2004P002

CMX

TRES RIOS LANDING

FINAL DRAINAGE REPORT
for
PARCELS 4 and 5

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Revised January 2003
Revised October 2002
May 2002
CMX Project No. 6125.01

DRAINAGE REPORT
TRES RIOS LANDING
Parcels 4 and 5

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I. INTRODUCTION

Tres Rios Landing is located in the City of Avondale within Section 14, T1N R1W. Parcels 4 and 5 are proposed as a single-family development. The two parcels are located in the southern portion of the Tres Rios Landing site (see Exhibit "A"). Parcel 4 consists of 147 lots (45' x 110' minimum size) on 26.14 net acres with a net density of 5.62 units per acre. Parcel 5 contains 119 lots (53' x 110' minimum size) on 29.84 net acres with a net density of 3.99 units per acre.

The purpose of this study is to evaluate the runoff potential of the site and develop hydraulic structures to convey these onsite runoffs to the downstream golf course or park site drainage easements.

The Maricopa County, Arizona and Incorporated Areas Flood Insurance Rate Map (FIRM) panel number 04013C2090F, dated September 30, 1995, indicates that the site falls within Flood Zone "X" (see Exhibit "D"). Zone "X" is defined by the Federal Emergency Management Agency (FEMA) as "Areas determined to be outside 500-year flood plain".

The site slopes southerly at approximately 0.27 percent. For number and size of lots and site density (see Exhibit "B").

II. OFF-SITE DRAINAGE

A. Agua Fria River Levee

At the Tres Rios Landing eastern boundary the site is protected against the 100-year flow in the Agua Fria River by a levee constructed on the river's west bank.

The 100-year water surface elevations within the Agua Fria River are shown on Drainage Map Exhibit B and are based on the Flood Insurance study results published by F.E.M.A. (See Appendix E).

B. Eliseo C. Felix Jr. Way Drainage Corridor

Just north of Parcels 4 and 5 of Tres Rios Landing is a proposed 9.00-acre commercial site (Parcel 1), a 16.39-acre Court Homes site (Parcel 3), and a 7.28-acre multi-family development (Parcel 2); all scheduled for future development. Additionally, there is an existing multi-family site pictured on Exhibit A as "The Village at Avondale Apartment Complex."

Existing catch basins as shown on Exhibit "C" were designed by Stantec Consulting Inc. to convey runoff from Buckeye Road onto Parcel 3 (proposed Commercial site) and Parcel 2 (proposed Multi-Family Development). The runoff from Buckeye Road was considered in the runoff calculations from the watershed north of the site (See Appendix C, Section C-1 for development of runoff values).

10-year and 100-year Q's were calculated at key Concentration Points (CP) along Eliseo C. Felix Jr. Way using the Rational Method. (See Appendix C, Section C-2).

It was assumed in this study that retention volume will be provided in Parcels 1, 2, and 3 when they are developed to the north that will retain the 100-year, 6-hour runoff volume allowing no offsite flow to enter the Eliseo C. Felix Jr. drainage corridor.

Hec-1 not applicable

In order to minimize the excess 100-year surface flows along the corridor a HEC-1 hydrologic method was developed to duplicate the 100-year Q's developed by the Rational Method. This model added the onsite 100-year onsite flow hydrographs with flow peaks not adding Peak-to-Peak. (See HEC-1 Output in Appendix C, Section C-4). The 100-year HEC-1 Q's (as tabulated in Table 4, of Appendix C, Section C-1) were used to develop HEC-RAS backwater calculation for surface flow along the corridor. (See Appendix C, Section C-5 for HEC-RAS Results).

This HEC-1 model noted above also included the 100-year, 6-hour runoff calculation for rainfall on the existing unimproved sites of Parcel 1, 2, and 3. An interim retention basin was sized to retain this offsite runoff. HEC-1 determined that a basin with the volume of 6.46 AC-Ft will retain the 100-year, 6-hour runoff from the unimproved sites. A basin with a constant 4 to 1 side slope and 3-Ft depth will require a surface area of 2.32 acres (See Appendix C, Section C-5 for Calculations).

C. Dysart Road Drainage Corridor

As-built drawings record an existing ADOT 10-year capacity storm drain aligned in Buckeye Road conveying flows from the west, with a 33-inch RGRCP storm drain. The storm drain turn south in Dysart Road and end in a ditch paralleling the Dysart Road alignment at a point approximately 315 feet south of Buckeye Road. Field investigation revealed the existing pipe to be a 36-inch pipe laid at an estimated longitudinal slope of 0.45 percent. ADOT calculated the design flow in Reference 6 to be 22.45 cfs. (See Appendix D, Section D-2).

Calculations were performed herein to determine the 100-year surface flow remaining in Buckeye Road as flow exceeding the storm drains capacity for a 10-year storm. It was determined that 27.49 cfs will remain as surface flow in Buckeye Road and was assumed to turn in Dysart Road and flow southerly (See Appendix D, Section D-1 for Calculations).

10-year and 100-year Q's along the drainage corridor were determined. Runoff values at key Dysart Road stations were summed up from the following sources:

1. 10-year Q from ADOT Storm Drain
2. 100-year excess surface Q from Buckeye Road
3. Q's from Harrison Drive
4. Q's from Dysart Road Right-of-Way

As a part of the Dysart Road Improvements the existing 10-year ADOT storm drain will be extended south in Dysart Road to Harrison Drive where it will discharge into a drainage ditch paralleling Dysart Road. A hydraulic backwater calculation was performed on the storm drain using the StormCAD computer program of the Haestad Methods, Inc. For computer output (See Appendix D, Section D-5).

A HEC-RAS hydraulic model was used to determine a Hydraulic Grade Line (H.G.L.) profile for surface flow in the drainage corridor. The conveyance included a parallel drainage channel and/or Dysart Road right-of-way.

HEC-RAS Results

10-Year Runoff

In Dysart Road north of Harrison Drive the 10-year flow depth will vary to a maximum of 0.26 Ft. above the gutter.

The 10-year runoff south of Harrison Drive will be contained within the parallel channel.

100-Year Runoff

In Dysart Road north of Harrison Drive the 100-year flow depth will vary to a maximum of 0.64 Ft. (less than 8-inch) above the gutter.

The 100-year flow depth south of Harrison Drive will be contained within the parallel channel.

Note: (See Appendix D, Section D-4 for HEC-RAS Computer Output).

Catch basins and a storm drain laterals were evaluated for interception and conveyance of 10-year runoff concentrating in Harrison Drive near Dysart Road. The storm drain laterals will be aligned in Harrison Drive and discharge into the parallel channel near the Dysart Road storm drain outlet.

The length of curb opening catch basins necessary to convey 10-year flow on the east side of Dysart into the channel was calculated (See Section D-3 of appendix D). An interim v-ditch located within the unimproved west half the Dysart Road right-of-way was evaluated as a conveyance of the 100-year excess flow in the west half of the street right-of-way. This ditch will carry the flow southerly following the existing drainage direction. (See Appendix D, Section D-3 for Calculations).

III. ON-SITE DRAINAGE

The recommended onsite grading for the Tres Rios Landing development ensures the continuance of existing drainage patterns. Onsite drainage was evaluated based on the following criteria:

A. Assumptions and Given Data

1. The Rational Method as set forth in Reference No. 1 was used to calculate the 10-year, 2-hour and 100-year, 2-hour onsite runoff.

   The onsite local street system was designed to convey the peak 10-year storm without overtopping the curb, and to contain the 100-year storm within the street right-of-way. Where possible, this was accomplished with the use of 4" roll curb and gutter. The 6" vertical curb and gutter was specified where the two conditions noted above were exceeded.

   Exception to the above occur at certain locations along the Eliseo C. Felix drainage corridor, where 100-year street flows exceeded the maximum 8-inch depth specified by Maricopa County. Limitation is storm drain design due to constraints caused by site grading and/or subsurface utility conflicts. This was discussed with Jim Badowich of City of Avondale Engineering Division in a project design meeting with Ron Hilgart and Del

Fox on 9/6/02. It was pointed out also that residential ingress and egress will be provided by local streets other than Eliseo C. Felix Jr. Way during a 100-year storm. Jim Badowich considered this an acceptable condition. It was requested that the inundation limits of the depths be shown in the drainage report; and exhibits E and F were included in the October 2002 revision showing the inundation areas adjacent to the streets.

2. Assumptions

   a. Area (A) in acres from Exhibit B
   b. Drainage Length (L) in ft. from Exhibit B
   c. Average Street Velocity (V) per Figure 3
   d. Lot Tc = 10 minutes
   e. Runoff Coefficient per (C) Reference No. 1 (Figure 4)

B. Rainfall Intensity:

$I = i_p (P^6_{10})/2.07$ Equation 3.3 Reference No. 1

Where:

I	= the desired intensity for a given duration and frequency
i_p	= the intensity for Phoenix Metro area. (See Figure 1)
P^6_{10}	= the 10-year, 6-hour, precipitation depth at the point of interest (Figure 2).

For tabulation of intensities (I) for various times of concentrations, (see Appendix A).

C. Runoff Rates, Q = CIA was determined based on data developed from the Onsite Drainage Map. (See Exhibit B).

D. Street Capacities:

In order to evaluate the flow capacities of the local onsite streets discharge vs. street slope tables where developed based on the normal depth Manning's formula. Tables were developed for four (4) different conditions:

1. 4-inch curb with flow depth to top of curb.
2. 4-inch curb with flow depth to R/W.
3. 6-inch curb with flow depth to top of curb.
4. 6-inch curb with flow depth to R/W.

(See Appendix B, Sections B-1 & B-2) for development of street capacity tables. Tables 1 and 2 are summaries of onsite street flows and capacities.

TABLE 1
ONSITE STREET CAPACITIES - PARCEL 4

Street & Loc.	CALC. Q (cfs)		Street Slope Ft/Ft	(1) Curb Type	STREET CAPACITY (cfs)			
	10-year	100-year			4" curb @ TOC	4" curb @ R/W	6" curb @ TOC	6" curb @ R/W
Corral Street - west	4.12	8.13	0.0030	4"	8.77	17.04	-	-
9th Street	4.12	8.13	0.0030	4"	8.77	17.04	-	-
Doris Street - west	7.52	14.91	0.0038	4"	9.87	19.18	-	-
Doris Street- center	2.93	5.76	0.0029	4"	8.62	16.76	-	
Corral Street - east	9.76	19.52	0.0034	6"	-	-	30.48	41.42
E.C.F. Way	9.76	19.52	0.0025	6"	-	-	26.13	35.52
Doris Street - east	7.96	15.79	0.0047	4"/6"	10.98	21.33	35.83	48.70
E.C.F. Way	14.80	29.76	0.0025	6"	-	-	26.13	35.52
9th Street	5.25	10.31	0.0025	4"	8.01	15.56	-	-
Dee Street - west	7.04	13.97	0.0035	4"	9.47	18.41	-	-
Dee Street - center	1.72	3.37	0.0030	4"	8.77	17.04	-	-
Dee Street - east	6.79	13.47	0.0040	4"	10.13	19.68	-	-

(1) 4" indicates 4-inch roll curb. 6" indicates 6-inch vertical curb.

TABLE 2
ONSITE STREET CAPACITIES - PARCEL 5

Street & Loc.	CALC. Q (cfs)		Street Slope Ft/Ft	(1) Curb Type	STREET CAPACITY (cfs)			
	10-year	100-year			4" curb @ TOC	4" curb @ R/W	6" curb @ TOC	6" curb @ R/W
9th Street	3.67	7.15	0.0040	4"	10.13	19.68	-	-
Randy Street	7.08	14.03	0.0031	4"	8.91	17.31	-	-
E.C.F. Way	1.99	43.00	0.0025	6"	-	-	26.13	35.52
9th Street	3.72	7.31	0.0043	4"	10.50	20.41	-	-
Harrison Drive	8.40	16.66	0.0043	4"	10.50	20.41	-	-
E.C.F. Way	0	44.67	0.0025	6"	-	-	26.13	35.52
Overlin Drive	9.29	18.60	0.0030	6"	-	-	28.63	38.91
Davis Lane	9.06	17.98	0.0030	6"	-	-	28.63	38.91
E.C.F. Way	0	50.01	0.0025	6"	-	-	26.13	35.52
Locust Lane	6.24	12.37	0.0025	4"	8.01	15.56	-	-
E.C.F. Way	0	61.01	0.0025	6"	-	-	26.13	35.52
9th Street	2.86	5.65	0.0034	4"	9.34	18.15	-	-
Whyman Ave	3.17	6.29	0.0061	4"/6"	12.51	24.30	40.82	55.94

(1) 4" indicates 4-inch roll curb. 6" indicates 6-inch vertical curb.

2. A waiver request for longitudinal street slopes less than 0.50% has been submitted to the Avondale City Engineer. See Appendix B, Section B-2 for copy of Waiver Request.

3. (See Exhibit B) for locations where 6-inch curbs are required.

E. Scupper and Catch Basin Capacities

The length of depressed scupper and catch basin openings for total interception was determined by the following equation from Reference No. 2

$L_T = 0.6\ (Q/CF)^{0.42}\ S^{0.3}\ (1/(NS_e)^{0.6}$ (Equation 3.4)

Where:
- Q = Total gutter flow
- S = Longitudinal Street Slope
- S_e = $S_x + S_wE_o$
- S_X = Pavement Cross Slope = .020
- S_w = Cross slope of the gutter
- E_o = Ratio of flow in depressed section of gutter to total gutter flow
- N = 0.015
- CF = Clogging Factor per Table 3.2, Reference 2

The efficiency of opening shorter than the length for total interception is:

$E = 1 - (1 - L/L_t)^{1.8}$ Equation 3.5, Reference No. 2

Where:
- L = Actual Opening
- L_t = Length of 100% Interception

For capacity of scupper and catch basin openings in sump:

$Q_i = Cw\ (L + 1.8W)d^{1.5}\ (CF)$

Where:
- Cw = 2.3
- W = 2 ft. for catch basin, 1.42 ft. for scupper
- d = 0.33 ft. for 4" roll curb or
  0.50 ft. for 6" curb and gutter.
- CF = Clogging Factor per Table 3.2, Reference No. 2

F. Storm Drain and Catch Basin Hydraulics

An onsite storm drain aligned within Parcel 4 Tract E crossing Dee Street will collect the 10-year runoff from the western portion of Parcel 4 and direct it to the basin in Tract B (See Appendix E, Section E-2 for Calculations). An onsite storm drain aligned within Eliseo C. Felix, Jr. Way and Parcel 4 Tract C and Parcel 5 Tracts E and F will collect excess offsite runoff from the northeast, runoff from the western portion of Parcel 4 and the majority of Parcel 5 and direct it to the basin in Parcel 5 Tract A. Storm drain sizes were determined based on Hydraulic Grade Line (H.G.L.) computations. For storm drain and catch basin calculations (See Appendix C, Section C-3).

G. Retention Basins and Drywells

Onsite retention basins were sized for the required volume of the 100-year, 2-hour storm based on the equation V=C'(P/12)A.

Where:
- V = required retention volume in acre-feet
- C' = weighted runoff coefficients from Figure 4
- P = 100-year, 2-hour precipitation from Figure 5
- A = contributing drainage are in acres

Basins were assumed to have a 3.0 ft water depth, 0.5 ft freeboard and constant 4:1 side slopes except in those areas where sidewalks and recreational amenities are present and slopes are designed to meet ADA requirements. Table 3 summarizes the onsite retention basins.

TABLE 3
Onsite Retention Basin Summary

Retention Basin	Contributing Drainage Area (Ac.)	Required Retention Volume (Ac. Ft.)	Retention Provided (Ac. Ft.)	Dry Wells
Parcel 4 Tract B	10.40	1.67	2.78	1
Parcel 5 Tract A	43.36	6.98	7.10	5

(See Appendix E, Section E-2 for calculations).

Drywells necessary to drain a basin within a 36-hour period are to be installed in each retention basin. Drywell percolations are based on the percolation tests for the project by CSI in Appendix E, Section E-2. Additionally, the basin in Tract A may be allowed to "bleed-off" to the existing drainage way to the south. The bleed-off rate shall not be allowed to exceed the peak flow rate from offsite drainage areas mixed within the basin.

The number of drywells tabulated above were calculated based on the conservative value of 0.5 cfs maximum per well specified in Reference 2 as a means of compensation for well deterioration over time. As instructed by the Engineering Division of the City of Avondale a single dry well per basin may be initially constructed and tested. Based on the tested disposal rate of this single well, additional wells are to be installed as needed to meet the 36-hour drain time.

For drywell calculations (See Appendix E, Section E-2).

An emergency spillway for the basin in Parcel 4 Tract B shall be located at the intersection of 9th Street and Randy Street. This weir's outlet elevation shall be set at the back of sidewalk elevation. The lowest adjacent finish floor elevation is 1.27' above the weir. Runoff excess of the basin capacity will flow easterly in Randy Street then southerly in the Eliseo C. Felix Jr. Drainage Corridor ultimately discharging into Parcel 5 Tract A Retention Basin. This is historically the ultimate destination of runoff from the undeveloped site.

An emergency spillway for the basin in Parcel 5 Tract A shall be located at the southern apex of the property. This weir outlet shall be set at an elevation that will allow runoff in excess of the basin capacity to spill over into the existing downstream drainage ditch, which is historically the ultimate destination of runoff from the undeveloped site. The lowest adjacent finish floor elevation is 2.62' above the weir.

IV. CONCLUSIONS

The design of grading and drainage meets the criteria set forth in the Drainage Design Manual for Maricopa County and City of Avondale Engineering Design Standards.

Flow depth in Dysart Road has been limited to a maximum depth equal to or less than 8-7/8 inches above the gutter for the 100-year, 6-hour storm.

All onsite local roads, except Eliseo C. Felix Jr. Way meet the flow depth requirements for either 4-inch roll curbs or 6-inch vertical curbs. In Eliseo C. Felix Jr. Way with 6-inch vertical curbs, flow depths to a maximum of less than 1.00 Ft. above the gutter were calculated. These flow depths were due primarily to backwater effects of restricted flow conveyance across Tracts E, F, & C.

No lots will be inundated by floodwaters from a 100-year 2-hour storm. Only five lots will have any inundation from a 100-year 6-hour storm. As shown on Exhibit E, Parcel 4 Site Inundation Map, 100-Year 6-Hour Storm, a portion of the front yards of Lots 102 and 147 will be inundated by this storm. As shown on Exhibit F, Parcel 5 Site Inundation Map, 100-Year 6-Hour Storm, a portion of the front yards of Lots 50, 70 and 108 will be inundated by this storm.

V. REFERENCES

1. *Drainage Design Manual for Maricopa County, Arizona.* Volume I, Hydrology. Flood Control District of Maricopa County. January 28, 1996

2. *Drainage Design Manual, Maricopa County, Arizona.* Volume 2, Hydraulics. Flood Control District of Maricopa County. January 28, 1996

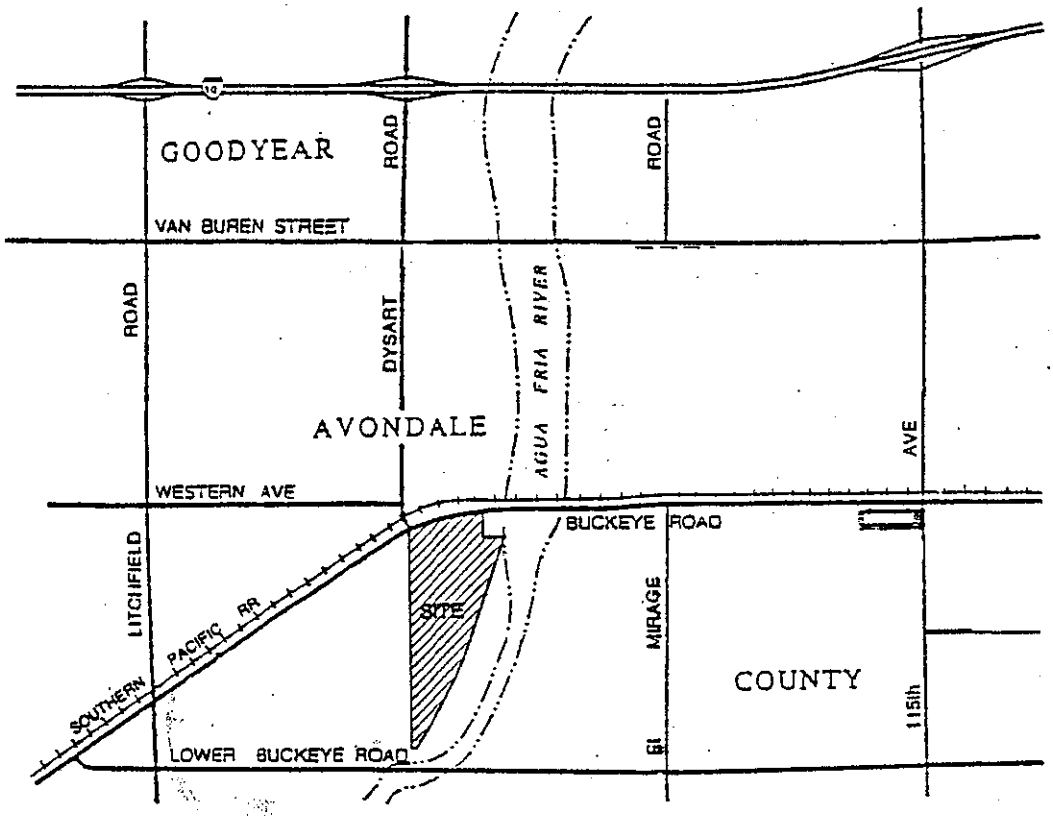
3. *Drainage Design Report for Rose Terrace.* Hoskin Engineering Consultants, Inc. February 8, 2001, revised May 9, 2001

4. *Engineering Design Standards.* City of Avondale, Public Works Department, Engineering Division. June 1997, revised September 2, 1999.

5. *Flood Insurance Rate Map 04013C2090F.* Federal Emergency Management Agency. September 30, 1995.

6. Hydraulic Studies, Buckeye Phoenix Highway, Avondale Street, Project No. S-371-503, ADOT, January 6, 1971.

7. *Drainage Report for Tres Rios Landing*, A Planned Area Development, CMX, L.L.C., Revised October 2, 2001.



BENCHMARK

The Benchmark Is Brass Cap In Handhole (Most Easterly) In The Area Of Intersection Of Dysart Road And Buckeye Road.

ELEVATION = 960.70 City of Avondale Datum

N

EXHIBIT A

VICINITY MAP

NOT TO SCALE

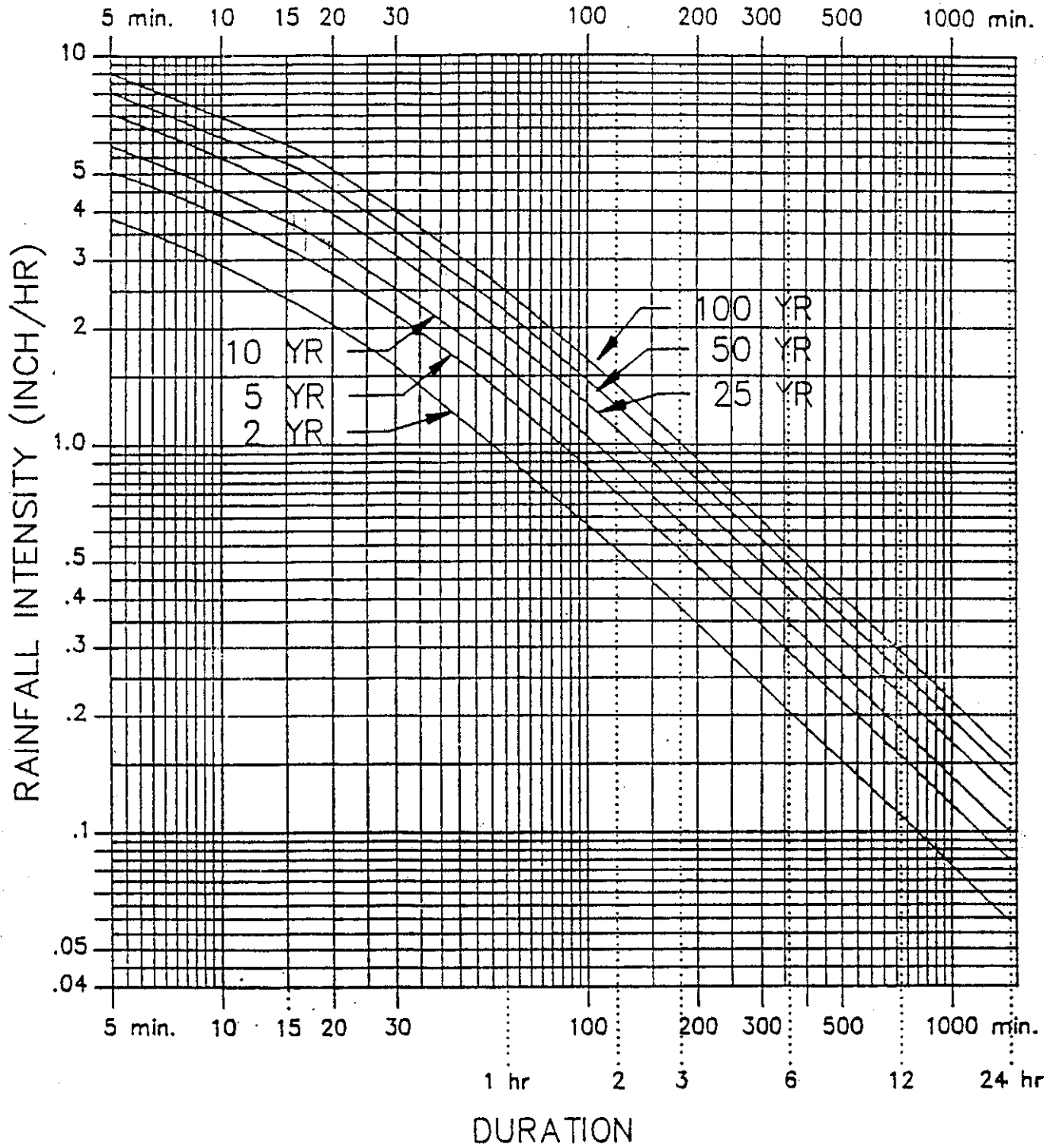
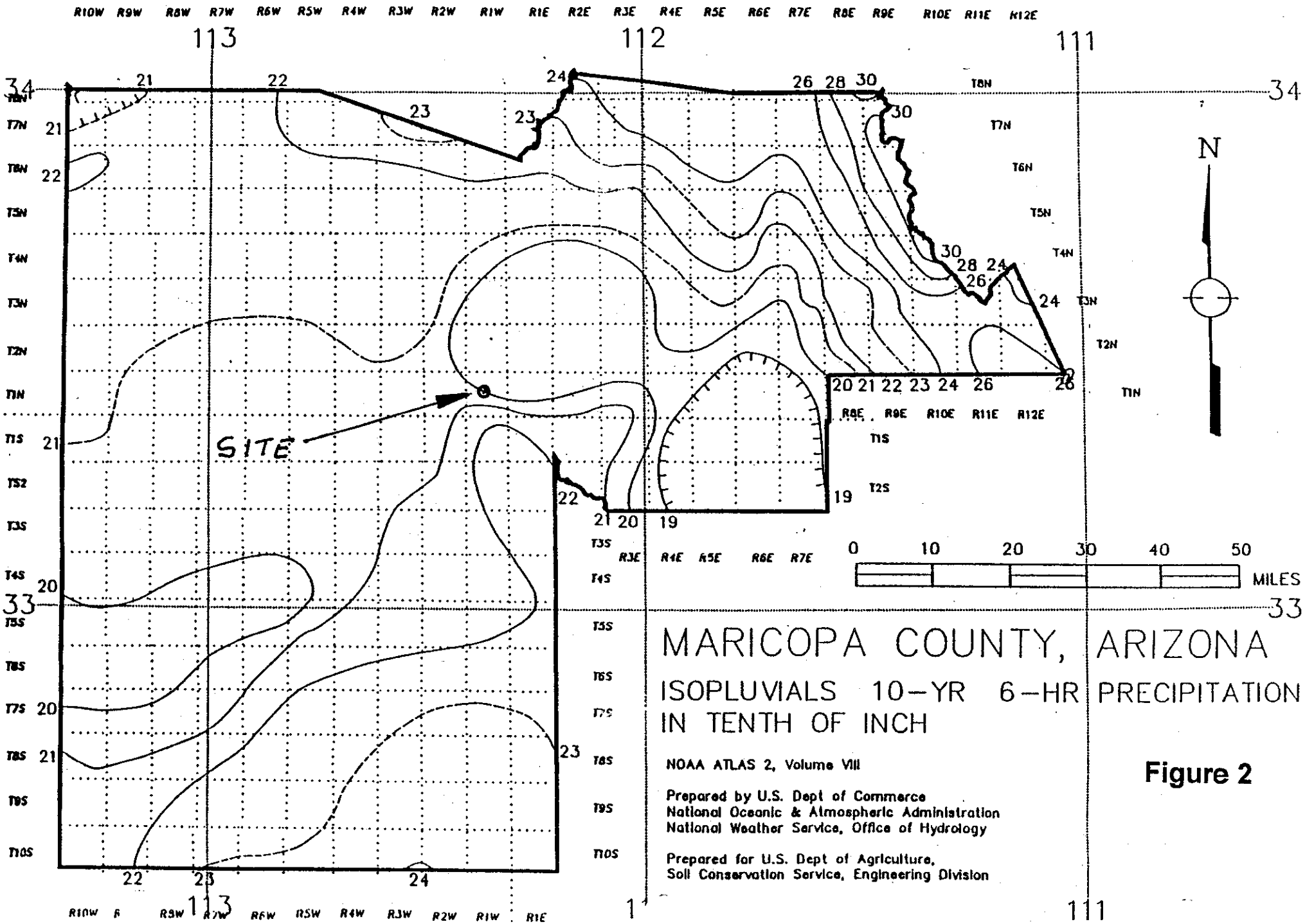


Figure 1

Rainfall Intensity-Duration-Frequency Relation
(Phoenix Metro Area)


MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 10-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division
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0 10 20 30 40 50
MILES
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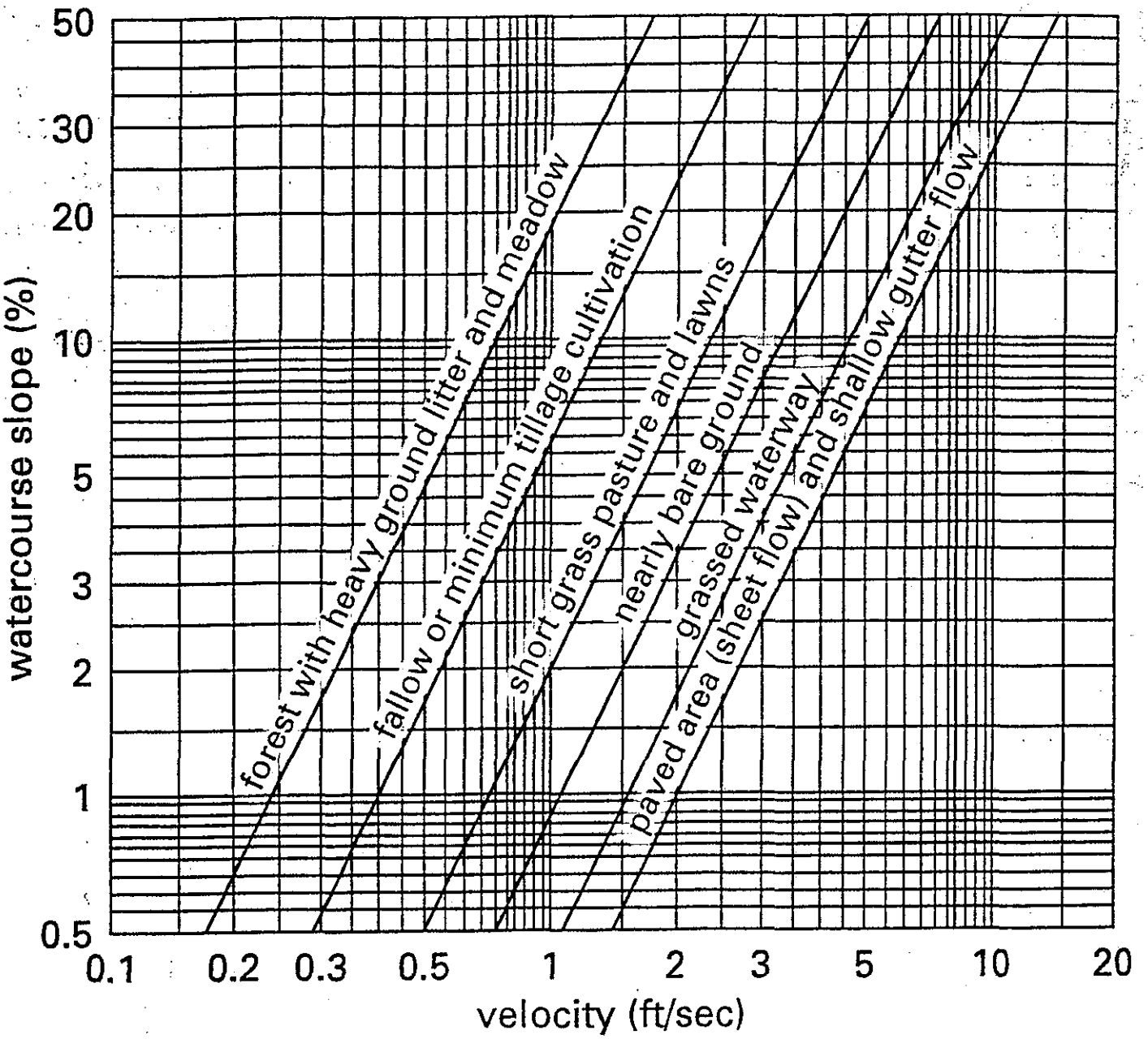
Figure 2



SCS Average Velocity Chart for Overland Flow Travel Time

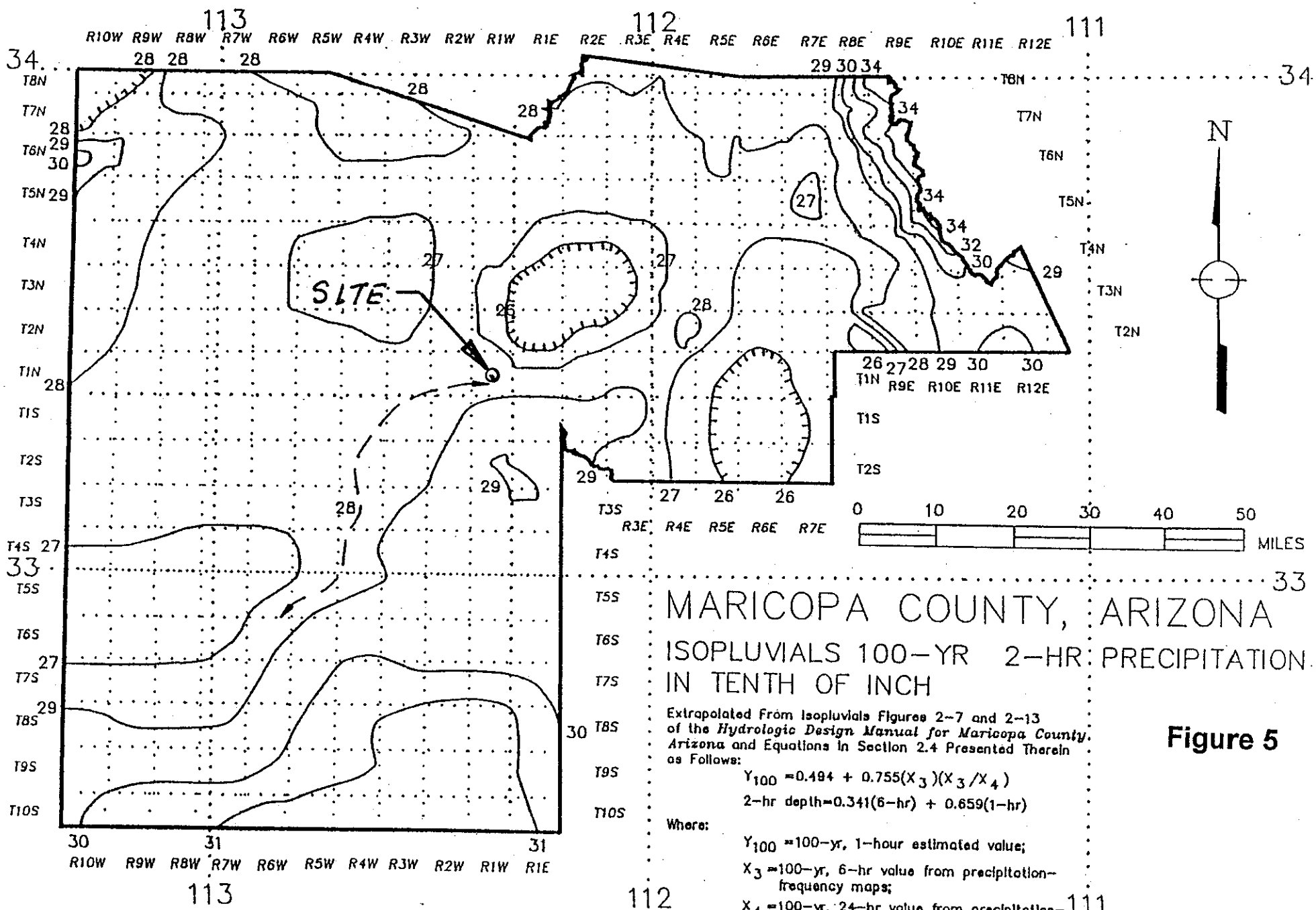
Figure 3

Figure 4

C Coefficients for Use with the Rational Method

Land Use	Return Period			
	2-10 Year	25 Year	50 Year	100 Year
Streets and Roads				
Paved Roads	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Gravel Roadways & Shoulders	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Industrial Areas				
Heavy	0.70 – 0.80	0.77 – 0.88	0.84 – 0.95	0.88 – 0.95
Light	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Business Areas				
Downtown	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Neighborhood	0.55 – 0.65	0.61 – 0.72	0.66 – 0.78	0.69 – 0.81
Residential Areas				
Lawns – Flat	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
– Steep	0.25 – 0.40	0.28 – 0.44	0.30 – 0.48	0.31 – 0.50
Suburban	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Single Family	0.45 – 0.55	0.50 – 0.61	0.54 – 0.66	0.56 – 0.69
Multi-Unit	0.50 – 0.60	0.55 – 0.66	0.60 – 0.72	0.63 – 0.75
Apartments	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Parks/Cemetaries	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
Playgrounds	0.40 – 0.50	0.44 – 0.55	0.48 – 0.60	0.50 – 0.63
Agricultural Areas	0.10 – 0.20	0.11 – 0.22	0.12 – 0.24	0.13 – 0.25
Bare Ground	0.20 – 0.30	0.22 – 0.33	0.24 – 0.36	0.25 – 0.38
Undeveloped Desert	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Mountain Terrain (Slopes > 10%)	0.60 – 0.80	0.66 – 0.88	0.72 – 0.95	0.75 – 0.95

Note: Values of C for 25, 50 and 100 Year were derived using frequency adjustment factors of 1.10, 1.20, and 1.25, respectively, with an upper limit of 0.95 for C for the 2-10 Year values.



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100-YR 2-HR PRECIPITATION IN TENTH OF INCH

Extrapolated From Isopluvials Figures 2-7 and 2-13 of the *Hydrologic Design Manual for Maricopa County, Arizona* and Equations in Section 2.4 Presented Therein as Follows:

$$Y_{100} = 0.494 + 0.755(X_3)(X_3/X_4)$$

$$\text{2-hr depth} = 0.341(\text{6-hr}) + 0.659(\text{1-hr})$$

Where:

Y_{100} = 100-yr, 1-hour estimated value;

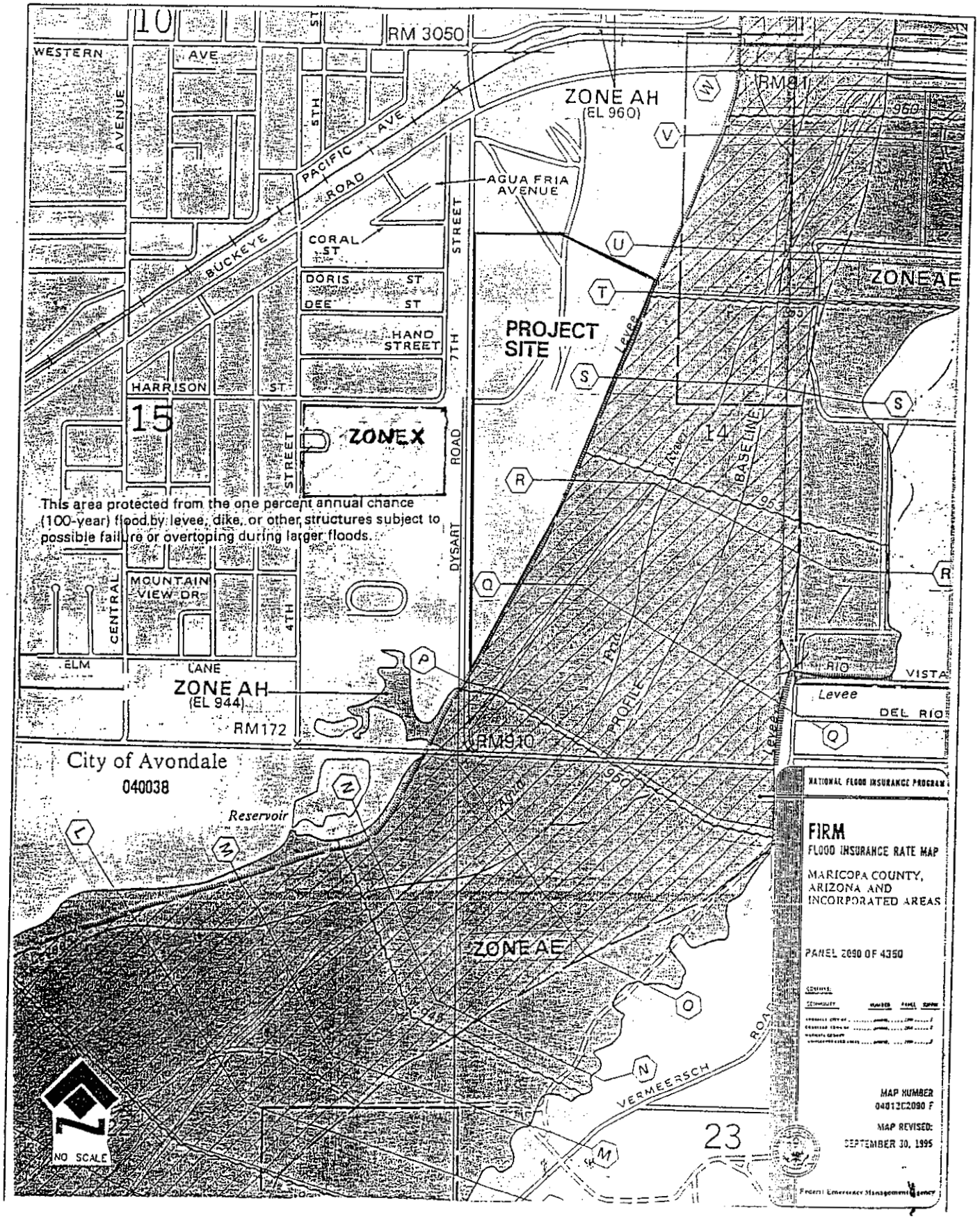
X_3 = 100-yr, 6-hr value from precipitation-frequency maps;

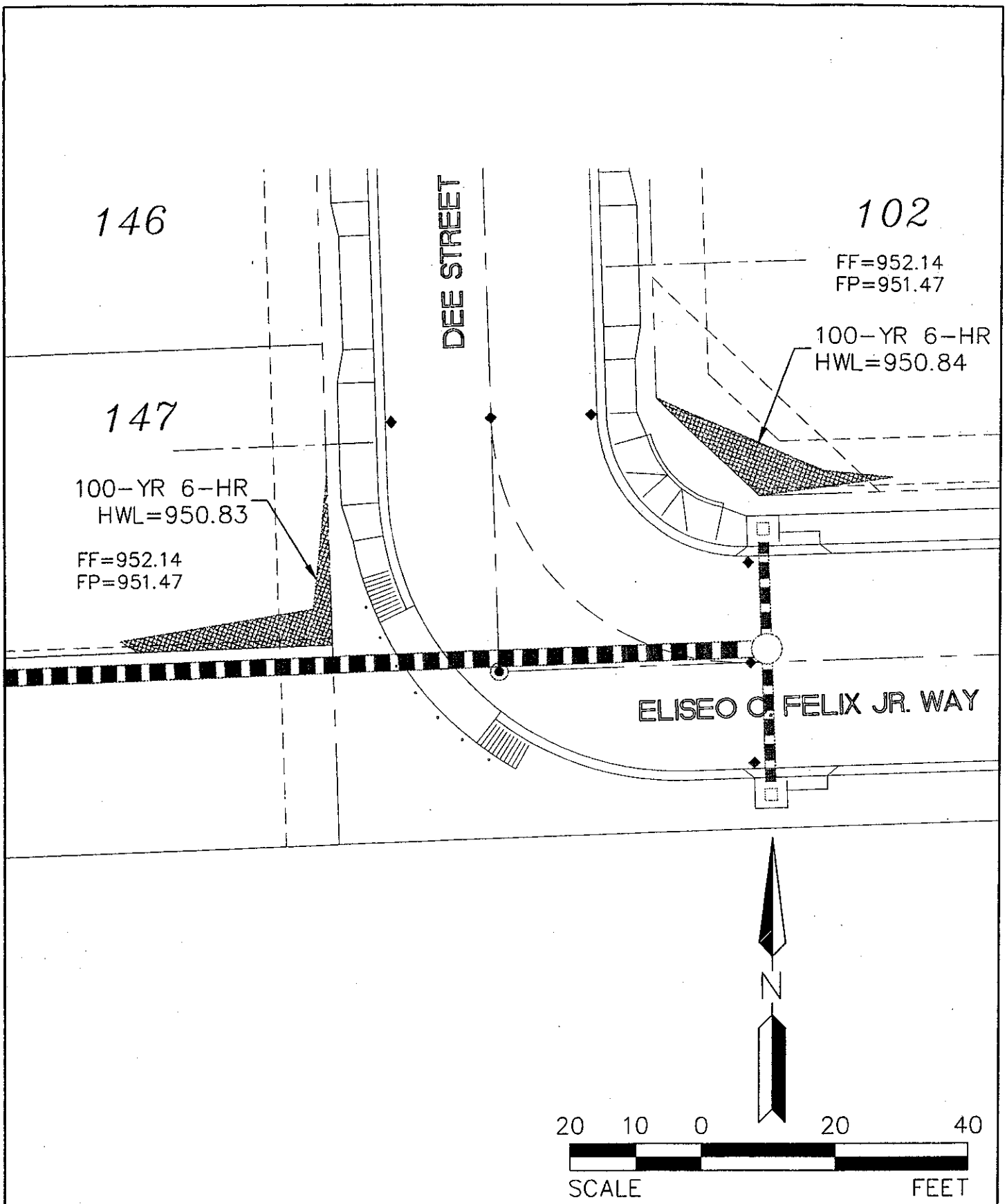
X_4 = 100-yr, 24-hr value from precipitation-frequency maps;

6-hr = isopluvial values from figure 2.7;
1-hr = Y_{100} value as computed above.

Figure 5

FEMA F.I.R.M. MAP
EXHIBIT D





CMX
1515 E. MISSOURI STE.115
PHOENIX, AZ 85014
PH (602)279-8436
FAX (602)265-1191
www.cmxinc.com

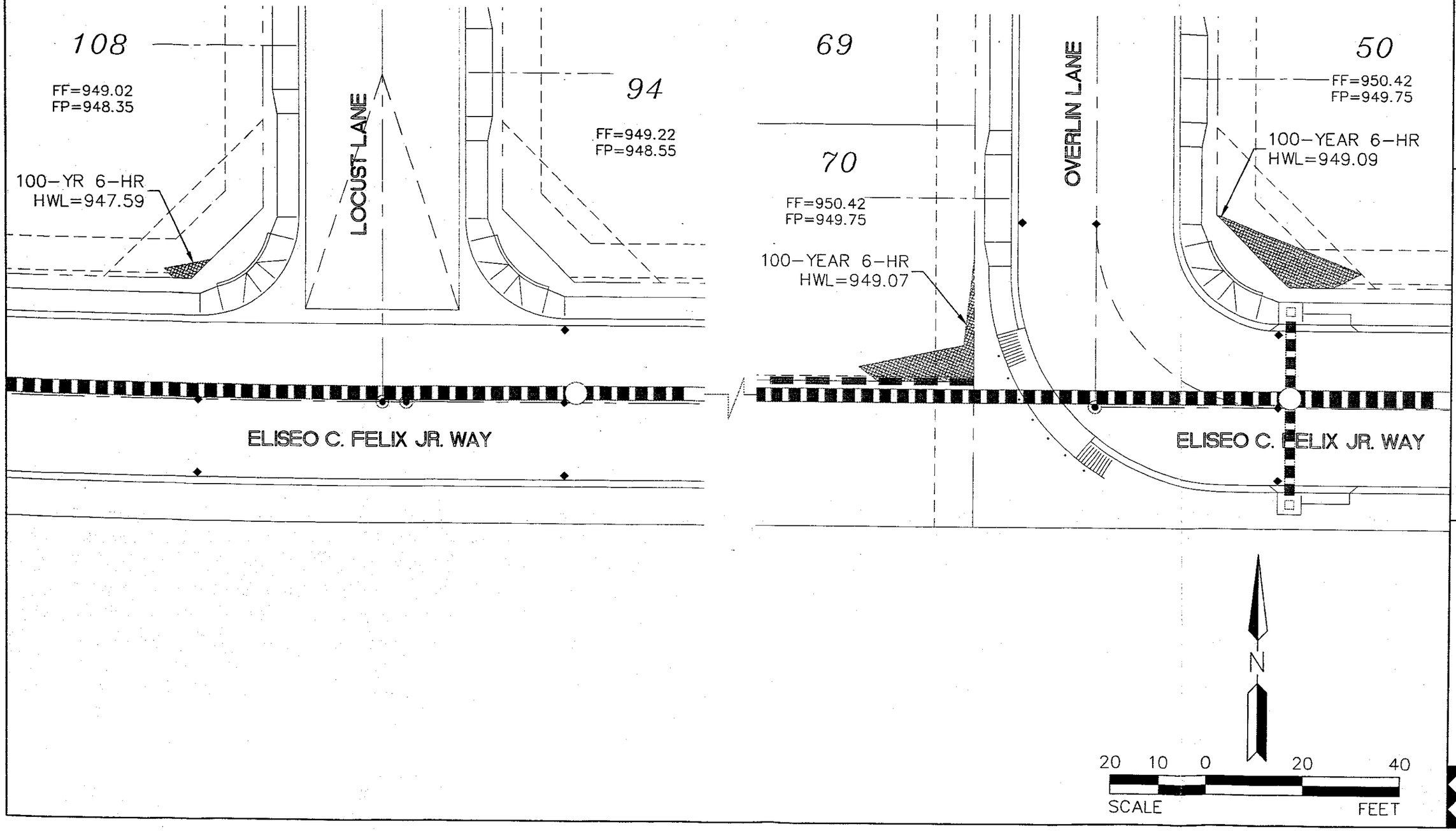
EXHIBIT E

TRES RIOS LANDING
AVONDALE, ARIZONA

PARCEL 4 SITE INUNDATION MAP, 100-YEAR 6-HOUR STORM

CMX PROJ.	6125.01
DATE:	10/02
SCALE:	1"=20'
DRAWN BY:	JP
CHECKED BY:	DF

X:\6100\6125.01\Master-Report\Drainage\Inundation map.dwg, 10/16/02 09:31:00 AM, JPRIEGO



CMX PROJ. 6125.01
DATE: 10/02
SCALE: 1"=20'
DRAWN BY: JP
CHECKED BY: DF

EXHIBIT F
TRES RIOS LANDING
AVONDALE, ARIZONA

PARCEL 5 SITE INUNDATION MAP, 100-YEAR 6-HOUR STORM

1515 E. MISSOURI STE.115
PHOENIX, AZ 85014
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www.cmxinc.com

SECTION A-1

- Tc Vs. Intensity Table
- Rational Method Data Sheets

Intensities for Various Times of Concentrations

10-year, 6-hour Isopluvial (P10) = 2 *
Values Fig. 3.2 of Maricopa County Hydrology Manual
Adjusted by the Factor (P10)/2.07

Tc	5 Yr	10 Yr	50 Yr	100 Yr
5	4.69	5.59	7.68	8.62
6	4.48	5.27	7.24	8.18
7	4.29	4.99	6.87	7.76
8	4.11	4.75	6.55	7.40
9	3.94	4.54	6.27	7.08
10	3.79	4.35	6.02	6.80
11	3.65	4.18	5.79	6.54
12	3.52	4.03	5.58	6.31
13	3.40	3.89	5.39	6.09
14	3.29	3.75	5.21	5.89
15	3.18	3.63	5.04	5.71
16	3.08	3.51	4.89	5.53
17	2.99	3.41	4.74	5.37
18	2.90	3.30	4.61	5.22
19	2.82	3.21	4.48	5.07
20	2.74	3.12	4.35	4.93
21	2.66	3.03	4.23	4.80
22	2.59	2.95	4.12	4.68
23	2.53	2.87	4.02	4.56
24	2.46	2.79	3.91	4.44
25	2.40	2.72	3.82	4.33
26	2.35	2.65	3.72	4.23
27	2.29	2.58	3.63	4.12
28	2.24	2.51	3.54	4.03
29	2.19	2.45	3.46	3.93
30	2.14	2.39	3.38	3.84
31	2.10	2.42	3.30	3.82
32	2.05	2.37	3.24	3.74
33	2.01	2.32	3.18	3.67
34	1.97	2.27	3.12	3.60

* SEE FIGURE 2

Intensities for Various Times of Concentrations

35	1.93	2.22	3.06	3.53
36	1.90	2.18	3.01	3.46
37	1.86	2.14	2.95	3.40
38	1.83	2.10	2.90	3.34
39	1.79	2.06	2.85	3.28
40	1.76	2.02	2.80	3.23
41	1.73	1.99	2.76	3.17
42	1.70	1.95	2.71	3.12
43	1.67	1.92	2.67	3.07
44	1.64	1.89	2.63	3.02
45	1.62	1.86	2.59	2.97
46	1.59	1.83	2.55	2.92
47	1.56	1.80	2.51	2.88
48	1.54	1.77	2.47	2.83
49	1.52	1.75	2.44	2.79
50	1.49	1.72	2.40	2.75
51	1.47	1.70	2.37	2.71
52	1.45	1.68	2.33	2.67
53	1.43	1.65	2.30	2.64
54	1.41	1.63	2.27	2.60
55	1.39	1.61	2.24	2.56
56	1.37	1.59	2.21	2.53
57	1.35	1.57	2.18	2.50
58	1.33	1.55	2.15	2.46
59	1.31	1.53	2.13	2.43
60	1.30	1.51	2.10	2.40

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label A

Concentration Point 1

DESIGN DATA

Drainage Area	2.02	acres
Street Drainage Length	282.63	feet
Street Slope	0.3	%
Average Velocity	1.09	fps
Street Tc	4.32	minutes
Initial Lot Tc	10	minutes
Total Tc	14.32	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	14.32		
Rainfall Intensity	i	3.71	5.16	5.83
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	4.12	6.88	8.13

Hydrologic Design Data Sheet
Rational Method

Sub-basins Labeled A + B

Concentration Point 2

DESIGN DATA

Drainage Area	4.34	acres
Street Drainage Length (Basin B only)	349.11	feet
Street Slope (Basin B Only)	0.3	%
Average Velocity (Basin B Only)	1.09	fps
Street Tc (Basin B Only)	5.34	minutes
Previous Tc to Point 1	14.32	minutes
Total Tc	19.66	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	19.66		
Rainfall Intensity	i	3.15	4.39	4.98
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	7.52	12.57	14.91

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label C

Concentration Point 3

DESIGN DATA

Drainage Area	1.39	acres
Street Drainage Length	225.14	feet
Street Slope	0.32	%
Average Velocity	1.10	fps
Street Tc	3.41	minutes
Initial Lot Tc	10	minutes
Total Tc	13.41	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	13.41		
Rainfall Intensity	i	3.83	5.32	6.01
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	2.93	4.88	5.76

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label F

Concentration Point 6

DESIGN DATA

Drainage Area	2.49	acres
Street Drainage Length	195.80	feet
Street Slope	0.25	%
Average Velocity	0.95	fps
Street Tc	3.44	minutes
Initial Lot Tc	10	minutes
Total Tc	13.44	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	13.44		
Rainfall Intensity	i	3.83	5.31	6.00
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	5.25	8.73	10.31

Hydrologic Design Data Sheet
Rational Method

Sub-basins Labeled F + D

Concentration Point 4

DESIGN DATA

Drainage Area	4.14	acres
Street Drainage Length (Basin D only)	391.72	feet
Street Slope (Basin D Only)	0.25	%
Average Velocity (Basin D Only)	0.95	fps
Street Tc (Basin D Only)	6.87	minutes
Previous Tc to Point 6	13.44	minutes
Total Tc	20.31	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	20.31		
Rainfall Intensity	i	3.09	4.31	4.89
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	7.04	11.78	13.97

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label E

Concentration Point 5

DESIGN DATA

Drainage Area	0.80	acres
Street Drainage Length	192.59	feet
Street Slope	0.3	%
Average Velocity	1.09	fps
Street Tc	2.94	minutes
Initial Lot Tc	10	minutes
Total Tc	12.94	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	12.94		
Rainfall Intensity	i	3.90	5.40	6.10
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	1.72	2.85	3.37

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label G

Concentration Point 7

DESIGN DATA

Drainage Area	6.72	acres
Street Drainage Length	1059.38	feet
Street Slope	0.3	%
Average Velocity	109	fps
Street Tc	16.20	minutes
Initial Lot Tc	10	minutes
Total Tc	26.20	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	26.20		
Rainfall Intensity	i	2.64	3.70	4.21
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	9.76	16.41	19.52

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label H

Concentration Point 8

DESIGN DATA

Drainage Area	4.31	acres
Street Drainage Length	623.84	feet
Street Slope	0.5	%
Average Velocity	1.4	fps
Street Tc	7.43	minutes
Initial Lot Tc	10	minutes
Total Tc	17.43	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	17.43		
Rainfall Intensity	i	3.36	4.68	5.31
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	7.96	13.31	15.79

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label I

Concentration Point 9

DESIGN DATA

Drainage Area	3.74	acres
Street Drainage Length	576.10	feet
Street Slope	0.4	%
Average Velocity	1.2	fps
Street Tc	8.00	minutes
Initial Lot Tc	10	minutes
Total Tc	18.00	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	18.00		
Rainfall Intensity	i	3.30	4.61	5.22
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	6.79	11.38	13.47

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label J

Concentration Point 10

DESIGN DATA

Drainage Area	4.09	acres
Street Drainage Length	669.01	feet
Street Slope	0.31	%
Average Velocity	1.15	fps
Street Tc	9.70	minutes
Initial Lot Tc	10	minutes
Total Tc	19.70	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	19.70		
Rainfall Intensity	i	3.15	4.39	4.97
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	7.08	11.85	14.03

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label K

Concentration Point 11

DESIGN DATA

Drainage Area	4.80	acres
Street Drainage Length	669.01	feet
Street Slope	0.4	%
Average Velocity	1.2	fps
Street Tc	9.29	minutes
Initial Lot Tc	10	minutes
Total Tc	19.29	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	19.29		
Rainfall Intensity	i	3.18	4.44	5.03
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	8.40	14.07	16.66

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label L

Concentration Point 12

DESIGN DATA

Drainage Area	1.76	acres
Street Drainage Length	288.88	feet
Street Slope	0.4	%
Average Velocity	1.2	fps
Street Tc	4.01	minutes
Initial Lot Tc	10	minutes
Total Tc	14.01	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	14.01		
Rainfall Intensity	i	3.75	5.21	5.89
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	3.63	6.05	7.15

Hydrologic Design Data Sheet
Rational Method

Sub-basins Labeled L + M

Concentration Point 13

DESIGN DATA

Drainage Area	6.45	acres
Street Drainage Length (Basin M only)	812.97	feet
Street Slope (Basin M Only)	0.3	%
Average Velocity (Basin M Only)	1.09	fps
Street Tc (Basin M Only)	12.43	minutes
Previous Tc to Point 12	14.01	minutes
Total Tc	26.44	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	26.44		
Rainfall Intensity	i	2.62	3.68	4.18
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	9.29	15.67	18.60

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label P

Concentration Point 16

DESIGN DATA

Drainage Area	3.46	acres
Street Drainage Length	540.96	feet
Street Slope	0.3	%
Average Velocity	1.09	fps
Street Tc	8.27	minutes
Initial Lot Tc	10	minutes
Total Tc	18.27	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	18.27		
Rainfall Intensity	i	3.28	4.57	5.18
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	6.24	10.44	12.37

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label Q

Concentration Point 17

DESIGN DATA

Drainage Area	1.49	acres
Street Drainage Length	405.47	feet
Street Slope	0.3	%
Average Velocity	1.09	fps
Street Tc	6.20	minutes
Initial Lot Tc	10	minutes
Total Tc	16.20	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	16.20		
Rainfall Intensity	i	3.49	4.86	5.50
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	2.86	4.78	5.65

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label R

Concentration Point 18

DESIGN DATA

Drainage Area	1.75	acres
Street Drainage Length	528.78	feet
Street Slope	0.3	%
Average Velocity	1.09	fps
Street Tc	8.09	minutes
Initial Lot Tc	10	minutes
Total Tc	18.09	minutes

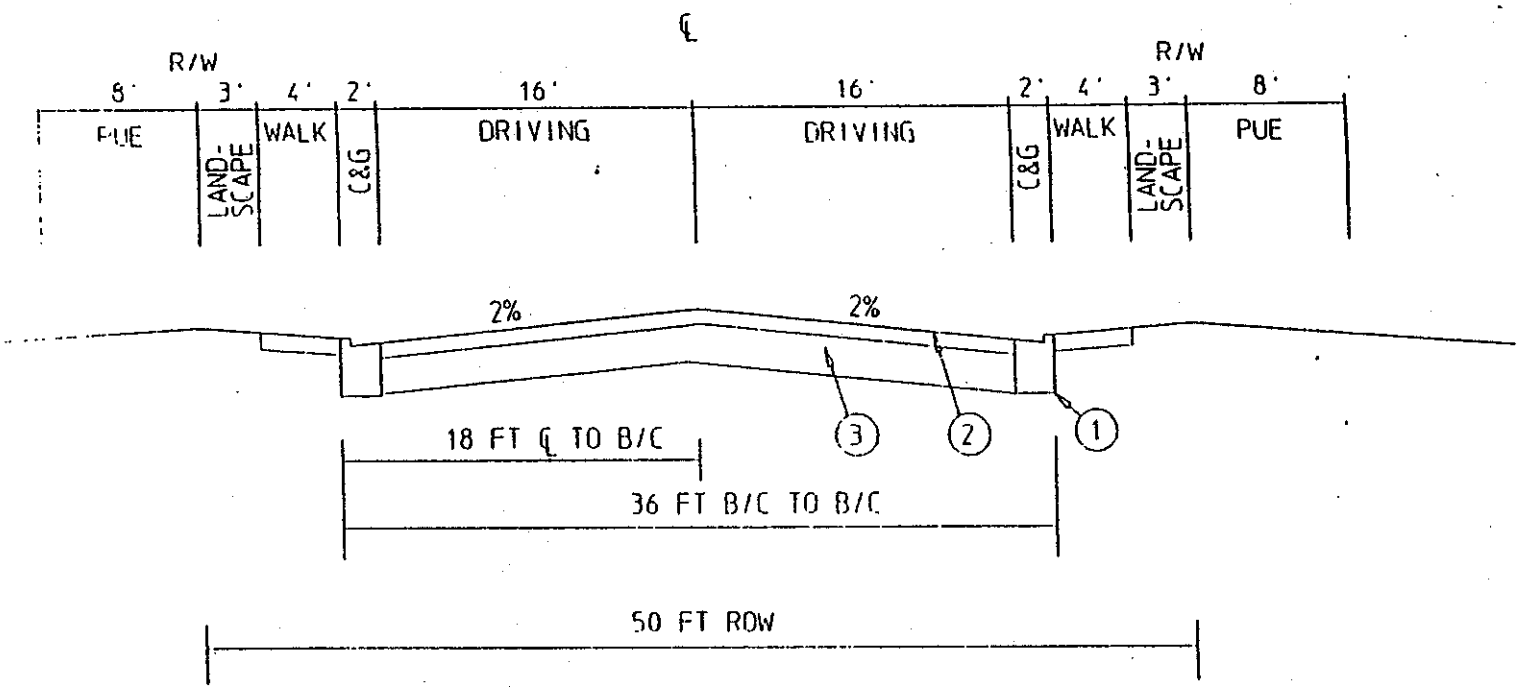
DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	18.09		
Rainfall Intensity	i	3.29	4.60	5.21
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	3.17	5.31	6.29

SECTION B-1

- Street Section, Local Road
- Avondale Local Road, w/Flow @ Top of 4" Curb
- Avondale Local Road, w/4" Curb & Flow @ R/W Line

STREET SECTION
LOCAL ROAD
50 FT ROW



(1) CURB PER MAG DETAIL NO 220, TYPE C

(2) 2 5 IN ASPHALT CEMENT

(3) 9 IN AGGREGATE BASE COURT

(NOT TO SCALE)

CITY OF AVONDALE

PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

ENGINEERING DESIGN
STANDARDS

June 1997

AVONDALE LOCAL RD. W/ FLOW @ TOP OF 4" CURB
Worksheet for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	0.001000	ft/ft
Water Surface Elevatio	100.33	ft

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Metho	mproved Lotter's Method
Closed Channel Weighting Met	Horton's Method

Results		
Mannings Coefficient	0.015	
Elevation Range	100.00 to 100.48	
Discharge	5.06	cfs
Flow Area	5.4	ft²
Wetted Perimeter	33.67	ft
Top Width	33.00	ft
Actual Depth	0.33	ft
Critical Elevation	100.23	ft
Critical Slope	0.006929	ft/ft
Velocity	0.93	ft/s
Velocity Head	0.01	ft
Specific Energy	100.34	ft
Froude Number	0.40	
Flow Type	Subcritical	

Calculation Messages:
Flow is divided.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+03.00	0.025
0+03.00	0+47.00	0.015
0+47.00	0+50.00	0.025

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	100.48
0+03.00	100.42
0+07.50	100.33
0+07.50	100.00
0+25.00	100.35
0+42.50	100.00
0+42.50	100.33
0+47.00	100.42

AVONDALE LOCAL RD. W/ FLOW @ TOP OF 4" CURB
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+50.00	100.48

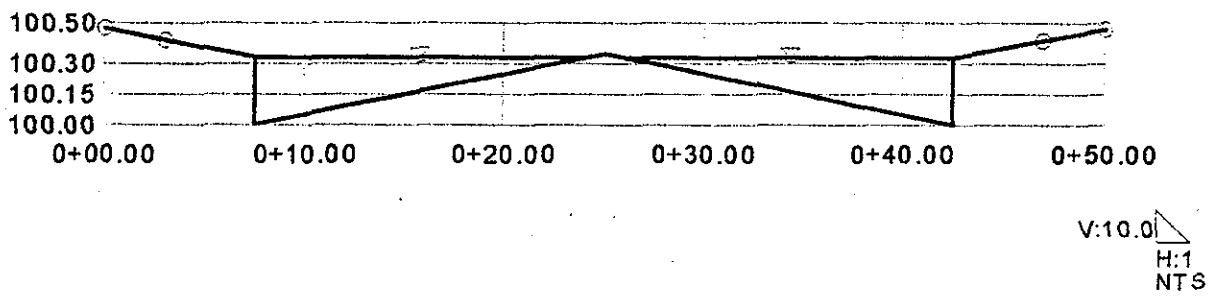
Notes: AVONDALE LOCAL ROAD W/FLOW @ TOP OF 4" CURB.

