PRELIMINARY DRAINAGE REPORT

MONUMENT CLUB CONDOMINIUMS AT TROON NORTH

For

Monument Club Condominiums, Troon North LCC

A Portion of the

SE 1/4, SEC. 29, T5N, R5E
Of the Gila & Salt River Base and Meridian,
City of Scottsdale
Maricopa County, Arizona

Assessor's Parcel Number 216-72-585 B

Graham Engineering & Surveying Job Number 07-169

Prepared for:

RD Architecture
7440 E Karen Drive
Scottsdale, AZ 85260
Contact
Rick Daugherty
(480) 607-3337

Prepared by:

GRAHAM ENGINEERING & SURVEYING, INC.
Post Office Box 1243
Carefree, Arizona 85377
Office (480) 488-4393
Facsimile (480) 488-2488

September 28, 2007

7/28

CASE DRAINAGE

4719-07

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FIGURES

APPENDICES

PLATES

1.0 Introduction

1.1 SCOPE

Provided herein are offsite and onsite hydrologic, hydraulic and detention analyses/designs. No off-site improvements are included in the design and specific surface drainage analyses but rather the pre-developed off-site, Scottsdale 2-foot interval topographic information is the basis for the HEC-1 offsite hydrology that is used for channel water surface profile elevation estimates.

This preliminary report does not include ground water hydrology or hydrogeology. Any issues that arise must be addressed by an engineering firm or an engineer whose specialty covers ground water issues. Graham Engineering & Surveying, Inc. will be held harmless for any damages as a result of ground water issues.

1.2 SITE DESCRIPTION

Monument Club Condominiums at Troon North is located to the northwest of 103rd St. and Dynamite Boulevard. The cadastral description is "That Portion of the Southeast one-quarter of Section 29, Township 5 North, Range 5 East of the Gila & Salt River Base and Meridian, City of Scottsdale, Maricopa County, Arizona. For the full legal description that is a meets and bounds description see the plate labeled figure The Assessor's Parcel Number is 216-72-585 B. The Graham Engineering & Surveying, Inc.™ Job Number is 07-169. This project gross area is 2.5574 acres.

Access to the site is provided to this lot off White Feather Lane being a paved local street with an asphalt surface and 4-inch concrete rolled curbs on either edge.

The site geography is typical of upper Sonoran Desert alluvial fan terrain. The slope is about 1.5% to the south and southwest with decomposed granite with various outcroppings of granite boulders and some granite latholith intrusion caps.

The predominant surface soil 'Gran', 'Wickenburg' and 'Rock Outcrop' and classified as hydrologic soil group 'D' according to the Aguila-Carefree Soil Study (United States Department of Agriculture, Soil Conservation Service, current publication).

2.0 Existing Conditions

2.1 OFF-SITE

This project is located adjacent to the Monument Golf Course at Troon which was not a mass graded development. The surface is covered with small braided washes that traverse down-slope to the south and southwest. A large wash runs along the northwest portion of this site. The tributary area is 330 acres of sparsely developed up slope residential homes.

2.2 ON-SITE

The proposed development consists of undeveloped sonoran desert. One poorly defined wash exists on the east half of the property and drains from the northeast to the southwest. Another poorly defined wash exists in the southwest section of the property and generally drains to the west into a large defined wash. The large off-site wash runs along the northwest portion of this site, between the roadway and the undeveloped desert area.

3.0 Hydrology

2.1 OFF-SITE

The off-site hydrology was estimated using HEC-1 for the entire off-site watershed. Individual basins were not delineated for this preliminary drainage report (see Appendix A). The 100-year, 24-hour S rainfall graph, (Phoenix Mountain, foothills area runoff basin) is used to model the off-site watershed. The results of which is a peak flow of 779 cfs.

2.2 ON-SITE

The off-site hydrology that affects the retention was estimated using HEC-1 for the entire off-site watershed for the water surface profile in HEC-RAS. Individual basins were not delineated for this preliminary drainage report (see Appendix A). The 100-year, 2-hour MCFCD rainfall graph (Phoenix Mountain, foothills area runoff basin) is used to model the off-site watershed. The results of which is a peak flow of 486 cfs.

An on-site hydrology estimate for the minor flow on this site is the area to the east of the property designated as wash W2 (See Figure 7) is estimated using the City of Scottsdale Rational Method with an added frequency factor. The City of Scottsdale Rational Method Form 2.2-18 is found in Appendix A. The resultant flow quantity estimated using the rational worksheet for the 100-year storm event is 34 cfs.

Pre and post on-site runoff was estimated to determine the size of the detention system and discharge rate. Flow-rates were estimated using the City of Scottsdale Rational Method Form 2.2-18. Two drainage basins, DA-1 and DA-2, were delineated for the pre-development surface runoff (see Figure 7). Both basins are comprised of nearly impervious soils (see Figure 4 and above description). A Runoff Coefficient of 0.78 was used for this soil. DA-1 pre-development condition (pre) has an area

of 1.2 acres and the resultant flow quantity estimated using the COS rational worksheet for the 100-year storm event is 11 cfs. This flow is discharged to the south to White Feather Ln. at concentration point CP1 (see Figure 7). DA-2 pre has an area of 0.45 acres and the resultant flow quantity estimated using the COS rational worksheet for the 100-year storm event is 4 cfs. This flow is discharged to west into a large wash at concentration point CP2 (see Figure 7).

Two drainage basins, DA-1 and DA-2 post development condition (post), were delineated (see Figure 8). A Runoff Coefficient of 0.95 is used for these basins for the moderately high content of impervious surfaces. DA-1 post has a total area of 0.68 acres and the resultant flow quantity estimated using the COS rational worksheet for the 100-year storm event is 7 cfs (see Figure 8). This flow consists entirely of roof runoff. Roof runoff will be conveyed from roof downspouts directly to an underground detention system. The reduction of flow from this area due to detention is 1 cfs from the peak flow. The peak flow occurs at a different time then the off-site peak and hence the metering will not increase the peak flow of the main channel that flows through the site on the northwest portion of this project.
DA-2 post has a total area of 0.94 acres and the resultant flow quantity estimated using the COS rational worksheet for the 100-year storm event is 10 cfs (see Figure 8). This flow consists of general ground runoff. Roof runoff will be conveyed from roof downspouts directly to an underground detention system. The reduction of flow from this area due to detention is 1 cfs from the peak flow. The peak flow occurs at a different time then the off-site peak and hence the metering will not increase the peak flow of the main channel that flows through the site on the northwest portion of this project.

4.0 Hydraulics

Hydraulic analysis supports the grading plan of which the intention is to direct storm water runoff around or away from all proposed building structures. Storm water runoff across the property is graded to maintain historic drainage patterns entering and exiting the site in a similar manner to the pre-improvement drainage patterns. Field investigations verified storm water runoff patterns and topographic mapping accuracy.

The water surface profile analysis using HEC-RAS version 3.1.1 uses mapping from two sources:

1. "Wash W-1" City of Scottsdale 2-foot contour interval

2. Local topographic information collected by Graham Engineering and Surveying, Inc, survey crews.

The vertical datum for source 1 and source 2 is based on the NAVD 88.

5.0 Erosion Set-Back

A level one procedure for estimation of channel degradation depth was used. This level of analysis provides an initial estimate of the potential scour depth to consider for design structures to be placed near the banks of a channel. Level I analysis requires the peak discharge associated with the 100-

year flood. The total scour depth is the combination of general degradation and long term degradation. Level I erosion set back SQRT (779) = 28 feet.

5.0 Flood Zone Information

See FIRM map (Figure 2) for flood zone information. The finish floor elevation is set one foot above the HEC-RAS water surface elevation being 2548.25.

FIGURES

SOILS SURVEY OF AGUILA–CAREFREE AREA

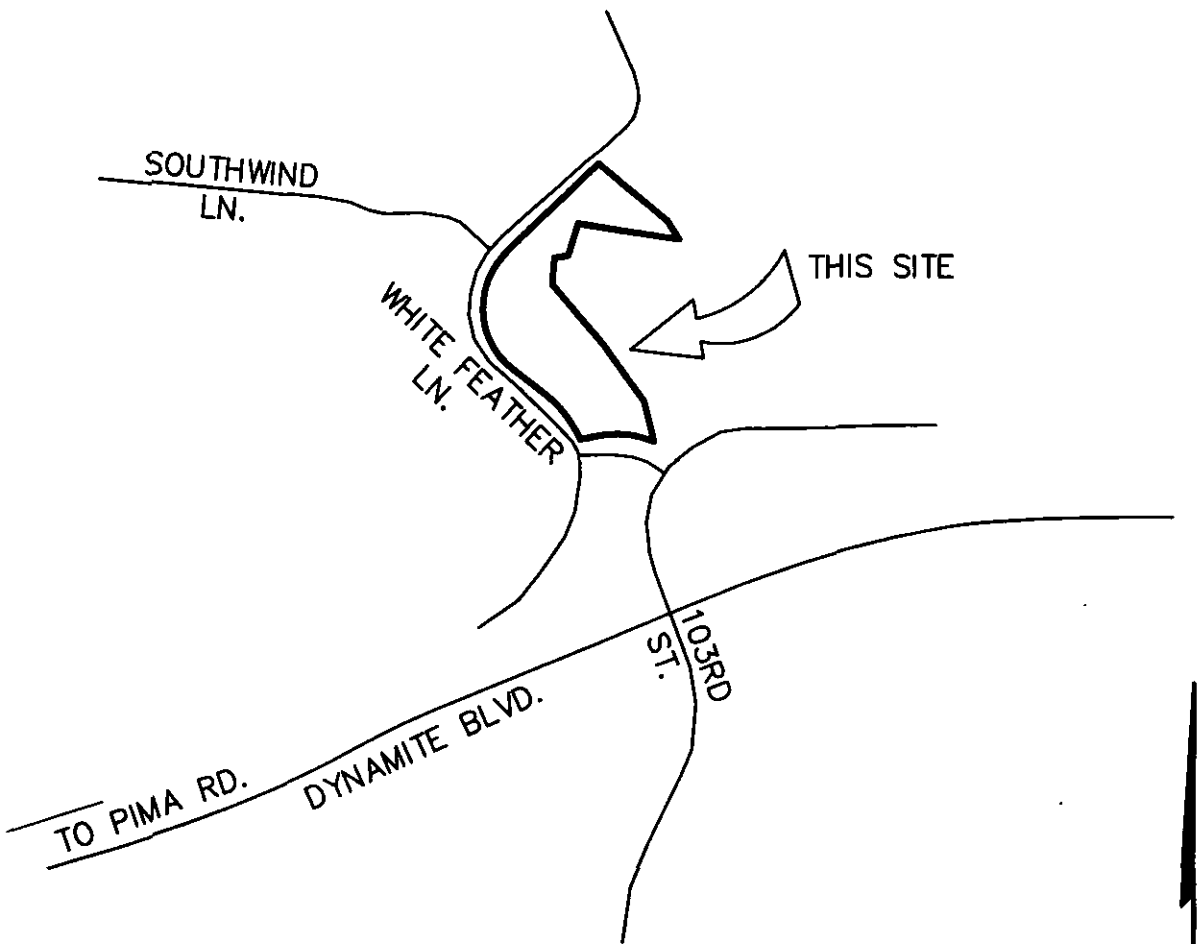
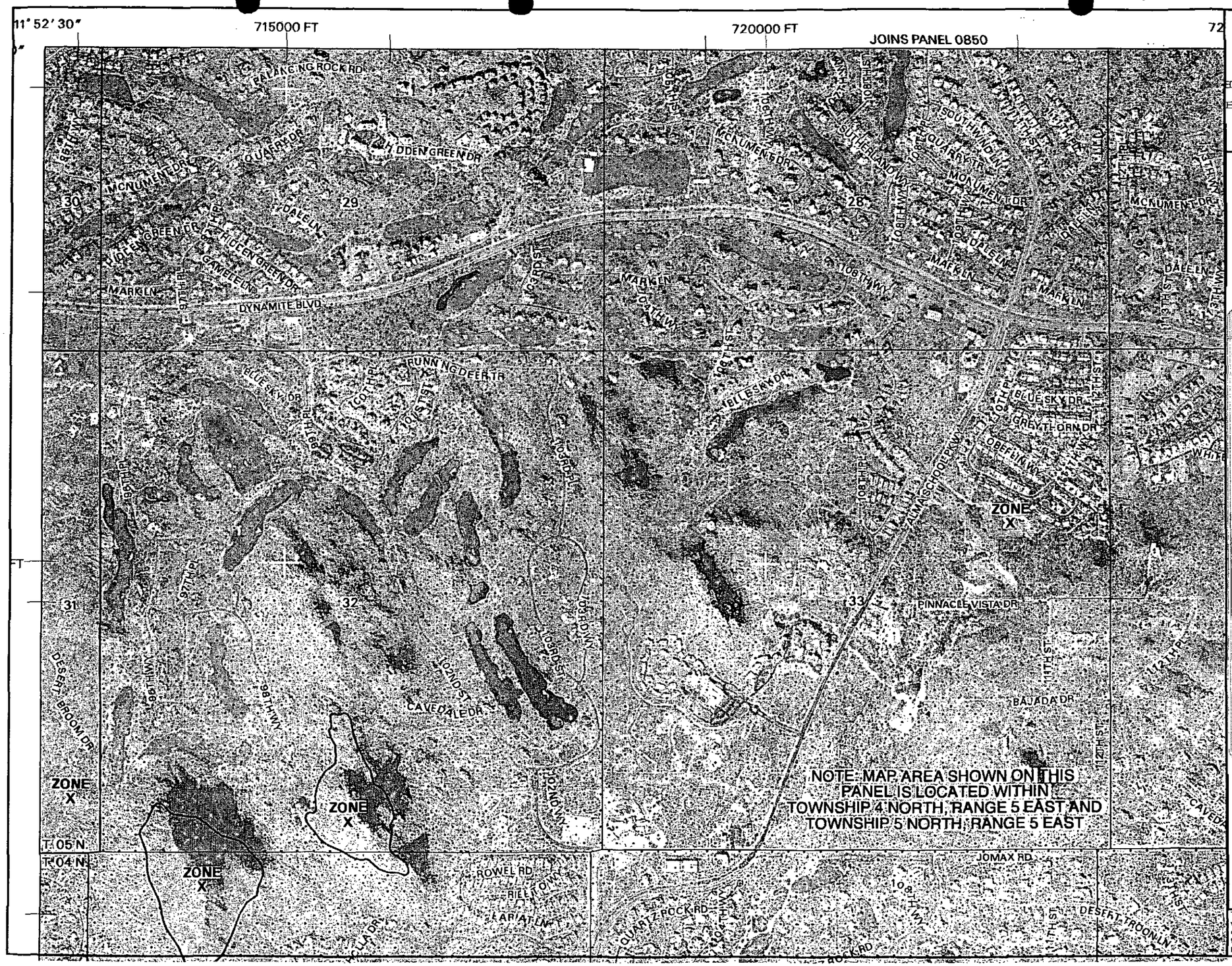


