FINAL DRAINAGE REPORT

DREAMING SUMMIT
UNIT 2A

AUGUST 1999
DEA PROJECT NO. STAR0071

Outstanding Professionals . . .
Outstanding Quality

DAVID EVANS AND ASSOCIATES, INC.

FINAL DRAINAGE REPORT
FOR

DREAMING SUMMIT
UNIT 2A

PREPARED FOR

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AUGUST, 1999
DEA PROJECT NO. STAR0071

Registered Professional Engineer (Civil)
CERTIFICATE NO.
30013
TERI S.
MINTZ
Date Signed 8/30/99
ARIZONA, U.S.A.

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1.0 INTRODUCTION

This final drainage report has been prepared under a contract from Stardust Development, Inc., Owner/Developer of the Dreaming Summit project. The purpose of this report is to provide the hydrologic and hydraulic analyses, required by Maricopa County, to support the final plat submittal for Unit 2A. This report utilizes the master drainage plan developed for the overall project as presented in the *Master Drainage Report, Dreaming Summit*, (Reference No. 1), and the *Infrastructure Drainage Report, Dreaming Summit*, (Reference 2), both prepared under a separate cover by David Evans and Associates. The studies are currently in review with the Flood Control District of Maricopa County and cities adjacent to the project. Preparation of this report has been done according to the procedures detailed in the *Drainage Design Manual for Maricopa County, Arizona, Volumes I & II* (Reference Nos. 3 & 4).

The Dreaming Summit project site is located within Maricopa County, Arizona. The site is located within Section 10, Township 2 North, Range 1 West of the Gila and Salt River Base and Meridian. To be more specific, the site is bounded by Litchfield Road to the west, a trailer park to the north, and vacant land to the south and east. Figure 1, located in Appendix A, illustrates the location of the project site in relation to Maricopa County street system. Access to the site will be provided by Litchfield Road.

The Dreaming Summit Unit 2A project is a proposed single family subdivision of approximately 106 acres. Improvements made on-site include full roadway sections with asphalt pavement, rolled and vertical curbing, gutter and sidewalks, and graded building pads. Litchfield Road and Bethany Home Road improvements are included in the *Infrastructure Drainage Report*. Exhibit A, located in the back pocket, illustrates in concept, the proposed improvements for the project.

2.0 EXISTING DRAINAGE CONDITIONS

The proposed site is located on an undeveloped parcel. Dale Creek Wash inters the site at the northern boundary and cuts across the site from the northwest to the south outletting into the Litchfield Detention Facility south of the project site. The eastern portion of the site drains southwest into Dale Creek Wash. The western portion of the site drains towards the detention facility in a southerly direction.

The current FEMA Flood Insurance Rate Map (FIRM) for this area, map number 04013C1615H (effective date September 30, 1995) shows most of the project site is in a flood hazard Zone X. Zone X is defined as "*Areas of 500-year flood; areas of 100-year flood with average depths of less than one foot or with drainage areas less than one square mile; and areas protected by levees from 100-year flood.*" The remainder of the site is located in a flood hazard Zone AE. Zone AE is defined as *"Base flood elevations determined."* The AE Zone was delineated as part of the White Tanks/Agua Fria ADMS. A copy of the current FIRM panel is provided on Appendix B.

3.0 PROPOSED DRAINAGE CONCEPT

The proposed drainage concept is presented in three parts: on-site drainage conveyance, off-site drainage conveyance, and on-site storm water retention. The hydrologic analysis is summarized in section 4.0 and the hydraulic analysis is summarized in section 5.0. On-site storm water retention calculations are in section 3.3. See Exhibit A in the back pocket for a graphical illustration of the proposed drainage concept.

3.1 On-site Drainage Conveyance

On-site storm water runoff is conveyed through the site by the paved roadway sections that have normal crown sections and either 4-inch roll or 6-inch vertical curb. Lots are graded to drain into the roadway on which they front. The roadway sections are designed to convey the 10-year peak flows between the curbs and the 100-year peak flows are contained between the property lines. Catch basins and scuppers are used to direct the flows from the street into Dale Creek Wash. Runoff generated within the project site is conveyed into the detention basin, adding to the runoff volume currently entering the basin from the north and west. Typical street sections are shown in Figure 2, located in Appendix A.

3.2 Off-site Drainage Conveyance

As stated in the *Master Drainage Report*, drainage from north of the project site enters the site primarily through Dale Creek Wash. The runoff will continue to be conveyed within the Dale Creek Wash, which is regraded to provided additional conveyance to contain the 100-year peak storm within the improved channel. Some localized drainage enters the project site at the intersection of 135th Avenue and Maryland Road and flows south along 135th Avenue. The majority of the flow is intercepted by a catch basin at the intersection of 135th Avenue and Marlette Street and is conveyed into Retention Basin 2, which is part of Unit 1. The remainder of the flow continues south and is conveyed to the Litchfield Detention Basin through a drainage ditch and the street system. Refer to the *Final Drainage Report for Unit 1*(Reference 9) for applicable calculations.

As described in the *Infrastructure Drainage Report*, off-site runoff from the west is conveyed across Litchfield Road by dip roadway sections. Runoff conveyed in a dip section located approximately 1000 feet north of the Bethany Home Road alignment (CP 225A) is directed south along the east side of Litchfield Road and then east along the north side of Bethany Home Road. The flow is released into the Detention Facility, as it is currently.

3.3 On-site Storm Water Retention

The County requires that all runoff from the 100-year, 2-hour event generated from the project site and half streets adjacent to the site be retained within the project site. The required retention volume for the project site is estimated as follows:

$$V_R = C*(P/12)*A$$

Where:

V_R = Estimated volume in cubic feet
C_{wt} = Weighted runoff coefficient (Figure 3)
P = 100-year, 2-hour depth of rainfall in inches (2.65 in)
A = Drainage area in acres

The required volume is retained within the Litchfield Park Detention Facility within Unit 2B. Refer to the *Final Drainage Report, Unit 2B* for the design requirements for the Detention Basin (Reference No. 8). Detailed calculations show that 10.96 acre-feet of volume is required for Unit 2A. The detailed calculations for the required retention volume are located in Appendix D.

4.0 HYDROLOGIC ANALYSIS

The hydrologic analysis for this study has been done using the County's *Drainage Design Manual, Volume I.* Peak flows for the site were computed using the Rational Method program from Maricopa County. The following establishes the Rational Method equation and the basic input data required:

$$Q = CIA$$

Where:

Q = Peak Flow (cfs)
C = runoff coefficient relating runoff to rainfall
A = the contributing drainage area in acres (from Exhibit A)
T_c = Time of Concentration (min.)

A summary of peak flows for the 10-year (Q_{10}), 50-year (Q_{50}) and 100-year (Q_{100})storm events is shown below in Table 4.1. Appendix C contains the detailed calculation sheets that establish the input data and estimated peak flow values for on-site drainage areas.

Summary of Peak Discharges
Table 4.1

Sub-basin Designation	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Sub-basin Designation	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
1A	8	15	18	6	4	7	9
1B	13	24	28	15	26	47	56
2A	9	16	20	16	18	33	40
2B	16	29	35	17A	10	17	20
3A	9	16	19	17B	24	43	52
3B	21	38	46	18	14	25	30
4A	7	13	15	19A	5	9	11
4B	17	31	37	19B	7	11	13
5A	25	45	55	19C	15	27	32
5B	29	52	63				

5.0 HYDRAULIC ANALYSIS

The hydraulic analyses of the proposed storm water management facilities have been completed according to County's *Drainage Design Manual, Volume II, Hydraulics.* Haestad Method's FlowMaster computer program (Reference 5) was utilized to determine the depth of flow within the roadway for the 10- and 100-year storm events. The depth of flow for the 10-year peak discharge is contained within the curbs and the 100-year peak discharge is contained within the property lines. Storm drain is incorporated into the drainage design where flow depths exceed these guidelines. A summary of the depth of flow for the 10- and 100-year storms is shown below in Table 5.1.

Summary of Depths of Flow
Table 5.1

Sub-basin Designation	d_{10} (ft)	d_{100} (ft)	Sub-basin Designation	d_{10} (ft)	d_{100} (ft)
1A	0.32	0.42	6	0.25	0.33
1B*	0.38	0.51	15*	0.43	0.59
2A	0.33	0.43	16*	0.38	0.51
2B*	0.41	0.55	17A	0.29	0.37
3A	0.33	0.43	17B*	0.40	0.54
3B*	0.45	0.62	18	0.31	0.41
4A	0.31	0.39	19A	0.27	0.36
4B*	0.42	0.57	19B	0.22	0.28
5A*	0.48	0.67	19C*	0.37	0.49
5B*	0.35	0.55	*6" vertical curb		

Catch basins and scuppers are used to convey the runoff into Dale Creek Wash. The catch basins are designed using the interceptions rates calculated with the HEC-12 computer software program (Reference 6). The catch basins computations utilize a 25% clogging factor for the inlets. The design is based on the 10-year storm event. A weir calculation was used to determine the 100-year water surface elevations where flow overtops the curb and spills into Dale Creek Wash. The HEC-12 computation sheets and the weir calculations are located in Appendix D. A summary of inlet sizes and water surface elevations is shown below in Table 5.2.

Summary of Inlet Sizes
Table 5.2

Catch basin Designation	Inlet Size (catch basin, CB, or scupper)	d_{10} / $WSEL_{10}$	d_{100} / $WSEL_{100}$
1B	10' CB	0.66' / 1072.79'	0.79' / 1073.09'
2B	17' CB	0.50' / 1069.58'	0.86' / 1070.11'
3B	17' CB	0.62' / 1067.81'	0.88' / 1068.24'
5A-N & 5A-S	17' CB	0.51' / 1068.90'	0.67' / 1069.07'
5B	10' CB	0.52' / 1066.76'	0.87' / 1067.28'
6	3' Scupper	0.50' / 1067.90'	0.70' / 1068.27'
16	17' CB	0.54' / 1070.87'	0.84' / 1070.34'
17B	Double 10' wing CB	0.62' / 1069.15'	0.93' / 1069.63'
18	17' CB	0.50' / 1067.65'	0.77' / 1068.09'

The HEC-12 program calculated depth of flow includes the 2" depression at the catch basin in a sump condition. The calculated depth of flow in a flow-by situation is measured from the flow line directly upstream of the catch basin. As stated in the *Infrastructure Drainage Report*, runoff from sub-basins 19A, 19B and 19C is intercepted by a catch basin on Bethany Home Road.

StormCAD 1.5 (Reference 7) was utilized to size storm drain pipe, conveying storm water runoff into Dale Creek Wash, and the storm drain system along Rovey Avenue Road. Pipes were designed to carry the 100-year runoff at a head elevation no greater than that calculated for the catch basins. The pipes range in size from 18" to 36". StormCAD worksheets are located in Appendix D.

6.0 CONCLUSIONS

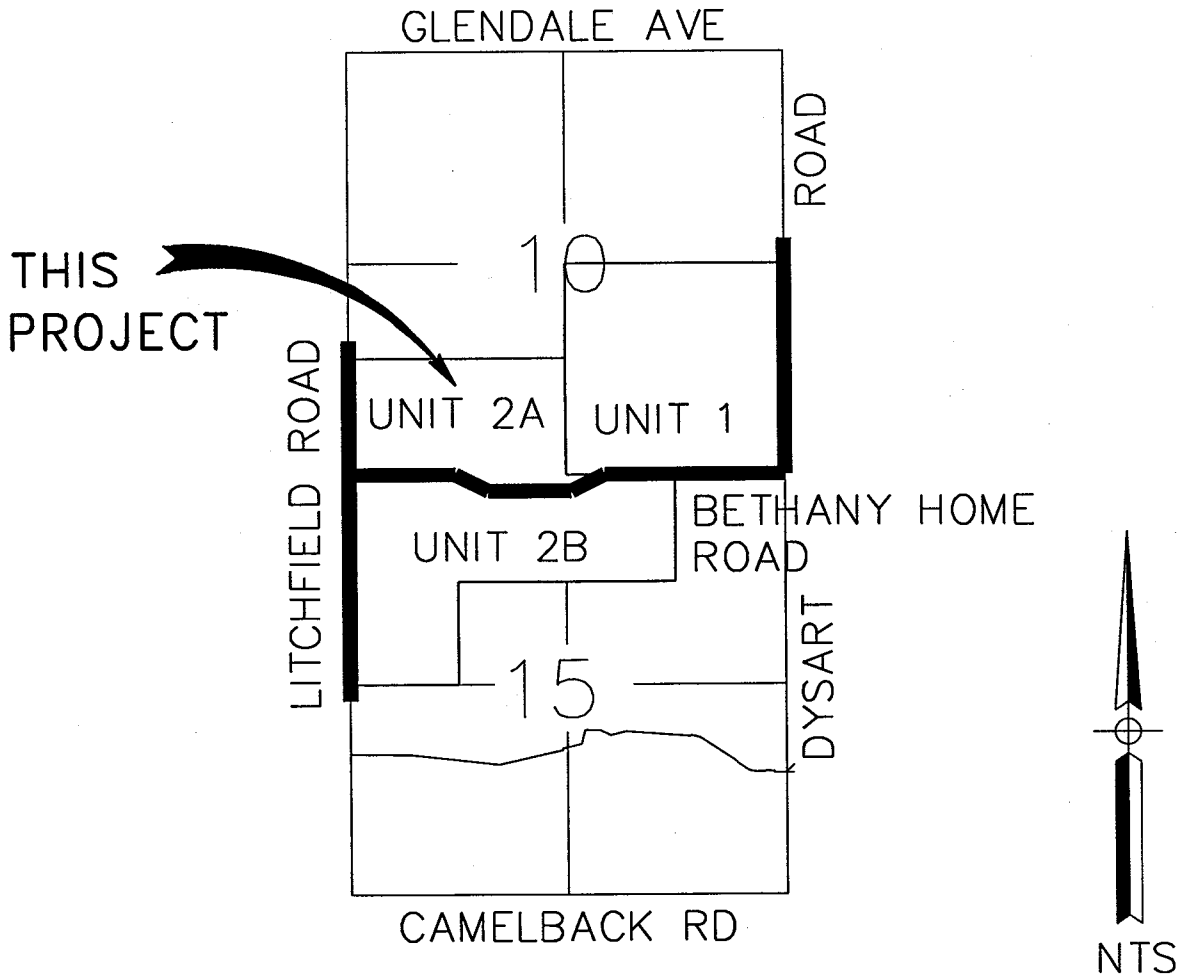
Based on the results of this study, it can be concluded that:

- The site can be developed according to the guidelines set in the *Drainage Design Manuals for Maricopa County*.
- The 10-year event is contained within the roadway and the 100-year event is contained within the property lines
- All finished floor elevations are set above the 100-year water surface elevation

7.0 REFERENCES

1) *Master Drainage Report, Dreaming Summit*, David Evans and Associates, August 1999
2) *Infrastructure Drainage Report, Dreaming Summit*, Davis Evans and Associates, August 1999.
3) *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology*, 1992
4) *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics*, 1991
5) Haestad Methods FlowMaster for Windows Professional Edition, Version 6.0, 1999
6) *SMF Pavement Drainage Program, HEC-12*, Version 2.11, 1991
7) Heasted Methods StormCAD, Version 1.5, 1997
8) *Final Drainage Report for Unit 2B, Dreaming Summit*, Davis Evans and Associates, August 1999.
9) *Final Drainage Report for Unit 1, Dreaming Summit*, Davis Evans and Associates, August 1999.

APPENDIX A
FIGURES



VICINITY MAP

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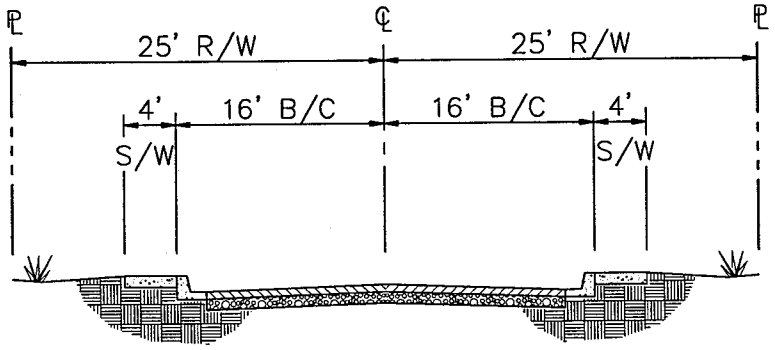

TYPICAL INTERIOR STREET

NTS

FIGURE 2

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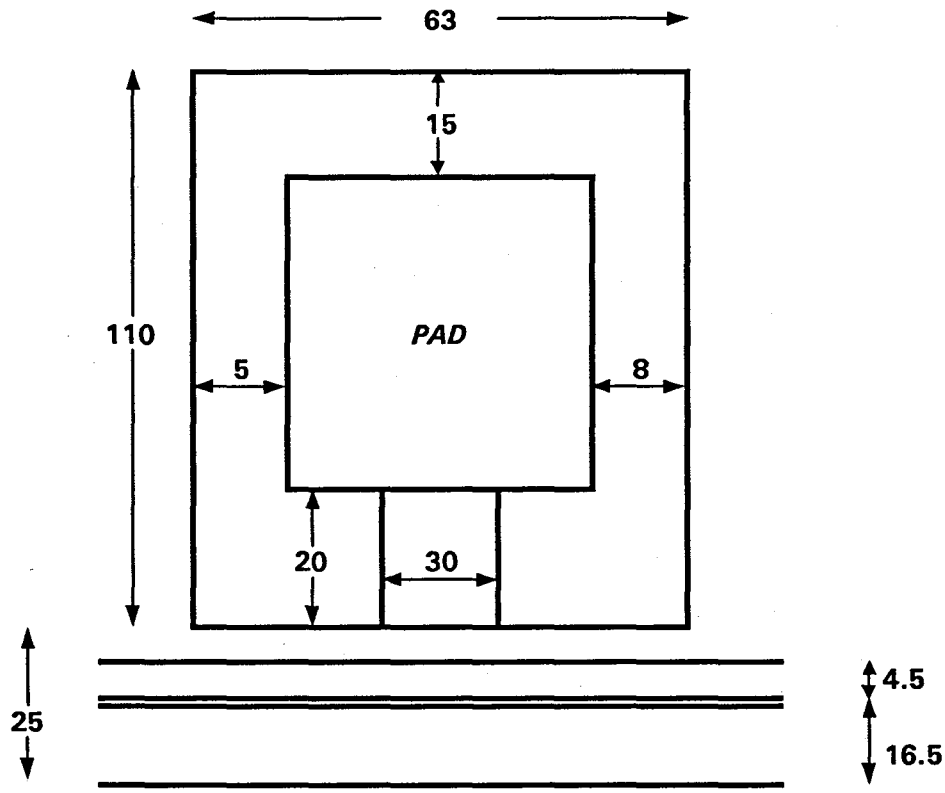
DREAMING SUMMIT
STAR0071
SCK-8/99

WEIGHTED RUNOFF COEFFICIENT (Cw)

100-YEAR STORM EVENT



HALF R/W TOTAL	25	X	63	=	1575 S.F.		
CONCRETE	4.5	X	63	=	283.5 S.F.	@	0.95
ASPHALT	16.5	X	63	=	1040 S.F.	@	0.85
RIGHT-OF-WAY (50/50)	4	X	63	=	252 S.F.	@	0.45
LOT AREA TOTAL	63	X	110	=	6930 S.F.		
ROOF (33% OF LOT)				=	2287 S.F.	@	0.85
YARD (50/50)				=	4089 S.F.	@	0.45
CONCRETE (8% OF LOT)				=	554 S.F.	@	0.95

