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PRELIMINARY/FINAL DRAINAGE REPORT

FOR

AUSTIN BLUFFS PARKWAY

FROM

WOODMEN ROAD NORTH TO MEADOW RIDGE

July, 1997

Prepared For:

LP47,LLC,dba
LA PLATA INVESTMENTS, L.L.C.
7150 Campus Drive, Suite 365
Colorado Springs, CO 80920
(719) 260-7477

Prepared By:

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4935 North 30th Street
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Job No. 8715.71

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FROM
Woodmen ROAD NORTH TO MEADOW RIDGE

DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

7-28-97

Kyle R. Campbell, Colorado P.E.#29794 Date
For and On Behalf of JR Engineering, Ltd.

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: LP47, LLC dba La Plata Investments,LLC

By:

Bob Ingels

Title: Director, Land Development

Address: 7150 Campus Drive, Suite 365

Colorado Springs, CO 80920

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

7/28/97

City Engineer Date

Conditions:

Recycled

PRELIMINARY/FINAL DRAINAGE REPORT
AUSTIN BLUFFS PARKWAY
FROM
Woodmen ROAD NORTH TO MEADOW RIDGE

TABLE OF CONTENTS

APPENDIX

PRELIMINARY/FINAL DRAINAGE REPORT
AUSTIN BLUFFS PARKWAY
FROM
Woodmen ROAD NORTH TO MEADOW RIDGE

PURPOSE

This document is the Preliminary/Final Drainage Report for Austin Bluffs Parkway (Pilot Road). The purpose of this report is to estimate anticipated storm water runoff quantities, recommend specific solutions for on-site and off-site drainage problems resulting from this development, and identify necessary improvements to safely route storm water runoff to adequate outfall facilities.

GENERAL DESCRIPTION

Austin Bluffs Parkway (Pilot Road) is located in the east half of Section 2, Township 13 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso, State of Colorado. The site is bounded to the south by Woodmen Road and Cottonwood Creek, to the north by Meadow Ridge Drive, to the east by Fairfax Residential Development and unplatted land and to the west by unplatted lands.

The development consists of construction of approximately 600 L.F. of full section minor arterial roadway, approximately 1600 L.F. of partial section roadway with no curb and gutter and associated permanent and temporary drainage improvements. The project extends between Woodmen Road and Meadow Ridge Drive exclusive of the required bridge to be constructed over Cottonwood Creek. The full section roadway is located at the northern end of the project.

The soils that exist within the project area and the contributing watershed are predominantly "Blakeland Soils" belonging to the Hydrologic Soil Group "A" as determined by the "Soil Survey of El Paso County Area" prepared by SCS. A small portion of the project area contains some "Stapleton Sandy Loam Soils" belonging to Hydrologic Soil Group "B".

EXISTING DRAINAGE CONDITIONS

Austin Bluffs Parkway (Pilot Road) is located in the Cottonwood Creek Drainage Basin. This area was examined in the report "Cottonwood Creek Drainage Basin Planning Study", prepared by URS Consultants, dated June 9, 1994. A recent analysis of the majority of the off-site watershed contributing runoff to the project was provided in the "Final Drainage Report" for Fairfax at Briargate Filing No. 6, prepared by JR Engineering, dated May 1997.

At present the land is vacant and drainage is primarily sheet flow to a tributary to Cottonwood Creek. The northern terminus of the project is impacted by significant flow that is developed offsite and collected in the existing interim section of Austin Bluffs Parkway located north of the project area. This flow is concentrated at analysis point DP-1, as shown on the drainage plan. The flow in the street at DP-1 was estimated to be Q_{100} = 227 cfs and Q_5 = 80 cfs in the Final Drainage Report for Fairfax at Briargate Filing No. 6, By J R Engineering. The limits of the watershed contributing to DP-1 are shown on the Vicinity Map contained in the Appendix. With the addition of flowby from the inlets located at DP-1 and DP-2 in Meadow Ridge Drive the total estimated flow contributed to the northern end of the project (DP-4) is Q_{100} = 240 cfs and Q_5 = 85 cfs. This flow exceeds the capacity of Austin Bluffs Parkway per current City of Colorado Springs criteria. This flow currently leaves the Austin Bluffs Parkway Street section at the southwest corner (non curbed) of the intersection with Meadow Ridge Drive and flows directly into the adjacent unimproved natural channel located south of Meadow Ridge Drive.

PROPOSED DRAINAGE CHARACTERISTICS

Construction of this project will include 8" high curb and gutter along the west side of 600' L.F. of Austin Bluffs Parkway located immediately south of Meadow Ridge Drive. The effect of this construction and associated raising of the grade between the adjacent unimproved channel and Austin Bluffs Parkway will be that the off-site flow concentrated at DP-4 will be confined to the street section. Two D-10-R inlets , 1- 25' long and 1- 20' long, are proposed to be constructed along the west curb immediately south of the intersection to intercept a large portion of this flow Q_{100} = 165 cfs Q_5 = 68 cfs and divert it to the existing adjacent unimproved channel via. a proposed 48"

diameter storm drain and associated temporary rip rap outlet protection. The proposed 48" diameter storm drain will ultimately connect to a permanent drainage conveyance to be constructed adjacent to Austin Bluffs Parkway in the future. The existing unimproved channel has sufficient capacity to handle this flow. Erosion that has been a problem at the intersection in the past will be mitigated. Erosion in the existing channel will be mitigated in the future with construction of the permanent conveyance. The flowby from these proposed inlets at DP-4 (estimated to be Q_{100} = 75 cfs and Q_5 = 17 cfs) will be combined with runoff from basin "E" resulting in flow rates of Q_{100} = 80 cfs and Q_5 = 21 cfs at analysis point DP-5 located at the end of the proposed full street section. A proposed 20' long D-10-R inlet will intercept an estimated Q_{100} = 41 cfs and Q_5 = 14 cfs at DP-5 leaving Q_{100} = 39 cfs and Q_5 = 7 cfs in the street. The intercepted flow will be conveyed to the proposed storm drain outfall from Fairfax at Briargate Filing No. 6 that will cross Austin Bluffs Parkway near DP-5. Flow in this storm drain east of DP-5 was estimated at Q_{100} = 87 cfs and Q_5 = 36 cfs in the Final Drainage Report for Fairfax at Briargate Filing No. 6. The combined flow intercepted at DP-5 and from Fairfax Filing No. 6 will be conveyed via. a proposed 48" diameter storm drain to a temporary earth lined trapezoidal channel (Channel "A") that will discharge to the existing unimproved channel adjacent to Austin Bluffs Parkway. The proposed Channel "A" will have limited rip rap protection at the outlet of the 48" diameter storm drain and at the entrance to the existing channel (unless non erodible materials encountered) to mitigate erosion. The existing natural channel has the capacity to handle this flow. The proposed temporary Channel "A" will have a 8' bottom width, 3:1 side slopes, and will carry the 100 year peak flow rate at approximately 2' deep at a minimum slope of 0.5%.When the permanent conveyance along Austin Bluffs Parkway is constructed the 48"diameter storm drain will be connected directly to that facility. The proposed curb and gutter will end just south of DP-5, so flowby from the inlet at DP-5 , (Q_{100} = 39 cfs and Q_5 = 7 cfs), will exit the street section and will be directed to the above mentioned proposed temporary channel. Temporary erosion mitigation measures will be employed at this location to prevent excessive erosion in large events.

to be constructed adjacent to the east side of Austin Bluffs Parkway to Cottonwood Creek. The ditch is planned to be a minimum depth of 1.5' and will convey the 100 year peak flow rate at a depth of 1.1' at minimum slopes of 3.0%. Rip rap lining will be constructed at the outlet of the ditch into Cottonwood Creek where slopes exceed 3% unless an erosion resistant material is encountered in the invert of the ditch.