FIGURE 1

NTS

GRAHAM ENGINEERING & SURVEYING INC.
Civil Engineers & Land Surveyors
P.O. BOX 1243, Carefree, Arizona 85377
(480) 488–4393

DATE: 09/27/07
JOB # 07–169



MAP SCALE 1" = 1000'

0 1000 2000 FEET

0 300 600 METERS

NFIP

PANEL 1255G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1255 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SCOTTSDALE, CITY OF	045012	1255	G

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER

04013C1255G

MAP REVISED

SEPTEMBER 30, 2005

Federal Emergency Management Agency

FIGURE 2

SOILS SURVEY OF AGUILA–CAREFREE AREA

FIGURE 4

GRAHAM ENGINEERING & SURVEYING INC.
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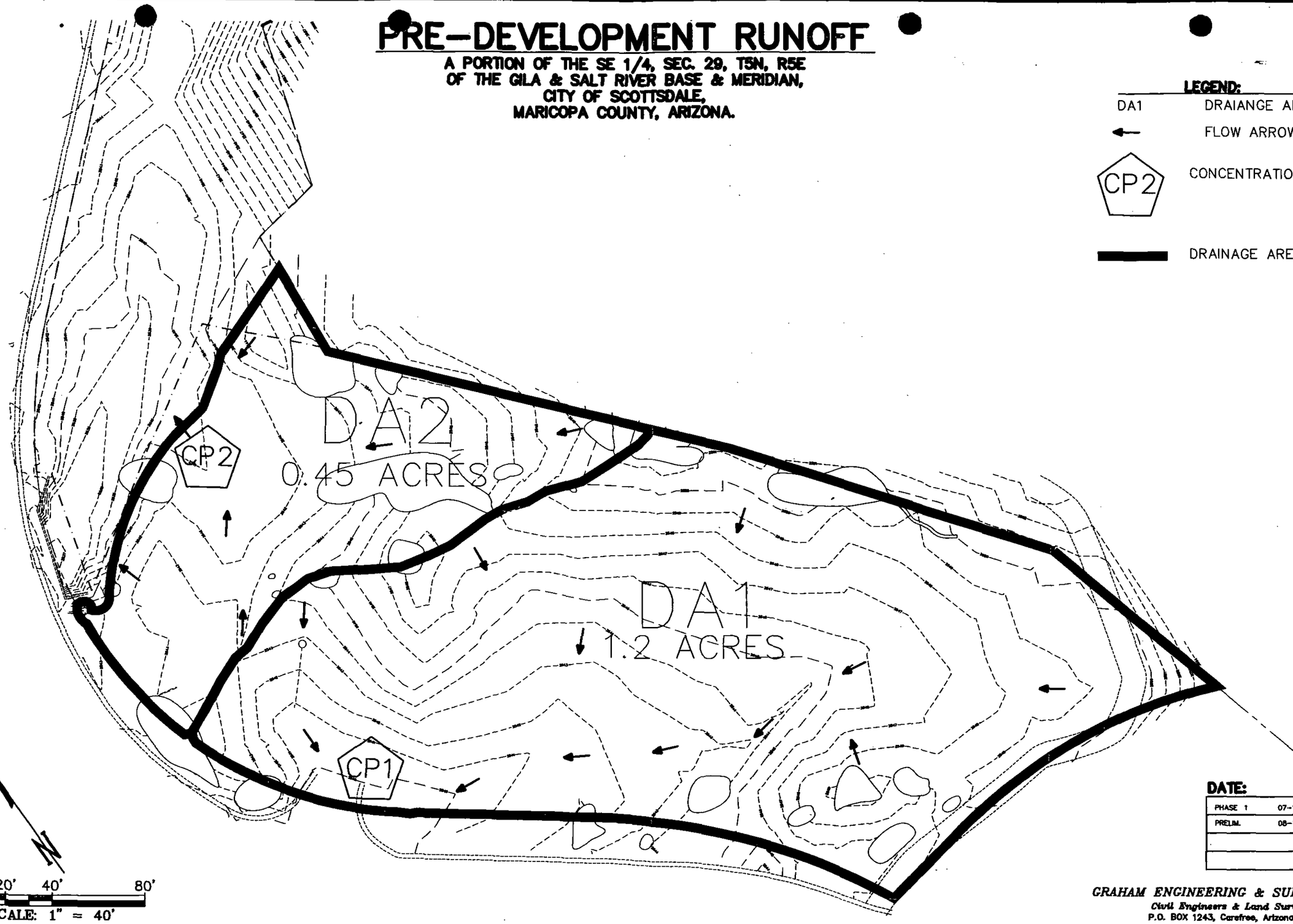
(480) 488–4393

DATE: 09/27/07
JOB # 07–169

PRE-DEVELOPMENT RUNOFF

A PORTION OF THE SE 1/4, SEC. 29, T5N, R5E
OF THE GILA & SALT RIVER BASE & MERIDIAN,
CITY OF SCOTTSDALE,
MARICOPA COUNTY, ARIZONA.



LEGEND:

DA1	DRAIANGE AREA
←	FLOW ARROW
CP2	CONCENTRATION POINT
▬	DRAINAGE AREA BOUNDARY

FIGURE 7

DATE:

PHASE 1	07-13-07	CAM
PRELIM.	08-14-07	PS

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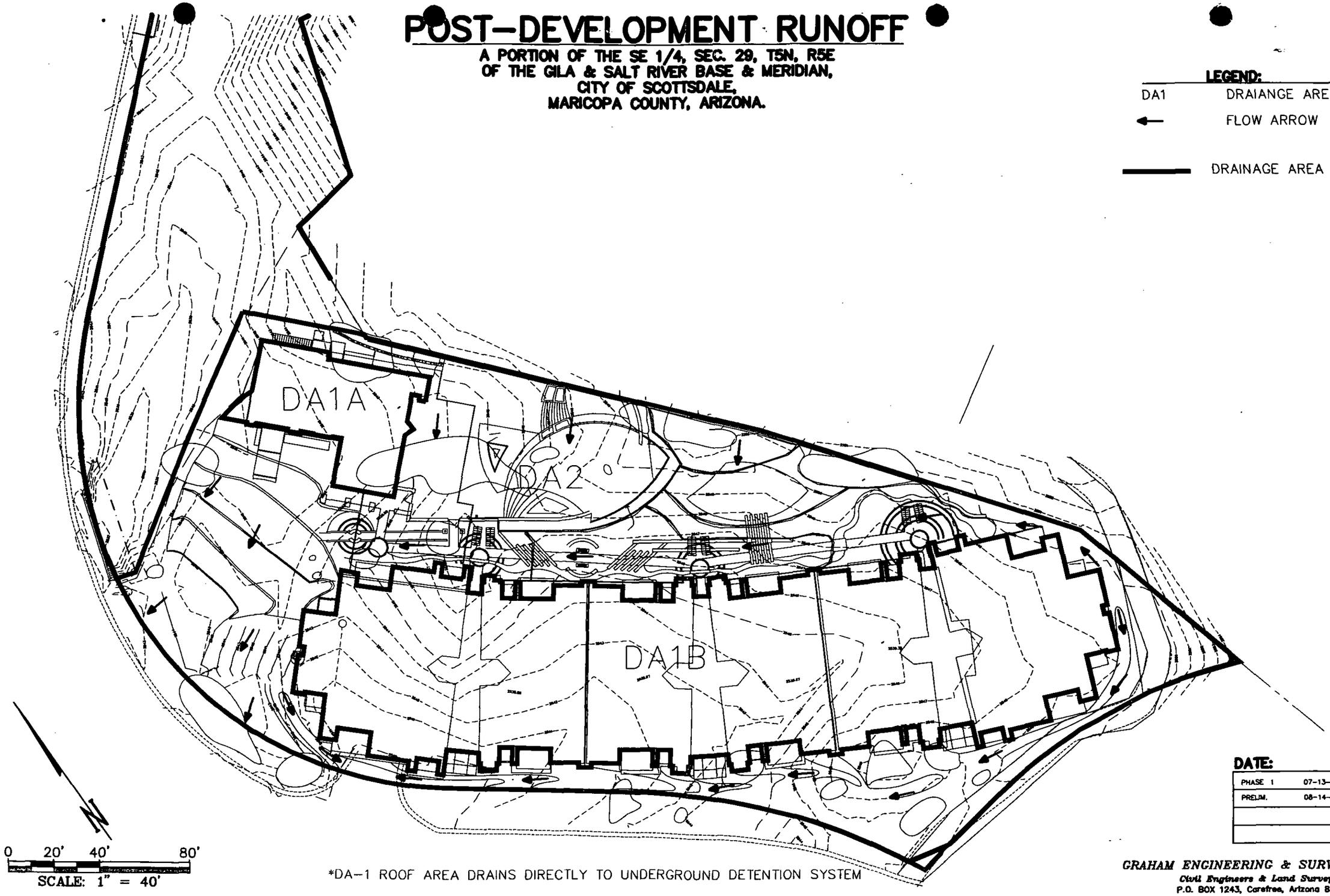
PART OF THE SE 1/4, SEC. 29, T5N, R5E, SHT. 1 OF 1, JOB #07-169

POST-DEVELOPMENT RUNOFF

A PORTION OF THE SE 1/4, SEC. 29, T5N, R5E
OF THE GILA & SALT RIVER BASE & MERIDIAN,
CITY OF SCOTTSDALE,
MARICOPA COUNTY, ARIZONA.

LEGEND:

DA1	DRAIANGE AREA
←	FLOW ARROW
▬▬	DRAINAGE AREA BOUNDARY



0 20' 40' 80'
SCALE: 1" = 40'

*DA-1 ROOF AREA DRAINS DIRECTLY TO UNDERGROUND DETENTION SYSTEM

FIGURE 8

DATE:

PHASE 1	07-13-07	CAM
PRELIM.	08-14-07	PS

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(480) 488-4393

PART OF THE SE 1/4, SEC. 29, T5N, R5E, SHT. 1 OF 1, JOB #07-169

Appendix A
Hydrology Backup

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD

RATIONAL METHOD

LOCATION DATA

EXHIBIT B

PROJECT: GRADING/DRAINAGE CONCENTRATION POINT: **EXIT FLOW**

LOCATION: 10200 E. Dynamite Blvd.

PROJECT NO.: 07-169 STATION:

NAME OF STREAM/WATERSHED: Pre-Development Onsite Flows

DESIGN DATA

DESIGN FREQUENCY:		2	5	10	25	50	100	YEARS
DRAINAGE AREA:	DA1						1.20	ACRES
	DA2						0.45	
	TOTAL (A)	Individual areas considered separately						
DRAINAGE LENGTH:							199	FEET
ELEVATION:								
TOP OF DRAINAGE AREA:							2554	FEET
AT STRUCTURE							2540	FEET
DRAINAGE AREA SLOPE:							7.0	PERCENT
HYDROLOGIC SOIL GROUP:							D	Gran
								Wickenburg

DESIGN COMPUTATIONS

FREQUENCY FACTOR (F):		1.00	1.00	1.00	1.10	1.20	1.25	
TIME OF CONCENTRATION:	T_C						5	MINUTES
RAINFALL INTENSITY (I):							9.25	INCHES/HOUR (Figure 2.2-13)
RUNOFF COEFFICIENT [C]:							0.78	
WEIGHTED RUNOFF COEFFICIENT (C_W):	C_W	Individual areas considered separately						
PEAK DISCHARGE $Q_P = C_W IA(F)$:	**CP1 (EXIT FLOW)**						**11**	cfs
	CP2 (EXIT FLOW)						**4**	cfs

COMPUTED BY: NATHAN WYLLIE, EIT DATE: 9/25/2007

CHECKED BY: RALPH NISENBAUM, P.E. DATE: 9/26/2007

FIGURE 2.2-18

Hydrologic Design Data Record

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD

RATIONAL METHOD

LOCATION DATA

EXHIBIT B 2

PROJECT: GRADING/DRAINAGE CONCENTRATION POINT: **EXIT FLOW**

LOCATION: 10200 E. Dynamite Blvd.