AVONDALE LOCAL RD. W/ FLOW @ 4" CURB

Cross Section for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.015	
Slope	0.001000	ft/ft
Water Surface Elevation	100.33	ft
Elevation Range	100.00 to 100.48	
Discharge	5.06	cfs



AVONDALE LOCAL RD. W/ FLOW @ TOP OF 4" CURB
Rating Table for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Water Surface Elevation	100.33 ft

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

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.001000	0.020000	0.000100

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.001000	5.06	0.93	5.4	33.67	33.00
0.001100	5.31	0.98	5.4	33.67	33.00
0.001200	5.55	1.02	5.4	33.67	33.00
0.001300	5.77	1.06	5.4	33.67	33.00
0.001400	5.99	1.10	5.4	33.67	33.00
0.001500	6.20	1.14	5.4	33.67	33.00
0.001600	6.40	1.18	5.4	33.67	33.00
0.001700	6.60	1.21	5.4	33.67	33.00
0.001800	6.79	1.25	5.4	33.67	33.00
0.001900	6.98	1.28	5.4	33.67	33.00
0.002000	7.16	1.32	5.4	33.67	33.00
0.002100	7.34	1.35	5.4	33.67	33.00
0.002200	7.51	1.38	5.4	33.67	33.00
0.002300	7.68	1.41	5.4	33.67	33.00
0.002400	7.84	1.44	5.4	33.67	33.00
0.002500	8.01	1.47	5.4	33.67	33.00
0.002600	8.16	1.50	5.4	33.67	33.00
0.002700	8.32	1.53	5.4	33.67	33.00
0.002800	8.47	1.56	5.4	33.67	33.00
0.002900	8.62	1.58	5.4	33.67	33.00
0.003000	8.77	1.61	5.4	33.67	33.00
0.003100	8.91	1.64	5.4	33.67	33.00
0.003200	9.06	1.66	5.4	33.67	33.00
0.003300	9.20	1.69	5.4	33.67	33.00
0.003400	9.34	1.71	5.4	33.67	33.00
0.003500	9.47	1.74	5.4	33.67	33.00
0.003600	9.61	1.76	5.4	33.67	33.00
0.003700	9.74	1.79	5.4	33.67	33.00
0.003800	9.87	1.81	5.4	33.67	33.00
0.003900	10.00	1.84	5.4	33.67	33.00
0.004000	10.13	1.86	5.4	33.67	33.00
0.004100	10.25	1.88	5.4	33.67	33.00

AVONDALE LOCAL RD. W/ FLOW @ TOP OF 4" CURB

Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.004200	10.38	1.91	5.4	33.67	33.00
0.004300	10.50	1.93	5.4	33.67	33.00
0.004400	10.62	1.95	5.4	33.67	33.00
0.004500	10.74	1.97	5.4	33.67	33.00
0.004600	10.86	1.99	5.4	33.67	33.00
0.004700	10.98	2.02	5.4	33.67	33.00
0.004800	11.09	2.04	5.4	33.67	33.00
0.004900	11.21	2.06	5.4	33.67	33.00
0.005000	11.32	2.08	5.4	33.67	33.00
0.005100	11.43	2.10	5.4	33.67	33.00
0.005200	11.55	2.12	5.4	33.67	33.00
0.005300	11.66	2.14	5.4	33.67	33.00
0.005400	11.77	2.16	5.4	33.67	33.00
0.005500	11.87	2.18	5.4	33.67	33.00
0.005600	11.98	2.20	5.4	33.67	33.00
0.005700	12.09	2.22	5.4	33.67	33.00
0.005800	12.19	2.24	5.4	33.67	33.00
0.005900	12.30	2.26	5.4	33.67	33.00
0.006000	12.40	2.28	5.4	33.67	33.00
0.006100	12.51	2.30	5.4	33.67	33.00
0.006200	12.61	2.32	5.4	33.67	33.00
0.006300	12.71	2.33	5.4	33.67	33.00
0.006400	12.81	2.35	5.4	33.67	33.00
0.006500	12.91	2.37	5.4	33.67	33.00
0.006600	13.01	2.39	5.4	33.67	33.00
0.006700	13.11	2.41	5.4	33.67	33.00
0.006800	13.20	2.42	5.4	33.67	33.00
0.006900	13.30	2.44	5.4	33.67	33.00
0.007000	13.40	2.46	5.4	33.67	33.00
0.007100	13.49	2.48	5.4	33.67	33.00
0.007200	13.59	2.50	5.4	33.67	33.00
0.007300	13.68	2.51	5.4	33.67	33.00
0.007400	13.77	2.53	5.4	33.67	33.00
0.007500	13.87	2.55	5.4	33.67	33.00
0.007600	13.96	2.56	5.4	33.67	33.00
0.007700	14.05	2.58	5.4	33.67	33.00
0.007800	14.14	2.60	5.4	33.67	33.00
0.007900	14.23	2.61	5.4	33.67	33.00
0.008000	14.32	2.63	5.4	33.67	33.00
0.008100	14.41	2.65	5.4	33.67	33.00
0.008200	14.50	2.66	5.4	33.67	33.00
0.008300	14.59	2.68	5.4	33.67	33.00
0.008400	14.67	2.70	5.4	33.67	33.00
0.008500	14.76	2.71	5.4	33.67	33.00
0.008600	14.85	2.73	5.4	33.67	33.00
0.008700	14.93	2.74	5.4	33.67	33.00
0.008800	15.02	2.76	5.4	33.67	33.00
0.008900	15.11	2.77	5.4	33.67	33.00
0.009000	15.19	2.79	5.4	33.67	33.00
0.009100	15.27	2.81	5.4	33.67	33.00
0.009200	15.36	2.82	5.4	33.67	33.00
0.009300	15.44	2.84	5.4	33.67	33.00

AVONDALE LOCAL RD. W/ FLOW @ TOP OF 4" CURB
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.009400	15.52	2.85	5.4	33.67	33.00
0.009500	15.61	2.87	5.4	33.67	33.00
0.009600	15.69	2.88	5.4	33.67	33.00
0.009700	15.77	2.90	5.4	33.67	33.00
0.009800	15.85	2.91	5.4	33.67	33.00
0.009900	15.93	2.93	5.4	33.67	33.00
0.010000	16.01	2.94	5.4	33.67	33.00
0.010100	16.09	2.96	5.4	33.67	33.00
0.010200	16.17	2.97	5.4	33.67	33.00
0.010300	16.25	2.98	5.4	33.67	33.00
0.010400	16.33	3.00	5.4	33.67	33.00
0.010500	16.41	3.01	5.4	33.67	33.00
0.010600	16.48	3.03	5.4	33.67	33.00
0.010700	16.56	3.04	5.4	33.67	33.00
0.010800	16.64	3.06	5.4	33.67	33.00
0.010900	16.72	3.07	5.4	33.67	33.00
0.011000	16.79	3.08	5.4	33.67	33.00
0.011100	16.87	3.10	5.4	33.67	33.00
0.011200	16.95	3.11	5.4	33.67	33.00
0.011300	17.02	3.13	5.4	33.67	33.00
0.011400	17.10	3.14	5.4	33.67	33.00
0.011500	17.17	3.15	5.4	33.67	33.00
0.011600	17.24	3.17	5.4	33.67	33.00
0.011700	17.32	3.18	5.4	33.67	33.00
0.011800	17.39	3.19	5.4	33.67	33.00
0.011900	17.47	3.21	5.4	33.67	33.00
0.012000	17.54	3.22	5.4	33.67	33.00
0.012100	17.61	3.23	5.4	33.67	33.00
0.012200	17.69	3.25	5.4	33.67	33.00
0.012300	17.76	3.26	5.4	33.67	33.00
0.012400	17.83	3.27	5.4	33.67	33.00
0.012500	17.90	3.29	5.4	33.67	33.00
0.012600	17.97	3.30	5.4	33.67	33.00
0.012700	18.04	3.31	5.4	33.67	33.00
0.012800	18.12	3.33	5.4	33.67	33.00
0.012900	18.19	3.34	5.4	33.67	33.00
0.013000	18.26	3.35	5.4	33.67	33.00
0.013100	18.33	3.37	5.4	33.67	33.00
0.013200	18.40	3.38	5.4	33.67	33.00
0.013300	18.47	3.39	5.4	33.67	33.00
0.013400	18.53	3.40	5.4	33.67	33.00
0.013500	18.60	3.42	5.4	33.67	33.00
0.013600	18.67	3.43	5.4	33.67	33.00
0.013700	18.74	3.44	5.4	33.67	33.00
0.013800	18.81	3.45	5.4	33.67	33.00
0.013900	18.88	3.47	5.4	33.67	33.00
0.014000	18.95	3.48	5.4	33.67	33.00
0.014100	19.01	3.49	5.4	33.67	33.00
0.014200	19.08	3.50	5.4	33.67	33.00
0.014300	19.15	3.52	5.4	33.67	33.00
0.014400	19.21	3.53	5.4	33.67	33.00
0.014500	19.28	3.54	5.4	33.67	33.00

AVONDALE LOCAL RD. W/ FLOW @ TOP OF 4" CURB

Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.014600	19.35	3.55	5.4	33.67	33.00
0.014700	19.41	3.57	5.4	33.67	33.00
0.014800	19.48	3.58	5.4	33.67	33.00
0.014900	19.54	3.59	5.4	33.67	33.00
0.015000	19.61	3.60	5.4	33.67	33.00
0.015100	19.68	3.61	5.4	33.67	33.00
0.015200	19.74	3.63	5.4	33.67	33.00
0.015300	19.81	3.64	5.4	33.67	33.00
0.015400	19.87	3.65	5.4	33.67	33.00
0.015500	19.93	3.66	5.4	33.67	33.00
0.015600	20.00	3.67	5.4	33.67	33.00
0.015700	20.06	3.68	5.4	33.67	33.00
0.015800	20.13	3.70	5.4	33.67	33.00
0.015900	20.19	3.71	5.4	33.67	33.00
0.016000	20.25	3.72	5.4	33.67	33.00
0.016100	20.32	3.73	5.4	33.67	33.00
0.016200	20.38	3.74	5.4	33.67	33.00
0.016300	20.44	3.75	5.4	33.67	33.00
0.016400	20.50	3.77	5.4	33.67	33.00
0.016500	20.57	3.78	5.4	33.67	33.00
0.016600	20.63	3.79	5.4	33.67	33.00
0.016700	20.69	3.80	5.4	33.67	33.00
0.016800	20.75	3.81	5.4	33.67	33.00
0.016900	20.82	3.82	5.4	33.67	33.00
0.017000	20.88	3.83	5.4	33.67	33.00
0.017100	20.94	3.85	5.4	33.67	33.00
0.017200	21.00	3.86	5.4	33.67	33.00
0.017300	21.06	3.87	5.4	33.67	33.00
0.017400	21.12	3.88	5.4	33.67	33.00
0.017500	21.18	3.89	5.4	33.67	33.00
0.017600	21.24	3.90	5.4	33.67	33.00
0.017700	21.30	3.91	5.4	33.67	33.00
0.017800	21.36	3.92	5.4	33.67	33.00
0.017900	21.42	3.93	5.4	33.67	33.00
0.018000	21.48	3.95	5.4	33.67	33.00
0.018100	21.54	3.96	5.4	33.67	33.00
0.018200	21.60	3.97	5.4	33.67	33.00
0.018300	21.66	3.98	5.4	33.67	33.00
0.018400	21.72	3.99	5.4	33.67	33.00
0.018500	21.78	4.00	5.4	33.67	33.00
0.018600	21.84	4.01	5.4	33.67	33.00
0.018700	21.90	4.02	5.4	33.67	33.00
0.018800	21.95	4.03	5.4	33.67	33.00
0.018900	22.01	4.04	5.4	33.67	33.00
0.019000	22.07	4.05	5.4	33.67	33.00
0.019100	22.13	4.06	5.4	33.67	33.00
0.019200	22.19	4.07	5.4	33.67	33.00
0.019300	22.24	4.09	5.4	33.67	33.00
0.019400	22.30	4.10	5.4	33.67	33.00
0.019500	22.36	4.11	5.4	33.67	33.00
0.019600	22.42	4.12	5.4	33.67	33.00
0.019700	22.47	4.13	5.4	33.67	33.00

AVONDALE LOCAL RD. W/ FLOW @ TOP OF 4" CURB
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.019800	22.53	4.14	5.4	33.67	33.00
0.019900	22.59	4.15	5.4	33.67	33.00
0.020000	22.64	4.16	5.4	33.67	33.00

AVONDALE LOCAL RD. W/ 4" CURB & FLOW TO R/W LINE
Worksheet for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	0.001000	ft/ft
Water Surface Elevation	100.44	ft

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

Results		
Mannings Coefficient	0.016	
Elevation Range	100.00 to 100.44	
Discharge	9.84	cfs
Flow Area	10.1	ft²
Wetted Perimeter	50.67	ft
Top Width	50.00	ft
Actual Depth	0.44	ft
Critical Elevation	100.30	ft
Critical Slope	0.007520	ft/ft
Velocity	0.98	ft/s
Velocity Head	0.01	ft
Specific Energy	100.45	ft
Froude Number	0.38	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+03.00	0.025
0+03.00	0+47.00	0.015
0+47.00	0+50.00	0.025

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	100.44
0+03.00	100.40
0+07.50	100.33
0+07.50	100.00
0+25.00	100.35
0+42.50	100.00
0+42.50	100.33
0+47.00	100.40
0+50.00	100.44

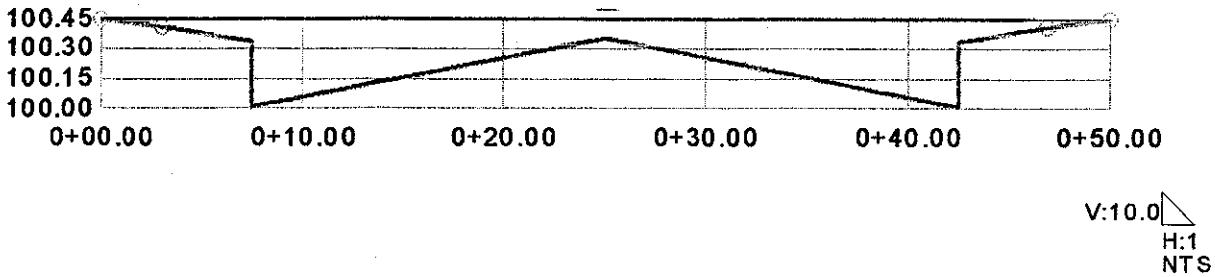
AVONDALE LOCAL RD. W/ 4" CURB & FLOW TO R/W LINE
Worksheet for Irregular Channel

Notes: AVONDALE LOCAL ROAD W/FLOW @ TOP OF 4" CURB.

AVONDALE LOCAL RD. W/ 4" CURB & FLOW TO R/W LINE
Cross Section for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.016	
Slope	0.001000	ft/ft
Water Surface Elevation	100.44	ft
Elevation Range	100.00 to 100.44	
Discharge	9.84	cfs



AVONDALE LOCAL RD. W/ 4" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Water Surface Elevatio	100.44 ft

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Metho	mproved Lotter's Method
Closed Channel Weighting Met	Horton's Method

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.001000	0.020000	0.000100

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.001000	9.84	0.98	10.1	50.67	50.00
0.001100	10.32	1.03	10.1	50.67	50.00
0.001200	10.78	1.07	10.1	50.67	50.00
0.001300	11.22	1.12	10.1	50.67	50.00
0.001400	11.64	1.16	10.1	50.67	50.00
0.001500	12.05	1.20	10.1	50.67	50.00
0.001600	12.45	1.24	10.1	50.67	50.00
0.001700	12.83	1.28	10.1	50.67	50.00
0.001800	13.20	1.31	10.1	50.67	50.00
0.001900	13.56	1.35	10.1	50.67	50.00
0.002000	13.92	1.38	10.1	50.67	50.00
0.002100	14.26	1.42	10.1	50.67	50.00
0.002200	14.60	1.45	10.1	50.67	50.00
0.002300	14.92	1.48	10.1	50.67	50.00
0.002400	15.25	1.52	10.1	50.67	50.00
0.002500	15.56	1.55	10.1	50.67	50.00
0.002600	15.87	1.58	10.1	50.67	50.00
0.002700	16.17	1.61	10.1	50.67	50.00
0.002800	16.47	1.64	10.1	50.67	50.00
0.002900	16.76	1.67	10.1	50.67	50.00
0.003000	17.04	1.70	10.1	50.67	50.00
0.003100	17.33	1.72	10.1	50.67	50.00
0.003200	17.60	1.75	10.1	50.67	50.00
0.003300	17.88	1.78	10.1	50.67	50.00
0.003400	18.15	1.80	10.1	50.67	50.00
0.003500	18.41	1.83	10.1	50.67	50.00
0.003600	18.67	1.86	10.1	50.67	50.00
0.003700	18.93	1.88	10.1	50.67	50.00
0.003800	19.18	1.91	10.1	50.67	50.00
0.003900	19.43	1.93	10.1	50.67	50.00
0.004000	19.68	1.96	10.1	50.67	50.00
0.004100	19.93	1.98	10.1	50.67	50.00
0.004200	20.17	2.01	10.1	50.67	50.00

AVONDALE LOCAL RD. W/ 4" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.004300	20.41	2.03	10.1	50.67	50.00
0.004400	20.64	2.05	10.1	50.67	50.00
0.004500	20.88	2.08	10.1	50.67	50.00
0.004600	21.11	2.10	10.1	50.67	50.00
0.004700	21.33	2.12	10.1	50.67	50.00
0.004800	21.56	2.14	10.1	50.67	50.00
0.004900	21.78	2.17	10.1	50.67	50.00
0.005000	22.00	2.19	10.1	50.67	50.00
0.005100	22.22	2.21	10.1	50.67	50.00
0.005200	22.44	2.23	10.1	50.67	50.00
0.005300	22.66	2.25	10.1	50.67	50.00
0.005400	22.87	2.27	10.1	50.67	50.00
0.005500	23.08	2.30	10.1	50.67	50.00
0.005600	23.29	2.32	10.1	50.67	50.00
0.005700	23.49	2.34	10.1	50.67	50.00
0.005800	23.70	2.36	10.1	50.67	50.00
0.005900	23.90	2.38	10.1	50.67	50.00
0.006000	24.10	2.40	10.1	50.67	50.00
0.006100	24.30	2.42	10.1	50.67	50.00
0.006200	24.50	2.44	10.1	50.67	50.00
0.006300	24.70	2.46	10.1	50.67	50.00
0.006400	24.90	2.48	10.1	50.67	50.00
0.006500	25.09	2.50	10.1	50.67	50.00
0.006600	25.28	2.51	10.1	50.67	50.00
0.006700	25.47	2.53	10.1	50.67	50.00
0.006800	25.66	2.55	10.1	50.67	50.00
0.006900	25.85	2.57	10.1	50.67	50.00
0.007000	26.04	2.59	10.1	50.67	50.00
0.007100	26.22	2.61	10.1	50.67	50.00
0.007200	26.41	2.63	10.1	50.67	50.00
0.007300	26.59	2.64	10.1	50.67	50.00
0.007400	26.77	2.66	10.1	50.67	50.00
0.007500	26.95	2.68	10.1	50.67	50.00
0.007600	27.13	2.70	10.1	50.67	50.00
0.007700	27.31	2.72	10.1	50.67	50.00
0.007800	27.48	2.73	10.1	50.67	50.00
0.007900	27.66	2.75	10.1	50.67	50.00
0.008000	27.83	2.77	10.1	50.67	50.00
0.008100	28.01	2.79	10.1	50.67	50.00
0.008200	28.18	2.80	10.1	50.67	50.00
0.008300	28.35	2.82	10.1	50.67	50.00
0.008400	28.52	2.84	10.1	50.67	50.00
0.008500	28.69	2.85	10.1	50.67	50.00
0.008600	28.86	2.87	10.1	50.67	50.00
0.008700	29.03	2.89	10.1	50.67	50.00
0.008800	29.19	2.90	10.1	50.67	50.00
0.008900	29.36	2.92	10.1	50.67	50.00
0.009000	29.52	2.94	10.1	50.67	50.00
0.009100	29.69	2.95	10.1	50.67	50.00
0.009200	29.85	2.97	10.1	50.67	50.00
0.009300	30.01	2.98	10.1	50.67	50.00
0.009400	30.17	3.00	10.1	50.67	50.00
0.009500	30.33	3.02	10.1	50.67	50.00

AVONDALE LOCAL RD. W/ 4" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.009600	30.49	3.03	10.1	50.67	50.00
0.009700	30.65	3.05	10.1	50.67	50.00
0.009800	30.81	3.06	10.1	50.67	50.00
0.009900	30.96	3.08	10.1	50.67	50.00
0.010000	31.12	3.09	10.1	50.67	50.00
0.010100	31.27	3.11	10.1	50.67	50.00
0.010200	31.43	3.13	10.1	50.67	50.00
0.010300	31.58	3.14	10.1	50.67	50.00
0.010400	31.74	3.16	10.1	50.67	50.00
0.010500	31.89	3.17	10.1	50.67	50.00
0.010600	32.04	3.19	10.1	50.67	50.00
0.010700	32.19	3.20	10.1	50.67	50.00
0.010800	32.34	3.22	10.1	50.67	50.00
0.010900	32.49	3.23	10.1	50.67	50.00
0.011000	32.64	3.25	10.1	50.67	50.00
0.011100	32.79	3.26	10.1	50.67	50.00
0.011200	32.93	3.28	10.1	50.67	50.00
0.011300	33.08	3.29	10.1	50.67	50.00
0.011400	33.23	3.30	10.1	50.67	50.00
0.011500	33.37	3.32	10.1	50.67	50.00
0.011600	33.52	3.33	10.1	50.67	50.00
0.011700	33.66	3.35	10.1	50.67	50.00
0.011800	33.80	3.36	10.1	50.67	50.00
0.011900	33.95	3.38	10.1	50.67	50.00
0.012000	34.09	3.39	10.1	50.67	50.00
0.012100	34.23	3.40	10.1	50.67	50.00
0.012200	34.37	3.42	10.1	50.67	50.00
0.012300	34.51	3.43	10.1	50.67	50.00
0.012400	34.65	3.45	10.1	50.67	50.00
0.012500	34.79	3.46	10.1	50.67	50.00
0.012600	34.93	3.47	10.1	50.67	50.00
0.012700	35.07	3.49	10.1	50.67	50.00
0.012800	35.21	3.50	10.1	50.67	50.00
0.012900	35.34	3.52	10.1	50.67	50.00
0.013000	35.48	3.53	10.1	50.67	50.00
0.013100	35.62	3.54	10.1	50.67	50.00
0.013200	35.75	3.56	10.1	50.67	50.00
0.013300	35.89	3.57	10.1	50.67	50.00
0.013400	36.02	3.58	10.1	50.67	50.00
0.013500	36.16	3.60	10.1	50.67	50.00
0.013600	36.29	3.61	10.1	50.67	50.00
0.013700	36.42	3.62	10.1	50.67	50.00
0.013800	36.56	3.64	10.1	50.67	50.00
0.013900	36.69	3.65	10.1	50.67	50.00
0.014000	36.82	3.66	10.1	50.67	50.00
0.014100	36.95	3.68	10.1	50.67	50.00
0.014200	37.08	3.69	10.1	50.67	50.00
0.014300	37.21	3.70	10.1	50.67	50.00
0.014400	37.34	3.71	10.1	50.67	50.00
0.014500	37.47	3.73	10.1	50.67	50.00
0.014600	37.60	3.74	10.1	50.67	50.00
0.014700	37.73	3.75	10.1	50.67	50.00
0.014800	37.86	3.77	10.1	50.67	50.00

AVONDALE LOCAL RD. W/ 4" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.014900	37.99	3.78	10.1	50.67	50.00
0.015000	38.11	3.79	10.1	50.67	50.00
0.015100	38.24	3.80	10.1	50.67	50.00
0.015200	38.37	3.82	10.1	50.67	50.00
0.015300	38.49	3.83	10.1	50.67	50.00
0.015400	38.62	3.84	10.1	50.67	50.00
0.015500	38.74	3.85	10.1	50.67	50.00
0.015600	38.87	3.87	10.1	50.67	50.00
0.015700	38.99	3.88	10.1	50.67	50.00
0.015800	39.12	3.89	10.1	50.67	50.00
0.015900	39.24	3.90	10.1	50.67	50.00
0.016000	39.36	3.91	10.1	50.67	50.00
0.016100	39.49	3.93	10.1	50.67	50.00
0.016200	39.61	3.94	10.1	50.67	50.00
0.016300	39.73	3.95	10.1	50.67	50.00
0.016400	39.85	3.96	10.1	50.67	50.00
0.016500	39.97	3.98	10.1	50.67	50.00
0.016600	40.09	3.99	10.1	50.67	50.00
0.016700	40.22	4.00	10.1	50.67	50.00
0.016800	40.34	4.01	10.1	50.67	50.00
0.016900	40.46	4.02	10.1	50.67	50.00
0.017000	40.57	4.04	10.1	50.67	50.00
0.017100	40.69	4.05	10.1	50.67	50.00
0.017200	40.81	4.06	10.1	50.67	50.00
0.017300	40.93	4.07	10.1	50.67	50.00
0.017400	41.05	4.08	10.1	50.67	50.00
0.017500	41.17	4.09	10.1	50.67	50.00
0.017600	41.28	4.11	10.1	50.67	50.00
0.017700	41.40	4.12	10.1	50.67	50.00
0.017800	41.52	4.13	10.1	50.67	50.00
0.017900	41.63	4.14	10.1	50.67	50.00
0.018000	41.75	4.15	10.1	50.67	50.00
0.018100	41.87	4.16	10.1	50.67	50.00
0.018200	41.98	4.18	10.1	50.67	50.00
0.018300	42.10	4.19	10.1	50.67	50.00
0.018400	42.21	4.20	10.1	50.67	50.00
0.018500	42.33	4.21	10.1	50.67	50.00
0.018600	42.44	4.22	10.1	50.67	50.00
0.018700	42.56	4.23	10.1	50.67	50.00
0.018800	42.67	4.24	10.1	50.67	50.00
0.018900	42.78	4.25	10.1	50.67	50.00
0.019000	42.90	4.27	10.1	50.67	50.00
0.019100	43.01	4.28	10.1	50.67	50.00
0.019200	43.12	4.29	10.1	50.67	50.00
0.019300	43.23	4.30	10.1	50.67	50.00
0.019400	43.34	4.31	10.1	50.67	50.00
0.019500	43.46	4.32	10.1	50.67	50.00
0.019600	43.57	4.33	10.1	50.67	50.00
0.019700	43.68	4.34	10.1	50.67	50.00
0.019800	43.79	4.35	10.1	50.67	50.00
0.019900	43.90	4.37	10.1	50.67	50.00
0.020000	44.01	4.38	10.1	50.67	50.00

SECTION B-2

- Avondale Local Road w/Flow @ Top of 6" Curb
- Avondale Local Road w/6" Curb & Flow to R/W Line
- Tres Rios Landing – Waiver Request for Street Slopes

AVONDALE LOCAL RD. W/FLOW @ TOP OF 6" CURB
Worksheet for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	0.001000	ft/ft
Water Surface Elevation	100.50	ft

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

Results		
Mannings Coefficient	0.015	
Elevation Range	100.00 to 100.65	
Discharge	16.53	cfs
Flow Area	11.4	ft²
Wetted Perimeter	36.01	ft
Top Width	35.00	ft
Actual Depth	0.50	ft
Critical Elevation	100.37	ft
Critical Slope	0.005857	ft/ft
Velocity	1.45	ft/s
Velocity Head	0.03	ft
Specific Energy	100.53	ft
Froude Number	0.45	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+03.00	0.025
0+03.00	0+47.00	0.015
0+47.00	0+50.00	0.025

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	100.65
0+03.00	100.59
0+07.50	100.50
0+07.50	100.00
0+25.00	100.35
0+42.50	100.00
0+42.50	100.50
0+47.00	100.59
0+50.00	100.65

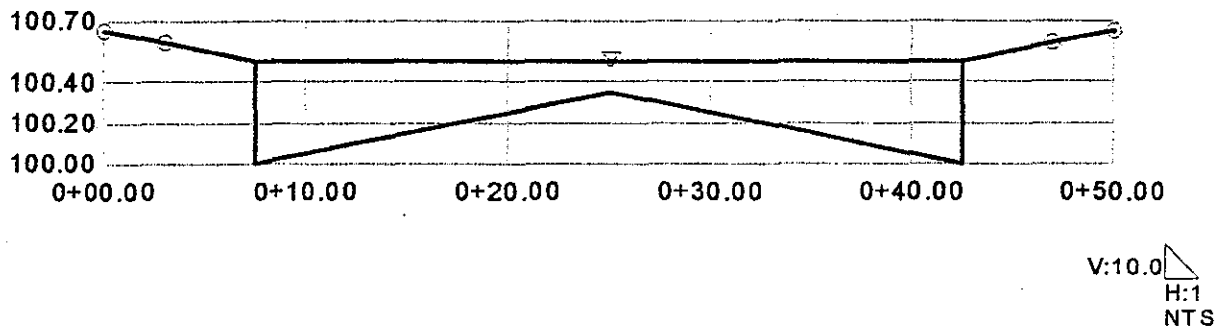
AVONDALE LOCAL RD. W/FLOW @ TOP OF 6" CURB
Worksheet for Irregular Channel

Notes: AVONDALE LOCAL ROAD W/FLOW @ TOP OF 4" CURB.

AVONDALE LOCAL RD. W/FLOW @ TOP OF 6" CURB
Cross Section for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.015	
Slope	0.001000	ft/ft
Water Surface Elevation	100.50	ft
Elevation Range	100.00 to 100.65	
Discharge	16.53	cfs



AVONDALE LOCAL RD. W/FLOW @ TOP OF 6" CURB
Rating Table for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Water Surface Elevatio	100.50 ft

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Metho	mproved Lotter's Method
Closed Channel Weighting Met	Horton's Method

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.001000	0.020000	0.000100

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.001000	16.53	1.45	11.4	36.01	35.00
0.001100	17.34	1.52	11.4	36.01	35.00
0.001200	18.11	1.59	11.4	36.01	35.00
0.001300	18.85	1.66	11.4	36.01	35.00
0.001400	19.56	1.72	11.4	36.01	35.00
0.001500	20.24	1.78	11.4	36.01	35.00
0.001600	20.91	1.84	11.4	36.01	35.00
0.001700	21.55	1.89	11.4	36.01	35.00
0.001800	22.18	1.95	11.4	36.01	35.00
0.001900	22.78	2.00	11.4	36.01	35.00
0.002000	23.37	2.05	11.4	36.01	35.00
0.002100	23.95	2.11	11.4	36.01	35.00
0.002200	24.52	2.16	11.4	36.01	35.00
0.002300	25.07	2.20	11.4	36.01	35.00
0.002400	25.61	2.25	11.4	36.01	35.00
0.002500	26.13	2.30	11.4	36.01	35.00
0.002600	26.65	2.34	11.4	36.01	35.00
0.002700	27.16	2.39	11.4	36.01	35.00
0.002800	27.66	2.43	11.4	36.01	35.00
0.002900	28.15	2.47	11.4	36.01	35.00
0.003000	28.63	2.52	11.4	36.01	35.00
0.003100	29.10	2.56	11.4	36.01	35.00
0.003200	29.57	2.60	11.4	36.01	35.00
0.003300	30.03	2.64	11.4	36.01	35.00
0.003400	30.48	2.68	11.4	36.01	35.00
0.003500	30.92	2.72	11.4	36.01	35.00
0.003600	31.36	2.76	11.4	36.01	35.00
0.003700	31.79	2.79	11.4	36.01	35.00
0.003800	32.22	2.83	11.4	36.01	35.00
0.003900	32.64	2.87	11.4	36.01	35.00
0.004000	33.06	2.91	11.4	36.01	35.00
0.004100	33.47	2.94	11.4	36.01	35.00
0.004200	33.87	2.98	11.4	36.01	35.00

AVONDALE LOCAL RD. W/FLOW @ TOP OF 6" CURB
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.004300	34.27	3.01	11.4	36.01	35.00
0.004400	34.67	3.05	11.4	36.01	35.00
0.004500	35.06	3.08	11.4	36.01	35.00
0.004600	35.45	3.12	11.4	36.01	35.00
0.004700	35.83	3.15	11.4	36.01	35.00
0.004800	36.21	3.18	11.4	36.01	35.00
0.004900	36.59	3.22	11.4	36.01	35.00
0.005000	36.96	3.25	11.4	36.01	35.00
0.005100	37.33	3.28	11.4	36.01	35.00
0.005200	37.69	3.31	11.4	36.01	35.00
0.005300	38.05	3.35	11.4	36.01	35.00
0.005400	38.41	3.38	11.4	36.01	35.00
0.005500	38.76	3.41	11.4	36.01	35.00
0.005600	39.11	3.44	11.4	36.01	35.00
0.005700	39.46	3.47	11.4	36.01	35.00
0.005800	39.81	3.50	11.4	36.01	35.00
0.005900	40.15	3.53	11.4	36.01	35.00
0.006000	40.49	3.56	11.4	36.01	35.00
0.006100	40.82	3.59	11.4	36.01	35.00
0.006200	41.16	3.62	11.4	36.01	35.00
0.006300	41.49	3.65	11.4	36.01	35.00
0.006400	41.81	3.68	11.4	36.01	35.00
0.006500	42.14	3.70	11.4	36.01	35.00
0.006600	42.46	3.73	11.4	36.01	35.00
0.006700	42.78	3.76	11.4	36.01	35.00
0.006800	43.10	3.79	11.4	36.01	35.00
0.006900	43.42	3.82	11.4	36.01	35.00
0.007000	43.73	3.84	11.4	36.01	35.00
0.007100	44.04	3.87	11.4	36.01	35.00
0.007200	44.35	3.90	11.4	36.01	35.00
0.007300	44.66	3.93	11.4	36.01	35.00
0.007400	44.96	3.95	11.4	36.01	35.00
0.007500	45.26	3.98	11.4	36.01	35.00
0.007600	45.57	4.01	11.4	36.01	35.00
0.007700	45.86	4.03	11.4	36.01	35.00
0.007800	46.16	4.06	11.4	36.01	35.00
0.007900	46.46	4.08	11.4	36.01	35.00
0.008000	46.75	4.11	11.4	36.01	35.00
0.008100	47.04	4.14	11.4	36.01	35.00
0.008200	47.33	4.16	11.4	36.01	35.00
0.008300	47.62	4.19	11.4	36.01	35.00
0.008400	47.90	4.21	11.4	36.01	35.00
0.008500	48.19	4.24	11.4	36.01	35.00
0.008600	48.47	4.26	11.4	36.01	35.00
0.008700	48.75	4.29	11.4	36.01	35.00
0.008800	49.03	4.31	11.4	36.01	35.00
0.008900	49.31	4.33	11.4	36.01	35.00
0.009000	49.59	4.36	11.4	36.01	35.00
0.009100	49.86	4.38	11.4	36.01	35.00
0.009200	50.13	4.41	11.4	36.01	35.00
0.009300	50.40	4.43	11.4	36.01	35.00
0.009400	50.68	4.45	11.4	36.01	35.00
0.009500	50.94	4.48	11.4	36.01	35.00

AVONDALE LOCAL RD. W/FLOW @ TOP OF 6" CURB
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.009600	51.21	4.50	11.4	36.01	35.00
0.009700	51.48	4.53	11.4	36.01	35.00
0.009800	51.74	4.55	11.4	36.01	35.00
0.009900	52.01	4.57	11.4	36.01	35.00
0.010000	52.27	4.59	11.4	36.01	35.00
0.010100	52.53	4.62	11.4	36.01	35.00
0.010200	52.79	4.64	11.4	36.01	35.00
0.010300	53.05	4.66	11.4	36.01	35.00
0.010400	53.30	4.69	11.4	36.01	35.00
0.010500	53.56	4.71	11.4	36.01	35.00
0.010600	53.81	4.73	11.4	36.01	35.00
0.010700	54.07	4.75	11.4	36.01	35.00
0.010800	54.32	4.78	11.4	36.01	35.00
0.010900	54.57	4.80	11.4	36.01	35.00
0.011000	54.82	4.82	11.4	36.01	35.00
0.011100	55.07	4.84	11.4	36.01	35.00
0.011200	55.31	4.86	11.4	36.01	35.00
0.011300	55.56	4.88	11.4	36.01	35.00
0.011400	55.81	4.91	11.4	36.01	35.00
0.011500	56.05	4.93	11.4	36.01	35.00
0.011600	56.29	4.95	11.4	36.01	35.00
0.011700	56.54	4.97	11.4	36.01	35.00
0.011800	56.78	4.99	11.4	36.01	35.00
0.011900	57.02	5.01	11.4	36.01	35.00
0.012000	57.26	5.03	11.4	36.01	35.00
0.012100	57.49	5.05	11.4	36.01	35.00
0.012200	57.73	5.08	11.4	36.01	35.00
0.012300	57.97	5.10	11.4	36.01	35.00
0.012400	58.20	5.12	11.4	36.01	35.00
0.012500	58.44	5.14	11.4	36.01	35.00
0.012600	58.67	5.16	11.4	36.01	35.00
0.012700	58.90	5.18	11.4	36.01	35.00
0.012800	59.13	5.20	11.4	36.01	35.00
0.012900	59.36	5.22	11.4	36.01	35.00
0.013000	59.59	5.24	11.4	36.01	35.00
0.013100	59.82	5.26	11.4	36.01	35.00
0.013200	60.05	5.28	11.4	36.01	35.00
0.013300	60.28	5.30	11.4	36.01	35.00
0.013400	60.50	5.32	11.4	36.01	35.00
0.013500	60.73	5.34	11.4	36.01	35.00
0.013600	60.95	5.36	11.4	36.01	35.00
0.013700	61.18	5.38	11.4	36.01	35.00
0.013800	61.40	5.40	11.4	36.01	35.00
0.013900	61.62	5.42	11.4	36.01	35.00
0.014000	61.84	5.44	11.4	36.01	35.00
0.014100	62.06	5.46	11.4	36.01	35.00
0.014200	62.28	5.48	11.4	36.01	35.00
0.014300	62.50	5.49	11.4	36.01	35.00
0.014400	62.72	5.51	11.4	36.01	35.00
0.014500	62.94	5.53	11.4	36.01	35.00
0.014600	63.16	5.55	11.4	36.01	35.00
0.014700	63.37	5.57	11.4	36.01	35.00
0.014800	63.59	5.59	11.4	36.01	35.00

AVONDALE LOCAL RD. W/FLOW @ TOP OF 6" CURB
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.014900	63.80	5.61	11.4	36.01	35.00
0.015000	64.01	5.63	11.4	36.01	35.00
0.015100	64.23	5.65	11.4	36.01	35.00
0.015200	64.44	5.67	11.4	36.01	35.00
0.015300	64.65	5.68	11.4	36.01	35.00
0.015400	64.86	5.70	11.4	36.01	35.00
0.015500	65.07	5.72	11.4	36.01	35.00
0.015600	65.28	5.74	11.4	36.01	35.00
0.015700	65.49	5.76	11.4	36.01	35.00
0.015800	65.70	5.78	11.4	36.01	35.00
0.015900	65.91	5.79	11.4	36.01	35.00
0.016000	66.11	5.81	11.4	36.01	35.00
0.016100	66.32	5.83	11.4	36.01	35.00
0.016200	66.53	5.85	11.4	36.01	35.00
0.016300	66.73	5.87	11.4	36.01	35.00
0.016400	66.94	5.88	11.4	36.01	35.00
0.016500	67.14	5.90	11.4	36.01	35.00
0.016600	67.34	5.92	11.4	36.01	35.00
0.016700	67.54	5.94	11.4	36.01	35.00
0.016800	67.75	5.96	11.4	36.01	35.00
0.016900	67.95	5.97	11.4	36.01	35.00
0.017000	68.15	5.99	11.4	36.01	35.00
0.017100	68.35	6.01	11.4	36.01	35.00
0.017200	68.55	6.03	11.4	36.01	35.00
0.017300	68.75	6.04	11.4	36.01	35.00
0.017400	68.95	6.06	11.4	36.01	35.00
0.017500	69.14	6.08	11.4	36.01	35.00
0.017600	69.34	6.10	11.4	36.01	35.00
0.017700	69.54	6.11	11.4	36.01	35.00
0.017800	69.73	6.13	11.4	36.01	35.00
0.017900	69.93	6.15	11.4	36.01	35.00
0.018000	70.12	6.16	11.4	36.01	35.00
0.018100	70.32	6.18	11.4	36.01	35.00
0.018200	70.51	6.20	11.4	36.01	35.00
0.018300	70.71	6.22	11.4	36.01	35.00
0.018400	70.90	6.23	11.4	36.01	35.00
0.018500	71.09	6.25	11.4	36.01	35.00
0.018600	71.28	6.27	11.4	36.01	35.00
0.018700	71.47	6.28	11.4	36.01	35.00
0.018800	71.67	6.30	11.4	36.01	35.00
0.018900	71.86	6.32	11.4	36.01	35.00
0.019000	72.05	6.33	11.4	36.01	35.00
0.019100	72.24	6.35	11.4	36.01	35.00
0.019200	72.42	6.37	11.4	36.01	35.00
0.019300	72.61	6.38	11.4	36.01	35.00
0.019400	72.80	6.40	11.4	36.01	35.00
0.019500	72.99	6.42	11.4	36.01	35.00
0.019600	73.17	6.43	11.4	36.01	35.00
0.019700	73.36	6.45	11.4	36.01	35.00
0.019800	73.55	6.47	11.4	36.01	35.00
0.019900	73.73	6.48	11.4	36.01	35.00
0.020000	73.92	6.50	11.4	36.01	35.00

AVONDALE LOCAL RD. W/ 6" CURB & FLOW TO R/W LINE
Worksheet for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	0.001000	ft/ft
Water Surface Elevatio	100.61	ft

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Metho	mproved Lotter's Method
Closed Channel Weighting Met	Horton's Method

Results		
Mannings Coefficient	0.016	
Elevation Range	100.00 to 100.61	
Discharge	22.47	cfs
Flow Area	16.4	ft²
Wetted Perimeter	50.30	ft
Top Width	49.45	ft
Actual Depth	0.61	ft
Critical Elevation	100.41	ft
Critical Slope	0.006456	ft/ft
Velocity	1.37	ft/s
Velocity Head	0.03	ft
Specific Energy	100.64	ft
Froude Number	0.42	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+03.00	0.025
0+03.00	0+47.00	0.015
0+47.00	0+50.00	0.025

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	100.61
0+03.00	100.57
0+07.50	100.50
0+07.50	100.00
0+25.00	100.35
0+42.50	100.00
0+42.50	100.33
0+47.00	100.57
0+50.00	100.61

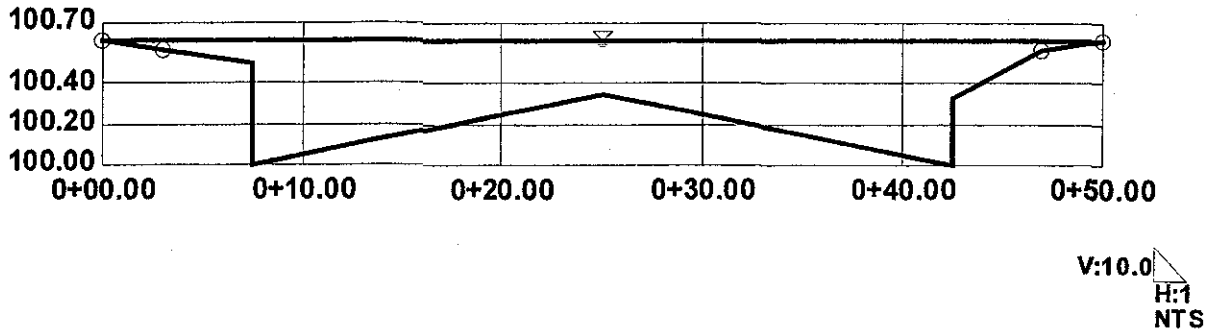
AVONDALE LOCAL RD. W/ 6" CURB & FLOW TO R/W LINE
Worksheet for Irregular Channel

Notes: AVONDALE LOCAL ROAD W/FLOW @ TOP OF 6" CURB.

AVONDALE LOCAL RD. W/ 6" CURB & FLOW TO R/W LINE
Cross Section for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.016	
Slope	0.001000	ft/ft
Water Surface Elevatio	100.61	ft
Elevation Range	100.00 to 100.61	
Discharge	22.47	cfs



AVONDALE LOCAL RD. W/ 6" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Project Description	
Worksheet	AVONDALE LOCAL
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Water Surface Elevatio	100.61 ft

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Metho	mproved Lotter's Method
Closed Channel Weighting Met	Horton's Method

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.001000	0.020000	0.000100

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.001000	22.47	1.37	16.4	50.30	49.45
0.001100	23.56	1.44	16.4	50.30	49.45
0.001200	24.61	1.50	16.4	50.30	49.45
0.001300	25.61	1.56	16.4	50.30	49.45
0.001400	26.58	1.62	16.4	50.30	49.45
0.001500	27.51	1.68	16.4	50.30	49.45
0.001600	28.42	1.73	16.4	50.30	49.45
0.001700	29.29	1.79	16.4	50.30	49.45
0.001800	30.14	1.84	16.4	50.30	49.45
0.001900	30.97	1.89	16.4	50.30	49.45
0.002000	31.77	1.94	16.4	50.30	49.45
0.002100	32.56	1.99	16.4	50.30	49.45
0.002200	33.32	2.03	16.4	50.30	49.45
0.002300	34.07	2.08	16.4	50.30	49.45
0.002400	34.80	2.12	16.4	50.30	49.45
0.002500	35.52	2.17	16.4	50.30	49.45
0.002600	36.22	2.21	16.4	50.30	49.45
0.002700	36.91	2.25	16.4	50.30	49.45
0.002800	37.59	2.29	16.4	50.30	49.45
0.002900	38.26	2.33	16.4	50.30	49.45
0.003000	38.91	2.37	16.4	50.30	49.45
0.003100	39.55	2.41	16.4	50.30	49.45
0.003200	40.19	2.45	16.4	50.30	49.45
0.003300	40.81	2.49	16.4	50.30	49.45
0.003400	41.42	2.53	16.4	50.30	49.45
0.003500	42.03	2.57	16.4	50.30	49.45
0.003600	42.62	2.60	16.4	50.30	49.45
0.003700	43.21	2.64	16.4	50.30	49.45
0.003800	43.79	2.67	16.4	50.30	49.45
0.003900	44.37	2.71	16.4	50.30	49.45
0.004000	44.93	2.74	16.4	50.30	49.45
0.004100	45.49	2.78	16.4	50.30	49.45
0.004200	46.04	2.81	16.4	50.30	49.45

AVONDALE LOCAL RD. W/ 6" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.004300	46.58	2.84	16.4	50.30	49.45
0.004400	47.12	2.88	16.4	50.30	49.45
0.004500	47.66	2.91	16.4	50.30	49.45
0.004600	48.18	2.94	16.4	50.30	49.45
0.004700	48.70	2.97	16.4	50.30	49.45
0.004800	49.22	3.00	16.4	50.30	49.45
0.004900	49.73	3.04	16.4	50.30	49.45
0.005000	50.23	3.07	16.4	50.30	49.45
0.005100	50.73	3.10	16.4	50.30	49.45
0.005200	51.23	3.13	16.4	50.30	49.45
0.005300	51.72	3.16	16.4	50.30	49.45
0.005400	52.20	3.19	16.4	50.30	49.45
0.005500	52.69	3.22	16.4	50.30	49.45
0.005600	53.16	3.24	16.4	50.30	49.45
0.005700	53.63	3.27	16.4	50.30	49.45
0.005800	54.10	3.30	16.4	50.30	49.45
0.005900	54.57	3.33	16.4	50.30	49.45
0.006000	55.03	3.36	16.4	50.30	49.45
0.006100	55.48	3.39	16.4	50.30	49.45
0.006200	55.94	3.41	16.4	50.30	49.45
0.006300	56.39	3.44	16.4	50.30	49.45
0.006400	56.83	3.47	16.4	50.30	49.45
0.006500	57.28	3.50	16.4	50.30	49.45
0.006600	57.71	3.52	16.4	50.30	49.45
0.006700	58.15	3.55	16.4	50.30	49.45
0.006800	58.58	3.58	16.4	50.30	49.45
0.006900	59.01	3.60	16.4	50.30	49.45
0.007000	59.44	3.63	16.4	50.30	49.45
0.007100	59.86	3.65	16.4	50.30	49.45
0.007200	60.28	3.68	16.4	50.30	49.45
0.007300	60.70	3.70	16.4	50.30	49.45
0.007400	61.11	3.73	16.4	50.30	49.45
0.007500	61.52	3.75	16.4	50.30	49.45
0.007600	61.93	3.78	16.4	50.30	49.45
0.007700	62.34	3.80	16.4	50.30	49.45
0.007800	62.74	3.83	16.4	50.30	49.45
0.007900	63.14	3.85	16.4	50.30	49.45
0.008000	63.54	3.88	16.4	50.30	49.45
0.008100	63.94	3.90	16.4	50.30	49.45
0.008200	64.33	3.93	16.4	50.30	49.45
0.008300	64.72	3.95	16.4	50.30	49.45
0.008400	65.11	3.97	16.4	50.30	49.45
0.008500	65.50	4.00	16.4	50.30	49.45
0.008600	65.88	4.02	16.4	50.30	49.45
0.008700	66.26	4.04	16.4	50.30	49.45
0.008800	66.64	4.07	16.4	50.30	49.45
0.008900	67.02	4.09	16.4	50.30	49.45
0.009000	67.40	4.11	16.4	50.30	49.45
0.009100	67.77	4.14	16.4	50.30	49.45
0.009200	68.14	4.16	16.4	50.30	49.45
0.009300	68.51	4.18	16.4	50.30	49.45
0.009400	68.88	4.20	16.4	50.30	49.45
0.009500	69.24	4.23	16.4	50.30	49.45

AVONDALE LOCAL RD. W/ 6" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.009600	69.61	4.25	16.4	50.30	49.45
0.009700	69.97	4.27	16.4	50.30	49.45
0.009800	70.33	4.29	16.4	50.30	49.45
0.009900	70.68	4.31	16.4	50.30	49.45
0.010000	71.04	4.34	16.4	50.30	49.45
0.010100	71.40	4.36	16.4	50.30	49.45
0.010200	71.75	4.38	16.4	50.30	49.45
0.010300	72.10	4.40	16.4	50.30	49.45
0.010400	72.45	4.42	16.4	50.30	49.45
0.010500	72.80	4.44	16.4	50.30	49.45
0.010600	73.14	4.46	16.4	50.30	49.45
0.010700	73.49	4.48	16.4	50.30	49.45
0.010800	73.83	4.51	16.4	50.30	49.45
0.010900	74.17	4.53	16.4	50.30	49.45
0.011000	74.51	4.55	16.4	50.30	49.45
0.011100	74.85	4.57	16.4	50.30	49.45
0.011200	75.18	4.59	16.4	50.30	49.45
0.011300	75.52	4.61	16.4	50.30	49.45
0.011400	75.85	4.63	16.4	50.30	49.45
0.011500	76.18	4.65	16.4	50.30	49.45
0.011600	76.51	4.67	16.4	50.30	49.45
0.011700	76.84	4.69	16.4	50.30	49.45
0.011800	77.17	4.71	16.4	50.30	49.45
0.011900	77.50	4.73	16.4	50.30	49.45
0.012000	77.82	4.75	16.4	50.30	49.45
0.012100	78.15	4.77	16.4	50.30	49.45
0.012200	78.47	4.79	16.4	50.30	49.45
0.012300	78.79	4.81	16.4	50.30	49.45
0.012400	79.11	4.83	16.4	50.30	49.45
0.012500	79.43	4.85	16.4	50.30	49.45
0.012600	79.74	4.87	16.4	50.30	49.45
0.012700	80.06	4.89	16.4	50.30	49.45
0.012800	80.37	4.91	16.4	50.30	49.45
0.012900	80.69	4.92	16.4	50.30	49.45
0.013000	81.00	4.94	16.4	50.30	49.45
0.013100	81.31	4.96	16.4	50.30	49.45
0.013200	81.62	4.98	16.4	50.30	49.45
0.013300	81.93	5.00	16.4	50.30	49.45
0.013400	82.24	5.02	16.4	50.30	49.45
0.013500	82.54	5.04	16.4	50.30	49.45
0.013600	82.85	5.06	16.4	50.30	49.45
0.013700	83.15	5.07	16.4	50.30	49.45
0.013800	83.45	5.09	16.4	50.30	49.45
0.013900	83.76	5.11	16.4	50.30	49.45
0.014000	84.06	5.13	16.4	50.30	49.45
0.014100	84.36	5.15	16.4	50.30	49.45
0.014200	84.66	5.17	16.4	50.30	49.45
0.014300	84.95	5.18	16.4	50.30	49.45
0.014400	85.25	5.20	16.4	50.30	49.45
0.014500	85.54	5.22	16.4	50.30	49.45
0.014600	85.84	5.24	16.4	50.30	49.45
0.014700	86.13	5.26	16.4	50.30	49.45
0.014800	86.43	5.27	16.4	50.30	49.45

AVONDALE LOCAL RD. W/ 6" CURB & FLOW TO R/W LINE
Rating Table for Irregular Channel

Slope (ft/ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.014900	86.72	5.29	16.4	50.30	49.45
0.015000	87.01	5.31	16.4	50.30	49.45
0.015100	87.30	5.33	16.4	50.30	49.45
0.015200	87.59	5.35	16.4	50.30	49.45
0.015300	87.87	5.36	16.4	50.30	49.45
0.015400	88.16	5.38	16.4	50.30	49.45
0.015500	88.45	5.40	16.4	50.30	49.45
0.015600	88.73	5.42	16.4	50.30	49.45
0.015700	89.01	5.43	16.4	50.30	49.45
0.015800	89.30	5.45	16.4	50.30	49.45
0.015900	89.58	5.47	16.4	50.30	49.45
0.016000	89.86	5.48	16.4	50.30	49.45
0.016100	90.14	5.50	16.4	50.30	49.45
0.016200	90.42	5.52	16.4	50.30	49.45
0.016300	90.70	5.54	16.4	50.30	49.45
0.016400	90.98	5.55	16.4	50.30	49.45
0.016500	91.25	5.57	16.4	50.30	49.45
0.016600	91.53	5.59	16.4	50.30	49.45
0.016700	91.81	5.60	16.4	50.30	49.45
0.016800	92.08	5.62	16.4	50.30	49.45
0.016900	92.35	5.64	16.4	50.30	49.45
0.017000	92.63	5.65	16.4	50.30	49.45
0.017100	92.90	5.67	16.4	50.30	49.45
0.017200	93.17	5.69	16.4	50.30	49.45
0.017300	93.44	5.70	16.4	50.30	49.45
0.017400	93.71	5.72	16.4	50.30	49.45
0.017500	93.98	5.74	16.4	50.30	49.45
0.017600	94.25	5.75	16.4	50.30	49.45
0.017700	94.51	5.77	16.4	50.30	49.45
0.017800	94.78	5.78	16.4	50.30	49.45
0.017900	95.05	5.80	16.4	50.30	49.45
0.018000	95.31	5.82	16.4	50.30	49.45
0.018100	95.58	5.83	16.4	50.30	49.45
0.018200	95.84	5.85	16.4	50.30	49.45
0.018300	96.10	5.87	16.4	50.30	49.45
0.018400	96.36	5.88	16.4	50.30	49.45
0.018500	96.63	5.90	16.4	50.30	49.45
0.018600	96.89	5.91	16.4	50.30	49.45
0.018700	97.15	5.93	16.4	50.30	49.45
0.018800	97.41	5.94	16.4	50.30	49.45
0.018900	97.67	5.96	16.4	50.30	49.45
0.019000	97.92	5.98	16.4	50.30	49.45
0.019100	98.18	5.99	16.4	50.30	49.45
0.019200	98.44	6.01	16.4	50.30	49.45
0.019300	98.69	6.02	16.4	50.30	49.45
0.019400	98.95	6.04	16.4	50.30	49.45
0.019500	99.20	6.05	16.4	50.30	49.45
0.019600	99.46	6.07	16.4	50.30	49.45
0.019700	99.71	6.09	16.4	50.30	49.45
0.019800	99.96	6.10	16.4	50.30	49.45
0.019900	100.22	6.12	16.4	50.30	49.45
0.020000	100.47	6.13	16.4	50.30	49.45

October 14, 2002

Mr. David W. Fitzhugh, P.E.
City Engineer
CITY OF AVONDALE
1211 South Fourth Street
Avondale, Arizona 85323

RE: TRES RIOS LANDING – WAIVER REQUEST FOR STREET SLOPES
(CMX Project No. 6125)

Dear Dave:

As required by the Development Services Department, Engineering Division, we hereby request a waiver for longitudinal street slopes less than 0.50%. In several locations throughout this site, we are utilizing 0.25% longitudinal grades with 0.30% to 0.35% grades at onsite valley gutters and knuckles. This design has been selected in part to avoid the need to import large volumes of fill material (after accounting for the shrinkage factors in the soils report).

Onsite, Eliseo C. Felix Jr. Way has been set at 0.25% grades with 0.35% valley gutters. It parallels the Agua Fria River Levee, which runs at a substantially flatter grade than 0.25%. Offsite, Dysart Road uses some 0.25% longitudinal grades due to a variety of drainage constraints. These grades are similar to designs we used earlier this year in Parcel 8 of the Coldwater Springs development, northeast of this project.

If you have questions, or need additional information, please do not hesitate to call.

Respectfully submitted,

CMX GROUP INC.

Delmar E. Fox, P.E.
Project Manager

SECTION C-1

- **Offsite Runoff @ North Site Boundary**

CMX Group Inc
1515 East Missouri
Suite 115
Phoenix, AZ 85014
☎ 602.279.8436
FAX 602.265.1191

PROJECT Tres Rios Landing
SUBJECT Offsite Runoff @ North Site Boundary
CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____
SHEET ____ OF ____ BY _____ DATE 9/9/02

Revised 9/9/02

Offsite runoff from watershed North of Site Revised for retention Volume provided to retain the 100-year, 6-hour storm volume

Attached HEC-1 output indicate Zero offsite Flow into Elise C. Felix Jr. Drainage Corridor

SECTION C-2

- Table 4, 10-year & 100-year Flow Distribution
- Hydrologic Data Sheets, Rational Method

TABLE 4
ELISEO C. FELIX JR. DRAINAGE CORRIDOR
(10-Yr. & 100-Yr. Flow Dristribution)

LOCATION		CATCH BASIN	RATIONAL METHOD RUNOFF		PIPE FLOW		100-YR.SURFACE FLOW	
C.P.	STREET	Q_{10} (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	Q_{10} (cfs)	INCREASE IN Q cfs)	RATIONAL METHOD(1) (cfs)	HEC-1 SUMM.(2) (cfs)
7	Corral St.	0	9.76	19.52	0	0	82.52	20.00
8	Doris St.	0	14.80	29.76	0	0	91.76	36.00
9	Dee St.	20.00	19.58	38.73	20.00	20.00	81.15	29.00
10	Randy St.	0	21.99	45.81	20.00	0	88.23	43.00
11	Harrison Dr.	15.33	27.20	54.36	35.33	15.33	96.78	44.67
13	Overlin Dr.	30.66	32.79	65.65	65.99	30.66	94.86	33.01
15	Davis Ln.	0	36.64	73.61	65.99	0	102.82	50.01
16	Locus Ln.	0	38.30	77.03	65.99	0	106.24	61.01
18	WhymanAve.	0	38.45	76.85	65.99	0	106.24	65.01

NOTE: (1) Flow Include 62 cfs Excess 100-Yr, 6-Hr Flow From Offsite Added Peak-to-Peak To Onsite Rational Method Q's.