The relatively minor flow (Q_{100} = 4 cfs and Q_5 = 2 cfs) from Basin "J" will be allowed to sheet flow to the west to Cottonwood Creek. Runoff from Basin "I" (Q_{100} = 1 cfs and Q_5 = 3 cfs) will sheet flow from the street to the adjacent natural channel adjacent to the west side of the street It is believed that these minor flows will present less of an erosion hazard if left unconcentrated than they would if collected in a ditch.

The runoff calculations for both the developed and undeveloped conditions assume that Fairfax Filing No. 6 Subdivision is in place. The adjacent property south of the land owned by LP47, LLC dba, La Plata Investments Inc, is assumed to be undeveloped in both conditions as it is not currently known how the onsite drainage will be handled in that area and construction of this project will not unduly restrict drainage outfall options from the property.

In the condition that was assumed to exist when the subject project is constructed, flow rates into the project will be high and in excess of the carrying capacity of the upstream facilities. This high flow rate is a result of upstream development that occurred when less stringent drainage requirements were enforced. It is the developers' understanding that the City will not require the developer to build facilities to treat the excess flow from subdivisions developed under the old criteria, unless such facilities are shown in the Cottonwood Drainage Basin Planning Study. The drainage facilities proposed for this project will however intercept the bulk of these excess flows at the upstream end of the project. The result will be that the bulk of the project will come very close to meeting the current City standards for street conveyance capacity with no additional treatment upstream.

The improvements needed to mitigate potential erosion and flooding hazards in Austin Bluffs Parkway north of the project area are not included in the current Drainage Basin Planning Study. It is recommended that these facilities be included in the Drainage Basin Planning Study if the study is updated in the future. If additional upstream improvements to intercept a portion of flow are constructed in the future, the project will easily meet the current City capacity standards. If no additional upstream drainage facilities are constructed in the future, additional inlets will be required along Austin Bluffs Parkway south of the Briargate property when the ultimate street section with curb and gutter is constructed. In the interim condition, the flow-by from inlets to be constructed with the current project will be conveyed from the end of the curb and gutter section to the adjacent existing natural drainage channel via a temporary channel as noted above.

As shown in the Basin Data Summary on the Drainage Plan contained in the Appendix the cumulative increase to peak discharge rates due to construction of this project will be approximately 9 cfs in the 5 year storm and 11 cfs in the 100 year storm. Because this increase in discharge is spread throughout the project and is not significant when compared to the flow rates in the natural conveyances, it will be discharged to the negative impact to downstream facilities due to construction of this project will be negligible.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. The Rational Method was used to estimate storm water runoff anticipated from the design storms with 5 and 100 year recurrence intervals.

EROSION CONTROL PLAN

The City of Colorado Springs Drainage Criteria Manual specifies that an Erosion Control Plan and associated cost estimate be submitted in conjunction with the Final Drainage Report. Sheets 2 thru 4 of the improvement plans for the project containing erosion control information have been included in the appendix of this report.

FLOODPLAIN STATEMENT

The portion of this site over Cottonwood Creek is within a designated F.E.M.A. Floodplain as determined by Flood Insurance Rate Map Community Panel Number 08041C0528 F dated March 17, 1997. See the Floodplain Information Map contained in the Appendix for the location of the floodplain.

CONSTRUCTION COST OPINION

Public Drainage Facilities (Non-Reimbursable)

ITEM	DESCRIPTION	QUANTITY	UNIT COST	COST
1.	20' D-10-R Inlet	2 EA	$ 7,600.00	$ 15,200.00
2.	25' D-10-R Inlet	1 EA	$ 8,500.00	$ 8,500.00
3.	30" DIA Storm Drain	10 LF	$ 40.00	$ 400.00
4.	42" DIA Storm Drain	570 LF	$ 70.00	$ 39,900.00
5.	48" DIA Storm Drain	120 LF	$ 90.00	$ 10,800.00
6.	Storm Drain Bend	3 EA	$ 1,200.00	$ 3,600.00
7.	Storm Drain Wye	1 EA	$ 1,500.00	$ 1,500.00
8.	Type 'M' rip rap with filter	650 CY	$ 25.00	$ 16,250.00
9.	Ditch/Channel Excavation	1900 CY	$ 1.25	$ 2,375.00
		SUB-TOTAL		**$ 98,525.00**
		10% Engineering and Contingencies		$ 9,852.50
		TOTAL		**$108,377.50**

JR Engineering, Ltd. cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

EROSION AND SEDIMENT CONTROL COST OPINION

ITEM	DESCRIPTION	QUANTITY	UNIT COST		COST
1.	3 Bale Check Dam	10	$12/EA	$	120.00
2.	25% Maintenance and Placement	1 L.S.	$30/LS	$	30.00
		TOTAL		**$**	**150.00**

JR Engineering, Ltd. cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

SUMMARY

Construction of this project will not adversely affect surrounding developments. Runoff from the offsite areas contributing to the project will be intercepted and conveyed to the existing unimproved channel adjacent to Austin Bluffs Parkway or directly to Cottonwood Creek via. permanent and temporary drainage facilities to be constructed with this project. Site specific storm drain facilities that will be constructed with this project include a 20-foot and a 25-foot D-10-R inlet at the south west corner of the intersection of Austin Bluffs Parkway and Meadow Ridge Drive and associated 48" diameter storm drain from the inlets to the adjacent unimproved channel, rip rap protection at the outlet of the 48" storm drain, the storm drain outfall from Fairfax Filing No. 6 consisting of 42" and 48" diameter storm drain and a temporary eathern channel connecting the storm drain to the existing unimproved channel located west of the project, rip rap erosion protection at the outlet of the Fairfax No. 6 outfall line and at the entrance to the unimproved channel as required, a 20-foot D-10-R inlet to be located along the west curb of Austin Bluffs Parkway approximately 550 linear feet south of the intersection with Meadow Ridge Drive and 30" diameter storm drain to connect it to the Fairfax 6 storm drain outfall, a temporary roadside ditch to be located along the east side of

Austin Bluffs Parkway beginning approximately 600 linear feet south of Meadow Ridge Drive and extending to Cottonwood Creek, and rip rap erosion protection at the outlet of the roadside ditch to Cottonwood Creek as required.

As indicated previously the increase to the peak flow rate in the facilities that the project facilities will discharge to will be insignificant. The impact of this project on the downstream facilities will be negligible.