PROJECT NO.: 07-169 STATION:

NAME OF STREAM/WATERSHED: Post-Development Onsite Flows

DESIGN DATA

DESIGN FREQUENCY:		2 | 5 | 10 | 25 | 50 | 100	YEARS
DRAINAGE AREA:	DA1	0.68	ACRES
	DA2	0.94	ACRES
	TOTAL (A)	Individual areas considered separately	
DRAINAGE LENGTH:		199	FEET
ELEVATION:			
TOP OF DRAINAGE AREA:		2554	FEET
AT STRUCTURE		2540	FEET
DRAINAGE AREA SLOPE:		7.0	PERCENT
HYDROLOGIC SOIL GROUP:		D	Gran Wickenburg

DESIGN COMPUTATIONS

FREQUENCY FACTOR (F):		1.00 | 1.00 | 1.00 | 1.10 | 1.20 | 1.25	
TIME OF CONCENTRATION:	T_C	5	MINUTES
RAINFALL INTENSITY (I):		9.25	INCHES/HOUR (Figure 2.2-13)
RUNOFF COEFFICIENT [C]:	Roof and Asphalt	0.95	
WEIGHTED RUNOFF COEFFICIENT (C_W):	C_W	Individual areas considered separately	
PEAK DISCHARGE $Q_P = C_W IA(F)$:	**DA1 (EXIT FLOW)**	**7**	cfs
	DA2 (EXIT FLOW)	**10**	cfs

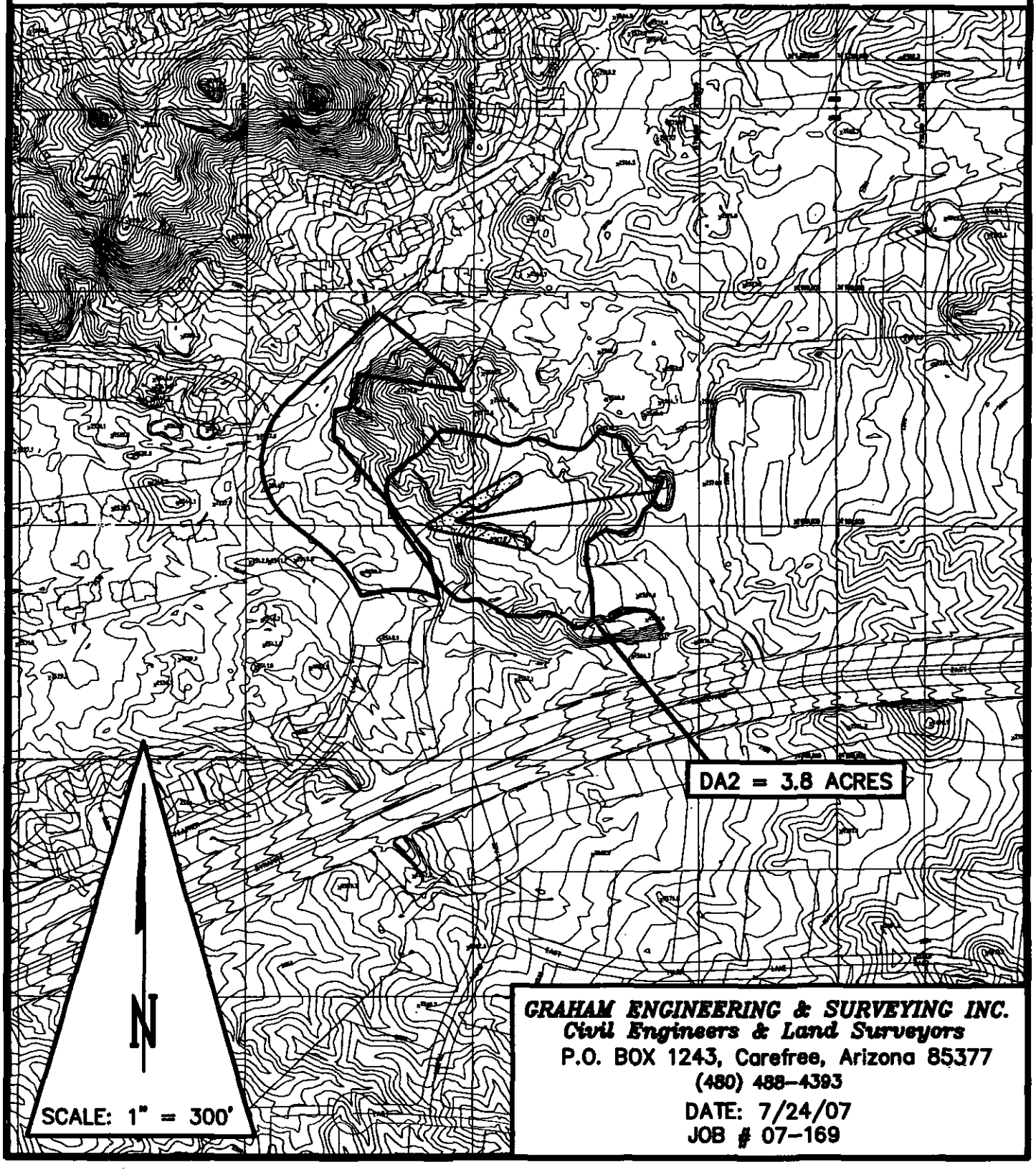
COMPUTED BY: NATHAN WYLLIE, EIT DATE: 9/25/2007

CHECKED BY: RALPH NISENBAUM, P.E. DATE: 9/26/2007

FIGURE 2.2-18

Hydrologic Design Data Record

EXHIBIT "A"
DRAINAGE AREA DELINEATION
MONUMENT CLUB



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Civil Engineers & Land Surveyors
P.O. BOX 1243, Carefree, Arizona 85377
(480) 488-4393

DATE: 7/24/07
JOB # 07-169

CITY OF SCOTTSDALE

HYDROLOGIC DESIGN DATA RECORD

RATIONAL METHOD

LOCATION DATA

EXHIBIT B2

PROJECT: GRADING/DRAINAGE CONCENTRATION POINT: **EXIT FLOW**

LOCATION:

PROJECT NO.: 07-169 STATION:

NAME OF STREAM/WATERSHED: DA-2 IN GRADING/DRAINAGE PLAN

DESIGN DATA

DESIGN FREQUENCY:		2	5	10	25	50	100	YEARS
DRAINAGE AREA:	DA2						3.8	ACRES
	TOTAL (A)	Individual areas considered separately						
DRAINAGE LENGTH:							553	FEET
ELEVATION:								
TOP OF DRAINAGE AREA:							2588	FEET
AT STRUCTURE							2554	FEET
DRAINAGE AREA SLOPE:							6.1	PERCENT
HYDROLOGIC SOIL GROUP:							D	Gran
								Wickenburg

DESIGN COMPUTATIONS

FREQUENCY FACTOR (F):		1.00	1.00	1.00	1.10	1.20	1.25	
TIME OF CONCENTRATION:	T_C						5	MINUTES
RAINFALL INTENSITY (I):							9.25	INCHES/HOUR (Figure 2.2-13)
RUNOFF COEFFICIENT [C]:	(FOR R4-R) SEE NEXT PAGE						0.78	
WEIGHTED RUNOFF COEFFICIENT (C_W):	C_W	Individual areas considered separately						
PEAK DISCHARGE $Q_P = C_W IA(F)$:	DA2						34	cfs

COMPUTED BY: Nathan Wyllie, EIT DATE: 9/25/2007

CHECKED BY: Ralph Nissembaum, P.E. DATE: 9/26/2007

FIGURE 2.2-18

Hydrologic Design Data Record

Runoff Coefficients

Land Use	"C" Value Hydrologic Soil Group B	C	D
Composite Area-wide Values			
Commercial and industrial areas:	0.9		
Residential areas-single family (avergae lot size):			
R1-1-190:	0.33	0.50	0.58
R1-130:	0.35	0.51	0.59
R1-70:	0.37	0.52	0.60
R1-43:	0.38	0.55	0.61
R1-35 (35,000 sq. ft./lot):	0.40	0.56	0.62
R1-18 (18,000 sq. ft./lot):	0.43	0.58	0.64
R1-10 (10,000 sq. ft./lot):	0.47	0.62	0.67
R1-7 (7,000 sq. ft./lot):	0.51	0.64	0.70
Townhouses (R-2, R-4):	0.63	0.74	0.78
Apartments and condominiums (R-3, R-5):	0.76	0.83	0.87
Specific Surface Type Values			
Paved streets or parking lot (concrete or asphalt), roofs, driveways, etc.	0.95		
Lawns, golf courses, and parks (grassed areas):	0.33	0.56	0.66
Undisturbed natural desert or desert landscaping (no impervious weed barrier):	0.31	0.48	0.56
Desert landscaping (with impervious weed barrier)	0.83	0.83	0.83
Mountain terrain - slopes greater than 10%:	0.70	0.70	0.70
Agricultural areas (Flood Irrigated Fields):	0.20	0.20	0.20

FIGURE 2.2-17

Runoff Coefficients "C" for use with the Rational Formula

Graham Engineering & Surveying, Inc.
POB 1243
7406 E. Nonchalant, Carefree, AZ 85377
Job Number: 07-169

28-Sep-07
Ralph Nisenbaum, PE
HEC-1 Input Parameters

INPUT PARAMETERS FOR BOTH S GRAPH AND MCFCD DISTRIBUTION

INPUT PARAMETER	VALUE & UNITS
AREA	0.517 SQ-MI
EVENT	100-YEAR, 24-HR
STORM SIZE	0.517 SQ-MI
STREAM LENGTH	2.029 MILES
LENGTH TO CA	0.918 MILES
SLOPE	152 FT./MI.
Kn ROUGHNESS	0.033
IA	0.25
DTHETA	0.1
PSIF	10
XKSAT	0.02
RTIMP	25
100 Yr. Precipitations	
24-Hr. =	4.60
2-Hr. =	2.75

S DISTRIBUTION LAG TIME USED IS 28 MINUTES
MCFCD DISTRIBUTION LAG TIME USED IS 23.17 MINUTES
Note: see the HEC-1 output files for more detailed information.

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 U.S. ARMY CORPS OF ENGINEERS            *
 *                JUN   1998             *
 HYDROLOGIC ENGINEERING CENTER           *
 *             VERSION 4.1               *
       609 SECOND STREET                 *
 *                                       *
    DAVIS, CALIFORNIA 95616              *
 *  RUN DATE   27SEP07  TIME  19:55:06   *
       (916) 756-1104                    *
 *                                       *
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X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX          XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT

PAGE 1

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

             1          ID   FULL WATERSHED, RALPH NISENBAUM, 27SEP07

             2          ID
```

```
        3           IT       15                    300
        4           IO        3

        5           KK
        6           KM     BASIN MONUMENT
        7           KM      THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
        8           KM      L=      2.0  Lca=       .9   S=  152.0  Kn= .033  LAG=  28.0
        9           KM      PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
       10           BA      .52
       11           IN       15
       12           KM     RAINFALL DEPTH OF 4.60 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
       13           KM     AN AREAL REDUCTION COEFFICIENT OF 1.000 WAS USED
       14           PB     4.600
       15           KM     THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II RAINFALL
       16           PC      .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
       17           PC      .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
       18           PC      .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
       19           PC      .110    .115    .120    .126    .135    .142    .150    .158    .166    .175
       20           PC      .184    .195    .208    .224    .243    .266    .318    .479    .678    .716
       21           PC      .743    .764    .781    .795    .808    .818    .828    .837    .844    .851
       22           PC      .858    .865    .871    .877    .883    .889    .895    .900    .905    .910
       23           PC      .915    .919    .923    .927    .931    .935    .939    .943    .947    .951
       24           PC      .954    .957    .960    .963    .966    .969    .972    .975    .978    .981
       25           PC      .984    .987    .990    .993    .996    .999   1.000
       26           LG      .25     .10   10.00     .02   20.00
       27           UI      188.    533.    300.    157.     78.     39.     19.     12.      0.      0.
       28           UI        0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
       29           ZZ
1*****************************************
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*                JUN   1998             *                                                       *
HYDROLOGIC ENGINEERING CENTER    *
*             VERSION 4.1               *                                                       *
      609 SECOND STREET          *
*                                       *                                                       *
   DAVIS, CALIFORNIA 95616       *
*  RUN DATE   27SEP07  TIME  19:55:06   *                                                       *
      (916) 756-1104             *
*                                       *                                                       *
                                 *
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FULL WATERSHED, RALPH NISENBAUM, 27SEP07

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

     IT         HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      4   0  ENDING DATE
                     NDTIME       0245  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .25 HOURS
                     TOTAL TIME BASE   74.75 HOURS

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

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
*** *** *** *** *** *** *** *** ***
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              **************
              *            *
   5 KK       *            *

              *            *
              **************
                           BASIN MONUMENT

                            THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN

                            L=      2.0  Lca=       .9   S=  152.0  Kn= .033  LAG=  28.0

                            PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN

                           RAINFALL DEPTH OF 4.60 WAS SPACIALLY REDUCED AS SHOWN BY THE PB
RECORD
                           AN AREAL REDUCTION COEFFICIENT OF 1.000 WAS USED

