Area(ac) ...	0.6	0.2	43.4	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	0%	0%	—	—	—	—	—
	Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0691**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

208G

Land Use Identifier ...	DE	LDR-N	LDR-P(14)	MDR-F	MDR-N	MDR-P(.5)	MDR-P(1)	VLDR-N
Land Use Area(ac) ...	11.5	23.4	22.7	4.3	2.0	5.8	9.3	3.7
Percent Impervious ...	0%	0%	14%	45%	0%	1%	1%	0%
Land Use Char. ...	Natural	Natural	Natural	Urban	Natural	Natural	Natural	Natural
Urban Area ...	—	—	—	4.3	—	—	—	—

5.2% ... Percent Urban — **Urban area in square miles = 0.0067**

6.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1294**

208H

Land Use Identifier ...	DE	LDR-N	MDR-P(.5)	MDR-P(1)	MDR-P(13)	0	0	0
Land Use Area(ac) ...	10.2	1.1	5.7	10.3	0.1	0.0	0.0	0.0
Percent Impervious ...	0%	0%	1%	1%	13%	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.5% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0428**

208I

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	74.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1171**

208J

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	51.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0811**

208K

Land Use Identifier ...	LDR-N	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	13.3	17.1	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0476**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

208L

Land Use Identifier ...	LDR-N	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	4.9	32.7	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0588**

208M

Land Use Identifier ...	DE	LDR-N	MDR-P(.5)	MDR-P(13)	VLDR-N	0	0	0
Land Use Area(ac) ...	0.2	29.1	27.1	5.4	40.3	0.0	0.0	0.0
Percent Impervious ...	0%	0%	1%	13%	0%	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.8% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1594**

208N

Land Use Identifier ...	DE	LDR-N	MDR-P(1)	MDR-P(13)	MDR-P(15)	MDR-P(18)	0	0
Land Use Area(ac) ...	4.0	0.4	4.1	17.0	0.0	4.7	0.0	0.0
Percent Impervious ...	0%	0%	1%	13%	15%	18%	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	Natural	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

10.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0471**

208O

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	147.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2299**

208P

Land Use Identifier ...	LDR-N	MDR-N	MDR-P(15)	VLDR-N	0	0	0	0
Land Use Area(ac) ...	4.5	18.6	0.7	13.6	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	15%	0%	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0584**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

208Q

Land Use Identifier ...	DE	LDR-N	MDR-N	MDR-P(13)	MDR-P(15)	VLDR-N	0	0
Land Use Area(ac) ...	5.5	5.5	15.1	2.2	0.2	31.9	0.0	0.0
Percent Impervious ...	0%	0%	0%	13%	15%	0%	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	Natural	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.5% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0943**

208R

Land Use Identifier ...	MDR-N	MDR-P(15)	VLDR-N	0	0	0	0	0
Land Use Area(ac) ...	3.3	0.1	3.3	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	15%	0%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0105**

208S

Land Use Identifier ...	DE	MDR-N	MDR-P(13)	MDR-P(15)	VLDR-N	0	0	0
Land Use Area(ac) ...	2.8	0.2	15.3	25.4	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	13%	15%	0%	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

13.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0682**

208T

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	84.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1318**

208U

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	85.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1337**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

208V

Land Use Identifier ...	MDR-N	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	0.7	17.1	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0278**

208W

Land Use Identifier ...	MDR-P(15)	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	10.8	21.5	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	15%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
5.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0504**

208X

Land Use Identifier ...	DE	MDR-P(13)	MDR-P(15)	MDR-P(18)	VLDR-N	0	0	0
Land Use Area(ac) ...	15.4	0.0	3.5	17.0	12.3	0.0	0.0	0.0
Percent Impervious ...	0%	13%	15%	18%	0%	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
7.4% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0754**

209A

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	134.8	100.6	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.3678**

209B

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	53.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0831**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

209C

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	5.4	35.5	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0639**

209D

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	14.2	142.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2442**

209E

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1490**

209F

Land Use Identifier ...	MDR-N	ND	VLDR-N	0	0	0	0	0
Land Use Area(ac) ...	12.4	79.9	52.2	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	0%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2257**

209G

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	0.7	129.8	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2038**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

209H

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	23.8	29.6	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0835**

209I

Land Use Identifier ...	ND	VLDR-N	0	0	0	0	0	0
Land Use Area(ac) ...	17.8	98.9	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	0%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1823**

210A

Land Use Identifier ...	DE	LDR-P(15)	LDR-P(4)	MDR-P(27)	VLDR-N	VLDR-P(10)	VLDR-P(5)	VLDR-P(7)
Land Use Area(ac) ...	0.6	0.4	0.2	4.4	26.1	0.6	12.9	33.3
Percent Impervious ...	0%	15%	4%	27%	0%	10%	5%	7%
Land Use Char. ...	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

5.5% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1227**

210B

Land Use Identifier ...	DE	LDR-P(4)	MDR-F	MDR-P(1)	MDR-P(18)	VLDR-N	VLDR-P(7)	0
Land Use Area(ac) ...	0.3	37.5	0.1	18.3	10.2	0.1	1.8	0.0
Percent Impervious ...	0%	4%	45%	1%	18%	0%	7%	—
Land Use Char. ...	Natural	Natural	Urban	Natural	Natural	Natural	Natural	—
Urban Area ...	—	—	0.1	—	—	—	—	—

0.1% ... Percent Urban — **Urban area in square miles = 0.0001**

5.4% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1067**

210C

Land Use Identifier ...	DE	MDR-P(18)	VLDR-N	0	0	0	0	0
Land Use Area(ac) ...	3.0	5.0	44.2	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	18%	0%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**

1.7% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0817**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

210D	Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	89.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1397**
210E	Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0275**
210F	Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	59.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0926**
210G	Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	103.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.1615**
210H	Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
	Land Use Area(ac) ...	44.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	—	—	—	—	—	—	—
	Land Use Char. ...	Natural	—	—	—	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0% ... Percent Urban						**Urban area in square miles =**		**0.0000**
	0.0% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0697**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

210I

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	31.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0491**

210J

Land Use Identifier ...	VLDR-N	0	0	0	0	0	0	0
Land Use Area(ac) ...	66.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1033**

210K

Land Use Identifier ...	VLDR-N	VLDR-P(10)	0	0	0	0	0	0
Land Use Area(ac) ...	48.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	10%	—	—	—	—	—	—
Land Use Char. ...	Natural	Natural	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.1% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0771**

210L

Land Use Identifier ...	MDR-F	MDR-N	MDR-P(35)	RW	VLDR-N	0	0	0
Land Use Area(ac) ...	0.0	2.6	0.0	0.0	85.3	0.0	0.0	0.0
Percent Impervious ...	45%	0%	35%	90%	0%	—	—	—
Land Use Char. ...	Urban	Natural	Natural	Urban	Natural	—	—	—
Urban Area ...	0.0	—	—	0.0	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0001**
0.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1374**

210M

Land Use Identifier ...	SCHOOL(22)	VLDR-N	VLDR-P(10)	0	0	0	0	0
Land Use Area(ac) ...	0.2	103.1	0.6	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	22%	0%	10%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
0.1% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1624**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

210N	Land Use Identifier ...	DE	MFR-P(7)	SCHOOL(22)	VLDR-P(10)	0	0	0	0
	Land Use Area(ac) ...	0.1	0.6	1.4	29.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	7%	22%	10%	—	—	—	—
	Land Use Char. ...	Natural	Natural	Natural	Natural	—	—	—	—
	Urban Area ...	—	—	—	—	—	—	—	—
	0.0%	**... Percent Urban**					**Urban area in square miles =**		**0.0000**
	10.4%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0485**
211A	Land Use Identifier ...	LDR-P(15)	MDR-F	MDR-P(27)	VLDR-P(5)	0	0	0	0
	Land Use Area(ac) ...	54.7	6.4	0.0	30.3	0.0	0.0	0.0	0.0
	Percent Impervious ...	15%	45%	27%	5%	—	—	—	—
	Land Use Char. ...	Natural	Urban	Natural	Natural	—	—	—	—
	Urban Area ...	—	6.4	—	—	—	—	—	—
	7.0%	**... Percent Urban**					**Urban area in square miles =**		**0.0100**
	13.8%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.1429**
211B	Land Use Identifier ...	LDR-N	LDR-P(15)	LDR-P(28)	MDR-F	VLDR-P(5)	0	0	0
	Land Use Area(ac) ...	0.5	0.2	11.8	7.9	49.0	0.0	0.0	0.0
	Percent Impervious ...	0%	15%	28%	45%	5%	—	—	—
	Land Use Char. ...	Natural	Natural	Natural	Urban	Natural	—	—	—
	Urban Area ...	—	—	—	7.9	—	—	—	—
	11.4%	**... Percent Urban**					**Urban area in square miles =**		**0.0124**
	13.4%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.1085**
211C	Land Use Identifier ...	MDR-F	SCHOOL(25)	0	0	0	0	0	0
	Land Use Area(ac) ...	26.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	45%	25%	—		—	—	—	—
	Land Use Char. ...	Urban	Natural	—	—	—	—	—	—
	Urban Area ...	26.7	—	—	—	—	—	—	—
	97.4%	**... Percent Urban**					**Urban area in square miles =**		**0.0417**
	44.5%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0428**
211D	Land Use Identifier ...	LDR-P(28)	MDR-F	MFR-P(7)	SCHOOL(25)	VLDR-P(10)	VLDR-P(5)	0	0
	Land Use Area(ac) ...	3.3	23.4	5.5	0.2	5.1	7.6	0.0	0.0
	Percent Impervious ...	28%	45%	7%	25%	10%	5%	—	—
	Land Use Char. ...	Natural	Urban	Natural	Natural	Natural	Natural	—	—
	Urban Area ...	—	23.4	—	—	—	—	—	—
	51.8%	**... Percent Urban**					**Urban area in square miles =**		**0.0365**
	28.3%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0705**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

211E

Land Use Identifier ...	MDR-F	MFR-F	SCHOOL(25)	0	0	0	0	0
Land Use Area(ac) ...	85.4	0.1	14.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	45%	65%	25%	—	—	—	—	—
Land Use Char. ...	Urban	Urban	Natural	—	—	—	—	—
Urban Area ...	85.4	0.1	—	—	—	—	—	—

86.0% ... Percent Urban — **Urban area in square miles = 0.1337**
42.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1555**

211F

Land Use Identifier ...	DE	MDR-F	MFR-F	MFR-P(34)	0	0	0	0
Land Use Area(ac) ...	2.4	0.0	69.6	0.2	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	45%	65%	34%	—	—	—	—
Land Use Char. ...	Natural	Urban	Urban	Natural	—	—	—	—
Urban Area ...	—	0.0	69.6	—	—	—	—	—

96.4% ... Percent Urban — **Urban area in square miles = 0.1088**
62.7% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1129**

211G

Land Use Identifier ...	RW	0	0	0	0	0	0	0
Land Use Area(ac) ...	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	90%	—	—	—	—	—	—	—
Land Use Char. ...	Urban	—	—	—	—	—	—	—
Urban Area ...	4.9	—	—	—	—	—	—	—

100.0% ... Percent Urban — **Urban area in square miles = 0.0076**
90.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0076**

211H

Land Use Identifier ...	MDR-N	MDR-P(35)	SCHOOL(22)	VLDR-N	0	0	0	0
Land Use Area(ac) ...	0.6	3.5	1.6	41.3	0.0	0.0	0.0	0.0
Percent Impervious ...	0%	35%	22%	0%	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	Natural	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
3.4% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0734**

211I

Land Use Identifier ...	MDR-P(35)	0	0	0	0	0	0	0
Land Use Area(ac) ...	26.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	35%	—	—	—	—	—	—	—
Land Use Char. ...	Natural	—	—	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
35.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0408**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

211J

Land Use Identifier ...	MDR-F	MDR-P(35)	SCHOOL(22)	0	0	0	0	0
Land Use Area(ac) ...	1.1	5.6	2.7	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	45%	35%	22%	—	—	—	—	—
Land Use Char. ...	Urban	Natural	Natural	—	—	—	—	—
Urban Area ...	1.1	—	—	—	—	—	—	—

11.6% ... Percent Urban — **Urban area in square miles = 0.0017**
32.4% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0148**

211K

Land Use Identifier ...	DE	MDR-F	MFR-P(7)	SCHOOL(22)	VLDR-P(10)	0	0	0
Land Use Area(ac) ...	10.7	7.6	13.6	32.9	0.5	0.0	0.0	0.0
Percent Impervious ...	0%	45%	7%	22%	10%	—	—	—
Land Use Char. ...	Natural	Urban	Natural	Natural	Natural	—	—	—
Urban Area ...	—	7.6	—	—	—	—	—	—

11.6% ... Percent Urban — **Urban area in square miles = 0.0118**
17.8% ... Composite Urban Percent Impervious — **Total area in square miles = 0.1020**

211L

Land Use Identifier ...	C-F	DE	MDR-F	MDR-P(35)	MFR-F	MFR-P(37)	MFR-P(9)	0
Land Use Area(ac) ...	0.8	8.8	39.2	1.7	2.7	6.4	1.5	0.0
Percent Impervious ...	75%	0%	45%	35%	65%	37%	9%	—
Land Use Char. ...	Urban	Natural	Urban	Natural	Urban	Natural	Natural	—
Urban Area ...	0.8	—	39.2	—	2.7	—	—	—

69.8% ... Percent Urban — **Urban area in square miles = 0.0668**
37.8% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0958**

211M

Land Use Identifier ...	MDR-P(35)	MFR-P(18)	MFR-P(9)	0	0	0	0	0
Land Use Area(ac) ...	38.9	11.0	2.1	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	35%	18%	9%	—	—	—	—	—
Land Use Char. ...	Natural	Natural	Natural	—	—	—	—	—
Urban Area ...	—	—	—	—	—	—	—	—

0.0% ... Percent Urban — **Urban area in square miles = 0.0000**
30.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0813**

211N

Land Use Identifier ...	MDR-F	MDR-P(35)	MFR-P(9)	0	0	0	0	0
Land Use Area(ac) ...	0.3	5.2	7.6	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	45%	35%	9%	—	—	—	—	—
Land Use Char. ...	Urban	Natural	Natural	—	—	—	—	—
Urban Area ...	0.3	—	—	—	—	—	—	—

2.6% ... Percent Urban — **Urban area in square miles = 0.0005**
20.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0204**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

211O	Land Use Identifier ...	MDR-F	MDR-P(35)	MFR-P(9)	0	0	0	0	0
	Land Use Area(ac) ...	0.1	25.9	0.4	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	45%	35%	9%	—	—	—	—	—
	Land Use Char. ...	Urban	Natural	Natural	—	—	—	—	—
	Urban Area ...	0.1	—	—	—	—	—	—	—
	0.3%	**... Percent Urban**					**Urban area in square miles =**		**0.0001**
	34.6%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0412**
211P	Land Use Identifier ...	MDR-F	MDR-P(35)	0	0	0	0	0	0
	Land Use Area(ac) ...	21.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	45%	35%	—	—	—	—	—	—
	Land Use Char. ...	Urban	Natural	—	—	—	—	—	—
	Urban Area ...	21.3	—	—	—	—	—	—	—
	99.2%	**... Percent Urban**					**Urban area in square miles =**		**0.0332**
	44.9%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0335**
211Q	Land Use Identifier ...	MDR-P(35)	MFR-F	SCHOOL(0)	0	0	0	0	0
	Land Use Area(ac) ...	1.9	0.8	10.8	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	35%	65%	0%	—	—	—	—	—
	Land Use Char. ...	Natural	Urban	Natural	—	—	—	—	—
	Urban Area ...	—	0.8	—	—	—	—	—	—
	5.6%	**... Percent Urban**					**Urban area in square miles =**		**0.0012**
	8.5%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0211**
211R	Land Use Identifier ...	DE	MDR-P(35)	MFR-F	SCHOOL(0)	0	0	0	0
	Land Use Area(ac) ...	0.0	25.3	4.6	24.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	35%	65%	0%	—	—	—	—
	Land Use Char. ...	Natural	Natural	Urban	Natural	—	—	—	—
	Urban Area ...	—	—	4.6	—	—	—	—	—
	8.6%	**... Percent Urban**					**Urban area in square miles =**		**0.0072**
	22.0%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0844**
211S	Land Use Identifier ...	DE	MDR-P(35)	MFR-F	MFR-P(18)	0	0	0	0
	Land Use Area(ac) ...	13.8	11.6	6.6	0.2	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	35%	65%	18%	—	—	—	—
	Land Use Char. ...	Natural	Natural	Urban	Natural	—	—	—	—
	Urban Area ...	—	—	6.6	—	—	—	—	—
	20.5%	**... Percent Urban**					**Urban area in square miles =**		**0.0103**
	26.1%	**... Composite Urban Percent Impervious**					**Total area in square miles =**		**0.0504**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

211T

Land Use Identifier ...	C-F	DE	MDR-P(35)	MFR-F	MFR-N	MFR-P(18)	MFR-P(35)	MFR-P(9)
Land Use Area(ac) ...	2.0	0.8	0.0	2.6	7.7	2.5	11.0	15.9
Percent Impervious ...	75%	0%	35%	65%	0%	18%	35%	9%
Land Use Char. ...	Urban	Natural	Natural	Urban	Natural	Natural	Natural	Natural
Urban Area ...	2.0	—	—	2.6	—	—	—	—

10.8% ... Percent Urban — **Urban area in square miles = 0.0072**

21.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0664**

211U

Land Use Identifier ...	MDR-F	MDR-P(35)	RW	VLDR-N	0	0	0	0
Land Use Area(ac) ...	8.5	0.7	8.3	0.1	0.0	0.0	0.0	0.0
Percent Impervious ...	45%	35%	90%	0%	—	—	—	—
Land Use Char. ...	Urban	Natural	Urban	Natural	—	—	—	—
Urban Area ...	8.5	—	8.3	—	—	—	—	—

95.5% ... Percent Urban — **Urban area in square miles = 0.0262**

65.5% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0274**

211V

Land Use Identifier ...	RW	0	0	0	0	0	0	0
Land Use Area(ac) ...	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	90%	—	—	—	—	—	—	—
Land Use Char. ...	Urban	—	—	—	—	—	—	—
Urban Area ...	3.1	—	—	—	—	—	—	—

100.0% ... Percent Urban — **Urban area in square miles = 0.0049**

90.0% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0049**

211W

Land Use Identifier ...	C-F	MFR-P(37)	0	0	0	0	0	0
Land Use Area(ac) ...	16.4	2.6	0.0	0.0	0.0	0.0	0.0	0.0
Percent Impervious ...	75%	37%	—	—	—	—	—	—
Land Use Char. ...	Urban	Natural	—	—	—	—	—	—
Urban Area ...	16.4	—	—	—	—	—	—	—

86.5% ... Percent Urban — **Urban area in square miles = 0.0257**

69.9% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0297**

211X

Land Use Identifier ...	DE	MDR-F	MFR-F	MFR-N	MFR-P(34)	MFR-P(37)	0	0
Land Use Area(ac) ...	17.4	0.6	61.7	3.0	40.3	13.9	0.0	0.0
Percent Impervious ...	0%	45%	65%	0%	34%	37%	—	—
Land Use Char. ...	Natural	Urban	Urban	Natural	Natural	Natural	—	—
Urban Area ...	—	0.6	61.7	—	—	—	—	—

45.5% ... Percent Urban — **Urban area in square miles = 0.0973**

43.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.2139**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

211Y	Land Use Identifier ...	DE	MDR-F	MFR-N	0	0	0	0	0
	Land Use Area(ac) ...	6.6	21.3	29.3	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	45%	0%	—	—	—	—	—
	Land Use Char. ...	Natural	Urban	Natural	—	—	—	—	—
	Urban Area ...	—	21.3	—	—	—	—	—	—
	37.3% ... Percent Urban						**Urban area in square miles =**		**0.0333**
	16.8% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0893**
211Z	Land Use Identifier ...	DE	MDR-F	0	0	0	0	0	0
	Land Use Area(ac) ...	12.4	40.4	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	45%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Urban	—	—	—	—	—	—
	Urban Area ...	—	40.4	—	—	—	—	—	—
	76.5% ... Percent Urban						**Urban area in square miles =**		**0.0632**
	34.4% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0825**
211AA	Land Use Identifier ...	MDR-F	SCHOOL(23)	0	0	0	0	0	0
	Land Use Area(ac) ...	15.6	6.1	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	45%	23%	—	—	—	—	—	—
	Land Use Char. ...	Urban	Natural	—	—	—	—	—	—
	Urban Area ...	15.6	—	—	—	—	—	—	—
	71.9% ... Percent Urban						**Urban area in square miles =**		**0.0244**
	38.8% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0340**
211AB	Land Use Identifier ...	MDR-F	MFR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	13.1	12.4	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	45%	0%	—	—	—	—	—	—
	Land Use Char. ...	Urban	Natural	—	—	—	—	—	—
	Urban Area ...	13.1	—	—	—	—	—	—	—
	51.4% ... Percent Urban						**Urban area in square miles =**		**0.0204**
	23.1% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0397**
211AC	Land Use Identifier ...	DE	MDR-F	0	0	0	0	0	0
	Land Use Area(ac) ...	0.1	17.5	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	45%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Urban	—	—	—	—	—	—
	Urban Area ...	—	17.5	—	—	—	—	—	—
	99.5% ... Percent Urban						**Urban area in square miles =**		**0.0273**
	44.8% ... Composite Urban Percent Impervious						**Total area in square miles =**		**0.0275**

Table S-5

Subbasin Land Use Areas and Urban RTIMP Estimates
Existing Condition

211AD	Land Use Identifier ...	DE	MDR-F	MFR-N	0	0	0	0	0
	Land Use Area(ac) ...	0.0	24.9	1.5	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	45%	0%	—	—	—	—	—
	Land Use Char. ...	Natural	Urban	Natural	—	—	—	—	—
	Urban Area ...	—	24.9	—	—	—	—	—	—

94.1% ... Percent Urban — **Urban area in square miles = 0.0389**

42.4% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0413**

211AE	Land Use Identifier ...	DE	MDR-F	0	0	0	0	0	0
	Land Use Area(ac) ...	3.4	18.7	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	0%	45%	—	—	—	—	—	—
	Land Use Char. ...	Natural	Urban	—	—	—	—	—	—
	Urban Area ...	—	18.7	—	—	—	—	—	—

84.8% ... Percent Urban — **Urban area in square miles = 0.0292**

38.2% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0344**

211AF	Land Use Identifier ...	MDR-F	MFR-N	0	0	0	0	0	0
	Land Use Area(ac) ...	21.2	12.5	0.0	0.0	0.0	0.0	0.0	0.0
	Percent Impervious ...	45%	0%	—	—	—	—	—	—
	Land Use Char. ...	Urban	Natural	—	—	—	—	—	—
	Urban Area ...	21.2	—	—	—	—	—	—	—

62.8% ... Percent Urban — **Urban area in square miles = 0.0331**

28.3% ... Composite Urban Percent Impervious — **Total area in square miles = 0.0527**

Table S-6

Subbasin Weighted DTHETA and Surface Loss Parameters
Existing Condition

[1] Sub-basin ID	[2] Log Avg. XKSAT	[3] DTHETA (Dry)	[4] DTHETA (Normal)	[5] PSIF	[6] Percent Valley Area	[7] Percent Hillslope Area	[8] Percent Mountain Area	[9] Percent Urban Area	[10] Adjusted Hillslope Area	[11] Adjusted Mountain Area	[12] Adjusted Valley Area	[13] V,H,M Veg. Cover	[14] Urban Veg. Cover	[15] RTIMP (urban)	[16] RTIMP (rock)	[17] RTIMP (total)	[18] DTHETA (wghtd)	[19] Vegetation Cover (wghtd)	[20] IA (wghtd)
201A	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	21%	15%	0.0%	0.0%	0.0%	0.39	21%	0.15
201B	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	25%	15%	0.0%	0.0%	0.0%	0.39	25%	0.15
201C	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	33%	15%	0.0%	0.0%	0.0%	0.39	33%	0.15
201D	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	26%	15%	0.0%	0.0%	0.0%	0.39	26%	0.15
201E	0.19	0.38	0.25	5.60	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	38%	15%	0.1%	0.0%	0.1%	0.38	38%	0.15
202A	0.32	0.35	0.25	4.40	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	30%	15%	7.0%	0.0%	7.0%	0.35	30%	0.15
202B	0.29	0.35	0.25	4.55	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	30%	15%	0.6%	0.0%	0.6%	0.35	30%	0.15
202C	0.33	0.35	0.25	4.35	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	32%	15%	7.0%	0.0%	7.0%	0.35	32%	0.15
202D	0.19	0.38	0.25	5.60	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	30%	15%	7.0%	0.0%	7.0%	0.38	30%	0.15
202E	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	31%	15%	0.3%	0.0%	0.3%	0.39	31%	0.15
202F	0.19	0.38	0.25	5.60	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	31%	15%	1.8%	0.0%	1.8%	0.38	31%	0.15
202G	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	31%	15%	1.5%	0.0%	1.5%	0.39	31%	0.15
202H	0.21	0.37	0.25	5.20	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	35%	15%	0.3%	0.0%	0.3%	0.37	35%	0.15
202I	0.23	0.36	0.25	5.10	0.0%	100.0%	0.0%	6.1%	93.9%	0.0%	0.0%	30%	15%	9.3%	0.0%	9.3%	0.35	29%	0.14
203A	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	14.4%	85.6%	0.0%	0.0%	31%	15%	4.2%	0.0%	4.2%	0.37	29%	0.14
203B	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	17.4%	82.6%	0.0%	0.0%	33%	15%	5.0%	0.0%	5.0%	0.37	30%	0.14
203C	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.3%	99.7%	0.0%	0.0%	30%	15%	9.3%	0.0%	9.3%	0.39	30%	0.15
203D	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	30%	15%	0.0%	0.0%	0.0%	0.39	30%	0.15
203E	0.13	0.37	0.19	6.60	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	23%	15%	0.0%	0.0%	0.0%	0.37	23%	0.15
203F	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	30%	15%	0.0%	0.0%	0.0%	0.39	30%	0.15
203G	0.16	0.40	0.25	6.00	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	27%	15%	0.0%	0.0%	0.0%	0.40	27%	0.15
203H	0.20	0.38	0.25	5.40	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	19%	15%	0.0%	0.0%	0.0%	0.38	19%	0.15
203I	0.26	0.35	0.25	4.80	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	25%	15%	0.6%	0.0%	0.6%	0.35	25%	0.15
203J	0.19	0.38	0.25	5.60	0.0%	100.0%	0.0%	16.8%	83.2%	0.0%	0.0%	21%	15%	12.7%	0.0%	12.7%	0.36	20%	0.14
203K	0.18	0.38	0.25	5.60	0.0%	100.0%	0.0%	91.6%	8.4%	0.0%	0.0%	27%	15%	41.6%	0.0%	41.6%	0.26	16%	0.08
204A	0.17	0.39	0.25	5.80	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	21%	15%	0.0%	0.0%	0.0%	0.39	21%	0.15
204B	0.17	0.39	0.25	5.80	0.7%	99.3%	0.0%	0.0%	99.3%	0.0%	0.7%	29%	15%	0.2%	0.0%	0.2%	0.39	29%	0.15
204C	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	21.8%	78.2%	0.0%	0.0%	27%	15%	25.4%	0.0%	25.4%	0.36	24%	0.13
204D	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	59.2%	40.8%	0.0%	0.0%	15%	15%	40.2%	0.0%	40.2%	0.31	15%	0.10

Table S-6

Subbasin Weighted DTHETA and Surface Loss Parameters
Existing Condition

[1] Sub-basin ID	[2] Log Avg. XKSAT	[3] DTHETA (Dry)	[4] DTHETA (Normal)	[5] PSIF	[6] Percent Valley Area	[7] Percent Hillslope Area	[8] Percent Mountain Area	[9] Percent Urban Area	[10] Adjusted Hillslope Area	[11] Adjusted Mountain Area	[12] Adjusted Valley Area	[13] V,H,M Veg. Cover	[14] Urban Veg. Cover	[15] RTIMP (urban)	[16] RTIMP (rock)	[17] RTIMP (total)	[18] DTHETA (wghtd)	[19] Vegetation Cover (wghtd)	[20] IA (wghtd)
204E	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	65.2%	34.8%	0.0%	0.0%	21%	15%	38.0%	0.0%	38.0%	0.30	17%	0.10
204F	0.10	0.35	0.15	7.00	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	20%	15%	45.0%	0.0%	45.0%	0.15	15%	0.08
205A	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
205B	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
205C	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	31%	15%	0.0%	35.0%	35.0%	0.35	31%	0.25
205D	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
205E	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
205F	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	31%	15%	0.0%	35.0%	35.0%	0.35	31%	0.25
205G	0.30	0.35	0.25	4.50	0.0%	10.8%	89.2%	0.0%	10.8%	89.2%	0.0%	38%	15%	0.0%	31.2%	31.2%	0.35	38%	0.24
205H	0.31	0.35	0.25	4.50	0.0%	9.9%	90.1%	0.0%	9.9%	90.1%	0.0%	35%	15%	0.0%	31.6%	31.6%	0.35	35%	0.24
205I	0.22	0.37	0.25	5.20	1.3%	55.3%	43.4%	0.0%	55.3%	43.4%	1.3%	35%	15%	0.0%	15.2%	15.2%	0.37	35%	0.20
205J	0.25	0.35	0.25	4.90	24.6%	65.5%	9.9%	0.0%	65.5%	9.9%	24.6%	30%	15%	0.0%	3.5%	3.5%	0.35	30%	0.21
205K	0.18	0.38	0.25	5.60	2.8%	92.7%	4.4%	0.0%	92.7%	4.4%	2.8%	30%	15%	0.0%	1.5%	1.5%	0.38	30%	0.16
205L	0.23	0.36	0.25	5.00	20.7%	79.3%	0.0%	0.0%	79.3%	0.0%	20.7%	30%	15%	0.0%	0.0%	0.0%	0.36	30%	0.19
205M	0.20	0.38	0.25	5.40	18.0%	82.0%	0.0%	42.2%	39.8%	0.0%	18.0%	25%	15%	21.0%	0.0%	21.0%	0.33	21%	0.15
205N	0.18	0.39	0.25	5.70	1.1%	98.9%	0.0%	1.8%	97.1%	0.0%	1.1%	28%	15%	0.8%	0.0%	0.8%	0.39	28%	0.15
206A	0.21	0.37	0.25	5.30	13.7%	86.3%	0.0%	70.9%	15.4%	0.0%	13.7%	27%	15%	32.8%	0.0%	32.8%	0.28	18%	0.13
206B	0.21	0.37	0.25	5.20	20.4%	79.6%	0.0%	91.5%	0.0%	0.0%	8.5%	30%	15%	41.3%	0.0%	41.3%	0.26	16%	0.10
206C	0.34	0.35	0.25	4.35	39.8%	60.2%	0.0%	27.5%	32.7%	0.0%	39.8%	29%	15%	12.4%	0.0%	12.4%	0.32	25%	0.21
206D	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	92.9%	7.1%	0.0%	0.0%	30%	15%	41.2%	0.0%	41.2%	0.26	16%	0.08
206E	0.34	0.35	0.25	4.30	40.6%	59.4%	0.0%	3.8%	55.7%	0.0%	40.6%	25%	15%	1.7%	0.0%	1.7%	0.35	25%	0.23
206F	0.29	0.35	0.25	4.60	34.0%	66.0%	0.0%	2.3%	63.6%	0.0%	34.0%	30%	15%	5.1%	0.0%	5.1%	0.35	30%	0.21
206G	0.21	0.37	0.25	5.20	13.0%	87.0%	0.0%	17.3%	69.7%	0.0%	13.0%	30%	15%	12.5%	0.0%	12.5%	0.35	27%	0.16
206H	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	56.5%	43.5%	0.0%	0.0%	30%	15%	26.1%	0.0%	26.1%	0.31	22%	0.11
206I	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	48.9%	51.1%	0.0%	0.0%	30%	15%	35.7%	0.0%	35.7%	0.32	23%	0.11
206J	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	97.6%	2.4%	0.0%	0.0%	25%	15%	44.6%	0.0%	44.6%	0.25	15%	0.08
206K	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	4.0%	96.0%	0.0%	0.0%	30%	15%	5.6%	0.0%	5.6%	0.38	29%	0.15
206L	0.17	0.39	0.25	5.80	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	30%	15%	14.7%	0.0%	14.7%	0.39	30%	0.14
206M	0.22	0.37	0.25	5.20	14.0%	86.0%	0.0%	97.1%	0.0%	0.0%	2.9%	25%	15%	46.2%	0.0%	46.2%	0.25	15%	0.08

Table S-6

Subbasin Weighted DTHETA and Surface Loss Parameters
Existing Condition

[1] Sub-basin ID	[2] Log Avg. XKSAT	[3] DTHETA (Dry)	[4] DTHETA (Normal)	[5] PSIF	[6] Percent Valley Area	[7] Percent Hillslope Area	[8] Percent Mountain Area	[9] Percent Urban Area	[10] Adjusted Hillslope Area	[11] Adjusted Mountain Area	[12] Adjusted Valley Area	[13] V,H,M Veg. Cover	[14] Urban Veg. Cover	[15] RTIMP (urban)	[16] RTIMP (rock)	[17] RTIMP (total)	[18] DTHETA (wghtd)	[19] Vegetation Cover (wghtd)	[20] IA (wghtd)
206N	0.27	0.35	0.25	4.65	27.5%	72.5%	0.0%	80.3%	0.0%	0.0%	19.7%	20%	15%	51.6%	0.0%	51.6%	0.27	16%	0.12
207A	0.30	0.35	0.25	4.55	0.0%	14.8%	85.2%	0.0%	14.8%	85.2%	0.0%	30%	15%	0.0%	29.8%	29.8%	0.35	30%	0.24
207B	0.31	0.35	0.25	4.45	0.0%	7.4%	92.6%	0.0%	7.4%	92.6%	0.0%	30%	15%	0.0%	32.4%	32.4%	0.35	30%	0.24
207C	0.21	0.37	0.25	5.30	0.0%	60.9%	39.1%	0.0%	60.9%	39.1%	0.0%	35%	15%	0.0%	13.7%	13.7%	0.37	35%	0.19
207D	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
207E	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	35%	15%	0.0%	35.0%	35.0%	0.35	35%	0.25
207F	0.32	0.35	0.25	4.40	0.0%	3.8%	96.2%	0.4%	3.4%	96.2%	0.0%	35%	15%	0.1%	33.7%	33.7%	0.35	35%	0.25
207G	0.19	0.38	0.25	5.60	0.0%	76.6%	23.4%	0.0%	76.6%	23.4%	0.0%	29%	15%	0.1%	8.2%	8.3%	0.38	29%	0.17
207H	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
207I	0.33	0.35	0.25	4.40	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
207J	0.32	0.35	0.25	4.40	0.0%	3.0%	97.0%	16.2%	0.0%	83.8%	0.0%	32%	15%	3.0%	34.0%	37.0%	0.33	29%	0.22
207K	0.19	0.38	0.25	5.40	0.0%	72.7%	27.3%	36.5%	36.2%	27.3%	0.0%	30%	15%	22.1%	9.6%	31.7%	0.33	25%	0.15
207L	0.15	0.40	0.25	6.00	0.0%	100.0%	0.0%	51.5%	48.5%	0.0%	0.0%	26%	15%	29.6%	0.0%	29.6%	0.32	20%	0.11
207M	0.15	0.40	0.25	6.00	3.0%	97.0%	0.0%	1.9%	95.0%	0.0%	3.0%	32%	15%	4.5%	0.0%	4.5%	0.40	32%	0.15
207N	0.25	0.35	0.25	4.80	26.2%	73.8%	0.0%	0.2%	73.5%	0.0%	26.2%	34%	15%	21.6%	0.0%	21.6%	0.35	34%	0.19
207O	0.19	0.38	0.25	5.60	14.6%	85.4%	0.0%	0.0%	85.4%	0.0%	14.6%	32%	15%	9.2%	0.0%	9.2%	0.38	32%	0.17
208A	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
208B	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	35%	15%	0.0%	35.0%	35.0%	0.35	35%	0.25
208C	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
208D	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	35%	15%	0.0%	35.0%	35.0%	0.35	35%	0.25
208E	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	32%	15%	0.0%	35.0%	35.0%	0.35	32%	0.25
208F	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	32%	15%	0.0%	35.0%	35.0%	0.35	32%	0.25
208G	0.29	0.35	0.25	4.60	0.0%	20.2%	79.8%	5.2%	15.0%	79.8%	0.0%	28%	15%	6.3%	27.9%	34.3%	0.34	27%	0.22
208H	0.19	0.38	0.25	5.60	0.0%	82.2%	17.8%	0.0%	82.2%	17.8%	0.0%	30%	15%	0.5%	8.0%	8.6%	0.38	30%	0.17
208I	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	35%	15%	0.0%	35.0%	35.0%	0.35	35%	0.25
208J	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	35%	15%	0.0%	35.0%	35.0%	0.35	35%	0.25
208K	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	37%	15%	0.0%	35.0%	35.0%	0.35	37%	0.25
208L	0.33	0.35	0.25	4.40	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	37%	15%	0.0%	35.0%	35.0%	0.35	37%	0.25
208M	0.32	0.35	0.25	4.40	0.0%	3.5%	96.5%	0.0%	3.5%	96.5%	0.0%	37%	15%	0.8%	34.7%	35.5%	0.35	37%	0.25

Table S-6

Subbasin Weighted DTHETA and Surface Loss Parameters
Existing Condition

[1] Sub-basin ID	[2] Log Avg. XKSAT	[3] DTHETA (Dry)	[4] DTHETA (Normal)	[5] PSIF	[6] Percent Valley Area	[7] Percent Hillslope Area	[8] Percent Mountain Area	[9] Percent Urban Area	[10] Adjusted Hillslope Area	[11] Adjusted Mountain Area	[12] Adjusted Valley Area	[13] V,H,M Veg. Cover	[14] Urban Veg. Cover	[15] RTIMP (urban)	[16] RTIMP (rock)	[17] RTIMP (total)	[18] DTHETA (wghtd)	[19] Vegetation Cover (wghtd)	[20] IA (wghtd)
208N	0.14	0.39	0.23	6.20	0.0%	99.4%	0.6%	0.0%	99.4%	0.6%	0.0%	28%	15%	10.3%	23.7%	34.0%	0.39	28%	0.15
208O	0.29	0.35	0.25	4.60	0.0%	15.1%	84.9%	0.0%	15.1%	84.9%	0.0%	35%	15%	0.0%	33.5%	33.5%	0.35	35%	0.23
208P	0.17	0.39	0.25	5.70	0.0%	74.3%	25.7%	0.0%	74.3%	25.7%	0.0%	28%	15%	0.3%	27.6%	27.9%	0.39	28%	0.18
208Q	0.23	0.36	0.25	5.00	0.0%	40.1%	59.9%	0.0%	40.1%	59.9%	0.0%	28%	15%	0.5%	31.0%	31.5%	0.36	28%	0.21
208R	0.14	0.39	0.23	6.20	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	28%	15%	0.3%	25.0%	25.3%	0.39	28%	0.15
208S	0.14	0.39	0.23	6.20	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	28%	15%	13.3%	25.0%	38.3%	0.39	28%	0.14
208T	0.21	0.37	0.25	5.20	0.0%	52.0%	48.0%	0.0%	52.0%	48.0%	0.0%	35%	15%	0.0%	29.8%	29.8%	0.37	35%	0.20
208U	0.20	0.37	0.25	5.30	0.0%	58.1%	41.9%	0.0%	58.1%	41.9%	0.0%	35%	15%	0.0%	29.2%	29.2%	0.37	35%	0.19
208V	0.14	0.38	0.21	6.40	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	28%	15%	0.0%	25.0%	25.0%	0.38	28%	0.15
208W	0.15	0.39	0.23	6.20	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	32%	15%	5.0%	17.7%	22.7%	0.39	32%	0.15
208X	0.19	0.38	0.25	5.60	12.6%	87.4%	0.0%	0.0%	87.4%	0.0%	12.6%	32%	15%	7.4%	16.5%	23.9%	0.38	32%	0.17
209A	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
209B	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
209C	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
209D	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	35%	15%	0.0%	35.0%	35.0%	0.35	35%	0.25
209E	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
209F	0.31	0.35	0.25	4.50	0.0%	11.6%	88.4%	0.0%	11.6%	88.4%	0.0%	35%	15%	0.0%	30.9%	30.9%	0.35	35%	0.24
209G	0.33	0.35	0.25	4.35	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	30%	15%	0.0%	35.0%	35.0%	0.35	30%	0.25
209H	0.19	0.38	0.25	5.60	0.0%	73.1%	26.9%	0.0%	73.1%	26.9%	0.0%	35%	15%	0.0%	18.3%	18.3%	0.38	35%	0.18
209I	0.16	0.40	0.25	6.00	0.0%	97.6%	2.4%	0.0%	97.6%	2.4%	0.0%	22%	15%	0.0%	5.3%	5.3%	0.40	22%	0.15
210A	0.23	0.36	0.25	5.00	25.1%	74.9%	0.0%	0.0%	74.9%	0.0%	25.1%	26%	15%	5.5%	0.0%	5.5%	0.36	26%	0.20
210B	0.16	0.39	0.25	5.80	0.0%	100.0%	0.0%	0.1%	99.9%	0.0%	0.0%	30%	15%	5.4%	4.2%	9.5%	0.39	30%	0.15
210C	0.26	0.35	0.25	4.80	32.1%	67.9%	0.0%	0.0%	67.9%	0.0%	32.1%	32%	15%	1.7%	5.3%	7.0%	0.35	32%	0.21
210D	0.17	0.39	0.25	5.80	0.0%	66.9%	33.1%	0.0%	66.9%	33.1%	0.0%	26%	15%	0.0%	18.7%	18.7%	0.39	26%	0.18
210E	0.11	0.36	0.17	6.80	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	32%	15%	0.0%	0.0%	0.0%	0.36	32%	0.15
210F	0.32	0.35	0.25	4.40	0.0%	1.6%	98.4%	0.0%	1.6%	98.4%	0.0%	30%	15%	0.0%	34.4%	34.4%	0.35	30%	0.25
210G	0.20	0.37	0.25	5.30	0.0%	30.8%	69.2%	0.0%	30.8%	69.2%	0.0%	28%	15%	0.0%	24.2%	24.2%	0.37	28%	0.22
210H	0.15	0.39	0.23	6.20	0.0%	85.4%	14.6%	0.0%	85.4%	14.6%	0.0%	32%	15%	0.0%	6.7%	6.7%	0.39	32%	0.16
210I	0.09	0.32	0.15	7.60	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	28%	15%	0.0%	0.0%	0.0%	0.32	28%	0.15

Table S-6

Subbasin Weighted DTHETA and Surface Loss Parameters
Existing Condition

[1] Sub-basin ID	[2] Log Avg. XKSAT	[3] DTHETA (Dry)	[4] DTHETA (Normal)	[5] PSIF	[6] Percent Valley Area	[7] Percent Hillslope Area	[8] Percent Mountain Area	[9] Percent Urban Area	[10] Adjusted Hillslope Area	[11] Adjusted Mountain Area	[12] Adjusted Valley Area	[13] V,H,M Veg. Cover	[14] Urban Veg. Cover	[15] RTIMP (urban)	[16] RTIMP (rock)	[17] RTIMP (total)	[18] DTHETA (wghtd)	[19] Vegetation Cover (wghtd)	[20] IA (wghtd)
210J	0.12	0.37	0.19	6.60	0.9%	99.1%	0.0%	0.0%	99.1%	0.0%	0.9%	32%	15%	0.0%	0.0%	0.0%	0.37	32%	0.15
210K	0.12	0.37	0.19	6.60	13.1%	86.9%	0.0%	0.0%	86.9%	0.0%	13.1%	28%	15%	0.1%	0.0%	0.1%	0.37	28%	0.18
210L	0.22	0.37	0.25	5.20	15.5%	84.5%	0.0%	0.0%	84.5%	0.0%	15.5%	34%	15%	0.0%	0.0%	0.0%	0.37	34%	0.18
210M	0.16	0.39	0.25	5.80	15.8%	84.2%	0.0%	0.0%	84.2%	0.0%	15.8%	29%	15%	0.1%	0.0%	0.1%	0.39	29%	0.18
210N	0.38	0.35	0.25	4.10	56.5%	43.5%	0.0%	0.0%	43.5%	0.0%	56.5%	30%	15%	10.4%	0.0%	10.4%	0.35	30%	0.26
211A	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	7.0%	93.0%	0.0%	0.0%	32%	15%	13.8%	0.0%	13.8%	0.38	31%	0.14
211B	0.17	0.39	0.25	5.80	0.0%	100.0%	0.0%	11.4%	88.6%	0.0%	0.0%	32%	15%	13.4%	0.0%	13.4%	0.37	30%	0.14
211C	0.17	0.39	0.25	5.70	9.1%	90.9%	0.0%	97.4%	0.0%	0.0%	2.6%	27%	15%	44.5%	0.0%	44.5%	0.25	15%	0.08
211D	0.44	0.35	0.25	3.85	55.6%	44.4%	0.0%	51.8%	0.0%	0.0%	48.2%	27%	15%	28.3%	0.0%	28.3%	0.30	21%	0.21
211E	0.22	0.36	0.25	5.10	22.7%	77.3%	0.0%	86.0%	0.0%	0.0%	14.0%	20%	15%	42.2%	0.0%	42.2%	0.27	16%	0.11
211F	0.34	0.35	0.25	4.30	40.9%	59.1%	0.0%	96.4%	0.0%	0.0%	3.6%	20%	15%	62.7%	0.0%	62.7%	0.25	15%	0.08
211G	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	30%	15%	90.0%	0.0%	90.0%	0.25	15%	0.06
211H	0.15	0.40	0.25	6.00	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	26%	15%	3.4%	0.0%	3.4%	0.40	26%	0.15
211I	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	24%	15%	35.0%	0.0%	35.0%	0.39	24%	0.13
211J	0.15	0.39	0.23	6.20	0.0%	100.0%	0.0%	11.6%	88.4%	0.0%	0.0%	27%	15%	32.4%	0.0%	32.4%	0.37	26%	0.13
211K	0.15	0.40	0.25	6.00	22.4%	77.6%	0.0%	11.6%	66.0%	0.0%	22.4%	27%	15%	17.8%	0.0%	17.8%	0.38	26%	0.18
211L	0.33	0.35	0.25	4.35	43.6%	56.4%	0.0%	69.8%	0.0%	0.0%	30.2%	20%	15%	37.8%	0.0%	37.8%	0.28	17%	0.16
211M	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	31%	15%	30.3%	0.0%	30.3%	0.39	31%	0.13
211N	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	2.6%	97.4%	0.0%	0.0%	27%	15%	20.2%	0.0%	20.2%	0.39	27%	0.14
211O	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	0.3%	99.7%	0.0%	0.0%	27%	15%	34.6%	0.0%	34.6%	0.39	27%	0.13
211P	0.10	0.35	0.15	7.00	3.3%	96.7%	0.0%	99.2%	0.0%	0.0%	0.8%	20%	15%	44.9%	0.0%	44.9%	0.15	15%	0.08
211Q	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	5.6%	94.4%	0.0%	0.0%	29%	15%	8.5%	0.0%	8.5%	0.38	28%	0.14
211R	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	8.6%	91.4%	0.0%	0.0%	29%	15%	22.0%	0.0%	22.0%	0.38	28%	0.13
211S	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	20.5%	79.5%	0.0%	0.0%	29%	15%	26.1%	0.0%	26.1%	0.36	26%	0.13
211T	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	10.8%	89.2%	0.0%	0.0%	28%	15%	21.0%	0.0%	21.0%	0.37	27%	0.13
211U	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	95.5%	4.5%	0.0%	0.0%	20%	15%	65.5%	0.0%	65.5%	0.26	15%	0.07
211V	0.17	0.39	0.25	5.80	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	30%	15%	90.0%	0.0%	90.0%	0.25	15%	0.06
211W	0.17	0.39	0.25	5.70	0.0%	100.0%	0.0%	86.5%	13.5%	0.0%	0.0%	30%	15%	69.9%	0.0%	69.9%	0.27	17%	0.07
211X	0.25	0.35	0.25	4.90	26.0%	74.0%	0.0%	45.5%	28.5%	0.0%	26.0%	20%	15%	43.2%	0.0%	43.2%	0.30	18%	0.16

Table S-6

Subbasin Weighted DTHETA and Surface Loss Parameters
Existing Condition

[1] Sub-basin ID	[2] Log Avg. XKSAT	[3] DTHETA (Dry)	[4] DTHETA (Normal)	[5] PSIF	[6] Percent Valley Area	[7] Percent Hillslope Area	[8] Percent Mountain Area	[9] Percent Urban Area	[10] Adjusted Hillslope Area	[11] Adjusted Mountain Area	[12] Adjusted Valley Area	[13] V,H,M Veg. Cover	[14] Urban Veg. Cover	[15] RTIMP (urban)	[16] RTIMP (rock)	[17] RTIMP (total)	[18] DTHETA (wghtd)	[19] Vegetation Cover (wghtd)	[20] IA (wghtd)
211Y	0.12	0.37	0.19	6.60	5.2%	94.8%	0.0%	37.3%	57.5%	0.0%	5.2%	30%	15%	16.8%	0.0%	16.8%	0.30	24%	0.13
211Z	0.31	0.35	0.25	4.50	47.0%	53.0%	0.0%	76.5%	0.0%	0.0%	23.5%	30%	15%	34.4%	0.0%	34.4%	0.27	19%	0.14
211AA	0.12	0.37	0.19	6.60	0.0%	100.0%	0.0%	71.9%	28.1%	0.0%	0.0%	30%	15%	38.8%	0.0%	38.8%	0.24	19%	0.09
211AB	0.12	0.36	0.17	6.80	0.0%	100.0%	0.0%	51.4%	48.6%	0.0%	0.0%	30%	15%	23.1%	0.0%	23.1%	0.26	22%	0.11
211AC	0.07	0.29	0.15	8.40	0.0%	100.0%	0.0%	99.5%	0.5%	0.0%	0.0%	30%	15%	44.8%	0.0%	44.8%	0.15	15%	0.08
211AD	0.08	0.30	0.15	8.00	0.0%	100.0%	0.0%	94.1%	5.9%	0.0%	0.0%	27%	15%	42.4%	0.0%	42.4%	0.16	16%	0.08
211AE	0.14	0.38	0.21	6.40	25.1%	74.9%	0.0%	84.8%	0.0%	0.0%	15.2%	27%	15%	38.2%	0.0%	38.2%	0.24	17%	0.12
211AF	0.16	0.39	0.25	5.80	0.0%	100.0%	0.0%	62.8%	37.2%	0.0%	0.0%	25%	15%	28.3%	0.0%	28.3%	0.30	19%	0.10

Note: 1. DTHETA(Dry), DTHETA(Normal), and PSIF are taken from Table S-1 using bare ground Log. Avg. XKSAT for lookup.

2. IA(weighted) is based on:

Valley:	0.35
Hillslope:	0.15
Mountain:	0.25
Urban (pervious):	0.10

Table S-7

Existing Condition Subbasin Time of Concentration Parameters

[1] Subbasin ID	[2] Drainage Area (sm)	[3] Elevation Top	[4] Elevation Bottom	[5] Flow Path (miles)	[6] Slope (ft/mi)	[7] Adjusted Slope (ft/mi)	[8] Valley Area (%)	[9] Hillslope Area (%)	[10] Mountain Area (%)	[11] Urban Area %	[12] Weighted Kb Equation Parameters m	[13] Weighted Kb Equation Parameters b	[14] Kb
201A	0.21655	1903.0	1639.0	1.269	208	208	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.10
201B	0.08068	1791.0	1639.0	0.680	223	223	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
201C	0.07857	1717.0	1578.0	0.674	206	206	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
201D	0.07093	1764.0	1578.0	0.898	207	207	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
201E	0.18315	1754.0	1533.0	1.245	178	178	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.10
202A	0.03778	1590.0	1537.2	0.409	129	129	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.12
202B	0.01794	1764.0	1536.0	0.364	627	322	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.12
202C	0.00765	1764.0	1529.0	0.192	1227	363	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.13
202D	0.06258	1740.0	1525.0	0.800	269	248	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
202E	0.10408	1757.0	1523.6	0.732	319	270	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.10
202F	0.01309	1678.0	1526.0	0.188	809	337	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.13
202G	0.01316	1676.0	1534.4	0.175	811	338	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.13
202H	0.17938	1759.0	1534.5	0.861	261	243	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.10
202I	0.01747	1556.0	1526.0	0.247	122	122	0.0%	93.9%	0.0%	6.1%	-0.02385	0.14	0.12
203A	0.27918	2159.0	1791.7	1.569	234	229	0.0%	85.6%	0.0%	14.4%	-0.02231	0.13	0.08
203B	0.04446	1853.0	1734.0	0.484	246	236	0.0%	82.6%	0.0%	17.4%	-0.02175	0.13	0.10
203C	0.10306	2020.0	1734.0	0.988	290	258	0.0%	99.7%	0.0%	0.3%	-0.02495	0.15	0.10
203D	0.10805	2012.0	1728.0	1.025	277	252	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.10
203E	0.09335	1806.0	1666.0	0.640	219	219	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
203F	0.33332	2171.0	1809.0	1.460	248	237	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.09
203G	0.24821	1972.0	1666.0	1.424	215	215	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.09
203H	0.20675	1774.0	1590.0	1.035	178	178	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.10
203I	0.17071	1764.0	1551.0	1.323	161	161	0.0%	100.0%	0.0%	0.0%	-0.02499	0.15	0.10
203J	0.03885	1710.0	1578.0	0.533	248	237	0.0%	83.2%	0.0%	16.8%	-0.02184	0.13	0.10
203K	0.16019	1654.0	1515.0	0.878	158	158	0.0%	8.4%	0.0%	91.6%	-0.00783	0.05	0.03
204A	0.10768	1834.0	1714.0	0.687	175	175	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.10
204B	0.12598	1749.0	1649.6	0.775	128	128	0.7%	99.3%	0.0%	0.0%	-0.02493	0.15	0.10
204C	0.07669	1676.0	1619.0	0.400	142	142	0.0%	78.2%	0.0%	21.8%	-0.02090	0.13	0.09
204D	0.04409	1630.0	1597.0	0.345	96	96	0.0%	40.8%	0.0%	59.2%	-0.01389	0.08	0.06
204E	0.07051	1620.0	1565.0	0.508	108	108	0.0%	34.8%	0.0%	65.2%	-0.01278	0.08	0.06

Table S-7

Existing Condition Subbasin Time of Concentration Parameters

[1] Subbasin ID	[2] Drainage Area (sm)	[3] Elevation Top	[4] Elevation Bottom	[5] Flow Path (miles)	[6] Slope (ft/mi)	[7] Adjusted Slope (ft/mi)	[8] Valley Area (%)	[9] Hillslope Area (%)	[10] Mountain Area (%)	[11] Urban Area %	[12] Weighted Kb Equation Parameters m	[13] Weighted Kb Equation Parameters b	[14] Kb
204F	0.07714	1593.0	1526.1	0.495	135	135	0.0%	0.0%	0.0%	100.0%	-0.00625	0.04	0.03
205A	0.11753	3985.0	2622.0	0.870	1567	378	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
205B	0.21124	3720.0	2622.0	0.759	1446	373	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
205C	0.05877	2890.0	2438.0	0.618	731	331	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
205D	0.31907	3690.0	2480.0	1.020	1186	361	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.13
205E	0.21753	4025.0	2480.0	1.357	1138	358	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
205F	0.16126	2865.0	2340.0	0.786	668	326	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
205G	0.18549	2940.0	2183.0	0.924	819	338	0.0%	10.8%	89.2%	0.0%	-0.02946	0.19	0.13
205H	0.26054	3145.0	2183.0	1.464	657	325	0.0%	9.9%	90.1%	0.0%	-0.02951	0.20	0.13
205I	0.35388	3145.0	2139.0	1.487	676	326	1.3%	55.3%	43.4%	0.0%	-0.02702	0.17	0.11
205J	0.36947	2391.0	1967.0	1.633	260	243	24.6%	65.5%	9.9%	0.0%	-0.02273	0.14	0.08
205K	0.24538	2449.0	1967.0	1.772	272	249	2.8%	92.7%	4.4%	0.0%	-0.02490	0.15	0.10
205L	0.11764	2169.0	1922.0	0.701	352	284	20.7%	79.3%	0.0%	0.0%	-0.02267	0.14	0.09
205M	0.13853	2049.0	1851.9	0.839	235	230	18.0%	39.8%	0.0%	42.2%	-0.01507	0.09	0.06
205N	0.15606	2163.0	1851.9	1.183	263	245	1.1%	97.1%	0.0%	1.8%	-0.02454	0.15	0.10
206A	0.12778	2002.0	1821.0	0.631	287	256	13.7%	15.4%	0.0%	70.9%	-0.01017	0.06	0.04
206B	0.09522	1855.0	1775.8	0.570	139	139	8.5%	0.0%	0.0%	91.5%	-0.00689	0.04	0.03
206C	0.02378	1789.0	1730.0	0.427	138	138	39.8%	32.7%	0.0%	27.5%	-0.01537	0.09	0.07
206D	0.06165	1909.0	1778.0	0.531	247	236	0.0%	7.1%	0.0%	92.9%	-0.00758	0.05	0.04
206E	0.02274	1790.0	1730.0	0.343	175	175	40.6%	55.7%	0.0%	3.8%	-0.01973	0.12	0.09
206F	0.15713	1856.0	1644.0	0.975	217	217	34.0%	63.6%	0.0%	2.3%	-0.02073	0.12	0.08
206G	0.08946	1733.0	1608.0	0.950	132	132	13.0%	69.7%	0.0%	17.3%	-0.02030	0.12	0.09
206H	0.05895	1813.0	1718.5	0.515	183	183	0.0%	43.5%	0.0%	56.5%	-0.01441	0.09	0.07
206I	0.02083	1797.0	1714.0	0.232	357	286	0.0%	51.1%	0.0%	48.9%	-0.01583	0.10	0.08
206J	0.05990	1755.0	1647.5	0.502	214	214	0.0%	2.4%	0.0%	97.6%	-0.00671	0.04	0.03
206K	0.05577	1876.0	1702.0	0.615	283	255	0.0%	96.0%	0.0%	4.0%	-0.02425	0.15	0.11
206L	0.05951	1802.0	1672.0	0.546	238	231	0.0%	100.0%	0.0%	0.0%	-0.02499	0.15	0.11
206M	0.05958	1685.0	1608.0	0.465	166	166	2.9%	0.0%	0.0%	97.1%	-0.00647	0.04	0.03
206N	0.15176	1644.0	1552.0	0.767	120	120	19.7%	0.0%	0.0%	80.3%	-0.00773	0.05	0.03
207A	0.25609	3615.0	2237.0	1.356	1016	351	0.0%	14.8%	85.2%	0.0%	-0.02926	0.19	0.13

Table S-7

Existing Condition Subbasin Time of Concentration Parameters

[1] Subbasin ID	[2] Drainage Area (sm)	[3] Elevation Top	[4] Elevation Bottom	[5] Flow Path (miles)	[6] Slope (ft/mi)	[7] Adjusted Slope (ft/mi)	[8] Valley Area (%)	[9] Hillslope Area (%)	[10] Mountain Area (%)	[11] Urban Area %	[12] Weighted Kb Equation Parameters m	[13] Weighted Kb Equation Parameters b	[14] Kb
207B	0.20823	3750.0	2237.0	1.312	1154	359	0.0%	7.4%	92.6%	0.0%	-0.02963	0.20	0.13
207C	0.17298	2454.0	2074.0	0.974	390	297	0.0%	60.9%	39.1%	0.0%	-0.02696	0.17	0.11
207D	0.19708	3800.0	2307.0	1.036	1440	373	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
207E	0.15651	2837.0	2074.0	1.366	559	315	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
207F	0.12613	2355.0	2029.0	0.794	411	296	0.0%	3.4%	96.2%	0.4%	-0.02974	0.20	0.14
207G	0.23634	2259.0	1968.0	1.467	198	198	0.0%	76.6%	23.4%	0.0%	-0.02617	0.16	0.10
207H	0.12447	3740.0	2291.0	1.044	1388	371	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
207I	0.07294	2619.0	2129.0	0.810	605	320	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
207J	0.09277	2161.0	1968.0	0.714	270	248	0.0%	0.0%	83.8%	16.2%	-0.02614	0.17	0.13
207K	0.12955	2253.0	1908.2	0.859	402	294	0.0%	36.2%	27.3%	36.5%	-0.01952	0.12	0.09
207L	0.08040	2073.0	1908.2	0.667	247	236	0.0%	48.5%	0.0%	51.5%	-0.01534	0.09	0.07
207M	0.11594	2087.0	1844.0	0.636	382	295	3.0%	95.0%	0.0%	1.9%	-0.02430	0.15	0.10
207N	0.04918	1939.0	1857.0	0.431	190	190	26.2%	73.5%	0.0%	0.2%	-0.02200	0.13	0.10
207O	0.13051	2020.0	1807.2	0.643	331	275	14.6%	85.4%	0.0%	0.0%	-0.02336	0.14	0.09
208A	0.13859	3234.0	2425.0	0.626	1292	366	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
208B	0.02690	2551.0	2225.0	0.491	663	325	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.16
208C	0.06644	3800.0	2639.0	0.639	1816	387	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
208D	0.07452	2756.0	2225.0	0.772	688	327	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
208E	0.06205	2390.0	2076.0	0.644	488	306	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
208F	0.06910	2296.0	2076.0	0.582	378	293	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
208G	0.12941	2253.0	1947.0	0.772	396	299	0.0%	15.0%	79.8%	5.2%	-0.02802	0.18	0.13
208H	0.04276	2094.0	1872.0	0.632	351	283	0.0%	82.2%	17.8%	0.0%	-0.02589	0.16	0.12
208I	0.11709	3088.0	2074.0	0.823	1231	363	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
208J	0.08107	3088.0	2074.0	0.974	1041	353	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
208K	0.04756	2265.0	2014.0	0.431	582	317	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.16
208L	0.05884	2517.0	2014.0	0.655	769	334	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
208M	0.15941	2509.0	1872.0	1.031	618	321	0.0%	3.5%	96.5%	0.0%	-0.02983	0.20	0.14
208N	0.04713	1899.0	1805.0	0.589	160	160	0.0%	99.4%	0.6%	0.0%	-0.02503	0.15	0.11
208O	0.22988	3056.0	1939.0	1.174	952	347	0.0%	15.1%	84.9%	0.0%	-0.02924	0.19	0.13
208P	0.05837	2122.0	1870.4	0.471	535	312	0.0%	74.3%	25.7%	0.0%	-0.02629	0.16	0.12

Table S-7

Existing Condition Subbasin Time of Concentration Parameters

[1] Subbasin ID	[2] Drainage Area (sm)	[3] Elevation Top	[4] Elevation Bottom	[5] Flow Path (miles)	[6] Slope (ft/mi)	[7] Adjusted Slope (ft/mi)	[8] Valley Area (%)	[9] Hillslope Area (%)	[10] Mountain Area (%)	[11] Urban Area %	[12] Weighted Kb Equation Parameters m	[13] Weighted Kb Equation Parameters b	[14] Kb
208Q	0.09426	2402.0	1870.4	0.823	646	324	0.0%	40.1%	59.9%	0.0%	-0.02800	0.18	0.13
208R	0.01047	2089.0	1926.0	0.238	686	327	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.13
208S	0.06825	1943.0	1805.0	0.568	243	234	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
208T	0.13175	2612.0	1947.0	0.787	845	340	0.0%	52.0%	48.0%	0.0%	-0.02740	0.17	0.12
208U	0.13368	2536.0	1947.0	0.507	1162	360	0.0%	58.1%	41.9%	0.0%	-0.02709	0.17	0.12
208V	0.02781	2130.0	1917.0	0.354	601	319	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.12
208W	0.05043	1991.0	1818.0	0.475	364	288	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
208X	0.07543	1870.0	1777.1	0.417	223	223	12.6%	87.4%	0.0%	0.0%	-0.02359	0.14	0.10
209A	0.36779	3770.0	2426.0	1.028	1308	367	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.13
209B	0.08313	3999.0	2321.0	0.716	2345	403	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
209C	0.06387	2951.0	2321.0	0.723	871	342	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.15
209D	0.24418	3065.0	2218.0	0.800	1059	354	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.13
209E	0.14899	3094.0	2218.0	1.018	861	341	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
209F	0.22574	2921.0	2034.0	1.191	745	332	0.0%	11.6%	88.4%	0.0%	-0.02942	0.19	0.13
209G	0.20380	2545.0	2034.0	1.050	487	306	0.0%	0.0%	100.0%	0.0%	-0.03000	0.20	0.14
209H	0.08348	2470.0	1994.0	0.542	878	343	0.0%	73.1%	26.9%	0.0%	-0.02634	0.16	0.12
209I	0.18233	2536.0	1883.5	0.691	945	347	0.0%	97.6%	2.4%	0.0%	-0.02512	0.15	0.10
210A	0.12274	1874.0	1722.0	0.631	241	233	25.1%	74.9%	0.0%	0.0%	-0.02217	0.13	0.09
210B	0.10672	2062.0	1805.6	0.930	276	251	0.0%	99.9%	0.0%	0.1%	-0.02498	0.15	0.10
210C	0.08171	1854.0	1728.0	0.637	198	198	32.1%	67.9%	0.0%	0.0%	-0.02138	0.13	0.09
210D	0.13967	2390.0	1836.0	0.832	666	325	0.0%	66.9%	33.1%	0.0%	-0.02666	0.17	0.11
210E	0.02753	1849.0	1798.0	0.339	151	151	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.12
210F	0.09263	2529.0	1872.0	0.668	983	349	0.0%	1.6%	98.4%	0.0%	-0.02992	0.20	0.15
210G	0.16152	2529.0	1798.0	0.969	755	333	0.0%	30.8%	69.2%	0.0%	-0.02846	0.18	0.13
210H	0.06974	2351.0	1875.0	0.565	842	340	0.0%	85.4%	14.6%	0.0%	-0.02573	0.16	0.11
210I	0.04910	1944.0	1770.0	0.634	275	250	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
210J	0.10328	1856.0	1728.0	0.684	187	187	0.9%	99.1%	0.0%	0.0%	-0.02489	0.15	0.10
210K	0.07706	1804.0	1716.0	0.425	207	207	13.1%	86.9%	0.0%	0.0%	-0.02353	0.14	0.10
210L	0.13741	2013.0	1787.0	0.820	276	251	15.5%	84.5%	0.0%	0.0%	-0.02325	0.14	0.09
210M	0.16239	1961.0	1716.0	1.022	240	232	15.8%	84.2%	0.0%	0.0%	-0.02322	0.14	0.09

Table S-7

Existing Condition Subbasin Time of Concentration Parameters

[1] Subbasin ID	[2] Drainage Area (sm)	[3] Elevation Top	[4] Elevation Bottom	[5] Flow Path (miles)	[6] Slope (ft/mi)	[7] Adjusted Slope (ft/mi)	[8] Valley Area (%)	[9] Hillslope Area (%)	[10] Mountain Area (%)	[11] Urban Area %	[12] Weighted Kb Equation Parameters m	[13] Weighted Kb Equation Parameters b	[14] Kb
210N	0.04852	1749.0	1693.9	0.309	178	178	56.5%	43.5%	0.0%	0.0%	-0.01864	0.11	0.08
211A	0.14294	1972.0	1751.0	0.820	269	248	0.0%	93.0%	0.0%	7.0%	-0.02368	0.14	0.10
211B	0.10855	1870.0	1708.7	0.618	261	244	0.0%	88.6%	0.0%	11.4%	-0.02286	0.14	0.10
211C	0.04277	1757.0	1683.0	0.479	154	154	2.6%	0.0%	0.0%	97.4%	-0.00644	0.04	0.03
211D	0.07054	1762.0	1683.0	0.686	115	115	48.2%	0.0%	0.0%	51.8%	-0.00987	0.06	0.04
211E	0.15557	1700.0	1628.0	0.609	118	118	14.0%	0.0%	0.0%	86.0%	-0.00730	0.05	0.03
211F	0.11280	1675.0	1572.0	0.770	134	134	3.6%	0.0%	0.0%	96.4%	-0.00652	0.04	0.03
211G	0.00759	1982.0	1897.0	0.448	190	190	0.0%	0.0%	0.0%	100.0%	-0.00625	0.04	0.04
211H	0.07345	1912.0	1728.0	0.501	368	289	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
211I	0.04077	1898.0	1717.0	0.626	289	257	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
211J	0.01480	1728.0	1686.6	0.249	166	166	0.0%	88.4%	0.0%	11.6%	-0.02282	0.14	0.11
211K	0.10197	1731.0	1672.0	0.376	157	157	22.4%	66.0%	0.0%	11.6%	-0.02031	0.12	0.08
211L	0.09575	1719.0	1627.0	0.508	181	181	30.2%	0.0%	0.0%	69.8%	-0.00852	0.05	0.04
211M	0.08133	1874.0	1707.0	0.541	308	266	0.0%	100.0%	0.0%	0.0%	-0.02500	0.15	0.11
211N	0.02038	1748.0	1684.0	0.261	245	235	0.0%	97.4%	0.0%	2.6%	-0.02452	0.15	0.12
211O	0.04119	1800.0	1693.4	0.371	288	257	0.0%	99.7%	0.0%	0.3%	-0.02494	0.15	0.11
211P	0.03347	1718.0	1659.0	0.307	192	192	0.8%	0.0%	0.0%	99.2%	-0.00631	0.04	0.03
211Q	0.02107	1964.0	1860.0	0.255	408	295	0.0%	94.4%	0.0%	5.6%	-0.02395	0.14	0.12
211R	0.08438	1981.0	1797.5	0.572	321	271	0.0%	91.4%	0.0%	8.6%	-0.02339	0.14	0.10
211S	0.05041	1875.0	1731.5	0.445	323	272	0.0%	79.5%	0.0%	20.5%	-0.02115	0.13	0.10
211T	0.06637	1813.0	1679.1	0.488	274	250	0.0%	89.2%	0.0%	10.8%	-0.02298	0.14	0.10
211U	0.02744	2023.0	1845.0	0.831	214	214	0.0%	4.5%	0.0%	95.5%	-0.00709	0.04	0.04
211V	0.00490	1847.0	1800.0	0.222	212	212	0.0%	0.0%	0.0%	100.0%	-0.00625	0.04	0.04
211W	0.02969	1713.0	1663.0	0.289	173	173	0.0%	13.5%	0.0%	86.5%	-0.00878	0.05	0.04
211X	0.21393	1675.0	1572.0	0.929	111	111	26.0%	28.5%	0.0%	45.5%	-0.01354	0.08	0.05
211Y	0.08928	1641.0	1552.0	0.606	147	147	5.2%	57.5%	0.0%	37.3%	-0.01743	0.11	0.07
211Z	0.08254	1592.0	1517.0	0.509	147	147	23.5%	0.0%	0.0%	76.5%	-0.00801	0.05	0.04
211AA	0.03399	1592.0	1551.0	0.480	85	85	0.0%	28.1%	0.0%	71.9%	-0.01152	0.07	0.06
211AB	0.03974	1721.0	1540.0	0.293	617	321	0.0%	48.6%	0.0%	51.4%	-0.01536	0.09	0.07
211AC	0.02745	1557.0	1532.0	0.306	82	82	0.0%	0.5%	0.0%	99.5%	-0.00635	0.04	0.03

Table S-7

Existing Condition Subbasin Time of Concentration Parameters

[1] Subbasin ID	[2] Drainage Area (sm)	[3] Elevation Top	[4] Elevation Bottom	[5] Flow Path (miles)	[6] Slope (ft/mi)	[7] Adjusted Slope (ft/mi)	[8] Valley Area (%)	[9] Hillslope Area (%)	[10] Mountain Area (%)	[11] Urban Area %	[12] Weighted Kb Equation Parameters m	[13] Weighted Kb Equation Parameters b	[14] Kb
211AD	0.04132	1684.0	1517.0	0.489	341	280	0.0%	5.9%	0.0%	94.1%	-0.00735	0.05	0.04
211AE	0.03443	1552.0	1504.0	0.313	153	153	15.2%	0.0%	0.0%	84.8%	-0.00739	0.05	0.04
211AF	0.05270	1666.0	1542.0	0.332	373	292	0.0%	37.2%	0.0%	62.8%	-0.01322	0.08	0.06

Note: The composite m and b values listed are based on the following:

	m	b
Urban:	-0.00625	0.04
Valley (desert rangeland):	-0.01375	0.08
Hillslope	-0.02500	0.15
Mountain	-0.03000	0.20

