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69th AVENUE IMPROVEMENTS STORM DRAIN REPORT

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Olive Avenue to Sunnyslope Lane

CITY OF PEORIA 1954

Project No. P-9626

By:

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

November 1997

Registered Professional Engineer (Civil)
CERTIFICATE NO.
24019
STEVEN E.
REX
Date Signed 12/5/97
ARIZONA, U.S.A.

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I. INTRODUCTION

This report has been prepared for the City of Peoria by Dibble and Associates Consulting Engineers to provide storm drain design for the 69th Avenue Improvements project. The report provides analysis of the street drainage as well as offsite runoff which enters the 69th Avenue alignment from adjacent areas. (See Exhibit A - 69th Avenue Vicinity Map.)

This project will provide the design and construction of the west half street improvements of 69th Avenue and the reconstruction, as necessary, of the existing east half street, between Olive Avenue and Sunnyslope Lane. The street improvements will include: concrete curb and gutter, concrete valley gutter, sidewalk, full pavement sections, storm drain, utility relocations and improvements, street lighting, and pavement marking and signing. Engineering design services include the field survey, preparation of construction plans, specifications, right-of-way exhibits, legal descriptions, engineer's estimates, design report, and a storm drain report.

The drainage study area consists of primarily residential development with some commercial development. In general, the land slopes downward from the northeast to the southwest at approximately 0.3 percent. During storm events, 69th Avenue receives runoff from adjacent areas. This runoff causes flooding to occur in both 69th Avenue and some of the adjacent properties. This project addresses these problems. (See Appendix A- Drainage Area Map)

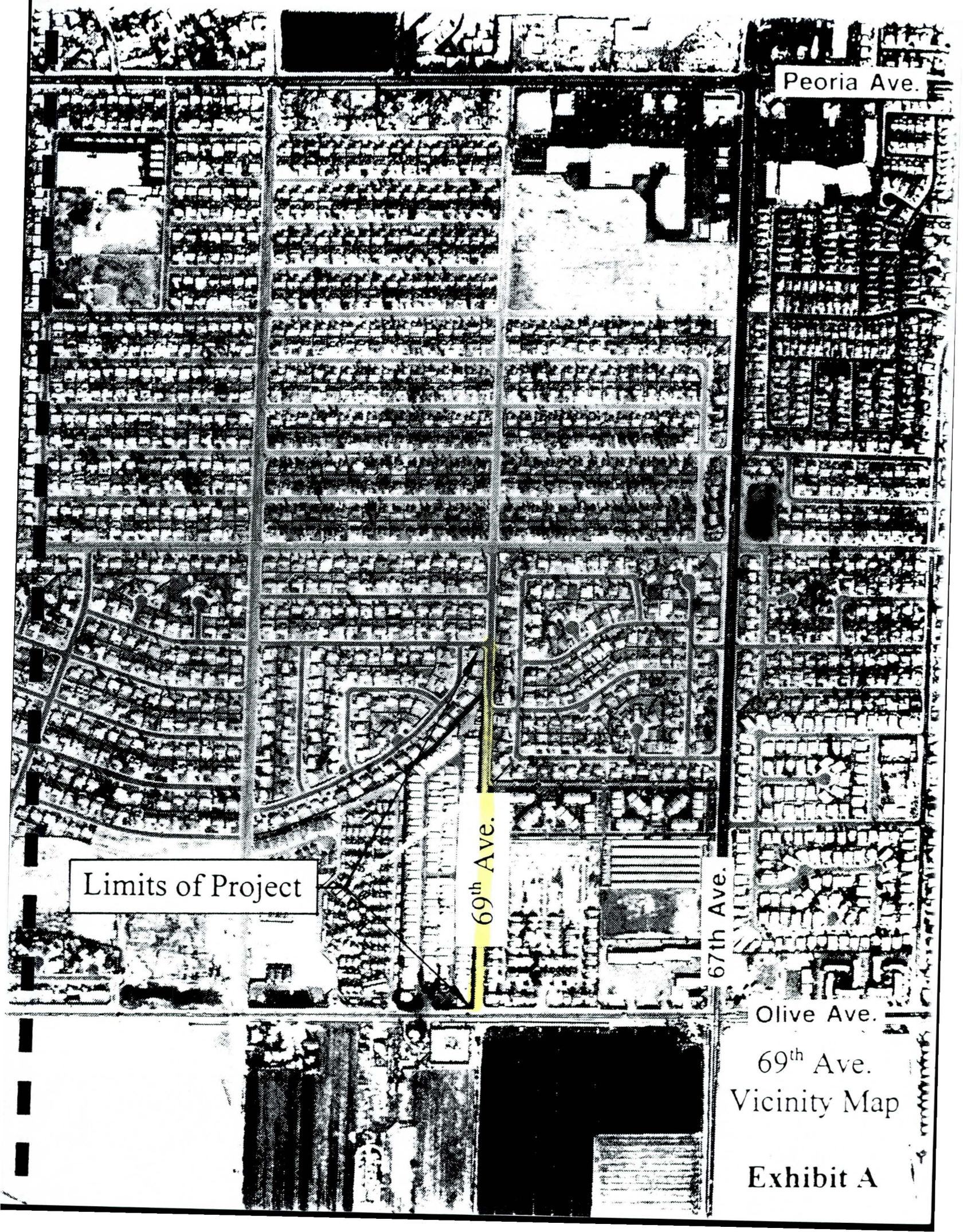
The information contained in this report is based on research of current utility quarter section maps, as-built drawings, site visits, photographs, telephone conversations and field surveys.

II. STUDY APPROACH

Historically, there has been a drainage problem along 69th Avenue. On February 27, 1997, Dibble and Associates visited the project site during a storm event. Dibble and Associates collected runoff flow direction information for the area bounded by Mountain View Road on the north, 67th Avenue on the east, 69th Avenue on the west, and Olive Avenue on the south.

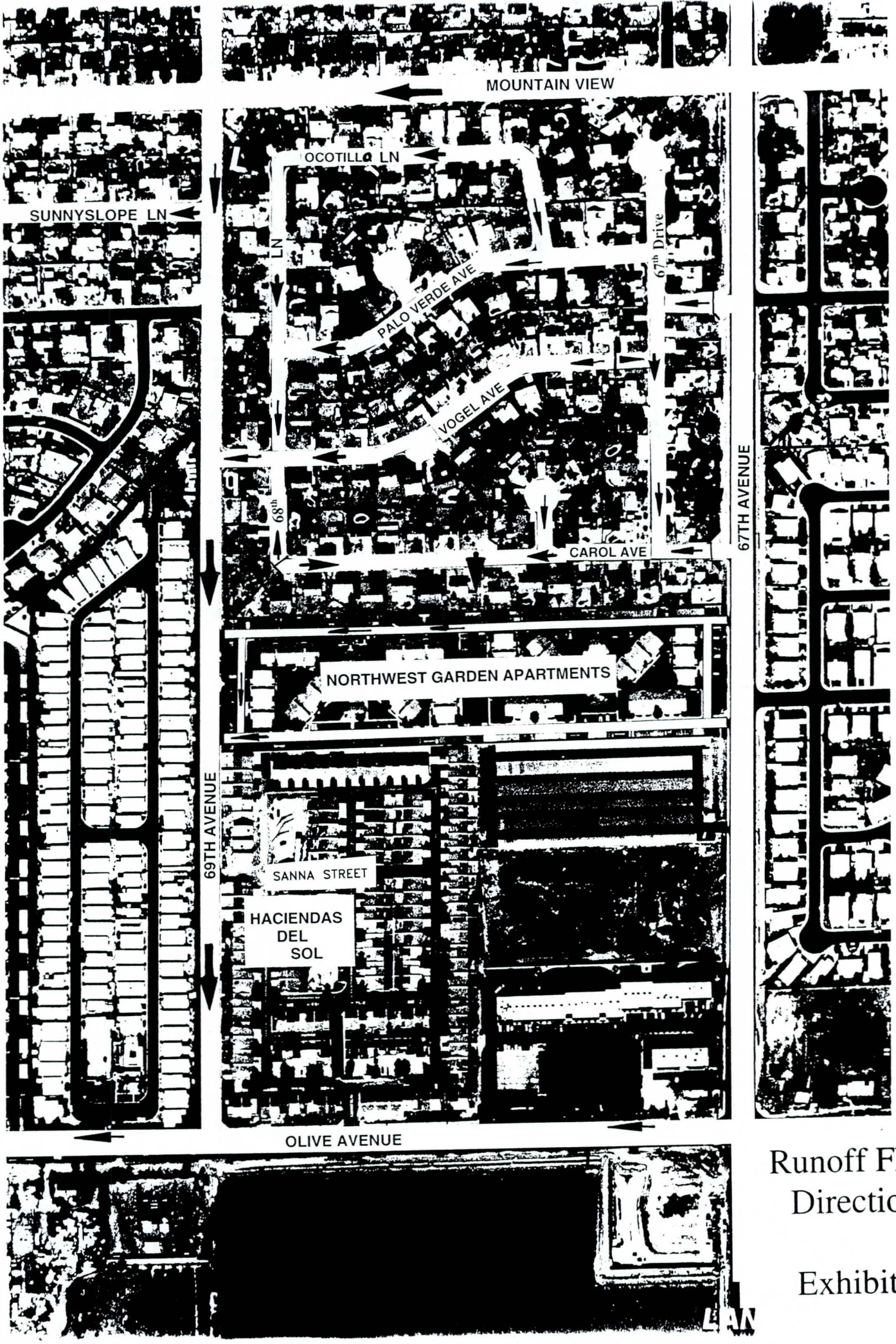
As shown in Exhibit B, much of the area east of 69th Avenue and south of Mountain View Road contributes runoff to the 69th Avenue alignment. Maricopa County hydrology methods yield a contributing area of 10.8 acres with approximately 16 cubic feet per second (cfs) of runoff during the 2 year storm event. Some runoff flows along Vogel Avenue to 69th Avenue which floods 69th Avenue. Other runoff flows south from Carol Avenue through the Northwest Gardens Apartments complex and enters onto 69th Avenue at the south driveway entrance. This runoff contributes to 69th Avenue flooding.

Until the Hacienda Del Sol development installed a berm at the Sanna Street entrance, 69th Avenue flooding caused water to enter the development. These offsite flows into the Hacienda Del Sol site caused flooding of the existing retention basins. No attempt has been made by Dibble and Associates to determine if the Hacienda Del Sol retention basin system is large enough to retain all of its on site water. However, it is clear that it will not retain the runoff from the 69th Avenue alignment.



69th Ave.
Vicinity Map

Exhibit A



Runoff Flow Directions

Exhibit B

The purpose of this storm drain work is four fold:

1. Provide 69th Avenue inlets to collect runoff from a 2 year storm event.
2. Provide one 10 foot wide travel lane in each direction during the 2 year storm event.
3. Provide inlets to collect runoff from Vogel Avenue and the Northwest Gardens Apartments.
4. Provide a hydraulic grade line (HGL) near the top of pipe during the 2 year design storm.

III. DESIGN CRITERIA

To quantify the flow rates in 69th Avenue, the Drainage Design Manual for Maricopa County was used. The manual suggests using the rational method for areas less than 160 acres. The rational method relates rainfall intensity, runoff coefficients, and watershed size to a peak discharge rate. The following shows the relationship:

$$Q = CiA$$

where

Q	=	the peak discharge (cfs) from a given area.
C	=	a coefficient relating the runoff to rainfall.
i	=	average rainfall intensity (inches/hour), lasting for time Tc.
Tc	=	the time of concentration (hours).
A	=	drainage area (acres).

The rational equation is based on the concept that a steady and uniform rainfall intensity will produce a peak discharge when the entire watershed is contributing to the outflow point. This condition is reached when the time of concentration (Tc) is reached.

A minimum time of concentration of ten (10) minutes was used for inlets collecting on site water. However, the time of concentration from offsite flows were calculated using the Drainage Design Manual for Maricopa County. This county manual suggests that the time of concentration be computed as follows:

$$Tc = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$$

where

Tc	=	time of concentration (hours).
L	=	length of the longest flow path (miles).
K_b	=	watershed resistance coefficient.
S	=	watercourse slope (feet / mile).
i	=	rainfall intensity (inches / hour).

Appendix B contains calculations for Tc.

Storm drain hydraulic grade line calculations were made using the Manning's equation to estimate friction losses.

$$Q = (1.49/n)\,(A)\,R^{0.67}\,S^{0.5}$$

where

Q	=	Flow rate (cubic feet per second)
n	=	Manning's roughness coefficient
A	=	Cross sectional flow area of pipe (square feet)
R	=	Hydraulic radius (feet)
S	=	Friction slope (feet per foot)

Junction losses (h_j) and bend losses (h_b) are estimated using the Los Angeles County Flood Control District Design Manual and a storm drain design computer program called "Storm Plus". Storm Plus uses Los Angeles County Flood Control District methods for computing uniform and nonuniform steady flow water surface profiles and pressure gradients in open channels or closed conduits with irregular or regular sections. The flow in a system may alternate between super critical, subcritical, or pressure flow in any sequence. (Storm Plus input and output files are located in Appendices G and H.)

IV. RESULTS AND RECOMMENDATIONS

From the storm drain analysis, the following design resulted:

1. Install 1000-feet of 30-inch storm drain from the Olive Avenue 102-inch outfall to 69th Avenue station 11+00.
2. Install 757-feet of 24-inch storm drain from 69th Avenue station 11+00 to station 18+57.
3. Install 69th Avenue inlets to collect the 2 year storm runoff while maintaining one 10 foot lane of traffic in each direction.
4. Install inlets to collect runoff from Vogel Avenue and the Northwest Garden Apartments south driveway.
5. Install a sump inlet north of Sanna Street to collect 69th Avenue storm runoff before it enters the Hacienda del Sol entrance at Sanna Street.

The inlets were sized for the calculated two (2) year flow using an inlet sizing spreadsheet. One "dry" travel lane is maintained in each direction, in spite of the 20% clogging factor used in the curb opening calculations. Appendix C gives runoff calculation summaries for different subareas. Appendix D shows inlet design calculation summaries for the project inlets, and Appendix E shows detailed inlet summary sheets for the project inlets.

Runoff from Vogel Avenue is collected in catch basin numbers 2 and 3. These large catch basins keep runoff from flooding 69th Avenue. Catch basin number 10 is located at station 8+70. This inlet is in a sump location which forces water into the storm drain system rather than into the Hacienda del Sol development via Sanna Street. A newly constructed intersection at 69th Avenue and Sanna Street will help prevent water from flowing into Sanna Street from 69th Avenue.

In larger storm events, the inlets and storm drain pipe will accept runoff equivalent to the 2 year event, and the roadway will carry the difference. Please note that we assume developments retain their 10 year water on site. Therefore, we consider the street right-of-ways only when computing runoff.

