

MASTER DEVELOPMENT DRAINAGE PLAN

FOR

POWERWOOD/GREENBRIAR

Prepared For:
Mr. Freid Zarie
480 East Happy Canyon
Castle Rock, CO 80108

And

Holger C. Christiansen & Partners, P.C.
100 East St Vrain Street, Suite 300
Colorado Springs, CO 80903

Prepared By:
Associated Design Professionals, Inc.
1861 Austin Bluffs Parkway, Suite 101
Colorado Springs, Colorado 80918
(719) 266-5212


Revised May 22, 2003
000303MDDP

RETURN WITHIN 2 WEEKS TO:
CITY OF COLORADO SPRINGS
SUBDIVISION ENGINEERING
30 SOUTH NEVADA AVE., SUITE 702
COLORADO SPRINGS, CO 80903
(719) 385-5978



ENGINEERS STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision 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/County 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.

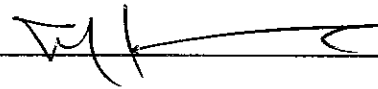

Michael A. Bartusek, P.E., #23329



DEVELOPER'S STATEMENT:

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



Freid Zarie
Business Name

By: 

Title: _____

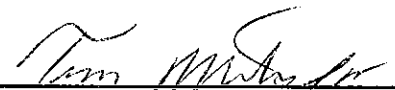
Address: 480 East Happy Canyon
Castle Rock, CO 80108

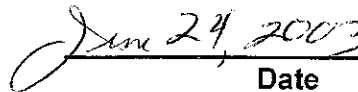
Holger C. Christiansen & Partners, P.C.
Business Name

By: 
Title: 

Address: 100 E. St. Vrain St., Ste 300
Colo. Spgs., CO 80903

Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, Colorado, 1980, as amended.


City Engineer


Date

Conditions:

POWERWOOD/GREENBRIAR MASTER DEVELOPMENT DRAINAGE PLAN

GENERAL

This is a drainage study for the platting and annexation of a 127.97-acre site described as Powerwood Retail Center and Greenbriar Retail Center. The site is located within the Cottonwood Creek Drainage Basin in Colorado Springs, Colorado. The future development of this property consists of a hospital site, medical/office center, commercial retail center, and industrial/office complex. This study will consider the impact, if any, on the existing development and neighboring properties.

This site is located south of Woodman Road between Templeton Gap Road and Powers Boulevard. No portion of the site is within a designated FEMA 100-year floodplain as designated on Map No. 08041C0529F, dated March 17, 1997. According to the El Paso County Area Soil Survey, the soil on the site is classified as a Blakeland Sandy Loam. This soil can be described as having a rapid permeability, slow surface runoff and a moderate hazard of erosion. The soil classification is 'A'; however, a soil classification of 'B' will be used for this study.

This site has been previously studied in the following reports:

- *Cottonwood Creek DBPS*, prepared by URS Consultants, dated June 1994
- *Cottonwood Creek Drainage Basin Planning Study*, prepared by Ayres Associates, dated June 2000
- *Powers Boulevard/Woodmen Road Interchange Preliminary Drainage Report*, prepared by URS Consultants, dated February 2002

METHOD OF COMPUTATIONS:

The Methodology utilized for this report is in accordance with the *City/County Drainage Criteria Manual*. The Rational Method for computation of runoff was used.

$$Q = cia$$

Where Q = maximum rate of runoff in cubic feet per second
c = runoff coefficient representing drainage area characteristics
i = average rainfall intensity, in inches per hour, for the duration
required for the runoff to become established
a = drainage basin size in acres

EXISTING DRAINAGE CHARACTERISTICS

Powerwood

The site is currently an undeveloped vacant area. The slope across the site is predominately four to six percent in a westerly direction. Off-site basins OS1, OS2, OS3, OS4, OS5, and OS6 contribute flows to the drainage. Portions of sub-basins OS4 and OS7 contain the site of the closed landfill.

The existing drainage pattern flows to two different drainage basins (A & B). Drainage Basin A1 is located in the northwestern corner of the property and contains one 60" RCP that flows under Powers Boulevard at Woodmen Road. These flows continue along Woodmen Road in a series of ditches and pipes in Cottonwood Creek. Off-site Basin OS1 contributes to this flow. Drainage Basin B1 is south of the property and flows under Powers Boulevard through three 60-inch CMPs. Sub-Basin B1 flows to the southwestern corner of the property and then to drains south through Sub-Basin OS3. Sub-Basin OS2 also contributes to this flow. Both of these existing drainage facilities take the flows under and to the western side of Powers Boulevard.

Greenbriar

The site is also currently an undeveloped vacant area. The existing terrain has a high point in the eastern center of the property. Flows are directed to the west onto the Powerwood property and to the south. Sub-Basin A2 flows west onto the Powerwood property and is taken to the 60" RCP.

Sub-Basin C2 in the northeastern corner of the property flows along the Templeton Gap Road roadway ditch and combines with flows from OS5 and OS6. These flows cross

Templeton Gap Road through an existing 35" x 24" culvert. These flows continue along the east side of Templeton Gap Road until they head overland and into Sand Creek. The eastern portion of C1 flows toward Templeton Gap Road until it turns westward, entering an existing swale through the property currently owned by Powers Boulevard Associates. The western portion of C1 flows enters a broad swale that flows south through property owned by the Polaceks. This swale crosses onto the Powers Boulevard Associates property, then turns westerly, joining flows from Templeton Gap Road. The existing swale continues to the two 60-inch and one 54" CMP under Powers Boulevard.

Based on the existing conditions of the site, the following storm flows will result:

Sub-Basin	5-Year Flow (CFS)	100-Year Flow (CFS)
OS1	7.3	13.8
OS2	5.2	10.5
OS3	9.3	18.6
OS4	8.5	20.7
OS5	12.4	30.3
OS6	8.0	19.5
OS7	19.2	47.0
A1	8.6	20.9
A2	17.6	42.9
B1	15.2	37.2
C1	33.7	82.4
C2	11.2	27.3
D1	7.3	13.8
DP-1	26.3	61.9
DP-2	20.6	46.8
DP-3	27.3	66.9
DP-4	62.0	151.6
DP-5	80.9	194.6

PROPOSED DRAINAGE CHARACTERISTICS

The proposed development will consist of two developments, Powerwood and Greenbriar Retail Centers. Powerwood Development will consist of a new hospital site. This Lot has two separate sub-basins (A & B). Sub-Basin A carries the drainage flows to the proposed 54-inch RCP storm sewer to be constructed by CDOT at the southeast corner of Woodmen Road and Powers Boulevard (see URS plans in Appendix C). Until the new drainage system is installed

by CDOT the existing 60-inch culvert will carry the developed flows under Woodmen Road and down to Cottonwood Creek.