Table S-8a

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 6-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at	Tc	Tc	R
Subbasin																			Excess	90% Excess			
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
201A	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.755	30	28	0.458	0.450
201B	0.45	0.44	0.44	0.13	0.10	0.09	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.736	30	19	0.313	0.314
201C	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.713	30	19	0.321	0.326
201D	0.45	0.44	0.44	0.13	0.10	0.09	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.736	30	24	0.392	0.542
201E	0.44	0.43	0.43	0.12	0.08	0.07	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.641	25	30	0.500	0.538
202A	0.43	0.42	0.42	0.11	0.07	0.06	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.637	30	18	0.304	0.312
202B	0.43	0.42	0.42	0.11	0.07	0.06	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.559	25	12	0.204	0.280
202C	0.43	0.42	0.42	0.11	0.07	0.05	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.612	30	9	0.150	0.193
202D	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.798	30	20	0.333	0.444
202E	0.44	0.44	0.43	0.13	0.09	0.08	0.03	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.695	25	17	0.283	0.258
202F	0.44	0.44	0.43	0.13	0.09	0.08	0.03	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.716	30	9	0.150	0.140
202G	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.739	30	9	0.142	0.124
202H	0.44	0.43	0.43	0.12	0.08	0.07	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.641	25	20	0.338	0.262
202I	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.806	35	14	0.225	0.232
203A	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.794	30	26	0.438	0.439
203B	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.814	30	14	0.233	0.243
203C	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.860	35	21	0.354	0.423
203D	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.712	30	22	0.367	0.441
203E	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.866	30	18	0.296	0.259
203F	0.44	0.44	0.43	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.705	25	27	0.450	0.386
203G	0.45	0.44	0.44	0.13	0.10	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.728	30	28	0.458	0.457
203H	0.45	0.44	0.44	0.13	0.10	0.09	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.736	30	26	0.429	0.365
203I	0.44	0.43	0.43	0.12	0.08	0.07	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.638	25	33	0.546	0.647
203J	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.948	40	15	0.242	0.294
203K	0.48	0.47	0.47	0.17	0.14	0.13	0.06	0.06	0.06	0.05	0.05	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.485	90	11	0.183	0.144
204A	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.753	30	20	0.325	0.280
204B	0.44	0.44	0.43	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.709	30	25	0.408	0.364
204C	0.46	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.159	55	14	0.233	0.153
204D	0.48	0.47	0.47	0.17	0.13	0.13	0.06	0.06	0.06	0.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.456	90	12	0.196	0.153

Table S-8a

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 6-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total Excess	Time at 90% Excess	Tc	Tc	R
Subbasin ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
204E	0.48	0.47	0.47	0.17	0.13	0.13	0.06	0.06	0.06	0.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.431	85	14	0.229	0.190
204F	0.49	0.49	0.49	0.18	0.15	0.15	0.07	0.07	0.07	0.07	0.07	0.07	0.01	0.01	0.01	0.01	0.01	0.01	2.705	90	9	0.146	0.107
205A	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.096	90	21	0.350	0.350
205B	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.093	90	19	0.321	0.204
205C	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.088	90	19	0.308	0.343
205D	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.089	90	23	0.379	0.246
205E	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.093	90	29	0.488	0.508
205F	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.084	90	21	0.350	0.269
205G	0.45	0.44	0.44	0.13	0.09	0.07	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.018	85	22	0.367	0.298
205H	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.034	85	31	0.513	0.514
205I	0.44	0.44	0.43	0.13	0.09	0.08	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.846	40	28	0.458	0.386
205J	0.44	0.43	0.42	0.12	0.08	0.06	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.647	30	27	0.450	0.398
205K	0.44	0.44	0.43	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.720	30	33	0.546	0.665
205L	0.44	0.43	0.42	0.12	0.08	0.06	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.606	25	15	0.254	0.206
205M	0.46	0.46	0.45	0.15	0.11	0.11	0.05	0.05	0.04	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.084	50	14	0.233	0.197
205N	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.723	30	25	0.413	0.457
206A	0.47	0.46	0.46	0.16	0.13	0.12	0.05	0.05	0.05	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.297	75	10	0.158	0.107
206B	0.48	0.47	0.47	0.17	0.13	0.13	0.06	0.06	0.05	0.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.451	90	9	0.154	0.113
206C	0.44	0.43	0.42	0.12	0.08	0.06	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.731	35	13	0.217	0.289
206D	0.48	0.48	0.47	0.17	0.14	0.13	0.06	0.06	0.06	0.05	0.05	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.509	90	9	0.146	0.129
206E	0.42	0.42	0.41	0.10	0.06	0.04	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.500	20	13	0.208	0.238
206F	0.43	0.42	0.42	0.11	0.07	0.06	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.620	25	20	0.333	0.308
206G	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.893	40	26	0.425	0.544
206H	0.47	0.46	0.46	0.16	0.13	0.12	0.05	0.05	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.233	55	13	0.213	0.196
206I	0.47	0.47	0.47	0.16	0.13	0.12	0.06	0.06	0.05	0.04	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.366	80	8	0.133	0.112
206J	0.48	0.48	0.48	0.17	0.14	0.14	0.06	0.06	0.06	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	2.562	90	8	0.125	0.105
206K	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.811	30	17	0.275	0.310
206L	0.45	0.45	0.45	0.14	0.10	0.09	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.945	40	16	0.263	0.258
206M	0.48	0.47	0.47	0.17	0.14	0.13	0.06	0.06	0.06	0.05	0.05	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.535	90	8	0.133	0.107

Table S-8a

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 6-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at			
Subbasin																			Excess	90% Excess	Tc	Tc	R
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
206N	0.48	0.47	0.47	0.17	0.13	0.13	0.06	0.06	0.06	0.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.547	90	11	0.188	0.137
207A	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.021	75	28	0.467	0.440
207B	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.065	85	27	0.450	0.463
207C	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.859	40	21	0.354	0.311
207D	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.093	90	24	0.396	0.343
207E	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.074	90	31	0.521	0.663
207F	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.058	90	22	0.367	0.329
207G	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.805	30	32	0.525	0.560
207H	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.096	90	24	0.400	0.454
207I	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.095	90	23	0.375	0.468
207J	0.45	0.45	0.45	0.14	0.10	0.09	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.165	90	21	0.346	0.337
207K	0.47	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.05	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.248	70	17	0.275	0.251
207L	0.47	0.47	0.47	0.16	0.13	0.12	0.06	0.06	0.05	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.300	60	13	0.221	0.211
207M	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.803	30	15	0.250	0.189
207N	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.951	55	14	0.238	0.213
207O	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.824	35	15	0.242	0.171
208A	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.096	90	17	0.283	0.194
208B	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.079	90	17	0.279	0.399
208C	0.45	0.44	0.44	0.13	0.10	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.098	90	18	0.296	0.314
208D	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.077	90	22	0.363	0.428
208E	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.088	90	20	0.329	0.370
208F	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.088	90	19	0.313	0.303
208G	0.46	0.45	0.45	0.14	0.10	0.09	0.04	0.04	0.04	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.152	90	20	0.338	0.289
208H	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.817	35	17	0.288	0.387
208I	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.075	90	21	0.346	0.331
208J	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.077	90	25	0.413	0.568
208K	0.45	0.44	0.44	0.13	0.09	0.07	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.068	90	16	0.258	0.238
208L	0.45	0.44	0.44	0.13	0.09	0.07	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.065	90	19	0.321	0.375
208M	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.080	90	26	0.425	0.418

Table S-8a

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 6-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total Excess	Time at 90% Excess	Tc	Tc	R
Subbasin ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
208N	0.47	0.46	0.46	0.16	0.12	0.12	0.05	0.05	0.05	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.298	80	19	0.317	0.386
208O	0.45	0.44	0.44	0.13	0.10	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.089	90	26	0.425	0.376
208P	0.46	0.46	0.45	0.15	0.11	0.10	0.05	0.05	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.147	60	14	0.229	0.199
208Q	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.146	75	20	0.338	0.364
208R	0.47	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.168	55	10	0.167	0.216
208S	0.47	0.47	0.47	0.16	0.13	0.12	0.06	0.06	0.05	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.365	90	16	0.263	0.246
208T	0.46	0.45	0.45	0.14	0.11	0.09	0.04	0.04	0.04	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.116	70	18	0.304	0.259
208U	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.118	65	14	0.229	0.132
208V	0.47	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.161	55	12	0.196	0.203
208W	0.46	0.46	0.45	0.15	0.11	0.11	0.05	0.05	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.107	50	14	0.225	0.214
208X	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.064	55	13	0.217	0.147
209A	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.087	90	23	0.379	0.228
209B	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.098	90	19	0.313	0.321
209C	0.45	0.44	0.44	0.13	0.10	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.098	90	20	0.338	0.410
209D	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.071	90	20	0.325	0.199
209E	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.095	90	25	0.408	0.411
209F	0.45	0.44	0.44	0.13	0.09	0.07	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.022	85	26	0.438	0.397
209G	0.45	0.44	0.44	0.13	0.09	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.093	90	26	0.438	0.381
209H	0.45	0.45	0.44	0.13	0.10	0.09	0.04	0.04	0.03	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.952	45	15	0.242	0.193
209I	0.45	0.45	0.44	0.14	0.10	0.09	0.04	0.04	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.836	30	15	0.246	0.153
210A	0.44	0.44	0.43	0.12	0.09	0.07	0.03	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.731	30	15	0.254	0.185
210B	0.45	0.45	0.44	0.14	0.10	0.09	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.878	35	21	0.342	0.379
210C	0.44	0.43	0.43	0.12	0.08	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.690	30	17	0.275	0.257
210D	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.011	45	18	0.300	0.258
210E	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.868	30	15	0.246	0.254
210F	0.45	0.44	0.44	0.13	0.10	0.08	0.04	0.04	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.094	90	19	0.317	0.290
210G	0.45	0.45	0.45	0.14	0.10	0.09	0.04	0.04	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.039	55	23	0.375	0.343
210H	0.45	0.44	0.44	0.13	0.10	0.09	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.833	30	14	0.238	0.217
210I	0.47	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.974	35	17	0.279	0.347

Table S-8a

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 6-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total Excess	Time at 90% Excess	Tc	Tc	R
Subbasin ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
210J	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.835	30	19	0.313	0.274
210K	0.46	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.822	30	14	0.225	0.154
210L	0.43	0.43	0.42	0.11	0.08	0.06	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.605	25	18	0.300	0.257
210M	0.45	0.44	0.44	0.13	0.09	0.08	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.716	30	21	0.354	0.335
210N	0.42	0.42	0.41	0.10	0.06	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.581	30	11	0.183	0.123
211A	0.45	0.45	0.45	0.14	0.10	0.10	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.941	40	19	0.313	0.263
211AA	0.48	0.48	0.48	0.17	0.14	0.14	0.07	0.06	0.06	0.06	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	2.529	85	14	0.238	0.287
211AB	0.48	0.47	0.47	0.17	0.13	0.13	0.06	0.06	0.06	0.05	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.322	55	8	0.133	0.093
211AC	0.49	0.49	0.49	0.19	0.16	0.15	0.08	0.08	0.07	0.07	0.07	0.07	0.01	0.01	0.01	0.01	0.01	0.01	2.762	90	8	0.133	0.119
211AD	0.49	0.49	0.49	0.18	0.15	0.15	0.07	0.07	0.07	0.07	0.07	0.07	0.01	0.01	0.01	0.01	0.01	0.01	2.713	85	8	0.133	0.137
211AE	0.48	0.48	0.48	0.17	0.14	0.13	0.06	0.06	0.06	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	2.500	85	8	0.129	0.103
211AF	0.47	0.47	0.47	0.16	0.13	0.12	0.06	0.06	0.05	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.291	60	8	0.138	0.091
211B	0.45	0.45	0.45	0.14	0.11	0.10	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.938	40	16	0.263	0.202
211C	0.48	0.48	0.48	0.17	0.14	0.14	0.06	0.06	0.06	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	2.561	90	8	0.138	0.137
211D	0.44	0.44	0.43	0.13	0.09	0.07	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	1.969	75	13	0.217	0.227
211E	0.47	0.47	0.47	0.16	0.13	0.13	0.06	0.06	0.05	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.443	90	10	0.171	0.101
211F	0.48	0.48	0.48	0.17	0.14	0.14	0.06	0.06	0.06	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	2.700	90	11	0.183	0.158
211G	0.50	0.50	0.50	0.19	0.16	0.16	0.08	0.08	0.08	0.08	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02	3.168	90	9	0.142	0.359
211H	0.45	0.45	0.44	0.14	0.10	0.09	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.811	30	14	0.233	0.187
211I	0.47	0.46	0.46	0.16	0.12	0.11	0.05	0.05	0.05	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.289	85	16	0.271	0.370
211J	0.47	0.46	0.46	0.16	0.12	0.12	0.05	0.05	0.05	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.276	75	12	0.192	0.215
211K	0.46	0.45	0.45	0.15	0.11	0.10	0.05	0.04	0.04	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.035	45	12	0.204	0.107
211L	0.46	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.263	90	10	0.158	0.106
211M	0.46	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.199	65	15	0.246	0.199
211N	0.46	0.45	0.45	0.15	0.11	0.10	0.05	0.04	0.04	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.057	45	11	0.188	0.181
211O	0.47	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.05	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.283	80	12	0.204	0.177
211P	0.49	0.49	0.49	0.18	0.15	0.15	0.07	0.07	0.07	0.07	0.07	0.07	0.01	0.01	0.01	0.01	0.01	0.01	2.706	90	6	0.100	0.077
211Q	0.45	0.45	0.45	0.14	0.10	0.09	0.04	0.04	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.882	35	10	0.171	0.157
211R	0.46	0.46	0.45	0.15	0.11	0.11	0.05	0.05	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.092	50	15	0.242	0.200

Table S-8a

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 6-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total Excess	Time at 90% Excess	Tc	Tc	R
Subbasin ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
211S	0.46	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.171	60	13	0.213	0.190
211T	0.46	0.46	0.45	0.15	0.11	0.11	0.05	0.05	0.04	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.085	50	14	0.229	0.191
211U	0.49	0.49	0.49	0.18	0.15	0.15	0.07	0.07	0.07	0.07	0.06	0.06	0.02	0.02	0.02	0.02	0.02	0.02	2.838	90	11	0.188	0.386
211V	0.50	0.50	0.50	0.19	0.16	0.16	0.08	0.08	0.08	0.08	0.08	0.08	0.02	0.02	0.02	0.02	0.02	0.02	3.167	90	6	0.096	0.170
211W	0.49	0.49	0.49	0.18	0.15	0.15	0.07	0.07	0.07	0.07	0.07	0.06	0.02	0.02	0.02	0.02	0.02	0.02	2.893	90	7	0.117	0.094
211X	0.47	0.47	0.46	0.16	0.13	0.12	0.06	0.05	0.05	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	2.398	90	17	0.288	0.211
211Y	0.47	0.47	0.46	0.16	0.13	0.12	0.05	0.05	0.05	0.04	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	2.175	45	15	0.246	0.207
211Z	0.46	0.46	0.46	0.15	0.12	0.11	0.05	0.05	0.04	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.232	85	10	0.171	0.126

Table S-8b

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 24-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at			
Subbasin																			Excess	90% Excess	Tc	Tc	R
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
201A	0.25	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.380	25	29	0.488	0.482
201B	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.356	25	22	0.367	0.375
201C	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.332	25	23	0.375	0.387
201D	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.356	25	26	0.433	0.606
201E	0.24	0.24	0.24	0.24	0.24	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.259	25	32	0.525	0.567
202A	0.23	0.23	0.23	0.23	0.23	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.373	30	22	0.363	0.380
202B	0.23	0.23	0.23	0.23	0.23	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.202	25	16	0.258	0.363
202C	0.23	0.23	0.23	0.23	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.357	30	11	0.188	0.248
202D	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.502	30	23	0.388	0.524
202E	0.25	0.25	0.24	0.24	0.24	0.24	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.317	25	21	0.346	0.322
202F	0.25	0.25	0.24	0.24	0.24	0.24	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.352	25	11	0.188	0.179
202G	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.375	30	11	0.179	0.161
202H	0.24	0.24	0.24	0.24	0.24	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.258	25	24	0.392	0.309
202I	0.25	0.25	0.24	0.24	0.24	0.24	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.528	30	17	0.279	0.295
203A	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.470	30	28	0.471	0.476
203B	0.25	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.493	30	17	0.288	0.306
203C	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.599	30	24	0.404	0.490
203D	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.332	25	25	0.417	0.508
203E	0.26	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.483	30	21	0.354	0.316
203F	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.332	25	29	0.479	0.414
203G	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.357	25	29	0.488	0.489
203H	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.357	25	28	0.463	0.397
203I	0.24	0.24	0.24	0.24	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.256	25	35	0.583	0.697
203J	0.26	0.26	0.26	0.25	0.25	0.25	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.724	40	18	0.300	0.374
203K	0.28	0.28	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.609	90	14	0.229	0.185
204A	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.375	25	23	0.379	0.333
204B	0.25	0.25	0.25	0.24	0.24	0.24	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.333	25	27	0.446	0.401
204C	0.27	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.099	90	17	0.288	0.193
204D	0.28	0.28	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.569	90	14	0.238	0.190

Table S-8b

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 24-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at			
Subbasin																			Excess	90% Excess	Tc	Tc	R
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
204E	0.28	0.28	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.513	90	17	0.279	0.237
204F	0.29	0.29	0.28	0.28	0.28	0.28	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02	2.918	90	11	0.175	0.131
205A	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	24	0.400	0.406
205B	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	23	0.375	0.242
205C	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.200	90	22	0.367	0.416
205D	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	26	0.425	0.279
205E	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	31	0.517	0.541
205F	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.200	90	24	0.400	0.312
205G	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.086	90	25	0.417	0.343
205H	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.106	90	33	0.542	0.547
205I	0.25	0.25	0.24	0.24	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.677	65	29	0.488	0.414
205J	0.24	0.24	0.24	0.24	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.328	30	29	0.479	0.427
205K	0.25	0.25	0.25	0.24	0.24	0.24	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.363	25	35	0.579	0.710
205L	0.24	0.24	0.23	0.23	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.229	25	19	0.317	0.263
205M	0.26	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	1.968	90	18	0.292	0.253
205N	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.355	25	27	0.450	0.503
206A	0.27	0.27	0.27	0.27	0.27	0.26	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.321	90	12	0.196	0.135
206B	0.28	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.575	90	12	0.192	0.144
206C	0.24	0.24	0.23	0.23	0.23	0.23	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.538	30	17	0.275	0.376
206D	0.28	0.28	0.28	0.28	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.620	90	11	0.179	0.162
206E	0.23	0.23	0.22	0.22	0.22	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.192	25	16	0.263	0.308
206F	0.24	0.23	0.23	0.23	0.23	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.336	30	23	0.388	0.364
206G	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.664	30	28	0.463	0.597
206H	0.27	0.27	0.27	0.27	0.27	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.167	90	16	0.263	0.248
206I	0.27	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.426	90	10	0.163	0.139
206J	0.28	0.28	0.28	0.28	0.28	0.28	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.715	90	9	0.154	0.133
206K	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.500	30	20	0.333	0.384
206L	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.751	55	20	0.325	0.327
206M	0.28	0.28	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	2.717	90	10	0.163	0.133

Table S-8b

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 24-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at			
Subbasin																			Excess	90% Excess	Tc	Tc	R
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
206N	0.28	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	2.814	90	14	0.233	0.174
207A	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.064	90	30	0.496	0.471
207B	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.139	90	29	0.483	0.502
207C	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.656	40	24	0.404	0.360
207D	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	27	0.442	0.388
207E	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.193	90	33	0.554	0.710
207F	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.158	90	25	0.417	0.379
207G	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.536	30	33	0.554	0.594
207H	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	27	0.442	0.507
207I	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.205	90	26	0.425	0.538
207J	0.26	0.25	0.25	0.25	0.25	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.285	90	24	0.396	0.392
207K	0.27	0.27	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.270	90	20	0.333	0.310
207L	0.27	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.281	90	17	0.275	0.269
207M	0.25	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.485	30	19	0.308	0.238
207N	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.855	90	18	0.292	0.268
207O	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.562	30	18	0.304	0.221
208A	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	21	0.346	0.241
208B	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.193	90	21	0.342	0.499
208C	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	21	0.354	0.383
208D	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.193	90	25	0.413	0.495
208E	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.200	90	23	0.383	0.438
208F	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.200	90	22	0.371	0.366
208G	0.26	0.25	0.25	0.25	0.25	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.227	90	23	0.388	0.337
208H	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.544	30	21	0.346	0.476
208I	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.193	90	24	0.396	0.384
208J	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.193	90	27	0.454	0.632
208K	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.187	90	19	0.321	0.303
208L	0.25	0.25	0.24	0.24	0.24	0.23	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.185	90	23	0.379	0.452
208M	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	28	0.463	0.459

Table S-8b

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 24-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at			
Subbasin																			Excess	90% Excess	Tc	Tc	R
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
208N	0.27	0.27	0.27	0.27	0.27	0.26	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.356	90	22	0.371	0.460
208O	0.25	0.25	0.25	0.25	0.25	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.176	90	28	0.463	0.413
208P	0.26	0.26	0.26	0.26	0.26	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.127	90	17	0.283	0.252
208Q	0.26	0.26	0.26	0.25	0.25	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.171	90	23	0.388	0.425
208R	0.27	0.27	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.113	90	12	0.204	0.271
208S	0.27	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.478	90	19	0.321	0.308
208T	0.26	0.26	0.25	0.25	0.25	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.121	90	22	0.358	0.310
208U	0.26	0.26	0.26	0.25	0.25	0.25	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	2.113	90	17	0.283	0.167
208V	0.27	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.103	90	15	0.242	0.257
208W	0.26	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.021	90	17	0.279	0.272
208X	0.26	0.26	0.26	0.25	0.25	0.25	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.989	90	16	0.271	0.188
209A	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	26	0.425	0.259
209B	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	22	0.371	0.389
209C	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	24	0.392	0.484
209D	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.193	90	23	0.379	0.236
209E	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	27	0.450	0.458
209F	0.25	0.25	0.24	0.24	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.084	90	29	0.475	0.435
209G	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.207	90	28	0.471	0.413
209H	0.25	0.25	0.25	0.25	0.25	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.806	90	18	0.300	0.245
209I	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.532	30	18	0.304	0.194
210A	0.25	0.24	0.24	0.24	0.24	0.24	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.418	30	19	0.317	0.236
210B	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.622	30	24	0.392	0.442
210C	0.24	0.24	0.24	0.24	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.415	30	20	0.338	0.322
210D	0.26	0.26	0.26	0.26	0.25	0.25	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.878	90	22	0.358	0.314
210E	0.26	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.482	30	18	0.300	0.317
210F	0.25	0.25	0.25	0.25	0.24	0.24	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.194	90	23	0.375	0.350
210G	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.975	90	25	0.421	0.390
210H	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.543	30	18	0.292	0.272
210I	0.27	0.27	0.27	0.27	0.27	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.579	30	20	0.333	0.423

Table S-8b

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 24-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at			
Subbasin																			Excess	90% Excess	Tc	Tc	R
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
210J	0.26	0.26	0.26	0.26	0.26	0.25	0.02	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.456	30	22	0.367	0.327
210K	0.26	0.26	0.26	0.26	0.25	0.25	0.02	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.452	30	17	0.279	0.195
210L	0.24	0.24	0.23	0.23	0.23	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.229	25	22	0.358	0.313
210M	0.25	0.25	0.25	0.25	0.24	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.347	25	24	0.404	0.388
210N	0.23	0.22	0.22	0.22	0.22	0.21	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.409	30	14	0.233	0.161
211A	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.737	50	22	0.371	0.318
211AA	0.28	0.28	0.28	0.28	0.28	0.28	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	2.614	90	18	0.292	0.360
211AB	0.28	0.28	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.208	90	10	0.163	0.116
211AC	0.29	0.29	0.29	0.29	0.29	0.29	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	3.052	90	10	0.163	0.148
211AD	0.29	0.29	0.29	0.29	0.29	0.29	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02	2.941	90	10	0.163	0.171
211AE	0.28	0.28	0.28	0.28	0.28	0.28	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.575	90	10	0.158	0.129
211AF	0.27	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.247	90	10	0.167	0.112
211B	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.728	45	19	0.321	0.253
211C	0.28	0.28	0.28	0.28	0.28	0.28	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.713	90	10	0.167	0.169
211D	0.24	0.24	0.24	0.24	0.24	0.23	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.989	90	16	0.271	0.291
211E	0.27	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	2.585	90	13	0.208	0.126
211F	0.28	0.28	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	3.106	90	14	0.225	0.199
211G	0.30	0.30	0.29	0.29	0.29	0.29	0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	3.932	90	11	0.175	0.454
211H	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.479	30	17	0.288	0.236
211I	0.27	0.27	0.27	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.355	90	20	0.329	0.459
211J	0.27	0.27	0.27	0.27	0.26	0.26	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.307	90	14	0.238	0.272
211K	0.26	0.26	0.26	0.26	0.26	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	1.891	90	15	0.254	0.136
211L	0.26	0.26	0.26	0.26	0.26	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.355	90	12	0.196	0.134
211M	0.27	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.205	90	18	0.304	0.252
211N	0.26	0.26	0.26	0.26	0.26	0.25	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	1.933	90	14	0.229	0.226
211O	0.27	0.27	0.27	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.343	90	15	0.254	0.225
211P	0.29	0.29	0.28	0.28	0.28	0.28	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02	2.916	90	8	0.125	0.099
211Q	0.26	0.25	0.25	0.25	0.25	0.25	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	1.607	30	13	0.213	0.201
211R	0.26	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	1.992	90	18	0.296	0.251

Table S-8b

Time of Concentration and Duration of Rainfall Excess
Existing Condition 100-year, 24-hour Storm

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
	Excess Rainfall Values (inches) By Decreasing Rank (time interval in minutes)																		Total	Time at			
Subbasin																			Excess	90% Excess	Tc	Tc	R
ID	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	(inches)	(minutes)	(min.)	(hours)	(hours)
211S	0.27	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.119	90	16	0.263	0.241
211T	0.26	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	1.969	90	17	0.283	0.241
211U	0.29	0.29	0.28	0.28	0.28	0.28	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02	3.273	90	14	0.229	0.483
211V	0.30	0.30	0.29	0.29	0.29	0.29	0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	3.932	90	7	0.117	0.212
211W	0.29	0.29	0.28	0.28	0.28	0.28	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02	3.389	90	9	0.146	0.120
211X	0.27	0.27	0.27	0.27	0.27	0.26	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.566	90	21	0.346	0.259
211Y	0.27	0.27	0.27	0.27	0.27	0.27	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	1.983	70	18	0.304	0.262
211Z	0.26	0.26	0.26	0.26	0.26	0.26	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	2.270	90	13	0.208	0.157

Table S-9

Summary of Existing Condition Subbasin Parameters

[1] Subbasin ID	[2] Area (sm)	[3] Kb	[4] Tc Slope (ft/mi)	[5] IA (in)	[6] DTHETA	[7] PSIF (in)	[8] XKSAT (in/hr)	[9] RTIMP (%)	[10] Time Area Curve	[11] Total Basin Area (sm)
201A	0.21655	0.10	208	0.15	0.39	5.70	0.19	0.0	Natural	
201B	0.08068	0.11	223	0.15	0.39	5.70	0.20	0.0	Natural	
201C	0.07857	0.11	206	0.15	0.39	5.70	0.21	0.0	Natural	
201D	0.07093	0.11	207	0.15	0.39	5.70	0.20	0.0	Natural	
201E	0.18315	0.10	178	0.15	0.38	5.60	0.25	0.1	Natural	0.62989
202A	0.03778	0.12	129	0.15	0.35	4.40	0.39	7.0	Natural	
202B	0.01794	0.12	322	0.15	0.35	4.55	0.36	0.6	Natural	
202C	0.00765	0.13	363	0.15	0.35	4.35	0.41	7.0	Natural	
202D	0.06258	0.11	248	0.15	0.38	5.60	0.23	7.0	Natural	
202E	0.10408	0.10	270	0.15	0.39	5.70	0.22	0.3	Natural	
202F	0.01309	0.13	337	0.15	0.38	5.60	0.23	1.8	Natural	
202G	0.01316	0.13	338	0.15	0.39	5.70	0.21	1.5	Natural	
202H	0.17938	0.10	243	0.15	0.37	5.20	0.27	0.3	Natural	
202I	0.01747	0.12	122	0.14	0.35	5.10	0.28	9.3	HEC-1	0.45312
203A	0.27918	0.08	229	0.14	0.37	5.70	0.21	4.2	HEC-1	
203B	0.04446	0.10	236	0.14	0.37	5.70	0.21	5.0	HEC-1	
203C	0.10306	0.10	258	0.15	0.39	5.70	0.21	9.3	HEC-1	
203D	0.10805	0.10	252	0.15	0.39	5.70	0.21	0.0	Natural	
203E	0.09335	0.11	219	0.15	0.37	6.60	0.14	0.0	Natural	
203F	0.33332	0.09	237	0.15	0.39	5.70	0.21	0.0	Natural	
203G	0.24821	0.09	215	0.15	0.40	6.00	0.19	0.0	Natural	
203H	0.20675	0.10	178	0.15	0.38	5.40	0.21	0.0	Natural	
203I	0.17071	0.10	161	0.15	0.35	4.80	0.30	0.6	HEC-1	
203J	0.03885	0.10	237	0.14	0.36	5.60	0.21	12.7	HEC-1	
203K	0.16019	0.03	158	0.08	0.26	5.60	0.20	41.6	Urban	1.78614
204A	0.10768	0.10	175	0.15	0.39	5.80	0.19	0.0	Natural	
204B	0.12598	0.10	128	0.15	0.39	5.80	0.21	0.2	Natural	
204C	0.07669	0.09	142	0.13	0.36	5.70	0.20	25.4	HEC-1	
204D	0.04409	0.06	96	0.10	0.31	5.70	0.18	40.2	Urban	
204E	0.07051	0.06	108	0.10	0.30	5.70	0.18	38.0	Urban	
204F	0.07714	0.03	135	0.08	0.15	7.00	0.11	45.0	Urban	0.50208
205A	0.11753	0.14	378	0.25	0.35	4.35	0.40	35.0	Natural	
205B	0.21124	0.14	373	0.25	0.35	4.35	0.40	35.0	Natural	
205C	0.05877	0.15	331	0.25	0.35	4.35	0.41	35.0	Natural	
205D	0.31907	0.13	361	0.25	0.35	4.35	0.40	35.0	Natural	
205E	0.21753	0.14	358	0.25	0.35	4.35	0.40	35.0	Natural	
205F	0.16126	0.14	326	0.25	0.35	4.35	0.41	35.0	Natural	
205G	0.18549	0.13	338	0.24	0.35	4.50	0.40	31.2	Natural	
205H	0.26054	0.13	325	0.24	0.35	4.50	0.39	31.6	Natural	

Table S-9

Summary of Existing Condition Subbasin Parameters

[1] Subbasin ID	[2] Area (sm)	[3] Kb	[4] Tc Slope (ft/mi)	[5] IA (in)	[6] DTHETA	[7] PSIF (in)	[8] XKSAT (in/hr)	[9] RTIMP (%)	[10] Time Area Curve	[11] Total Basin Area (sm)
205I	0.35388	0.11	326	0.20	0.37	5.20	0.28	15.2	Natural	
205J	0.36947	0.08	243	0.21	0.35	4.90	0.30	3.5	Natural	
205K	0.24538	0.10	249	0.16	0.38	5.60	0.22	1.5	Natural	
205L	0.11764	0.09	284	0.19	0.36	5.00	0.29	0.0	Natural	
205M	0.13853	0.06	230	0.15	0.33	5.40	0.22	21.0	HEC-1	
205N	0.15606	0.10	245	0.15	0.39	5.70	0.21	0.8	HEC-1	2.91240
206A	0.12778	0.04	256	0.13	0.28	5.30	0.23	32.8	Urban	
206B	0.09522	0.03	139	0.10	0.26	5.20	0.23	41.3	Urban	
206C	0.02378	0.07	138	0.21	0.32	4.35	0.40	12.4	HEC-1	
206D	0.06165	0.04	236	0.08	0.26	5.70	0.18	41.2	Urban	
206E	0.02274	0.09	175	0.23	0.35	4.30	0.40	1.7	HEC-1	
206F	0.15713	0.08	217	0.21	0.35	4.60	0.35	5.1	HEC-1	
206G	0.08946	0.09	132	0.16	0.35	5.20	0.25	12.5	HEC-1	
206H	0.05895	0.07	183	0.11	0.31	5.70	0.19	26.1	Urban	
206I	0.02083	0.08	286	0.11	0.32	5.70	0.19	35.7	HEC-1	
206J	0.05990	0.03	214	0.08	0.25	5.70	0.18	44.6	Urban	
206K	0.05577	0.11	255	0.15	0.38	5.70	0.21	5.6	HEC-1	
206L	0.05951	0.11	231	0.14	0.39	5.80	0.21	14.7	HEC-1	
206M	0.05958	0.03	166	0.08	0.25	5.20	0.23	46.2	Urban	
206N	0.15176	0.03	120	0.12	0.27	4.65	0.29	51.6	Urban	1.04406
207A	0.25609	0.13	351	0.24	0.35	4.55	0.37	29.8	Natural	
207B	0.20823	0.13	359	0.24	0.35	4.45	0.38	32.4	Natural	
207C	0.17298	0.11	297	0.19	0.37	5.30	0.26	13.7	Natural	
207D	0.19708	0.14	373	0.25	0.35	4.35	0.40	35.0	Natural	
207E	0.15651	0.14	315	0.25	0.35	4.35	0.42	35.0	Natural	
207F	0.12613	0.14	296	0.25	0.35	4.40	0.41	33.7	HEC-1	
207G	0.23634	0.10	198	0.17	0.38	5.60	0.23	8.3	Natural	
207H	0.12447	0.14	371	0.25	0.35	4.35	0.40	35.0	Natural	
207I	0.07294	0.15	320	0.25	0.35	4.40	0.40	35.0	Natural	
207J	0.09277	0.13	248	0.22	0.33	4.40	0.39	37.0	HEC-1	
207K	0.12955	0.09	294	0.15	0.33	5.40	0.22	31.7	HEC-1	
207L	0.08040	0.07	236	0.11	0.32	6.00	0.17	29.6	Urban	
207M	0.11594	0.10	295	0.15	0.40	6.00	0.19	4.5	HEC-1	
207N	0.04918	0.10	190	0.19	0.35	4.80	0.32	21.6	HEC-1	
207O	0.13051	0.09	275	0.17	0.38	5.60	0.23	9.2	Natural	2.14911
208A	0.13859	0.14	366	0.25	0.35	4.35	0.40	35.0	Natural	
208B	0.02690	0.16	325	0.25	0.35	4.35	0.42	35.0	Natural	
208C	0.06644	0.15	387	0.25	0.35	4.35	0.40	35.0	Natural	
208D	0.07452	0.15	327	0.25	0.35	4.35	0.42	35.0	Natural	

Table S-9

Summary of Existing Condition Subbasin Parameters

[1] Subbasin ID	[2] Area (sm)	[3] Kb	[4] Tc Slope (ft/mi)	[5] IA (in)	[6] DTHETA	[7] PSIF (in)	[8] XKSAT (in/hr)	[9] RTIMP (%)	[10] Time Area Curve	[11] Total Basin Area (sm)
208E	0.06205	0.15	306	0.25	0.35	4.35	0.41	35.0	Natural	
208F	0.06910	0.15	293	0.25	0.35	4.35	0.41	35.0	Natural	
208G	0.12941	0.13	299	0.22	0.34	4.60	0.34	34.3	HEC-1	
208H	0.04276	0.12	283	0.17	0.38	5.60	0.23	8.6	Natural	
208I	0.11709	0.14	363	0.25	0.35	4.35	0.42	35.0	Natural	
208J	0.08107	0.15	353	0.25	0.35	4.35	0.42	35.0	Natural	
208K	0.04756	0.16	317	0.25	0.35	4.35	0.43	35.0	Natural	
208L	0.05884	0.15	334	0.25	0.35	4.40	0.43	35.0	Natural	
208M	0.15941	0.14	321	0.25	0.35	4.40	0.42	35.5	Natural	
208N	0.04713	0.11	160	0.15	0.39	6.20	0.17	34.0	Natural	
208O	0.22988	0.13	347	0.23	0.35	4.60	0.37	33.5	Natural	
208P	0.05837	0.12	312	0.18	0.39	5.70	0.21	27.9	Natural	
208Q	0.09426	0.13	324	0.21	0.36	5.00	0.28	31.5	Natural	
208R	0.01047	0.13	327	0.15	0.39	6.20	0.17	25.3	Natural	
208S	0.06825	0.11	234	0.14	0.39	6.20	0.17	38.3	Natural	
208T	0.13175	0.12	340	0.20	0.37	5.20	0.27	29.8	Natural	
208U	0.13368	0.12	360	0.19	0.37	5.30	0.26	29.2	Natural	
208V	0.02781	0.12	319	0.15	0.38	6.40	0.17	25.0	Natural	
208W	0.05043	0.11	288	0.15	0.39	6.20	0.18	22.7	Natural	
208X	0.07543	0.10	223	0.17	0.38	5.60	0.23	23.9	Natural	2.00121
209A	0.36779	0.13	367	0.25	0.35	4.35	0.40	35.0	Natural	
209B	0.08313	0.15	403	0.25	0.35	4.35	0.40	35.0	Natural	
209C	0.06387	0.15	342	0.25	0.35	4.35	0.40	35.0	Natural	
209D	0.24418	0.13	354	0.25	0.35	4.35	0.42	35.0	Natural	
209E	0.14899	0.14	341	0.25	0.35	4.35	0.40	35.0	Natural	
209F	0.22574	0.13	332	0.24	0.35	4.50	0.39	30.9	Natural	
209G	0.20380	0.14	306	0.25	0.35	4.35	0.40	35.0	Natural	
209H	0.08348	0.12	343	0.18	0.38	5.60	0.24	18.3	Natural	
209I	0.18233	0.10	347	0.15	0.40	6.00	0.18	5.3	Natural	1.60331
210A	0.12274	0.09	233	0.20	0.36	5.00	0.27	5.5	Natural	
210B	0.10672	0.10	251	0.15	0.39	5.80	0.20	9.5	HEC-1	
210C	0.08171	0.09	198	0.21	0.35	4.80	0.32	7.0	Natural	
210D	0.13967	0.11	325	0.18	0.39	5.80	0.20	18.7	Natural	
210E	0.02753	0.12	151	0.15	0.36	6.80	0.14	0.0	Natural	
210F	0.09263	0.15	349	0.25	0.35	4.40	0.39	34.4	Natural	
210G	0.16152	0.13	333	0.22	0.37	5.30	0.25	24.2	Natural	
210H	0.06974	0.11	340	0.16	0.39	6.20	0.19	6.7	Natural	
210I	0.04910	0.11	250	0.15	0.32	7.60	0.11	0.0	Natural	
210J	0.10328	0.10	187	0.15	0.37	6.60	0.15	0.0	Natural	

Table S-9

Summary of Existing Condition Subbasin Parameters

[1] Subbasin ID	[2] Area (sm)	[3] Kb	[4] Tc Slope (ft/mi)	[5] IA (in)	[6] DTHETA	[7] PSIF (in)	[8] XKSAT (in/hr)	[9] RTIMP (%)	[10] Time Area Curve	[11] Total Basin Area (sm)
210K	0.07706	0.10	207	0.18	0.37	6.60	0.15	0.1	Natural	
210L	0.13741	0.09	251	0.18	0.37	5.20	0.28	0.0	HEC-1	
210M	0.16239	0.09	232	0.18	0.39	5.80	0.20	0.1	Natural	
210N	0.04852	0.08	178	0.26	0.35	4.10	0.46	10.4	Natural	1.38000
211A	0.14294	0.10	248	0.14	0.38	5.70	0.21	13.8	HEC-1	
211B	0.10855	0.10	244	0.14	0.37	5.80	0.21	13.4	HEC-1	
211C	0.04277	0.03	154	0.08	0.25	5.70	0.18	44.5	Urban	
211D	0.07054	0.04	115	0.21	0.30	3.85	0.49	28.3	Urban	
211E	0.15557	0.03	118	0.11	0.27	5.10	0.24	42.2	Urban	
211F	0.11280	0.03	134	0.08	0.25	4.30	0.36	62.7	Urban	
211G	0.00759	0.04	190	0.06	0.25	5.70	0.18	90.0	Urban	
211H	0.07345	0.11	289	0.15	0.40	6.00	0.18	3.4	Natural	
211I	0.04077	0.11	257	0.13	0.39	5.70	0.20	35.0	Natural	
211J	0.01480	0.11	166	0.13	0.37	6.20	0.18	32.4	HEC-1	
211K	0.10197	0.08	157	0.18	0.38	6.00	0.18	17.8	HEC-1	
211L	0.09575	0.04	181	0.16	0.28	4.35	0.36	37.8	Urban	
211M	0.08133	0.11	266	0.13	0.39	5.70	0.21	30.3	Natural	
211N	0.02038	0.12	235	0.14	0.39	5.70	0.20	20.2	HEC-1	
211O	0.04119	0.11	257	0.13	0.39	5.70	0.20	34.6	HEC-1	
211P	0.03347	0.03	192	0.08	0.15	7.00	0.11	44.9	Urban	
211Q	0.02107	0.12	295	0.14	0.38	5.70	0.20	8.5	HEC-1	
211R	0.08438	0.10	271	0.13	0.38	5.70	0.20	22.0	HEC-1	
211S	0.05041	0.10	272	0.13	0.36	5.70	0.20	26.1	HEC-1	
211T	0.06637	0.10	250	0.13	0.37	5.70	0.20	21.0	HEC-1	
211U	0.02744	0.04	214	0.07	0.26	5.70	0.18	65.5	Urban	
211V	0.00490	0.04	212	0.06	0.25	5.80	0.18	90.0	Urban	
211W	0.02969	0.04	173	0.07	0.27	5.70	0.18	69.9	Urban	
211X	0.21393	0.05	111	0.16	0.30	4.90	0.27	43.2	HEC-1	
211Y	0.08928	0.07	147	0.13	0.30	6.60	0.14	16.8	HEC-1	
211Z	0.08254	0.04	147	0.14	0.27	4.50	0.34	34.4	Urban	
211AA	0.03399	0.06	85	0.09	0.24	6.60	0.14	38.8	Urban	
211AB	0.03974	0.07	321	0.11	0.26	6.80	0.13	23.1	Urban	
211AC	0.02745	0.03	82	0.08	0.15	8.40	0.07	44.8	Urban	
211AD	0.04132	0.04	280	0.08	0.16	8.00	0.08	42.4	Urban	
211AE	0.03443	0.04	153	0.12	0.24	6.40	0.15	38.2	Urban	
211AF	0.05270	0.06	292	0.10	0.30	5.80	0.18	28.3	Urban	2.04349

Total Watershed Area = **16.50481**
(excluding non-contributing area)

Table S-10

Summary of Clark Unit Hydrograph Parameters
100-year Existing Condition Tc and R values

[1]	[2]	[3]	[4]	[5]
	Tc		R	
Subbasin ID	6-hour (hours)	24-hour (hours)	6-hour (hours)	24-hour (hours)
201A	0.458	0.488	0.450	0.482
201B	0.313	0.367	0.314	0.375
201C	0.321	0.375	0.326	0.387
201D	0.392	0.433	0.542	0.606
201E	0.500	0.525	0.538	0.567
202A	0.304	0.363	0.312	0.380
202B	0.204	0.258	0.280	0.363
202C	0.150	0.188	0.193	0.248
202D	0.333	0.388	0.444	0.524
202E	0.283	0.346	0.258	0.322
202F	0.150	0.188	0.140	0.179
202G	0.142	0.179	0.124	0.161
202H	0.338	0.392	0.262	0.309
202I	0.225	0.279	0.232	0.295
203A	0.438	0.471	0.439	0.476
203B	0.233	0.288	0.243	0.306
203C	0.354	0.404	0.423	0.490
203D	0.367	0.417	0.441	0.508
203F	0.296	0.354	0.259	0.316
203E	0.450	0.479	0.386	0.414
203G	0.458	0.488	0.457	0.489
203H	0.429	0.463	0.365	0.397
203I	0.546	0.583	0.647	0.697
203J	0.242	0.300	0.294	0.374
203K	0.183	0.229	0.144	0.185
204A	0.325	0.379	0.280	0.333
204B	0.408	0.446	0.364	0.401
204C	0.233	0.288	0.153	0.193
204D	0.196	0.238	0.153	0.190
204E	0.229	0.279	0.190	0.237
204F	0.146	0.175	0.107	0.131
205A	0.350	0.400	0.350	0.406
205B	0.321	0.375	0.204	0.242
205D	0.308	0.367	0.343	0.416
205E	0.379	0.425	0.246	0.279
205C	0.488	0.517	0.508	0.541
205F	0.350	0.400	0.269	0.312
205G	0.367	0.417	0.298	0.343
205H	0.513	0.542	0.514	0.547

Table S-10

Summary of Clark Unit Hydrograph Parameters
100-year Existing Condition Tc and R values

[1]	[2]	[3]	[4]	[5]
	Tc		R	
Subbasin ID	6-hour (hours)	24-hour (hours)	6-hour (hours)	24-hour (hours)
205I	0.458	0.488	0.386	0.414
205J	0.450	0.479	0.398	0.427
205K	0.546	0.579	0.665	0.710
205L	0.254	0.317	0.206	0.263
205M	0.233	0.292	0.197	0.253
205N	0.413	0.450	0.457	0.503
206A	0.158	0.196	0.107	0.135
206B	0.154	0.192	0.113	0.144
206D	0.217	0.275	0.289	0.376
206C	0.146	0.179	0.129	0.162
206E	0.208	0.263	0.238	0.308
206F	0.333	0.388	0.308	0.364
206H	0.425	0.463	0.544	0.597
206I	0.213	0.263	0.196	0.248
206K	0.133	0.163	0.112	0.139
206L	0.125	0.154	0.105	0.133
206J	0.275	0.333	0.310	0.384
206G	0.263	0.325	0.258	0.327
206M	0.133	0.163	0.107	0.133
206N	0.188	0.233	0.137	0.174
207A	0.467	0.496	0.440	0.471
207B	0.450	0.483	0.463	0.502
207D	0.354	0.404	0.311	0.360
207C	0.396	0.442	0.343	0.388
207E	0.521	0.554	0.663	0.710
207F	0.367	0.417	0.329	0.379
207H	0.525	0.554	0.560	0.594
207I	0.400	0.442	0.454	0.507
207G	0.375	0.425	0.468	0.538
207J	0.346	0.396	0.337	0.392
207K	0.275	0.333	0.251	0.310
207L	0.221	0.275	0.211	0.269
207M	0.250	0.308	0.189	0.238
207N	0.238	0.292	0.213	0.268
207O	0.242	0.304	0.171	0.221
210A	0.283	0.346	0.194	0.241
208A	0.279	0.342	0.399	0.499
208C	0.296	0.354	0.314	0.383
208B	0.363	0.413	0.428	0.495

Table S-10

Summary of Clark Unit Hydrograph Parameters
100-year Existing Condition Tc and R values

[1]	[2]	[3]	[4]	[5]
	Tc		R	
Subbasin ID	6-hour (hours)	24-hour (hours)	6-hour (hours)	24-hour (hours)
208D	0.329	0.383	0.370	0.438
208E	0.313	0.371	0.303	0.366
208F	0.338	0.388	0.289	0.337
208G	0.288	0.346	0.387	0.476
208I	0.346	0.396	0.331	0.384
208J	0.413	0.454	0.568	0.632
208K	0.258	0.321	0.238	0.303
208L	0.321	0.379	0.375	0.452
208H	0.425	0.463	0.418	0.459
208M	0.317	0.371	0.386	0.460
208O	0.425	0.463	0.376	0.413
208P	0.229	0.283	0.199	0.252
208Q	0.338	0.388	0.364	0.425
208R	0.167	0.204	0.216	0.271
208N	0.263	0.321	0.246	0.308
208S	0.304	0.358	0.259	0.310
208T	0.229	0.283	0.132	0.167
208U	0.196	0.242	0.203	0.257
208V	0.225	0.279	0.214	0.272
208W	0.217	0.271	0.147	0.188
208X	0.379	0.425	0.228	0.259
210B	0.313	0.371	0.321	0.389
210D	0.338	0.392	0.410	0.484
210F	0.325	0.379	0.199	0.236
210E	0.408	0.450	0.411	0.458
210G	0.438	0.475	0.397	0.435
210H	0.438	0.471	0.381	0.413
210I	0.242	0.300	0.193	0.245
210C	0.246	0.304	0.153	0.194
210J	0.254	0.317	0.185	0.236
210K	0.342	0.392	0.379	0.442
209A	0.275	0.338	0.257	0.322
209B	0.300	0.358	0.258	0.314
209C	0.246	0.300	0.254	0.317
209D	0.317	0.375	0.290	0.350
209E	0.375	0.421	0.343	0.390
209F	0.238	0.292	0.217	0.272
209G	0.279	0.333	0.347	0.423
209H	0.313	0.367	0.274	0.327

Table S-10

Summary of Clark Unit Hydrograph Parameters
100-year Existing Condition Tc and R values

[1]	[2]	[3]	[4]	[5]
	Tc		R	
Subbasin ID	6-hour (hours)	24-hour (hours)	6-hour (hours)	24-hour (hours)
209I	0.225	0.279	0.154	0.195
210L	0.300	0.358	0.257	0.313
210M	0.354	0.404	0.335	0.388
210N	0.183	0.233	0.123	0.161
211G	0.313	0.371	0.263	0.318
211H	0.238	0.292	0.287	0.360
211I	0.133	0.163	0.093	0.116
211J	0.133	0.163	0.119	0.148
211K	0.133	0.163	0.137	0.171
211P	0.129	0.158	0.103	0.129
211M	0.138	0.167	0.091	0.112
211O	0.263	0.321	0.202	0.253
211N	0.138	0.167	0.137	0.169
211Q	0.217	0.271	0.227	0.291
211R	0.171	0.208	0.101	0.126
211S	0.183	0.225	0.158	0.199
211U	0.142	0.175	0.359	0.454
211V	0.233	0.288	0.187	0.236
211T	0.271	0.329	0.370	0.459
211W	0.192	0.238	0.215	0.272
211L	0.204	0.254	0.107	0.136
211A	0.158	0.196	0.106	0.134
211B	0.246	0.304	0.199	0.252
211C	0.188	0.229	0.181	0.226
211D	0.204	0.254	0.177	0.225
211E	0.100	0.125	0.077	0.099
211F	0.171	0.213	0.157	0.201
211X	0.242	0.296	0.200	0.251
211Y	0.213	0.263	0.190	0.241
211AA	0.229	0.283	0.191	0.241
211AB	0.188	0.229	0.386	0.483
211AC	0.096	0.117	0.170	0.212
211AD	0.117	0.146	0.094	0.120
211Z	0.288	0.346	0.211	0.259
211AE	0.246	0.304	0.207	0.262
211AF	0.171	0.208	0.126	0.157

3.2.2.2 Reach Route Parameters

General

Routing of subbasin hydrographs is done utilizing the normal depth channel option under HEC-1. The routing reach paths are shown in Exhibit D. Plots of the cross sections used for each route are shown in Appendix C. Refer to Exhibit E for a flood routing diagram on which the combination and routing logic is depicted for both the 6-hour and the 24-hour storms. Each route is identified by a name which consists of the upper and lower concentration point numbers which define the reach. Reach 501502, for instance, starts at concentration point 501 at the upper end, and extends to concentration point 502 at the lower end.

Field Reconnaissance

A field reconnaissance was done during the period 19 April 1993 through 23 April 1993. The reconnaissance included the following tasks:

1. Verification of selected subbasin boundaries and T_c paths;
2. Obtaining typical cross sections for routing reaches where detailed topographic mapping is not available;
3. Obtaining vegetation transects for the purpose of estimating vegetation cover density at selected locations on the watershed; and
4. Obtaining topographic data for estimating the hydraulic characteristics of flow splits.

Reach Route Cross Sections

Reach route cross sections were determined using following data sources:

1. The 100 Scale Mapping;
2. The 200 Scale Mapping;
3. The 400 Scale Mapping;
4. By field reconnaissance;
5. Photodigitized HEC-2 cross sections; and
6. As-built construction plans.

The appropriate mapping was used for those reaches where photodigitized cross sections are not available. Cross sections were surveyed during the field reconnaissance in reaches where the only maps available are USGS quadrangle maps. The cross section used for any particular reach is deemed representative of the hydraulic characteristics of that reach.

The source used to develop a cross section for each reach is listed in column 4 of Table R-1. That table also lists the name of the subbasin that contains the reach, the reach length, and the reach top and bottom elevations and average slope. These physical characteristics are obtained from the available mapping.

Reach Route n Values

The Mannings n value report prepared for the floodplain delineation portion of this project was used as the basis for n value estimation. The n values selected are representative of the average values for the channel and both overbanks for the reach. The n values selected for each reach are shown on the cross section plots in Appendix C. The n values were checked for reasonableness using USGS values and methodology [6.5:27].

Photographs were taken during the field reconnaissance of the channels upstream and downstream of hydraulic structures, and where field cross sections were taken in the upper watershed. These photographs were used as an aid for n value estimation. The photographs are bound in notebook format and are available for review at the District. The following photographs are an example of a typical wash in the upper reaches of the watershed. These photographs are taken in reach 532533. Refer to sheet 1 of Exhibit D. The cross section was taken approximately 550 feet upstream of C533.

The wash lies in subbasin 205G and is named Hesperus Wash. Note the flat, rocky bottom, free of vegetation and the dense vegetation on the channel banks and in the overbank areas. The n values selected for routing computations for this reach are 0.045 for the channel and 0.060 for the overbank areas. These are typical values used for the routing reaches in the upper watershed.

Location 532533: Looking upstream at channel

Location 532533: Looking downstream at right overbank

Hydraulic Computations

General - Routing computations are accomplished using the Normal Depth channel routing option in HEC-1. The eight point cross section for each reach was determined as described above. The other parameters necessary for the hydraulic computations are:

1. Number of routing computation steps;
2. Main time interval; and
3. Channel infiltration losses.

The selection of these parameters, and a check on the reasonableness of the selections, is discussed in the following sections.

Reach Route Step Estimation - Estimation of the number of routing steps for input to the HEC-1 models is an iterative process. The process for estimating the number of steps is as follows:

Step 1: An initial estimate of the number of steps (NSTEPS) for each reach was made, assuming an average velocity of 5 feet per second. The HEC-1 models were run using the assumed values.

Step 2: The reach travel time was calculated by subtracting the time-to-peak (T_p) at the beginning of route operation from the T_p at the end of the route operation. A new estimate of NSTEPS for each reach was then calculated using the reach length and HEC-1 travel time. The HEC-1 models were then rerun using the new NSTEPS estimates.

Step 3: Step 2 was repeated until the travel time from the previous run equaled the travel time from the current run. Convergence normally occurred within three iterations.

The results for the final iteration are shown in columns 15,16 and 17 in Tables R-2 and R-3. Table R-2 contains the results for the 100-year, 6-hour storm and Table R-3 the results for the 100-year, 24-hour storm. The values in these tables are described as follows:

Table R-2 Description

Column 1: Reach name consisting of the top and bottom concentration point numbers.

Column 2: Average slope of the reach, ft/ft.

Column 3: Length of the reach, in feet.

Column 4: The average n value for the reach cross section based on horizontal width of the left and right overbanks, and channel.

Column 5: Discharge, in cfs, entering the top of the reach.

Column 6: Routed discharge, in cfs, calculated by HEC-1 at the bottom of the reach.

Column 7: The average discharge in the reach calculated using columns 5 and 6.

Column 8: Channel base width, in feet.

Column 9: Top width of flow, in feet, calculated using Manning's equation, the average discharge from column 7 and the average n value from column 4.

Column 10: Depth of flow, in feet, calculated using Manning's equation.

Column 11: Average velocity in the reach, in fps, calculated using Manning's equation.

Column 12: Wave celerity, in fps, calculated by dividing the value in column 3 by that in column 15 and converting the units appropriately. The wave celerity value is accurate to plus or minus one HEC-1 computation time step.

Column 13: Minimum average velocity in the reach, in fps, calculated as follows:

$$[13] = [3] / (([15] + 0.0167)(3600)(1.67))$$

where: 0.0167 is the main time interval, in hours
3600 is the conversion factor from hours to seconds
1.67 is the factor relating wave celerity to average velocity

Wave celerity for subcritical turbulent streams can be estimated to range from 1.33 to 1.67 times the average velocity [6.5:12]. The reach travel time calculated by HEC-1 can be expected to be accurate to within plus or minus one time step.

Table R-2 Description (continued)

Column 14: Maximum average velocity in the reach, in fps, calculated as follows:

[14] = [3] / (([15] - 0.0167) (3600) (1.33))

Column 15: Travel time through the reach, in hours, calculated using HEC-1.

Column 16: Value of NSTEPS from the HEC-1 output file calculated as follows:

[16] = [15]/0.0167

where: 0.0167 is the main time interval, in hours.

The check for reasonableness of routing results included the following:

1. Checking the HEC-1 output file for warning or error messages, and then evaluating those messages (refer to section 3.4.2).
2. Checking columns 5 and 6 to verify that peak discharges were attenuated and did not increase.
3. Checking the average velocity in column 11 to determine if it falls within, or reasonably close to, the range defined by columns 13 and 14.
4. Checking top width and depth of flow for reasonableness against the cross section plots in Appendix C.

The results presented in Tables R-2 and R-3 are found to be reasonable.

Computation Time Interval and Minimum Reach Length - The computation time interval (CTI) should lie within the range of 0.1 and 0.25 times the smallest T_c value. The shortest T_c is 0.133 hours, with many subbasins having T_c's in the range of 0.200 to 0.300 hours. A CTI of 0.1 times 0.133 is 0.0133 hours or 0.8 minutes. Since this subbasin (211V) is very small, about 3 acres, and is not representative of the majority of the subbasins, a larger CTI could be used. However, a CTI value of 1 minute was selected for this study in order to resolve routing warning errors given by HEC-1. Refer to section 3.4.6 for more details.

Assuming an average velocity in any given routing reach of 10 fps, the minimum length of a reach is estimated as follows:

$$L_{min} = (60 \text{ sec})(10 \text{ fps}) = 600 \text{ feet.}$$

In general, routing reaches of less than 600 feet are not included in the HEC-1 models. Exceptions are made for reaches with velocities much slower than 10 fps. Routing reaches that are considered too short to route are noted in Table R-1.

Channel Infiltration Losses - Channel infiltration losses are not included in the routing computations. These losses are considered negligible because of the typically narrow channels and moderately impervious soils which underlie the channel beds.

Table R-1

Reach Route Physical Data

Reach Route Concentration Points		In		Length		Elevation (feet)		Slope
Top	Bottom	Sub-Basin	Cross Section Source	Feet	Miles	Top	Bottom	(ft/ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
501	502	201C	200 Scale 2' CI Mapping	2999.8	0.5681	1639.0	1578.0	0.0203
502	503	201E	200 Scale 2' CI Mapping	2453.4	0.4646	1578.0	1533.0	0.0183
503	504	202A	200 Scale 2' CI Mapping	1151.1	0.2180	1548.5	1537.2	0.0098
508	507	202D	Plan Set #23 & 200 Scale Mapping	934.4	0.1770	1527.6	1525.0	0.0028
511	512	202I	200 Scale 2' CI Mapping	760.2	0.1440	1534.5	1526.0	0.0112
512	591	203K	Too Short to Route	586.3	0.1110	1532.0	1528.0	0.0068
513	514	203B	200 Scale 2' CI Mapping	2402.5	0.4550	1791.7	1734.0	0.0240
514	515	203D	Too Short to Route	346.8	0.0657	1734.0	1728.0	0.0173
515	517	203E	200 Scale 2' CI Mapping	3340.4	0.6326	1728.0	1666.0	0.0186
516	517	203G	200 Scale 2' CI Mapping	6719.7	1.2727	1809.0	1666.0	0.0213
517	518	203H	Escalante Wash Section 3.522	4367.3	0.8271	1666.0	1590.0	0.0174
518	519	203I	Escalante Wash Section 3.072	1796.5	0.3402	1590.0	1551.0	0.0217
519	591	203K	Escalante Wash Section 2.695	1273.7	0.2412	1551.0	1528.0	0.0181
520	591	203K	Hydrology Field Reconnaissance	2014.5	0.3815	1578.0	1528.0	0.0248
522	523	204B	200 Scale 2' CI Mapping	3274.6	0.6202	1714.0	1649.6	0.0197
523	524	204C	Caliente Wash Section 2.072	1732.4	0.3281	1649.6	1619.0	0.0177
523	548	206G	Plan Set #18 & 200 Scale Mapping	2679.5	0.5075	1658.6	1608.0	0.0189
524	525	204D	Caliente Wash Section 1.898	1044.7	0.1979	1619.0	1597.0	0.0211
525	526	204E	Caliente Wash Section 1.663	1520.2	0.2879	1597.0	1565.0	0.0211
526	527	204F	Caliente Wash Section 1.186	2128.8	0.4032	1565.0	1526.1	0.0183
528	530	205C	Hydrology Field Reconnaissance	2594.4	0.4914	2622.0	2438.0	0.0709
529	530	205E	Too Short to Route	557.4	0.1056	2480.0	2438.0	0.0753
530	531	205F	Hydrology Field Reconnaissance	2425.7	0.4594	2438.0	2340.0	0.0404
531	532	205G	Hydrology Field Reconnaissance	3391.1	0.6423	2340.0	2183.0	0.0463
532	533	205I	Hydrology Field Reconnaissance	1554.9	0.2945	2183.0	2139.0	0.0283
533	534	205J	Hydrology Field Reconnaissance	7145.0	1.3532	2139.0	1967.0	0.0241
534	535	205L	Hydrology Field Reconnaissance	2036.8	0.3858	1967.0	1922.0	0.0221
535	536	205M	Hesperus Wash Section 3.275	2975.3	0.5635	1922.0	1851.9	0.0236
536	537	206A	Hesperus Wash Section 2.729	1479.5	0.2802	1851.9	1821.0	0.0209
537	538	206B	Hesperus Wash Section 2.493	2154.9	0.4081	1821.0	1775.8	0.0210
538	540	206C	Hesperus Wash Section 1.990	2176.4	0.4122	1775.8	1730.0	0.0210
539	540	206E	200 Scale 2' CI Mapping	1872.4	0.3546	1778.0	1730.0	0.0256
540	541	206F	Balboa Wash Section 1.645	4206.7	0.7967	1730.0	1644.0	0.0204
541	548	206G	Balboa Wash Section 0.905	1137.7	0.2155	1644.0	1608.0	0.0316
542	543	206I	Oxford Wash Section 0.931	685.6	0.1298	1718.5	1714.0	0.0066
543	544	206K	Hydrology Field Reconnaissance & 200 Scale Mapping	596.5	0.1130	1718.5	1702.0	0.0277
543	547	206J	Oxford Wash Section 0.638	2395.0	0.4536	1714.0	1647.5	0.0278
544	545	206J	Hydrology Field Reconnaissance & 200 Scale Mapping	984.8	0.1865	1702.0	1679.0	0.0234
545	547	206J	Oxford Wash Section 0.542	1215.8	0.2303	1679.0	1647.5	0.0259
545	546	206J	Hydrology Field Reconnaissance & 200 Scale Mapping	428.1	0.0811	1679.0	1672.0	0.0164
546	547	206J	Plan Set #18 & 200 Scale Mapping	749.3	0.1419	1672.0	1647.5	0.0327
547	548	206M	Oxford Wash Section 0.235	2165.4	0.4101	1647.5	1608.0	0.0182
548	549	206N	Balboa Wash Section 0.246	3257.7	0.6170	1608.0	1552.0	0.0172
549	626	211Z	Ashbrook Wash Section 1.855	2043.6	0.3870	1552.0	1517.0	0.0171
550	552	207C	Hydrology Field Reconnaissance	3412.7	0.6463	2237.0	2074.0	0.0478
551	552	207E	100 Scale 4' CI Mapping	4410.0	0.8352	2307.0	2074.0	0.0528
552	553	207F	Hydrology Field Reconnaissance	1335.7	0.2530	2074.0	2029.0	0.0337
553	556	207G	Ashbrook Wash Section 6.118	2393.4	0.4533	2029.0	1968.0	0.0255
554	555	207I	100 Scale 4' CI Mapping	2497.0	0.4729	2291.0	2129.0	0.0649

Table R-1

Reach Route Physical Data

Reach Route Concentration Points		In		Length		Elevation (feet)		Slope
Top	Bottom	Sub-Basin	Cross Section Source	Feet	Miles	Top	Bottom	(ft/ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
555	556	207J	200 Scale 2' CI Mapping	3353.0	0.6350	2129.0	1968.0	0.0480
556	557	207K	Ashbrook Wash Section 5.765	2298.4	0.4353	1968.0	1908.2	0.0260
557	558	207M	Ashbrook Wash Section 5.254	2651.9	0.5022	1908.2	1844.0	0.0242
558	560	207O	Ashbrook Wash Section 4.839	1985.7	0.3761	1844.0	1807.2	0.0185
559	560	207O	200 Scale 2' CI Mapping	2169.6	0.4109	1857.0	1807.2	0.0230
560	585	210A	Ashbrook Wash Section 4.311	3127.1	0.5923	1807.2	1722.0	0.0272
561	563	208B	100 Scale 4' CI Mapping	2335.4	0.4423	2425.0	2225.0	0.0856
562	563	208D	100 Scale 4' CI Mapping	3744.5	0.7092	2639.0	2225.0	0.1106
563	564	208E	Bristol Wash Section 2.667	2761.5	0.5230	2225.0	2076.0	0.0540
564	565	208G	Bristol Wash Section 2.236	3242.6	0.6141	2076.0	1947.0	0.0398
565	568	208H	Bristol Wash Section 1.853	2254.2	0.4269	1947.0	1872.0	0.0333
566	567	208K	Cholula Wash Section 0.766	1462.6	0.2770	2074.0	2014.0	0.0410
567	568	208M	Cholula Wash Section 0.129	3649.6	0.6912	2014.0	1872.0	0.0389
568	573	208N	Bristol Wash Section 1.340	2067.5	0.3916	1872.0	1805.0	0.0324
569	570	208P	Zapata Wash Section 0.493	1696.2	0.3212	1939.0	1870.4	0.0404
570	572	208S	Too Short to Route	277.0	0.0525	1870.4	1848.0	0.0809
571	572	208S	200 Scale 2' CI Mapping	1378.6	0.2611	1926.0	1848.0	0.0566
572	573	208S	Zapata Wash Section 0.142	1284.6	0.2433	1848.0	1805.0	0.0335
573	577	208X	Too Short to Route	442.8	0.0839	1805.0	1793.0	0.0271
574	575	208V	Montezuma Wash Section 0.587	822.8	0.1558	1947.0	1917.0	0.0365
575	576	208W	Montezuma Wash Section 0.307	2341.8	0.4435	1917.0	1818.0	0.0423
576	577	208X	Montezuma Wash Section 0.116	740.0	0.1402	1818.0	1793.0	0.0338
577	578	208X	Bristol Wash Section 1.099	1078.1	0.2042	1793.0	1777.1	0.0147
578	587	210C	Bristol Wash Section 0.697	1627.8	0.3083	1777.1	1746.0	0.0191
579	580	209B	100 Scale 4' CI Mapping	1751.2	0.3317	2426.0	2321.0	0.0600
580	581	209D	100 Scale 4' CI Mapping	2339.3	0.4430	2321.0	2218.0	0.0440
581	582	209F	100 Scale 4' CI Mapping	4012.3	0.7599	2218.0	2034.0	0.0459
582	583	209H	100 Scale 4' CI Mapping	1725.0	0.3267	2034.0	1994.0	0.0232
583	584	209I	Cloudburst Wash Section 1.664	3106.8	0.5884	1994.0	1883.5	0.0356
584	597	210L	Cloudburst Wash Section 1.032	3703.7	0.7015	1883.5	1787.0	0.0261
585	599	210N	Storage Route at Dam 4	1473.7	0.2791	1722.0	1693.9	0.0191
586	587	210C	200 Scale 2' CI Mapping	1905.2	0.3608	1805.6	1746.0	0.0313
587	595	210C	Bristol Wash Section 0.533	1038.6	0.1967	1746.0	1728.0	0.0173
588	590	210E	Longmont Wash (left) Section 0.128	1117.1	0.2116	1836.0	1798.0	0.0340
589	590	210G	Longmont Wash Section 0.813	1750.6	0.3316	1872.0	1798.0	0.0423
590	593	210I	Too Short to Route	303.3	0.0574	1798.0	1790.0	0.0264
591	521	203K	Escalante Wash Section 2.614	915.2	0.1733	1528.0	1515.0	0.0142
592	593	210I	Longmont Wash (right) Section 0.583	2062.2	0.3906	1875.0	1790.0	0.0412
593	594	210I	Longmont Wash Section 0.413	988.0	0.1871	1790.0	1770.0	0.0202
594	595	210J	Longmont Wash Section 0.184	2092.7	0.3963	1770.0	1728.0	0.0201
595	596	210K	Bristol Wash Section 0.290	1094.6	0.2073	1728.0	1716.0	0.0110
596	599	210N	Storage Route at Dam 4	1270.6	0.2406	1716.0	1693.9	0.0174
597	598	210M	Cloudburst Wash Section 0.328	2821.7	0.5344	1787.0	1716.0	0.0252
598	599	210N	Storage Route at Dam 4	1050.7	0.1990	1716.0	1693.9	0.0210
599	608	211K	Ashbrook Wash Section 3.621	1476.1	0.2796	1693.9	1672.0	0.0148
600	601	211B	Tulip Wash Section 1.538	2405.6	0.4556	1751.0	1708.7	0.0176
601	602	211C	Tulip Wash Section 1.102	1765.5	0.3344	1708.7	1683.0	0.0146
602	603	211E	Lengend Wash Section 0.672	2609.8	0.4943	1683.0	1628.0	0.0211
603	622	211F	Lengend Wash Section 0.287	2745.0	0.5199	1628.0	1572.0	0.0204

Table R-1

Reach Route Physical Data

Reach Route Concentration Points		In		Length		Elevation (feet)		Slope
Top	Bottom	Sub-Basin	Cross Section Source	Feet	Miles	Top	Bottom	(ft/ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
604	606	211I	Plan Set #18 & 200 Scale Mapping	2784.1	0.5273	1897.0	1717.0	0.0647
605	606	211I	Too short to route	253.6	0.0480	1728.0	1717.0	0.0434
606	607	211J	200 Scale 2' CI Mapping	1061.2	0.2010	1717.0	1686.6	0.0286
607	608	211K	200 Scale 2' CI Mapping	1007.9	0.1909	1686.6	1672.0	0.0145
608	613	211L	Ashbrook Wash Section 3.421	1337.9	0.2534	1672.0	1645.0	0.0202
609	611	211N	Plan Set #34 & 200 Scale Mapping	469.6	0.0889	1693.4	1684.0	0.0200
610	611	211N	Sunflower Wash Section 0.216	1090.4	0.2065	1707.0	1684.0	0.0211
611	620	211W	Lag Route (storm drain)	635.1	0.1203	1684.0	1663.0	0.0331
611	612	211P	Plan Set #18 & 200 Scale Mapping	925.4	0.1753	1684.0	1659.0	0.0270
612	613	211L	Too Short to Route	291.5	0.0552	1659.0	1645.0	0.0480
613	621	211L	Ashbrook Wash Section 3.241	717.6	0.1359	1645.0	1627.0	0.0251
614	617	211R	Too Short to Route	887.5	0.1681	1844.8	1797.5	0.0533
614	615	211V	Hydrology Field Reconnaissance	1113.9	0.2110	1844.2	1800.0	0.0397
615	618	211S	Hydrology Field Reconnaissance	499.3	0.0946	1798.3	1731.5	0.1338
615	619	211T	Hydrology Field Reconnaissance	2444.0	0.4629	1799.7	1679.1	0.0493
616	617	211R	200 Scale 2' CI Mapping	1131.1	0.2142	1860.0	1797.5	0.0553
617	618	211S	Arrow Wash Section 0.836	1912.0	0.3621	1797.5	1731.5	0.0345
618	619	211T	Arrow Wash Section 0.441	1837.2	0.3479	1731.5	1679.1	0.0285
619	620	211W	Lag Route (storm drain)	737.2	0.1396	1679.1	1663.0	0.0218
620	621	211L	Arrow Wash Section 0.081	914.5	0.1732	1663.0	1627.0	0.0394
621	622	211X	Ashbrook Wash Section 2.785	3830.0	0.7254	1627.0	1572.0	0.0144
622	549	211Y	Ashbrook Wash Section 2.279	1697.3	0.3215	1572.0	1552.0	0.0118
623	624	211AC	Plan Set #19 & 200 Scale Mapping	700.9	0.1327	1540.0	1532.0	0.0114
624	626	211Z	Ashbrook Wash Section 1.727	637.3	0.1207	1532.0	1517.0	0.0235
625	626	211Z	Plan Set #19 & 200 Scale Mapping	1349.9	0.2557	1551.0	1517.0	0.0252
626	627	211AE	Ashbrook Wash Section 1.602	624.9	0.1183	1517.0	1504.0	0.0208