(2) Q's Based On Hydrograph Summations By HEC-1 Method With 100-Yr., 6-Hr. Retention In Offsite Watershed & Zero Outflow.

Hydrologic Design Data Sheet
Rational Method

Sub-basin Label G

Concentration Point 7

DESIGN DATA

Drainage Area	6.72	acres
Street Drainage Length	1059.38	feet
Street Slope	0.3	%
Average Velocity	109	fps
Street Tc	16.20	minutes
Initial Lot Tc	10	minutes
Total Tc	26.20	minutes

DESIGN CONDITIONS

Design Frequency		10	50	100
Precipitation	P			
Time of Concentration	Tc	26.20		
Rainfall Intensity	i	2.64	3.70	4.21
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge	Q=CiA	9.76	16.41	19.52

FOR C.B.

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G & H

CONCENTRATION POINT 8

DESIGN DATA

Drainage Area 11.03 acres

Drainage Length (Area H Only) 270 feet

Average Velocity (Area H Only) 1.5 fps

Tc for Area H 3 minutes

Previous Tc to Point 7 26.20 minutes

Total Tc 29.20 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	29.20		
Rainfall Intensity	i	2.44	3.44	3.91
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		14.80	25.04	29.76

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA H & I

CONCENTRATION POINT 9

DESIGN DATA

Drainage Area 8.05 acres

Drainage Length (Area I Only) 270 feet

Average Velocity (Area I Only) 1.5 fps

Tc for Area H 3.00 minutes

Previous Tc to Point 8 17.43 minutes

Total Tc 20.43 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	20.43		
Rainfall Intensity	i	3.17	4.42	5.01
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		14.03	23.48	27.83

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G, H, & I

CONCENTRATION POINT 9

DESIGN DATA

Drainage Area	14.77	acres
Drainage Length (Area H & I Only)	540	feet
Average Velocity (Area H & I Only)	1.5	fps
Tc for Area H & I	6.00	minutes
Previous Tc to Point 7	26.20	minutes
Total Tc	32.20	minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	32.20		
Rainfall Intensity	i	2.41	3.29	3.80
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		19.58	32.07	38.73

FOR C.B.

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G THRU J

CONCENTRATION POINT 10

DESIGN DATA

Drainage Area 18.86 acres

Drainage Length (Area G-J Only) 270 feet

Average Velocity (Area G-J Only) 1.5 fps

Tc for Area _____ 3 minutes

Previous Tc to Point 9 32.20 minutes

Total Tc 35.20 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	35.20		
Rainfall Intensity	i	2.21	3.05	3.52
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		21.99	37.97	45.81

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G Thru K

CONCENTRATION POINT 11

DESIGN DATA

Drainage Area 23.66 acres

Drainage Length (Area K Only) 270 feet

Average Velocity (Area K Only) 1.5 fps

Tc for Area K 3.00 minutes

Previous Tc to Point 10 35.20 minutes

Total Tc 38.20 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	38.20		
Rainfall Intensity	i	2.09	2.89	3.33
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		27.20	45.13	54.36

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA J, K, L, & M

CONCENTRATION POINT 13

DESIGN DATA

Drainage Area 15.34 acres

Drainage Length (Area L & M Only) 0 feet

Average Velocity (Area L & M Only) _____ fps

Tc for Area L & M 0 minutes

Previous Tc to Point 13 26.44 minutes

Total Tc 26.44 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	26.44		
Rainfall Intensity	i	2.62	3.68	4.18
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		22.10	37.26	44.24

For C.B.

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G Thru M

CONCENTRATION POINT 13

DESIGN DATA

Drainage Area 30.11 acres

Drainage Length (Area J → M Only) 810 feet

Average Velocity (Area J → M Only) 1.5 fps

Tc for Area J → M 9.00 minutes

Previous Tc to Point 9 32.20 minutes

Total Tc 41.20 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	41.20		
Rainfall Intensity	i	1.98	2.75	3.16
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		32.79	54.65	65.65

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G Th D O

CONCENTRATION POINT 15

DESIGN DATA

Drainage Area	35.44	acres
Drainage Length (Area 0 Only)	270	feet
Average Velocity (Area 0 Only)	1.5	fps
Tc for Area 0	3.00	minutes
Previous Tc to Point 13	41.20	minutes
Total Tc	44.20	minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	44.20		
Rainfall Intensity	i	1.88	2.62	3.01
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		36.64	61.28	73.61

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G Thru P

CONCENTRATION POINT 16

DESIGN DATA

Drainage Area 38.90 acres

Drainage Length (Area P Only) 270 feet

Average Velocity (Area P Only) 1.5 fps

Tc for Area P 3 minutes

Previous Tc to Point 15 44.20 minutes

Total Tc 47.20 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	47.20		
Rainfall Intensity	i	1.79	2.50	2.87
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		38.30	64.19	77.03

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA G → P plus R

CONCENTRATION POINT 18

DESIGN DATA

Drainage Area 40.65 acres

Drainage Length (Area P & R Only) 540 feet

Average Velocity (Area P & R Only) 1.5 fps

Tc for Area P & R 6.00 minutes

Previous Tc to Point 15 44.20 minutes

Total Tc 50.20 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	50.20		
Rainfall Intensity	i	1.72	2.39	2.74
Runoff Coefficient	C	.55	.66	.69
Peak Discharge Qp = CiA =		38.45	64.12	76.85

SECTION C-3

- **Eliseo C. Felix Jr. Storm Drain**

Scenario: ELISEO C. FELIX S.D. W/HORIZONTAL ELIPITICAL PIPES

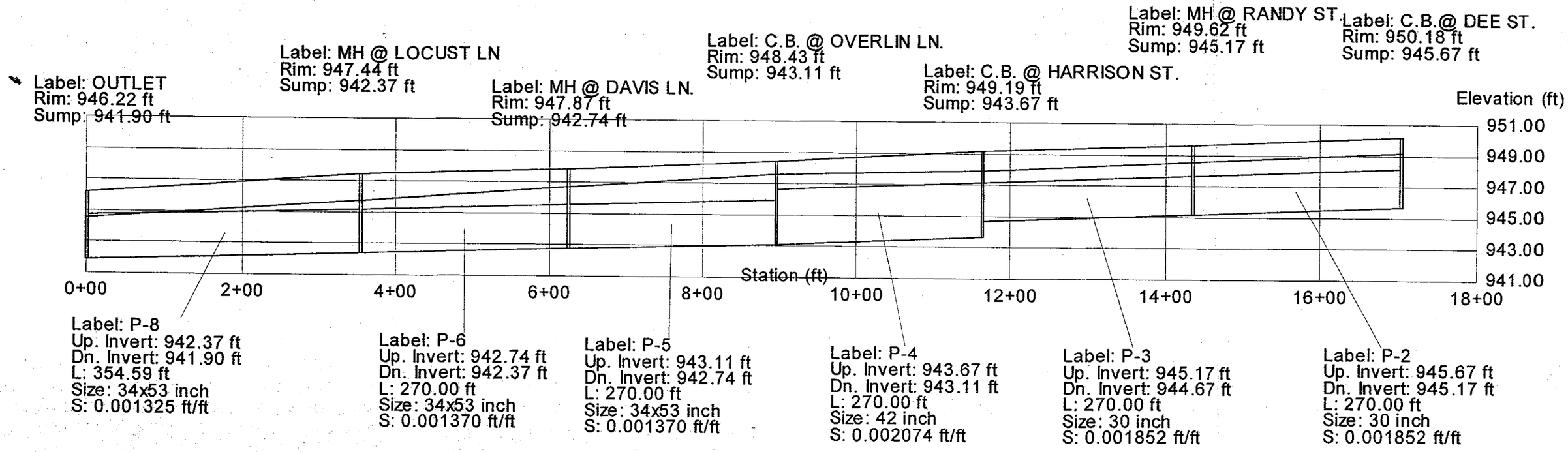
Pipe Report

Label	Section Size	Q (cfs)	Length L (ft)	n	D.S. Inv. Elev. (ft)	U.S. Inv. Elev. (ft)	D.S. Cover (ft)	U.S. Cover (ft)	H.G.L. Out (ft)	H.G.L. IN (ft)	v Out (ft/s)	v In (ft/s)	Material	Shape	Downstream Node	Upstream Node
P-2	30 inch	20.00	270.00	0.013	945.17	945.67	1.95	2.01	948.57	949.21	4.07	4.07	Concrete	Circular	MH @ RANDY ST.	C.B.@ DEE ST.
P-3	30 inch	20.00	270.00	0.013	944.67	945.17	2.02	1.95	947.93	948.57	4.07	4.07	Concrete	Circular	C.B. @ HARRISON ST.	MH @ RANDY ST.
P-4	42 inch	35.33	270.00	0.013	943.11	943.67	1.82	2.02	947.60	947.93	3.67	3.67	Concrete	Circular	C.B. @ OVERLIN LN.	C.B. @ HARRISON ST.
P-5	34x53 inch	65.99	270.00	0.013	942.74	943.11	2.30	2.49	946.68	947.60	6.47	6.47	Concrete	Horizontal Ellipse	MH @ DAVIS LN.	C.B. @ OVERLIN LN.
P-6	34x53 inch	65.99	270.00	0.013	942.37	942.74	2.24	2.30	945.76	946.68	6.47	6.47	Concrete	Horizontal Ellipse	MH @ LOCUST LN	MH @ DAVIS LN.
P-8	34x53 inch	65.99	354.59	0.013	941.90	942.37	1.49	2.24	944.51	945.76	6.71	6.47	Concrete	Horizontal Ellipse	OUTLET	MH @ LOCUST LN

Inlet Report

Label	Calculated Station (ft)	Ground Elevation (ft)	Set Rim Equal to Ground Elevation?	Rim Elevation (ft)	Sump Elevation (ft)	Carryover Additional Flow (cfs)	Bypassed Additional Flow (cfs)	Intercepted Additional Flow (cfs)	Additional Flow (cfs)
C.B.@ DEE ST.	17+05	950.18	true	950.18	945.67	0.00	0.00	0.00	20.00
C.B. @ HARRISON ST.	11+65	949.19	true	949.19	943.67	0.00	0.00	0.00	15.33
C.B. @ OVERLIN LN.	8+95	948.43	true	948.43	943.11	0.00	0.00	0.00	30.66

Profile
Scenario: ELISEO C. FELIX S.D. W/HORIZONTAL ELIPITICAL PIPES



CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing, Elisco C. Felix S.D.
C.B. @ Dee St., P1569-1 M-1

EQUATION(S):

1. Scupper Capacity (Q)=.67*H\12*L*(2g*Do)^.5)*Fcl
   (D+a) >(H+a) Therefore Orifice Flow)

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height(D) = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. HEIGHT OF CURB OPENING (H) = 5 INCHES
6. Do= .4583334 Ft.=(D+a-H/2)/12

SCUPPER (OR CB W/O GRATE) IN SUMP AREA

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH	STANDARD LENGTH	SCUPPER CAPACITY
DEE ST.	10.00 =Q/2	8.24	9.00	10.92

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing, Eliseo C. Felix S.D.,
C.B. @ Harrison Dr, P1569-1 M-1

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= 1

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .002526

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
HARRISON	7.67=Q/2	18.37	20.	7.67

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing, Eliseo C. Felix S.D.
C.B. @ Overlin Ln., P1569-1 M-1.

EQUATION(S):

1. Scupper Capacity (Q)=.67*H\12*L*(2g*Do)^.5)*Fcl
   (D+a) >(H+a) Therefore Orifice Flow)

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height(D) = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. HEIGHT OF CURB OPENING (H) = 5 INCHES
6. Do= .4583334 Ft.=(D+a-H/2)/12

SCUPPER (OR CB W/O GRATE) IN SUMP AREA

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH	STANDARD LENGTH	SCUPPER CAPACITY
OVERLIN	15.33 =Q/2	12.63	13.00	15.77

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

PROJECT TRES RIOS LANDING

SUBJECT Eliseo C. Filix Jr. way, Catch basin Hydraulics

PROJECT NUMBER _____ CMX PROJECT NUMBER _____

SHEET ____ OF ____ BY _____ DATE _____

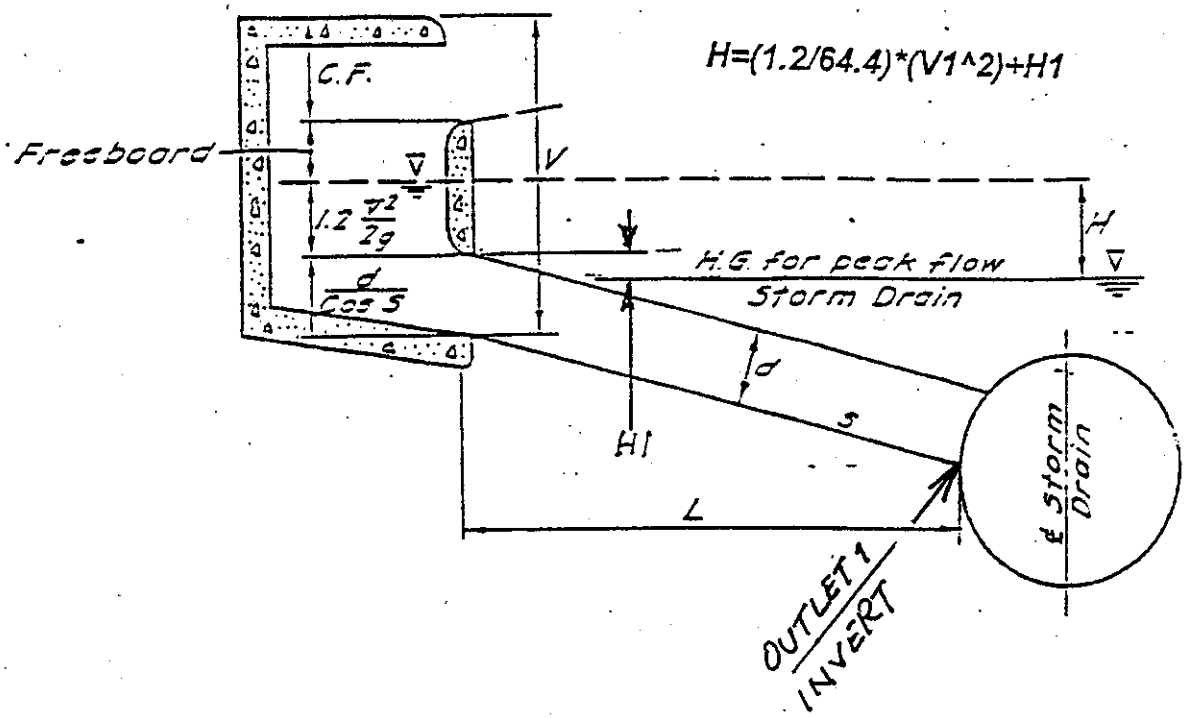
CMX Group Inc
1515 East Missouri
Suite 115
Phoenix, AZ 85014
☎ 602.279.8436
FAX 602.265.1191

CMX

SINGLE CATCH BASIN

H1=2.87*N1^2*L1*V1^2/D1^(4/3)

H=(1.2/64.4)*(V1^2)+H1



CATCH BASIN HYDRAULICS

MAG 533-2, COP 1569-1, OR EQUIVALENT TYPES
CALCULATION FOR SINGLE CATCH BASIN

Project Tres Rios Landing, Eliseo C. Felix S.D.

LOCATION C.B. @ Harrison Dr, COP 1569-1

CATCH BASIN No.1

BEGINNING TAILWATER ELEVATION = 947.93 (a)
OUTLET INVERT ELEVATION = 943.33
INLET INVERT ELEVATION @ C.B.NO.1= 943.3635
PIPE DIAMETER FOR C.B.No.1 = 1.5 Ft.
LENGTH OF PIPE No.1 = 16.75 Ft.
SLOPE OF PIPE No.1 = .002 Ft/Ft
MANNINGS N-VALUE FOR PIPE No.1 = .013
FLOW IN PIPE No.1 = 7.67 cfs
VELOCITY IN PIPE No.1 = 4.340336
TOP OF CURB ELEV. @ C.B. No.1 = 949.06
V-DEPTH @ C.B.No.1 = 5.696472 FT.
W.S.ELEVATION IN C.B.1 = 948.3702
FREEBOARD @ CATCH BASIN No.1 = 2.313233E-02 Ft.

(a) CHECK CAUSE OF DOWNSTREAM TAILWATER DEPTH:
1. DEPTH DUE TO PONDING ( )
2. DEPTH ASSUMED @ TOP OF PIPE ( )
3. H.G.L. IN DOWNSTREAM PIPE JUNCTION (X)
4. NORMAL DEPTH FLOW < PIPE DIAMETER ( )

CATCH BASIN HYDRAULICS

MAG 533-2, COP 1569-1, OR EQUIVALENT TYPES
CALCULATION FOR SINGLE CATCH BASIN

Project Tres Rios Landing, Eliseo C. Felix S.D.

LOCATION C.B.@ Overlin Ln, COP 1569-1

CATCH BASIN No.1

BEGINNING TAILWATER ELEVATION = 947.6 (a)
OUTLET INVERT ELEVATION = 942.77
INLET INVERT ELEVATION @ C.B.NO.1= 942.8202
PIPE DIAMETER FOR C.B.No.1 = 2 Ft.
LENGTH OF PIPE No.1 = 16.75 Ft.
SLOPE OF PIPE No.1 = .003 Ft/Ft
MANNINGS N-VALUE FOR PIPE No.1 = .013
FLOW IN PIPE No.1 = 15.33 cfs
VELOCITY IN PIPE No.1 = 4.879695
TOP OF CURB ELEV. @ C.B. No.1 = 948.6
V-DEPTH @ C.B.No.1 = 5.779724 FT.
W.S.ELEVATION IN C.B.1 = 948.1204
FREEBOARD @ CATCH BASIN No.1 = -.1871338 Ft.

(a) CHECK CAUSE OF DOWNSTREAM TAILWATER DEPTH:
1. DEPTH DUE TO PONDING ( )
2. DEPTH ASSUMED @ TOP OF PIPE ( )
3. H.G.L. IN DOWNSTREAM PIPE JUNCTION (X)
4. NORMAL DEPTH FLOW < PIPE DIAMETER ( )

SECTION C-4

- Catch Basin Design Procedures
- Catch Basin Hydraulics
- Catch Basin Capacities along Buckeye Road

PROJECT Tres Rios Landing
SUBJECT Catch Basin Capacities along Buckeye Rd
CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____
SHEET ____ OF ____ BY _____ DATE _____

CMX Group Inc
1515 East Missouri
Suite 115
Phoenix, AZ 85014
☎ 602.279.8436
FAX 602.265.1191

CMX

I Tributary Areas

Assume 70 Ft wide paved areas

CB@ STA 86+/-55

From Sta 90+96.12 to Sta 86+55

Area = (9096.12 - 8655) × 70/43560 = 0.709 Acres

S = (67.67 - 65.21)/(9696.12 - 8655) = 0.0056

C.B. @ STA 81+/-53

From Sta 86+55 to Sta 81+53

Area = (8655 - 8153) × 70/43560 = 0.807 Acres

S = (65.21 - 62.29)/(8655 - 8153) = .0056

C.B @ STA 78+/-80

From Sta 81+53 to Sta 78+80

Area = (8153 - 7880)(75+70)/(2 × 43560) = 0.454 Acres

S = (62.29 - 61.28)/(8153 - 7880) = 0.00369

II For 10yr and 100-yr Q's See Atached MCFCD Rational Method Calc Sheets

III Given Existing Catch basins with L = 3 Ft See Attached C.B. Calc Shts for basin Capacities and Flow-by for 10-yr and 100-yr Q's

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMX Date: 01-23-03

LOCATION DATA

Location: BUCKEYE RD.

Project Name: TRES RIOS LANDI Subarea id: STA86+-55

Drainage Area Cover: PAVED

DESIGN DATA

Drainage Area	0.71	acres
Watercourse Length	441.1	feet
Top Elevation	67.7	feet
Bottom Elevation	65.2	feet
Slope	.00558	feet/feet
Roughness Coefficient (Kb)	.04093	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	2	3	4	5	6
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	8.6	7.6	7.2	6.6	6.2	5.9
i (in/hr)	3.0	4.2	4.8	6.2	7.1	8.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMX Date: 01-23-03

LOCATION DATA

Location: BUCKEYE RD.

Project Name: TRES RIOS LANDI Subarea id: STA81+-53

Drainage Area Cover: PAVED

DESIGN DATA

Drainage Area	0.81	acres
Watercourse Length	502.0	feet
Top Elevation	65.2	feet
Bottom Elevation	62.3	feet
Slope	.00582	feet/feet
Roughness Coefficient (Kb)	.04058	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	3	4	5	6
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	9.1	8.1	7.7	6.9	6.6	6.2
i (in/hr)	3.0	4.1	4.7	6.1	7.0	8.1

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMX Date: 01-23-03

LOCATION DATA

Location: BUCKEYE RD.

Project Name: TRES RIOS LANDI Subarea id: STA78+-80

Drainage Area Cover: PAVED

DESIGN DATA

Drainage Area	0.45	acres
Watercourse Length	273.0	feet
Top Elevation	62.3	feet
Bottom Elevation	61.3	feet
Slope	.00370	feet/feet
Roughness Coefficient (Kb)	.04214	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	3	4
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	7.7	6.8	6.4	5.9	5.6	5.3
i (in/hr)	3.2	4.4	5.1	6.4	7.4	8.5

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing
Buckeye Rd C.B. @ Sta 86+/-55
Q10

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .3145641

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .00575

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA86+-55	3.00	15.85	3.	0.94

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

Flow-by = 3 - 0.94 = 2.06

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing
Buckeye Rd @ Sta 81+/- 53
Q_{10}

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23
2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .2837144
3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. Street Slope (S)= .00547
6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA81+-53	4.06 *	17.73	3.	1.15

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

* Q_{10} = Q @ Sta 81±53 + Flow by From Sta 86 ±55

Flow by = 4.06 - 1.15 = 2.91

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing
Buckeye Rd @ STA 78 +/- 80
Q_{10}

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .408142

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .0011

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA78+-80	4.91 *	11.87	3.	2.00

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

* Q_{10} = Q @ STA 78 +/- 80 + Flow-by From Sta 81 +/- 53
Flow-by = 4.91 - 2.00 = 2.91

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing
Buckeye Rd C.B. @ Sta 86+/-55
Q_{100}

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .2400991

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .00575

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(~~10YR~~) 100yr	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA86+-55	6.00	21.21	3.	1.44

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

Flow-by = 6.00 - 1.44 = 4.56

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION_____

_____

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23
2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .2859665
3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. Street Slope (S)= .0011
6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q (~~10YR~~) 100 yr	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA78+-80	12.51 *	17.58	3.	3.58

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

* Q_{100} = Q @ Sta 78+/-80 + Flow-by From Sta 81+/-53

Flow-by = 12.51 − 3.58 = 8.93

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing
Buckeye Rd. @ sta 81+/-53
Q_{100}

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23
2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .1945539
3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. Street Slope (S)= .00547
6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(~~10YR~~) 100yr	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA81+-53	10.56 *	26.49	3.	2.05

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

* Q_{100} = Q @ sta 81+/-53 + Flow-by From sta 81+/-55
Flow-by = 10.56 - 2.05 = 8.51

SECTION C-5

- HEC-1 Hydrology
- Interim Retention Basin for Parcels 1, 2, & 3

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*          SEPTEMBER 1990              *
*           VERSION 4.0                *
*                                      *
* RUN DATE  01/23/2003  TIME  15:16:03 *
*                                      *
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****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
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X     X  XXXXXXX   XXXXX          X
X     X  X       X     X        XX
X     X  X       X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X       X              X
X     X  X       X     X        X
X     X  XXXXXXX   XXXXX        XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

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

  1           ID   100-YR., 6-HR. OFFSITE RUNOFF FROM NORTH OF PROJECT SITE
  2           ID   WITH WATERSHED IN AN UNDEVELOPED STATE.
  3           ID   ROUTED THRU AN INTERIM RET. DASIN SIZED FOR A 100-YR., 6-HR. RUNOFF FROM
  4           ID   UNDEVELOPED OFFSITE AREA  PLUS 100-YR., 6-HR RAINFALL ON ONSITE DEVELOPED
  5           ID   AREA FROM CARRAL ST.THRU WHYMAN AVE.
  6           ID   FILE:TRESRIO2.DAT
  7           IT       5                    300
  8           IO       5
              *DIAGRAM

  9           KK    SUBA
 10           KM   SUB-BASIN A (UNSEVELOPED AREA)
 11           KM   6-HOUR RAINFALL, PATTERN NO. 1.00 WAS USED TO FIND TC & R FOR THIS BASIN
 12           KM   THIS BASIN USED RAINFALL REDUCTION FACTOR OF .993
 13           BA  .08248
 14           IN      15
 15           KM   RAINFALL DEPTH OF 3.20 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 16           PB   3.179
 17           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN No. OF 1.00
 18           PC    .000    .008    .016    .025    .033    .041    .050    .058    .066    .074
 19           PC    .087    .099    .118    .138    .216    .377    .834    .911    .931    .950
 20           PC    .962    .972    .983    .991   1.000
 21           LG    .220    .300   4.660    .360   0.000
 22           UC    .500    .306
 23           UA       0       3       5       8      12      20      43      75      90      96
 24           UA     100

 25           KK     CP1
 26           KO       2
 27           KM   ROUTE RUNOFF THRU INTERIM RETENTION BASIN SIZED FOR 100-YR., 6-HR. RAINFALL
 28           KM   ON THE UNDEVELOPED WATERSHED.
 29           KM   VOLUME = CPA/12
 30           DT    DET.    6.46
 31           DI       0      50     100     200
 32           DQ       0      50     100     200

 33           KK    SUBG
 34           KM    RUNOFF IN CORRAL ST. FROM SUBAREA G
 35           BA   .0140
 36           LG    .220    .300   4.660    .360  78.000
 37           UC    .437    .548
 38           UA       0       5      16      30      65      77      84      90      94      97
 39           UA     100

 40           KK     CP7
 41           KM    COMBINE RUNOFF FROM SUBAREA G WITH OFFSITE FLOW
 42           HC       2

 43           KK    SUBH
 44           KM    RUNOFF IN DORIS ST. FROM SUBAREA H
 45           BA  .00769
 46           UC    .291    .295
 47           UA       0       5      16      30      65      77      84      90      94      97
 48           UA     100
```

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

  49          KK     CP8
  50          KM    ADD RUNOFF FROM SUBAREA H TO HYDROGRAPH
  51          HC       2

  52          KK    SUBI
  53          KM    RUNOFF IN DEE FROM SUBAREA I
  54          BA  .00656
  55          LG    .220    .300   4.660    .360   69.00
  56          UC    .300    .310
  57          UA       0       5      16      30      65      77      84      90      94      97
  58          UA     100

  59          KK     CP9
  60          KM     COMBINE RUNOFF FROM SUBAREA I TO MAIN HYDROGRAPH
  61          HC       2

  62          KK    RCP9
  63          KM    ROUTE FLOW FROM CP9 TO CP10
  64          RS       7              -1       0
  65          RC    .027    .015    .026     270  .00247
  66          RX       0       0    15.5    15.5    50.5    50.5    75.0    93.8
  67          RY  957.73  946.89  946.66  946.16  946.16  946.66  947.03  951.73

  68          KK    SUBJ
  69          KM    RUNOFF IN RANDY ST. FROM SUBAREA J
  70          BA  .00747
  71          LG    .220    .300   4.660    .360   69.00
  72          UC    .328    .366
  73          UA       0       5      16      30      65      77      84      90      94      97
  74          UA     100

  75          KK    CP10
  76          KM    COMBINE RUNOFF FROM SUBAREA J TO MAIN HYDROGRAPH
  77          HC       2

  78          KK   RCP10
  79          KM   ROUTE FLOW FROM CP10 TO CP11
  80          RS       7              -1       0
  81          RC    .027    .015    .026     270  .00247
  82          RX       0       0    15.5    15.5    50.5    50.5    75.0    93.8
  83          RY  957.73  946.89  946.66  946.16  946.16  946.66  947.03  951.73

  84          KK    SUBK
  85          KM    RUNOFF IN HARRISOM DR.FROM SUBAREA K
  86          BA   .0089
  87          LG    .220    .300   4.660    .360   69.00
  88          UC    .322    .328
  89          UA       0       5      16      30      65      77      84      90      94      97
  90          UA     100
```

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

 91           KK    CP11
 92           KM    COMBINE RUNOFF FROM SUBAREA K TO MAIN HYDROGRAPH
 93           HC       2

 94           KK   RCP11
 95           KM   ROUTE FLOW FROM CP11 TO CP13
 96           RS       7              -1       0
 97           RC    .027    .015    .026     270  .00253
 98           RX       0       0    15.5    15.5    50.5    50.5    75.0    93.8
 99           RY  957.73  946.89  946.66  946 16  946.16  946.66  947.03  951.73

100           KK    SUBM
101           KM    RUNOFF IN OVERLIN DR. FROM SUBAREAS L & M
102           BA  .01172
103           LG    .220    .300   4.660    .360   69.00
104           UC    .441    .459
105           UA       0       5      16      30      65      77      84      90      94      97
106           UA     100

107           KK    CP13
108           KM    COMBINE RUNOFF FROM SUBAREAS L & M TO MAIN HYDROGRAPH
109           HC       2

110           KK   RCP13
111           KM   ROUTE FLOW FROM CP13 TO CP15
112           RS       7              -1       0
113           RC    .027    .015    .026     270  .00253
114           RX       0       0    15.5    15.5    50.5    50.5    75.0    93.8
115           RY  957.73  946.89  946.66  946.16  946.16  946.66  947.03  951.73

116           KK    SUBO
117           KM    RUNOFF IN DAVIS LN. FROM SUBAREAS N & O
118           BA  .00833
119           LG    .220    .300   4.660    .360   69.00
120           UC    .339    .245
121           UA       0       5      16      30      65      77      84      90      94      97
122           UA     100

123           KK    CP15
124           KM    COMBINE RUNOFF FROM SUBAREAS N & O TO MAIN HYDROGRAPH
125           HC       2

126           KK   RCP15
127           KM   ROUTE FLOW FROM CP15 TO CP16
128           RS       7              -1       0
129           RC    .027    .015    .026     270  .00247
130           RX       0       0    15.5    15.5    50.5    50.5    75.0    93.8
131           RY  957.73  946.89  946.66  946.16  946.16  946.66  947.03  951.73
```

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

 132        KK    SUBP
 133        KM    RUNOFF IN LOCUST LN. FROM SUBAREA P
 134        BA  .00609
 135        LG    .220    .300   4.660    .360   69.00
 136        UC    .305    .314
 137        UA       0       5      16      30      65      77      84      90      94      97
 138        UA     100

 139        KK    CP16
 140        KM   COMBINE RUNOFF FROM SUBAREA P TO MAIN HYDROGRAPH
 141        HC       2

 142        KK   RCP16
 143        KM    ROUTE FLOW FROM CP16 TO CP18
 144        RS       7              -1       0
 145        RC    .027    .015    .026     270  .00248
 146        RX       0       0    15.5    15.5    50.5    50.5    75.0    93.8
 147        RY  957.73  946.89  946.66  946.16  946.16  946.66  947.03  951.73

 148        KK    SUBR
 149        KM    RUNOFF IN WHYMAN AVE. FROM SUBAREA R
 150        BA  .00343
 151        LG    .220    .300   4.660    .360   69.00
 152        UC    .302    .450
 153        UA       0       5      16      30      65      77      84      90      94      97
 154        UA     100

 155        KK    CP18
 156        KM    COMBINE RUNOFF FROM SUBAREA R TO MAIN HYDROGRAPH
 157        HC       2
 158        ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  9         SUBA
               .
               .
 30            .------->   DET.
```

```
          .
          .
33        .        SUBG
          .          .
          .          .
40      CP7............
          .
          .
43        .        SUBH
          .          .
          .          .
49      CP8............
          .
          .
52        .        SUBI
          .          .
          .          .
59      CP9............
          V
          V
62     RCP9
          .
          .
68        .        SUBJ
          .          .
          .          .
75     CP10............
          V
          V
78     RCP10
          .
          .
84        .        SUBK
          .          .
          .          .
91     CP11............
          V
          V
94     RCP11
          .
          .
100       .        SUBM
          .          .
          .          .
107    CP13............
          V
          V
110    RCP13
```

```
              .
              .
116           .        SUBO
              .          .
              .          .
123        CP15............
              V
              V
126       RCP15
              .
              .
132           .        SUBP
              .          .
              .          .
139        CP16............
              V
              V
142       RCP16
              .
              .
148           .        SUBR
              .          .
              .          .
155        CP18............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*************************************                    *************************************
*                                   *                    *                                   *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS    *
*          SEPTEMBER 1990           *                    *   HYDROLOGIC ENGINEERING CENTER   *
*           VERSION 4.0             *                    *        609 SECOND STREET          *
*                                   *                    *      DAVIS, CALIFORNIA 95616      *
*  RUN DATE  01/23/2003  TIME  15:16:03 *                *          (916) 756-1104           *
*                                   *                    *                                   *
*************************************                    *************************************
```

```
                    100-YR., 6-HR. OFFSITE RUNOFF FROM NORTH OF PROJECT SITE
                    WITH WATERSHED IN AN UNDEVELOPED STATE.
                    ROUTED THRU AN INTERIM RET. DASIN SIZED FOR A 100-YR., 6-HR. RUNOFF FROM
                    UNDEVELOPED OFFSITE AREA  PLUS 100-YR., 6-HR RAINFALL ON ONSITE DEVELOPED
                    AREA FROM CARRAL ST.THRU WHYMAN AVE.
                    FILE:TRESRI02.DAT

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

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

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   24.92 HOURS

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


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

          **************
          *            *
 25 KK    *      CP1   *
          *            *
          **************

 26 KO        OUTPUT CONTROL VARIABLES
                   IPRNT          2  PRINT CONTROL
```

```
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
                   ROUTE RUNOFF THRU INTERIM RETENTION BASIN SIZED FOR 100-YR., 6-HR. RAINFALL
                   ON THE UNDEVELOPED WATERSHED.
                   VOLUME = CPA/12

DT          DIVERSION
                 ISTAD       DET.  DIVERSION HYDROGRAPH IDENTIFICATION
                DSTRMX       6.46  MAXIMUM VOLUME TO BE DIVERTED

DI            INFLOW        .00     50.00    100.00    200.00

DQ      DIVERTED FLOW       .00     50.00    100.00    200.00

                                                  ***
```

****

DIVERSION HYDROGRAPH DET.

****

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0615	76	0.	1		1230	151	0.	1		1845	226	0.
1		0005	2	0.	1		0620	77	0.	1		1235	152	0.	1		1850	227	0.
1		0010	3	0.	1		0625	78	0.	1		1240	153	0.	1		1855	228	0.
1		0015	4	0.	1		0630	79	0.	1		1245	154	0.	1		1900	229	0.
1		0020	5	0.	1		0635	80	0.	1		1250	155	0.	1		1905	230	0.
1		0025	6	0.	1		0640	81	0.	1		1255	156	0.	1		1910	231	0.
1		0030	7	0.	1		0645	82	0.	1		1300	157	0.	1		1915	232	0.
1		0035	8	0.	1		0650	83	0.	1		1305	158	0.	1		1920	233	0.
1		0040	9	0.	1		0655	84	0.	1		1310	159	0.	1		1925	234	0.
1		0045	10	0.	1		0700	85	0.	1		1315	160	0.	1		1930	235	0.
1		0050	11	0.	1		0705	86	0.	1		1320	161	0.	1		1935	236	0.
1		0055	12	0.	1		0710	87	0.	1		1325	162	0.	1		1940	237	0.
1		0100	13	0.	1		0715	88	0.	1		1330	163	0.	1		1945	238	0.
1		0105	14	0.	1		0720	89	0.	1		1335	164	0.	1		1950	239	0.
1		0110	15	0.	1		0725	90	0.	1		1340	165	0.	1		1955	240	0.
1		0115	16	0.	1		0730	91	0.	1		1345	166	0.	1		2000	241	0.
1		0120	17	0.	1		0735	92	0.	1		1350	167	0.	1		2005	242	0.
1		0125	18	0.	1		0740	93	0.	1		1355	168	0.	1		2010	243	0.
1		0130	19	0.	1		0745	94	0.	1		1400	169	0.	1		2015	244	0.
1		0135	20	0.	1		0750	95	0.	1		1405	170	0.	1		2020	245	0.
1		0140	21	0.	1		0755	96	0.	1		1410	171	0.	1		2025	246	0.
1		0145	22	0.	1		0800	97	0.	1		1415	172	0.	1		2030	247	0.
1		0150	23	0.	1		0805	98	0.	1		1420	173	0.	1		2035	248	0.
1		0155	24	0.	1		0810	99	0.	1		1425	174	0.	1		2040	249	0.
1		0200	25	0.	1		0815	100	0.	1		1430	175	0.	1		2045	250	0.
1		0205	26	0.	1		0820	101	0.	1		1435	176	0.	1		2050	251	0.
1		0210	27	0.	1		0825	102	0.	1		1440	177	0.	1		2055	252	0.
1		0215	28	0.	1		0830	103	0.	1		1445	178	0.	1		2100	253	0.
1		0220	29	0.	1		0835	104	0.	1		1450	179	0.	1		2105	254	0.
1		0225	30	0.	1		0840	105	0.	1		1455	180	0.	1		2110	255	0.
1		0230	31	0.	1		0845	106	0.	1		1500	181	0.	1		2115	256	0.
1		0235	32	0.	1		0850	107	0.	1		1505	182	0.	1		2120	257	0.
1		0240	33	0.	1		0855	108	0.	1		1510	183	0.	1		2125	258	0.
1		0245	34	0.	1		0900	109	0.	1		1515	184	0.	1		2130	259	0.
1		0250	35	0.	1		0905	110	0.	1		1520	185	0.	1		2135	260	0.
1		0255	36	0.	1		0910	111	0.	1		1525	186	0.	1		2140	261	0.

1	0300	37	0.	*	1	0915	112	0.	*	1	1530	187	0.	*	1	2145	262	0.
1	0305	38	0.	*	1	0920	113	0.	*	1	1535	188	0.	*	1	2150	263	0.
1	0310	39	0.	*	1	0925	114	0.	*	1	1540	189	0.	*	1	2155	264	0.
1	0315	40	0.	*	1	0930	115	0.	*	1	1545	190	0.	*	1	2200	265	0.
1	0320	41	0.	*	1	0935	116	0.	*	1	1550	191	0.	*	1	2205	266	0.
1	0325	42	0.	*	1	0940	117	0.	*	1	1555	192	0.	*	1	2210	267	0.
1	0330	43	0.	*	1	0945	118	0.	*	1	1600	193	0.	*	1	2215	268	0.
1	0335	44	0.	*	1	0950	119	0.	*	1	1605	194	0.	*	1	2220	269	0.
1	0340	45	1.	*	1	0955	120	0.	*	1	1610	195	0.	*	1	2225	270	0.
1	0345	46	2.	*	1	1000	121	0.	*	1	1615	196	0.	*	1	2230	271	0.
1	0350	47	7.	*	1	1005	122	0.	*	1	1620	197	0.	*	1	2235	272	0.
1	0355	48	17.	*	1	1010	123	0.	*	1	1625	198	0.	*	1	2240	273	0.
1	0400	49	31.	*	1	1015	124	0.	*	1	1630	199	0.	*	1	2245	274	0.
1	0405	50	55.	*	1	1020	125	0.	*	1	1635	200	0.	*	1	2250	275	0.
1	0410	51	89.	*	1	1025	126	0.	*	1	1640	201	0.	*	1	2255	276	0.
1	0415	52	119.	*	1	1030	127	0.	*	1	1645	202	0.	*	1	2300	277	0.
1	0420	53	128.	*	1	1035	128	0.	*	1	1650	203	0.	*	1	2305	278	0.
1	0425	54	112.	*	1	1040	129	0.	*	1	1655	204	0.	*	1	2310	279	0.
1	0430	55	89.	*	1	1045	130	0.	*	1	1700	205	0.	*	1	2315	280	0.
1	0435	56	69.	*	1	1050	131	0.	*	1	1705	206	0.	*	1	2320	281	0.
1	0440	57	53.	*	1	1055	132	0.	*	1	1710	207	0.	*	1	2325	282	0.
1	0445	58	41.	*	1	1100	133	0.	*	1	1715	208	0.	*	1	2330	283	0.
1	0450	59	31.	*	1	1105	134	0.	*	1	1720	209	0.	*	1	2335	284	0.
1	0455	60	23.	*	1	1110	135	0.	*	1	1725	210	0.	*	1	2340	285	0.
1	0500	61	18.	*	1	1115	136	0.	*	1	1730	211	0.	*	1	2345	286	0.
1	0505	62	14.	*	1	1120	137	0.	*	1	1735	212	0.	*	1	2350	287	0.
1	0510	63	10.	*	1	1125	138	0.	*	1	1740	213	0.	*	1	2355	288	0.
1	0515	64	8.	*	1	1130	139	0.	*	1	1745	214	0.	*	2	0000	289	0.
1	0520	65	6.	*	1	1135	140	0.	*	1	1750	215	0.	*	2	0005	290	0.
1	0525	66	5.	*	1	1140	141	0.	*	1	1755	216	0.	*	2	0010	291	0.
1	0530	67	3.	*	1	1145	142	0.	*	1	1800	217	0.	*	2	0015	292	0.
1	0535	68	3.	*	1	1150	143	0.	*	1	1805	218	0.	*	2	0020	293	0.
1	0540	69	2.	*	1	1155	144	0.	*	1	1810	219	0.	*	2	0025	294	0.
1	0545	70	1.	*	1	1200	145	0.	*	1	1815	220	0.	*	2	0030	295	0.
1	0550	71	1.	*	1	1205	146	0.	*	1	1820	221	0.	*	2	0035	296	0.
1	0555	72	0.	*	1	1210	147	0.	*	1	1825	222	0.	*	2	0040	297	0.
1	0600	73	0.	*	1	1215	148	0.	*	1	1830	223	0.	*	2	0045	298	0.
1	0605	74	0.	*	1	1220	149	0.	*	1	1835	224	0.	*	2	0050	299	0.
1	0610	75	0.	*	1	1225	150	0.	*	1	1840	225	0.	*	2	0055	300	0.

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PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
128.	4.33	(CFS)	13.	3.	3.	3.
		(INCHES)	1.469	1.469	1.469	1.469
		(AC-FT)	6.	6.	6.	6.

CUMULATIVE AREA = .08 SQ MI

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HYDROGRAPH AT STATION CP1

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DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0615	76	0.	1		1230	151	0.	1		1845	226	0.

1	0005	2	0.	*	1	0620	77	0.	*	1	1235	152	0.	*	1	1850	227	0.
1	0010	3	0.	*	1	0625	78	0.	*	1	1240	153	0.	*	1	1855	228	0.
1	0015	4	0.	*	1	0630	79	0.	*	1	1245	154	0.	*	1	1900	229	0.
1	0020	5	0.	*	1	0635	80	0.	*	1	1250	155	0.	*	1	1905	230	0.
1	0025	6	0.	*	1	0640	81	0.	*	1	1255	156	0.	*	1	1910	231	0.
1	0030	7	0.	*	1	0645	82	0.	*	1	1300	157	0.	*	1	1915	232	0.
1	0035	8	0.	*	1	0650	83	0.	*	1	1305	158	0.	*	1	1920	233	0.
1	0040	9	0.	*	1	0655	84	0.	*	1	1310	159	0.	*	1	1925	234	0.
1	0045	10	0.	*	1	0700	85	0.	*	1	1315	160	0.	*	1	1930	235	0.
1	0050	11	0.	*	1	0705	86	0.	*	1	1320	161	0.	*	1	1935	236	0.
1	0055	12	0.	*	1	0710	87	0.	*	1	1325	162	0.	*	1	1940	237	0.
1	0100	13	0.	*	1	0715	88	0.	*	1	1330	163	0.	*	1	1945	238	0.
1	0105	14	0.	*	1	0720	89	0.	*	1	1335	164	0.	*	1	1950	239	0.
1	0110	15	0.	*	1	0725	90	0.	*	1	1340	165	0.	*	1	1955	240	0.
1	0115	16	0.	*	1	0730	91	0.	*	1	1345	166	0.	*	1	2000	241	0.
1	0120	17	0.	*	1	0735	92	0.	*	1	1350	167	0.	*	1	2005	242	0.
1	0125	18	0.	*	1	0740	93	0.	*	1	1355	168	0.	*	1	2010	243	0.
1	0130	19	0.	*	1	0745	94	0.	*	1	1400	169	0.	*	1	2015	244	0.
1	0135	20	0.	*	1	0750	95	0.	*	1	1405	170	0.	*	1	2020	245	0.
1	0140	21	0.	*	1	0755	96	0.	*	1	1410	171	0.	*	1	2025	246	0.
1	0145	22	0.	*	1	0800	97	0.	*	1	1415	172	0.	*	1	2030	247	0.
1	0150	23	0.	*	1	0805	98	0.	*	1	1420	173	0.	*	1	2035	248	0.
1	0155	24	0.	*	1	0810	99	0.	*	1	1425	174	0.	*	1	2040	249	0.
1	0200	25	0.	*	1	0815	100	0.	*	1	1430	175	0.	*	1	2045	250	0.
1	0205	26	0.	*	1	0820	101	0.	*	1	1435	176	0.	*	1	2050	251	0.
1	0210	27	0.	*	1	0825	102	0.	*	1	1440	177	0.	*	1	2055	252	0.
1	0215	28	0.	*	1	0830	103	0.	*	1	1445	178	0.	*	1	2100	253	0.
1	0220	29	0.	*	1	0835	104	0.	*	1	1450	179	0.	*	1	2105	254	0.
1	0225	30	0.	*	1	0840	105	0.	*	1	1455	180	0.	*	1	2110	255	0.
1	0230	31	0.	*	1	0845	106	0.	*	1	1500	181	0.	*	1	2115	256	0.
1	0235	32	0.	*	1	0850	107	0.	*	1	1505	182	0.	*	1	2120	257	0.
1	0240	33	0.	*	1	0855	108	0.	*	1	1510	183	0.	*	1	2125	258	0.
1	0245	34	0.	*	1	0900	109	0.	*	1	1515	184	0.	*	1	2130	259	0.
1	0250	35	0.	*	1	0905	110	0.	*	1	1520	185	0.	*	1	2135	260	0.
1	0255	36	0.	*	1	0910	111	0.	*	1	1525	186	0.	*	1	2140	261	0.
1	0300	37	0.	*	1	0915	112	0.	*	1	1530	187	0.	*	1	2145	262	0.
1	0305	38	0.	*	1	0920	113	0.	*	1	1535	188	0.	*	1	2150	263	0.
1	0310	39	0.	*	1	0925	114	0.	*	1	1540	189	0.	*	1	2155	264	0.
1	0315	40	0.	*	1	0930	115	0.	*	1	1545	190	0.	*	1	2200	265	0.
1	0320	41	0.	*	1	0935	116	0.	*	1	1550	191	0.	*	1	2205	266	0.
1	0325	42	0.	*	1	0940	117	0.	*	1	1555	192	0.	*	1	2210	267	0.
1	0330	43	0.	*	1	0945	118	0.	*	1	1600	193	0.	*	1	2215	268	0.
1	0335	44	0.	*	1	0950	119	0.	*	1	1605	194	0.	*	1	2220	269	0.
1	0340	45	0.	*	1	0955	120	0.	*	1	1610	195	0.	*	1	2225	270	0.
1	0345	46	0.	*	1	1000	121	0.	*	1	1615	196	0.	*	1	2230	271	0.
1	0350	47	0.	*	1	1005	122	0.	*	1	1620	197	0.	*	1	2235	272	0.
1	0355	48	0.	*	1	1010	123	0.	*	1	1625	198	0.	*	1	2240	273	0.
1	0400	49	0.	*	1	1015	124	0.	*	1	1630	199	0.	*	1	2245	274	0.
1	0405	50	0.	*	1	1020	125	0.	*	1	1635	200	0.	*	1	2250	275	0.
1	0410	51	0.	*	1	1025	126	0.	*	1	1640	201	0.	*	1	2255	276	0.
1	0415	52	0.	*	1	1030	127	0.	*	1	1645	202	0.	*	1	2300	277	0.
1	0420	53	0.	*	1	1035	128	0.	*	1	1650	203	0.	*	1	2305	278	0.
1	0425	54	0.	*	1	1040	129	0.	*	1	1655	204	0.	*	1	2310	279	0.
1	0430	55	0.	*	1	1045	130	0.	*	1	1700	205	0.	*	1	2315	280	0.
1	0435	56	0.	*	1	1050	131	0.	*	1	1705	206	0.	*	1	2320	281	0.
1	0440	57	0.	*	1	1055	132	0.	*	1	1710	207	0.	*	1	2325	282	0.
1	0445	58	0.	*	1	1100	133	0.	*	1	1715	208	0.	*	1	2330	283	0.
1	0450	59	0.	*	1	1105	134	0.	*	1	1720	209	0.	*	1	2335	284	0.
1	0455	60	0.	*	1	1110	135	0.	*	1	1725	210	0.	*	1	2340	285	0.
1	0500	61	0.	*	1	1115	136	0.	*	1	1730	211	0.	*	1	2345	286	0.

1	0505	62	0.	*	1	1120	137	0.	*	1	1735	212	0.	*	1	2350	287	0.
1	0510	63	0.	*	1	1125	138	0.	*	1	1740	213	0.	*	1	2355	288	0.
1	0515	64	0.	*	1	1130	139	0.	*	1	1745	214	0.	*	2	0000	289	0.
1	0520	65	0.	*	1	1135	140	0.	*	1	1750	215	0.	*	2	0005	290	0.
1	0525	66	0.	*	1	1140	141	0.	*	1	1755	216	0.	*	2	0010	291	0.
1	0530	67	0.	*	1	1145	142	0.	*	1	1800	217	0.	*	2	0015	292	0.
1	0535	68	0.	*	1	1150	143	0.	*	1	1805	218	0.	*	2	0020	293	0.
1	0540	69	0.	*	1	1155	144	0.	*	1	1810	219	0.	*	2	0025	294	0.
1	0545	70	0.	*	1	1200	145	0.	*	1	1815	220	0.	*	2	0030	295	0.
1	0550	71	0.	*	1	1205	146	0.	*	1	1820	221	0.	*	2	0035	296	0.
1	0555	72	0.	*	1	1210	147	0.	*	1	1825	222	0.	*	2	0040	297	0.
1	0600	73	0.	*	1	1215	148	0.	*	1	1830	223	0.	*	2	0045	298	0.
1	0605	74	0.	*	1	1220	149	0.	*	1	1835	224	0.	*	2	0050	299	0.
1	0610	75	0.	*	1	1225	150	0.	*	1	1840	225	0.	*	2	0055	300	0.
				*					*					*				

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PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	24.92-HR
0.	5.92	(CFS)	0.	0.	0.	0.
		(INCHES)	.001	.001	.001	.001
		(AC-FT)	0.	0.	0.	0.

CUMULATIVE AREA = .08 SQ MI

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

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SUBA	128.	4.33	13.	3.	3.	.08		
DIVERSION TO	DET.	128.	5.92	13.	3.	3.	.08		
HYDROGRAPH AT	CP1	0.	5.92	0.	0.	0.	.08		
HYDROGRAPH AT	SUBG	20.	4.17	4.	1.	1.	.01		
2 COMBINED AT	CP7	20.	4.17	4.	1.	1.	.10		
HYDROGRAPH AT	SUBH	16.	4.08	2.	1.	1.	.01		
2 COMBINED AT	CP8	36.	4.17	6.	2.	2.	.10		
HYDROGRAPH AT	SUBI	13.	4.08	2.	0.	0.	.01		
2 COMBINED AT	CP9	49.	4.17	8.	2.	2.	.11		
ROUTED TO	RCP9	50.	4.17	8.	2.	2.	.11	946.56	4.17
HYDROGRAPH AT	SUBJ	14.	4.17	2.	1.	1.	.01		
2 COMBINED AT	CP10	63.	4.17	10.	3.	3.	.12		
ROUTED TO	RCP10	63.	4.17	10.	3.	3.	.12	946.68	4.17
HYDROGRAPH AT	SUBK	17.	4.17	3.	1.	1.	.01		
2 COMBINED AT	CP11	80.	4.17	13.	3.	3.	.13		
ROUTED TO	RCP11	80.	4.17	13.	3.	3.	.13	946.16	4.17
HYDROGRAPH AT	SUBM	18.	4.17	3.	1.	1.	.01		
2 COMBINED AT	CP13	99.	4.17	16.	4.	4.	.14		
ROUTED TO	RCP13	98.	4.17	16.	4.	4.	.14	946.84	4.17
HYDROGRAPH AT	SUBO	18.	4.08	2.	1.	1.	.01		
2 COMBINED AT	CP15	116.	4.17	19.	5.	5.	.15		
ROUTED TO	RCP15	115.	4.17	19.	5.	5.	.15	946.89	4.17
HYDROGRAPH AT	SUBP	12.	4.08	2.	0.	0.	.01		
2 COMBINED AT	CP16	127.	4.17	20.	5.	5.	.15		
ROUTED TO	RCP16	126.	4.17	20.	5.	5.	.15	946.92	4.17
HYDROGRAPH AT	SUBR	6.	4.17	1.	0.	0.	.00		

2 COMBINED AT	CP18	131.	4.17	21.	5.	5.	.16

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

DETENTION BASIN VOLUME
BASED ON THE FRUSTUM EQUATION
VOLUME=HEIGHT/3*(AREA1+AREA2+(AREA1*AREA2)^.5)

PONDING VOLUME (Ac-Ft)	SURFACE AREA (Acres)	W.S. ELEV (Ft)	BOTTOM AREA (Acres)
0.00	1.99	100.00	1.99
0.50	2.02	100.25	1.99
1.01	2.05	100.50	1.99
1.52	2.07	100.75	1.99
2.04	2.10	101.00	1.99
2.57	2.13	101.25	1.99
3.11	2.16	101.50	1.99
3.65	2.18	101.75	1.99
4.20	2.21	102.00	1.99
4.75	2.24	102.25	1.99
5.32	2.27	102.50	1.99
5.88	2.29	102.75	1.99

NOTES:

1. DESIGN W.S. DEPTH = 3 FT.
2. DESIGN W.S. AREA = 2.32 ACRES
3. DESIGN VOLUME = 6.46 AC-FT
4. DESIGN FREEBOARD = 0 FT.

Interim Ret. Basin For Parcels 1, 2, & 3
Value Used in HEC-1 Model

Retention Provided

Retention Basin North of Parcel 4 in unsubdivided area
BOTTOM = 949.50, AREA = 86573.78 sq. ft.
@ ELEV=950.50, VOL=2.0442 ac. ft., AREA=91520.12 sq. ft.
@ ELEV=951.50, VOL=4.2032 ac. ft., AREA=96566.99 sq. ft.
@ ELEV=952.50, VOL=6.4791 ac. ft., AREA=101713.25 sq. ft.