PREPARED BY:

Vancel Fossinger

Vancel Fossinger
Project Engineer
For and On Behalf of JR Engineering, Ltd.

/vb/871571/drainage.rpt

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated October, 1991.

2. Engineering Study of Cottonwood Creek Drainage Basin, Lincoln DeVore, August 7, 1979.

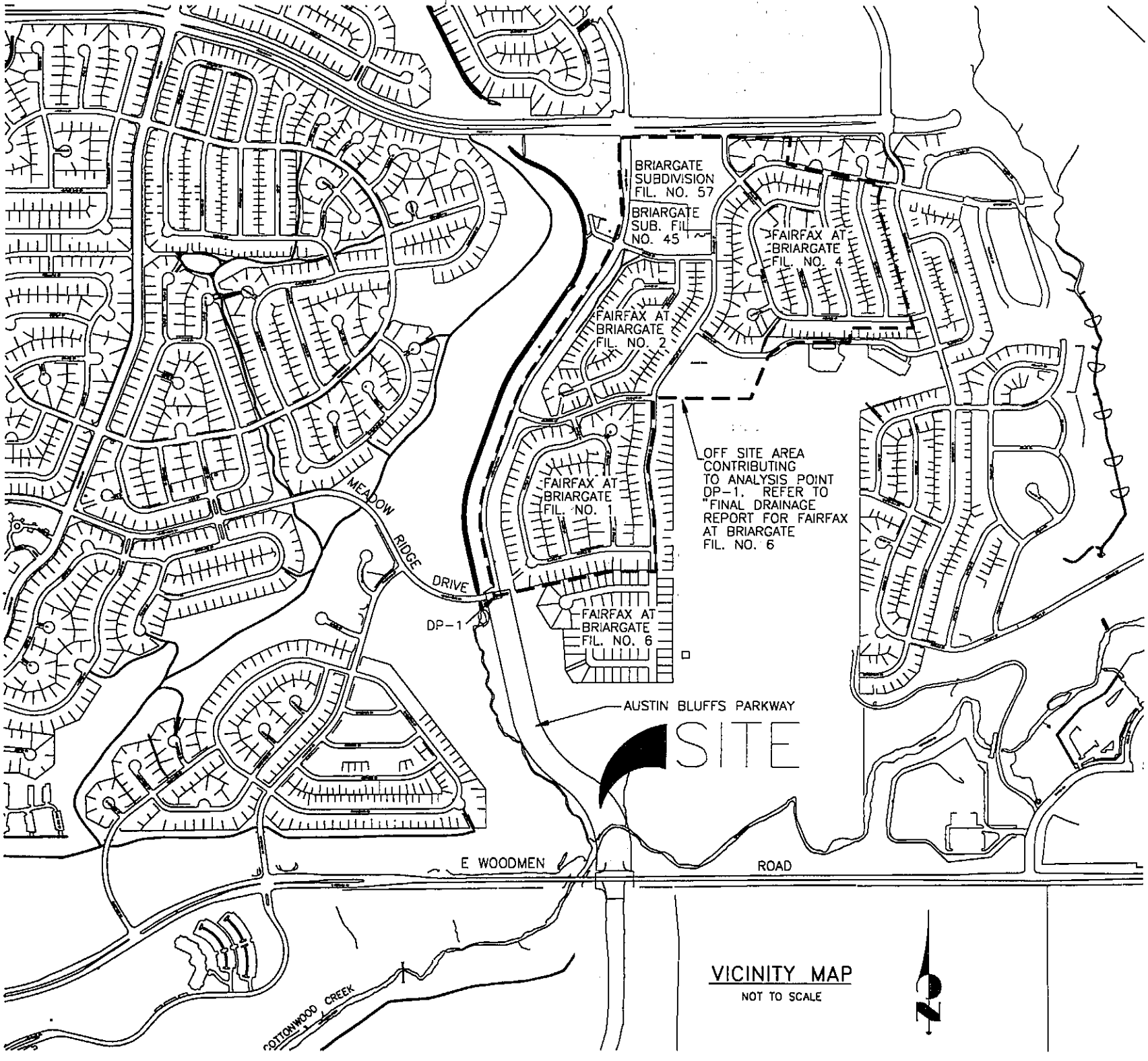
3. Cottonwood Creek Drainage Basin Planning Study, URS Consultants, June 9, 1994.

4. Drainage Report and Plan, Fairfax at Briargate Filing No. 1, Fairfax at Briargate Filing No. 2, Fairfax at Briargate Filing No. 4, Leigh Whitehead and Associates, March 1985.

5. Final Drainage Report for Fairfax at Briargate Filing No. 6, JR Engineering, Ltd. May 1997.

APPENDIX

VICINITY MAP


BRIARGATE SUBDIVISION FIL. NO. 57
BRIARGATE SUB. FIL NO. 45
FAIRFAX AT BRIARGATE FIL. NO. 4
FAIRFAX AT BRIARGATE FIL. NO. 2
FAIRFAX AT BRIARGATE FIL. NO. 1
FAIRFAX AT BRIARGATE FIL. NO. 6
OFF SITE AREA CONTRIBUTING TO ANALYSIS POINT DP-1. REFER TO "FINAL DRAINAGE REPORT FOR FAIRFAX AT BRIARGATE FIL. NO. 6
MEADOW RIDGE DRIVE
DP-1
AUSTIN BLUFFS PARKWAY
SITE
E WOODMEN ROAD
COTTONWOOD CREEK
VICINITY MAP
NOT TO SCALE
N