Table R-2
Reach Route Hydraulic Data for the 100-year, 6-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope in ft/ft	Length in feet	Average n value	Discharge, in cfs			Channel Base Width in feet	Flow Top Width in feet	Flow Depth in feet	Channel Velocity in fps	Wave Celerity in fps	Velocity Range in fps		Travel Time in hours	NSTEPS Computed	
				Top	Bottom	Average						Min.	Max.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
501502	0.020	3000	0.045	446	437	442	30.0	72.8	1.7	5.3	7.1	3.7	6.3	0.1167	7	7
502503	0.018	2453	0.045	622	609	616	120.0	225.9	1.1	3.8	5.1	2.7	4.4	0.1333	8	8
503504	0.010	1151	0.045	0	0	0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	1	1
508507	0.003	934	0.026	135	130	133	14.0	63.9	2.4	2.6	3.1	1.6	2.9	0.0833	5	5
511512	0.011	760	0.045	263	263	263	20.0	48.5	1.9	4.2	6.3	2.5	9.5	0.0333	2	2
513514	0.024	2403	0.045	369	355	362	20.0	72.3	1.6	5.2	5.7	3.0	5.0	0.1167	7	7
515517	0.019	3340	0.045	609	600	605	20.0	71.8	2.3	5.8	9.3	4.8	8.4	0.1000	6	6
516517	0.021	6720	0.045	524	495	510	40.0	69.6	1.7	5.8	8.0	4.5	6.5	0.2333	14	14
517518	0.017	4367	0.045	1227	1211	1219	16.6	114.8	3.4	8.6	9.1	4.8	7.8	0.1333	8	8
518519	0.022	1796	0.052	1331	1323	1327	45.4	85.7	3.0	7.3	15.0	6.0	22.5	0.0333	2	2
519591	0.018	1274	0.050	1406	1402	1404	68.8	87.9	3.1	6.7	10.6	4.2	16.0	0.0333	2	2
520591	0.025	2014	0.024	77	76	77	16.0	41.4	0.5	6.3	11.2	5.0	12.6	0.0500	3	4
522523	0.020	3275	0.050	214	201	208	15.0	65.8	1.5	3.8	5.5	3.0	4.6	0.1667	10	10
523524	0.018	1732	0.051	266	263	265	20.8	52.5	1.9	4.4	5.8	2.9	5.4	0.0833	5	5
523548	0.019	2680	0.026	19	16	18	40.0	49.4	0.2	2.8	3.0	1.7	2.4	0.2500	15	15
524525	0.021	1045	0.035	282	280	281	22.2	37.4	1.7	6.1	17.4	5.2	26.2	0.0167	1	1
525526	0.021	1520	0.035	358	355	357	19.8	33.0	2.1	7.1	12.7	5.1	19.0	0.0333	2	2
526527	0.018	2129	0.035	523	517	520	42.6	57.5	1.7	6.9	8.9	4.2	8.9	0.0667	4	4
528530	0.071	2594	0.043	690	680	685	10.0	25.5	3.1	13.4	21.6	8.6	32.5	0.0333	2	2
530531	0.040	2426	0.059	1472	1455	1464	15.0	50.2	5.1	10.3	13.5	6.1	15.2	0.0500	3	3
531532	0.046	3391	0.063	1639	1619	1629	18.0	49.8	4.6	11.3	14.1	6.8	14.2	0.0667	4	4
532533	0.028	1555	0.048	1970	1956	1963	17.0	55.2	4.6	11.7	25.9	7.8	39.0	0.0167	1	1
533534	0.024	7145	0.047	2232	2189	2211	87.0	127.8	3.0	8.5	11.9	6.5	9.9	0.1667	10	10
534535	0.022	2037	0.047	2507	2495	2501	75.0	144.9	4.5	8.2	17.0	6.8	25.5	0.0333	2	3
535536	0.024	2975	0.066	2520	2496	2508	15.6	231.1	4.9	7.7	6.2	3.3	5.3	0.1333	8	8
536537	0.021	1480	0.050	326	326	326	45.7	55.0	1.8	4.6	8.2	3.7	9.3	0.0500	3	3
537538	0.021	2155	0.050	344	339	342	5.2	48.2	2.5	5.3	12.0	5.4	13.5	0.0500	3	3
538540	0.021	2176	0.050	434	433	434	41.1	71.2	1.7	5.0	7.3	3.6	6.8	0.0833	5	5
539540	0.026	1872	0.050	195	185	190	10.0	51.0	1.5	4.4	7.8	3.7	7.8	0.0667	4	4
540541	0.020	4207	0.048	545	541	543	17.5	77.4	2.4	7.8	5.8	3.2	4.8	0.2000	12	12
541548	0.032	1138	0.045	651	649	650	7.8	86.4	2.2	6.7	18.9	5.7	28.5	0.0167	1	1
542543	0.007	686	0.040	153	149	151	26.8	34.1	2.0	3.2	11.4	3.4	17.2	0.0167	1	1
543544	0.028	597	0.040	0	0	0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	1	1

Table R-2
Reach Route Hydraulic Data for the 100-year, 6-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope in ft/ft	Length in feet	Average n value	Discharge, in cfs			Channel Base Width in feet	Flow Top Width in feet	Flow Depth in feet	Channel Velocity in fps	Wave Celerity in fps	Velocity Range in fps		Travel Time in hours	NSTEPS Computed	
				Top	Bottom	Average						Min.	Max.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
543547	0.028	2395	0.040	210	202	206	34.5	39.1	1.5	5.2	8.0	4.0	7.5	0.0833	5	5
544545	0.023	985	0.019	102	102	102	30.0	64.2	0.5	6.0	8.2	3.3	12.3	0.0333	2	2
545547	0.026	1216	0.040	51	50	51	26.7	29.6	0.7	2.9	5.1	2.4	5.1	0.0667	4	4
545546	0.016	428	0.020	51	51	51	30.0	67.4	0.4	4.1	7.1	2.1	10.7	0.0167	1	2
546547	0.033	749	0.020	171	170	171	16.0	39.9	0.8	9.4	12.5	3.7	18.8	0.0167	1	1
547548	0.018	2165	0.040	525	521	523	29.8	52.9	2.1	6.5	9.0	4.3	9.0	0.0667	4	4
548549	0.017	3258	0.080	1038	1028	1033	66.1	91.1	3.2	4.5	6.0	3.3	5.1	0.1500	9	9
549626	0.017	2044	0.120	2880	2865	2873	13.5	203.4	7.2	4.0	6.8	3.4	6.4	0.0833	5	5
550552	0.053	4410	0.045	687	675	681	10.0	22.7	3.4	12.6	18.4	8.8	18.4	0.0667	4	4
551552	0.053	4410	0.045	349	341	345	10.0	19.2	2.5	10.0	14.7	7.3	13.8	0.0833	5	5
552553	0.034	1336	0.056	1244	1236	1240	21.0	103.6	2.2	7.3	11.1	4.4	16.7	0.0333	2	2
553556	0.026	2393	0.049	1345	1338	1342	7.5	45.6	4.7	10.5	13.3	6.0	15.0	0.0500	3	3
554555	0.065	2497	0.045	188	184	186	20.0	33.4	1.1	7.0	10.4	5.0	10.4	0.0667	4	4
555556	0.048	3353	0.050	285	279	282	35.0	52.8	1.7	6.2	7.0	3.7	6.0	0.1333	8	8
556557	0.026	2298	0.047	1752	1744	1748	30.4	100.4	2.5	8.6	12.8	5.7	14.4	0.0500	3	3
557558	0.024	2652	0.045	1879	1871	1875	72.0	97.7	3.6	8.6	11.0	5.3	11.1	0.0667	4	4
558560	0.019	1986	0.045	1918	1908	1913	71.6	92.2	3.8	7.9	16.6	6.6	24.9	0.0333	2	2
559560	0.023	2170	0.045	109	106	108	10.0	39.5	1.2	4.0	5.2	2.7	4.5	0.1167	7	7
560585	0.027	3127	0.026	287	287	287	35.5	66.9	0.9	7.2	8.7	4.5	7.8	0.1000	6	6
561563	0.086	2335	0.045	331	327	329	18.0	25.1	1.6	10.3	13.0	5.8	14.6	0.0500	3	3
562563	0.111	3745	0.046	127	123	125	5.0	19.0	0.9	9.4	15.6	7.5	15.6	0.0667	4	4
563564	0.054	2762	0.080	599	584	592	4.5	23.2	4.2	8.6	15.3	6.9	17.3	0.0500	3	3
564565	0.040	3243	0.080	804	783	794	8.6	61.0	3.1	6.4	9.0	4.6	8.1	0.1000	6	6
565568	0.033	2254	0.058	938	927	933	17.9	49.5	3.0	8.3	12.5	5.6	14.1	0.0500	3	3
566567	0.041	1463	0.080	313	308	311	11.7	41.9	2.9	5.0	6.1	2.9	6.1	0.0667	4	4
567568	0.039	3650	0.057	478	468	473	16.4	49.8	1.9	6.7	10.1	5.2	9.1	0.1000	6	6
568573	0.032	2067	0.078	1428	1420	1424	8.7	63.6	5.2	7.6	8.6	4.1	8.6	0.0667	4	4
569570	0.040	1696	0.036	386	382	384	10.6	21.8	3.1	11.6	14.1	5.6	21.3	0.0333	2	2
571572	0.057	1379	0.020	25	24	25	32.0	42.6	0.2	5.4	7.7	3.4	8.6	0.0500	3	3
572573	0.034	1285	0.039	647	644	646	22.5	41.1	2.2	10.9	21.4	6.4	32.2	0.0167	1	1
574575	0.037	823	0.050	643	638	641	6.4	25.4	4.3	9.7	13.7	4.1	20.6	0.0167	1	1
575576	0.042	2342	0.053	704	691	698	0.5	29.8	3.6	10.9	19.5	7.8	29.3	0.0333	2	2
576577	0.034	740	0.054	803	800	802	0.1	28.0	4.3	10.9	12.3	3.7	18.5	0.0167	1	1

Table R-2
Reach Route Hydraulic Data for the 100-year, 6-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope in ft/ft	Length in feet	Average n value	Discharge, in cfs			Channel Base Width in feet	Flow Top Width in feet	Flow Depth in feet	Channel Velocity in fps	Wave Celerity in fps	Velocity Range in fps		Travel Time in hours	NSTEPS Computed	
				Top	Bottom	Average						Min.	Max.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
577578	0.015	1078	0.047	2187	2184	2186	24.1	88.1	5.2	8.5	9.0	3.6	13.5	0.0333	2	2
578587	0.019	1628	0.047	381	381	381	15.3	46.4	1.9	5.7	9.0	4.1	10.2	0.0500	3	3
579580	0.060	1751	0.047	792	787	790	5.0	27.5	3.0	14.0	14.6	5.8	21.9	0.0333	2	2
580581	0.044	2339	0.048	1031	1019	1025	10.0	45.4	3.0	11.7	13.0	5.8	14.7	0.0500	3	3
581582	0.046	4012	0.048	1511	1488	1500	5.0	38.6	4.3	14.4	22.3	10.0	25.1	0.0500	3	3
582583	0.023	1725	0.057	1886	1867	1877	10.0	70.6	5.0	9.4	14.4	5.7	21.6	0.0333	2	2
583584	0.036	3107	0.070	1928	1903	1916	26.1	67.3	5.7	8.2	12.9	6.2	13.0	0.0667	4	4
584597	0.026	3704	0.050	469	466	468	64.7	97.1	1.6	4.9	7.7	4.1	6.6	0.1333	8	8
586587	0.031	1905	0.036	162	161	162	10.0	24.7	1.3	7.7	10.6	4.8	11.9	0.0500	3	3
587595	0.017	1039	0.046	401	401	401	20.0	39.0	2.3	6.3	8.7	3.5	13.0	0.0333	2	2
588590	0.034	1117	0.051	301	297	299	13.4	40.9	2.0	6.2	9.3	3.7	14.0	0.0333	2	2
589590	0.042	1751	0.050	184	180	182	12.7	19.2	2.2	6.4	14.6	5.8	21.9	0.0333	2	2
591521	0.014	915	0.050	1402	1390	1396	75.9	98.8	3.1	6.0	7.6	3.0	11.5	0.0333	2	2
592593	0.041	2062	0.050	163	158	161	7.8	18.4	2.2	5.9	11.5	5.1	12.9	0.0500	3	3
593594	0.020	988	0.056	972	963	968	14.9	70.3	3.7	7.0	8.2	3.3	12.4	0.0333	2	2
594595	0.020	2093	0.050	1030	1007	1019	5.9	125.0	4.7	5.5	5.8	3.0	5.2	0.1000	6	6
595596	0.011	1095	0.049	1205	1201	1203	32.4	125.8	4.7	5.3	6.1	2.7	6.9	0.0500	3	3
597598	0.025	2822	0.050	460	458	459	32.2	59.5	2.3	5.6	9.4	4.7	8.8	0.0833	5	5
599608	0.015	1476	0.045	954	954	954	15.2	70.9	3.8	6.4	8.2	3.7	9.2	0.0500	3	2
600601	0.018	2406	0.025	266	263	265	14.1	35.3	2.0	7.7	10.0	4.8	10.1	0.0667	4	4
601602	0.015	1765	0.040	462	458	460	23.8	35.1	3.0	6.4	9.8	4.4	11.1	0.0500	3	3
602603	0.021	2610	0.048	635	632	634	12.7	37.7	3.0	7.7	10.9	5.2	10.9	0.0667	4	4
603622	0.020	2745	0.045	936	918	927	50.6	67.2	3.0	6.9	9.2	4.6	8.6	0.0833	5	5
604606	0.065	2784	0.027	18	17	18	16.0	49.3	0.3	4.1	4.2	2.3	3.5	0.1833	11	11
606607	0.029	1061	0.055	206	204	205	10.0	26.4	2.1	5.5	8.9	3.5	13.3	0.0333	2	2
607608	0.015	1008	0.047	230	228	229	1.0	31.5	3.3	5.2	8.4	3.4	12.6	0.0333	2	2
608613	0.020	1338	0.047	957	957	957	26.2	80.0	2.5	6.8	7.4	3.3	8.4	0.0500	3	2
609611	0.020	470	0.050	61	61	61	10.0	15.2	1.3	4.0	3.9	1.6	5.9	0.0333	2	2
610611	0.021	1090	0.045	203	200	202	18.5	28.0	2.0	5.1	9.1	3.6	13.7	0.0333	2	2
611612	0.027	925	0.050	0	0	0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	1	1
613621	0.025	718	0.048	956	956	956	42.7	78.1	2.3	7.4	11.9	3.6	18.0	0.0167	1	1
614615	0.040	1114	0.020	39	39	39	32.0	50.0	0.2	5.2	6.2	2.8	7.0	0.0500	3	3
615618	0.134	499	0.022	33	33	33	14.0	18.5	0.5	11.3	0.0	0.0	0.0	0.0000	1	1

Table R-2
Reach Route Hydraulic Data for the 100-year, 6-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope in ft/ft	Length in feet	Average n value	Discharge, in cfs			Channel Base Width in feet	Flow Top Width in feet	Flow Depth in feet	Channel Velocity in fps	Wave Celerity in fps	Velocity Range in fps		Travel Time in hours	NSTEPS Computed	
				Top	Bottom	Average						Min.	Max.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
615619	0.049	2444	0.024	18	18	18	2.3	14.1	0.6	5.5	8.1	4.1	7.7	0.0833	5	5
616617	0.055	1131	0.060	56	55	56	5.0	22.1	1.1	3.9	4.7	2.3	4.7	0.0667	4	4
617618	0.035	1912	0.060	270	263	267	40.4	51.7	1.4	4.8	6.4	3.2	6.0	0.0833	5	5
618619	0.029	1837	0.060	398	389	394	8.0	30.7	3.8	5.8	6.1	3.1	5.8	0.0833	5	4
619620	0.029	800	0.027	192	192	192	40.0	96.3	0.7	5.6	13.3	4.0	20.1	0.0167	1	1
620621	0.039	915	0.050	485	482	484	10.1	26.2	3.5	7.8	7.6	3.0	11.5	0.0333	2	2
621622	0.014	3830	0.049	1184	1175	1180	2.7	99.6	3.2	6.2	10.6	5.5	9.6	0.1000	6	6
622549	0.012	1697	0.125	1965	1954	1960	189.8	210.0	3.7	2.9	4.7	2.4	4.3	0.1000	6	6
623624	0.011	701	0.025	135	133	134	16.0	48.8	0.8	5.9	11.7	3.5	17.6	0.0167	1	1
624626	0.024	637	0.069	223	215	219	65.4	139.9	1.3	2.9	5.3	2.1	8.0	0.0333	2	2
625626	0.025	1350	0.020	78	76	77	34.0	62.0	0.6	5.5	7.5	3.4	8.5	0.0500	3	3
626627	0.021	625	0.061	2983	2981	2982	63.2	125.4	4.3	7.7	10.4	3.1	15.7	0.0167	1	1

Table R-3

Reach Route Hydraulic Data for the 100-year, 24-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope in ft/ft	Length in feet	Average n value	Discharge, in cfs Top	Bottom	Average	Channel Base Width in feet	Flow Top Width in feet	Flow Depth in feet	Channel Velocity in fps	Wave Celerity in fps	Velocity Range in fps Min.	Max.	Travel Time in hours	NSTEPS Computed	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
501502	0.020	3000	0.045	298	294	296	30.0	65.0	1.4	4.7	6.3	3.3	5.4	0.1333	8	8
502503	0.018	2453	0.045	419	412	416	120.0	206.5	0.9	3.4	4.5	2.4	3.8	0.1500	9	9
503504	0.010	1151	0.045	0	0	0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	1	1
508507	0.003	934	0.030	56	54	55	14.0	33.2	1.9	2.2	2.6	1.3	2.3	0.1000	6	6
511512	0.011	760	0.045	201	200	201	20.0	45.1	1.7	3.9	6.3	2.5	9.5	0.0333	2	2
513514	0.024	2403	0.045	232	229	231	20.0	62.6	1.3	4.6	5.7	3.0	5.0	0.1167	7	7
515517	0.019	3340	0.045	405	402	404	20.0	67.8	1.9	5.1	6.2	3.3	5.2	0.1500	9	9
516517	0.021	6720	0.045	345	333	339	40.0	63.8	1.4	5.1	8.0	4.5	6.5	0.2333	14	14
517518	0.017	4367	0.042	975	967	971	16.6	85.9	3.1	8.5	9.1	4.8	7.8	0.1333	8	8
518519	0.022	1796	0.052	1091	1087	1089	45.4	82.0	2.7	6.9	10.0	4.5	11.3	0.0500	3	3
519591	0.018	1274	0.050	1177	1174	1176	68.8	86.1	2.8	6.3	10.6	4.2	16.0	0.0333	2	2
520591	0.025	2014	0.022	46	45	46	16.0	38.7	0.4	5.4	6.7	3.3	6.3	0.0833	5	5
522523	0.020	3275	0.050	130	126	128	15.0	56.0	1.2	3.3	4.5	2.5	3.7	0.2000	12	12
523524	0.018	1732	0.050	202	201	202	20.8	47.8	1.7	4.0	7.2	3.5	7.2	0.0667	4	4
523548	0.019	2680	0.045	0	0	0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	1	1
524525	0.021	1045	0.035	228	228	228	22.2	35.9	1.6	5.7	5.8	2.6	6.5	0.0500	3	3
525526	0.021	1520	0.035	249	248	249	19.8	30.8	1.8	6.2	8.4	3.8	9.5	0.0500	3	2
526527	0.018	2129	0.035	343	340	342	42.6	54.4	1.4	6.0	8.9	4.2	8.9	0.0667	4	4
528530	0.071	2594	0.043	411	408	410	10.0	22.2	2.5	11.2	21.6	8.6	32.5	0.0333	2	2
530531	0.040	2426	0.059	1064	1056	1060	15.0	47.4	4.5	9.4	13.5	6.1	15.2	0.0500	3	3
531532	0.046	3391	0.064	1241	1230	1236	18.0	45.2	4.0	10.4	14.1	6.8	14.2	0.0667	4	4
532533	0.028	1555	0.048	1654	1649	1652	17.0	53.7	4.3	11.1	13.0	5.2	19.5	0.0333	2	2
533534	0.024	7145	0.047	2000	1959	1980	87.0	123.4	2.8	8.2	13.2	7.1	11.2	0.1500	9	9
534535	0.022	2037	0.047	2390	2378	2384	75.0	142.2	4.4	8.1	11.3	5.1	12.8	0.0500	3	3
535536	0.024	2975	0.065	2425	2397	2411	15.6	228.2	4.9	7.7	6.2	3.3	5.3	0.1333	8	8
536537	0.021	1480	0.050	321	321	321	45.7	54.9	1.8	4.5	6.2	3.0	6.2	0.0667	4	4
537538	0.021	2155	0.050	348	341	345	5.2	48.2	2.5	5.3	12.0	5.4	13.5	0.0500	3	3
538540	0.021	2176	0.050	446	438	442	41.1	71.6	1.7	5.1	6.0	3.1	5.5	0.1000	6	6
539540	0.026	1872	0.050	110	108	109	10.0	42.4	1.2	3.8	6.2	3.1	5.9	0.0833	5	5

Table R-3

Reach Route Hydraulic Data for the 100-year, 24-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope In ft/ft	Length In feet	Average n value	Discharge, In cfs Top	Bottom	Average	Channel Base Width In feet	Flow Top Width In feet	Flow Depth In feet	Channel Velocity In fps	Wave Celerity In fps	Velocity Range In fps Min.	Max.	Travel Time In hours	NSTEPS Computed	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
540541	0.020	4207	0.049	560	545	553	17.5	81.4	2.4	7.8	6.4	3.5	5.3	0.1833	11	11
541548	0.032	1138	0.045	655	654	655	7.8	86.4	2.2	6.7	18.9	5.7	28.5	0.0167	1	1
542543	0.007	686	0.040	89	88	89	26.8	32.2	1.6	2.6	5.7	2.3	8.6	0.0333	2	2
543544	0.028	597	0.040	0	0	0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	1	1
543547	0.028	2395	0.040	122	121	122	34.5	38.0	1.3	4.3	8.0	4.0	7.5	0.0833	5	5
544545	0.023	985	0.019	62	61	62	30.0	63.3	0.4	5.0	5.5	2.5	6.2	0.0500	3	3
545547	0.026	1216	0.040	31	30	31	26.7	29.0	0.6	2.4	6.8	3.0	7.6	0.0500	3	3
545546	0.016	428	0.020	31	31	31	30.0	66.3	0.4	3.5	7.1	2.1	10.7	0.0167	1	1
546547	0.033	749	0.020	102	102	102	16.0	39.1	0.7	7.9	6.2	2.5	9.4	0.0333	2	2
547548	0.018	2165	0.040	335	330	333	29.8	48.2	1.7	5.6	9.0	4.3	9.0	0.0667	4	4
548549	0.017	3258	0.080	1038	1025	1032	66.1	91.1	3.2	4.5	7.8	4.1	6.8	0.1167	7	7
549626	0.017	2044	0.120	3095	3072	3084	13.5	204.8	7.4	4.1	5.7	2.9	5.1	0.1000	6	6
550552	0.053	4410	0.045	455	450	453	10.0	20.5	2.8	11.0	18.4	8.8	18.4	0.0667	4	4
551552	0.053	4410	0.045	219	216	218	10.0	17.4	2.0	8.5	12.3	6.3	11.1	0.1000	6	6
552553	0.034	1336	0.056	951	947	949	21.0	101.0	1.9	6.6	11.1	4.4	16.7	0.0333	2	2
553556	0.026	2393	0.048	1057	1053	1055	7.5	43.8	4.3	9.6	13.3	6.0	15.0	0.0500	3	3
554555	0.065	2497	0.045	122	120	121	20.0	30.8	0.9	6.1	10.4	5.0	10.4	0.0667	4	4
555556	0.048	3353	0.050	187	184	186	35.0	47.2	1.4	5.4	7.0	3.7	6.0	0.1333	8	8
556557	0.026	2298	0.047	1505	1498	1502	30.4	99.4	2.3	8.1	12.8	5.7	14.4	0.0500	3	3
557558	0.024	2652	0.045	1647	1640	1644	72.0	96.1	3.4	8.2	11.0	5.3	11.1	0.0667	4	4
558560	0.019	1986	0.045	1696	1691	1694	71.6	90.9	3.6	7.6	11.0	5.0	12.4	0.0500	3	3
559560	0.023	2170	0.045	64	62	63	10.0	33.5	0.9	3.5	4.5	2.4	3.9	0.1333	8	8
560585	0.027	3127	0.026	275	275	275	35.5	66.8	0.9	7.1	10.4	5.2	9.8	0.0833	5	5
561563	0.086	2335	0.045	189	187	188	18.0	23.2	1.2	8.4	13.0	5.8	14.6	0.0500	3	3
562563	0.111	3745	0.046	76	74	75	5.0	17.9	0.7	8.0	12.5	6.2	11.7	0.0833	5	5
563564	0.054	2762	0.080	359	355	357	4.5	20.4	3.3	7.3	11.5	5.5	11.5	0.0667	4	4
564565	0.040	3243	0.080	492	484	488	8.6	58.5	2.5	5.5	7.7	4.0	6.8	0.1167	7	7
565568	0.033	2254	0.059	598	593	596	17.9	47.1	2.5	7.1	12.5	5.6	14.1	0.0500	3	3
566567	0.041	1463	0.080	198	196	197	11.7	35.7	2.5	4.4	6.1	2.9	6.1	0.0667	4	4

Table R-3

Reach Route Hydraulic Data for the 100-year, 24-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope In ft/ft	Length In feet	Average n value	Discharge, In cfs Top	Bottom	Average	Channel Base Width In feet	Flow Top Width In feet	Flow Depth In feet	Channel Velocity In fps	Wave Celerity In fps	Velocity Range In fps Min.	Max.	Travel Time In hours	NSTEPS Computed	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
567568	0.039	3650	0.058	305	301	303	16.4	47.3	1.6	5.7	10.1	5.2	9.1	0.1000	6	6
568573	0.032	2067	0.078	1067	1060	1064	8.7	60.0	4.7	7.0	11.5	5.2	13.0	0.0500	3	3
569570	0.040	1696	0.035	249	248	249	10.6	19.2	2.7	10.0	14.1	5.6	21.3	0.0333	2	2
571572	0.057	1379	0.020	15	14	15	32.0	40.5	0.2	4.7	7.7	3.4	8.6	0.0500	3	3
572573	0.034	1285	0.038	427	426	427	22.5	36.5	1.8	9.6	10.7	4.3	16.1	0.0333	2	2
574575	0.037	823	0.050	372	371	372	6.4	21.5	3.4	8.1	13.7	4.1	20.6	0.0167	1	1
575576	0.042	2342	0.052	411	407	409	0.5	27.0	2.9	9.1	19.5	7.8	29.3	0.0333	2	2
576577	0.034	740	0.053	475	474	475	0.1	25.4	3.5	9.2	12.3	3.7	18.5	0.0167	1	1
577578	0.015	1078	0.047	1879	1874	1877	24.1	86.4	4.9	8.0	17.9	5.4	27.0	0.0167	1	1
578587	0.019	1628	0.046	319	319	319	15.3	45.0	1.7	5.4	6.8	3.2	6.8	0.0667	4	4
579580	0.060	1751	0.047	478	477	478	5.0	24.2	2.3	12.1	14.6	5.8	21.9	0.0333	2	2
580581	0.044	2339	0.047	633	629	631	10.0	39.1	2.4	10.3	13.0	5.8	14.7	0.0500	3	3
581582	0.046	4012	0.048	1085	1076	1081	5.0	34.7	3.7	13.3	16.7	8.0	16.8	0.0667	4	4
582583	0.023	1725	0.057	1521	1510	1516	10.0	65.1	4.5	8.9	14.4	5.7	21.6	0.0333	2	2
583584	0.036	3107	0.070	1580	1568	1574	26.1	63.7	5.3	7.7	10.4	5.2	9.7	0.0833	5	5
584597	0.026	3704	0.050	351	351	351	64.7	93.1	1.4	4.5	6.2	3.4	5.2	0.1667	10	10
586587	0.031	1905	0.035	108	108	108	10.0	21.7	1.1	6.8	7.9	3.8	8.0	0.0667	4	4
587595	0.017	1039	0.045	375	374	375	20.0	37.9	2.2	6.2	8.7	3.5	13.0	0.0333	2	2
588590	0.034	1117	0.051	180	178	179	13.4	38.0	1.7	5.2	18.6	5.6	28.0	0.0167	1	1
589590	0.042	1751	0.050	110	109	110	12.7	17.7	1.7	5.3	9.7	4.4	11.0	0.0500	3	3
591521	0.014	915	0.050	1193	1188	1191	75.9	96.8	2.9	5.7	15.2	4.6	22.9	0.0167	1	1
592593	0.041	2062	0.050	94	93	94	7.8	16.1	1.7	4.8	11.5	5.1	12.9	0.0500	3	3
593594	0.020	988	0.056	593	590	592	14.9	66.1	3.0	6.2	8.2	3.3	12.4	0.0333	2	2
594595	0.020	2093	0.050	645	635	640	5.9	98.1	4.2	5.0	7.0	3.5	6.6	0.0833	5	5
595596	0.011	1095	0.049	1172	1167	1170	32.4	123.7	4.7	5.3	6.1	2.7	6.9	0.0500	3	3
597598	0.025	2822	0.050	388	387	388	32.2	56.9	2.1	5.3	6.7	3.5	5.9	0.1167	7	7
599608	0.015	1476	0.045	966	966	966	15.2	71.1	3.8	6.5	12.3	4.9	18.5	0.0333	2	3
600601	0.018	2406	0.025	171	169	170	14.1	30.4	1.7	6.9	10.0	4.8	10.1	0.0667	4	4
601602	0.015	1765	0.040	300	298	299	23.8	32.8	2.5	5.4	7.4	3.5	7.4	0.0667	4	4

Table R-3

Reach Route Hydraulic Data for the 100-year, 24-hour Storm
Existing Condition

Routing Reach	Reach						Manning's Equation				Computed Using HEC-1 Summary Data					NSTEPS from HEC-1 Input File
	Slope In ft/ft	Length In feet	Average n value	Discharge, In cfs			Channel Base Width In feet	Flow Top Width In feet	Flow Depth In feet	Channel Velocity In fps	Wave Celerity In fps	Velocity Range In fps		Travel Time In hours	NSTEPS Computed	
				Top	Bottom	Average						Min.	Max.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
602603	0.021	2610	0.047	418	415	417	12.7	35.1	2.4	6.7	10.9	5.2	10.9	0.0667	4	4
603622	0.020	2745	0.045	617	605	611	50.6	63.5	2.5	5.9	9.2	4.6	8.6	0.0833	5	5
604606	0.065	2784	0.028	11	11	11	16.0	45.6	0.2	3.7	4.2	2.3	3.5	0.1833	11	11
606607	0.029	1061	0.055	146	145	146	10.0	24.0	1.8	5.0	8.9	3.5	13.3	0.0333	2	2
607608	0.015	1008	0.050	161	160	161	1.0	24.2	2.9	4.6	8.4	3.4	12.6	0.0333	2	2
608613	0.020	1338	0.047	972	972	972	26.2	80.2	2.5	6.8	11.2	4.5	16.8	0.0333	2	2
609611	0.020	470	0.050	48	48	48	10.0	14.6	1.1	3.7	7.8	2.3	11.8	0.0167	1	1
610611	0.021	1090	0.045	117	116	117	18.5	25.7	1.5	4.2	9.1	3.6	13.7	0.0333	2	2
611612	0.027	925	0.050	0	0	0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0000	1	1
613621	0.025	718	0.048	972	972	972	42.7	78.2	2.3	7.4	11.9	3.6	18.0	0.0167	1	1
614615	0.040	1114	0.020	24	24	24	32.0	39.9	0.2	4.7	9.3	3.7	14.0	0.0333	2	2
615618	0.134	499	0.019	21	21	21	14.0	13.8	0.4	10.4	8.3	2.5	12.5	0.0167	1	1
615619	0.049	2444	0.024	11	10	11	2.3	11.8	0.5	4.8	5.8	3.0	5.1	0.1167	7	7
616617	0.055	1131	0.060	32	31	32	5.0	18.7	0.9	3.3	6.3	2.8	7.1	0.0500	3	3
617618	0.035	1912	0.060	159	157	158	40.4	49.2	1.1	4.0	6.4	3.2	6.0	0.0833	5	5
618619	0.029	1837	0.060	239	235	237	8.0	26.3	3.1	4.9	7.7	3.7	7.7	0.0667	4	4
619620	0.029	800	0.027	176	176	176	40.0	95.8	0.7	5.4	13.3	4.0	20.1	0.0167	1	1
620621	0.039	915	0.050	312	312	312	10.1	23.3	2.9	6.7	15.2	4.6	22.9	0.0167	1	1
621622	0.014	3830	0.049	1152	1147	1150	2.7	98.9	3.2	6.1	10.6	5.5	9.6	0.1000	6	6
622549	0.012	1697	0.125	2053	2028	2041	189.8	210.2	3.8	2.9	4.0	2.1	3.5	0.1167	7	6
623624	0.011	701	0.023	74	73	74	16.0	42.5	0.6	5.0	0.0	0.0	0.0	0.0000	1	1
624626	0.024	637	0.067	125	124	125	65.4	112.0	1.0	2.6	3.5	1.6	4.0	0.0500	3	3
625626	0.025	1350	0.019	47	46	47	34.0	51.0	0.5	4.9	5.6	2.7	5.6	0.0667	4	4
626627	0.021	625	0.061	3180	3176	3178	63.2	126.1	4.4	7.9	10.4	3.1	15.7	0.0167	1	1

3.2.2.3 Storage Route Parameters

General

Reservoir storage routing computations are done for the five flood control structures present on the watershed, and at numerous locations where ponded water could have a significant attenuation effect on peak discharges resultant from a 10-year storm. The hydraulics of the control structures at each location were modeled to obtain stage versus discharge curves. The storage characteristics of each impoundment area was determined and stage versus storage curves prepared. Each storage location was modeled using the HEC-1 Modified Puls Method option.

Field Reconnaissance and Survey

Each storage area was visited in the field and photographs taken of the impoundment area and control structures. Control structures for which there are no reliable as-builts were field surveyed. Non-critical structures were surveyed using a laser level and hand tape. Critical structures were as-built by a survey crew. The physical information gathered included the size, type, length and number of barrels, inlet and outlet elevations, a cross section typical of the downstream channel, and a profile along potential embankment overtop locations. Table R-4 contains a list of drainage culvert structures which were visited during the field reconnaissance. Table R-4 columns which require additional description are listed below:

Column 1: The HEC-1 concentration point where the structure is located. If the identifier starts with an "M", then that row describes a miscellaneous culvert for which a HEC-1 concentration point was not defined. Those culverts typically lie in a reach where the floodplain will be defined using HEC-2.

Column 2: This column lists the culvert material, where:
- CMP = corrugated metal pipe;
- RCP = reinforced concrete pipe; and
- RC = reinforced concrete

Column 9: This column lists whether or not a reservoir route operation is performed at this location.

Column 10: This column lists whether or not a flow diversion occurs at this location.

Column 11: This column lists whether or not existing suitable as-built plans are available. A "y" indicates that suitable plans are available. The number listed is the GVSCE file number which can be cross referenced using the reference list in section 6. An "n" indicates that suitable as-builts are not available and a field survey was performed.

Column 12: This column lists whether or not the structure lies in a HEC-2 study reach.

Percolation Losses

Percolation loss rates are included in the storage routing computations for the five flood control structures present on the watershed. Percolation losses are assumed to be negligible for the other reservoir route operations, due to relatively small surface ponding areas. The loss rate at each flood control structure was selected using the following method:

1. The highest anticipated ponding stage was sketched on Exhibit B.
2. The dominate soil map units in the ponding area were selected.
3. The XKSAT values for the selected map units were averaged and the resultant value converted into a loss rate in cfs/acre.

The loss rates are applied in the HEC-1 models using the RL record option. The percolation loss rates for each structure are:

1. Dam 4 (C599): 0.97 cfs/acre;
2. Dam 6 (C560): 0.40 cfs/acre;
3. Dam 7 (C584): 0.15 cfs/acre;
4. Dam 11 (C578): 0.97 cfs/acre;
5. Dam 36(C536): 0.17 cfs/acre.

These loss rates are conservative. Actual losses could be as much as ten times greater. However, sufficient data is not available to substantiate use of higher loss rates.

Table R-4

List of Drainage Culvert Structures

CP ID #	Location	Size & Number	Shape	Length	Type	Asphalt Lining y/n	Headwall Type	Detention y/n	Flow Split y/n	As Builts & Plan # y/n & #	Study Wash y/n	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
503	NE 1/4 Sec. 2	1 - 72"	Circ.	190'	CMP	y	Projecting	y	possible	y #22&23	n	McDowell Mtn. Rd. Sta. 99+85, no obstruction
504	NE 1/4 Sec. 2	1 - 24"	Circ.	100'	CMP	y	Projecting	y	y, to C505	y #22&23	n	McDowell Mtn. Rd. Sta. 89+34, no obstruction
505	NE 1/4 Sec. 2	1 - 21"	Circ.	70'	CMP	y	Projecting	n	y, to C506	y #22&23	n	McDowell Mtn. Rd. Sta. 86+32, no obstruction
506	NE 1/4 Sec. 2	1 - 18"	Circ.	60'	CMP	y	Projecting	n	y, to C507	y #22&23	n	McDowell Mtn. Rd. Sta. 82+60, clogged both ends
507	SE 1/4 Sec. 2	1 - 24"	Circ.	70'	CMP	y	Projecting	y	n	y #22&23	n	McDowell Mtn. Rd. Sta. 78+40, no obstruction
508	SE 1/4 Sec. 2	1 - 42"	Circ.	120'	CMP	y	Projecting	y	y, to C507	y #22&23	n	McDowell Mtn. Rd. Sta. 69+40, no obstruction
509	SE 1/4 Sec. 2	1 - 18"	Circ.	80'	CMP	y	Projecting	n	possible	y #22&23	n	McDowell Mtn. Rd. Sta. 65+86, no obstruction
510	SE 1/4 Sec. 2	1 - 24"	Circ.	80'	CMP	y	Projecting	n	possible	y #22&23	n	McDowell Mtn. Rd. Sta. 59+80, no obstruction
511	SW 1/4 Sec. 2	2 - 54"	Circ.	90'	CMP	y	Projecting	y, see M13	n	y #22&23	n	McDowell Mtn. Rd. Sta. 48+10, no obstruction
513	NE 1/4 Sec. 4	1 - 60"	Circ.	72'	CMP	n	Projecting	y	n	none	n	No obstructions
523	SW 1/4 Sec. 2	1 - 66"	Circ.	100'	CMP	y	Projecting	y	y	y #22&23	y	No obstructions
525	NW 1/4 Sec. 11	3 - 70"x60"	Elipt.	55'	CMP	y	Hdwl w/wings	n	possible	n #24	y	Town will AS BUILT
527	NE 1/4 Sec. 11	1 - 42"	Circ.	25'	CMP	y	Projecting	n	n	none	y	Vegetation at inlet, not obstructed
536	NW 1/4 Sec. 4	1 - 48"	Circ.	165'	RCP	- - -	Hdwl w/wings	y	n	y #13-36	y	DAM # 36
538	SE 1/4 Sec. 4	1 - 60"	Circ.	164.3'	CMP	n	Projecting	y	n	none	y	No obstructions
557	NE 1/4 Sec. 5	1 - 60"	Circ.	110'	CMP	n	Projecting	n	n	none	y	No obstructions
560	SW 1/4 Sec. 4	1 - 48"	Circ.	162'	RCP	- - -	Hdwl w/wings	y	n	y #13-6	y	DAM # 6
570	NE 1/4 Sec. 8	4 - 8'x4'	Box	85.5	RC	- - -	Hdwl w/wings	n	n	n #4	y	No obstructions
578	NW 1/4 Sec. 9	48"	Circ	194.5'	RCP	- - -	Hdwl w/wings	y	n	n #13-11	y	DAM # 11
584	NW 1/4 Sec. 16	48"	Circ.	188.5'	RCP	- - -	Hdwl w/wings	y	possible	y #13-7	y	DAM # 7
585	NE 1/4 Sec. 9	2 - 8'x4'	Box	242'	RC	- - -	Hdwl w/wings	n	n	y #10	y	No obstructions
586	NW 1/4 Sec. 9	2 -48"	Circ.	155'	CMP	y	Hdwl w/ wings	y	n	none	n	No obstructions
596	SE 1/4 Sec. 9	3 - 12'x8'	Box	123'	RC	- - -	Hdwl w/wings	n	n	y #10	y	No obstructions
598	SE 1/4 Sec. 9	2 - 10'x4'	Box	136'	RC	- - -	Hdwl w/wings	n	n	y #10	y	No obstructions. Check w/Frank about x-sect.
599	SW 1/4 Sec. 10	60" +	Circ.	104'	RCP	- - -	Hdwl w/wings	y	n	y #13-4	y	DAM # 4
599	SW 1/4 Sec. 10	59"x36"	Arch	104'	RCP	- - -	Hdwl w/wings	y	n	y #5	y	Sewer line
600	SE 1/4 Sec. 4	1 - 60"	Circ.	125'	CMP	n	Projecting	y	n	none	y	No obstructions
601	NW 1/4 Sec. 10	2 - 60"	Circ.	88'	CMP	y	Hdwl w/wings	n	n	none	y	No obstructions
605	SE 1/4 Sec. 9	1 - 60"	Circ.	357.5'	CMP	y	Drop Inlet	y	n	n #14	n	No obstructions
607	SW 1/4 Sec. 10	4 - 48"	Circ.	108.5'	CMP	y	Hdwl w/ wings	n	n	n #14	n	No obstructions
608	SW 1/4 Sec. 10	3 - 10'x7'	Box	61.5	RC	- - -	Hdwl w/wings	n	n	none	y	No obstructions
609	SW 1/4 Sec. 10	1 - 36"	Circ.	76'	CMP	y	Hdwl w/wings	y	n	n #34	n	No obstructions
611	SW 1/4 Sec. 10	1 - 60"	Circ.	748'	CMP	y	Drop Inlet	y	n	n #15	y	"Plat 601-C off site"
617	NE 1/4 Sec. 16	1 - 36"	Circ.	???	CMP	n	Projecting	n	n	none	y	Plugged on D/S by boulders
618	NW 1/4 Sec. 15	1 - 36"	Circ.	97'	CMP	n	Projecting	y	n	none	y	1/2 full of sediment at outlet

Table R-4

List of Drainage Culvert Structures

CP ID #	Location	Size & Number	Shape	Length	Type	Asphalt Lining y/n	Headwall Type	Detention y/n	Flow Split y/n	As Builts & Plan # y/n & #	Study Wash y/n	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
619	NW 1/4 Sec. 15	1 - 60"	Circ.	???	CMP	???	Projecting	y	n	n #2	y	"Palisades Plaza"
622	SW 1/4 Sec. 11	3 - 60"	Circ.	121'	CMP	n	Projecting	n	n	none	y	No obstructions
M01	NW 1/4 Sec. 15	1 - 36"	Circ.	120.7'	CMP	n	Projecting	n	n	n #19	y	Town Will AS BUILT
M02	SW 1/4 Sec. 9	3 - 54"	Circ.	72.3'	CMP	y	Mitered	n	possible	n #18	y	Town Will AS BUILT
M03	NE 1/4 Sec. 8	3 - 36"	Circ.	73'	RCP	- - -	Projecting	n	n	n #4	y	No obstructions
M04	SE 1/4 Sec. 5	4 - 7'x6'	Box	81.3'	RC	- - -	Hdwl w/wings	n	n	none	y	No obstructions
M05	NE 1/4 Sec. 9	5 - 10'x3'	Box	74.5'	RC	- - -	Hdwl w/wings	n	n	none	y	No obstructions
M06	SW 1/4 Sec. 10	1 - 18"	Circ.		CMP	n	Hdwl w/grate	n	n	none	y	Do not model culvert
M07	SW 1/4 Sec. 11	3 - 60"	Circ.	84'	CMP	n	Projecting	n	n	none	y	No obstructions
M08	SW 1/4 Sec. 4	1 -60"	Circ.	92'	CMP	???	Projecting	n	n	n #3	n	No obstructions, no pictures
M09	NW 1/4 Sec. 10	3 - 42"	Circ.	71.4'	CMP	y	Mitered	n	n	n #25	y	Town will AS BUILT Sediment (approx. 3" deep)
M10	NE 1/4 Sec. 10	2 - 54"	Circ.	122'	CMP	n	Projecting	n	n	none	y	No obstructions
M11	NW 1/4 Sec. 11	3 - 10'x3'	Box	55'	RC	- - -	Hdwl w/wings	n	possible	n #24	y	Town will AS BUILT.
M12	SW 1/4 Sec. 2	1 - 30"	Circ.	150'	CMP	y	Projecting	n	n	y #22&23	n	McDowell Mtn. Rd. Sta. 23+80, no pictures
M13	SE 1/4 Sec. 2	1 - 21"	Circ.	98'	CMP	y	Projecting	y, see C511	n	y #22&23	n	McDowell Mtn. Rd. Sta. 50+16, no obstruction
M14	SE 1/4 Sec. 2	1 - 18"	Circ.	100'	CMP	y	Projecting	n	possible	y #22&23	n	McDowell Mtn. Rd. Sta. 58+00, no pictures
M15	SW 1/4 Sec. 10	2 - 36"	Circ.		CMP	y	Hdwl w/wings	n	n	n #15	n	No obstructions

Hydraulic Computations

The hydraulics of most culvert structures were modeled using the HY-8 computer program [6.5:26]. The U.S. Army Corps of Engineers HEC-2 computer program [6.5:18] was used for selected culverts. Each structure was checked under inlet and outlet control. The highest stage resultant from the two conditions was used.

The hydraulics of overflow of dam emergency spillways and roadway embankments were modeled using the Ohio Department of Natural Resources Uneven Weir computer program, version 1.0 [6.5:15].

The results of the storage route hydraulic calculations are shown in Tables R-5 through R-25. The results are shown graphically on Figures R-1 through R-21. Supporting calculations are contained in Appendix A.

Tables R-13, R-15, R-16, R-17 and R-19 are the rating curves for the five flood control structures existing on the watershed. These correspond to Dams 36, 6, 11, 7 and 4, respectively. The original design data for the dams, prepared by TRICO, Inc. [6.6:13, 6.6:D-R] is included. The TRICO design data is based on the Town of Fountain Hills local bench mark datum, not NGVD1929.

Surface Area Computations

The ponding areas upstream of each structure were planimetered from the available mapping. The area associated with each contour up to an elevation typically 2 feet higher than the top of the overflow embankment was measured. The total storage volume in acre-feet for appropriate elevations was then calculated using the conical method. The calculated volumes were input to the HEC-1 computer models with corresponding outflow discharges. The results are shown in Table R-5 through R-25 and Figures R-1 through R-21.

TABLE R-5

Storage and Discharge vs. Stage Data for C503

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge			
			Culvert Flow (cfs)	Ditch Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1535.14	0.00	0.00	0	---	---	0
1538.00	0.70	0.67	50	---	---	50
1540.00	1.56	2.87	133	---	---	133
1542.00	2.79	7.16	210	---	---	210
1544.00	3.90	13.82	273	---	---	273
1546.00	5.08	22.77	325	---	---	325
1548.00	6.55	34.37	367	---	---	367
1548.50	---	38.0	377	0	---	377
1549.00	---	41.8	386	21	---	407
1549.20	---	43.2	391	50	---	441
1549.40	---	44.7	394	87	---	481
1549.60	---	46.1	398	147	---	545
1549.80	---	47.8	402	210	---	612
1550.00	8.22	49.11	405	310	---	715
1550.20	---	50.9	408	410	---	818
1550.40	---	52.8	412	559	---	971
1550.60	---	54.6	415	700	---	1115
1550.80	---	56.4	418	850	---	1268
1551.00	---	58.3	422	1020	---	1442
1551.20	---	60.1	426	1210	---	1636
1551.40	---	61.9	428	1385	---	1813
1551.41	---	62.0	429	1400	0	1829
1552.00	10.28	67.57	439		*	*

* Note: Weir flow over the road will start at El > 1551.41

TABLE R-6

Storage and Discharge vs. Stage Data for C504

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Ditch Flow (cfs)	Total Flow (cfs)
1538.14	0.00	0.00	0	---	0
1540.00	0.27	0.17	11	---	11
1541.66	---	0.9	20	0	20
1541.80	---	1.0	20	2	22
1542.00	0.69	1.10	21	4	24
1542.20	---	1.3	22	8	30
1542.40	---	1.6	22	19	41
1542.60	---	1.8	23	37	60
1542.80	---	2.0	23	62	85
1543.00	---	2.3	24	97	121
1543.20	---	2.5	24	147	171
1543.40	---	2.7	25	215	240
1543.60	---	3.0	26	296	322
1543.74	---	3.1	26	370	396
1544.00	1.72	3.42	27	513	*
1546.00	2.80	7.90	30	---	*

* Note: Weir flow over the road will start at EL > 1543.74

TABLE R-7

Storage and Discharge vs. Stage Data for C50

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1525.24	0.000	0.00	0	---	0
1526.00	---	0.28	2	---	2
1526.50	---	0.46	5	---	5
1527.00	---	0.65	9	---	9
1527.50	---	0.85	13	---	13
1528.00	---	1.03	15	---	15
1528.95	---	1.38	18	0	18
1529.00	---	1.40	19	2	20
1529.10	---	1.44	19	17	36
1529.20	---	1.48	19	49	69
1529.30	---	1.52	20	98	118
1529.40	---	1.55	20	165	185
1529.50	---	1.59	20	252	272
1529.60	---	1.64	21	358	378
1529.70	---	1.67	21	485	506
1529.80	---	1.70	22	631	652
1529.90	---	1.75	22	794	816
1530.00	1.117	1.772	22	975	997
1532.00	1.957	4.807	---	---	---
1534.00	2.753	9.495	---	---	---

TABLE R-8

Storage and Discharge vs. Stage Data for C508

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge			
			Culvert Flow (cfs)	Ditch Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1524.24	0.00	0.00	0	---	---	0
1525.00	---	0.05	6	---	---	6
1525.50	---	0.09	9	---	---	9
1526.00	---	0.13	16	---	---	16
1526.50	---	0.17	22	---	---	22
1527.00	---	0.21	28	---	---	28
1527.56	---	0.25	38	0	---	38
1528.00	0.224	0.281	47	4	---	51
1528.20	---	0.36	52	6	---	58
1528.40	---	0.46	56	14	---	70
1528.60	---	0.55	60	24	---	84
1528.80	---	0.64	63	37	---	100
1529.00	---	0.72	66	56	---	122
1529.20	---	0.81	68	81	---	149
1529.40	---	0.90	71	112	---	183
1529.60	---	1.00	73	143	---	216
1529.64	---	1.02	73	154	0	227
1529.80	---	1.09	75	196	3	274
1530.00	0.707	1.167	77	250	26	353
1532.00	1.461	3.290	94	---	---	---

TABLE R-9

Storage and Discharge vs. Stage Data for C511 and M13

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1535.24	0.00	0.00	0	—	0
1537.00	—	0.4	42	—	42
1538.00	—	0.7	88	—	88
1540.00	0.75	1.19	200	—	200
1541.64	—	3.1	274	0	274
1541.80	—	3.2	280	6	286
1542.00	1.68	3.55	288	37	325
1542.20	—	4.0	297	96	393
1542.40	—	4.5	304	187	491
1542.60	—	4.9	310	312	622
1542.80	—	5.4	316	474	790
1543.00	—	5.8	324	676	1000
1543.20	—	6.3	330	911	1241
1543.40	—	6.8	335	1183	1518
1543.60	—	7.2	343	1492	1835
1543.80	—	7.7	350	1839	2189
1544.00	2.97	8.13	355	2225	2580
1546.00	4.06	15.13	—	—	—
1548.00	4.92	24.09	—	—	—
1550.00	5.91	34.91	—	—	—

TABLE R-10

Storage and Discharge vs. Stage Data for C512 (Stock Tank)

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Channel Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1517.00	0.00	0.00	---	---	0
1518.00	0.08	0.03	---	---	0
1520.00	0.19	0.29	---	---	0
1522.00	0.27	0.75	---	---	0
1524.00	0.37	1.38	---	---	0
1526.00	0.65	2.39	---	---	0
1528.00	1.15	4.17	---	---	0
1530.00	2.17	7.43	---	---	0
1531.00	---	10.3	---	0	0
1531.60	---	12.2	0	15	15
1531.80	---	12.7	4	31	35
1532.00	3.84	13.36	10	55	65
1532.20	---	14.1	49	88	137
1532.40	---	15.1	112	132	244
1532.60	---	16.2	190	186	376
1532.80	---	17.0	289	252	541
1533.00	---	17.9	395	330	725
1534.00	5.45	22.61	---	---	---
1536.00	7.04	35.06	---	---	---

TABLE R-11

Storage and Discharge vs. Stage Data for C513

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1789.00	0.00	0.00	0	---	0
1794.00	0.21	0.35	112	---	112
1794.20	---	0.4	118	0	118
1794.40	---	0.5	124	6	130
1794.60	---	0.5	129	24	153
1794.80	---	0.6	135	54	189
1795.00	---	0.7	140	97	237
1795.20	---	0.7	146	154	300
1795.40	---	0.8	151	224	375
1795.60	---	0.9	155	308	463
1795.80	---	0.9	160	406	566
1796.00	0.43	0.97	164	518	682
1798.00	0.65	2.05	---	---	0
1800.00	0.83	3.54	---	---	0
1802.00	1.18	5.54	---	---	0
1804.00	1.46	8.17	---	---	0

TABLE R-12

Storage and Discharge vs. Stage Data for C523

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge			
			Culvert Flow (cfs)	Ditch Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1650.28	0.00	0.00	0	---	---	0
1652.00	0.01	0.01	22	---	---	22
1654.00	0.13	0.12	78	---	---	78
1656.00	0.50	0.71	144	---	---	144
1658.00	1.05	2.23	209	---	---	209
1658.20	---	2.5	214	---	---	214
1658.40	---	2.8	220	---	---	220
1658.60	---	3.1	224	---	---	224
1658.64	---	3.2	226	0	---	226
1658.80	---	3.4	229	3	---	232
1659.00	---	3.7	234	5	---	239
1659.20	---	4.0	239	10	0	249
1659.40	---	4.3	243	20	25	288
1659.60	---	4.6	247	37	100	384
1659.80	---	4.9	252	61	216	529
1660.00	1.97	5.20	256	96	374	726
1660.20	---	5.5	262	139	559	960
1662.00	3.04	10.17	---	---	---	---

TABLE R-13
Storage and Discharge vs Stage Data for C536 (Dam 36)

GVSCE					
Stage NGVD 29 Datum	Surface Area (acres)	Storage Volume (acre-feet)	Discharge, in cfs		
			Principal Spillway	Emergency Spillway	Total
1852.06	0.00	0.00	0	---	0
1856.00	0.07	0.09	63	---	63
1858.00	0.35	0.48	108	---	108
1860.00	0.91	1.69	142	---	142
1862.00	1.37	3.96	168	---	168
1864.00	2.58	7.84	193	---	193
1866.00	4.04	14.41	211	---	211
1868.00	5.44	23.85	228	---	228
1870.00	6.67	35.94	245	---	245
1872.00	7.93	50.53	262	---	262
1874.00	9.20	67.64	276	---	276
1876.00	10.26	87.09	289	---	289
1878.00	11.27	108.61	301	---	301
1880.00	12.35	132.22	311	---	311
1882.00	13.50	158.07	320	---	320
1884.00	14.88	186.43	329	---	329
1886.00	16.85	218.14	338	---	338
1888.00	19.87	254.82	345	---	345
1888.98	---	276	347	0	347
1889.00	---	276	348	0	348
1889.20	---	280	348	8	356
1889.40	---	285	349	42	391
1889.60	---	289	350	110	459
1889.80	---	294	350	206	556
1890.00	23.38	298.02	351	328	679
1890.20	---	303	352	473	825
1890.40	---	308	352	643	995
1890.60	---	313	353	837	1190
1890.80	---	317	354	1054	1408
1891.00	---	322	355	1293	1647
1891.20	---	327	355	1550	1905
1891.40	---	332	356	1826	2182
1891.60	---	337	356	2121	2477
1891.80	---	342	357	2432	2789
1892.00	25.56	346.95	358	2761	3119
1892.20	---	352	358	3106	3463
1892.40	---	358	359	3467	3826
1892.60	---	363	359	3845	4204
1892.80	---	368	359	4239	4598
1893.00	---	374	360	4649	5009
1894.00	28.78	401.26	---	---	---
1896.00	31.34	461.36	---	---	---

Tri-Co.			
Stage		Storage Volume (acre-feet)	Total Discharge (cfs)
NGVD 29 Datum	Local Datum		
1853.39	1854.65	0.00	0
1858.74	1860.00	2.00	142
1862.74	1864.00	7.00	188
1866.74	1868.00	11.00	225
1870.74	1872.00	21.00	256
1874.74	1876.00	47.00	284
1878.74	1880.00	84.00	310
1882.74	1884.00	138.00	333
1886.74	1888.00	223.00	355
1888.74	1890.00	284.00	366
1889.74	1891.00	315.00	1036
1890.74	1892.00	347.00	2280
1891.74	1893.00	380.00	3920
1892.74	1894.00	407.00	5898
1893.74	1895.00	443.00	8183
1894.74	1896.00	473.00	10755

TABLE R-14

Storage and Discharge vs. Stage Data for C538

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1778.20	0.00	0.00	0	---	0
1782.00	0.08	0.10	82	---	82
1784.00	0.45	0.57	133	---	133
1786.00	0.67	1.69	185	---	185
1787.1	---	2.6	207	0	207
1787.20	---	2.7	208	0	208
1787.40	---	2.9	211	1	212
1787.60	---	3.0	214	4	218
1787.80	---	3.2	217	9	226
1788.00	1.03	3.38	219	16	235
1788.20	---	3.6	222	27	249
1788.40	---	3.9	224	41	265
1788.60	---	4.1	227	59	286
1788.80	---	4.3	230	80	310
1789.00	---	4.6	233	105	338
1789.20	---	4.8	235	132	367
1789.40	---	5.1	237	163	400
1789.60	---	5.3	240	197	437
1789.80	---	5.6	243	239	482
1790.00	1.42	5.82	245	294	539
1790.20	---	6.1	247	364	611
1790.40	---	6.4	250	451	701
1790.60	---	6.8	253	560	813
1790.80	---	7.1	254	688	942
1791.00	---	7.4	257	834	1091
1791.20	---	7.7	259	997	1256
1791.40	---	8.1	262	1177	1439
1792.00	1.80	9.03	---	---	---
1794.00	2.41	13.23	---	---	---

TABLE R-15
Storage and Discharge vs Stage Data for C560 (Dam 6)

GVSCE					
Stage NGVD 29 Datum	Surface Area (acres)	Storage Volume (acre-feet)	Discharge, in cfs		
			Principal Spillway	Emergency Spillway	Total
1808.79	0	0	0	---	0
1810.00	0.11	0.00	20	---	20
1812.00	1.99	1.71	57	---	57
1814.00	3.46	7.09	102	---	102
1816.00	4.27	14.81	136	---	136
1818.00	4.97	24.04	163	---	163
1820.00	5.65	34.65	184	---	184
1822.00	6.40	46.70	206	---	206
1824.00	7.34	60.43	224	---	224
1826.00	8.22	75.98	242	---	242
1828.00	9.28	93.47	257	---	257
1830.00	10.45	113.19	272	---	272
1832.00	12.02	135.64	285	---	285
1834.00	13.84	161.48	296	---	296
1835.36	---	183	303	0	303
1835.40	---	183	304	0	304
1835.60	---	186	305	14	319
1835.80	---	188	306	58	364
1836.00	16.15	191.44	307	133	440
1836.20	---	194	308	240	548
1836.40	---	197	309	382	691
1836.60	---	201	311	551	862
1836.80	---	205	312	743	1055
1837.00	17.60	208.31	313	955	1268
1837.20	---	212	314	1186	1500
1837.40	---	215	315	1436	1751
1837.60	---	219	316	1702	2018
1837.80	---	223	317	1984	2301
1838.00	18.85	226.40	318	2282	2600
1838.20	---	230	319	2595	2914
1838.40	---	234	320	2923	3243
1838.60	---	238	321	3265	3586
1838.80	---	242	322	3622	3944
1839.00	---	246	323	3992	4315
1839.20	---	250	324	4375	4699
1839.40	---	254	325	4772	5097
1840.00	20.92	266.15	---	---	---
1842.00	23.64	310.69	---	---	---
1844.00	26.45	360.75	---	---	---
1846.00	28.89	416.07	---	---	---

Tri-Co.			
Stage		Storage Volume (acre-feet)	Total Discharge (cfs)
NGVD 29 Datum	Local Datum		
1808.74	1810.00	0.00	0
1814.74	1816.00	0.30	183
1818.74	1820.00	6.30	268
1822.74	1824.00	25.10	331
1826.74	1828.00	55.20	385
1830.74	1832.00	97.30	431
1834.74	1836.00	152.10	474
1835.74	1837.00	169.60	485
1836.74	1838.00	187.00	1146
1837.74	1839.00	204.50	2391
1839.74	1841.00	242.00	5950
1841.74	1843.00	281.00	10666
1843.74	1845.00	320.00	16408
1845.74	1847.00	375.00	22966

TABLE R-16
Storage and Discharge vs Stage Data for C578 (Dam 11)

GVSCE					
Stage NGVD 29 Datum	Surface Area (acres)	Storage Volume (acre-feet)	Discharge, in cfs		
			Principal Spillway	Emergency Spillway	Total
1779.15	0.00	0.00	0	---	0
1784.00	0.09	0.15	95	---	95
1786.00	0.63	0.78	131	---	131
1788.00	1.41	2.77	160	---	160
1790.00	1.98	6.15	181	---	181
1792.00	2.62	10.73	203	---	203
1794.00	3.03	16.38	221	---	221
1796.00	3.65	23.05	239	---	239
1798.00	4.62	31.30	254	---	254
1800.00	5.59	41.49	269	---	269
1802.00	6.58	53.65	283	---	283
1804.00	7.68	67.89	294	---	294
1806.00	8.83	84.39	305	---	305
1808.00	10.23	103.43	316	---	316
1810.00	12.55	126.17	325	---	325
1810.78	---	137	327	0	327
1810.80	---	138	328	0	328
1811.00	---	139	329	7	336
1811.20	---	143	330	36	366
1811.40	---	145	331	95	426
1811.60	---	147	332	190	522
1811.80	---	151	332	321	653
1812.00	15.81	154.47	333	479	812
1812.20	---	157	333	659	992
1812.40	---	161	334	860	1194
1812.60	---	164	334	1080	1414
1812.80	---	167	335	1317	1651
1813.00	---	171	336	1570	1906
1813.20	---	174	336	1840	2176
1813.40	---	177	337	2125	2462
1813.60	---	181	338	2425	2763
1813.80	---	184	339	2739	3077
1814.00	17.16	187.43	340	3066	3406
1814.20	---	190	340	3408	3748
1814.40	---	194	341	3763	4104
1814.60	---	197	342	4131	4473
1814.80	---	202	343	4512	4855
1815.00	---	205	344	4906	5250
1816.00	18.44	223.03	---	---	---
1818.00	19.92	261.38	---	---	---
1820.00	20.71	302.00	---	---	---
1822.00	23.18	345.87	---	---	---

Tri-Co.			
Stage		Storage Volume (acre-feet)	Total Discharge (cfs)
NGVD 29 Datum	Local Datum		
1778.74	1780.00	0.00	0
1782.74	1784.00	0.00	88
1786.74	1788.00	3.04	153
1790.74	1792.00	10.64	198
1794.74	1796.00	22.68	234
1798.74	1800.00	42.40	265
1802.74	1804.00	72.60	293
1806.74	1808.00	112.80	319
1810.74	1812.00	165.40	343
1812.74	1814.00	198.05	2243
1814.74	1816.00	230.70	5775
1816.74	1818.00	269.10	10502
1818.74	1820.00	307.50	16215

TABLE R-17
Storage and Discharge vs Stage Data for C584 (Dam 7)

GVSCE					
Stage NGVD 29 Datum	Surface Area (acres)	Storage Volume (acre-feet)	Discharge, in cfs		
			Principal Spillway	Emergency Spillway	Total
1884.84	0.00	0.00	0	---	0
1886.00	0.00	0.00	18	---	18
1888.00	0.00	0.00	55	---	55
1890.00	0.00	0.00	100	---	100
1892.00	0.14	0.09	135	---	135
1894.00	0.39	0.60	163	---	163
1896.00	0.48	1.47	185	---	185
1898.00	0.72	2.66	205	---	205
1900.00	0.92	4.30	223	---	223
1902.00	1.02	6.24	241	---	241
1904.00	1.28	8.53	257	---	257
1906.00	1.46	11.27	272	---	272
1908.00	1.83	14.55	285	---	285
1910.00	2.28	18.66	296	---	296
1912.00	2.81	23.74	307	---	307
1914.00	3.30	29.84	318	---	318
1916.00	4.04	37.17	326	---	326
1918.00	5.10	46.29	333	---	333
1920.00	6.15	57.52	341	---	341
1922.00	7.32	70.97	348	---	348
1924.00	8.37	86.65	355	---	355
1924.76	---	94	357	0	357
1924.80	---	94	358	0	358
1925.00	---	96	359	6	365
1925.20	---	97	359	26	385
1925.40	---	99	360	67	427
1925.60	---	101	360	133	493
1925.80	---	103	361	226	587
1926.00	9.90	104.90	362	342	704
1926.20	---	107	362	481	843
1926.40	---	109	363	644	1007
1926.60	---	111	364	828	1192
1926.80	---	113	364	1030	1394
1927.00	---	115	365	1250	1615
1927.20	---	118	365	1487	1852
1927.40	---	120	366	1740	2106
1927.60	---	122	366	2008	2374
1927.80	---	124	367	2291	2658
1928.00	11.47	126.25	367	2589	2956
1928.20	---	128	368	2901	3269
1928.40	---	131	369	3227	3596
1928.60	---	133	370	3567	3937
1928.80	---	136	371	3921	4292
1929.00	---	139	372	4289	4661
1930.00	13.37	151.07	---	---	---
1932.00	15.08	179.50	---	---	---
1934.00	16.66	211.23	---	---	---

Tri-Co.			
Stage		Storage Volume (acre-feet)	Total Discharge (cfs)
NGVD 29 Datum	Local Datum		
1882.74	1884.00	0.00	0
1894.74	1896.00	2.80	198
1898.74	1900.00	6.40	233
1902.74	1904.00	11.60	265
1906.74	1908.00	18.60	293
1910.74	1912.00	28.60	319
1914.74	1916.00	41.80	343
1918.74	1920.00	61.80	365
1924.74	1926.00	108.00	395
1925.74	1927.00	128.10	829
1926.74	1928.00	148.20	1640
1928.74	1930.00	173.70	4033
1930.74	1932.00	203.70	7306
1932.74	1934.00	233.60	11384

Note: When stage > 1928 a flow split will occur into sub basin 210H. Total discharge column is for flow passing dam 7 only, it does not include diversion discharges into sub basin 210H for stages above 1928.

TABLE R-18

Storage and Discharge vs. Stage Data for C586

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1804.37	0.00	0.00	0	---	0
1806.00	0.09	0.05	37	---	37
1808.00	0.23	0.36	130	---	130
1810.00	0.53	1.09	219	---	219
1812.00	0.85	2.45	284	---	284
1814.00	1.16	4.45	322	---	322
1816.00	1.39	7.00	353	---	353
1817.55	---	9.5	375	0	375
1817.60	---	9.6	377	0	377
1817.80	---	10.0	379	14	393
1818.00	1.96	10.34	382	50	432
1818.20	---	10.7	385	107	492
1818.40	---	11.2	387	187	574
1818.60	---	11.6	391	289	680
1818.80	---	12.1	393	415	808
1819.00	---	12.5	396	563	959
1820.00	2.38	14.67	---	---	---

TABLE R-19
Storage and Discharge vs Stage Data for C599 (Dam 4)

GVSCE					
Stage NGVD 29 Datum	Surface Area (acres)	Storage Volume (acre-feet)	Discharge, in cfs		
			Principal Spillway	Emergency Spillway	Total
1694.69	0.00	0.00	0	—	0
1696.00	0.00	0.00	38	—	38
1698.00	0.00	0.00	95	—	95
1700.00	0.05	0.03	214	—	214
1702.00	0.45	0.47	312	—	312
1704.00	1.54	2.35	384	—	384
1706.00	3.61	7.35	443	—	443
1708.00	5.99	16.85	497	—	497
1710.00	8.91	31.66	543	—	543
1712.00	12.23	52.71	587	—	587
1714.00	15.99	80.85	628	—	628
1714.84	—	95	642	0	642
1715.00	—	98	647	4	651
1715.20	—	102	650	39	689
1715.40	—	105	654	100	754
1715.60	—	109	658	185	843
1715.80	—	113	661	296	957
1716.00	19.36	116.14	665	431	1096
1716.20	—	120	668	594	1262
1716.40	—	124	672	781	1453
1716.60	—	128	677	988	1665
1716.80	—	132	680	1227	1907
1717.00	—	136	684	1498	2182
1717.20	—	139	687	1796	2483
1717.40	—	144	690	2121	2811
1717.60	—	148	694	2470	3164
1717.80	—	152	697	2843	3540
1718.00	20.73	156.22	700	3240	3940
1720.00	23.97	200.89	—	—	—
1722.00	27.28	252.10	—	—	—
1724.00	31.13	310.47	—	—	—

Tri-Co.			
Stage		Storage Volume (acre-feet)	Total Discharge (cfs)
NGVD 29 Datum	Local Datum		
1694.74	1696.00	—	0
1696.74	1698.00	—	150
1698.74	1700.00	0.00	285
1700.74	1702.00	2.25	420
1702.74	1704.00	7.88	510
1704.74	1706.00	15.75	555
1706.74	1708.00	28.13	610
1708.74	1710.00	44.25	645
1710.74	1712.00	65.63	705
1712.74	1714.00	91.88	755
1714.74	1716.00	129.38	825
1715.74	1717.00	148.13	1650
1716.74	1718.00	170.63	4875
1718.74	1720.00	213.75	10710
1720.74	1722.00	267.00	13665

Note: NE Corner of High School Cafeteria EL = 1716.49

TABLE R-20

Storage and Discharge vs. Stage Data for C600

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1754.00	0.01	0.00	0	---	0
1756.00	0.15	0.14	55	---	55
1758.00	0.35	0.62	183	---	183
1760.00	0.57	1.52	320	---	320
1762.00	0.87	2.95	427	---	427
1764.00	1.25	5.06	513	---	513
1766.00	1.69	7.98	570	---	570
1768.00	2.14	11.80	620	---	620
1770.00	2.68	16.61	665	---	665
1772.00	3.39	22.67	709	---	709
1774.00	4.03	30.07	750	---	750
1776.00	4.61	38.71	789	---	789
1776.36	---	40.5	795	0	795
1776.40	---	40.6	795	0	795
1776.60	---	41.6	799	13	812
1776.80	---	42.7	803	46	849
1777.00	---	43.7	806	100	906
1777.20	---	44.6	810	174	984
1777.40	---	45.7	814	270	1084
1778.00	5.48	48.78	---	---	---
1780.00	6.25	60.50	---	---	----

TABLE R-21

Storage and Discharge vs. Stage Data for C605

[1] Stage (ft)	[2] Head (d) at Inlet Trash Rack (feet)	[3] Surface Area (acres)	[4] Storage Volume (acre-ft)	[5] Discharge: Culvert Flow (cfs)	[6] Discharge: Inlet Flow (cfs)	[7] Discharge: Weir Flow (cfs)	[8] Discharge: Total Flow (cfs)
1722.45	0.00	0.00	0.00	0	---	---	0
1723.00	0.00	---	0.0	7	---	---	0
1724.00	0.00	---	0.1	22	---	---	0
1725.00	0.00	---	0.1	44	---	---	0
1726.00	0.00	---	0.2	77	---	---	0
1726.80	0.00	---	0.2	107	0	---	0
1727.00	0.15	---	0.2	113	5	---	5
1727.20	0.35	---	0.2	120	10	---	10
1727.40	0.55	---	0.2	128	20	---	20
1727.60	0.75	---	0.3	135	43	---	43
1727.80	0.95	---	0.3	142	63	---	63
1728.00	1.15	0.15	0.28	147	73	---	73
1728.20	1.35	---	0.4	154	78	---	78
1728.40	1.55	---	0.6	160	85	---	85
1728.60	1.75	---	0.7	166	91	---	91
1728.80	1.95	---	0.9	173	96	---	96
1729.00	2.15	---	1.0	178	101	---	101
1729.20	2.35	---	1.2	183	105	---	105
1729.40	2.55	---	1.4	189	109	---	109
1729.60	2.75	---	1.6	194	113	---	113
1729.80	2.95	---	1.7	200	117	---	117
1730.00	3.15	1.72	1.86	205	122	---	122
1730.20	3.35	---	2.3	210	126	---	126
1730.40	3.55	---	2.8	214	130	---	130
1730.60	3.75	---	3.2	218	134	---	134
1730.70	**3.85**	---	**3.4**	**220**	**136**	**0**	**136**
1730.80	3.95	---	3.6	223	138	1	139
1731.00	4.15	---	4.1	226	---	---	---
1731.20	4.35	---	4.5	230	---	---	---
1731.40	4.55	---	5.0	234	---	---	---
1731.60	4.75	---	5.4	236	---	---	---
1731.80	4.95	---	5.9	238	---	---	---
1732.00	5.15	2.77	6.31	240	---	---	---
1734.00	7.15	3.44	12.50	---	---	---	---

* Note: 1. Weir flow over the road will start at EL > 1730.70.
2. Total flow is the lesser of columns 5 and 6 plus column 7.