Under the developed conditions, flows from Woodmen Road (Basin OS1) will combine with flows from the northwest corner of the site (Basins A1 and A2). A 30-inch storm sewer will transport flows from Sub-Basin A2 and intercept flows from Sub-Basin A1 and the hospital building and direct them into the new CDOT storm system. The combined Q_{100} is 138.3 cfs, which is greater than historic flows but within the capacity of the proposed CDOT 54-inch RCP storm sewer at the intersection of Powers Boulevard and Woodmen Road. These flows have been coordinated with CDOT. The final on-site storm sewer design will be coordinated with the final CDOT storm sewer.

Sub-Basin B will intercept flows from the hospital site, as well as from a portion of the medical and commercial developments. These areas will be heavily landscaped to fit into the hospital site plan. Flows from Sub-Basin B2 will be directed to the southwest corner of the sub-basin where they will be collected in a storm sewer and directed to the proposed public detention basin in a protected swale. Sub-Basin B1 will flow to the southwest portion of the hospital site where it will be intercepted by a 30-inch RCP storm sewer and directed into the detention basin through a five-foot lined swale. The proposed public 3.7-acre foot detention basin will reduce developed flows, based on the rational method, from 124.2 cfs to 37.5 cfs. The flows from the detention basin will be directed into a 36-inch RCP to be located within an existing drainage and utility easement along the east side of Powers Boulevard. This system is acceptable to the Colorado Department of Health.

Basin OS5 crosses under Woodmen Road through a 36-inch CMP. No change is planned to this pipe under the upcoming roadway improvements. Basins OS6 and OS5 combine and flow to the roadway ditch and will continue under Templeton Gap Road at the 35" x 24" CMP. These flows will continue along the east side of Templeton Gap Road until they head overland in a swale flowing easterly. These off-site areas are tributary to the Sand Creek Basin.

36"
↙

Most of the Greenbriar development will continue flowing south toward the existing three CMPs that cross Powers Boulevard as described below. Basin C3 will be regarded and directed toward Tutt Boulevard and the southerly road connecting Tutt Boulevard with Templeton Gap Road. This basin will be intercepted by a 30-inch storm sewer and directed west along a proposed interior roadway. The storm sewer will increase in size to a 42-inch storm sewer with the inclusion of Basin C2. The 42-inch storm sewer will turn south along proposed Tutt Boulevard, where flows from Basin C1 will enter the storm sewer. At this point, the storm sewer will turn west and be directed to the public Detention Basin 2. This facility will be located in the southwest corner of the proposed industrial area of the Greenbriar development. The 7.3-acre foot detention basin will reduce developed flows from 262.0 cfs to 81 cfs. These detained flows will be released and spread out into the existing broad swale at historic levels. A drainage easement may still need to be obtained from the Poleceks and Powers Boulevard Associates to transport the flows to Powers Boulevard; however, no improvements are anticipated at this time. The drainage easement will be obtained at the time of platting. This detention basin may also be relocated to a point closer to Powers Boulevard if the Polecek and Powers Boulevard Associates property is annexed into the City.

The Cottonwood Creek DBPS does not detail any improvements within the Powerwood or Greenbriar developments. The only improvement specified in the DBPS is the upgrading of the Powers Boulevard culvert from two 60-inch and one 54" CMP to a DBL 6-foot by 9-foot RCBC. However, as part of the Powers Boulevard improvements for CDOT the existing culvert crossing will be replaced with two 66-inch RCPs. The potential future developed flow at the Powers Boulevard culvert would be 419.4 cfs. However, with the construction of the proposed detention basins, the flows under Powers Boulevard would be limited to the historic rate of 194.6 cfs.

Based on the developed conditions of the site, the following storm flows will result:

Sub-Basin	5-Year Flow (CFS)	100-Year Flow (CFS)
OS1	11.4	21.5
OS2	5.2	10.5
OS3	9.3	18.6
OS4	8.5	20.7
OS5	12.4	30.3
OS6	8.2	20.1
OS7	19.2	47.0
A1	30.4	61.9
A2	37.7	70.3
B1	33.1	65.1
B2	37.6	70.1
C1	94.5	188.7
C2	45.2	78.9
C3	30.1	52.5
D1	40.9	71.5
DP-1	71.5	138.3
DP-2	64.9	124.2
DP-3	18.5	45.1
DP-4	72.0	125.8
DP-5	139.8	262.0
DP-6	181.0	333.9
DP-7	28.0	68.6
DP-8	76.4	147.1
DP-9	223.6	419.4

Although the Cottonwood Creek Drainage Basin plan allows for the release of developed flows, several adjacent landowners along the *historic drainageway* will not accept developed flows as shown in the Cottonwood Creek study. The landowners who will not accept developed flows include the owner of the greenbelt south of the Bridle Pass subdivision and several downstream landowners from Dublin Boulevard to Oakwood and then downstream approximately 2,000 feet. The inability to release developed flows also affects the area west of Powers Boulevard, which also contributes flows to the greenbelt and to additional downstream properties.

In addition, the greenbelt, which is the natural drainageway, has been filled in by the owner, Richard Dalby. Both the city of Colorado Springs and El Paso County have notified Mr.

Dalby that the greenbelt must be restored to its previous condition. Until the greenbelt is restored, flows will be trespassing onto Norwood's property in the proposed open space.

DRAINAGE FEES

Drainage fees for 2003 for the Cottonwood Creek Drainage Basin are as follows:

Powerwood

Drainage Fees:	\$8002/Acre x 35.583 =	\$284,735.17
Bridge Fees:	\$676/Acre x 35.583 =	24,054.11
Total Fees:		\$308,789.28

Greenbriar

Drainage Fees:	\$8002/Acre x 92.383=	\$739,248.77
Bridge Fees:	\$676/Acre x 92.383 =	62,450.91
Total Fees:		\$801,699.68

Since only historic undeveloped flows will be permitted west of Powers Boulevard at the existing three 54-inch CMPs, the detention ponds are proposed to be permanent public reimbursable structures pending City/County Drainage Board approval. The developer will present the following proposals to the City/County Drainage Board:

1. accept the detention pond as a public reimbursable facility,
 2. exempt the unplatted areas tributary to the pond from paying drainage fees
 3. amend the Cottonwood Creek drainage fee.
- ✓ will not be suggested by the City SRM 6/24/03*