F.E.M.A. FLOODPLAIN MAP

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 528 OF 1300

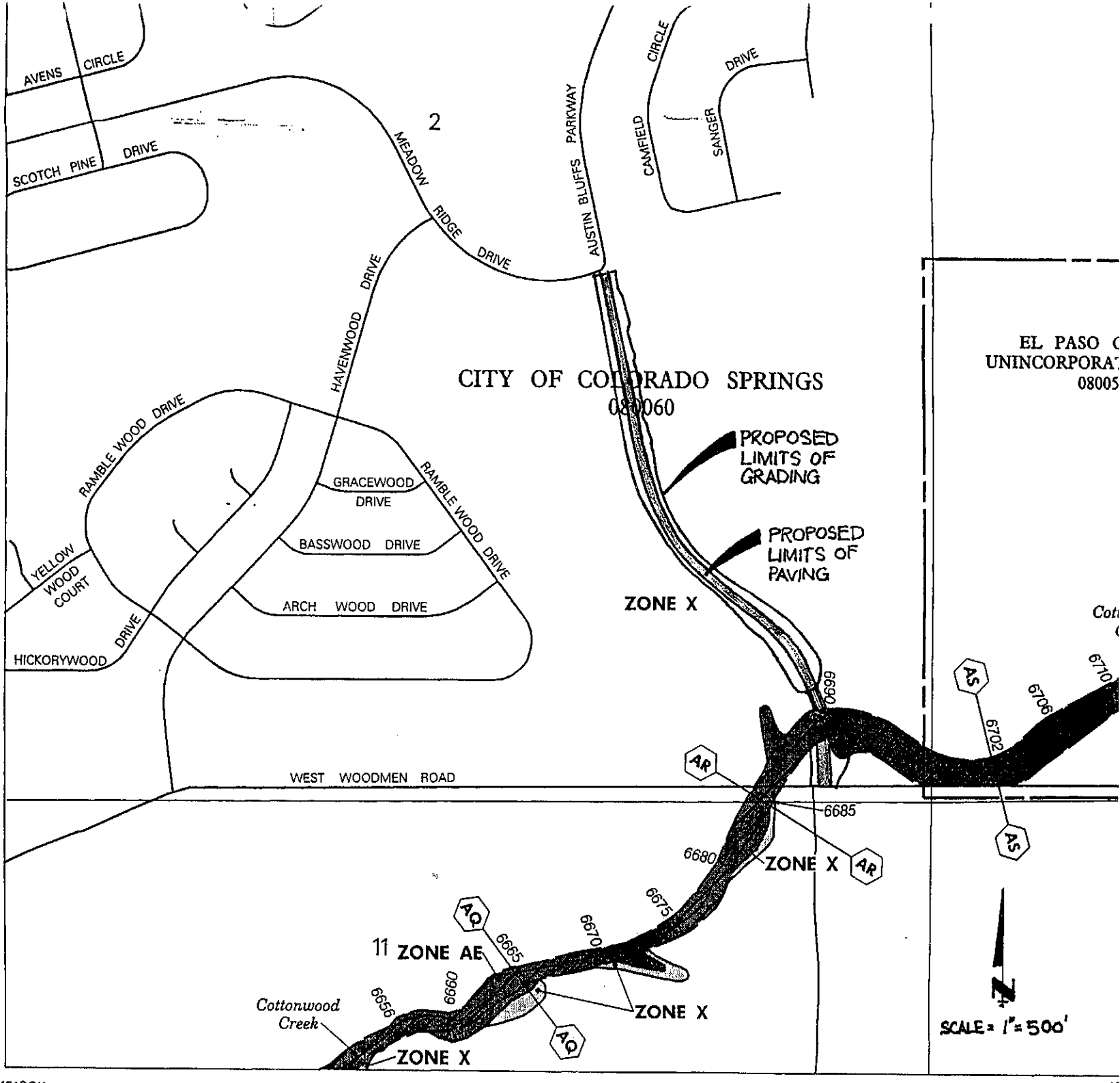
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0528	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0528	F

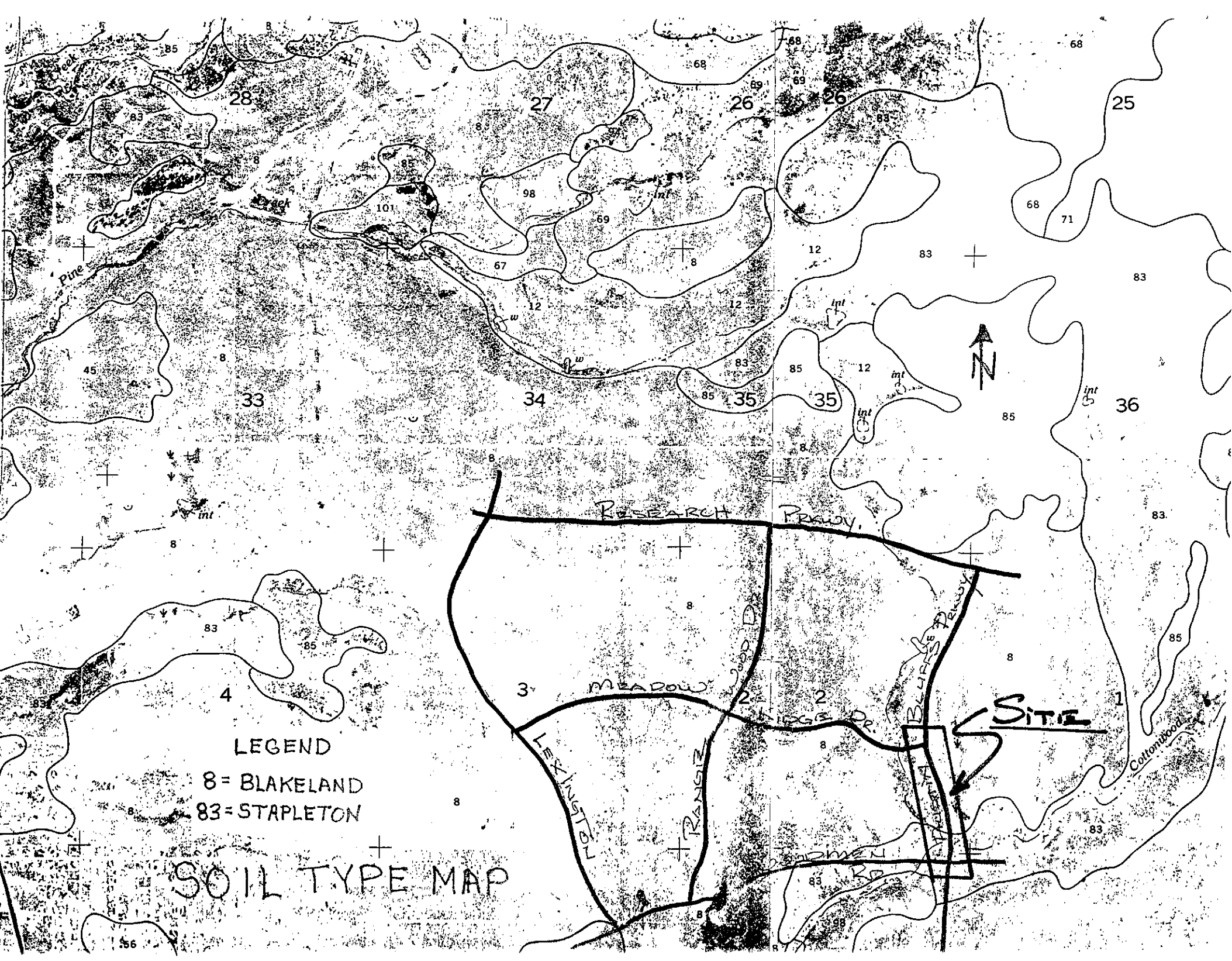
MAP NUMBER
08041C0528 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency



S.C.S. SOIL MAP


RESEARCH PKWY.
MEADOW RD. DR.
LEXINGTON
RANGE
BELLARS PKWY
SITE
Cottonwood
LEGEND
8 = BLAKELAND
83 = STAPLETON
SOIL TYPE MAP

HYDROLOGIC CALCULATIONS

AUSTIN BLUFFS PILOT ROAD
FINAL DRAINAGE REPORT
(Area Drainage Summary)