TABLE R-22

Storage and Discharge vs. Stage Data for C609

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1694.00	0.03	0.00	0	---	0
1695.00	---	0.1	6	---	6
1696.00	0.21	0.21	16	---	16
1697.00	---	0.5	33	---	33
1698.00	0.46	0.86	48	---	48
1699.00	---	1.4	59	---	59
1700.00	0.61	1.93	68	---	68
1701.00	---	2.6	75	---	75
1701.60	---	3.1	79	0	79
1701.80	---	3.2	81	5	85
1702.00	0.85	3.39	82	26	108
1702.20	---	3.6	83	66	149
1702.40	---	3.8	84	125	209
1702.60	---	4.0	85	204	289
1702.80	---	4.1	87	303	390
1703.00	---	4.3	88	424	512
1703.20	---	4.5	89	569	658
1703.40	---	4.7	90	739	829
1703.60	---	4.9	91	934	1025
1703.80	---	5.1	92	1155	1247
1704.00	1.03	5.27		---	0
1706.00	1.20	7.50		---	0

TABLE R-23

Storage and Discharge vs Stage Data for C611

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
				Discharge			
Stage (ft)	Head (d) at Inlet Trash Rack (feet)	Surface Area (acres)	Storage Volume (acre-ft)	Culvert Flow (cfs)	Inlet Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1668.36	0.00	0.00	0.00	0	0	0	0
1670.00	0.00	---	0.00	18	0	0	0
1672.00	0.00	---	0.00	59	0	0	0
1674.00	0.00	---	0.00	98	0	0	0
1676.00	0.00	0.16	0.41	152	0	0	0
1678.00	2.35	0.58	1.10	162	86	0	86
1680.00	4.35	0.81	2.49	174	117	0	117
1682.00	6.35	1.05	4.34	187	141	0	141
1684.00	***8.35***	***1.25***	***6.64***	***198***	***162***	***0***	***162***
1684.20	8.55	---	6.72	199	164	1	164
1684.40	8.75	---	6.81	200	165	5	170
1684.60	8.95	---	6.89	202	167	14	181
1684.80	9.15	---	6.97	203	169	29	199
1685.00	9.35	---	7.06	204	171	54	225
1685.20	9.55	---	7.14	205	173	89	262
1685.40	9.75	---	7.22	206	175	138	313
1685.60	9.95	---	7.31	208	176	202	378
1685.80	10.15	---	7.39	209	178	282	460
1686.00	10.35	---	7.47	210	180	378	558
1686.20	10.55	---	7.56	211	182	491	673
1686.40	10.75	---	7.64	212	183	624	807
1686.60	10.95	---	7.72	214	185	773	958
1686.80	11.15	---	7.81	215	187	932	1118
1688.00	12.35	---	7.89	216	197	2274	2471

* Note: 1. Weir flow over the road will start at EL > 1684.0.
2. Total flow is the lesser of columns 5 and 6 plus column 7.
3. Column 5 is calculated using the equation Q=0.67A(2gd)^0.5, where is the cross sectional area of the grated inlet and d is the depth above elevation 1675.65. The value of A is assumed to be 10.4 sf which refle a clogging factor of 2.

TABLE R-24

Storage and Discharge vs. Stage Data for C618

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1730.62	0.00	0.00	0.0	---	0
1734.00	0.01	0.01	2.2	---	2
1736.00	0.04	0.06	2.6	---	3
1737.00	---	0.1	2.8	---	3
1738.00	0.16	0.24	3.0	---	3
1739.00	---	0.5	3.1	---	3
1740.00	0.36	0.75	3.2	---	3
1741.00	---	1.2	3.3	---	3
1742.00	0.56	1.66	3.5	---	3
1743.00	---	2.3	3.6	---	4
1744.00	0.72	2.94	3.7	---	4
1744.35	---	3.2	3.7	0	4
1744.40	---	3.3	3.8	0	4
1744.60	---	3.4	3.8	4	8
1744.80	---	3.6	3.8	17	21
1745.00	---	3.8	3.8	44	48
1745.20	---	3.9	3.8	85	88
1745.40	---	4.1	3.9	139	143
1745.60	---	4.3	3.9	208	212
1745.80	---	4.5	3.9	291	295
1746.00	1.00	4.74	3.9	386	390
1746.20	---	5.0	4.0	495	499
1748.00	1.50	7.29	---	---	---

* Note: Weir flow over the road will start at EL > 1744.35

TABLE R-25

Storage and Discharge vs. Stage Data for C619

Stage (ft)	Surface Area (acres)	Storage Volume (acre-ft)	Discharge		
			Culvert Flow (cfs)	Weir Flow (cfs)	Total Flow (cfs)
1675.60	0.00	0.00	0	0	0
1676.00	---	0.00	4	0	4
1678.00	---	0.02	25	0	25
1680.00	0.03	0.04	72	0	72
1682.00	0.18	0.23	128	0	128
1684.00	0.39	0.79	155	0	155
1686.00	0.54	1.72	163	0	163
1688.00	0.73	2.98	172	0	172
1690.00	1.00	4.70	178	0	178
1692.00	***1.30***	***7.00***	***187***	0	***187***
1692.20	---	7.08	188	8	195
1692.40	---	7.17	188	24	213
1692.60	---	7.26	189	49	238
1692.80	---	7.34	190	83	273
1693.00	---	7.43	190	128	318
1693.20	---	7.51	191	182	374
1693.40	---	7.60	192	249	441
1693.60	---	7.69	193	325	518
1693.80	---	7.77	193	412	606
1694.00	---	7.86	194	512	706