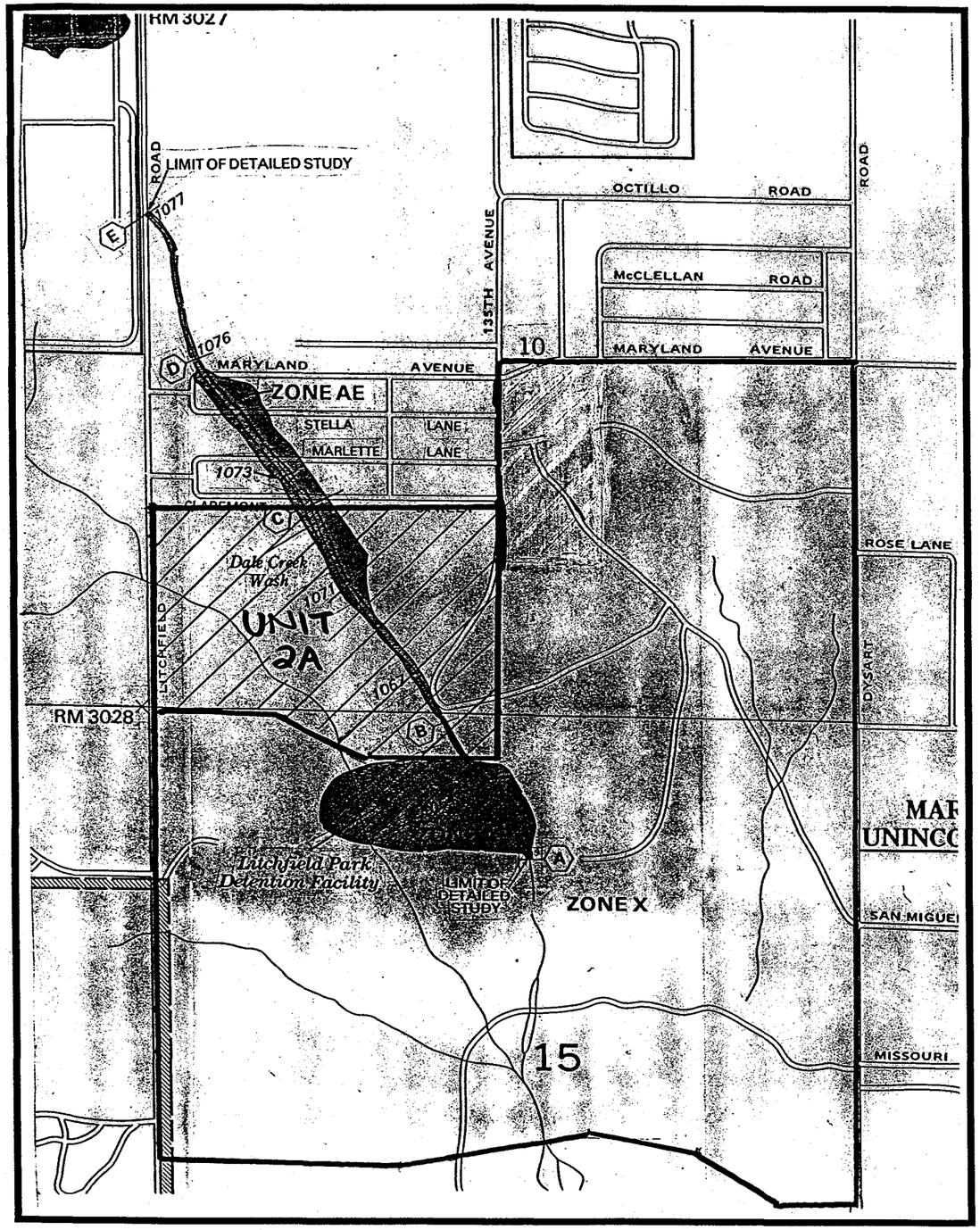
$$Cw = \frac{(284*0.95)+(1040*0.85)+(252*0.45)+(2287*0.85)+(4089*0.45)+(554*0.90)}{8505}$$

Cw = 0.66

FIGURE 3

s:\drn\star0071\calcs\coeffcnt.xls

APPENDIX B
FEMA FLOOD INSURANCE RATE MAP



PORTION OF PANEL SHOWING SITE

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*

RM7X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

APPROXIMATE SCALE IN FEET

1000 0 1000

MAP LEGEND

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1615 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AVONDALE, CITY OF	040038	1615	H
EL MIRAGE, TOWN OF	040041	1615	H
GLENDALE, CITY OF	040045	1615	H
GOODYEAR, TOWN OF	040046	1615	H
LITCHFIELD PARK, CITY OF	040128	1615	H
MARICOPA COUNTY			
UNINCORPORATED AREAS	040037	1615	H
PHOENIX, CITY OF	040051	1615	H

MAP NUMBER
04013C1615 H

MAP REVISED:
SEPTEMBER 30, 1995

Federal Emergency Management Agency

FIRM PANEL

APPENDIX C
HYDROLOGIC CALCULATIONS

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP1A

Project Name: DREAMING SUMMIT Subarea id: 1A

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	3.94	acres
Watercourse Length	774.0	feet
Top Elevation	75.1	feet
Bottom Elevation	73.0	feet
Slope	.00275	feet/feet
Roughness Coefficient (Kb)	.03628	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	5	7	8	12	15	18
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	14.6	12.9	12.0	10.9	10.4	9.8
i (in/hr)	2.4	3.3	4.0	5.1	5.9	6.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP1B

Project Name: DREAMING SUMMIT Subarea id: 1B

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	6.72	acres
Watercourse Length	1152.0	feet
Top Elevation	75.1	feet
Bottom Elevation	71.2	feet
Slope	.00339	feet/feet
Roughness Coefficient (Kb)	.03483	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	8	11	13	19	24	28
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	16.8	14.8	13.8	12.5	11.9	11.2
i (in/hr)	2.2	3.1	3.7	4.8	5.5	6.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP2A

Project Name: DREAMING SUMMIT Subarea id: 2A

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	4.45	acres
Watercourse Length	906.0	feet
Top Elevation	75.1	feet
Bottom Elevation	72.1	feet
Slope	.00334	feet/feet
Roughness Coefficient (Kb)	.03595	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	6	8	9	13	16	20
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	14.8	13.1	12.2	11.1	10.6	10.0
i (in/hr)	2.4	3.3	4.0	5.1	5.8	6.8

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP2B

Project Name: DREAMING SUMMIT Subarea id: 2B

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	8.91 acres
Watercourse Length	1600.0 feet
Top Elevation	75.1 feet
Bottom Elevation	69.6 feet
Slope	.00344 feet/feet
Roughness Coefficient (Kb)	.03407
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	10	13	16	23	29	35
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	20.2	17.7	16.6	15.0	14.2	13.4
i (in/hr)	2.0	2.9	3.4	4.4	5.1	6.0

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP3A

Project Name: DREAMING SUMMIT Subarea id: 3A

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	4.33 acres
Watercourse Length	794.0 feet
Top Elevation	74.1 feet
Bottom Elevation	72.3 feet
Slope	.00232 feet/feet
Roughness Coefficient (Kb)	.03602
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	5	7	9	12	16	19
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	15.7	13.9	13.0	11.8	11.2	10.6
i (in/hr)	2.3	3.2	3.9	5.0	5.7	6.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP3B

Project Name: DREAMING SUMMIT Subarea id: 3B

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	12.41 acres
Watercourse Length	2067.0 feet
Top Elevation	74.4 feet
Bottom Elevation	67.2 feet
Slope	.00348 feet/feet
Roughness Coefficient (Kb)	.03317
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	12	17	21	30	38	46
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	23.3	20.5	19.0	17.2	16.2	15.3
i (in/hr)	1.9	2.6	3.2	4.1	4.8	5.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP4A

Project Name: DREAMING SUMMIT Subarea id: 4A

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	3.14	acres
Watercourse Length	700.0	feet
Top Elevation	75.0	feet
Bottom Elevation	71.9	feet
Slope	.00443	feet/feet
Roughness Coefficient (Kb)	.03690	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	6	7	10	13	15
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	11.6	10.3	9.6	8.7	8.3	7.9
i (in/hr)	2.7	3.7	4.4	5.6	6.4	7.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP4B

Project Name: DREAMING SUMMIT Subarea id: 4B

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	8.59 acres
Watercourse Length	1239.0 feet
Top Elevation	75.0 feet
Bottom Elevation	69.7 feet
Slope	.00428 feet/feet
Roughness Coefficient (Kb)	.03417
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	10	15	17	25	31	37
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	15.8	14.0	13.1	11.9	11.3	10.6
i (in/hr)	2.3	3.2	3.8	4.9	5.7	6.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 7-29-99

LOCATION DATA

Location: CP5A

Project Name: DREAMING SUMMIT Subarea id: 5A

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	14.12	acres
Watercourse Length	1872.0	feet
Top Elevation	75.0	feet
Bottom Elevation	67.9	feet
Slope	.00379	feet/feet
Roughness Coefficient (Kb)	.03282	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	15	21	25	36	45	55
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	20.9	18.4	17.1	15.6	14.7	13.9
i (in/hr)	2.0	2.8	3.4	4.3	5.1	5.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-3-99

LOCATION DATA

Location: CP5B

Project Name: DREAMING SUMMIT Subarea id: 5B

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	17.10	acres
Watercourse Length	2304.0	feet
Top Elevation	75.0	feet
Bottom Elevation	66.0	feet
Slope	.00391	feet/feet
Roughness Coefficient (Kb)	.03230	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	17	24	29	41	52	63
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	23.5	20.6	19.1	17.4	16.3	15.4
i (in/hr)	1.9	2.6	3.2	4.1	4.8	5.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-27-99

LOCATION DATA

Location: CP6

Project Name: DREAMING SUMMIT Subarea id: 6

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	1.49	acres
Watercourse Length	335.0	feet
Top Elevation	69.9	feet
Bottom Elevation	67.6	feet
Slope	.00693	feet/feet
Roughness Coefficient (Kb)	.03892	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	4	6	7	9
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	6.6	5.8	5.5	5.1	5.0	5.0
i (in/hr)	3.4	4.6	5.5	6.7	7.7	8.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-24-99

LOCATION DATA

Location: CP15

Project Name: DREAMING SUMMIT Subarea id: 15

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	12.34	acres
Watercourse Length	1730.0	feet
Top Elevation	91.1	feet
Bottom Elevation	74.4	feet
Slope	.00965	feet/feet
Roughness Coefficient (Kb)	.03318	
10-Year, 6-Hour Rainfall	2.00	inches

Sub-basin 15 + Flow from Unit 1

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	16	22	26	37	47	56
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	14.0	12.4	11.6	10.5	10.0	9.5
i (in/hr)	2.4	3.4	4.1	5.2	6.0	6.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-24-99

LOCATION DATA

Location: CP16

Project Name: DREAMING SUMMIT Subarea id: 16

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	9.42	acres = Sub-basin 16 + 1/2 sub-basin 15
Watercourse Length	2219.0	feet
Top Elevation	91.1	feet
Bottom Elevation	71.5	feet
Slope	.00883	feet/feet
Roughness Coefficient (Kb)	.03392	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	11	15	18	26	33	40
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	17.1	15.1	14.1	12.8	12.1	11.5
i (in/hr)	2.2	3.1	3.7	4.8	5.5	6.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-24-99

LOCATION DATA

Location: CP17A

Project Name: DREAMING SUMMIT Subarea id: 17A

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	3.81 acres
Watercourse Length	665.0 feet
Top Elevation	77.1 feet
Bottom Elevation	72.0 feet
Slope	.00767 feet/feet
Roughness Coefficient (Kb)	.03637
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	6	8	10	13	17	20
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	9.1	8.1	7.5	6.9	6.6	6.2
i (in/hr)	3.0	4.1	4.9	6.1	7.0	8.1

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-24-99

LOCATION DATA

Location: CP17B

Project Name: DREAMING SUMMIT Subarea id: 17B

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	12.20	acres = Subbasin 17B + 17A + 1/2 15
Watercourse Length	2203.0	feet
Top Elevation	91.1	feet
Bottom Elevation	70.2	feet
Slope	.00949	feet/feet
Roughness Coefficient (Kb)	.03321	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	15	20	24	35	43	52
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	16.4	14.4	13.5	12.2	11.6	11.0
i (in/hr)	2.3	3.2	3.8	4.9	5.6	6.5

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-24-99

LOCATION DATA

Location: CP18

Project Name: DREAMING SUMMIT Subarea id: 18

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	6.00	acres
Watercourse Length	1029.0	feet
Top Elevation	77.7	feet
Bottom Elevation	68.6	feet
Slope	.00884	feet/feet
Roughness Coefficient (Kb)	.03514	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	9	12	14	20	25	30
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	11.0	9.7	9.1	8.3	7.9	7.5
i (in/hr)	2.7	3.8	4.5	5.7	6.6	7.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-10-99

LOCATION DATA

Location: CP19A

Project Name: DREAMING SUMMIT Subarea id: 19A

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	2.00	acres
Watercourse Length	459.0	feet
Top Elevation	73.1	feet
Bottom Elevation	70.4	feet
Slope	.00588	feet/feet
Roughness Coefficient (Kb)	.03812	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	5	7	9	11
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	8.3	7.3	6.9	6.3	6.0	5.7
i (in/hr)	3.1	4.2	5.0	6.3	7.2	8.3

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-10-99

LOCATION DATA

Location: CP19B

Project Name: DREAMING SUMMIT Subarea id: 19B

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	2.25	acres
Watercourse Length	317.6	feet
Top Elevation	73.4	feet
Bottom Elevation	70.1	feet
Slope	.01039	feet/feet
Roughness Coefficient (Kb)	.03780	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	6	7	9	11	13
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	5.4	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.6	4.9	5.7	6.7	7.7	8.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: TJCL Date: 8-10-99

LOCATION DATA

Location: CP19C

Project Name: DREAMING SUMMIT Subarea id: 19C

Drainage Area Cover: RESIDENTIAL

DESIGN DATA

Drainage Area	6.68	acres
Watercourse Length	894.0	feet
Top Elevation	73.1	feet
Bottom Elevation	68.6	feet
Slope	.00503	feet/feet
Roughness Coefficient (Kb)	.03485	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	9	13	15	21	27	32
C	0.528	0.528	0.528	0.581	0.634	0.660
Tc (min)	12.4	10.9	10.2	9.3	8.8	8.4
i (in/hr)	2.6	3.6	4.3	5.5	6.3	7.2

APPENDIX D
HYDRAULIC CALCULATIONS

RETENTION BASIN CALCULATIONS

V = C (P/12) A P = 2.65"

CONTRIBUTING DRAINAGE AREAS Unit 2A

Type	Area (Ac)	C' Coefficient	Precip (in)	Retention Required (AF)	
Residential	72.89	0.66	2.65	10.62	
Open Space (DG)	4.37	0.35	2.65	0.34	
Open Space	0.00	0.25	2.65	0.00	
Roadway	0.00	0.95	2.65	0.00	
Total	77.26			10.96	Required for site

TYP STREET SECTION - 4" ROLL CURB CP1A
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP1A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	18.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.42	ft
Elevation Range	0.00 to 0.63	
Flow Area	8.8	ft²
Wetted Perimeter	41.32	ft
Top Width	41.21	ft
Actual Depth	0.42	ft
Critical Elevation	0.38	ft
Critical Slope	0.005422	ft/ft
Velocity	2.05	ft/s
Velocity Head	0.07	ft
Specific Energy	0.48	ft
Froude Number	0.78	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP1A
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP1A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	18.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	
0.00	0.00	0.00	0.0	0.00	0.00	
2.00	0.19	1.10	1.8	19.10	19.04	
4.00	0.25	1.31	3.1	24.77	24.69	
6.00	0.29	1.45	4.1	28.84	28.74	
8.00	0.32	1.56	5.1	32.05	31.94	← $Q_{10} = 8$ cfs, $d_{10} = 0.32'$
10.00	0.34	1.69	5.9	34.11	34.00	
12.00	0.37	1.80	6.7	36.97	36.85	
14.00	0.39	1.89	7.4	39.54	39.42	
16.00	0.40	1.97	8.1	40.65	40.54	
18.00	0.42	2.05	8.8	41.32	41.21	← $Q_{100} = 18$ cfs, $d_{100} = 0.42'$

TYP STREET SECTION - 6" VERTICAL CURB CP1B
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP1B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	28.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.51	ft
Elevation Range	0.00 to 0.80	
Flow Area	11.1	ft²
Wetted Perimeter	33.81	ft
Top Width	32.80	ft
Actual Depth	0.51	ft
Critical Elevation	0.45	ft
Critical Slope	0.005718	ft/ft
Velocity	2.53	ft/s
Velocity Head	0.10	ft
Specific Energy	0.61	ft
Froude Number	0.77	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+09	0.013
0+09	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+09	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP1B
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP1B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	28.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.09	1.8	19.56	19.18
4.00	0.25	1.29	3.1	25.37	24.87
6.00	0.29	1.43	4.2	29.54	28.95
8.00	0.32	1.54	5.2	32.65	32.00
10.00	0.35	1.69	5.9	32.70	32.00
12.00	0.37	1.81	6.6	32.74	32.00
14.00	0.39	1.93	7.3	32.78	32.00
16.00	0.41	2.03	7.9	32.82	32.00
18.00	0.42	2.13	8.5	32.85	32.00
20.00	0.44	2.22	9.0	32.89	32.00
22.00	0.46	2.31	9.5	32.92	32.00
24.00	0.47	2.39	10.1	32.95	32.00
26.00	0.49	2.46	10.6	32.99	32.00
28.00	0.51	2.53	11.1	33.81	32.80

$Q_{10} = 13$ cfs, $d_{10} = 0.38'$

$Q_{100} = 28$ cfs, $d_{100} = 0.51'$

TYP STREET SECTION - 4" ROLL CURB CP2A
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP2A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	20.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.43	ft
Elevation Range	0.00 to 0.63	
Flow Area	9.4	ft^2
Wetted Perimeter	41.96	ft
Top Width	41.84	ft
Actual Depth	0.43	ft
Critical Elevation	0.40	ft
Critical Slope	0.005336	ft/ft
Velocity	2.13	ft/s
Velocity Head	0.07	ft
Specific Energy	0.50	ft
Froude Number	0.79	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP2A
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP2A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	20.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.10	1.8	19.10	19.04
4.00	0.25	1.31	3.1	24.77	24.69
6.00	0.29	1.45	4.1	28.84	28.74
8.00	0.32	1.56	5.1	32.05	31.94
10.00	0.34	1.69	5.9	34.11	34.00
12.00	0.37	1.80	6.7	36.97	36.85
14.00	0.39	1.89	7.4	39.54	39.42
16.00	0.40	1.97	8.1	40.65	40.54
18.00	0.42	2.05	8.8	41.32	41.21
20.00	0.43	2.13	9.4	41.96	41.84

$Q_{10} = 9cfs, d_{10} = 0.33'$

$Q_{100} = 20cfs, d_{100} = 0.43'$

TYP STREET SECTION - 6" VERTICAL CURB CP2B
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP2B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	35.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 0.80	
Flow Area	12.7	ft²
Wetted Perimeter	39.92	ft
Top Width	38.91	ft
Actual Depth	0.55	ft
Critical Elevation	0.49	ft
Critical Slope	0.004441	ft/ft
Velocity	2.75	ft/s
Velocity Head	0.12	ft
Specific Energy	0.67	ft
Froude Number	0.85	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+09	0.013
0+09	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+09	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP2B
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP2B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	36.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.09	1.8	19.56	19.18
4.00	0.25	1.29	3.1	25.37	24.87
6.00	0.29	1.43	4.2	29.54	28.95
8.00	0.32	1.54	5.2	32.65	32.00
10.00	0.35	1.69	5.9	32.70	32.00
12.00	0.37	1.81	6.6	32.74	32.00
14.00	0.39	1.93	7.3	32.78	32.00
16.00	0.41	2.03	7.9	32.82	32.00
18.00	0.42	2.13	8.5	32.85	32.00
20.00	0.44	2.22	9.0	32.89	32.00
22.00	0.46	2.31	9.5	32.92	32.00
24.00	0.47	2.39	10.1	32.95	32.00
26.00	0.49	2.46	10.6	32.99	32.00
28.00	0.51	2.53	11.1	33.81	32.80
30.00	0.52	2.62	11.5	35.37	34.37
32.00	0.53	2.67	12.0	37.24	36.23
34.00	0.55	2.73	12.5	39.04	38.03
36.00	0.56	2.78	13.0	40.78	39.77

$Q_{10} = 16$ cfs, $d_{10} = 0.41'$

$Q_{100} = 35$ cfs, $d_{100} = 0.56'$

TYP STREET SECTION - 4" ROLL CURB CP3A
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP3A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	19.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.43	ft
Elevation Range	0.00 to 0.63	
Flow Area	9.1	ft²
Wetted Perimeter	41.64	ft
Top Width	41.53	ft
Actual Depth	0.43	ft
Critical Elevation	0.39	ft
Critical Slope	0.005387	ft/ft
Velocity	2.09	ft/s
Velocity Head	0.07	ft
Specific Energy	0.49	ft
Froude Number	0.79	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP3A
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP3A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	20.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.10	1.8	19.10	19.04
4.00	0.25	1.31	3.1	24.77	24.69
6.00	0.29	1.45	4.1	28.84	28.74
8.00	0.32	1.56	5.1	32.05	31.94
10.00	0.34	1.69	5.9	34.11	34.00
12.00	0.37	1.80	6.7	36.97	36.85
14.00	0.39	1.89	7.4	39.54	39.42
16.00	0.40	1.97	8.1	40.65	40.54
18.00	0.42	2.05	8.8	41.32	41.21
20.00	0.43	2.13	9.4	41.96	41.84

$Q_{10} = 9$ cfs, $d_{10} = 0.33'$

$Q_{100} = 19$ cfs, $d_{100} = 0.43'$

TYP STREET SECTION - 6" VERTICAL CURB CP3B
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP3B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	46.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.62	ft
Elevation Range	0.00 to 0.80	
Flow Area	15.4	ft²
Wetted Perimeter	43.14	ft
Top Width	42.51	ft
Actual Depth	0.62	ft
Critical Elevation	0.58	ft
Critical Slope	0.004310	ft/ft
Velocity	2.98	ft/s
Velocity Head	0.14	ft
Specific Energy	0.76	ft
Froude Number	0.87	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+10	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP3B
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP3B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	46.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.10	1.8	19.23	18.99
4.00	0.25	1.30	3.1	24.94	24.63
6.00	0.29	1.44	4.2	29.03	28.67
8.00	0.32	1.56	5.1	32.05	31.64
10.00	0.35	1.70	5.9	32.13	31.69
12.00	0.37	1.83	6.6	32.20	31.73
14.00	0.39	1.94	7.2	32.26	31.78
16.00	0.41	2.05	7.8	32.32	31.81
18.00	0.42	2.15	8.4	32.38	31.85
20.00	0.44	2.24	8.9	32.44	31.88
22.00	0.46	2.32	9.5	32.49	31.92
24.00	0.47	2.40	10.0	32.54	31.95
26.00	0.49	2.48	10.5	32.59	31.98
28.00	0.51	2.55	11.0	33.44	32.82
30.00	0.52	2.61	11.5	35.50	34.87
32.00	0.54	2.66	12.0	37.41	36.79
34.00	0.55	2.71	12.5	39.23	38.61
36.00	0.56	2.76	13.1	40.73	40.11
38.00	0.57	2.81	13.5	41.24	40.61
40.00	0.59	2.85	14.0	41.73	41.11
42.00	0.60	2.90	14.5	42.22	41.59
44.00	0.61	2.94	15.0	42.68	42.06
46.00	0.62	2.98	15.4	43.14	42.51