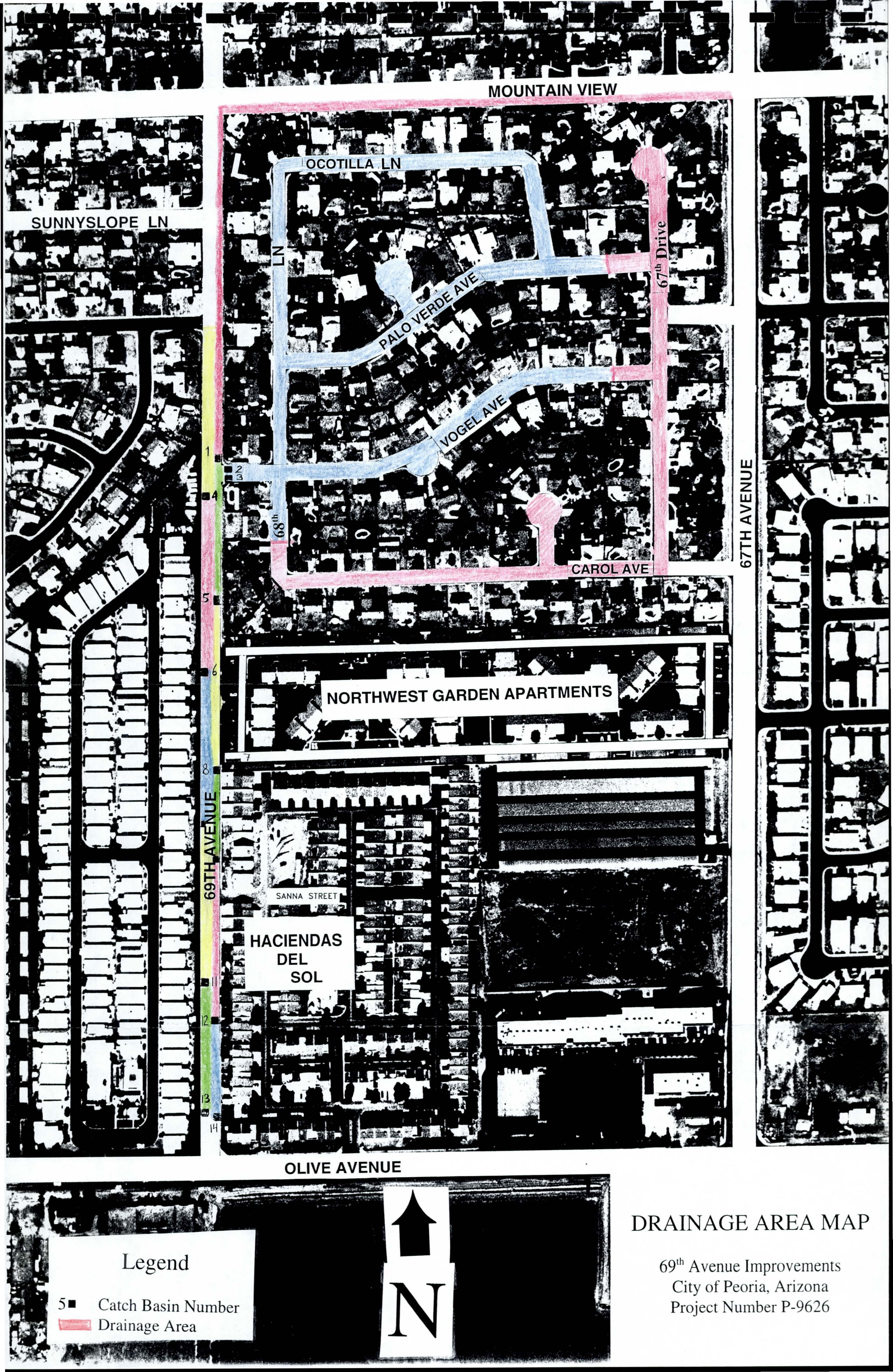
The Olive Avenue Storm Drain Report, completed by Boyle Engineering, could not be located. Neither the original design consultant, the Flood Control District, the City of Glendale, nor the City of Peoria could locate a copy of this report. However, the "Final Drainage Report Detention Basin and Park Design" completed by Cella Barr and Associates (CBA Job No. 241527-01-0280, and City of Peoria Project SS-9002) stated that the Olive Avenue Storm Drain was designed for the two year storm. As a result, the 69th Avenue Storm drain was sized for the calculated two (2) year flow using a Manning's n of 0.013. The minimum pipe sizes used are the 15 and 18-inch connector pipes; with 24 and 30-inch diameter pipes used in the storm drain lateral.

Energy Grade line (EGL) information was taken from the Olive Avenue Storm Drain Plans (FCD 89-16). The 2 year EGL elevation at the Olive Avenue and 69th Avenue intersection was approximately 1,144. This value was inserted into the Storm Plus model. Appendix G contains the Storm Plus input and output files for the case where the Olive Avenue and 69th Avenue storm drains have concurrent peak flows at their intersection. This is a worst case scenario. With this assumption, the 69th Avenue minimum flow velocities of 3-feet per second are maintained. In addition, the 69th Avenue HGL is near the top of pipe as shown in Appendix I.

Appendix H contains the Storm Plus input and output files for the case where the 69th Avenue peak flow occurs before the Olive Avenue peak flow. In this case the flow velocities are approximately 6 feet per second. (See appendix I for the HGL associated with this scenario.)

Appendix A

Drainage Area Map



DRAINAGE AREA MAP

69th Avenue Improvements
City of Peoria, Arizona
Project Number P-9626

Appendix B

Time of Concentration (Tc) Calculations

69th Avenue Improvements
Olive Avenue to Sunnyslope Lane
City of Peoria, Arizona
P-9626

Time of Concentration Calculations

Catch Basin No. 2 & 3 at Vogel Avenue

Tc (min)	Tc (Hr)	Rough Coef	Length (miles)	Kb	Slope (ft/mile)	County i (2 Yr) (in/hr)	Tc Calc (Hr)	
10	0.166667	11.4	0.293561	0.034	15.84	2.9	0.301639	
11	0.183333	11.4	0.293561	0.034	15.84	2.8	0.305688	
12	0.2	11.4	0.293561	0.034	15.84	2.7	0.309942	
13	0.216667	11.4	0.293561	0.034	15.84	2.6	0.314419	
14	0.233333	11.4	0.293561	0.034	15.84	2.5	0.31914	
15	0.25	11.4	0.293561	0.034	15.84	2.4	0.324129	
16	0.266667	11.4	0.293561	0.034	15.84	2.3	0.329414	
17	0.283333	11.4	0.293561	0.034	15.84	2.2	0.335026	
18	0.3	11.4	0.293561	0.034	15.84	2.1	0.341001	
19	0.316667	11.4	0.293561	0.034	15.84	2.1	0.341001	
20	0.333333	11.4	0.293561	0.034	15.84	2	0.347382	
21	0.35	11.4	0.293561	0.034	15.84	2	0.347382	Use Tc=21 min for Catch Basin No.2&3.
22	0.366667	11.4	0.293561	0.034	15.84	1.9	0.354219	
23	0.383333	11.4	0.293561	0.034	15.84	1.8	0.361572	
24	0.4	11.4	0.293561	0.034	15.84	1.8	0.361572	
25	0.416667	11.4	0.293561	0.034	15.84	1.7	0.369512	
26	0.433333	11.4	0.293561	0.034	15.84	1.7	0.369512	
27	0.45	11.4	0.293561	0.034	15.84	1.7	0.369512	
28	0.466667	11.4	0.293561	0.034	15.84	1.6	0.378123	
29	0.483333	11.4	0.293561	0.034	15.84	1.6	0.378123	
30	0.5	11.4	0.293561	0.034	15.84	1.6	0.378123	
31	0.516667	11.4	0.293561	0.034	15.84	1.6	0.378123	
32	0.533333	11.4	0.293561	0.034	15.84	1.5	0.387511	
33	0.55	11.4	0.293561	0.034	15.84	1.5	0.387511	
34	0.566667	11.4	0.293561	0.034	15.84	1.4	0.397805	
35	0.583333	11.4	0.293561	0.034	15.84	1.4	0.397805	
36	0.6	11.4	0.293561	0.034	15.84	1.3	0.409167	

69th Avenue Improvements
Olive Avenue to Sunnyslope Lane
City of Peoria, Arizona
P-9626

Time of Concentration Calculations

Catch Basin No. 7, Northwest Apartments

Tc (min)	Tc (Hr)	Rough Coef	Length (miles)	Kb	Slope (ft/mile)	County i (2 Yr) (in/hr)	Tc Calc (Hr)	
10	0.166667	11.4	0.492424	0.034	15.84	2.9	0.390668	
11	0.183333	11.4	0.492424	0.034	15.84	2.8	0.395913	
12	0.2	11.4	0.492424	0.034	15.84	2.7	0.401422	
13	0.216667	11.4	0.492424	0.034	15.84	2.6	0.40722	
14	0.233333	11.4	0.492424	0.034	15.84	2.5	0.413335	
15	0.25	11.4	0.492424	0.034	15.84	2.4	0.419797	
16	0.266667	11.4	0.492424	0.034	15.84	2.3	0.426641	
17	0.283333	11.4	0.492424	0.034	15.84	2.2	0.433909	
18	0.3	11.4	0.492424	0.034	15.84	2.1	0.441648	
19	0.316667	11.4	0.492424	0.034	15.84	2.1	0.441648	
20	0.333333	11.4	0.492424	0.034	15.84	2	0.449913	
21	0.35	11.4	0.492424	0.034	15.84	2	0.449913	
22	0.366667	11.4	0.492424	0.034	15.84	1.9	0.458768	
23	0.383333	11.4	0.492424	0.034	15.84	1.8	0.468291	
24	0.4	11.4	0.492424	0.034	15.84	1.8	0.468291	
25	0.416667	11.4	0.492424	0.034	15.84	1.7	0.478574	
26	0.433333	11.4	0.492424	0.034	15.84	1.7	0.478574	
27	0.45	11.4	0.492424	0.034	15.84	1.7	0.478574	
28	0.466667	11.4	0.492424	0.034	15.84	1.6	0.489727	
29	0.483333	11.4	0.492424	0.034	15.84	1.6	0.489727	Use Tc=29 min for Catch Basin No. 7
30	0.5	11.4	0.492424	0.034	15.84	1.6	0.489727	
31	0.516667	11.4	0.492424	0.034	15.84	1.6	0.489727	
32	0.533333	11.4	0.492424	0.034	15.84	1.5	0.501886	
33	0.55	11.4	0.492424	0.034	15.84	1.5	0.501886	
34	0.566667	11.4	0.492424	0.034	15.84	1.4	0.515218	
35	0.583333	11.4	0.492424	0.034	15.84	1.4	0.515218	
36	0.6	11.4	0.492424	0.034	15.84	1.3	0.529933	

69th Avenue Improvements
Olive Avenue to Sunnyslope Lane
City of Peoria, Arizona
P-9626

Time of Concentration Calculations

Catch Basin No. 1 at Station 18+70

Tc (min)	Tc (Hr)	Rough Coef	Length (miles)	Kb	Slope (ft/mile)	County i (2 Yr) (in/hr)	Tc Calc (Hr)	
10	0.166667	11.4	0.416667	0.034	15.84	2.9	0.359363	
11	0.183333	11.4	0.416667	0.034	15.84	2.8	0.364187	
12	0.2	11.4	0.416667	0.034	15.84	2.7	0.369255	
13	0.216667	11.4	0.416667	0.034	15.84	2.6	0.374588	
14	0.233333	11.4	0.416667	0.034	15.84	2.5	0.380213	
15	0.25	11.4	0.416667	0.034	15.84	2.4	0.386157	
16	0.266667	11.4	0.416667	0.034	15.84	2.3	0.392453	
17	0.283333	11.4	0.416667	0.034	15.84	2.2	0.399138	
18	0.3	11.4	0.416667	0.034	15.84	2.1	0.406257	
19	0.316667	11.4	0.416667	0.034	15.84	2.1	0.406257	
20	0.333333	11.4	0.416667	0.034	15.84	2	0.413859	
21	0.35	11.4	0.416667	0.034	15.84	2	0.413859	
22	0.366667	11.4	0.416667	0.034	15.84	1.9	0.422005	
23	0.383333	11.4	0.416667	0.034	15.84	1.8	0.430765	
24	0.4	11.4	0.416667	0.034	15.84	1.8	0.430765	
25	0.416667	11.4	0.416667	0.034	15.84	1.7	0.440224	
26	0.433333	11.4	0.416667	0.034	15.84	1.7	0.440224	Use Tc=26 min for Catch Basin No.1
27	0.45	11.4	0.416667	0.034	15.84	1.7	0.440224	
28	0.466667	11.4	0.416667	0.034	15.84	1.6	0.450483	
29	0.483333	11.4	0.416667	0.034	15.84	1.6	0.450483	
30	0.5	11.4	0.416667	0.034	15.84	1.6	0.450483	
31	0.516667	11.4	0.416667	0.034	15.84	1.6	0.450483	
32	0.533333	11.4	0.416667	0.034	15.84	1.5	0.461668	
33	0.55	11.4	0.416667	0.034	15.84	1.5	0.461668	
34	0.566667	11.4	0.416667	0.034	15.84	1.4	0.473931	
35	0.583333	11.4	0.416667	0.034	15.84	1.4	0.473931	
36	0.6	11.4	0.416667	0.034	15.84	1.3	0.487468	

Appendix C

Runoff Calculation Summary Sheets
(For Roadway Inlets)

Project Number: P-9626
Project Name: 69th Avenue Improvements
Location/Station: City of Peoria
Designer: G. Haggerty Checker: S. Rex

RUNOFF CALCULATION SUMMARY

Design Frequency = 2 Years
Minimum Tc = 10 Minutes

Area No.	Station to Station	Subarea 1 Area acres	Subarea 1 C Factor	Subarea 2 Area acres	Subarea 2 C Factor	Subarea 3 Area acres	Subarea 3 C Factor	Sum C A	Length feet	DA Slope ft/ft	tc min	i in/hr	Q cfs
*													
* **Phoenix-Arizona Air National Guard**													
*													
*	69th AVE EAST												
1	Rt Mntn View & 69th to Sta 18+70	1.53	0.85					1.30	2220.00	0.30	21.00	1.94	2.53
2	Vogel (North)	2.12	0.85					1.80	1500.00	0.30	21.00	1.94	3.50
3	Vogel (South)	2.12	0.85					1.80	1500.00	0.30	21.00	1.94	3.50
5	Rt 18+70 to 15+10	0.25	0.95					0.24	360.00	0.29	10.00	2.94	0.70
7	Rt Northwest Apartments Driveway	2.58	0.85					2.19	2600.00	0.30	29.00	1.60	3.52
8	Rt 15+10 to 11+00	0.28	0.95					0.27	410.00	0.77	10.00	2.94	0.78
10A	Rt 11+00 to 8+70	0.16	0.95					0.15	230.00	0.26	10.00	2.94	0.45
10B	Rt 8+10 to 8+70	0.04	0.95					0.04	60.00	0.60	10.00	2.94	0.11
12	Rt 8+10 to 4+90	0.22	0.95					0.21	320.00	0.26	10.00	2.94	0.62
14	Rt 4+90 to 2+50	0.17	0.95					0.16	240.00	0.26	10.00	2.94	0.48
*													
*	69th AVE WEST												
4	Lt Palo Verde to 17+70	0.28	0.95					0.27	400.00	0.30	10.00	2.94	0.78
6	Lt 17+70 to 13+40	0.30	0.95					0.29	430.00	0.77	10.00	2.94	0.84
9	Lt 13+40 to 9+70	0.25	0.95					0.24	370.00	0.26	10.00	2.94	0.70
11	Lt 9+70 to 5+70	0.28	0.95					0.27	400.00	0.26	10.00	2.94	0.78
13	Lt 5+70 to 2+60	0.21	0.95					0.20	310.00	0.26	10.00	2.94	0.59
*													
END													