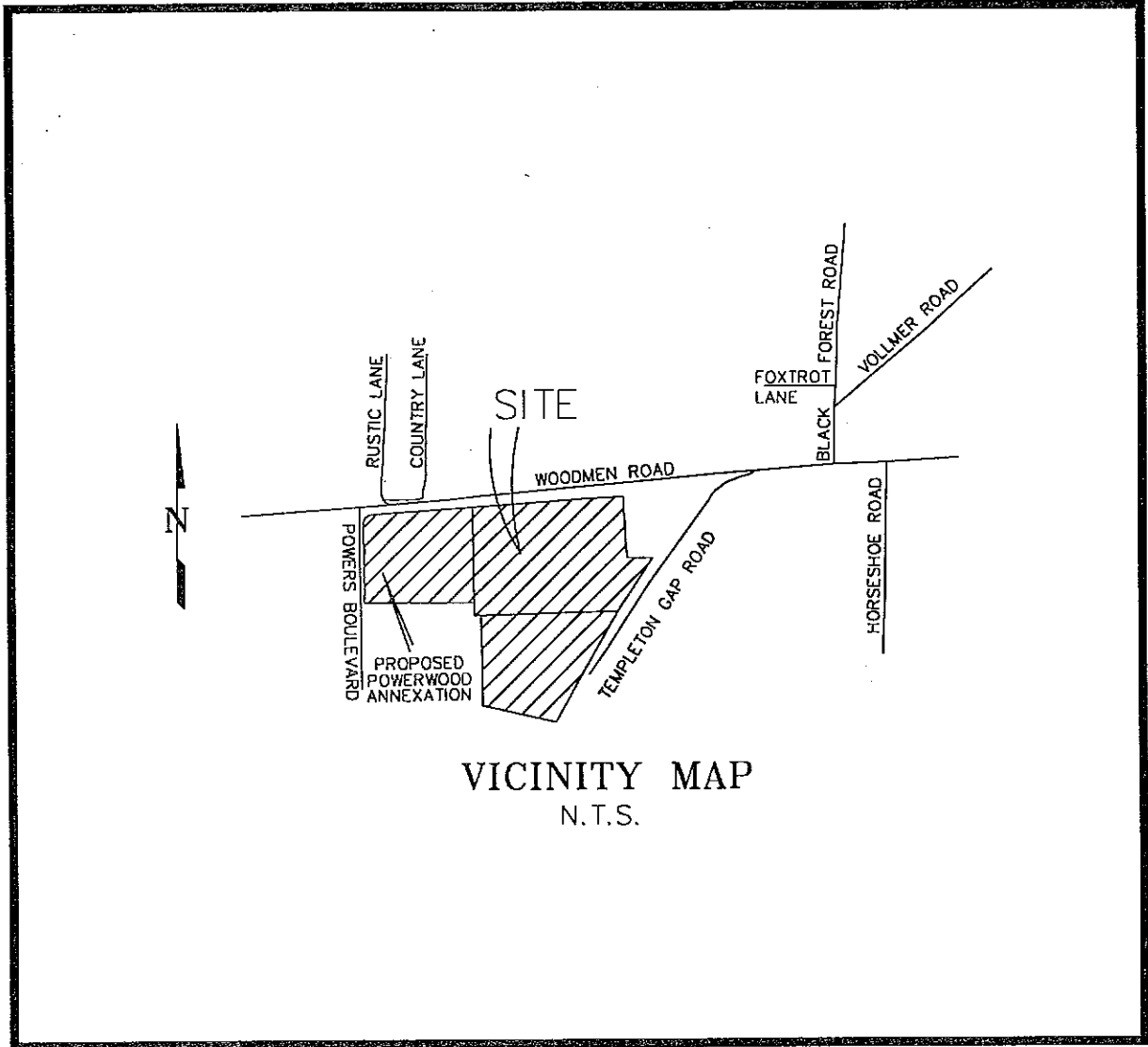
These items will be presented to the Drainage Board with the understanding that this drainage report can be approved and plats can be recorded, pending the Drainage Board's approval.

SUMMARY

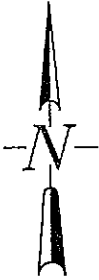
Development of this site will cause no damage to adjacent property owners. The overall drainage pattern is being improved to flow to existing drainage systems that are capable of handling said flows. Fee and detention changes to the Cottonwood Creek Basin will be submitted to the City/County Drainage Board for approval. All areas disturbed by construction will be reseeded and erosion control measures will be installed during construction of the proposed site.

Appendix A

Maps



VICINITY MAP
N.T.S.



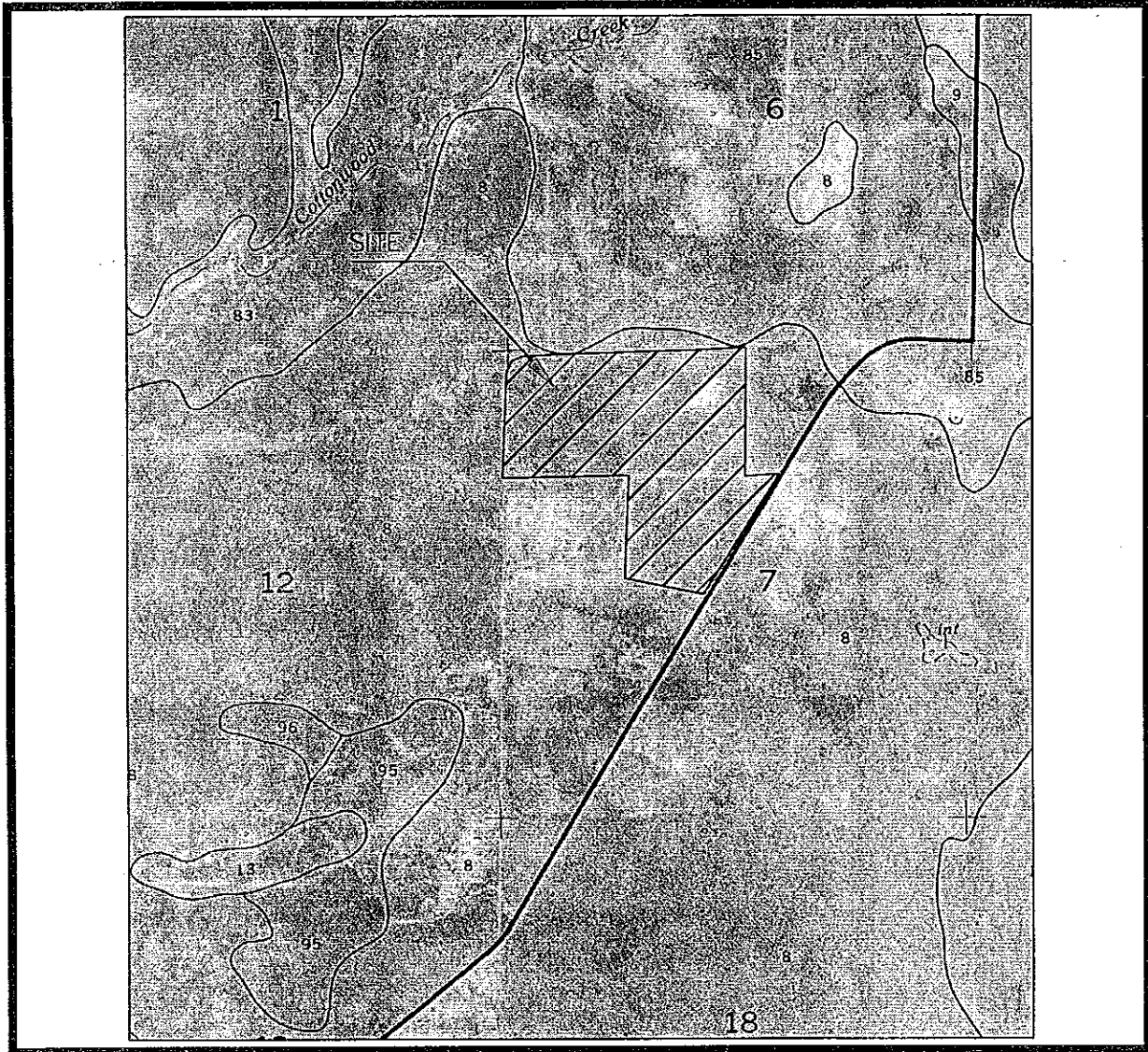
VICINITY MAP
N.T.S.