$Q_{10} = 21$ cfs, $d_{10} = 0.45'$

$Q_{100} = 46$ cfs, $d_{100} = 0.62'$

TYP STREET SECTION - 4" ROLL CURB CP4A
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP4A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	15.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.39	ft
Elevation Range	0.00 to 0.63	
Flow Area	7.8	ft²
Wetted Perimeter	40.30	ft
Top Width	40.19	ft
Actual Depth	0.39	ft
Critical Elevation	0.36	ft
Critical Slope	0.005502	ft/ft
Velocity	1.93	ft/s
Velocity Head	0.06	ft
Specific Energy	0.45	ft
Froude Number	0.77	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP4A
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP4A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	16.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	
0.00	0.00	0.00	0.0	0.00	0.00	
2.00	0.19	1.10	1.8	19.10	19.04	
4.00	0.25	1.31	3.1	24.77	24.69	
6.00	0.29	1.45	4.1	28.84	28.74	← $Q_{10} = 7$ cfs, $d_{10} = 0.31'$
8.00	0.32	1.56	5.1	32.05	31.94	
10.00	0.34	1.69	5.9	34.11	34.00	
12.00	0.37	1.80	6.7	36.97	36.85	
14.00	0.39	1.89	7.4	39.54	39.42	← $Q_{100} = 15$ cfs, $d_{100} = 0.39'$
16.00	0.40	1.97	8.1	40.65	40.54	

TYP STREET SECTION - 6" VERTICAL CURB CP4B
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP4B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	37.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.57	ft
Elevation Range	0.00 to 0.80	
Flow Area	13.3	ft²
Wetted Perimeter	40.99	ft
Top Width	40.36	ft
Actual Depth	0.57	ft
Critical Elevation	0.52	ft
Critical Slope	0.004389	ft/ft
Velocity	2.78	ft/s
Velocity Head	0.12	ft
Specific Energy	0.69	ft
Froude Number	0.85	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+10	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP4B
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP4B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	38.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.10	1.8	19.23	18.99
4.00	0.25	1.30	3.1	24.94	24.63
6.00	0.29	1.44	4.2	29.03	28.67
8.00	0.32	1.56	5.1	32.05	31.64
10.00	0.35	1.70	5.9	32.13	31.69
12.00	0.37	1.83	6.6	32.20	31.73
14.00	0.39	1.94	7.2	32.26	31.78
16.00	0.41	2.05	7.8	32.32	31.81
18.00	0.42	2.15	8.4	32.38	31.85
20.00	0.44	2.24	8.9	32.44	31.88
22.00	0.46	2.32	9.5	32.49	31.92
24.00	0.47	2.40	10.0	32.54	31.95
26.00	0.49	2.48	10.5	32.59	31.98
28.00	0.51	2.55	11.0	33.44	32.82
30.00	0.52	2.61	11.5	35.50	34.87
32.00	0.54	2.66	12.0	37.41	36.79
34.00	0.55	2.71	12.5	39.23	38.61
36.00	0.56	2.76	13.1	40.73	40.11
38.00	0.57	2.81	13.5	41.24	40.61

← $Q_{10} = 17$ cfs, $d_{10} = 0.42'$

← $Q_{100} = 37$ cfs, $d_{100} = 0.57'$

TYP STREET SECTION - 6" VERTICAL CURB CP5A
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP5A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	55.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.67	ft
Elevation Range	0.00 to 0.80	
Flow Area	17.5	ft²
Wetted Perimeter	45.08	ft
Top Width	44.45	ft
Actual Depth	0.67	ft
Critical Elevation	0.63	ft
Critical Slope	0.004160	ft/ft
Velocity	3.15	ft/s
Velocity Head	0.15	ft
Specific Energy	0.82	ft
Froude Number	0.89	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+10	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP5A
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP5A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	56.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.10	1.8	19.23	18.99
4.00	0.25	1.30	3.1	24.94	24.63
6.00	0.29	1.44	4.2	29.03	28.67
8.00	0.32	1.56	5.1	32.05	31.64
10.00	0.35	1.70	5.9	32.13	31.69
12.00	0.37	1.83	6.6	32.20	31.73
14.00	0.39	1.94	7.2	32.26	31.78
16.00	0.41	2.05	7.8	32.32	31.81
18.00	0.42	2.15	8.4	32.38	31.85
20.00	0.44	2.24	8.9	32.44	31.88
22.00	0.46	2.32	9.5	32.49	31.92
24.00	0.47	2.40	10.0	32.54	31.95
26.00	0.49	2.48	10.5	32.59	31.98
28.00	0.51	2.55	11.0	33.44	32.82
30.00	0.52	2.61	11.5	35.50	34.87
32.00	0.54	2.66	12.0	37.41	36.79
34.00	0.55	2.71	12.5	39.23	38.61
36.00	0.56	2.76	13.1	40.73	40.11
38.00	0.57	2.81	13.5	41.24	40.61
40.00	0.59	2.85	14.0	41.73	41.11
42.00	0.60	2.90	14.5	42.22	41.59
44.00	0.61	2.94	15.0	42.68	42.06
46.00	0.62	2.98	15.4	43.14	42.51
48.00	0.63	3.02	15.9	43.59	42.96
50.00	0.64	3.06	16.4	44.03	43.40
52.00	0.65	3.10	16.8	44.46	43.83
54.00	0.66	3.13	17.2	44.88	44.25
56.00	0.67	3.17	17.7	45.29	44.66

← $Q_{10} = 25$ cfs, $d_{10} = 0.48'$

← $Q_{100} = 55$ cfs, $d_{100} = 0.67'$

TYP STREET SECTION - 6" VERTICAL CURB CP5B
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP5B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	34.80	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 0.80	
Flow Area	12.7	ft²
Wetted Perimeter	39.94	ft
Top Width	39.31	ft
Actual Depth	0.55	ft
Critical Elevation	0.50	ft
Critical Slope	0.004460	ft/ft
Velocity	2.73	ft/s
Velocity Head	0.12	ft
Specific Energy	0.67	ft
Froude Number	0.85	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+10	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP5B
Worksheet for Irregular Channel

Notes:
Total Q = Q(Rational) - Q(intercept CP5A)

10-year Q = 29 cfs - 18.6 cfs = 10.4 cfs

100-year Q = 63 cfs - 28.2 cfs = 34.8 cfs

TYP STREET SECTION - 6" VERTICAL CURB CP5B
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP5B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	36.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.10	1.8	19.23	18.99
4.00	0.25	1.30	3.1	24.94	24.63
6.00	0.29	1.44	4.2	29.03	28.67
8.00	0.32	1.56	5.1	32.05	31.64
10.00	0.35	1.70	5.9	32.13	31.69
12.00	0.37	1.83	6.6	32.20	31.73
14.00	0.39	1.94	7.2	32.26	31.78
16.00	0.41	2.05	7.8	32.32	31.81
18.00	0.42	2.15	8.4	32.38	31.85
20.00	0.44	2.24	8.9	32.44	31.88
22.00	0.46	2.32	9.5	32.49	31.92
24.00	0.47	2.40	10.0	32.54	31.95
26.00	0.49	2.48	10.5	32.59	31.98
28.00	0.51	2.55	11.0	33.44	32.82
30.00	0.52	2.61	11.5	35.50	34.87
32.00	0.54	2.66	12.0	37.41	36.79
34.00	0.55	2.71	12.5	39.23	38.61
36.00	0.56	2.76	13.1	40.73	40.11

← $Q_{10} = 10.4$ cfs, $d_{10} = 0.35'$

← $Q_{100} = 34.8$ cfs, $d_{100} = 0.55'$

TYP STREET SECTION - 4" ROLL CURB CP6
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP6
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	9.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.33	ft
Elevation Range	0.00 to 0.63	
Flow Area	5.5	ft²
Wetted Perimeter	32.50	ft
Top Width	32.39	ft
Actual Depth	0.33	ft
Critical Elevation	0.29	ft
Critical Slope	0.006986	ft/ft
Velocity	1.63	ft/s
Velocity Head	0.04	ft
Specific Energy	0.37	ft
Froude Number	0.70	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP6
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP6
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	10.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	
0.00	0.00	0.00	0.0	0.00	0.00	
2.00	0.19	1.10	1.8	19.10	19.04	
4.00	0.25	1.31	3.1	24.77	24.69	← $Q_{10} = 4$ cfs, $d_{10} = 0.25'$
6.00	0.29	1.45	4.1	28.84	28.74	
8.00	0.32	1.56	5.1	32.05	31.94	
10.00	0.34	1.69	5.9	34.11	34.00	← $Q_{100} = 9$ cfs, $d_{100} = 0.33'$

TYP STREET SECTION - 6" VERTICAL CURB CP15
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP15
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.006400	ft/ft
Discharge	58.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.59	ft
Elevation Range	0.00 to 0.80	
Flow Area	14.2	ft²
Wetted Perimeter	42.21	ft
Top Width	41.20	ft
Actual Depth	0.59	ft
Critical Elevation	0.64	ft
Critical Slope	0.004118	ft/ft
Velocity	4.08	ft/s
Velocity Head	0.26	ft
Specific Energy	0.85	ft
Froude Number	1.23	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+09	0.013
0+09	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+09	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP15
Worksheet for Irregular Channel

Notes:
Total Q = Q(Rational CP15) + Q(CPB)

10-yr Q = 26 cfs + 1 cfs = 27 cfs

100-yr Q = 56 cfs + 2 cfs = 58 cfs

TYP STREET SECTION - 6" VERTICAL CURB CP15
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP15
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.006400 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	58.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.17	1.41	1.4	17.18	16.84
4.00	0.22	1.68	2.4	22.28	21.84
6.00	0.25	1.86	3.2	25.94	25.42
8.00	0.28	2.00	4.0	28.89	28.32
10.00	0.31	2.11	4.7	31.41	30.79
12.00	0.33	2.23	5.4	32.66	32.00
14.00	0.34	2.38	5.9	32.69	32.00
16.00	0.36	2.50	6.4	32.73	32.00
18.00	0.37	2.62	6.9	32.75	32.00
20.00	0.39	2.74	7.3	32.78	32.00
22.00	0.40	2.84	7.7	32.81	32.00
24.00	0.41	2.94	8.2	32.84	32.00
26.00	0.43	3.04	8.6	32.86	32.00
28.00	0.44	3.13	9.0	32.89	32.00
30.00	0.45	3.21	9.3	32.91	32.00
32.00	0.46	3.30	9.7	32.93	32.00
34.00	0.47	3.38	10.1	32.96	32.00
36.00	0.49	3.46	10.4	32.98	32.00
38.00	0.50	3.53	10.8	33.00	32.00
40.00	0.51	3.58	11.2	34.16	33.15
42.00	0.52	3.69	11.4	35.09	34.08
44.00	0.53	3.75	11.7	36.42	35.41
46.00	0.54	3.80	12.1	37.72	36.71
48.00	0.54	3.86	12.4	38.99	37.98
50.00	0.55	3.90	12.8	40.22	39.22
52.00	0.56	3.95	13.2	41.14	40.13
54.00	0.57	3.99	13.5	41.50	40.50
56.00	0.58	4.04	13.9	41.86	40.85
58.00	0.59	4.08	14.2	42.21	41.20

← $Q_{10} = 27$ cfs, $d_{10} = 0.43'$

← $Q_{100} = 58$ cfs, $d_{100} = 0.59'$

TYP STREET SECTION - 6" VERTICAL CURB CP16
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP16
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.006400	ft/ft
Discharge	41.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.51	ft
Elevation Range	0.00 to 0.80	
Flow Area	11.4	ft²
Wetted Perimeter	35.00	ft
Top Width	34.00	ft
Actual Depth	0.51	ft
Critical Elevation	0.55	ft
Critical Slope	0.005317	ft/ft
Velocity	3.60	ft/s
Velocity Head	0.20	ft
Specific Energy	0.72	ft
Froude Number	1.10	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+09	0.013
0+09	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+09	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP16
Worksheet for Irregular Channel

Notes:
Total Q = Q(Rational CP16) + Q(1/2 CPB)

10-yr Q = 18 cfs + 0.5 cfs = 18.5 cfs

100-yr Q = 40 cfs + 1 cfs = 41 cfs

TYP STREET SECTION - 6" VERTICAL CURB CP16
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP16
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.006400 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	42.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.17	1.41	1.4	17.18	16.84
4.00	0.22	1.68	2.4	22.28	21.84
6.00	0.25	1.86	3.2	25.94	25.42
8.00	0.28	2.00	4.0	28.89	28.32
10.00	0.31	2.11	4.7	31.41	30.79
12.00	0.33	2.23	5.4	32.66	32.00
14.00	0.34	2.38	5.9	32.69	32.00
16.00	0.36	2.50	6.4	32.73	32.00
18.00	0.37	2.62	6.9	32.75	32.00
20.00	0.39	2.74	7.3	32.78	32.00
22.00	0.40	2.84	7.7	32.81	32.00
24.00	0.41	2.94	8.2	32.84	32.00
26.00	0.43	3.04	8.6	32.86	32.00
28.00	0.44	3.13	9.0	32.89	32.00
30.00	0.45	3.21	9.3	32.91	32.00
32.00	0.46	3.30	9.7	32.93	32.00
34.00	0.47	3.38	10.1	32.96	32.00
36.00	0.49	3.46	10.4	32.98	32.00
38.00	0.50	3.53	10.8	33.00	32.00
40.00	0.51	3.58	11.2	34.16	33.15
42.00	0.52	3.69	11.4	35.09	34.08

$Q_{10} = 18.5$ cfs, $d_{10} = 0.38'$

$Q_{100} = 41$ cfs, $d_{100} = 0.51'$

TYP STREET SECTION - 4" ROLL CURB CP17A
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP17A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.008000	ft/ft
Discharge	20.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.37	ft
Elevation Range	0.00 to 0.63	
Flow Area	6.9	ft²
Wetted Perimeter	37.83	ft
Top Width	37.71	ft
Actual Depth	0.37	ft
Critical Elevation	0.40	ft
Critical Slope	0.005532	ft/ft
Velocity	2.89	ft/s
Velocity Head	0.13	ft
Specific Energy	0.50	ft
Froude Number	1.19	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP17A
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP17A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.008000 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	20.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	
0.00	0.00	0.00	0.0	0.00	0.00	
2.00	0.16	1.55	1.3	16.09	16.03	
4.00	0.21	1.85	2.2	20.86	20.79	
6.00	0.24	2.04	2.9	24.29	24.21	
8.00	0.27	2.20	3.6	27.06	26.96	
10.00	0.29	2.32	4.3	29.42	29.32	← $Q_{10} = 10$ cfs, $d_{10} = 0.29'$
12.00	0.31	2.43	4.9	31.50	31.39	
14.00	0.33	2.56	5.5	32.24	32.13	
16.00	0.35	2.68	6.0	34.29	34.18	
18.00	0.36	2.79	6.5	36.12	36.01	
20.00	0.37	2.89	6.9	37.83	37.71	← $Q_{100} = 20$ cfs, $d_{100} = 0.37$

TYP STREET SECTION - 6" VERTICAL CURB CP17B
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP17B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.008000	ft/ft
Discharge	53.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Water Surface Elevation	0.54	ft
Elevation Range	0.00 to 0.80	
Flow Area	12.3	ft²
Wetted Perimeter	38.61	ft
Top Width	37.61	ft
Actual Depth	0.54	ft
Critical Elevation	0.62	ft
Critical Slope	0.004408	ft/ft
Velocity	4.29	ft/s
Velocity Head	0.29	ft
Specific Energy	0.83	ft
Froude Number	1.32	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+09	0.013
0+09	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+09	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP17B
Worksheet for Irregular Channel

Notes:
Total Q = Q(Rational) + 1/2 Q(CPB)

10-yr Q = 24 cfs + 0.5 cfs = 24.5 cfs

100-yr Q = 52 cfs + 1 cfs = 53 cfs

TYP STREET SECTION - 6" VERTICAL CURB CP17B
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP17B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.008000 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	54.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.16	1.53	1.3	16.47	16.15
4.00	0.21	1.82	2.2	21.37	20.94
6.00	0.24	2.02	3.0	24.87	24.38
8.00	0.27	2.17	3.7	27.71	27.16
10.00	0.30	2.29	4.4	30.13	29.53
12.00	0.32	2.40	5.0	32.26	31.62
14.00	0.33	2.54	5.5	32.67	32.00
16.00	0.35	2.68	6.0	32.70	32.00
18.00	0.36	2.81	6.4	32.73	32.00
20.00	0.37	2.93	6.8	32.75	32.00
22.00	0.39	3.04	7.2	32.78	32.00
24.00	0.40	3.15	7.6	32.80	32.00
26.00	0.41	3.25	8.0	32.83	32.00
28.00	0.42	3.35	8.4	32.85	32.00
30.00	0.43	3.44	8.7	32.87	32.00
32.00	0.44	3.53	9.1	32.89	32.00
34.00	0.45	3.61	9.4	32.91	32.00
36.00	0.46	3.70	9.7	32.94	32.00
38.00	0.47	3.78	10.1	32.96	32.00
40.00	0.48	3.85	10.4	32.98	32.00
42.00	0.49	3.93	10.7	32.99	32.00
44.00	0.50	3.99	11.0	33.60	32.59
46.00	0.52	4.04	11.4	35.07	34.06
48.00	0.52	4.15	11.6	35.71	34.71
50.00	0.53	4.21	11.9	36.89	35.89
52.00	0.54	4.27	12.2	38.05	37.04
54.00	0.55	4.32	12.5	39.17	38.17

$Q_{10} = 24.5$ cfs, $d_{10} = 0.40'$

$Q_{100} = 53$ cfs, $d_{100} = 0.54'$

TYP STREET SECTION - 4" ROLL CURB CP18
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP18
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.010800	ft/ft
Discharge	30.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.41	ft
Elevation Range	0.00 to 0.63	
Flow Area	8.2	ft²
Wetted Perimeter	40.77	ft
Top Width	40.65	ft
Actual Depth	0.41	ft
Critical Elevation	0.46	ft
Critical Slope	0.004936	ft/ft
Velocity	3.65	ft/s
Velocity Head	0.21	ft
Specific Energy	0.61	ft
Froude Number	1.43	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP18
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP18
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.010800 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	30.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.15	1.74	1.2	15.21	15.16
4.00	0.20	2.07	1.9	19.72	19.65
6.00	0.23	2.29	2.6	22.96	22.88
8.00	0.26	2.46	3.3	25.58	25.49
10.00	0.28	2.60	3.8	27.81	27.71
12.00	0.30	2.72	4.4	29.78	29.67
14.00	0.31	2.83	5.0	31.55	31.44
16.00	0.33	2.96	5.4	32.11	31.99
18.00	0.34	3.08	5.8	33.80	33.68
20.00	0.35	3.19	6.3	35.42	35.31
22.00	0.37	3.30	6.7	36.93	36.82
24.00	0.38	3.39	7.1	38.36	38.25
26.00	0.39	3.48	7.5	39.72	39.61
28.00	0.40	3.56	7.9	40.39	40.27
30.00	0.41	3.65	8.2	40.77	40.65

$Q_{10} = 14$ cfs, $d_{10} = 0.31'$

$Q_{100} = 30$ cfs, $d_{100} = 0.41'$

TYP STREET SECTION - 4" ROLL CURB CP19A
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP19A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.003200	ft/ft
Discharge	11.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.36	ft
Elevation Range	0.00 to 0.63	
Flow Area	6.3	ft²
Wetted Perimeter	35.58	ft
Top Width	35.47	ft
Actual Depth	0.36	ft
Critical Elevation	0.31	ft
Critical Slope	0.006282	ft/ft
Velocity	1.74	ft/s
Velocity Head	0.05	ft
Specific Energy	0.40	ft
Froude Number	0.73	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP19A
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP19A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	12.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.19	1.10	1.8	19.10	19.04
4.00	0.25	1.31	3.1	24.77	24.69
6.00	0.29	1.45	4.1	28.84	28.74
8.00	0.32	1.56	5.1	32.05	31.94
10.00	0.34	1.69	5.9	34.11	34.00
12.00	0.37	1.80	6.7	36.97	36.85

$Q_{10} = 5cfs, d_{10} = 0.27'$

$Q_{100} = 11cfs, d_{100} = 0.36'$

TYP STREET SECTION - 4" ROLL CURB CP19B
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP19B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.017200 ft/ft
Discharge	13.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.016
Water Surface Elevation	0.28 ft
Elevation Range	0.00 to 0.63
Flow Area	3.9 ft²
Wetted Perimeter	28.12 ft
Top Width	28.02 ft
Actual Depth	0.28 ft
Critical Elevation	0.33 ft
Critical Slope	0.006664 ft/ft
Velocity	3.30 ft/s
Velocity Head	0.17 ft
Specific Energy	0.45 ft
Froude Number	1.55
Flow Type	Supercritical