Interim Retention Basin
AVAILABLE VOLUME CALCULATED

DRY-UP CALCULATIONS

Interim Retention Basin:

Based on a volume required of 281,400 cubic feet, a bottom area of 86,574 square feet, and a percolation rate of 1.00 cubic feet per hour per square foot, with a reduction factor of 0.50, the Interim Retention Basin dry-up time is estimated to be:

$$281{,}400/(86{,}574 \times 1.00 \times 0.50) = 6.5 \text{ hours}$$

SECTION C-6

- HEC-RAS (Surface Flow Hydraulics)

```
HEC-RAS Version 3.0.1  Mar 2001
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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

PROJECT DATA
Project Title: ELISEO C. FELIX JR. DRAINAGE CORRIDOR
Project File : TRESRIO3.prj
Run Date and Time: 9/12/2002 6:51:58 AM

Project in English units

Project Description:
TRES RIOS LANDING 8-30-02
  ELISEO C. FELIX JR. WAY DRAINAGE CORRIDOR
  Q'S
BASED ON HEC-1 SUMMATION OF HYDROGRAPHS FOR
  100-YEAR, 6-HR. OFFSITE FLOW
RETAINED ONSITE (ZERO OUTFLOW)
   PLUS 100-YR., 6-HR. ONSITE FLOW IN EXCESS OF
THE   PROPOSED STORM   DRAIN CAPACITY.
   CMX HEC-2 FILE:TRESRIO3.DAT
REVISED 9-9-02

GEOMETRY DATA

Geometry Title: Imported Geom 01
Geometry File : C:\HEC\Ras\Data\CMX\TRESRIO3.g01

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 19

INPUT
Description: @ END OF TRACT "G"
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	955	0	951.51	24	951.51	64	955	85.5	960

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	0	.03	64	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	64	55	55	55	.1	.3

```
CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 18.5

INPUT
Description: @ MIDDLE OF TRACT "G"
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  954.89       0   951.4      24   951.4      64  954.89    85.5  959.89

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      64     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      64               55      55      55             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 18

INPUT
Description: @ CORRAL ST. RIBBON CURB
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     954       0  951.89      13  951.89      20  951.37      42  951.29
      49  951.87     113  951.87     121     954

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .015      13    .015      49    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             13      49            59.69   59.69   59.69             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 17

INPUT
Description: @ CORRAL ST. BCR
@ END OF TRACT "G"
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  956.66       0  951.82    15.5  951.59    15.5  951.09      33  951.44
    50.5  951.09    50.5  951.59      75  951.96    93.8  956.66

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           15.5    50.5              194     194     195             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 16

INPUT
Description: @ DORIS ST. ECR
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  956.18       0  951.34    15.5  951.11    15.5  950.61      33  950.96
    50.5  950.61    50.5  951.11      75  951.48    93.8  956.18

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5                76      76      76             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 15

INPUT
Description: @ DORIS ST. BCR
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  955.91       0  951.07    15.5  950.84    15.5  950.34      33  950.69
    50.5  950.34    50.5  950.84      75  951.21    93.8  955.91

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5               194     194     194             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 14

INPUT
Description: GB @ DEE ST.
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  955.42       0  950.58    15.5  950.35    15.5  949.85      33   950.2
    50.5  949.85    50.5  950.35      75  950.72    93.8  955.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5             59.69   59.69   59.69             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 13

INPUT
Description: @ DEE ST. RIBBON CURB
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   952.8       0  950.76      13  950.71      20  950.18      42  950.09
      49  950.65      59   950.8    67.4   952.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .015      13    .015      49    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            13      49                20      20      20             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 12.8

INPUT
Description: NEAR END OF TRACT C
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  953.53       0  950.04      21  950.04    24.4  950.89    36.4  951.07
    43.7   952.9
```

```
Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
       0     .03        0     .03     24.4     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0    24.4               180     180     180             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 12.4

INPUT
Description: NEAR BEGINNING OF TRACT F
Station Elevation Data      num=        6
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0  953.08        0  949.59       21  949.59    24.5  950.46    36.5  950.64
    41.1   951.8

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
       0     .03        0     .03     24.5     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0    24.5                20      20      20             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 12

INPUT
Description: @ RANDY ST. RIBBON CURB
Station Elevation Data      num=        8
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0  952.25        0  950.19       13  950.14      20  949.62      42  949.54
      49  950.11       59  950.26     65.2   951.8

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .015       13    .015       49    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            13      49             59.69   59.69   59.69             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 11

INPUT
Description: @ RANDY ST. BCR
@ RANDY ST. BCR
Station Elevation Data      num=        9
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0  954.91        0  950.07     15.5  949.84    15.5  949.34      33  949.69
    50.5  949.34     50.5  949.84       75  950.21    93.8  954.91

Manning's n Values          num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .026     15.5    .015     50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5               194     194     194             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 10

INPUT
```

```
Description: @ HARRISON DR. ECR
Station Elevation Data     num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  954.43       0  949.59    15.5  949.36    15.5  948.86      33  949.21
    50.5  948.86    50.5  949.36      75  949.73    93.8  954.43

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5                 76      76      76              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 9

INPUT
Description: @ HARRISON DR. BCR
Station Elevation Data     num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  954.16       0  949.32    15.5  949.09    15.5  948.59      33  948.94
    50.5  948.59    50.5  949.09      75  949.46    93.8  954.16

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5                194     194     194              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 8

INPUT
Description: GB @ OVERLIN DR.
GB @ OVERLIN DR.
Station Elevation Data     num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  953.67       0  948.83    15.5   948.6    15.5   948.1      33  948.45
    50.5   948.1    50.5   948.6      75  948.97    93.8  953.67

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5             56.69   56.69   56.69              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 7

INPUT
Description: @ OVERLIN  DR. RIBBON CURB
Station Elevation Data     num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  951.05       0  949.01      13  948.96      20  948.43      42  948.34
      49   948.9      59  949.05      69  951.55

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
     02200.015      13    .015      49    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             13      49                 20      20      20              .1       .3
```

```
CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 6.8

INPUT
Description: NEAR END OF TRACT "E"
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  951.78       0  948.29      24  948.29    27.2  949.08    39.2  949.26
    49.4   951.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03    27.2     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0    27.2              180     180     180             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 6.4

INPUT
Description: NEAR BEGINNING OF TRACT "E"
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  951.33       0  947.84      24  947.84    26.1  948.36    38.1  948.54
    49.6   951.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03    26.1     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0    26.1               20      20      20             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 6

INPUT
Description: @ DAVIS LN. RIBBON CURB
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   950.5       0  948.44      13  948.39      20  947.87      42  947.79
      49  948.36      59  948.51    68.9  950.98

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .015      13    .015      49    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            13      49            59.69   59.69   59.69             .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5

INPUT
Description: @ DAVIS LN. BCR
@ DAVIS LN. BCR
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  953.16       0  948.32    15.5  948.09    15.5  947.59      33  947.94
    50.5  947.59    50.5  948.09      75  948.46    93.8  953.16

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5              194     194     194              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 4

INPUT
Description: @ LOCUST LN. ECR
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  952.68       0  947.84    15.5  947.61    15.5  947.11      33  947.46
    50.5  947.11    50.5  947.61      75  947.98    93.8  952.68

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5             76.52   76.52   76.52              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 3

INPUT
Description: @ LOCUS LN. BCR
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  952.41       0  947.57    15.5  947.34    15.5  946.84      33  947.19
    50.5  946.84    50.5  947.34      75  947.71    93.8  952.41

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5            201.84  201.84  201.84              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 2

INPUT
Description: GB @ WHYMAN
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  951.91       0  947.07    15.5  946.84    15.5  946.34      33  946.69
    50.5  946.34    50.5  946.84      75  947.21    93.8  951.91

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .026    15.5    .015    50.5    .027

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          15.5    50.5             45.28   45.28   45.28              .1       .3

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 1

INPUT
Description: @ WHYMAN RIBBON CURB
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

0	946.88	7.5	946.32	13	946.32	18	946.03	27	946.03
32	946.25	53.5	946.88	80	950	101.5	954		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.015	13	.015	32	.027

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
13	32	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	19	.03	.03	.03
Reach-1	18.5	.03	.03	.03
Reach-1	18	.015	.015	.027
Reach-1	17	.026	.015	.027
Reach-1	16	.026	.015	.027
Reach-1	15	.026	.015	.027
Reach-1	14	.026	.015	.027
Reach-1	13	.015	.015	.027
Reach-1	12.8	.03	.03	.03
Reach-1	12.4	.03	.03	.03
Reach-1	12	.015	.015	.027
Reach-1	11	.026	.015	.027
Reach-1	10	.026	.015	.027
Reach-1	9	.026	.015	.027
Reach-1	8	.026	.015	.027
Reach-1	7	2200.015	.015	.027
Reach-1	6.8	.03	.03	.03
Reach-1	6.4	.03	.03	.03
Reach-1	6	.015	.015	.027
Reach-1	5	.026	.015	.027
Reach-1	4	.026	.015	.027
Reach-1	3	.026	.015	.027
Reach-1	2	.026	.015	.027
Reach-1	1	.015	.015	.027

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

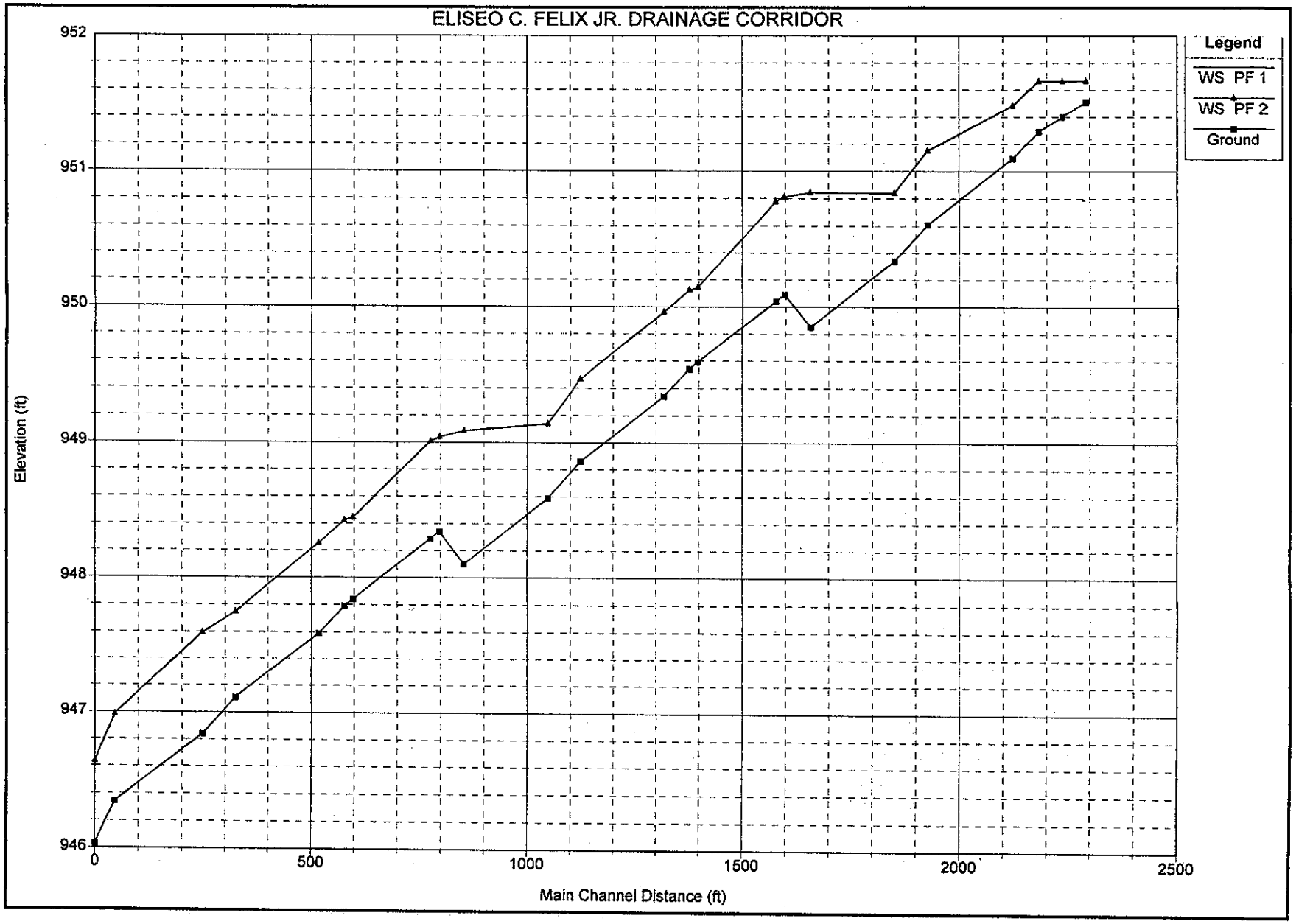
Reach	River Sta.	Contr.	Expan.
Reach-1	19	.1	.3
Reach-1	18.5	.1	.3
Reach-1	18	.1	.3
Reach-1	17	.1	.3
Reach-1	16	.1	.3
Reach-1	15	.1	.3
Reach-1	14	.1	.3
Reach-1	13	.1	.3
Reach-1	12.8	.1	.3
Reach-1	12.4	.1	.3
Reach-1	12	.1	.3
Reach-1	11	.1	.3

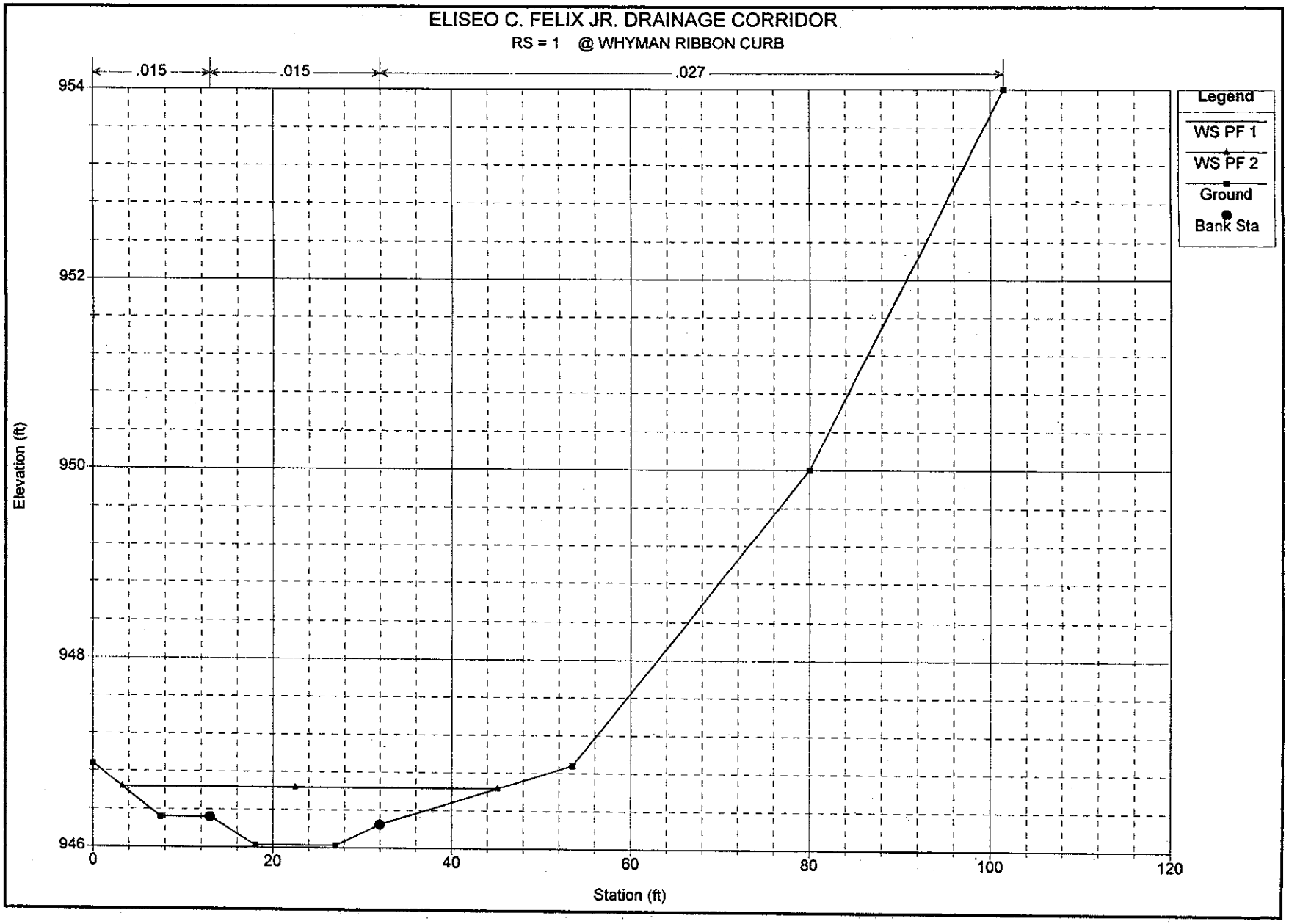
Reach-1	10	.1	.3
Reach-1	9	.1	.3
Reach-1	8	.1	.3
Reach-1	7	.1	.3
Reach-1	6.8	.1	.3
Reach-1	6.4	.1	.3
Reach-1	6	.1	.3
Reach-1	5	.1	.3
Reach-1	4	.1	.3
Reach-1	3	.1	.3
Reach-1	2	.1	.3
Reach-1	1	.1	.3

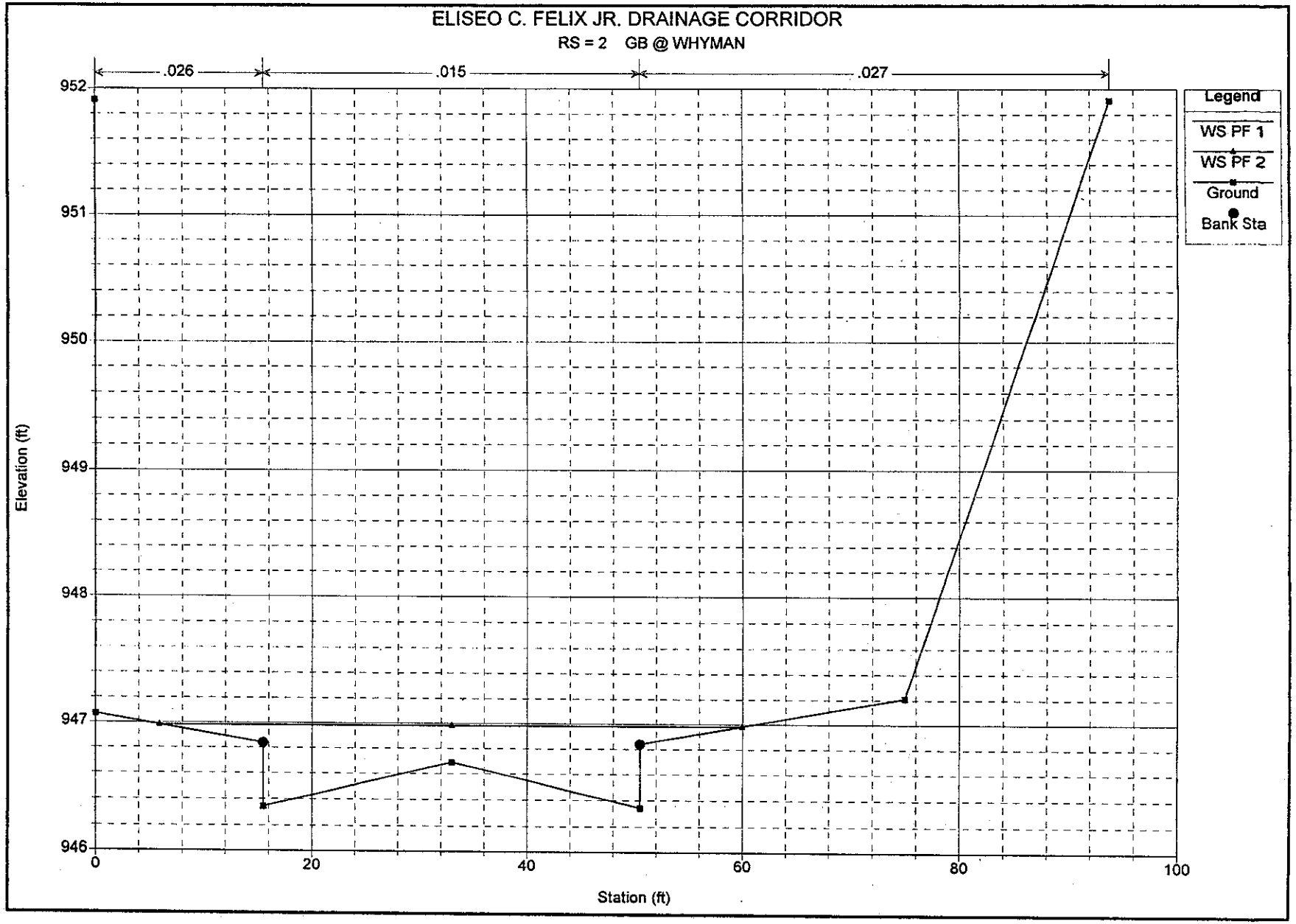
HEC-RAS Plan: Imported Pla River: RIVER-1 Reach: Reach-1

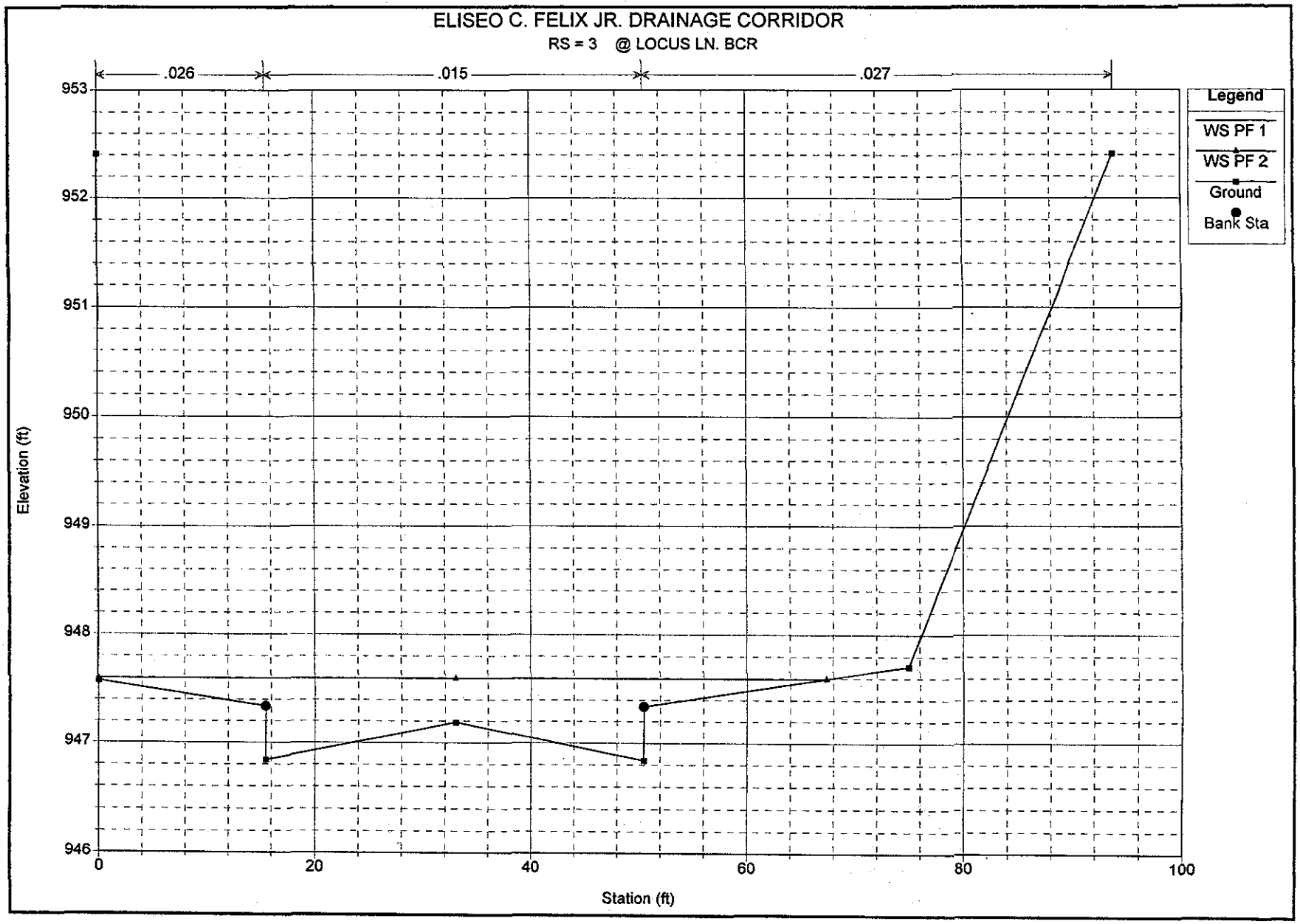
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	ROB Elev	Q Channel	Max Chl Dpth	Vel Chnl	Crit W.S.	Q Right	Invert Slope	Length Chnl	Cum Ch Len
		(cfs)	(ft)	(ft)	(ft)	(cfs)	(ft)	(ft/s)	(ft)	(cfs)		(ft)	(ft)
Reach-1	1	61.01	946.03	946.64	946.25	50.47	0.60	4.94	946.72	3.50			
Reach-1	1	61.01	946.03	946.64	946.25	50.47	0.60	4.94	946.72	3.50			
Reach-1	2	61.01	946.34	946.98	946.84	60.19	0.64	3.68	946.98	0.40	0.0068	45.28	45.28
Reach-1	2	61.01	946.34	946.98	946.84	60.19	0.64	3.68	946.98	0.40	0.0068	45.28	45.28
Reach-1	3	61.01	946.84	947.59	947.34	58.33	0.75	2.88	947.48	1.27	0.0025	201.84	247.12
Reach-1	3	61.01	946.84	947.59	947.34	58.33	0.75	2.88	947.48	1.27	0.0025	201.84	247.12
Reach-1	4	50.01	947.11	947.75	947.61	49.41	0.64	3.07		0.29	0.0035	76.52	323.64
Reach-1	4	50.01	947.11	947.75	947.61	49.41	0.64	3.07		0.29	0.0035	76.52	323.64
Reach-1	5	50.01	947.59	948.25	948.09	49.11	0.66	2.87	948.17	0.44	0.0025	194.00	517.64
Reach-1	5	50.01	947.59	948.25	948.09	49.11	0.66	2.87	948.17	0.44	0.0025	194.00	517.64
Reach-1	6	33.01	947.79	948.42	948.36	32.96	0.63	1.88		0.02	0.0033	59.69	577.33
Reach-1	6	33.01	947.79	948.42	948.36	32.96	0.63	1.88		0.02	0.0033	59.69	577.33
Reach-1	6.4	33.01	947.84	948.44	948.36	32.92	0.60	2.17		0.09	0.0025	20.00	597.33
Reach-1	6.4	33.01	947.84	948.44	948.36	32.92	0.60	2.17		0.09	0.0025	20.00	597.33
Reach-1	6.8	33.01	948.29	949.01	949.08	33.01	0.72	1.80	948.67		0.0025	180.00	777.33
Reach-1	6.8	33.01	948.29	949.01	949.08	33.01	0.72	1.80	948.67		0.0025	180.00	777.33
Reach-1	7	33.01	948.34	949.04	948.90	32.86	0.70	1.67		0.15	0.0025	20.00	797.33
Reach-1	7	33.01	948.34	949.04	948.90	32.86	0.70	1.67		0.15	0.0025	20.00	797.33
Reach-1	8	33.01	948.10	949.09	948.60	28.83	0.99	1.02	948.57	2.17	-0.0042	56.69	854.02
Reach-1	8	33.01	948.10	949.09	948.60	28.83	0.99	1.02	948.57	2.17	-0.0042	56.69	854.02
Reach-1	9	44.67	948.59	949.14	949.09	44.63	0.55	3.44	949.14	0.02	0.0025	194.00	1048.02
Reach-1	9	44.67	948.59	949.14	949.09	44.63	0.55	3.44	949.14	0.02	0.0025	194.00	1048.02
Reach-1	10	43.00	948.86	949.46	949.36	42.71	0.60	2.84	949.40	0.14	0.0036	76.00	1124.02
Reach-1	10	43.00	948.86	949.46	949.36	42.71	0.60	2.84	949.40	0.14	0.0036	76.00	1124.02
Reach-1	11	43.00	949.34	949.96	949.84	42.61	0.62	2.75	949.88	0.19	0.0025	194.00	1318.02
Reach-1	11	43.00	949.34	949.96	949.84	42.61	0.62	2.75	949.88	0.19	0.0025	194.00	1318.02
Reach-1	12	29.00	949.54	950.12	950.11	29.00	0.58	1.84		0.00	0.0033	59.69	1377.71
Reach-1	12	29.00	949.54	950.12	950.11	29.00	0.58	1.84		0.00	0.0033	59.69	1377.71

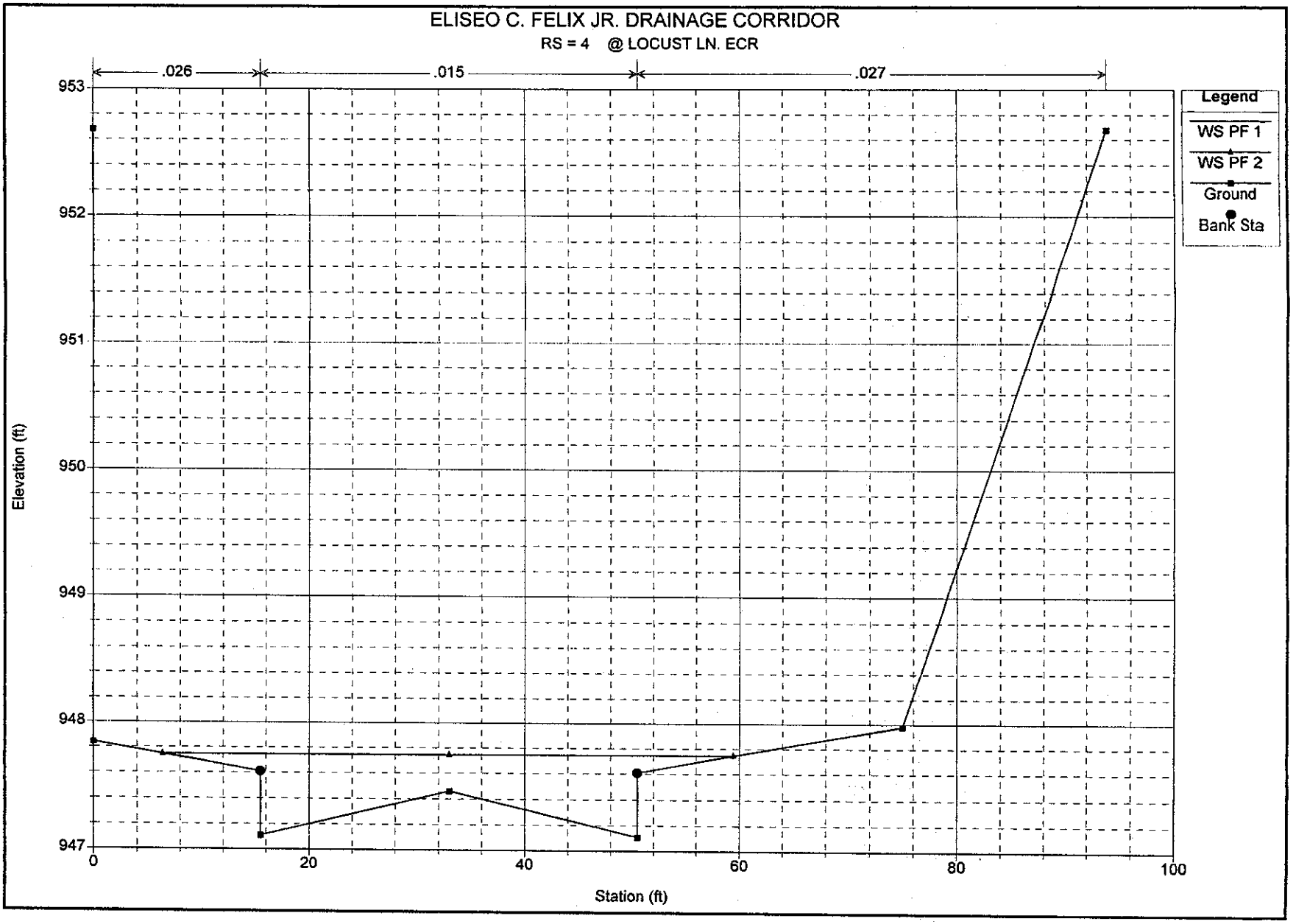
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	ROB Elev	Q Channel	Max Chl Dpth	Vel Chnl	Crit W.S.	Q Right	Invert Slope	Length Chnl	Cum Ch Len
		(cfs)	(ft)	(ft)	(ft)	(cfs)	(ft)	(ft/s)	(ft)	(cfs)		(ft)	(ft)
Reach-1	12.4	29.00	949.59	950.14	950.46	29.00	0.55	2.38			0.0025	20.00	1397.71
Reach-1	12.4	29.00	949.59	950.14	950.46	29.00	0.55	2.38			0.0025	20.00	1397.71
Reach-1	12.8	29.00	950.04	950.78	950.89	29.00	0.74	1.75	950.42		0.0025	180.00	1577.71
Reach-1	12.8	29.00	950.04	950.78	950.89	29.00	0.74	1.75	950.42		0.0025	180.00	1577.71
Reach-1	13	29.00	950.09	950.81	950.65	28.44	0.72	1.38		0.19	0.0025	20.00	1597.71
Reach-1	13	29.00	950.09	950.81	950.65	28.44	0.72	1.38		0.19	0.0025	20.00	1597.71
Reach-1	14	36.00	949.85	950.84	950.35	31.35	0.99	1.09		2.42	-0.0040	59.69	1657.40
Reach-1	14	36.00	949.85	950.84	950.35	31.35	0.99	1.09		2.42	-0.0040	59.69	1657.40
Reach-1	15	36.00	950.34	950.84	950.84	36.00	0.50	3.18	950.83		0.0025	194.00	1851.40
Reach-1	15	36.00	950.34	950.84	950.84	36.00	0.50	3.18	950.83		0.0025	194.00	1851.40
Reach-1	16	20.00	950.61	951.15	951.11	19.99	0.54	1.57	951.00	0.01	0.0036	76.00	1927.40
Reach-1	16	20.00	950.61	951.15	951.11	19.99	0.54	1.57	951.00	0.01	0.0036	76.00	1927.40
Reach-1	17	20.00	951.09	951.48	951.59	20.00	0.39	2.62	951.48		0.0025	194.00	2121.40
Reach-1	17	20.00	951.09	951.48	951.59	20.00	0.39	2.62	951.48		0.0025	194.00	2121.40
Reach-1	18	1.00	951.29	951.66	951.87	1.00	0.37	0.11			0.0033	59.69	2181.09
Reach-1	18	1.00	951.29	951.66	951.87	1.00	0.37	0.11			0.0033	59.69	2181.09
Reach-1	18.5	0.50	951.40	951.66	954.89	0.50	0.26	0.07			0.0020	55.00	2236.09
Reach-1	18.5	0.50	951.40	951.66	954.89	0.50	0.26	0.07			0.0020	55.00	2236.09
Reach-1	19	0.50	951.51	951.66	955.00	0.50	0.15	0.13	951.54		0.0020	55.00	2291.09
Reach-1	19	0.50	951.51	951.66	955.00	0.50	0.15	0.13	951.54		0.0020	55.00	2291.09

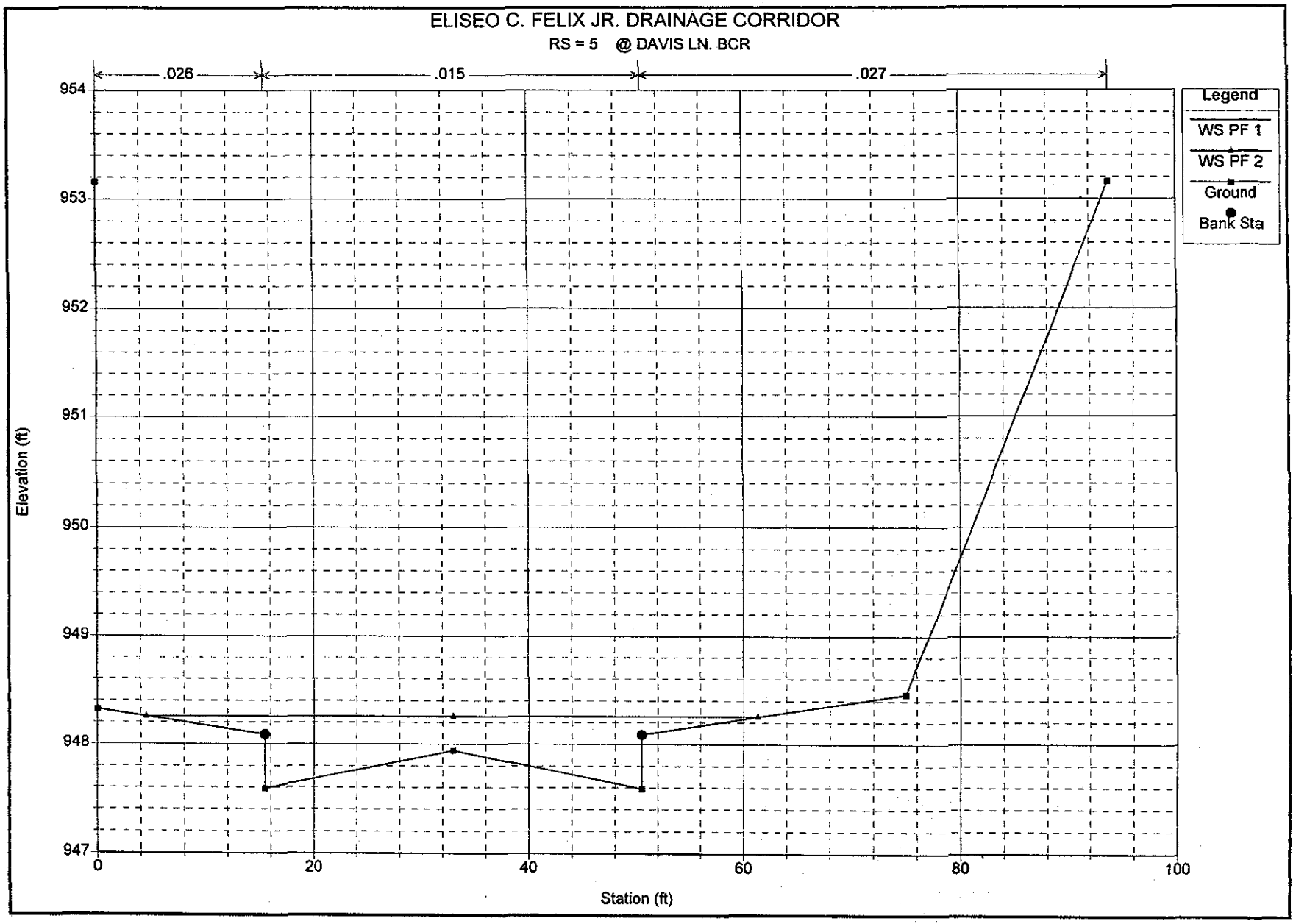

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
Legend
WS PF 1
WS PF 2
Ground
Elevation (ft)
952
951
950
949
948
947
946
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

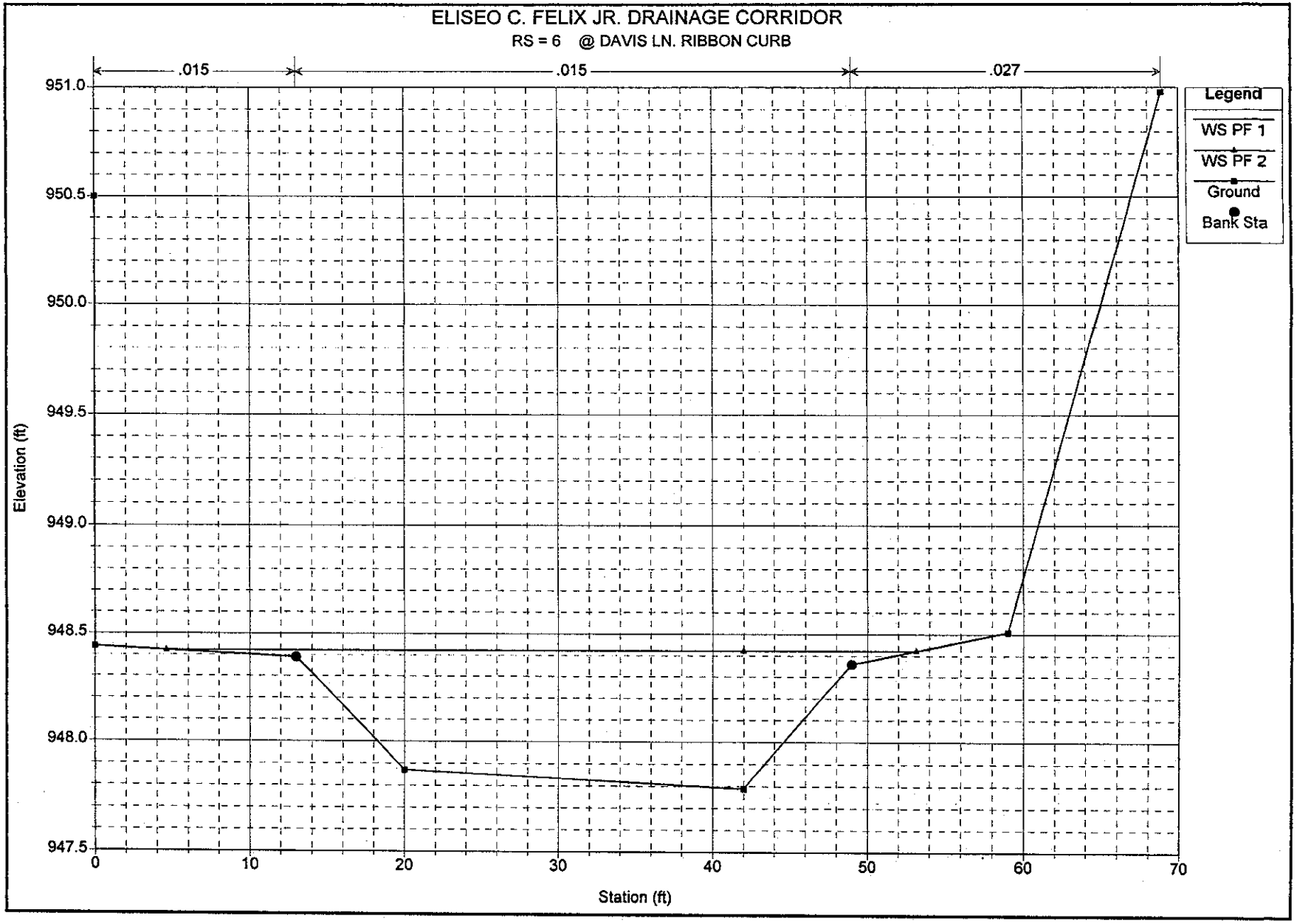

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 1 @ WHYMAN RIBBON CURB
.015
.015
.027
954
952
950
948
946
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta

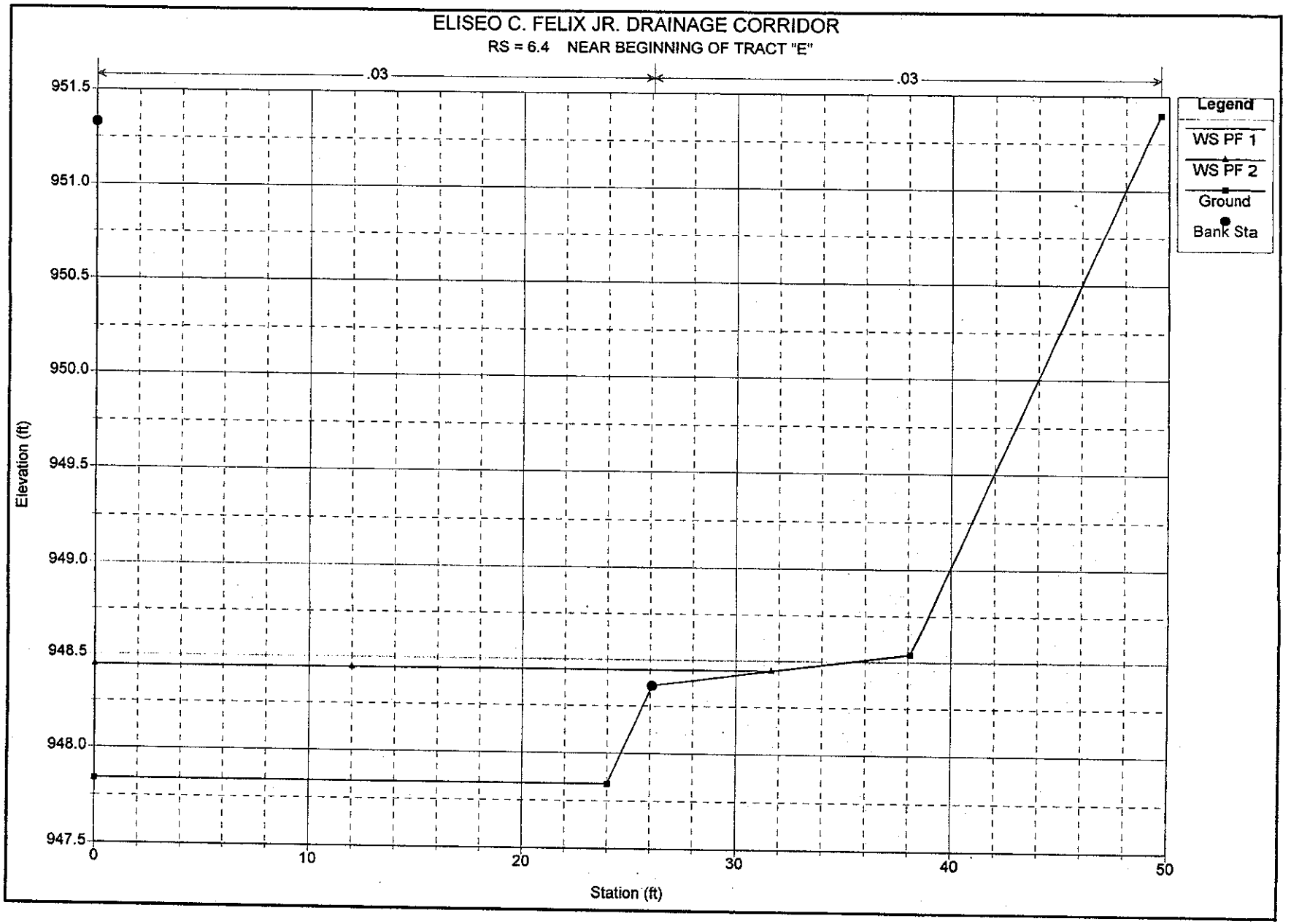

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 2 GB @ WHYMAN
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
952
951
950
949
948
947
946
0
20
40
60
80
100
Station (ft)

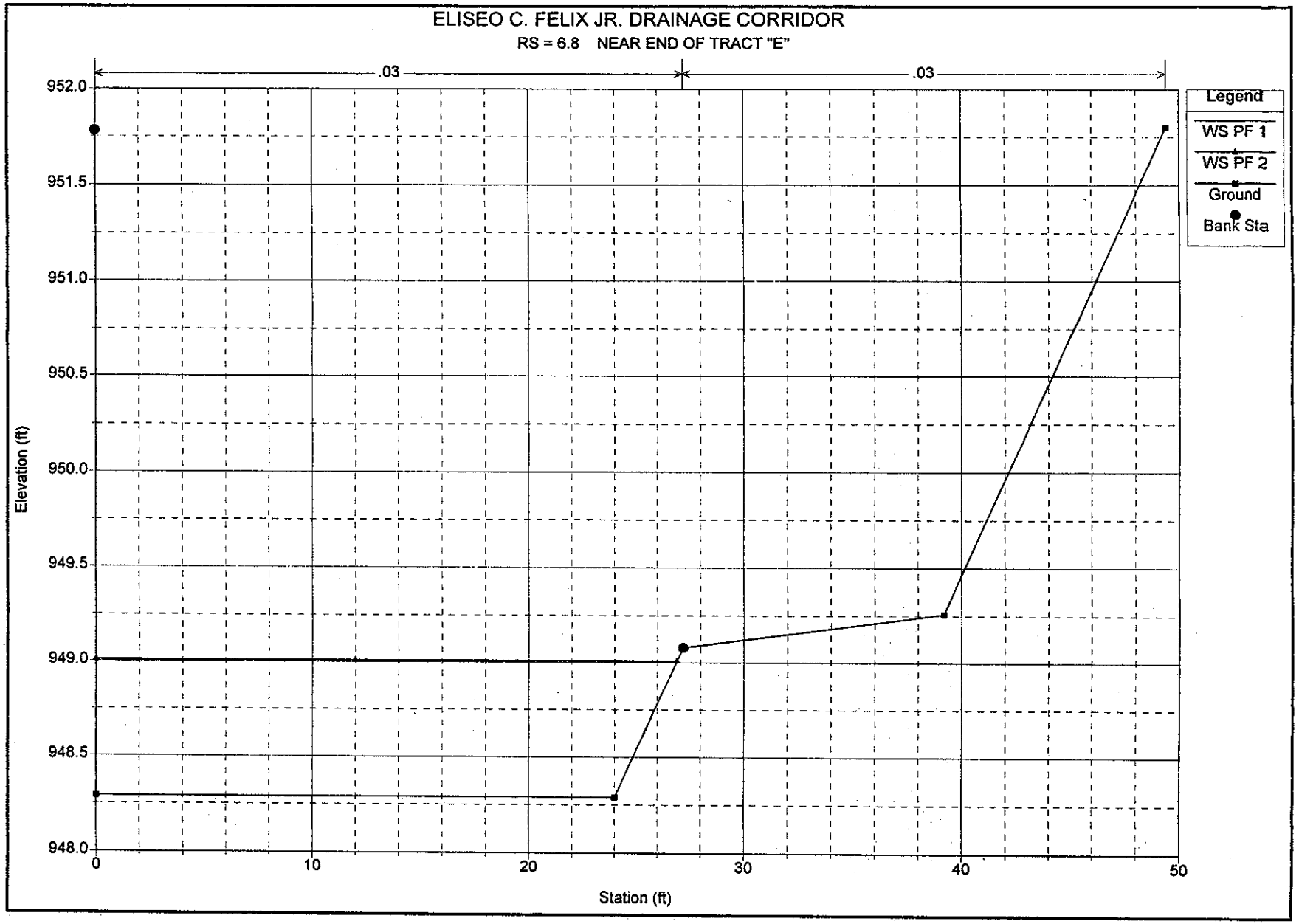

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 3 @ LOCUS LN. BCR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
953
952
951
950
949
948
947
946
0
20
40
60
80
100
Station (ft)

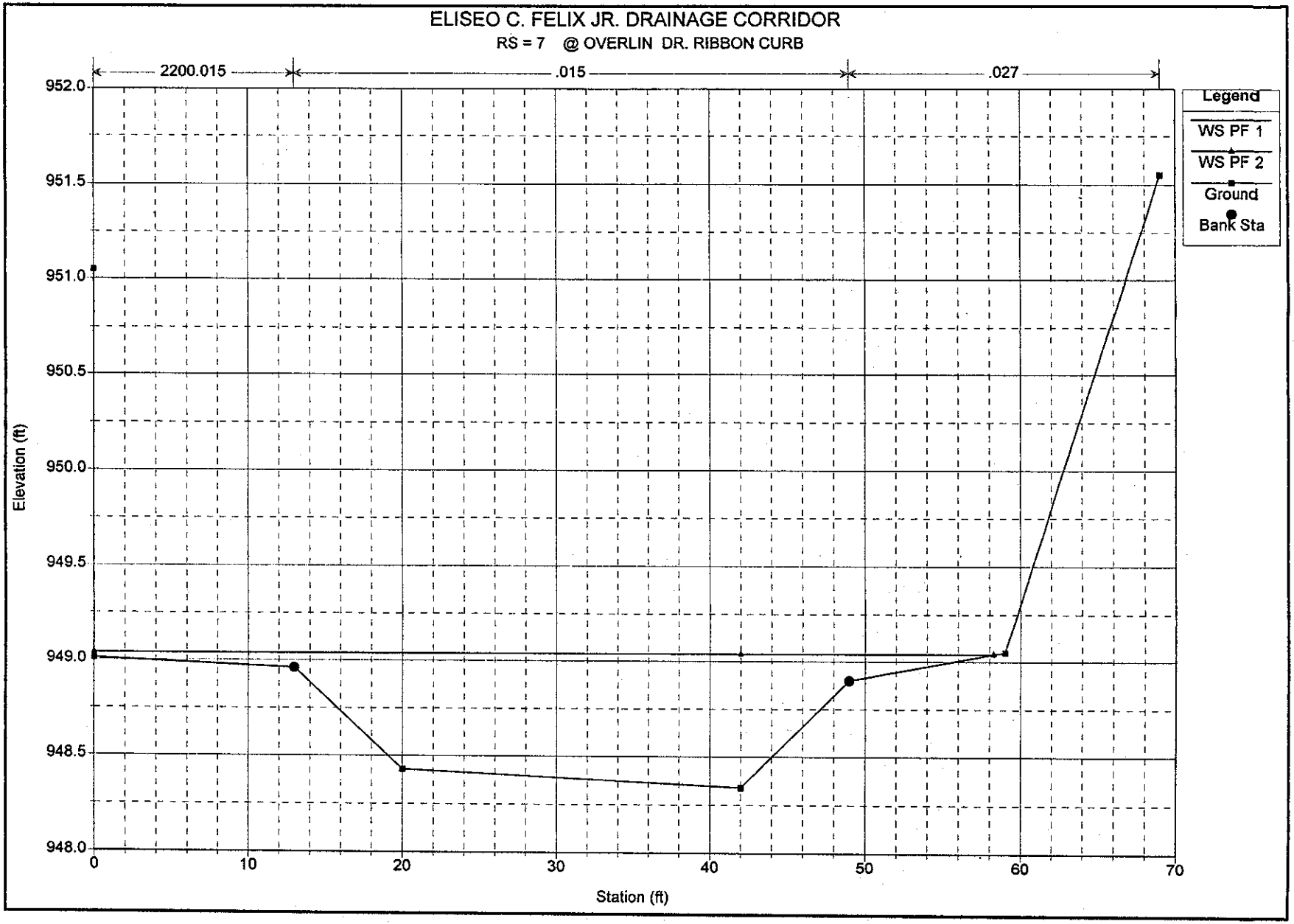

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 4 @ LOCUST LN. ECR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
953
952
951
950
949
948
947
0
20
40
60
80
100
Station (ft)

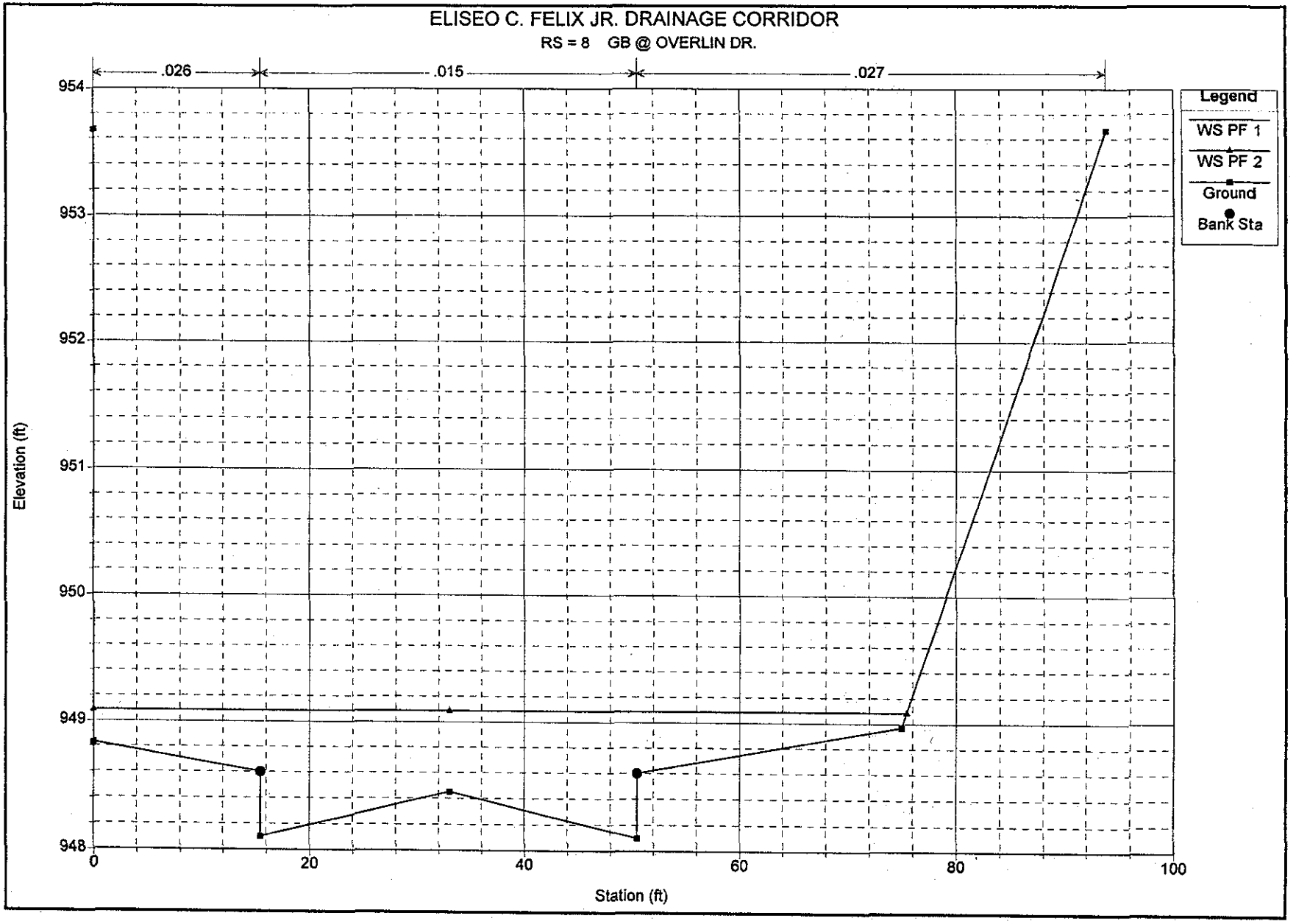

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 5 @ DAVIS LN. BCR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
954
953
952
951
950
949
948
947
0
20
40
60
80
100
Station (ft)

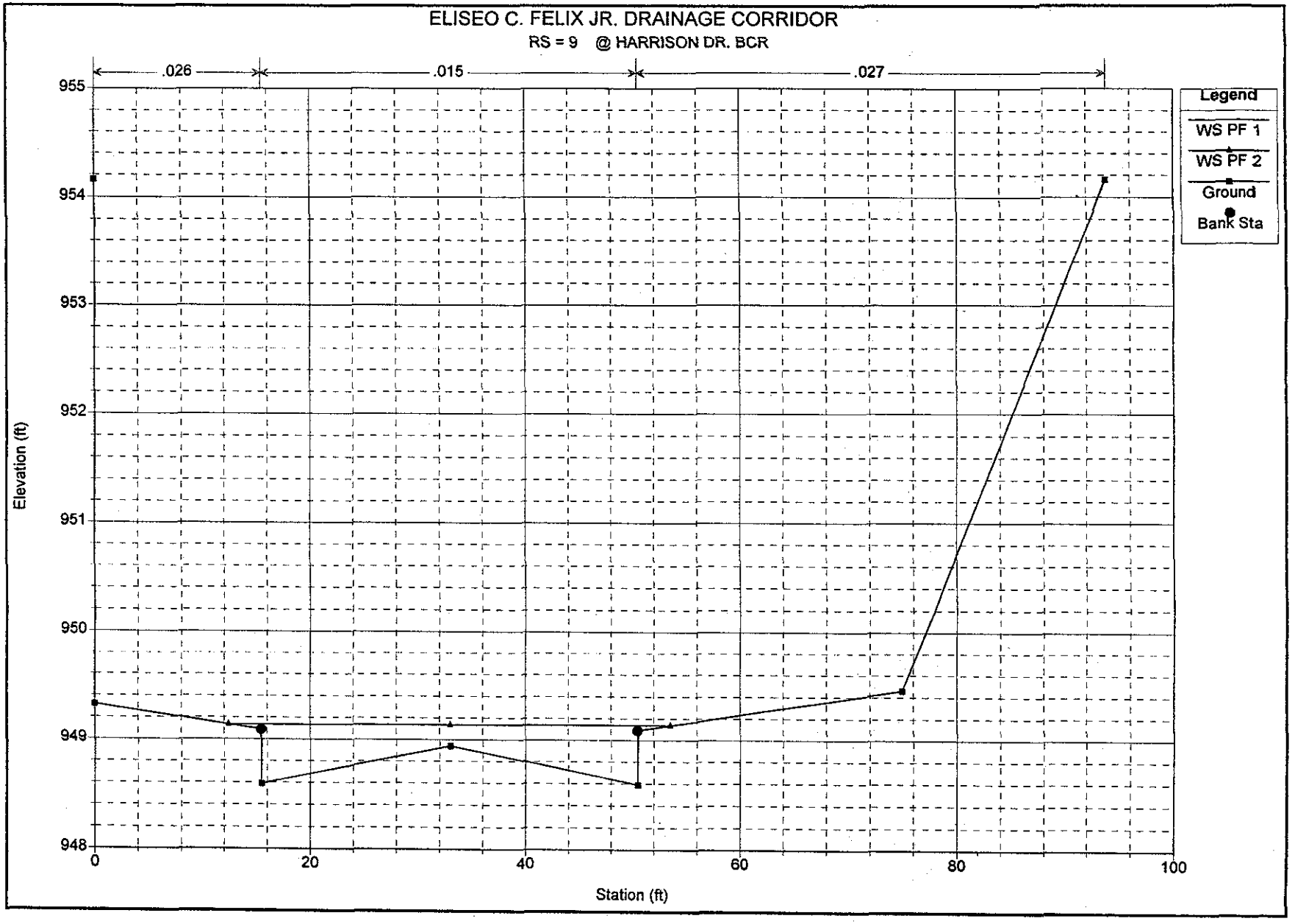

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 6 @ DAVIS LN. RIBBON CURB
.015
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
951.0
950.5
950.0
949.5
949.0
948.5
948.0
947.5
0
10
20
30
40
50
60
70
Station (ft)

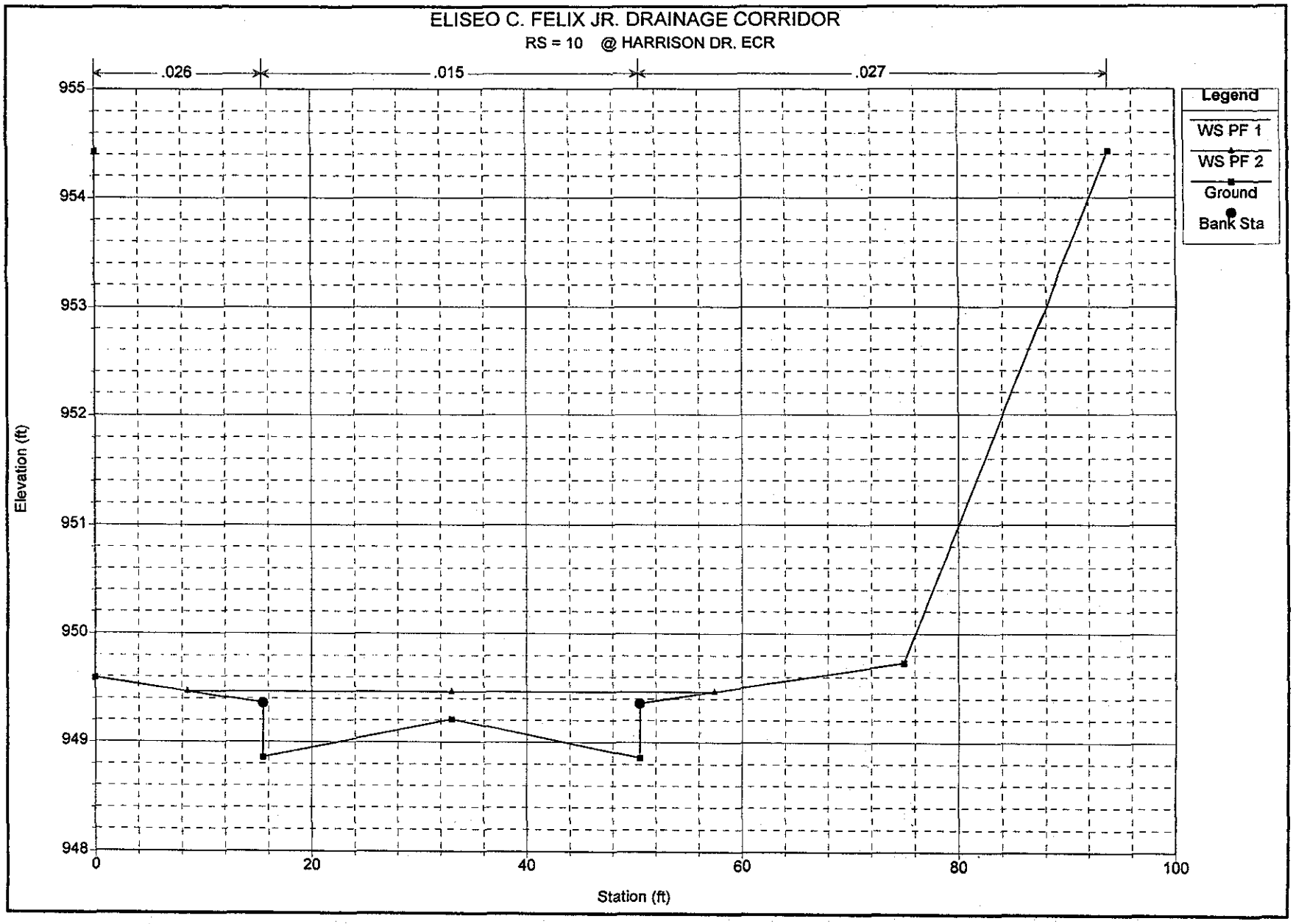

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 6.4 NEAR BEGINNING OF TRACT "E"
.03
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
951.5
951.0
950.5
950.0
949.5
949.0
948.5
948.0
947.5
0
10
20
30
40
50
Station (ft)

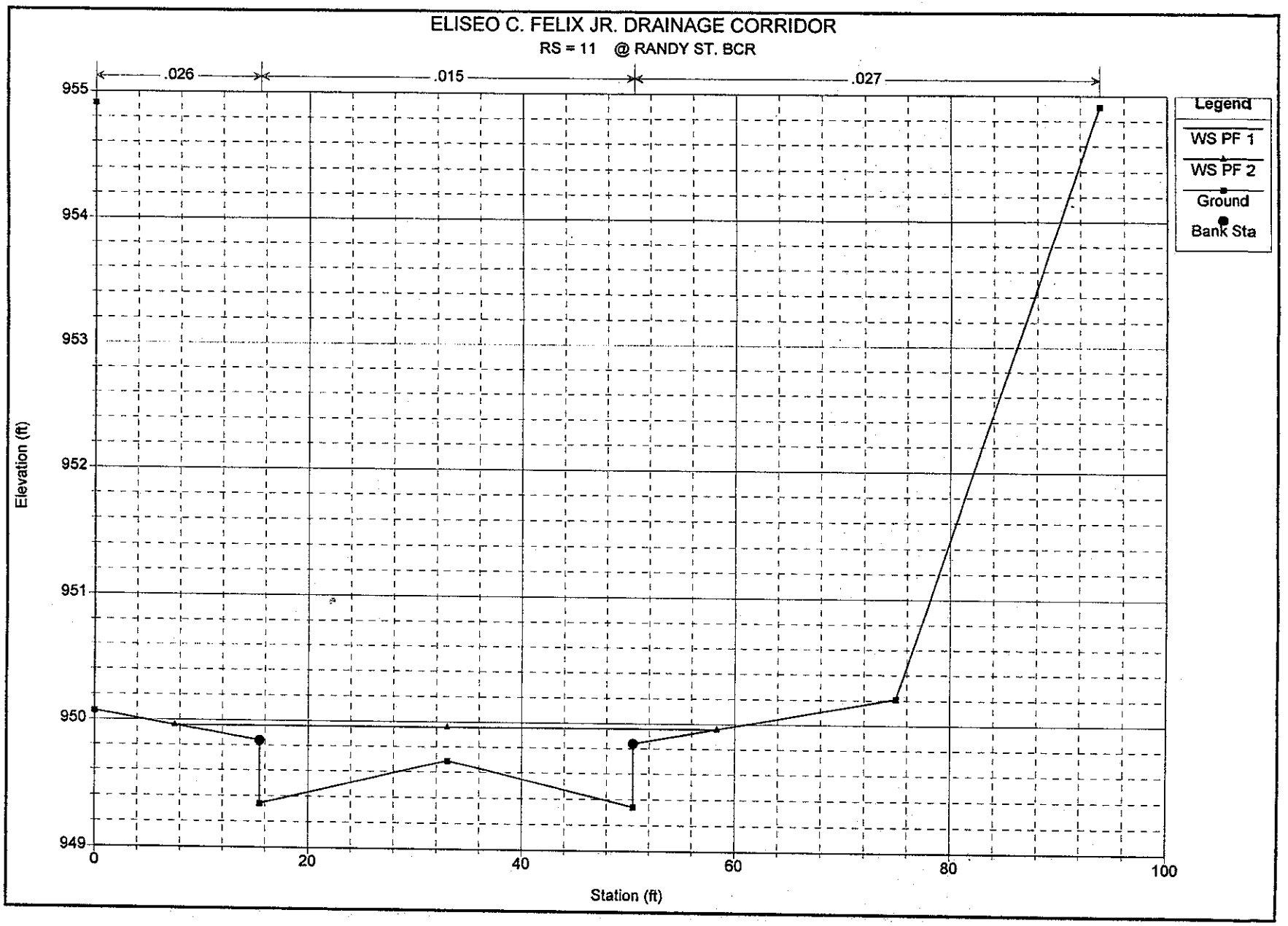

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 6.8 NEAR END OF TRACT "E"
.03
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
952.0
951.5
951.0
950.5
950.0
949.5
949.0
948.5
948.0
0
10
20
30
40
50
Station (ft)