PREPARED BY:



Associated Design Professionals, Inc.

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 SOILS MAP
N.T.S.

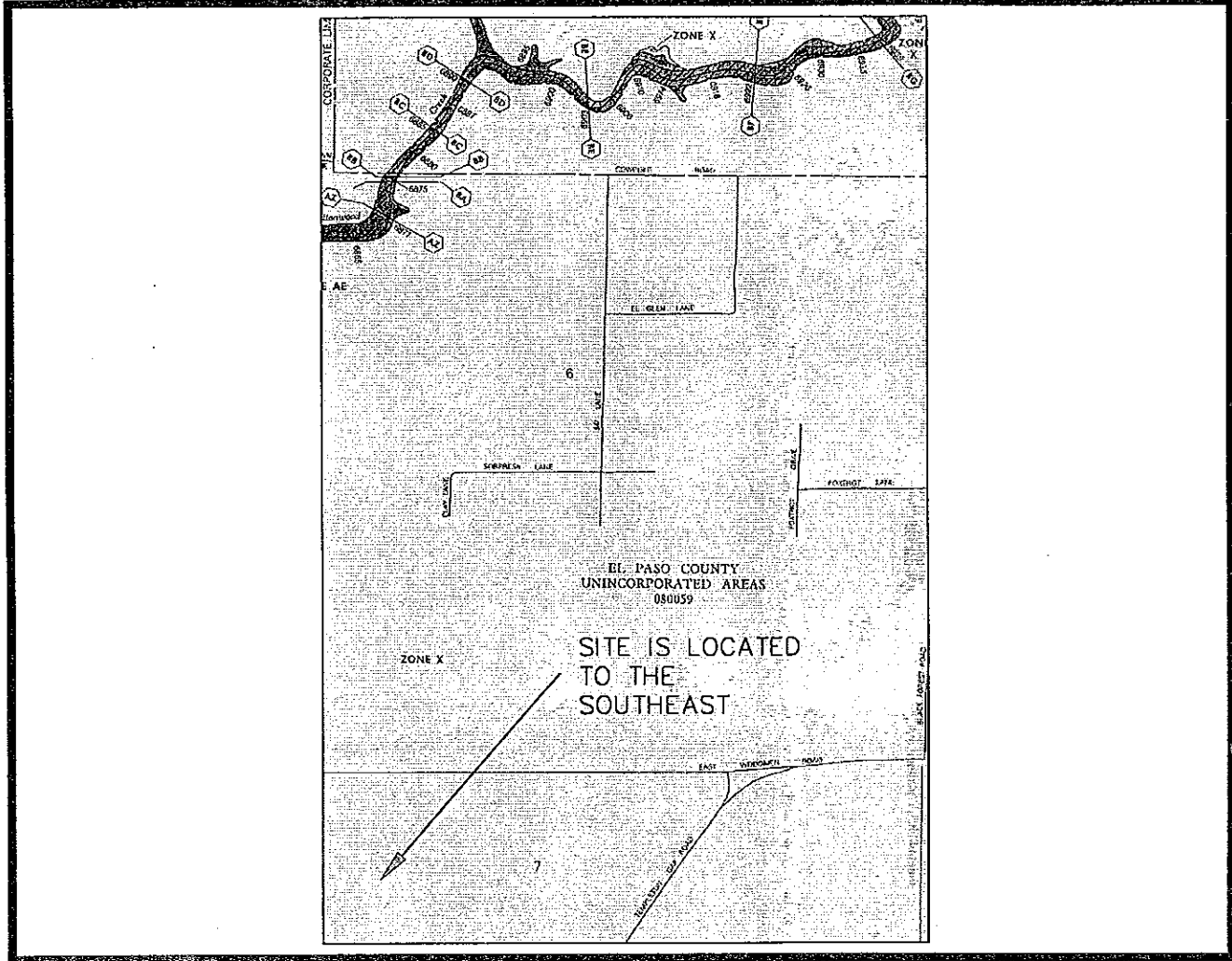
PREPARED BY:



ADP

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FLOODPLAIN MAP
 N.T.S.

NATIONAL FLOOD INSURANCE PROGRAM

FIRM *E6*

FLOOD INSURANCE RATE MAP


EL PASO COUNTY,
COLORADO AND
UNINCORPORATED AREAS

PANEL 529 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COUNTY	NUMBER	PANEL	SHEET
COLORADO	SPRINGFIELD CITY OF	0804	463 F
EL PASO COUNTY	UNINCORPORATED AREAS	529	529 F

MAP NUMBER
0804100529 F

EFFECTIVE DATE:
MARCH 17, 1997



Federal Emergency Management Agency

PREPARED BY:



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Appendix B

Drainage Calculations

PowerWood - Historic Runoff

RATIONAL METHOD (Q=CiA)