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+10	0.013
0+10	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.63
0+05	0.39
0+09	0.33
0+10	0.00
0+25	0.32

TYP STREET SECTION - 4" ROLL CURB CP19B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+40	0.00
0+41	0.33
0+45	0.39
0+50	0.63

TYP SECTION 4" ROLL CURB - CP19B
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 4" ROLL CURB STREET SECTION - CP19B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.017200 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	14.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.14	2.07	1.0	13.94	13.89
4.00	0.18	2.46	1.6	18.07	18.01
6.00	0.21	2.72	2.2	21.04	20.97
8.00	0.23	2.93	2.7	23.44	23.36
10.00	0.25	3.09	3.2	25.48	25.40
12.00	0.27	3.24	3.7	27.29	27.19
14.00	0.29	3.37	4.2	28.91	28.81

← $Q_{10} = 7$ cfs, $d_{10} = 0.22'$

← $Q_{100} = 13$ cfs, $d_{100} = 0.28'$

TYP STREET SECTION - 6" VERTICAL CURB CP19C
Worksheet for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP19C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.004800 ft/ft
Discharge	32.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.016
Water Surface Elevation	0.49 ft
Elevation Range	0.00 to 0.80
Flow Area	10.6 ft²
Wetted Perimeter	32.99 ft
Top Width	32.00 ft
Actual Depth	0.49 ft
Critical Elevation	0.47 ft
Critical Slope	0.005675 ft/ft
Velocity	3.02 ft/s
Velocity Head	0.14 ft
Specific Energy	0.63 ft
Froude Number	0.93
Flow Type	Subcritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	0+05	0.030
0+05	0+09	0.013
0+09	0+41	0.016
0+41	0+45	0.013
0+45	0+50	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	0.80
0+05	0.56
0+09	0.50
0+09	0.00
0+25	0.32
0+41	0.00
0+41	0.50
0+45	0.56
0+50	0.80

TYP STREET SECTION - 6" VERTICAL CURB CP19C
Rating Table for Irregular Channel

Project Description	
Worksheet	TYPICAL 6" VERTICAL CURB STREET SECTION - CP19C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.004800 ft/ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	0.00	32.00	2.00

Discharge (cfs)	Water Surface Elevation (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00	0.00	0.00	0.0	0.00	0.00
2.00	0.18	1.27	1.6	18.13	17.77
4.00	0.23	1.51	2.7	23.51	23.05
6.00	0.27	1.67	3.6	27.37	26.83
8.00	0.30	1.79	4.5	30.49	29.89
10.00	0.32	1.91	5.2	32.65	32.00
12.00	0.34	2.05	5.9	32.69	32.00
14.00	0.36	2.18	6.4	32.73	32.00
16.00	0.38	2.30	7.0	32.76	32.00
18.00	0.39	2.41	7.5	32.79	32.00
20.00	0.41	2.51	8.0	32.82	32.00
22.00	0.42	2.61	8.4	32.85	32.00
24.00	0.44	2.70	8.9	32.88	32.00
26.00	0.45	2.78	9.3	32.91	32.00
28.00	0.47	2.87	9.8	32.94	32.00
30.00	0.48	2.95	10.2	32.96	32.00
32.00	0.49	3.02	10.6	32.99	32.00

← $Q_{10} = 15$ cfs, $d_{10} = 0.37'$

← $Q_{100} = 32$ cfs, $d_{100} = 0.49'$

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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                    Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                       |
|Project    : DREAMING SUMMIT:CP1B 10-YR, FILE:ST711B                            |
|--------------------------------------------------------------------------------|
|Sta                                    INPUT                                    |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 13.0    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 1B   C2=0.00  A2= 0.00 Qrunoff= 13.0    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=10.00|
|................................................................................|
|                                       OUTPUT                                   |
|Flowby=  0.0 Qtotal= 13.0 Qint= 13.0 Flowby dn=  0.0 Depth=0.66 Spread= 20.97 Veloc= 0.00|
|--------------------------------------------------------------------------------|
|                                     CRITERIA                                   |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                               |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                           |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|--------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:10:26:56     Checked by:        Date:          |
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                                Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                                |
|Project    : DREAMING SUMMIT:CP1B 100-YR, FILE:ST711B2                                   |
|-----------------------------------------------------------------------------------------|
|Sta                                      INPUT                                           |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 13.1    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 1B   C2=0.00  A2= 0.00 Qrunoff= 13.1    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=10.00|
|.........................................................................................|
|                                         OUTPUT                                          |
|Flowby=  0.0 Qtotal= 13.1 Qint= 13.1 Flowby dn=  0.0 Depth=0.67 Spread= 21.32 Veloc= 0.00|
|-----------------------------------------------------------------------------------------|
|                                        CRITERIA                                         |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:10:26:38     Checked by:        Date:        |
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Flow intercepted @ top of curb

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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                              Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                                |
|Project    : DREAMING SUMMIT:CP2B 10-YR, FILE:ST712B                                     |
|-----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                         |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 16.0    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 2B   C2=0.00  A2= 0.00 Qrunoff= 16.0    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.........................................................................................|
|                                           OUTPUT                                        |
|Flowby=  0.0 Qtotal= 16.0 Qint= 16.0 Flowby dn=  0.0 Depth=0.50 Spread= 12.82 Veloc= 0.00|
|-----------------------------------------------------------------------------------------|
|                                         CRITERIA                                        |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:10:30:17     Checked by:        Date:        |
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PAVEMENT DRAINAGE PROGRAM - HEC-12                                        Page   1
Licensed to: David Evans & Associates, Phoenix, AZ  85016
Project    : DREAMING SUMMIT:CP2B 100-YR, FILE:ST712B2
-------------------------------------------------------------------------------
Sta                                   INPUT
Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 22.2    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00
CB ID  = 2B   C2=0.00  A2= 0.00 Qrunoff= 22.2    Slope2= 0.0590 a     = 2.00 Perim = 0.00
Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00
-------------------------------------------------------------------------------
                                      OUTPUT
Flowby=  0.0 Qtotal= 22.2 Qint= 22.2 Flowby dn=  0.0 Depth=0.67 Spread= 21.17 Veloc= 0.00
-------------------------------------------------------------------------------
                                    CRITERIA
Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016
Clogging Factors in Sag Location:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
Clogging Factors on Continuous Grade:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
-------------------------------------------------------------------------------
Prepared by:          Date:08/20/99    Time:10:31:10     Checked by:        Date:
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Flow intercepted @ top of curb

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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                              Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                                |
|Project    : DREAMING SUMMIT:CP3B 10-YR, FILE:ST713B                                     |
|-----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                         |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 21.0    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 3B   C2=0.00  A2= 0.00 Qrunoff= 21.0    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.........................................................................................|
|                                           OUTPUT                                        |
|Flowby=  0.0 Qtotal= 21.0 Qint= 21.0 Flowby dn=  0.0 Depth=0.62 Spread= 18.97 Veloc= 0.00|
|-----------------------------------------------------------------------------------------|
|                                         CRITERIA                                        |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:         Date:08/20/99    Time:10:56:48     Checked by:        Date:         |
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                    Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                      |
|Project    : DREAMING SUMMIT:CP3B 100-YR, FILE:ST713B2                         |
|-------------------------------------------------------------------------------|
|Sta                                    INPUT                                   |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 22.2   Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 3B   C2=0.00  A2= 0.00 Qrunoff= 22.2   Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|...............................................................................|
|                                       OUTPUT                                  |
|Flowby=  0.0 Qtotal= 22.2 Qint= 22.2 Flowby dn=  0.0 Depth=0.67 Spread= 21.17 Veloc= 0.00|
|-------------------------------------------------------------------------------|
|                                      CRITERIA                                 |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                              |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                          |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:10:57:35     Checked by:        Date:|
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Flow intercepted @ top of curb

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==========================================================================================
|PAVEMENT DRAINAGE PROGRAM - HEC-12                                                Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                                |
|Project    : DREAMING SUMMIT:CP5A-10-YEAR, FILE:ST715A                                   |
|-----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                         |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 12.5    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 5A   C2=0.00  A2= 0.00 Qrunoff= 12.5    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0032 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.........................................................................................|
|                                           OUTPUT                                        |
|Flowby=  0.0 Qtotal= 12.5 Qint=  9.3 Flowby dn=  3.2 Depth=0.51 Spread= 21.80 Veloc= 2.58|
|-----------------------------------------------------------------------------------------|
|                                         CRITERIA                                        |
|Runoff computed by Rational Method   Manning's n Gutter=0.016  Manning's n Pavement=0.013|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:         Date:08/03/99    Time:13:36:22     Checked by:        Date:         |
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                          Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                              |
|Project    : DREAMING SUMMIT:CP5A 100-YEAR, FILE:ST715A2                               |
|-----------------------------------------------------------------------------------------|
|Sta                                      INPUT                                         |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 27.5    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 5A   C2=0.00  A2= 0.00 Qrunoff= 27.5    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0032 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.........................................................................................|
|                                         OUTPUT                                        |
|Flowby=  0.0 Qtotal= 27.5 Qint= 14.1 Flowby dn= 13.4 Depth=0.67 Spread= 29.35 Veloc= 3.15|
|-----------------------------------------------------------------------------------------|
|                                       CRITERIA                                        |
|Runoff computed by Rational Method   Manning's n Gutter=0.016  Manning's n Pavement=0.013|
|Clogging Factors in Sag Location:                                                      |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                  |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/03/99    Time:13:40:01     Checked by:        Date:       |
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==========================================================================================
|PAVEMENT DRAINAGE PROGRAM - HEC-12                                                Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                                |
|Project    : DREAMING SUMMIT:CP5B 10-YR, FILE:ST715B                                     |
|----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                        |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 10.4    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 5B   C2=0.00  A2= 0.00 Qrunoff= 10.4    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=10.00|
|........................................................................................|
|                                           OUTPUT                                       |
|Flowby=  0.0 Qtotal= 10.4 Qint= 10.4 Flowby dn=  0.0 Depth=0.52 Spread= 13.52 Veloc= 0.00|
|----------------------------------------------------------------------------------------|
|                                         CRITERIA                                       |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                       |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                   |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|----------------------------------------------------------------------------------------|
|Prepared by:         Date:08/23/99    Time:09:03:11     Checked by:        Date:        |
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==========================================================================================
```

```
PAVEMENT DRAINAGE PROGRAM - HEC-12                                        Page   1
Licensed to: David Evans & Associates, Phoenix, AZ  85016
Project    : DREAMING SUMMIT:CP5B 100-YR, FILE:ST715B2
-----------------------------------------------------------------------------------
Sta                                      INPUT
Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 13.1    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00
CB ID  = 5B   C2=0.00  A2= 0.00 Qrunoff= 13.1    Slope2= 0.0590 a     = 2.00 Perim = 0.00
Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=10.00
-----------------------------------------------------------------------------------
                                         OUTPUT
Flowby=  0.0 Qtotal= 13.1 Qint= 13.1 Flowby dn=  0.0 Depth=0.67 Spread= 21.32 Veloc= 0.00
-----------------------------------------------------------------------------------
                                       CRITERIA
Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016
Clogging Factors in Sag Location:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
Clogging Factors on Continuous Grade:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
-----------------------------------------------------------------------------------
Prepared by:          Date:08/23/99    Time:09:04:17     Checked by:        Date:
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Flow intercepted @ Top of curb

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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                          Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                              |
|Project    : DREAMING SUMMIT:CP6 10-YR, FILE:ST716                                     |
|-----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                       |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   =  4.0    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 6    C2=0.00  A2= 0.00 Qrunoff=  4.0    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length= 3.00|
|.........................................................................................|
|                                           OUTPUT                                      |
|Flowby=  0.0 Qtotal=  4.0 Qint=  4.0 Flowby dn=  0.0 Depth=0.50 Spread= 12.62 Veloc= 0.00|
|-----------------------------------------------------------------------------------------|
|                                        CRITERIA                                       |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/18/99    Time:09:50:24     Checked by:        Date:       |
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                        Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                            |
|Project    : DREAMING SUMMIT:CP6 100-YR, FILE:ST7162                                 |
|-------------------------------------------------------------------------------------|
|Sta                                        INPUT                                     |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   =  4.1   Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 6    C2=0.00  A2= 0.00 Qrunoff=  4.1   Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length= 3.00|
|.....................................................................................|
|                                           OUTPUT                                    |
|Flowby=  0.0 Qtotal=  4.1 Qint=  4.1 Flowby dn=  0.0 Depth=0.70 Spread= 22.62 Veloc= 0.00|
|-------------------------------------------------------------------------------------|
|                                         CRITERIA                                    |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-------------------------------------------------------------------------------------|
|Prepared by:          Date:08/18/99    Time:09:52:26     Checked by:        Date:    |
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=======================================================================================
```

Flow intercepted @ top of curb

```
|PAVEMENT DRAINAGE PROGRAM - HEC-12                                          Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                             |
|Project    : DREAMING SUMMIT:CP16 10-YR, FILE:ST7116                                  |
|--------------------------------------------------------------------------------------|
|Sta                                      INPUT                                        |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 18.5    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 16   C2=0.00  A2= 0.00 Qrunoff= 18.5    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|......................................................................................|
|                                         OUTPUT                                       |
|Flowby=  0.0 Qtotal= 18.5 Qint= 18.5 Flowby dn=  0.0 Depth=0.54 Spread= 14.77 Veloc= 0.00|
|--------------------------------------------------------------------------------------|
|                                       CRITERIA                                       |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                     |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                 |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|--------------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:11:42:09     Checked by:        Date:     |
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                        Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                            |
|Project    : DREAMING SUMMIT:CP16 100-YR, FILE:ST71162                               |
|-------------------------------------------------------------------------------------|
|Sta                                      INPUT                                       |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 22.2    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 16   C2=0.00  A2= 0.00 Qrunoff= 22.2    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.....................................................................................|
|                                         OUTPUT                                      |
|Flowby=  0.0 Qtotal= 22.2 Qint= 22.2 Flowby dn=  0.0 Depth=0.67 Spread= 21.17 Veloc= 0.00|
|-------------------------------------------------------------------------------------|
|                                        CRITERIA                                     |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-------------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:11:42:42     Checked by:        Date:    |
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```

Flow intercepted @ top of curb

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==========================================================================================
|PAVEMENT DRAINAGE PROGRAM - HEC-12                                                Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                                |
|Project    : DREAMING SUMMIT:CP17B 10-YEAR, FILE:ST7117B                                 |
|-----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                         |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 24.5    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 17B  C2=0.00  A2= 0.00 Qrunoff= 24.5    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=20.00|
|.........................................................................................|
|                                           OUTPUT                                        |
|Flowby=  0.0 Qtotal= 24.5 Qint= 24.5 Flowby dn=  0.0 Depth=0.62 Spread= 18.67 Veloc= 0.00|
|-----------------------------------------------------------------------------------------|
|                                          CRITERIA                                       |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/24/99    Time:12:58:42     Checked by:        Date:        |
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                          Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                              |
|Project     : DREAMING SUMMIT:CP17B 100-YR, FILE:ST7117B2                              |
|----------------------------------------------------------------------------------------|
|Ste                                      INPUT                                          |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 26.1    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 17B  C2=0.00  A2= 0.00 Qrunoff= 26.1    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=20.00|
|........................................................................................|
|                                        OUTPUT                                          |
|Flowby=  0.0 Qtotal= 26.1 Qint= 26.1 Flowby dn=  0.0 Depth=0.67 Spread= 21.12 Veloc= 0.00|
|----------------------------------------------------------------------------------------|
|                                       CRITERIA                                         |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                       |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                   |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/24/99    Time:12:59:48     Checked by:        Date:       |
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```

Flow intercepted @ top of curb

```
|PAVEMENT DRAINAGE PROGRAM - HEC-12                                          Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                             |
|Project    : DREAMING SUMMIT:CP18 10-YR, FILE:ST7118                                  |
|-------------------------------------------------------------------------------------|
|Sta                                        INPUT                                     |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 14.0    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 18   C2=0.00  A2= 0.00 Qrunoff= 14.0    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.....................................................................................|
|                                           OUTPUT                                    |
|Flowby=  0.0 Qtotal= 14.0 Qint= 14.0 Flowby dn=  0.0 Depth=0.50 Spread= 12.82 Veloc= 0.00|
|-------------------------------------------------------------------------------------|
|                                          CRITERIA                                   |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                     |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                 |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-------------------------------------------------------------------------------------|
|Prepared by:          Date:08/24/99    Time:08:53:47     Checked by:        Date:     |
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                        Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                            |
|Project    : DREAMING SUMMIT:CP16 100-YR, FILE:ST71162                               |
|-------------------------------------------------------------------------------------|
|Sta                                      INPUT                                       |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 22.2    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 16   C2=0.00  A2= 0.00 Qrunoff= 22.2    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.....................................................................................|
|                                         OUTPUT                                      |
|Flowby=  0.0 Qtotal= 22.2 Qint= 22.2 Flowby dn=  0.0 Depth=0.67 Spread= 21.17 Veloc= 0.00|
|-------------------------------------------------------------------------------------|
|                                        CRITERIA                                     |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-------------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:11:42:42     Checked by:        Date:    |
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Flow intercepted @ top of curb

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==========================================================================================
|PAVEMENT DRAINAGE PROGRAM - HEC-12                                                Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                                |
|Project    : DREAMING SUMMIT:CP17B 10-YEAR, FILE:ST7117B                                 |
|-----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                         |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 24.5    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 17B  C2=0.00  A2= 0.00 Qrunoff= 24.5    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=20.00|
|.........................................................................................|
|                                           OUTPUT                                        |
|Flowby=  0.0 Qtotal= 24.5 Qint= 24.5 Flowby dn=  0.0 Depth=0.62 Spread= 18.67 Veloc= 0.00|
|-----------------------------------------------------------------------------------------|
|                                          CRITERIA                                       |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/24/99    Time:12:58:42     Checked by:        Date:        |
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```
PAVEMENT DRAINAGE PROGRAM - HEC-12                                          Page   1
Licensed to: David Evans & Associates, Phoenix, AZ  85016
Project    : DREAMING SUMMIT:CP17B 100-YR, FILE:ST7117B2
-------------------------------------------------------------------------------
Sta                                      INPUT
Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 26.1    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00
CB ID  = 17B  C2=0.00  A2= 0.00 Qrunoff= 26.1    Slope2= 0.0590 a     = 2.00 Perim = 0.00
Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=20.00
...............................................................................
                                         OUTPUT
Flowby=  0.0 Qtotal= 26.1 Qint= 26.1 Flowby dn=  0.0 Depth=0.67 Spread= 21.12 Veloc= 0.00
-------------------------------------------------------------------------------
                                        CRITERIA
Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016
Clogging Factors in Sag Location:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
Clogging Factors on Continuous Grade:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
-------------------------------------------------------------------------------
Prepared by:          Date:08/24/99    Time:12:59:48     Checked by:        Date:
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===============================================================================
```