                           THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II RAINFALL


   11 IN            TIME DATA FOR INPUT TIME SERIES
                          JXMIN          15  TIME INTERVAL IN MINUTES
                         JXDATE      1    0  STARTING DATE
                         JXTIME           0  STARTING TIME

                  SUBBASIN RUNOFF DATA

   10 BA            SUBBASIN CHARACTERISTICS
                          TAREA         .52  SUBBASIN AREA

                    PRECIPITATION DATA

   15 PB                  STORM        4.60  BASIN TOTAL PRECIPITATION

   15 PI              INCREMENTAL PRECIPITATION PATTERN
                          .00      .00      .00      .00      .00      .00      .00
 .00      .00      .00
                          .00      .00      .00      .00      .00      .00      .00
 .00      .00      .00
                          .00      .00      .00      .00      .01      .01      .00
 .01      .00      .01
                          .01      .00      .01      .01      .01      .01      .01
 .01      .01      .01
                          .01      .01      .02      .02      .02      .05      .16
 .20      .04      .03
                          .02      .02      .01      .01      .01      .01      .01
 .01      .01      .01
                          .01      .01      .01      .01      .01      .01      .00
 .00      .01      .00
                          .00      .00      .00      .00      .00      .00      .00
 .00      .00      .00
                          .00      .00      .00      .00      .00      .00      .00
 .00      .00      .00
                          .00      .00      .00      .00      .00      .00
```

26 LG GREEN AND AMPT LOSS RATE

STRTL	.25	STARTING LOSS
DTH	.10	MOISTURE DEFICIT
PSIF	10.00	WETTING FRONT SUCTION
XKSAT	.02	HYDRAULIC CONDUCTIVITY
RTIMP	20.00	PERCENT IMPERVIOUS AREA

26 UI INPUT UNITGRAPH, 8 ORDINATES, VOLUME = .99

188.0 533.0 300.0 157.0 78.0 39.0 19.0
12.0

***

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

HYDROGRAPH AT STATION

TOTAL RAINFALL = 4.60, TOTAL LOSS = 1.08, TOTAL EXCESS = 3.52

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	74.75-HR
(CFS)	(HR)	(CFS)			
779.	12.25	165.	49.	16.	16.
		(INCHES) 2.946	3.478	3.481	3.481
		(AC-FT) 82.	96.	97.	97.

CUMULATIVE AREA = .52 SQ MI

1

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

BASIN AREA	MAXIMUM OPERATION STAGE	TIME OF MAX STAGE	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR
HYDROGRAPH AT							
.52			779.	12.25	165.	49.	16.

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

1HR

```
1*****************************************
*****************************************
 *                                       *
                                         *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 U.S. ARMY CORPS OF ENGINEERS            *
 *                JUN   1998             *
 HYDROLOGIC ENGINEERING CENTER           *
 *            VERSION 4.1                *
       609 SECOND STREET                 *
 *                                       *
    DAVIS, CALIFORNIA 95616              *
 *  RUN DATE   28SEP07  TIME  09:00:04   *
       (916) 756-1104                    *
 *                                       *
                                         *
 *****************************************
*****************************************
```

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

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

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

1 HEC-1 INPUT

PAGE 1

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

             1          ID   MONUMENT5MINOUTFALL,RDN

             2          ID
```

```
IT      5                  300
IO      3

KK
KM   BASIN M5
KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
KM    L=      2.0  LCa=       .9   S=  152.0  Kn= .033  LAG=  28.0
KM    PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN
BA     .52
IN      15
KM   RAINFALL DEPTH OF 4.60 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
KM   AN AREAL REDUCTION COEFFICIENT OF 1.000 WAS USED
PB   2.750
KM   THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II RAINFALL
PC    .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
PC    .110    .115    .120    .126    .135    .142    .150    .158    .166    .175
PC    .184    .195    .208    .224    .243    .266    .318    .479    .678    .716
PC    .743    .764    .781    .795    .808    .818    .828    .837    .844    .851
PC    .858    .865    .871    .877    .883    .889    .895    .900    .905    .910
PC    .915    .919    .923    .927    .931    .935    .939    .943    .947    .951
PC    .954    .957    .960    .963    .966    .969    .972    .975    .978    .981
PC    .984    .987    .990    .993    .996    .999   1.000
LG     .25     .10   10.00     .02   25.00
UI     62.    161.    341.    466.    669.    466.    355.    299.    246.    189.
UI    151.    130.     94.     76.     65.     48.     39.     30.     30.     15.
UI     12.     12.     12.     12.     12.      0.      0.      0.      0.      0.
UI      0.      0.      0.      0.      0.      0.      0.      0.
```

0. 0.
31 ZZ

```
1*****************************************
*****************************************
 *                                       *                                       *
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                       *
 U.S. ARMY CORPS OF ENGINEERS      *
 *                JUN   1998             *                                       *
 HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.1               *                                       *
       609 SECOND STREET           *
 *                                       *                                       *
    DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   28SEP07  TIME  09:00:04   *                                       *
       (916) 756-1104              *
 *                                       *                                       *
                                       *
 *****************************************
*****************************************
```

MONUMENT5MINOUTFALL,RDN

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

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL      .08 HOURS
                     TOTAL TIME BASE    24.92 HOURS

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

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


            **************
            *            *
   5 KK     *            *

            *            *
            **************
                           BASIN M5

                            THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN

                            L=       2.0  Lca=        .9   S=  152.0  Kn= .033  LAG=  28.0

                            PHOENIX MOUNTAIN S-GRAPH WAS USED FOR THIS BASIN

                           RAINFALL DEPTH OF 4.60 WAS SPACIALLY REDUCED AS SHOWN BY THE PB
RECORD
                           AN AREAL REDUCTION COEFFICIENT OF 1.000 WAS USED

                           THE FOLLOWING PC RECORD USED A 24-HOUR SCS TYPE II RAINFALL


  11 IN           TIME DATA FOR INPUT TIME SERIES
                        JXMIN          15  TIME INTERVAL IN MINUTES
                       JXDATE     1     0  STARTING DATE
                       JXTIME           0  STARTING TIME

                 SUBBASIN RUNOFF DATA

  10 BA           SUBBASIN CHARACTERISTICS
                        TAREA         .52  SUBBASIN AREA

                  PRECIPITATION DATA

  15 PB                 STORM        2.75  BASIN TOTAL PRECIPITATION

  15 PI             INCREMENTAL PRECIPITATION PATTERN
                        .00       .00       .00       .00       .00       .00       .00
.00        .00        .00
                        .00       .00       .00       .00       .00       .00       .00
.00        .00        .00
                        .00       .00       .00       .00       .00       .00       .00
.00        .00        .00
                        .00       .00       .00       .00       .00       .00       .00
.00        .00        .00
                        .00       .00       .00       .00       .00       .00       .00
.00        .00        .00
                        .00       .00       .00       .00       .00       .00       .00
.00        .00        .00
                        .00       .00       .00       .00       .00       .00       .00
.00        .00        .00
                        .00       .00       .00       .00       .00       .00       .00
```

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.02	.02
.02	.05	.05	.05	.07	.07	.07	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00									

```
   26 LG            GREEN AND AMPT LOSS RATE
                          STRTL          .25  STARTING LOSS
                            DTH          .10  MOISTURE DEFICIT
                           PSIF        10.00  WETTING FRONT SUCTION
                          XKSAT          .02  HYDRAULIC CONDUCTIVITY
                          RTIMP        25.00  PERCENT IMPERVIOUS AREA

   26 UI            INPUT UNITGRAPH,  25 ORDINATES,  VOLUME =  .99
          62.0     161.0     341.0     466.0     669.0     466.0     355.0
  299.0     246.0     189.0
         151.0     130.0      94.0      76.0      65.0      48.0      39.0
   30.0      30.0      15.0
          12.0      12.0      12.0      12.0      12.0
```

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

HYDROGRAPH AT STATION

TOTAL RAINFALL = 2.75, TOTAL LOSS = .90, TOTAL EXCESS = 1.85

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	24.92-HR
(CFS)	(HR)	(CFS)			
463.	12.17	90.	26.	25.	25.
		(INCHES) 1.613	1.829	1.830	1.830
		(AC-FT) 45.	51.	51.	51.

CUMULATIVE AREA = .52 SQ MI

1

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

BASIN AREA	MAXIMUM OPERATION STAGE	TIME OF MAX STAGE	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR
.52	HYDROGRAPH AT			463.	12.17	90.	26.	25.

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

Appendix B
Hydrologic Backup

24 HR

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Wash W-1
Project File : 07169100YR24HRprj.prj
Run Date and Time: 9/28/2007 9:53:50 AM

Project in English units

Project Description:
FLOW = 790 CFS 100-YR 24-HOUR STORM

PLAN DATA

Plan Title: Plan 02
Plan File : z:\Projects\2007\07-169\HEC-RAS\07169100YR24HRprj.p02

Geometry Title: Geom 01
Geometry File : z:\Projects\2007\07-169\HEC-RAS\07169100YR24HRprj.g01

Flow Title : Flow 06
Flow File : z:\Projects\2007\07-169\HEC-RAS\07169100YR24HRprj.f06

Plan Summary Information:
Number of: Cross Sections = 11 Multiple Openings = 0
Culverts = 1 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Flow 06
Flow File : z:\Projects\2007\07-169\HEC-RAS\07169100YR24HRprj.f06

Flow Data (cfs)

River	Reach	RS	PF 1
W-1	Wash W-1	11	779

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
W-1	Wash W-1	PF 1	Normal S = 0.0267	Normal S = 0.0305

GEOMETRY DATA

Geometry Title: Geom 01
Geometry File : z:\Projects\2007\07-169\HEC-RAS\07169100YR24HRprj.g01

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 11

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2549	3.47	2548	15.15	2547	39.22	2546	54.63	2545
57.94	2546	61.3	2547	70.51	2548	78.78	2548.91		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	39.22	.03	57.94	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
39.22	57.94	58.47	49.8	50.03	.1 .3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 10

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2548	3.99	2547	7.76	2546	11.53	2545	15.26	2544
20.81	2543.8	26.64	2544	30.64	2545	34.74	2546	38.92	2547
51.21	2548	52.21	2548.1	53.02	2548				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	15.26	.03	26.64	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
15.26	26.64	50.17	50.85	50.51	.1 .3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 9

INPUT

Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2547	2.64	2546	5.28	2545	7.93	2544	23.95	2543
32.08	2542.91	34.76	2543	38.35	2544	42.34	2545	46.42	2546
59.66	2546.58								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	23.95	.03	34.76	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
23.95	34.76	50.02	50.51	50.29	.1	.3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 8

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2545	5.8	2544	11.27	2543	19.76	2542	24.44	2541.81
28.57	2542	42.09	2543	55.93	2544	64.39	2544.86		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	19.76	.03	28.57	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
19.76	28.57	56.96	50.5	50.31	.1	.3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 7

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2544	15.95	2543	21.54	2542	28.75	2541	54.08	2540
58.55	2539.83	61.64	2540	67.62	2541	73.91	2542	85.61	2543
96.93	2543.67								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	54.08	.03	61.64	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
54.08	61.64	52.54	49.75	49.99	.1	.3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 6

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2549.25	0	2541.51	3.62	2541	21	2540	31.85	2539
38.94	2538.45	46.25	2539	59.59	2540	67.12	2541	75.03	2542
84.66	2543								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

0	.04	31.85	.03	46.25	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
31.85	46.25	45.76	42.18	40.42	.1 .3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 5

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2549	0	2541.2	6.77	2541	10.64	2540	14.13	2539
24.62	2538	29.6	2537.69	34.83	2538	40.12	2539	43.61	2540
45.88	2541	55.05	2542	61.44	2542.75				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	24.62	.03	34.83	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
24.62	34.83	30.54	20.58	21.29	.1 .3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 4

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2546.5	0	2540.14	.91	2540	7.42	2539	13.94	2538
23.27	2537.68	30.68	2538	32.53	2539	34.38	2540	36.25	2541
36.94	2541.3	36.94	2542						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	13.94	.03	30.68	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13.94	30.68	42.2	23.89	9.92	.1 .3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 3

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2544	0	2543.2	.34	2543	1.28	2542	2.23	2541
3.21	2540	4.19	2539	5.28	2538	17.26	2537	25.38	2536.9
25.92	2537	35.52	2538	37.24	2539	40.06	2540	42.5	2541
44.17	2542	45	2542.2						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	5.28	.03	35.52	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
5.28	35.52	108.63	71.04	74.11	.1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	5.2	2543	F

```
   39.7      45    2543        F

CULVERT


RIVER: W-1
REACH: Wash W-1          RS: 2.0902

INPUT
Description:
Distance from Upstream XS =    10.2
Deck/Roadway Width        =      24
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2543.95    2536      53 2543.95    2536

Upstream Bridge Cross Section Data
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    2544       0  2543.2      .34    2543    1.28    2542    2.23    2541
    3.21    2540    4.19    2539    5.28    2538   17.26    2537   25.38  2536.9
   25.92    2537   35.52    2538   37.24    2539   40.06    2540    42.5    2541
   44.17    2542      45  2542.2

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04    5.28     .03   35.52     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
          5.28   35.52            .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     5.2    2543          F
    39.7      45    2543          F

Downstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0 2543.95    2535     121 2543.95    2535

Downstream Bridge Cross Section Data
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    2540   65.92    2538   87.93    2536   91.28    2536  107.72    2538
  121.36    2540

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   87.93     .03   91.28     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
         87.93   91.28            .1       .3

Upstream Embankment side slope             =       2 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins        =
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #1        Ellipse     4.5       6
FHWA Chart # 29- Horizontal Ellipse; Concrete
FHWA Scale # 1 - Square edge with headwall
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
```

Coef

5.32	58.96	24	.024	0	.5	1

Number of Barrels = 4
Upstream Elevation = 2536.95
Centerline Stations

Sta.	Sta.	Sta.	Sta.
8.86	16.77	27.88	35.98

Downstream Elevation = 2535.8
Centerline Stations

Sta.	Sta.	Sta.	Sta.
85.17	93.08	104.19	112.29

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 2

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2540	65.92	2538	87.93	2536	91.28	2536	107.72	2538
121.36	2540								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	87.93	.03	91.28	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
87.93	91.28	107.85	101.61	93.35	.1	.3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 1

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2538	60.32	2536	63.52	2534	69.48	2533.56	75.95	2534
87.33	2536	114.67	2538						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	63.52	.03	75.95	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
63.52	75.95	.1	.3

SUMMARY OF MANNING'S N VALUES

River:W-1

Reach	River Sta.	n1	n2	n3
Wash W-1	11	.04	.03	.04
Wash W-1	10	.04	.03	.04
Wash W-1	9	.04	.03	.04
Wash W-1	8	.04	.03	.04
Wash W-1	7	.04	.03	.04
Wash W-1	6	.04	.03	.04
Wash W-1	5	.04	.03	.04
Wash W-1	4	.04	.03	.04
Wash W-1	3	.04	.03	.04
Wash W-1	2.0902	Culvert		
Wash W-1	2	.04	.03	.04

Wash W-1	1	.04	.03	.04

SUMMARY OF REACH LENGTHS

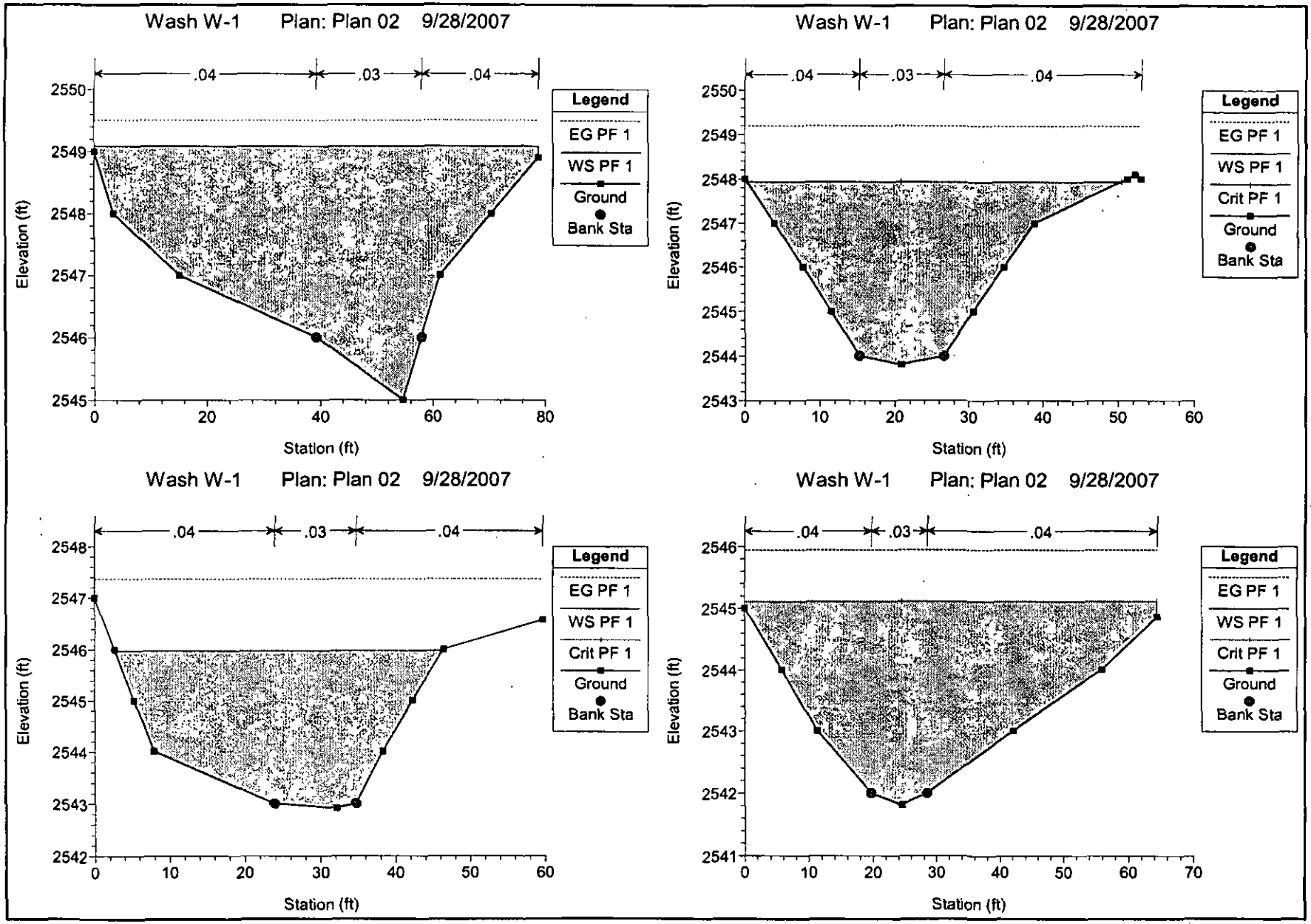
River: W-1

Reach	River Sta.	Left	Channel	Right
Wash W-1	11	58.47	49.8	50.03
Wash W-1	10	50.17	50.85	50.51
Wash W-1	9	50.02	50.51	50.29
Wash W-1	8	56.96	50.5	50.31
Wash W-1	7	52.54	49.75	49.99
Wash W-1	6	45.76	42.18	40.42
Wash W-1	5	30.54	20.58	21.29
Wash W-1	4	42.2	23.89	9.92
Wash W-1	3	108.63	71.04	74.11
Wash W-1	2.0902	Culvert		
Wash W-1	2	107.85	101.61	93.35
Wash W-1	1			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: W-1

Reach	River Sta.	Contr.	Expan.
Wash W-1	11	.1	.3
Wash W-1	10	.1	.3
Wash W-1	9	.1	.3
Wash W-1	8	.1	.3
Wash W-1	7	.1	.3
Wash W-1	6	.1	.3
Wash W-1	5	.1	.3
Wash W-1	4	.1	.3
Wash W-1	3	.1	.3
Wash W-1	2.0902	Culvert	
Wash W-1	2	.1	.3
Wash W-1	1	.1	.3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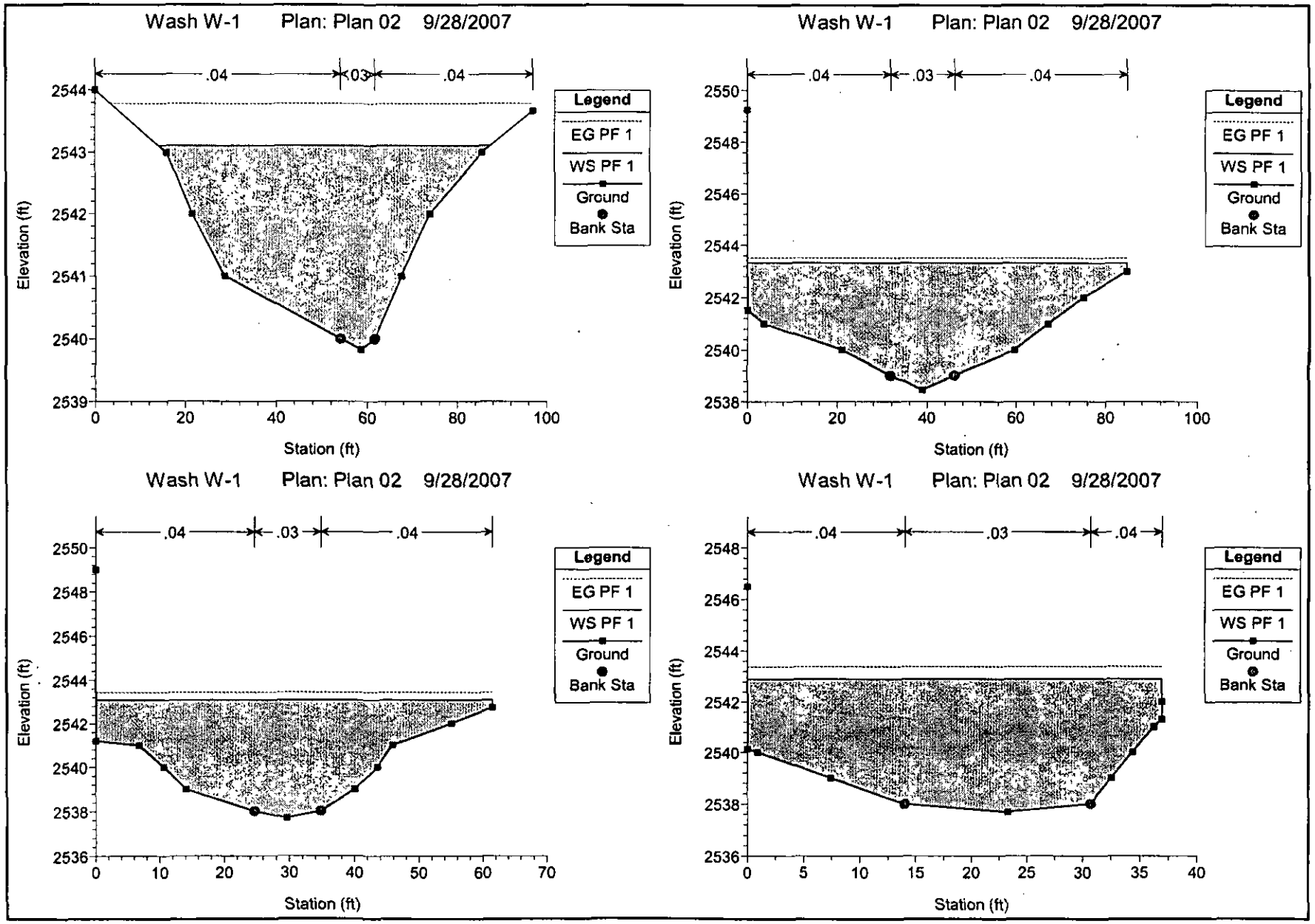
.04
.03
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2550
2549
2548
2547
2546
2545
0
20
40
60
80
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2550
2549
2548
2547
2546
2545
2544
2543
0
10
20
30
40
50
60
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2548
2547
2546
2545
2544
2543
2542
0
10
20
30
40
50
60
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2546
2545
2544
2543
2542
2541
0
10
20
30
40
50
60
70


Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2544
2543
2542
2541
2540
2539
0
20
40
60
80
100
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2550
2548
2546
2544
2542
2540
2538
0
20
40
60
80
100
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2550
2548
2546
2544
2542
2540
2538
2536
0
10
20
30
40
50
60
70
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2548
2546
2544
2542
2540
2538
2536
0
5
10
15
20
25
30
35
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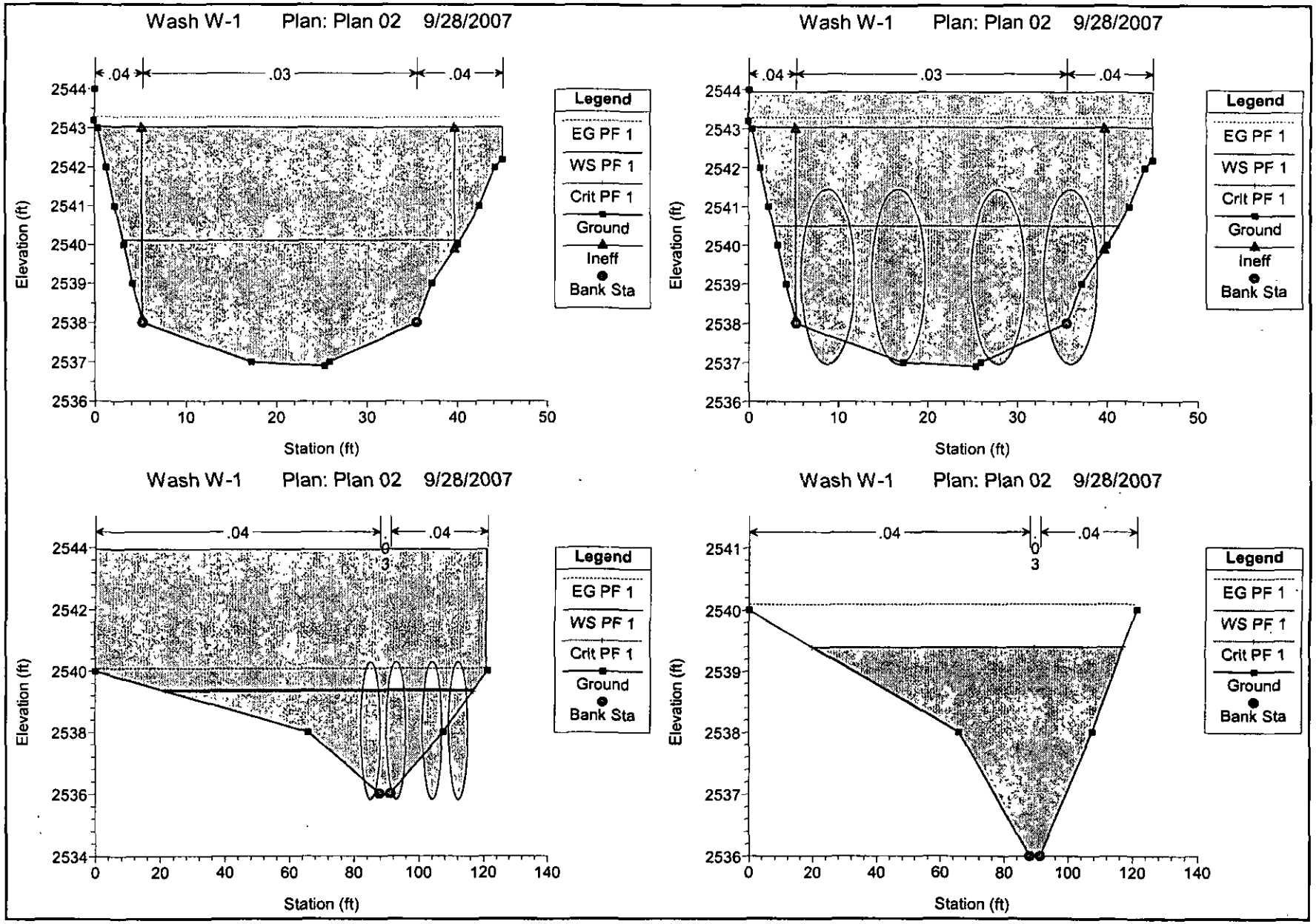
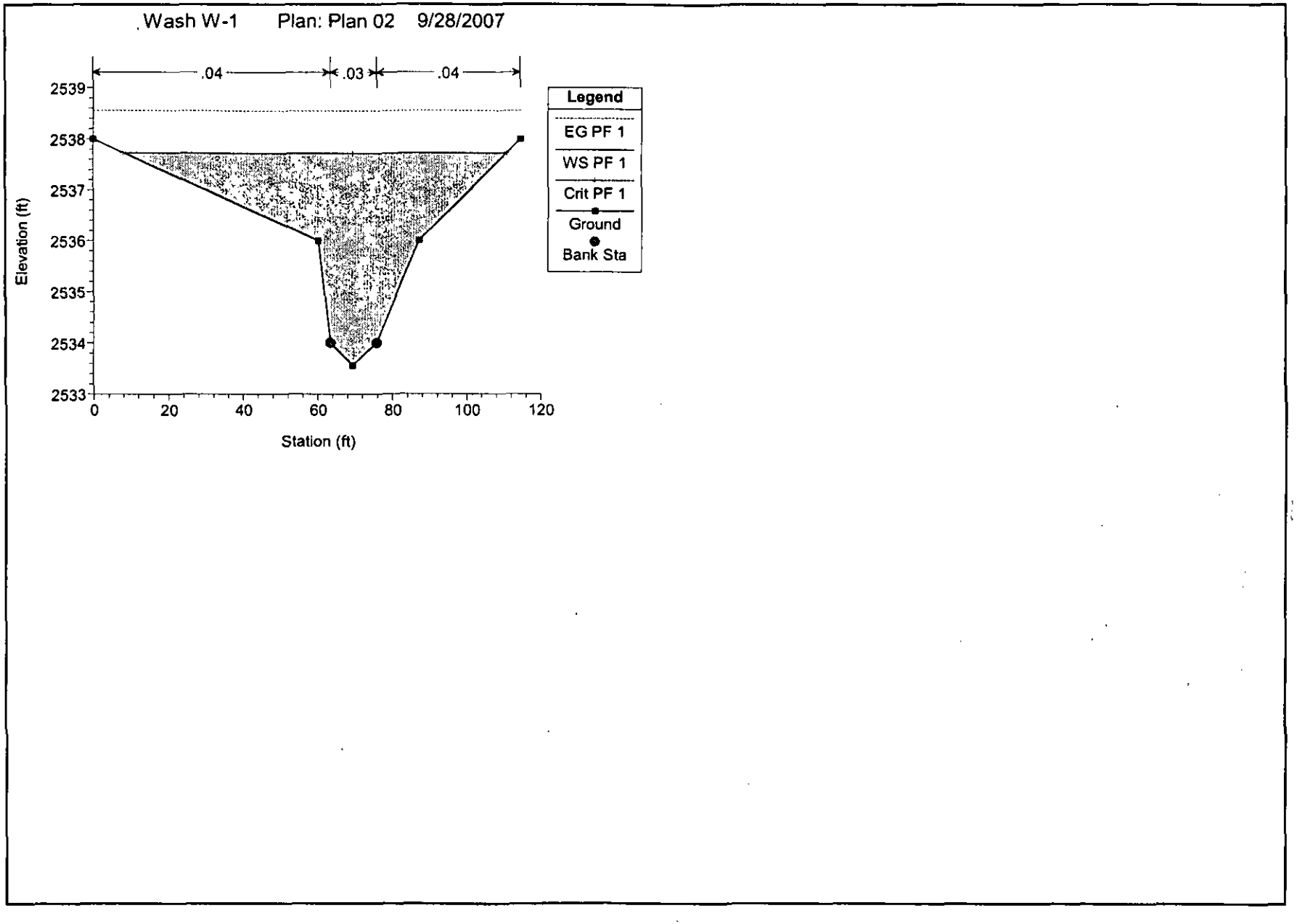

Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Wash W-1 Plan: Plan 02 9/28/2007
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Wash W-1 Plan: Plan 02 9/28/2007
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
2539
2538
2537
2536
2535
2534
2533
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

2 HR

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Wash W-1
Project File : 07169.prj
Run Date and Time: 9/28/2007 9:13:13 AM

Project in English units

Project Description:
FLOW = 496 CFS 100-YR 2-HOUR STORM

PLAN DATA

Plan Title: Plan 02
Plan File : z:\Projects\2007\07-169\HEC-RAS\07169.p02

Geometry Title: Geom 01
Geometry File : z:\Projects\2007\07-169\HEC-RAS\07169.g01

Flow Title : Flow 06
Flow File : z:\Projects\2007\07-169\HEC-RAS\07169.f06

Plan Summary Information:

Number of:	Cross Sections	= 11	Multiple Openings	=	0
	Culverts	= 1	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Flow 06
Flow File : z:\Projects\2007\07-169\HEC-RAS\07169.f06

Flow Data (cfs)