BASIN	TOTAL AREA (acres)	WEIGHTED		OVERLAND FLOW				CHANNEL FLOW				Tc TOTAL (min.)	INTENSITY		PEAK FLOWS	
		C(5)	C(100)	C(5)	Length (feet)	Slope (%)	Ti (min.)	Slope (%)	Length (feet)	Velocity (f.p.s.)	Tt (min.)		I(5) (in./hr.)	I(100) (in./hr.)	Q(5) (c.f.s.)	Q(100) (c.f.s.)
A1	11.99	0.25	0.35	0.25	300	5.3%	15.8	3.8%	900	3.0	5.0	20.8	2.9	5.0 CA(equiv)	8.6 3.00	20.9 4.20
A2	27.45	0.25	0.35	0.25	300	3.3%	18.5	3.1%	1150	2.8	6.8	25.3	2.6	4.5 CA(equiv)	17.6 6.86	42.9 9.61
B1	22.82	0.25	0.35	0.25	300	4.0%	17.3	3.0%	1000	2.7	6.2	23.5	2.7	4.7 CA(equiv)	15.2 5.71	37.2 7.99
C1	50.42	0.25	0.35	0.25	300	6.7%	14.6	4.8%	1750	3.3	8.8	23.4	2.7	4.7 CA(equiv)	33.7 12.61	82.4 17.65
C2	15.77	0.25	0.35	0.25	290	5.0%	15.8	3.0%	850	2.7	5.2	21.1	2.8	4.9 CA(equiv)	11.2 3.94	27.3 5.52
D1	16.50	0.25	0.35	0.25	300	3.0%	19.1	3.0%	1900	2.7	11.7	30.8	2.3	4.0 CA(equiv)	9.4 4.13	23.0 5.78
OS1	3.45	0.60	0.65	0.90	30	2.0%	1.6	3.5%	2700	3.7	12.2	13.8	3.5	6.1 CA(equiv)	7.3 2.07	13.8 2.24
OS2	2.36	0.54	0.62	0.90	50	2.0%	2.1	1.5%	1050	2.3	7.6	9.7	4.1	7.2 CA(equiv)	5.2 1.27	10.5 1.46
OS3	4.35	0.54	0.62	0.90	30	2.0%	1.6	3.1%	1900	3.5	9.0	10.7	3.9	6.9 CA(equiv)	9.3 2.35	18.6 2.70
OS4	17.38	0.25	0.35	0.25	350	1.5%	26.0	3.7%	2400	2.9	13.8	39.8	2.0	3.4 CA(equiv)	8.5 4.35	20.7 6.08
OS5	15.00	0.25	0.35	0.25	250	5.0%	14.7	3.5%	160	2.8	1.0	15.7	3.3	5.8 CA(equiv)	12.4 3.75	30.3 5.25
OS6	11.68	0.25	0.35	0.25	350	4.0%	18.7	2.5%	550	2.4	3.8	22.6	2.7	4.8 CA(equiv)	8.0 2.92	19.5 4.09
OS7	37.91	0.25	0.35	0.25	300	1.2%	25.9	4.2%	2200	3.2	11.5	37.4	2.0	3.5 CA(equiv)	19.2 9.48	47.0 13.27

PowerWood

EXISTING RUNOFF ROUTING

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent)		Tc (min.)	INTENSITY I(5) (in./hr.)	TOTAL FLOWS		
		CA(5)	CA(100)			I(100) (in./hr.)	Q(5) (c.f.s)	Q(100) (c.f.s)
DP-1	A1	3.00	4.20	25.3	2.2	3.9	26.3	61.9
	A2	6.86	9.61					
	OS1	2.07	2.24					
		11.93	16.05	Travel Channel	Length 1300	Velocity 3	Tt 7.22	Routed Tc 32.56
DP-2	B1	5.71	7.99	23.5	2.2	3.9	20.6	46.8
	OS2	1.27	1.46					
	OS3	2.35	2.70					
		9.33	12.15	Travel Channel	Length 1900	Velocity 3.5	Tt 9.05	Routed Tc 32.56
DP-3	C2	3.94	5.52	22.6	2.6	4.5	27.3	66.9
	OS5	3.75	5.25					
	OS6	2.92	4.09					
		10.61	14.86	Travel Channel	Length 400	Velocity 2.7	Tt 2.47	Routed Tc 25.02
DP-4	C1	12.61	17.65	37.4	2.0	3.5	62.0	151.6
	D1	4.13	5.78					
	OS4	4.35	6.08					
	OS7	9.48	13.27					
		30.55	42.77	Travel Channel	Length 0	Velocity 2.7	Tt 0.00	Routed Tc 37.37
DP-5	DP-2	9.33	12.15	37.4	2.0	3.5	80.9	194.6
	DP-4	30.55	42.77					
		39.88	54.92					

PowerWood - Developed Runoff

RATIONAL METHOD (Q=CIA)

BASIN	TOTAL AREA (acres)	WEIGHTED		OVERLAND FLOW				STREET FLOW				Tc TOTAL (min.)	INTENSITY		PEAK FLOWS	
		C(5)	C(100)	C(5)	Length (feet)	Slope (%)	Ti (min.)	Slope (%)	Length (feet)	Velocity (f.p.s.)	Tt (min.)		I(5) (in./hr.)	I(100) (in./hr.)	Q(5) (c.f.s.)	Q(100) (c.f.s.)
A1	16.25	0.60	0.70	0.30	200	3.0%	14.7	3.0%	600	3.4	2.9	17.6	3.1	5.4 CA(equiv)	30.4 9.75	61.9 11.38
A2	15.74	0.75	0.80	0.30	100	3.0%	10.4	3.0%	1300	3.4	6.4	16.7	3.2	5.6 CA(equiv)	37.7 11.81	70.3 12.59
B1	16.45	0.60	0.68	0.60	75	3.0%	5.6	3.0%	1000	1.8	9.5	15.1	3.4	5.9 CA(equiv)	33.1 9.87	65.1 11.10
B2	14.33	0.75	0.80	0.30	75	3.0%	9.0	3.0%	1000	3.4	4.9	13.9	3.5	6.1 CA(equiv)	37.6 10.75	70.1 11.46
C1	36.80	0.70	0.80	0.70	100	3.0%	5.2	3.0%	1500	3.4	7.4	12.5	3.7	6.4 CA(equiv)	94.5 25.76	188.7 29.44
C2	16.42	0.90	0.90	0.30	100	2.0%	11.9	3.0%	1300	3.4	6.4	18.2	3.1	5.3 CA(equiv)	45.2 14.78	78.9 14.78
C3	11.08	0.90	0.90	0.30	100	2.0%	11.9	3.0%	1400	3.4	6.9	18.7	3.0	5.3 CA(equiv)	30.1 9.97	52.5 9.97
D1	16.50	0.90	0.90	0.30	100	2.0%	11.9	3.0%	2100	3.4	10.3	22.2	2.8	4.8 CA(equiv)	40.9 14.85	71.5 14.85
OS1	5.40	0.60	0.65	0.90	30	2.0%	1.6	3.5%	2700	3.7	12.2	13.8	3.5	6.1 CA(equiv)	11.4 3.24	21.5 3.51
OS2	2.36	0.54	0.62	0.90	50	2.0%	2.1	1.5%	1050	2.3	7.6	9.7	4.1	7.2 CA(equiv)	5.2 1.27	10.5 1.46
OS3	4.35	0.54	0.62	0.90	30	2.0%	1.6	3.1%	1900	3.5	9.0	10.7	3.9	6.9 CA(equiv)	9.3 2.35	18.6 2.70
OS4	17.38	0.25	0.35	0.25	350	1.5%	26.0	3.7%	2400	2.9	13.8	39.8	2.0	3.4 CA(equiv)	8.5 4.35	20.7 6.08
OS5	15.00	0.25	0.35	0.25	250	5.0%	14.7	3.5%	160	2.8	1.0	15.7	3.3	5.8 CA(equiv)	12.4 3.75	30.3 5.25
OS6	12.04	0.25	0.35	0.25	350	4.0%	18.7	2.5%	550	2.4	3.8	22.6	2.7	4.8 CA(equiv)	8.2 3.01	20.1 4.21
OS7	37.91	0.25	0.35	0.25	300	1.2%	25.9	4.2%	2200	3.2	11.5	37.4	2.0	3.5 CA(equiv)	19.2 9.48	47.0 13.27