Appendix D

Inlet Design Calculation Summary Sheets (For Roadway Inlets)

Project Number: P-9626
Project Name: 69th Avenue Improvements
Location/Station: City of Peoria
Designer: G. Haggerty
Checker: S. Rex

INLET DESIGN CALCULATION SUMMARY

Design Frequency = 2 Years

Inlet No.	Area No.	Location	Inlet Type	Q cfs	Flowby cfs	Qtotal cfs	So ft/ft	Sx ft/ft	C&G Type	depth ft	Spread ft	Ave Vel fps	E	Qi cfs	Qc cfs	To Inlet
BEGIN																
*																
* 69th AVE (EAST)																
*																
1	1	Rt Mtn View & 69th to 18+70	M-1, L=10'	2.53		2.53	0.0030	0.0250	MAG A	0.33	10.97	1.65	0.95	2.41	0.12	5
2	2	Rt Vogel (North)	M-1, L=10'	3.50		3.50	0.0030	0.0250	MAG A	0.37	12.44	1.78	0.88	3.08	0.42	5
3	3	Rt Vogel (South)	M-1, L=10'	3.50		3.50	0.0030	0.0250	MAG A	0.37	12.44	1.78	0.88	3.08	0.42	5
5	5	Rt 15+10	M-1, L=6'	0.70	0.97	1.67	0.0029	0.0250	MAG A	0.29	9.39	1.48	0.89	1.48	0.19	8
7	7	Rt Northwest Apartments	M-1, L=10'	3.52		3.52	0.0000	0.0200	MAG A	0.25	9.35		1.00	3.52	0.00	-
8	8	Rt 11+00	M-1, L=6'	0.78	0.19	0.97	0.0077	0.0250	MAG A	0.21	6.21	1.90	0.91	0.88	0.09	10A
10A	10A	Rt 11+00 to 8+70		0.45	0.09	0.54	0.0026	0.0250	MAG A	0.21	6.08	1.09	0.00	0.00	0.54	10
10B	10B	Rt 8+10 to 8+70		0.11		0.11	0.0060	0.0250	MAG A	0.12	2.31	1.17	0.00	0.00	0.11	10
10		Rt 8+70	M-1, L=3'	0.00	0.65	0.65	0.0000	0.0250	MAG A	0.12	2.55		1.00	0.65	0.00	-
12	12	Rt 4+90	M-1, L=3'	0.62		0.62	0.0000	0.0250	MAG A	0.12	2.39		1.00	0.62	0.00	14
14	14	Rt 2+50	M-1, L=3'	0.48	0.00	0.48	0.0026	0.0250	MAG A	0.20	5.78	1.06	0.99	0.47	0.00	Out
*																
*																
* 69th AVE (WEST)																
*																
4	4	Lt 17+70	M-1, L=3'	0.78		0.78	0.0029	0.02	MAG A	0.22	7.97	1.17	0.85	0.67	0.12	6
6	6	Lt 13+40	M-1, L=6'	0.84	0.12	0.95	0.0077	0.02	MAG A	0.20	7.07	1.79	0.89	0.85	0.11	9
9	9	Lt 9+70	M-1, L=3'	0.70	0.11	0.81	0.0026	0.02	MAG A	0.23	8.25	1.13	0.86	0.69	0.12	11
11	11	Lt 5+70	M-1, L=3'	0.78	0.12	0.90	0.0026	0.02	MAG A	0.24	8.62	1.16	0.83	0.74	0.16	13
13	13	Lt 2+60	M-1, L=3'	0.59	0.16	0.74	0.0026	0.02	MAG A	0.22	7.98	1.11	0.88	0.65	0.09	Out
*																
END																

Appendix E

Detailed Inlet Summary Sheets

Location: **Rt Mtn View & 69th to 18+70** Inlet No: 1
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0030 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	2.5276 cfs
d = depth of flow at curb =	0.3325 ft
T = spread =	10.9664 ft
V = average velocity =	1.6494 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=10'
La = actual length of curb opening provided =	13.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	10.4000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	24.9721 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0400 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	15.9711 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	2.5276 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.9516
Qi = flow intercepted by curb opening = E * Q =	2.4051 cfs
Qc = flowby = Q - Qi =	0.1224 cfs

Location: **Rt Vogel (North)** Inlet No: 2
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0030 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	3.5022 cfs
d = depth of flow at curb =	0.3693 ft
T = spread =	12.4377 ft
V = average velocity =	1.7842 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=10'
La = actual length of curb opening provided =	13.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	10.4000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	26.1568 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0382 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	18.8323 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	3.5022 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8788
Qi = flow intercepted by curb opening = E * Q =	3.0776 cfs
Qc = flowby = Q - Qi =	0.4246 cfs

Location: **Rt Vogel (South)** Inlet No: 3
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0030 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	3.5022 cfs
d = depth of flow at curb =	0.3693 ft
T = spread =	12.4377 ft
V = average velocity =	1.7842 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=10'
La = actual length of curb opening provided =	13.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	10.4000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	26.1568 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0382 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	18.8323 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	3.5022 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8788
Qi = flow intercepted by curb opening = E * Q =	3.0776 cfs
Qc = flowby = Q - Qi =	0.4246 cfs

Location: **Rt 15+10** Inlet No: 5
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0029 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	1.6706 cfs
d = depth of flow at curb =	0.2932 ft
T = spread =	9.3945 ft
V = average velocity =	1.4753 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=6'
La = actual length of curb opening provided =	9.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	7.2000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	23.4782 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0426 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	12.8032 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	1.6706 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8875
Qi = flow intercepted by curb opening = E * Q =	1.4827 cfs
Qc = flowby = Q - Qi =	0.1879 cfs

Location: **Rt Northwest Apartments** Inlet No: 7
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0000 ft/ft
Sx = roadway cross slope =	0.0200 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Curb Opening Inlet in Sump Analysis:

Q = Total flow to sump from all sides =	3.5156 cfs
Catch Basin Type:	M-1, L=10'
La = Actual length of curb opening inlet =	13.0000 ft
Ha = Actual height of curb opening inlet =	0.4167 sq ft
a = Local gutter depression at inlet =	0.1667
Clog = Clogging Factor =	0.8000
g = acceleration of gravity =	32.1740 fps
Le = Effective length of curb opening = (La)(Clog) =	10.4000 ft
Ae = Effective clear opening area = (La)(Ha)(Clog) =	4.3337 sq ft
Calculate ponding depth for weir flow:	
Dweir = Weir depth = (Q/2.3/(Le+1.8*Wg))^(2/3) =	0.2504 ft
Calculate ponding depth for orifice flow:	
Dorifice = Orifice Depth = (Q/0.67/Ae/sqrt(2g))^2 + Ha/2 - a =	0.0644 ft
Weir Flow Governs:	
Dsump = Depth in sump =	0.2504 ft
T = Spread given depth Dsump =	9.3525 ft

Location: **Rt 11+00** Inlet No: 8
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0077 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.9707 cfs
d = depth of flow at curb =	0.2136 ft
T = spread =	6.2096 ft
V = average velocity =	1.8990 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=6'
La = actual length of curb opening provided =	9.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	7.2000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	19.4881 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0513 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	12.2172 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	0.9707 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.9094
Qi = flow intercepted by curb opening = E * Q =	0.8828 cfs
Qc = flowby = Q - Qi =	0.0879 cfs

Location: **Rt 11+00 to 8+70** Inlet No: 10A
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0026 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.5352 cfs
d = depth of flow at curb =	0.2102 ft
T = spread =	6.0758 ft
V = average velocity =	1.0909 fps

Location: **Rt 8+10 to 8+70** Inlet No: 10B
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0060 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.1118 cfs
d = depth of flow at curb =	0.1160 ft
T = spread =	2.3067 ft
V = average velocity =	1.1688 fps

Location: **Rt 8+70** Inlet No: 10
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0000 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Curb Opening Inlet in Sump Analysis:

Q = Total flow to sump from all sides =	0.6470 cfs
Catch Basin Type:	M-1, L=3'
La = Actual length of curb opening inlet =	6.0000 ft
Ha = Actual height of curb opening inlet =	0.4167 sq ft
a = Local gutter depression at inlet =	0.1667
Clog = Clogging Factor =	0.8000
g = acceleration of gravity =	32.1740 fps
Le = Effective length of curb opening = (La)(Clog) =	4.8000 ft
Ae = Effective clear opening area = (La)(Ha)(Clog) =	2.0002 sq ft
Calculate ponding depth for weir flow:	
Dweir = Weir depth = (Q/2.3/(Le+1.8*Wg))^(2/3) =	0.1220 ft
Calculate ponding depth for orifice flow:	
Dorifice = Orifice Depth = (Q/0.67/Ae/sqrt(2g))^2 + Ha/2 - a =	0.0453 ft
Weir Flow Governs:	
Dsump = Depth in sump =	0.1220 ft
T = Spread given depth Dsump =	2.5474 ft

Location: **Rt 4+90** Inlet No: 12
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0000 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Curb Opening Inlet in Sump Analysis:

Q = Total flow to sump from all sides =	0.6150 cfs
Catch Basin Type:	M-1, L=3'
La = Actual length of curb opening inlet =	6.0000 ft
Ha = Actual height of curb opening inlet =	0.4167 sq ft
a = Local gutter depression at inlet =	0.1667
Clog = Clogging Factor =	0.8000
g = acceleration of gravity =	32.1740 fps
Le = Effective length of curb opening = (La)(Clog) =	4.8000 ft
Ae = Effective clear opening area = (La)(Ha)(Clog) =	2.0002 sq ft
Calculate ponding depth for weir flow:	
Dweir = Weir depth = (Q/2.3/(Le+1.8*Wg))^(2/3) =	0.1180 ft
Calculate ponding depth for orifice flow:	
Dorifice = Orifice Depth = (Q/0.67/Ae/sqrt(2g))^2 + Ha/2 - a =	0.0449 ft
Weir Flow Governs:	
Dsump = Depth in sump =	0.1180 ft
T = Spread given depth Dsump =	2.3852 ft

Location: **Rt 2+50** Inlet No: 14
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0026 ft/ft
Sx = roadway cross slope =	0.0250 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.4752 cfs
d = depth of flow at curb =	0.2029 ft
T = spread =	5.7815 ft
V = average velocity =	1.0632 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=3'
La = actual length of curb opening provided =	6.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	4.8000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	18.8328 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0531 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	6.4023 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	0.4752 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.9931
Qi = flow intercepted by curb opening = E * Q =	0.4720 cfs
Qc = flowby = Q - Qi =	0.0033 cfs

Location: **Lt 17+70** Inlet No: 4
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0029 ft/ft
Sx = roadway cross slope =	0.0200 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.7828 cfs
d = depth of flow at curb =	0.2227 ft
T = spread =	7.9705 ft
V = average velocity =	1.1736 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=3'
La = actual length of curb opening provided =	6.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	4.8000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	22.8920 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0437 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	9.1716 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	0.7828 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8521
Qi = flow intercepted by curb opening = E * Q =	0.6670 cfs
Qc = flowby = Q - Qi =	0.1158 cfs

Location: **Lt 13+40** Inlet No: 6
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0077 ft/ft
Sx = roadway cross slope =	0.0200 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.9544 cfs
d = depth of flow at curb =	0.2048 ft
T = spread =	7.0725 ft
V = average velocity =	1.7945 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=6'
La = actual length of curb opening provided =	9.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	7.2000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	21.4345 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0467 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	12.8439 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	0.9544 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8860
Qi = flow intercepted by curb opening = E * Q =	0.8456 cfs
Qc = flowby = Q - Qi =	0.1088 cfs

Location: **Lt 9+70** Inlet No: 9
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0026 ft/ft
Sx = roadway cross slope =	0.0200 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.8077 cfs
d = depth of flow at curb =	0.2284 ft
T = spread =	8.2542 ft
V = average velocity =	1.1328 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=3'
La = actual length of curb opening provided =	6.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	4.8000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	23.3285 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0429 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	9.0962 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	0.8077 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8563
Qi = flow intercepted by curb opening = E * Q =	0.6916 cfs
Qc = flowby = Q - Qi =	0.1161 cfs

Location: **Lt 5+70** Inlet No: 11
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0026 ft/ft
Sx = roadway cross slope =	0.0200 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.8989 cfs
d = depth of flow at curb =	0.2357 ft
T = spread =	8.6190 ft
V = average velocity =	1.1605 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=3'
La = actual length of curb opening provided =	6.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	4.8000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	23.8734 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0419 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	9.6467 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	0.8989 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8264
Qi = flow intercepted by curb opening = E * Q =	0.7428 cfs
Qc = flowby = Q - Qi =	0.1560 cfs

Location: **Lt 2+60** Inlet No: 13
Comment:

Gutter flow section geometry data:

So = longitudinal slope =	0.0026 ft/ft
Sx = roadway cross slope =	0.0200 ft/ft
Curb & Gutter Type =	0
Zc = Slope of curb face (horiz:vert) =	1 : 1
Wg = gutter width =	1.0000 ft
Gdrop = gutter drop =	1.0000 in
DropType = Gutter drop type (measured from rdwy Xslope or Horiz) =	Horiz
n = Manning's n factor =	0.0160

Calculate depth of flow in section:

Q = total flow in gutter =	0.7431 cfs
d = depth of flow at curb =	0.2229 ft
T = spread =	7.9789 ft
V = average velocity =	1.1119 fps

On Grade Curb Opening Inlet Analysis:

Catch Basin Type:	M-1, L=3'
La = actual length of curb opening provided =	6.0000 ft
Clogging Factor =	0.8000
Le = Effective length of curb opening = La * Clog =	4.8000
Calculate length of curb opening drain req'd for 100% interception:	
Zequiv = Equiv. Z for simple section = Q*n/.55725/sqrt(So)/d^(8/3) =	22.9059 :1
Sx = Equivalent cross slope for simple section = 1/Zequiv =	0.0437 ft/ft
Lt = 100% length = 0.6 Q^0.42 * So^0.3 * (Zequiv/n)^0.6 / Clog =	8.6874 ft
Calculate interception capacity of curb opening:	
Q = Total flow to curb opening =	0.7431 cfs
E = Efficiency of curb opening = 1 - (1 - La/Lt)^1.8 =	0.8790
Qi = flow intercepted by curb opening = E * Q =	0.6532 cfs
Qc = flowby = Q - Qi =	0.0899 cfs