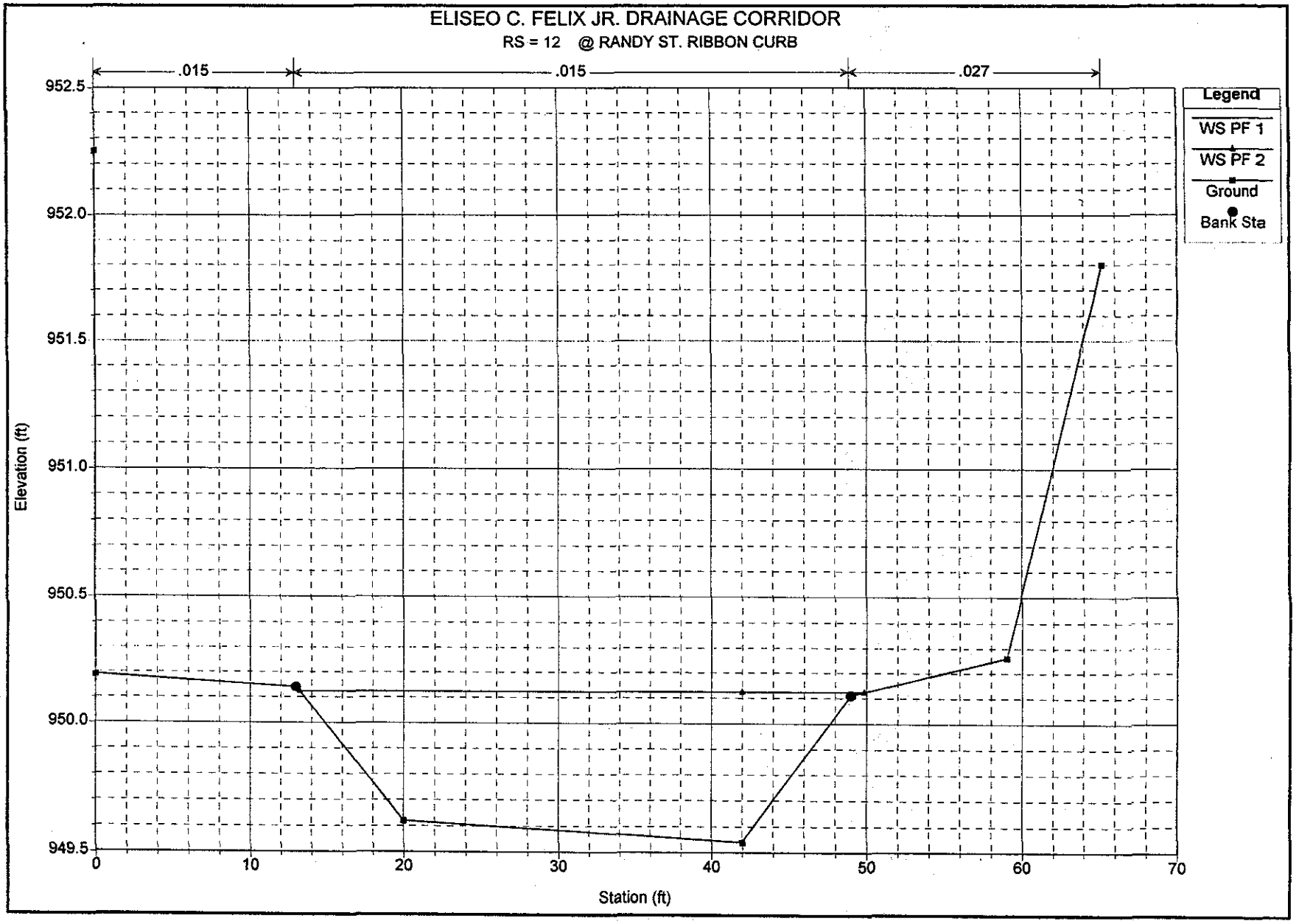

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 7 @ OVERLIN DR. RIBBON CURB
2200.015
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
952.0
951.5
951.0
950.5
950.0
949.5
949.0
948.5
948.0
0
10
20
30
40
50
60
70
Station (ft)

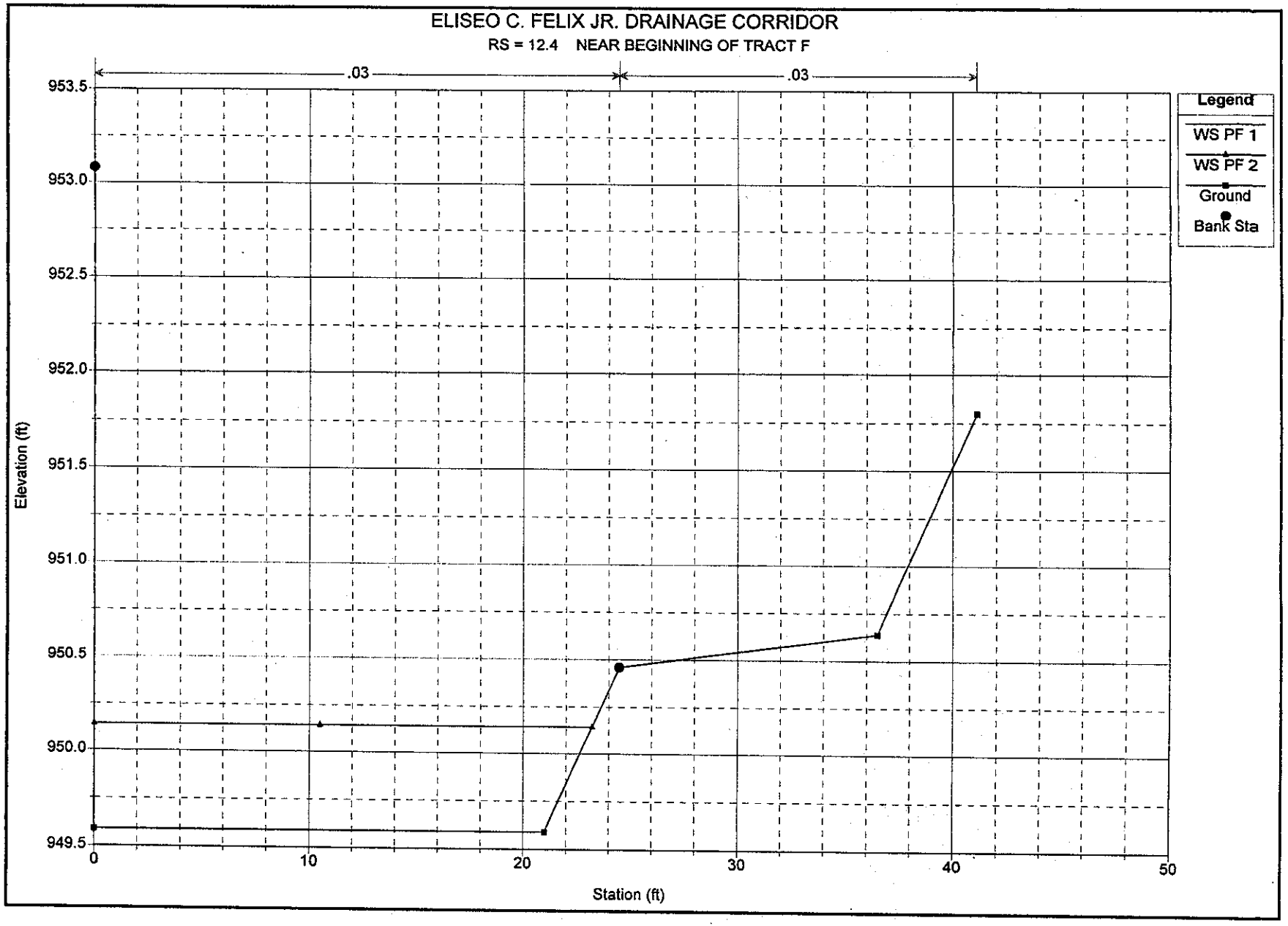

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 8 GB @ OVERLIN DR.
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
954
953
952
951
950
949
948
0
20
40
60
80
100
Station (ft)

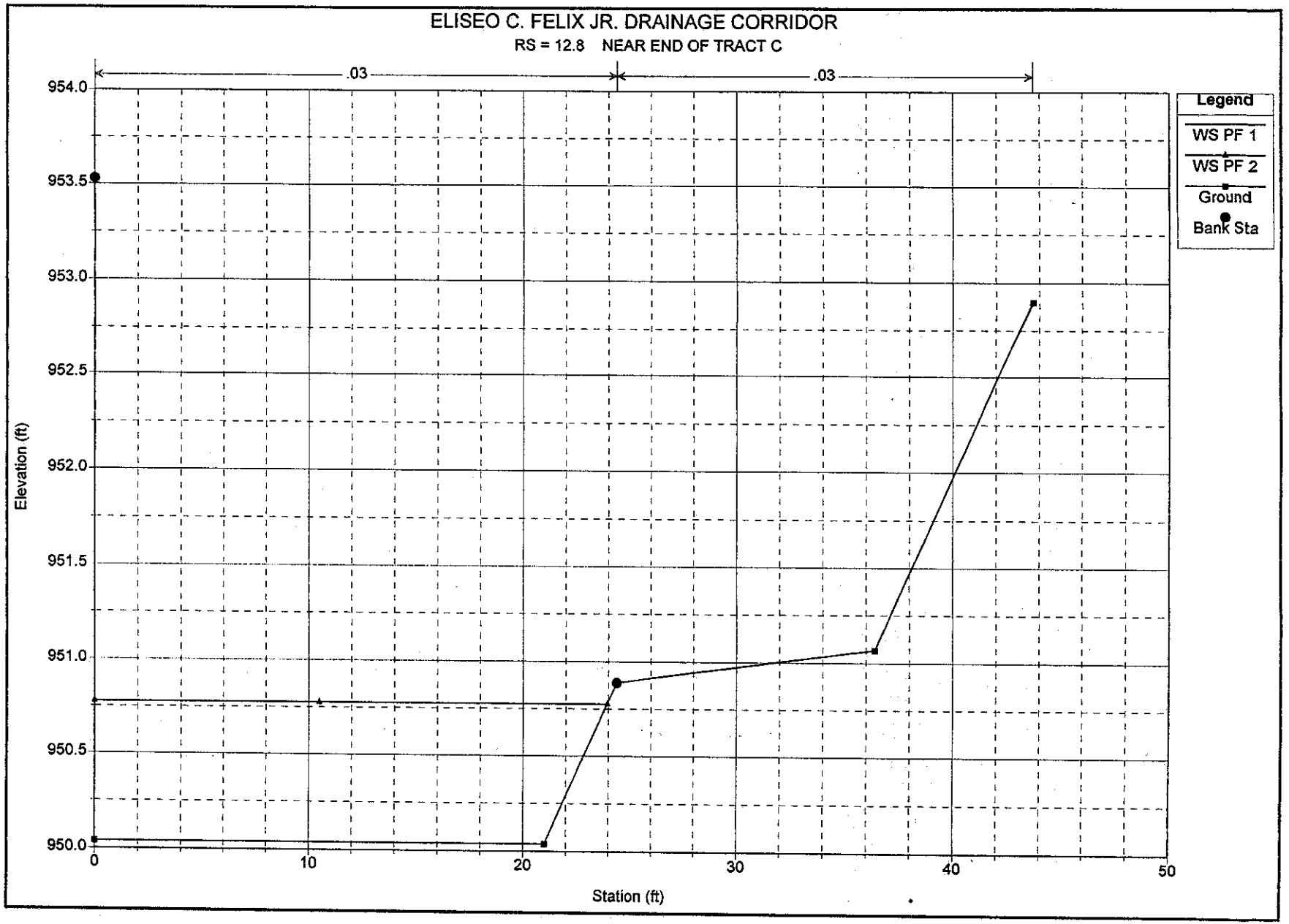

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 9 @ HARRISON DR. BCR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
955
954
953
952
951
950
949
948
0
20
40
60
80
100
Station (ft)

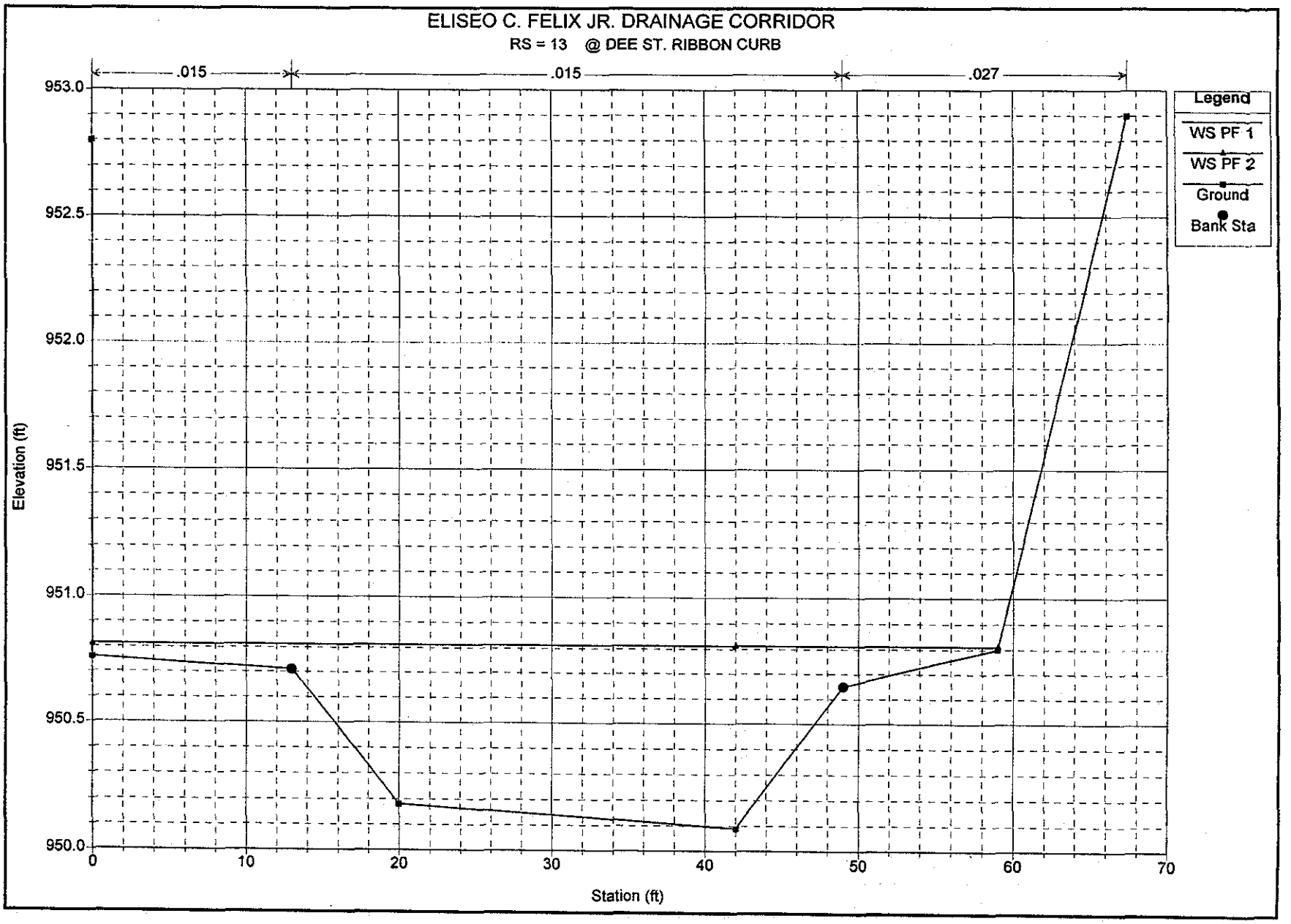

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 10 @ HARRISON DR. ECR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
955
954
953
952
951
950
949
948
0
20
40
60
80
100
Station (ft)

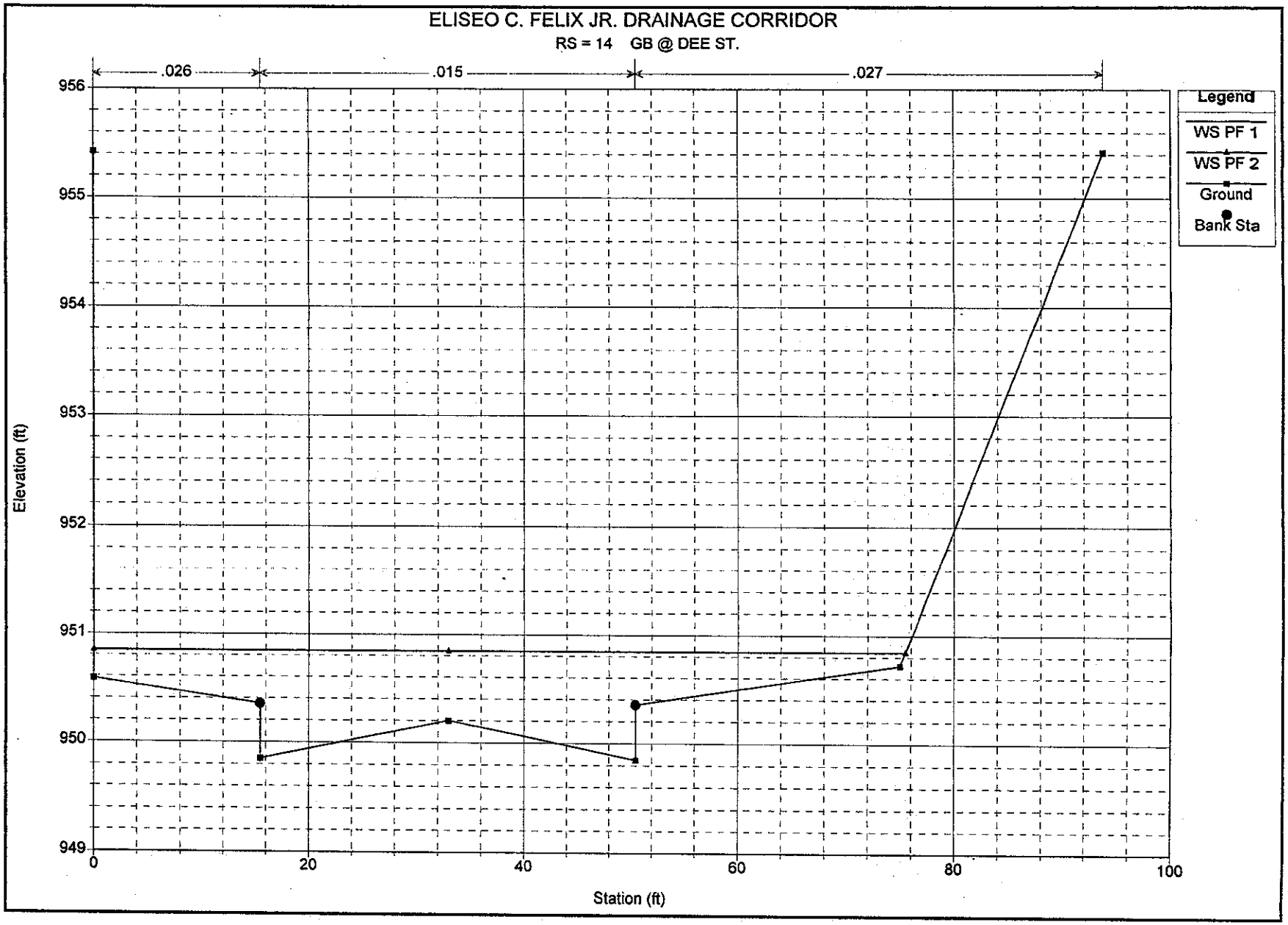

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 11 @ RANDY ST. BCR
.026
.015
.027
955
954
953
952
951
950
949
Elevation (ft)
0
20
40
60
80
100
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta

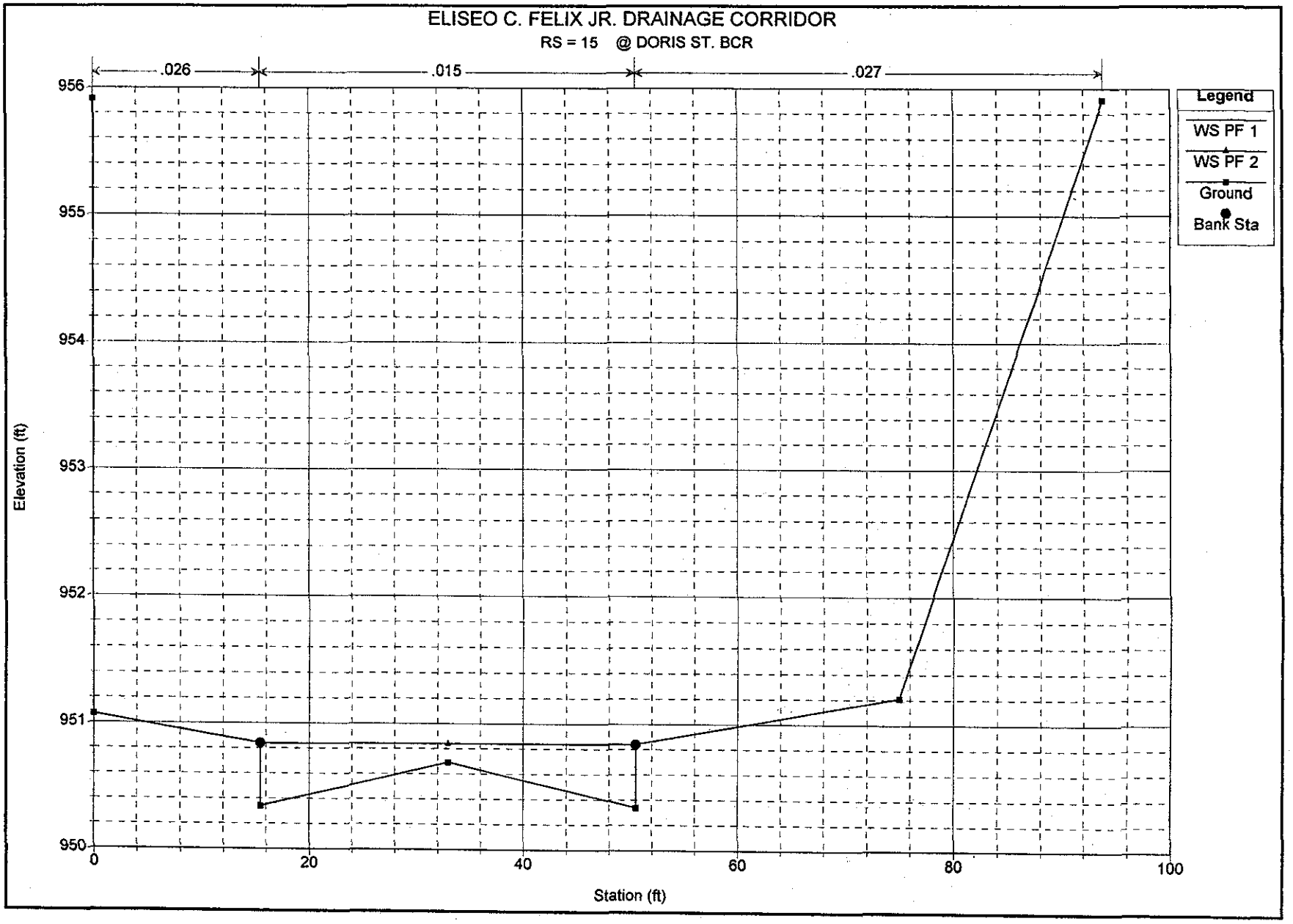

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 12 @ RANDY ST. RIBBON CURB
.015
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
952.5
952.0
951.5
951.0
950.5
950.0
949.5
0
10
20
30
40
50
60
70
Station (ft)

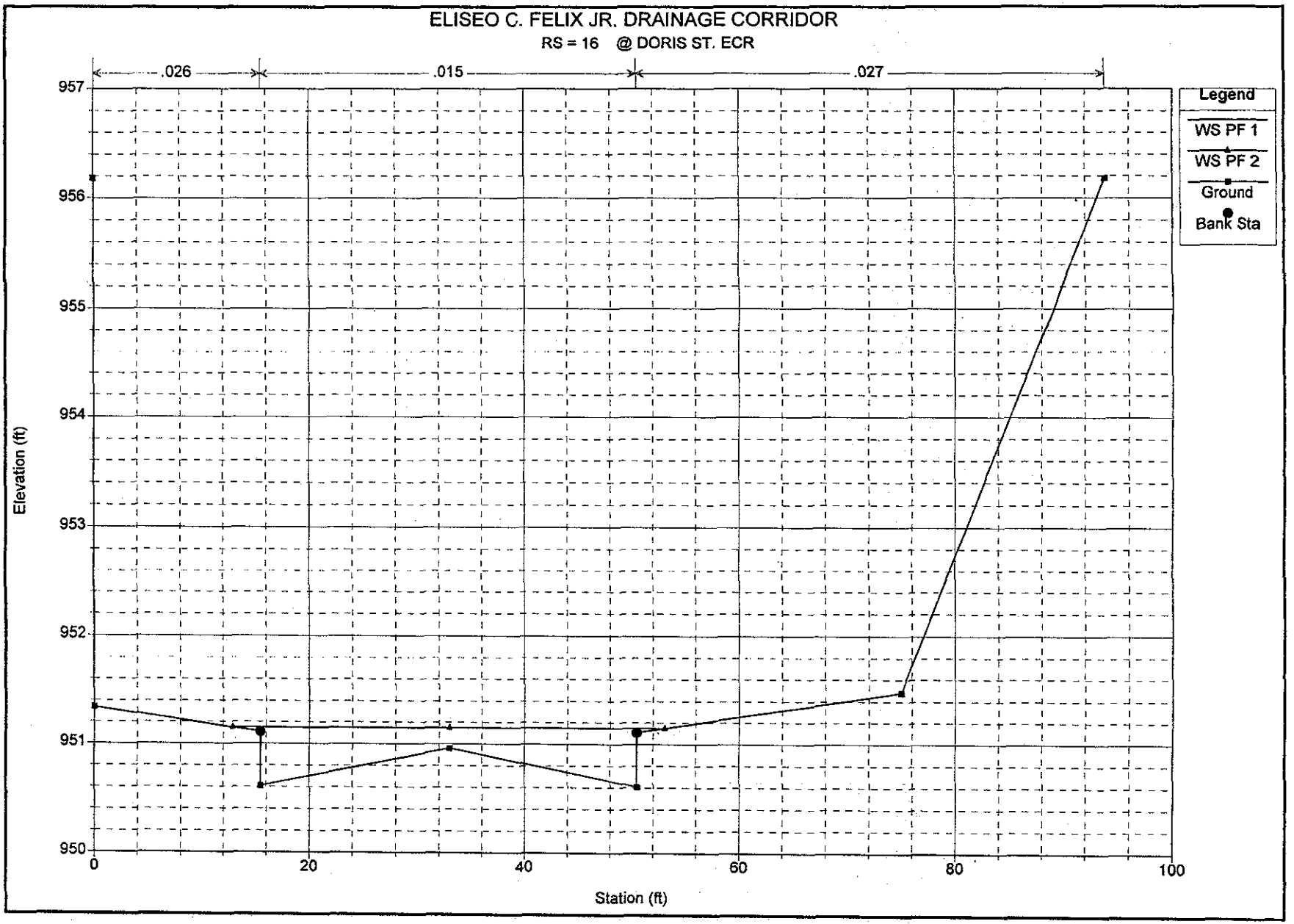

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 12.4 NEAR BEGINNING OF TRACT F
.03
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
953.5
953.0
952.5
952.0
951.5
951.0
950.5
950.0
949.5
0
10
20
30
40
50
Station (ft)

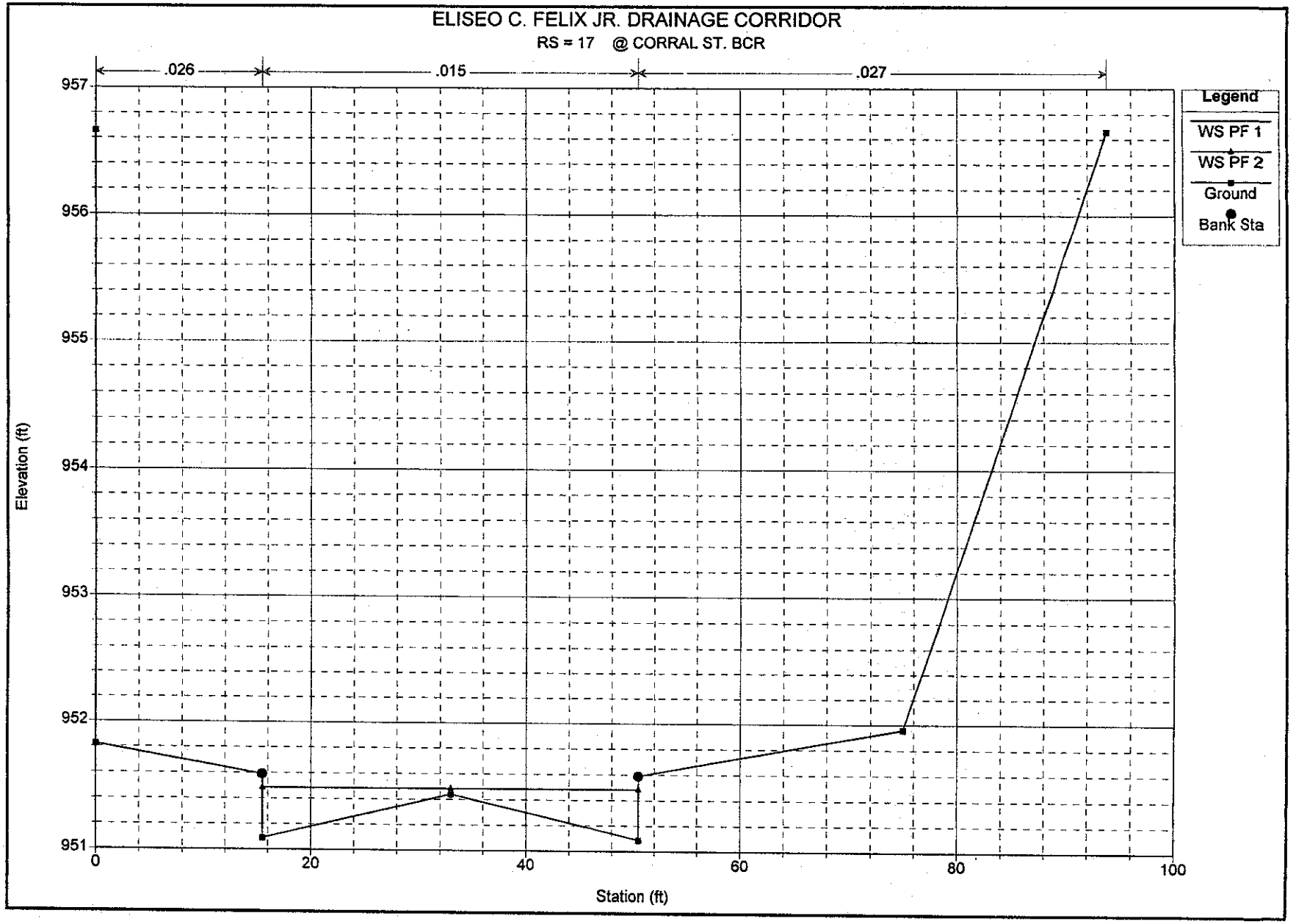

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 12.8 NEAR END OF TRACT C
.03
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
954.0
953.5
953.0
952.5
952.0
951.5
951.0
950.5
950.0
0
10
20
30
40
50
Station (ft)

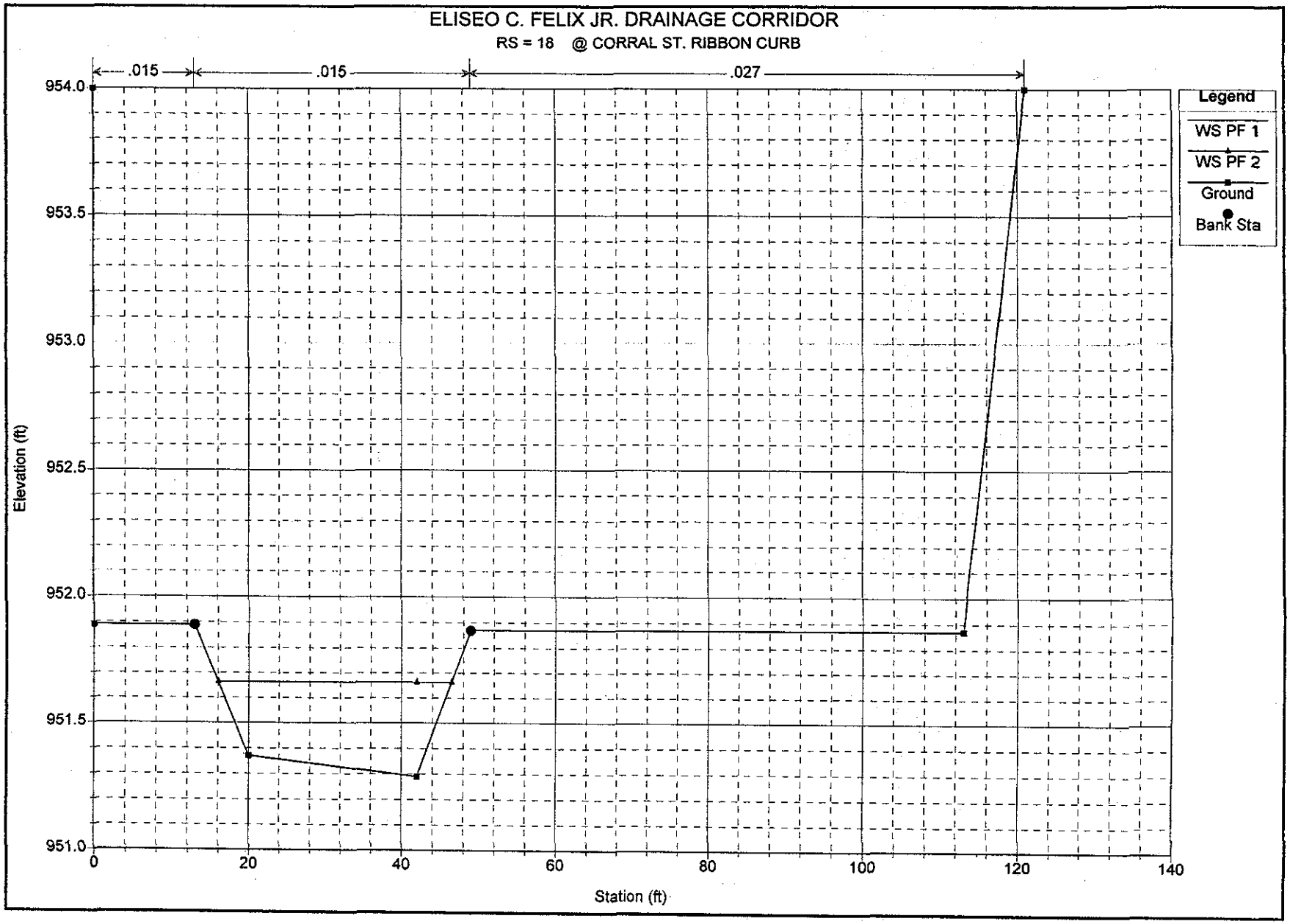

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 13 @ DEE ST. RIBBON CURB
.015
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
953.0
952.5
952.0
951.5
951.0
950.5
950.0
0
10
20
30
40
50
60
70
Station (ft)

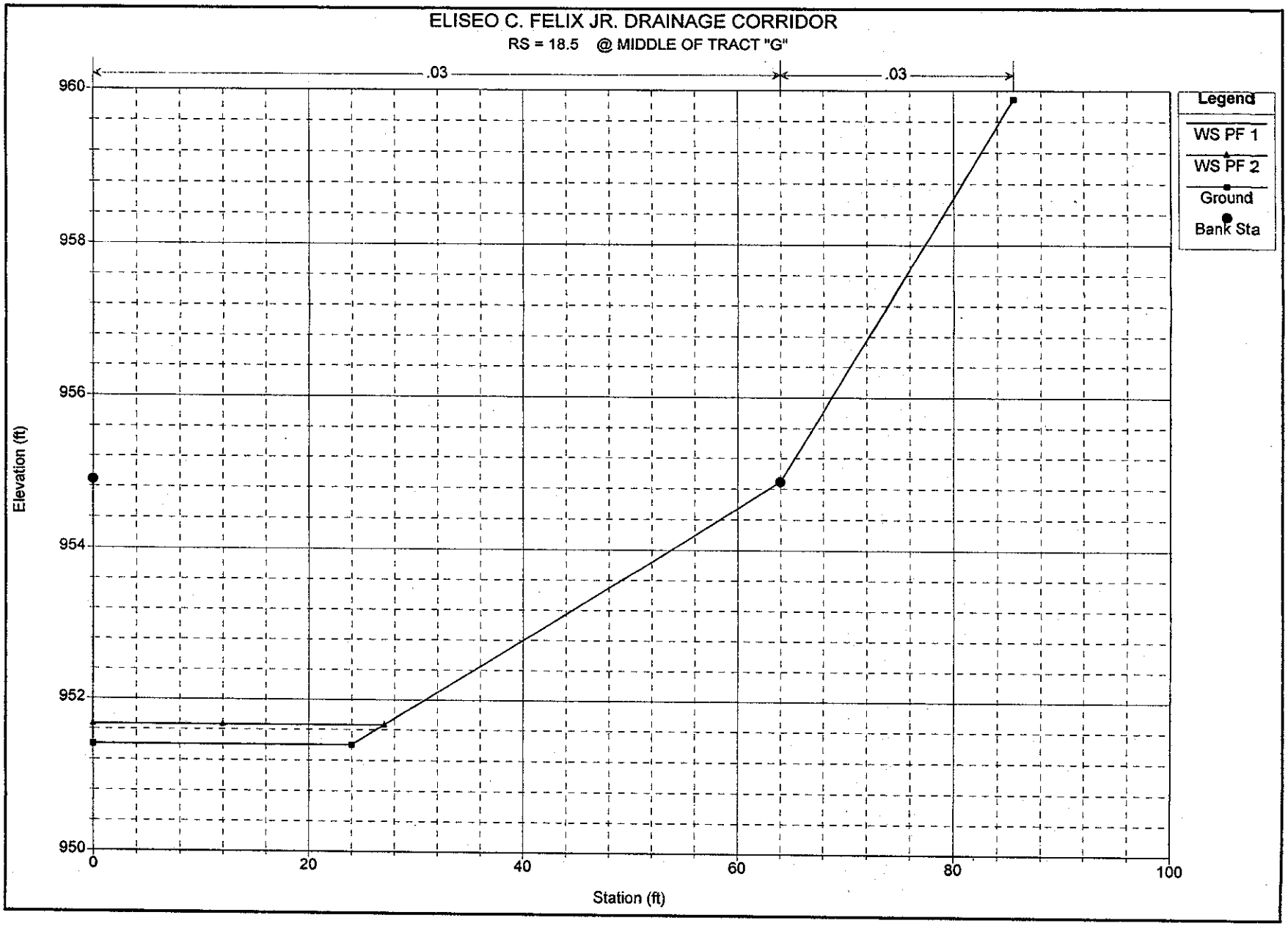

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 14 GB @ DEE ST.
.026
.015
.027
956
955
954
953
952
951
950
949
Elevation (ft)
0
20
40
60
80
100
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta

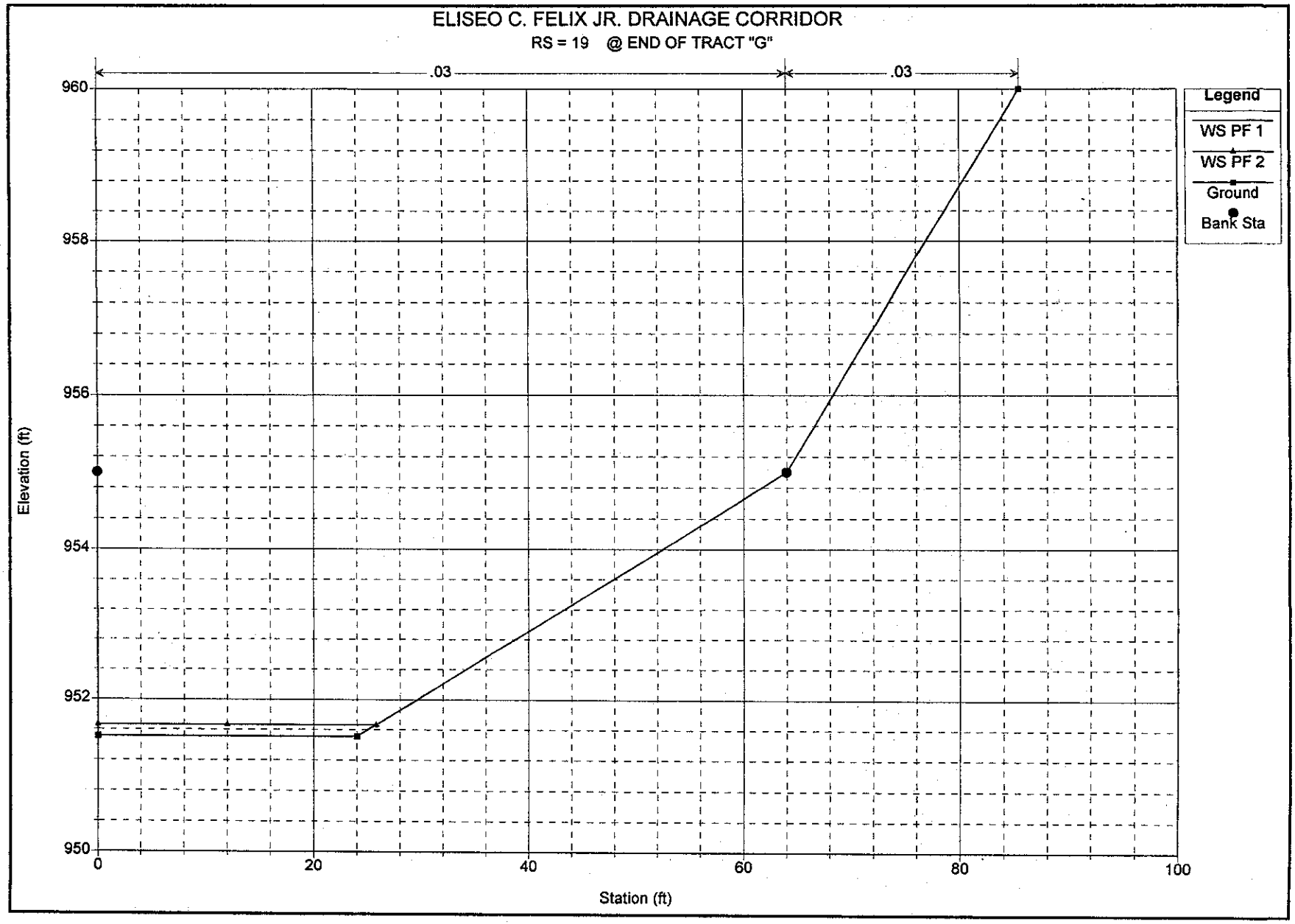

ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 15 @ DORIS ST. BCR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
956
955
954
953
952
951
950
0
20
40
60
80
100
Station (ft)


ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 16 @ DORIS ST. ECR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
957
956
955
954
953
952
951
950
0
20
40
60
80
100
Station (ft)


ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 17 @ CORRAL ST. BCR
.026
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
957
956
955
954
953
952
951
0
20
40
60
80
100
Station (ft)


ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 18 @ CORRAL ST. RIBBON CURB
.015
.015
.027
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
954.0
953.5
953.0
952.5
952.0
951.5
951.0
0
20
40
60
80
100
120
140
Station (ft)


ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 18.5 @ MIDDLE OF TRACT "G"
.03
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
960
958
956
954
952
950
0
20
40
60
80
100
Station (ft)


ELISEO C. FELIX JR. DRAINAGE CORRIDOR
RS = 19 @ END OF TRACT "G"
.03
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
960
958
956
954
952
950
0
20
40
60
80
100
Station (ft)

SECTION D-1

- Arizona Highway Department Hydraulic Studies
  - Offsite Flow in Excess of ADOT S.D.

ARIZONA HIGHWAY DEPARTMENT

Hydraulic Studies

PROJECT NUMBER

S-371-503
Buckeye Phoenix Hwy.
Avondale STREET

AREA DESCRIPTION

The project area runs generally west to east. At Central Avenue, approximately the middle of the project, the elevation is the highest. This forms two drainage areas. The area to the west will be surface drained to existing ditches. The area to the east will be the report area.

The report area contains approximately 20.5 acres sloping to the east. The Santa Fe Railroad runs parallel to Route 80 on the north forming a dam which controls runoff from the north to the immediate area. The south side of Route 80 slopes to the south and east towards the Agua Fria River.

ANALYSIS

This design storm drain will run in an easterly direction to Dysart Road (8th Street). Thence it will run south approximately 300 feet and empty into new 10' x 3' ditch running south 4,500' to Agua Fria River.

A design frequency of 10 years was used as most of the drainage has street or off street business area qualifications.

Determination of Design Rainfall Intensity Curve (Exhibit No.3) was made as follows:

(1) Isopluvials for a 6 hr. 10 year storm show a rainfall of 2.0 inches (Exhibit No.4)

(2) Isopluvials for a 24 hour 10 year storm show a rainfall of 2.5 inches (Exhibit No.5)

(3) Conversion to a 10 year 1 hour storm shows 1.5 inches (Exhibit No.3)

(4) The standard Rainfall Duration Intensity Curves (Exhibit No.6) gives 5 minute increments of inches per hour which are shown on Exhibit No. 9

(5) Runoff coefficient "C" was assigned to the various areas as business or pavement in accordance with standard values with modifications (Exhibit No.8). A roadside park, between Central Street and 4th Street, is irrigated within a bermed area and a "C" factor of 0.00 was assigned.

HYDRAULIC GRADE DETERMINATION

Run	From Junct.	From Inv. Elev.	To Junct.	To Inv. Elev.	Q c.f.s.	Pipe Size	HW/D	HW ft.	K_e	H ft.	d_c ft.	$\frac{d_c+D}{2}$ ft.	TW ft.	h_o ft.	L ft/ft.	S_o ft/ft.	LS_o ft.	HW ft.	Control HW ft.	Hyd. Gr. El.	
1	827+60	953.31	Ditch	953.15	22.45	33"	.86	2.37	0.5	0.75	1.55	2.15	0	2.15	300	.0016	.48	2.42	2.42	955.73	
2	826+80	951.09	826+60	953.31	22.45	30"	1.1	2.75	"	1.2	1.6	2.05	2.42	2.42	280	.0026	.73	2.89	2.89	956.93	5124
3	826+12	951.32	826+80	954.09	17.60	27"	1.1	2.18	"	0.85	1.45	1.85	2.89	2.89	79	.0035	.28	3.46	3.46	957.73	
4	821+55	955.69	826+12	954.32	18.26	27"	1.05	2.36	"	1.8	1.4	1.83	3.46	3.46	457	.0130	1.37	3.89	3.89	957.58	
5	817+55	956.69	821+55	955.69	16.74	27"	0.98	2.21	"	1.5	1.35	1.8	3.87	3.89	100	.0025	1.0	4.39	4.39	961.08	
6	813+45	957.55	817+55	956.69	15.07	27"	0.91	2.05	"	1.17	1.3	1.78	4.39	4.39	410	.0021	0.86	4.70	4.70	962.25	
7	809+30	958.30	813+45	957.55	13.99	27"	0.87	1.96	"	1.0	1.25	1.75	4.70	4.70	415	.0018	0.75	4.95	4.95	963.25	
8	805+17	958.96	809+30	958.30	13.05	27"	0.83	1.87	"	0.88	1.2	1.73	4.95	4.95	413	.0016	0.66	5.17	5.17	964.13	
9	797+80	959.82	805+17	958.96	10.89	27"	0.74	1.67	"	0.85	1.1	1.68	5.17	5.17	719	.0012	0.86	5.16	5.16	964.98	
10	791+00	960.16	797+80	959.82	9.96	27"	0.7	1.58	"	0.68	1	1.63	5.16	5.16	628	.0012	0.81	5.00	5.00	965.66	
11	787+[illegible]	961.02	791+00	960.16	5.16	24"	0.56	1.12	"	0.22	0.8	1.4	5.00	5.00	361	.0010	0.36	4.86	4.86	965.89	
12	784+70	961.17	787+57	961.02	2.58	18"	0.57	0.86	"	0.19	0.6	1.05	4.86	4.86	269	.00055	0.15	4.90	4.90	966.07	966.14

SECTION D-2

- Dysart Road Drainage
- Flood Control District of Maricopa County, Hydraulic Design Manual Rational Method

CMX Group Inc
1515 East Missouri
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Phoenix, AZ 85014
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PROJECT Tres Rios Landing
SUBJECT Dysart Rd Drainage
CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____
SHEET 1 OF ___ BY _____ DATE 5/29/02

1. Determine St. runoff in Dysart between sta 33+00 and Sta 43+60 (80' Wide corridor)

Area = 80 (4360 − 3300) = 84800 SF = 1.947 Ac

$$C_{10}' = \frac{52(.85)}{80} + \frac{28(.40)}{80} = 0.69$$

2. Determine St. runoff in Dysart between Sta 20+75 and Sta 33+00

Area = 80 (3300 − 2075) = 98000 SF = 2.25 Ac

3. Determine St. Runoff in Dysart between sta 10+00 and Sta 20+75

$$\text{Area} = \frac{80}{2}(2075 - 1000) = 43000 \text{ SF} = 0.987 \text{ Ac}$$

4. Determine ADOT Q For Existing Storm Drain

Q = 22.45 (See Attached ADOT H.G.L. Calcs)

PROJECT

SUBJECT

CLIENT PROJECT NUMBER CMX PROJECT NUMBER

SHEET 2 OF BY DATE

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CMX

6. Determine H.G.L. Profile for Drainage Ditch and/or Roadway Right-of-way for 10-year and 100-year runoff

A. Determine Q's along alignment

Location	Q_{10}	Q_{100}
Sta 35+00	22.45 cfs ADOT in pipe 6 cfs in pipe	22.45 cfs ADOT in pipe 6 cfs in pipe 7 cfs in St. 27.49 cfs Excess from BUCKEYE Rd
Sta 22+00±	22.45 cfs ADOT From pipe 6 cfs from pipe 6 cfs in street 6.5 cfs from Harrison St.	22.45 cfs ADOT From pipe 6 cfs From pipe 7 cfs in street 13 cfs in street 129 cfs From Harrison 27.49 cfs From Buckeye
Sta 10+00±	99.45 cfs From upstream. 2 cfs St. Runoff.	204.99 cfs From upstream. 5 cfs St. Runoff.

For Results see Attached HEC-RAS Output

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PROJECT
SUBJECT
CLIENT PROJECT NUMBER CMX PROJECT NUMBER
SHEET OF 3 BY DATE

HEC-RAS RESULTS

10-year Runoff

In Dysart Road north of Harrison Dr. The 10-year flow depth will vary to a maximum of 0.26 Ft. above the gutter

The 10-year runoff South of Harrison Dr. will be conveyed within the parallel channel.

100-year Runoff

In Dysart Road north of Harrison Dr the 100-year flow depth will vary to a maximum of 0.64 Ft (less than 8-inches) above the gutter.

The 100-year flow depth South of Harrison Dr. will be contained within the parallel channel.

NOTE: See Section D-4 For HEC-RAS Computer Output

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PROJECT Tres Rios Landing
SUBJECT Offsite Flow in excess of ADOT SD
CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____
SHEET ____ OF ____ BY _____ DATE _____

Estimate Q_{100} Flowing easterly in Buckeye Road, to Dysart Road

Reference: 1. Arizona Highway Dept. Hydraulic Studies, Project No. S-371-503, Buckeye Phoenix Hwy, January 6, 1971

Assumptions & Given Data:

1. Storm drain design for Q_{10} for Buckeye Rd west of Dysart Rd per reference 1.
2. $Q_{10} = C'IA = 22.45$ cfs per reference 1.
3. Street surface Flow $= Q_{100} - Q_{10}$
4. $Q_{10} = C'IA$ per reference 1
   @ C' = Weighted runoff Coefficient
   $I_{10} = 1.55$ in/hr for $T_c = 55$ Minutes
   A = Area in Acres

Calculations:

1. $I_{100} = 2.53$ in/hr @ $T_c = 55$ minutes (see Intensites For Various T_c Table in APPENDIX A)
2. $C'A = Q_{10}/I_{10} = 22.45/1.55 = 17.764$
3. $Q_{100} = (C'A)\,I_{100} = (17.764)(2.53) = 49.94$ cfs
4. Street Surface Flow $= 49.94 - 22.45$
   $= \boxed{27.49 \text{ cfs}}$

NOTE: Flow in Buckeye Rd east of Dysart Rd will be intercepted by Catch Basins and Conveyed Southerly into the adjacent Property.

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SID Date: 5-29-02

LOCATION DATA

Location: DYSART RD.

Project Name: TRES RIOS Subarea id: STA21+75

Drainage Area Cover: ST.R/W

DESIGN DATA

Drainage Area	2.25	acres
Watercourse Length	1125.0	feet
Top Elevation	954.0	feet
Bottom Elevation	949.3	feet
Slope	.00421	feet/feet
Roughness Coefficient (Kb)	.03780	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	5	6	8	11	13
C	0.690	0.690	0.690	0.759	0.828	0.863
Tc (min)	16.0	14.1	13.4	12.0	11.4	10.8
i (in/hr)	2.3	3.2	3.7	4.9	5.7	6.5

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SID Date: 5-29-02

LOCATION DATA

Location: DYSART RD.

Project Name: TRES RIOS Subarea id: STA35+00

Drainage Area Cover: ST.R/W

DESIGN DATA

Drainage Area	1.95	acres
Watercourse Length	860.0	feet
Top Elevation	960.3	feet
Bottom Elevation	953.5	feet
Slope	.00788	feet/feet
Roughness Coefficient (Kb)	.03819	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	4	5	6	9	11	13
C	0.690	0.690	0.690	0.759	0.828	0.863
Tc (min)	10.8	9.6	9.1	8.2	7.8	7.4
i (in/hr)	2.8	3.8	4.3	5.8	6.6	7.6

SECTION D-3

- Surface Flow @ Dysart/Harrison Intersection
- Dysart Road Interim V-Ditch
- Catch Basin Design Procedures
- C.B. @ STA 35 + 25
- Catch Basin Hydraulics
- C. B. @ STA 15 + 00
- C.B. @ STA 21 + 58.05

PROJECT TRES RIOS LANDING

SUBJECT Surface Flow @ Dysart/Harrison Intersection

CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____

SHEET 1 OF 2 BY _____ DATE _____

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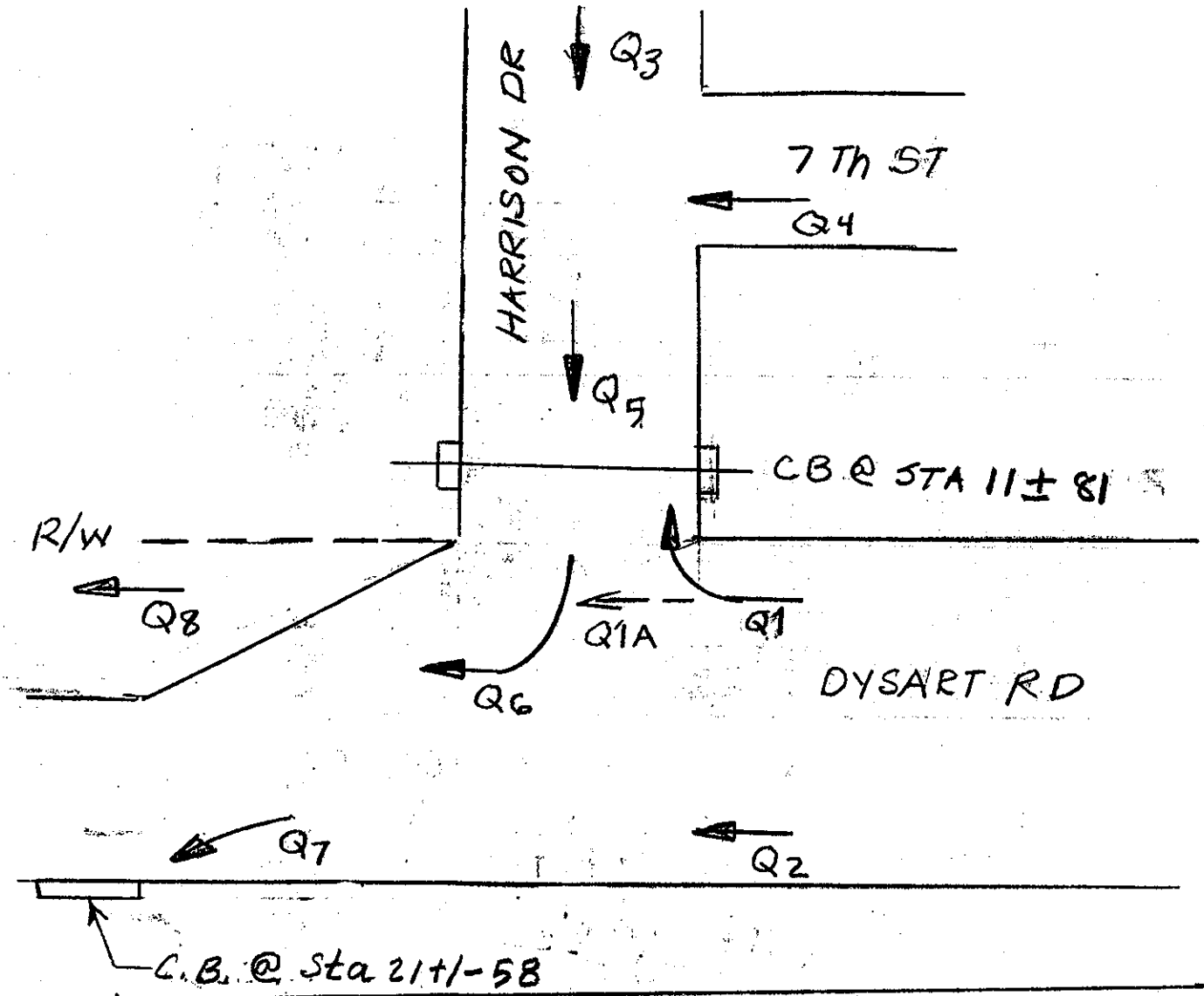

Qi	10-yr Q	100-yr Q	Notes
Q1	3	0	STA 11+31.05 C.B. include Q_{10}
Q1A	0	(7+13+27.49)/2	Q_{100} = ½ st Flow
Q2	3	(7+13+27.49)/2	Q_{100} = ½ st Flow
Q3	11	11	Excess Flow PER REF. 3
Q4	54	118	
Q5	54 + 11	11+118	
Q6	0	129 − 68	Reduced by Q_{10} C.B.'s
Q7	3	23.75 + 61/2	Provide Ribbon curb
Q8	0	23.75+61/2	Provide V-Ditch

PROJECT

SUBJECT

CLIENT PROJECT NUMBER CMX PROJECT NUMBER

SHEET 2 OF 2 BY DATE

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CMX

Calculate Length (L) of Ribbon Curb to Convey Q_7 into Channel ← DELETED

$$Q_7 = 54.25 = C L H^{3/2}$$

@ $C = 2.63$ & $H = 0.50$ Ft

$$L = \frac{Q}{C H^{1.5}} = \frac{54.25}{(2.63)(0.5)^{1.5}} = 58.34 \text{ Ft.}$$

Calculate Interim V-Ditch For Excess Q_{100} on West Side of Dysart

$Q_{100} = 54.25$ cfs

Assume S_o = Street slope = 0.002498

$Z = 4:1$

See Attached FlowMaster Calcs

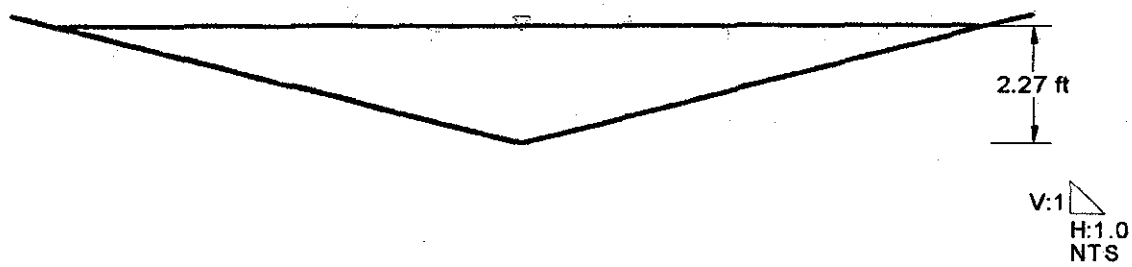
Size Catch Basins for 10-yr Qs

See Attached Catch Basin Calc Sheets

DYSART RD. INTERIM V-DITCH
Cross Section for Triangular Channel

Project Description	
Worksheet	DYSART INTERIM V-D
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Slope	0.002498	ft/ft
Depth	2.27	ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	54.25	cfs

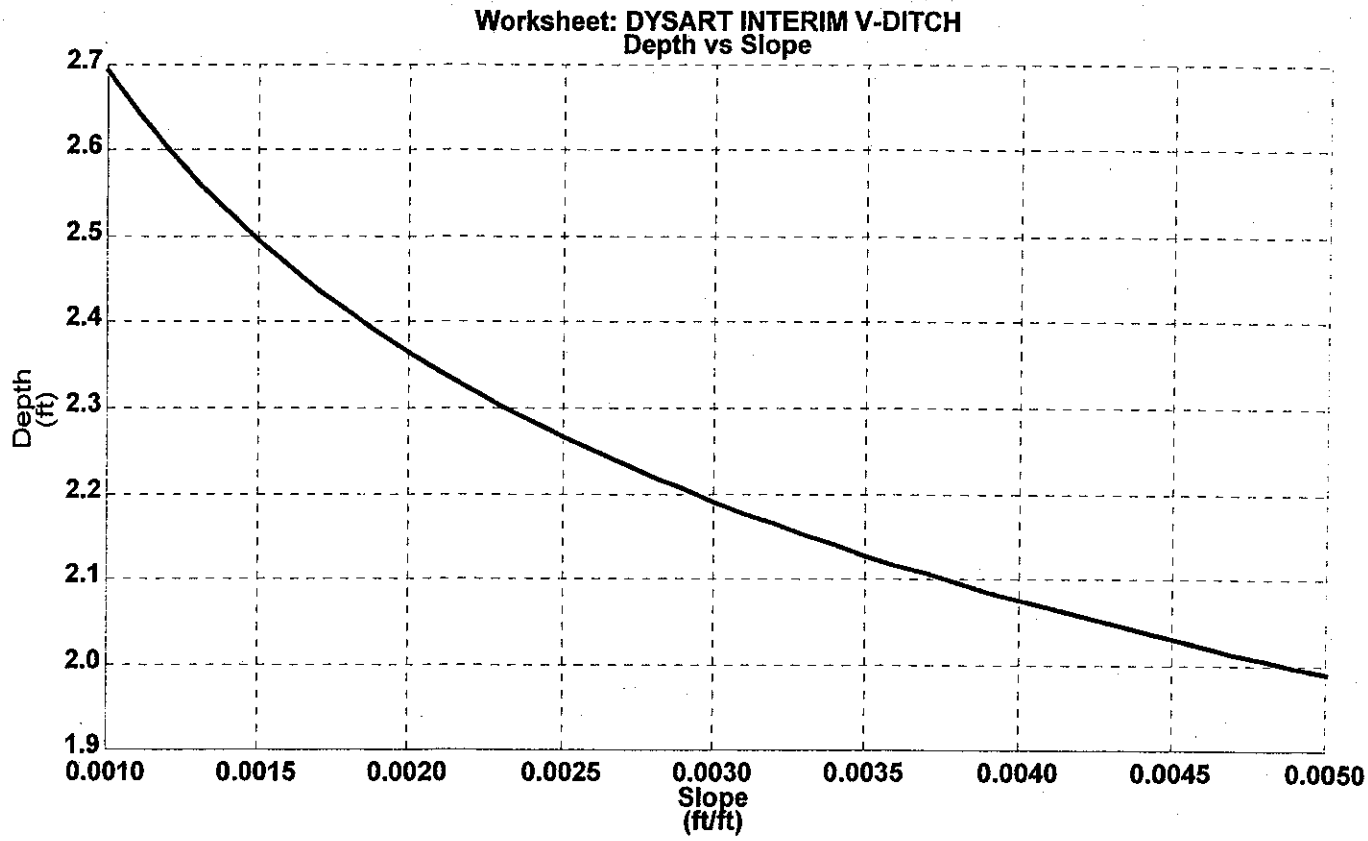


DYSART RD. INTERIM V-DITCH
Plotted Curves for Triangular Channel

Project Description	
Worksheet	DYSART INTERIM V-
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	54.25	cfs

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.001000	0.005000	0.000100



CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION DYSART Rd @ STA 35+25
P-1569-1 Type M C.B. (East & West Side)

EQUATION(S):

1. Scupper Capacity (Q)=.67*H\12*L*(2g*Do)^.5)*Fcl
   (D+a) >(H+a) Therefore Orifice Flow)

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height(D) = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. HEIGHT OF CURB OPENING (H) = 5 INCHES
6. Do= .4583334 Ft.=(D+a-H/2)/12

SCUPPER (OR CB W/O GRATE) IN SUMP AREA

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH	STANDARD LENGTH	SCUPPER CAPACITY
STA35+25	3.00 $= Q_{10}/2$	2.47	3.00	3.64

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

CATCH BASIN HYDRAULICS

MAG 533-2, COP 1569-1, OR EQUIVALENT TYPES
CALCULATION FOR SINGLE CATCH BASIN

Project Tres Rios Landing

LOCATION Dysart Rd @ STA 35+25, COP 1569-1

CATCH BASIN No.1

BEGINNING TAILWATER ELEVATION = 951.1 (a)
OUTLET INVERT ELEVATION = 949.69
INLET INVERT ELEVATION @ C.B.NO.1= 949.74
PIPE DIAMETER FOR C.B.No.1 = 1.5 Ft.
LENGTH OF PIPE No.1 = 25 Ft.
SLOPE OF PIPE No.1 = .002 Ft/Ft
MANNINGS N-VALUE FOR PIPE No.1 = .013
FLOW IN PIPE No.1 = 3 cfs
VELOCITY IN PIPE No.1 = 1.697654
TOP OF CURB ELEV. @ C.B. No.1 = 953.6
V-DEPTH @ C.B.No.1 = 3.859985 FT.
W.S.ELEVATION IN C.B.1 = 951.174
FREEBOARD @ CATCH BASIN No.1 = 1.759277 Ft.