DEVELOPED

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5) * For Calcs See Runoff Summary	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
A	3.00	0.32	0.54	0.25	100	3.50	10.5	1000	9.0%	10.5	1.6	12.1	3.8	6.5	4	11
														CA(equiv.)	0.96	1.62
B	0.30	0.90	0.95	0.25	10	0.20	4.0	600	8.0%	9.9	1.0	5.0	5.0	9.1	1	3
														CA(equiv.)	0.27	0.29
C	5.90	0.34	0.42	0.25	200	14.00	11.8	900	9.0%	10.5	1.4	13.3	3.7	6.2	7	15
														CA(equiv.)	2.01	2.48
D	0.30	0.90	0.95	0.25	10	0.20	4.0	600	8.0%	9.9	1.0	5.0	5.0	9.1	1	3
														CA(equiv.)	0.27	0.29
E	4.80	0.41	0.49	0.25	100	5.00	9.3	900	4.6%	7.5	2.0	11.4	3.9	6.7	8	16
														CA(equiv.)	1.97	2.35
F	2.30	0.35	0.45	0.25	100	16.00	6.4	500	8.8%	10.4	0.8	7.2	4.5	8.0	4	8
														CA(equiv.)	0.80	1.04
G	10.70	0.30	0.39	0.25	100	8.00	8.0	1050	5.0%	7.8	2.2	10.2	4.0	7.0	13	29
														CA(equiv.)	3.21	4.17

AUSTIN BLUFFS PILOT ROAD
FINAL DRAINAGE REPORT
(Area Drainage Summary)

DEVELOPED

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
H	0.50	0.63	0.69	0.25	10	0.20	4.0	400	2.8%	5.9	1.1	5.1	5.0	9.0	2	3
														CA(equiv.)	0.32	0.35
I	0.30	0.90	0.95	0.25	10	0.20	4.0	400	2.8%	5.9	1.1	5.1	5.0	9.0	1	3
														CA(equiv.)	0.27	0.29
J	1.00	0.48	0.57	0.25	100	3.00	11.1	200	1.5%	4.3	0.8	11.8	3.8	6.6	2	4
														CA(equiv.)	0.48	0.57

AUSTIN BLUFFS PILOT ROAD
FINAL DRAINAGE PLAN

COMPOSITE "CA" CALCULATION

(DEVELOPED)

ANALYSIS POINT	SUB-BASIN I.D.	SUB-BASIN AREA (ac)	SUB-BASIN CA(5)	SUB-BASIN CA(100)	COMPOSITE CA(5)	COMPOSITE CA(100)
DP-1	SEE NOTE No. 1 BELOW	N.A.	31.31	54.13		
	TOTAL	N.A.			31.31	54.13
DP-2	A	3	0.96	1.62		
	B	0.3	0.27	0.29		
	TOTAL	3.3			1.23	1.91
DP-3	C	5.9	2.01	2.48		
	D	0.3	0.27	0.29		
	TOTAL	6.2			2.28	2.77
DP-4	DP-1		31.31	54.13		
	F.B. DP-2		0.70	1.14		
	F.B. DP-3		1.26	1.79		
	TOTAL	N.A.			33.27	57.06
DP-5	FB-4B		6.41	17.81		
	E		1.97	2.35		
	TOTAL	N.A.			8.38	20.16
DP-6	F	2.3	0.80	1.04		
	TOTAL	2.3			0.80	1.04
DP-7	F	2.3	0.80	1.04		
	G	10.7	3.21	4.17		
	TOTAL	13			4.01	5.21
DP-8	H	0.5	0.32	0.35		
	TOTAL	0.5			0.32	0.35
DP-9	J	1	0.48	0.57		
	TOTAL	1			0.48	0.57
DP-10	I	0.3	0.27	0.29		
	TOTAL	0.3			0.27	0.29

NOTE No. 1: ANALYSIS POINT DP-1 REPRESENTS THE RUNOFF FROM BASINS LOCATED NORTH AND EAST OF THE INTERSECTION OF MEADOW RIDGE DRIVE AND AUSTIN BLUFFS PARKWAY AS DETERMINED IN THE ANALYSIS DONE FOR THE FINAL DRAINAGE REPORT FOR FAIRFAX AT BRIARGATE FILING NO. 6, BY J R ENGINEERING, LTD, MAY 1997 THIS POINT IS THE SAME AS DP-18 IN THE FAIRFAX NO. 6 REPORT.

AUSTIN BLUFFS PILOT ROAD
FINAL DRAINAGE REPORT
(DEVELOPED CONDITION ROUTING)

ANALYSIS POINT	AREA TOTAL (Ac)	WEIGHTED CA(5) * For Calcs See Runoff Summary	CA(100)	OVERLAND/OTHER SEE NOTE 1 C(5)	Length (ft)	Height (ft)	Tc (min)	STREET / CHANNEL/PIPE Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	Q(100) (c.f.s.)
DP-1		31.31	54.13				28.2					28.2	2.6	4.2	80	227
DP-2 BASINS A+B	3.30	1.23	1.91	0.25	100	3.50	10.5	1000 580	9.0% 8.0%	10.5 9.9	1.6 1.0	13.1	3.7	6.3	5	12
DP-3 BASINS C+D	6.20	2.28	2.77	0.25	200	14.00	11.8	900 580	9.0% 8.0%	10.5 9.9	1.4 1.0	14.2	3.5	6.0	8	17
DP-4 DP-1 + F.B. DP-2 + F.B. DP-3		33.27	57.06				28.2					28.2	2.6	4.2	85	240
DP-5 F.B. AP-4B + BASIN E		8.38	20.16				28.2	950	3.1%	6.2	2.6	30.8	2.4	4.0	21	80
DP-6 BASIN F	2.30	0.80	1.04	0.25	100	16.00	6.4	500	8.8%	10.4	0.8	7.2	4.5	8.0	4	8
DP-7 BASINS F+G	13.00	4.01	5.21	0.25	100	16.00	6.4	1100	2.2%	5.2	3.5	9.9	4.1	7.1	16	37
DP-8 BASIN H	0.50	0.32	0.35	0.25	10	0.20	4.0	400	2.8%	5.9	1.1	5.1	5.0	9.0	2	3
DP-9 BASIN J	1.00	0.48	0.57	0.25	100	3.00	11.1	200	1.5%	4.3	0.8	11.8	3.8	6.6	2	4
DP-10 BASIN I	0.30	0.27	0.29	0.25	10	0.20	4.0	400	2.8%	5.9	1.1	5.1	5.0	9.0	1	3

NOTE 1 : TIME OF CONCENTRATION AND WEIGHTED CA VALUES RELATED TO ANALYSIS POINT "DP-1" ARE TAKEN FROM THE FINAL DRAINAGE REPORT FOR FAIRFAX AT BRIARGATE FILING NO. 6, BY J R ENGINEERING LTD. , MAY 1997. THE POINT DP-1 OF THIS ANALYSIS IS THE SAME AS DP-18 OF THE FAIRFAX ANALYSIS.