PowerWood

DEVELOPED RUNOFF ROUTING

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent)		Tc (min.)	INTENSITY		TOTAL FLOWS	
		CA(5)	CA(100)		I(5) (in./hr.)	I(100) (in./hr.)	Q(5) (c.f.s.)	Q(100) (c.f.s.)
DP-1	OS1 A1 A2	3.24	3.51	16.7 Travel Pipe	2.9 Length 2200	5.0 Velocity 10	71.5	138.3
		9.75	11.38				Tt 3.67	Routed Tc 20.41
		11.81	12.59					
		24.80	27.48					
DP-2	B1 B2	9.87	11.10	13.9 Travel Ditch	3.1 Length 1000	5.5 Velocity 5	64.9	124.2
		10.75	11.46				Tt 3.33	Routed Tc 17.22
		20.62	22.57					
DP-3	OS5 OS6	3.75	5.25	22.6 Travel Ditch	2.7 Length 0	4.8 Velocity 5.0	18.5	45.1
		3.01	4.21				Tt 0.00	Routed Tc 22.55
		6.76	9.46					
DP-4	C3 C2	9.97	9.97	18.7 Travel Pipe	2.9 Length 790	5.1 Velocity 10	72.0	125.8
		14.78	14.78				Tt 1.32	Routed Tc 20.05
		24.75	24.75					
DP-5	DP-4 C1	24.75	24.75	20.1 Travel Pipe	2.8 Length 1160	4.8 Velocity 10	139.8	262.0
		25.76	29.44				Tt 1.93	Routed Tc 21.99
		50.51	54.19					
DP-6	DP-5 D1	50.51	54.19	22.0 Travel Channel	2.8 Length 2050	4.8 Velocity 3.4	181.0	333.9
		14.85	14.85				Tt 10.05	Routed Tc 32.04
		65.36	69.04					
DP-7	OS4 OS7	4.35	6.08	37.4 Travel Ditch	2.0 Length 0	3.5 Velocity 10	28.0	68.6
		9.48	13.27				Tt 0.00	Routed Tc 37.37
		13.82	19.35					
DP-8	DP-2 OS2 OS3	20.62	22.57	17.2 Travel Pipe	3.1 Length 2000	5.5 Velocity 10	76.4	147.1
		1.27	1.46				Tt 3.33	Routed Tc 20.55
		2.35	2.70					
		24.24	26.73					
DP-9	DP-6 DP-7 DP-8	65.36	69.04	37.4	2.0	3.5	223.6	419.4
		24.24	26.73					
		20.62	22.57					
		110.22	118.34					

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: POWERWOOD/GREENBRIAR

Comment: PROPOSED STORM SEWER CAPACITY

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	2.50 ft
Slope.....	0.0200 ft/ft
Manning's n.....	0.013
Discharge.....	58.01 cfs

Computed Results:

Full Flow Capacity.....	58.01 cfs
Full Flow Depth.....	2.50 ft
Velocity.....	11.82 fps
Flow Area.....	4.91 sf
Critical Depth....	2.38 ft
Critical Slope....	0.0173 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	58.01 cfs
QMAX @.94D.....	62.40 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: POWERWOOD/GREENBRIAR

Comment: PROPOSED STORM SEWER CAPACITY

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	3.00 ft
Slope.....	0.0300 ft/ft
Manning's n.....	0.013
Discharge.....	115.53 cfs

Computed Results:

Full Flow Capacity.....	115.53 cfs
Full Flow Depth.....	3.00 ft
Velocity.....	16.34 fps
Flow Area.....	7.07 sf
Critical Depth....	2.94 ft
Critical Slope....	0.0269 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	115.53 cfs
QMAX @.94D.....	124.27 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: POWERWOOD/GREENBRIAR

Comment: PROPOSED STORM SEWER CAPACITY

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	3.50 ft
Slope.....	0.0600 ft/ft
Manning's n.....	0.013
Discharge.....	246.44 cfs

Computed Results:

Full Flow Capacity.....	246.44 cfs
Full Flow Depth.....	3.50 ft
Velocity.....	25.61 fps
Flow Area.....	9.62 sf
Critical Depth....	3.48 ft
Critical Slope....	0.0567 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	246.44 cfs
QMAX @.94D.....	265.10 cfs
Froude Number.....	FULL

Trapezoidal Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: POWERWOOD/GREENBRIAR