(a) CHECK CAUSE OF DOWNSTREAM TAILWATER DEPTH:
1. DEPTH DUE TO PONDING ( )
2. DEPTH ASSUMED @ TOP OF PIPE ( )
3. H.G.L. IN DOWNSTREAM PIPE JUNCTION (X)
4. NORMAL DEPTH FLOW < PIPE DIAMETER ( )

PROJECT DYSART RD DRAINAGE

SUBJECT M.H. @ STA 35+25

CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____

SHEET ____ OF ____ BY _____ DATE _____

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1515 East Missouri
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Phoenix, AZ 85014
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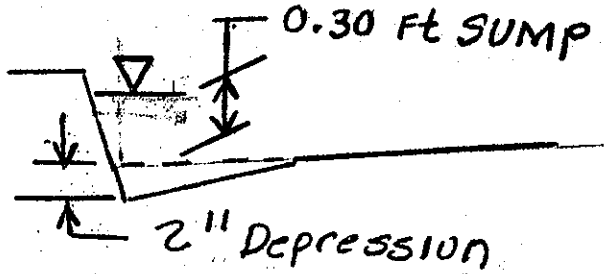
Evaluate catch basin Capacity for Street sump depth of 0.3 Ft.

GIVEN: 1. CB Type P1569-1, M, L = 3.0
2. Q_{10} = 3 cfs
3. Gutter Depression = 2 inches



$$Q_i = C_w(L + 1.8W)d^{1.5}(CF) \quad (3.8)$$

Equation 3.8

where $C_w = 2.3$. CF = .80

$d = 0.30 + 2/12 = 0.467$

$3 = 2.3\,[L + 1.8(1.42)](.467)^{1.5}(.80)$

$L = \dfrac{3}{(2.3)(.467)^{1.5}(.80)} - (1.8)(1.42) = 2.55$

L Required (2.55) < Standard L (3.00)

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing
C.B.'s @ Harrison Dr. near Dysart Rd.
P1569-1, M-2

EQUATION(S):

1. Scupper Capacity (Q)=.67*H\12*L*(2g*Do)^.5)*Fcl
   (D+a) >(H+a) Therefore Orifice Flow)

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height(D) = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. HEIGHT OF CURB OPENING (H) = 5 INCHES
6. Do= .4583334 Ft.=(D+a-H/2)/12

SCUPPER (OR CB W/O GRATE) IN SUMP AREA

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH	STANDARD LENGTH	SCUPPER CAPACITY
STA11+/-30	34.00	28.02	34.00	41.25

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

PROJECT Tres Rios Landing

SUBJECT C.B.'S in Harrison Dr. Near Dysart Rd

PROJECT NUMBER _____ CMX PROJECT NUMBER _____

SHEET ____ OF ____ BY _____ DATE Revised 10/1/02

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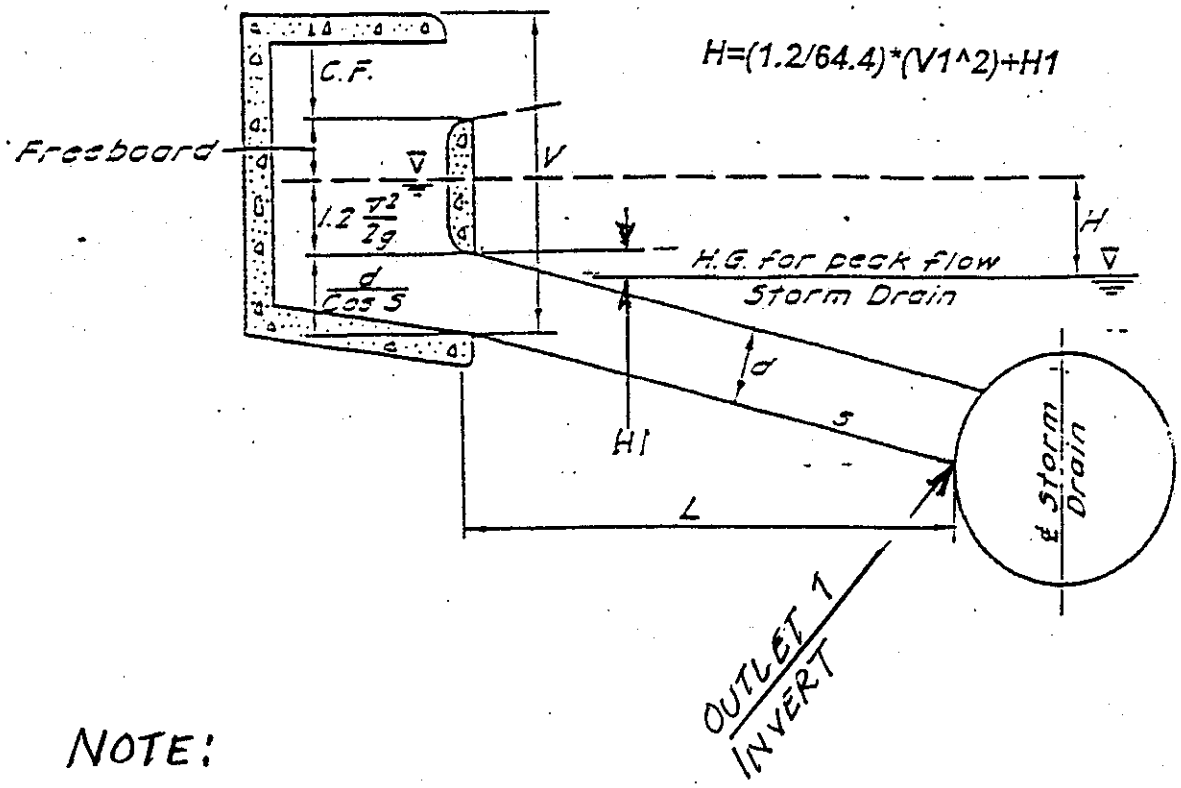
SINGLE CATCH BASIN

H1=2.87*N1^2*L1*V1^2/D1^(4/3)

H=(1.2/64.4)*(V1^2)+H1



NOTE:
Calculation Revised to include 22 1/2 x 36 1/4 Arch connector pipe using Storm CAD Hydraulic Model

Scenario: CATCH BASIN @ N.SIDE OF HARRISON WITH ARCHED CONNECTOR PIPE

Pipe Report

Label	Section Size	Q (cfs)	Length L (ft)	n	D.S. Inv. Elev. (ft)	U.S. Inv. Elev. (ft)	D.S. Cover (ft)	U.S. Cover (ft)	H.G.L. Out (ft)	H.G.L. IN (ft)	v Out (ft/s)	v In (ft/s)	Material	Shape	Downstream Node	Upstream Node	Full Area (ft²)
P-1	36.25 x 22.5 inch	34.00	154.00	0.013	945.65	945.88	1.26	1.48	947.53	949.03	7.69	7.69	Concrete	Arch	OUTLET	C.B.@ N. SIDE HARRISON	4.424

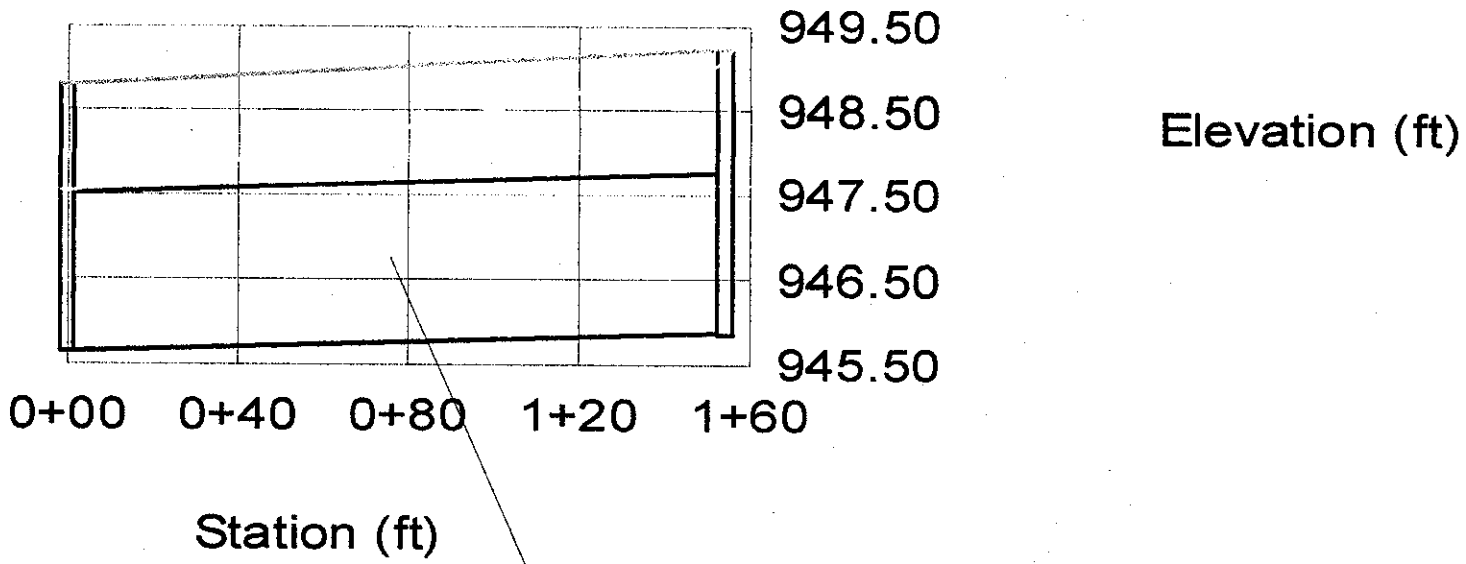
Gutter Elev. @ C.B. = 949.23 (RIM)
Freeboard = 949.23 - 949.03 = 0.20 Ft.
V-depth = (949.23 + 0.5) - 945.86 = 3.87 Ft

Profile

Scenario: CATCH BASIN @ N.SIDE OF HARRISON WITH ARCHED CONNECTOR PIPE

Label: OUTLET
Rim: 948.79 ft
Sump: 945.65 ft

Label: C.B.@ N. SIDE HARRISON
Rim: 949.23 ft
Sump: 945.86 ft



Label: P-1
Up. Invert: 945.88 ft
Dn. Invert: 945.65 ft
L: 154.00 ft
Size: 36.25 x 22.5 inch
S: 0.001494 ft/ft

Scenario: CATCH BASIN @ S. SIDE OF HARRISON WITH ARCHED CONNECTOR PIPE

Pipe Report

Label	Section Size	Q (cfs)	Length L (ft)	n	D.S. Inv. Elev. (ft)	U.S. Inv. Elev. (ft)	D.S. Cover (ft)	U.S. Cover (ft)	H.G.L. Out (ft)	H.G.L. IN (ft)	v Out (ft/s)	v In (ft/s)	Material	Shape	Downstream Node	Upstream Node
P-1	36.25 x 22.5 inch	34.00	34.00	0.013	945.65	945.84	1.26	1.51	947.66	948.96	7.69	7.69	Concret	Arch	OUTLET	C.B.@ S. SIDE HARRISON

Gutter Elev. @ C.B = 949.23 (RIM)

Freeboard = 949.23 - 948.96 = 0.27 Ft.

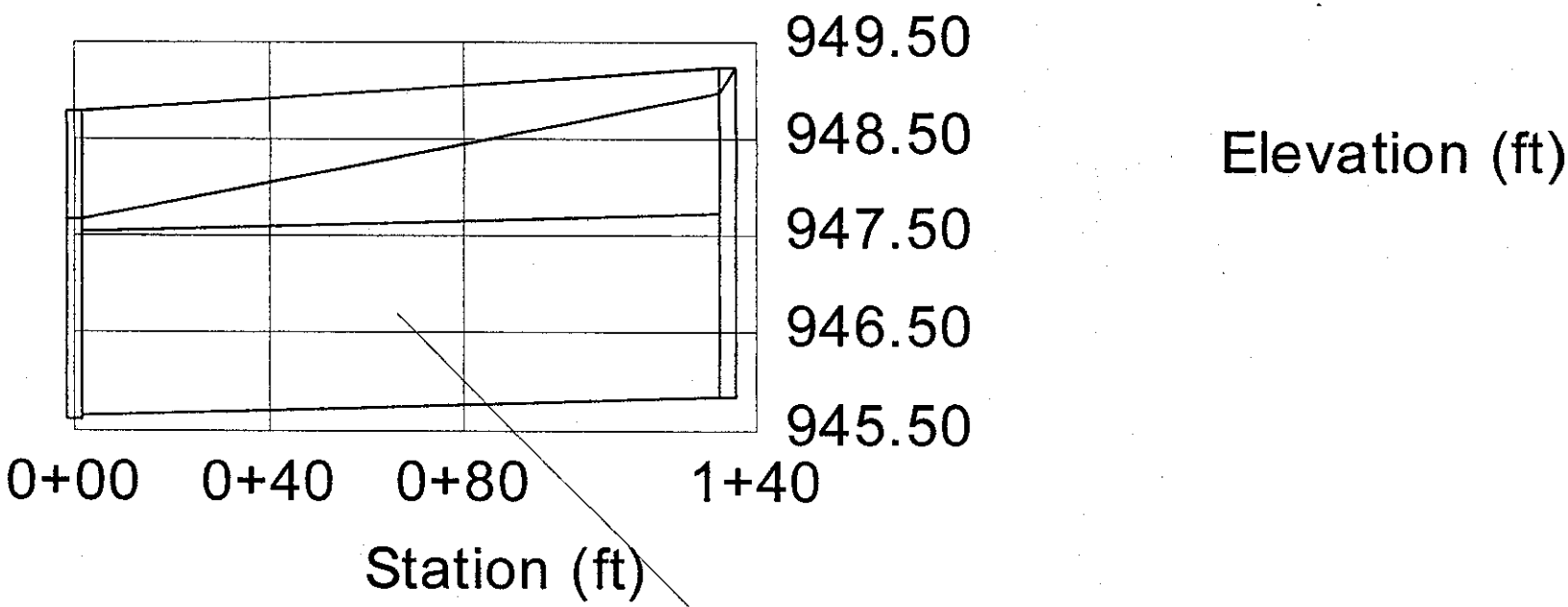
V-depth = (949.23 + 0.5) - 945.84 = 3.89 Ft.

Profile

Scenario: CATCH BASIN @ S. SIDE OF HARRISON WITH ARCHED CONNECTOR PIPE

Label: C.B.@ S. SIDE HARRISON
Rim: 949.23 ft
Sump: 945.84 ft

Label: OUTLET
Rim: 948.79 ft
Sump: 945.61 ft



Label: P-1
Up. Invert: 945.84 ft
Dn. Invert: 945.65 ft
L: 134.00 ft
Size: 36.25 x 22.5 inch
S: 0.001418 ft/ft

PROJECT Tres Rios Landing

SUBJECT Dysart Rd C.B.'s @ STA 15+00 & STA 21+58.05

CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____

SHEET ____ OF ____ BY _____ DATE 1/24/03

CMX Group Inc
1515 East Missouri
Suite 115
Phoenix, AZ 85014
☎ 602.279.8436
FAX 602.265.1191

1. Determine Q_{10} & Q_{100} @ STA 15+00 C.B.
   See MCFCD Rational Method Calcs
2. Determine Q_{10} & Q_{100} @ STA 21+58.05
   See "Surface Flow @ Dysart/Harrison Intersection" in Section D-3
3. Size 21+58.05 C.B. for Q_{10} & Determine Q_{100} flow-by
4. Size sta 15+00 C.B. for Q_{10} & Determine Q_{100} Flow-by
5. Calculate C.B. Hydraulics for Basins

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMX Date: 1-24-03

LOCATION DATA

Location: DYSART RD

Project Name: TRES RIOS LANDI Subarea id: STA15+00

Drainage Area Cover: PAVED

DESIGN DATA

Drainage Area	0.40	acres
Watercourse Length	658.0	feet
Top Elevation	949.9	feet
Bottom Elevation	947.8	feet
Slope	.00330	feet/feet
Roughness Coefficient (Kb)	.04249	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	2	2	3
C	0.800	0.800	0.800	0.880	0.950	0.950
Tc (min)	13.6	12.0	11.5	10.2	9.7	9.2
i (in/hr)	2.5	3.4	3.9	5.3	6.0	7.0

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Dysart Rd @ STA 21+58.05
P-1569-1 Type M-1, L=10'
Q_{10}

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= 1

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .002579

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA21+-58	3.00	12.46	13.	3.00

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Dysart Rd @ Sta 21+58.05
P-1569-1 Type M-1, L=10'
Q_{100}

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .4862452

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .002579

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(~~10YR~~) 100-yr	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA21+-58	54.25	42.03	13.	26.38

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

Q_{100} Flow-by = 54.25 - 26.38 = 27.87

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Dysart Rd @ Sta 15+00
P-1569-1 Type M-1, L=6'
Q10

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= 1

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .002498

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA15+-00	1.00	7.78	9.	1.00

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Dysart Rd @ Sta 15+00
P-1569-1 Type M-1, L=6'
Q100

EQUATION(S):

1. Scupper Length (LE)=0.6*(Q10/.8)^.42*S^.3*(1/(.015*Se))^.6
   (Se = Sx + Sw x Eo), Eo From Fig.3.23

2. Hydraulic Efficiency (E)=1-(1-L/LE)^1.8= .4379645

3. Scupper Capacity (Q)=E*Q10

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height = 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Street Slope (S)= .002498

6. Street Cross Slope (Sx)= .02

SCUPPER (OR CB W/O GRATE)ON SLOPING STREET

CONCENTRATION POINT	Q(~~10YR~~) 100 yr	CALCULATED LENGTH(Lt)	STANDARD LENGTH(L)	SCUPPER CAPACITY
STA15+-00	30.87 *	32.86	9.	13.52

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

* Q_{100} = Q @ Sta 15+/-00 + Flow by From Sta 21+/-58

Flow by = 30.87 - 13.52 = 17.35

PROJECT Dysart Road

SUBJECT Sta 21+58.05 & Sta 15+00 C.B.

PROJECT NUMBER _____ CMX PROJECT NUMBER _____

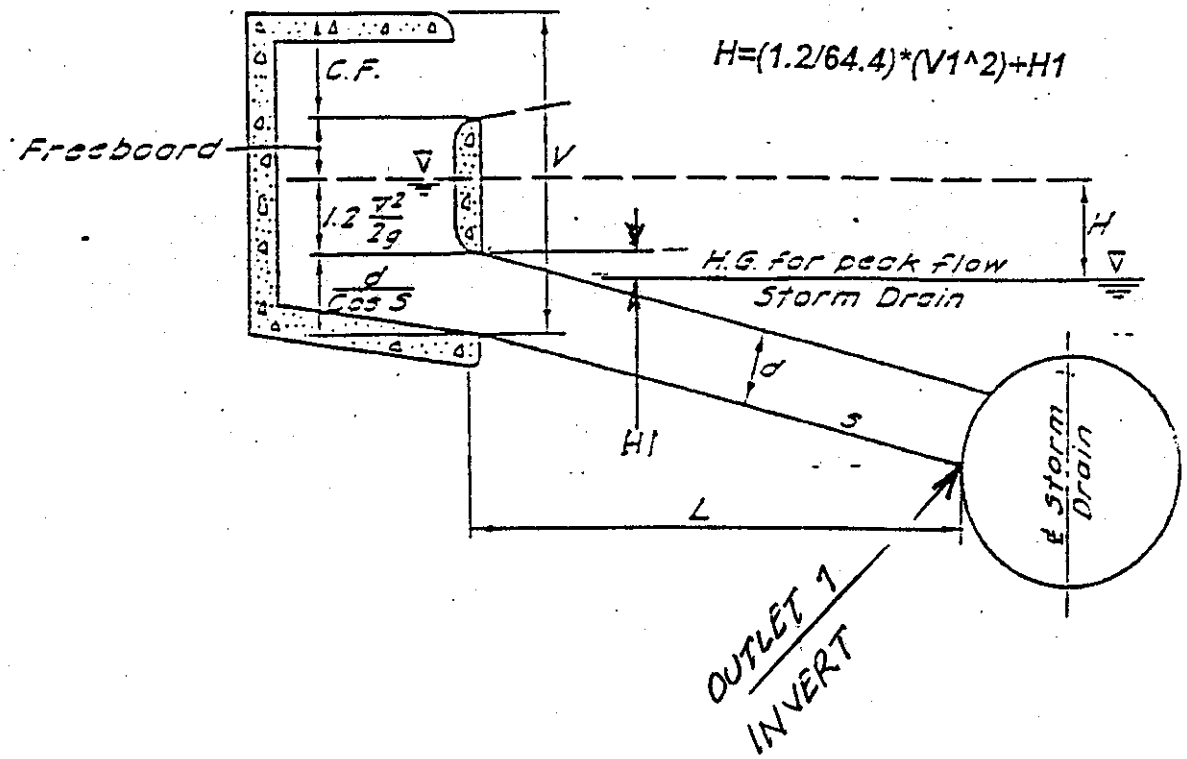
SHEET ____ OF ____ BY _____ DATE _____

CMX Group Inc
1515 East Missouri
Suite 115
Phoenix, AZ 85014
☎ 602.279.8436
FAX 602.265.1191

SINGLE CATCH BASIN

H1=2.87*N1^2*L1*V1^2/D1^(4/3)

H=(1.2/64.4)*(V1^2)+H1



CATCH BASIN HYDRAULICS

MAG 533-2, COP 1569-1, OR EQUIVALENT TYPES
CALCULATION FOR SINGLE CATCH BASIN

Project Tres Rios Landing

LOCATION Dysart Rd C.B.@ stA 21+58.05

CATCH BASIN No.1

BEGINNING TAILWATER ELEVATION = 947.55 (a)
OUTLET INVERT ELEVATION = 945.51
INLET INVERT ELEVATION @ C.B.NO.1= 945.58
PIPE DIAMETER FOR C.B.No.1 = 2.5 Ft.
LENGTH OF PIPE No.1 = 17.25 Ft.
SLOPE OF PIPE No.1 = .004058 Ft/Ft
MANNINGS N-VALUE FOR PIPE No.1 = .013
FLOW IN PIPE No.1 = 26.38 cfs
VELOCITY IN PIPE No.1 = 5.374094
TOP OF CURB ELEV. @ C.B. No.1 = 949.93
V-DEPTH @ C.B.No.1 = 4.349976 FT.
W.S.ELEVATION IN C.B.1 = 948.1594
FREEBOARD @ CATCH BASIN No.1 = 1.103943 Ft.

(a) CHECK CAUSE OF DOWNSTREAM TAILWATER DEPTH:
1. DEPTH DUE TO PONDING ( )
2. DEPTH ASSUMED @ TOP OF PIPE ( )
3. H.G.L. IN DOWNSTREAM PIPE JUNCTION ( )
4. NORMAL DEPTH FLOW < PIPE DIAMETER ( )

CATCH BASIN HYDRAULICS

MAG 533-2, COP 1569-1, OR EQUIVALENT TYPES
CALCULATION FOR SINGLE CATCH BASIN

Project Tres Rios Landing

LOCATION Dysart Rd C.B. @ Sta 15+00

CATCH BASIN No.1

BEGINNING TAILWATER ELEVATION = 946.11 (a)
OUTLET INVERT ELEVATION = 943.89
INLET INVERT ELEVATION @ C.B.NO.1= 943.9245
PIPE DIAMETER FOR C.B.No.1 = 2 Ft.
LENGTH OF PIPE No.1 = 17.25 Ft.
SLOPE OF PIPE No.1 = .002 Ft/Ft
MANNINGS N-VALUE FOR PIPE No.1 = .013
FLOW IN PIPE No.1 = 13.52 cfs
VELOCITY IN PIPE No.1 = 4.303553
TOP OF CURB ELEV. @ C.B. No.1 = 948.26
V-DEPTH @ C.B.No.1 = 4.335511 FT.
W.S.ELEVATION IN C.B.1 = 946.5166
FREEBOARD @ CATCH BASIN No.1 = 1.076721 Ft.

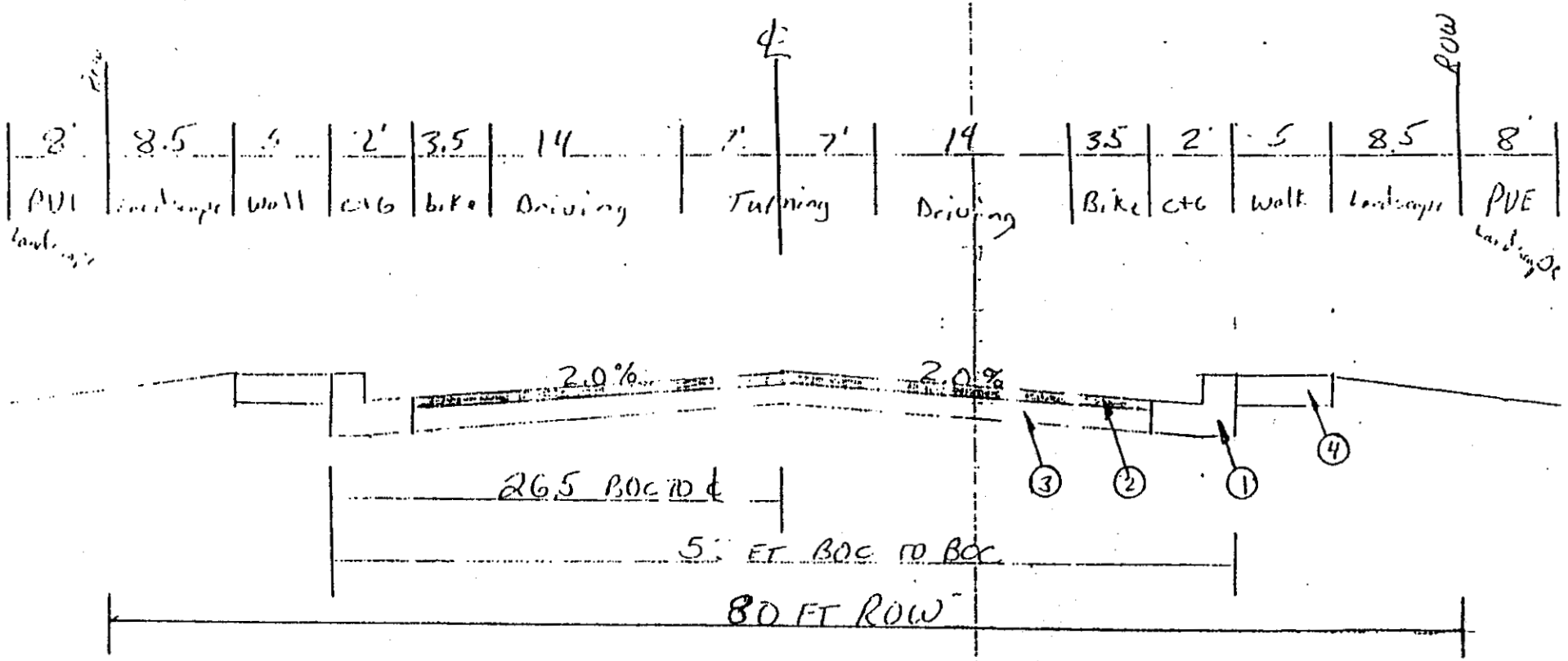
(a) CHECK CAUSE OF DOWNSTREAM TAILWATER DEPTH:
1. DEPTH DUE TO PONDING ( )
2. DEPTH ASSUMED @ TOP OF PIPE ( )
3. H.G.L. IN DOWNSTREAM PIPE JUNCTION ( )
4. NORMAL DEPTH FLOW < PIPE DIAMETER ( )

SECTION D-4

- City of Avondale, Engineering Design Standard, Primary Collector Road
- Typical Channel and Street X-Section
- HEC-RAS Drainage Corridor Hydraulics

Primary collector

80 FT ROW



① Curbing Per MAG Detail No. 220, Type A

② 3/4" Asphalt Cement

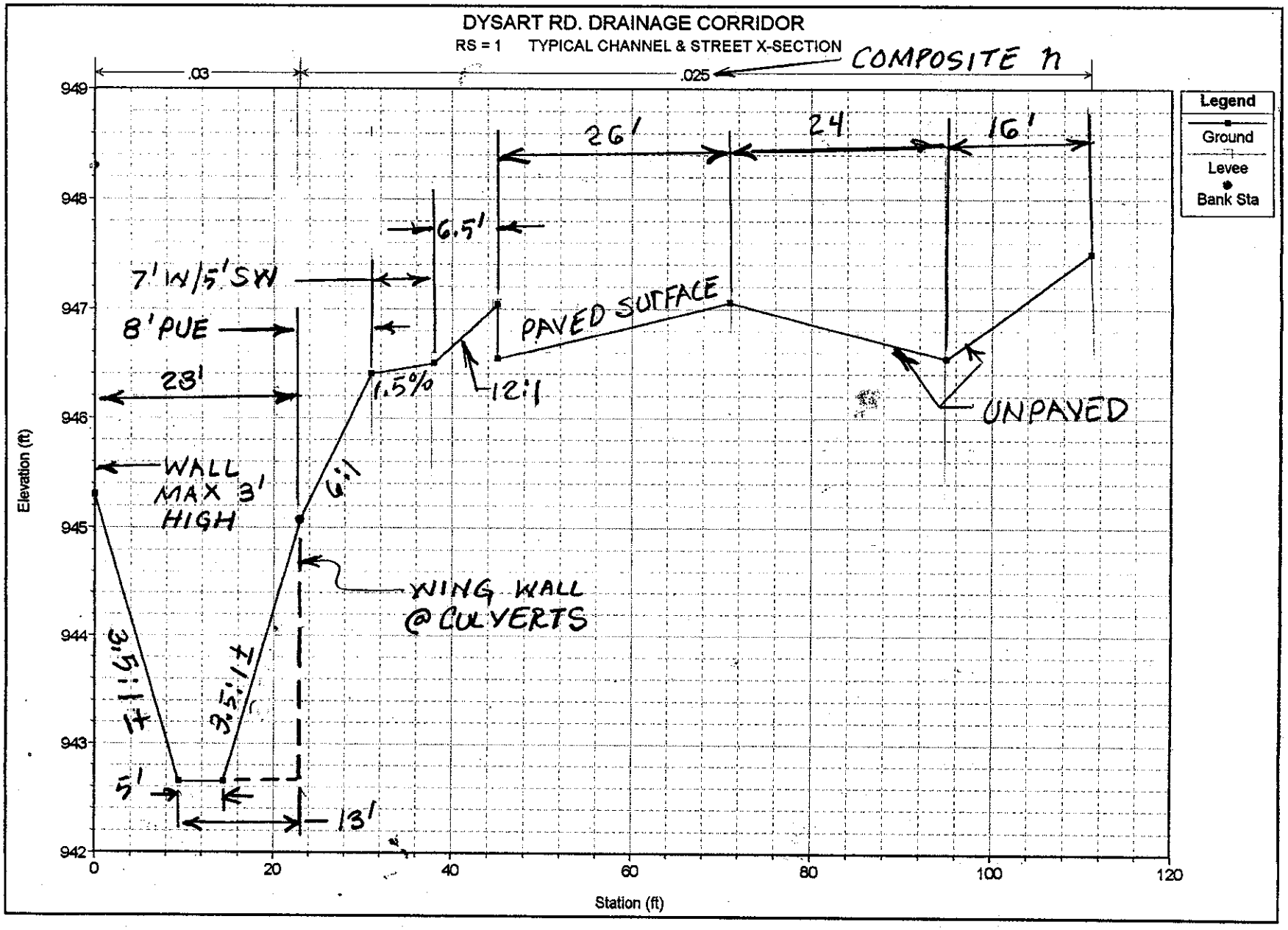
③ 3/4" Aggregate Base Course

④ Meandering 5 FT Sidewalk

CITY OF AVONDALE

PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

ENGINEERING DESIGN
STANDARDS


DYSART RD. DRAINAGE CORRIDOR
RS = 1 TYPICAL CHANNEL & STREET X-SECTION
COMPOSITE n
.03
.025
26'
24
16'
6.5'
7' IN/5' SW
8' PUE
23'
PAVED SURFACE
1.5%
12:1
UNPAVED
WALL MAX 3' HIGH
6:1
WING WALL @ CULVERTS
3.5:1±
3.5:1±
5'
13'
Legend
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
949
948
947
946
945
944
943
942
0
20
40
60
80
100
120

HEC-RAS Version 3.0.1 Mar 2001
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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

PROJECT DATA
Project Title: DYSART RD. DRAINAGE CORRIDOR
Project File : DYSARTRD3.prj
Run Date and Time: 9/10/2002 1:39:08 PM

Project in English units

Project Description:
TRES RIOS LANDING, 10-YEAR & 100-YEAR RUNOFF.

DYSART ROAD DRAINAGE
CORRIDOR WITH
FLOWS FROM ADOT STORM DRAIN, DYSART RIGHT-OF-WAY RUNOFF,
RUNOFF
FROM WATERSHED TO THE WEST OF DYSART CONCENTRATING @ HARRISON DR.,
& FLOW FROM BUCKEYE RD. IN EXCESS OF 10-YR. STORM DRAIN CAPACITY.

GEOMETRY DATA

Geometry Title: Imported Geom 01
Geometry File : C:\HEC\Ras\Data\CMX\DYSARTRD3.g01

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 16

INPUT
Description: STA 35+00
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	957.896	0	954.876	19.1	954.496	19.1	953.996	43.27	954.526
67.18	953.996	67.18	954.496	80	954.716	80	957.896		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	19.1	.015	67.18	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
19.1	67.18	200	200	200	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 15

INPUT
Description: STA 33+00
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
	0957.3968		0954.3768	19.1	953.9968	19.1	953.4968	43.27	954.0268
67.18	953.4968	67.18	953.9968	3 80	954.2168	80	957.3968		

Manning's n Values num=

Description: STA 31+00
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
	0956.8976		0953.8776	19.1	953.4976	19.1	952.9976	43.27	953.5276
67.18	952.9976	67.18	953.4976	80	953.7176	80	956.8976		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	19.1	.015	67.18	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
19.1	67.18	200	200	200	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 13

INPUT
Description: STA 29+00
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
	0956.3984		0953.3784	19.1	952.9984	19.1	952.4984	43.27	953.0284
67.18	952.4984	67.18	952.9984	80	953.2184	80	956.3984		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	19.1	.015	67.18	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
19.1	67.18	200	200	200	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 12

INPUT
Description: STA 27+00
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	955.9	0	952.88	19.1	952.5	19.1	952	43.27	952.53
67.18	952	67.18	952.5	80	952.72	80	955.9		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	19.1	.015	67.18	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
19.1	67.18	200	200	200	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 11

INPUT
Description: STA 25+00
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	955.06	0	952.04	19.1	951.66	19.1	951.16	43.27	951.69
67.18	951.16	67.18	951.66	80	951.88	80	955.06		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	19.1	.015	67.18	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
19.1	67.18	175	175	175	.1	.3

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 10

INPUT
Description: STA 23+75
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	954.05	0	951.03	19.1	950.65	19.1	950.15	43.27	950.68
67.18	950.15	67.18	950.65	80	950.87	80	954.05		

Manning's n Values num=

```
Description: STA22=06.89
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0   951.3       0   948.3     9.4  945.65    14.4  945.65      23  948.07
      31   949.4      38   949.5      45  950.04   45.08  949.54      71  950.06
      95  949.54     111   950.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      23    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      23           149.17  149.17  149.17             .1       .3
Right Levee     Station=      45      Elevation=  950.04

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 8

INPUT
Description: STA20+57.72
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  950.93       0  947.93     9.4  945.28      23  945.28      23   947.7
      31  949.03      38  949.13      45  949.67   45.08  949.17      71  949.69
      95  949.17     111  950.13

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      23    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      23              110     110     110             .1       .3
Right Levee     Station=      45      Elevation=  949.67

CULVERT                RIVER: RIVER-1
REACH: Reach-1            RS: 7.5

INPUT
Description:
Distance from Upstream XS =       4
Deck/Roadway Width        =     104
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0  950.26              45  949.67

Upstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  950.93       0  947.93     9.4  945.28      23  945.28      23   947.7
      31  949.03      38  949.13      45  949.67   45.08  949.17      71  949.69
      95  949.17     111  950.13

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      23    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
             0      23             .1       .3
Right Levee     Station=      45      Elevation=  949.67

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
       0  950.06              45   949.4

Downstream Bridge Cross Section Data
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  950.66       0  947.66     9.4  945.01      23  945.01      23  947.43
      31  948.76      38  948.86      45   949.4   45.08   948.9      71  949.42
      95   948.9     111  949.86
```

```
Elevation at which weir flow begins          =
Energy head used in spillway design          =
Spillway height used in design               =
Weir crest shape                             = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #2          Box       3       6
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
                  4     104       .013                  .2                1
Number of Barrels =  2
Upstream   Elevation =  945.29
Centerline Stations
    Sta.    Sta.
    12.4    19.4
Downstream Elevation =  945.025
Centerline Stations
    Sta.    Sta.
    12.4    19.4

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 7

INPUT
Description: STA19+47.72
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  950.66       0  947.66     9.4  945.01      23  945.01      23  947.43
      31  948.76      38  948.86      45   949.4   45.08   948.9      71  949.42
      95   948.9     111  949.86

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      23    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      23           147.72  147.72  147.72             .1       .3
Right Levee     Station=      45      Elevation=   949.4

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 6

INPUT
Description: STA18+00
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  950.29       0  947.29     9.4  944.64    14.4  944.64      23  947.06
      31  948.39      38  948.49      45  949.03   45.08  948.53      71  949.05
      95  948.53     111  949.49

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      23    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      23              200     200     200             .1       .3
Right Levee     Station=      45      Elevation=  949.03

CROSS SECTION          RIVER: RIVER-1
REACH: Reach-1            RS: 5

INPUT
Description: STA16+00
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  949.79       0  946.79     9.4  944.14    14.4  944.14      23  946.56
      31  947.89      38  947.99      45  948.53   45.08  948.03      71  948.55
      95  948.03     111  948.99
```

```
Description: STA 14+62.90
Station Elevation Data     num=      12
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       5  948.02       5  945.02      9.4  943.79      23  943.79      23  946.21
      31  947.54      38  947.64       45  948.18   45.08  947.68      71   948.2
      95  947.68     111  948.64

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       5     .03       5     .03       23    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            5      23              110     110     110              .1       .3
Right Levee     Station=      45      Elevation=  948.18

CULVERT                 RIVER: RIVER-1
REACH: Reach-1             RS: 3.5

INPUT
Description:
Distance from Upstream XS =       4
Deck/Roadway Width        =     104
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
       0  948.55               45  948.18

Upstream Bridge Cross Section Data
Station Elevation Data     num=      12
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       5  948.02       5  945.02      9.4  943.79      23  943.79      23  946.21
      31  947.54      38  947.64       45  948.18   45.08  947.68      71   948.2
      95  947.68     111  948.64

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       5     .03       5     .03       23    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
            5      23              .1       .3
Right Levee     Station=      45      Elevation=  948.18

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
       0  948.55               45   947.9

Downstream Bridge Cross Section Data
Station Elevation Data     num=      12
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0  949.16       0  946.16      9.4  943.51      23  943.51      23  945.93
      31  947.26      38  947.36       45   947.9   45.08   947.4      71  947.92
      95   947.4     111  948.36

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0     .03       0     .03       23    .025

Bank Sta: Left   Right    Coeff Contr.   Expan.
            0      23              .1       .3
Right Levee     Station=      45      Elevation=   947.9

Upstream Embankment side slope              =      0 horiz. to 1.0 vertical
Downstream Embankment side slope            =      0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1
Culvert Name     Shape      Rise    Span
```

Downstream Elevation = 943.526
Centerline Stations

Sta.	Sta.
12.4	19.4

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 3

INPUT
Description: STA 13+52.90
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	949.16	0	946.16	9.4	943.51	23	943.51	23	945.93
31	947.26	38	947.36	45	947.9	45.08	947.4	71	947.92
95	947.4	111	948.36						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	0	.03	23	.025

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	23	152.9	152.9	152.9	.1	.3

Right Levee Station= 45 Elevation= 947.9

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 2

INPUT
Description: STA12+00
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	948.78	0	945.78	9.4	943.13	14.4	943.13	23	945.55
31	946.88	38	946.98	45	947.52	45.08	947.02	71	947.54
95	947.02	111	947.98						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	0	.03	23	.025

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	23	200	200	200	.1	.3

Right Levee Station= 45 Elevation= 947.52

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 1

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	948.3	0	945.3	9.4	942.65	14.4	942.65	23	945.07
31	946.4	38	946.5	45	947.04	45.08	946.54	71	947.06
95	946.54	111	947.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	0	.03	23	.025

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
0	23	57.5	57.5	57.5	.1	.3

Right Levee Station= 45 Elevation= 947.04

CROSS SECTION RIVER: RIVER-1
REACH: Reach-1 RS: 0

INPUT
Description: @ RET. BASIN,
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	948	4.5	947	9	946	13.5	945	17.5	944
22.5	943	27	942	32	942	37.5	943	43	944
47	945	55	946						

Reach	River Sta.	n1	n2	n3
Reach-1	16	.03	.015	.03
Reach-1	15	.03	.015	.03
Reach-1	14	.03	.015	.03
Reach-1	13	.03	.015	.03
Reach-1	12	.03	.015	.03
Reach-1	11	.03	.015	.03
Reach-1	10	.03	.015	.03
Reach-1	9	.03	.03	.025
Reach-1	8	.03	.03	.025
Reach-1	7.5	Culvert		
Reach-1	7	.03	.03	.025
Reach-1	6	.03	.03	.025
Reach-1	5	.03	.03	.025
Reach-1	4	.03	.03	.025
Reach-1	3.5	Culvert		
Reach-1	3	.03	.03	.025
Reach-1	2	.03	.03	.025
Reach-1	1	.03	.03	.025
Reach-1	0	.03	.03	.03

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

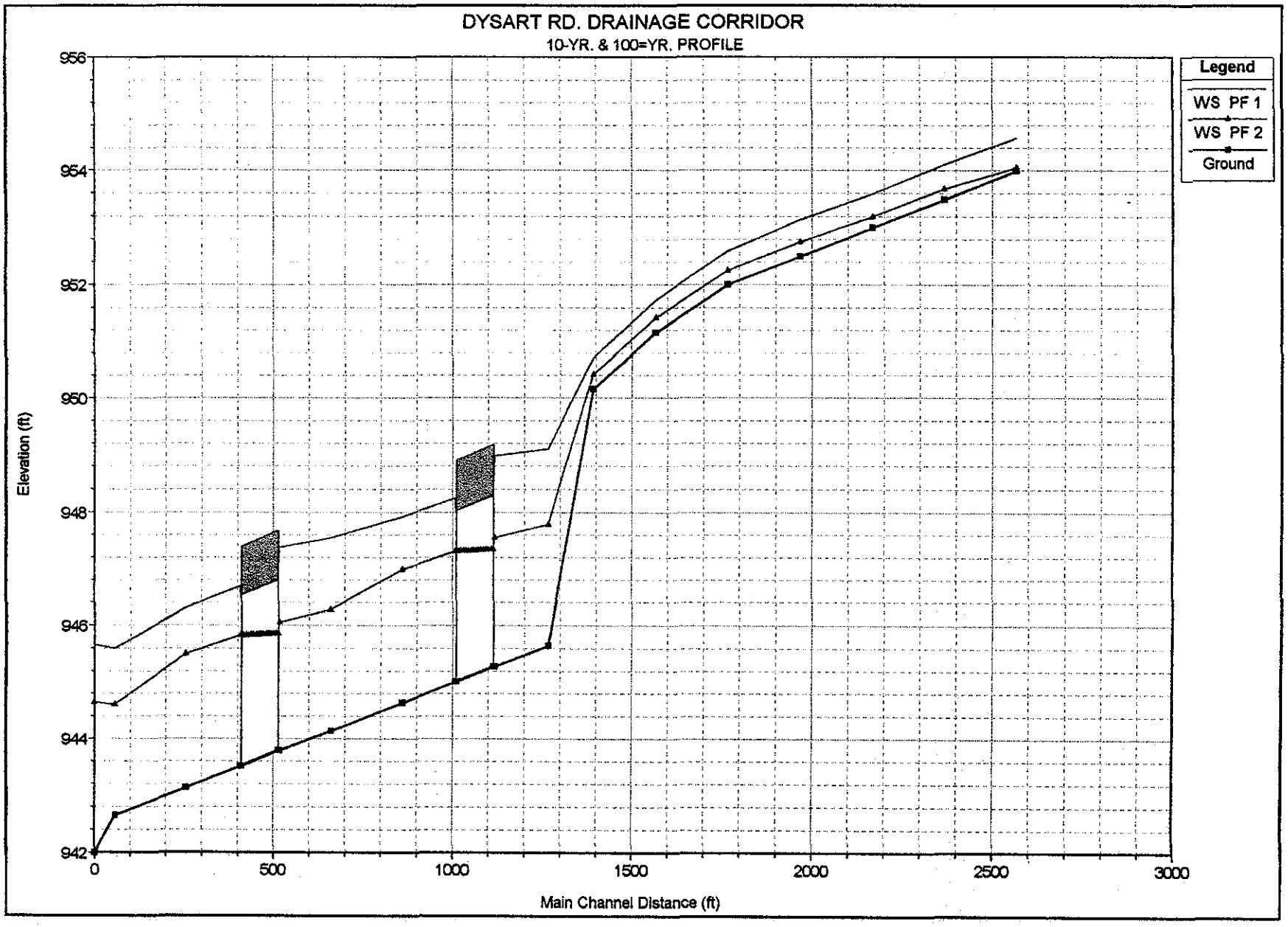
Reach	River Sta.	Contr.	Expan.
Reach-1	16	.1	.3
Reach-1	15	.1	.3
Reach-1	14	.1	.3
Reach-1	13	.1	.3
Reach-1	12	.1	.3
Reach-1	11	.1	.3
Reach-1	10	.1	.3
Reach-1	9	.1	.3
Reach-1	8	.1	.3
Reach-1	7.5	Culvert	
Reach-1	7	.1	.3
Reach-1	6	.1	.3
Reach-1	5	.1	.3
Reach-1	4	.1	.3
Reach-1	3.5	Culvert	
Reach-1	3	.1	.3
Reach-1	2	.1	.3
Reach-1	1	.1	.3
Reach-1	0	.1	.3

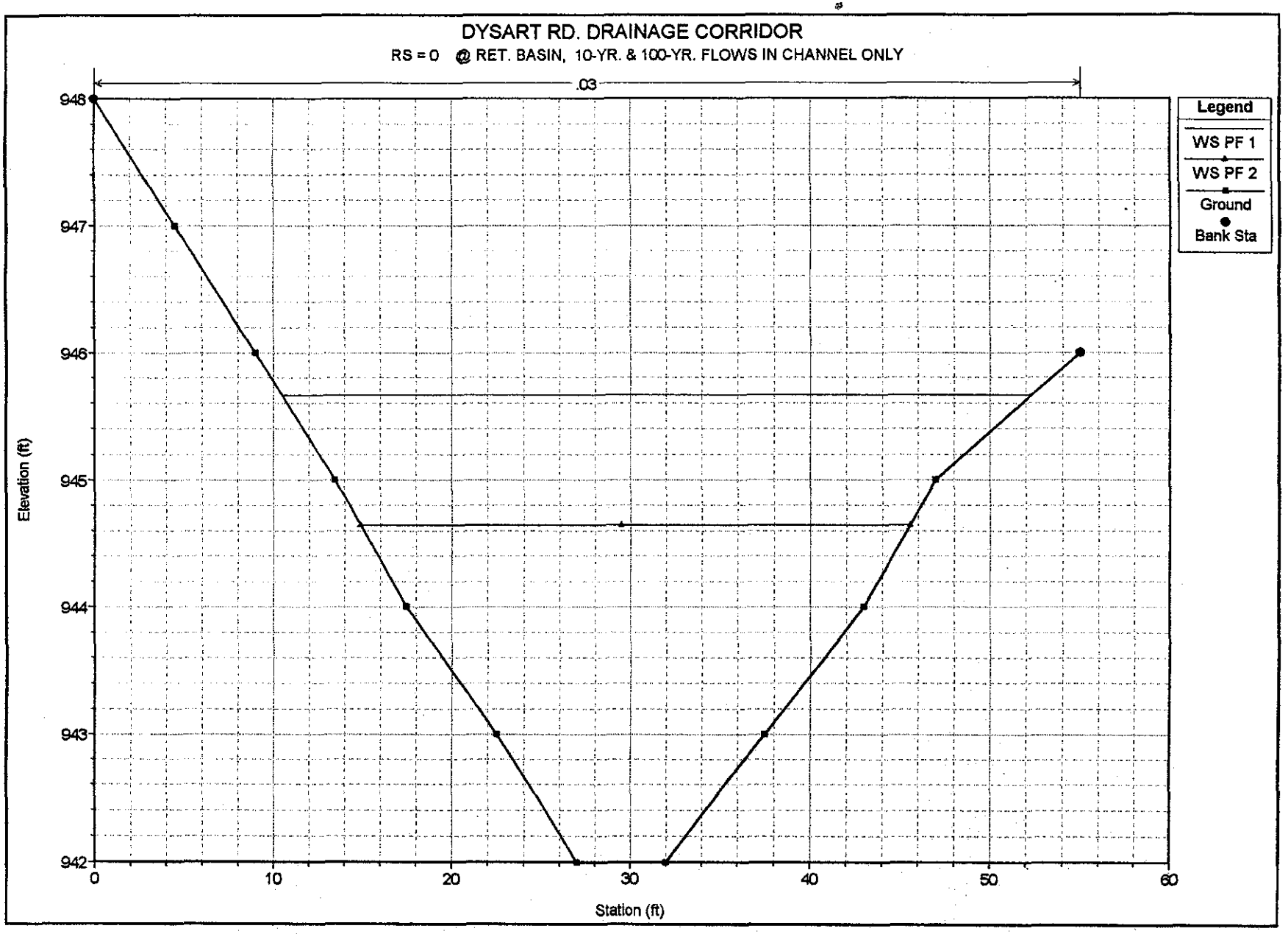
HEC-RAS Plan: Plan 02 River: RIVER-1 Reach: Reach-1

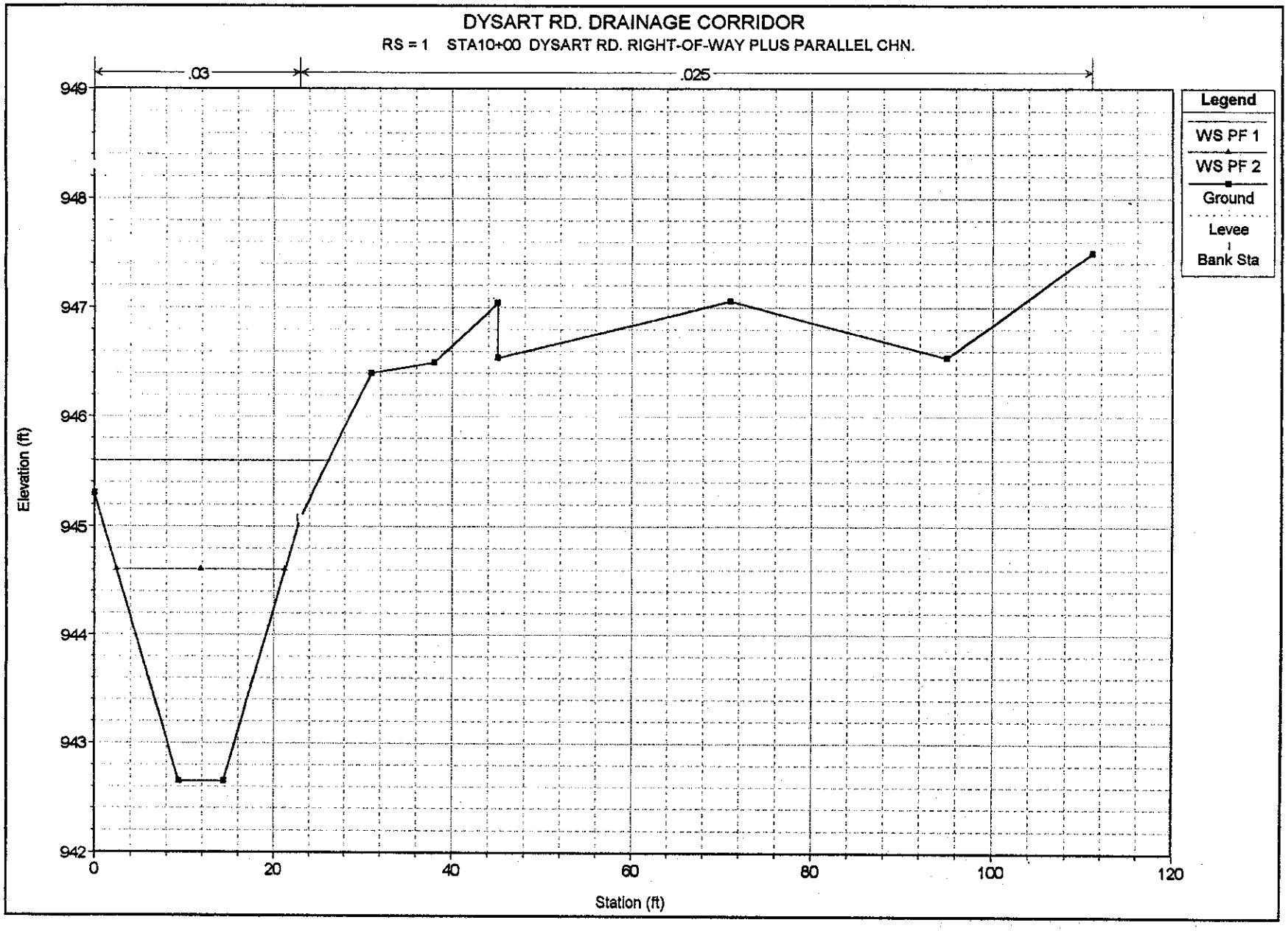
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	ROB Elev	Q Channel	Max Chl Dpth	Vel Chnl	Crit W.S.	Q Right	Invert Slope	Length Chnl	Cum Ch Len
		(cfs)	(ft)	(ft)	(ft)	(cfs)	(ft)	(ft/s)	(ft)	(cfs)		(ft)	(ft)
Reach-1	0 *	209.94	942.00	945.66	946.00	209.94	3.66	2.48	944.11				
Reach-1	0	101.45	942.00	944.64	946.00	101.45	2.64	2.10	943.49				
Reach-1	1	209.94	942.65	945.60	945.07	208.70	2.95	4.65	944.97	1.24	0.0113	57.50	57.50
Reach-1	1	101.45	942.65	944.61	945.07	101.45	1.96	4.35	944.26		0.0113	57.50	57.50
Reach-1	2	204.94	943.13	946.30	945.55	202.31	3.17	4.04	945.43	2.63	0.0024	200.00	257.50
Reach-1	2	99.45	943.13	945.50	945.55	99.45	2.37	3.12	944.73		0.0024	200.00	257.50
Reach-1	3	204.94	943.51	946.68	945.93	202.92	3.17	3.35	945.28	2.02	0.0025	152.90	410.40
Reach-1	3	99.45	943.51	945.82	945.93	99.45	2.31	2.43	944.63		0.0025	152.90	410.40
Reach-1	3.5	Culvert											
Reach-1	4	204.94	943.79	947.38	946.21	199.24	3.59	3.22	945.53	5.70	0.0025	110.00	520.40
Reach-1	4	99.45	943.79	946.05	946.21	99.45	2.26	2.62	944.91		0.0025	110.00	520.40
Reach-1	5	204.94	944.14	947.55	946.56	200.37	3.41	3.61	946.43	4.57	0.0025	141.10	661.50
Reach-1	5	99.45	944.14	946.27	946.56	99.45	2.13	3.70	945.74		0.0025	141.10	661.50
Reach-1	6	204.94	944.64	947.92	947.06	201.48	3.28	3.83	946.94	3.46	0.0025	200.00	861.50
Reach-1	6	99.45	944.64	946.98	947.06	99.45	2.34	3.20	946.24		0.0025	200.00	861.50
Reach-1	7	204.94	945.01	948.24	947.43	202.56	3.23	3.28	946.78	2.38	0.0025	147.72	1009.22
Reach-1	7	99.45	945.01	947.31	947.43	99.45	2.30	2.45	946.13		0.0025	147.72	1009.22
Reach-1	7.5	Culvert											
Reach-1	8	204.94	945.28	948.99	947.70	198.76	3.71	2.73	947.04	6.19	0.0025	110.00	1119.22
Reach-1	8	99.45	945.28	947.55	947.70	99.45	2.27	2.49	946.40		0.0025	110.00	1119.22
Reach-1	9	204.94	945.65	949.10	948.07	200.00	3.45	3.54	947.96	4.94	0.0025	149.17	1268.39
Reach-1	9	99.45	945.65	947.78	948.07	99.45	2.13	3.71	947.25		0.0025	149.17	1268.39
Reach-1	10	47.49	950.15	950.70	950.65	47.43	0.55	3.41	950.73	0.03	0.0360	125.00	1393.39
Reach-1	10	6.00	950.15	950.40	950.65	6.00	0.25	2.04	950.40		0.0360	125.00	1393.39
Reach-1	11	44.49	951.16	951.72	951.66	44.41	0.56	3.08	951.72	0.04	0.0058	175.00	1568.39
Reach-1	11	5.00	951.16	951.42	951.66	5.00	0.26	1.68			0.0058	175.00	1568.39
Reach-1	12	42.49	952.00	952.59	952.50	42.33	0.59	2.72	952.55	0.08	0.0042	200.00	1768.39
Reach-1	12	4.00	952.00	952.25	952.50	4.00	0.25	1.44	952.22		0.0042	200.00	1768.39

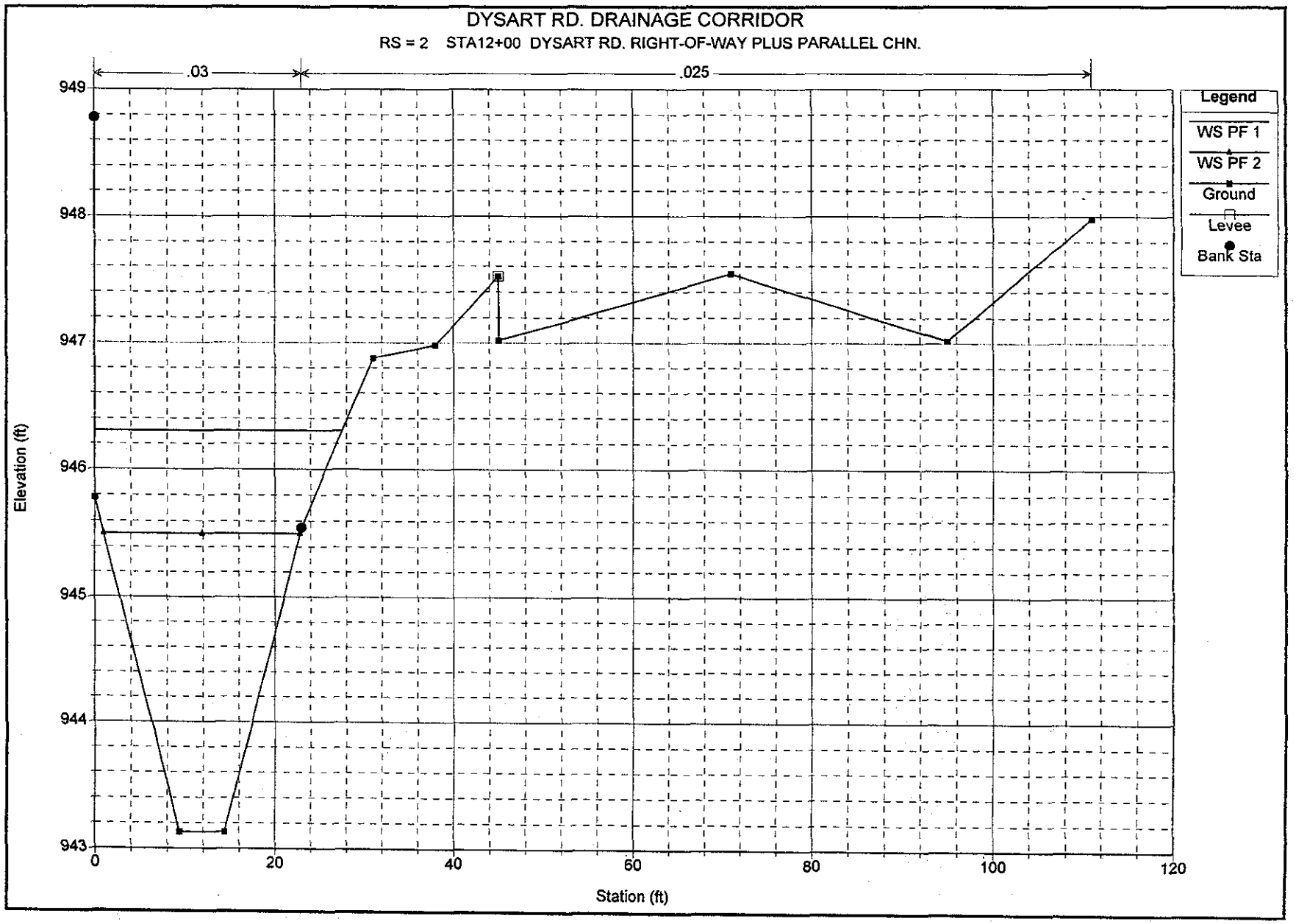
*** For Corresponding Dysart Road Stations See x-Section Plots**