```
      0     .04   31.85     .03   46.25     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
         31.85   46.25             45.76   42.18   40.42             .1       .3

CROSS SECTION


RIVER: W-1
REACH: Wash W-1           RS: 5

INPUT
Description:
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    2549       0  2541.2    6.77    2541   10.64    2540   14.13    2539
   24.62    2538    29.6 2537.69   34.83    2538   40.12    2539   43.61    2540
   45.88    2541   55.05    2542   61.44 2542.75

Manning's n Values        num=      3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   24.62     .03   34.83     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
         24.62   34.83             30.54   20.58   21.29             .1       .3

CROSS SECTION


RIVER: W-1
REACH: Wash W-1           RS: 4

INPUT
Description:
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  2546.5       0 2540.14     .91    2540    7.42    2539   13.94    2538
   23.27 2537.68   30.68    2538   32.53    2539   34.38    2540   36.25    2541
   36.94  2541.3   36.94    2542

Manning's n Values        num=      3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   13.94     .03   30.68     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
         13.94   30.68             42.2    23.89    9.92             .1       .3

CROSS SECTION


RIVER: W-1
REACH: Wash W-1           RS: 3

INPUT
Description:
Station Elevation Data    num=      17
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    2544       0  2543.2     .34    2543    1.28    2542    2.23    2541
    3.21    2540    4.19    2539    5.28    2538   17.26    2537   25.38  2536.9
   25.92    2537   35.52    2538   37.24    2539   40.06    2540    42.5    2541
   44.17    2542      45  2542.2

Manning's n Values        num=      3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04    5.28     .03   35.52     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
         5.28    35.52            108.63   71.04   74.11             .1       .3
Ineffective Flow     num=      2
   Sta L   Sta R    Elev  Permanent
       0     5.2    2543         F
```

```
    39.7      45    2543        F

CULVERT


RIVER: W-1
REACH: Wash W-1           RS: 2.0902

 INPUT
Description:
Distance from Upstream XS =    10.2
 Deck/Roadway Width       =      24
 Weir Coefficient         =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
      Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
        0 2543.95    2536      53 2543.95    2536

Upstream Bridge Cross Section Data
 Station Elevation Data    num=      17
      Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
        0    2544       0  2543.2      .34    2543    1.28    2542    2.23    2541
     3.21    2540    4.19    2539    5.28    2538   17.26    2537   25.38  2536.9
    25.92    2537   35.52    2538   37.24    2539   40.06    2540    42.5    2541
    44.17    2542      45  2542.2

 Manning's n Values        num=       3
      Sta   n Val     Sta   n Val     Sta   n Val
        0     .04    5.28     .03   35.52     .04

 Bank Sta: Left   Right    Coeff Contr.   Expan.
           5.28   35.52            .1       .3
 Ineffective Flow     num=       2
    Sta L   Sta R    Elev  Permanent
        0     5.2    2543          F
     39.7      45    2543          F

Downstream  Deck/Roadway Coordinates
    num=       2
      Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
        0 2543.95    2535     121 2543.95    2535

Downstream Bridge Cross Section Data
 Station Elevation Data    num=       6
      Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
        0    2540   65.92    2538   87.93    2536   91.28    2536  107.72    2538
   121.36    2540

 Manning's n Values        num=       3
      Sta   n Val     Sta   n Val     Sta   n Val
        0     .04   87.93     .03   91.28     .04

 Bank Sta: Left   Right    Coeff Contr.   Expan.
          87.93   91.28            .1       .3

Upstream Embankment side slope                =       2 horiz. to 1.0 vertical
 Downstream Embankment side slope             =       2 horiz. to 1.0 vertical
 Maximum allowable submergence for weir flow  =     .95
 Elevation at which weir flow begins          =
 Energy head used in spillway design          =
 Spillway height used in design               =
 Weir crest shape                             = Broad Crested