* Note: Weir flow over the road will start at EL > 1692.0

Figure R-1

Storage and Discharge vs Stage for C503

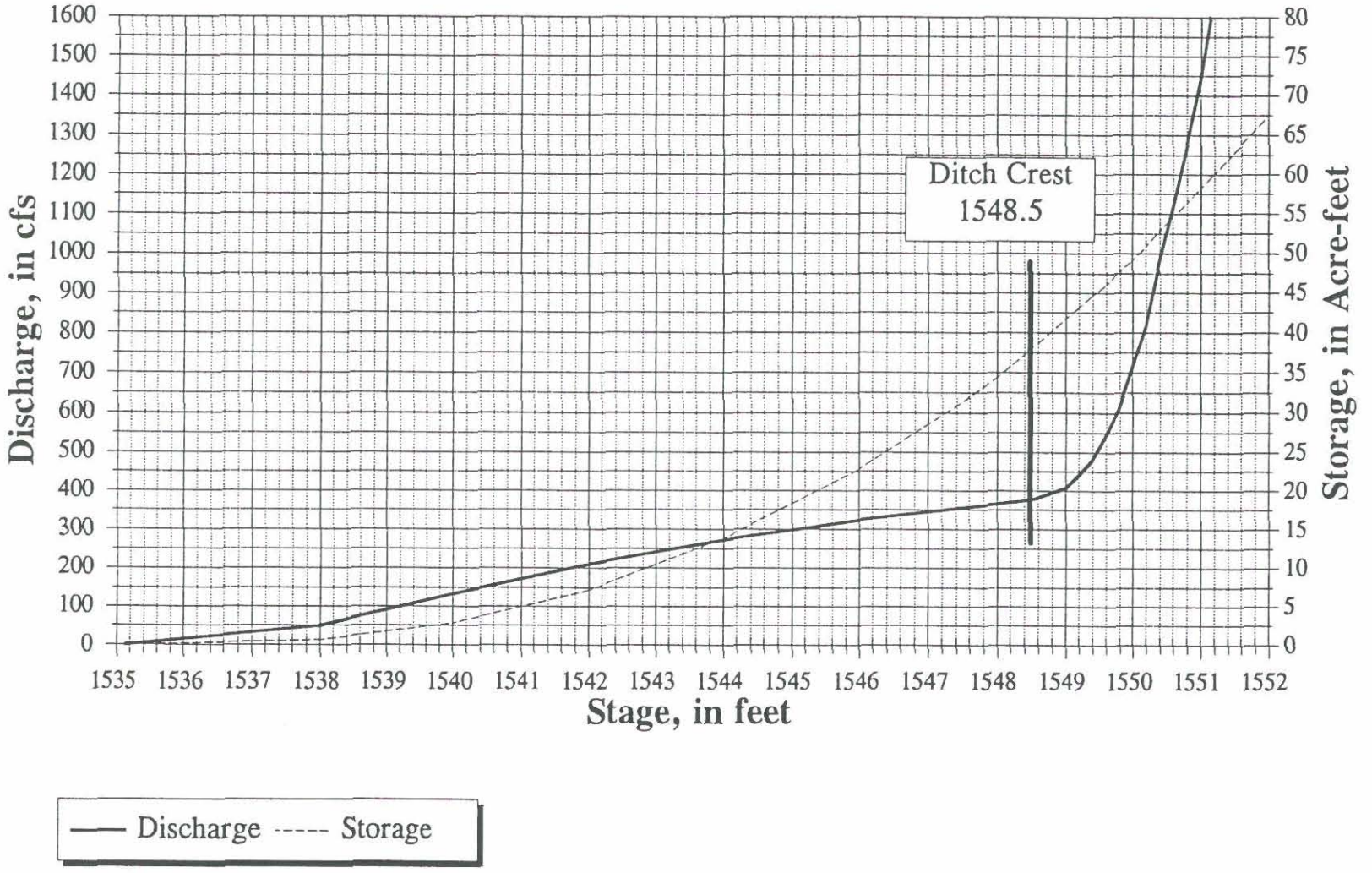


Figure R-2

Storage and Discharge vs Stage for C504

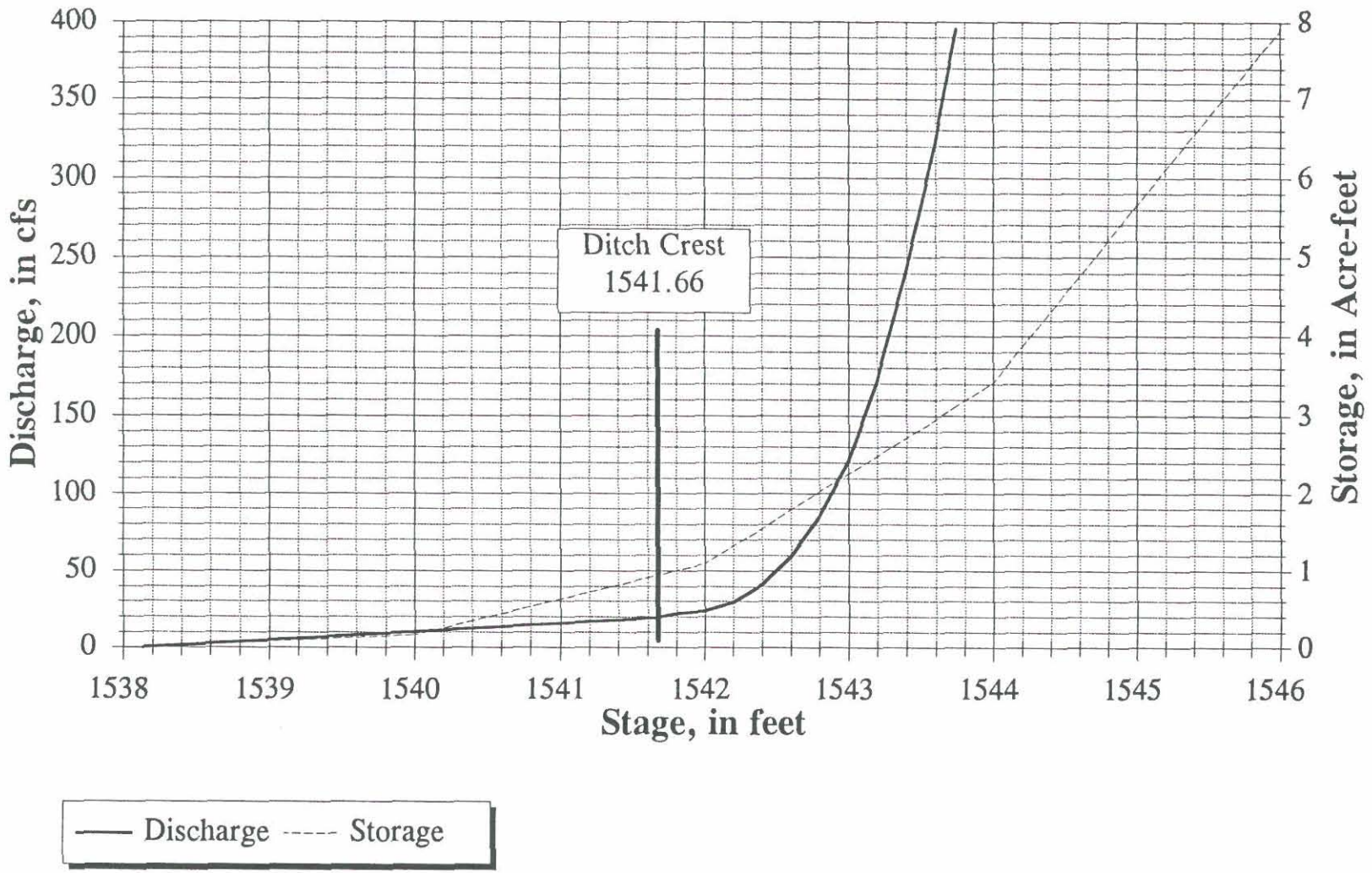


Figure R-3

Storage and Discharge vs Stage for C507

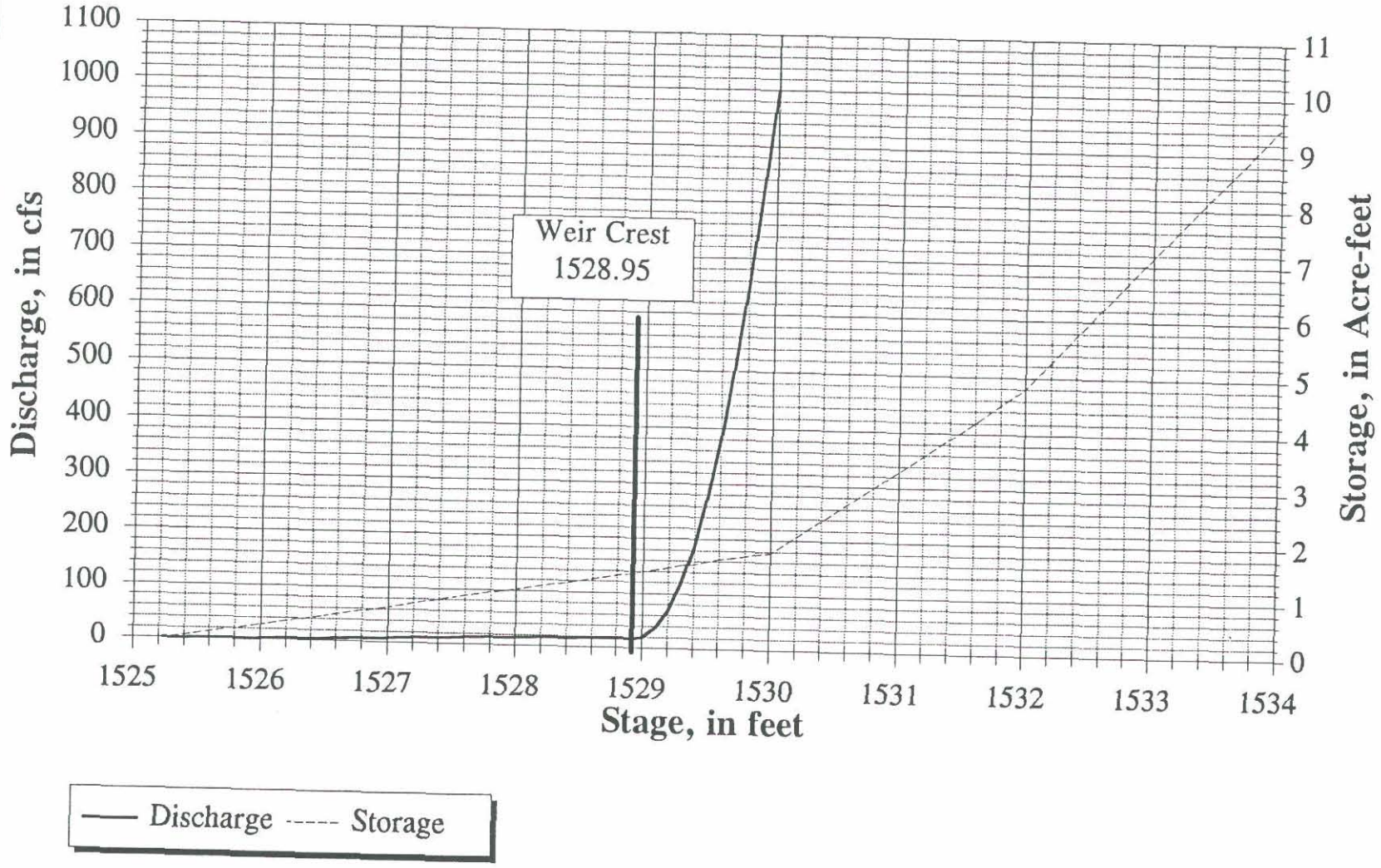


Figure R-4

Storage and Discharge vs Stage for C508

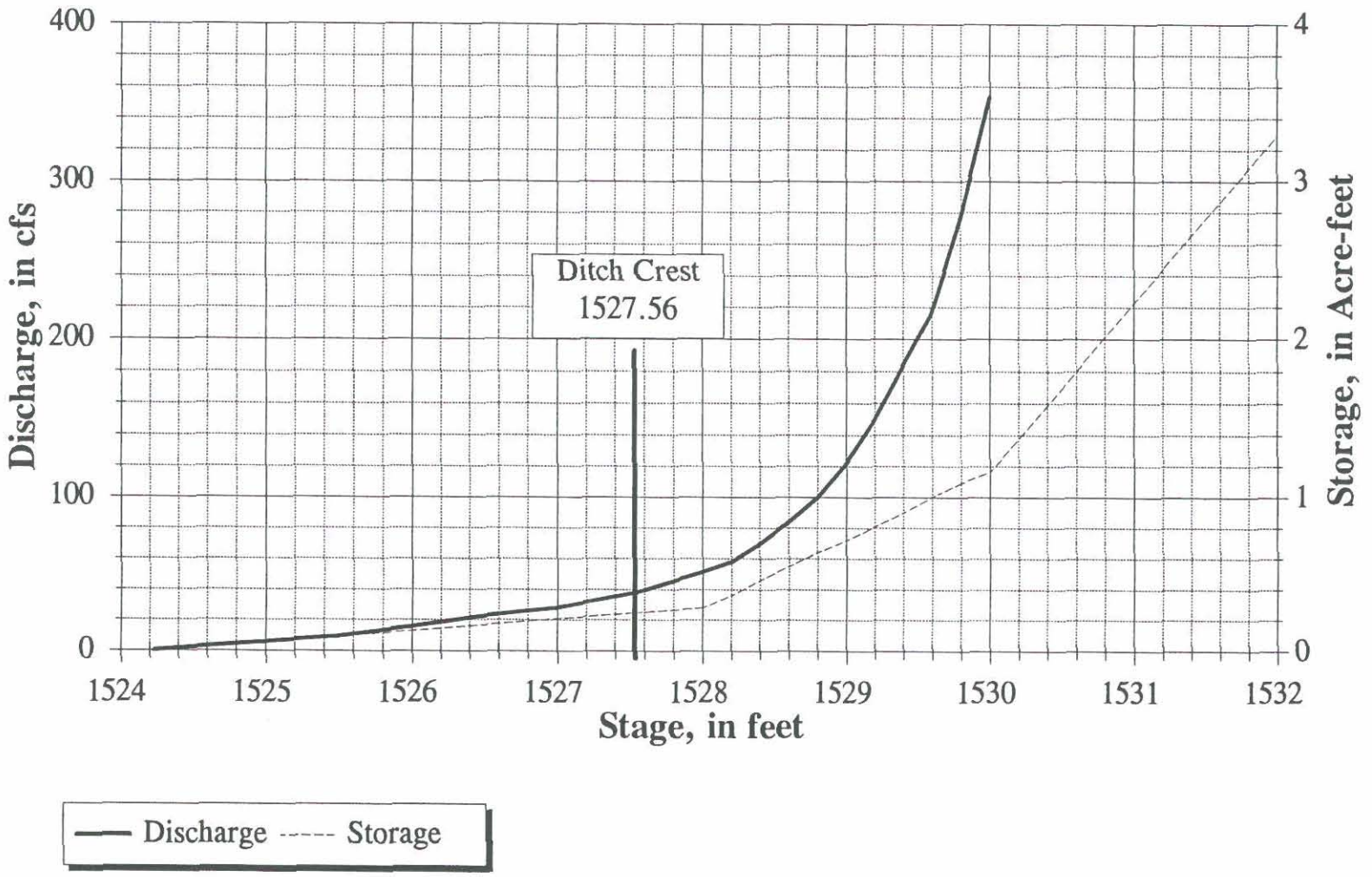


Figure R-5

Storage and Discharge vs Stage for C511

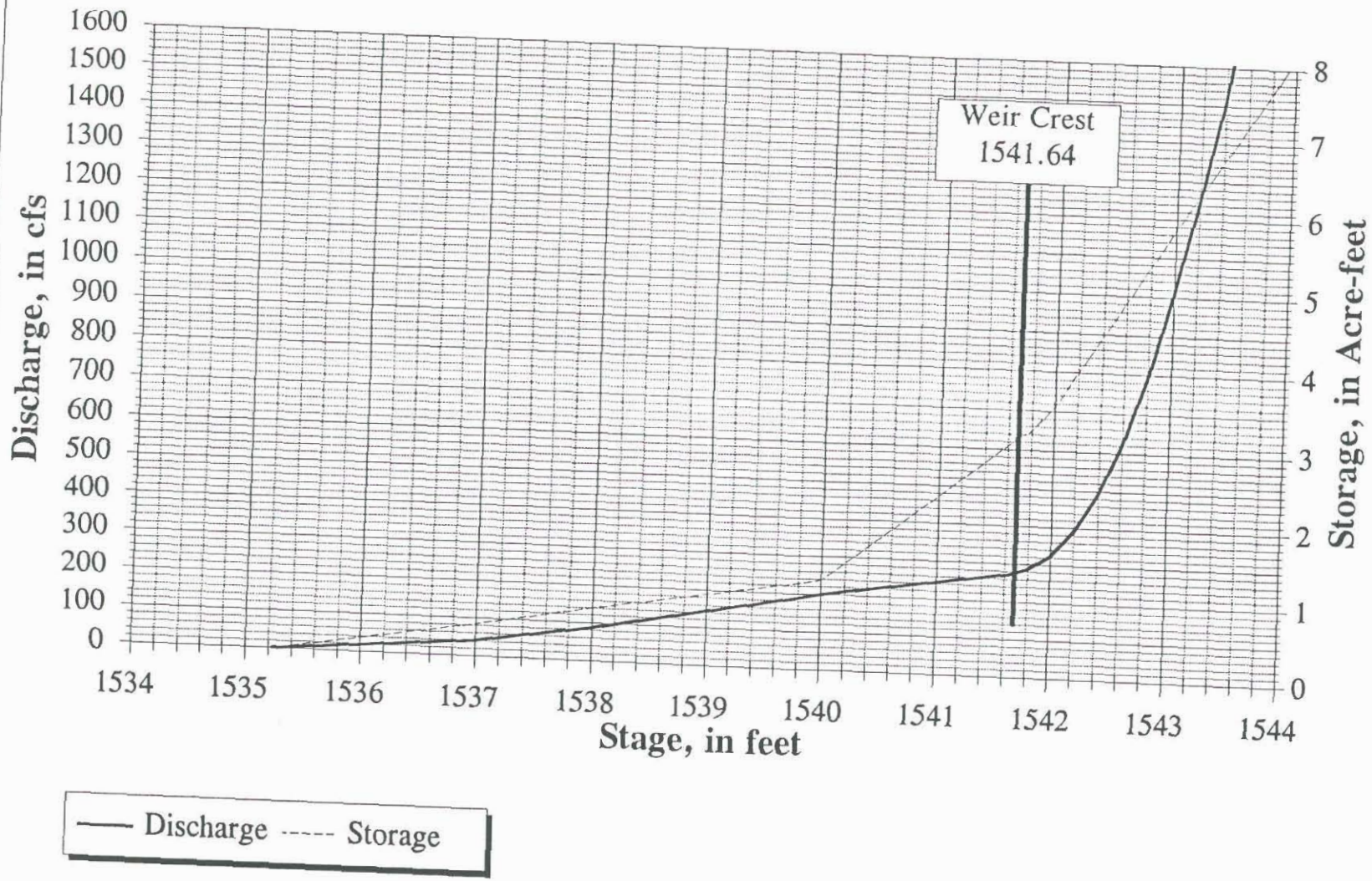


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Figure R-6

Storage & Discharge vs Stage for C512

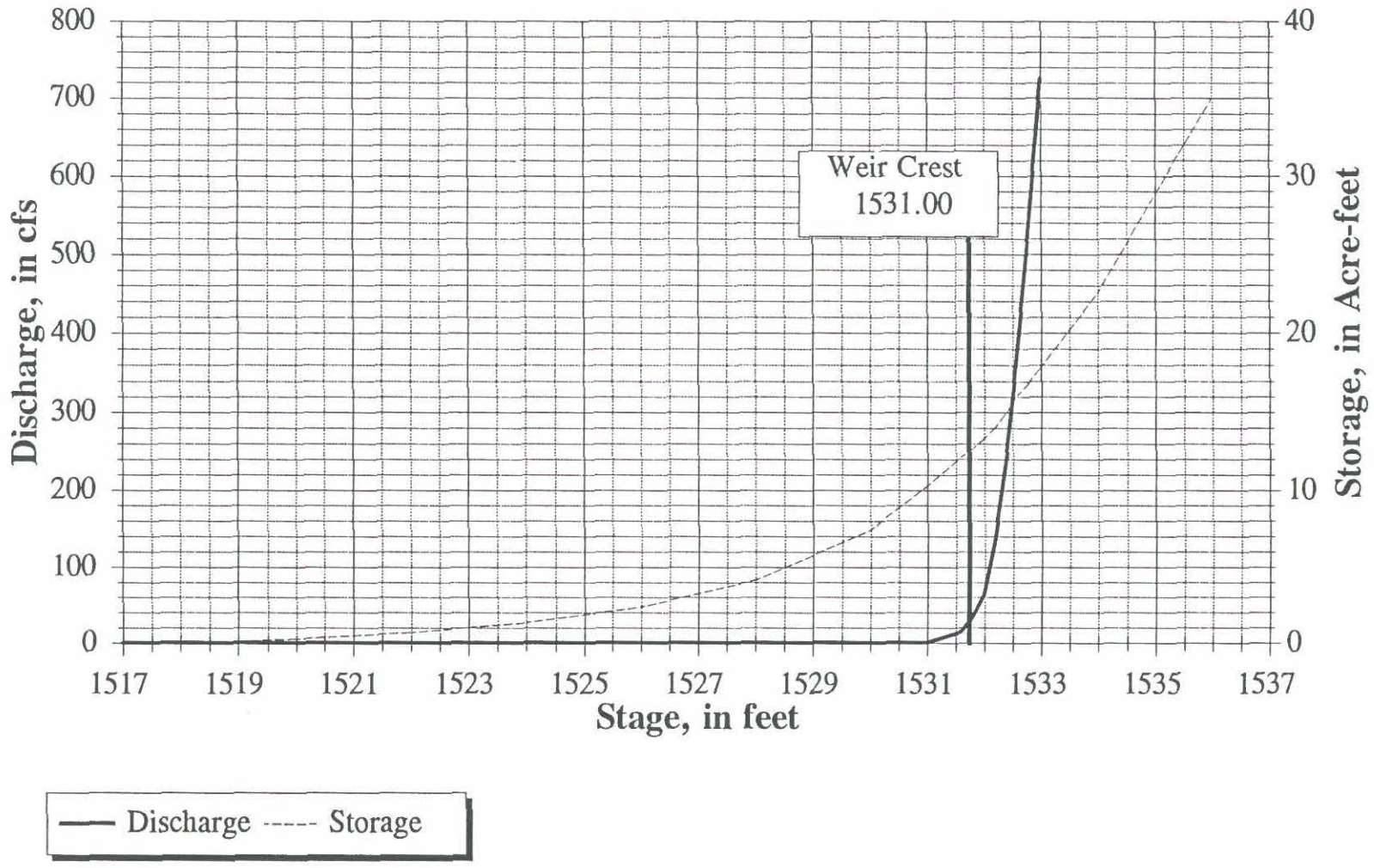

Figure R-7

Storage & Discharge vs Stage for C513

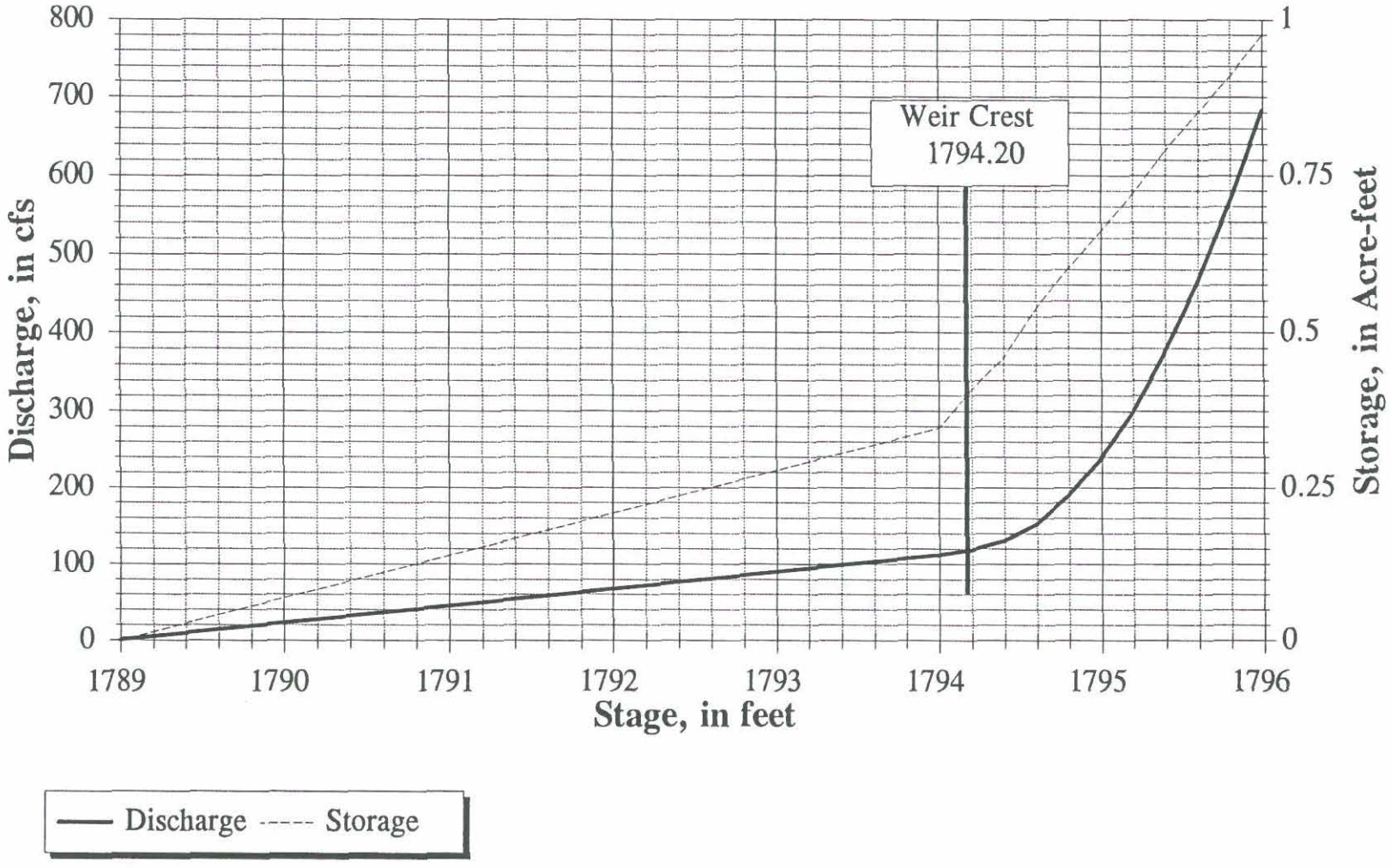

Figure R-8

Storage and Discharge vs Stage for C523

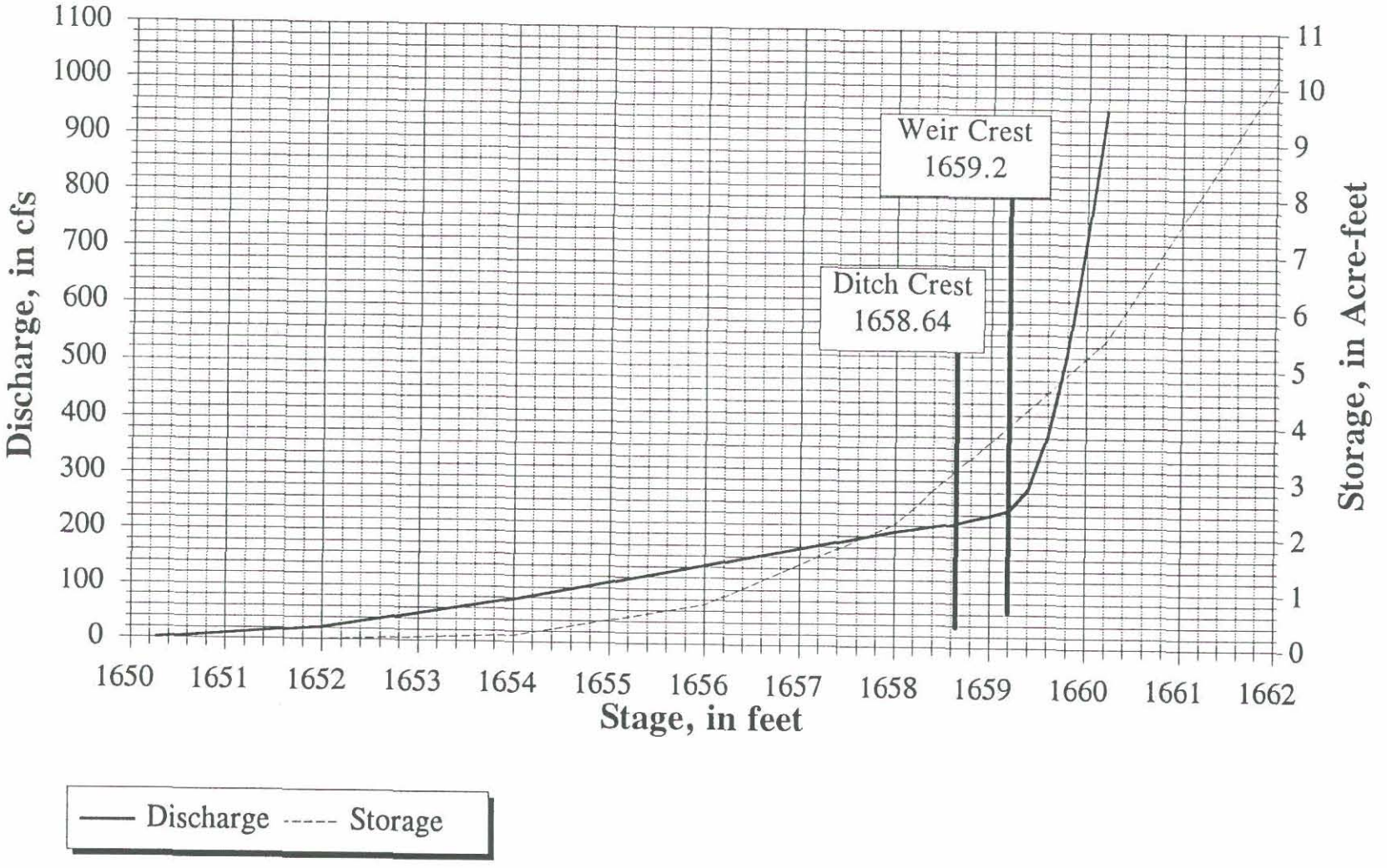

Figure R-9a

Storage and Discharge vs Stage for C536 (Dam 36) Below Emergency Spillway Crest

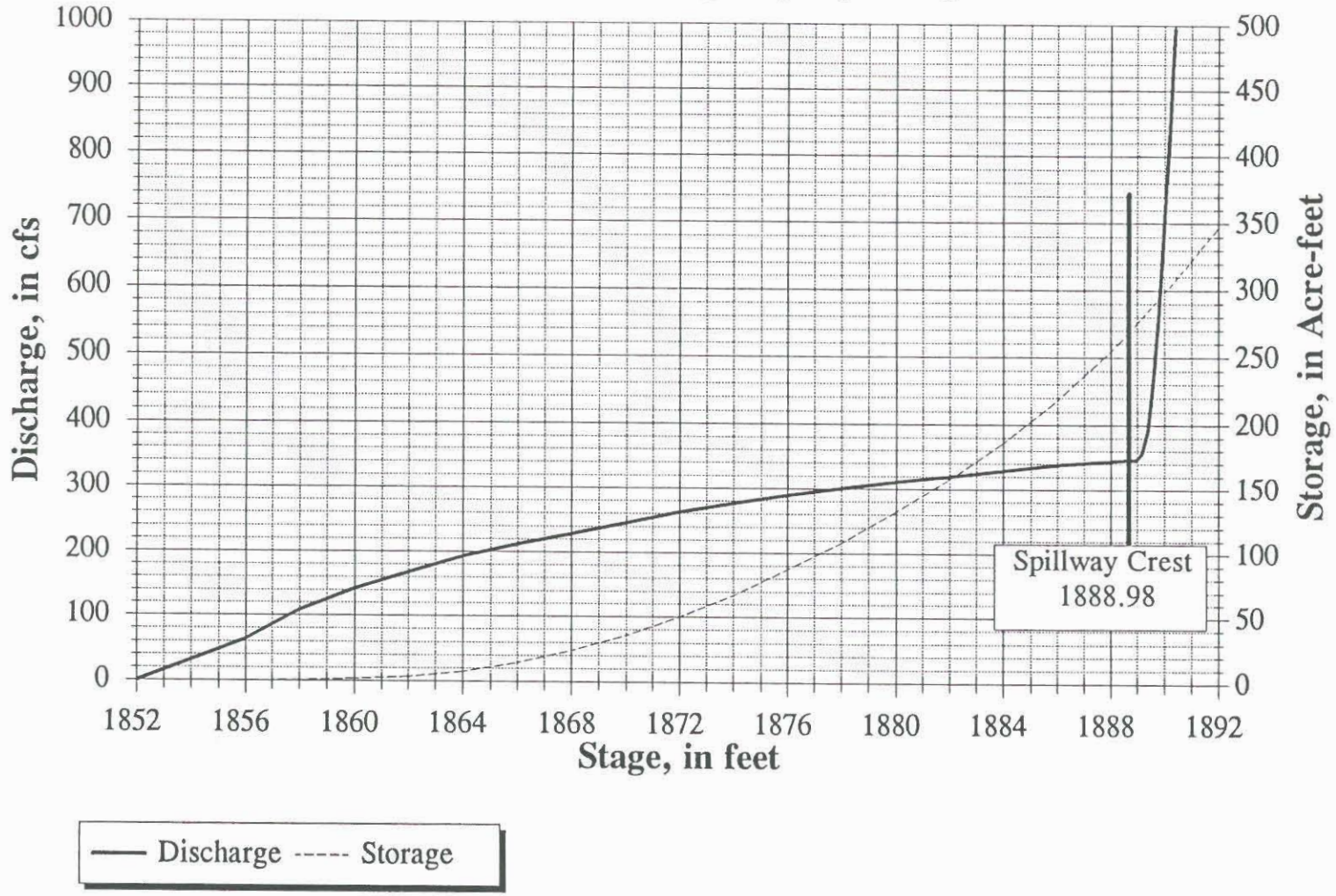

Figure R-9b

Storage and Discharge vs Stage for C536 (Dam 36) Above Emergency Spillway Crest

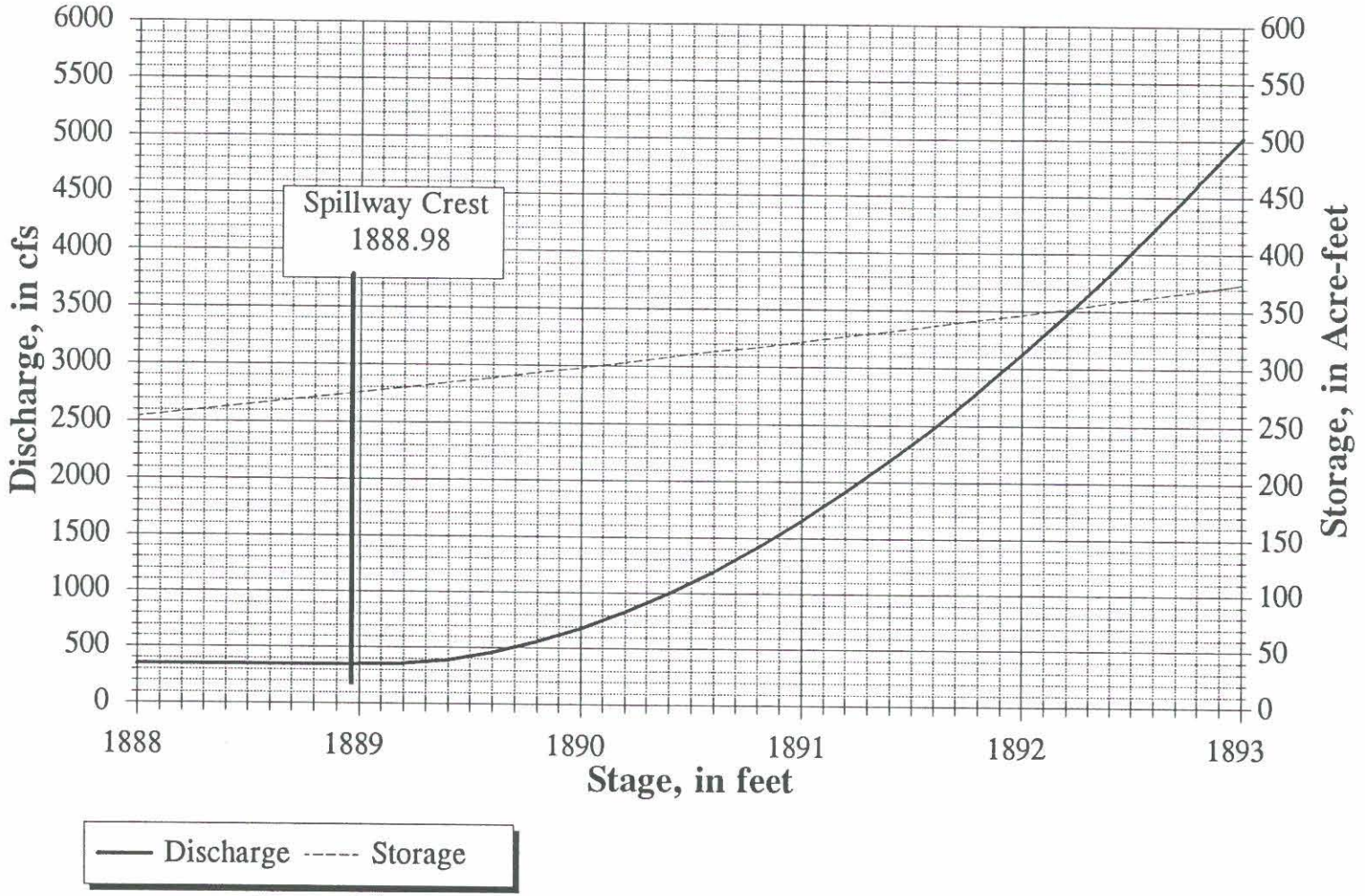

Figure R-10

Storage and Discharge vs Stage for C538

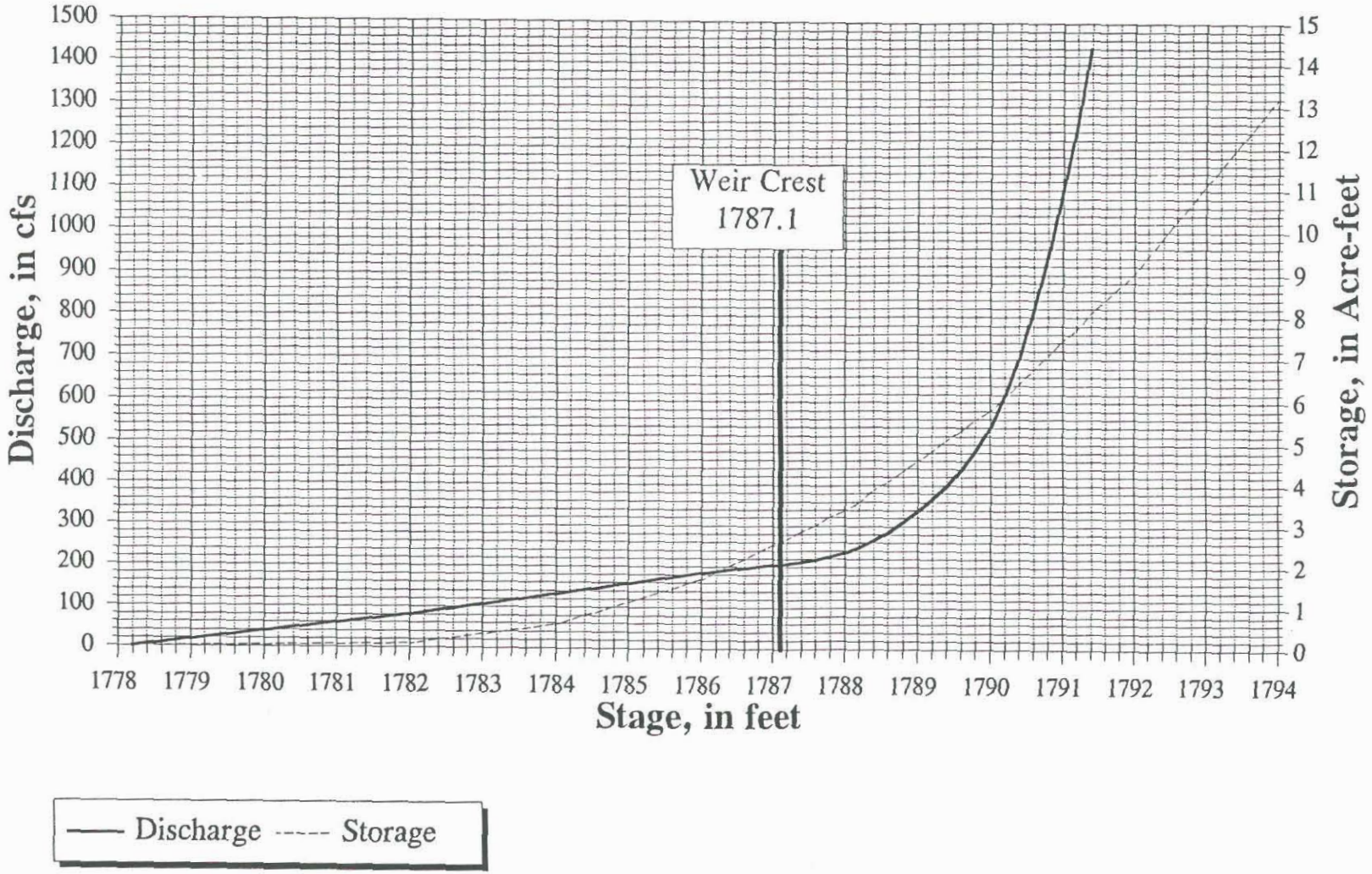

Figure R-11a

Storage and Discharge vs Stage for C560 (Dam 6) Below Emergency Spillway Crest

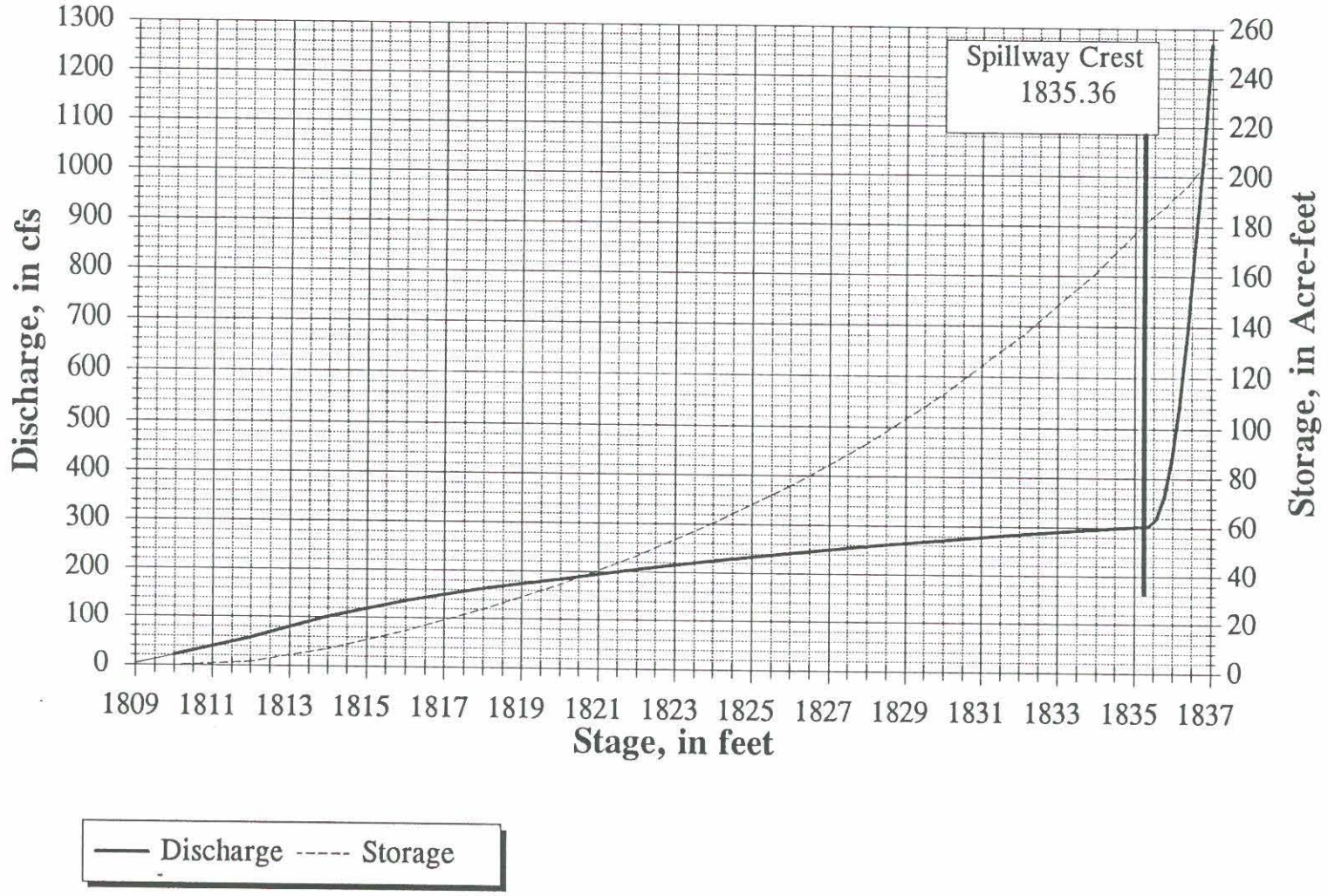

Figure R-11b

Storage and Discharge vs Stage for C560 (Dam 6) Above Emergency Spillway Crest

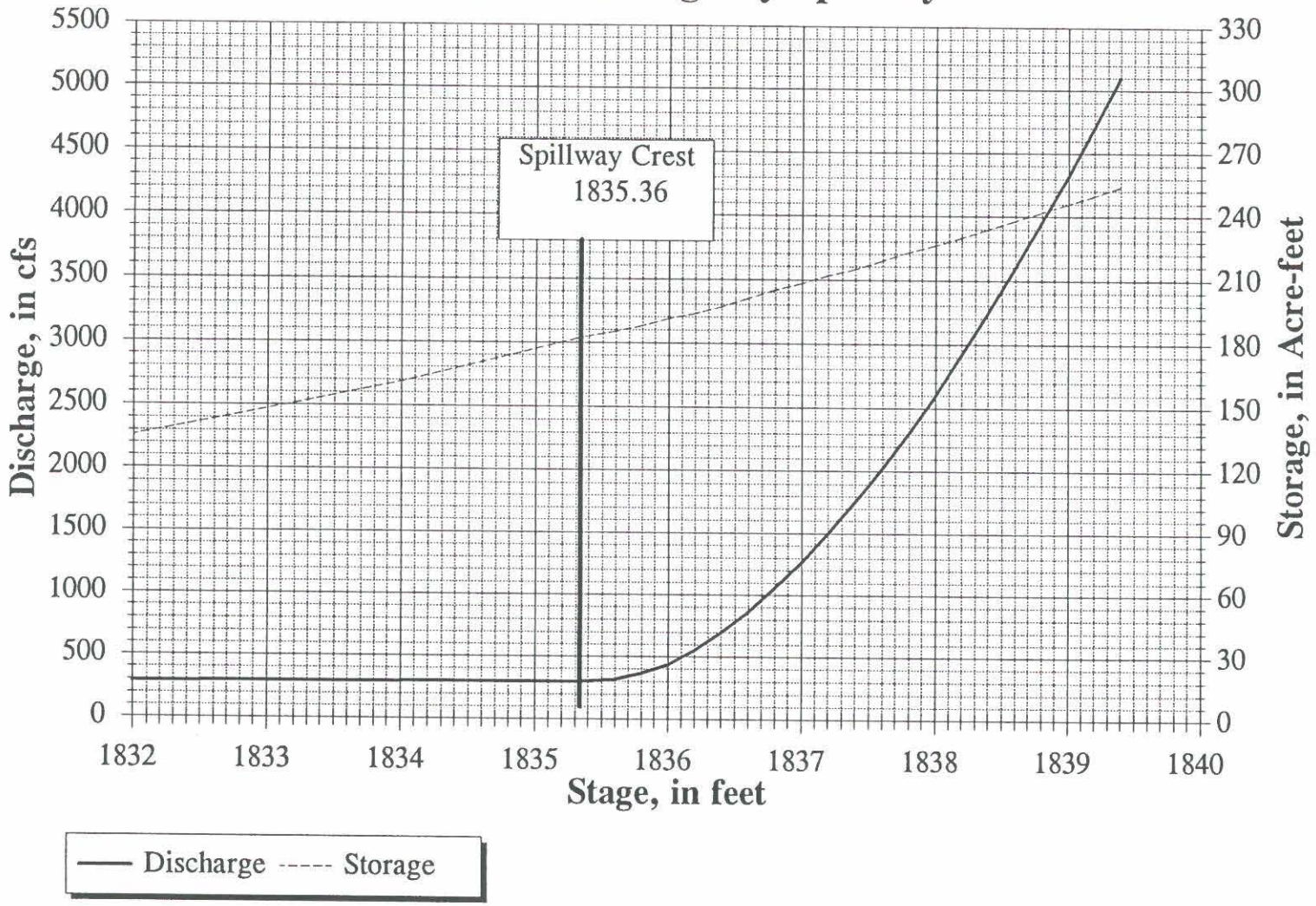

Figure R-12a

Storage and Discharge vs Stage for C578 (Dam 11) Below Emergency Spillway Crest

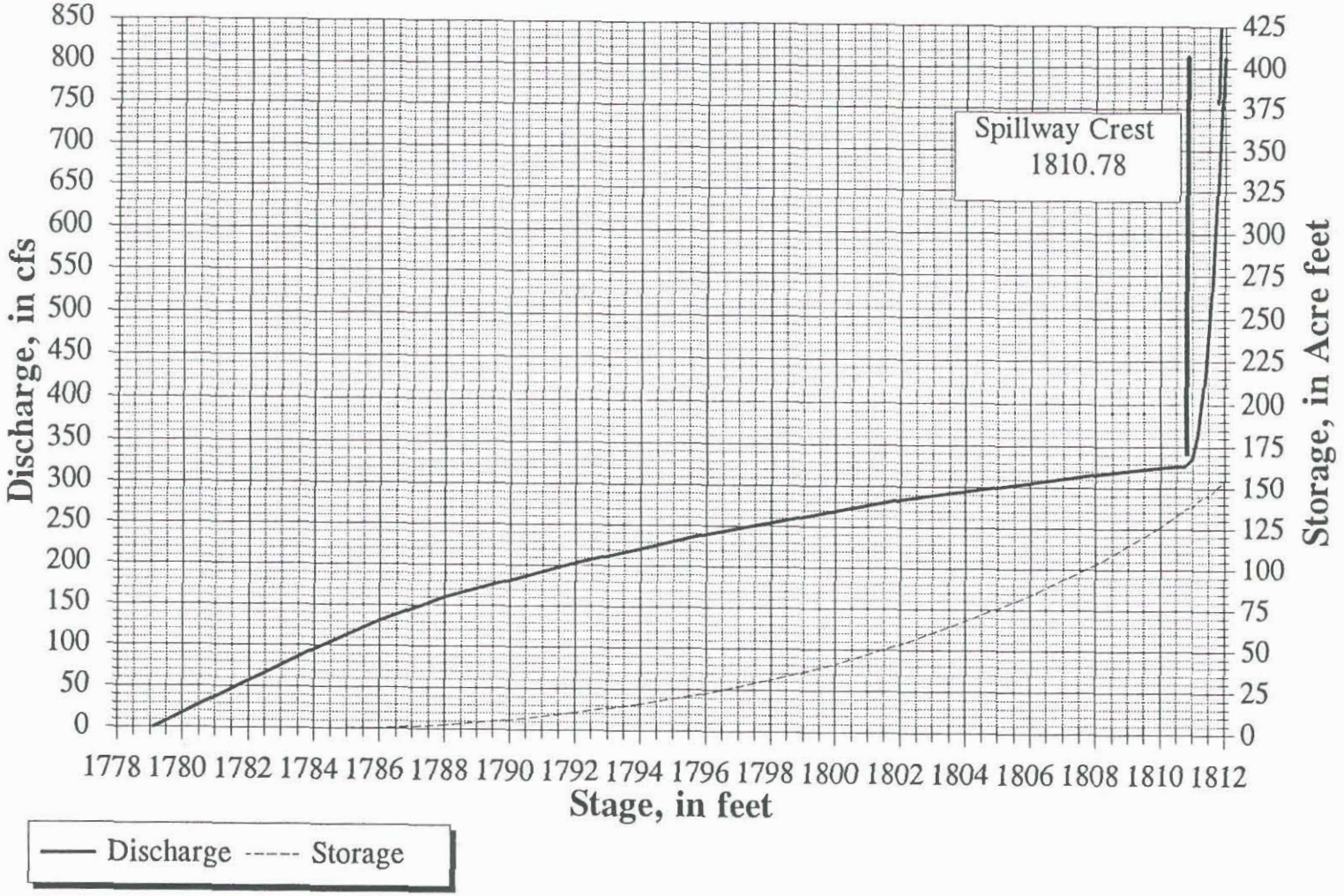

Figure R-12b

Storage and Discharge vs Stage for C578 (Dam 11) Above Emergency Spillway Crest

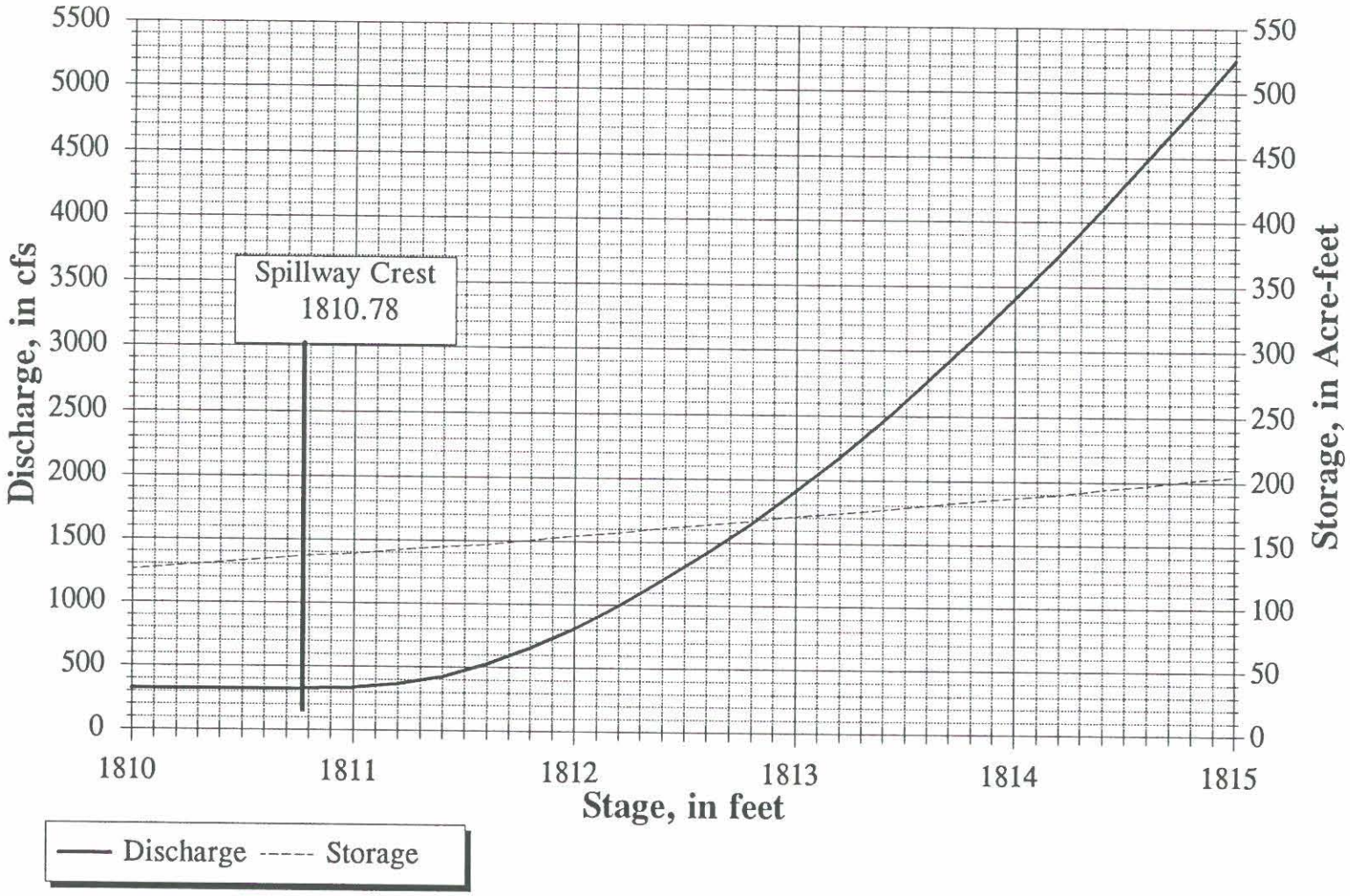

Figure R-13a

Storage and Discharge vs Stage for C584 (Dam 7) Below Emergency Spillway Crest

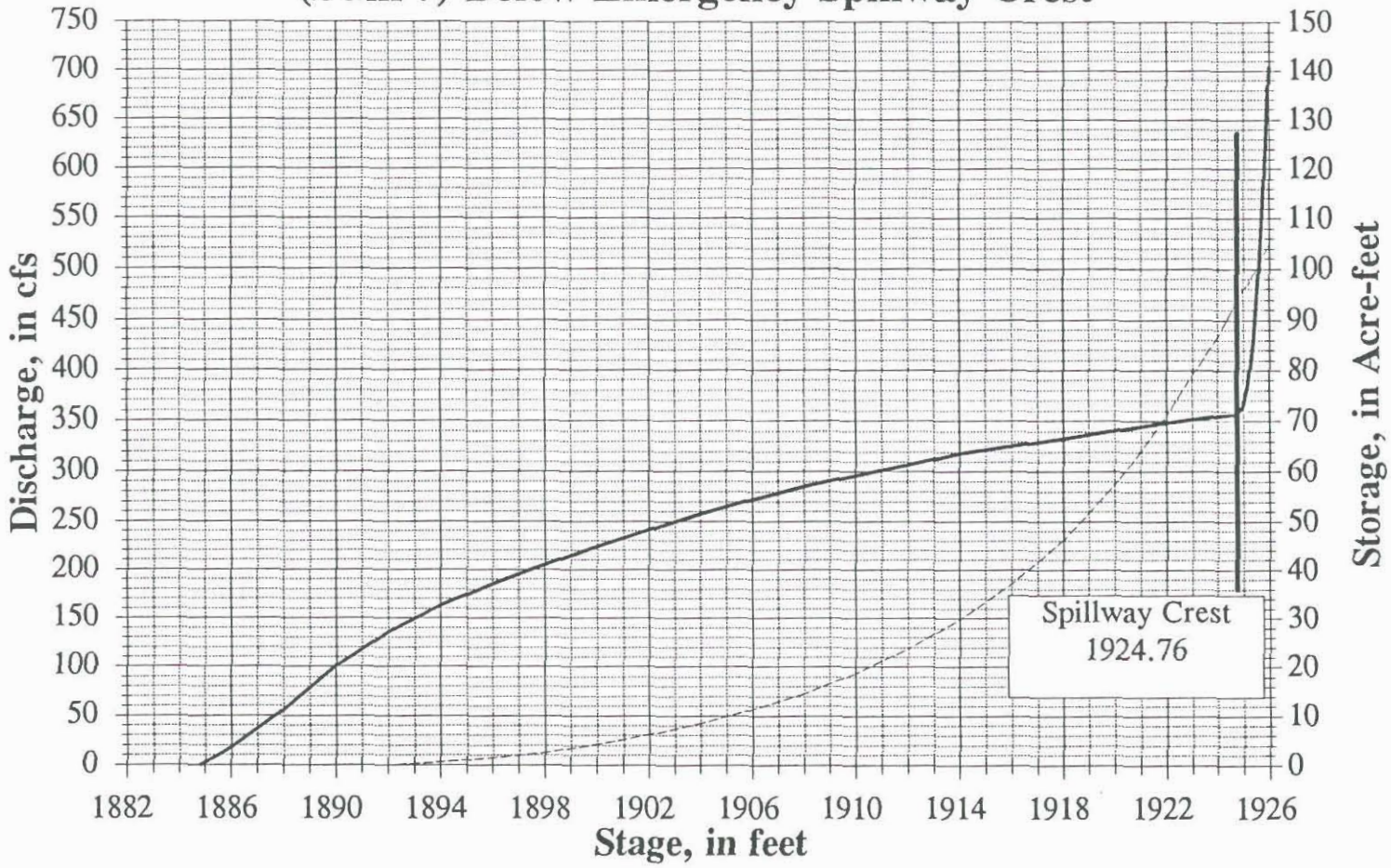

Figure R-13b

Storage and Discharge vs Stage for C584 (Dam 7) Above Emergency Spillway Crest

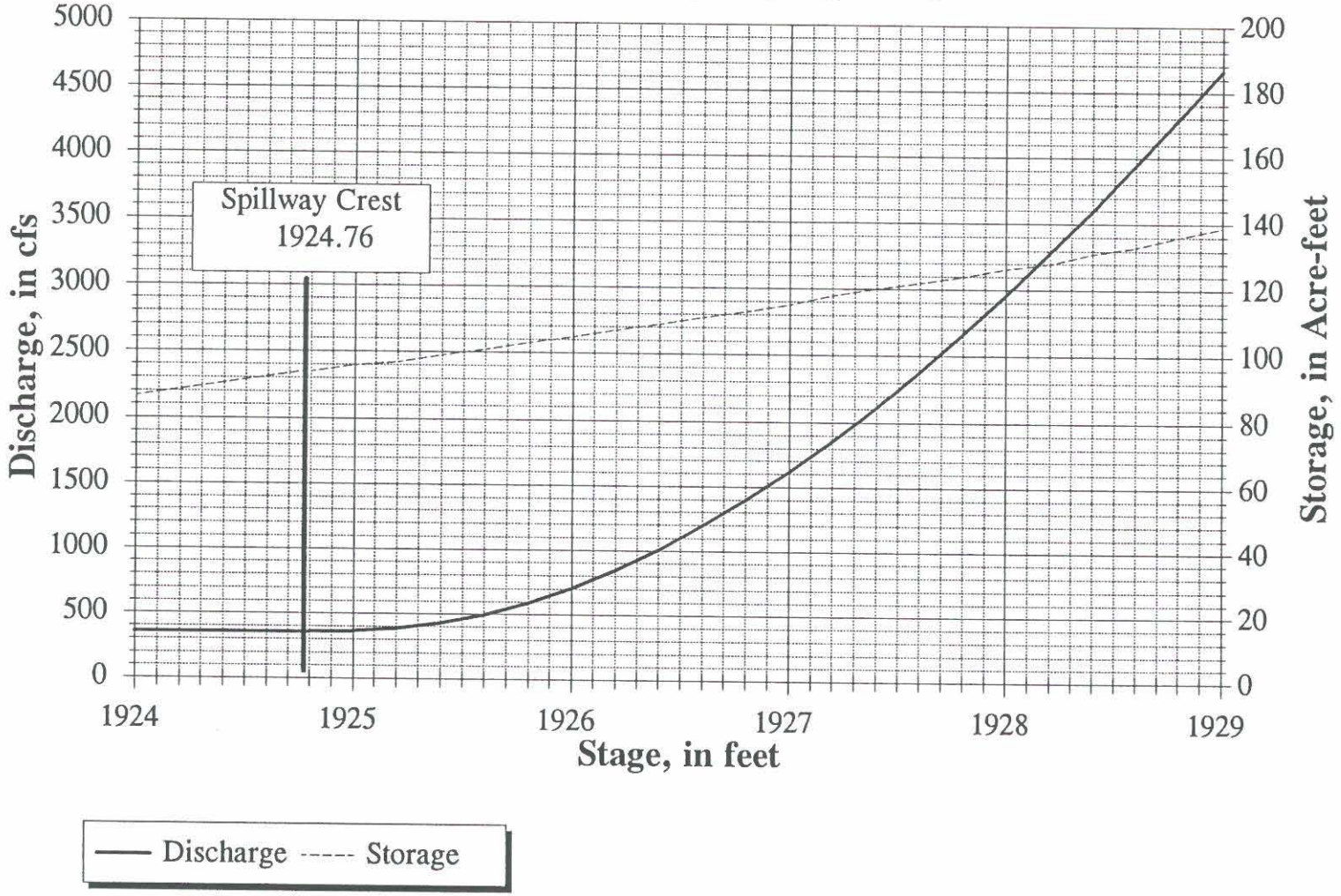

Figure R-14

Storage and Discharge vs Stage for C586

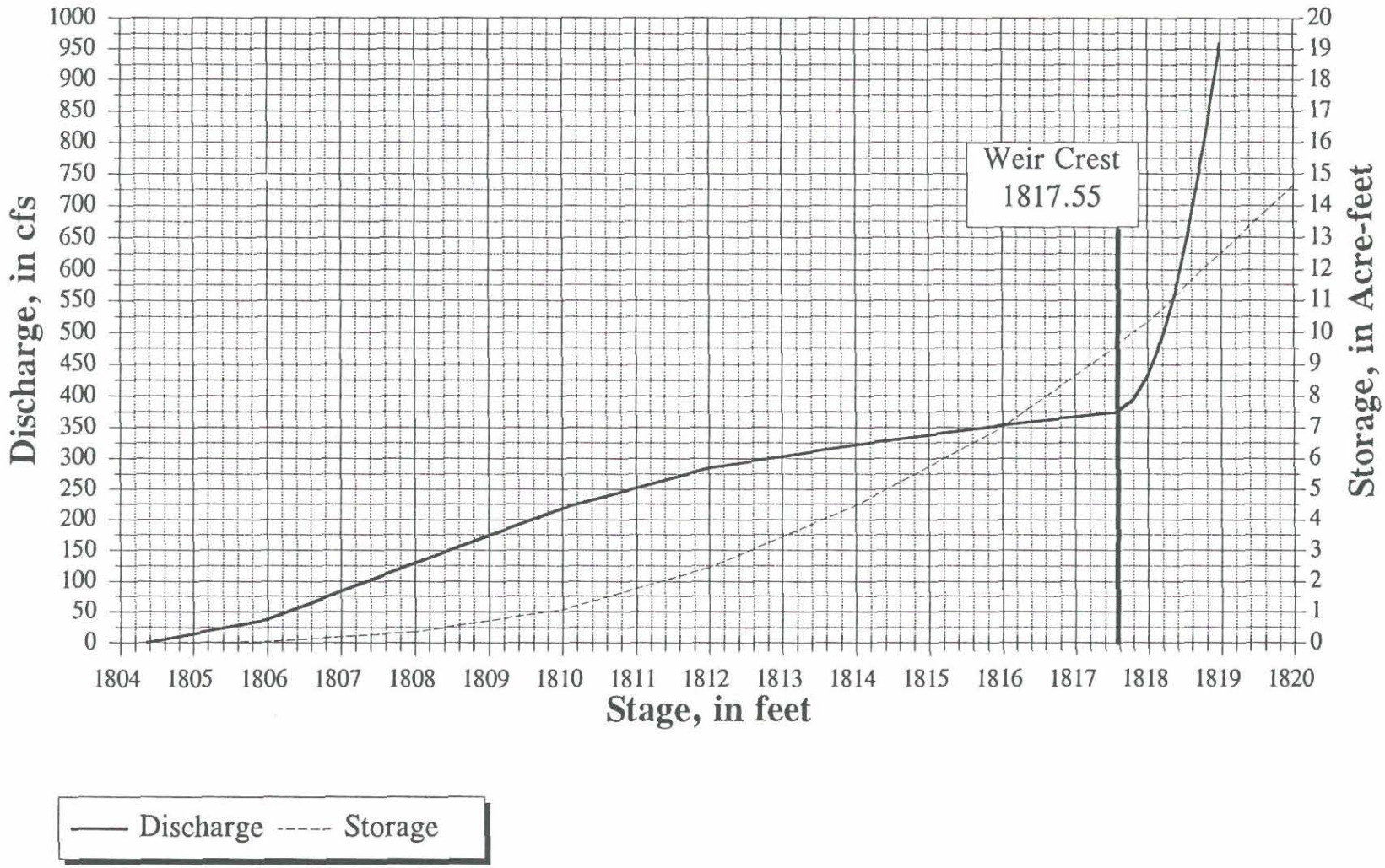

Figure R-15a

Storage and Discharge vs Stage for C599 (Dam 4) Below Emergency Spillway Crest

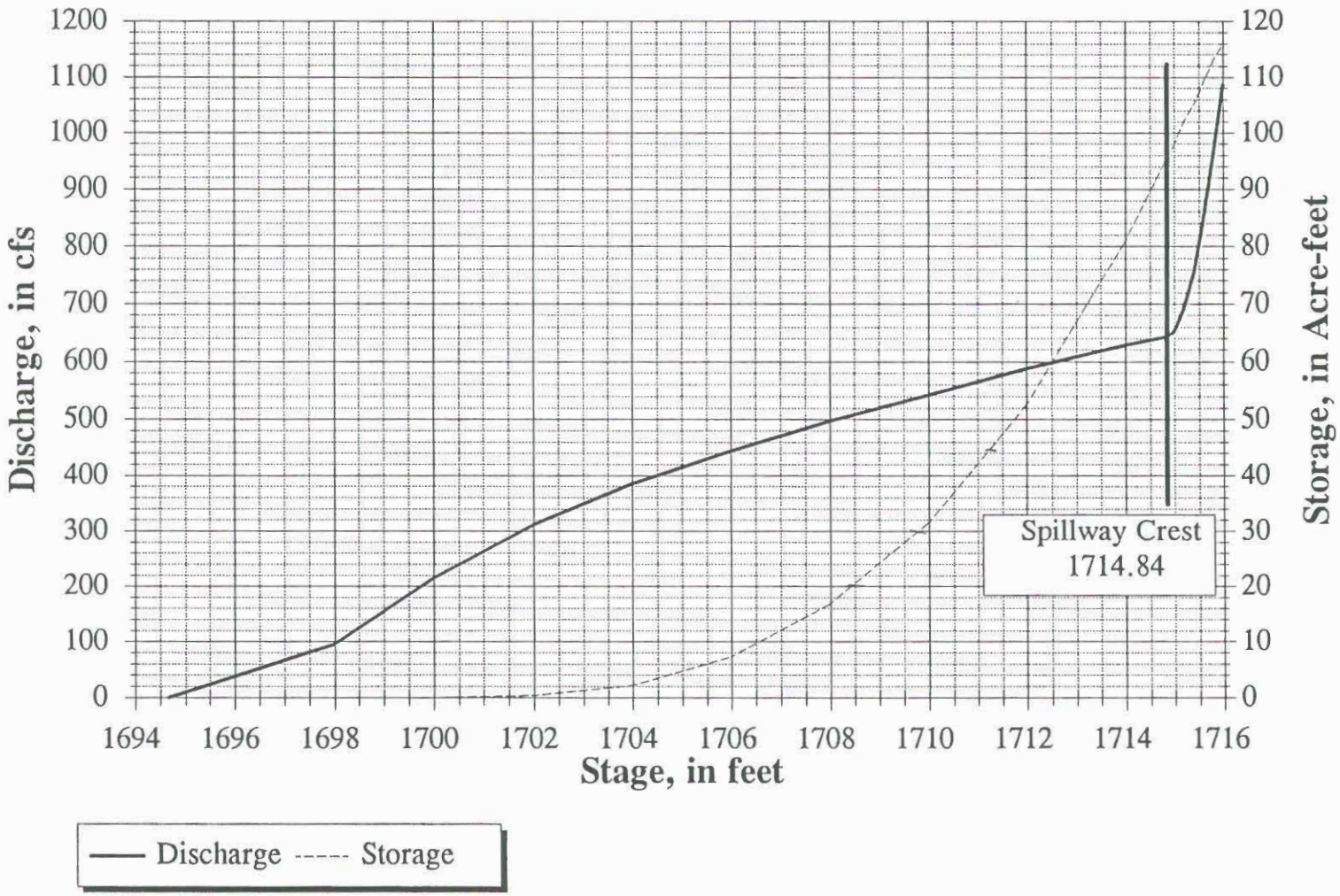

Figure R-15b

Storage and Discharge vs Stage for C599 (Dam 4) Above Emergency Spillway Crest

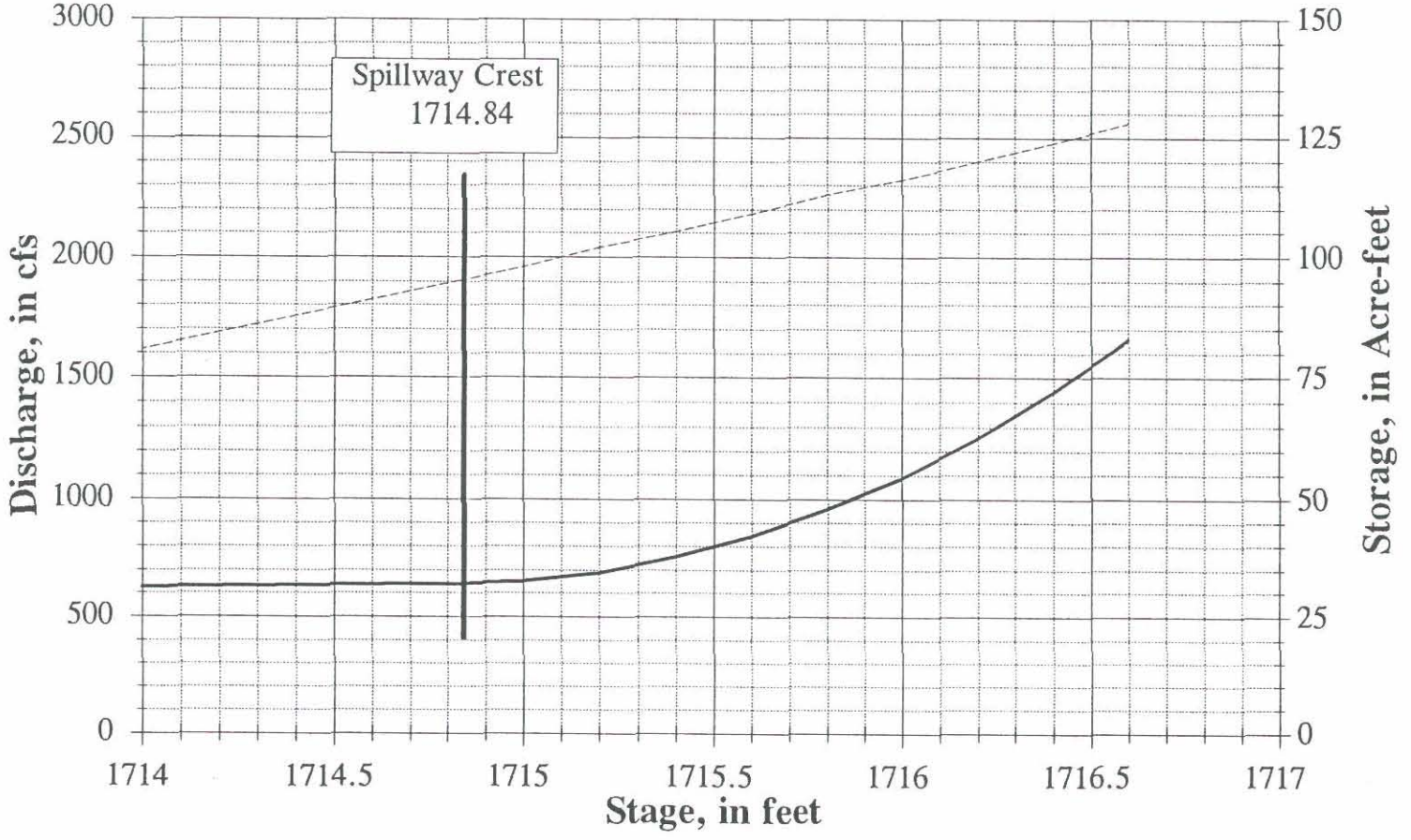

Figure R-16

Storage and Discharge vs Stage for C600

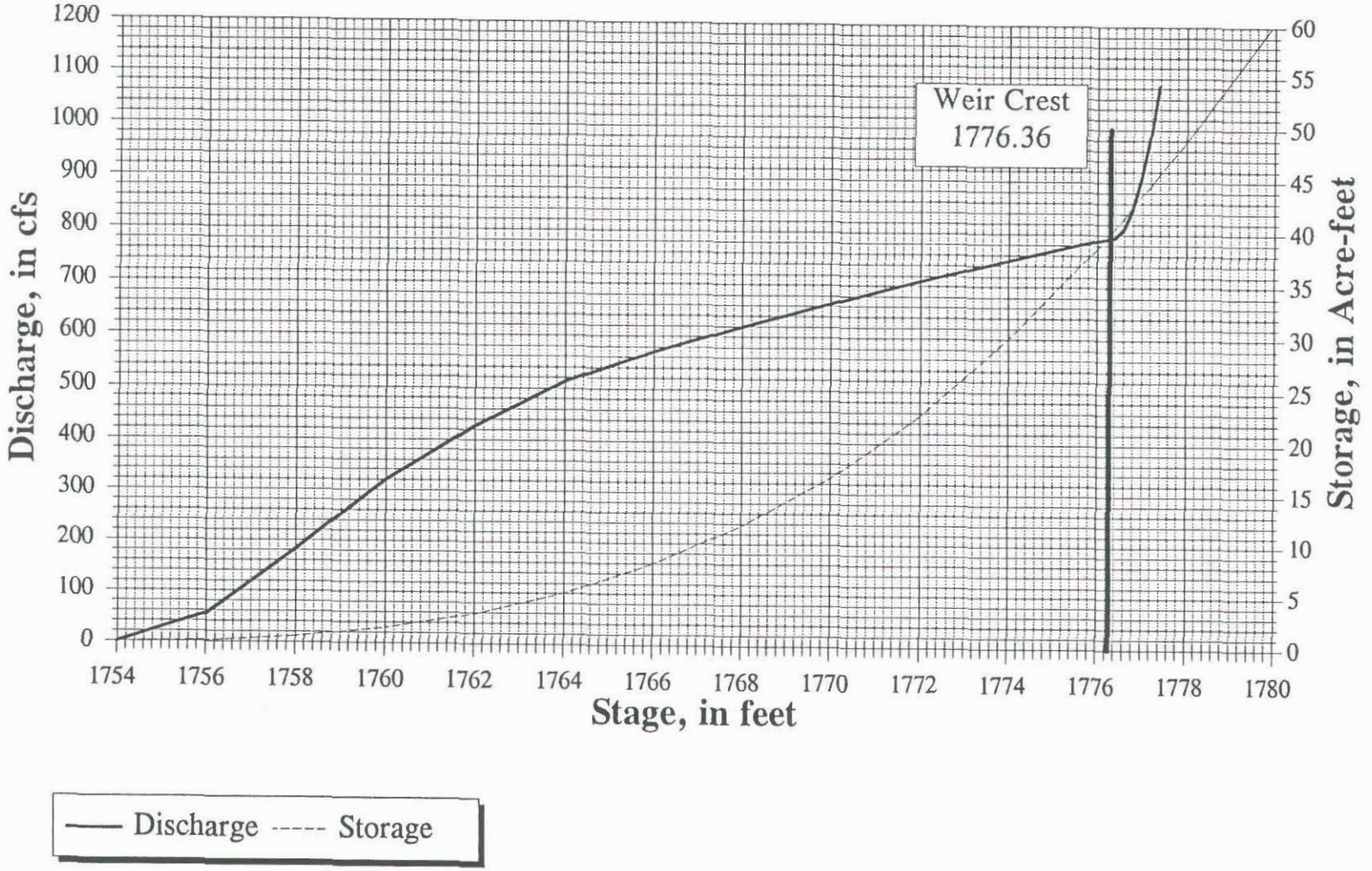

Figure R-17

Storage and Discharge vs Stage for C605

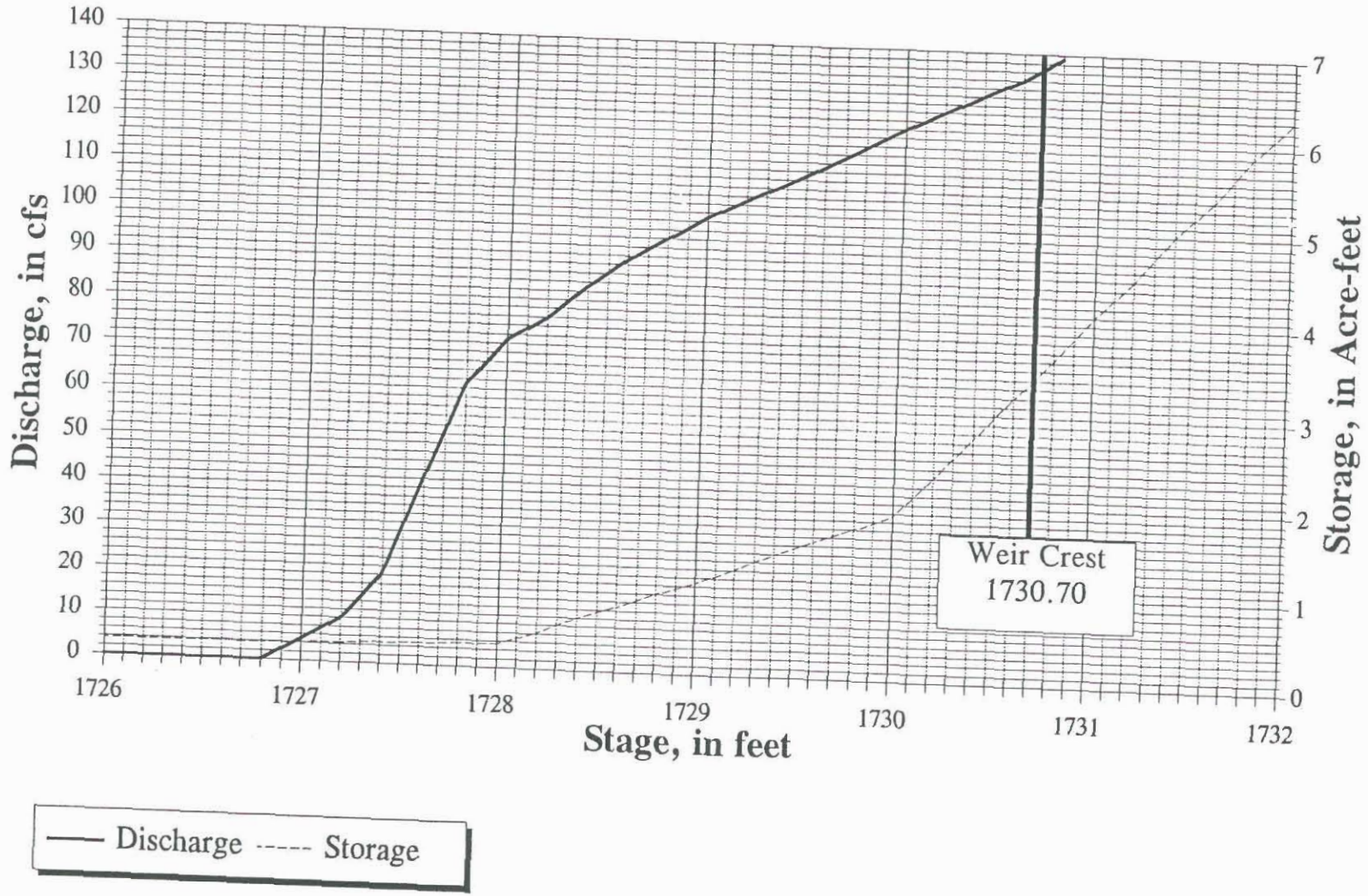

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Figure R-18

Storage and Discharge vs Stage for C609

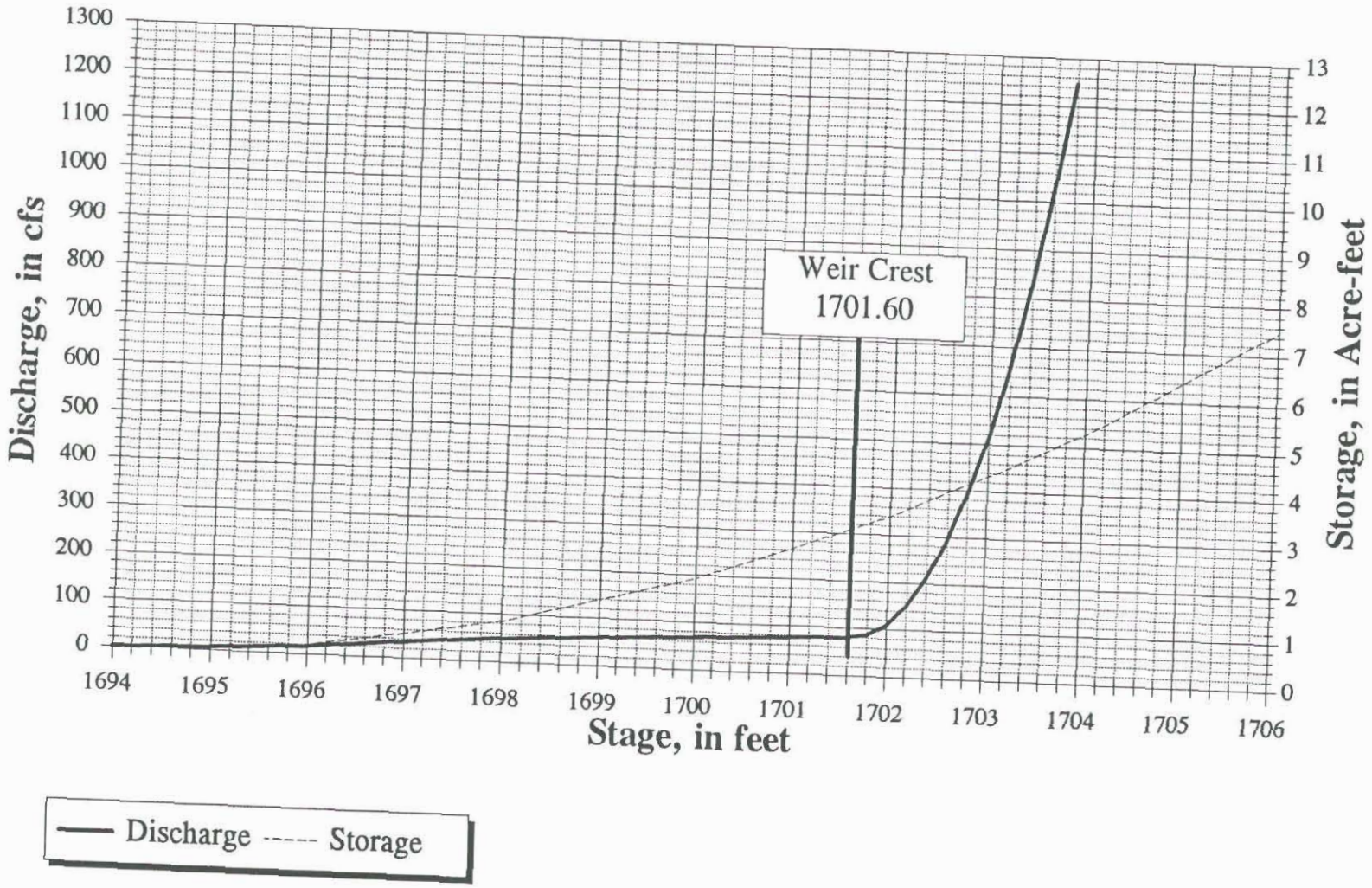

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Figure R-19

Storage and Discharge vs Stage for C611

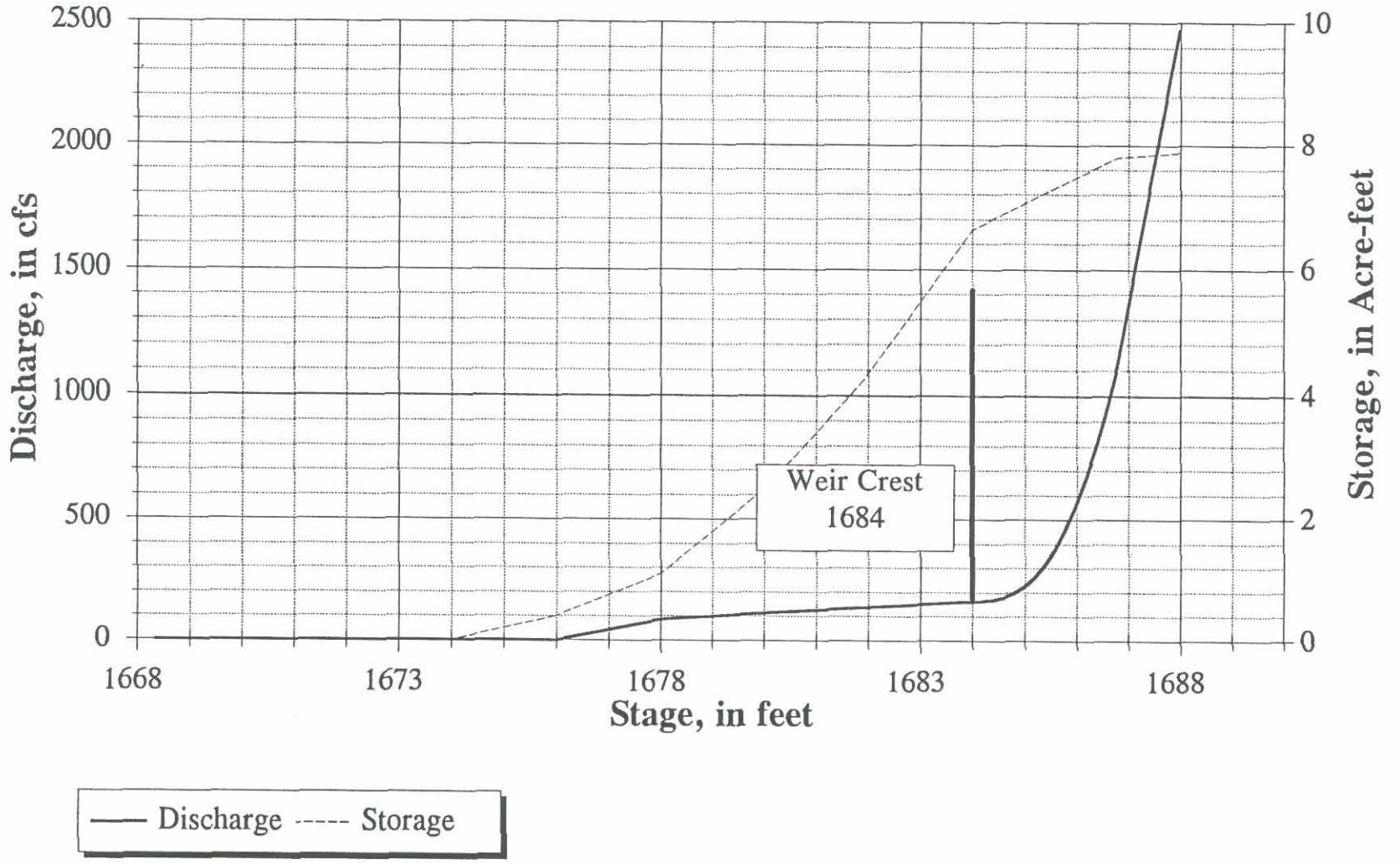


Figure R-20

Storage and Discharge vs Stage for C618

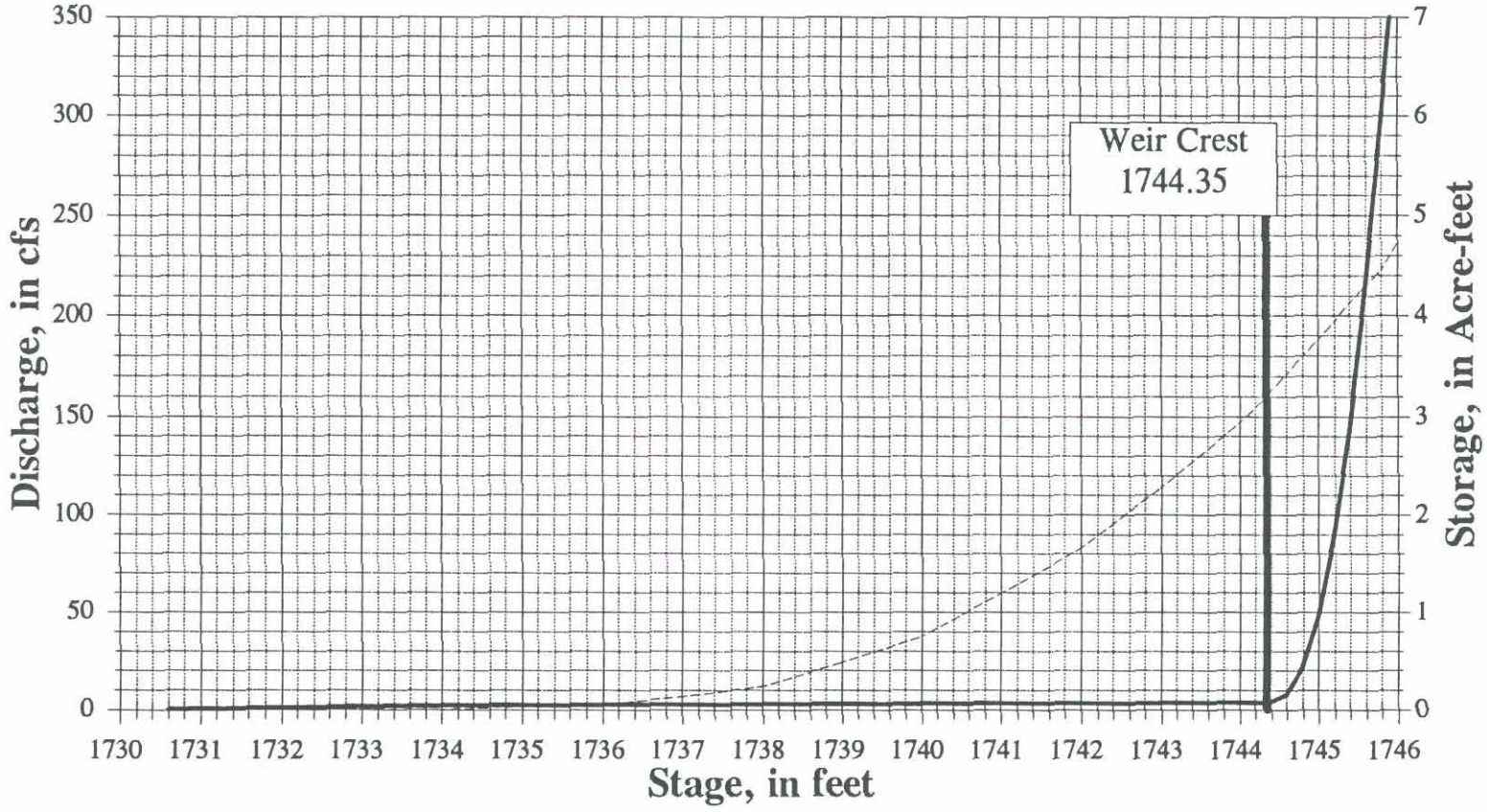
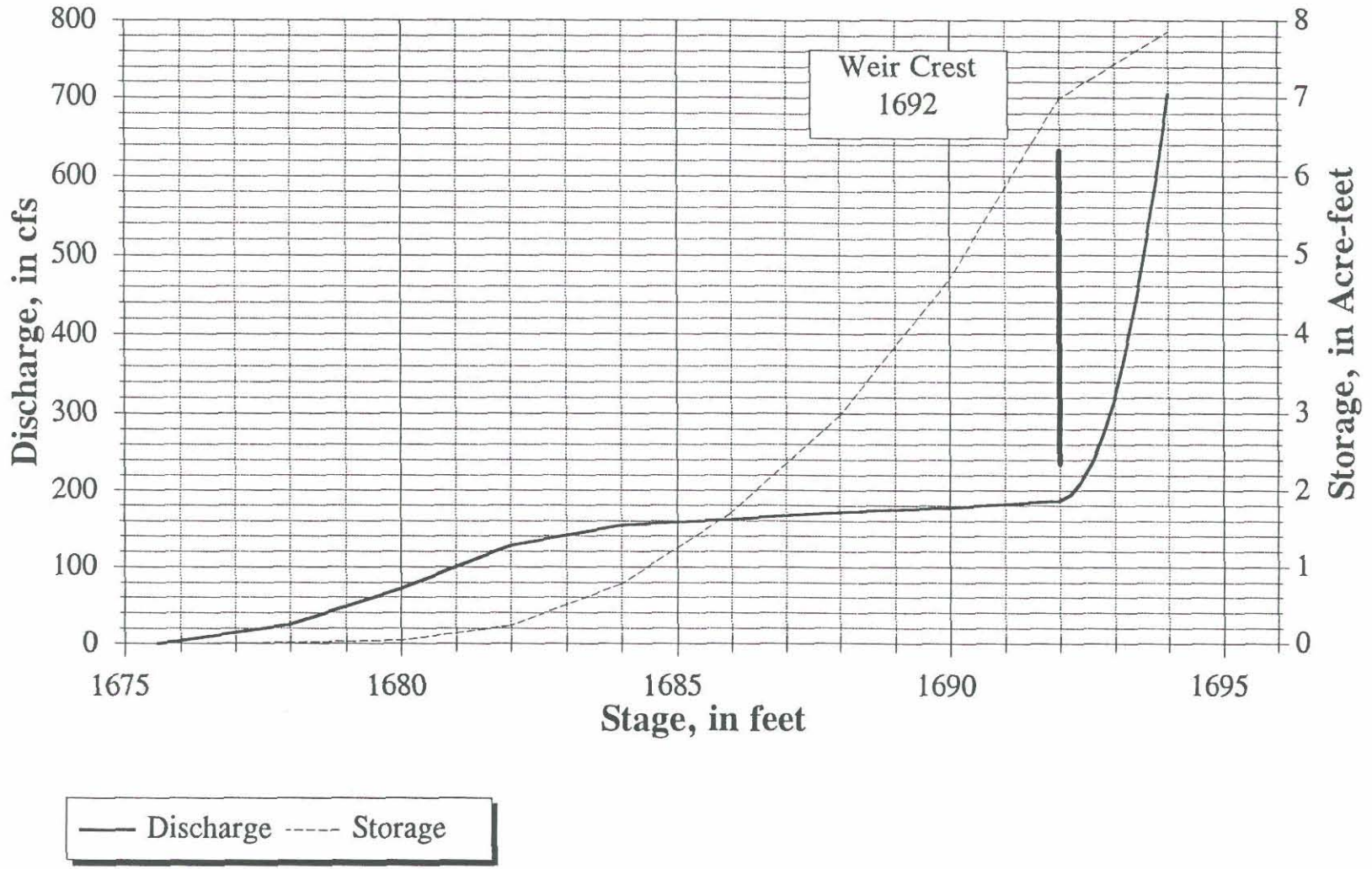


Figure R-21

Storage and Discharge vs Stage for C619



3.2.3 Statistical Parameters

There are no statistical data available for this watershed other than regional precipitation data and minimal gage data for a few watersheds that may be hydrologically comparable. The precipitation depth-duration-frequency statistics used for this study are derived from the NOAA Atlas 2 for Arizona [6.5:24]. Deficiencies of that Atlas are recognized, and a revised precipitation-frequency analysis is currently underway by the National Oceanographic and Atmospheric Administration. The results of the revised Atlas may differ from the precipitation statistics that are used herein; however, until the revised Atlas or an equally accepted presentation of precipitation statistics is available, the current Atlas precipitation-frequency statistics are recommended for use.

3.2.4 Precipitation

3.2.4.1 Rainfall Distributions

The storms specified for analysis in this study are the 100-year, 6-hour and 24-hour duration storms. The rainfall distributions, based on watershed area, for the 6-hour duration storm are furnished by the District and are listed in Section 2.4.2 of the Design Manual. Each precipitation pattern is valid for a certain watershed area. The five precipitation patterns and corresponding watershed areas are input to the HEC-1 model using the JD record option. The 24-hour rainfall distribution used for this study is the SCS Type II, in accordance with the requirements set forth in the Design Manual.

3.2.4.2 Precipitation Data

Point precipitation values used for this study are derived from the isopluvial maps in the Design Manual. Refer to Figures P-1 and P-2 for a depiction of the isopluvials for the 100-year, 6-hour and 24-hour storms, respectively, overlaid on the watershed. Those figures were used to estimate an average point precipitation value for the entire watershed for both storms. The point precipitation values used for this study are listed in Table P-1.

TABLE P-1

Point Precipitation Values for Fountain Hills North

Storm Frequency and Duration (1)	Point Precipitation inches (2)
10-year, 6-hour	2.2
10-year, 24-hour	2.8
100-year, 6-hour	3.3
100-year, 24-hour	4.2

3.2.4.3 Aerial Precipitation Reduction

The precipitation reduction for the 6-hour storms is based upon the depth-area curve developed for the historic storm of 1954 over the Queen Creek, Arizona area, as developed by the U.S. Army Corps of Engineers in 1974. That depth-area curve is listed in the Design Manual.

The precipitation reduction factors used for the 24-hour storms are derived from information contained in *NOAA Technical Memorandum NWS HYDRO-40* [6.5:14]. The point precipitation values versus watershed drainage area are contained in Table P-2. Depth-area reduction for all storms was simulated in HEC-1 using the JD record option.

TABLE P-2

24-Hour Aerial Precipitation Reduction Factors
Zones A and C - Central Arizona
NOAA Technical Memorandum NWS Hydro-40

Watershed Area square miles (1)	Reduction Factor (2)	Point Precipitation, inches 10-year (3)	100-year (4)
0.01	1.000	2.80	4.20
5.00	0.980	2.74	4.12
10.00	0.949	2.66	3.99
50.00	0.883	2.47	3.71
80.00	0.861	2.41	3.62
100.00	0.850	2.38	3.57
200.00	0.819	2.29	3.44

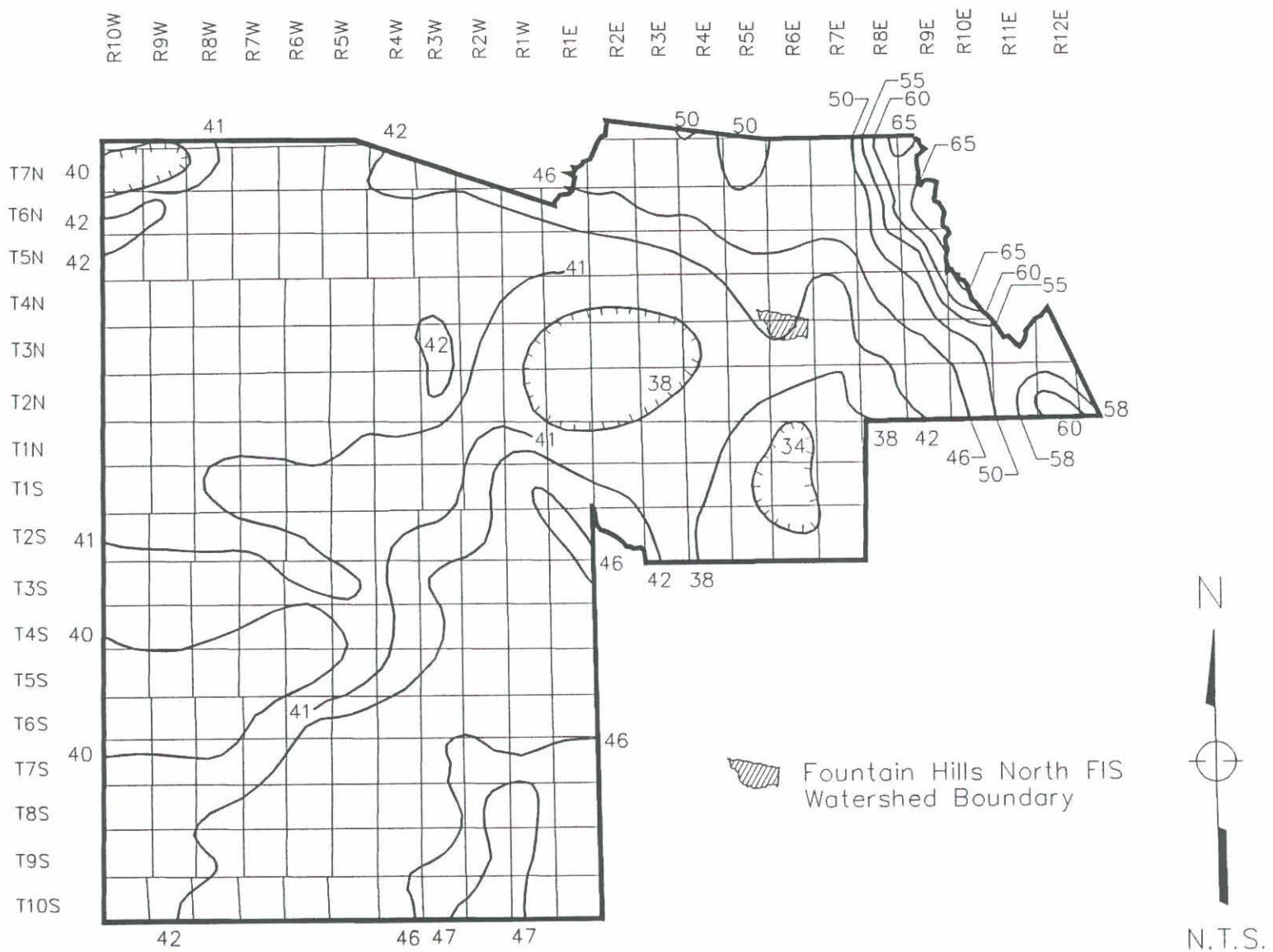


Figure P-1
100-year, 6-hour Precipitation Isopluvials

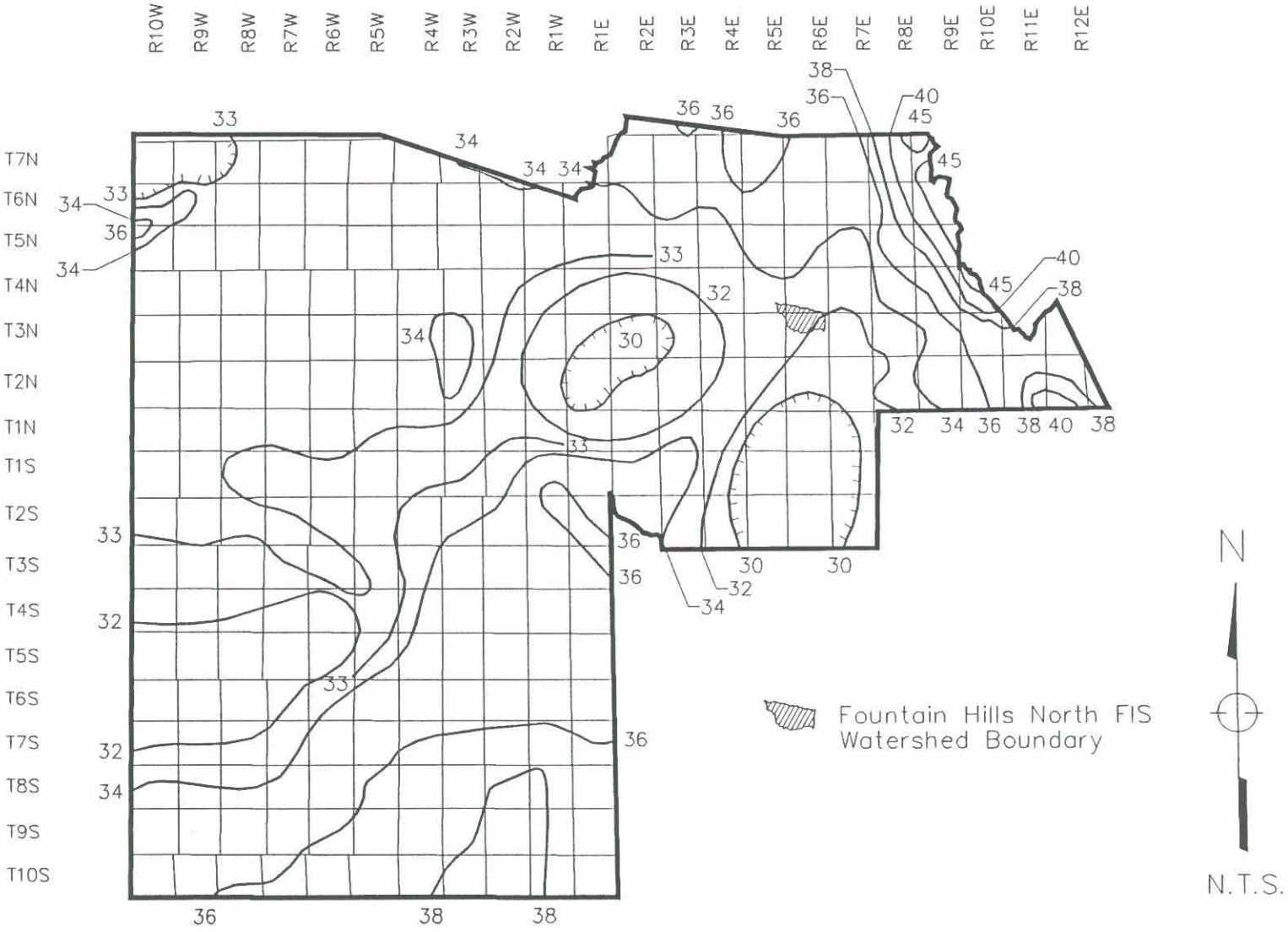


Figure P-2
100-year, 24-hour Precipitation Isopluvials

3.2.5 Gage Data

3.2.5.1 Streamflow Gaging Stations

The District, ADWR and the USGS have compiled streamflow gage data for various washes in Maricopa County and the State of Arizona. The data is summarized in a state-wide report entitled *Basin Characteristics and Streamflow Statistics in Arizona as of 1989* [6.5:27]. In addition to USGS gage data, the District also maintains a series of streamflow gages in Maricopa County. Unfortunately, none of these gages lie in or near the Fountain Hills North study area. The results from that study for representative washes in central and southern Arizona are summarized in Table G-1 and shown graphically in Figure G-1.

Modeling results for typical subbasins and key concentration points upstream of the flood control structures are summarized in Table G-2. Those modeling results are also plotted on Figure G-1 for comparison with the USGS data. Refer to Section 3.3 for a discussion of the comparison between the USGS data and the modeling results.

Table G-1

Log Pearson III Analysis Summary for Representative Washes in Central and Southern Arizona

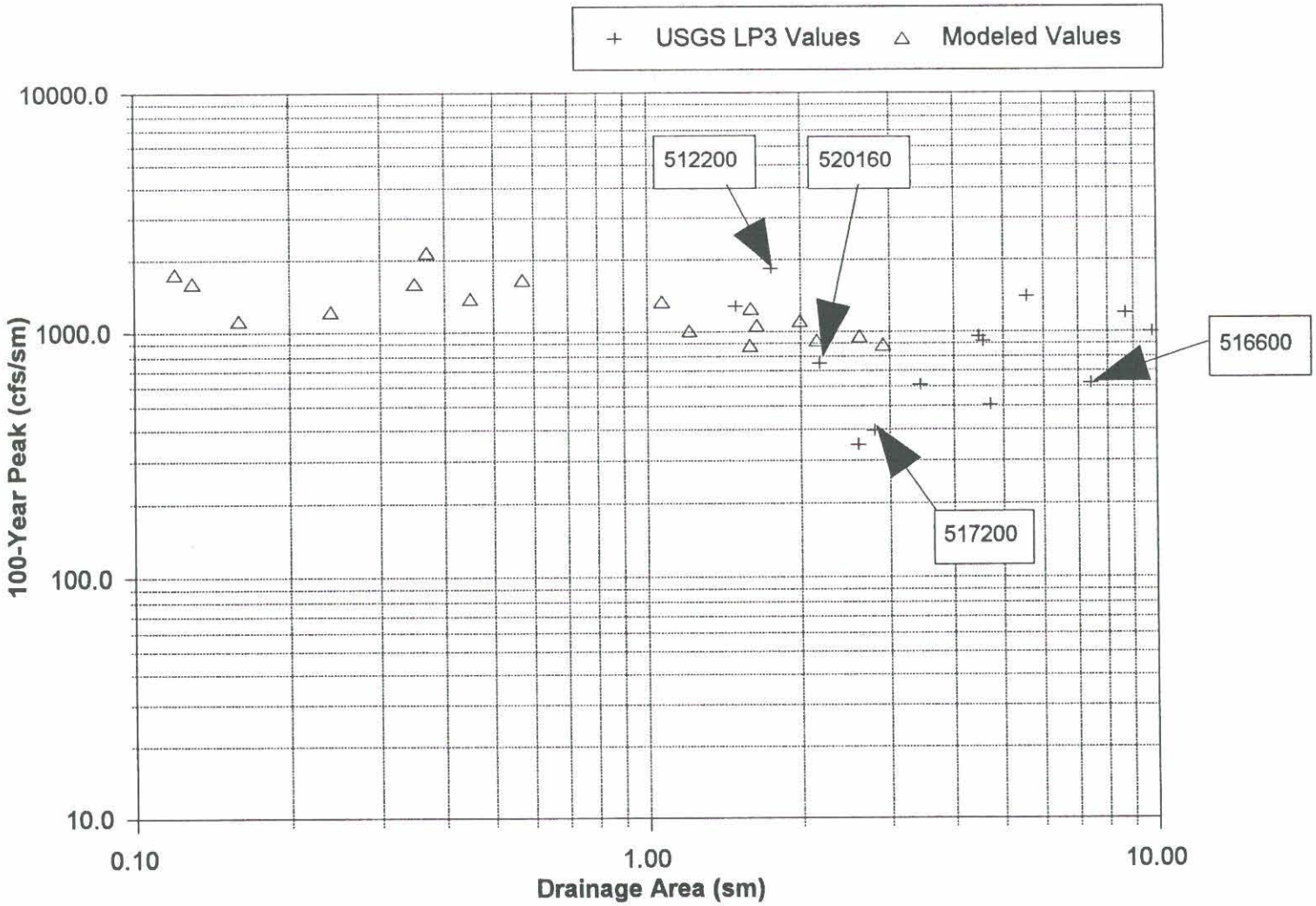
Station Number (1)	Station Name (2)	Drainage Area sm (3)	Mean Elevation feet (4)	Main Channel Slope ft/mi (5)	Record Length years (6)	Qmax cfs (7)	Log Pearson III Discharge For 100-Year Storm cfs (8)	Log Pearson III Discharge For 100-Year Storm cfs/sm (9)
*510070	West Fork Sycamore Creek Near Sunflower	4.58	5,430	260	11	1,700	4,200	917
510080	West Fork Sycamore Creek Near Sunflower	9.80	5,260	353	18	3,480	9,800	1,000
510100	East Fork Sycamore Creek Near Sunflower	4.49	5,760	370	25	1,940	4,300	958
510170	Camp Creek Near Sunflower	2.60	3,520	498	16	402	900	346
*512200	Salt River Tributary In S. Mountain Park	1.75	1,730	244	27	670	3,200	1,829
515800	Hartman Wash Near Wickenburg	5.57	2,690	72	15	2,600	7,800	1,400
*516600	Ox Wash Near Morristown	7.44	2,290	101	16	2,900	4,600	618
*517200	Centennial Wash Tributary Near Wendon	2.79	2,480	193	16	720	1,100	394
519600	Rainbow Wash Tributary Near Buckeye	3.45	950	34	16	1,430	2,100	609
520100	Military Wash Near Sentinel	8.70	674	56	16	1,530	10,400	1,195
520130	Darby Arroyo Near Ajo, AZ	4.72	1,920	71	16	1,670	2,380	504
*520160	Gibson Arroyo at Ajo, AZ	2.18	2,100	171	15	1,800	1,620	743
*520230	Crater Range Wash Near Ajo	1.49	1,280	69	16	440	1,900	1,275

* Watershed is similar to the Fountain Hills area.

Table G-2

Modeling Results at Representative Locations for the 100-year, 6-hour Storm

HEC-1 Identifier	Station Name	Drainage Area	Mean Elevation	Main Channel Slope	100-year, 6-hour Peak Discharge	
		sm	feet	ft/mi	cfs	cfs/sm
(1)	(2)	(3)	(4)	(5)	(6)	(7)
204B	Subbasin in upper Caliente Wash watershed	0.13	1,699	128	208	1,600
205A	Subbasin in upper Hesperus Wash watershed	0.12	3,304	378	210	1,750
205I	Subbasin in upper Hesperus Wash watershed	0.35	2,642	326	559	1,597
207E	Subbasin in upper Ashbrook Wash watershed	0.16	2,456	315	180	1,125
207G	Subbasin in upper Ashbrook Wash watershed	0.24	2,114	198	294	1,225
209A	Subbasin in upper Cloudburst Wash watershed	0.37	3,098	367	792	2,141
C502	Un-named wash	0.45	1,741	177	622	1,382
C517	Escalante Wash d/s of McDowell Mtn. Park	1.21	1,919	185	1,227	1,014
C519	Escalante Wash at McDowell Mtn. Road	1.59	1,861	159	1,406	884
C535	Hesperus Wash at N. Town boundary	2.62	2,974	304	2,514	960
C536	Above Dam 36	2.91	2,939	299	2,580	887
C556	Ashbrook Wash at N. Town boundary	1.64	2,854	339	1,752	1,068
C560	Above Dam 6	2.15	2,774	315	1,989	925
C565	Bristol Wash at Montezuma Blvd.	0.57	2,874	332	938	1,646
C568	Bristol Wash d/s of Montezuma Blvd.	1.07	2,836	325	1,428	1,335
C578	Above Dam 11	2.00	2,417	323	2,231	1,116
C584	Above Dam 7	1.60	2,827	313	1,999	1,249



Note:

The USGS gages listed in boxes are on washes that are similiar to the Fountain Hills area.

Figure G-1

Comparison of USGS LP3 Values with Modelling Results
100-year Unit Peak Discharges vs Area

3.2.5.2 Precipitation Stations

One recording precipitation gage has been established on the study watershed by the District. Two other gages are situated about 4 and 6 miles north of Fountain Hills. These gages are located as follows:

Fountain Hills Gage: Established 9 December 1993. Located in Section 15 T3N R6E at Latitude 33°36'40" and Longitude 111°43'29". The gage is at elevation 2,280 feet.

McDowell Mountain Gage: Established 6 August 1990. Located in Section 16 T4N R6E at Latitude 33°43'00" and Longitude 111°44'42". The gage is at elevation 2,040 feet.

Asher Hills Gage: Established 2 August 1990. Located in Section 1 T4N R6E at Latitude 33°43'03" and Longitude 111°41'01". The gage is at elevation 1,680 feet.

3.3 Calibration

3.3.1 General

Calibration of the HEC-1 models is not possible because of the lack of available physical data. In lieu of calibration, confidence checks are performed on the modeling results. These confidence checks consist of:

1. Comparison with USGS gage data for representative watersheds;
2. Runoff volume checks using surveyed high water marks in the impoundment areas upstream of the major flood control structures (dams);
3. Comparison of modeled results with estimates using a USGS regional regression equation; and
4. Comparison of modeled results with results from previous FIS studies completed in Maricopa County.

These checks are only made using the watershed upstream of the dams. Peak discharges in washes downstream of the dams are significantly affected by those structures.

3.3.2 Comparison with USGS Gage Data

The selected USGS gage data for representative washes are summarized in Table G-1. The modeled results selected for comparison are listed in Table G-2. The data from Tables G-1 and G-2 is plotted on Figure G-1. The USGS gaged watersheds which are the most similar to the Fountain Hills area are identified on both Table G-1 and Figure G-1. The USGS data are for watersheds in the size range of about 1.5 to almost 10 square miles, and the unit peak discharges range from about 350 cfs/square mile to about 1,800 cfs/square mile. The average of the data from Table G-1 is about 900 cfs/square mile for these small watersheds. The model subbasins for comparison are generally smaller than the gaged watersheds and range in size from 0.12 square miles to 2.91 square miles. The unit peak discharges range from 884 cfs/square mile to 2,141 cfs/square mile, and the average of the data from Table G-2 is about 1,300 cfs/square mile. It is reasonable for the smaller model subbasins to produce higher unit peak discharges than the selected gaged watersheds, and this is depicted in Figure G-1. There is no reason to doubt the validity of the modeled results based on this comparison.

3.3.3 Runoff Volume Checks Using Surveyed High Water Marks

High water debris lines were noted upstream of the major flood control structures during the hydrology field reconnaissance in April 1993. The high water marks were staked in the field and later field surveyed to obtain the ponding elevation upstream of each of the five dams. The debris lines appeared to be recent; therefore, the precipitation records of the two gages described in Section 3.2.5.2 were obtained for the previous 24 months. Two convective summer storms and one general winter storm were noted. The winter storm, which occurred on 3 and 4 December 1992, was determined to be the most likely cause of the high water marks.

The two precipitation gages for which data are available, the McDowell Mountain and Asher Hills gages, lie north of the study watershed. The assumption was made that the storm had a similar distribution and total rainfall over the study watershed as recorded by the two gages. The actual precipitation distributions recorded by both gages were used as input to the HEC-1 model and a separate run was made using both rainfall distributions. The two rainfall distributions are plotted on Figure C-1.

The results of this confidence check are shown in Table C-1. The actual stage for each structure is listed in column 3. This is the average of the field surveyed elevations at each structure. The estimated peak discharge leaving the structure and the corresponding upstream stage are listed in columns 4 and 5, respectively, for rainfall input using the McDowell Mountain gage, and in columns 6 and 7, respectively, for rainfall input using the Asher Hills gage. The measured high water elevation for each dam lies within the range of stage defined by columns 5 and 7.

There is no reason to doubt the validity of the HEC-1 model based on this comparison.

Table C-1

Comparison of Modeling Results with Surveyed HighWater Marks for the Storm of 3 and 4 December 1992

			Modeled Results			
		Surveyed Stage	McDowell Mtn.		Asher Hills	
	HEC-1 ID	(high water mark)	Q_p	Stage	Q_p	Stage
(1)	(2)	(3)	(4)	(5)	(6)	(7)
4	C599	1,706.5	513	1,708.7	203	1,699.8
6	C560	1,814.6	138	1,816.1	59	1,812.1
7	C584	1,890.7	188	1,896.3	64	1,888.4
11	C578	1,791.2	204	1,792.1	76	1,783.6
36	C536	1,866.7	212	1,866.1	74	1,856.5

High water marks were observed in the outlet ends of the principal spillways of Dam 7 and Dam 11. The marks were water stains located 3.2 feet and 3.0 feet above the outlet flowline of Dams 7 and 11, respectively. The modeled outlet depths of flow (from HY-8), assuming the surveyed high water mark stage elevations at the inlet, are 2.6 feet and 3.5 feet for Dams 7 and 11, respectively. These depths are reasonably close to the measured depths and provide a measure of confidence for the culvert hydraulic models.

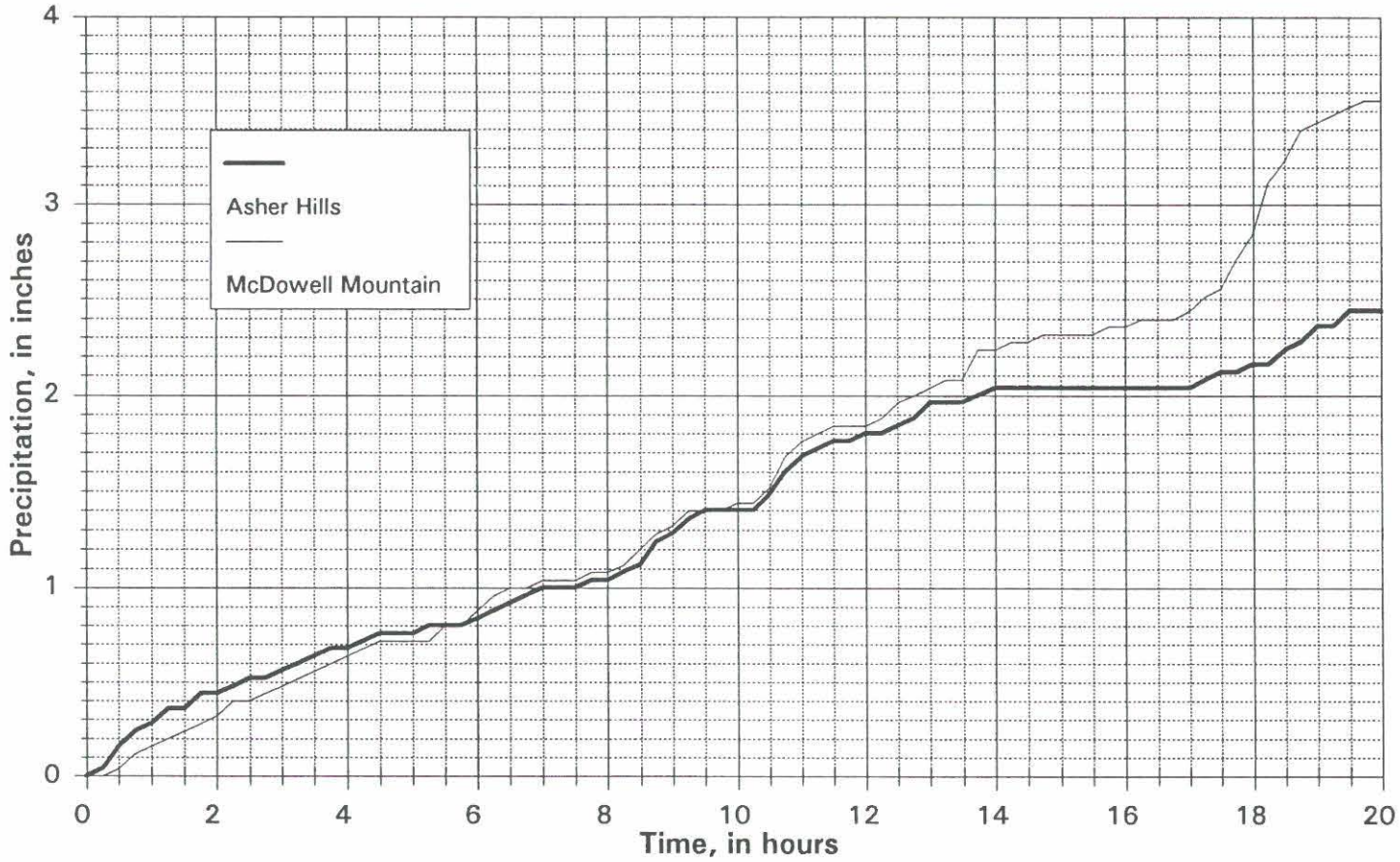


Figure C-1

Cumulative Precipitation vs Time for Storm of 3 and 4 December 1992

3.3.4 Comparison With USGS Regional Regression Equation

The Arizona Department of Transportation (ADOT) *Highway Drainage Design Manual - Hydrology* (ADOT Hydrology Manual [1]) lists preliminary USGS regional regression equations for use in Arizona. The Fountain Hills North study watershed lies in flood region 12. The regression equations for flood region 12 are listed in ADOT Table 10-6 which is included herein as Table C-2. ADOT Figure 10-20 is also included herein as Figure C-2. Figure C-2 is a scatter diagram of mean basin elevation versus drainage area for the gages upon which the regression analysis was performed.

The comparison is made using the 100-year, 6-hour modeled results for Dams 6, 7, 11 and 36. Dam 4 is not included because it is influenced by Dams 6, 7 and 11. The results of the comparison are shown in Table C-3. The modeled results are significantly lower than those estimated using the 100-year regression equation but fall within the 31 percent standard error. There is no reason to doubt the model results based on this confidence check.

Table C-2
(Ref. - ADOT Hydrology Manual Table 10-6)

Flood Magnitude-Frequency Relations for the Central Arizona Region (R12)

Equation: Q, peak discharge, in cubic feet per second/ AREA, drainage area, in square miles; and ELEV, mean basin elevation, in feet divided by 1,000.

Recurrence interval in years (1)	Equation (2)	Average standard error of model in percent (3)
2	$Q = 41.1\ AREA^{0.629}$	102
5	$Q = 238\ AREA^{0.687}\ ELEV^{-0.358}$	64
10	$Q = 479\ AREA^{0.661}\ ELEV^{-0.398}$	47
25	$Q = 942\ AREA^{0.630}\ ELEV^{-0.383}$	34
50	$LOG\ Q = 7.36 - 4.17\ AREA^{-0.08} - 0.440\ LOG\ ELEV$	30
100	$LOG\ Q = 6.55 - 3.17\ AREA^{-0.11} - 0.454\ LOG\ ELEV$	31

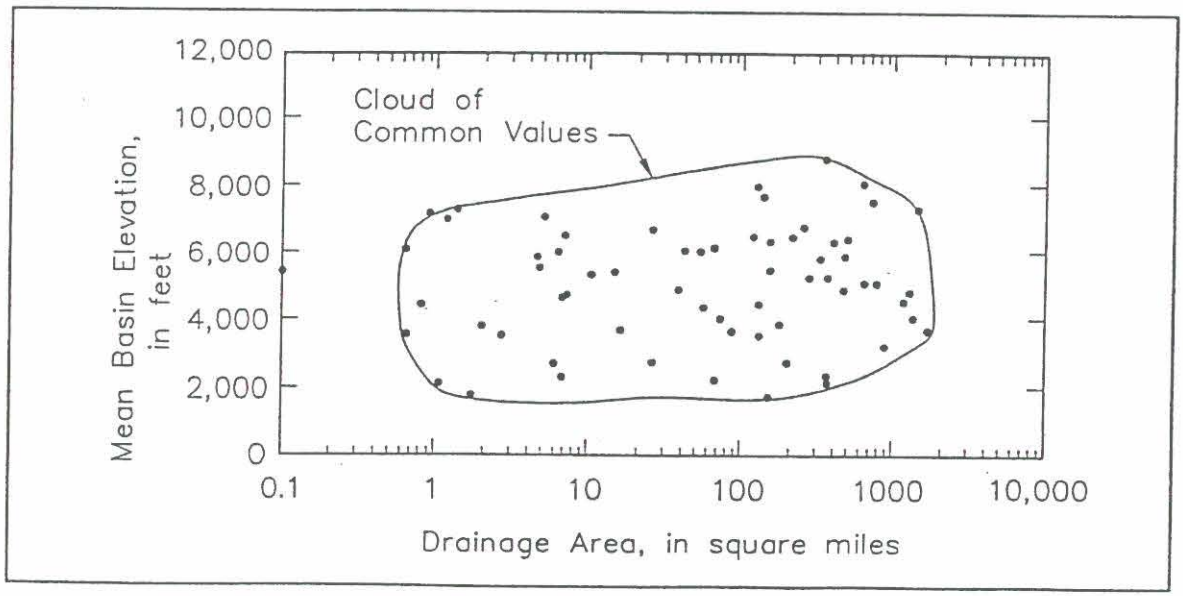


FIGURE C-2
(Ref. - ADOT Hydrology Manual Figure 10-20)

Scatter Diagram of Independent Variables for R12 Regression Equation

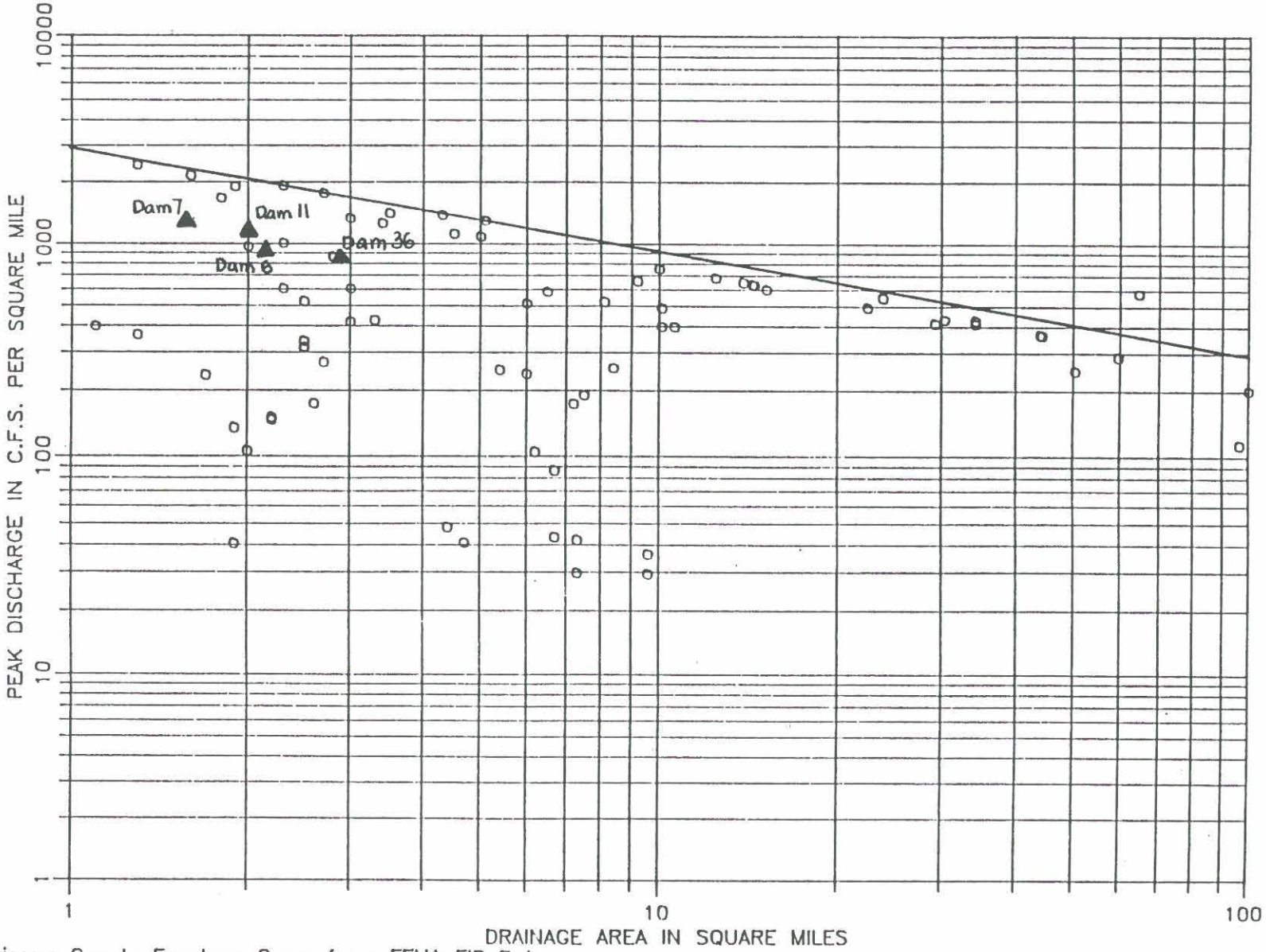
Table C-3

Comparison of Modeled Results with USGS Regional Regression Equation

Dam No.	HEC-1 ID	Drainage Area, sm	Mean Elevation	100-year Discharge,cfs	
				USGS	HEC-1 Model
(1)	(2)	(3)	(4)	(5)	(6)
6	C560	2.15	2,774	2,723	1,989
7	C584	1.60	2,827	2,162	1,999
11	C578	2.00	2,417	2,746	2,231
36	C536	2.91	2,939	3,303	2,580

3.3.5 Comparison with Previous FIS Studies in Maricopa County

The Arizona Department of Water Resources (ADWR) has adopted State Standard SS-2 [6.5:3] which includes envelope curves of FIS 100-year peak discharges for each county in the state. The curve for Maricopa County is included herein as Figure C-3. The 100-year, 6-hour peak discharges for Dams 6, 7, 11 and 36 are plotted on Figure C-3 for comparison. There is no reason to doubt the validity of the HEC-1 model based on this comparison.



Maricopa County Envelope Curve from FEMA FIS Data
SSA 2-91 ADWR

▲ - Fountain Hills HEC-1 Model

FIGURE C-3

Comparison of Modeled Results with FEMA FIS Data

3.4 Special Problems and Solutions

3.4.1 Channel Flow Splits

3.4.1.1 Discussion of Problem

There are eleven (11) significant flow splits on the study watershed identified during the subbasin delineation process. All of these are caused by development on the watershed. The development conditions which can result in these flow diversions are:

1. Roadway embankments which cause ponded storm water to overtop the roadway or bar ditches and be directed away from the main channel into a different watershed.
2. Street intersections where the street cross section is the primary conveyance mechanism. Intersection grades result in diversion of flow from one street into another.
3. A stock pond where flow can escape at two different locations.

The locations of significant flow splits on the watershed are identified on the various exhibits by use of a triangle symbol around the concentration point number.

3.4.1.2 Solution and Results

The flow split rating curves used for input to the HEC-1 diversion operation at each split location were developed by hydraulic analyses as described in Section 3.2.2.3. A separate rating curve was prepared for each leg of the split and the results plotted in a stage versus discharge format. The flow split tables were then created by reading the discharge from each rating curve at common stage elevations. The results are summarized in Figures D-1 through D-11. The following is a brief description of each split location, the hydraulic analysis methods used, and the location of supporting calculations.

C504 - C504 is located at the bottom of subbasin 202A at McDowell Mountain Road. Water ponds against the roadway embankment and drains under the road through a single 24" CMP. A reservoir route is performed at this location. When stage 1541.7 is reached, flow begins to spill into the west bar ditch. The overflow drains south to C505. The culvert rating curve is developed using HY-8. The overflow rating curve is developed using HEC-2. Refer to Appendix A for

supporting calculations, and Figure D-1 for the rating table and curve.

C505 - C505 is located at the bottom of subbasin 202B at McDowell Mountain Road. Water ponds against the roadway embankment and drains under the road through a single 21" CMP. The ponded volume is not significant enough to warrant a reservoir route. When stage 1538.8 is reached, flow begins to spill into the west bar ditch. The overflow drains south to C506. The culvert rating curve is developed using HY-8. The overflow rating curve is developed using HEC-2. Refer to Appendix B for supporting calculations, and Figure D-2 for the rating table and curve.

C506 - C506 is located at the bottom of subbasin 202C at McDowell Mountain Road. Water ponds against the roadway embankment and drains under the road through a single 18" CMP. The culvert is completely filled with sediment; therefore, the culvert hydraulic capacity is not included in the flow split rating curves. The culvert is modeled using HY-8 and the results are included for future use. The ponded volume is not significant enough to warrant a reservoir route. When stage 1531.4 is reached, flow begins to spill into the west bar ditch. The overflow drains south to C507. The bar ditch rating curve is developed using HEC-2. When stage 1533.5 is reached, flow begins to overtop McDowell Mountain Road and reenters the wash downstream of the culvert. The roadway overflow is modeled using the uneven weir program. Refer to Appendix B for supporting calculations, and Figure D-3 for the rating table and curve.

C508 - C508 is located at the bottom of subbasin 202E at McDowell Mountain Road. Water ponds against the roadway embankment and drains under the road through a single 42" CMP. A reservoir route is performed at this location. When stage 1527.6 is reached, flow begins to spill into the west bar ditch and flow north to C507. The culvert rating curve is developed using HY-8. The bar ditch rating curve is developed using HEC-2. Refer to Appendix A for supporting calculations, and Figure D-4 for the rating table and curve.

C512 - C512 is located at the bottom of subbasin 202H downstream from McDowell Mountain Road. An existing stock tank is located at this point. When

stage 1531.0 is reached, flow begins to overtop the embankment adjacent to the south shoulder of McDowell Mountain Road. This flow follows the historical drainage pattern (pre-stock tank) in an easterly direction. The embankment overflow is modeled using the uneven weir program. When stage 1531.6 is reached, flow drains south into Bahia Drive and drains to C591. The overflow rating curve for this component of the split is developed using HEC-2. A reservoir route is performed at this location. Refer to Appendix A for supporting calculations, and Figure D-5 for the rating table and curve.

C523 - C523 is located on Caliente Wash at McDowell Mountain Road. The split consists of three flow components. Flow drains under the roadway via a single 66" CMP. When stage 1658.6 is reached, flow begins to drain southerly in the west bar ditch to Fountain Hills Boulevard and then to Balboa Wash at C548. When stage 1659.2 is reached, flow begins to overtop McDowell Mountain Road and drain into the wash downstream of the culvert. The culvert rating curve is developed using HY-8. The bar ditch rating curve is developed using HEC-2. The roadway overflow curve is developed using the uneven weir program. A reservoir route is performed at this location. Refer to Appendix A for supporting calculations, and Figure D-6 for the rating table and curve.

C543 - C543 is located at Oxford Wash and Maple Drive. The majority of the flow is contained in Oxford Wash. At stage 1715.6, flow can spill into Glenbrook Boulevard. Both flow components are modeled using HEC-2. This flow split and C545 were modeled at request of the District to determine if a flood hazard exists along Glenbrook Boulevard. No flow during the 100-year event is diverted into Glenbrook Boulevard; therefore, only minor local flows cause a problem in this street. Refer to Appendix B for supporting calculations, and Figure D-7 for the rating table and curve.

C545 - C545 is located at the intersection of Glenbrook Boulevard and Tamarack Lane. The flow split is caused by the street intersections. Both flow components are modeled using HEC-2. Refer to Appendix B for supporting calculations, and Figure D-8 for the rating table and curve.

C611 - C611 is a detention basin located just south of the intersection of Palisades Boulevard and Wendover Drive. A reservoir route was performed at this location. The basin is drained by a single 60" CMP storm drain that drains to Arrow Wash at C620. The inlet to the storm drain is protected by a "beehive" shaped trash rack. Flow which overtops the basin drains across Palisades Boulevard into Wendover Drive. Before construction of the basin and storm drain, flooding occurred at the intersection of Wendover Drive and Stancrest Drive. The storm drain is modeled using THYSYS. The basin overflow is modeled using the uneven weir program. The capacity of the trash rack was estimated using the orifice equation and assuming a 50 percent clogging factor. The capacity of the trash rack is less than the capacity of the storm drain. The flow split rating curve is based on the trash rack capacity. This flow split was modeled at the request of the District to determine the effectiveness of the detention basin and storm drain. No flow during the 100-year event is diverted into Wendover Drive. Refer to Appendix A for supporting calculations, and Figure D-9 for the rating table and curve.