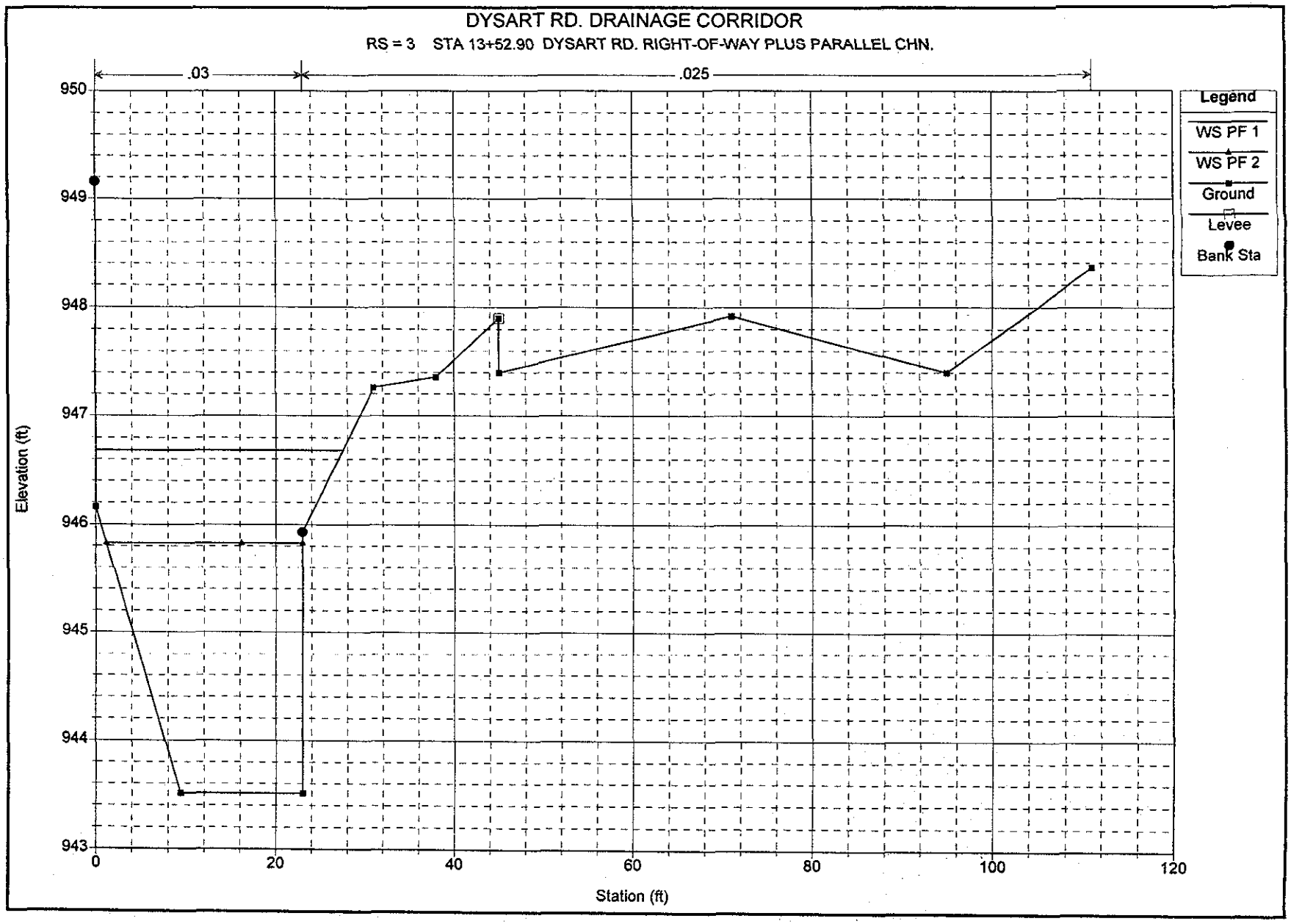
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	ROB Elev	Q Channel	Max Chl Dpth	Vel Chnl	Crit W.S.	Q Right	Invert Slope	Length Chnl	Cum Ch Len
		(cfs)	(ft)	(ft)	(ft)	(cfs)	(ft)	(ft/s)	(ft)	(cfs)		(ft)	(ft)
Reach-1	13	40.49	952.50	953.14	953.00	40.10	0.64	2.22	953.04	0.21	0.0025	200.00	1968.39
Reach-1	13	3.00	952.50	952.76	953.00	3.00	0.26	1.00	952.69		0.0025	200.00	1968.39
Reach-1	14	38.49	953.00	953.59	953.50	38.35	0.59	2.46	953.53	0.08	0.0025	200.00	2168.39
Reach-1	14	2.00	953.00	953.19	953.50	2.00	0.19	1.24	953.16		0.0025	200.00	2168.39
Reach-1	15	36.49	953.50	954.10	954.00	36.29	0.61	2.22		0.11	0.0025	200.00	2368.39
Reach-1	15	1.00	953.50	953.68	954.00	1.00	0.18	0.68	953.62		0.0025	200.00	2368.39
Reach-1	16	34.49	954.00	954.57	954.50	34.40	0.58	2.30	954.51	0.05	0.0025	200.00	2568.39
Reach-1	16	0.10	954.00	954.05	954.50	0.10	0.05	0.90	954.05		0.0025	200.00	2568.39

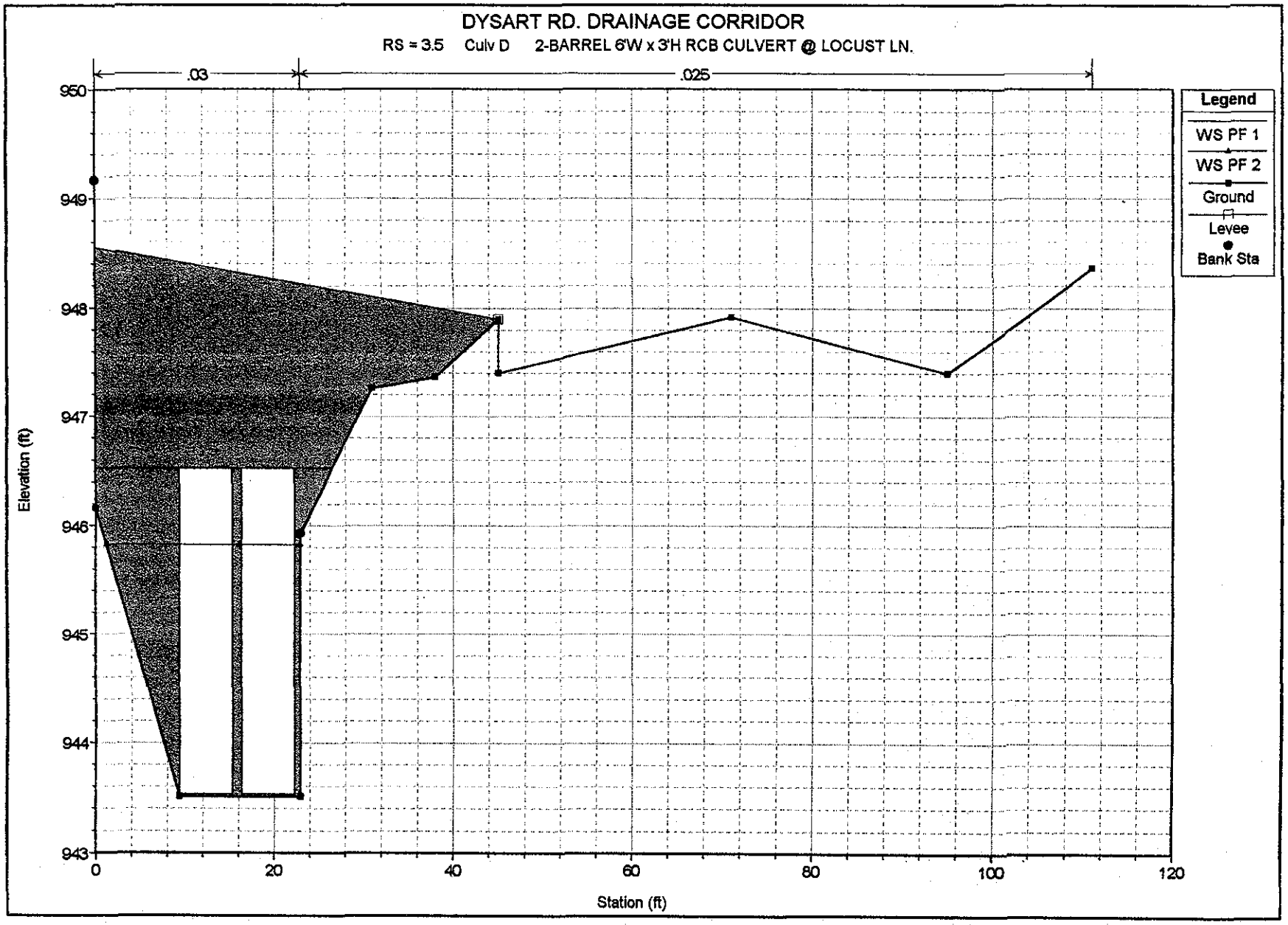

DYSART RD. DRAINAGE CORRIDOR
10-YR. & 100=YR. PROFILE
Legend
WS PF 1
WS PF 2
Ground
Elevation (ft)
956
954
952
950
948
946
944
942
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)

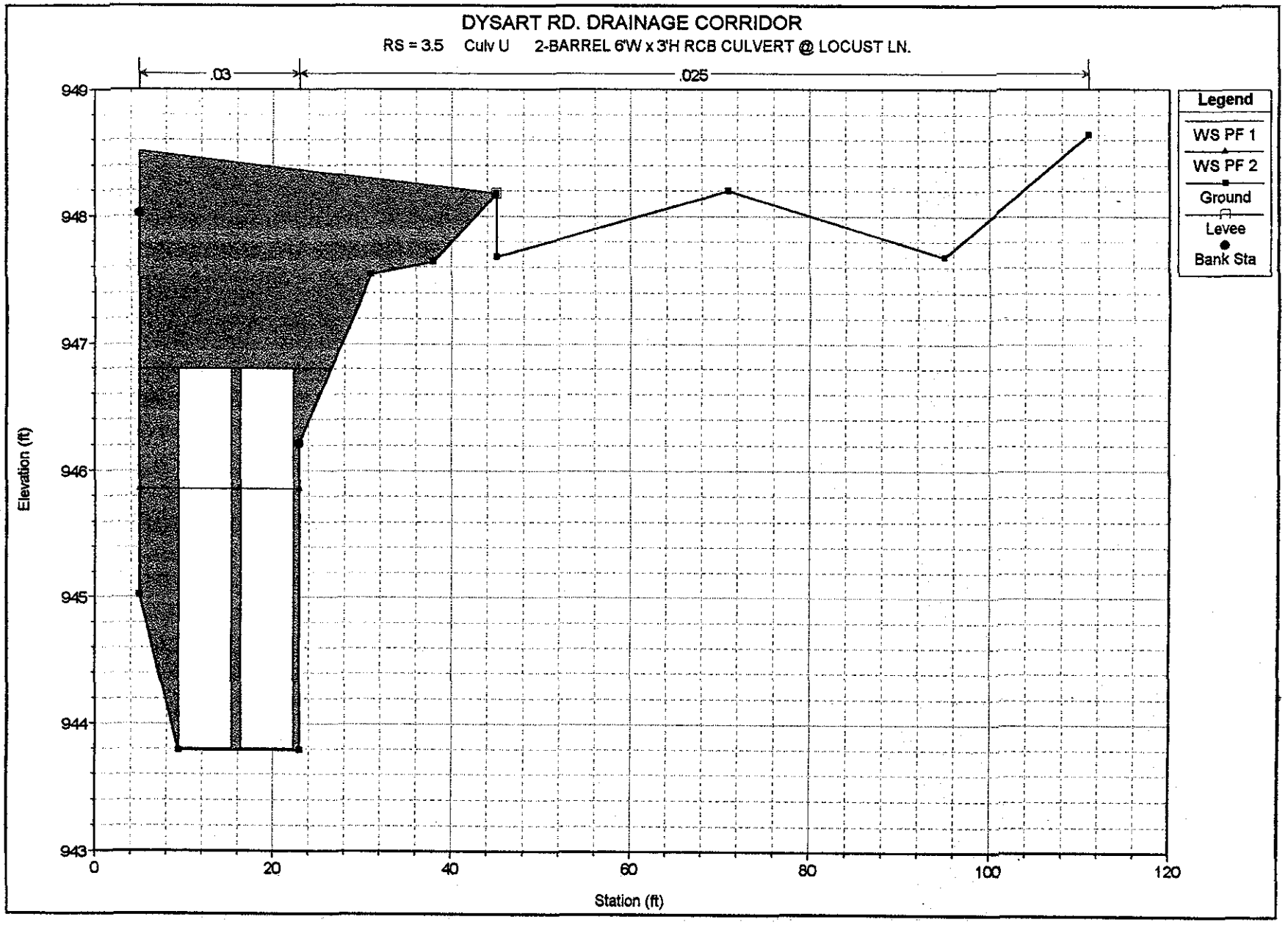

DYSART RD. DRAINAGE CORRIDOR
RS = 0 @ RET. BASIN, 10-YR. & 100-YR. FLOWS IN CHANNEL ONLY
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
948
947
946
945
944
943
942
0
10
20
30
40
50
60
Station (ft)

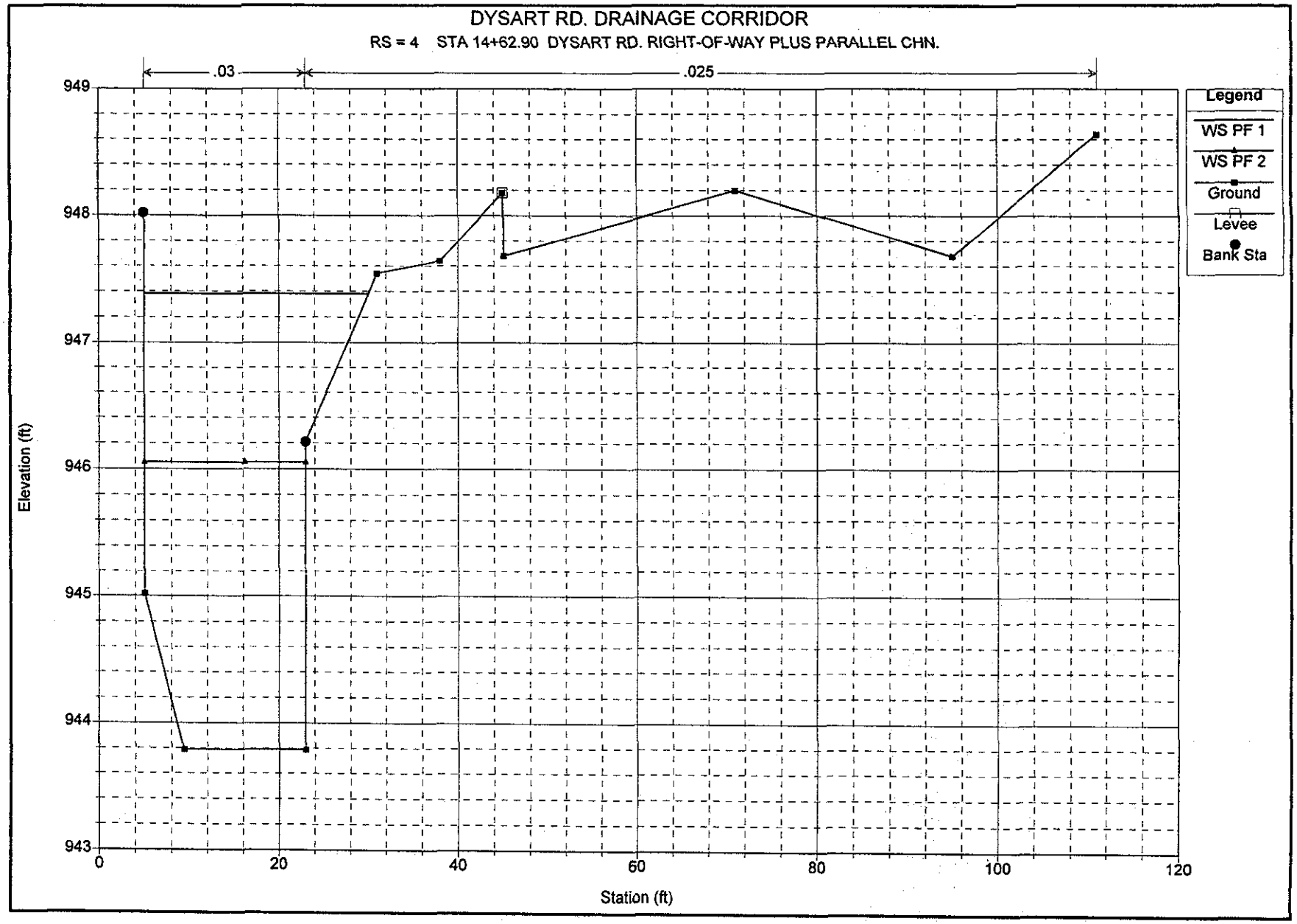

DYSART RD. DRAINAGE CORRIDOR
RS = 1 STA10+00 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
949
948
947
946
945
944
943
942
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta

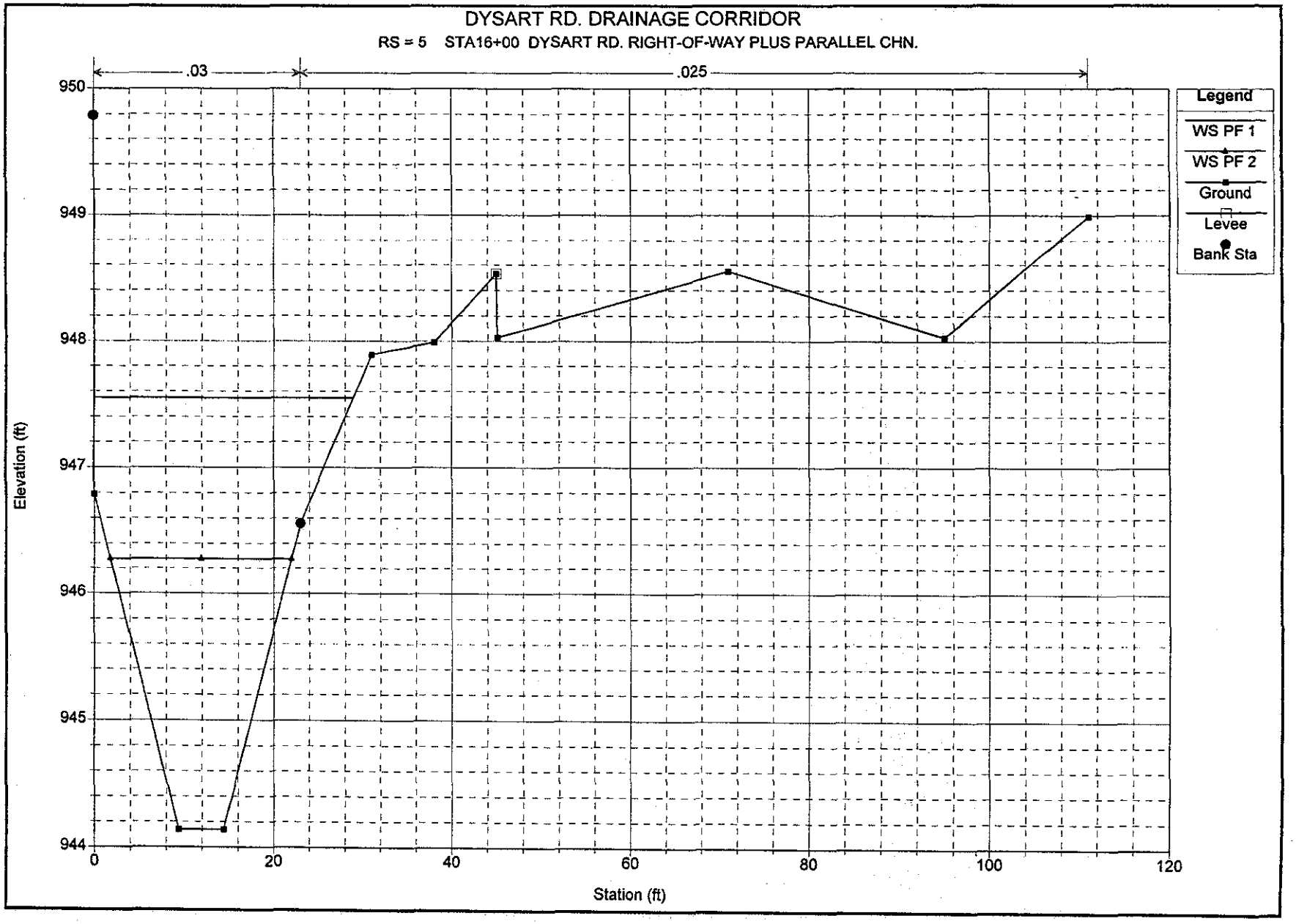

DYSART RD. DRAINAGE CORRIDOR
RS = 2 STA12+00 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
949
948
947
946
945
944
943
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta


DYSART RD. DRAINAGE CORRIDOR
RS = 3 STA 13+52.90 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
950
949
948
947
946
945
944
943
0
20
40
60
80
100
120
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 3.5 Culv D 2-BARREL 6'W x 3'H RCB CULVERT @ LOCUST LN.
.03
.025
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
950
949
948
947
946
945
944
943
0
20
40
60
80
100
120
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 3.5 Culv U 2-BARREL 6'W x 3'H RCB CULVERT @ LOCUST LN.
.03
.025
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
949
948
947
946
945
944
943
0
20
40
60
80
100
120
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 4 STA 14+62.90 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
949
948
947
946
945
944
943
0
20
40
60
80
100
120
Station (ft)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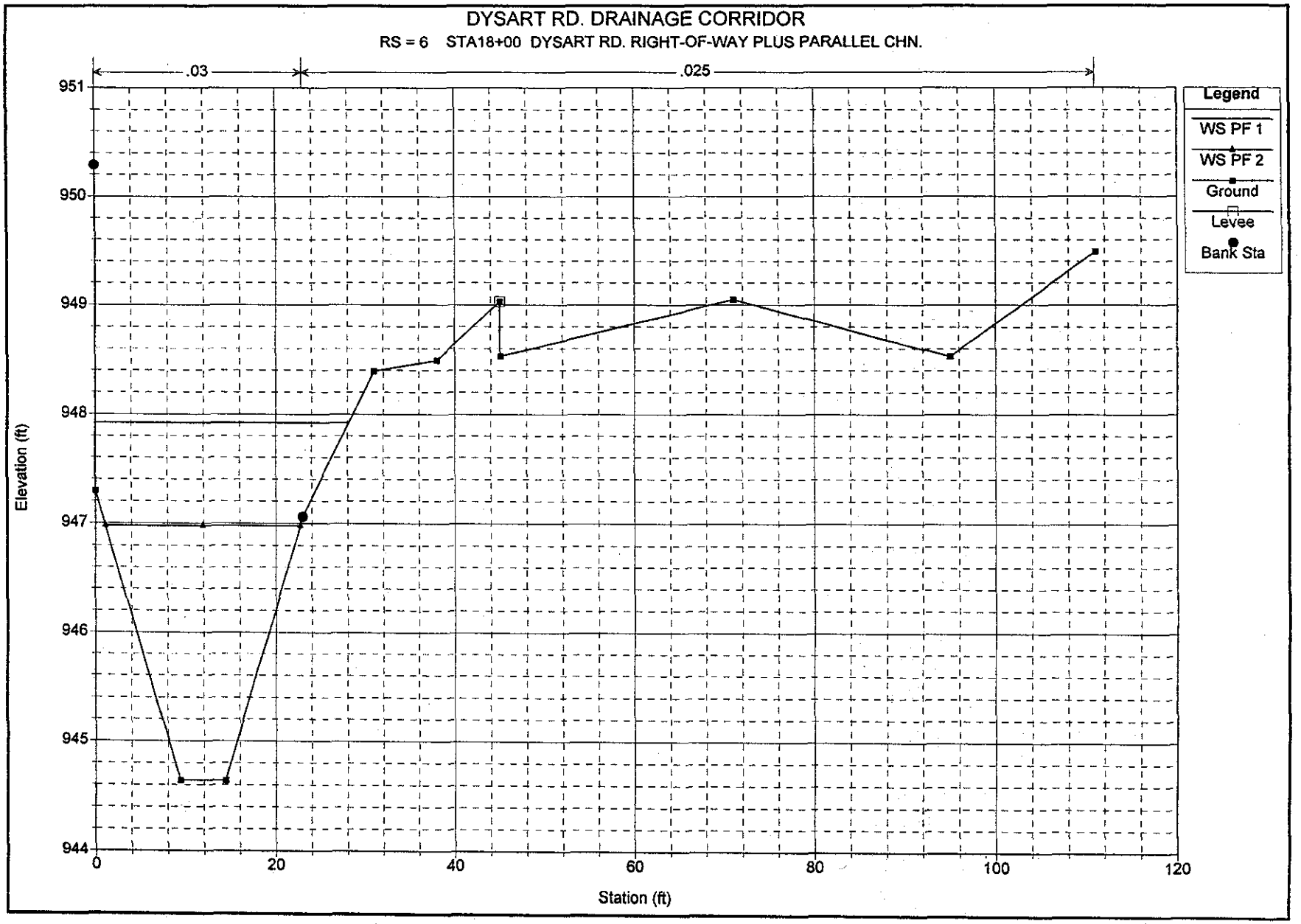
RS = 5 STA16+00 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
950
949
948
947
946
945
944
0
20
40
60
80
100
120
Station (ft)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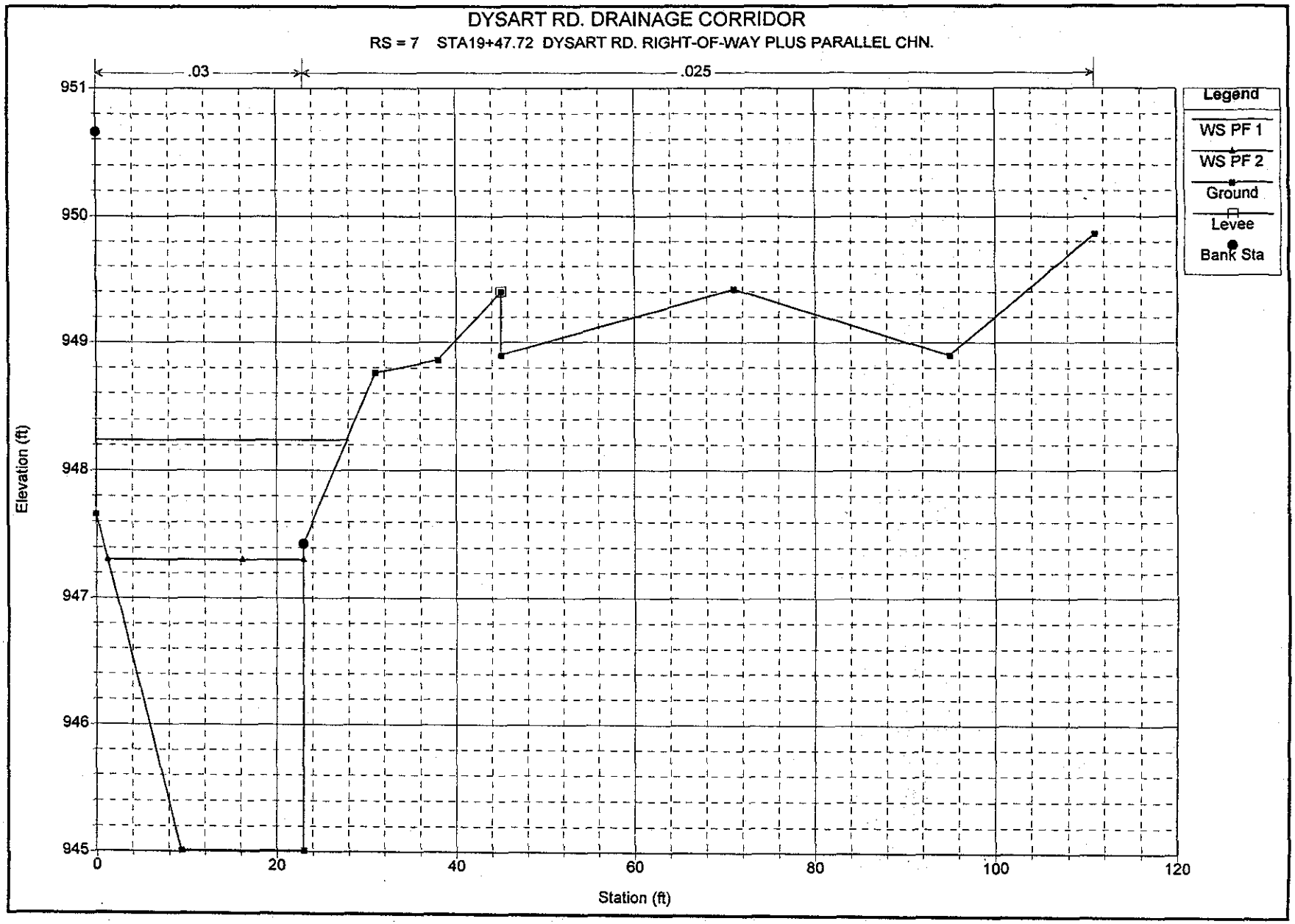
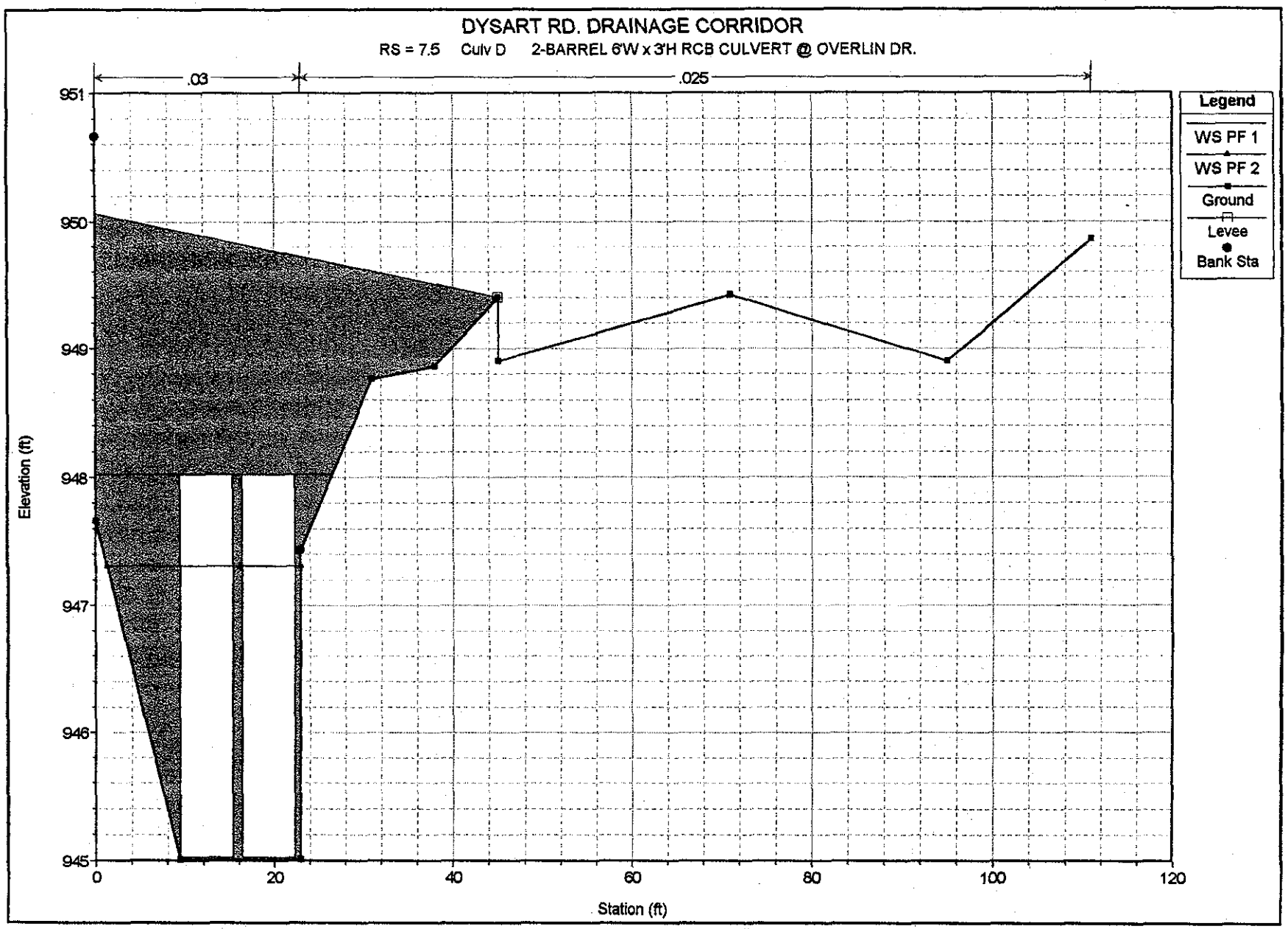
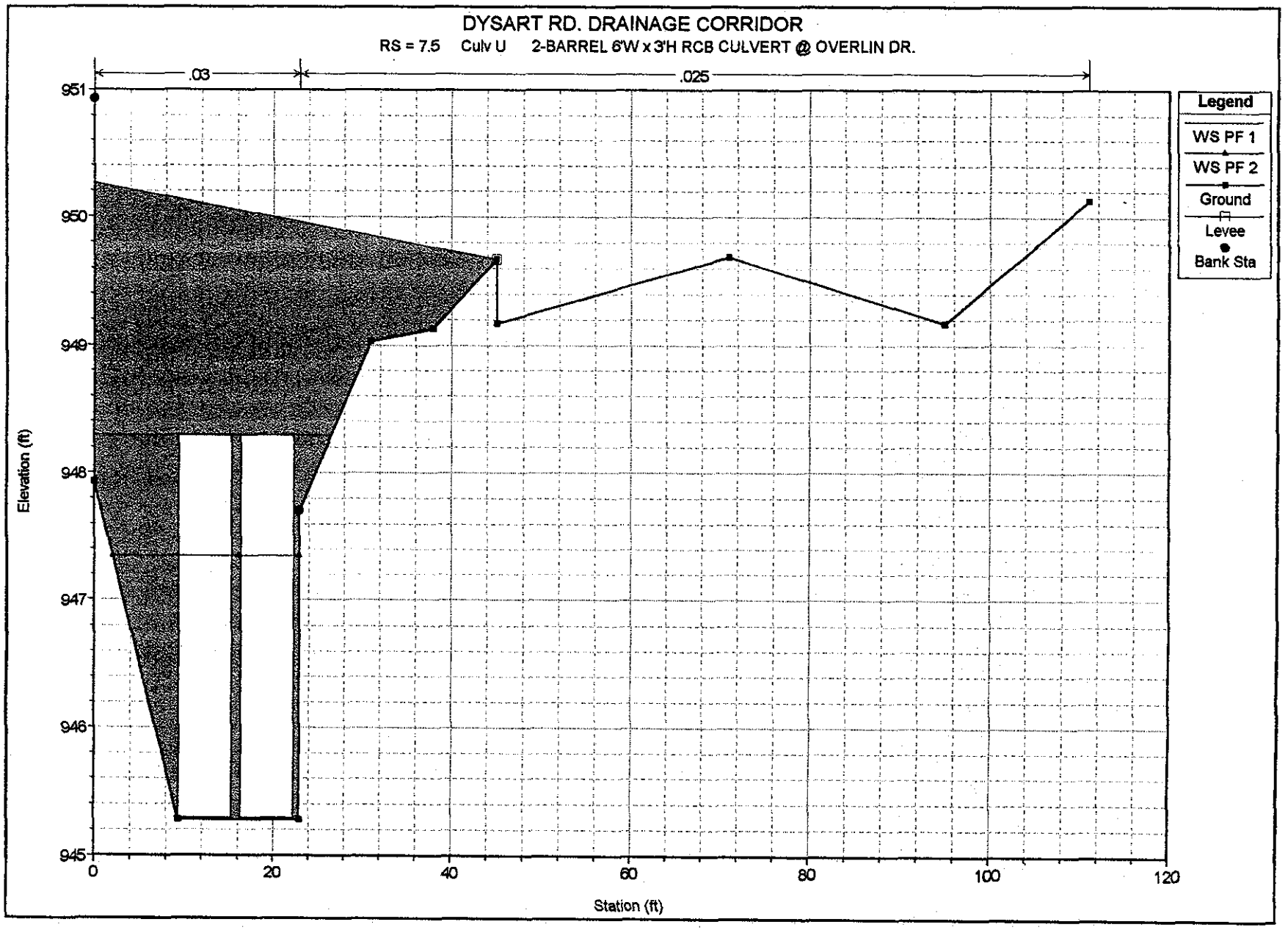
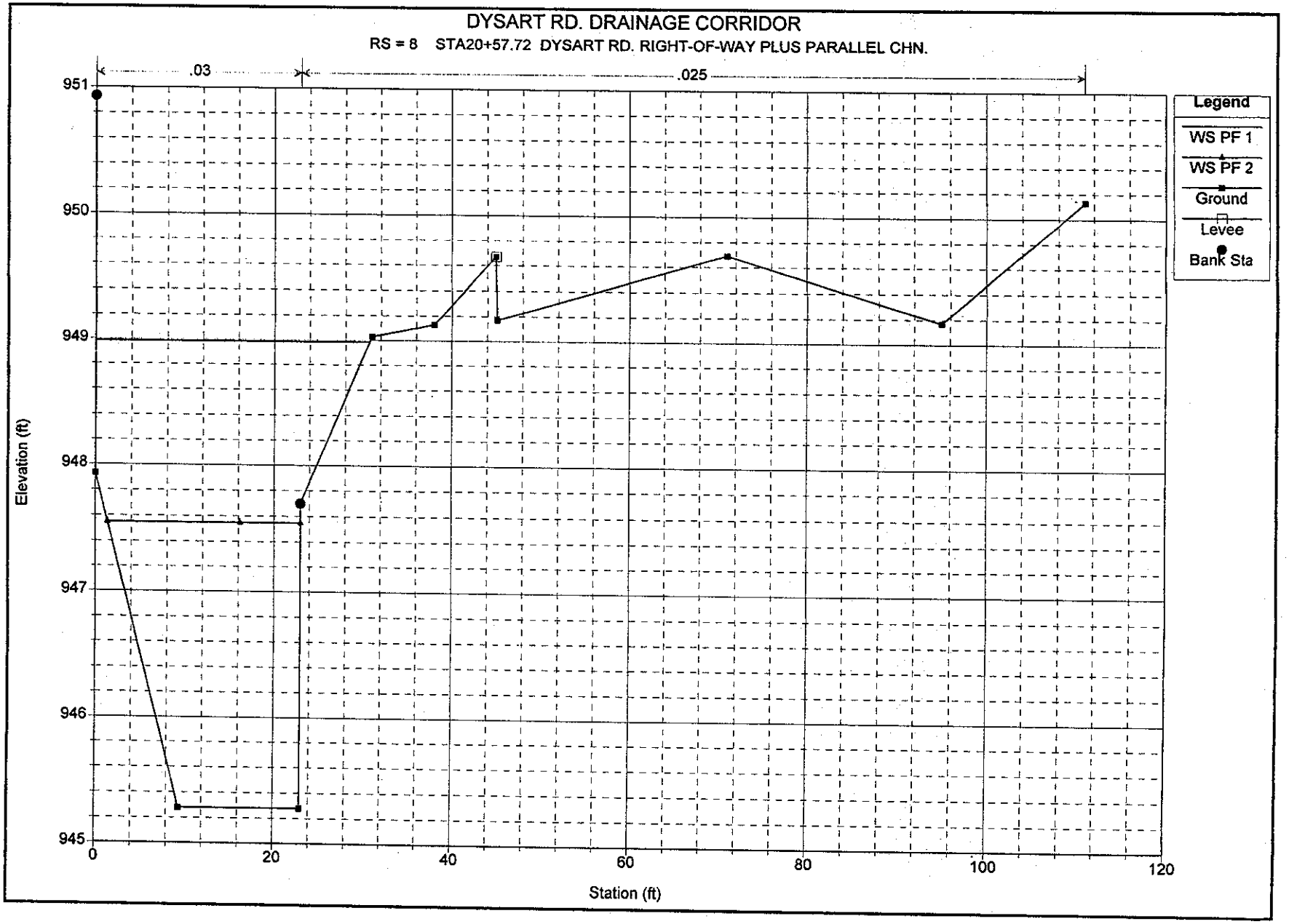
RS = 6 STA18+00 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
951
950
949
948
947
946
945
944
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta


DYSART RD. DRAINAGE CORRIDOR
RS = 7 STA19+47.72 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
Elevation (ft)
951
950
949
948
947
946
945
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta


DYSART RD. DRAINAGE CORRIDOR
RS = 7.5 Culv D 2-BARREL 6'W x 3'H RCB CULVERT @ OVERLIN DR.
.03
.025
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
951
950
949
948
947
946
945
0
20
40
60
80
100
120
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 7.5 Culv U 2-BARREL 6'W x 3'H RCB CULVERT @ OVERLIN DR.
.03
.025
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta
Elevation (ft)
951
950
949
948
947
946
945
0
20
40
60
80
100
120
Station (ft)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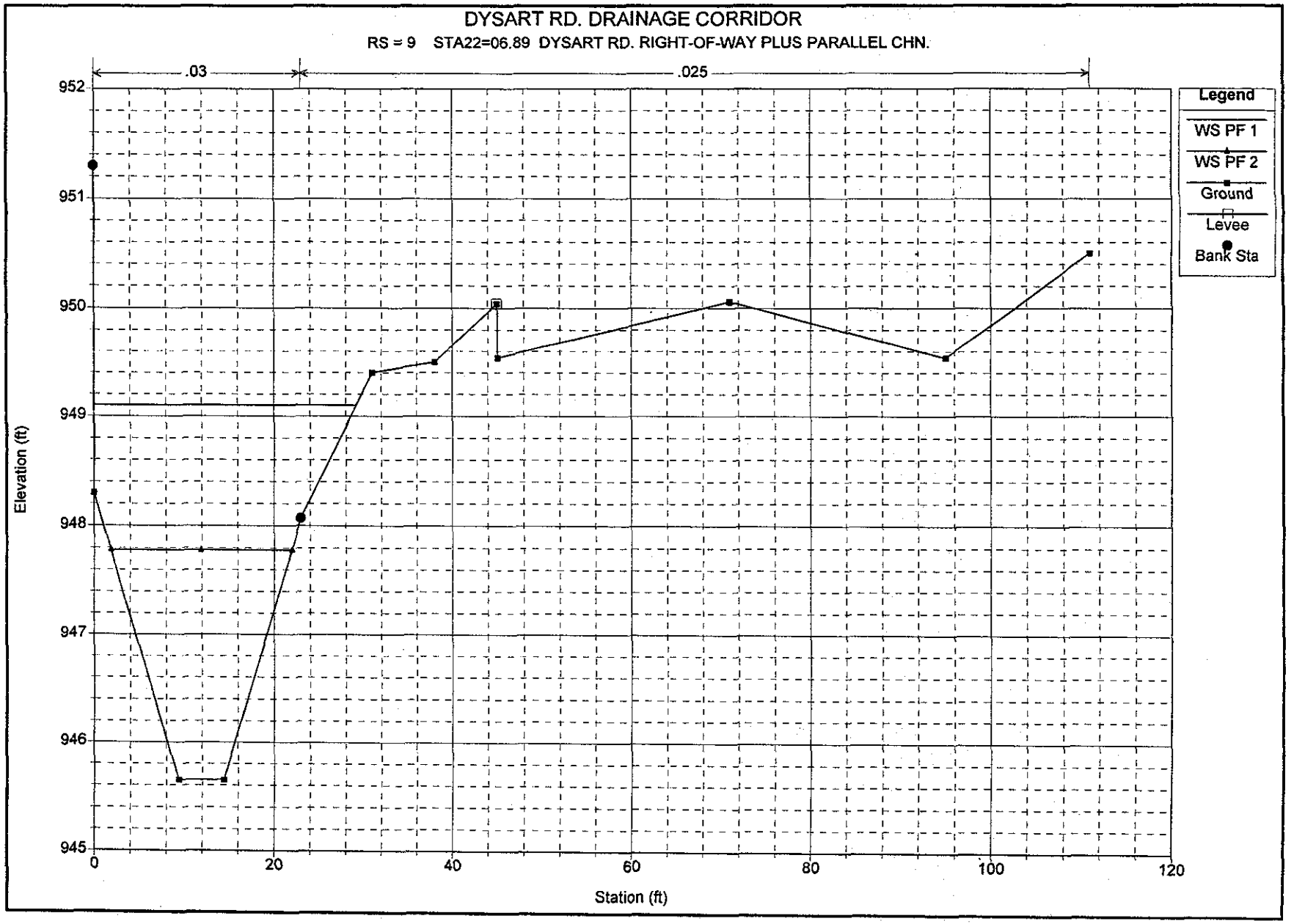
RS = 8 STA20+57.72 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
951
950
949
948
947
946
945
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta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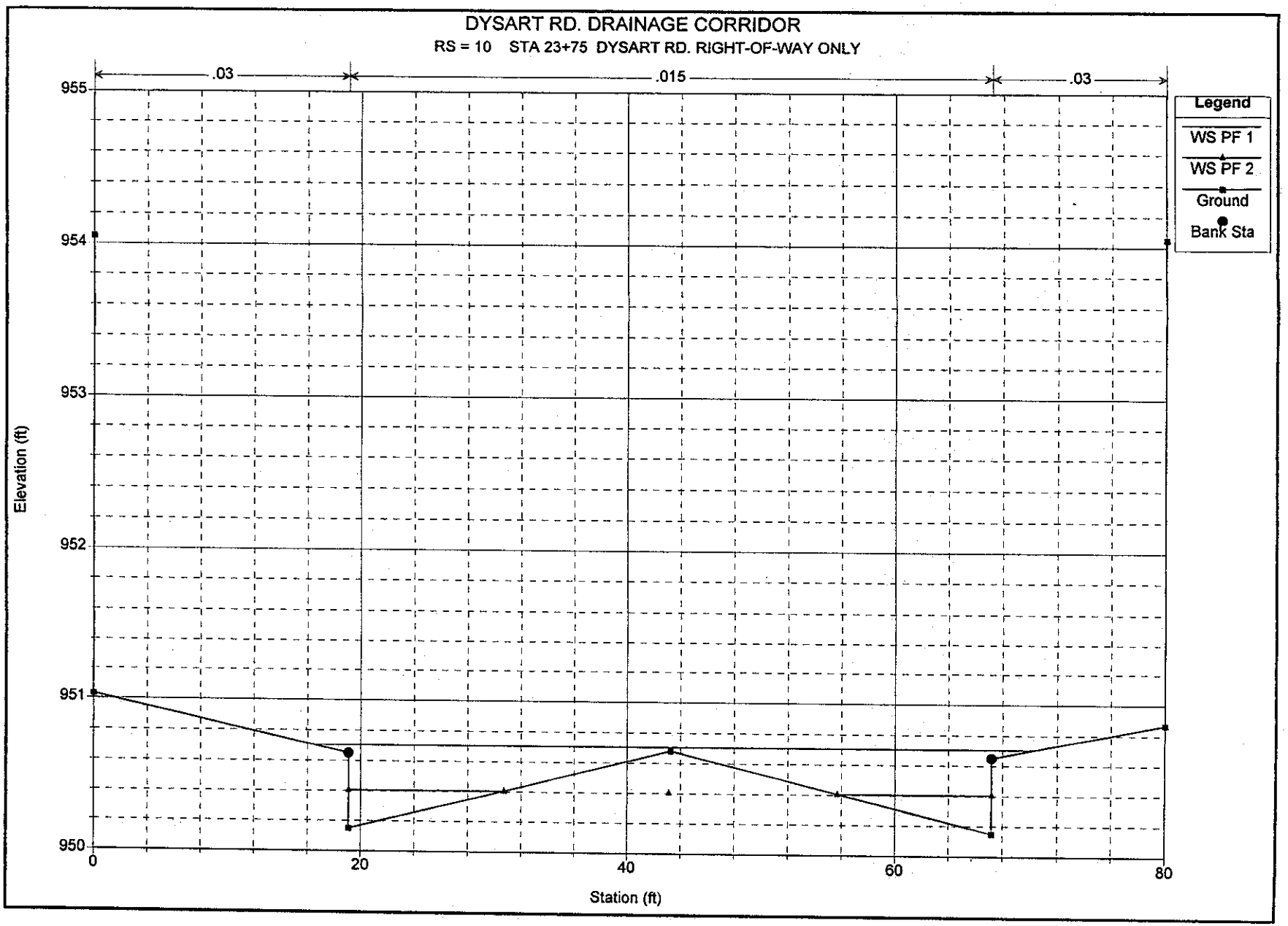
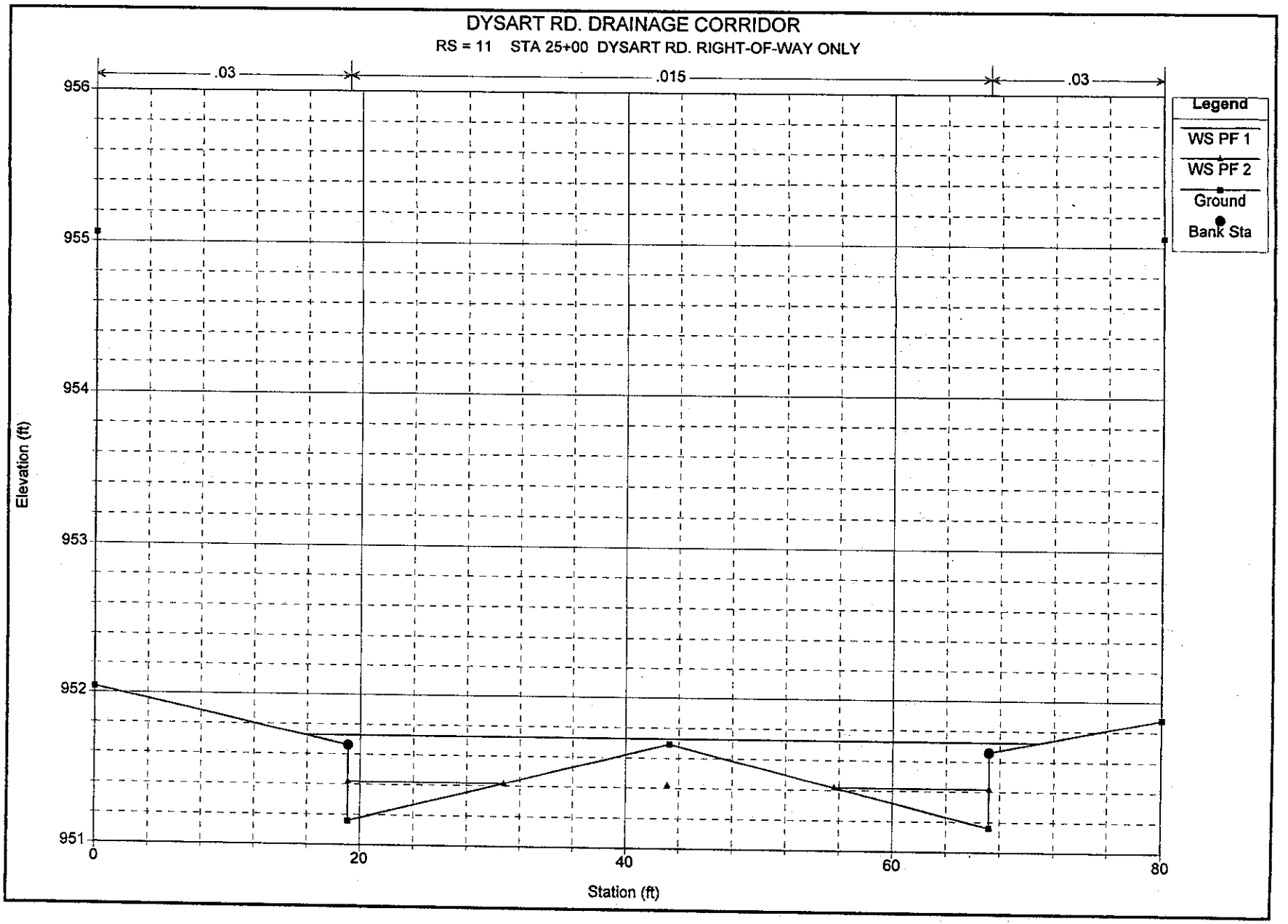
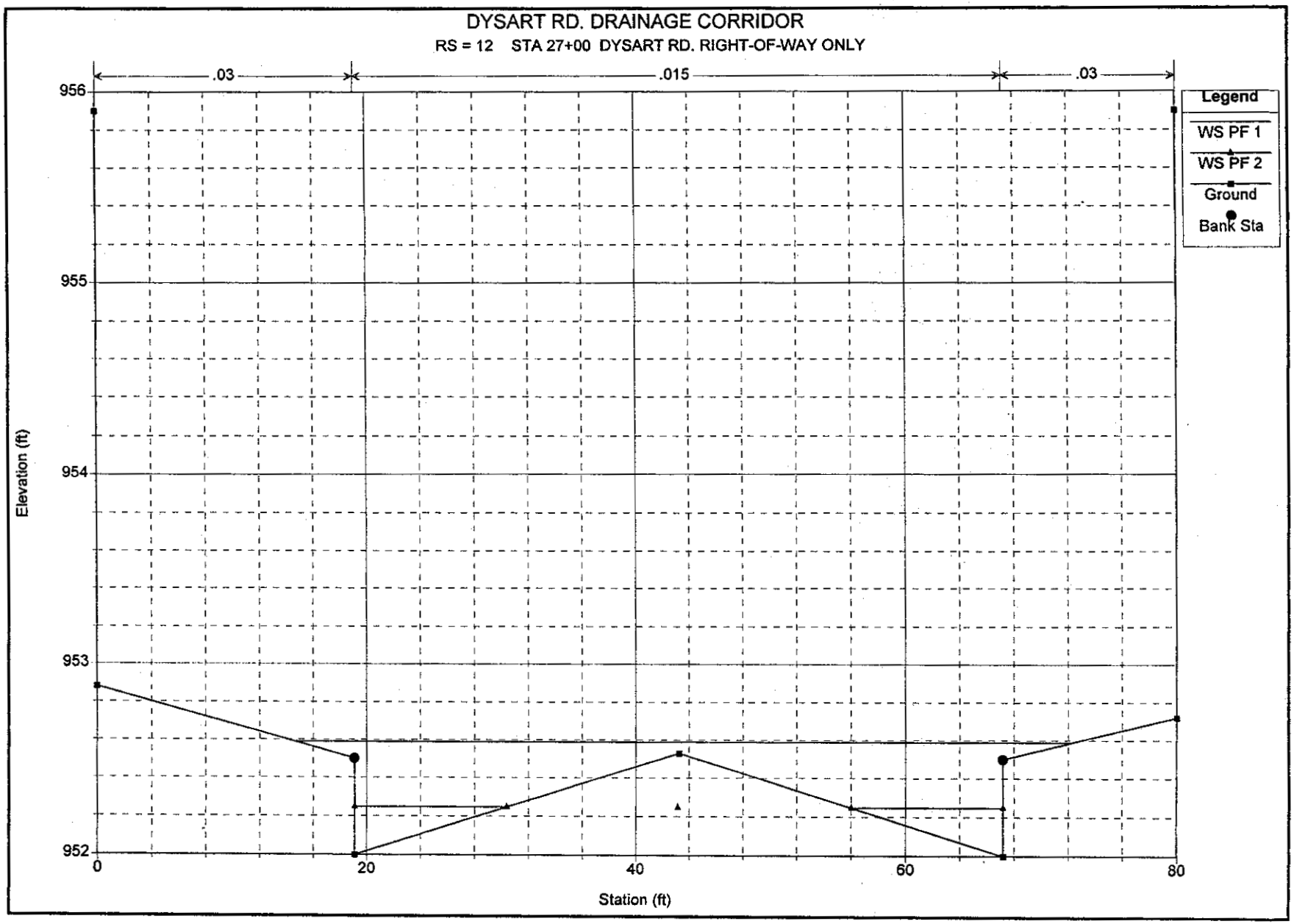
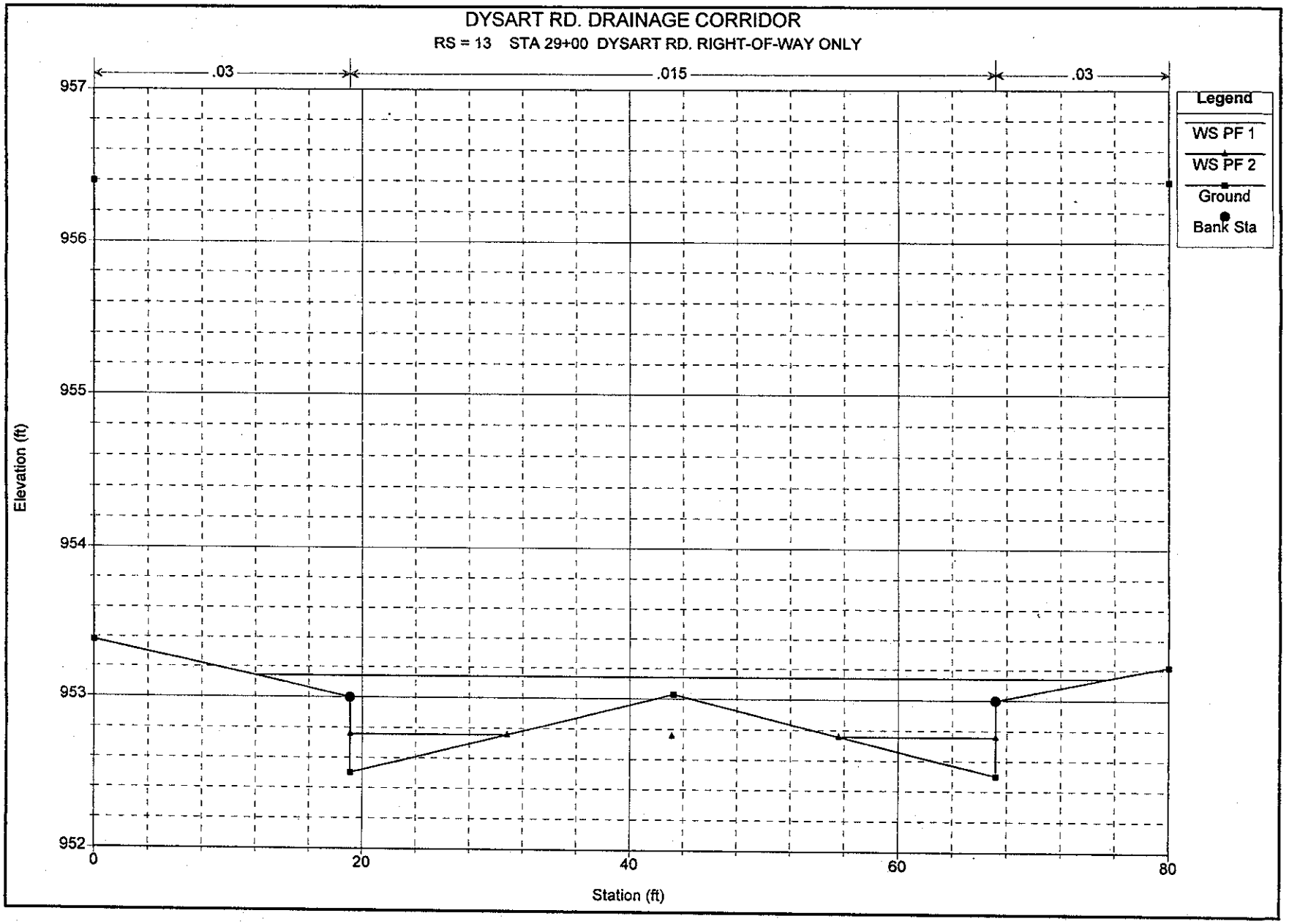
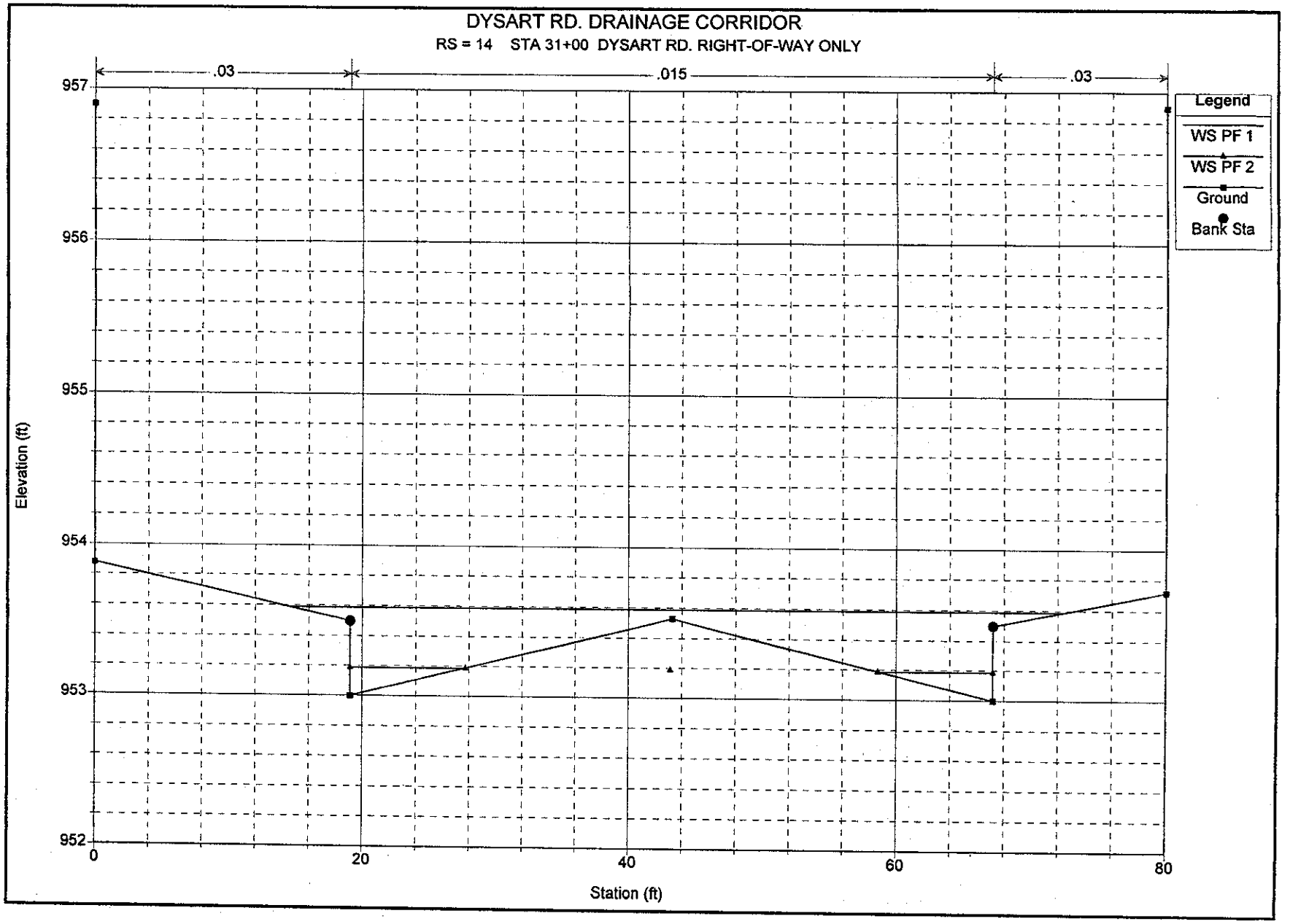
RS = 9 STA22=06.89 DYSART RD. RIGHT-OF-WAY PLUS PARALLEL CHN.
.03
.025
952
951
950
949
948
947
946
945
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Levee
Bank Sta