Flow intercepted @ top of curb

```
PAVEMENT DRAINAGE PROGRAM - HEC-12                                        Page   1
Licensed to: David Evans & Associates, Phoenix, AZ  85016
Project    : DREAMING SUMMIT:CP18 10-YR, FILE:ST7118
-------------------------------------------------------------------------------
Sta                                      INPUT
Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 14.0    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00
CB ID  = 18   C2=0.00  A2= 0.00 Qrunoff= 14.0    Slope2= 0.0590 a     = 2.00 Perim = 0.00
Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00
-------------------------------------------------------------------------------
                                         OUTPUT
Flowby=  0.0 Qtotal= 14.0 Qint= 14.0 Flowby dn=  0.0 Depth=0.50 Spread= 12.82 Veloc= 0.00
-------------------------------------------------------------------------------
                                       CRITERIA
Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016
Clogging Factors in Sag Location:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
Clogging Factors on Continuous Grade:
----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00
-------------------------------------------------------------------------------
Prepared by:          Date:08/24/99    Time:08:53:47     Checked by:        Date:
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|PAVEMENT DRAINAGE PROGRAM - HEC-12                                          Page   1 |
|Licensed to: David Evans & Associates, Phoenix, AZ  85016                              |
|Project    : DREAMING SUMMIT:CP18 100-YR, FILE:ST71182                                 |
|-----------------------------------------------------------------------------------------|
|Sta                                        INPUT                                       |
|Intens.= 0.00 C1=0.00  A1= 0.00 Qadd   = 22.2    Slope1= 6.0000 Gutter= 2.00 Area  = 0.00|
|CB ID  = 18   C2=0.00  A2= 0.00 Qrunoff= 22.2    Slope2= 0.0590 a     = 2.00 Perim = 0.00|
|Curb Opening  C3=0.00  A3= 0.00 Grade  =  0.0000 Slope3= 0.0200 W     = 2.00 Length=17.00|
|.........................................................................................|
|                                           OUTPUT                                        |
|Flowby=  0.0 Qtotal= 22.2 Qint= 22.2 Flowby dn=  0.0 Depth=0.67 Spread= 21.17 Veloc= 0.00|
|-----------------------------------------------------------------------------------------|
|                                          CRITERIA                                       |
|Runoff computed by Rational Method   Manning's n Gutter=0.013  Manning's n Pavement=0.016|
|Clogging Factors in Sag Location:                                                        |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|Clogging Factors on Continuous Grade:                                                    |
|----- Curb Opening= 1.33 Grate= 2.00 Slotted Drain= 2.00 Comb-Curb= 1.33 Comb-Grate= 2.00|
|-----------------------------------------------------------------------------------------|
|Prepared by:          Date:08/20/99    Time:12:23:26     Checked by:        Date:        |
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```

Flow intercepted @ top of curb

WEIR CALCULATIONS

Q = C * L * H^(1.5)
BREADTH OF WEIR CREST = 5'

$d_{100} = H_{CALC} + 0.5$ ft

CONCENTRATION POINT 1B - d_{100}

Q_{100} = 28 cfs -13.1 cfs = **14.9 cfs**

Q_{100} =	14.9 cfs
C =	2.34
L =	50 ft
H_{CALC} =	**0.29** ft
d_{100} =	**0.79 ft**

CONCENTRATION POINT 2B - d_{100}

Q_{100} = 35 cfs - 22.2 cfs = **12.8 cfs**

Q_{100} =	12.8 cfs
C =	2.5
L =	30 ft
H_{CALC} =	**0.36** ft
d_{100} =	**0.86 ft**

CONCENTRATION POINT 3B - d_{100}

Q_{100} = 46 cfs - 22.2 cfs = **23.8 cfs**

Q_{100} =	23.8 cfs
C =	2.5
L =	50 ft
H_{CALC} =	**0.38** ft
d_{100} =	**0.88 ft**

CONCENTRATION POINT 5B - d_{100}

Q_{100} = 34.8 cfs - 13.1 cfs = **21.7 cfs**

Q_{100} =	21.7 cfs
C =	2.4
L =	50 ft
H_{CALC} =	**0.37** ft
d_{100} =	**0.87 ft**

CONCENTRATION POINT 6 - d_{100}

Q_{100} = 9 cfs - 4 cfs = **5 cfs**

Q_{100} =	5 cfs
C =	2.34
L =	30 ft
H_{CALC} =	**0.20** ft
d_{100} =	**0.70 ft**

s:\drn\star0071\calcs\weir.xls

WEIR CALCULATIONS

Q = C * L * H^(1.5)
BREADTH OF WEIR CREST = 5'

$d_{100} = H_{CALC} + 0.5$ ft

CONCENTRATION POINT 16 - d_{100}

Q_{100} = 41 cfs - 22.2 cfs = 18.8 cfs

Q_{100} =	18.8 cfs
C =	2.34
L =	50 ft
H_{CALC} =	**0.34** ft
d_{100} =	**0.84 ft**

CONCENTRATION POINT 17B - d_{100}

Q_{100} = 53 cfs - 26.1 cfs = 26.9 cfs

Q_{100} =	26.9 cfs
C =	2.4
L =	50 ft
H_{CALC} =	**0.43** ft
d_{100} =	**0.93 ft**

CONCENTRATION POINT 18 - d_{100}

Q_{100} = 30 cfs - 22.2 cfs = 7.8 cfs

Q_{100} =	7.8 cfs
C =	2.34
L =	30 ft
H_{CALC} =	**0.27** ft
d_{100} =	**0.77 ft**

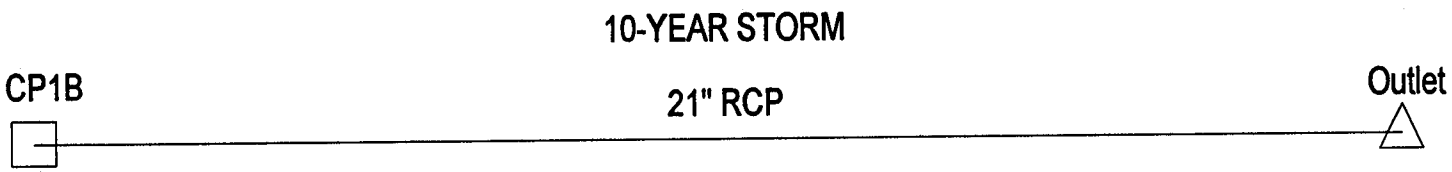