Appendix F

Pipe Sizing Spreadsheet

69th Avenue Improvements
Storm Drain Improvements
City of Peoria, Arizona
Project # P-9626

STORM DRAIN SIZING SPREADSHEET (69th Avenue Peak Flow Before Olive Avenue Peak Flow)
2-YEAR STORM

MANNING'S n = 0.013

	Station From -	To	Area (Acres)	Tc (Min.)	I (in/hr)	Weighted C	Q (cfs)	Slope (ft/ft)	Size (in)	Velocity (fps)	Length (ft)
PIPE	1870	1770	5.78	21.0	2.00	0.85	9.83	0.00600	24	5.61	100
JCT.											
PIPE	1770	1510	0.28	21.3	2.00	0.85	10	0.00600	24	5.80	260
JCT.											
PIPE	1510	1340	0.25	22.0	1.90	0.86	10.31	0.00600	24	5.8	170
JCT.											
PIPE	1340	1100	0.30	22.5	1.90	0.86	10.8	0.00600	24	5.8	240
JCT.											
PIPE	1100	970	2.86	24.0	1.80	0.86	14.66	0.00600	30	6.2	130
JCT.											
PIPE	970	870	0.25	24.3	1.80	0.86	15.05	0.00600	30	6.3	100
JCT.											
PIPE	870	570	0.20	24.6	1.80	0.87	15.53	0.00600	30	6.40	300
JCT.											
PIPE	570	490	0.28	25.4	1.80	0.87	15.97	0.00600	30	6.4	80
JCT.											
PIPE	490	260	0.22	25.6	1.80	0.87	16.32	0.00600	30	6.40	230
JCT.											
PIPE	260	250	0.21	26.2	1.70	0.87	15.72	0.00600	30	6.40	10
JCT.											
PIPE	250	170	0.17	26.2	1.70	0.87	15.97	0.00600	30	6.40	80
JCT.											
PIPE	170	100	0.00	26.4	1.70	0.87	15.97	0.08100	30	15.30	70
Starting HGL											

1. Olive Avenue Storm Drain Has An Elevated Hydraulic Grade Line (HGL) During its Peak 2-Year Flow.
2. The 69th Avenue Storm Drain Has An Elevated Hydraulic Grade Line If the Olive Avenue Peak Flow Is Concurrent With The 69th Avenue Peak Flow.
3. The 69th Avenue Storm Drain Has An HGL Inside The Pipe If the 69th Avenue Peak Flow Occurs Before The Olive Avenue Peak Flow.
4. See Appendices G, H, and I For A Detailed Look At The System Hydraulics.

Appendix G

Storm Plus Input and Output Files

(Olive Avenue Peak Flow Concurrent With 69th Avenue Peak Flow)

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

Nov 20, 1997 8: 1:37

Input file : 69th.dat
Output file: 69th.out

INPUT FILE LISTING

```
T1  69th Avenue Improvements   BY: DIBBLE AND ASSOCIATES
T2  CITY OF Peoria, Arizona    FILENAME:  69th.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702
SO    100.00 130.63  9                          144.00
R     170.00 136.30  9      .013                                      1
R     250.00 136.77  9      .013
JX    250.00 136.78  9 11   .013    0.01        136.50        90.0
R     260.00 136.83  9      .013                                      1
JX    260.00 136.84  9 11   .013    0.01        136.55        90.0
R     490.00 138.21  9      .013
JX    490.00 138.22  9 11   .013    0.34        137.80        90.0
R     570.00 138.69  9      .013                                      1
JX    570.00 138.70  9 11   .013    0.44        138.40        90.0
R     870.00 140.49  9      .013
JX    870.00 140.50  9 11   .013    0.48        140.10        90.0
R     970.00 141.09  9      .013
JX    970.00 141.10  9 11   .013    0.39        140.70        90.0
R    1100.00 141.88  9      .013                                      1
JX   1100.00 142.38 10 11   .013    3.86        141.40        90.0
R    1340.00 143.81 10      .013                                      1
JX   1340.00 143.82 10 11   .013    0.49        143.30        90.0
R    1510.00 144.83 10      .013
JX   1510.00 144.84 10 11   .013    0.31        144.40        90.0
R    1770.00 146.39 10      .013                                      1
JX   1770.00 146.40 10 11   .013    0.16        146.00        90.0
R    1847.00 146.85 10      .013
JX   1847.00 146.86 10 11   .013    0.01        146.40        90.0
SH                  10
1                                                          SP
                                WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                          PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR    INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH                DROP

  CD      1    3      0      .00      8.00    10.00    .00   .00   .00
  CD      2    4                      8.00
  CD      3    4                      7.50
  CD      4    4                      7.00
  CD      5    4                      6.50
  CD      6    4                      4.00
  CD      7    4                      3.50
  CD      8    4                      3.00
  CD      9    4                      2.50
  CD     10    4                      2.00
  CD     11    4                      1.50
  CD     12    4                      1.25
1                                                                                          PAGE NO    1
```

```
0
0HEADING LINE NO 1 IS -
0
0HEADING LINE NO 2 IS -
0
0HEADING LINE NO 3 IS -
0
1
```

WATER SURFACE PROFILE - TITLE CARD LISTING

69th Avenue Improvements BY: DIBBLE AND ASSOCIATES

CITY OF Peoria, Arizona FILENAME: 69th.DAT

STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

```
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *         *     *
                      U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                    100.00  130.63    9                                       144.00
0 ELEMENT NO   2 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    170.00  136.30    9              .013                                 .00    .00     .00      1
0 ELEMENT NO   3 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    250.00  136.77    9              .013                                 .00    .00     .00      0
0 ELEMENT NO   4 IS A JUNCTION           *         *     *     *                  *                   *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    250.00  136.78    9    11     0   .013      .0       .0   136.50      .00  90.00     .00
0 ELEMENT NO   5 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    260.00  136.83    9              .013                                 .00    .00     .00      1
0 ELEMENT NO   6 IS A JUNCTION           *         *     *     *                  *                   *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    260.00  136.84    9    11     0   .013      .0       .0   136.55      .00  90.00     .00
0 ELEMENT NO   7 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    490.00  138.21    9              .013                                 .00    .00     .00      0
0 ELEMENT NO   8 IS A JUNCTION           *         *     *     *                  *                   *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    490.00  138.22    9    11     0   .013      .3       .0   137.80      .00  90.00     .00
0 ELEMENT NO   9 IS A REACH              *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    570.00  138.69    9              .013                                 .00    .00     .00      1
0 ELEMENT NO  10 IS A JUNCTION           *         *     *     *                  *                   *                *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    570.00  138.70    9    11     0   .013      .4       .0   138.40      .00  90.00     .00
1                                                                                                                        PAGE NO   3
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0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  11 IS A REACH              *         *     *
                  U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                               870.00  140.49    9                .013                                   .00    .00     .00      0
0 ELEMENT NO  12 IS A JUNCTION           *         *     *     *            *                   *              *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               870.00  140.50    9    11     0   .013       .5       .0   140.10      .00  90.00     .00
0 ELEMENT NO  13 IS A REACH              *         *     *
                  U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                               970.00  141.09    9                .013                                   .00    .00     .00      0
0 ELEMENT NO  14 IS A JUNCTION           *         *     *     *            *                   *              *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               970.00  141.10    9    11     0   .013       .4       .0   140.70      .00  90.00     .00
0 ELEMENT NO  15 IS A REACH              *         *     *
                  U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                              1100.00  141.88    9                .013                                   .00    .00     .00      1
0 ELEMENT NO  16 IS A JUNCTION           *         *     *     *            *                   *              *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                              1100.00  142.38   10    11     0   .013      3.9       .0   141.40      .00  90.00     .00
0 ELEMENT NO  17 IS A REACH              *         *     *
                  U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                              1340.00  143.81   10                .013                                   .00    .00     .00      1
0 ELEMENT NO  18 IS A JUNCTION           *         *     *     *            *                   *              *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                              1340.00  143.82   10    11     0   .013       .5       .0   143.30      .00  90.00     .00
0 ELEMENT NO  19 IS A REACH              *         *     *
                  U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                              1510.00  144.83   10                .013                                   .00    .00     .00      0
0 ELEMENT NO  20 IS A JUNCTION           *         *     *     *            *                   *              *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                              1510.00  144.84   10    11     0   .013       .3       .0   144.40      .00  90.00     .00
1                                                                                                                   PAGE NO    4
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0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  21 IS A REACH              *         *     *
                  U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                               1770.00  146.39   10                .013                                  .00    .00     .00      1
0 ELEMENT NO  22 IS A JUNCTION           *         *     *     *              *                   *                *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               1770.00  146.40   10    11     0   .013       .2       .0   146.00      .00  90.00     .00
0 ELEMENT NO  23 IS A REACH              *         *     *
                  U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                               1847.00  146.85   10                .013                                  .00    .00     .00      0
0 ELEMENT NO  24 IS A JUNCTION           *         *     *     *              *                   *                *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               1847.00  146.86   10    11     0   .013       .0       .0   146.40      .00  90.00     .00
0 ELEMENT NO  25 IS A SYSTEM HEADWORKS                   *                  *
                  U/S DATA   STATION    INVERT  SECT                                     W S ELEV
                               1847.00  146.86   10                                          .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                                          PAGE    1
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WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 100.00	130.63	13.37	144.00	16.3	3.32	.17	144.17	.00	1.37	2.50	.00	.00	0	.00
0 70.00	.08100					.00158	.11		.63			.00		
0 170.00	136.30	7.82	144.12	16.3	3.32	.17	144.29	.00	1.37	2.50	.00	.00	0	.00
0 80.00	.00587					.00158	.13		1.28			.00		
0 250.00	136.77	7.48	144.25	16.3	3.32	.17	144.42	.00	1.37	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00158	.00					.00		
0 250.00	136.78	7.47	144.25	16.3	3.32	.17	144.42	.00	1.37	2.50	.00	.00	0	.00
0 10.00	.00500					.00158	.02		1.34			.00		
0 260.00	136.83	7.44	144.27	16.3	3.32	.17	144.44	.00	1.37	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00158	.00					.00		
0 260.00	136.84	7.43	144.27	16.3	3.32	.17	144.44	.00	1.37	2.50	.00	.00	0	.00
0 230.00	.00596					.00158	.36		1.27			.00		
0 490.00	138.21	6.42	144.63	16.3	3.32	.17	144.80	.00	1.37	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00155	.00					.00		
0 490.00	138.22	6.43	144.65	16.0	3.26	.17	144.81	.00	1.35	2.50	.00	.00	0	.00
0 80.00	.00587					.00152	.12		1.26			.00		
0 570.00	138.69	6.09	144.78	16.0	3.26	.17	144.94	.00	1.35	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00148	.00					.00		
0 570.00	138.70	6.09	144.79	15.6	3.18	.16	144.95	.00	1.34	2.50	.00	.00	0	.00
0 300.00	.00597					.00145	.43		1.24			.00		
0 870.00	140.49	4.74	145.23	15.6	3.18	.16	145.38	.00	1.34	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00140	.00					.00		

1

WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 870.00	140.50	4.75	145.25	15.1	3.08	.15	145.39	.00	1.31		2.50	.00	.00	0	.00
0 100.00	.00590					.00136	.14			1.22			.00		
0 970.00	141.09	4.29	145.38	15.1	3.08	.15	145.53	.00	1.31		2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00132	.00						.00		
0 970.00	141.10	4.30	145.40	14.7	2.99	.14	145.54	.00	1.29		2.50	.00	.00	0	.00
0 130.00	.00600					.00128	.17			1.19			.00		
0 1100.00	141.88	3.69	145.57	14.7	2.99	.14	145.71	.00	1.29		2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00178	.00						.00		
0 1100.00	142.38	3.24	145.62	10.8	3.44	.18	145.81	.00	1.18		2.00	.00	.00	0	.00
0 240.00	.00596					.00228	.55			1.14			.00		
0 1340.00	143.81	2.37	146.18	10.8	3.44	.18	146.36	.00	1.18		2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00218	.00						.00		
0 1340.00	143.82	2.39	146.21	10.3	3.28	.17	146.38	.00	1.15		2.00	.00	.00	0	.00
0 101.62	.00594					.00205	.21			1.11			.00		
0 1441.62	144.42	2.00	146.42	10.3	3.28	.17	146.59	.00	1.15		2.00	.00	.00	0	.00
0 41.86	.00594					.00192	.08			1.11			.00		
0 1483.48	144.67	1.81	146.49	10.3	3.44	.18	146.67	.00	1.15		2.00	.00	.00	0	.00
0 22.05	.00594					.00188	.04			1.11			.00		
0 1505.53	144.80	1.71	146.51	10.3	3.61	.20	146.71	.00	1.15		2.00	.00	.00	0	.00
0 4.47	.00594					.00196	.01			1.11			.00		
0 1510.00	144.83	1.68	146.51	10.3	3.65	.21	146.72	.00	1.15		2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00191	.00						.00		

1

WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 1510.00	144.84	1.70	146.54	10.0	3.51	.19	146.73	.00	1.13	2.00	.00	.00	0	.00
0 17.25	.00596					.00193	.03		1.08			.00		
0 1527.25	144.94	1.61	146.55	10.0	3.68	.21	146.77	.00	1.13	2.00	.00	.00	0	.00
0 14.55	.00596					.00212	.03		1.08			.00		
0 1541.80	145.03	1.54	146.56	10.0	3.86	.23	146.80	.00	1.13	2.00	.00	.00	0	.00
0 12.70	.00596					.00235	.03		1.08			.00		
0 1554.49	145.11	1.47	146.57	10.0	4.05	.26	146.83	.00	1.13	2.00	.00	.00	0	.00
0 11.54	.00596					.00263	.03		1.08			.00		
0 1566.04	145.17	1.40	146.58	10.0	4.25	.28	146.86	.00	1.13	2.00	.00	.00	0	.00
0 10.25	.00596					.00294	.03		1.08			.00		
0 1576.29	145.24	1.34	146.58	10.0	4.46	.31	146.89	.00	1.13	2.00	.00	.00	0	.00
0 9.10	.00596					.00331	.03		1.08			.00		
0 1585.39	145.29	1.29	146.58	10.0	4.67	.34	146.92	.00	1.13	2.00	.00	.00	0	.00
0 8.07	.00596					.00373	.03		1.08			.00		
0 1593.46	145.34	1.24	146.57	10.0	4.90	.37	146.95	.00	1.13	2.00	.00	.00	0	.00
0 6.07	.00596					.00421	.03		1.08			.00		
0 1599.53	145.37	1.19	146.56	10.0	5.14	.41	146.97	.00	1.13	2.00	.00	.00	0	.00
0 .99	.00596					.00446	.00		1.08			.00		
0 1600.52	145.38	1.19	146.57	10.0	5.14	.41	146.98	.00	1.13	2.00	.00	.00	0	.00
0HYDRAULIC JUMP												.00		
0 1600.52	145.38	1.08	146.46	10.0	5.75	.51	146.98	.00	1.13	2.00	.00	.00	0	.00
0 137.22	.00596					.00597	.82		1.08			.00		

1

WATER SURFACE PROFILE LISTING

69th Avenue Improvements BY: DIBBLE AND ASSOCIATES

CITY OF Peoria, Arizona FILENAME: 69th.DAT

STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 1737.74	146.20	1.08	147.28	10.0	5.75	.51	147.80	.00	1.13		2.00	.00	.00	0	.00
0 24.45	.00596					.00593	.14			1.08			.00		
0 1762.19	146.34	1.09	147.43	10.0	5.72	.51	147.94	.00	1.13		2.00	.00	.00	0	.00
0 7.81	.00596					.00553	.04			1.08			.00		
0 1770.00	146.39	1.13	147.52	10.0	5.45	.46	147.98	.00	1.13		2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00443	.00						.00		
0 1770.00	146.40	1.25	147.65	9.8	4.75	.35	148.00	.00	1.12		2.00	.00	.00	0	.00
0 7.38	.00584					.00392	.03			1.08			.00		
0 1777.38	146.44	1.20	147.64	9.8	4.98	.39	148.03	.00	1.12		2.00	.00	.00	0	.00
0 5.34	.00584					.00443	.02			1.08			.00		
0 1782.73	146.47	1.15	147.63	9.8	5.22	.42	148.05	.00	1.12		2.00	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0 1782.73	146.47	1.08	147.55	9.8	5.66	.50	148.05	.00	1.12		2.00	.00	.00	0	.00
0 38.12	.00584					.00581	.22			1.08			.00		
0 1820.84	146.70	1.08	147.78	9.8	5.66	.50	148.28	.00	1.12		2.00	.00	.00	0	.00
0 26.16	.00584					.00612	.16			1.08			.00		
0 1847.00	146.85	1.05	147.90	9.8	5.89	.54	148.44	.00	1.12		2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00579	.00						.00		
0 1847.00	146.86	1.12	147.98	9.8	5.41	.45	148.44	.00	1.12		2.00	.00	.00	0	.00

1

Appendix H

Storm Plus Input and Output Files

(69th Avenue Peak Flow Before Olive Avenue Peak Flow)

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

Nov 20, 1997 8:50:57

Input file : 69th.dat
Output file: 69th.out

INPUT FILE LISTING