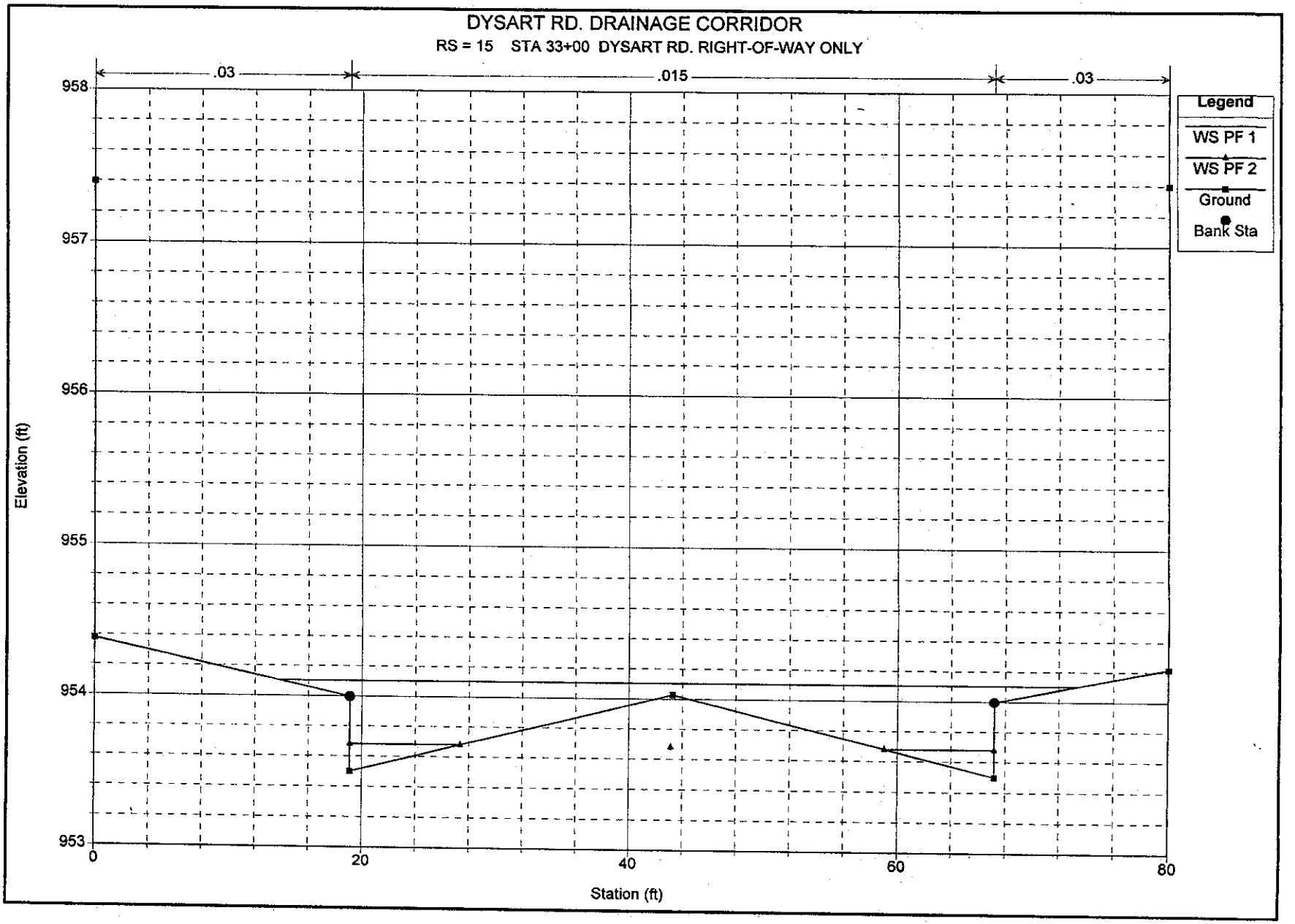

DYSART RD. DRAINAGE CORRIDOR
RS = 10 STA 23+75 DYSART RD. RIGHT-OF-WAY ONLY
.03
.015
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
955
954
953
952
951
950
0
20
40
60
80
Station (ft)

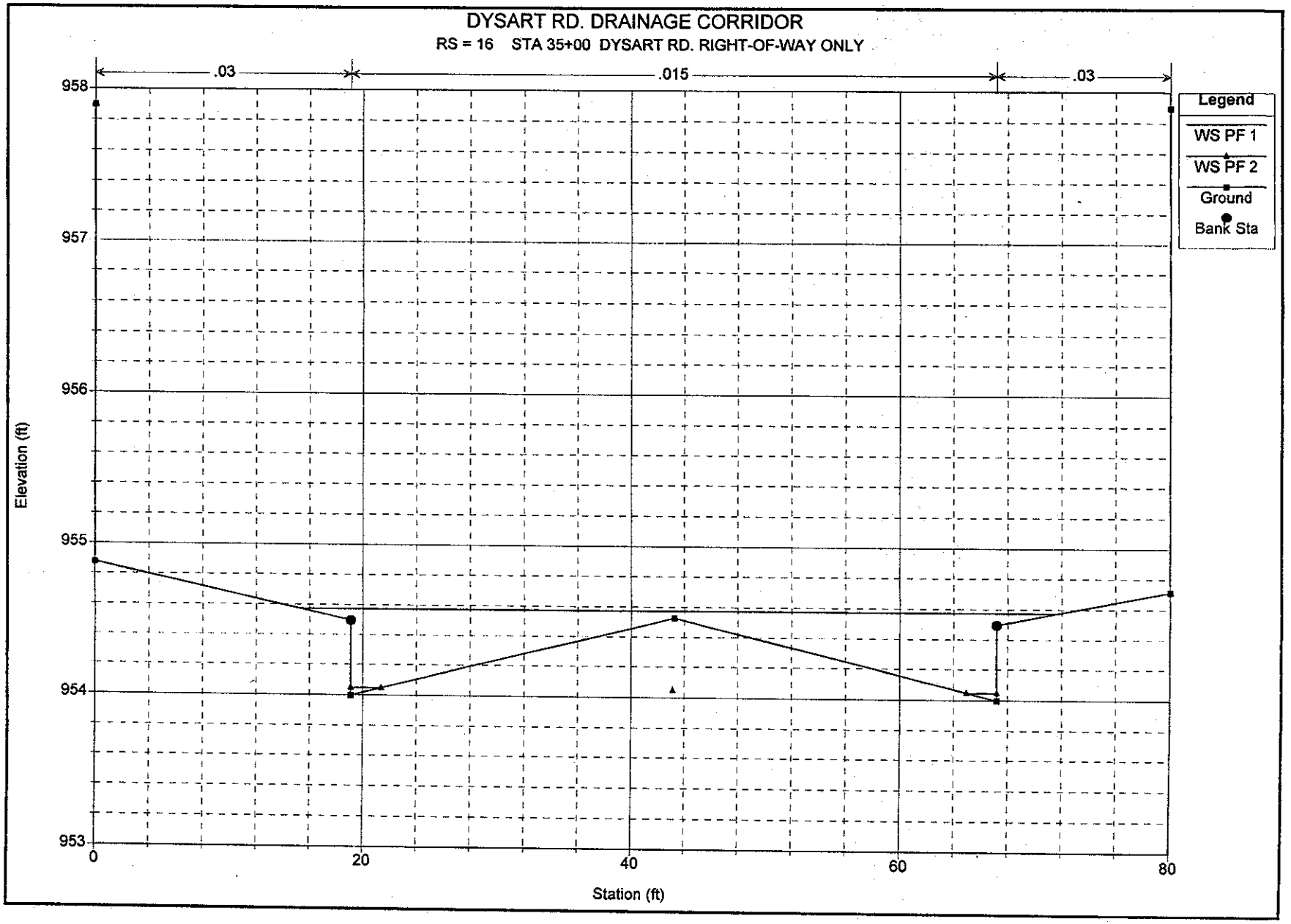

DYSART RD. DRAINAGE CORRIDOR
RS = 11 STA 25+00 DYSART RD. RIGHT-OF-WAY ONLY
.03
.015
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
956
955
954
953
952
951
0
20
40
60
80
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 12 STA 27+00 DYSART RD. RIGHT-OF-WAY ONLY
.03
.015
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
956
955
954
953
952
0
20
40
60
80
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 13 STA 29+00 DYSART RD. RIGHT-OF-WAY ONLY
.03
.015
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
957
956
955
954
953
952
0
20
40
60
80
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 14 STA 31+00 DYSART RD. RIGHT-OF-WAY ONLY
.03
.015
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
957
956
955
954
953
952
0
20
40
60
80
Station (ft)

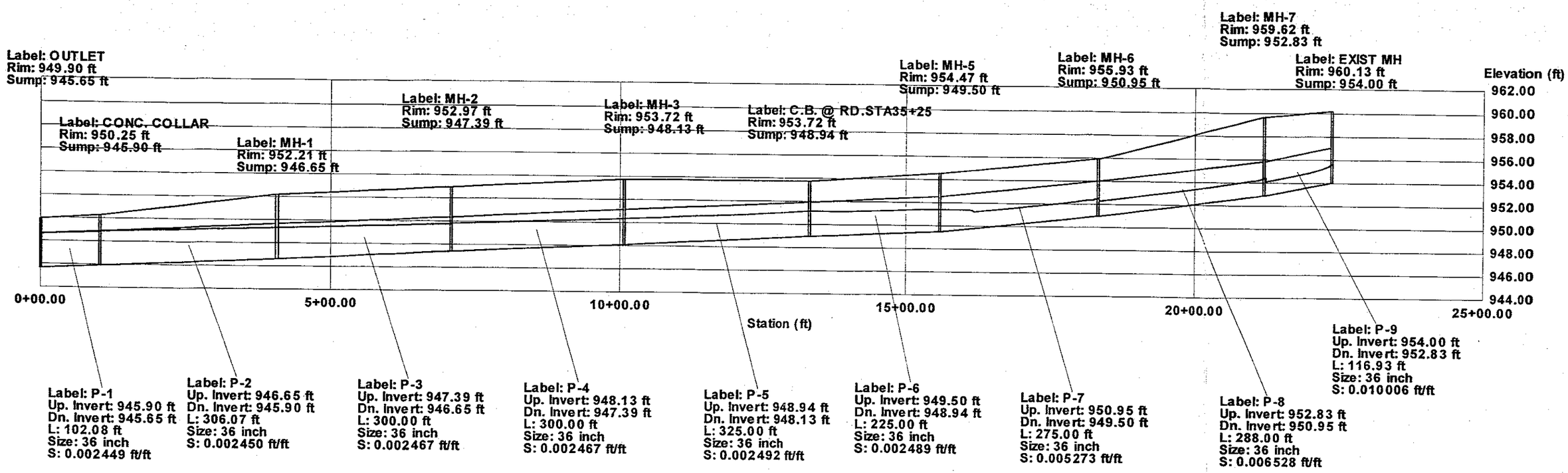

DYSART RD. DRAINAGE CORRIDOR
RS = 15 STA 33+00 DYSART RD. RIGHT-OF-WAY ONLY
.03
.015
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
958
957
956
955
954
953
0
20
40
60
80
Station (ft)


DYSART RD. DRAINAGE CORRIDOR
RS = 16 STA 35+00 DYSART RD. RIGHT-OF-WAY ONLY
.03
.015
.03
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
958
957
956
955
954
953
0
20
40
60
80
Station (ft)

SECTION D-5

- **Dysart Road Storm Drain Hydraulics**

Profile
Scenario: DYSART RD. STORM DRAIN



SECTION D-6

- Drainage Report Excerpts for Rose Terrace

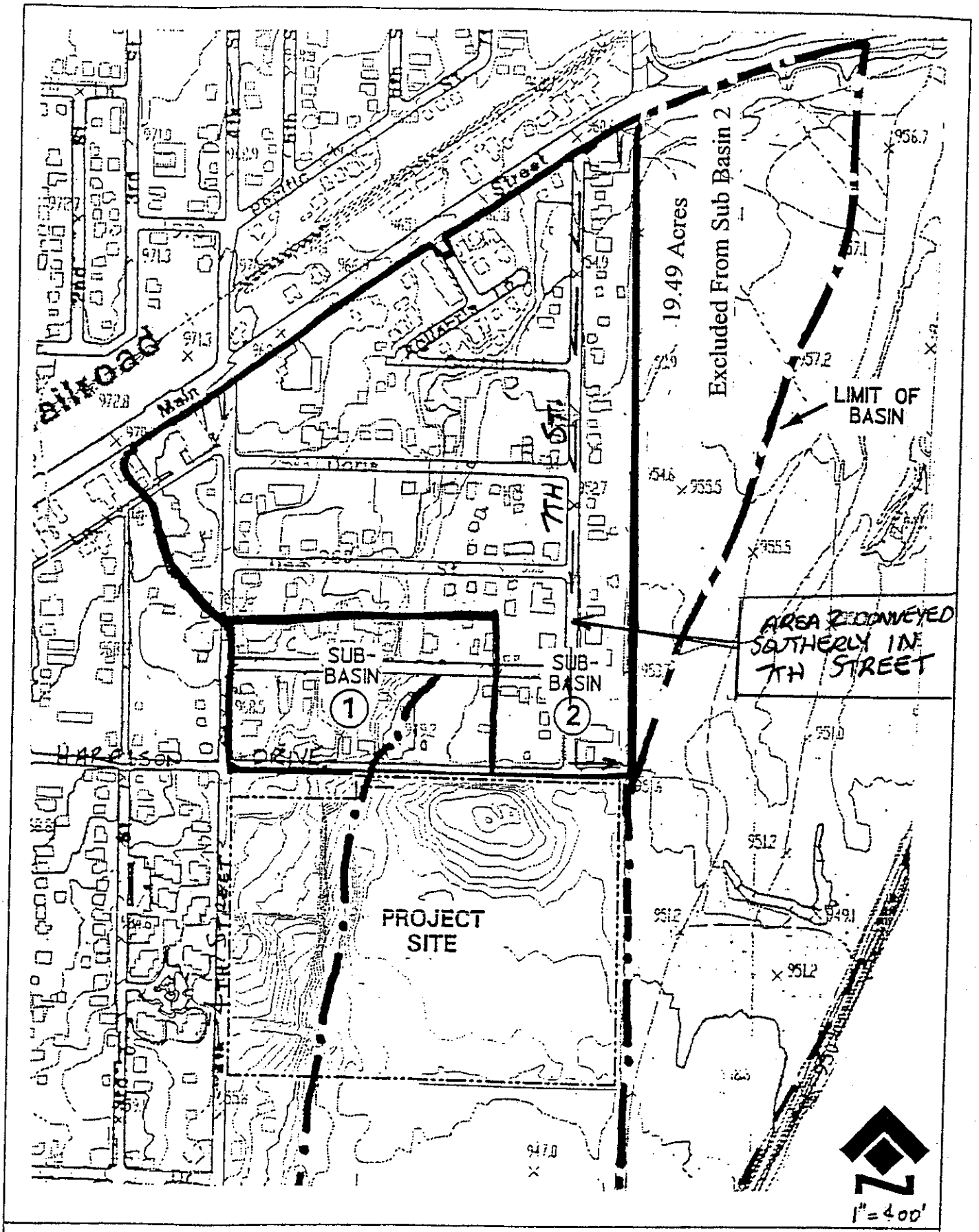
Scenario: DYSART RD. STORM DRAIN

Pipe Report

Label	Section Size	Q (cfs)	Length L (ft)	n	D.S. Inv. Elev. (ft)	U.S. Inv. Elev. (ft)	D.S. Cover (ft)	U.S. Cover (ft)	H.G.L. Out (ft)	H.G.L. IN (ft)	v Out (ft/s)	v In (ft/s)	Material	Shape	Downstream Node	Upstream Node
P-1	36 inch	28.45	102.08	0.013	945.65	945.90	1.25	1.35	948.65	948.82	4.02	4.05	Concrete	Circular	OUTLET	CONC. COLLAR
P-2	36 inch	28.45	306.07	0.013	945.90	946.65	1.35	2.56	948.86	949.32	4.03	4.28	Concrete	Circular	CONC. COLLAR	MH-1
P-3	36 inch	28.45	300.00	0.013	946.65	947.39	2.56	2.58	949.33	949.79	4.27	4.69	Concrete	Circular	MH-1	MH-2
P-4	36 inch	28.45	300.00	0.013	947.39	948.13	2.58	2.59	949.80	950.36	4.68	5.04	Concrete	Circular	MH-2	MH-3
P-5	36 inch	28.45	325.00	0.013	948.13	948.94	2.59	1.78	950.37	951.10	5.02	5.23	Concrete	Circular	MH-3	C.B. @ RD.STA35+25
P-6	36 inch	22.45	225.00	0.013	948.94	949.50	1.78	1.97	951.11	951.43	4.11	4.68	Concrete	Circular	C.B. @ RD.STA35+25	MH-5
P-7	36 inch	22.45	275.00	0.013	949.50	950.95	1.97	1.98	951.43	952.47	4.68	6.22	Concrete	Circular	MH-5	MH-6
P-8	36 inch	22.45	288.00	0.013	950.95	952.83	1.98	3.79	952.49	954.35	6.16	6.22	Concrete	Circular	MH-6	MH-7
P-9	36 inch	22.45	116.93	0.013	952.83	954.00	3.79	3.13	954.45	955.52	5.76	6.22	Concrete	Circular	MH-7	EXIST MH

Inlet Report

Label	Calculated Station (ft)	Ground Elevation (ft)	Set Rim Equal to Ground Elevation?	Rim Elevation (ft)	Sump Elevation (ft)	Carryover Additional Flow (cfs)	Bypassed Additional Flow (cfs)	Intercepted Additional Flow (cfs)	Additional Flow (cfs)
EXIST MH	22+38.08	960.13	true	960.13	954.00	0.00	0.00	0.00	22.45
C.B. @ RD.STA35+25	13+33.15	953.72	true	953.72	948.94	0.00	0.00	0.00	6.00



Hoskin Engineering Consultants, Inc.
523 West Roosevelt Street
Suite 200
Phoenix, Arizona 85003-1136
Tel: (602) 252-8584
Fax: (602) 252-8585

ROSE TERRACE APARTMENTS
OFF-SITE DRAINAGE MAP

FIGURE 3

g:\filedir\00 00 008 - avondale housing project\0ofdr03.dgn
03/06/2001

- Finished floor elevations shall be a minimum of 12 inches above the 100-year flood elevation. Finished floor elevations shall be no less than 14 inches above the top of curb for the low end lots and no less than six inches above the top of curb for the high end lots.
- Catch basins and storm sewers shall be designed for the 10-year, 6-hour storm event.
- Retention / detention basins shall be designed to retain 100 percent of the 100-year, 2-hour storm runoff from the gross area being developed.
- Drywells shall be considered to dissipate standing water in retention basins.

5 Off-Site Drainage

Main Street, also known as MC 85, is raised, preventing runoff from areas north of Main Street from flowing southward towards the site. Areas west of Fourth Street flow to the south, therefore no drainage enters the site along the western boundary. Off-site drainage enters the site at two locations along the northern border of the site (See Figure 3). The off-site drainage was evaluated using the Rational Method per the Maricopa County standards, and calculations are included in the appendix.

Drainage Area 1 consists of 8.49 acres of mostly low-density housing, and produces a 100-year peak flow of 42 cfs. Runoff concentrates at an existing low point just north of Harrison Drive, where it ponds before flowing east along the north side of Harrison Drive and within Harrison Drive itself. The capacity of Harrison Drive was calculated using normal depth computations, which are included in the appendix. The capacity of Harrison Drive is approximately 11 cfs. For the purpose of this design analysis, the remaining 31 cfs was assumed to overtop Harrison Drive and flow into the site at Retention Basin A. From Retention Basin A, the flow continues south through a series of graded retention basins and culverts, exiting the site at approximately the current drainage path. The basins will be

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: KVM Date: 5-1-01

LOCATION DATA

Location: ROSE TERRACE

Project Name: 00-008 Subarea id: OFFSITE 1

Drainage Area Cover: _____

DESIGN DATA Copied From Reference 3

Drainage Area	8.49 acres
Watercourse Length	300.0 feet
Top Elevation	952.0 feet
Bottom Elevation	949.0 feet
Slope	.01000 feet/feet
Roughness Coefficient (Kb)	.03420
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	14	19	22	28	35	42
C	0.450	0.450	0.450	0.495	0.540	0.563
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.7	4.9	5.7	6.7	7.7	8.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: KVM

Date: 5-1-01

LOCATION DATA

Location: ROSE TERRACE

Project Name: 00-008

Subarea id: OFFSITE-2

Drainage Area Cover: _____

DESIGN DATA Copied From Reference 3

Drainage Area	62.11 acres
Watercourse Length	2300.0 feet
Top Elevation	956.0 feet
Bottom Elevation	951.0 feet
Slope	.00217 feet/feet
Roughness Coefficient (Kb)	.02880
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	41	58	75	105	134	162
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	27.7	24.2	22.0	20.1	18.9	17.9
i (in/hr)	1.6	2.4	3.0	3.8	4.5	5.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SID Date: 7-24-01

LOCATION DATA

Location: 2

Project Name: TRES RIOS LANDI Subarea id: SUBBASIN2

Drainage Area Cover: SINGLE FAMILY, EXISTING

DESIGN DATA

Drainage Area	42.62 acres
Watercourse Length	2400.0 feet
Top Elevation	960.0 feet
Bottom Elevation	951.6 feet
Slope	.00350 feet/feet
Roughness Coefficient (Kb)	.02982
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	31	44	54	76	98	118
C	0.400	0.400	0.400	0.440	0.480	0.500
Tc (min)	23.9	21.0	19.4	17.6	16.6	15.7
i (in/hr)	1.8	2.6	3.2	4.1	4.8	5.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SID Date: 7-25-01

LOCATION DATA

Location: SOUTH RET.BAS.

Project Name: TRES RIOS Subarea id: DYSART(S)

Drainage Area Cover: PAVED

DESIGN DATA

Drainage Area	2.31 acres
Watercourse Length	1260.0 feet
Top Elevation	1000.0 feet
Bottom Elevation	998.5 feet
Slope	.00119 feet/feet
Roughness Coefficient (Kb)	.03773
10-Year, 6-Hour Rainfall	2.00 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	5	7	9	11
C	0.750	0.750	0.750	0.825	0.900	0.938
Tc (min)	28.8	25.1	22.8	20.8	19.6	18.5
i (in/hr)	1.6	2.3	3.0	3.8	4.4	5.1

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SID Date: 10-5-01

LOCATION DATA

Location: @HARRISON

Project Name: TRES RIOS Subarea id: DYSART(N)

Drainage Area Cover: PAVED

DESIGN DATA

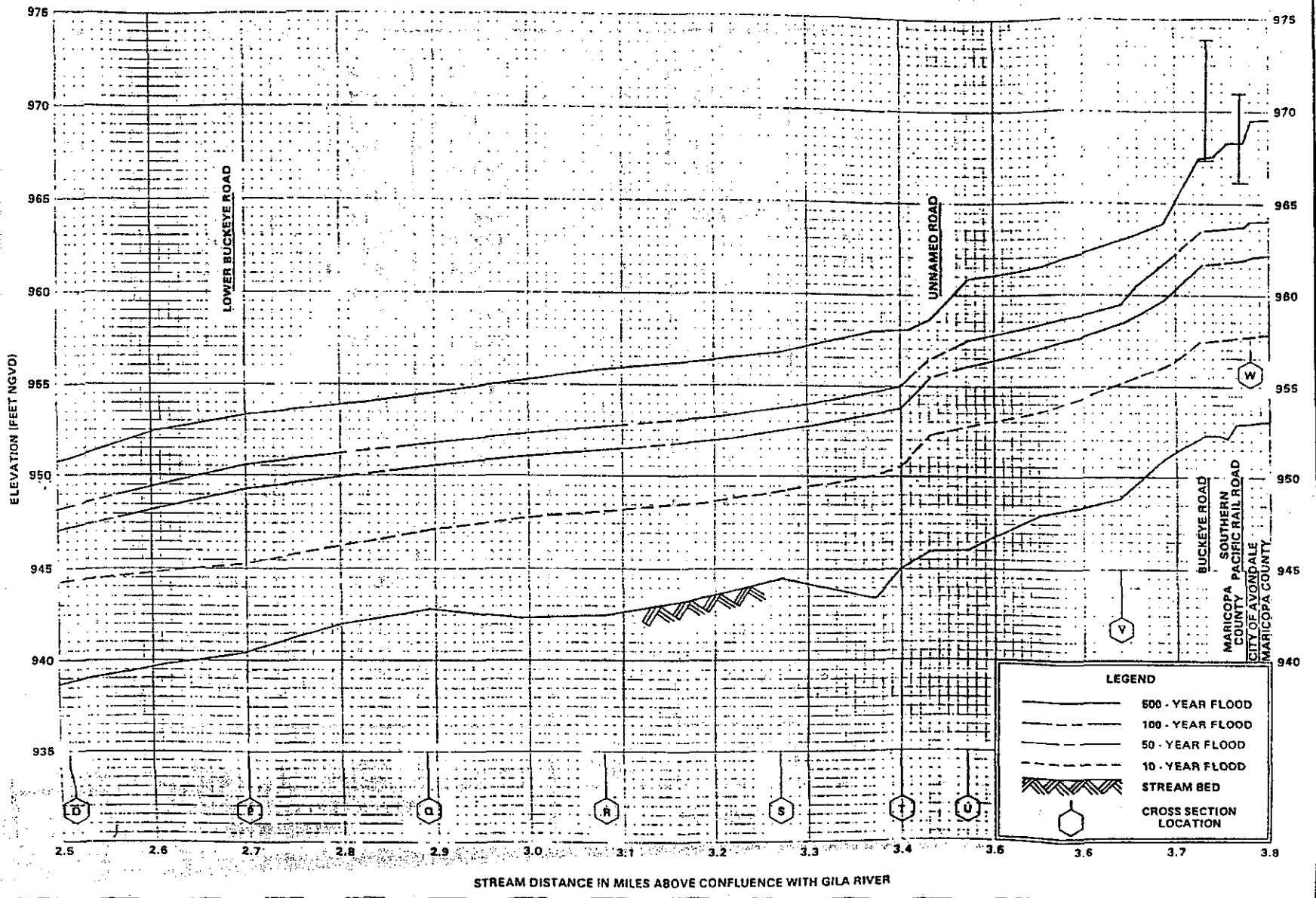
Drainage Area	4.83	acres
Watercourse Length	2700.0	feet
Top Elevation	1000.0	feet
Bottom Elevation	996.7	feet
Slope	.00121	feet/feet
Roughness Coefficient (Kb)	.03573	
10-Year, 6-Hour Rainfall	2.00	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	6	8	11	14	17
C	0.710	0.710	0.710	0.781	0.852	0.887
Tc (min)	48.5	40.7	36.1	32.4	30.5	28.8
i (in/hr)	1.0	1.6	2.2	2.9	3.4	4.0

SECTION E-1

- FEMA Agua Fria River Profile
- FEMA Agua Fria River Floodway Data Table



FLOOD PROFILES

AGUA FRIA RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

08P

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Agua Fria River								
A	0.16	3,170	22,101	4.3	922.4	919.3[2]	920.0	1.0
B	0.35	3,275	18,353	5.1	922.5	920.3[2]	921.3	1.0
C	0.54	3,315	17,014	5.5	923.2	922.6[2]	923.4	0.8
D	0.73	3,160	16,985	5.6	925.2	925.2	926.1	0.9
E	0.92	3,010	14,998	6.3	927.4	927.4	928.3	0.9
F	1.10	2,930	17,192	5.5	929.9	929.9	930.8	0.9
G	1.25	2,830	13,381	7.0	932.0	932.0	932.9	0.9
H	1.40	2,670	12,711	7.4	935.5	935.5	936.2	0.7
I	1.56	2,422	18,884	5.0	938.1	938.1	938.9	0.8
J	1.71	2,650	17,841	5.3	939.0	939.0	939.8	0.8
K	1.87	2,708	17,174	5.5	940.0	940.0	940.9	0.9
L	2.02	2,324	14,011	6.8	941.6	941.6	942.4	0.8
M	2.18	1,989	13,570	7.0	943.4	943.4	944.3	0.9
N	2.33	1,683	12,200	7.8	945.7	945.7	946.5	0.8
O	2.51	1,835	13,727	6.9	947.8	947.2	948.8	1.0
P	2.70	1,964	14,707	6.5	950.1	950.1	950.7	0.6
Q	2.89	2,200	16,523	5.7	951.3	951.3	951.9	0.6
R	3.08	1,872	15,620	6.1	952.4	952.4	952.8	0.4
S	3.27	1,430	11,163	8.5	953.6	953.6	953.9	0.3
T	3.40	1,317	7,189	13.2	954.9	954.9	955.0	0.1
U	3.47	1,300	9,659	9.8	957.5	957.5	957.5	0.0
V	3.64	1,246	7,083	13.4	959.4	959.4	959.7	0.3
W	3.78	1,240	12,017	7.9	963.9	963.9	963.9	0.0
X	3.93	1,240	11,643	8.2	964.6	964.6	964.6	0.0
Y	4.094	1,240	6,782	14.0	964.7	964.7	964.7	0.0
Z	4.3	1,220	10,680	8.9	968.5	968.5	968.5	0.0

[1]Miles Above Confluence With Gila River
[2]Elevation Computed Without Consideration of Backwater From Gila River

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

FLOODWAY DATA

AGUA FRIA RIVER

SECTION E-2

- Hydraulic Design Data Sheets (Rational Method Q's for Tract E Storm Drain)
- Parcel 4, Tract E Storm Drain
- Parcel 4, Tract E Catch Basin Hydraulics
- Onsite Retention Basin Calculations
- Drywell Calculations
- Tract E Surface Flow

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA A Thru C

CONCENTRATION POINT 3

DESIGN DATA

Drainage Area 5.73 acres

Drainage Length (Area _____ Only) _____ feet

Average Velocity (Area _____ Only) _____ fps

Tc for Area _____ _____ minutes

Previous Tc to Point 2 19.66 minutes

Total Tc 19.66 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	19.66		
Rainfall Intensity	i	3.15	4.39	4.98
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge Qp = CiA =		9.93	16.60	19.69

C.B. & Pipe Flow

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA D, E, & F

CONCENTRATION POINT 4

DESIGN DATA

Drainage Area 4.94 acres

Drainage Length (Area _____ Only) — feet

Average Velocity (Area _____ Only) — fps

Tc for Area _____ — minutes

Previous Tc to Point 4 20.31 minutes

Total Tc 20.31 minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	20.31		
Rainfall Intensity	i	3.09	4.31	4.89
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge Qp = CiA =		8.40	14.05	16.67

C.B.

HYDROLOGIC DESIGN DATA SHEET
RATIONAL METHOD

DRAINAGE AREA A Thru F

CONCENTRATION POINT 5

DESIGN DATA

Drainage Area	10.67	acres
Drainage Length (Area _____ Only)	—	feet
Average Velocity (Area _____ Only)	—	fps
Tc for Area _____	—	minutes
Previous Tc to Point 4	20.31	minutes
Total Tc	20.31	minutes

DESIGN COMPUTATIONS

Design Frequency		10	50	100
Precipitation P1 = 1 hour				
Time of Concentration	Tc	20.31		
Rainfall Intensity	i	3.09	4.31	4.89
Runoff Coefficient	C	0.55	0.66	0.69
Peak Discharge Qp = CiA =		18.13	30.35	36.00

Pipe Flow

Scenario: PARCEL 4, TRACT " E" STORM DRAIN

Pipe Report

Label	Section Size	Q (cfs)	Length L (ft)	n	D.S. Inv. Elev. (ft)	U.S. Inv. Elev. (ft)	D.S. Cover (ft)	U.S. Cover (ft)	H.G.L. Out (ft)	H.G.L. IN (ft)	v Out (ft/s)	v In (ft/s)	Material	Shape	Downstream Node	Upstream Node	Full Area (ft²)
P-1	24 inch	18.13	16.00	0.013	948.00	948.11	1.00	1.58	949.77	949.84	6.16	6.27	Concrete	Circular	OUTLET IN RET. BASIN	CB @ S. SIDE DEE ST.	3.1
P-2	24 inch	14.13	36.00	0.013	948.11	948.25	1.58	1.44	949.84	949.97	4.89	4.92	Concrete	Circular	CB @ S. SIDE DEE ST.	CB @ N. SIDE OF DEE ST.	3.1
P-3	24 inch	9.93	233.50	0.013	948.25	949.00	1.44	1.92	949.97	950.40	3.46	4.24	Concrete	Circular	CB @ N. SIDE OF DEE S	CB @ S. SIDE OF DORIS S	3.1
P-4	18 inch	4.97	36.00	0.013	949.50	949.75	1.92	1.67	950.40	950.61	4.51	4.76	Concrete	Circular	CB @ S. SIDE OF DORIS	CB @ N.SISE OF DORIS ST	1.8

Scenario: PARCEL 4, TRACT " E" STORM DRAIN

Inlet Report

Label	Calculated Station (ft)	Ground Elevation (ft)	Set Rim Equal to Ground Elevation?	Rim Elevation (ft)	Sump Elevation (ft)	Carryover Additional Flow (cfs)	Bypassed Additional Flow (cfs)	Intercepted Additional Flow (cfs)	Additional Flow (cfs)
CB @ N.SISE OF DORIS ST.	3+22	952.92	true	952.92	949.75	0.00	0.00	0.00	4.97
CB @ S. SIDE OF DORIS ST.	2+86	952.92	true	952.92	949.00	0.00	0.00	0.00	4.96
CB @ N. SIDE OF DEE ST.	0+52	951.69	true	951.69	948.25	0.00	0.00	0.00	4.20
CB @ S. SIDE DEE ST.	0+16	951.69	true	951.69	948.11	0.00	0.00	0.00	4.00

Profile
Scenario: PARCEL 4, TRACT " E" STORM DRAIN

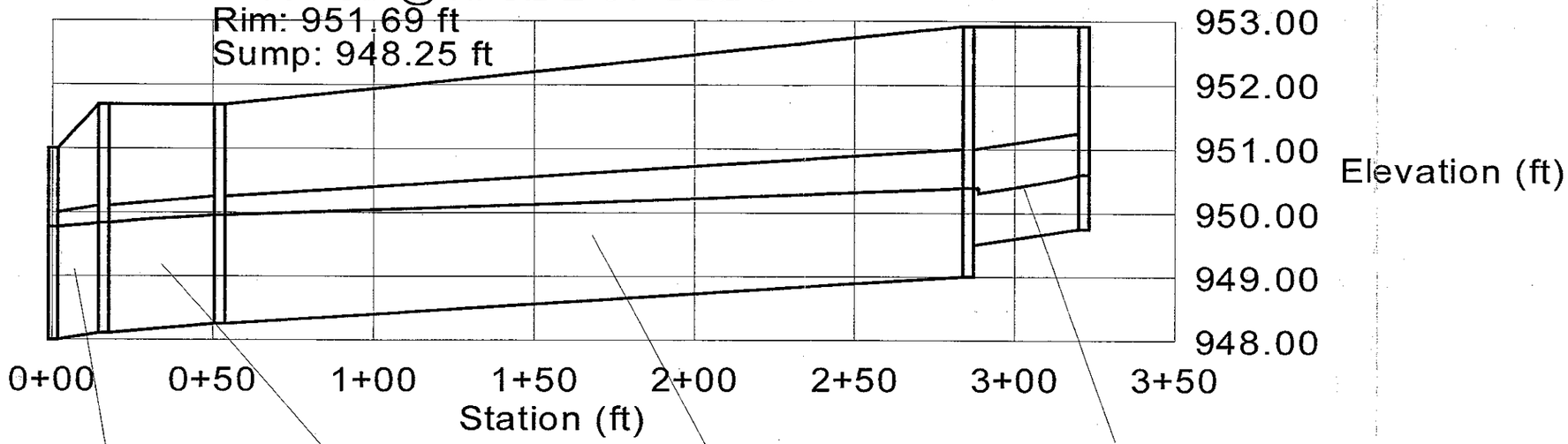
Label: OUTLET IN RET. BASIN
Rim: 951.00 ft
Sump: 948.00 ft

Label: CB @ S. SIDE OF DORIS ST.
Rim: 952.92 ft
Sump: 949.00 ft

Label: CB @ S. SIDE DEE ST.
Rim: 951.69 ft
Sump: 948.11 ft

Label: CB @ N.SISE OF DORIS ST.
Rim: 952.92 ft
Sump: 949.75 ft

Label: CB @ N. SIDE OF DEE ST.
Rim: 951.69 ft
Sump: 948.25 ft



Label: P-2
Up. Invert: 948.25 ft
Dn. Invert: 948.11 ft
L: 36.00 ft
Size: 24 inch
S: 0.003889 ft/ft

Label: P-4
Up. Invert: 949.75 ft
Dn. Invert: 949.50 ft
L: 36.00 ft
Size: 18 inch
S: 0.006944 ft/ft

Label: P-1
Up. Invert: 948.11 ft
Dn. Invert: 948.00 ft
L: 16.00 ft
Size: 24 inch
S: 0.006875 ft/ft

Label: P-3
Up. Invert: 949.00 ft
Dn. Invert: 948.25 ft
L: 233.50 ft
Size: 24 inch
S: 0.003212 ft/ft

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing, in Doris St @ CP2 & 3
C.B 1569-1, M-1

EQUATION(S):

1. Scupper Capacity (Q)=.67*H\12*L*(2g*Do)^.5)*Fcl
   (D+a) >(H+a) Therefore Orifice Flow)

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height(D) = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. HEIGHT OF CURB OPENING (H) = 5 INCHES
6. Do= .4583334 Ft.=(D+a-H/2)/12

SCUPPER (OR CB W/O GRATE) IN SUMP AREA

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH	STANDARD LENGTH	SCUPPER CAPACITY
CP2&3	4.97=$Q_{10}/2$	4.10	6.00	7.28

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing, in Doris St @ CP 2&3
C.B. 1569-1, M-1 with Flow over Curb

EQUATION(S):

1a. Scupper Capacity (Q)=2.3*(L+1.8*W)*do^1.5*Fcl
(Weir Flow For D1 < (h+a)/12)

1b. Scupper Capicity(Q)=0.67*h/12*L*(64.4*d)^.5*Fcl
(Orifice Flow For D1 > (h+a)/12)

1c. Weir Capacity = 2.63*LWEIR*(H1)^1.5

2. Effective Depth (do)=(Q/(1.84*(L+1.8*W)))^.667= .6000622 FT.

3. Water Depth @ Lip of Curb (d1)=do+h/24= .8083622 FT.

4. Height of Water Above Curb (H1)=d1-(d+a)/12= .1416955 FT.

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height (d)= 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Length of Overtopping Weir= 11 FT.

5. Height of Curb Opening (h)=5-Inches

SCUPPER (OR CB W/O GRATE) IN SUMP WITH CURB OVERFLOW

CONCENTRATION POINT	TOTAL Q	STANDARD LENGTH	OVERTOPPING Q	SCUPPER Q
CP2&3	9.85 = $Q_{100}/2$	6.00	1.52	8.33

NOTE: 1. D1 > (H+a)/12 THEREFORE ORIFICE FLOW PREVAIL
2. SCUPPER 10-YR DESIGN CAPACITY @ L= 6 IS 7.280109 CFS

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing, In Dee St @ CP 4&5
C.B. 1569-1, M-1

EQUATION(S):

1. Scupper Capacity (Q)=.67*H\12*L*(2g*Do)^.5)*Fcl
   (D+a) >(H+a) Therefore Orifice Flow)

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.
2. Curb height(D) = 6 Inches
3. Gutter Depression (a) In Inches= 2 Inches
4. Clogging Factor (Fcl)=0.80
5. HEIGHT OF CURB OPENING (H) = 5 INCHES
6. Do= .4583334 Ft.=(D+a-H/2)/12

SCUPPER (OR CB W/O GRATE) IN SUMP AREA

CONCENTRATION POINT	Q(10YR)	CALCULATED LENGTH	STANDARD LENGTH	SCUPPER CAPACITY
CP4&5	4.20	3.46	6.00	7.28

NOTE: 1. STANDARD LENGTH APPLY TO MAG 533-1 OR PHX P1569-1
2. CALCULATED LENGTH IS SCUPPER LENGTH

CATCH BASIN DESIGN PROCEDURES
MAG 533-1 CATCH BASIN TYPE D, WITH GRATE
(OR EQUIVALENT STANDARD DETAIL)
OR
MAG 206.1 CONCRETE SCUPPER, OR EQUIVILENT
(OR PHOENIX C.B., STD P1569-1 TYPE M, WITHOUT GRATE, OR EQUIV.)

CALCULATIONS BASED ON
MARICOPA COUNTY. HYDRAULICS MANUAL

DETAIL DESCRIPTION Tres Rios Landing, in Dee St @ CP 4&5
C.B. 1569-1, M-1 with Flow over Curb

EQUATION(S):

1a. Scupper Capacity (Q)=2.3*(L+1.8*W)*do^1.5*Fcl
(Weir Flow For D1 < (h+a)/12)

1b. Scupper Capicity(Q)=0.67*h/12*L*(64.4*d)^.5*Fcl
(Orifice Flow For D1 > (h+a)/12)

1c. Weir Capacity = 2.63*LWEIR*(H1)^1.5

2. Effective Depth (do)=(Q/(1.84*(L+1.8*W)))^.667= .4810637 FT.

3. Water Depth @ Lip of Curb (d1)=do+h/24= .6893637 FT.

4. Height of Water Above Curb (H1)=d1-(d+a)/12= 2.269703E-02 FT.

DESIGN DATA:

1. Width of Depression (W)= 1.42 Ft.

2. Curb height (d)= 6 Inches

3. Gutter Depression (a) In Inches= 2 Inches

4. Clogging Factor (Fcl)=0.80

5. Length of Overtopping Weir= 100 FT.

5. Height of Curb Opening (h)=5-Inches

SCUPPER (OR CB W/O GRATE) IN SUMP WITH CURB OVERFLOW

CONCENTRATION POINT	TOTAL Q	STANDARD LENGTH	OVERTOPPING Q	SCUPPER Q
CP4&5	8.34	6.00	0.88	7.46

NOTE: 1. D1 > (H+a)/12 THEREFORE ORIFICE FLOW PREVAIL
2. SCUPPER 10-YR DESIGN CAPACITY @ L= 6 IS 7.280109 CFS

Retention Provided

Retention Basin in Parcel 4, Tract 'B'

BOTTOM = 948.00, AREA = 33243.55 sq. ft.

@ ELEV=949.00, VOL=0.8094 ac. ft., AREA=37272.27 sq. ft.

@ ELEV=950.00, VOL=1.7135 ac. ft., AREA=41489.95 sq. ft.

@ ELEV=951.00, VOL=2.7798 ac. ft., AREA=51409.45 sq. ft.

Retention Provided

Retention Basin in Parcel 5, Tracts 'A' & 'B'
BOTTOM = 941.90, AREA = 83782.40 sq. ft.
@ ELEV=942.90, VOL=2.0521 ac. ft., AREA=94998.46 sq. ft.
@ ELEV=943.90, VOL=4.4112 ac. ft., AREA=110523.27 sq. ft.
@ ELEV=944.90, VOL=7.1010 ac. ft., AREA=123811.54 sq. ft.

PROJECT Tres Rios Landing

SUBJECT Onsite Retention Basins & Drywells

CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____

SHEET ____ OF ____ BY _____ DATE _____

CMX Group Inc
1515 East Missouri
Suite 115
Phoenix, AZ 85014
☎ 602.279.8436
FAX 602.265.1191

CMX

Parcel 4, Tract B

$$Vol = CPA/12 = \frac{(.69)(2.80)(10.40)}{12} = 1.67 \text{ Ac-Ft}$$

No. of Dry Wells (based on 0.50 cfs/dry well

$$= (\text{Ac-Ft})\left(\frac{\text{dry Well}}{0.5\ ft^3/sec}\right)\left(\frac{hrs}{3600 sec}\right)\left(\frac{43560\ ft^3}{\text{Ac-Ft}}\right)\left(\frac{1}{36\ hrs}\right)$$

No = (Ac-Ft) (0.6722 dry well/Ac-Ft)

= (1.67 Ac-Ft)(0.6722) = 1.12 Say 1 dry well

Parcel 5 Tract A

Vol = (.69)(2.80)(43.30)/12 =

= 6.98 Ac-Ft

No of Dry wells = (6.98)(0.6722) = 4.69 Say 5

PROJECT Tres Rios Landing

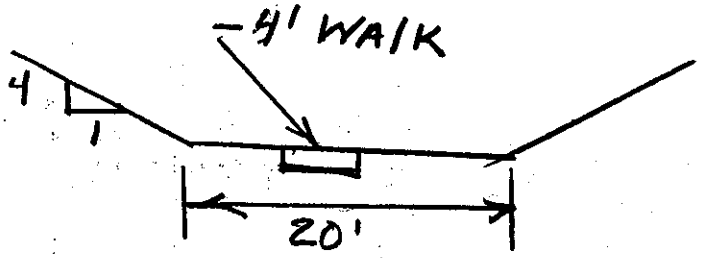
SUBJECT Parcel 4, Tract E Surface Flow

CLIENT PROJECT NUMBER _____ CMX PROJECT NUMBER _____

SHEET ____ OF ____ BY _____ DATE _____

CMX Group Inc
1515 East Missouri
Suite 115
Phoenix, AZ 85014
☎ 602.279.8436
FAX 602.265.1191

Q100 over Top of curb = 2(1.52) = 3.04 cfs
(From Catch basin Design procedures)



$S_o = 0.005325$

For Results See Attached Flow Master Calcs

TRACT E SURFACE FLOW
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	PARCEL 4,TRACT E CH.
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

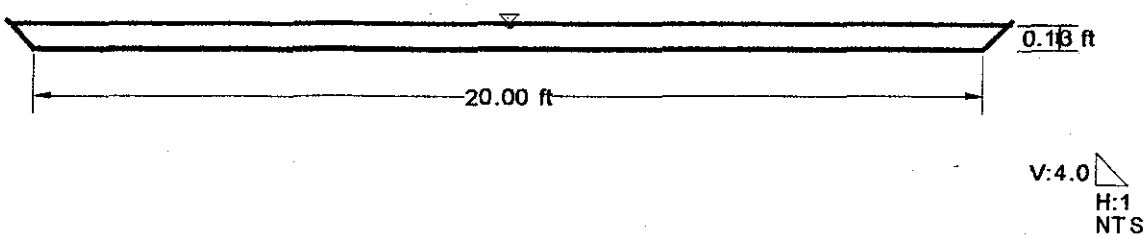
Input Data		
Mannings Coefficient	0.025	
Slope	0.005325	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	20.00	ft
Discharge	3.04	cfs

Results		
Depth	0.13	ft
Flow Area	2.7	ft²
Wetted Perimeter	21.10	ft
Top Width	21.07	ft
Critical Depth	0.09	ft
Critical Slope	0.020545	ft/ft
Velocity	1.11	ft/s
Velocity Head	0.02	ft
Specific Energy	0.15	ft
Froude Number	0.54	
Flow Type	Subcritical	

Cross Section
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	PARCEL 4,TRACT E CH.
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.025	
Slope	0.005325	ft/ft
Depth	0.13	ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	20.00	ft
Discharge	3.04	cfs



Percolation Test And Geological Report For Retention Basins

Project

Tres Rios Landing
SEC, Dysart Road and Buckeye Road
Avondale, Arizona

Prepared For

CMX, L.L.C.
1515 E. Missouri Avenue, Suite 115
Phoenix, Arizona 85014

CONSTRUCTION INSPECTION & TESTING CO.
2137 WEST 7TH STREET
TEMPE, ARIZONA 85281-7227
(480) 446-9876 FAX (480) 446-7580

CONSTRUCTION INSPECTION & TESTING CO.

2137 WEST 7TH STREET
TEMPE, ARIZONA 85281-7227
(480) 446-9876 FAX (480) 446-7580

Tuesday, April 30, 2002

CMX, L.L.C.
1515 E. Missouri Avenue, Suite 115
Phoenix, Arizona 85014

Re: **Percolation Test Report**
For Retention Basins

Project: Tres Rios Landing
SEC, Dysart Road and Buckeye Road
Avondale, Arizona

Project No. 02-20817-1

Attention: Ron Hilgart

In accordance with your request, we have completed the percolation tests for Tres Rios Landing in accordance with the requirements as of May 1, 1988, for the city of Avondale.

The accompanying report presents the results of this testing.

Respectfully Submitted,
Construction Inspection & Testing Co.

Prepared By: Gregory S. Wnenta

Registered Professional Engineer (Civil)
CERTIFICATE NO. 26880
SCOTT R. SMITH
Date Signed 4-30-02
ARIZONA U.S.A.

Scott R. Smith, P.E.

Copies to: Addressee (3)

Tres Rios Landing
SEC, Dysart Road and Buckeye Road
Avondale, Arizona
02-20817-1

Percolation Test Report
For Retention Basins

In accordance with the city of Avondale requirements as of May 1, 1988, the following items are submitted:

1. General Description of Area:

   Tres Rios Landing consists of approximately 50 acres of native desert land. The topography has a slight downward slope towards the southwest.

3. Method of Making Soil Profile & Percolation Tests:

   Two (2) test holes 12" in diameter were excavated utilizing a hand shovel. The holes were lined with an impermeable membrane, pre-soaked and water levels recorded at five-minute intervals until uniformity in rate of fall. The "stabilized rates" were determined from the above fall/time results.

4. Map Showing Location of Test Pits:

   See Attached Site Plan

Tres Rios Landing
SEC, Dysart Road and Buckeye Road
Avondale, Arizona
02-20817-1

5. Boring Logs and Percolation Test Results:

Stabilized percolation rates as determined for the retention basins in cubic feet per hour per square foot are given in the following table:

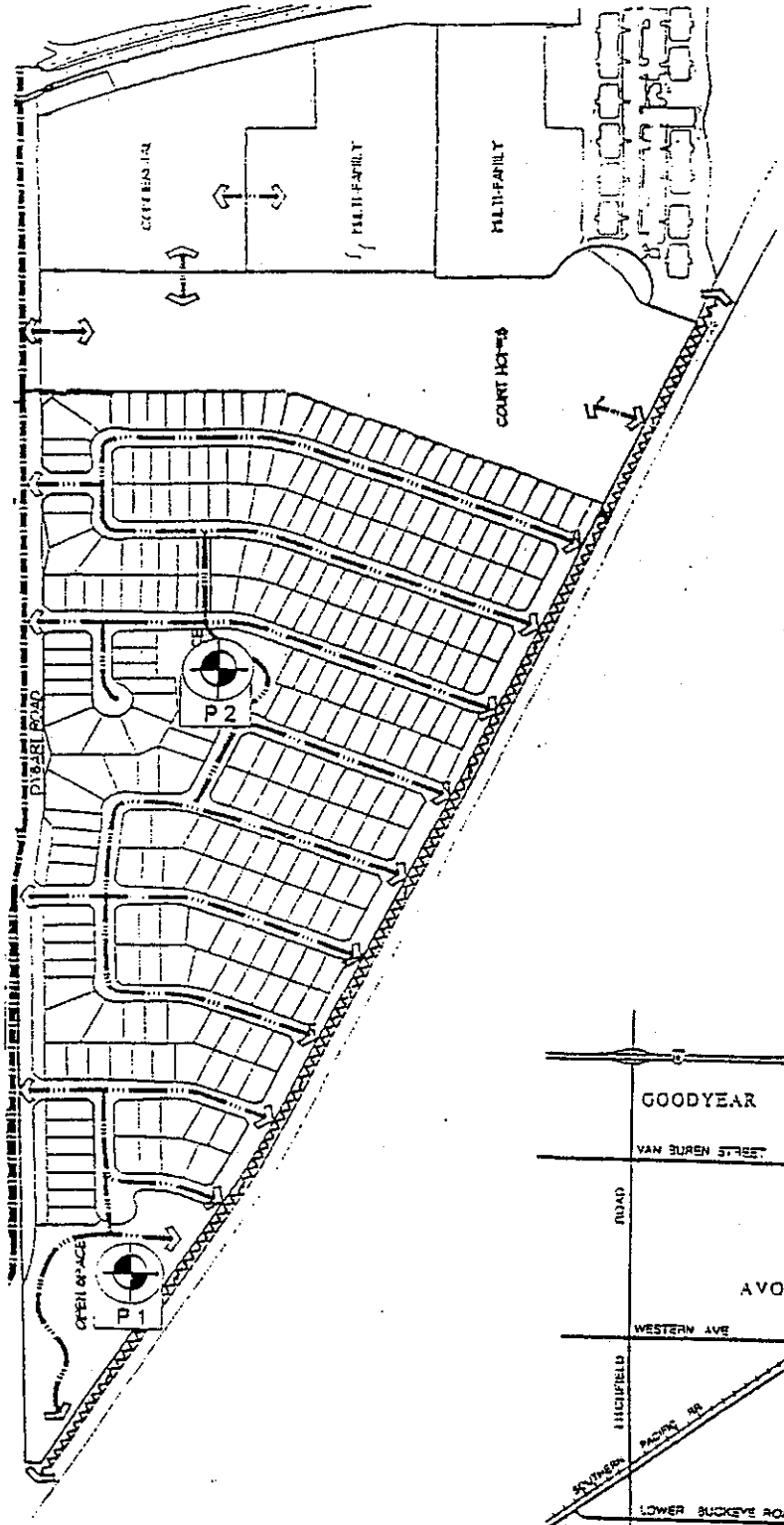
Test Hole	Depth Below Natural Ground	Soil Type	Percolation Rate (Ft3/Ft2/Hr)
P1	3.5'	Sandy Silt	0.75
P2	3.5'	Sandy Silt	1.00

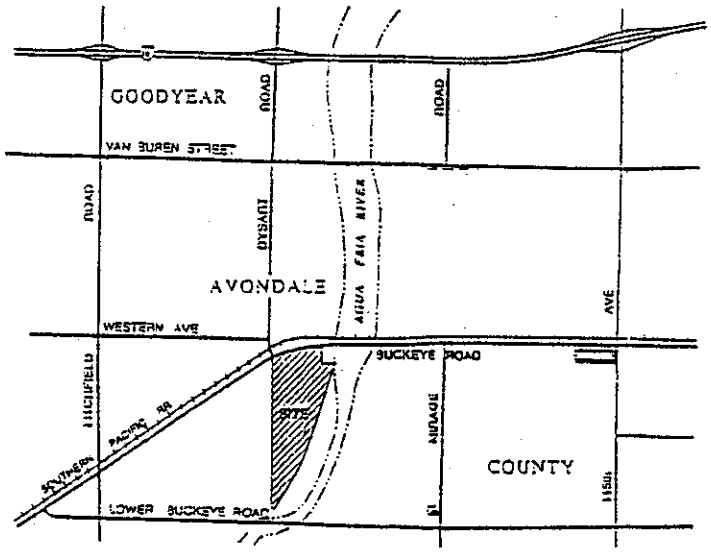
6. Description of Topography:

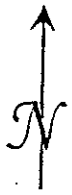
See Item 1

8. Present and Future Uses Around Site:

The immediate area surrounding the site is primarily residential. Vacant land to the West is currently under construction for residential living. Surrounding land uses will probably change as the surrounding area is developed.







GEND:

APPROXIMATE TEST HOLE LOCATION

SITE PLAN

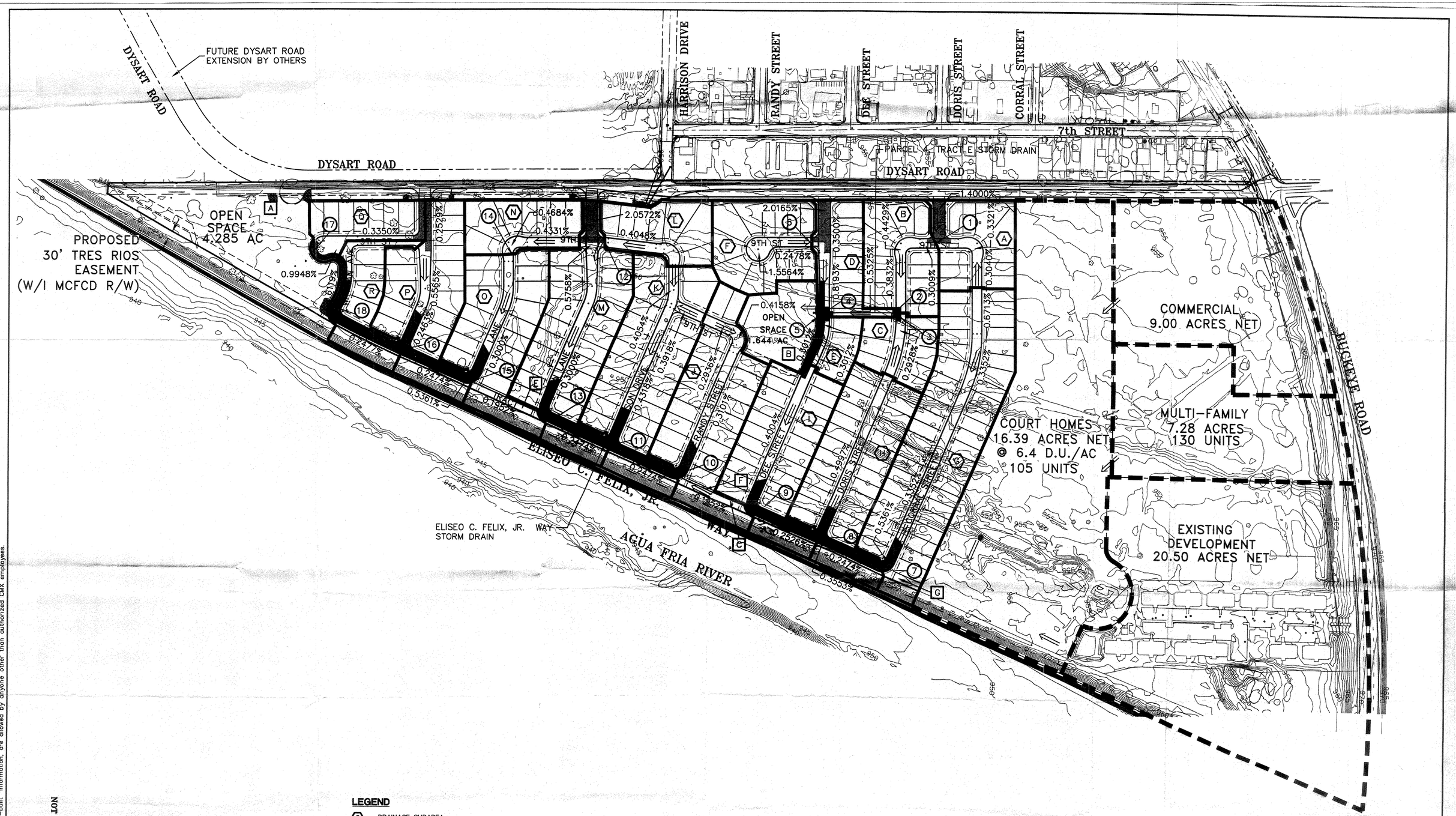
SCALE: N.T.S.	DRAWN BY:cr	DATE:4/30/02

TRES RIOS LANDING

SEC, DYSART ROAD AND BUCKEYE ROAD

AVONDALE, ARIZONA

C.I.T. PROJECT NO.:02-20817-1



ONSITE DRAINAGE MAP

NOT TO SCALE

LEGEND

- DRAINAGE SUBAREA
- DRAINAGE CONCENTRATION POINT
- ONSITE SUBAREA DRAINAGE BOUNDARY
- SURFACE FLOW DIRECTION
- OFFSITE SUBAREA DRAINAGE BOUNDARY
- RETENTION BASIN AND/OR TRACT IDENTIFICATION
- CATCH BASIN
- SCUPPER
- 6" VERTICAL STREET CURB FOR DRAINAGE
- OTHER 6" VERTICAL STREET CURB

LAND USE TABLE

PADD PARCEL NO.	GROSS AREA (AC)	NET AREA (AC)	LAND USE ZONING	MIN. LOT SIZE	UNITS	GROSS DENSITY	NET DENSITY
4	27.96	26.14	SINGLE FAMILY 5.6 D.U./AC	45' X 110'	147	5.26	5.62
5	31.74	29.84	SINGLE FAMILY 3.94 D.U./AC	53' X 110'	119	3.75	3.99
DYSART EXTENTION TO BUCKEYE	1.50	0	R/W	NA	NA	NA	NA
TOTALS	61.20	55.98			266	4.35	4.75

TRES RIOS LANDING

DYSART ROAD & BUCKEYE ROAD
AVONDALE, ARIZONA

EXHIBIT "B"

CMX

CMX PROJ. 6125	
DATE:	10-02-02
SCALE:	N.T.S.
DESIGNED: JDL	DRAWN: CMX	APPROVED: CMX
REV.	DWG. NO. 1
	SHT. 1 OF 1

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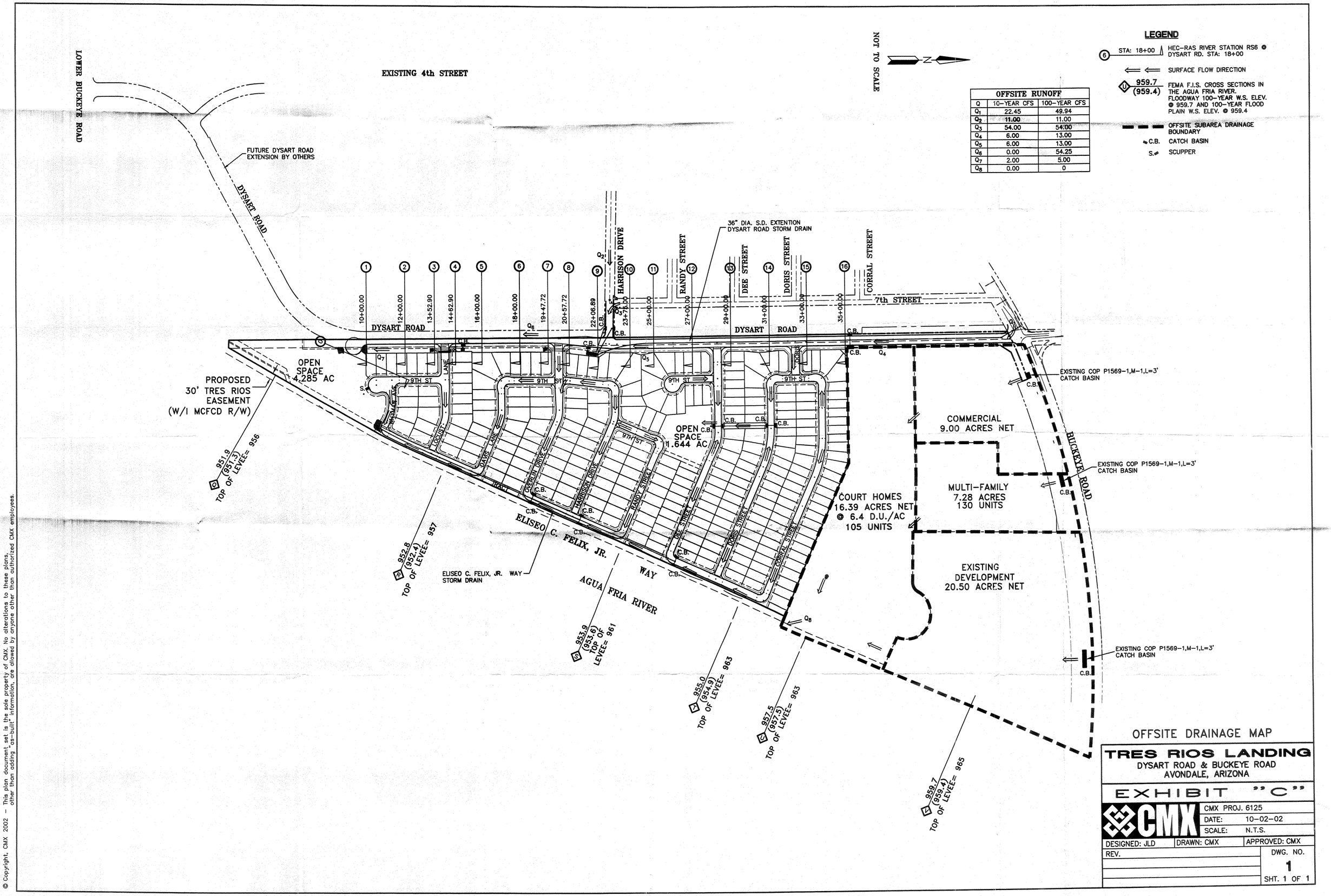

OFFSITE RUNOFF		
Q	10-YEAR CFS	100-YEAR CFS
Q_1	22.45	49.94
Q_2	11.00	11.00
Q_3	54.00	54.00
Q_4	6.00	13.00
Q_5	6.00	13.00
Q_6	0.00	54.25
Q_7	2.00	5.00
Q_8	0.00	0

OFFSITE DRAINAGE MAP

TRES RIOS LANDING
DYSART ROAD & BUCKEYE ROAD
AVONDALE, ARIZONA

EXHIBIT "C"

CMX

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