CONCENTRATION POINT 13B - CURB OPENING

Q10 =	3 cfs	Q100 =	6 cfs
C =	2.5	C =	2.7
L =	6 ft.	L =	6 ft
H_{CALC} =	**0.40** ft	H_{CALC} =	**0.60** ft

Width of opening provided ($L_{PROV.}$) is 6 feet

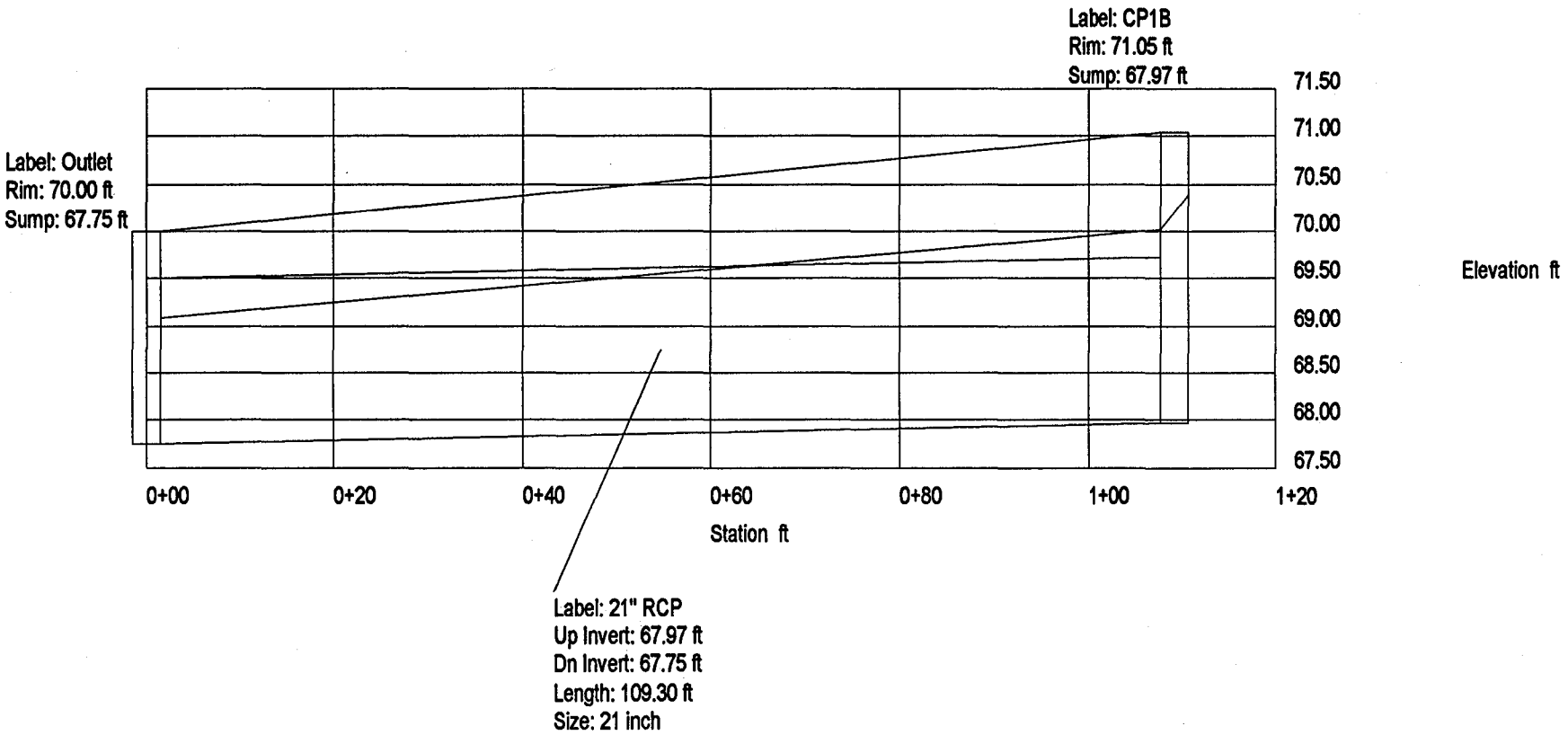
Actual Length used for calculations considers a minimum 20% clog factor
C derived from Handbook of Hydraulics, 6th Edition, Table 5-3

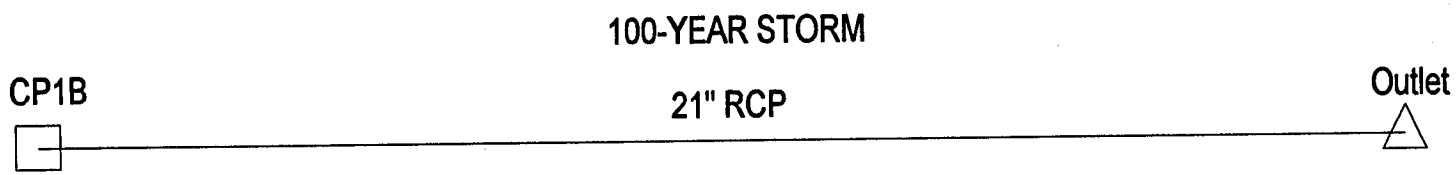
s:\dm\star0071\calcs\weir.xls


10-YEAR STORM
CP1B
21" RCP
Outlet

DEA Table

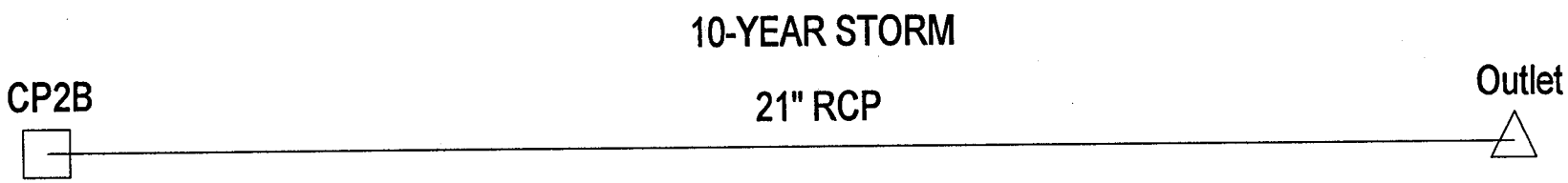
Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
21" RCP	CP1B	Outlet	67.97	67.75	71.05	70.00	70.02	69.09	109.30	21 inch	0.002013	13.00	7.11	5.98	1.33	0.50	.00


Label: CP1B
Rim: 71.05 ft
Sump: 67.97 ft
Label: Outlet
Rim: 70.00 ft
Sump: 67.75 ft
71.50
71.00
70.50
70.00
69.50
69.00
68.50
68.00
67.50
Elevation ft
0+00
0+20
0+40
0+60
0+80
1+00
1+20
Station ft
Label: 21" RCP
Up Invert: 67.97 ft
Dn Invert: 67.75 ft
Length: 109.30 ft
Size: 21 inch


100-YEAR STORM
CP1B
21" RCP
Outlet

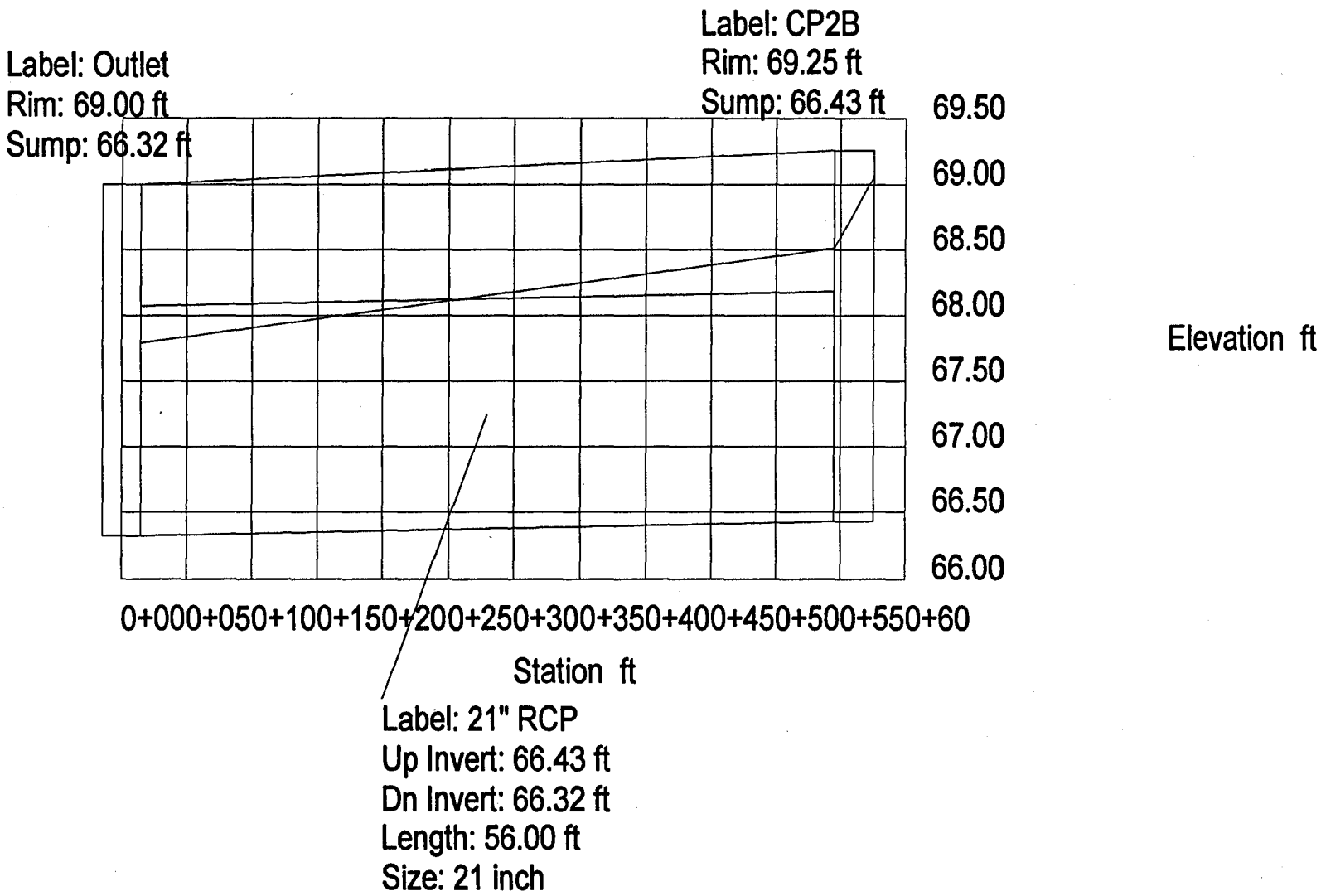
DEA Table

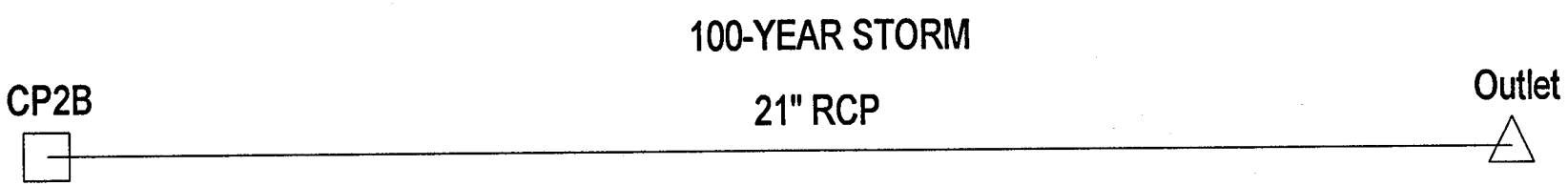
Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
21" RCP	CP1B	Outlet	67.97	67.75	71.05	70.00	72.90	69.45	109.30	21 inch	0.002013	28.00	7.11	11.68	1.33	0.50	.00


10-YEAR STORM
CP2B
21" RCP
Outlet

DEA Table

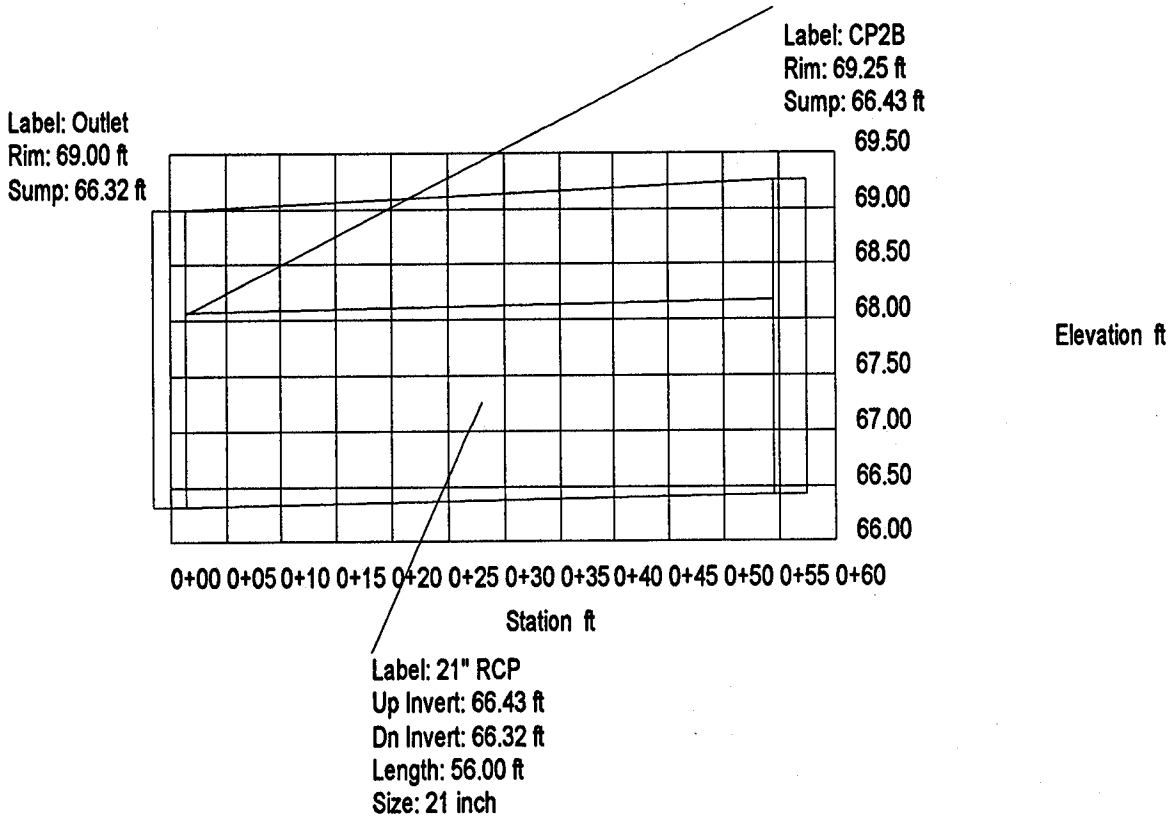
Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
21" RCP	CP2B	Outlet	66.43	66.32	69.25	69.00	68.51	67.80	56.00	21 inch	0.001964	16.00	7.02	7.02	1.07	0.93	.00


Label: Outlet
Rim: 69.00 ft
Sump: 66.32 ft
Label: CP2B
Rim: 69.25 ft
Sump: 66.43 ft
69.50
69.00
68.50
68.00
67.50
67.00
66.50
66.00
Elevation ft
0+000+050+100+150+200+250+300+350+400+450+500+550+60
Station ft
Label: 21" RCP
Up Invert: 66.43 ft
Dn Invert: 66.32 ft
Length: 56.00 ft
Size: 21 inch

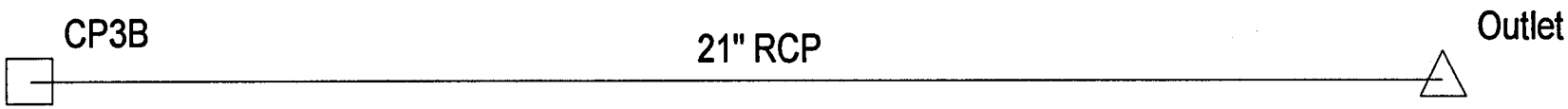

100-YEAR STORM
CP2B
21" RCP
Outlet

DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
21" RCP	CP2B	Outlet	66.43	66.32	69.25	69.00	70.80	68.05	56.00	21 inch	0.001964	35.00	7.02	14.57	1.07	0.93	.00

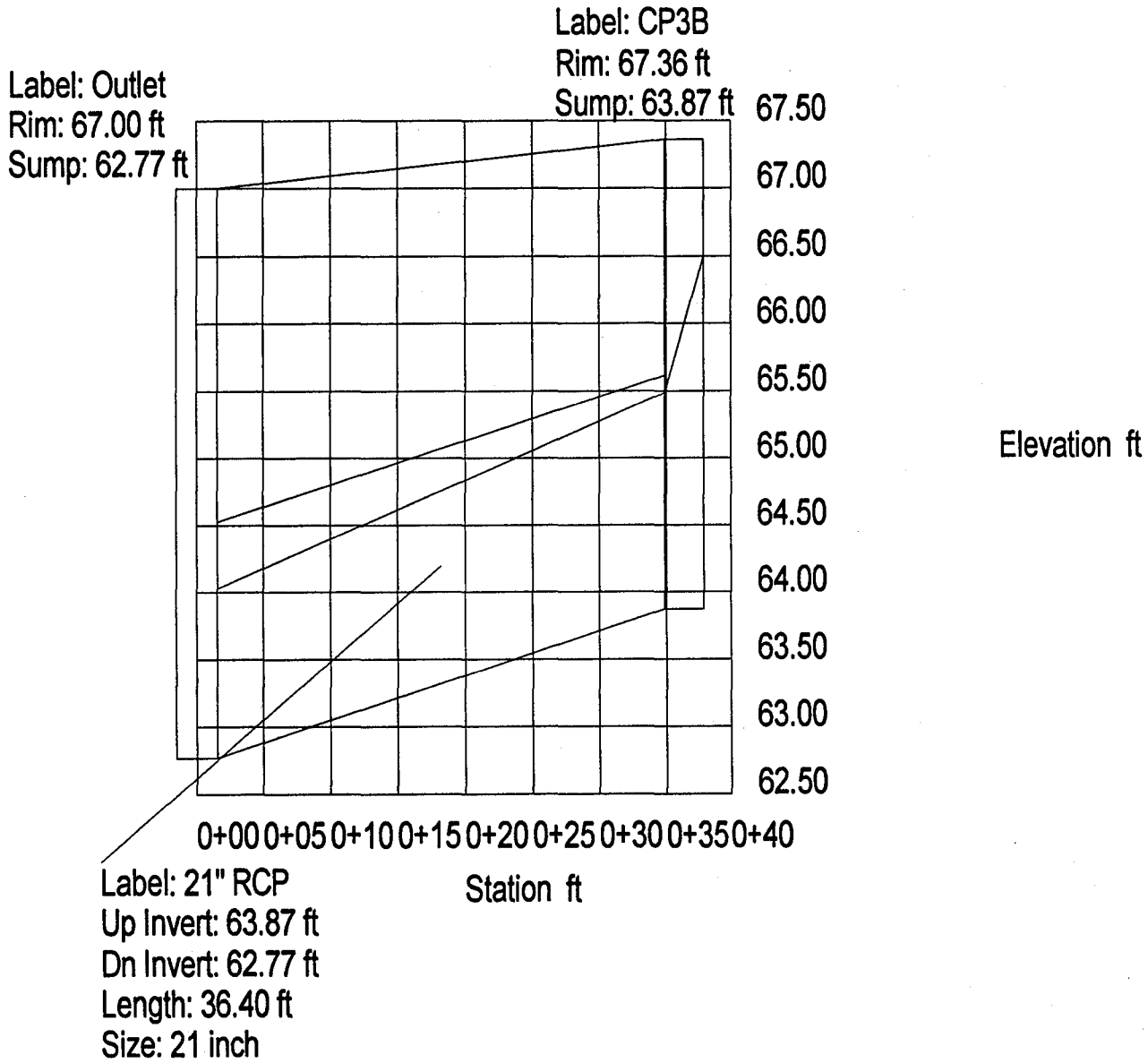

Label: CP2B
Rim: 69.25 ft
Sump: 66.43 ft
Label: Outlet
Rim: 69.00 ft
Sump: 66.32 ft
69.50
69.00
68.50
68.00
67.50
67.00
66.50
66.00
Elevation ft
0+00 0+05 0+10 0+15 0+20 0+25 0+30 0+35 0+40 0+45 0+50 0+55 0+60
Station ft
Label: 21" RCP
Up Invert: 66.43 ft
Dn Invert: 66.32 ft
Length: 56.00 ft
Size: 21 inch

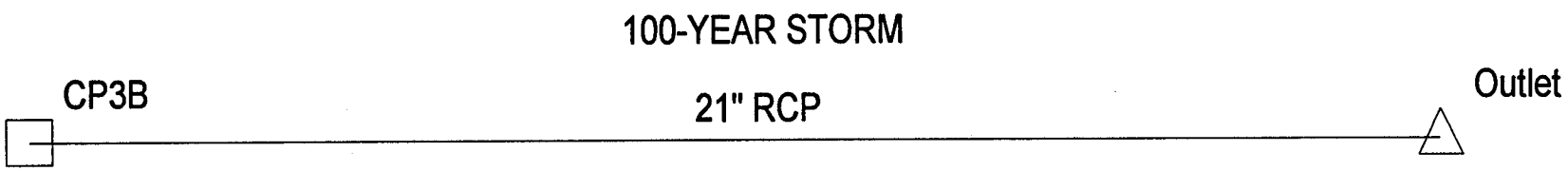
10-YEAR STORM



DEA Table

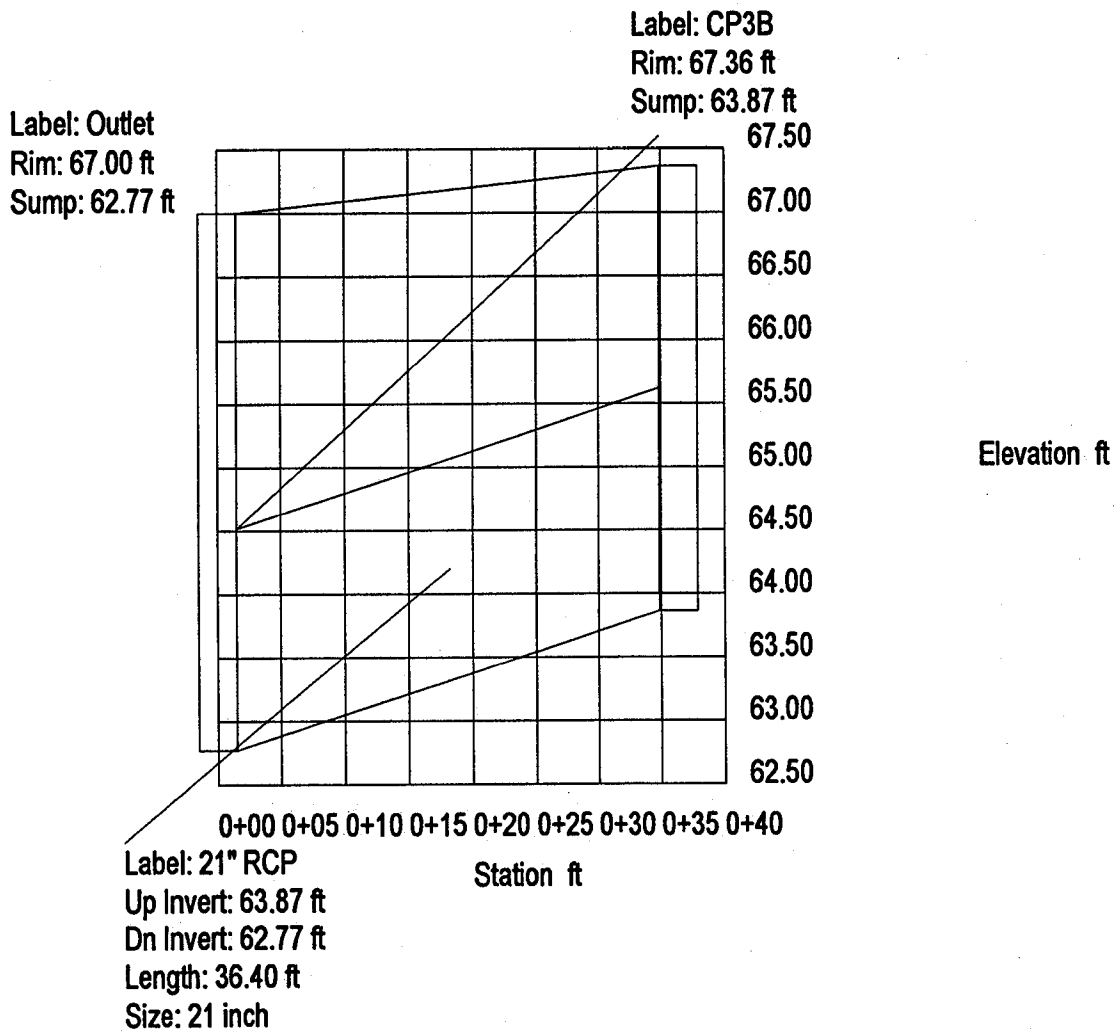
Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
21" RCP	CP3B	Outlet	63.87	62.77	67.36	67.00	65.49	64.03	36.40	21 inch	0.030220	21.00	27.54	10.19	1.74	2.48	.00

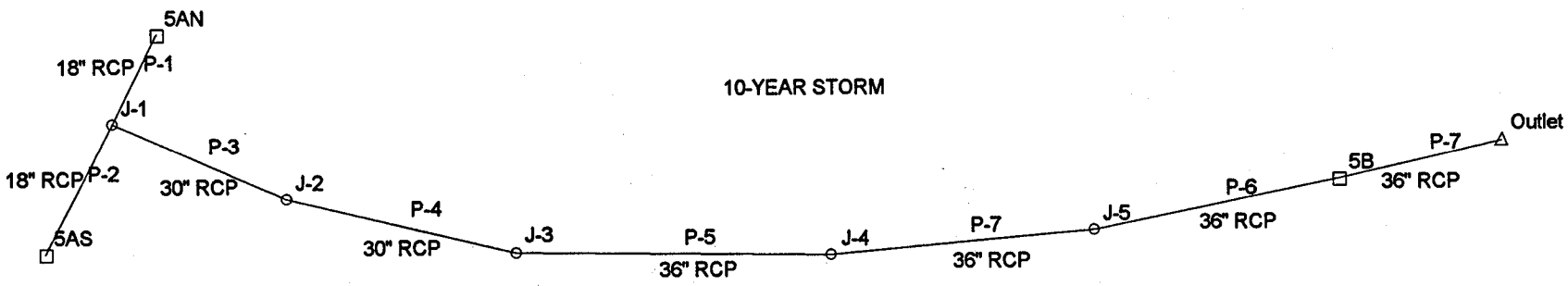

Label: CP3B
Rim: 67.36 ft
Sump: 63.87 ft
Label: Outlet
Rim: 67.00 ft
Sump: 62.77 ft
67.50
67.00
66.50
66.00
65.50
65.00
64.50
64.00
63.50
63.00
62.50
Elevation ft
0+00 0+05 0+10 0+15 0+20 0+25 0+30 0+35 0+40
Station ft
Label: 21" RCP
Up Invert: 63.87 ft
Dn Invert: 62.77 ft
Length: 36.40 ft
Size: 21 inch


100-YEAR STORM
CP3B
21" RCP
Outlet

DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
21" RCP	CP3B	Outlet	63.87	62.77	67.36	67.00	67.59	64.51	36.40	21 inch	0.030220	46.00	27.54	19.13	1.74	2.48	.00


Label: CP3B
Rim: 67.36 ft
Sump: 63.87 ft
Label: Outlet
Rim: 67.00 ft
Sump: 62.77 ft
67.50
67.00
66.50
66.00
65.50
65.00
64.50
64.00
63.50
63.00
62.50
Elevation ft
0+00 0+05 0+10 0+15 0+20 0+25 0+30 0+35 0+40
Station ft
Label: 21" RCP
Up Invert: 63.87 ft
Dn Invert: 62.77 ft
Length: 36.40 ft
Size: 21 inch



Project Title: DREAMING SUMMIT
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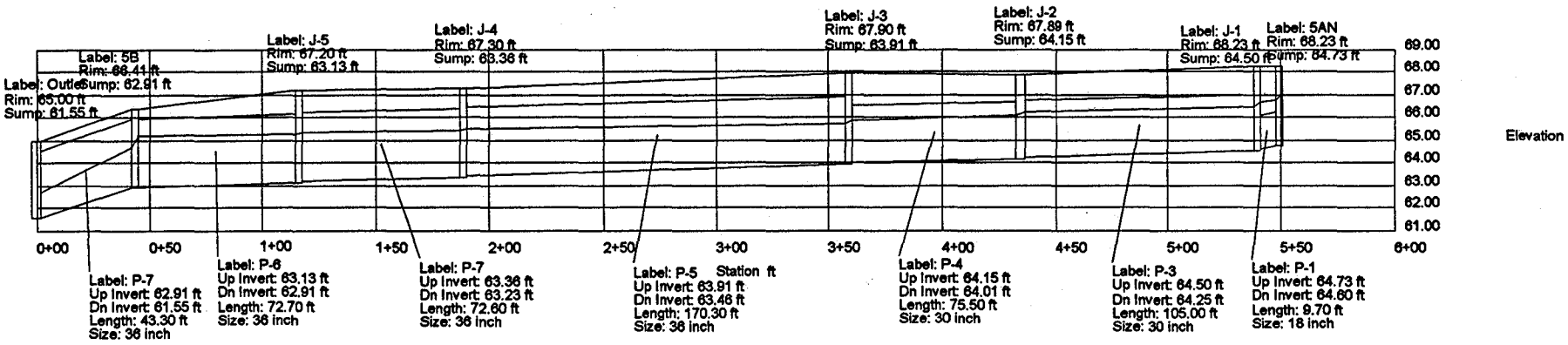
David Evans & Assoc
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Project Engineer: David Evans and Associates
StormCAD v1.5 [158]
Page 1 of 1

DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	5AN	J-1	64.73	64.60	68.23	68.23	66.72	66.64	9.70	18 inch	0.013402	9.30	12.16	5.26	2.00	2.13	.00
P-2	5AS	J-1	64.73	64.60	68.23	68.23	66.78	66.64	17.70	18 inch	0.007345	9.30	9.00	5.26	2.00	2.13	.00
P-3	J-1	J-2	64.50	64.25	68.23	67.89	66.45	66.22	105.00	30 inch	0.002381	18.60	20.01	4.50	1.23	1.14	N/A
P-4	J-2	J-3	64.15	64.01	67.89	67.90	66.06	65.83	75.50	30 inch	0.001854	18.60	17.66	4.74	1.24	1.39	N/A
P-5	J-3	J-4	63.91	63.46	67.90	67.30	65.69	65.53	170.30	36 inch	0.002642	18.60	34.28	3.91	0.99	0.84	N/A
P-7	J-4	J-5	63.36	63.23	67.30	67.20	65.43	65.36	72.60	36 inch	0.001791	18.60	28.22	3.52	0.94	0.97	N/A
P-6	J-5	5B	63.13	62.91	67.20	66.41	65.27	65.23	72.70	36 inch	0.003026	18.60	36.69	3.31	1.07	0.50	N/A
P-7	5B	Outlet	62.91	61.55	66.41	65.00	64.65	62.70	43.30	36 inch	0.031409	29.00	118.20	9.20	0.50	0.45	.00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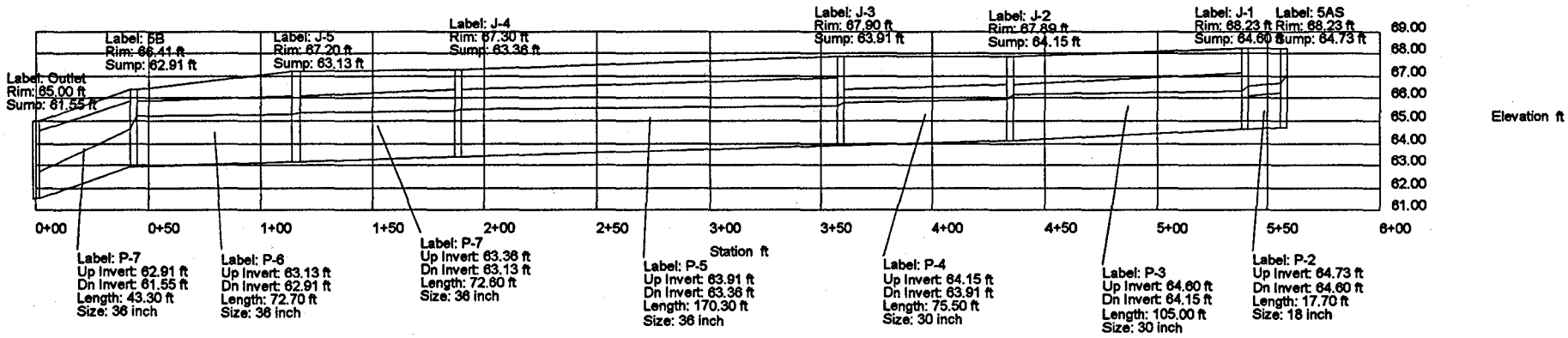