```
T1  69th Avenue Improvements   BY: DIBBLE AND ASSOCIATES
T2  CITY OF Peoria, Arizona    FILENAME:  69th.DAT
T3  STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702
SO    100.00 130.63  9
R     170.00 136.30  9      .013                                        1
R     250.00 136.77  9      .013
JX    250.00 136.78  9 11   .013    0.01        136.50        90.0
R     260.00 136.83  9      .013                                        1
JX    260.00 136.84  9 11   .013    0.01        136.55        90.0
R     490.00 138.21  9      .013
JX    490.00 138.22  9 11   .013    0.34        137.80        90.0
R     570.00 138.69  9      .013                                        1
JX    570.00 138.70  9 11   .013    0.44        138.40        90.0
R     870.00 140.49  9      .013
JX    870.00 140.50  9 11   .013    0.48        140.10        90.0
R     970.00 141.09  9      .013
JX    970.00 141.10  9 11   .013    0.39        140.70        90.0
R    1100.00 141.88  9      .013                                        1
JX   1100.00 142.38 10 11   .013    3.86        141.40        90.0
R    1340.00 143.81 10      .013                                        1
JX   1340.00 143.82 10 11   .013    0.49        143.30        90.0
R    1510.00 144.83 10      .013
JX   1510.00 144.84 10 11   .013    0.31        144.40        90.0
R    1770.00 146.39 10      .013                                        1
JX   1770.00 146.40 10 11   .013    0.16        146.00        90.0
R    1847.00 146.85 10      .013
JX   1847.00 146.86 10 11   .013    0.01        146.40        90.0
SH                  10
1                                                          SP
```

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING PAGE 1

0 CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	3	0	.00	8.00	10.00	.00	.00	.00										
CD	2	4			8.00														
CD	3	4			7.50														
CD	4	4			7.00														
CD	5	4			6.50														
CD	6	4			4.00														
CD	7	4			3.50														
CD	8	4			3.00														
CD	9	4			2.50														
CD	10	4			2.00														
CD	11	4			1.50														
CD	12	4			1.25														

1

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0                                WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                   69th Avenue Improvements   BY: DIBBLE AND ASSOCIATES
0HEADING LINE NO 2 IS -
0                                   CITY OF Peoria, Arizona    FILENAME:  69th.DAT
0HEADING LINE NO 3 IS -
0                                   STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702
1                                                                                                PAGE NO    2
```

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0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                      U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                    100.00  130.63    9                                         .00
0 ELEMENT NO   2 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    170.00  136.30    9              .013                                 .00    .00     .00      1
0 ELEMENT NO   3 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    250.00  136.77    9              .013                                 .00    .00     .00      0
0 ELEMENT NO   4 IS A JUNCTION          *         *     *     *                 *                 *                 *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    250.00  136.78    9    11     0   .013       .0       .0   136.50      .00  90.00     .00
0 ELEMENT NO   5 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    260.00  136.83    9              .013                                 .00    .00     .00      1
0 ELEMENT NO   6 IS A JUNCTION          *         *     *     *                 *                 *                 *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    260.00  136.84    9    11     0   .013       .0       .0   136.55      .00  90.00     .00
0 ELEMENT NO   7 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    490.00  138.21    9              .013                                 .00    .00     .00      0
0 ELEMENT NO   8 IS A JUNCTION          *         *     *     *                 *                 *                 *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    490.00  138.22    9    11     0   .013       .3       .0   137.80      .00  90.00     .00
0 ELEMENT NO   9 IS A REACH             *         *     *
                      U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    570.00  138.69    9              .013                                 .00    .00     .00      1
0 ELEMENT NO  10 IS A JUNCTION          *         *     *     *                 *                 *                 *
                      U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    570.00  138.70    9    11     0   .013       .4       .0   138.40      .00  90.00     .00
1                                                                                                                   PAGE NO    3
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0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  11 IS A REACH          *        *     *
                         U/S DATA  STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                     870.00  140.49    9              .013                                  .00    .00     .00      0
0 ELEMENT NO  12 IS A JUNCTION       *        *     *     *                *                    *            *
                         U/S DATA  STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                     870.00  140.50    9    11     0   .013       .5       .0   140.10      .00  90.00     .00
0 ELEMENT NO  13 IS A REACH          *        *     *
                         U/S DATA  STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                     970.00  141.09    9              .013                                  .00    .00     .00      0
0 ELEMENT NO  14 IS A JUNCTION       *        *     *     *                *                    *            *
                         U/S DATA  STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                     970.00  141.10    9    11     0   .013       .4       .0   140.70      .00  90.00     .00
0 ELEMENT NO  15 IS A REACH          *        *     *
                         U/S DATA  STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    1100.00  141.88    9              .013                                  .00    .00     .00      1
0 ELEMENT NO  16 IS A JUNCTION       *        *     *     *                *                    *            *
                         U/S DATA  STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    1100.00  142.38   10    11     0   .013      3.9       .0   141.40      .00  90.00     .00
0 ELEMENT NO  17 IS A REACH          *        *     *
                         U/S DATA  STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    1340.00  143.81   10              .013                                  .00    .00     .00      1
0 ELEMENT NO  18 IS A JUNCTION       *        *     *     *                *                    *            *
                         U/S DATA  STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    1340.00  143.82   10    11     0   .013       .5       .0   143.30      .00  90.00     .00
0 ELEMENT NO  19 IS A REACH          *        *     *
                         U/S DATA  STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                    1510.00  144.83   10              .013                                  .00    .00     .00      0
0 ELEMENT NO  20 IS A JUNCTION       *        *     *     *                *                    *            *
                         U/S DATA  STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                    1510.00  144.84   10    11     0   .013       .3       .0   144.40      .00  90.00     .00
1                                                                                                                          PAGE NO   4
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0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  21 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                 1770.00  146.39   10              .013                                  .00    .00     .00      1
0 ELEMENT NO  22 IS A JUNCTION           *         *     *     *              *                    *                 *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                 1770.00  146.40   10    11     0   .013       .2       .0   146.00      .00  90.00     .00
0 ELEMENT NO  23 IS A REACH              *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                 1847.00  146.85   10              .013                                  .00    .00     .00      0
0 ELEMENT NO  24 IS A JUNCTION           *         *     *     *              *                    *                 *
                     U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                 1847.00  146.86   10    11     0   .013       .0       .0   146.40      .00  90.00     .00
0 ELEMENT NO  25 IS A SYSTEM HEADWORKS                 *                    *
                     U/S DATA   STATION    INVERT  SECT                                   W S ELEV
                                 1847.00  146.86   10                                        .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                                          PAGE    1
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WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	100.00	130.63	.66	131.29	16.3	15.70	3.83	135.12	.00	1.37		2.50	.00	.00	0	.00
0	100.00	130.63	.66	131.29	16.3	15.70	3.83	135.12	.00	1.37		2.50	.00	.00	0	.00
0	13.97	.08100					.06452	.90			.63			.00		
0	113.97	131.76	.68	132.44	16.3	15.20	3.59	136.03	.00	1.37		2.50	.00	.00	0	.00
0	13.00	.08100					.05768	.75			.63			.00		
0	126.98	132.82	.70	133.51	16.3	14.49	3.26	136.78	.00	1.37		2.50	.00	.00	0	.00
0	8.90	.08100					.05048	.45			.63			.00		
0	135.87	133.54	.72	134.26	16.3	13.81	2.97	137.23	.00	1.37		2.50	.00	.00	0	.00
0	6.65	.08100					.04420	.29			.63			.00		
0	142.52	134.07	.75	134.82	16.3	13.17	2.70	137.52	.00	1.37		2.50	.00	.00	0	.00
0	5.18	.08100					.03868	.20			.63			.00		
0	147.70	134.49	.78	135.27	16.3	12.56	2.45	137.72	.00	1.37		2.50	.00	.00	0	.00
0	4.13	.08100					.03388	.14			.63			.00		
0	151.83	134.83	.80	135.63	16.3	11.97	2.23	137.86	.00	1.37		2.50	.00	.00	0	.00
0	3.40	.08100					.02968	.10			.63			.00		
0	155.23	135.10	.83	135.93	16.3	11.42	2.03	137.96	.00	1.37		2.50	.00	.00	0	.00
0	2.82	.08100					.02600	.07			.63			.00		
0	158.05	135.33	.86	136.19	16.3	10.89	1.84	138.03	.00	1.37		2.50	.00	.00	0	.00
0	2.34	.08100					.02278	.05			.63			.00		
0	160.39	135.52	.89	136.41	16.3	10.38	1.67	138.09	.00	1.37		2.50	.00	.00	0	.00
0	1.97	.08100					.01997	.04			.63			.00		
1															PAGE	2

WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 162.36	135.68	.92	136.60	16.3	9.90	1.52	138.13	.00	1.37		2.50	.00	.00	0	.00
0 1.66	.08100					.01752	.03			.63			.00		
0 164.02	135.82	.96	136.77	16.3	9.44	1.38	138.16	.00	1.37		2.50	.00	.00	0	.00
0 1.38	.08100					.01537	.02			.63			.00		
0 165.41	135.93	.99	136.92	16.3	9.00	1.26	138.18	.00	1.37		2.50	.00	.00	0	.00
0 1.16	.08100					.01349	.02			.63			.00		
0 166.57	136.02	1.03	137.05	16.3	8.58	1.14	138.19	.00	1.37		2.50	.00	.00	0	.00
0 .97	.08100					.01184	.01			.63			.00		
0 167.53	136.10	1.06	137.16	16.3	8.18	1.04	138.20	.00	1.37		2.50	.00	.00	0	.00
0 .77	.08100					.01040	.01			.63			.00		
0 168.31	136.16	1.10	137.27	16.3	7.80	.94	138.21	.00	1.37		2.50	.00	.00	0	.00
0 .62	.08100					.00914	.01			.63			.00		
0 168.93	136.21	1.15	137.36	16.3	7.43	.86	138.22	.00	1.37		2.50	.00	.00	0	.00
0 .49	.08100					.00803	.00			.63			.00		
0 169.43	136.25	1.19	137.44	16.3	7.09	.78	138.22	.00	1.37		2.50	.00	.00	0	.00
0 .35	.08100					.00707	.00			.63			.00		
0 169.78	136.28	1.23	137.51	16.3	6.76	.71	138.22	.00	1.37		2.50	.00	.00	0	.00
0 .22	.08100					.00622	.00			.63			.00		
0 170.00	136.30	1.28	137.58	16.3	6.44	.65	138.23	.00	1.37		2.50	.00	.00	0	.00
0 29.79	.00587					.00583	.17			1.28			.00		
0 199.79	136.48	1.28	137.76	16.3	6.44	.65	138.40	.00	1.37		2.50	.00	.00	0	.00
0 50.21	.00587					.00609	.31			1.28			.00		

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WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 250.00	136.77	1.25	138.02	16.3	6.65	.69	138.71	.00	1.37		2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00611	.00						.00		
0 250.00	136.78	1.28	138.06	16.3	6.46	.65	138.71	.00	1.37		2.50	.00	.00	0	.00
0 10.00	.00500					.00614	.06			1.34			.00		
0 260.00	136.83	1.24	138.07	16.3	6.68	.69	138.77	.00	1.37		2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00618	.00						.00		
0 260.00	136.84	1.27	138.11	16.3	6.50	.66	138.77	.00	1.37		2.50	.00	.00	0	.00
0 192.88	.00596					.00595	1.15			1.27			.00		
0 452.88	137.99	1.27	139.26	16.3	6.50	.66	139.92	.00	1.37		2.50	.00	.00	0	.00
0 33.70	.00596					.00565	.19			1.27			.00		
0 486.58	138.19	1.31	139.50	16.3	6.24	.61	140.11	.00	1.37		2.50	.00	.00	0	.00
0 3.42	.00596					.00503	.02			1.27			.00		
0 490.00	138.21	1.37	139.58	16.3	5.95	.55	140.12	.00	1.37		2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00403	.00						.00		
0 490.00	138.22	1.50	139.72	16.0	5.19	.42	140.14	.00	1.35		2.50	.00	.00	0	.00
0 7.37	.00587					.00357	.03			1.26			.00		
0 497.37	138.26	1.44	139.71	16.0	5.44	.46	140.17	.00	1.35		2.50	.00	.00	0	.00
0 .06	.00587					.00379	.00			1.26			.00		
0 497.42	138.26	1.44	139.71	16.0	5.45	.46	140.17	.00	1.35		2.50	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0 497.42	138.26	1.26	139.53	16.0	6.43	.64	140.17	.00	1.35		2.50	.00	.00	0	.00
0 36.51	.00587					.00588	.21			1.26			.00		