C614 - C614 is located at the intersection of El Lago Boulevard and Cavern Drive. El Lago Boulevard is the significant drainage conveyance and flow is diverted northerly into Cavern Drive. Both flow components are modeled using HEC-2. Refer to Appendix B for supporting calculations, and Figure D-10 for the rating table and curve.

C615 - C615 is located at the intersection of El Lago Boulevard and Mimosa Drive. El Lago Boulevard is the significant drainage conveyance and flow is diverted northerly into Mimosa Drive. Both flow components are modeled using HEC-2. Refer to Appendix B for supporting calculations, and Figure D-11 for the rating table and curve.

The physical data used for the flow split calculations were obtained from the 200 Scale Mapping, by field survey and by field reconnaissance. The flow splits are implemented in HEC-1 using the DT, DI and DQ record options. The HEC-1 model drops the total watershed area from memory below a diversion operation. Since the JD record option is used for this study, the total watershed area must be known at each hydrograph combination point. The HEC-1 HC record option allows the total area to be set at any

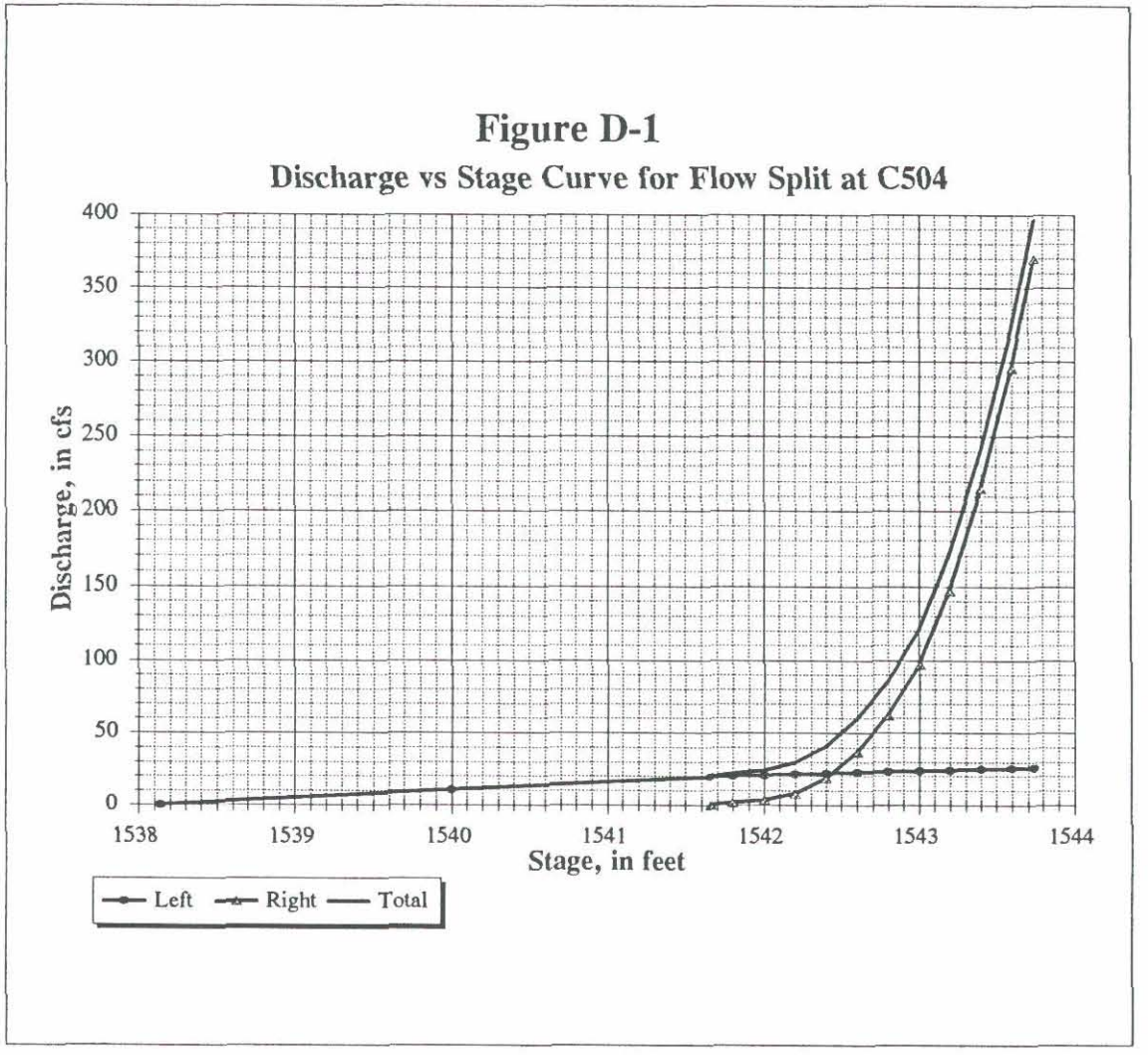
given hydrograph combination operation. This option was used to reset the watershed areas downstream of diversions at the first combination downstream of the recalled diversion hydrograph. The new areas are input to the HEC-1 models as follows:

HEC-1 ID	Upstream HEC-1 Operations	Total Area sm
C591	519591, 520591, C512R	1.83
C548L	541548, 206G, 523548	3.72
C547	206H, 206I, 206J, 206K, 206L	0.26
C615	614615, 211V	0.03
C618	C618I, 615618	0.19
C619I	211Q, 211R, 211S, 211T, 211U, 211V	0.25
C620R	211Q through 211W	0.28
C620	620R, 611620	0.42
C621	207, 208, 209, 210, 211G through 211W	7.93

C504 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1538.14	0	---	0
1540.00	11	---	11
1541.66	20	0	20
1541.80	20	2	22
1542.00	21	4	24
1542.20	22	8	30
1542.40	22	19	41
1542.60	23	37	60
1542.80	23	62	85
1543.00	24	97	121
1543.20	24	147	171
1543.40	25	215	240
1543.60	26	296	322
1543.74	26	370	396

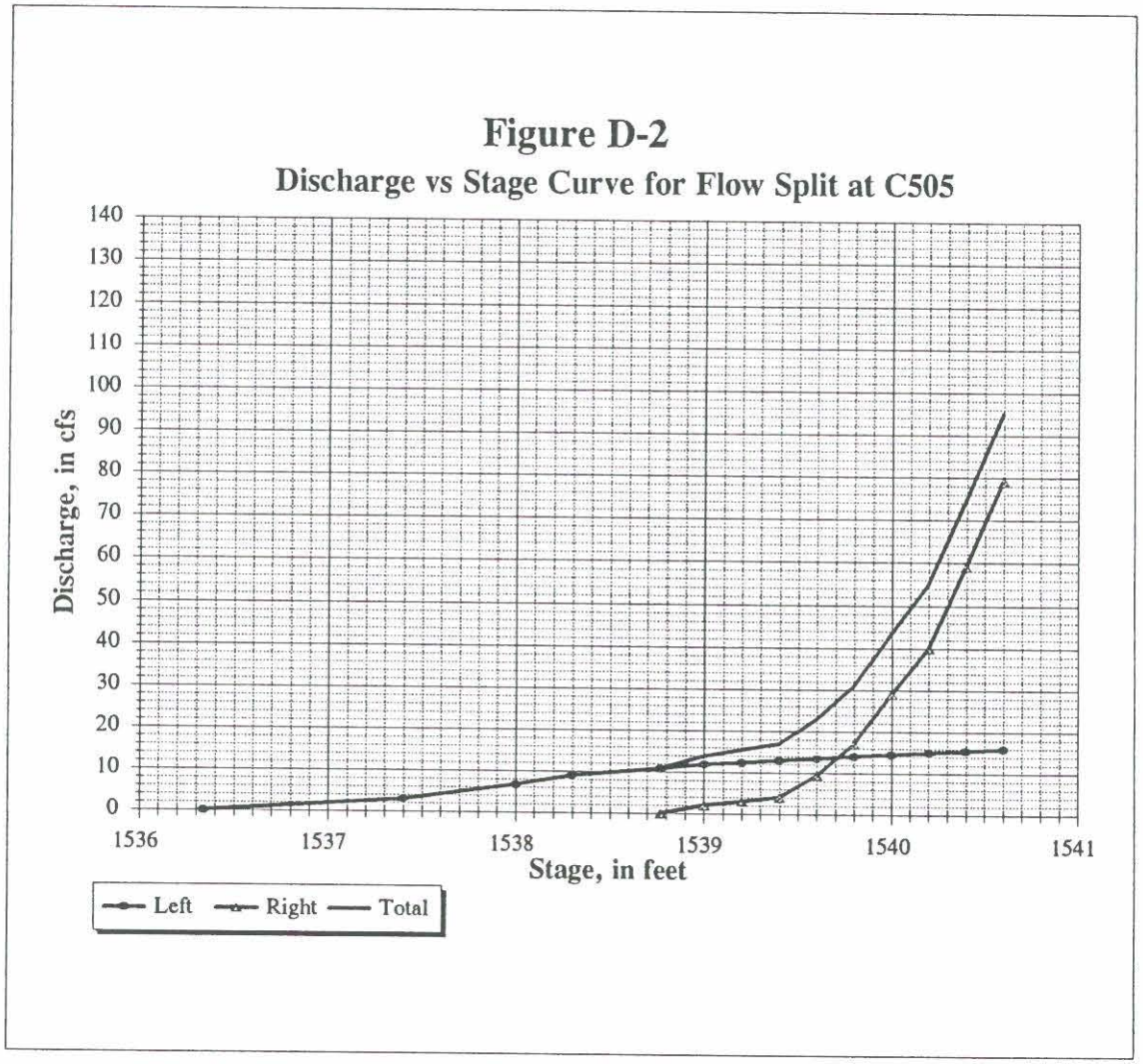
* Note: Weir flow over the road will start at EL > 1543.74



C505 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1536.34	0	---	0
1537.40	3	---	3
1538.00	7	---	7
1538.30	9	---	9
1538.77	11	0	11
1539.00	12	2	14
1539.20	12	3	15
1539.40	13	4	17
1539.60	14	9	23
1539.80	14	17	31
1540.00	15	29	44
1540.20	15	40	55
1540.40	16	59	75
1540.60	16	79	95
1540.80	16	107	123
1540.85	17	117	134

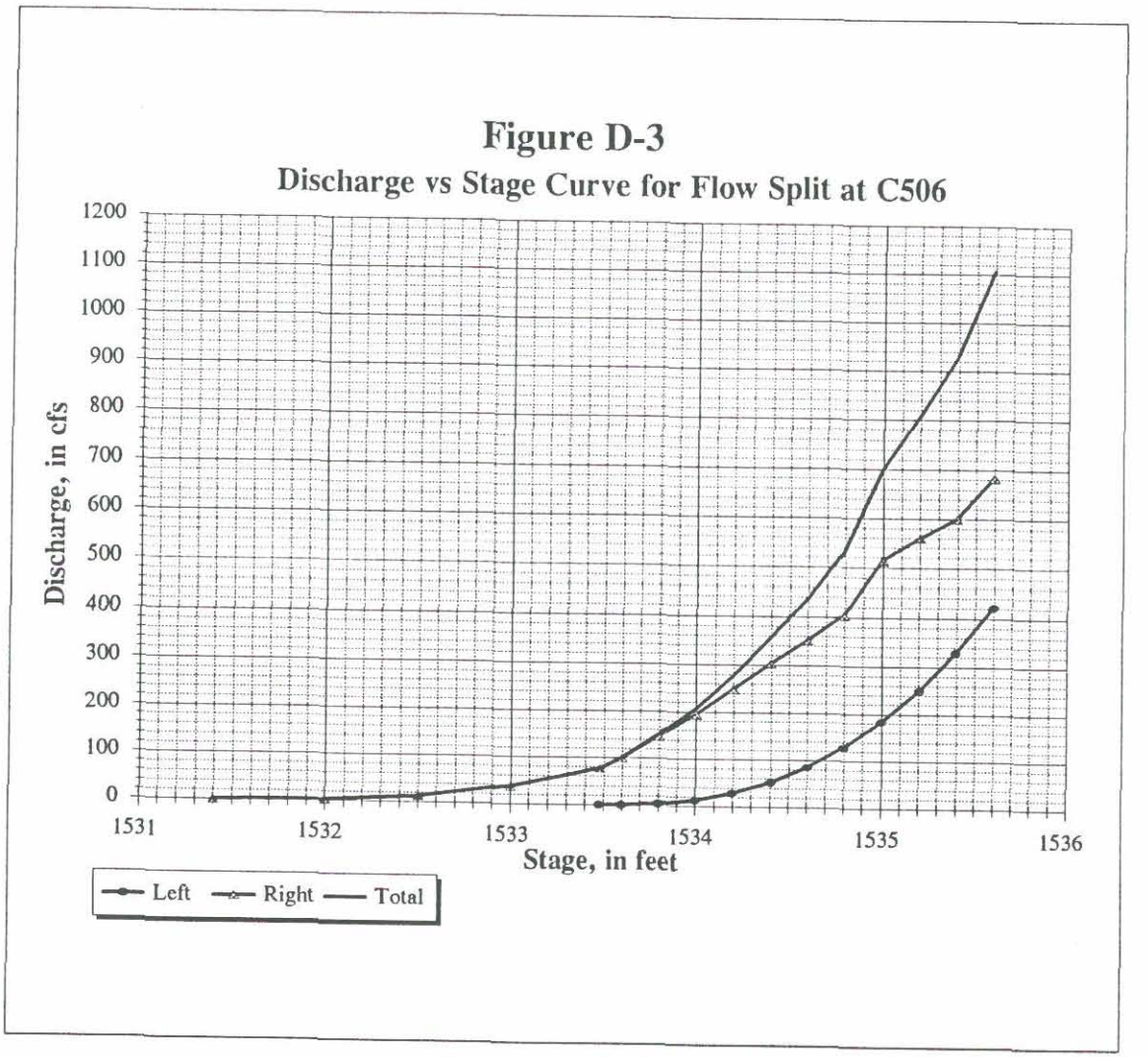
* Note: Weir flow over the road will start at EL > 1540.85



C506 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1531.40	---	0	0
1532.00	---	3	3
1532.50	---	13	13
1533.00	---	37	37
1533.48	0	77	77
1533.60	0	100	100
1533.80	4	147	151
1534.00	12	194	206
1534.20	28	248	276
1534.40	52	303	355
1534.60	85	352	437
1534.80	128	404	532
1535.00	183	515	698
1535.20	249	560	809
1535.40	328	600	928
1535.60	421	683	1104

Note: Culvert 506 is clogged, thus it is not modeled

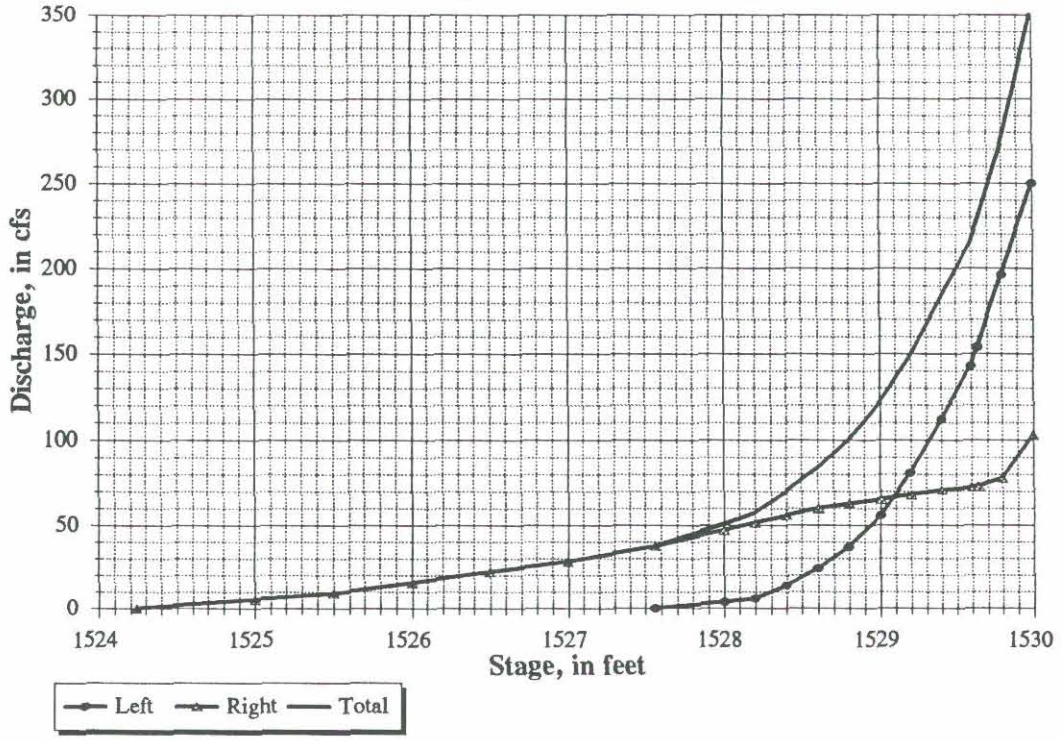


C508 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1524.24	---	0	0
1525.00	---	6	6
1525.50	---	9	9
1526.00	---	16	16
1526.50	---	22	22
1527.00	---	28	28
1527.56	0	38	38
1528.00	4	47	51
1528.20	6	52	58
1528.40	14	56	70
1528.60	24	60	84
1528.80	37	63	100
1529.00	56	66	122
1529.20	81	68	149
1529.40	112	71	183
1529.60	143	73	216
1529.64	154	73	227
1529.80	196	78	274
1530.00	250	103	353

Figure D-4

Discharge vs Stage Curve for Flow Split at C508

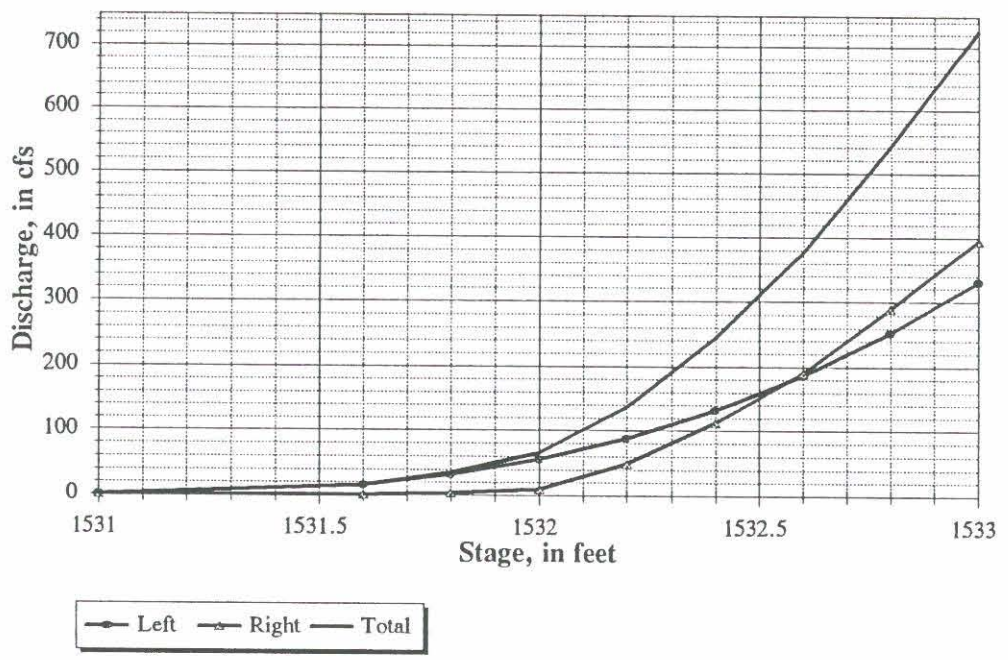


C512 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Weir	Right Channel	Total
1531.00	0	0	0
1531.60	15	0	15
1531.80	31	4	35
1532.00	55	10	65
1532.20	88	49	137
1532.40	132	112	244
1532.60	186	190	376
1532.80	252	289	541
1533.00	330	395	725

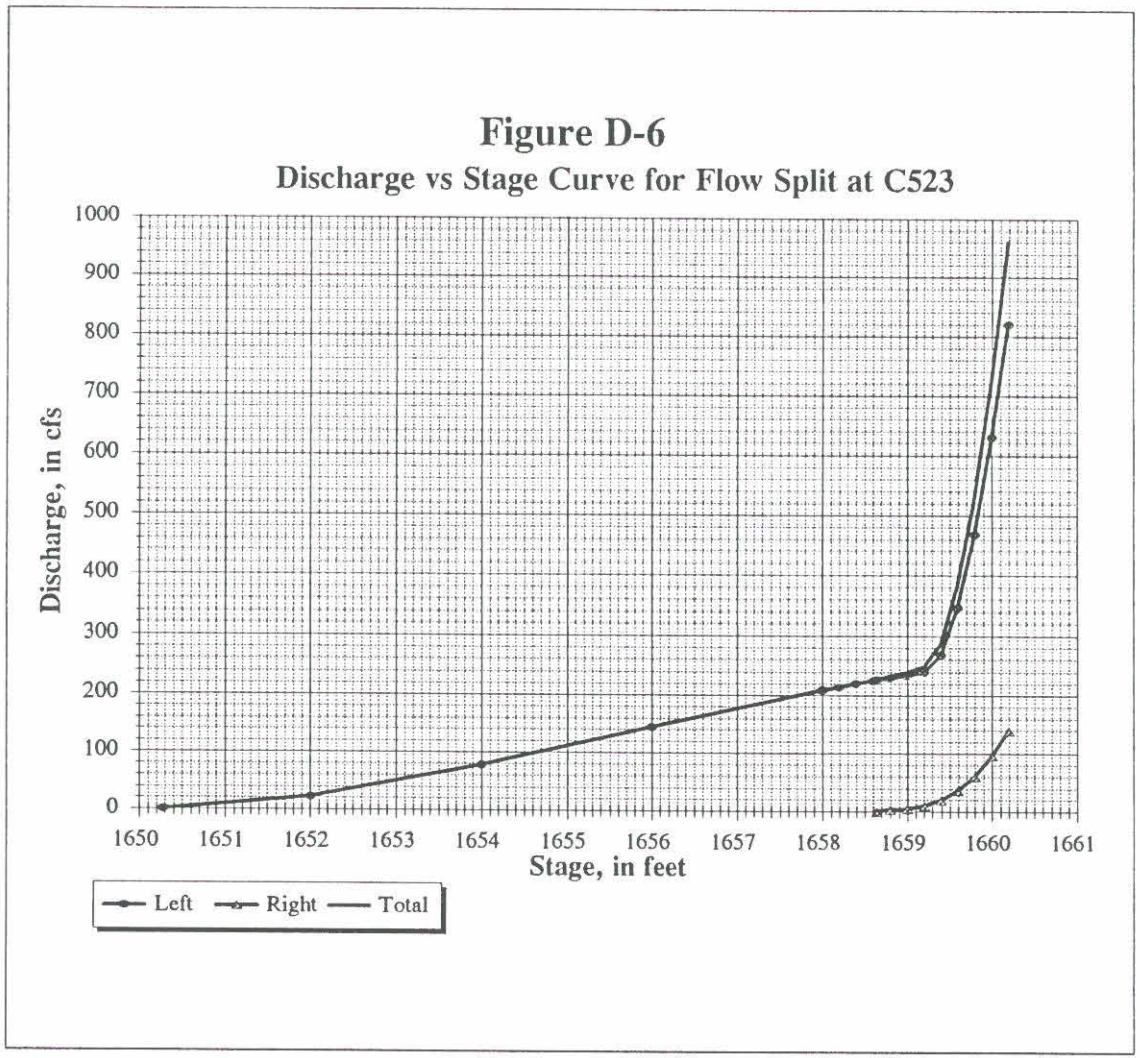
Figure D-5

Discharge vs Stage Curve for Flow Split at C512 (Stock Tank)



C523 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1650.28	0	---	0
1652.00	22	---	22
1654.00	78	---	78
1656.00	144	---	144
1658.00	209	---	209
1658.20	214	---	214
1658.40	220	---	220
1658.60	224	---	224
1658.64	226	0	226
1658.80	229	3	232
1659.00	234	5	239
1659.20	239	10	249
1659.40	268	20	288
1659.60	347	37	384
1659.80	468	61	529
1660.00	630	96	726
1660.20	821	139	960

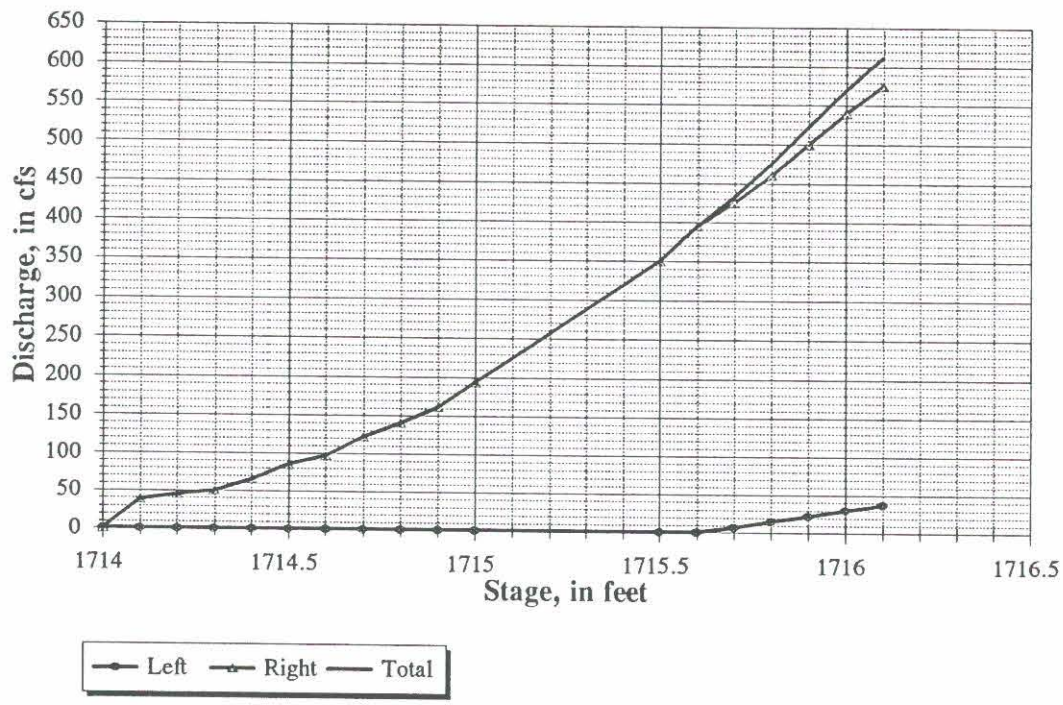


C543 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1714.00	0	0	0
1714.10	0	38	38
1714.20	0	45	45
1714.30	0	50	50
1714.40	0	65	65
1714.50	0	85	85
1714.60	0	97	97
1714.70	0	122	122
1714.80	0	141	141
1714.90	0	162	162
1715.00	0	194	194
1715.50	0	350	350
1715.60	0	395	395
1715.70	7	425	432
1715.80	15	460	475
1715.90	22	500	522
1716.00	30	540	570
1716.10	37	575	612

Figure D-7

Discharge vs Stage Curve for Flow Split at C543

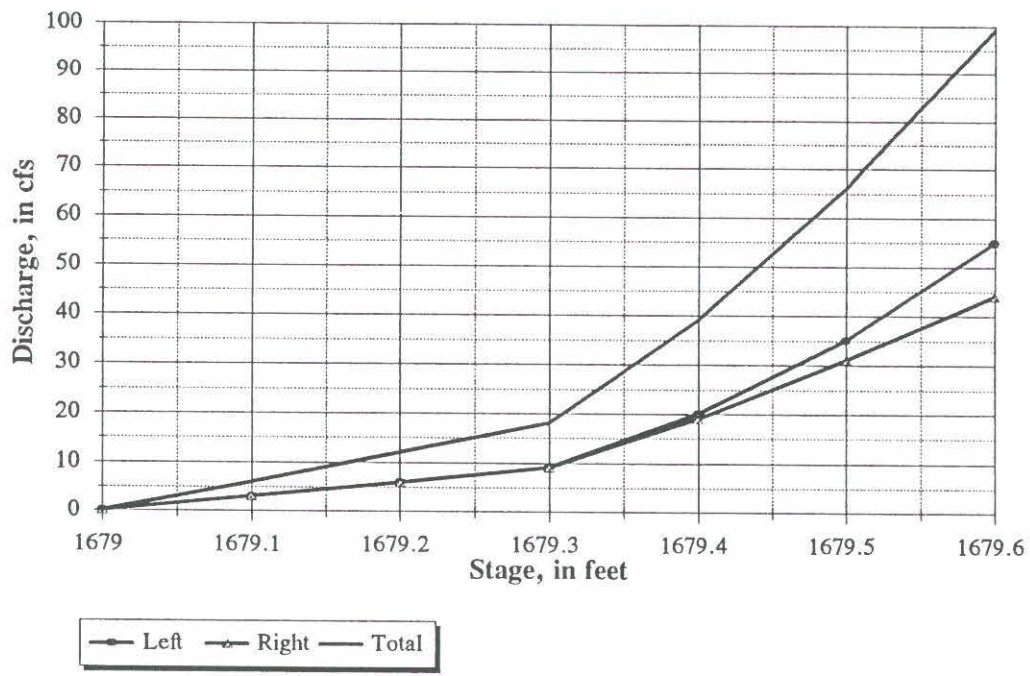


C545 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1679.00	0	0	0
1679.10	3	3	6
1679.20	6	6	12
1679.30	9	9	18
1679.40	20	19	39
1679.50	35	31	66
1679.60	55	44	99

Figure D-8

Discharge vs Stage Curve for Flow Split at C545

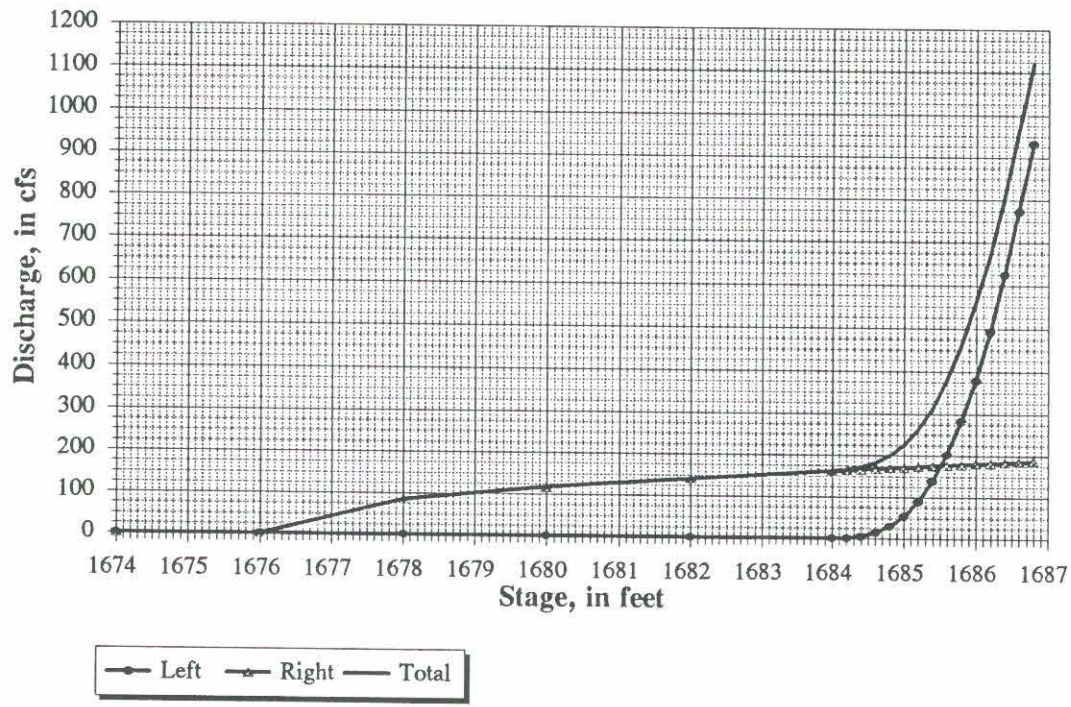


C611 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left (weir)	Right (pipe)	Total
1674.00	0	0	0
1676.00	0	0	0
1678.00	0	86	86
1680.00	0	117	117
1682.00	0	141	141
1684.00	0	162	162
1684.20	1	164	164
1684.40	5	165	170
1684.60	14	167	181
1684.80	29	169	199
1685.00	54	171	225
1685.20	89	173	262
1685.40	138	175	313
1685.60	202	176	378
1685.80	282	178	460
1686.00	378	180	558
1686.20	491	182	673
1686.40	624	183	807
1686.60	773	185	958
1686.80	932	187	1118

Figure D-9

Discharge vs Stage Curve for Flow Split at C611

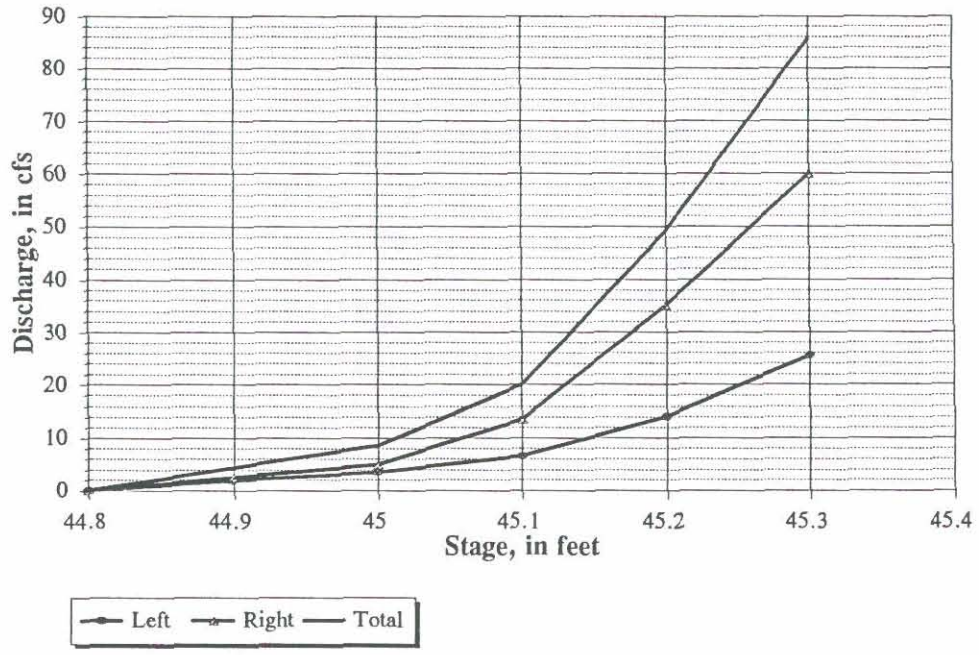


C614 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
44.80	0.0	0.0	0.0
44.90	1.8	2.5	4.3
45.00	3.5	5.0	8.5
45.10	6.5	13.5	20.0
45.20	14.0	35.0	49.0
45.30	25.5	60.0	85.5

Figure D-10

Discharge vs Stage Curve for Flow Split at C614

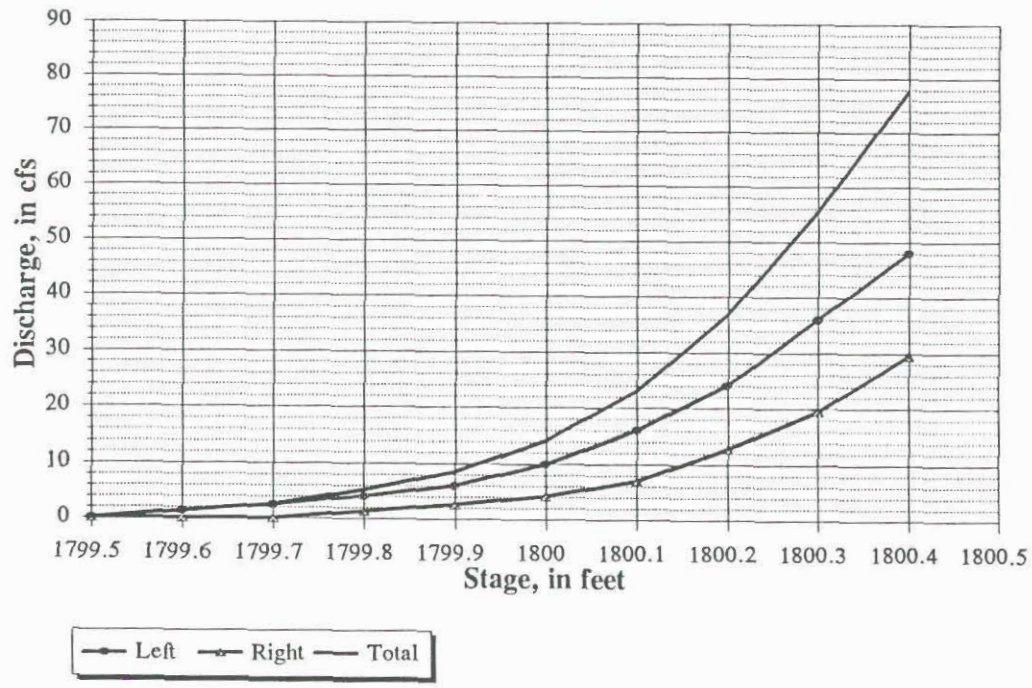


C615 Flow Split Table

Stage (ft)	Discharge, in cfs		
	Left Channel	Right Channel	Total
1799.50	0.0	0.0	0.0
1799.60	1.3	0.0	1.3
1799.70	2.5	0.0	2.5
1799.80	4.0	1.3	5.3
1799.90	6.0	2.6	8.6
1800.00	10.0	4.2	14.2
1800.10	16.0	7.0	23.0
1800.20	24.0	12.8	36.8
1800.30	36.0	19.5	55.5
1800.40	48.0	29.5	77.5

Figure D-11

Discharge vs Stage Curve for Flow Split at C615



3.4.2 HEC-1 Warnings and Errors

3.4.2.1 General

The warnings encountered in the HEC-1 output are concerning hydrograph routing and subbasin runoff calculations. Examples of the warnings noted are:

501502* ***WARNING*Modified Puls Routing May Be Numerically Unstable For Outflows Between 3704 To 7085.*

**204F* Warning Excess At Ponding Less Than Zero For Period. Excess Set to Zero.*

The warning messages are discussed below. No errors are reported by HEC-1 for any of the models.

3.4.2.2 Routing Operation Warnings

The first warning listed above specifies a range of peak flows for which the hydrograph may be unstable. For example, in the first warning message above, the routed peak discharge for the reach is 437 cfs (see the 100-year, 6-hour HEC-1 model). Note that the computed peak discharge is less than the range specified in the warning message. All of the reaches for which warning messages were noted were checked for the following:

1. The routed peak discharge was compared to the range listed in the warning message;
2. The routed peak discharge was compared with the inflow peak discharge to determine if the peak discharge increased as a result of the routing computations; and
3. The routed hydrograph was plotted and checked for oscillations if either item 1 or 2 above was a concern.

Only one reach is found to have a hydrograph with discharges in the range of the warning message. This is the reservoir route operation at C523. The warning range was 0 to 22 cfs and the routed peak discharges are 286 cfs and 202 cfs for the 6-hour and 24-hour storms, respectively. The hydrographs were checked for oscillations and found to have a reasonable shape. None of the routing operations were found to increase the peak discharge as a result of the routing computations. The routing warning messages were inconsequential to

have a reasonable shape. None of the routing operations were found to increase the peak discharge as a result of the routing computations. The routing warning messages were inconsequential to the model input and do not affect the veracity of the model results.

3.4.2.3 Subbasin Runoff Calculation Warnings

The second warning listed in Section 3.4.2.1 is in regard to the rainfall loss calculation and it can result from an internal HEC-1 check that is performed when applying the Green-Ampt rainfall excess relationship. The check is performed by HEC-1 for each time interval to answer the following questions:

1. Does ponding (generation of rainfall excess) occur throughout the interval?
2. Does ponding occur at end of the interval?
3. Does ponding begin during the interval?

The warning is given when the second and third checks are true. The rainfall excess calculation for a time interval is done by subtracting the estimated average precipitation loss from the rainfall for the time interval. If ponding begins at the end of the interval or during the interval, then the average excess can be less than zero, resulting in the warning. In these cases, the rainfall excess is set to zero. This warning occurs for subbasins 204F, 206A, 208P, 211K, 211P and 211X for the 6-hour storm, and 204B, 208N, 208R, 211B, 211T, 211Z and 211AD for the 24-hour storm. This warning is not an indication of instability in the model and can be disregarded.

3.5 Final Results

3.5.1 General

The results of this study are summarized in Tables F-1 through F-4. Refer to Exhibit A for a summary of 100-year peak discharges at key locations on the watershed. Table F-1 is a listing of the 100-year, 6-hour results. The left half of Table F-1 presents the results in HEC-1 run order, the right half of Table F-1 presents the results in operation order (subbasin operations, followed by hydrograph recall operations, followed by reservoir route

operations, followed by diversion operations, and finally reach route operations). Table F-2 is similiar to Table F-1 except the results of the 100-year, 24-hour storm are listed. Table F-3 is a comparison listing, in numerical order, of the 100-year, 6-hour and 100-year, 24-hour storm results. Table F-4 is a listing of runoff volume in acre-feet for the 100-year, 6-hour and 100-year, 24-hour storms.

The 6-hour storm produces higher peak discharges than the 24-hour storm in all washes except Ashbrook Wash below Dam 4 (C599) and Hesperus/Balboa Wash below C537. The watershed is broken into eleven (11) major basins. These major basins represent the following washes:

Basin 201: A minor unnamed watershed.

Basin 202: A number of small unnamed watersheds.

Basin 203: Escalante Wash.

Basin 204: Caliente Wash.

Basin 205: Hesperus Wash above Dam 36.

Basin 206: Hesperus Wash below Dam 36, Balboa Wash and Oxford Wash.

Basin 207: Ashbrook Wash above Dam 6.

Basin 208: Bristol Wash, Cholula Wash, Zapata Wash and Montezuma Wash above Dam 11.

Basin 209: Cloudburst Wash above Dam 7.

Basin 210: Bristol Wash below Dam 11, Cloudburst Wash below Dam 7, Ashbrook Wash between Dams 6 and 4, and Longmont Wash.

Basin 211: Ashbrook Wash below Dam 4, Tulip Wash, Legend Wash, Sunflower Wash, and Arrow Wash.

The HEC-1 output files for both the 6-hour and 24-hour storms are included as Appendices C and D, respectively. The input files are included in digital form on 3.5" diskette.

The modeling results are strongly affected by the dams. It is important to keep in mind the physical characteristics of the structures when reviewing the modeling results.

Dam 4 - Dam 4 has a crest length of 660 feet, a height of 28 feet, a crest width of 12 feet and an upstream and downstream slope of 2:1. The principal spillway consists of two 60-inch RCP culverts with one culvert partially blocked by a concrete encased sewer line that runs the length of the pipe. The principal spillway capacity is approximately 990 cfs. The emergency spillway is unlined earth with a concrete sill and rock riprap. The emergency spillway width is 300 feet and has a capacity of about 15,000 cfs.

Dam 6 - Dam 6 has a crest length of 840 feet, a height of 36 feet, a crest width of 12 feet and upstream and downstream slopes of 3:1 and 2:1, respectively. The principal spillway consists of a single 60-inch RCP culvert with a capacity of approximately 625 cfs. The emergency spillway is unlined earth with a reinforced concrete wing wall on one side and a concrete lined bank on the other. The emergency spillway has a width of 250 feet and a capacity of about 18,750 cfs.

Dam 7 - Dam 7 has a crest length of 535 feet, a height of 53 feet, a crest width of 12 feet and upstream and downstream slopes at 2:1. The principal spillway consists of a single 48-inch RCP culvert with a capacity of about 435 cfs. The emergency spillway is unlined earth with a width of 160 feet and a capacity of about 11,400 cfs.

Dam 11 - Dam 11 has a crest length of 820 feet, a height of 59 feet, a crest width of 12 feet and upstream and downstream slopes of 3:1 and 2:1, respectively. The principal spillway consists of a single 48-inch diameter RCP culvert with a capacity of about 470 cfs. The emergency spillway is unlined earth with a concrete cutoff wall, a spillway width of 250 feet and a capacity of about 18,750 cfs.

Dam 36 - Dam 36 has a crest length of 1,060 feet, a height of 49 feet, a crest width of 12 feet and upstream and downstream slopes at 2:1. The principal spillway consists of a single 48-inch RCP culvert with a capacity of about 365 cfs. The emergency spillway is unlined earth with a concrete sill and rock riprap. The emergency spillway has a width of 250 feet and a capacity of about 11,800 cfs.

3.5.2 Summary of HEC-1 Nomenclature and Modeling Results

Subbasin names, concentration point numbers and routing reaches are named according to the following nomenclature.

HEC-1 Computer Model Nomenclature

HEC-1 ID	Description
201A	Hydrograph identifier for subbasin 201A. Refers to subbasin A in major basin 201.
C542	Hydrograph identifier for concentration point 542. More than one hydrograph is combined at this location. Point 542 is a physical location on the watershed which is labeled on Exhibit A or Exhibit D.
C599I	Hydrograph identifier for concentration point 599. The "I" signifies this is an inflow hydrograph to a reservoir route.
C599O	Hydrograph identifier at concentration point 599. The "O" signifies this is an outflow hydrograph from a reservoir route.
C563L C563R	Hydrograph identifiers for concentration point 563. The "L" symbolizes this is an intermediate hydrograph for the left wash (looking downstream) immediately upstream of the confluence with the right wash ("R") at concentration point 563.
D503L D503R	Hydrograph identifiers for concentration point 503 in the left branch ("L"), or right branch ("R"), immediately downstream of concentration point 503. This is a hydrograph created by a diversion operation performed on the hydrograph at concentration point 503.
BB614R	This signifies a hydrograph in the right ("R") wash immediately downstream of a flow split at concentration point 614. The "BB" signifies the hydrograph is recalled to active memory using the HEC-1 DR record.
511512	Hydrograph resultant from a normal depth channel route from concentration point 511 to concentration point 512.
CLEAR	A hydrograph combine operation used to clear unneeded hydrographs from active memory.

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
201A	318	213	6-hour controls
201B	151	92	6-hour controls
201C	143	87	6-hour controls
201D	93	61	6-hour controls
201E	225	153	6-hour controls
202A	67	39	6-hour controls
202B	35	19	6-hour controls
202C	19	10	6-hour controls
202D	96	60	6-hour controls
202E	214	124	6-hour controls
202F	36	20	6-hour controls
202G	38	20	6-hour controls
202H	351	208	6-hour controls
202I	36	21	6-hour controls
203A	389	262	6-hour controls
203B	93	55	6-hour controls
203C	154	99	6-hour controls
203D	161	103	6-hour controls
203E	201	120	6-hour controls
203F	524	345	6-hour controls
203G	356	238	6-hour controls
203H	343	223	6-hour controls
203I	170	116	6-hour controls
203J	77	46	6-hour controls
203K	478	272	6-hour controls
204A	214	130	6-hour controls
204B	208	134	6-hour controls
204C	205	119	6-hour controls
204D	128	74	6-hour controls
204E	189	111	6-hour controls
204F	260	147	6-hour controls
205A	210	130	6-hour controls
205B	486	284	6-hour controls
205C	107	65	6-hour controls
205D	665	405	6-hour controls
205E	301	203	6-hour controls
205F	325	197	6-hour controls
205G	349	214	6-hour controls
205H	350	237	6-hour controls
205I	559	367	6-hour controls
205J	551	361	6-hour controls
205K	266	183	6-hour controls
205L	263	147	6-hour controls
205M	335	195	6-hour controls
205N	211	141	6-hour controls
206A	408	224	6-hour controls
206B	304	168	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
206C	45	26	6-hour controls
206D	195	110	6-hour controls
206E	45	25	6-hour controls
206F	259	159	6-hour controls
206G	112	75	6-hour controls
206H	153	89	6-hour controls
206I	67	37	6-hour controls
206J	200	111	6-hour controls
206K	103	62	6-hour controls
206L	123	73	6-hour controls
206M	198	109	6-hour controls
206N	458	259	6-hour controls
207A	382	254	6-hour controls
207B	306	202	6-hour controls
207C	321	197	6-hour controls
207D	349	219	6-hour controls
207E	180	123	6-hour controls
207F	213	135	6-hour controls
207G	294	201	6-hour controls
207H	188	122	6-hour controls
207I	109	70	6-hour controls
207J	162	102	6-hour controls
207K	283	171	6-hour controls
207L	203	119	6-hour controls
207M	270	158	6-hour controls
207N	109	64	6-hour controls
207O	330	183	6-hour controls
208A	331	189	6-hour controls
208B	45	27	6-hour controls
208C	127	76	6-hour controls
208D	118	74	6-hour controls
208E	107	66	6-hour controls
208F	133	80	6-hour controls
208G	244	153	6-hour controls
208H	72	44	6-hour controls
208I	213	131	6-hour controls
208J	106	70	6-hour controls
208K	106	60	6-hour controls
208L	101	61	6-hour controls
208M	249	162	6-hour controls
208N	86	54	6-hour controls
208O	386	249	6-hour controls
208P	145	84	6-hour controls
208Q	169	106	6-hour controls
208R	25	15	6-hour controls
208S	160	95	6-hour controls
208T	283	170	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
208U	379	209	6-hour controls
208V	71	41	6-hour controls
208W	122	71	6-hour controls
208X	206	115	6-hour controls
209A	792	478	6-hour controls
209B	156	94	6-hour controls
209C	105	65	6-hour controls
209D	563	327	6-hour controls
209E	238	153	6-hour controls
209F	360	233	6-hour controls
209G	337	219	6-hour controls
209H	203	115	6-hour controls
209I	481	270	6-hour controls
210A	294	164	6-hour controls
210B	172	110	6-hour controls
210C	165	95	6-hour controls
210D	301	180	6-hour controls
210E	62	37	6-hour controls
210F	184	110	6-hour controls
210G	293	185	6-hour controls
210H	163	94	6-hour controls
210I	94	58	6-hour controls
210J	213	130	6-hour controls
210K	207	117	6-hour controls
210L	255	153	6-hour controls
210M	286	178	6-hour controls
210N	130	66	6-hour controls
211A	283	173	6-hour controls
211AA	78	47	6-hour controls
211AB	135	74	6-hour controls
211AC	90	51	6-hour controls
211AD	132	76	6-hour controls
211AE	114	63	6-hour controls
211AF	177	96	6-hour controls
211B	249	147	6-hour controls
211C	134	77	6-hour controls
211D	159	89	6-hour controls
211E	507	279	6-hour controls
211F	332	190	6-hour controls
211G	18	11	6-hour controls
211H	181	103	6-hour controls
211I	78	47	6-hour controls
211J	37	22	6-hour controls
211K	302	169	6-hour controls
211L	301	162	6-hour controls
211M	203	117	6-hour controls
211N	51	30	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
211O	107	62	6-hour controls
211P	119	65	6-hour controls
211Q	56	32	6-hour controls
211R	200	118	6-hour controls
211S	125	73	6-hour controls
211T	162	95	6-hour controls
211U	56	34	6-hour controls
211V	16	9	6-hour controls
211W	105	58	6-hour controls
211X	503	304	6-hour controls
211Y	216	128	6-hour controls
211Z	249	137	6-hour controls
BB512R	30	0	6-hour controls
BB523R	19	0	6-hour controls
BB543R	210	122	6-hour controls
BB545R	51	31	6-hour controls
BB611R	151	126	6-hour controls
BB614R	39	24	6-hour controls
BB615R	18	11	6-hour controls
BB619L	171	0	6-hour controls
C501	446	298	6-hour controls
C502	622	419	6-hour controls
C502R	537	361	6-hour controls
C503I	769	543	6-hour controls
C503O	323	278	6-hour controls
C504I	62	39	6-hour controls
C504O	30	20	6-hour controls
C505I	32	19	6-hour controls
C506	34	15	6-hour controls
C507I	203	118	6-hour controls
C507O	203	118	6-hour controls
C508O	208	122	6-hour controls
C511O	263	201	6-hour controls
C512I	280	215	6-hour controls
C512O	102	14	6-hour controls
C513O	369	232	6-hour controls
C514	496	321	6-hour controls
C514R	388	251	6-hour controls
C515	609	405	6-hour controls
C517	1227	975	6-hour controls
C517L	741	516	6-hour controls
C517R	661	462	6-hour controls
C518	1331	1091	6-hour controls
C519	1406	1177	6-hour controls
C521	1407	1230	6-hour controls
C523I	386	248	6-hour controls
C523O	286	202	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
C524	282	228	6-hour controls
C525	358	249	6-hour controls
C526	523	343	6-hour controls
C527	665	426	6-hour controls
C528	690	411	6-hour controls
C529	917	596	6-hour controls
C530	1472	1064	6-hour controls
C530R	785	472	6-hour controls
C531	1639	1241	6-hour controls
C532	1970	1654	6-hour controls
C532L	1791	1420	6-hour controls
C533	2232	2000	6-hour controls
C534	2507	2390	6-hour controls
C534R	2392	2220	6-hour controls
C535	2520	2425	6-hour controls
C536I	2586	2520	6-hour controls
C536O	326	321	6-hour controls
C536R	2516	2443	6-hour controls
C537	344	348	24-hour control
C538I	463	489	24-hour control
C538O	434	446	24-hour control
C540	545	560	24-hour control
C540L	230	133	6-hour controls
C540R	452	459	24-hour control
C541	651	655	24-hour control
C543	210	122	6-hour controls
C544	102	62	6-hour controls
C546	171	102	6-hour controls
C547	525	335	6-hour controls
C548	1038	1038	6-hour controls
C548L	713	721	24-hour control
C548R	635	412	6-hour controls
C549	2880	3095	24-hour control
C549L	1128	1105	6-hour controls
C549R	2026	2112	24-hour control
C550	687	455	6-hour controls
C552	1244	951	6-hour controls
C552L	878	617	6-hour controls
C552R	518	339	6-hour controls
C553	1345	1057	6-hour controls
C555	285	187	6-hour controls
C556	1752	1505	6-hour controls
C556L	1513	1249	6-hour controls
C556R	385	260	6-hour controls
C557	1879	1647	6-hour controls
C557R	1833	1595	6-hour controls
C558	1918	1696	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
C560I	1989	1781	6-hour controls
C560O	287	275	6-hour controls
C560R	1953	1745	6-hour controls
C563	599	359	6-hour controls
C563L	240	148	6-hour controls
C563R	372	214	6-hour controls
C564	804	492	6-hour controls
C564R	684	417	6-hour controls
C565	938	598	6-hour controls
C566	313	198	6-hour controls
C567	478	305	6-hour controls
C567L	383	245	6-hour controls
C568	1428	1067	6-hour controls
C568L	961	625	6-hour controls
C568R	701	455	6-hour controls
C570	628	414	6-hour controls
C570R	467	310	6-hour controls
C572	647	427	6-hour controls
C573	1872	1532	6-hour controls
C573L	1460	1101	6-hour controls
C573R	772	514	6-hour controls
C574	643	372	6-hour controls
C575	704	411	6-hour controls
C576	803	475	6-hour controls
C577	2187	1879	6-hour controls
C578I	2231	1922	6-hour controls
C578O	381	319	6-hour controls
C580	1031	633	6-hour controls
C580R	889	541	6-hour controls
C581	1511	1085	6-hour controls
C581R	1368	935	6-hour controls
C582	1886	1521	6-hour controls
C582R	1698	1306	6-hour controls
C583	1928	1580	6-hour controls
C584I	1999	1683	6-hour controls
C584O	469	351	6-hour controls
C585	295	282	6-hour controls
C586O	162	108	6-hour controls
C587	401	375	6-hour controls
C590	819	502	6-hour controls
C590L	353	212	6-hour controls
C590R	472	293	6-hour controls
C591	1402	1193	6-hour controls
C593	972	593	6-hour controls
C594	1030	645	6-hour controls
C595	1205	1172	6-hour controls
C595L	468	436	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
C595R	1119	741	6-hour controls
C596	1268	1221	6-hour controls
C597	460	388	6-hour controls
C598	587	517	6-hour controls
C599I	1917	1967	24-hour control
C599O	954	966	24-hour control
C600O	266	171	6-hour controls
C601	462	300	6-hour controls
C602	635	418	6-hour controls
C602L	515	338	6-hour controls
C603	936	617	6-hour controls
C605O	115	89	6-hour controls
C606	206	146	6-hour controls
C606R	94	58	6-hour controls
C607	230	161	6-hour controls
C608	957	972	24-hour control
C608L	954	967	24-hour control
C609O	61	48	6-hour controls
C611I	299	188	6-hour controls
C611O	151	126	6-hour controls
C611R	241	142	6-hour controls
C612	119	64	6-hour controls
C613	956	972	24-hour control
C615	51	31	6-hour controls
C617	270	159	6-hour controls
C617L	255	149	6-hour controls
C618	398	239	6-hour controls
C618I	370	225	6-hour controls
C618O	367	220	6-hour controls
C619I	520	317	6-hour controls
C619L	503	307	6-hour controls
C619O	363	176	6-hour controls
C620	485	312	6-hour controls
C620R	335	187	6-hour controls
C621	1184	1152	6-hour controls
C621L	957	975	24-hour control
C622	1965	2053	24-hour control
C622L	1121	753	6-hour controls
C622R	1376	1384	24-hour control
C624	223	125	6-hour controls
C626	2983	3180	24-hour control
C626C	2895	3096	24-hour control
C626R	342	198	6-hour controls
C627	2996	3187	24-hour control
CLEAR	1646	1570	6-hour controls
CLEAR	1364	1278	6-hour controls
D503L	323	278	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
D503R	0	0	6-hour controls
D504L	22	20	6-hour controls
D504R	8	0	6-hour controls
D505L	14	13	6-hour controls
D505R	18	6	6-hour controls
D506L	0	0	6-hour controls
D506R	34	15	6-hour controls
D508L	135	56	6-hour controls
D508R	72	66	6-hour controls
D512L	72	14	6-hour controls
D512R	30	0	6-hour controls
D523L	266	202	6-hour controls
D523R	19	0	6-hour controls
D543L	0	0	6-hour controls
D543R	210	122	6-hour controls
D545L	51	31	6-hour controls
D545R	51	31	6-hour controls
D611L	0	0	6-hour controls
D611R	151	126	6-hour controls
D614L	16	10	6-hour controls
D614R	39	24	6-hour controls
D615L	33	21	6-hour controls
D615R	18	11	6-hour controls
D619L	171	0	6-hour controls
D619R	192	176	6-hour controls
501502	437	294	6-hour controls
502503	609	412	6-hour controls
503504	0	0	6-hour controls
508507	130	54	6-hour controls
511512	263	200	6-hour controls
513514	355	229	6-hour controls
515517	600	402	6-hour controls
516517	495	333	6-hour controls
517518	1211	967	6-hour controls
518519	1323	1087	6-hour controls
519591	1402	1174	6-hour controls
520591	76	45	6-hour controls
522523	201	126	6-hour controls
523524	263	201	6-hour controls
523548	16	0	6-hour controls
524525	280	228	6-hour controls
525526	355	248	6-hour controls
526527	517	340	6-hour controls
528530	680	408	6-hour controls
530531	1455	1056	6-hour controls
531532	1619	1230	6-hour controls
532533	1956	1649	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
533534	2189	1959	6-hour controls
534535	2495	2378	6-hour controls
535536	2496	2397	6-hour controls
536537	326	321	6-hour controls
537538	339	341	24-hour control
538540	433	438	24-hour control
539540	185	108	6-hour controls
540541	541	545	24-hour control
541548	649	654	24-hour control
542543	149	88	6-hour controls
543544	0	0	6-hour controls
543547	202	121	6-hour controls
544545	102	61	6-hour controls
545546	51	31	6-hour controls
545547	50	30	6-hour controls
546547	170	102	6-hour controls
547548	521	330	6-hour controls
548549	1028	1025	6-hour controls
549626	2865	3072	24-hour control
550552	675	450	6-hour controls
551552	341	216	6-hour controls
552553	1236	947	6-hour controls
553556	1338	1053	6-hour controls
554555	184	120	6-hour controls
555556	279	184	6-hour controls
556557	1744	1498	6-hour controls
557558	1871	1640	6-hour controls
558560	1908	1691	6-hour controls
559560	106	62	6-hour controls
560585	287	275	6-hour controls
561563	327	187	6-hour controls
562563	123	74	6-hour controls
563564	584	355	6-hour controls
564565	783	484	6-hour controls
565568	927	593	6-hour controls
566567	308	196	6-hour controls
567568	468	301	6-hour controls
568573	1420	1060	6-hour controls
569570	382	248	6-hour controls
571572	24	14	6-hour controls
572573	644	426	6-hour controls
574575	638	371	6-hour controls
575576	691	407	6-hour controls
576577	800	474	6-hour controls
577578	2184	1874	6-hour controls
578587	381	319	6-hour controls
579580	787	477	6-hour controls

Table F-3

Existing Condition
100-year Peak Discharges in HEC-1
In Numerical Order By Operation Type

HEC-1	Discharge, in cfs		
ID	6-hr	24-hr	Control
580581	1019	629	6-hour controls
581582	1488	1076	6-hour controls
582583	1867	1510	6-hour controls
583584	1903	1568	6-hour controls
584597	466	351	6-hour controls
586587	161	108	6-hour controls
587595	401	374	6-hour controls
588590	297	178	6-hour controls
589590	180	109	6-hour controls
591521	1390	1188	6-hour controls
592593	158	93	6-hour controls
593594	963	590	6-hour controls
594595	1007	635	6-hour controls
595596	1201	1167	6-hour controls
597598	458	387	6-hour controls
599608	954	966	24-hour control
600601	263	169	6-hour controls
601602	458	298	6-hour controls
602603	632	415	6-hour controls
603622	918	605	6-hour controls
604606	17	11	6-hour controls
606607	204	145	6-hour controls
607608	228	160	6-hour controls
608613	957	972	24-hour control
609611	61	48	6-hour controls
610611	200	116	6-hour controls
611612	0	0	6-hour controls
611620	151	126	6-hour controls
613621	956	972	24-hour control
614615	39	24	6-hour controls
615618	33	21	6-hour controls
615619	18	10	6-hour controls
616617	55	31	6-hour controls
617618	263	157	6-hour controls
618619	389	235	6-hour controls
619620	192	176	6-hour controls
619620	136	0	6-hour controls
620621	482	312	6-hour controls
621622	1175	1147	6-hour controls
622549	1954	2028	24-hour control
623624	133	73	6-hour controls
624626	215	124	6-hour controls
625626	76	46	6-hour controls
626627	2981	3176	24-hour control

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID	Drainage Area sm	100-year, 6-hour Excess inches	100-year, 6-hour Volume acre-feet	100-year, 24-hour Excess inches	100-year, 24-hour Volume acre-feet
(1)	(2)	(3)	(4)	(5)	(6)
201A	0.22	1.75	20.5	1.35	15.9
201B	0.08	1.73	7.4	1.34	5.7
201C	0.08	1.70	7.3	1.31	5.6
201D	0.07	1.73	6.4	1.34	5.0
201E	0.18	1.63	15.7	1.24	11.9
202A	0.04	1.63	3.5	1.36	2.9
202B	0.02	1.55	1.7	1.19	1.3
202C	0.01	1.61	0.9	1.35	0.7
202D	0.06	1.79	5.7	1.48	4.7
202E	0.10	1.69	9.0	1.30	6.9
202F	0.01	1.71	0.9	1.34	0.7
202G	0.01	1.73	0.9	1.37	0.7
202H	0.18	1.63	15.7	1.24	11.9
202I	0.02	1.80	1.9	1.52	1.6
203A	0.28	1.78	26.6	1.44	21.5
203B	0.04	1.80	3.8	1.48	3.1
203C	0.10	1.85	9.9	1.58	8.4
203D	0.11	1.70	10.0	1.31	7.7
203E	0.09	1.86	8.9	1.46	7.0
203F	0.33	1.70	29.9	1.30	22.9
203G	0.25	1.72	22.9	1.33	17.7
203H	0.21	1.73	19.3	1.33	14.9
203I	0.17	1.63	14.8	1.23	11.2
203J	0.04	1.94	4.1	1.71	3.6
203K	0.16	2.47	21.1	2.57	21.9
204A	0.11	1.74	10.2	1.35	7.9
204B	0.13	1.70	11.8	1.31	9.1
204C	0.08	2.15	9.2	2.07	8.8
204D	0.04	2.44	5.2	2.54	5.4
204E	0.07	2.42	9.0	2.48	9.3
204F	0.08	2.69	11.5	2.87	12.3
205A	0.12	2.08	13.3	2.18	13.9
205B	0.21	2.08	23.3	2.17	24.3
205C	0.06	2.08	6.6	2.18	7.0
205D	0.32	2.08	35.5	2.17	37.0
205E	0.22	2.08	24.4	2.17	25.5
205F	0.16	2.07	17.7	2.17	18.5
205G	0.19	2.01	20.3	2.05	20.8
205H	0.26	2.02	28.0	2.07	28.7
205I	0.35	1.84	34.3	1.65	30.7
205J	0.37	1.64	32.4	1.30	25.7
205K	0.25	1.71	22.8	1.34	17.8
205L	0.12	1.60	10.2	1.21	7.7
205M	0.14	2.07	15.5	1.94	14.5
205N	0.16	1.71	14.6	1.33	11.4
206A	0.13	2.28	15.8	2.29	15.9
206B	0.09	2.44	11.7	2.54	12.2

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID	Drainage Area sm	100-year, 6-hour Excess inches	100-year, 6-hour Volume acre-feet	100-year, 24-hour Excess inches	100-year, 24-hour Volume acre-feet
(1)	(2)	(3)	(4)	(5)	(6)
206C	0.02	1.72	1.8	1.53	1.6
206D	0.06	2.49	8.0	2.59	8.3
206E	0.02	1.50	1.6	1.18	1.3
206F	0.16	1.61	13.7	1.31	11.2
206G	0.09	1.88	9.0	1.64	7.9
206H	0.06	2.22	7.1	2.14	6.9
206I	0.02	2.36	2.5	2.41	2.6
206J	0.06	2.55	8.1	2.69	8.6
206K	0.06	1.80	5.8	1.48	4.7
206L	0.06	1.93	6.2	1.73	5.5
206M	0.06	2.52	8.1	2.69	8.6
206N	0.15	2.53	20.2	2.78	22.2
207A	0.26	2.01	27.9	2.03	28.1
207B	0.21	2.05	23.0	2.11	23.6
207C	0.17	1.85	16.7	1.63	14.8
207D	0.20	2.08	22.2	2.17	23.2
207E	0.16	2.06	17.6	2.16	18.4
207F	0.13	2.05	14.2	2.13	14.8
207G	0.24	1.80	23.0	1.51	19.3
207H	0.12	2.08	13.3	2.18	13.9
207I	0.07	2.08	7.8	2.18	8.1
207J	0.09	2.15	10.3	2.26	10.8
207K	0.13	2.23	15.5	2.24	15.5
207L	0.08	2.29	9.8	2.25	9.6
207M	0.12	1.79	11.5	1.46	9.4
207N	0.05	1.94	5.2	1.84	4.9
207O	0.13	1.81	12.6	1.54	10.6
208A	0.14	2.08	15.5	2.18	16.2
208B	0.03	2.07	3.3	2.18	3.5
208C	0.07	2.09	7.8	2.18	8.1
208D	0.08	2.06	8.8	2.17	9.2
208E	0.06	2.08	6.6	2.18	7.0
208F	0.07	2.07	7.7	2.17	8.1
208G	0.13	2.14	14.8	2.20	15.2
208H	0.04	1.81	3.9	1.53	3.3
208I	0.12	2.06	13.2	2.16	13.8
208J	0.08	2.06	8.8	2.17	9.2
208K	0.05	2.06	5.5	2.16	5.8
208L	0.06	2.05	6.6	2.16	6.9
208M	0.16	2.07	17.6	2.17	18.6
208N	0.05	2.29	6.1	2.33	6.2
208O	0.23	2.08	25.5	2.14	26.3
208P	0.06	2.13	6.8	2.10	6.7
208Q	0.09	2.13	10.2	2.14	10.3
208R	0.01	2.16	1.2	2.10	1.1
208S	0.07	2.35	8.8	2.45	9.1
208T	0.13	2.10	14.6	2.09	14.5

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID	Drainage Area sm	100-year, 6-hour Excess inches	100-year, 6-hour Volume acre-feet	100-year, 24-hour Excess inches	100-year, 24-hour Volume acre-feet
(1)	(2)	(3)	(4)	(5)	(6)
208U	0.13	2.10	14.6	2.08	14.4
208V	0.03	2.15	3.4	2.09	3.3
208W	0.05	2.09	5.6	2.00	5.3
208X	0.08	2.05	8.8	1.96	8.4
209A	0.37	2.08	41.0	2.17	42.8
209B	0.08	2.08	8.9	2.18	9.3
209C	0.06	2.09	6.7	2.18	7.0
209D	0.24	2.06	26.4	2.16	27.6
209E	0.15	2.08	16.6	2.18	17.4
209F	0.23	2.01	24.7	2.05	25.1
209G	0.20	2.08	22.2	2.17	23.2
209H	0.08	1.94	8.3	1.78	7.6
209I	0.18	1.83	17.5	1.51	14.5
210A	0.12	1.72	11.0	1.40	8.9
210B	0.11	1.87	10.9	1.60	9.4
210C	0.08	1.68	7.2	1.40	6.0
210D	0.14	2.00	14.9	1.85	13.8
210E	0.03	1.86	3.0	1.47	2.4
210F	0.09	2.08	10.0	2.17	10.4
210G	0.16	2.03	17.3	1.94	16.6
210H	0.07	1.82	6.8	1.52	5.7
210I	0.05	1.96	5.2	1.56	4.2
210J	0.10	1.82	9.7	1.43	7.6
210K	0.08	1.81	7.7	1.43	6.1
210L	0.14	1.60	11.9	1.21	9.0
210M	0.16	1.71	14.6	1.32	11.3
210N	0.05	1.57	4.2	1.39	3.7
211A	0.14	1.93	14.4	1.71	12.8
211AA	0.03	2.52	4.0	2.59	4.1
211AB	0.04	2.31	4.9	2.18	4.7
211AC	0.03	2.75	4.4	3.00	4.8
211AD	0.04	2.70	5.8	2.89	6.2
211AE	0.03	2.49	4.0	2.55	4.1
211AF	0.05	2.28	6.1	2.22	5.9
211B	0.11	1.93	11.3	1.70	10.0
211C	0.04	2.55	5.4	2.69	5.7
211D	0.07	1.96	7.3	1.97	7.3
211E	0.16	2.43	20.7	2.55	21.8
211F	0.11	2.68	15.7	3.07	18.0
211G	0.01	3.15	1.7	3.92	2.1
211H	0.07	1.80	6.7	1.46	5.4
211I	0.04	2.28	4.9	2.33	5.0
211J	0.01	2.27	1.2	2.29	1.2
211K	0.10	2.02	10.8	1.87	9.9
211L	0.10	2.25	12.0	2.33	12.4
211M	0.08	2.19	9.3	2.18	9.3
211N	0.02	2.05	2.2	1.92	2.0

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID	Drainage Area sm	100-year, 6-hour Excess inches	100-year, 6-hour Volume acre-feet	100-year, 24-hour Excess inches	100-year, 24-hour Volume acre-feet
(1)	(2)	(3)	(4)	(5)	(6)
211O	0.04	2.27	4.8	2.32	4.9
211P	0.03	2.69	4.3	2.88	4.6
211Q	0.02	1.88	2.0	1.60	1.7
211R	0.08	2.08	8.9	1.97	8.4
211S	0.05	2.16	5.8	2.10	5.6
211T	0.07	2.07	7.7	1.95	7.3
211U	0.03	2.82	4.5	3.25	5.2
211V	0.00	3.16	0.0	3.92	0.0
211W	0.03	2.88	4.6	3.36	5.4
211X	0.21	2.38	26.7	2.53	28.3
211Y	0.09	2.16	10.4	1.96	9.4
211Z	0.08	2.22	9.5	2.24	9.6
BB512R	0.20	0.09	0.9	0.00	0.0
BB523R	0.23	0.03	0.4	0.00	0.0
BB543R	0.08	2.25	9.6	2.21	9.4
BB545R	0.14	0.37	2.8	0.30	2.3
BB611R	0.14	2.13	15.9	2.12	15.8
BB614R	0.03	1.89	3.0	2.05	3.3
BB615R	0.03	0.62	1.0	0.46	0.7
BB619L	0.25	0.16	2.1	0.00	0.0
C501	0.30	1.74	27.8	1.35	21.5
C502	0.45	1.73	41.4	1.33	32.0
C502R	0.38	1.73	35.0	1.34	27.1
C503I	0.63	1.66	55.7	1.30	43.7
C503O	0.63	1.68	56.3	1.32	44.2
C504I	0.67	0.09	3.2	0.08	2.7
C504O	0.67	0.09	3.2	0.08	2.7
C505I	0.69	0.05	1.7	0.03	1.1
C506	0.69	0.03	1.2	0.02	0.7
C507I	0.86	0.22	10.1	0.16	7.4
C507O	0.86	0.22	10.1	0.16	7.4
C508O	0.10	1.69	9.0	1.30	6.9
C511O	0.18	1.63	15.7	1.24	11.9
C512I	0.20	1.64	17.5	1.26	13.4
C512O	0.20	0.66	7.0	0.27	2.9
C513O	0.28	1.76	26.3	1.42	21.2
C514	0.43	1.78	40.9	1.46	33.4
C514R	0.32	1.77	30.1	1.42	24.3
C515	0.53	1.76	49.6	1.42	40.2
C517	1.21	1.61	103.6	1.37	88.2
C517L	0.58	1.68	52.0	1.31	40.5
C517R	0.63	1.74	58.6	1.43	47.9
C518	1.41	1.58	118.7	1.36	102.1
C519	1.59	1.55	131.0	1.34	113.8
C521	1.99	1.43	151.6	1.31	138.6
C523I	0.23	1.72	21.0	1.33	16.3
C523O	0.23	1.72	21.0	1.33	16.3