AUSTIN BLUFFS PILOT ROAD
FINAL DRAINAGE REPORT
(Area Drainage Summary)

UNDEVELOPED

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5) * For Calcs See Runoff Summary	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
A	3.00	0.32	0.54	0.25	100	3.50	10.5	1000	9.0%	10.5	1.6	12.1	3.8	6.5	4	11
														CA(equiv.)	0.96	1.62
B	0.30	0.90	0.95	0.25	10	0.20	4.0	600	8.0%	9.9	1.0	5.0	5.0	9.1	1	3
														CA(equiv.)	0.27	0.29
C	5.90	0.34	0.42	0.25	200	14.00	11.8	900	9.0%	10.5	1.4	13.3	3.7	6.2	7	15
														CA(equiv.)	2.01	2.48
D	0.30	0.90	0.95	0.25	10	0.20	4.0	600	8.0%	9.9	1.0	5.0	5.0	9.1	1	3
														CA(equiv.)	0.27	0.29
E	4.80	0.30	0.40	0.25	100	5.00	9.3	900	4.6%	7.5	2.0	11.4	3.9	6.7	6	13
														CA(equiv.)	1.44	1.92
F	2.30	0.32	0.41	0.25	100	16.00	6.4	500	8.8%	10.4	0.8	7.2	4.5	8.0	3	8
														CA(equiv.)	0.74	0.94
G	10.70	0.26	0.36	0.25	100	8.00	8.0	1050	5.0%	7.8	2.2	10.2	4.0	7.0	11	27
														CA(equiv.)	2.78	3.85

AUSTIN BLUFFS PILOT ROAD
FINAL DRAINAGE REPORT
(Area Drainage Summary)

UNDEVELOPED

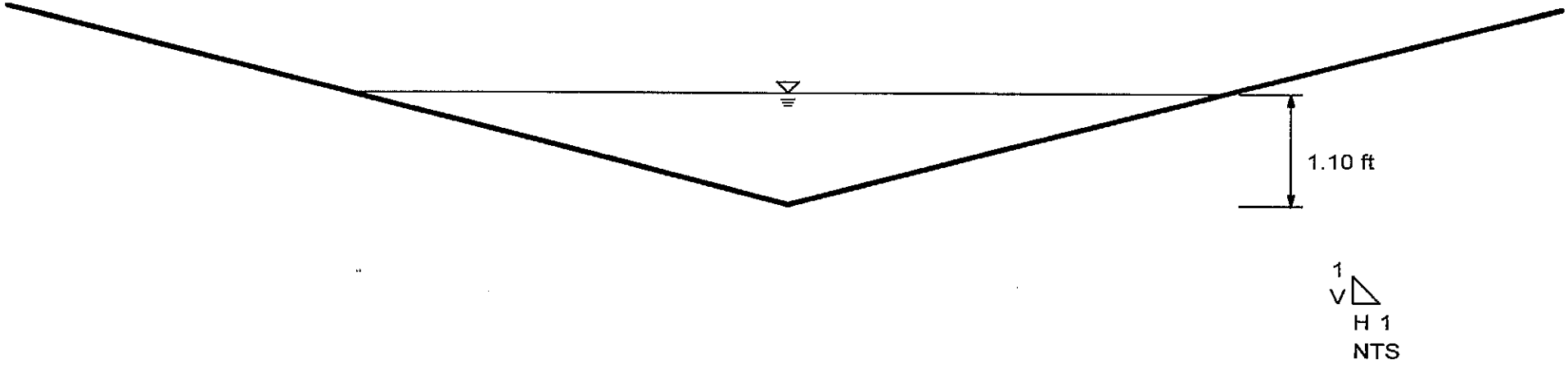
BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
H	0.50	0.25	0.35	0.25	150	8.00	11.2	30	13.0%	12.6	0.0	11.2	3.9	6.7	**0**	**1**
														CA(equiv.)	**0.13**	**0.18**
I	0.30	0.25	0.35	0.25	200	6.00	15.6	200	3.0%	6.1	0.5	16.2	3.4	5.7	**0**	**1**
														CA(equiv.)	**0.07**	**0.11**
J	1.00	0.25	0.35	0.25	100	3.00	11.1	200	1.5%	4.3	0.8	11.8	3.8	6.6	**1**	**2**
														CA(equiv.)	**0.25**	**0.35**

HYDRAULIC CALCULATIONS

ROADSIDE DITCH (EARTH LINED)
Cross Section for Triangular Channel

Project Description	
Project File	x:\871571\hydro\abpkw.fm2
Worksheet	ROADSIDE DITCH
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.022	
Channel Slope	0.030000	ft/ft
Depth	1.10	ft
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Discharge	37.00	cfs



ROADSIDE DITCH (EARTH LINED)
Rating Table for Triangular Channel

Project Description	
Project File	x:\871571\hydro\abpkw.fm2
Worksheet	ROADSIDE DITCH
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Constant Data		
Mannings Coefficient	0.022	
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Discharge	37.00	cfs

Input Data			
	Minimum	Maximum	Increment
Channel Slope	0.030000	0.100000	0.010000 ft/ft

Rating Table		
Channel Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
0.030000	1.10	7.68
0.040000	1.04	8.56
0.050000	1.00	9.31
0.060000	0.96	9.96
0.070000	0.94	10.56
0.080000	0.91	11.10
0.090000	0.89	11.60
0.100000	0.88	12.07

ROADSIDE DITCH (RIP RAP LINED)
Rating Table for Triangular Channel

Project Description	
Project File	x:\871571\hydro\abpkw.fm2
Worksheet	ROADSIDE DITCH
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Constant Data		
Mannings Coefficient	0.040	
Left Side Slope	4.000000	H : V
Right Side Slope	4.000000	H : V
Discharge	37.00	cfs

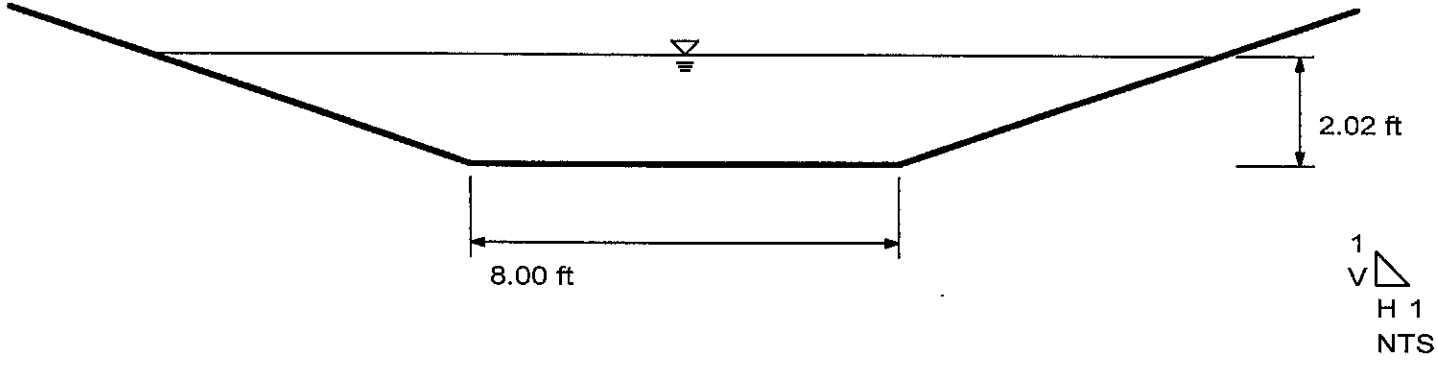
Input Data			
	Minimum	Maximum	Increment
Channel Slope	0.030000	0.100000	0.010000 ft/ft