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WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 533.94	138.48	1.26	139.74	16.0	6.43	.64	140.38	.00	1.35	2.50	.00	.00	0	.00
0 32.12	.00587					.00560	.18		1.26			.00		
0 566.06	138.67	1.30	139.97	16.0	6.20	.60	140.56	.00	1.35	2.50	.00	.00	0	.00
0 3.94	.00587					.00501	.02		1.26			.00		
0 570.00	138.69	1.35	140.04	16.0	5.91	.54	140.58	.00	1.35	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00389	.00					.00		
0 570.00	138.70	1.52	140.22	15.6	5.00	.39	140.61	.00	1.34	2.50	.00	.00	0	.00
0 7.60	.00597					.00330	.03		1.24			.00		
0 577.60	138.75	1.46	140.20	15.6	5.25	.43	140.63	.00	1.34	2.50	.00	.00	0	.00
0 3.17	.00597					.00361	.01		1.24			.00		
0 580.77	138.76	1.43	140.19	15.6	5.37	.45	140.64	.00	1.34	2.50	.00	.00	0	.00
0HYDRAULIC JUMP												.00		
0 580.77	138.76	1.24	140.00	15.6	6.42	.64	140.65	.00	1.34	2.50	.00	.00	0	.00
0 255.89	.00597					.00595	1.52		1.24			.00		
0 836.67	140.29	1.24	141.53	15.6	6.42	.64	142.17	.00	1.34	2.50	.00	.00	0	.00
0 29.95	.00597					.00561	.17		1.24			.00		
0 866.62	140.47	1.28	141.75	15.6	6.14	.59	142.34	.00	1.34	2.50	.00	.00	0	.00
0 3.38	.00597					.00496	.02		1.24			.00		
0 870.00	140.49	1.34	141.83	15.6	5.85	.53	142.36	.00	1.34	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00376	.00					.00		
0 870.00	140.50	1.52	142.02	15.1	4.82	.36	142.38	.00	1.31	2.50	.00	.00	0	.00
0 8.48	.00590					.00306	.03		1.22			.00		

1

WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 878.48	140.55	1.46	142.01	15.1	5.06	.40	142.41	.00	1.31	2.50	.00	.00	0	.00
0 6.61	.00590					.00346	.02		1.22			.00		
0 885.09	140.59	1.41	142.00	15.1	5.31	.44	142.43	.00	1.31	2.50	.00	.00	0	.00
0HYDRAULIC JUMP												.00		
0 885.09	140.59	1.22	141.81	15.1	6.35	.63	142.43	.00	1.31	2.50	.00	.00	0	.00
0 51.09	.00590					.00589	.30		1.22			.00		
0 936.18	140.89	1.22	142.11	15.1	6.35	.63	142.74	.00	1.31	2.50	.00	.00	0	.00
0 30.48	.00590					.00557	.17		1.22			.00		
0 966.66	141.07	1.26	142.33	15.1	6.08	.57	142.91	.00	1.31	2.50	.00	.00	0	.00
0 3.34	.00590					.00492	.02		1.22			.00		
0 970.00	141.09	1.31	142.40	15.1	5.79	.52	142.92	.00	1.31	2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00380	.00					.00		
0 970.00	141.10	1.48	142.58	14.7	4.87	.37	142.95	.00	1.29	2.50	.00	.00	0	.00
0 7.37	.00600					.00319	.02		1.19			.00		
0 977.37	141.14	1.42	142.56	14.7	5.11	.41	142.97	.00	1.29	2.50	.00	.00	0	.00
0 2.39	.00600					.00349	.01		1.19			.00		
0 979.76	141.16	1.39	142.55	14.7	5.23	.43	142.98	.00	1.29	2.50	.00	.00	0	.00
0HYDRAULIC JUMP												.00		
0 979.76	141.16	1.19	142.35	14.7	6.35	.63	142.98	.00	1.29	2.50	.00	.00	0	.00
0 73.78	.00600					.00601	.44		1.19			.00		
0 1053.54	141.60	1.19	142.80	14.7	6.35	.63	143.42	.00	1.29	2.50	.00	.00	0	.00
0 46.46	.00600					.00594	.28		1.19			.00		

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WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 1100.00	141.88	1.20	143.08	14.7	6.29	.62	143.70	.00	1.29		2.50	.00	.00	0	.00
0JUNCT STR	.00000					.00589	.00						.00		
0 1100.00	142.38	1.14	143.52	10.8	5.84	.53	144.05	.00	1.18		2.00	.00	.00	0	.00
0 232.46	.00596					.00592	1.38			1.14			.00		
0 1332.46	143.77	1.14	144.91	10.8	5.84	.53	145.43	.00	1.18		2.00	.00	.00	0	.00
0 7.54	.00596					.00562	.04			1.14			.00		
0 1340.00	143.81	1.18	144.99	10.8	5.60	.49	145.48	.00	1.18		2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00418	.00						.00		
0 1340.00	143.82	1.39	145.21	10.3	4.43	.31	145.51	.00	1.15		2.00	.00	.00	0	.00
0 10.13	.00594					.00322	.03			1.11			.00		
0 1350.13	143.88	1.33	145.21	10.3	4.65	.34	145.54	.00	1.15		2.00	.00	.00	0	.00
0 8.81	.00594					.00362	.03			1.11			.00		
0 1358.93	143.93	1.27	145.21	10.3	4.88	.37	145.58	.00	1.15		2.00	.00	.00	0	.00
0 7.56	.00594					.00408	.03			1.11			.00		
0 1366.50	143.98	1.22	145.20	10.3	5.11	.41	145.61	.00	1.15		2.00	.00	.00	0	.00
0 4.39	.00594					.00461	.02			1.11			.00		
0 1370.89	144.00	1.18	145.18	10.3	5.37	.45	145.63	.00	1.15		2.00	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0 1370.89	144.00	1.11	145.11	10.3	5.75	.51	145.63	.00	1.15		2.00	.00	.00	0	.00
0 132.07	.00594					.00587	.78			1.11			.00		
0 1502.96	144.79	1.11	145.90	10.3	5.75	.51	146.41	.00	1.15		2.00	.00	.00	0	.00
0 7.04	.00594					.00555	.04			1.11			.00		

1

WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 1510.00	144.83	1.15	145.98	10.3	5.50	.47	146.45	.00	1.15	2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00431	.00					.00		
0 1510.00	144.84	1.30	146.14	10.0	4.61	.33	146.47	.00	1.13	2.00	.00	.00	0	.00
0 8.39	.00596					.00361	.03		1.08			.00		
0 1518.39	144.89	1.25	146.14	10.0	4.84	.36	146.50	.00	1.13	2.00	.00	.00	0	.00
0 6.66	.00596					.00407	.03		1.08			.00		
0 1525.05	144.93	1.20	146.13	10.0	5.08	.40	146.53	.00	1.13	2.00	.00	.00	0	.00
0 2.81	.00596					.00445	.01		1.08			.00		
0 1527.86	144.95	1.18	146.12	10.0	5.19	.42	146.54	.00	1.13	2.00	.00	.00	0	.00
0HYDRAULIC JUMP												.00		
0 1527.86	144.95	1.08	146.03	10.0	5.75	.51	146.54	.00	1.13	2.00	.00	.00	0	.00
0 209.88	.00596					.00597	1.25		1.08			.00		
0 1737.74	146.20	1.08	147.28	10.0	5.75	.51	147.80	.00	1.13	2.00	.00	.00	0	.00
0 24.45	.00596					.00593	.14		1.08			.00		
0 1762.19	146.34	1.09	147.43	10.0	5.72	.51	147.94	.00	1.13	2.00	.00	.00	0	.00
0 7.81	.00596					.00553	.04		1.08			.00		
0 1770.00	146.39	1.13	147.52	10.0	5.45	.46	147.98	.00	1.13	2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00443	.00					.00		
0 1770.00	146.40	1.25	147.65	9.8	4.75	.35	148.00	.00	1.12	2.00	.00	.00	0	.00
0 7.38	.00584					.00392	.03		1.08			.00		
0 1777.38	146.44	1.20	147.64	9.8	4.98	.39	148.03	.00	1.12	2.00	.00	.00	0	.00
0 5.34	.00584					.00443	.02		1.08			.00		

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WATER SURFACE PROFILE LISTING
69th Avenue Improvements BY: DIBBLE AND ASSOCIATES
CITY OF Peoria, Arizona FILENAME: 69th.DAT
STORM DRAIN DESIGN - HYDRAULIC GRADE LINE, JOB NO: 9702

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 1782.73	146.47	1.15	147.63	9.8	5.22	.42	148.05	.00	1.12		2.00	.00	.00	0	.00
0HYDRAULIC JUMP													.00		
0 1782.73	146.47	1.08	147.55	9.8	5.66	.50	148.05	.00	1.12		2.00	.00	.00	0	.00
0 38.12	.00584					.00581	.22			1.08			.00		
0 1820.84	146.70	1.08	147.78	9.8	5.66	.50	148.28	.00	1.12		2.00	.00	.00	0	.00
0 26.16	.00584					.00612	.16			1.08			.00		
0 1847.00	146.85	1.05	147.90	9.8	5.89	.54	148.44	.00	1.12		2.00	.00	.00	0	.00
0JUNCT STR	.00000					.00579	.00						.00		
0 1847.00	146.86	1.12	147.98	9.8	5.41	.45	148.44	.00	1.12		2.00	.00	.00	0	.00

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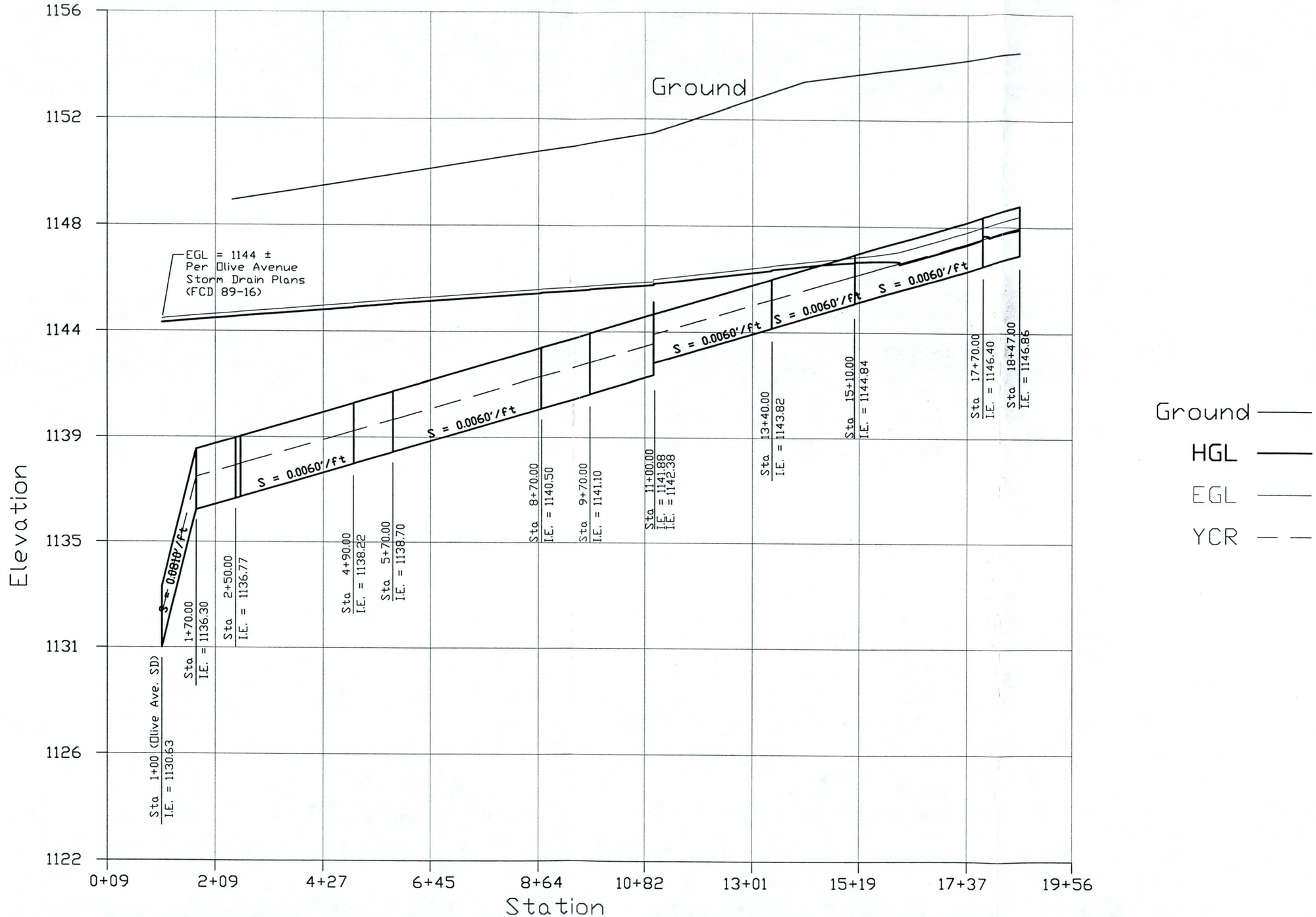
→

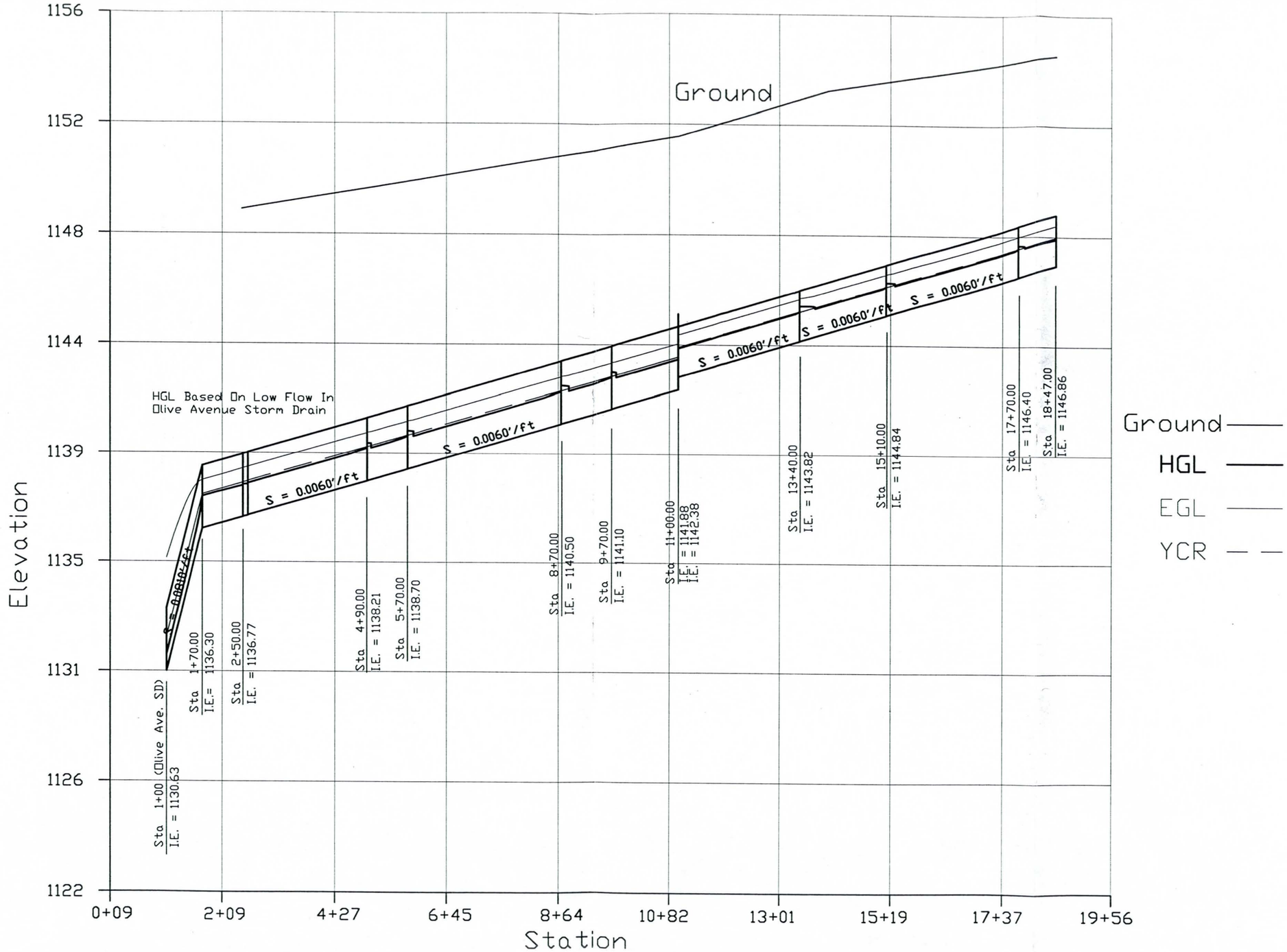
Appendix I

Hydraulic Grade Line Plots
(Produced by Storm Plus)