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID	Drainage Area sm	100-year, 6-hour Excess inches	100-year, 6-hour Volume acre-feet	100-year, 24-hour Excess inches	100-year, 24-hour Volume acre-feet
(1)	(2)	(3)	(4)	(5)	(6)
C524	0.31	1.80	29.7	1.51	24.9
C525	0.35	1.88	35.0	1.63	30.5
C526	0.43	1.96	45.0	1.77	40.6
C527	0.50	2.07	55.3	1.94	51.6
C528	0.33	2.08	36.6	2.17	38.2
C529	0.54	2.07	59.5	2.16	62.3
C530	0.93	1.99	98.8	2.16	107.1
C530R	0.39	2.08	43.2	2.17	45.0
C531	1.09	1.97	114.3	2.16	125.4
C532	1.53	1.90	155.0	2.12	173.2
C532L	1.27	1.93	131.0	2.14	144.9
C533	1.89	1.83	184.0	2.03	204.6
C534	2.50	1.69	225.1	1.85	246.7
C534R	2.25	1.73	207.6	1.91	229.0
C535	2.62	1.66	232.5	1.82	254.3
C536I	2.91	1.64	255.1	1.80	278.7
C536O	2.91	1.64	255.1	1.80	278.7
C536R	2.76	1.67	245.2	1.82	268.5
C537	3.04	1.66	268.3	1.82	294.3
C538I	3.14	1.67	279.2	1.84	307.5
C538O	3.14	1.67	279.2	1.84	307.5
C540	3.24	1.67	288.2	1.84	318.3
C540L	0.09	2.22	10.7	2.21	10.6
C540R	3.16	1.66	280.4	1.83	309.1
C541	3.40	1.64	297.6	1.82	329.5
C543	0.08	2.25	9.6	2.21	9.4
C544	0.14	0.74	5.5	0.61	4.5
C546	0.20	0.85	9.0	0.74	7.9
C547	0.26	2.11	29.2	2.01	27.8
C548	4.04	1.54	332.7	1.73	373.0
C548L	3.72	1.52	302.4	1.70	337.1
C548R	0.32	2.18	37.3	2.13	36.4
C549	13.06	1.49	1037.8	1.80	1255.8
C549L	4.19	1.56	349.5	1.77	394.9
C549R	8.87	1.61	759.7	1.91	903.1
C550	0.46	2.03	49.7	2.06	50.5
C552	0.99	1.91	100.8	2.01	106.2
C552L	0.64	1.94	66.2	1.94	66.1
C552R	0.35	2.07	38.6	2.16	40.3
C553	1.12	1.90	113.3	2.02	120.8
C555	0.20	2.08	22.2	2.17	23.2
C556	1.64	1.82	159.5	1.97	172.5
C556L	1.35	1.83	131.6	1.93	138.9
C556R	0.29	2.10	32.5	2.19	33.9
C557	1.85	1.84	181.5	2.00	197.2
C557R	1.77	1.83	173.0	1.99	187.8
C558	1.97	1.82	190.9	1.97	206.6

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID	Drainage Area sm	100-year, 6-hour Excess inches	100-year, 6-hour Volume acre-feet	100-year, 24-hour Excess inches	100-year, 24-hour Volume acre-feet
(1)	(2)	(3)	(4)	(5)	(6)
C560I	2.15	1.79	205.1	1.93	221.8
C560O	2.15	1.79	205.1	1.93	221.8
C560R	2.10	1.79	200.9	1.94	216.9
C563	0.31	2.07	34.3	2.16	35.8
C563L	0.14	2.07	15.5	2.17	16.2
C563R	0.17	2.08	18.8	2.17	19.7
C564	0.44	2.07	48.6	2.16	50.7
C564R	0.37	2.07	40.8	2.16	42.7
C565	0.57	2.07	62.8	2.16	65.8
C566	0.20	2.06	22.0	2.16	23.0
C567	0.31	2.05	33.9	2.15	35.6
C567L	0.25	2.06	27.4	2.16	28.7
C568	1.07	1.95	111.5	2.13	121.4
C568L	0.61	2.04	66.2	2.12	68.9
C568R	0.46	2.06	50.4	2.15	52.8
C570	0.38	2.10	42.5	2.13	43.1
C570R	0.29	2.09	32.3	2.13	32.9
C572	0.39	2.10	43.6	2.13	44.2
C573	1.58	1.93	162.7	2.14	180.3
C573L	1.12	1.96	117.0	2.14	127.5
C573R	0.46	2.13	52.3	2.17	53.2
C574	0.27	2.10	30.2	2.08	30.0
C575	0.29	2.10	32.5	2.08	32.2
C576	0.34	2.10	38.1	2.06	37.4
C577	1.92	1.91	195.4	2.12	217.4
C578I	2.00	1.90	202.8	2.12	225.7
C578O	2.00	1.90	202.8	2.12	225.6
C580	0.51	2.07	56.4	2.17	58.9
C580R	0.43	2.08	47.6	2.17	49.7
C581	0.91	1.99	96.5	2.16	104.6
C581R	0.76	2.01	81.6	2.16	87.4
C582	1.34	1.92	137.5	2.13	152.5
C582R	1.13	1.94	117.2	2.13	128.4
C583	1.42	1.91	144.4	2.11	159.9
C584I	1.60	1.86	159.0	2.04	174.1
C584O	1.60	1.86	159.0	2.04	174.1
C585	2.27	1.76	213.4	1.90	230.4
C586O	0.11	1.87	10.9	1.60	9.4
C587	2.11	1.88	211.7	2.09	235.0
C590	0.42	2.01	45.1	1.92	43.0
C590L	0.17	1.97	17.9	1.78	16.2
C590R	0.25	2.04	27.2	2.02	26.9
C591	1.83	1.37	133.2	1.20	116.9
C593	0.49	1.98	51.8	1.86	48.6
C594	0.54	1.97	56.7	1.83	52.7
C595	2.83	1.80	271.7	1.99	300.2
C595L	2.19	1.86	217.1	2.06	240.7

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID (1)	Drainage Area sm (2)	100-year, 6-hour Excess inches (3)	100-year, 6-hour Volume acre-feet (4)	100-year, 24-hour Excess inches (5)	100-year, 24-hour Volume acre-feet (6)
C595R	0.64	1.92	65.5	1.77	60.2
C596	2.91	1.79	277.8	1.97	306.2
C597	1.74	1.81	168.2	1.97	183.1
C598	1.90	1.77	179.8	1.92	194.2
C599I	7.13	1.59	605.8	1.89	717.2
C599O	7.13	1.59	605.8	1.89	717.2
C600O	0.14	1.93	14.4	1.71	12.8
C601	0.25	1.92	25.7	1.70	22.7
C602	0.37	2.00	39.5	1.86	36.7
C602L	0.30	2.01	32.2	1.84	29.5
C603	0.52	2.12	58.8	2.06	57.2
C605O	0.07	1.75	6.5	1.41	5.3
C606	0.12	2.01	12.9	1.87	12.0
C606R	0.05	2.42	6.4	2.59	6.9
C607	0.14	2.04	15.2	1.92	14.3
C608	7.37	1.59	624.6	1.88	739.0
C608L	7.24	1.59	614.3	1.88	727.1
C609O	0.04	2.27	4.8	2.32	4.9
C611I	0.14	2.19	16.3	2.17	16.2
C611O	0.14	2.13	15.9	2.12	15.8
C611R	0.10	2.16	11.5	2.12	11.3
C612	0.17	0.51	4.6	0.54	4.9
C613	7.55	1.56	627.8	1.85	743.3
C615	0.03	2.22	3.6	2.50	4.0
C617	0.13	1.81	12.5	1.74	12.1
C617L	0.10	2.04	10.9	1.89	10.1
C618	0.19	2.07	21.0	2.04	20.6
C618I	0.18	1.90	18.3	1.84	17.6
C618O	0.18	1.90	18.2	1.79	17.2
C619I	0.25	2.19	29.2	2.11	28.1
C619L	0.26	2.07	28.6	2.01	27.8
C619O	0.25	2.19	29.1	2.11	28.1
C620	0.42	2.22	49.8	2.20	49.3
C620R	0.28	2.26	33.7	2.24	33.4
C621	7.93	1.60	675.4	1.89	799.8
C621L	7.64	1.56	636.1	1.85	753.8
C622	8.78	1.61	753.0	1.91	895.3
C622L	0.63	2.20	73.8	2.24	75.1
C622R	8.14	1.60	695.9	1.90	825.7
C624	0.07	2.48	9.3	2.51	9.4
C626	13.28	1.50	1059.6	1.81	1282.0
C626C	13.14	1.49	1044.2	1.80	1264.2
C626R	0.11	2.56	15.0	2.65	15.5
C627	13.32	1.50	1063.5	1.81	1286.5
CLEAR	3.58	1.07	204.1	1.06	201.8
CLEAR	3.07	0.96	157.7	0.92	150.0
D503L	0.63	1.68	56.3	1.32	44.2

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID	Drainage Area sm	100-year, 6-hour Excess inches	100-year, 6-hour Volume acre-feet	100-year, 24-hour Excess inches	100-year, 24-hour Volume acre-feet
(1)	(2)	(3)	(4)	(5)	(6)
D503R	0.63	0.00	0.0	0.00	0.0
D504L	0.67	0.08	2.9	0.08	2.7
D504R	0.67	0.01	0.3	0.00	0.0
D505L	0.69	0.03	1.1	0.03	1.0
D505R	0.69	0.02	0.6	0.00	0.1
D506L	0.69	0.00	0.0	0.00	0.0
D506R	0.69	0.03	1.2	0.02	0.7
D508L	0.10	0.70	3.7	0.33	1.7
D508R	0.10	0.99	5.3	0.97	5.2
D512L	0.20	0.57	6.1	0.27	2.9
D512R	0.20	0.09	0.9	0.00	0.0
D523L	0.23	1.69	20.7	1.33	16.3
D523R	0.23	0.03	0.4	0.00	0.0
D543L	0.08	0.00	0.0	0.00	0.0
D543R	0.08	2.25	9.6	2.21	9.4
D545L	0.14	0.37	2.8	0.30	2.3
D545R	0.14	0.37	2.8	0.30	2.3
D611L	0.14	0.00	0.0	0.00	0.0
D611R	0.14	2.13	15.9	2.12	15.8
D614L	0.03	0.93	1.5	1.20	1.9
D614R	0.03	1.89	3.0	2.05	3.3
D615L	0.03	1.60	2.6	2.03	3.3
D615R	0.03	0.62	1.0	0.46	0.7
D619L	0.25	0.16	2.1	0.00	0.0
D619R	0.25	2.03	27.1	2.11	28.1
501502	0.30	1.74	27.8	1.35	21.5
502503	0.45	1.73	41.4	1.33	32.0
503504	0.63	0.00	0.0	0.00	0.0
508507	0.10	0.70	3.7	0.33	1.7
511512	0.18	1.63	15.7	1.24	11.9
513514	0.28	1.76	26.3	1.42	21.2
515517	0.53	1.76	49.6	1.42	40.2
516517	0.33	1.70	29.9	1.30	22.9
517518	1.21	1.61	103.6	1.37	88.2
518519	1.41	1.58	118.7	1.36	102.1
519591	1.59	1.55	131.0	1.34	113.8
520591	0.04	1.94	4.1	1.71	3.6
522523	0.11	1.74	10.2	1.35	7.9
523524	0.23	1.69	20.7	1.33	16.3
523548	0.23	0.03	0.4	0.00	0.0
524525	0.31	1.80	29.7	1.51	24.9
525526	0.35	1.88	35.0	1.63	30.5
526527	0.43	1.96	45.0	1.77	40.6
528530	0.33	2.08	36.6	2.17	38.2
530531	0.93	1.99	98.8	2.16	107.1
531532	1.09	1.97	114.3	2.16	125.4
532533	1.53	1.90	155.0	2.12	173.2

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID (1)	Drainage Area sm (2)	100-year, 6-hour Excess inches (3)	100-year, 6-hour Volume acre-feet (4)	100-year, 24-hour Excess inches (5)	100-year, 24-hour Volume acre-feet (6)
533534	1.89	1.83	184.0	2.03	204.6
534535	2.50	1.69	225.1	1.85	246.7
535536	2.62	1.66	232.5	1.82	254.3
536537	2.91	1.64	255.1	1.80	278.7
537538	3.04	1.66	268.3	1.82	294.3
538540	3.14	1.67	279.2	1.84	307.5
539540	0.06	2.49	8.0	2.59	8.3
540541	3.24	1.67	288.2	1.84	318.3
541548	3.40	1.64	297.6	1.82	329.5
542543	0.06	2.22	7.1	2.14	6.9
543544	0.08	0.00	0.0	0.00	0.0
543547	0.08	2.25	9.6	2.21	9.4
544545	0.14	0.74	5.5	0.61	4.5
545546	0.14	0.37	2.8	0.30	2.3
545547	0.14	0.37	2.8	0.30	2.3
546547	0.20	0.85	9.0	0.74	7.9
547548	0.26	2.11	29.2	2.01	27.8
548549	4.04	1.54	332.5	1.73	373.0
549626	13.06	1.49	1037.8	1.80	1255.8
550552	0.46	2.03	49.7	2.06	50.5
551552	0.20	2.08	22.2	2.17	23.2
552553	0.99	1.91	100.8	2.01	106.2
553556	1.12	1.90	113.3	2.02	120.8
554555	0.12	2.08	13.3	2.18	13.9
555556	0.20	2.08	22.2	2.17	23.2
556557	1.64	1.82	159.5	1.97	172.5
557558	1.85	1.84	181.5	2.00	197.2
558560	1.97	1.82	190.9	1.97	206.6
559560	0.05	1.94	5.2	1.84	4.9
560585	2.15	1.79	205.1	1.93	221.8
561563	0.14	2.08	15.5	2.18	16.2
562563	0.07	2.09	7.8	2.18	8.1
563564	0.31	2.07	34.3	2.16	35.8
564565	0.44	2.07	48.6	2.16	50.7
565568	0.57	2.07	62.8	2.16	65.8
566567	0.20	2.06	22.0	2.16	23.0
567568	0.31	2.05	33.9	2.15	35.6
568573	1.07	1.95	111.5	2.13	121.4
569570	0.23	2.08	25.5	2.14	26.3
571572	0.01	2.16	1.2	2.10	1.1
572573	0.39	2.10	43.6	2.13	44.2
574575	0.27	2.10	30.2	2.08	30.0
575576	0.29	2.10	32.5	2.08	32.2
576577	0.34	2.10	38.1	2.06	37.4
577578	1.92	1.91	195.4	2.12	217.4
578587	2.00	1.90	202.8	2.12	225.6
579580	0.37	2.08	41.0	2.17	42.8

Table F-4

Summary of 100-year, 6-hour and 24-hour Runoff Volumes

HEC-1 ID (1)	Drainage Area sm (2)	100-year, 6-hour Excess inches (3)	100-year, 6-hour Volume acre-feet (4)	100-year, 24-hour Excess inches (5)	100-year, 24-hour Volume acre-feet (6)
580581	0.51	2.07	56.4	2.17	58.9
581582	0.91	1.99	96.5	2.16	104.6
582583	1.34	1.92	137.5	2.13	152.5
583584	1.42	1.91	144.4	2.11	159.9
584597	1.60	1.86	159.0	2.04	174.1
586587	0.11	1.87	10.9	1.60	9.4
587595	2.11	1.88	211.7	2.09	235.0
588590	0.14	2.00	14.9	1.85	13.8
589590	0.09	2.08	10.0	2.17	10.4
591521	1.83	1.36	132.7	1.20	116.9
592593	0.07	1.82	6.8	1.52	5.7
593594	0.49	1.98	51.8	1.86	48.6
594595	0.54	1.97	56.7	1.83	52.7
595596	2.83	1.80	271.7	1.99	300.2
597598	1.74	1.81	168.2	1.97	183.1
599608	7.13	1.59	605.8	1.89	717.2
600601	0.14	1.93	14.4	1.71	12.8
601602	0.25	1.92	25.7	1.70	22.7
602603	0.37	2.00	39.5	1.86	36.7
603622	0.52	2.12	58.8	2.06	57.2
604606	0.01	3.15	1.7	3.92	2.1
606607	0.12	2.01	12.9	1.87	12.0
607608	0.14	2.04	15.2	1.92	14.3
608613	7.37	1.59	624.6	1.88	739.0
609611	0.04	2.27	4.8	2.32	4.9
610611	0.08	2.19	9.3	2.18	9.3
611612	0.14	0.00	0.0	0.00	0.0
611620	0.14	2.13	15.9	2.12	15.8
613621	7.55	1.56	627.8	1.85	743.3
614615	0.03	1.89	3.0	2.05	3.3
615618	0.03	1.60	2.6	2.03	3.3
615619	0.03	0.62	1.0	0.46	0.7
616617	0.02	1.88	2.0	1.60	1.7
617618	0.13	1.81	12.5	1.74	12.1
618619	0.19	2.07	20.9	2.03	20.6
619620	0.25	2.03	27.1	2.11	28.1
619620	0.25	0.16	2.1	0.00	0.0
620621	0.42	2.22	49.8	2.20	49.3
621622	7.93	1.60	675.0	1.89	799.8
622549	8.78	1.61	752.0	1.91	894.9
623624	0.04	2.31	4.9	2.18	4.7
624626	0.07	2.48	9.3	2.51	9.4
625626	0.03	2.52	4.0	2.59	4.1
626627	13.28	1.50	1059.6	1.81	1282.0

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
201A	318	4.30	0.22	1445
201B	151	4.20	0.08	1888
C501	446	4.27	0.30	1487
501502	437	4.38	0.30	1457
201C	143	4.20	0.08	1788
C502R	537	4.37	0.38	1413
201D	93	4.27	0.07	1329
C502	622	4.35	0.45	1382
502503	609	4.48	0.45	1353
201E	225	4.33	0.18	1250
C503I	769	4.47	0.63	1221
C503O	323	5.02	0.63	513
D503L	323	5.02	0.63	513
D503R	0	0.02	0.63	0
503504	0	0.02	0.63	0
202A	67	4.18	0.04	1675
C504I	62	4.18	0.67	93
C504O	30	4.48	0.67	45
D504L	22	4.43	0.67	33
D504R	8	4.48	0.67	12
202B	35	4.12	0.02	1750
C505I	32	4.12	0.69	46
D505L	14	4.12	0.69	20
D505R	18	4.12	0.69	26
202C	19	4.08	0.01	1900
C506	34	4.10	0.69	49
D506L	0	0.02	0.69	0
D506R	34	4.10	0.69	49
202D	96	4.22	0.06	1600
202E	214	4.17	0.10	2140
C508O	208	4.20	0.10	2080
D508R	72	4.20	0.10	720
D508L	135	4.20	0.10	1350
508507	130	4.28	0.10	1300
C507I	203	4.27	0.86	236
C507O	203	4.27	0.86	236
202F	36	4.07	0.01	3600
202G	38	4.07	0.01	3800
202H	351	4.20	0.18	1950
C511O	263	4.33	0.18	1461
511512	263	4.37	0.18	1461
202I	36	4.10	0.02	1800
C512I	280	4.35	0.20	1400
C512O	102	4.77	0.20	510
D512R	30	4.77	0.20	150

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
201A	318	4.30	0.22	1445
201B	151	4.20	0.08	1888
201C	143	4.20	0.08	1788
201D	93	4.27	0.07	1329
201E	225	4.33	0.18	1250
202A	67	4.18	0.04	1675
202B	35	4.12	0.02	1750
202C	19	4.08	0.01	1900
202D	96	4.22	0.06	1600
202E	214	4.17	0.10	2140
202F	36	4.07	0.01	3600
202G	38	4.07	0.01	3800
202H	351	4.20	0.18	1950
202I	36	4.10	0.02	1800
203A	389	4.27	0.28	1389
203B	93	4.10	0.04	2325
203C	154	4.20	0.10	1540
203D	161	4.23	0.11	1464
203E	201	4.18	0.09	2233
203F	524	4.28	0.33	1588
203G	356	4.30	0.25	1424
203H	343	4.27	0.21	1633
203I	170	4.37	0.17	1000
203J	77	4.12	0.04	1925
203K	478	4.05	0.16	2988
204A	214	4.20	0.11	1945
204B	208	4.27	0.13	1600
204C	205	4.08	0.08	2563
204D	128	4.05	0.04	3200
204E	189	4.07	0.07	2700
204F	260	4.02	0.08	3250
205A	210	4.22	0.12	1750
205B	486	4.18	0.21	2314
205C	107	4.20	0.06	1783
205D	665	4.23	0.32	2078
205E	301	4.33	0.22	1368
205F	325	4.22	0.16	2031
205G	349	4.23	0.19	1837
205H	350	4.35	0.26	1346
205I	559	4.30	0.35	1597
205J	551	4.28	0.37	1489
205K	266	4.38	0.25	1064
205L	263	4.15	0.12	2192
205M	335	4.10	0.14	2393
205N	211	4.25	0.16	1319

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
D512L	72	4.77	0.20	360
203A	389	4.27	0.28	1389
C513O	369	4.35	0.28	1318
513514	355	4.47	0.28	1268
203B	93	4.10	0.04	2325
C514R	388	4.45	0.32	1213
203C	154	4.20	0.10	1540
C514	496	4.43	0.43	1153
203D	161	4.23	0.11	1464
C515	609	4.42	0.53	1149
515517	600	4.52	0.53	1132
203E	201	4.18	0.09	2233
C517R	661	4.48	0.63	1049
203F	524	4.28	0.33	1588
516517	495	4.52	0.33	1500
203G	356	4.30	0.25	1424
C517L	741	4.50	0.58	1278
C517	1227	4.50	1.21	1014
517518	1211	4.63	1.21	1001
203H	343	4.27	0.21	1633
C518	1331	4.62	1.41	944
518519	1323	4.65	1.41	938
203I	170	4.37	0.17	1000
C519	1406	4.65	1.59	884
519591	1402	4.68	1.59	882
203J	77	4.12	0.04	1925
520591	76	4.17	0.04	1900
BB512R	30	4.77	0.20	150
C591	1402	4.68	1.83	766
591521	1390	4.72	1.83	760
203K	478	4.05	0.16	2988
C521	1407	4.70	1.99	707
CLEAR	1364	4.70	3.07	444
204A	214	4.20	0.11	1945
522523	201	4.37	0.11	1827
204B	208	4.27	0.13	1600
C523I	386	4.33	0.23	1678
C523O	286	4.52	0.23	1243
D523R	19	4.52	0.23	83
D523L	266	4.52	0.23	1157
523524	263	4.60	0.23	1143
204C	205	4.08	0.08	2563
C524	282	4.58	0.31	910
524525	280	4.60	0.31	903
204D	128	4.05	0.04	3200

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
206A	408	4.03	0.13	3138
206B	304	4.03	0.09	3378
206C	45	4.10	0.02	2250
206D	195	4.03	0.06	3250
206E	45	4.08	0.02	2250
206F	259	4.17	0.16	1619
206G	112	4.27	0.09	1244
206H	153	4.07	0.06	2550
206I	67	4.03	0.02	3350
206J	200	4.02	0.06	3333
206K	103	4.13	0.06	1717
206L	123	4.12	0.06	2050
206M	198	4.02	0.06	3300
206N	458	4.05	0.15	3053
207A	382	4.30	0.26	1469
207B	306	4.30	0.21	1457
207C	321	4.22	0.17	1888
207D	349	4.25	0.20	1745
207E	180	4.37	0.16	1125
207F	213	4.20	0.13	1638
207G	294	4.35	0.24	1225
207H	188	4.27	0.12	1567
207I	109	4.25	0.07	1557
207J	162	4.18	0.09	1800
207K	283	4.13	0.13	2177
207L	203	4.07	0.08	2538
207M	270	4.10	0.12	2250
207N	109	4.10	0.05	2180
207O	330	4.13	0.13	2538
208A	331	4.15	0.14	2364
208B	45	4.18	0.03	1500
208C	127	4.18	0.07	1814
208D	118	4.23	0.08	1475
208E	107	4.22	0.06	1783
208F	133	4.18	0.07	1900
208G	244	4.17	0.13	1877
208H	72	4.18	0.04	1800
208I	213	4.22	0.12	1775
208J	106	4.28	0.08	1325
208K	106	4.15	0.05	2120
208L	101	4.20	0.06	1683
208M	249	4.28	0.16	1556
208N	86	4.20	0.05	1720
208O	386	4.27	0.23	1678
208P	145	4.13	0.06	2417

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C525	358	4.12	0.35	1023
525526	355	4.15	0.35	1014
204E	189	4.07	0.07	2700
C526	523	4.10	0.43	1216
526527	517	4.17	0.43	1202
204F	260	4.02	0.08	3250
C527	665	4.12	0.50	1330
CLEAR	1646	4.67	3.58	460
205A	210	4.22	0.12	1750
205B	486	4.18	0.21	2314
C528	690	4.20	0.33	2091
528530	680	4.23	0.33	2061
205C	107	4.20	0.06	1783
C530R	785	4.22	0.39	2013
205D	665	4.23	0.32	2078
205E	301	4.33	0.22	1368
C529	917	4.25	0.54	1698
C530	1472	4.23	0.93	1583
530531	1455	4.28	0.93	1565
205F	325	4.22	0.16	2031
C531	1639	4.27	1.09	1504
531532	1619	4.33	1.09	1485
205G	349	4.23	0.19	1837
C532L	1791	4.32	1.27	1410
205H	350	4.35	0.26	1346
C532	1970	4.33	1.53	1288
532533	1956	4.35	1.53	1278
205I	559	4.30	0.35	1597
C533	2232	4.35	1.89	1181
533534	2189	4.52	1.89	1158
205J	551	4.28	0.37	1489
C534R	2392	4.50	2.25	1063
205K	266	4.38	0.25	1064
C534	2507	4.52	2.50	1003
534535	2495	4.55	2.50	998
205L	263	4.15	0.12	2192
C535	2520	4.55	2.62	962
535536	2496	4.68	2.62	953
205M	335	4.10	0.14	2393
C536R	2516	4.67	2.76	912
205N	211	4.25	0.16	1319
C536I	2586	4.67	2.91	889
C536O	326	6.03	2.91	112
536537	326	6.08	2.91	112
206A	408	4.03	0.13	3138

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
208Q	169	4.22	0.09	1878
208R	25	4.10	0.01	2500
208S	160	4.15	0.07	2286
208T	283	4.18	0.13	2177
208U	379	4.12	0.13	2915
208V	71	4.12	0.03	2367
208W	122	4.13	0.05	2440
208X	206	4.12	0.08	2575
209A	792	4.22	0.37	2141
209B	156	4.20	0.08	1950
209C	105	4.22	0.06	1750
209D	563	4.18	0.24	2346
209E	238	4.27	0.15	1587
209F	360	4.28	0.23	1565
209G	337	4.28	0.20	1685
209H	203	4.13	0.08	2538
209I	481	4.13	0.18	2672
210A	294	4.13	0.12	2450
210B	172	4.18	0.11	1564
210C	165	4.17	0.08	2063
210D	301	4.18	0.14	2150
210E	62	4.15	0.03	2067
210F	184	4.20	0.09	2044
210G	293	4.23	0.16	1831
210H	163	4.13	0.07	2329
210I	94	4.17	0.05	1880
210J	213	4.18	0.10	2130
210K	207	4.12	0.08	2588
210L	255	4.15	0.14	1821
210M	286	4.22	0.16	1788
210N	130	4.08	0.05	2600
211A	283	4.15	0.14	2021
211AA	78	4.08	0.03	2600
211AB	135	4.02	0.04	3375
211AC	90	4.02	0.03	3000
211AD	132	4.03	0.04	3300
211AE	114	4.02	0.03	3800
211AF	177	4.02	0.05	3540
211B	249	4.12	0.11	2264
211C	134	4.03	0.04	3350
211D	159	4.07	0.07	2271
211E	507	4.03	0.16	3169
211F	332	4.05	0.11	3018
211G	18	4.05	0.01	1800
211H	181	4.13	0.07	2586

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C537	344	4.28	3.04	113
537538	339	4.33	3.04	112
206B	304	4.03	0.09	3378
C538I	463	4.08	3.14	147
C538O	434	4.28	3.14	138
538540	433	4.37	3.14	138
206C	45	4.10	0.02	2250
C540R	452	4.35	3.16	143
206D	195	4.03	0.06	3250
539540	185	4.10	0.06	3083
206E	45	4.08	0.02	2250
C540L	230	4.10	0.09	2556
C540	545	4.30	3.24	168
540541	541	4.50	3.24	167
206F	259	4.17	0.16	1619
C541	651	4.43	3.40	191
541548	649	4.45	3.40	191
206G	112	4.27	0.09	1244
BB523R	19	4.52	0.23	83
523548	16	4.77	0.23	70
C548L	713	4.45	3.72	192
206H	153	4.07	0.06	2550
542543	149	4.08	0.06	2483
206I	67	4.03	0.02	3350
C543	210	4.07	0.08	2625
D543R	210	4.07	0.08	2625
D543L	0	0.02	0.08	0
543544	0	0.02	0.08	0
206K	103	4.13	0.06	1717
C544	102	4.13	0.14	729
544545	102	4.17	0.14	729
D545R	51	4.17	0.14	364
D545L	51	4.17	0.14	364
545546	51	4.18	0.14	364
206L	123	4.12	0.06	2050
C546	171	4.15	0.20	855
546547	170	4.17	0.20	850
BB543R	210	4.07	0.08	2625
543547	202	4.15	0.08	2525
BB545R	51	4.17	0.14	364
545547	50	4.23	0.14	357
206J	200	4.02	0.06	3333
C547	525	4.10	0.26	2019
547548	521	4.17	0.26	2004
206M	198	4.02	0.06	3300

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
211I	78	4.17	0.04	1950
211J	37	4.08	0.01	3700
211K	302	4.05	0.10	3020
211L	301	4.03	0.10	3010
211M	203	4.13	0.08	2538
211N	51	4.07	0.02	2550
211O	107	4.07	0.04	2675
211P	119	4.00	0.03	3967
211Q	56	4.05	0.02	2800
211R	200	4.10	0.08	2500
211S	125	4.08	0.05	2500
211T	162	4.08	0.07	2314
211U	56	4.07	0.03	1867
211V	16	4.02	0.00	ERR
211W	105	4.02	0.03	3500
211X	503	4.12	0.21	2395
211Y	216	4.10	0.09	2400
211Z	249	4.03	0.08	3113
BB512R	30	4.77	0.20	150
BB523R	19	4.52	0.23	83
BB543R	210	4.07	0.08	2625
BB545R	51	4.17	0.14	364
BB611R	151	4.45	0.14	1079
BB614R	39	4.07	0.03	1300
BB615R	18	4.08	0.03	600
BB619L	171	4.40	0.25	684
C501	446	4.27	0.30	1487
C502	622	4.35	0.45	1382
C502R	537	4.37	0.38	1413
C503I	769	4.47	0.63	1221
C503O	323	5.02	0.63	513
C504I	62	4.18	0.67	93
C504O	30	4.48	0.67	45
C505I	32	4.12	0.69	46
C506	34	4.10	0.69	49
C507I	203	4.27	0.86	236
C507O	203	4.27	0.86	236
C508O	208	4.20	0.10	2080
C511O	263	4.33	0.18	1461
C512I	280	4.35	0.20	1400
C512O	102	4.77	0.20	510
C513O	369	4.35	0.28	1318
C514	496	4.43	0.43	1153
C514R	388	4.45	0.32	1213
C515	609	4.42	0.53	1149

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C548R	635	4.12	0.32	1984
C548	1038	4.30	4.04	257
548549	1028	4.45	4.04	254
206N	458	4.05	0.15	3053
C549L	1128	4.40	4.19	269
207A	382	4.30	0.26	1469
207B	306	4.30	0.21	1457
C550	687	4.30	0.46	1493
550552	675	4.37	0.46	1467
207C	321	4.22	0.17	1888
C552L	878	4.35	0.64	1372
207D	349	4.25	0.20	1745
551552	341	4.33	0.20	1705
207E	180	4.37	0.16	1125
C552R	518	4.33	0.35	1480
C552	1244	4.35	0.99	1257
552553	1236	4.38	0.99	1248
207F	213	4.20	0.13	1638
C553	1345	4.37	1.12	1201
553556	1338	4.42	1.12	1195
207G	294	4.35	0.24	1225
C556L	1513	4.40	1.35	1121
207H	188	4.27	0.12	1567
554555	184	4.33	0.12	1533
207I	109	4.25	0.07	1557
C555	285	4.32	0.20	1425
555556	279	4.45	0.20	1395
207J	162	4.18	0.09	1800
C556R	385	4.40	0.29	1328
C556	1752	4.42	1.64	1068
556557	1744	4.47	1.64	1063
207K	283	4.13	0.13	2177
C557R	1833	4.45	1.77	1036
207L	203	4.07	0.08	2538
C557	1879	4.43	1.85	1016
557558	1871	4.50	1.85	1011
207M	270	4.10	0.12	2250
C558	1918	4.48	1.97	974
558560	1908	4.52	1.97	969
207O	330	4.13	0.13	2538
C560R	1953	4.52	2.10	930
207N	109	4.10	0.05	2180
559560	106	4.22	0.05	2120
C560I	1989	4.50	2.15	925
C560O	287	5.93	2.15	133

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C517	1227	4.50	1.21	1014
C517L	741	4.50	0.58	1278
C517R	661	4.48	0.63	1049
C518	1331	4.62	1.41	944
C519	1406	4.65	1.59	884
C521	1407	4.70	1.99	707
C523I	386	4.33	0.23	1678
C523O	286	4.52	0.23	1243
C524	282	4.58	0.31	910
C525	358	4.12	0.35	1023
C526	523	4.10	0.43	1216
C527	665	4.12	0.50	1330
C528	690	4.20	0.33	2091
C529	917	4.25	0.54	1698
C530	1472	4.23	0.93	1583
C530R	785	4.22	0.39	2013
C531	1639	4.27	1.09	1504
C532	1970	4.33	1.53	1288
C532L	1791	4.32	1.27	1410
C533	2232	4.35	1.89	1181
C534	2507	4.52	2.50	1003
C534R	2392	4.50	2.25	1063
C535	2520	4.55	2.62	962
C536I	2586	4.67	2.91	889
C536O	326	6.03	2.91	112
C536R	2516	4.67	2.76	912
C537	344	4.28	3.04	113
C538I	463	4.08	3.14	147
C538O	434	4.28	3.14	138
C540	545	4.30	3.24	168
C540L	230	4.10	0.09	2556
C540R	452	4.35	3.16	143
C541	651	4.43	3.40	191
C543	210	4.07	0.08	2625
C544	102	4.13	0.14	729
C546	171	4.15	0.20	855
C547	525	4.10	0.26	2019
C548	1038	4.30	4.04	257
C548L	713	4.45	3.72	192
C548R	635	4.12	0.32	1984
C549	2880	4.43	13.06	221
C549L	1128	4.40	4.19	269
C549R	2026	4.42	8.87	228
C550	687	4.30	0.46	1493
C552	1244	4.35	0.99	1257

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
560585	287	6.03	2.15	133
210A	294	4.13	0.12	2450
C585	295	4.18	2.27	130
208A	331	4.15	0.14	2364
561563	327	4.20	0.14	2336
208B	45	4.18	0.03	1500
C563R	372	4.18	0.17	2188
208C	127	4.18	0.07	1814
562563	123	4.25	0.07	1757
208D	118	4.23	0.08	1475
C563L	240	4.25	0.14	1714
C563	599	4.22	0.31	1932
563564	584	4.27	0.31	1884
208E	107	4.22	0.06	1783
C564R	684	4.27	0.37	1849
208F	133	4.18	0.07	1900
C564	804	4.25	0.44	1827
564565	783	4.35	0.44	1780
208G	244	4.17	0.13	1877
C565	938	4.33	0.57	1646
565568	927	4.38	0.57	1626
208H	72	4.18	0.04	1800
C568L	961	4.38	0.61	1575
208I	213	4.22	0.12	1775
208J	106	4.28	0.08	1325
C566	313	4.23	0.20	1565
566567	308	4.30	0.20	1540
208K	106	4.15	0.05	2120
C567L	383	4.27	0.25	1532
208L	101	4.20	0.06	1683
C567	478	4.25	0.31	1542
567568	468	4.35	0.31	1510
208M	249	4.28	0.16	1556
C568R	701	4.33	0.46	1524
C568	1428	4.37	1.07	1335
568573	1420	4.43	1.07	1327
208N	86	4.20	0.05	1720
C573L	1460	4.43	1.12	1304
208O	386	4.27	0.23	1678
569570	382	4.30	0.23	1661
208P	145	4.13	0.06	2417
C570R	467	4.28	0.29	1610
208Q	169	4.22	0.09	1878
C570	628	4.25	0.38	1653
208R	25	4.10	0.01	2500

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C552L	878	4.35	0.64	1372
C552R	518	4.33	0.35	1480
C553	1345	4.37	1.12	1201
C555	285	4.32	0.20	1425
C556	1752	4.42	1.64	1068
C556L	1513	4.40	1.35	1121
C556R	385	4.40	0.29	1328
C557	1879	4.43	1.85	1016
C557R	1833	4.45	1.77	1036
C558	1918	4.48	1.97	974
C560I	1989	4.50	2.15	925
C560O	287	5.93	2.15	133
C560R	1953	4.52	2.10	930
C563	599	4.22	0.31	1932
C563L	240	4.25	0.14	1714
C563R	372	4.18	0.17	2188
C564	804	4.25	0.44	1827
C564R	684	4.27	0.37	1849
C565	938	4.33	0.57	1646
C566	313	4.23	0.20	1565
C567	478	4.25	0.31	1542
C567L	383	4.27	0.25	1532
C568	1428	4.37	1.07	1335
C568L	961	4.38	0.61	1575
C568R	701	4.33	0.46	1524
C570	628	4.25	0.38	1653
C570R	467	4.28	0.29	1610
C572	647	4.25	0.39	1659
C573	1872	4.40	1.58	1185
C573L	1460	4.43	1.12	1304
C573R	772	4.23	0.46	1678
C574	643	4.13	0.27	2381
C575	704	4.15	0.29	2428
C576	803	4.17	0.34	2362
C577	2187	4.37	1.92	1139
C578I	2231	4.38	2.00	1116
C578O	381	5.15	2.00	191
C580	1031	4.23	0.51	2022
C580R	889	4.25	0.43	2067
C581	1511	4.25	0.91	1660
C581R	1368	4.23	0.76	1800
C582	1886	4.30	1.34	1407
C582R	1698	4.30	1.13	1503
C583	1928	4.33	1.42	1358
C584I	1999	4.40	1.60	1249

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
571572	24	4.15	0.01	2400
C572	647	4.25	0.39	1659
572573	644	4.27	0.39	1651
208S	160	4.15	0.07	2286
C573R	772	4.23	0.46	1678
C573	1872	4.40	1.58	1185
208T	283	4.18	0.13	2177
208U	379	4.12	0.13	2915
C574	643	4.13	0.27	2381
574575	638	4.15	0.27	2363
208V	71	4.12	0.03	2367
C575	704	4.15	0.29	2428
575576	691	4.18	0.29	2383
208W	122	4.13	0.05	2440
C576	803	4.17	0.34	2362
576577	800	4.18	0.34	2353
C577	2187	4.37	1.92	1139
577578	2184	4.40	1.92	1138
208X	206	4.12	0.08	2575
C578I	2231	4.38	2.00	1116
C578O	381	5.15	2.00	191
578587	381	5.20	2.00	191
210B	172	4.18	0.11	1564
C586O	162	4.27	0.11	1473
586587	161	4.32	0.11	1464
C587	401	4.47	2.11	190
587595	401	4.50	2.11	190
210C	165	4.17	0.08	2063
C595L	468	4.40	2.19	214
210D	301	4.18	0.14	2150
588590	297	4.22	0.14	2121
210E	62	4.15	0.03	2067
C590L	353	4.20	0.17	2076
210F	184	4.20	0.09	2044
589590	180	4.23	0.09	2000
210G	293	4.23	0.16	1831
C590R	472	4.23	0.25	1888
C590	819	4.22	0.42	1950
210H	163	4.13	0.07	2329
592593	158	4.18	0.07	2257
C593	972	4.22	0.49	1984
593594	963	4.25	0.49	1965
210I	94	4.17	0.05	1880
C594	1030	4.23	0.54	1907
594595	1007	4.33	0.54	1865

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C584O	469	4.95	1.60	293
C585	295	4.18	2.27	130
C586O	162	4.27	0.11	1473
C587	401	4.47	2.11	190
C590	819	4.22	0.42	1950
C590L	353	4.20	0.17	2076
C590R	472	4.23	0.25	1888
C591	1402	4.68	1.83	766
C593	972	4.22	0.49	1984
C594	1030	4.23	0.54	1907
C595	1205	4.35	2.83	426
C595L	468	4.40	2.19	214
C595R	1119	4.32	0.64	1748
C596	1268	4.38	2.91	436
C597	460	5.07	1.74	264
C598	587	4.37	1.90	309
C599I	1917	4.40	7.13	269
C599O	954	6.13	7.13	134
C600O	266	4.22	0.14	1900
C601	462	4.18	0.25	1848
C602	635	4.15	0.37	1716
C602L	515	4.20	0.30	1717
C603	936	4.07	0.52	1800
C605O	115	4.27	0.07	1643
C606	206	4.20	0.12	1717
C606R	94	4.18	0.05	1880
C607	230	4.22	0.14	1643
C608	957	6.12	7.37	130
C608L	954	6.13	7.24	132
C609O	61	4.25	0.04	1525
C611I	299	4.17	0.14	2136
C611O	151	4.45	0.14	1079
C611R	241	4.15	0.10	2410
C612	119	4.00	0.17	700
C613	956	6.15	7.55	127
C615	51	4.08	0.03	1700
C617	270	4.10	0.13	2077
C617L	255	4.10	0.10	2550
C618	398	4.17	0.19	2095
C618I	370	4.15	0.18	2056
C618O	367	4.17	0.18	2039
C619I	520	4.22	0.25	2080
C619L	503	4.22	0.26	1935
C619O	363	4.40	0.25	1452
C620	485	4.43	0.42	1155

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
210J	213	4.18	0.10	2130
C595R	1119	4.32	0.64	1748
C595	1205	4.35	2.83	426
595596	1201	4.40	2.83	424
210K	207	4.12	0.08	2588
C596	1268	4.38	2.91	436
209A	792	4.22	0.37	2141
579580	787	4.25	0.37	2127
209C	105	4.22	0.06	1750
C580R	889	4.25	0.43	2067
209B	156	4.20	0.08	1950
C580	1031	4.23	0.51	2022
580581	1019	4.28	0.51	1998
209D	563	4.18	0.24	2346
C581R	1368	4.23	0.76	1800
209E	238	4.27	0.15	1587
C581	1511	4.25	0.91	1660
581582	1488	4.30	0.91	1635
209F	360	4.28	0.23	1565
C582R	1698	4.30	1.13	1503
209G	337	4.28	0.20	1685
C582	1886	4.30	1.34	1407
582583	1867	4.33	1.34	1393
209H	203	4.13	0.08	2538
C583	1928	4.33	1.42	1358
583584	1903	4.40	1.42	1340
209I	481	4.13	0.18	2672
C584I	1999	4.40	1.60	1249
C584O	469	4.95	1.60	293
584597	466	5.08	1.60	291
210L	255	4.15	0.14	1821
C597	460	5.07	1.74	264
597598	458	5.15	1.74	263
210M	286	4.22	0.16	1788
C598	587	4.37	1.90	309
210N	130	4.08	0.05	2600
C599I	1917	4.40	7.13	269
C599O	954	6.13	7.13	134
599608	954	6.18	7.13	134
211K	302	4.05	0.10	3020
C608L	954	6.13	7.24	132
211G	18	4.05	0.01	1800
604606	17	4.23	0.01	1700
211I	78	4.17	0.04	1950
C606R	94	4.18	0.05	1880

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C620R	335	4.43	0.28	1196
C621	1184	4.30	7.93	149
C621L	957	6.07	7.64	125
C622	1965	4.33	8.78	224
C622L	1121	4.13	0.63	1779
C622R	1376	4.37	8.14	169
C624	223	4.03	0.07	3186
C626	2983	4.50	13.28	225
C626C	2895	4.52	13.14	220
C626R	342	4.05	0.11	3109
C627	2996	4.52	13.32	225
CLEAR	1646	4.67	3.58	460
CLEAR	1364	4.70	3.07	444
D503L	323	5.02	0.63	513
D503R	0	0.02	0.63	0
D504L	22	4.43	0.67	33
D504R	8	4.48	0.67	12
D505L	14	4.12	0.69	20
D505R	18	4.12	0.69	26
D506L	0	0.02	0.69	0
D506R	34	4.10	0.69	49
D508L	135	4.20	0.10	1350
D508R	72	4.20	0.10	720
D512L	72	4.77	0.20	360
D512R	30	4.77	0.20	150
D523L	266	4.52	0.23	1157
D523R	19	4.52	0.23	83
D543L	0	0.02	0.08	0
D543R	210	4.07	0.08	2625
D545L	51	4.17	0.14	364
D545R	51	4.17	0.14	364
D611L	0	0.02	0.14	0
D611R	151	4.45	0.14	1079
D614L	16	4.07	0.03	533
D614R	39	4.07	0.03	1300
D615L	33	4.08	0.03	1100
D615R	18	4.08	0.03	600
D619L	171	4.40	0.25	684
D619R	192	4.40	0.25	768
501502	437	4.38	0.30	1457
502503	609	4.48	0.45	1353
503504	0	0.02	0.63	0
508507	130	4.28	0.10	1300
511512	263	4.37	0.18	1461
513514	355	4.47	0.28	1268

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
211H	181	4.13	0.07	2586
C605O	115	4.27	0.07	1643
C606	206	4.20	0.12	1717
606607	204	4.23	0.12	1700
211J	37	4.08	0.01	3700
C607	230	4.22	0.14	1643
607608	228	4.25	0.14	1629
C608	957	6.12	7.37	130
608613	957	6.17	7.37	130
211M	203	4.13	0.08	2538
610611	200	4.17	0.08	2500
211N	51	4.07	0.02	2550
C611R	241	4.15	0.10	2410
211O	107	4.07	0.04	2675
C609O	61	4.25	0.04	1525
609611	61	4.28	0.04	1525
C611I	299	4.17	0.14	2136
C611O	151	4.45	0.14	1079
D611R	151	4.45	0.14	1079
D611L	0	0.02	0.14	0
611612	0	0.02	0.14	0
211P	119	4.00	0.03	3967
C612	119	4.00	0.17	700
C613	956	6.15	7.55	127
613621	956	6.17	7.55	127
211L	301	4.03	0.10	3010
C621L	957	6.07	7.64	125
211Q	56	4.05	0.02	2800
616617	55	4.12	0.02	2750
211R	200	4.10	0.08	2500
C617L	255	4.10	0.10	2550
211U	56	4.07	0.03	1867
D614R	39	4.07	0.03	1300
D614L	16	4.07	0.03	533
C617	270	4.10	0.13	2077
617618	263	4.18	0.13	2023
211S	125	4.08	0.05	2500
C618I	370	4.15	0.18	2056
C618O	367	4.17	0.18	2039
BB614R	39	4.07	0.03	1300
614615	39	4.12	0.03	1300
211V	16	4.02	0.00	ERR
C615	51	4.08	0.03	1700
D615R	18	4.08	0.03	600
D615L	33	4.08	0.03	1100

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
515517	600	4.52	0.53	1132
516517	495	4.52	0.33	1500
517518	1211	4.63	1.21	1001
518519	1323	4.65	1.41	938
519591	1402	4.68	1.59	882
520591	76	4.17	0.04	1900
522523	201	4.37	0.11	1827
523524	263	4.60	0.23	1143
523548	16	4.77	0.23	70
524525	280	4.60	0.31	903
525526	355	4.15	0.35	1014
526527	517	4.17	0.43	1202
528530	680	4.23	0.33	2061
530531	1455	4.28	0.93	1565
531532	1619	4.33	1.09	1485
532533	1956	4.35	1.53	1278
533534	2189	4.52	1.89	1158
534535	2495	4.55	2.50	998
535536	2496	4.68	2.62	953
536537	326	6.08	2.91	112
537538	339	4.33	3.04	112
538540	433	4.37	3.14	138
539540	185	4.10	0.06	3083
540541	541	4.50	3.24	167
541548	649	4.45	3.40	191
542543	149	4.08	0.06	2483
543544	0	0.02	0.08	0
543547	202	4.15	0.08	2525
544545	102	4.17	0.14	729
545546	51	4.18	0.14	364
545547	50	4.23	0.14	357
546547	170	4.17	0.20	850
547548	521	4.17	0.26	2004
548549	1028	4.45	4.04	254
549626	2865	4.52	13.06	219
550552	675	4.37	0.46	1467
551552	341	4.33	0.20	1705
552553	1236	4.38	0.99	1248
553556	1338	4.42	1.12	1195
554555	184	4.33	0.12	1533
555556	279	4.45	0.20	1395
556557	1744	4.47	1.64	1063
557558	1871	4.50	1.85	1011
558560	1908	4.52	1.97	969
559560	106	4.22	0.05	2120

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
615618	33	4.08	0.03	1100
C618	398	4.17	0.19	2095
618619	389	4.25	0.19	2047
211T	162	4.08	0.07	2314
C619L	503	4.22	0.26	1935
BB615R	18	4.08	0.03	600
615619	18	4.17	0.03	600
C619I	520	4.22	0.25	2080
C619O	363	4.40	0.25	1452
D619L	171	4.40	0.25	684
D619R	192	4.40	0.25	768
619620	192	4.42	0.25	768
BB619L	171	4.40	0.25	684
619620	136	4.45	0.25	544
211W	105	4.02	0.03	3500
C620R	335	4.43	0.28	1196
BB611R	151	4.45	0.14	1079
611620	151	4.47	0.14	1079
C620	485	4.43	0.42	1155
620621	482	4.47	0.42	1148
C621	1184	4.30	7.93	149
621622	1175	4.40	7.93	148
211X	503	4.12	0.21	2395
C622R	1376	4.37	8.14	169
211A	283	4.15	0.14	2021
C600O	266	4.22	0.14	1900
600601	263	4.28	0.14	1879
211B	249	4.12	0.11	2264
C601	462	4.18	0.25	1848
601602	458	4.23	0.25	1832
211C	134	4.03	0.04	3350
C602L	515	4.20	0.30	1717
211D	159	4.07	0.07	2271
C602	635	4.15	0.37	1716
602603	632	4.22	0.37	1708
211E	507	4.03	0.16	3169
C603	936	4.07	0.52	1800
603622	918	4.15	0.52	1765
211F	332	4.05	0.11	3018
C622L	1121	4.13	0.63	1779
C622	1965	4.33	8.78	224
622549	1954	4.43	8.78	223
211Y	216	4.10	0.09	2400
C549R	2026	4.42	8.87	228
C549	2880	4.43	13.06	221

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
560585	287	6.03	2.15	133
561563	327	4.20	0.14	2336
562563	123	4.25	0.07	1757
563564	584	4.27	0.31	1884
564565	783	4.35	0.44	1780
565568	927	4.38	0.57	1626
566567	308	4.30	0.20	1540
567568	468	4.35	0.31	1510
568573	1420	4.43	1.07	1327
569570	382	4.30	0.23	1661
571572	24	4.15	0.01	2400
572573	644	4.27	0.39	1651
574575	638	4.15	0.27	2363
575576	691	4.18	0.29	2383
576577	800	4.18	0.34	2353
577578	2184	4.40	1.92	1138
578587	381	5.20	2.00	191
579580	787	4.25	0.37	2127
580581	1019	4.28	0.51	1998
581582	1488	4.30	0.91	1635
582583	1867	4.33	1.34	1393
583584	1903	4.40	1.42	1340
584597	466	5.08	1.60	291
586587	161	4.32	0.11	1464
587595	401	4.50	2.11	190
588590	297	4.22	0.14	2121
589590	180	4.23	0.09	2000
591521	1390	4.72	1.83	760
592593	158	4.18	0.07	2257
593594	963	4.25	0.49	1965
594595	1007	4.33	0.54	1865
595596	1201	4.40	2.83	424
597598	458	5.15	1.74	263
599608	954	6.18	7.13	134
600601	263	4.28	0.14	1879
601602	458	4.23	0.25	1832
602603	632	4.22	0.37	1708
603622	918	4.15	0.52	1765
604606	17	4.23	0.01	1700
606607	204	4.23	0.12	1700
607608	228	4.25	0.14	1629
608613	957	6.17	7.37	130
609611	61	4.28	0.04	1525
610611	200	4.17	0.08	2500
611612	0	0.02	0.14	0

Table F-1
100-year, 6-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
549626	2865	4.52	13.06	219
211Z	249	4.03	0.08	3113
C626C	2895	4.52	13.14	220
211AA	78	4.08	0.03	2600
625626	76	4.13	0.03	2533
211AB	135	4.02	0.04	3375
623624	133	4.03	0.04	3325
211AC	90	4.02	0.03	3000
C624	223	4.03	0.07	3186
624626	215	4.07	0.07	3071
211AD	132	4.03	0.04	3300
C626R	342	4.05	0.11	3109
C626	2983	4.50	13.28	225
626627	2981	4.52	13.28	224
211AE	114	4.02	0.03	3800
C627	2996	4.52	13.32	225
211AF	177	4.02	0.05	3540

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
611620	151	4.47	0.14	1079
613621	956	6.17	7.55	127
614615	39	4.12	0.03	1300
615618	33	4.08	0.03	1100
615619	18	4.17	0.03	600
616617	55	4.12	0.02	2750
617618	263	4.18	0.13	2023
618619	389	4.25	0.19	2047
619620	192	4.42	0.25	768
619620	136	4.45	0.25	544
620621	482	4.47	0.42	1148
621622	1175	4.40	7.93	148
622549	1954	4.43	8.78	223
623624	133	4.03	0.04	3325
624626	215	4.07	0.07	3071
625626	76	4.13	0.03	2533
626627	2981	4.52	13.28	224

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
201A	213	12.30	0.22	968
201B	92	12.20	0.08	1150
C501	298	12.25	0.30	993
501502	294	12.38	0.30	980
201C	87	12.22	0.08	1088
C502R	361	12.35	0.38	950
201D	61	12.27	0.07	871
C502	419	12.33	0.45	931
502503	412	12.48	0.45	916
201E	153	12.32	0.18	850
C503I	543	12.45	0.63	862
C503O	278	12.95	0.63	441
D503L	278	12.95	0.63	441
D503R	0	0.02	0.63	0
503504	0	0.02	0.63	0
202A	39	12.20	0.04	975
C504I	39	12.20	0.67	58
C504O	20	12.52	0.67	30
D504L	20	12.52	0.67	30
D504R	0	12.52	0.67	0
202B	19	12.13	0.02	950
C505I	19	12.13	0.69	28
D505L	13	12.13	0.69	19
D505R	6	12.13	0.69	9
202C	10	12.08	0.01	1000
C506	15	12.12	0.69	22
D506L	0	0.02	0.69	0
D506R	15	12.12	0.69	22
202D	60	12.23	0.06	1000
202E	124	12.18	0.10	1240
C508O	122	12.22	0.10	1220
D508R	66	12.22	0.10	660
D508L	56	12.22	0.10	560
508507	54	12.32	0.10	540
C507I	118	12.27	0.86	137
C507O	118	12.27	0.86	137
202F	20	12.07	0.01	2000
202G	20	12.05	0.01	2000
202H	208	12.22	0.18	1156
C511O	201	12.27	0.18	1117
511512	200	12.30	0.18	1111
202I	21	12.08	0.02	1050
C512I	215	12.27	0.20	1075
C512O	14	13.33	0.20	70
D512R	0	13.32	0.20	0

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
201A	213	12.30	0.22	968
201B	92	12.20	0.08	1150
201C	87	12.22	0.08	1088
201D	61	12.27	0.07	871
201E	153	12.32	0.18	850
202A	39	12.20	0.04	975
202B	19	12.13	0.02	950
202C	10	12.08	0.01	1000
202D	60	12.23	0.06	1000
202E	124	12.18	0.10	1240
202F	20	12.07	0.01	2000
202G	20	12.05	0.01	2000
202H	208	12.22	0.18	1156
202I	21	12.08	0.02	1050
203A	262	12.22	0.28	936
203B	55	12.10	0.04	1375
203C	99	12.18	0.10	990
203D	103	12.25	0.11	936
203E	120	12.18	0.09	1333
203F	345	12.28	0.33	1045
203G	238	12.30	0.25	952
203H	223	12.27	0.21	1062
203I	116	12.32	0.17	682
203J	46	12.12	0.04	1150
203K	272	12.03	0.16	1700
204A	130	12.20	0.11	1182
204B	134	12.25	0.13	1031
204C	119	12.07	0.08	1488
204D	74	12.03	0.04	1850
204E	111	12.07	0.07	1586
204F	147	12.02	0.08	1838
205A	130	12.23	0.12	1083
205B	284	12.18	0.21	1352
205C	65	12.22	0.06	1083
205D	405	12.22	0.32	1266
205E	203	12.32	0.22	923
205F	197	12.22	0.16	1231
205G	214	12.23	0.19	1126
205H	237	12.33	0.26	912
205I	367	12.28	0.35	1049
205J	361	12.28	0.37	976
205K	183	12.37	0.25	732
205L	147	12.17	0.12	1225
205M	195	12.08	0.14	1393
205N	141	12.22	0.16	881

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
D512L	14	13.33	0.20	70
203A	262	12.22	0.28	936
C513O	232	12.38	0.28	829
513514	229	12.50	0.28	818
203B	55	12.10	0.04	1375
C514R	251	12.48	0.32	784
203C	99	12.18	0.10	990
C514	321	12.43	0.43	747
203D	103	12.25	0.11	936
C515	405	12.37	0.53	764
515517	402	12.52	0.53	758
203E	120	12.18	0.09	1333
C517R	462	12.47	0.63	733
203F	345	12.28	0.33	1045
516517	333	12.52	0.33	1009
203G	238	12.30	0.25	952
C517L	516	12.45	0.58	890
C517	975	12.45	1.21	806
517518	967	12.58	1.21	799
203H	223	12.27	0.21	1062
C518	1091	12.55	1.41	774
518519	1087	12.60	1.41	771
203I	116	12.32	0.17	682
C519	1177	12.60	1.59	740
519591	1174	12.63	1.59	738
203J	46	12.12	0.04	1150
520591	45	12.20	0.04	1125
BB512R	0	13.32	0.20	0
C591	1193	12.63	1.83	652
591521	1188	12.65	1.83	649
203K	272	12.03	0.16	1700
C521	1230	12.65	1.99	618
CLEAR	1278	12.63	3.07	416
204A	130	12.20	0.11	1182
522523	126	12.40	0.11	1145
204B	134	12.25	0.13	1031
C523I	248	12.30	0.23	1078
C523O	202	12.50	0.23	878
D523R	0	0.02	0.23	0
D523L	202	12.50	0.23	878
523524	201	12.57	0.23	874
204C	119	12.07	0.08	1488
C524	228	12.50	0.31	735
524525	228	12.55	0.31	735
204D	74	12.03	0.04	1850

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
206A	224	12.02	0.13	1723
206B	168	12.02	0.09	1867
206C	26	12.10	0.02	1300
206D	110	12.02	0.06	1833
206E	25	12.08	0.02	1250
206F	159	12.15	0.16	994
206G	75	12.23	0.09	833
206H	89	12.07	0.06	1483
206I	37	12.02	0.02	1850
206J	111	12.02	0.06	1850
206K	62	12.13	0.06	1033
206L	73	12.12	0.06	1217
206M	109	12.02	0.06	1817
206N	259	12.03	0.15	1727
207A	254	12.30	0.26	977
207B	202	12.30	0.21	962
207C	197	12.22	0.17	1159
207D	219	12.25	0.20	1095
207E	123	12.35	0.16	769
207F	135	12.18	0.13	1038
207G	201	12.35	0.24	838
207H	122	12.27	0.12	1017
207I	70	12.27	0.07	1000
207J	102	12.17	0.09	1133
207K	171	12.12	0.13	1315
207L	119	12.07	0.08	1488
207M	158	12.08	0.12	1317
207N	64	12.08	0.05	1280
207O	183	12.15	0.13	1408
208A	189	12.17	0.14	1350
208B	27	12.20	0.03	900
208C	76	12.20	0.07	1086
208D	74	12.25	0.08	925
208E	66	12.22	0.06	1100
208F	80	12.20	0.07	1143
208G	153	12.15	0.13	1177
208H	44	12.20	0.04	1100
208I	131	12.23	0.12	1092
208J	70	12.28	0.08	875
208K	60	12.17	0.05	1200
208L	61	12.22	0.06	1017
208M	162	12.28	0.16	1013
208N	54	12.22	0.05	1080
208O	249	12.27	0.23	1083
208P	84	12.13	0.06	1400

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C525	249	12.18	0.35	711
525526	248	12.23	0.35	709
204E	111	12.07	0.07	1586
C526	343	12.13	0.43	798
526527	340	12.20	0.43	791
204F	147	12.02	0.08	1838
C527	426	12.12	0.50	852
CLEAR	1570	12.62	3.58	439
205A	130	12.23	0.12	1083
205B	284	12.18	0.21	1352
C528	411	12.20	0.33	1245
528530	408	12.23	0.33	1236
205C	65	12.22	0.06	1083
C530R	472	12.23	0.39	1210
205D	405	12.22	0.32	1266
205E	203	12.32	0.22	923
C529	596	12.25	0.54	1104
C530	1064	12.23	0.93	1144
530531	1056	12.28	0.93	1135
205F	197	12.22	0.16	1231
C531	1241	12.27	1.09	1139
531532	1230	12.33	1.09	1128
205G	214	12.23	0.19	1126
C532L	1420	12.32	1.27	1118
205H	237	12.33	0.26	912
C532	1654	12.32	1.53	1081
532533	1649	12.35	1.53	1078
205I	367	12.28	0.35	1049
C533	2000	12.33	1.89	1058
533534	1959	12.48	1.89	1037
205J	361	12.28	0.37	976
C534R	2220	12.47	2.25	987
205K	183	12.37	0.25	732
C534	2390	12.47	2.50	956
534535	2378	12.52	2.50	951
205L	147	12.17	0.12	1225
C535	2425	12.50	2.62	926
535536	2397	12.63	2.62	915
205M	195	12.08	0.14	1393
C536R	2443	12.63	2.76	885
205N	141	12.22	0.16	881
C536I	2520	12.62	2.91	866
C536O	321	14.02	2.91	110
536537	321	14.08	2.91	110
206A	224	12.02	0.13	1723

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
208Q	106	12.23	0.09	1178
208R	15	12.10	0.01	1500
208S	95	12.17	0.07	1357
208T	170	12.18	0.13	1308
208U	209	12.10	0.13	1608
208V	41	12.12	0.03	1367
208W	71	12.13	0.05	1420
208X	115	12.12	0.08	1438
209A	478	12.22	0.37	1292
209B	94	12.22	0.08	1175
209C	65	12.23	0.06	1083
209D	327	12.18	0.24	1363
209E	153	12.27	0.15	1020
209F	233	12.28	0.23	1013
209G	219	12.27	0.20	1095
209H	115	12.15	0.08	1438
209I	270	12.13	0.18	1500
210A	164	12.15	0.12	1367
210B	110	12.18	0.11	1000
210C	95	12.18	0.08	1188
210D	180	12.20	0.14	1286
210E	37	12.17	0.03	1233
210F	110	12.20	0.09	1222
210G	185	12.23	0.16	1156
210H	94	12.15	0.07	1343
210I	58	12.20	0.05	1160
210J	130	12.20	0.10	1300
210K	117	12.12	0.08	1463
210L	153	12.13	0.14	1093
210M	178	12.23	0.16	1113
210N	66	12.08	0.05	1320
211A	173	12.13	0.14	1236
211AA	47	12.08	0.03	1567
211AB	74	12.02	0.04	1850
211AC	51	12.02	0.03	1700
211AD	76	12.02	0.04	1900
211AE	63	12.02	0.03	2100
211AF	96	12.02	0.05	1920
211B	147	12.10	0.11	1336
211C	77	12.02	0.04	1925
211D	89	12.07	0.07	1271
211E	279	12.02	0.16	1744
211F	190	12.03	0.11	1727
211G	11	12.05	0.01	1100
211H	103	12.13	0.07	1471

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C537	348	12.07	3.04	114
537538	341	12.12	3.04	112
206B	168	12.02	0.09	1867
C538I	489	12.07	3.14	156
C538O	446	12.15	3.14	142
538540	438	12.25	3.14	139
206C	26	12.10	0.02	1300
C540R	459	12.25	3.16	145
206D	110	12.02	0.06	1833
539540	108	12.10	0.06	1800
206E	25	12.08	0.02	1250
C540L	133	12.10	0.09	1478
C540	560	12.22	3.24	173
540541	545	12.40	3.24	168
206F	159	12.15	0.16	994
C541	655	12.37	3.40	193
541548	654	12.38	3.40	192
206G	75	12.23	0.09	833
BB523R	0	0.02	0.23	0
523548	0	0.02	0.23	0
C548L	721	12.37	3.72	194
206H	89	12.07	0.06	1483
542543	88	12.10	0.06	1467
206I	37	12.02	0.02	1850
C543	122	12.07	0.08	1525
D543R	122	12.07	0.08	1525
D543L	0	0.02	0.08	0
543544	0	0.02	0.08	0
206K	62	12.13	0.06	1033
C544	62	12.13	0.14	443
544545	61	12.18	0.14	436
D545R	31	12.18	0.14	221
D545L	31	12.18	0.14	221
545546	31	12.20	0.14	221
206L	73	12.12	0.06	1217
C546	102	12.13	0.20	510
546547	102	12.17	0.20	510
BB543R	122	12.07	0.08	1525
543547	121	12.15	0.08	1513
BB545R	31	12.18	0.14	221
545547	30	12.23	0.14	214
206J	111	12.02	0.06	1850
C547	335	12.07	0.26	1288
547548	330	12.13	0.26	1269
206M	109	12.02	0.06	1817

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
211I	47	12.20	0.04	1175
211J	22	12.07	0.01	2200
211K	169	12.03	0.10	1690
211L	162	12.02	0.10	1620
211M	117	12.15	0.08	1463
211N	30	12.05	0.02	1500
211O	62	12.07	0.04	1550
211P	65	12.00	0.03	2167
211Q	32	12.05	0.02	1600
211R	118	12.08	0.08	1475
211S	73	12.07	0.05	1460
211T	95	12.08	0.07	1357
211U	34	12.08	0.03	1133
211V	9	12.02	0.00	ERR
211W	58	12.00	0.03	1933
211X	304	12.10	0.21	1448
211Y	128	12.10	0.09	1422
211Z	137	12.02	0.08	1713
BB512R	0	13.32	0.20	0
BB523R	0	0.02	0.23	0
BB543R	122	12.07	0.08	1525
BB545R	31	12.18	0.14	221
BB611R	126	12.38	0.14	900
BB614R	24	12.08	0.03	800
BB615R	11	12.07	0.03	367
BB619L	0	0.02	0.25	0
C501	298	12.25	0.30	993
C502	419	12.33	0.45	931
C502R	361	12.35	0.38	950
C503I	543	12.45	0.63	862
C503O	278	12.95	0.63	441
C504I	39	12.20	0.67	58
C504O	20	12.52	0.67	30
C505I	19	12.13	0.69	28
C506	15	12.12	0.69	22
C507I	118	12.27	0.86	137
C507O	118	12.27	0.86	137
C508O	122	12.22	0.10	1220
C511O	201	12.27	0.18	1117
C512I	215	12.27	0.20	1075
C512O	14	13.33	0.20	70
C513O	232	12.38	0.28	829
C514	321	12.43	0.43	747
C514R	251	12.48	0.32	784
C515	405	12.37	0.53	764

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C548R	412	12.08	0.32	1288
C548	1038	12.27	4.04	257
548549	1025	12.38	4.04	254
206N	259	12.03	0.15	1727
C549L	1105	12.35	4.19	264
207A	254	12.30	0.26	977
207B	202	12.30	0.21	962
C550	455	12.30	0.46	989
550552	450	12.37	0.46	978
207C	197	12.22	0.17	1159
C552L	617	12.32	0.64	964
207D	219	12.25	0.20	1095
551552	216	12.35	0.20	1080
207E	123	12.35	0.16	769
C552R	339	12.35	0.35	969
C552	951	12.33	0.99	961
552553	947	12.37	0.99	957
207F	135	12.18	0.13	1038
C553	1057	12.35	1.12	944
553556	1053	12.40	1.12	940
207G	201	12.35	0.24	838
C556L	1249	12.38	1.35	925
207H	122	12.27	0.12	1017
554555	120	12.33	0.12	1000
207I	70	12.27	0.07	1000
C555	187	12.30	0.20	935
555556	184	12.43	0.20	920
207J	102	12.17	0.09	1133
C556R	260	12.37	0.29	897
C556	1505	12.38	1.64	918
556557	1498	12.43	1.64	913
207K	171	12.12	0.13	1315
C557R	1595	12.42	1.77	901
207L	119	12.07	0.08	1488
C557	1647	12.40	1.85	890
557558	1640	12.47	1.85	886
207M	158	12.08	0.12	1317
C558	1696	12.45	1.97	861
558560	1691	12.50	1.97	858
207O	183	12.15	0.13	1408
C560R	1745	12.48	2.10	831
207N	64	12.08	0.05	1280
559560	62	12.22	0.05	1240
C560I	1781	12.48	2.15	828
C560O	275	13.95	2.15	128

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C517	975	12.45	1.21	806
C517L	516	12.45	0.58	890
C517R	462	12.47	0.63	733
C518	1091	12.55	1.41	774
C519	1177	12.60	1.59	740
C521	1230	12.65	1.99	618
C523I	248	12.30	0.23	1078
C523O	202	12.50	0.23	878
C524	228	12.50	0.31	735
C525	249	12.18	0.35	711
C526	343	12.13	0.43	798
C527	426	12.12	0.50	852
C528	411	12.20	0.33	1245
C529	596	12.25	0.54	1104
C530	1064	12.23	0.93	1144
C530R	472	12.23	0.39	1210
C531	1241	12.27	1.09	1139
C532	1654	12.32	1.53	1081
C532L	1420	12.32	1.27	1118
C533	2000	12.33	1.89	1058
C534	2390	12.47	2.50	956
C534R	2220	12.47	2.25	987
C535	2425	12.50	2.62	926
C536I	2520	12.62	2.91	866
C536O	321	14.02	2.91	110
C536R	2443	12.63	2.76	885
C537	348	12.07	3.04	114
C538I	489	12.07	3.14	156
C538O	446	12.15	3.14	142
C540	560	12.22	3.24	173
C540L	133	12.10	0.09	1478
C540R	459	12.25	3.16	145
C541	655	12.37	3.40	193
C543	122	12.07	0.08	1525
C544	62	12.13	0.14	443
C546	102	12.13	0.20	510
C547	335	12.07	0.26	1288
C548	1038	12.27	4.04	257
C548L	721	12.37	3.72	194
C548R	412	12.08	0.32	1288
C549	3095	12.32	13.06	237
C549L	1105	12.35	4.19	264
C549R	2112	12.30	8.87	238
C550	455	12.30	0.46	989
C552	951	12.33	0.99	961

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
560585	275	14.03	2.15	128
210A	164	12.15	0.12	1367
C585	282	12.20	2.27	124
208A	189	12.17	0.14	1350
561563	187	12.22	0.14	1336
208B	27	12.20	0.03	900
C563R	214	12.22	0.17	1259
208C	76	12.20	0.07	1086
562563	74	12.28	0.07	1057
208D	74	12.25	0.08	925
C563L	148	12.27	0.14	1057
C563	359	12.23	0.31	1158
563564	355	12.30	0.31	1145
208E	66	12.22	0.06	1100
C564R	417	12.28	0.37	1127
208F	80	12.20	0.07	1143
C564	492	12.27	0.44	1118
564565	484	12.38	0.44	1100
208G	153	12.15	0.13	1177
C565	598	12.35	0.57	1049
565568	593	12.40	0.57	1040
208H	44	12.20	0.04	1100
C568L	625	12.40	0.61	1025
208I	131	12.23	0.12	1092
208J	70	12.28	0.08	875
C566	198	12.25	0.20	990
566567	196	12.32	0.20	980
208K	60	12.17	0.05	1200
C567L	245	12.27	0.25	980
208L	61	12.22	0.06	1017
C567	305	12.25	0.31	984
567568	301	12.35	0.31	971
208M	162	12.28	0.16	1013
C568R	455	12.32	0.46	989
C568	1067	12.37	1.07	997
568573	1060	12.42	1.07	991
208N	54	12.22	0.05	1080
C573L	1101	12.42	1.12	983
208O	249	12.27	0.23	1083
569570	248	12.30	0.23	1078
208P	84	12.13	0.06	1400
C570R	310	12.23	0.29	1069
208Q	106	12.23	0.09	1178
C570	414	12.23	0.38	1089
208R	15	12.10	0.01	1500