Rating Table		
Channel Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
0.030000	1.37	4.91
0.040000	1.30	5.47
0.050000	1.25	5.94
0.060000	1.21	6.36
0.070000	1.17	6.74
0.080000	1.14	7.09
0.090000	1.12	7.41
0.100000	1.10	7.71

TEMPORARY CHANNEL 'A' (EARTH LINED)
Cross Section for Trapezoidal Channel

Project Description	
Project File	x:\871571\hydro\abpkw.fm2
Worksheet	TEMPORARY CHANNEL 'A'
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.022	
Channel Slope	0.005000	ft/ft
Depth	2.02	ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	8.00	ft
Discharge	167.00	cfs



TEMPORARY CHANNEL 'A' (EARTH LINED)
Rating Table for Trapezoidal Channel

Project Description	
Project File	x:\871571\hydro\abpkw.fm2
Worksheet	TEMPORARY CHANNEL 'A'
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Constant Data		
Mannings Coefficient	0.022	
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	8.00	ft
Discharge	167.00	cfs

Input Data			
	Minimum	Maximum	Increment
Channel Slope	0.005000	0.100000	0.005000 ft/ft

Rating Table

Channel Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
0.005000	2.02	5.88
0.010000	1.69	7.55
0.015000	1.52	8.73
0.020000	1.41	9.68
0.025000	1.33	10.48
0.030000	1.27	11.17
0.035000	1.22	11.80
0.040000	1.17	12.37
0.045000	1.14	12.89

TEMPORARY CHANNEL 'A' (EARTH LINED)
Rating Table for Trapezoidal Channel

Rating Table		
Channel Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
0.050000	1.10	13.38
0.055000	1.08	13.83
0.060000	1.05	14.26
0.065000	1.03	14.66
0.070000	1.01	15.04
0.075000	0.99	15.41
0.080000	0.97	15.76
0.085000	0.95	16.10
0.090000	0.94	16.42
0.095000	0.93	16.73
0.100000	0.91	17.03

TEMPORARY CHANNEL 'A' (RIP RAP LINED)
Rating Table for Trapezoidal Channel

Project Description	
Project File	x:\871571\hydro\abpkw.fm2
Worksheet	TEMPORARY CHANNEL 'A'
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Constant Data		
Mannings Coefficient	0.040	
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	8.00	ft
Discharge	167.00	cfs

Input Data			
	Minimum	Maximum	Increment
Channel Slope	0.005000	0.100000	0.005000 ft/ft

Rating Table		
Channel Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
0.005000	2.72	3.80
0.010000	2.29	4.90
0.015000	2.07	5.68
0.020000	1.92	6.30
0.025000	1.82	6.83
0.030000	1.73	7.29
0.035000	1.67	7.71
0.040000	1.61	8.09
0.045000	1.56	8.44

TEMPORARY CHANNEL 'A' (RIP RAP LINED)
Rating Table for Trapezoidal Channel

Rating Table		
Channel Slope (ft/ft)	Depth (ft)	Velocity (ft/s)
0.050000	1.52	8.76
0.055000	1.48	9.06
0.060000	1.45	9.35
0.065000	1.42	9.62
0.070000	1.39	9.88
0.075000	1.36	10.12
0.080000	1.34	10.36
0.085000	1.32	10.58
0.090000	1.30	10.80
0.095000	1.28	11.01
0.100000	1.26	11.21

Worksheet
Worksheet for Circular Channel

Project Description	
Project File	untitled.fm2
Worksheet	FAIRFAX NO. 6 STORM DRAIN OUTFALL
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	48.00	in

Results		
Depth	4.00	ft
Discharge	143.64	cfs
Flow Area	12.57	ft²
Wetted Perimeter	12.57	ft
Top Width	0.00	ft
Critical Depth	3.54	ft
Percent Full	100.00	
Critical Slope	0.008934	ft/ft
Velocity	11.43	ft/s
Velocity Head	2.03	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	154.51	cfs
Full Flow Capacity	143.64	cfs
Full Flow Slope	0.010000	ft/ft

Worksheet
Worksheet for Circular Channel

Project Description	
Project File	untitled.fm2
Worksheet	FAIRFAX NO. 6 STORM DRAIN OUTFALL
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Diameter	48.00	in
Discharge	126.00	cfs

Results		
Depth	2.90	ft
Flow Area	9.77	ft^2
Wetted Perimeter	8.16	ft
Top Width	3.57	ft
Critical Depth	3.37	ft
Percent Full	72.62	
Critical Slope	0.007353	ft/ft
Velocity	12.89	ft/s
Velocity Head	2.58	ft
Specific Energy	5.49	ft
Froude Number	1.37	
Maximum Discharge	154.51	cfs
Full Flow Capacity	143.64	cfs
Full Flow Slope	0.007695	ft/ft
Flow is supercritical.		

Worksheet
Worksheet for Circular Channel

Project Description	
Project File	untitled.fm2
Worksheet	MEADOWRIDGE/AUSTIN BLUFFS PKWY INLET SD
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Slope

Input Data		
Mannings Coefficient	0.013	
Diameter	48.00	in
Discharge	165.00	cfs

Results		
Channel Slope	0.013196	ft/ft
Depth	48.0	in
Flow Area	12.57	ft^2
Wetted Perimeter	12.57	ft
Top Width	0.00	ft
Critical Depth	3.70	ft
Percent Full	100.00	
Critical Slope	0.011433	ft/ft
Velocity	13.13	ft/s
Velocity Head	2.68	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	177.49	cfs
Full Flow Capacity	165.00	cfs
Full Flow Slope	0.013196	ft/ft

Worksheet
Worksheet for Circular Channel

Project Description	
Project File	untitled.fm2
Worksheet	MEADOWRIDGE/AUSTIN BLUFFS PKWY INLET SD
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