Comment: PROPOSED 5' RIPRAP SWALE CAP. TO DET #1

Flow For Depth

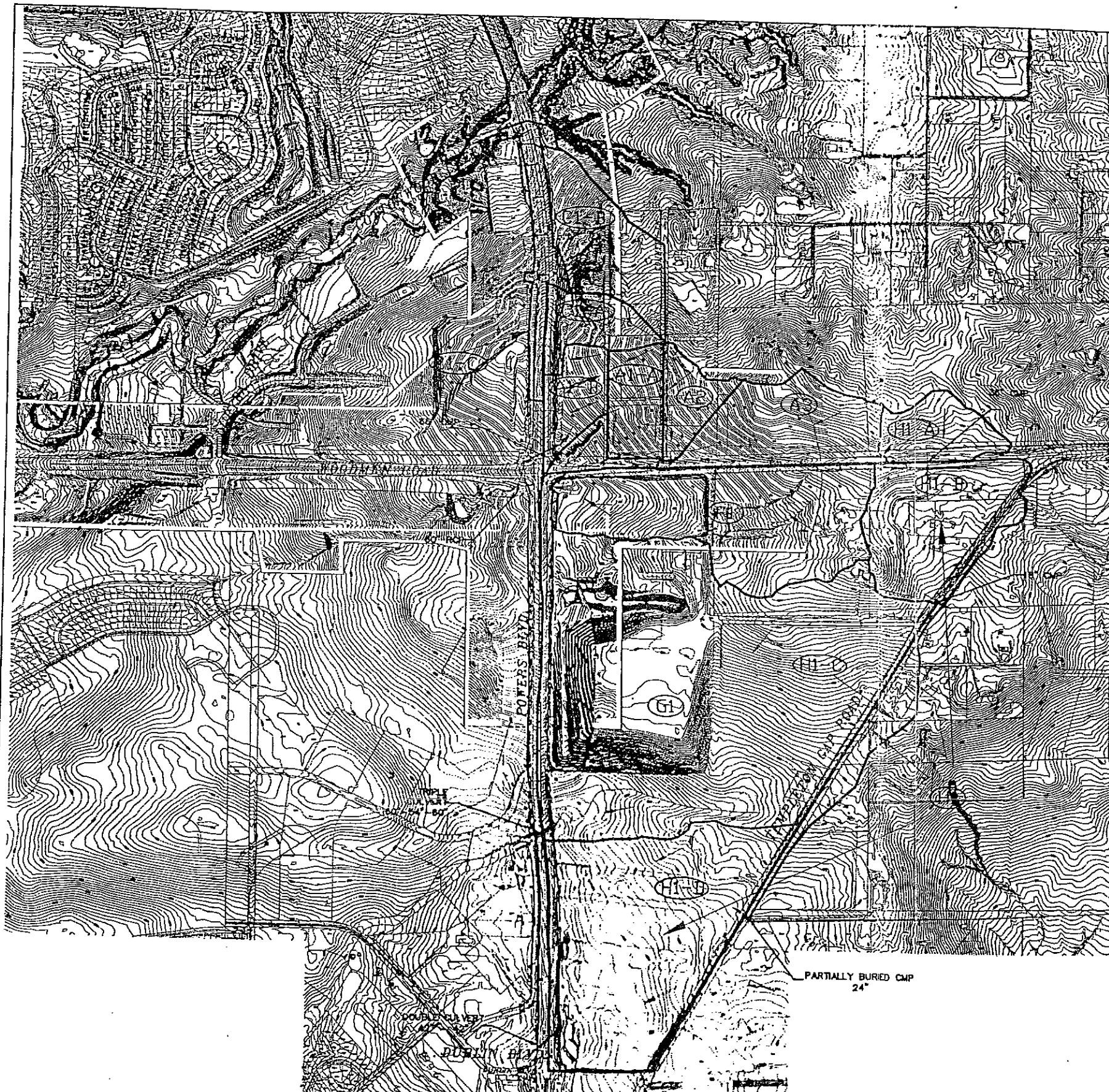
Given Input Data:

Bottom Width.....	5.00 ft
Left Side Slope..	2.50:1 (H:V)
Right Side Slope.	2.50:1 (H:V)
Manning's n.....	0.040
Channel Slope....	0.0300 ft/ft
Discharge.....	70.10 cfs

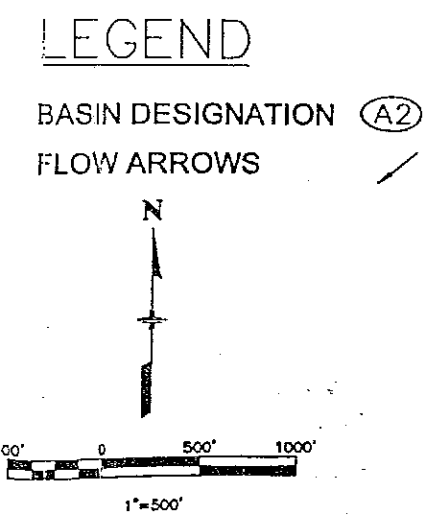
Computed Results:

Depth.....	1.36 ft
Velocity.....	6.12 fps
Flow Area.....	11.45 sf
Flow Top Width...	11.81 ft
Wetted Perimeter.	12.34 ft
Critical Depth...	1.43 ft
Critical Slope...	0.0247 ft/ft
Froude Number....	1.10 (flow is Supercritical)

Appendix C
Powers Boulevard
Calculations & Plans



BASIN SUMMARY				
BASIN	ACRES	EXISTING Q100 (CFS)	FUTURE Q100 (CFS)	METHOD
A1-A	9.92	111	144	Rational Method
A1-B	8.75			
A2	7.57			
A3	27.27	139	161	Rational Method
C1-A	9.32			
C1-B	18.89			
C1-C	38.29	46	154	Rational Method
F1	47.12			
G1	148.58	220	393	TR-55
H1-A	10.93	146	264	TR-55
H1-B	30.00			
H1-C	10.23			
H1-D	65.91			



Computer File Information	
Creation Date:	06/04/01 Initials: HNG
Last Modification Date:	06/04/01 Initials: HNG
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Drawing File Name:	GWTBasinDelineation.DWG
Acad. Ver.	LDD2 Scale: 1"=500' Units: Feet

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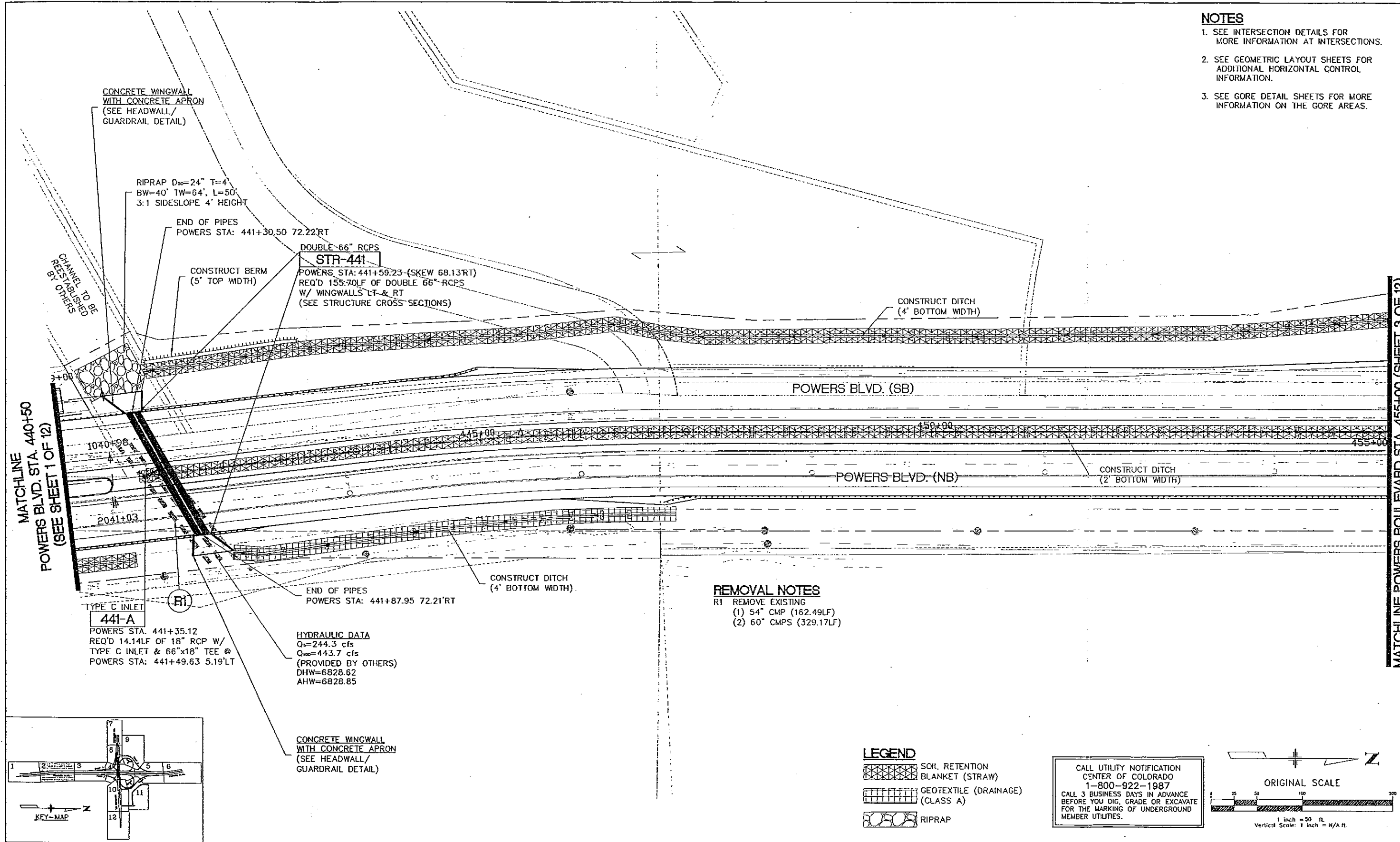