Rim: 65.00 ft
Sump: 61.55 ft
Label: 5B
Rim: 66.41 ft
Sump: 62.91 ft
Label: J-5
Rim: 67.20 ft
Sump: 63.13 ft
Label: J-4
Rim: 67.30 ft
Sump: 63.36 ft
Label: J-3
Rim: 67.90 ft
Sump: 63.91 ft
Label: J-2
Rim: 67.89 ft
Sump: 64.15 ft
Label: J-1
Rim: 68.23 ft
Sump: 64.50 ft
Label: 5AN
Rim: 68.23 ft
Sump: 64.73 ft
69.00
68.00
67.00
66.00
65.00
64.00
63.00
62.00
61.00
Elevation
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
5+50
6+00
Station ft
Label: P-7
Up Invert: 62.91 ft
Dn Invert: 61.55 ft
Length: 43.30 ft
Size: 36 inch
Label: P-6
Up Invert: 63.13 ft
Dn Invert: 62.91 ft
Length: 72.70 ft
Size: 36 inch
Label: P-7
Up Invert: 63.36 ft
Dn Invert: 63.23 ft
Length: 72.60 ft
Size: 36 inch
Label: P-5
Up Invert: 63.91 ft
Dn Invert: 63.46 ft
Length: 170.30 ft
Size: 36 inch
Label: P-4
Up Invert: 64.15 ft
Dn Invert: 64.01 ft
Length: 75.50 ft
Size: 30 inch
Label: P-3
Up Invert: 64.50 ft
Dn Invert: 64.25 ft
Length: 105.00 ft
Size: 30 inch
Label: P-1
Up Invert: 64.73 ft
Dn Invert: 64.60 ft
Length: 9.70 ft
Size: 18 inch


Label: Outlet
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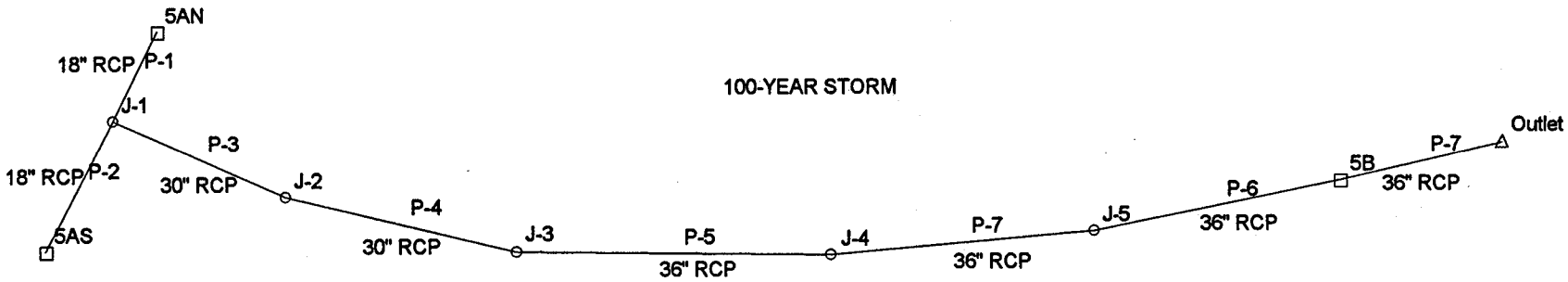
Sump: 61.55 ft
Label: 5B
Rim: 66.41 ft
Sump: 62.91 ft
Label: J-5
Rim: 67.20 ft
Sump: 63.13 ft
Label: J-4
Rim: 67.30 ft
Sump: 63.36 ft
Label: J-3
Rim: 67.90 ft
Sump: 63.91 ft
Label: J-2
Rim: 67.89 ft
Sump: 64.15 ft
Label: J-1
Rim: 68.23 ft
Sump: 64.60 ft
Label: 5AS
Rim: 68.23 ft
Sump: 64.73 ft
69.00
68.00
67.00
66.00
65.00
64.00
63.00
62.00
61.00
Elevation ft
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
5+50
6+00
Station ft
Label: P-7
Up Invert: 62.91 ft
Dn Invert: 61.55 ft
Length: 43.30 ft
Size: 36 inch
Label: P-6
Up Invert: 63.13 ft
Dn Invert: 62.91 ft
Length: 72.70 ft
Size: 36 inch
Label: P-7
Up Invert: 63.36 ft
Dn Invert: 63.13 ft
Length: 72.60 ft
Size: 36 inch
Label: P-5
Up Invert: 63.91 ft
Dn Invert: 63.36 ft
Length: 170.30 ft
Size: 36 inch
Label: P-4
Up Invert: 64.15 ft
Dn Invert: 63.91 ft
Length: 75.50 ft
Size: 30 inch
Label: P-3
Up Invert: 64.60 ft
Dn Invert: 64.15 ft
Length: 105.00 ft
Size: 30 inch
Label: P-2
Up Invert: 64.73 ft
Dn Invert: 64.60 ft
Length: 17.70 ft
Size: 18 inch



Project Title: DREAMING SUMMIT
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David Evans & Assoc
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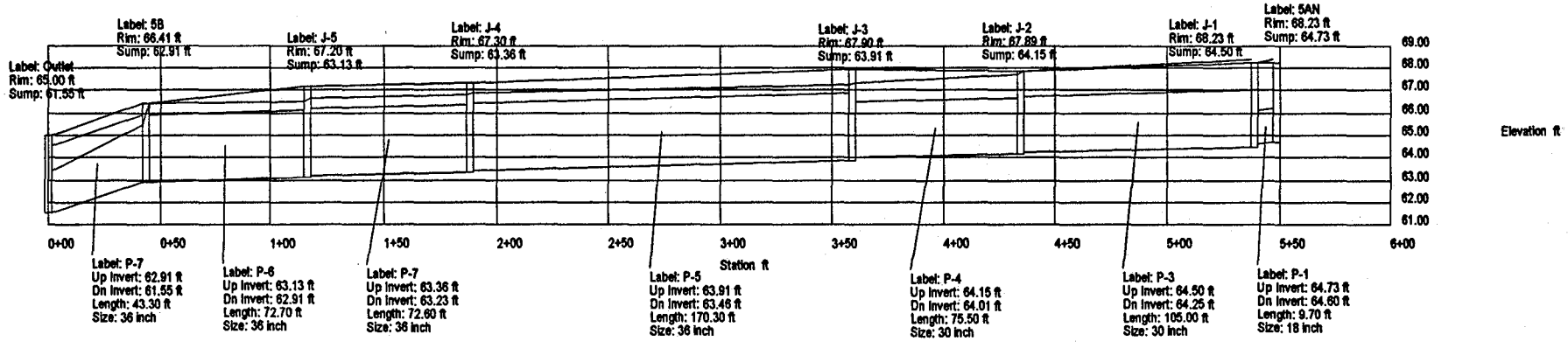
Project Engineer: David Evans and Associates
StormCAD v1.5 [158]
Page 1 of 1

DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	5AN	J-1	64.73	64.60	68.23	68.23	68.40	68.23	9.70	18 inch	0.013402	14.10	12.16	7.98	2.00	2.13	.00
P-2	5AS	J-1	64.73	64.60	68.23	68.23	68.55	68.23	17.70	18 inch	0.007345	14.10	9.00	7.98	2.00	2.13	.00
P-3	J-1	J-2	64.50	64.25	68.23	67.89	68.39	67.89	105.00	30 inch	0.002381	28.20	20.01	5.74	1.23	1.14	N/A
P-4	J-2	J-3	64.15	64.01	67.89	67.90	67.70	67.35	75.50	30 inch	0.001854	28.20	17.66	5.74	1.24	1.39	N/A
P-5	J-3	J-4	63.91	63.46	67.90	67.30	67.22	66.92	170.30	36 inch	0.002642	28.20	34.28	3.99	0.99	0.84	N/A
P-7	J-4	J-5	63.36	63.23	67.30	67.20	66.79	66.66	72.60	36 inch	0.001791	28.20	28.22	3.99	0.94	0.97	N/A
P-6	J-5	5B	63.13	62.91	67.20	66.41	66.54	66.41	72.70	36 inch	0.003026	28.20	36.69	3.99	1.07	0.50	N/A
P-7	5B	Outlet	62.91	61.55	66.41	65.00	65.46	63.40	43.30	36 inch	0.031409	63.00	118.20	11.80	0.50	0.45	.00


Label: Outlet
Rim: 65.00 ft
Sump: 61.55 ft
Label: 5B
Rim: 66.41 ft
Sump: 62.91 ft
Label: J-5
Rim: 67.20 ft
Sump: 63.13 ft
Label: J-4
Rim: 67.30 ft
Sump: 63.36 ft
Label: J-3
Rim: 67.90 ft
Sump: 63.91 ft
Label: J-2
Rim: 67.89 ft
Sump: 64.15 ft
Label: J-1
Rim: 68.23 ft
Sump: 64.50 ft
Label: 5AN
Rim: 68.23 ft
Sump: 64.73 ft
69.00
68.00
67.00
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Elevation ft
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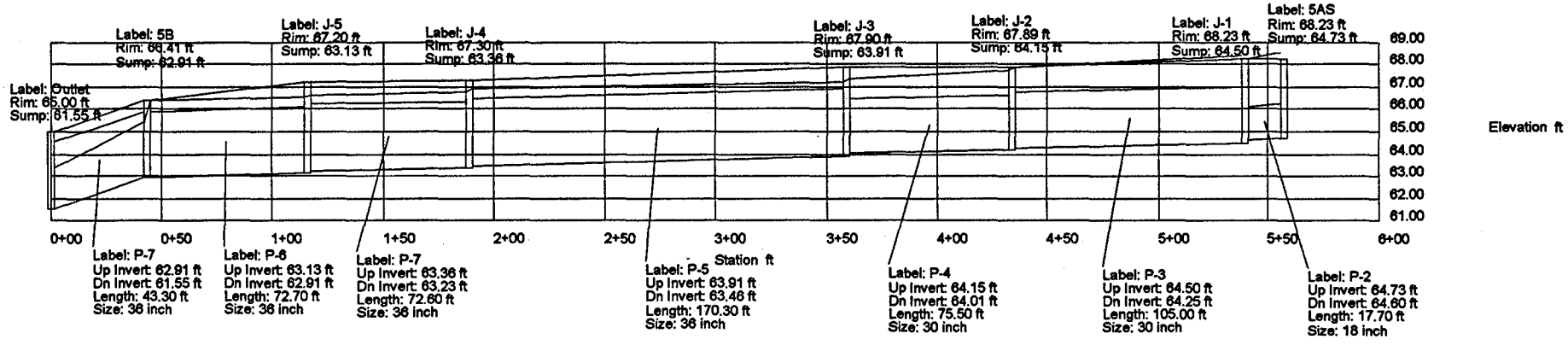
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
5+50
6+00
Station ft
Label: P-7
Up Invert: 62.91 ft
Dn Invert: 61.55 ft
Length: 43.30 ft
Size: 36 inch
Label: P-6
Up Invert: 63.13 ft
Dn Invert: 62.91 ft
Length: 72.70 ft
Size: 36 inch
Label: P-7
Up Invert: 63.36 ft
Dn Invert: 63.23 ft
Length: 72.60 ft
Size: 36 inch
Label: P-5
Up Invert: 63.91 ft
Dn Invert: 63.46 ft
Length: 170.30 ft
Size: 36 inch
Label: P-4
Up Invert: 64.15 ft
Dn Invert: 64.01 ft
Length: 75.50 ft
Size: 30 inch
Label: P-3
Up Invert: 64.50 ft
Dn Invert: 64.25 ft
Length: 105.00 ft
Size: 30 inch
Label: P-1
Up Invert: 64.73 ft
Dn Invert: 64.60 ft
Length: 9.70 ft
Size: 18 inch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Sump: 61.55 ft
Label: 5B
Rim: 66.41 ft
Sump: 62.91 ft
Label: J-5
Rim: 67.20 ft
Sump: 63.13 ft
Label: J-4
Rim: 67.30 ft
Sump: 63.36 ft
Label: J-3
Rim: 67.90 ft
Sump: 63.91 ft
Label: J-2
Rim: 67.89 ft
Sump: 64.15 ft
Label: J-1
Rim: 68.23 ft
Sump: 64.50 ft
Label: 5AS
Rim: 68.23 ft
Sump: 64.73 ft
69.00
68.00
67.00
66.00
65.00
64.00