Number of Culverts =  1

 Culvert Name     Shape      Rise    Span
 Culvert #1       Ellipse     4.5       6
 FHWA Chart # 29- Horizontal Ellipse; Concrete
 FHWA Scale # 1 - Square edge with headwall
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss
```

Coef
5.32 58.96 24 .024 0 .5 1
Number of Barrels = 4
Upstream Elevation = 2536.95
Centerline Stations
Sta. Sta. Sta. Sta.
8.86 16.77 27.88 35.98
Downstream Elevation = 2535.8
Centerline Stations
Sta. Sta. Sta. Sta.
85.17 93.08 104.19 112.29

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 2

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2540	65.92	2538	87.93	2536	91.28	2536	107.72	2538
121.36	2540								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	87.93	.03	91.28	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
87.93	91.28	107.85	101.61	93.35	.1 .3

CROSS SECTION

RIVER: W-1
REACH: Wash W-1 RS: 1

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2538	60.32	2536	63.52	2534	69.48	2533.56	75.95	2534
87.33	2536	114.67	2538						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	63.52	.03	75.95	.04

Bank Sta: Left	Right	Coeff Contr.	Expan.
63.52	75.95	.1	.3

SUMMARY OF MANNING'S N VALUES

River:W-1

Reach	River Sta.	n1	n2	n3
Wash W-1	11	.04	.03	.04
Wash W-1	10	.04	.03	.04
Wash W-1	9	.04	.03	.04
Wash W-1	8	.04	.03	.04
Wash W-1	7	.04	.03	.04
Wash W-1	6	.04	.03	.04
Wash W-1	5	.04	.03	.04
Wash W-1	4	.04	.03	.04
Wash W-1	3	.04	.03	.04
Wash W-1	2.0902	Culvert		
Wash W-1	2	.04	.03	.04

Wash W-1	1	.04	.03	.04

SUMMARY OF REACH LENGTHS

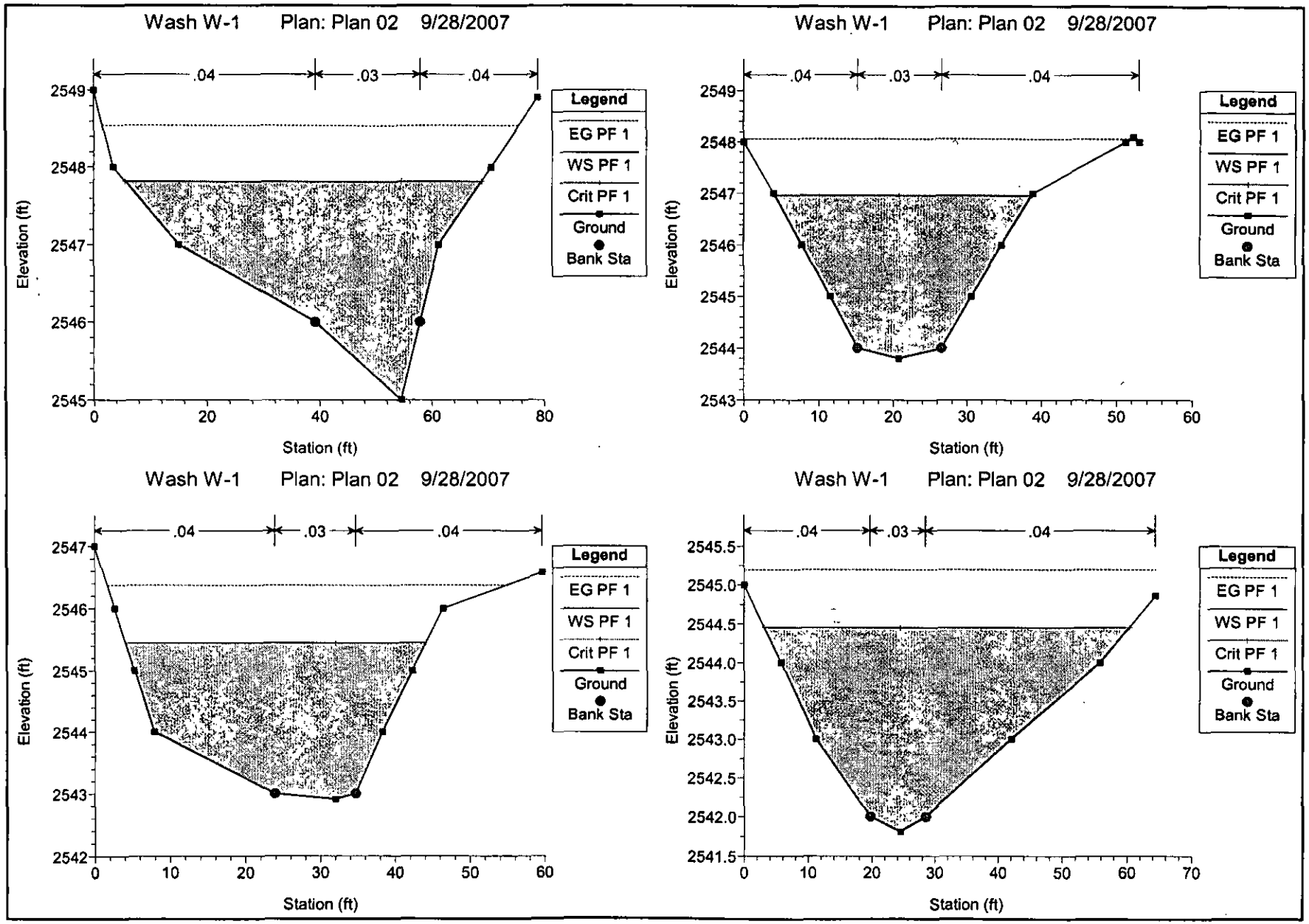
River: W-1

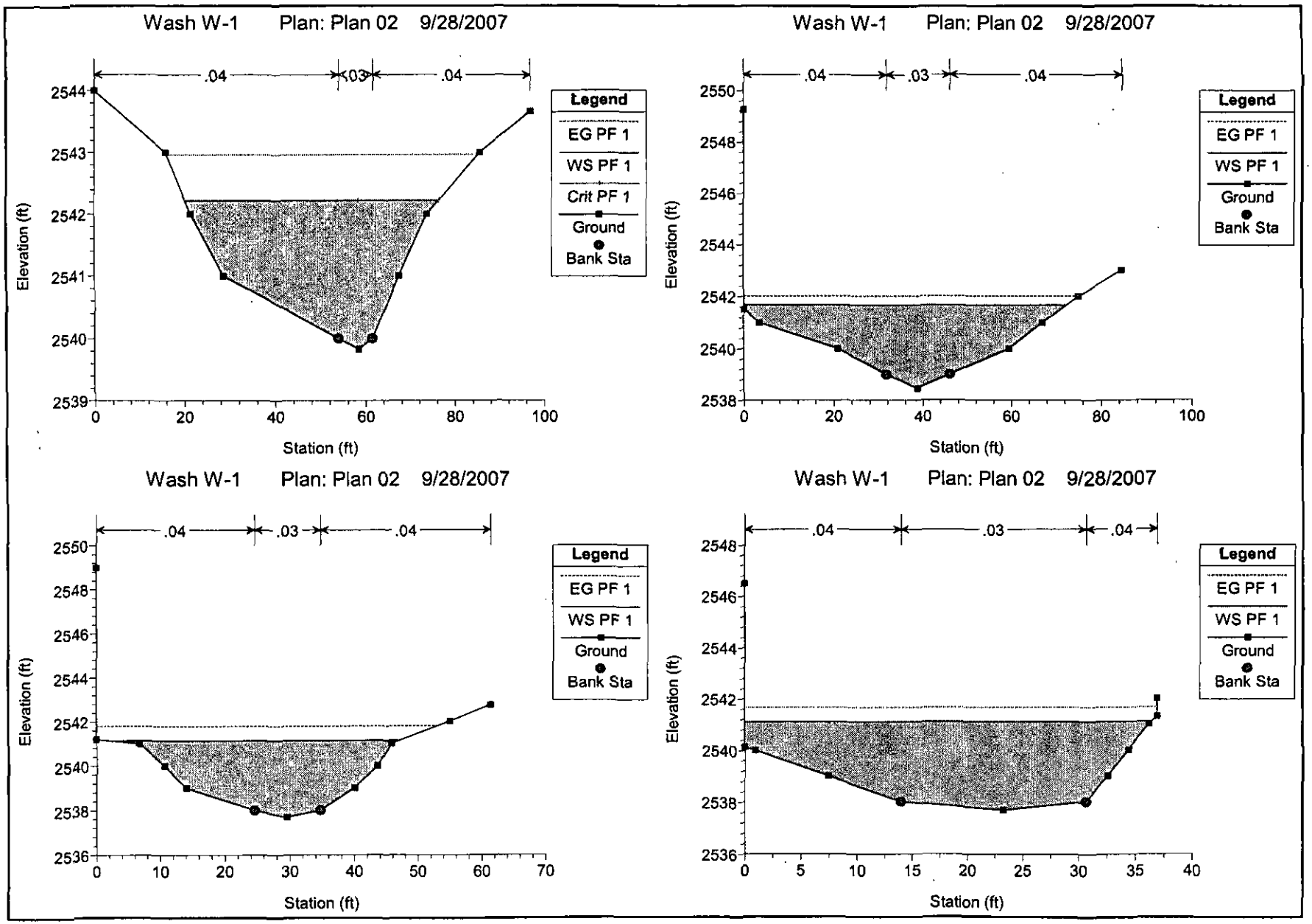
Reach	River Sta.	Left	Channel	Right
Wash W-1	11	58.47	49.8	50.03
Wash W-1	10	50.17	50.85	50.51
Wash W-1	9	50.02	50.51	50.29
Wash W-1	8	56.96	50.5	50.31
Wash W-1	7	52.54	49.75	49.99
Wash W-1	6	45.76	42.18	40.42
Wash W-1	5	30.54	20.58	21.29
Wash W-1	4	42.2	23.89	9.92
Wash W-1	3	108.63	71.04	74.11
Wash W-1	2.0902	Culvert		
Wash W-1	2	107.85	101.61	93.35
Wash W-1	1			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: W-1

Reach	River Sta.	Contr.	Expan.