STORM DRAIN HGL ELEVATIONS

69TH AVENUE: OLIVE AVENUE TO SUNNYSLOPE LANE
(If Olive Avenue Peak Is Concurrent With 69th Ave Peak)



STORM DRAIN HGL ELEVATIONS

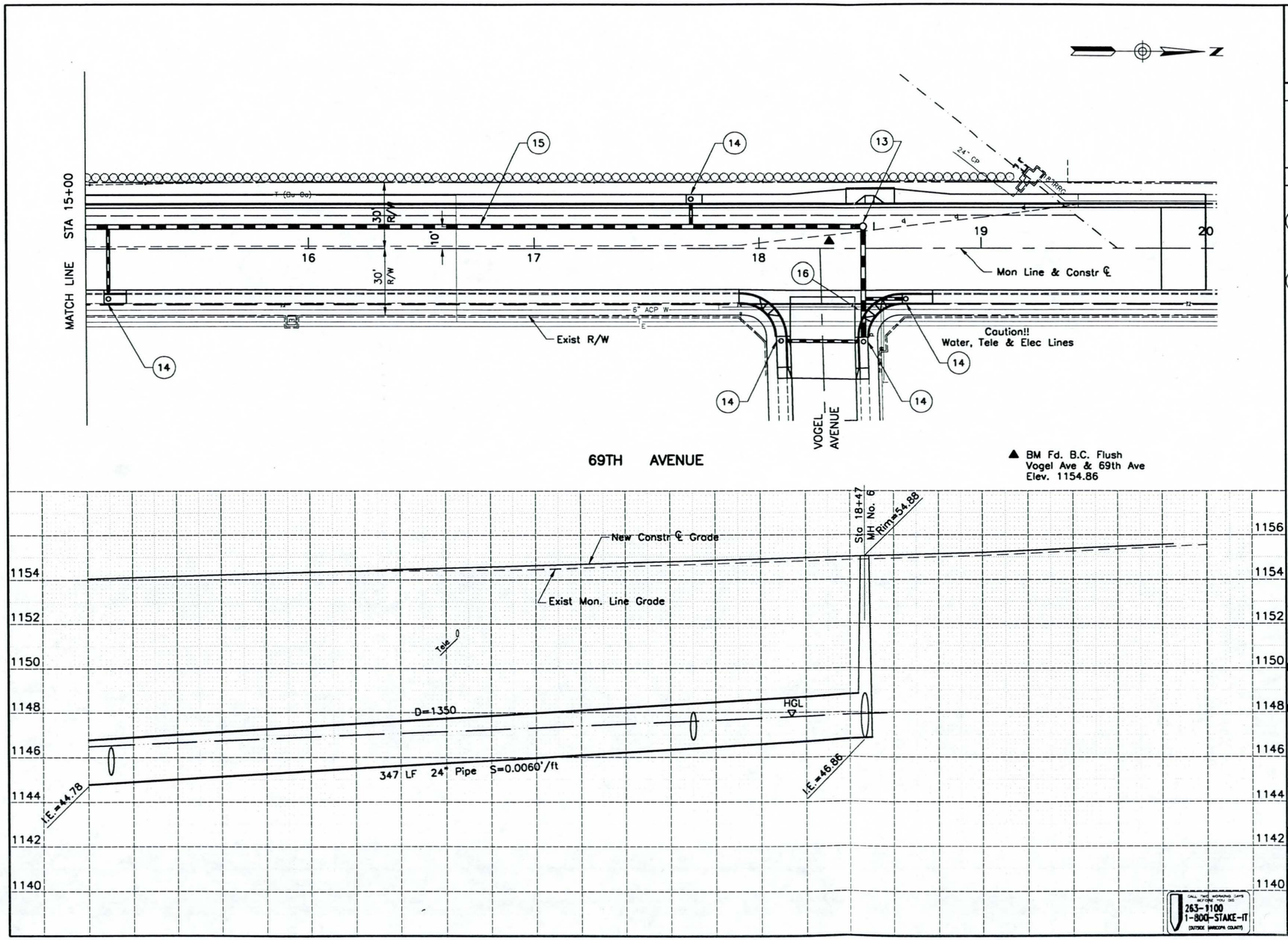
(If 69th Avenue Peak Is Before Olive Avenue Peak)

Appendix J

Preliminary Construction Drawings
(For Information Only)

Appendix K

Topographic Map



DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

REMOVAL NOTES

CONSTRUCTION NOTES

(13) 10' Lt, Sta 18+47
New Manhole, Std Det 520 & 522
(1 Each)

(14) Rt Sta 15+10
New Catch Basin, Std Det P-1569,
M-1, L=6', (1 Each)
New 15" RGRCP, Class III, (30 LF)
New 24"x24"x15" Prefabricated Tee
(1 Each)

Lt Sta 17+70
New Catch Basin, Std Det P-1569,
M-1, L=3', (1 Each)
New 15" RGRCP, Class III, (11 LF)
New 24"x24"x15" Prefabricated Tee
(1 Each)

Rt. 18+12.30 (So. Side Vogel Ave)
(Face of Curb)
New Catch Basin, Std Det P-1569,
M-1, L=10', (1 Each)
New 18" RGRCP, Class III, (34 LF)

Rt Sta 18+44.35 (N. Side Vogel Ave)
(Face of Curb)
New Catch Basin, Std Det P-1569,
M-1, L=10', (1 Each)
New 24" RGRCP, Class III, (50 LF)

Rt Sta 18+70
New Catch Basin, Std Det P-1569,
M-1, L=10', (1 Each)
New 15" RGRCP, Class III, (18 LF)
New 24"x24"x15" Prefabricated Tee
(1 Each)

(15) Sta 15+00 to 18+47
New 24" Pipe, Class III, (347 LF)

(16) Install Pipe Support For 6" ACP W
(N.P.I.)

See Sheet 15 For Conn. Pipe Profiles
See Sheet 9 For Paving

CITY OF PEORIA, ARIZONA
ENGINEERING DEPARTMENT

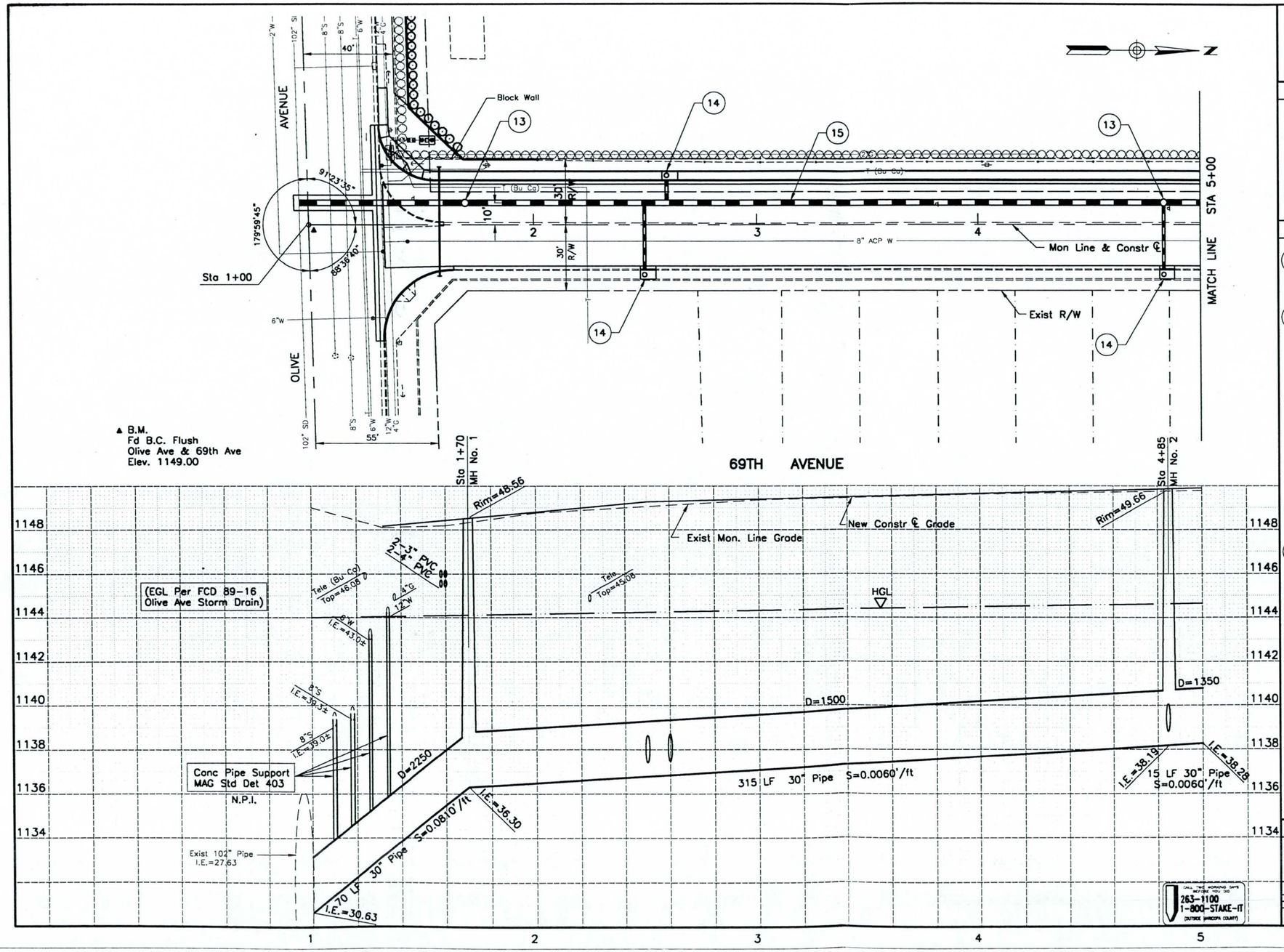
69TH AVENUE IMPROVEMENTS
OLIVE AVENUE TO SUNNYSLOPE LANE
STA 15+00 TO STA 20+00

CALL TWO WORKING DAYS BEFORE YOU DIG
263-9100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

PROJECT NO.			CATALOG NO.				
P-9626							
DESIGN	DRAWN	CHECKED	DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
GPH	DB	NER	11/97	13	19	

SCALE: 1" = 20' HORIZONTAL
1" = 2' VERTICAL

Filename: J:\9702\ACAD\SDPPSH04.DWG Last Revised: 08/19/1997, 08:36:42 Plot Date: 08/19/1997, 10:45:23
Cross References: PPSH=9702PPSH, PLAN=9702PLAN, PROF=sdprof01, PLSH=9702PLSH



DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

REMOVAL NOTES

CONSTRUCTION NOTES

(13) 10' Lt Sta 1+70 & 4+85
New Manhole, Std Det 520 & 522
(2 Each)

(14) Rt Sta 2+50
New Catch Basin, Std Det P-1569, M-1, L=3', (1Each)
New 15" RGRCP, Class IV, (31 LF)
New 30"x30"x15" Prefabricated Tee (1 Each)

Lt Sta 2+60
New Catch Basin, Std Det P-1569, M-1, L=3', (1 Each)
New 15" RGRCP, Class IV, (12 LF)
New 30"x30"x15" Prefabricated Tee (1 Each)

Rt Sta 4+85
New Catch Basin, Std Det P-1569, M-1, L=3', (1 Each)
New 15" RGRCP, Class IV, (31 LF)
Connect to MH 2

(15) 10' Lt Sta 1+00 to 1+70
New 30" Pipe, Class V (70 LF)
Connect To Exist 102" Pipe
Std Det 524

10' Lt Sta 1+70 to 4+85
New 30" Pipe, Class IV (315 LF)

10' Lt Sta 4+85 to 5+00
New 30" Pipe, Class III (15 LF)

See Sheet 14 For Conn. Pipe Profiles
See Sheet 6 For Paving

CITY OF PEORIA, ARIZONA
ENGINEERING DEPARTMENT

69TH AVENUE IMPROVEMENTS
OLIVE AVENUE TO SUNNYSLOPE LANE
STA 1+00 TO STA 5+00

PROJECT NO.			CATALOG NO.			
P-9626						
DESIGN	DRAWN	CHECKED	DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
GRB	DB	SER	11/97	10	19	
SCALE: 1"= 20' HORIZONTAL, 1"= 2' VERTICAL						