63.00
62.00
61.00
Elevation ft
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0+50
1+00
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3+00
3+50
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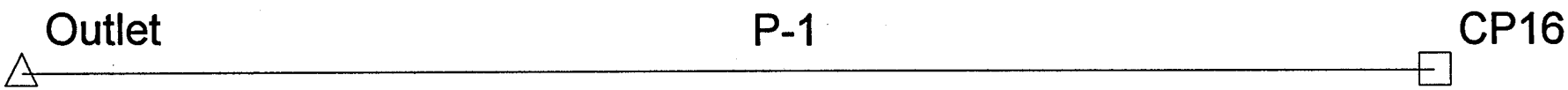
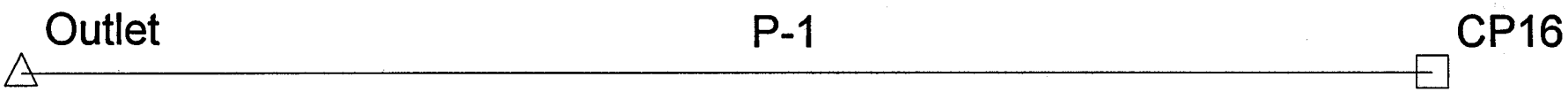
4+50
5+00
5+50
6+00
Station ft
Label: P-7
Up Invert: 62.91 ft
Dn Invert: 61.55 ft
Length: 43.30 ft
Size: 36 inch
Label: P-6
Up Invert: 63.13 ft
Dn Invert: 62.91 ft
Length: 72.70 ft
Size: 36 inch
Label: P-7
Up Invert: 63.36 ft
Dn Invert: 63.23 ft
Length: 72.60 ft
Size: 36 inch
Label: P-5
Up Invert: 63.91 ft
Dn Invert: 63.46 ft
Length: 170.30 ft
Size: 36 inch
Label: P-4
Up Invert: 64.15 ft
Dn Invert: 64.01 ft
Length: 75.50 ft
Size: 30 inch
Label: P-3
Up Invert: 64.50 ft
Dn Invert: 64.25 ft
Length: 105.00 ft
Size: 30 inch
Label: P-2
Up Invert: 64.73 ft
Dn Invert: 64.60 ft
Length: 17.70 ft
Size: 18 inch

10-YEAR STORM

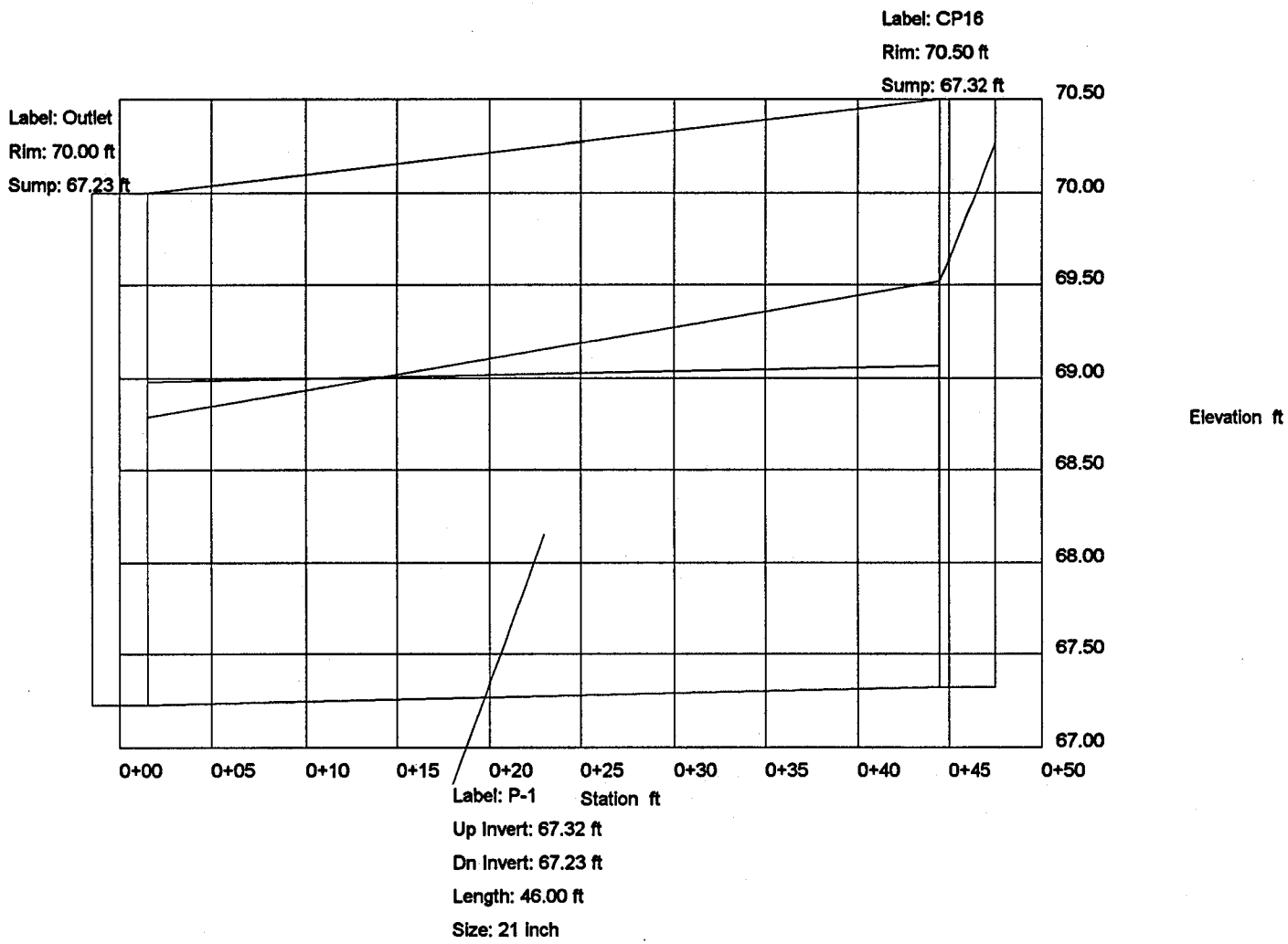


10-YEAR STORM

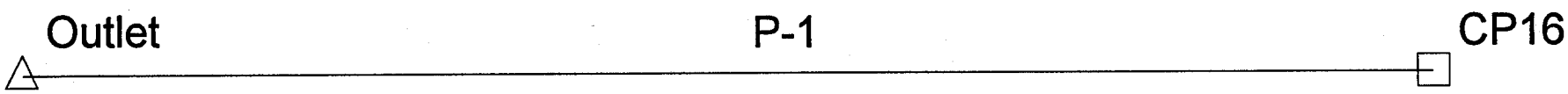


DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	CP16	Outlet	67.32	67.23	70.50	70.00	69.53	68.79	46.00	21 inch	0.001957	18.50	7.01	7.93	1.43	1.02	.00

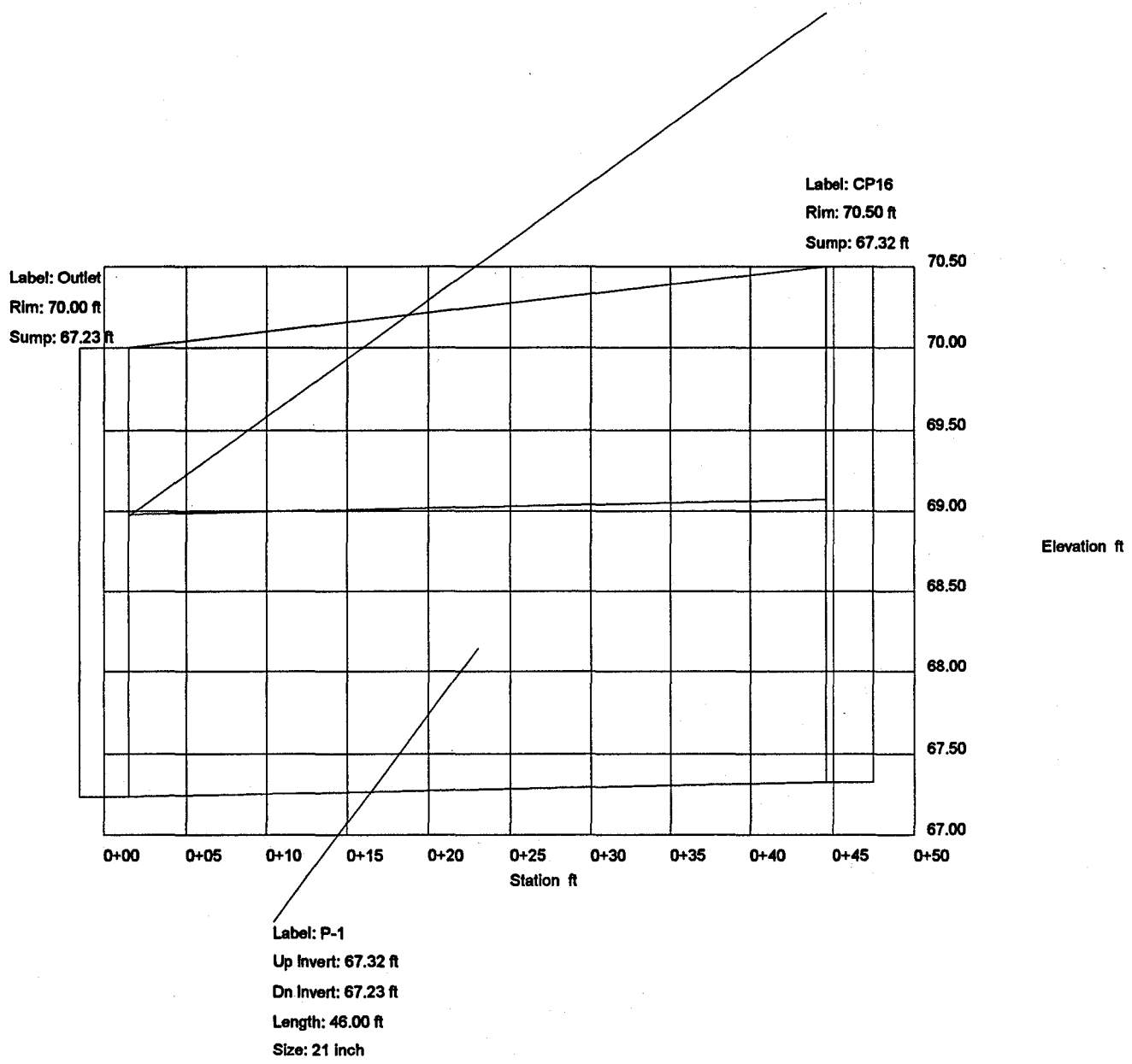

Label: CP16
Rim: 70.50 ft
Sump: 67.32 ft
Label: Outlet
Rim: 70.00 ft
Sump: 67.23 ft
70.50
70.00
69.50
69.00
68.50
68.00
67.50
67.00
Elevation ft
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
Station ft
Label: P-1
Up Invert: 67.32 ft
Dn Invert: 67.23 ft
Length: 46.00 ft
Size: 21 inch

100-YEAR STORM

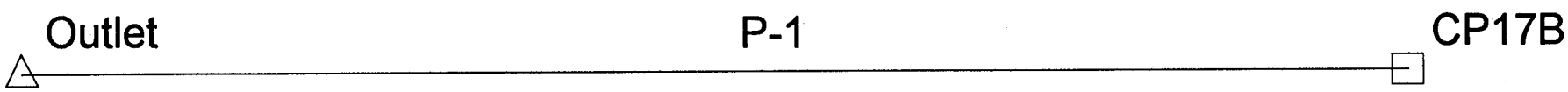


DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	CP16	Outlet	67.32	67.23	70.50	70.00	72.06	68.97	46.00	21 inch	0.001957	41.00	7.01	17.05	1.43	1.02	.00

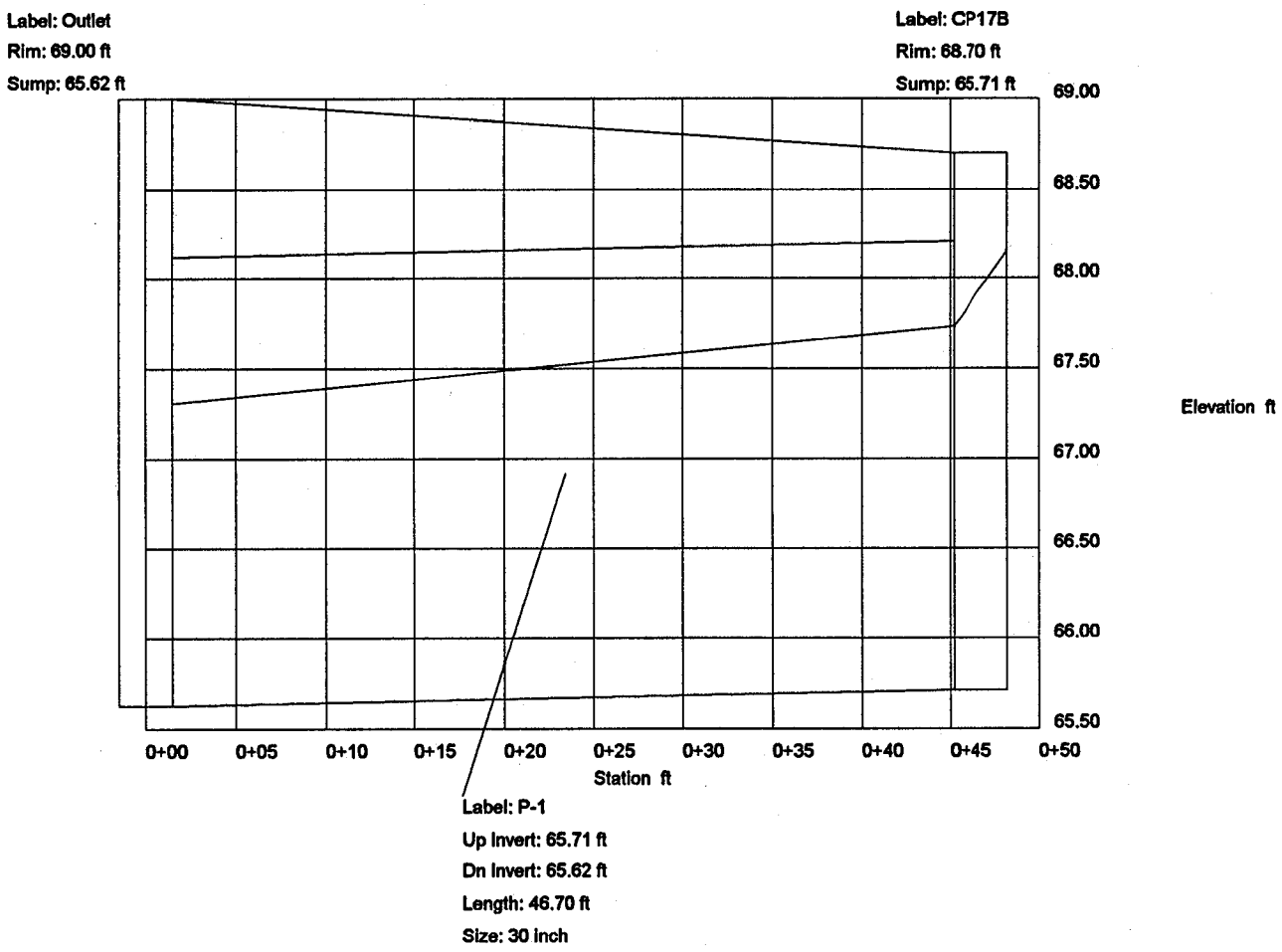

Label: CP16
Rim: 70.50 ft
Sump: 67.32 ft
Label: Outlet
Rim: 70.00 ft
Sump: 67.23 ft
70.50
70.00
69.50
69.00
68.50
68.00
67.50
67.00
Elevation ft
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
Station ft
Label: P-1
Up Invert: 67.32 ft
Dn Invert: 67.23 ft
Length: 46.00 ft
Size: 21 inch

10-YEAR STORM

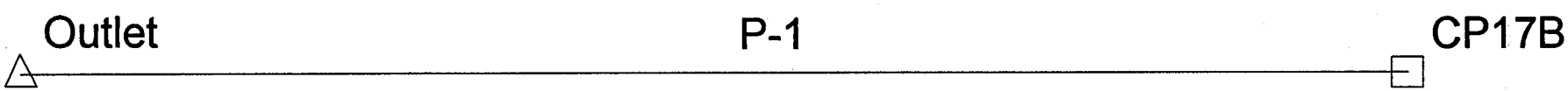


DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	CP17B	Outlet	65.71	65.62	68.70	69.00	67.74	67.31	46.70	30 inch	0.001927	24.50	18.01	6.34	0.49	0.88	.00

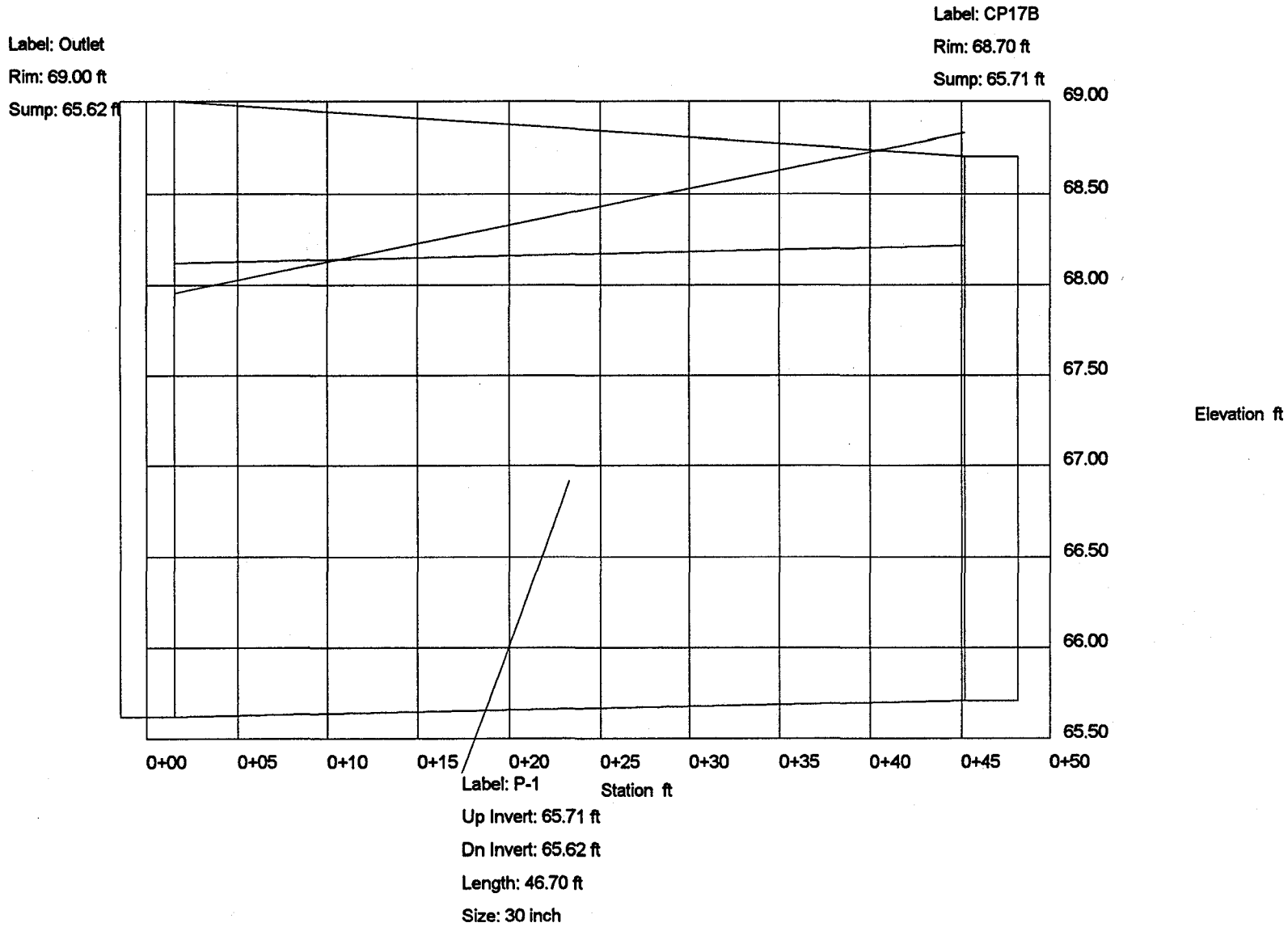

Label: Outlet
Rim: 69.00 ft
Sump: 65.62 ft
Label: CP17B
Rim: 68.70 ft
Sump: 65.71 ft
69.00
68.50
68.00
67.50
67.00
66.50
66.00
65.50
Elevation ft
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
Station ft
Label: P-1
Up Invert: 65.71 ft
Dn Invert: 65.62 ft
Length: 46.70 ft
Size: 30 inch

100-YEAR STORM

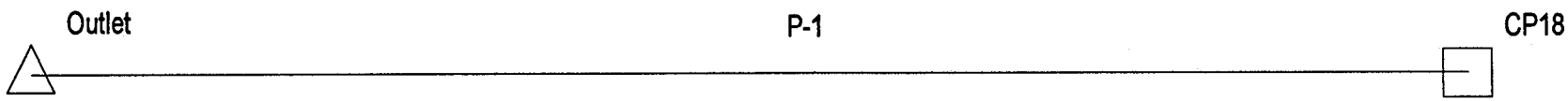


DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	CP17B	Outlet	65.71	65.62	68.70	69.00	68.84	67.95	46.70	30 inch	0.001927	53.00	18.01	10.95	0.49	0.88	.00

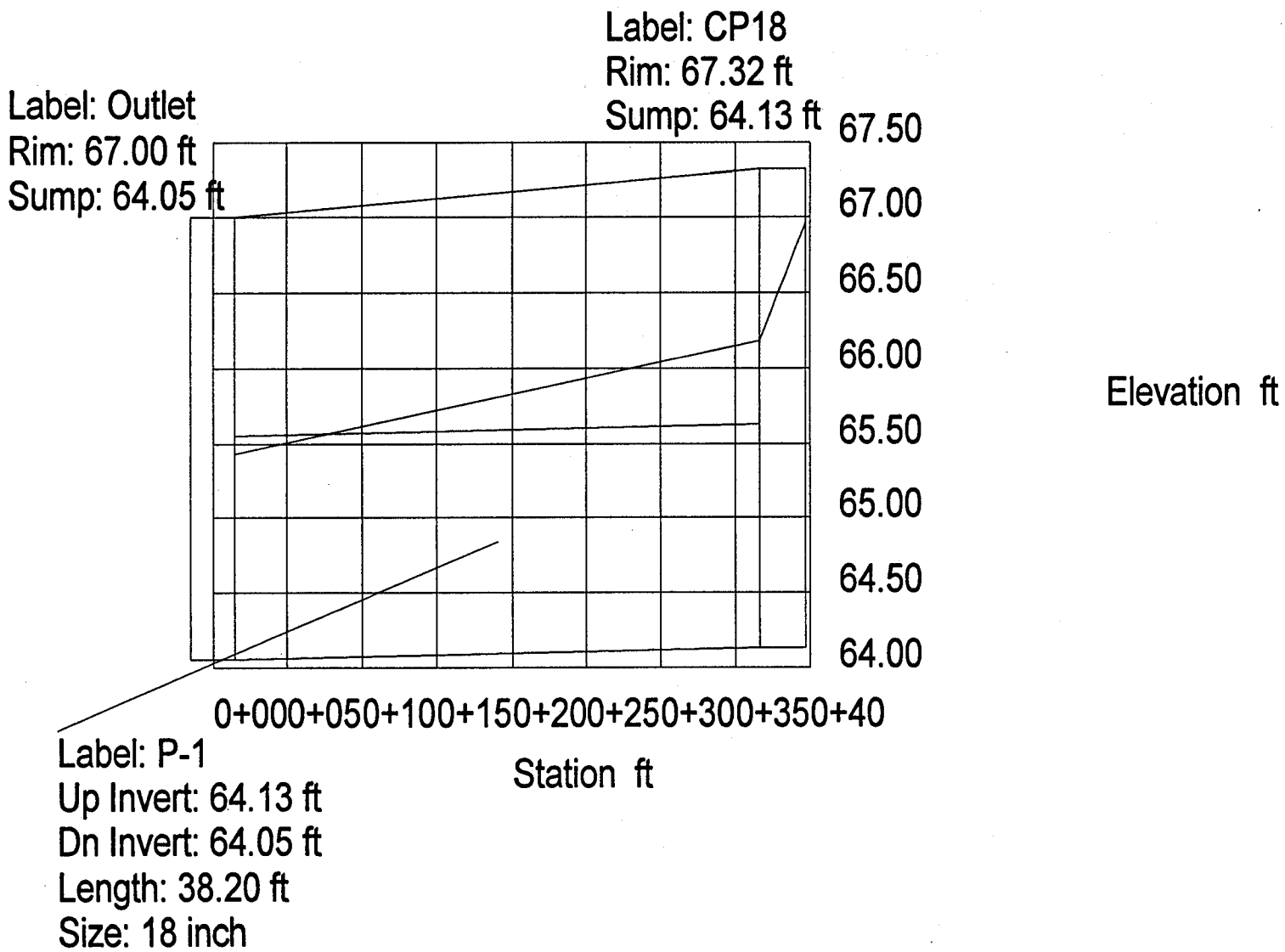

Label: Outlet
Rim: 69.00 ft
Sump: 65.62 ft
Label: CP17B
Rim: 68.70 ft
Sump: 65.71 ft
69.00
68.50
68.00
67.50
67.00
66.50
66.00
65.50
Elevation ft
0+00
0+05
0+10
0+15
0+20
0+25
0+30
0+35
0+40
0+45
0+50
Station ft
Label: P-1
Up Invert: 65.71 ft
Dn Invert: 65.62 ft
Length: 46.70 ft
Size: 30 inch

10-YEAR STORM

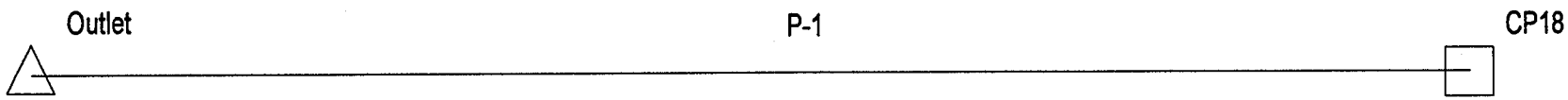


DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	CP18	Outlet	64.13	64.05	67.32	67.00	66.18	65.43	38.20	18 inch	0.002094	14.00	4.81	8.07	1.69	1.45	.00

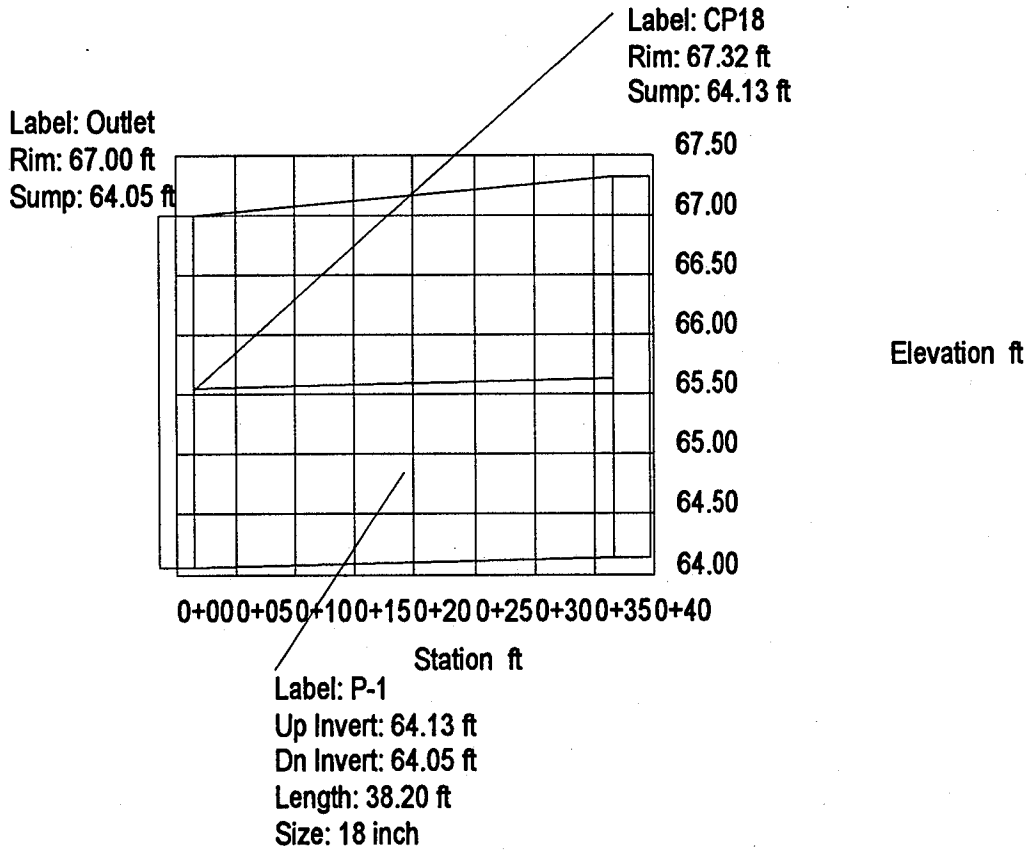

Label: CP18
Rim: 67.32 ft
Sump: 64.13 ft
Label: Outlet
Rim: 67.00 ft
Sump: 64.05 ft
67.50
67.00
66.50
66.00
65.50
65.00
64.50
64.00
Elevation ft
0+000+050+100+150+200+250+300+350+40
Station ft
Label: P-1
Up Invert: 64.13 ft
Dn Invert: 64.05 ft
Length: 38.20 ft
Size: 18 inch

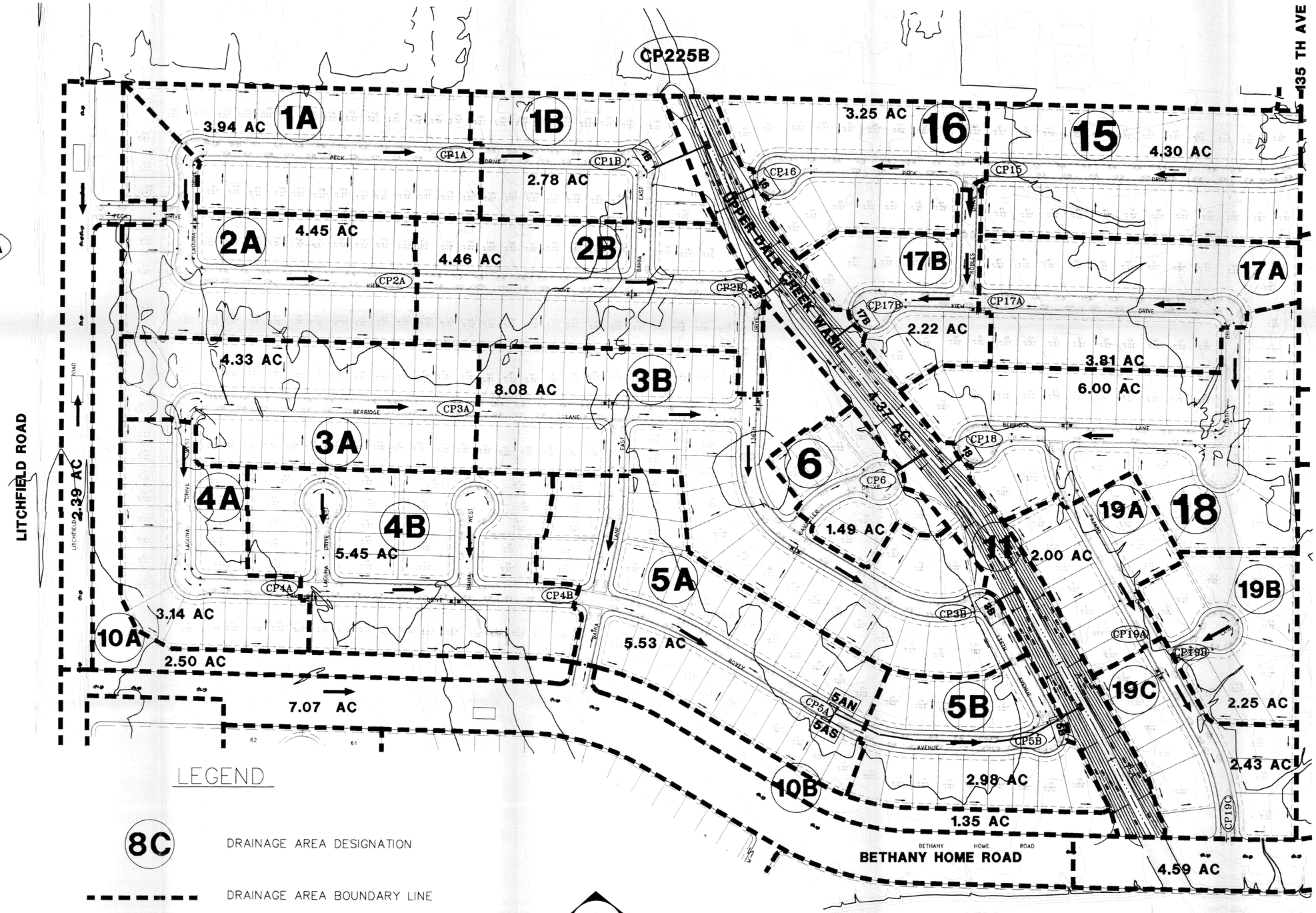
100-YEAR STORM



DEA Table

Pipe	Up Node	Dn Node	Up Invert (ft)	Dn Invert (ft)	Up Gr Elev (ft)	Dn Gr Elev (ft)	Up HGL (ft)	Dn HGL (ft)	Length (ft)	Size	Slope (ft/ft)	Q (cfs)	Cap (cfs)	V avg (ft/s)	Up Cover (ft)	Dn Cover (ft)	C
P-1	CP18	Outlet	64.13	64.05	67.32	67.00	68.66	65.54	38.20	18 inch	0.002094	30.00	4.81	16.98	1.69	1.45	.00


Label: CP18
Rim: 67.32 ft
Sump: 64.13 ft
Label: Outlet
Rim: 67.00 ft
Sump: 64.05 ft
67.50
67.00
66.50
66.00
65.50
65.00
64.50
64.00
Elevation ft
0+00 0+05 0+10 0+15 0+20 0+25 0+30 0+35 0+40
Station ft
Label: P-1
Up Invert: 64.13 ft
Dn Invert: 64.05 ft
Length: 38.20 ft
Size: 18 inch



REVISION	BY

DESIGN BY: TJCL
CHECKED BY:
DATE: 8/99

DAVID EVANS AND ASSOCIATES, INC.
7878 N. 16TH STREET, STE. #250
PHOENIX, AZ 85020-4458 (602) 678-5151

DREAMING SUMMIT UNIT 2A DRAINAGE REPORT

EXHIBIT A UNIT 2ADRAINAGE AREA

SCALE: 1"=100'
SECTION: 10
TWNSHP: 2N
RANGE: 1W
SHEET 1 OF 1
JOB NO.: STAR0071

CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 BLUE STAKE CENTER

STAR0071 tjcl 08/30/99 11:14:32 tjc S:\DRN\STAR0071\CAD\UNIT2A\STF001A.DWG