Wash W-1	11	.1	.3
Wash W-1	10	.1	.3
Wash W-1	9	.1	.3
Wash W-1	8	.1	.3
Wash W-1	7	.1	.3
Wash W-1	6	.1	.3
Wash W-1	5	.1	.3
Wash W-1	4	.1	.3
Wash W-1	3	.1	.3
Wash W-1	2.0902	Culvert	
Wash W-1	2	.1	.3
Wash W-1	1	.1	.3


Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Wash W-1 Plan: Plan 02 9/28/2007
Wash W-1 Plan: Plan 02 9/28/2007
Wash W-1 Plan: Plan 02 9/28/2007


Wash W-1 Plan: Plan 02 9/28/2007
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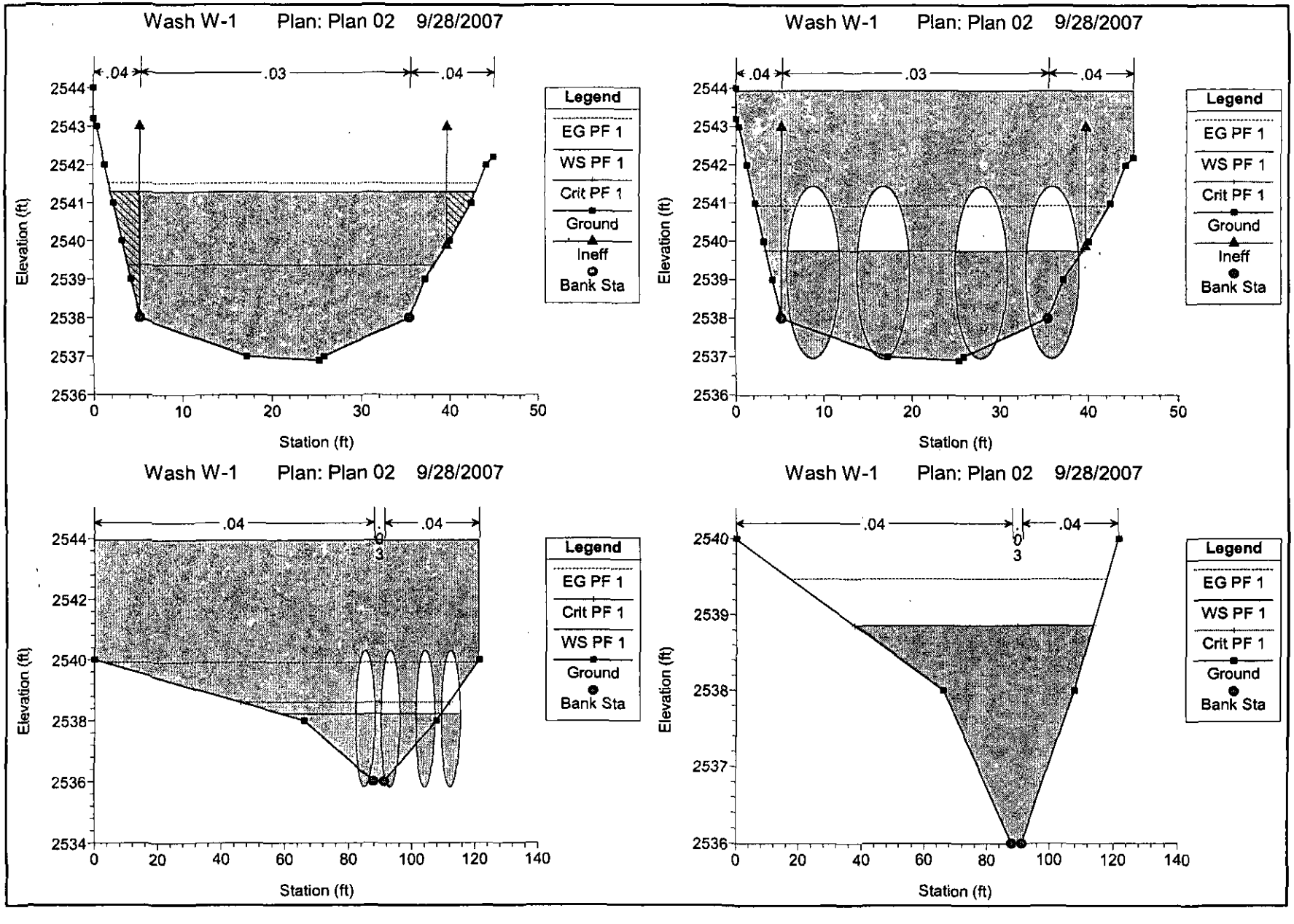
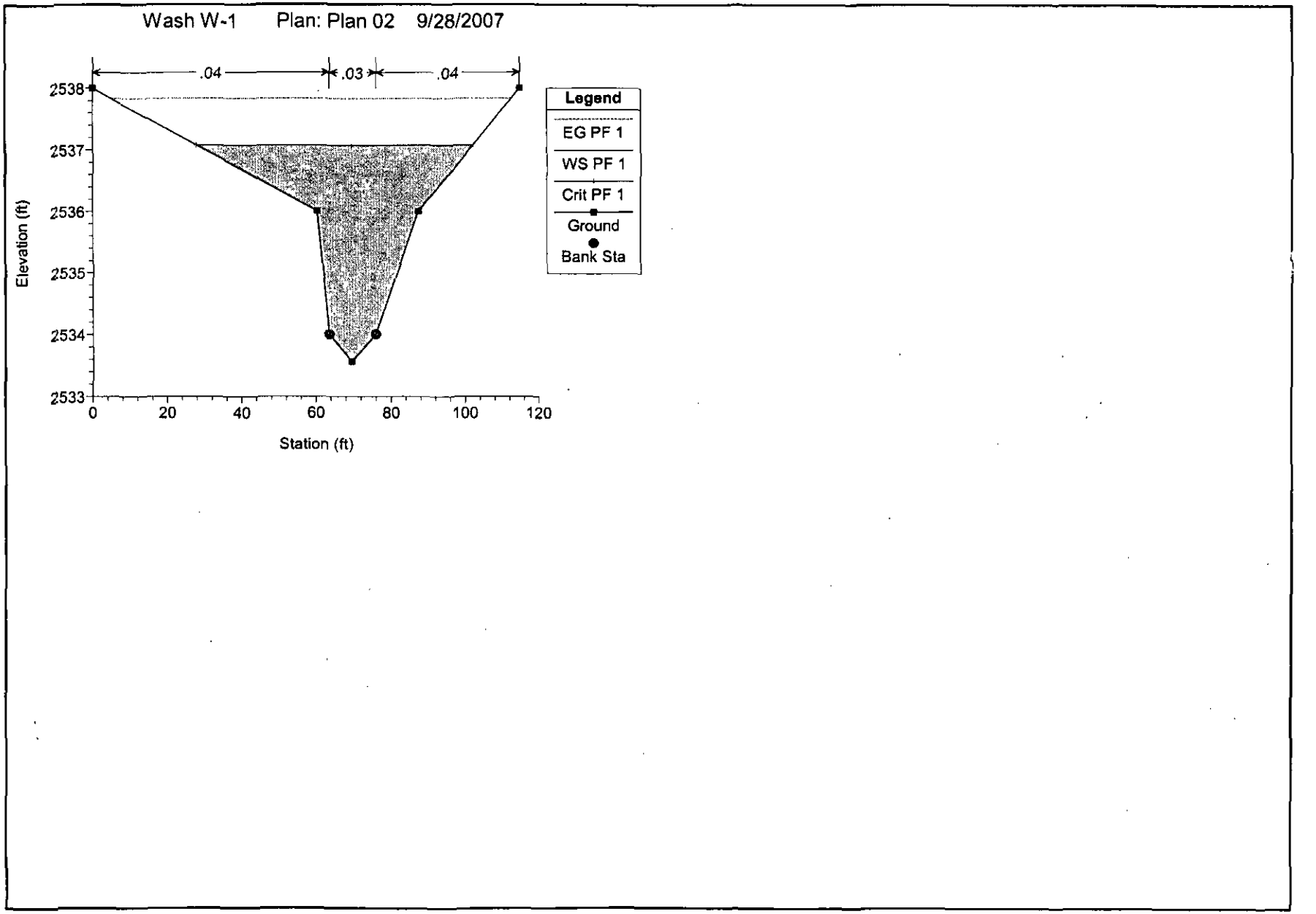
.03
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Wash W-1 Plan: Plan 02 9/28/2007
Wash W-1 Plan: Plan 02 9/28/2007
Wash W-1 Plan: Plan 02 9/28/2007


Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Wash W-1 Plan: Plan 02 9/28/2007
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Wash W-1 Plan: Plan 02 9/28/2007
.04
.04
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta


Wash W-1 Plan: Plan 02 9/28/2007
.04
.03
.04
2538
2537
2536
2535
2534
2533
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

Pond 2P: DETENTION STORAGE

Inflow	=	7.16 cfs @	1.05 hrs, Volume=	0.092 af
Outflow	=	2.97 cfs @	1.12 hrs, Volume=	0.089 af, Atten= 59%, Lag= 4.0 min
Primary	=	2.97 cfs @	1.12 hrs, Volume=	0.089 af

Routing by Sim-Route method, Time Span= 0.00-2.00 hrs, dt= 0.01 hrs

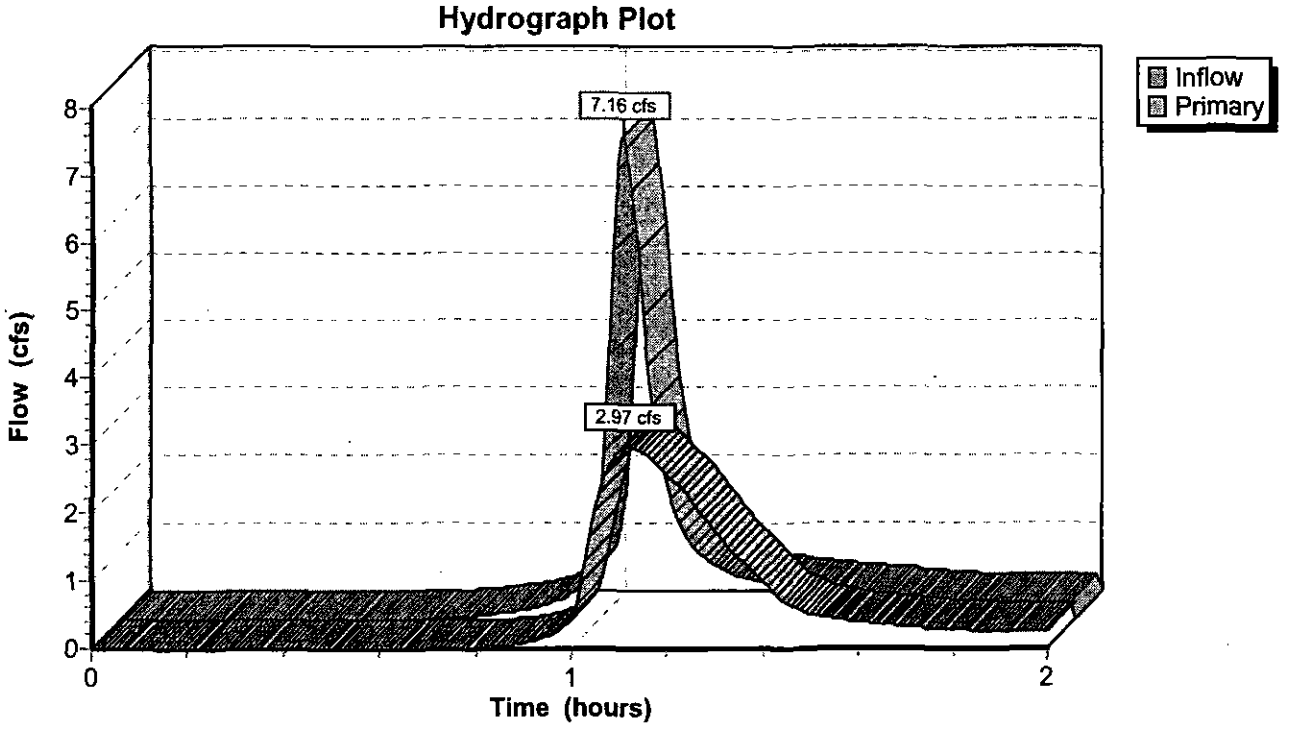
Peak Elev= 2,544.72' Storage= 1,381 cf
Flood Elev= 2,544.77' Storage= 1,400 cf
Plug-Flow detention time= 6.4 min calculated for 0.089 af (97% of inflow)

Elevation (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,541.27	0	0
2,541.77	200	200
2,542.77	400	600
2,543.77	400	1,000
2,544.77	400	1,400

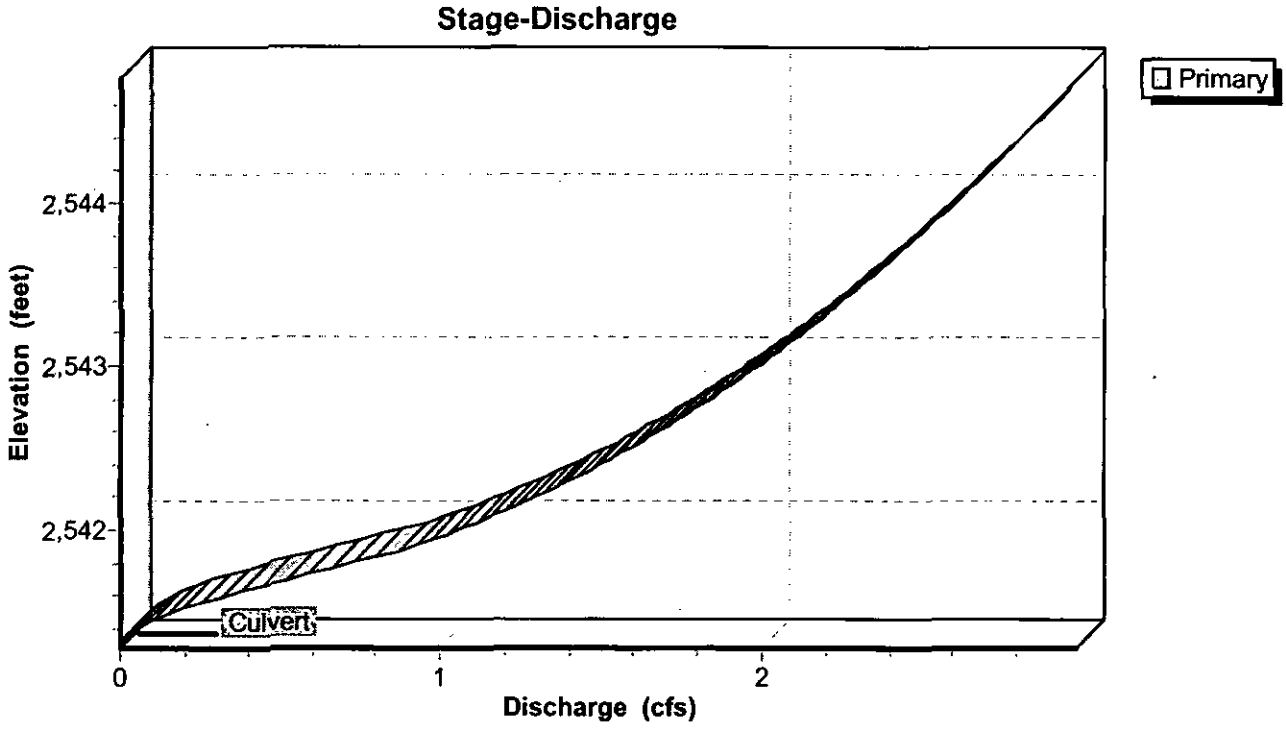
Primary OutFlow *(Dynamic Tailwater)*
↑—1=Culvert

#	Routing	Invert	Outlet Devices
1	Primary	2,541.27'	**8.0" x 15.0' long Culvert** CMP, square edge headwall, Ke= 0.500 Outlet Invert= 2,540.50' S= 0.0513 '/' n= 0.015 Cc= 0.900

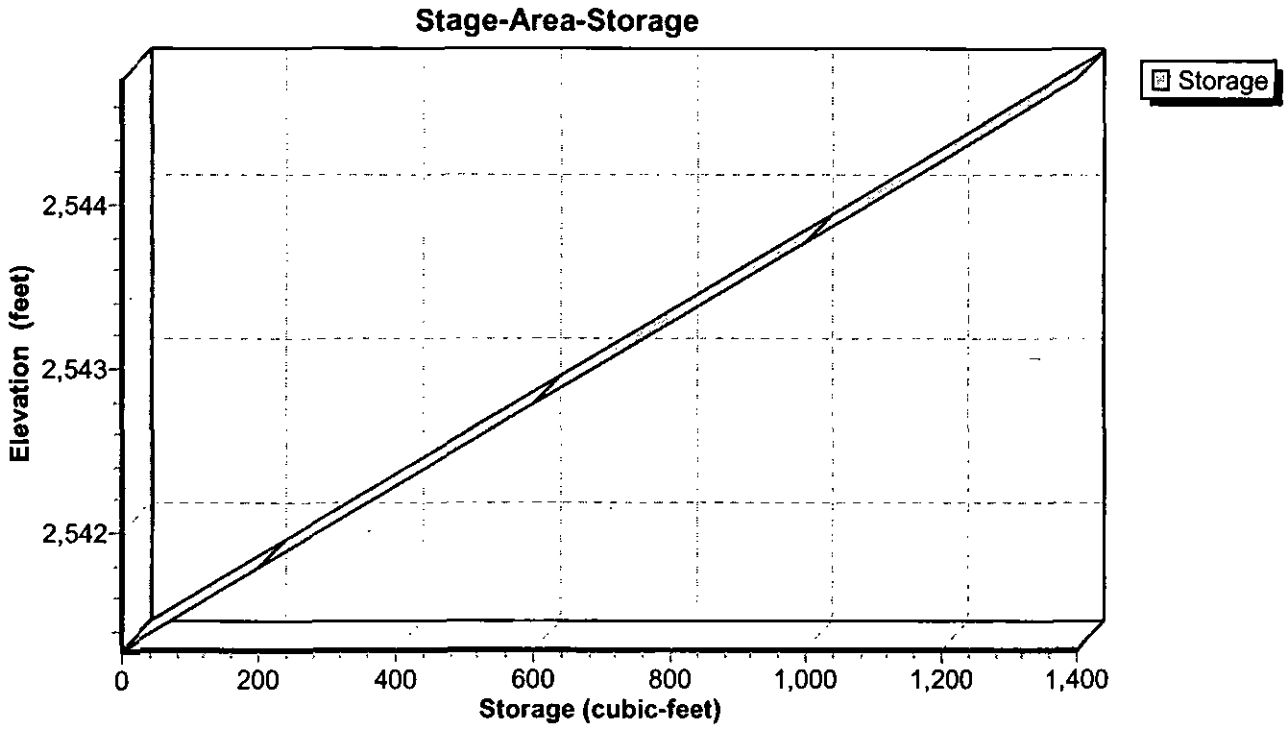
Pond 2P: DETENTION STORAGE



Pond 2P: DETENTION STORAGE



Pond 2P: DETENTION STORAGE



Pond 2P: DETENTION STORAGE