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Filename: J:\9702\ACAD\SDPPSH01.DWG Last Revised: 06/18/1997, 17:43:16 Plot Date: 06/19/1997, 10:42:34
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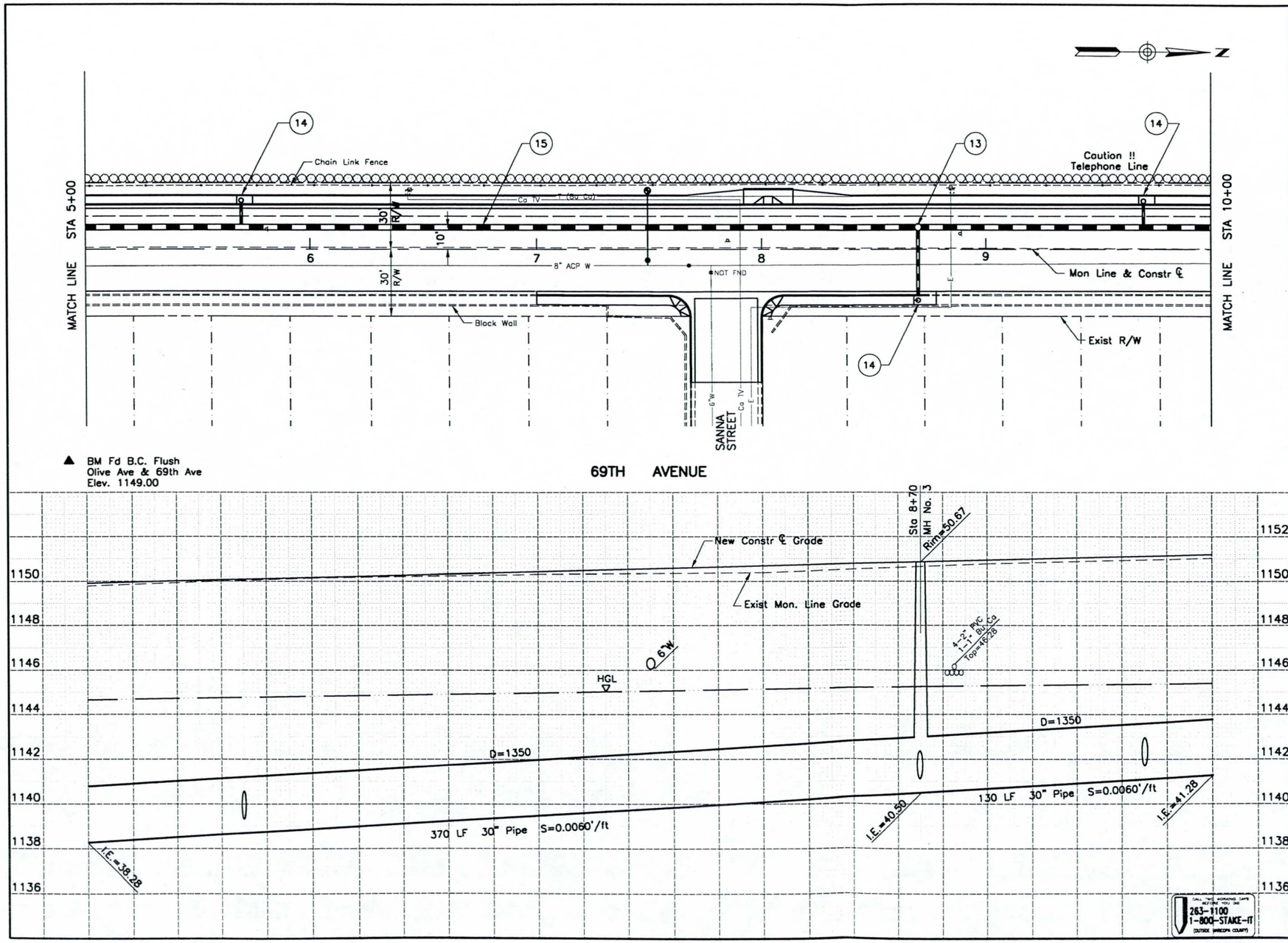

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

REMOVAL NOTES

CONSTRUCTION NOTES

(13) 10' Lt, Sta 8+70
New Manhole, Std Det 520 & 522
(1 Each)

(14) Lt Sta 5+70
New Catch Basin, Std Det P-1569,
M-1, L=3', (1 Each)
New 15" RGRCP, Class IV, (12 LF)
New 30"x30"x15" Prefabricated Tee
(1 Each)

Rt Sta 8+70
New Catch Basin, Std Det P-1569,
M-1, L=6', (1 Each)
New 15" RGRCP, Class III, (30 LF)

Lt Sta 9+70
New Catch Basin, Std Det P-1569,
M-1, L=3', (1 Each)
New 15" RGRCP, Class III, (11 LF)
New 30"x30"x15" Prefabricated Tee
(1 Each)

(15) Sta 5+00 to 10+00
New 30" Pipe, Class III, (500 LF)

See Sheet 14 For Conn. Pipe Profiles
See Sheet 7 For Paving

CITY OF PEORIA, ARIZONA
ENGINEERING DEPARTMENT

69TH AVENUE IMPROVEMENTS
OLIVE AVENUE TO SUNNYSLOPE LANE
STA 5+00 TO 10+00

PROJECT NO.			CATALOG NO.			
P-9626						
DESIGN	DRAWN	CHECKED	DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
GPH	DB	SLR	11/97	11	19	
SCALE: 1"= 20' HORIZONTAL, 1"= 2' VERTICAL						

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Filename: J:\9702\ACAD\SDPPSH02.DWG Last Revised: 08/18/1997, 14:06:16 Plot Date: 08/19/1997, 10:43:33
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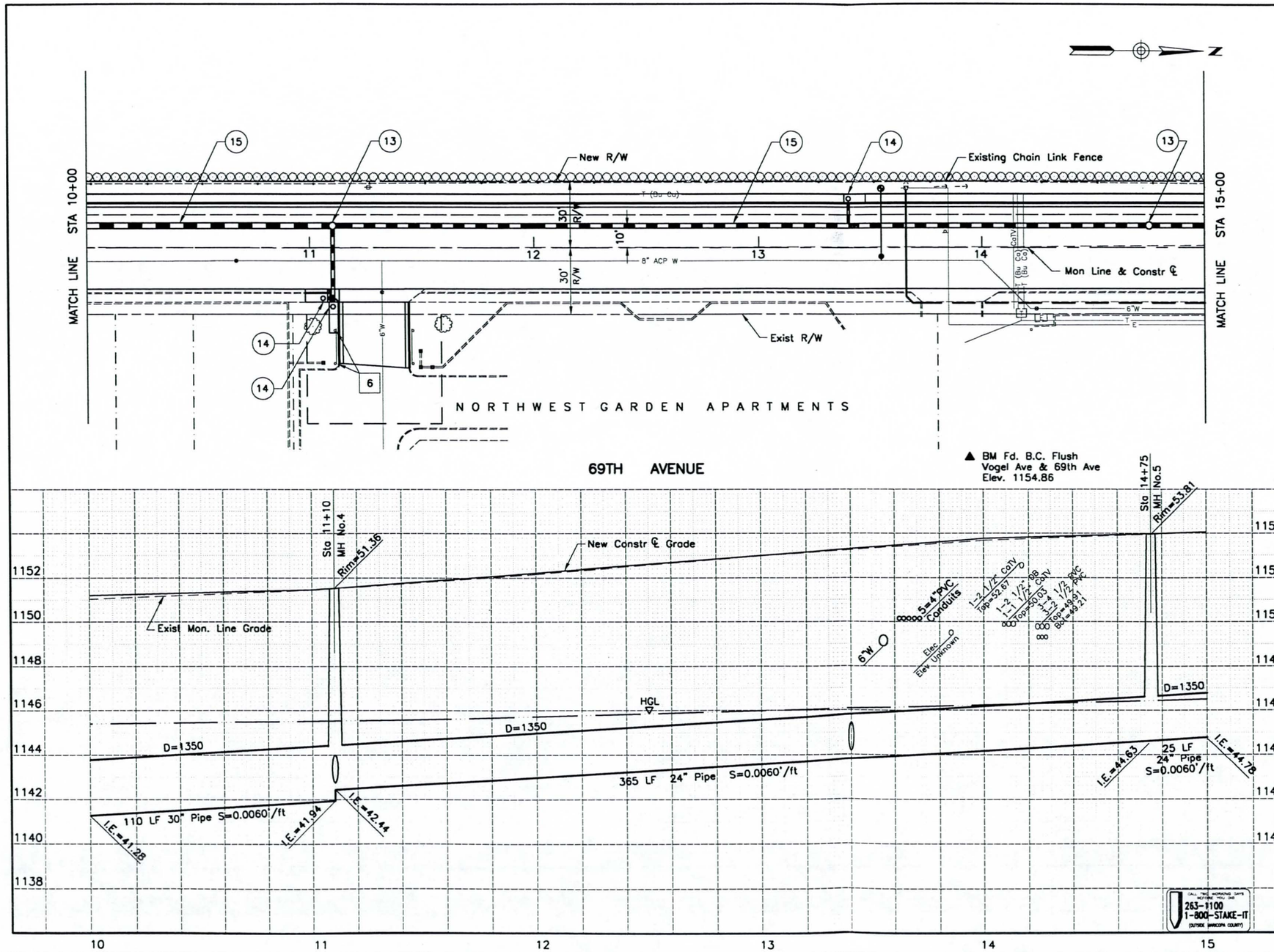


DIBBLE & ASSOCIATES
CONSULTING ENGINEERS

REMOVAL NOTES

CONSTRUCTION NOTES

(13) 10' Lt, Sta 11+10 & 14+75
New Manhole, Std Det 520 & 522
(1 Each)

(14) Rt Sta 11+06
New Catch Basin, Std Det P-1569
M-1, L-6' (1 Each)
New 15" RGRCP, Class III, (3 LF)
New 18"x18"x15" Prefabricated Tee

Rt Sta 11+13.1
Northwest Garden Apts Driveway
New Catch Basin, (Face of Curb)
Std Det P-1569, M-1,L=10'(1 Ea)
New 18" RGRCP, Class III, (33 LF)

Lt Sta 13+40
New Catch Basin, Std Det P-1569
M-1, L=6' (1 Each)
New 15" RGRCP, Class III, (11 LF)
New 24x24x15 Prefabricated Tee

(15) Sta 10+00 to 11+10
New 30" Pipe, Class III, (110 LF)

Sta 11+10 to 15+00
New 24" Pipe, Class III, (390 LF)

RELOCATION NOTES

[6] Rt Sta 11+10
Remove & Relocate Northwest Garden Apts. Gate Posts to Allow for Construction of Catch Basin (N.P.I.)

See Shts 14&15 For Conn. Pipe Profiles
See Sht 8 For Paving

CITY OF PEORIA, ARIZONA
ENGINEERING DEPARTMENT

69TH AVENUE IMPROVEMENTS
OLIVE AVENUE TO SUNNYSLOPE LANE
STA 10+00 TO 15+00

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

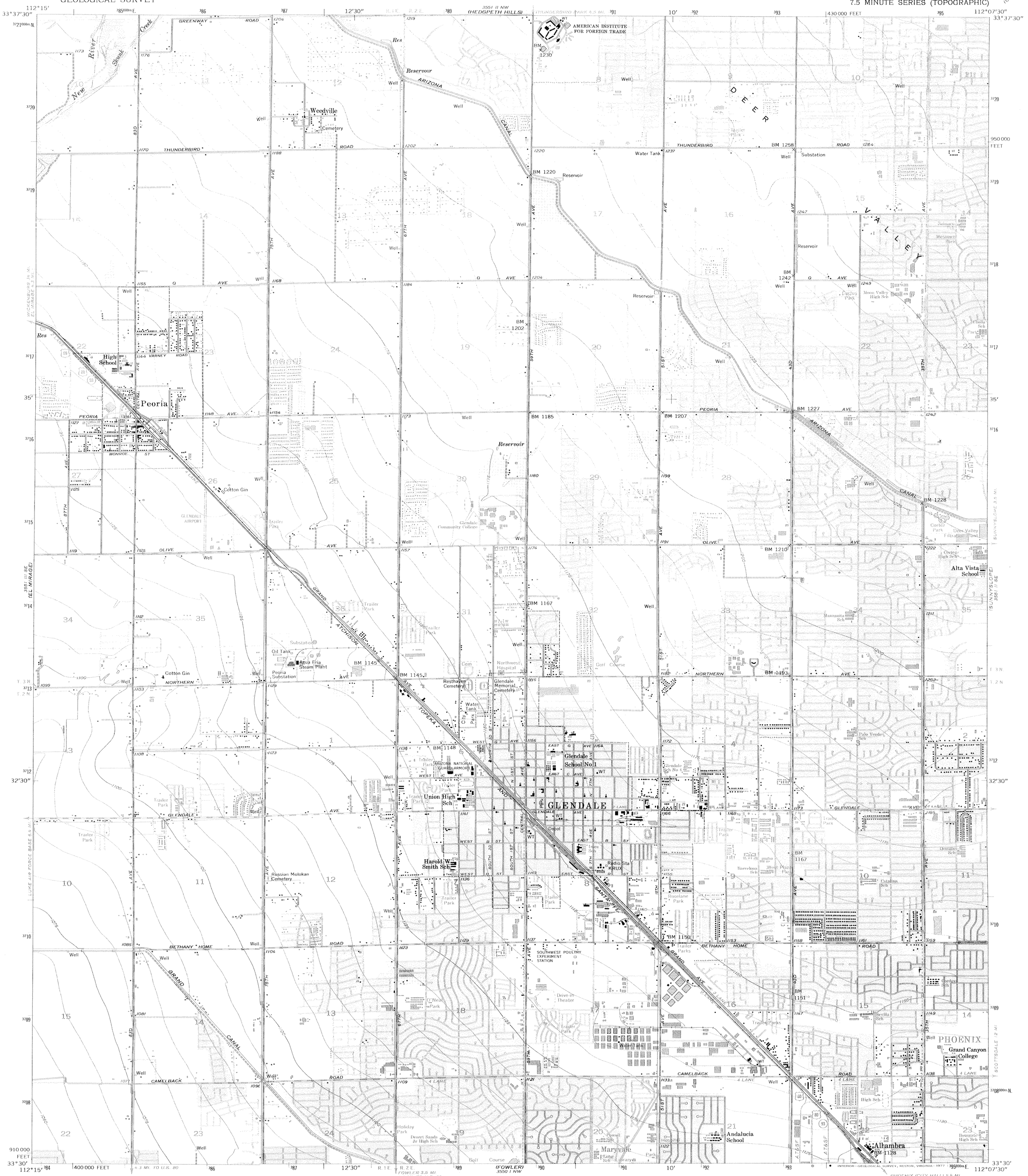
PROJECT NO.			CATALOG NO.			
P-9626						
DESIGN	DRAWN	CHECKED	DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
GPH	DB	MJR	11/97	12	19	

SCALE: 1" = 20' HORIZONTAL, 1" = 2' VERTICAL

Filename: J:\9702\ACAD\SOPPSH03.DWG Last Revised: 08/18/1997, 17:47:13
Cross References: PPSH=9702PPSH, PLAN=9702PLAN, PROF=sdprof01, PLSH=9702PLSH
Plot Date: 08/19/1997, 10:44:26

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GLENDALE QUADRANGLE
ARIZONA—MARICOPA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS, and USC&GS

Culture and drainage compiled from aerial photographs taken 1954. Topography by planetable surveys 1957

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Revisions shown in purple compiled from aerial photographs taken 1971 and 1974. This information not field checked

Purple tint indicates extension of urban areas

UTM GRID AND 1974 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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

QUADRANGLE LOCATION

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ROAD CLASSIFICATION

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

GLENDALE, ARIZ.
N3330—W11207.5/7.5

1957
PHOTOREVISED 1971 AND 1974
AMS 3551 II SW—SERIES V898