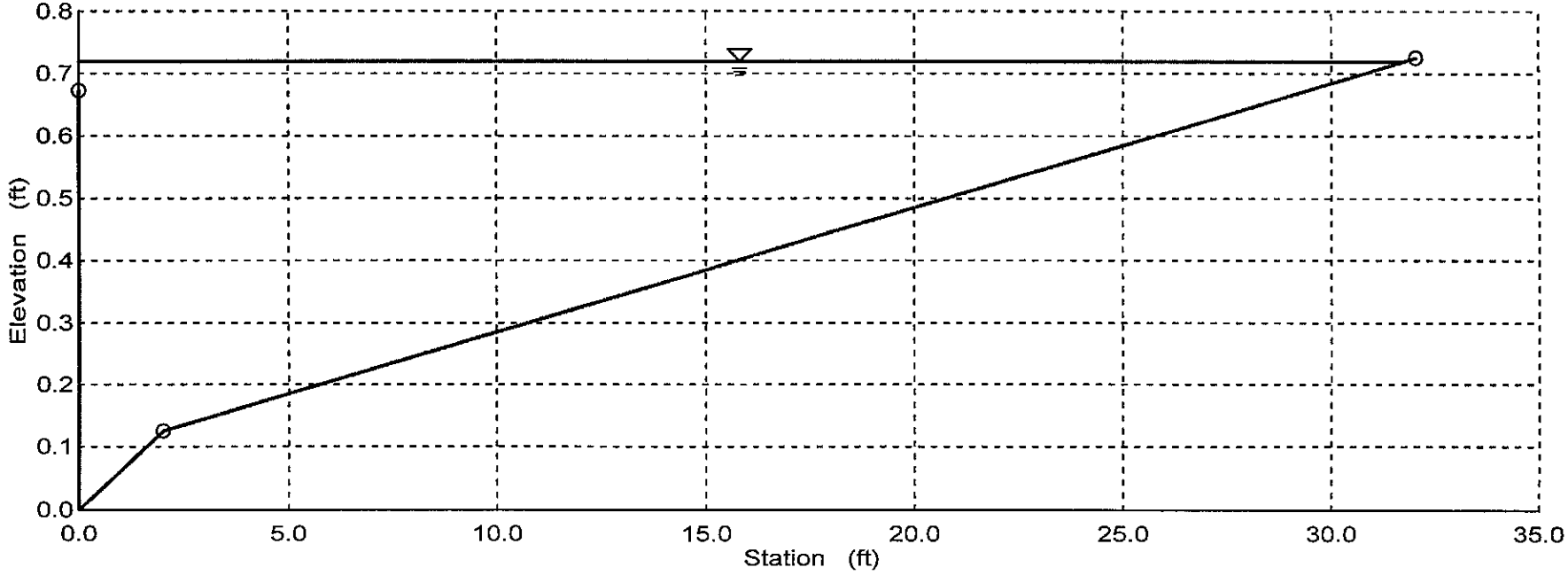
Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.020000	ft/ft
Diameter	48.00	in
Discharge	165.00	cfs

Results		
Depth	32.8	in
Flow Area	9.16	ft^2
Wetted Perimeter	7.79	ft
Top Width	3.72	ft
Critical Depth	3.70	ft
Percent Full	68.42	
Critical Slope	0.011433	ft/ft
Velocity	18.01	ft/s
Velocity Head	5.04	ft
Specific Energy	7.78	ft
Froude Number	2.02	
Maximum Discharge	218.51	cfs
Full Flow Capacity	203.13	cfs
Full Flow Slope	0.013196	ft/ft
Flow is supercritical.		

AUSTIN BLUFFS PARKWAY AT DP-5
Cross Section for Irregular Channel

Project Description	
Project File	x:\871571\hydro\abpkw.fm2
Worksheet	AUSTIN BLUFFS PKWY CAPACITY
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.031000	ft/ft
Water Surface Elevation	0.72	ft
Discharge	80.00	cfs



AUTIN BLUFFS PILOT ROAD
INLET CALCULATIONS

DP-2
100-YR. FLOW

Q(100)	12	I(100)	6.3	Inlet size ? L(i) =	4
DEPTH	0.28	Fr	2.41	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	10.0	L(1)	18.5		
				If Li > L(2) then Qi =	5
CROSS SLOPE	2.0%	L(2)	11.1	CA(eqv.) =	0.7603
STREET SLOPE	4.0%	L(3)	39.7	FB =	7
				CA(eqv.) =	1.14

5-YR. FLOW

Q(5)	5	I(10)	3.7	Inlet size ? L(i) =	4
DEPTH	0.20	Fr	2.14	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	5.9	L(1)	9.7		
				If Li > L(2) then Qi =	3
CROSS SLOPE	2.0%	L(2)	5.8	CA(eqv.) =	0.6981
STREET SLOPE	4.0%	L(3)	20.9	FB =	2
				CA(eqv.) =	0.65

DP-3
100-YR. FLOW

Q(100)	17	I(100)	6.0	Inlet size ? L(i) =	4
DEPTH	0.32	Fr	2.49	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	11.9	L(1)	22.7		
				If Li > L(2) then Qi =	6
CROSS SLOPE	2.0%	L(2)	13.6	CA(eqv.) =	1.0407
STREET SLOPE	4.0%	L(3)	48.9	FB =	11
				CA(eqv.) =	1.79

5-YR. FLOW

Q(5)	8	I(10)	3.5	Inlet size ? L(i) =	4
DEPTH	0.24	Fr	2.29	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	7.9	L(1)	13.8		
				If Li > L(2) then Qi =	4
CROSS SLOPE	2.0%	L(2)	8.3	CA(eqv.) =	1.0238
STREET SLOPE	4.0%	L(3)	29.8	FB =	4
				CA(eqv.) =	1.26

DP-4A
100-YR. FLOW

Q(100)	240	I(100)	4.2	Inlet size ? L(i) =	25
DEPTH	0.86	Fr	3.11	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	39.5	L(1)	94.2		
				If Li > L(2) then Qi =	104
CROSS SLOPE	2.0%	L(2)	56.4	CA(eqv.) =	24.737
STREET SLOPE	4.0%	L(3)	202.8	FB =	136
				CA(eqv.) =	32.41

5-YR. FLOW

Q(5)	85	I(10)	2.6	Inlet size ? L(i) =	25
DEPTH	0.58	Fr	2.88	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	25.3	L(1)	55.9		
				If Li > L(2) then Qi =	45
CROSS SLOPE	2.0%	L(2)	33.5	CA(eqv.) =	17.438
STREET SLOPE	4.0%	L(3)	120.3	FB =	40
				CA(eqv.) =	15.25

DP-4B
100-YR. FLOW

Q(100)	136	I(100)	4.2	Inlet size ? L(i) =	20
DEPTH	0.73	Fr	2.74	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	32.6	L(1)	68.7		
				If Li > L(2) then Qi =	61
CROSS SLOPE	2.0%	L(2)	41.3	CA(eqv.) =	14.569
STREET SLOPE	3.3%	L(3)	147.3	FB =	75
				CA(eqv.) =	17.81

5-YR. FLOW

Q(5)	40	I(10)	2.6	Inlet size ? L(i) =	20
DEPTH	0.46	Fr	2.48	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	18.9	L(1)	35.8		
				If Li > L(2) then Qi =	23
CROSS SLOPE	2.0%	L(2)	21.4	CA(eqv.) =	8.9719
STREET SLOPE	3.3%	L(3)	77.0	FB =	17
				CA(eqv.) =	6.41

DP-5
100-YR. FLOW

Q(100)	80	I(100)	4.0	Inlet size ? L(i) =	20
DEPTH	0.60	Fr	2.55	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	26.1	L(1)	50.9		
				If Li > L(2) then Qi =	41
CROSS SLOPE	2.0%	L(2)	30.5	CA(eqv.) =	10.126
STREET SLOPE	3.1%	L(3)	109.6	FB =	39
				CA(eqv.) =	9.87

5-YR. FLOW

Q(5)	21	I(10)	2.4	Inlet size ? L(i) =	20
DEPTH	0.36	Fr	2.27	If Li < L(2) then Qi =	
				CA(eqv.) =	
SPREAD	14.1	L(1)	24.5		
				If Li > L(2) then Qi =	14
CROSS SLOPE	2.0%	L(2)	14.7	CA(eqv.) =	5.9356
STREET SLOPE	3.1%	L(3)	52.8	FB =	7
				CA(eqv.) =	2.81

DRAINAGE MAP