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C552L	617	12.32	0.64	964
C552R	339	12.35	0.35	969
C553	1057	12.35	1.12	944
C555	187	12.30	0.20	935
C556	1505	12.38	1.64	918
C556L	1249	12.38	1.35	925
C556R	260	12.37	0.29	897
C557	1647	12.40	1.85	890
C557R	1595	12.42	1.77	901
C558	1696	12.45	1.97	861
C560I	1781	12.48	2.15	828
C560O	275	13.95	2.15	128
C560R	1745	12.48	2.10	831
C563	359	12.23	0.31	1158
C563L	148	12.27	0.14	1057
C563R	214	12.22	0.17	1259
C564	492	12.27	0.44	1118
C564R	417	12.28	0.37	1127
C565	598	12.35	0.57	1049
C566	198	12.25	0.20	990
C567	305	12.25	0.31	984
C567L	245	12.27	0.25	980
C568	1067	12.37	1.07	997
C568L	625	12.40	0.61	1025
C568R	455	12.32	0.46	989
C570	414	12.23	0.38	1089
C570R	310	12.23	0.29	1069
C572	427	12.22	0.39	1095
C573	1532	12.38	1.58	970
C573L	1101	12.42	1.12	983
C573R	514	12.23	0.46	1117
C574	372	12.13	0.27	1378
C575	411	12.15	0.29	1417
C576	475	12.18	0.34	1397
C577	1879	12.35	1.92	979
C578I	1922	12.35	2.00	961
C578O	319	13.52	2.00	160
C580	633	12.23	0.51	1241
C580R	541	12.25	0.43	1258
C581	1085	12.23	0.91	1192
C581R	935	12.23	0.76	1230
C582	1521	12.30	1.34	1135
C582R	1306	12.30	1.13	1156
C583	1580	12.32	1.42	1113
C584I	1683	12.37	1.60	1052

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
571572	14	12.15	0.01	1400
C572	427	12.22	0.39	1095
572573	426	12.25	0.39	1092
208S	95	12.17	0.07	1357
C573R	514	12.23	0.46	1117
C573	1532	12.38	1.58	970
208T	170	12.18	0.13	1308
208U	209	12.10	0.13	1608
C574	372	12.13	0.27	1378
574575	371	12.15	0.27	1374
208V	41	12.12	0.03	1367
C575	411	12.15	0.29	1417
575576	407	12.18	0.29	1403
208W	71	12.13	0.05	1420
C576	475	12.18	0.34	1397
576577	474	12.20	0.34	1394
C577	1879	12.35	1.92	979
577578	1874	12.37	1.92	976
208X	115	12.12	0.08	1438
C578I	1922	12.35	2.00	961
C578O	319	13.52	2.00	160
578587	319	13.58	2.00	160
210B	110	12.18	0.11	1000
C586O	108	12.22	0.11	982
586587	108	12.28	0.11	982
C587	375	12.42	2.11	178
587595	374	12.45	2.11	177
210C	95	12.18	0.08	1188
C595L	436	12.30	2.19	199
210D	180	12.20	0.14	1286
588590	178	12.22	0.14	1271
210E	37	12.17	0.03	1233
C590L	212	12.20	0.17	1247
210F	110	12.20	0.09	1222
589590	109	12.25	0.09	1211
210G	185	12.23	0.16	1156
C590R	293	12.25	0.25	1172
C590	502	12.23	0.42	1195
210H	94	12.15	0.07	1343
592593	93	12.20	0.07	1329
C593	593	12.22	0.49	1210
593594	590	12.25	0.49	1204
210I	58	12.20	0.05	1160
C594	645	12.25	0.54	1194
594595	635	12.33	0.54	1176

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C584O	351	13.23	1.60	219
C585	282	12.20	2.27	124
C586O	108	12.22	0.11	982
C587	375	12.42	2.11	178
C590	502	12.23	0.42	1195
C590L	212	12.20	0.17	1247
C590R	293	12.25	0.25	1172
C591	1193	12.63	1.83	652
C593	593	12.22	0.49	1210
C594	645	12.25	0.54	1194
C595	1172	12.32	2.83	414
C595L	436	12.30	2.19	199
C595R	741	12.32	0.64	1158
C596	1221	12.33	2.91	420
C597	388	12.35	1.74	223
C598	517	12.37	1.90	272
C599I	1967	12.33	7.13	276
C599O	966	14.10	7.13	135
C600O	171	12.18	0.14	1221
C601	300	12.17	0.25	1200
C602	418	12.13	0.37	1130
C602L	338	12.18	0.30	1127
C603	617	12.08	0.52	1187
C605O	89	12.23	0.07	1271
C606	146	12.22	0.12	1217
C606R	58	12.20	0.05	1160
C607	161	12.23	0.14	1150
C608	972	14.13	7.37	132
C608L	967	14.15	7.24	134
C609O	48	12.22	0.04	1200
C611I	188	12.17	0.14	1343
C611O	126	12.38	0.14	900
C611R	142	12.15	0.10	1420
C612	64	12.00	0.17	376
C613	972	14.17	7.55	129
C615	31	12.07	0.03	1033
C617	159	12.08	0.13	1223
C617L	149	12.08	0.10	1490
C618	239	12.18	0.19	1258
C618I	225	12.13	0.18	1250
C618O	220	12.18	0.18	1222
C619I	317	12.23	0.25	1268
C619L	307	12.23	0.26	1181
C619O	176	12.53	0.25	704
C620	312	12.40	0.42	743

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
210J	130	12.20	0.10	1300
C595R	741	12.32	0.64	1158
C595	1172	12.32	2.83	414
595596	1167	12.37	2.83	412
210K	117	12.12	0.08	1463
C596	1221	12.33	2.91	420
209A	478	12.22	0.37	1292
579580	477	12.25	0.37	1289
209C	65	12.23	0.06	1083
C580R	541	12.25	0.43	1258
209B	94	12.22	0.08	1175
C580	633	12.23	0.51	1241
580581	629	12.28	0.51	1233
209D	327	12.18	0.24	1363
C581R	935	12.23	0.76	1230
209E	153	12.27	0.15	1020
C581	1085	12.23	0.91	1192
581582	1076	12.30	0.91	1182
209F	233	12.28	0.23	1013
C582R	1306	12.30	1.13	1156
209G	219	12.27	0.20	1095
C582	1521	12.30	1.34	1135
582583	1510	12.33	1.34	1127
209H	115	12.15	0.08	1438
C583	1580	12.32	1.42	1113
583584	1568	12.40	1.42	1104
209I	270	12.13	0.18	1500
C584I	1683	12.37	1.60	1052
C584O	351	13.23	1.60	219
584597	351	13.40	1.60	219
210L	153	12.13	0.14	1093
C597	388	12.35	1.74	223
597598	387	12.47	1.74	222
210M	178	12.23	0.16	1113
C598	517	12.37	1.90	272
210N	66	12.08	0.05	1320
C599I	1967	12.33	7.13	276
C599O	966	14.10	7.13	135
599608	966	14.13	7.13	135
211K	169	12.03	0.10	1690
C608L	967	14.15	7.24	134
211G	11	12.05	0.01	1100
604606	11	12.23	0.01	1100
211I	47	12.20	0.04	1175
C606R	58	12.20	0.05	1160

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
C620R	187	12.33	0.28	668
C621	1152	12.22	7.93	145
C621L	975	14.18	7.64	128
C622	2053	12.20	8.78	234
C622L	753	12.13	0.63	1195
C622R	1384	12.23	8.14	170
C624	125	12.02	0.07	1786
C626	3180	12.40	13.28	239
C626C	3096	12.42	13.14	236
C626R	198	12.03	0.11	1800
C627	3187	12.42	13.32	239
CLEAR	1570	12.62	3.58	439
CLEAR	1278	12.63	3.07	416
D503L	278	12.95	0.63	441
D503R	0	0.02	0.63	0
D504L	20	12.52	0.67	30
D504R	0	12.52	0.67	0
D505L	13	12.13	0.69	19
D505R	6	12.13	0.69	9
D506L	0	0.02	0.69	0
D506R	15	12.12	0.69	22
D508L	56	12.22	0.10	560
D508R	66	12.22	0.10	660
D512L	14	13.33	0.20	70
D512R	0	13.32	0.20	0
D523L	202	12.50	0.23	878
D523R	0	0.02	0.23	0
D543L	0	0.02	0.08	0
D543R	122	12.07	0.08	1525
D545L	31	12.18	0.14	221
D545R	31	12.18	0.14	221
D611L	0	0.02	0.14	0
D611R	126	12.38	0.14	900
D614L	10	12.08	0.03	333
D614R	24	12.08	0.03	800
D615L	21	12.07	0.03	700
D615R	11	12.07	0.03	367
D619L	0	0.02	0.25	0
D619R	176	12.53	0.25	704
501502	294	12.38	0.30	980
502503	412	12.48	0.45	916
503504	0	0.02	0.63	0
508507	54	12.32	0.10	540
511512	200	12.30	0.18	1111
513514	229	12.50	0.28	818

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
211H	103	12.13	0.07	1471
C605O	89	12.23	0.07	1271
C606	146	12.22	0.12	1217
606607	145	12.25	0.12	1208
211J	22	12.07	0.01	2200
C607	161	12.23	0.14	1150
607608	160	12.27	0.14	1143
C608	972	14.13	7.37	132
608613	972	14.17	7.37	132
211M	117	12.15	0.08	1463
610611	116	12.18	0.08	1450
211N	30	12.05	0.02	1500
C611R	142	12.15	0.10	1420
211O	62	12.07	0.04	1550
C609O	48	12.22	0.04	1200
609611	48	12.23	0.04	1200
C611I	188	12.17	0.14	1343
C611O	126	12.38	0.14	900
D611R	126	12.38	0.14	900
D611L	0	0.02	0.14	0
611612	0	0.02	0.14	0
211P	65	12.00	0.03	2167
C612	64	12.00	0.17	376
C613	972	14.17	7.55	129
613621	972	14.18	7.55	129
211L	162	12.02	0.10	1620
C621L	975	14.18	7.64	128
211Q	32	12.05	0.02	1600
616617	31	12.10	0.02	1550
211R	118	12.08	0.08	1475
C617L	149	12.08	0.10	1490
211U	34	12.08	0.03	1133
D614R	24	12.08	0.03	800
D614L	10	12.08	0.03	333
C617	159	12.08	0.13	1223
617618	157	12.17	0.13	1208
211S	73	12.07	0.05	1460
C618I	225	12.13	0.18	1250
C618O	220	12.18	0.18	1222
BB614R	24	12.08	0.03	800
614615	24	12.12	0.03	800
211V	9	12.02	0.00	ERR
C615	31	12.07	0.03	1033
D615R	11	12.07	0.03	367
D615L	21	12.07	0.03	700

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
515517	402	12.52	0.53	758
516517	333	12.52	0.33	1009
517518	967	12.58	1.21	799
518519	1087	12.60	1.41	771
519591	1174	12.63	1.59	738
520591	45	12.20	0.04	1125
522523	126	12.40	0.11	1145
523524	201	12.57	0.23	874
523548	0	0.02	0.23	0
524525	228	12.55	0.31	735
525526	248	12.23	0.35	709
526527	340	12.20	0.43	791
528530	408	12.23	0.33	1236
530531	1056	12.28	0.93	1135
531532	1230	12.33	1.09	1128
532533	1649	12.35	1.53	1078
533534	1959	12.48	1.89	1037
534535	2378	12.52	2.50	951
535536	2397	12.63	2.62	915
536537	321	14.08	2.91	110
537538	341	12.12	3.04	112
538540	438	12.25	3.14	139
539540	108	12.10	0.06	1800
540541	545	12.40	3.24	168
541548	654	12.38	3.40	192
542543	88	12.10	0.06	1467
543544	0	0.02	0.08	0
543547	121	12.15	0.08	1513
544545	61	12.18	0.14	436
545546	31	12.20	0.14	221
545547	30	12.23	0.14	214
546547	102	12.17	0.20	510
547548	330	12.13	0.26	1269
548549	1025	12.38	4.04	254
549626	3072	12.42	13.06	235
550552	450	12.37	0.46	978
551552	216	12.35	0.20	1080
552553	947	12.37	0.99	957
553556	1053	12.40	1.12	940
554555	120	12.33	0.12	1000
555556	184	12.43	0.20	920
556557	1498	12.43	1.64	913
557558	1640	12.47	1.85	886
558560	1691	12.50	1.97	858
559560	62	12.22	0.05	1240

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
615618	21	12.08	0.03	700
C618	239	12.18	0.19	1258
618619	235	12.25	0.19	1237
211T	95	12.08	0.07	1357
C619L	307	12.23	0.26	1181
BB615R	11	12.07	0.03	367
615619	10	12.18	0.03	333
C619I	317	12.23	0.25	1268
C619O	176	12.53	0.25	704
D619L	0	0.02	0.25	0
D619R	176	12.53	0.25	704
619620	176	12.55	0.25	704
BB619L	0	0.02	0.25	0
619620	0	0.02	0.25	0
211W	58	12.00	0.03	1933
C620R	187	12.33	0.28	668
BB611R	126	12.38	0.14	900
611620	126	12.40	0.14	900
C620	312	12.40	0.42	743
620621	312	12.42	0.42	743
C621	1152	12.22	7.93	145
621622	1147	12.32	7.93	145
211X	304	12.10	0.21	1448
C622R	1384	12.23	8.14	170
211A	173	12.13	0.14	1236
C600O	171	12.18	0.14	1221
600601	169	12.25	0.14	1207
211B	147	12.10	0.11	1336
C601	300	12.17	0.25	1200
601602	298	12.23	0.25	1192
211C	77	12.02	0.04	1925
C602L	338	12.18	0.30	1127
211D	89	12.07	0.07	1271
C602	418	12.13	0.37	1130
602603	415	12.20	0.37	1122
211E	279	12.02	0.16	1744
C603	617	12.08	0.52	1187
603622	605	12.17	0.52	1163
211F	190	12.03	0.11	1727
C622L	753	12.13	0.63	1195
C622	2053	12.20	8.78	234
622549	2028	12.32	8.78	231
211Y	128	12.10	0.09	1422
C549R	2112	12.30	8.87	238
C549	3095	12.32	13.06	237

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
560585	275	14.03	2.15	128
561563	187	12.22	0.14	1336
562563	74	12.28	0.07	1057
563564	355	12.30	0.31	1145
564565	484	12.38	0.44	1100
565568	593	12.40	0.57	1040
566567	196	12.32	0.20	980
567568	301	12.35	0.31	971
568573	1060	12.42	1.07	991
569570	248	12.30	0.23	1078
571572	14	12.15	0.01	1400
572573	426	12.25	0.39	1092
574575	371	12.15	0.27	1374
575576	407	12.18	0.29	1403
576577	474	12.20	0.34	1394
577578	1874	12.37	1.92	976
578587	319	13.58	2.00	160
579580	477	12.25	0.37	1289
580581	629	12.28	0.51	1233
581582	1076	12.30	0.91	1182
582583	1510	12.33	1.34	1127
583584	1568	12.40	1.42	1104
584597	351	13.40	1.60	219
586587	108	12.28	0.11	982
587595	374	12.45	2.11	177
588590	178	12.22	0.14	1271
589590	109	12.25	0.09	1211
591521	1188	12.65	1.83	649
592593	93	12.20	0.07	1329
593594	590	12.25	0.49	1204
594595	635	12.33	0.54	1176
595596	1167	12.37	2.83	412
597598	387	12.47	1.74	222
599608	966	14.13	7.13	135
600601	169	12.25	0.14	1207
601602	298	12.23	0.25	1192
602603	415	12.20	0.37	1122
603622	605	12.17	0.52	1163
604606	11	12.23	0.01	1100
606607	145	12.25	0.12	1208
607608	160	12.27	0.14	1143
608613	972	14.17	7.37	132
609611	48	12.23	0.04	1200
610611	116	12.18	0.08	1450
611612	0	0.02	0.14	0

Table F-2
100-year, 24-hour Storm Results

Existing Condition In HEC-1 Run Order

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
549626	3072	12.42	13.06	235
211Z	137	12.02	0.08	1713
C626C	3096	12.42	13.14	236
211AA	47	12.08	0.03	1567
625626	46	12.15	0.03	1533
211AB	74	12.02	0.04	1850
623624	73	12.02	0.04	1825
211AC	51	12.02	0.03	1700
C624	125	12.02	0.07	1786
624626	124	12.07	0.07	1771
211AD	76	12.02	0.04	1900
C626R	198	12.03	0.11	1800
C626	3180	12.40	13.28	239
626627	3176	12.42	13.28	239
211AE	63	12.02	0.03	2100
C627	3187	12.42	13.32	239
211AF	96	12.02	0.05	1920

Existing Condition In Numerical Order by Operation Type

HEC-1 ID	Peak Discharge in cfs	Time to Peak in hours	Drainage Area, in sq miles	Unit Discharge in cfs/sm
611620	126	12.40	0.14	900
613621	972	14.18	7.55	129
614615	24	12.12	0.03	800
615618	21	12.08	0.03	700
615619	10	12.18	0.03	333
616617	31	12.10	0.02	1550
617618	157	12.17	0.13	1208
618619	235	12.25	0.19	1237
619620	176	12.55	0.25	704
619620	0	0.02	0.25	0
620621	312	12.42	0.42	743
621622	1147	12.32	7.93	145
622549	2028	12.32	8.78	231
623624	73	12.02	0.04	1825
624626	124	12.07	0.07	1771
625626	46	12.15	0.03	1533
626627	3176	12.42	13.28	239

3.5.3 Comparison of Results with Previous Studies

There is only one previous study of record that encompasses the entire study area. That study is the *Master Drainage Control Study for Fountain Hills, Arizona* [6.6:12] (MDCSFH). The results of that study are shown on a map obtained from the Town of Fountain Hills, which is not dated. That study was done by Trico, Inc. using the TR-20 computer program and a 100-year, 24-hour storm precipitation of 4.2 inches.

A search of the records of ADWR yielded files pertaining to each major flood control structure. The file for Dam 4 contains TR-20 output printouts prepared by Trico, Inc. and dated July 1971. That TR-20 printout lists results for a 100-year, 6-hour storm precipitation of 3.2 inches and a 100-year, 24-hour storm precipitation of 4.2 inches. Dams 4, 6, 7 and 11 were modeled. A separate file is available for each dam, but the file for Dam 4 contains the clearest summary of the TR-20 modeling. The file for Dam 36 contained a TR-20 printout for that dam, also dated July 1971. Both TR-20 models used a curve number of 90 for all subbasins.

The results from both previous studies are compared with the modeled results in Table F-5, for representative locations. Watershed areas are not available for the MDCSFH. Other available studies are either based on the Trico, Inc. hydrology, or cover minor watershed areas.

Table F-5

Comparison of Peak Discharges from Previous Studies with Modeled Results

HEC-1 ID	Description	100-year Peak Discharge, in cfs					Watershed Area, in sm	
		Modeled Results		MDCSFH	ADWR Files			
		6-hour	24-hour	24-hour	6-hour	24-hour	Modeled Results	ADWR Files
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
C536I	Dam 36, inflow	2580	2520	2865	2493	3695	2.91	2.83
C536O	Dam 36, outflow	326	321	------	400	506	2.91	2.83
C549L	Balboa Wash U/S of confluence with Ashbrook Wash	1128	1105	1410	------	------	4.40	------
C549R	Ashbrook Wash U/S of confluence with Balboa Wash	2024	2115	2893	------	------	8.87	------
C560I	Dam 6, inflow	1989	1781	2964	2201	3112	2.15	2.26
C560O	Dam 6, outflow	287	275	------	450	483	2.15	2.26
C578I	Dam 11, inflow	2231	1922	3031	2077	3230	2.00	2.02
C578O	Dam 11, outflow	381	319	------	325	342	2.00	2.02
C584I	Dam 7, inflow	1999	1683	2336	1679	2486	1.60	1.66
C584O	Dam 7, outflow	469	351	------	378	548	1.60	1.66
C599I	Dam 4, inflow	1917	1967	------	2337	3281	7.13	5.76
C599O	Dam 4, outflow	954	966	------	1293	1499	7.13	5.76
C627	Ashbrook Wash at Fort McDowell Indian Reservation	2994	3190	4407	------	------	13.32	------

The results of previous studies do not compare well with the modeled results. The results from the MDCSFH compare favorably with the results found in the ADWR files. This is to be expected since both sets of previous results were prepared by the same engineering firm. The modeled results, examining only the 24-hour results, range from 7 percent to 43 percent less than the results from previous studies. The watershed areas compare favorably with the exception of Dam 4. The modeled results area at Dam 4 is 1.37 square miles less than the area reported in the ADWR files. Since a watershed map was not found in the ADWR files, and the watershed area for this study is based on more accurate mapping than was available in 1971, there is no reason to doubt the watershed area at Dam 4 for this study.

The differences in peak discharges appear due to a combination of factors, including rainfall losses, time of concentration and unit hydrograph method. Precipitation depth is not a factor because the precipitation amounts used are comparable. Rainfall excess and time to peak (Tp) for the modeled results and the results found in the ADWR files are compared in Table F-6.

Table F-6

Comparison of Rainfall Excess and T_p from Previous Studies with Modeled Results for the 100-year, 24-hour storm

	Rainfall Excess, in inches		Time to Peak, in hours	
Location	Modeled Results	ADWR Files	Modeled Results	ADWR Files
(1)	(2)	(3)	(4)	(5)
Dam 4	1.89	4.15	14.08	12.87
Dam 6	1.93	3.13	13.95	13.20
Dam 7	2.04	3.13	13.23	12.83
Dam 11	2.12	3.09	13.52	13.26
Dam 36	1.80	3.15	14.02	13.60

The rainfall excess values from the ADWR files are based on the SCS curve number method. A curve number of 90 was used for all subbasins. This is a very conservative estimate. The detailed soils mapping, which the modeled results are based on, did not become available until 1986. Detailed soils mapping of the Fountain Hills area was not available in 1971. The majority of the soils present on the watershed upstream of Dams 6, 7, 11 and 36 are soil map unit 40 or 41. These soils are classified as hydrologic soil group D which results in a very high rainfall excess when using the SCS curve number method. However, both soils have a relatively high XKSAT value of about 0.2 inches per hour when adjusted for vegetation cover density. A typical uniform loss value for D soils is 0.05 inches per hour [6.5:10]. The Green-Ampt method, used for the modeled results, provides a more accurate physically based method for estimating rainfall losses than the empirically based curve number method. The rainfall losses for the results from the ADWR files are probably over estimated. A second reason to doubt the losses from the TR-20 model is the high rainfall excess value of 4.15 inches at Dam 4. The majority of the watershed upstream of Dam 4 is composed of the watersheds for Dams 6, 7 and 11, which have a much lower rainfall excess of about 3.1 inches. Two runoff operations in the TR-20 model upstream of Dam 4 report rainfall excess greater than the total precipitation (4.68 and 10.42 inches). The TR-20 results are therefore questionable regarding rainfall losses.

The differences between T_p estimates in columns 4 and 5 of Table F-6 are significant. These differences contribute to the differences in peak discharges noted in Table F-5. The T_p estimates are directly related to the T_c estimate for subbasins. A higher level of confidence is placed in the Design Manual T_c relationship than the relationship historically used with the SCS unit hydrograph procedure. The Design Manual T_c relationship has been tested against historical data for Maricopa County.

The Clark unit hydrograph has a different shape than the SCS unit hydrograph. This difference will affect calculated peak discharges.

There is no reason to doubt the validity of the modeled results based on the discussion of rainfall excess, T_p estimates and unit hydrograph shape.

3.5.4 Discussion of Results

The modeled results appear reasonable based on the discussion in Section 3.3 of confidence checks. The final results are lower than those presented in previous studies, but the modeled results are based on more reasonable input parameters, current locally accepted technology, and a more detailed level of study.

The confidence checks were done either at, or upstream of, the dams. Since the dams have a significant impact on downstream peak discharges, the results at the dams are discussed in more detail. The five dams were constructed by Trico Properties, Inc. between 1972 and 1974 as a part of the initial development of the Town of Fountain Hills. The dams were designed by Trico, Inc. After construction, trash racks were installed on the principal spillways. The dams have been inspected on a regular basis by ADWR. The only significant changes which have occurred since the dams were constructed relate to Dam 4.

Dam 4 has a principal spillway which consists of two 60 inch reinforced concrete pipe culverts. A portion of one of the pipes was obstructed in 1989 by construction of a concrete encased sewer line in the pipe invert [6.6:5]. This obstruction has the effect of reducing the design capacity of the principal spillway from 840 cfs to 640 cfs. Both capacities are based on a head elevation at the crest of the emergency spillway. The dam design criteria is listed in the ADWR files. The dam principal spillways were to be designed to convey the 100-year peak discharge without overtopping the emergency spillway. The design conditions are summarized in Table F-7.

Column 2 is based on the Fountain Hills local vertical datum which was used for design. Column 3 is based on an upstream head elevation equal to Column 2. Column 3 is derived from Table F-5 Columns 6 and 7. Dams 4, 7 and 36 did not meet the original design criteria when constructed. The constriction to the principal spillway of Dam 4 makes the problem worse. In addition, the available storage volume upstream of Dam 4 is less than the original design capacity.

Table F-7

Design Principal Spillway Capacities for Dams 4, 6, 7, 11 and 36

Dam	Emergency Spillway Crest Elevation	Principal Spillway Capacity cfs	100-year Peak Discharge cfs
(1)	(2)	(3)	(4)
4	1716.0	825	1499
6	1837.0	485	483
7	1926.0	395	548
11	1812.0	343	342
36	1890.0	366	506

The results of this study for all five dams are shown in Table F-8. Refer to Tables R-13, R-15, R-16, R-17 and R-19 for storage and discharge data for each structure. The original Trico, Inc. design data is also summarized on those tables.

The results of this study are that the crest of the emergency spillway of Dams 4, 7 and 11 are overtopped by the 100-year storm.

The inflow and outflow hydrographs from the 100-year, 6-hour storm for each dam are plotted on Figures F-1 through F-5. The attenuation resultant from storage is clearly depicted on these figures. Note that the duration of overtopping of the emergency spillway of Dams 4, 7 and 11 is approximately 5.3, 0.9 and 0.6 hours, respectively. The inflow hydrographs for the dams are compared graphically on Figure F-6. The outflow hydrographs for the dams are compared graphically on Figure F-7. Note the similiar hydrograph shape and peak discharge for Dams 6, 7, 11 and 36, and the much longer receding limb of the hydrographs for Dam 4. The modeling results appear reasonable at these locations. The watersheds for Dams 6, 7, 11 and 36 have similiar areas, shape and hydrologic parameters; therefore, the resultant runoff hydrographs should be similiar. The outflow from Dams 6, 7, and 11 combine upstream of, and pass through, Dam 4. A much larger runoff volume is passed through Dam 4, resulting in the long receding limb.

Table F-8

Summary of Results for Dams 4, 6, 7, 11 and 36

Dam	Emergency Spillway Crest Elev.	100-year, 6-hour Discharge, cfs in	100-year, 6-hour Discharge, cfs out	100-year, 6-hour Peak Stage feet	100-year, 6-hour Peak Storage acre-feet	100-year, 24-hour Discharge, cfs in	100-year, 24-hour Discharge, cfs out	100-year, 24-hour Peak Stage feet	100-year, 24-hour Peak Storage acre-feet
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
4	1714.8	1917	957	1715.8	113	1967	968	1715.8	113
6	1835.4	1989	287	1832.4	141	1781	275	1830.5	119
7	1924.8	1999	469	1925.5	100	1683	351	1922.9	78
11	1810.8	2231	381	1811.3	144	1922	319	1808.7	111
36	1889.0	2580	326	1883.3	177	2520	321	1882.2	161

Several reservoir routes affect starting water surface elevations for the floodplain delineations done as a part of this study. The ponding water surface elevations for the dams are listed in Table F-8. The remaining reservoir routes in question are listed in Table F-9.

Table F-9

Summary of Reservoir Route Stage Elevations at Locations Affecting Floodplain Delineation Starting Conditions

Concentration Point	100-year Peak Discharge, in cfs in	100-year Peak Discharge, in cfs out	Stage Elevation feet
(1)	(2)	(3)	(4)
C523	386	286	1,659.4
C538	489	446	1,789.6
C618	370	367	1,746.0
C619	520	363	1,693.2

3.5.5 Applicability of Hydrologic Models for Other Uses

The HEC-1 models have been developed for the existing condition 6-hour and 24-hour storms as a part of this study. The future condition 10-year and 100-year, 6-hour and 24-hour, storms have also been modeled, but are not included as a part of this report. The specific purpose in preparing the existing condition models is for floodplain delineation and flood insurance purposes. A secondary purpose is for use as the basis for an Area Drainage Master Study (ADMS). The watershed was modeled in more detail for that reason. The key assumpions upon which this study is based were made with both purposes in mind. Therefore, if the models are used for other purposes, such as for design of drainage improvements or for new develpments, the following should be considered:

1. The time of concentration and routing parameters may not be appropriate for other storm frequencies.

2. The flow splits (diversions) that are modeled as existing condition may need to be reevaluated, or different assumptions made regarding the percentage of flow in the branches downstream of the split. This could particularly be true for a design condition.

3. The percent impervious (RTIMP) for the watershed under consideration should be verified and updated to reflect development that has occurred since the time of this study.

3.6 Final Modeling Results on Diskette

The diskette containing the HEC-1 input files is located at the back of Book 1 of 3 following Section 6.

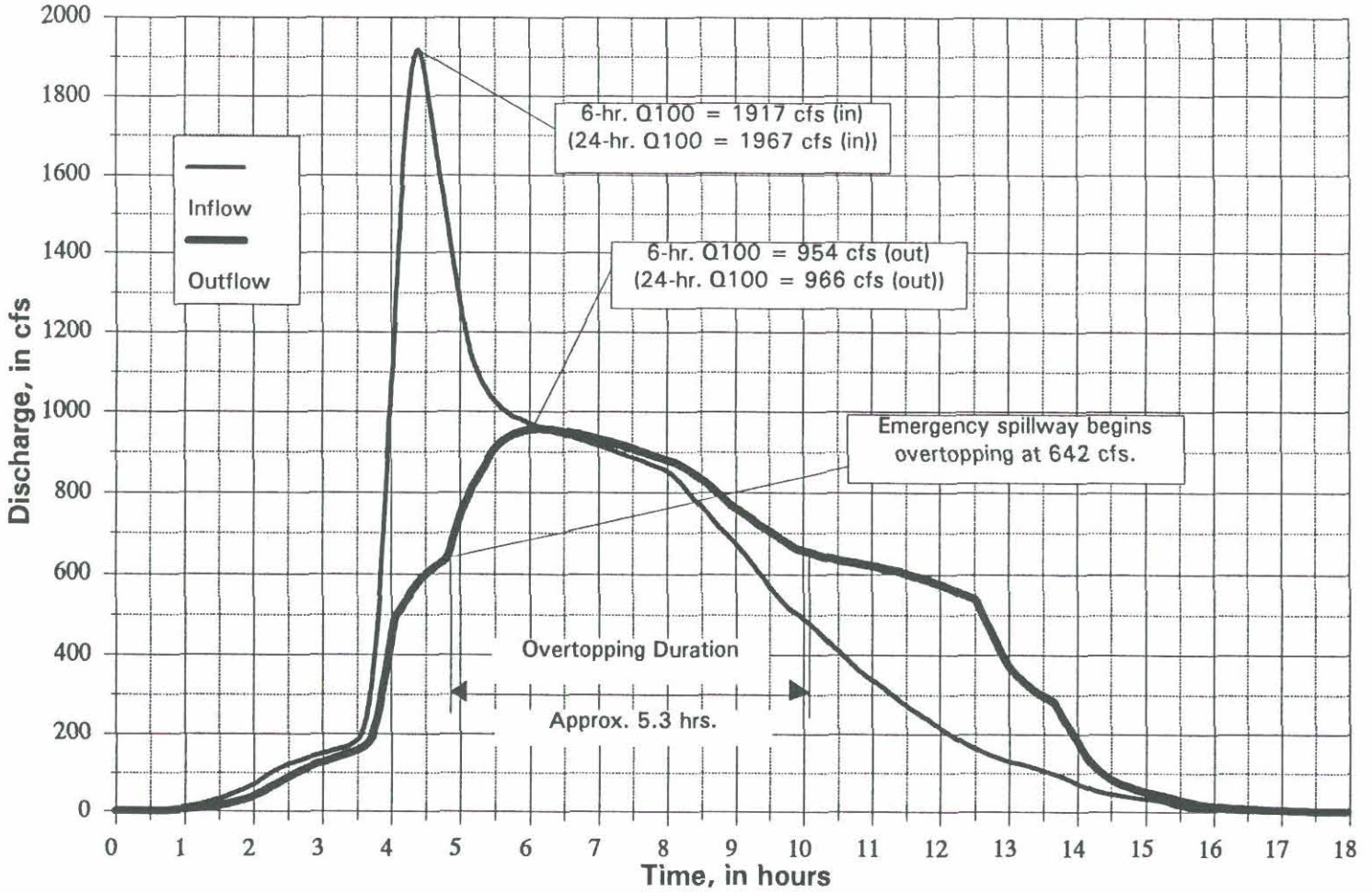


Figure F-1

Hydrograph at C599 from a 100-Year, 6-Hour Storm
Inflow and Outflow from Dam 4 Existing Condition

ex_hydgf.wb1

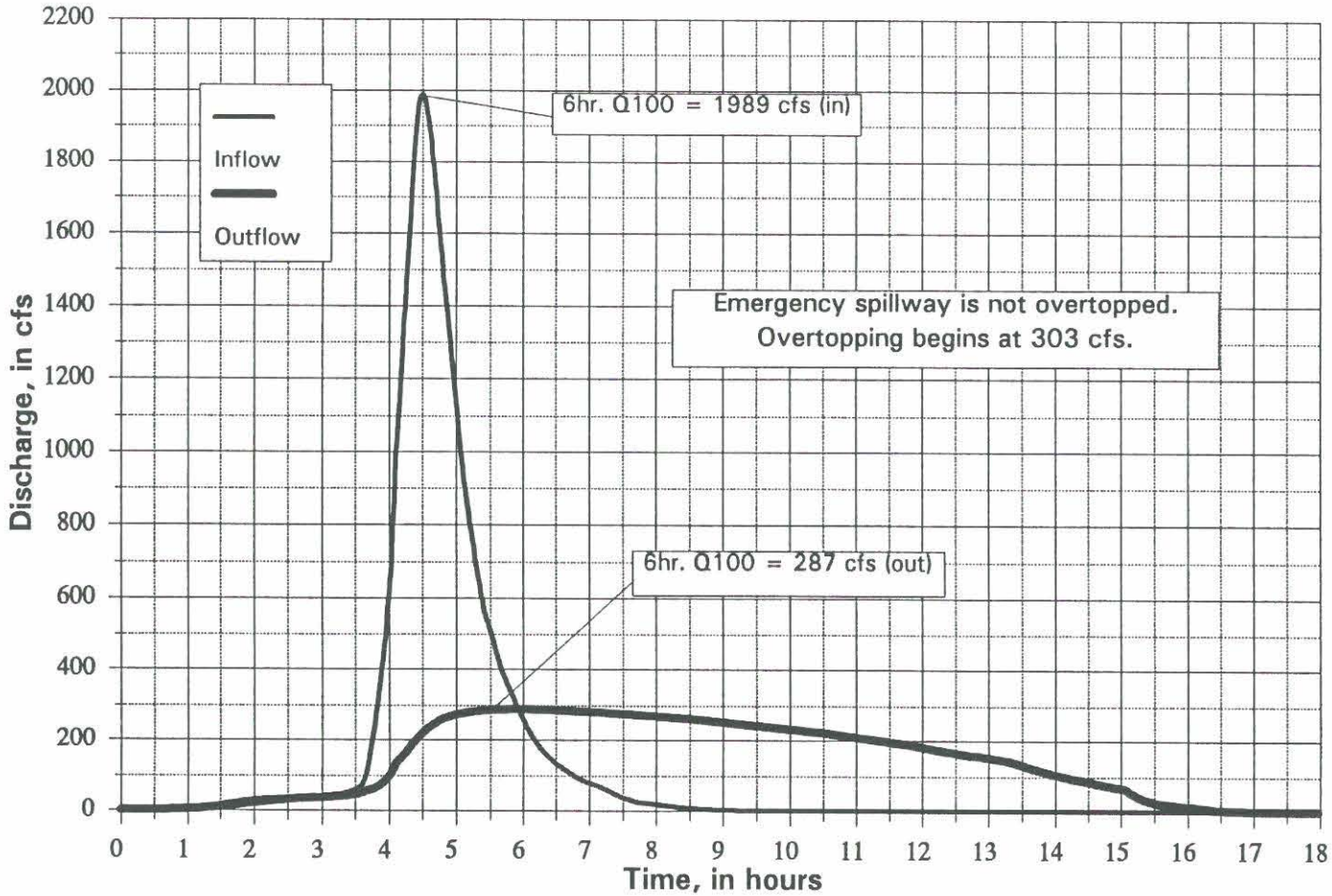


Figure F-2

Hydrograph at C560 from a 100-Year, 6-Hour Storm
Inflow and Outflow from Dam 6 Existing Condition

ex_hydgf.wb1

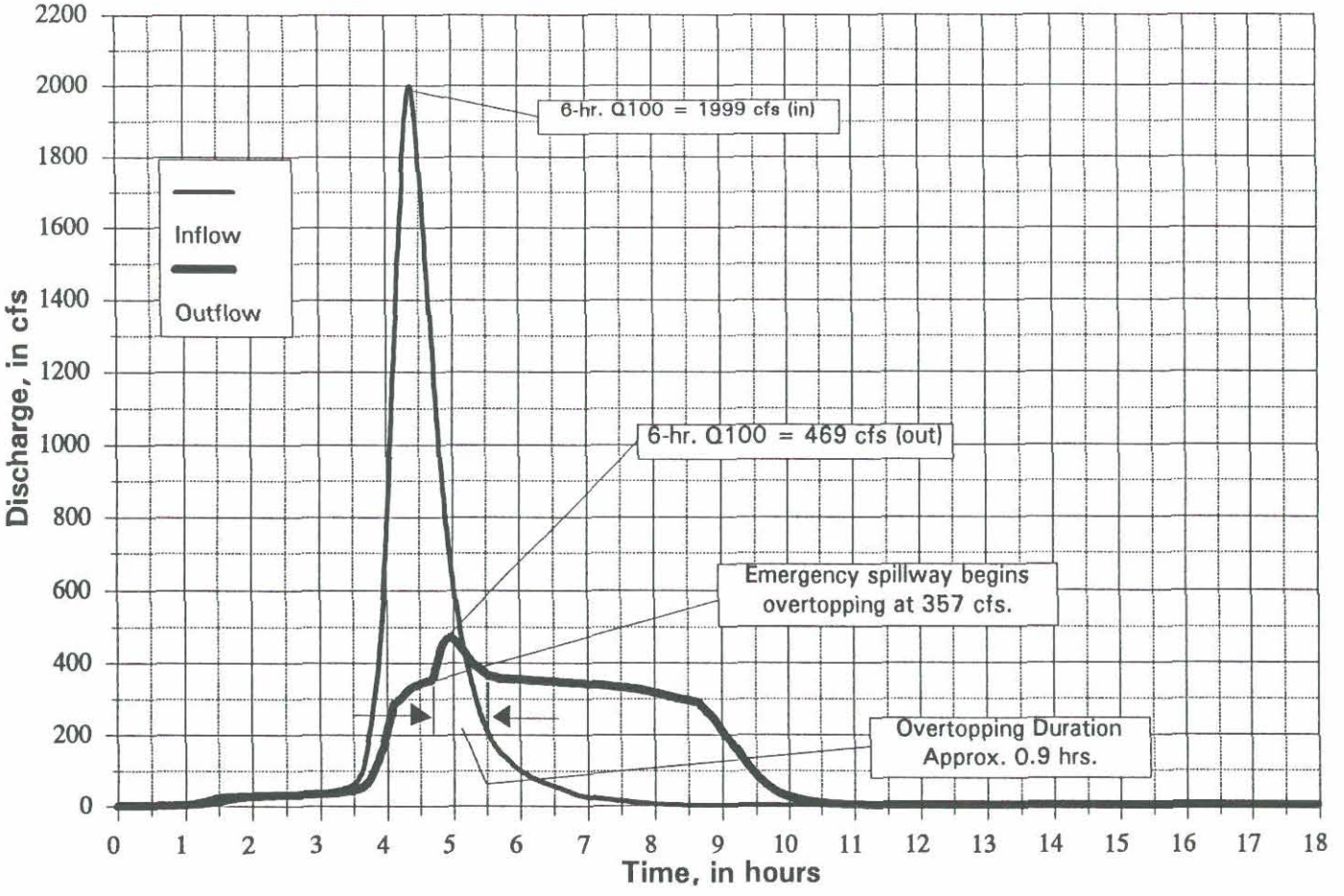


Figure F-3

Hydrograph at C584 from a 100-Year, 6-Hour Storm
Inflow and Outflow from Dam 7 Existing Condition

ex_hydgf.wb1

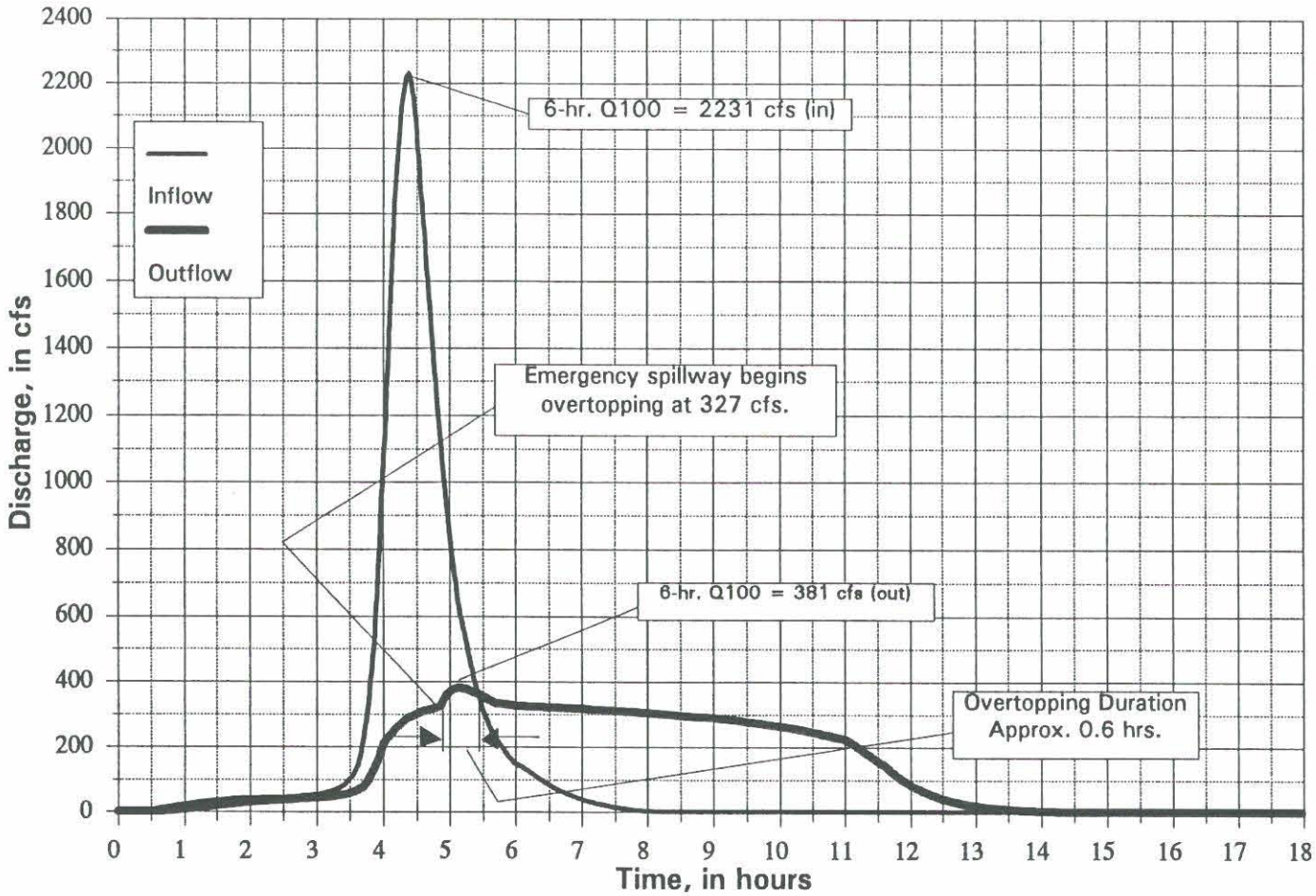


Figure F-4

Hydrograph at C578 from a 100-Year, 6-Hour Storm
Inflow and Outflow from Dam 11 Existing Condition

ex_hydgf.wb1

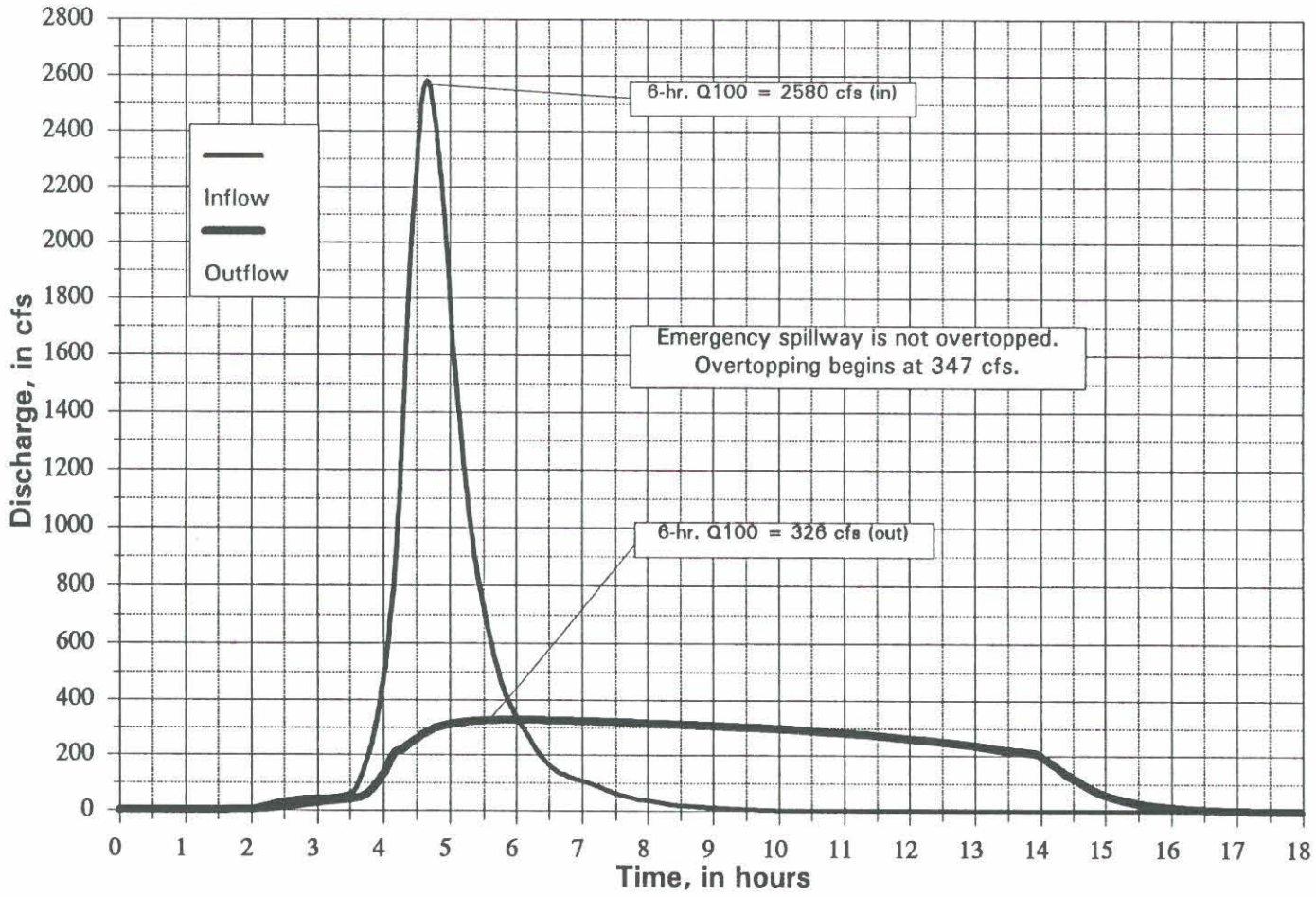


Figure F-5

Hydrograph at C536 from a 100-Year, 6-Hour Storm
Inflow and Outflow from Dam 36 Existing Condition

ex_hydgf.wb1

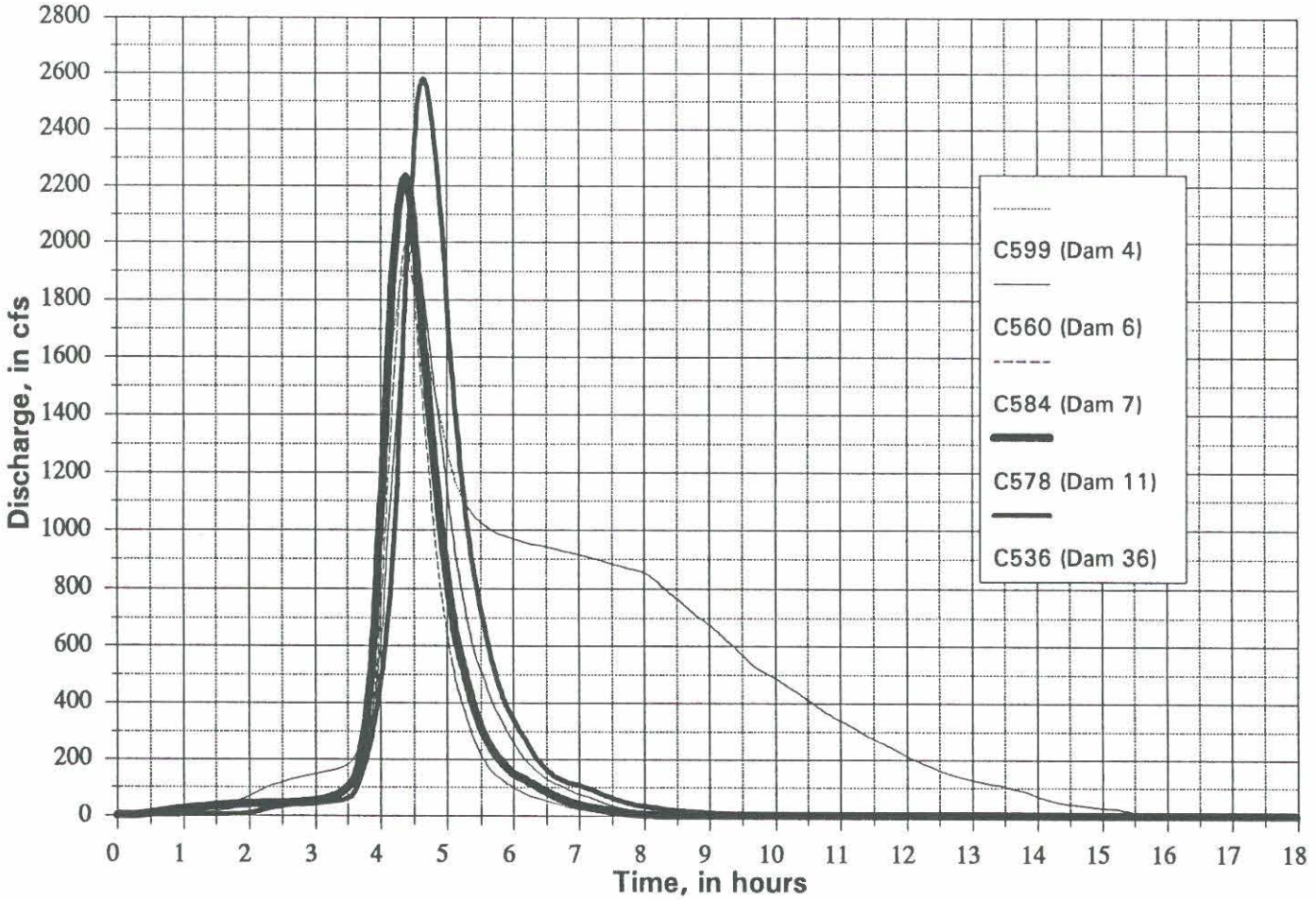


Figure F-6

Existing Condition Inflow Hydrographs
100-year, 6-hour Storm

ex_hydgf.wb1

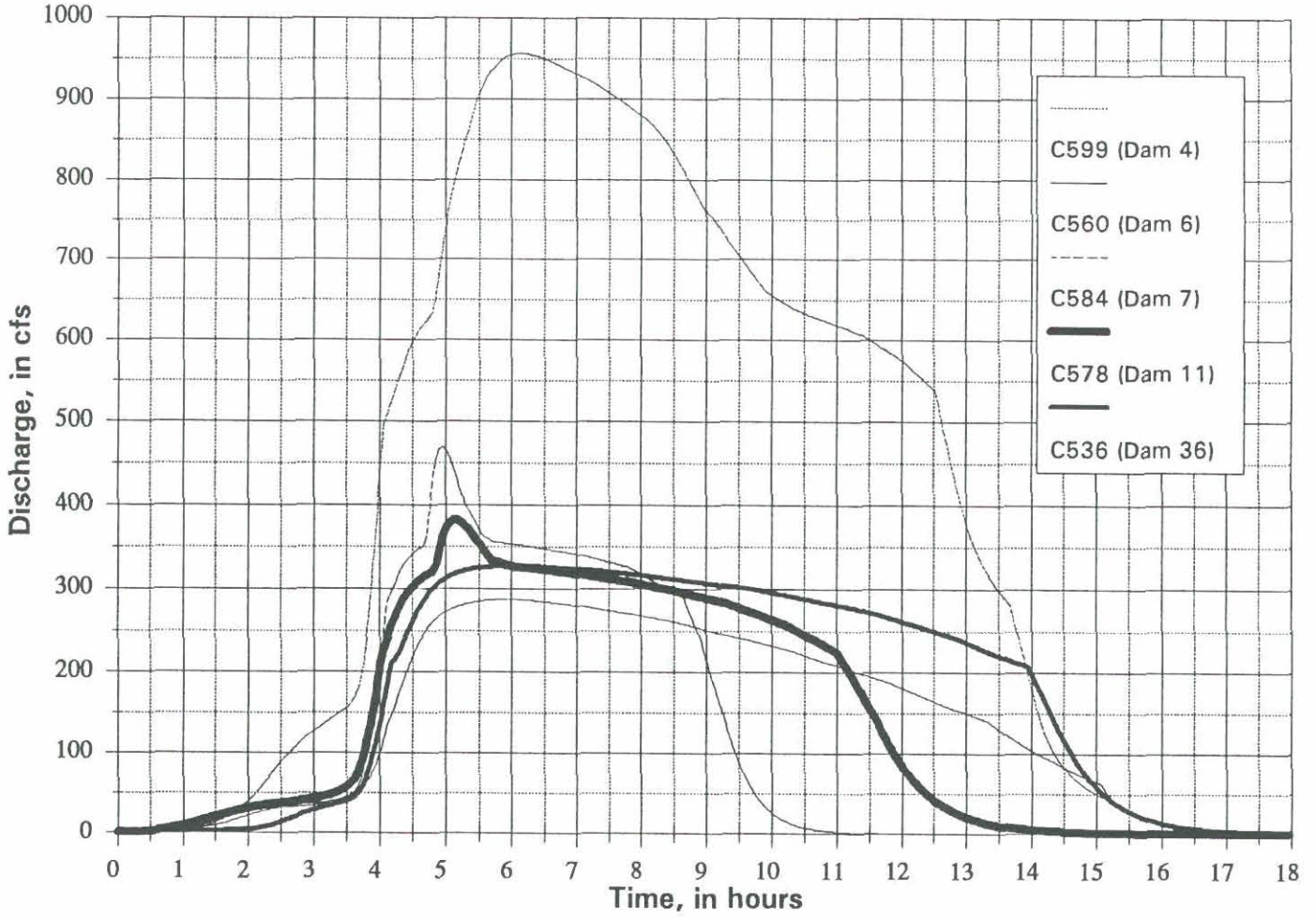


Figure F-7

Existing Condition Outflow Hydrographs
100-year, 6-hour Storm

ex_hydgf.wb1

SECTION 6: REFERENCE MATERIALS

6.1 Other Published Flood Studies

There are no other significant published flood studies of record. Refer to Section 6.6.

6.2 Previous FEMA Studies

There are no previous FEMA studies for the study watershed.

6.3 Other Applicable Studies

Refer to Sections 6.5 and 6.6.

6.4 Published and Unpublished Historical Flood Information

There is no significant historical flood information of record for this watershed.

6.5 Bibliography

1. Arizona Department of Transportation, March 1993. Highway Drainage Design Manual - Hydrology.

2. Arizona Department of Water Resources, Engineering Division, Flood Management Section, September 1991. Instructions for Organizing and Submitting Technical Documentation for Flood Study.

3. Arizona Department of Water Resources, Engineering Division, Flood Management Section, December 1991. Requirement For Floodplain Delineation In Riverine Environments.

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5. Chow, Maidment and Mays, 1988. Applied Hydrology.

6. Dodson & Associates, Inc., February 1990. Hands-On HEC-1, draft.

7. Dodson & Associates, Inc. 1991. ProHEC-1 User's Manual and Program Reference.

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9. Federal Emergency Management Agency, March, 1991. FEMA 37, Flood Insurance Study Guidelines and Specifications for Study Contractors.

10. Flood Control District of Maricopa County, September, 1990. Hydrologic Design Manual for Maricopa County.

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12. Linsley, Kohler and Paulhus, 1975. Hydrology for Engineers.

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14. National Weather Service, August, 1984. NOAA Technical Memorandum NWS Hydro-40, Depth-Area Ratios in the Semi-Arid Southwest United States.

15. Ohio Department of Natural Resources, October 1987. Uneven Weir Program, fortran version.

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18. U.S. Army, Corps of Engineers, September, 1990. HEC-2 Water Surface Profiles Users Manual.

19. U.S. Army, Corps of Engineers, April, 1982. Hydrologic Analysis of Ungaged Watersheds Using HEC-1.

20. U.S. Bureau of Reclamation, 1987. Design of Small Dams, Third Edition.

21. U.S. Bureau of Reclamation, 1989. Flood Hydrology Manual, 1st Edition.

22. U.S. Department of Agriculture, Soil Conservation Service, 1973. General Soil Map of Maricopa County.

23. U.S. Department of Agriculture, Soil Conservation Service, April, 1986. Soil Survey of Aguila-Carefree Area, Parts of Maricopa County and Pinal Counties, Arizona.

24. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1973. Precipitation-Frequency Atlas of the Western United States, Volume VIII-Arizona.

25. U.S. Department of Transportation, September, 1985. Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5, FHWA Report No. 1P-85-15.

26. U.S. Department of Transportation, May 1987. HY8 Culvert Analysis Microcomputer Program Applications Guide.

27. U.S. Geological Survey, 1991. Basin Characteristics and Streamflow Statistics in Arizona as of 1989.

28. U.S. Geological Survey, 1991. Manning's Roughness Coefficients for Stream Channels and Floodplains in Maricopa County, Arizona.

6.6 Applicable Improvement Plans, Maps and Related Documents

Reference Source Abbreviations:

Abbreviation:	Reference Source:
A-N	Anderson-Nelson, Inc.
ADWR	Arizona Department of Water Resources
AMC	Aerial Mapping Company, Inc.
F. Hills	Town of Fountain Hills
FCDMC	Flood Control District of Maricopa County
GCA	GIS Consultants of Arizona, Ltd.
KAM	Kenney Aerial Mapping Company
MCDOT	Maricopa County Department of Transportation
SCS	U.S. Soil Conservation Service
USGS	U.S. Geological Survey

Source	Type	Description	File I.D.
F. Hills	Map	Anderson-Nelson Inc., 1991. *Low level horizontal control map of Fountain Hills used in preparation of Improvement District plans.* Sections 4-11, 14-17, 20-23, and 26-29, T3N, R6E, G&SRB&M, Maricopa County, Arizona. Scale 1" = 400′.	1
F. Hills	Plans	Anderson-Nelson Inc., 1990. *Palisades Plaza Plans. Fountain Hills.* Scale: Horizontal 1" = 20′,Vertical 1" = 2′.	2
F. Hills	Plans	Anderson-Nelson Inc., 1992. *Fountain Hills Street Paving Plans: Cerro Alta Drive.* Scale: Horizontal 1" = 40′, Vertical 1" = 10′	3

Source	Type	Description	File I.D.
F. Hills	Plans	Anderson-Nelson Inc., 1992. *Final Plat 509 Paving Plans.* Scale: Horizontal 1" = 40′, Vertical 1" = 4′	4
F. Hills	Plans	Anderson-Nelson Inc., 1989. *Fountain Hills Sanitary District Sewer Improvements.* As-Built 1989. Structure #4.	5
FCDMC	Maps	Anderson-Nelson Inc. and Kenney Aerial Mapping, 1991. *Topographic Mapping. Sections 2-5, 8-11, and 14-17, T3N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: 1" = 200′. Job #910804.	6
F. Hills	Plans	Castro Fleet Engineering Inc., 1992. *Fountain Hills Storm Sewer, Grading & Drainage Plans for Bainbridge, Hampstead & Glenview Drive.* Scale: Horizontal 1" = 40′, Vertical 1" = 8′.	7
FCDMC	Plans	Howard, Needles, Tammen & Bergendorf Engineers, 1991. *Fountain Hills Unified School District Site, Junior High and High School Drainage & Site Plans.* Scale: 1" = 50′.	8
F. Hills	Map	Town of Fountain Hills Engineering Department, 1992. *Bench Mark Map. Sections 4-11, 14-17, 20-23, and 26-29, T3N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: 1" = 800′.	9
A-N	Plans	Anderson-Nelson Inc., June 1989. *Fountain Hills Improvement Project #8. Golden Eagle Blvd Paving Improvements. As-Built 18 August 1989.* Scale: Horizontal 1" = 20′, Vertical 1" = 4′.	10
F. Hills	Map	Town of Fountain Hills, 1992. *Zoning Map. Sections 4-11,14-17, 20-23, and 26-29, T3N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: Horizontal 1" = 800′.	11
F. Hills	Map	Trico Internationaf Inc. and McCulloch Properties, 1979.*Master Drainage Control Study for Fountain Hills, AZ.*, with Channel Cross Sectigfs, and 100-year Storm Data. Scale: 1" = 650′ (Approx.)	12
ADWR	Plans	Trico International Inc., 6 June 1971. *Fountain Hills Storm Water Retardation Basin #4.* As-Built 1 July 1974.	13(4)
ADWR	Plans	Trico International Inc., 10 October 1972. *Fountain Hills Storm Water Retardation Basin #6.* As-Built 1 July 1974.	13(6)
ADWR	Plans	Trico International Inc., 27 July 1972. *Fountain Hills Storm Water Retardation Basin #7.* As-Built.	13(7)
ADWR	Plans	Trico International Inc., 1 December 1972. *Fountain Hills Storm Water Retardation Basin #11.*	13(11)

Source	Type	Description	File I.D.
ADWR	Plans	Trico International Inc., 25 August 1972. *Fountain Hills Storm Water Retardation Basin #36.* As-Built 1 July 1974.	13(36)
A-N	Plans	Anderson-Nelson Inc., 1989. *Fountain Hills Improvement Project #8: Palisades Boulevard Paving Plans.* Scale: Horizontal 1" = 20´, Vertical 1" = 4´.	14
A-N	Plans	Anderson-Nelson Inc., 1989. *Fountain Hills Plat #601-C Off-Site Storm Drain Improvements.* See File I.D. 34. Scale: Horizontal 1" = 20´, Vertical 1" = 4´.	15
A-N	Plans	Anderson-Nelson Inc., 1988. *Drainage Plan and Catch BasinDetail for Wendover Drive and Stancrest Drive Drainage, Fountain Hills, AZ.* Scale: Horizontal 1" = 20´.	16
F. Hills	Map	Town of Fountain Hills, Undated. *Fountain Hills Index Map.* No Scale Given.	17
F. Hills	Plans	P & D Technologies, 4 April 1992. *Town of Fountain HillsStreet Paving Project East of Fountain Hills Blvd.* Scale: Horizontal 1" = 40´, Vertical 1" = 4´	18
F. Hills	Plans	Stanley Consultants, Inc., 1 April 1992. *Town of Fountain Hills Street Paving Project West of Fountain Hills Blvd.* Scale: Horizontal 1" = 40´, Vertical q" = 4´.	19
GCA	Map	GIS Consultants of Arizona, December 1992. *Topographicmap of project study area prepared by Rastor Scan and Vector conversion of USGS Quadrangle maps to AutoCAD format. Scale: Horizontal 1" = 1000'.*	20
KAM	Map	Kenney Aerial Mapping, Preliminary. *Topographic map of Section 10, T3N, R6E, and digital test cross sections. Also, plots of field check cross sections.*	21
MCDOT	Plans	Sverdrup & Parcel and Associates, Inc., May 1981. *McDowell Mountain Road Grading and Drainage Plans, Project No. 68030.* As-Built 27 October 1982. Scale: Horizontal 1" = 100', Vertical 1" = 10'.	22
MCDOT	Plans	Maricopa County Highway Department, 23 March 1984. *McDowell Mountain Road Construction Plans, Project No. 68254.* As-Built 6 May 1985. Scale: Horizontal 1"=100', Vertical 1"=10'.	23
F. Hills	Plans	P&D Technologies, June 1992. *Town of Fountain Hills Street Paving Project East of Fountain Hills Blvd. Revised sheets 8 and 11.* See File I.D. 18. Scale: Horizontal 1"=40', Vertical 1"=4'.	24

Source	Type	Description	File I.D.
F. Hills	Plans	Stanley Consultants, Inc., 1 April 1992. *Town of Fountain Hills Street Paving Project West of Fountain Hills Blvd. Revised Sheets 8 and 20.* See File I.D. 19. Scale: Horizontal 1" = 40', Vertical 1" = 4'.	25
F. Hills	Map	Town of Fountain Hills, 3 November 1992. *Plat Map. Sections 4-11, 14-17, 20-23, and 26-29, T3N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: Horizontal 1"-800'.	26
F. Hills	Map	Maricopa County Parks and Recreation, 1962. *Topographic Map of McDowell Mountain Park, Sections 1-36, T4N, R6E, G&SRB&M, Maricopa Co., Arizona.* Scale: Horizontal 1" = 1000'. Contour interval = 10'.	27
F. Hills	Map	Maricopa County Parks and Recreation, 1962. *Topographic Map of McDowell Mountain Park, Sections 19-36, T4N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: Horizontal 1" = 400'. Contour interval = 10'.	28
F. Hills	Map	Maricopa County Parks and Recreation, 14 August 1962. *Aerial Photographs of McDowell Mountain Park, Sections 1-36, T4N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: Horizontal 1"-800'.	29
A-N	Map	Kenney Aerial Mapping, 19 July 1972. *Topographic Maps of Sections 5-8, 17, and 31, T3N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: Horizontal 1" = 100', Contour interval = 4' with 2' supplementals. Kenney Aerial Mapping project number 691003.	30
A-N	Map	Kenney Aerial Mapping, undated. *Topographic Maps of Portions of Sections 9 and 10, T4N, R6E, G&SRB&M, Maricopa County, Arizona.* Scale: Horizontal 1" = 40', Contour interval = 1'. Kenney Aerial Mapping project number 891028-1.	31
FCDMC	Plans	Coe & Van Loo, 8 February 1993. *Golden Eagle Park, Master Plan - Phase 1 Improvements.* Scale: 1" = 50'.	32
FCDMC	Plans	Coe & Van Loo, 5 May 1993. *Golden Eagle Park, Phase 1 Improvements.* Scale: 1" = 30'.	33
A-N	Plans	Anderson-Nelson, Inc., 13 June 1988. *F. H. Plat 601-C Paving Improvements, Sheets 7 and 8 of 10.* See File I.D. 15. Scale: Varies.	34
F. Hills	Doc.	Anderson-Nelson, Inc., 24 June 1991. *Hydrology Report for Mirage Resort Casitas.* A 1.2 acre condominium development at Fountain Hills Blvd. and Oxford Wash.	A

Source	Type	Description	File I.D.
F. Hills	Doc.	Vernon Swaback Associates, 23 July 1992. *Town of Fountain Hills Land Use Elements General Plan.*	B
F. Hills	Doc.	Town of Fountain Hills, Undated. *Preliminary Zoning Ordinance.*	C
ADWR	Doc.	Arizona Department of Water Resources, June 1980. *Dam #6 (ADWR 7-39) Phase I Inspection Report #0075, National Dam Safety Program.*	D
ADWR	Doc.	Trico International, Inc., Undated. *Dam #6 (ADWR 7-39) Engineering Calculations, Computer Hydrology, and Cost Estimates.*	E
ADWR	Doc.	Arizona Department of Water Resources, July 1980. *Dam #11 (ADWR 7-40) Phase I Inspection Report #00167, National Dam Safety Program.*	F
ADWR	Doc.	Trico International, Inc., December 1972. *Dam #11 (ADWR 7-40) Engineering Calculations, Computer Hydrology, and Cost Estimates.*	G
ADWR	Doc.	Arizona Department of Water Resources, June 1980. *Dam #36 (ADWR 7-38) Phase I Inspection Report #00074, National Dam Safety Program.*	H
ADWR	Doc.	Trico International, Inc., October 1972. *Dam #36 (ADWR 7-38) Engineering Calculations, Computer Hydrology, and Cost Estimates.*	I
ADWR	Doc.	Cox, G.D., November 1972. *Dam #36 (ADWR 7-38) Review of Geologic Conditions for Fountain Hills Dam #36.*	J
ADWR	Doc.	Trico International, Inc., May 1972. *Dam #7 ((ADWR 7-32) Hydraulic Calculations and Computer Hydrology.*	K
ADWR	Doc.	U.S. Army Corps of Engineers, Los Angeles District, August 1972. *Dam #4 (ADWR 7-33) Phase 1 Inspection Report #03AZ0011, National Dam Safety Program.*	L
ADWR	Doc.	Trico International Inc., August 1972. *Dam #4 (ADWR 7-33) Hydraulic Calculations and Computer Hydrology.*	M
ADWR	Doc.	Howard, Needles, Tammen, and Bergendorf, April 1991. *Dam #4 (ADWR 7-33) Miscellaneous hydraulic calculations for the modification of the emergency spillway* (not in report format).	N
ADWR	Doc.	Arizona Department of Water Resources. 16 January 1990. *Dams No. 4, 6, 7, 11, and 36 Dam Safety Inspection Report. This report is typical of previous years.*	O

Source	Type	Description	File I.D.
ADWR	Doc.	Arizona Department of Water Resources. *Dam #4 (ADWR 7-33) Miscellaneous correspondence and calculations regarding principal and emergency spillway modifications.*	P
ADWR	Doc.	Trico International, Inc., 25 August 1975. *Design Calculations for Trash Rack Modifications Retardation Structure Nos. 4, 6, 7, 19 and 36, Fountain Hills, AZ.*	Q
ADWR	Doc.	Anderson-Nelson, Inc., 6 July 1989. *Dam #4 (ADWR 7-33) Fountain Hills Structure #4 - Sewer Line Proposal.*	R
F. Hills	Doc.	Standage & Associates Consulting Engineers, 2 July 1992. *Mirage Resort Casitas Condominium Development.* Letter with attachments regarding channel modifications.	S
F. Hills	Doc.	Anderson-Nelson, Inc., 31 August 1991. *Mirage Resort Casitas Drainage Study.* Response to Town review comments, with attachments.	T
A-N	Doc.	Anderson-Nelson, Inc., undated. *Monument Descriptions, Fountain Hills Mapping, High Altitude Aerial Panels.* (refer to Map 1).	U
F. Hills	Doc.	Town of Fountain Hills, 20 November 1991. *Bench mark and coordinate data list for local coordinate system.*	V
FCDMC	Doc.	Tudor Engineering, March 1992. *Preliminary McDowell Mountain Road Initial Drainage Report.* Project No. 68812/1991-14.	W
AMC	Map	Aerial Mapping Company, Inc., 10 December 1992. *Aerial Photographs of Fountain Hills Area.* Scale: Horizontal 1" = 1760'.	X
F. Hills	Doc.	Anderson-Nelson, Inc., 1991. *Fountain Hills Aerial Control, Street Paving Project, Vertical Control.*	Y
F. Hills	Doc.	Anderson-Nelson, Inc., 1991. *Fountain Hills Aerial Control, Street Paving Project, Horizontal Control.*	Z
SCS	Doc.	U.S. Soil Conservation Service, April 1986. *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona.*	AA

Source	Type	Description		File I.D.
USGS	Map	U.S. Geological Survey. USGS 7.5 minute quadrangle maps, and orthophotos, as follows:		Flatfile
		Granite Reef Dam:	1964, 1962 photo date, 1974 photorevised, 20' contour interval (CI), 10' supplementary CI (SCI). Orthophoto dated 1971.	
		McDowell Peak:	1965, 1962 photo date, 1982 photorevised, 20' CI. Orthophoto dated 1971.	
		Sawik Mountain:	1964, 1962 photo date, 1982 photorevised, 20' CI, 10' SCI. Orthophoto dated 1971.	
		Fort McDowell:	1964, 1962 photo date, 1974 photorevised, 1978 photoinspected, 20' CI, 10' SCI. Orthophoto dated 1971.	