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As Constructed		FIGURE 2-2 EXISTING DRAINAGE MAP		Project No./Code
No Revisions:		Designer: ADT	Structure Numbers	6742487
Revised:		Detailer: ADT		
Void		Sheet/Subset:	Subset Sheets of	Sheet Number 6

NOTES

1. SEE INTERSECTION DETAILS FOR MORE INFORMATION AT INTERSECTIONS.
2. SEE GEOMETRIC LAYOUT SHEETS FOR ADDITIONAL HORIZONTAL CONTROL INFORMATION.
3. SEE GORE DETAIL SHEETS FOR MORE INFORMATION ON THE GORE AREAS.



Computer File Information

Creation Date:	12/30/02	Initials:	JJM
Last Modification Date:	3/18/03	Initials:	JJM
Full Path:	\\6742618\CAD\planshts\		
Drawing File Name:	shpt--drainage.dwg		
Acad. Ver.	LDD2	Scale:	1"=50'
		Units:	Feet

Index of Revisions

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(R-)			
(R-)			

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Revised:	
Void:	

**DRAINAGE PLAN
POWERS BOULEVARD**

Designer:	EDE	Structure Numbers:	
Detailer:	JJM	Subset Sheets:	2 of 12

Project No./Code	STU R200-097
	13129
Sheet Number	256

MATCHLINE POWERS BOULEVARD STA. 455+00 (SHEET 3 OF 12)

LINE AA NOTES

AA6 WOODMEN STA: 122+77.41 46.50'RT
 REQ'D 176.75LF OF 54" RCP W/
 TYPE R INLET - L=10.00' W=7.25'
 (SEE PROFILE LINE AA)

AA7 WOODMEN STA: 128+06.45 46.50'RT
 REQ'D 519.95LF OF 54" RCP W/
 TYPE R INLET - L=10.00' W=7.50'
 (SEE PROFILE LINE AA)

AA8 WOODMEN STA: 128+94.36 83.12'RT
 REQ'D 81.52LF OF 54" RCP W/
 TYPE C INLET - L=7.00' W=7.00'
 (SEE PROFILE LINE AA)

NOTES

1. SEE INTERSECTION DETAILS FOR MORE INFORMATION AT INTERSECTIONS.
2. SEE GEOMETRIC LAYOUT SHEETS FOR ADDITIONAL HORIZONTAL CONTROL INFORMATION.
3. SEE GORE DETAIL SHEETS FOR MORE INFORMATION ON THE GORE AREAS.
4. EMBANKMENT PROTECTOR TYPE 5 PER CDOT M&S STANDARD M-615-2.

REMOVAL NOTES

- R2 REMOVE EXISTING
 60" RCP (447.85LF) &
 18" RCP (17.10LF) W/
 CORRESPONDING FES
- R3 REMOVE EXISTING
 60" RCP (315.00LF) W/
 CORRESPONDING FES
- R18 REMOVE EXISTING
 60" RCP (455.64LF) W/
 CORRESPONDING MANHOLE

LINE AE NOTES

AE1 WOODMEN STA: 122+77.41 71.50'LT
 REQ'D 118.67LF OF 24" RCP W/
 TYPE R INLET - L=15.00'
 (SEE PROFILE LINE AE)

LINE AF NOTES

AF1 WOODMEN STA: 123+00.00 75.55'RT
 REQ'D 28.49LF OF 30" RCP W/
 TYPE C INLET - W=4.00'
 (SEE PROFILE LINE AF)

AF2 RAMP A STA: 711+60.00 50.00'RT
 REQ'D 187.64LF OF 24" RCP (CLASS IV)
 W/ TYPE C INLET
 (SEE PROFILE LINE AF)

LINE AG NOTES

AG1 WOODMEN STA: 128+06.45 71.50'LT
 REQ'D 119.34LF OF 24" RCP (CLASS IV)
 W/ TYPE R INLET - L=10.00'
 (SEE PROFILE LINE AG)

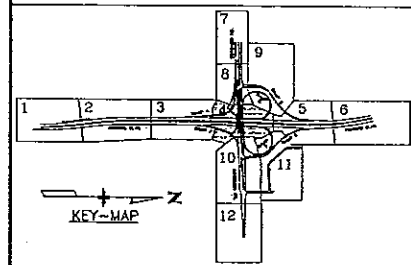
AG2 WOODMEN STA: 128+64.06 130.94'LT
 REQ'D 71.43LF OF 24" RCP (CLASS IV)
 W/24" RCES
 (SEE PROFILE LINE AG)

LINE AH NOTES

AH1 RAMP F STA: 309+25.00 85.00'LT
 REQ'D 159.08LF OF 24" RCP (CLASS IV)
 W/TYPE C INLET
 (SEE PROFILE LINE AH)

LINE AI NOTES

AI1 RAMP F STA: 310+24.85 77.35'RT
 REQ'D 153.83LF OF 54" RCP W/54" RCES
 (SEE PROFILE LINE AI)



Computer File Information

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Last Modification Date:	3/18/03	Initials:	JJM
Full Path:	\\6742618\CAD\planshts\		
Drawing File Name:	shpl-drainage.dwg		
Acad. Ver.	LDD2	Scale:	1"=50'
		Units:	Feet

Index of Revisions

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(R-)		
(R-)		

LEGEND

SOIL RETENTION BLANKET (STRAW)

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No Revisions:

Revised:

Void:

DRAINAGE PLAN
POWERS BOULEVARD

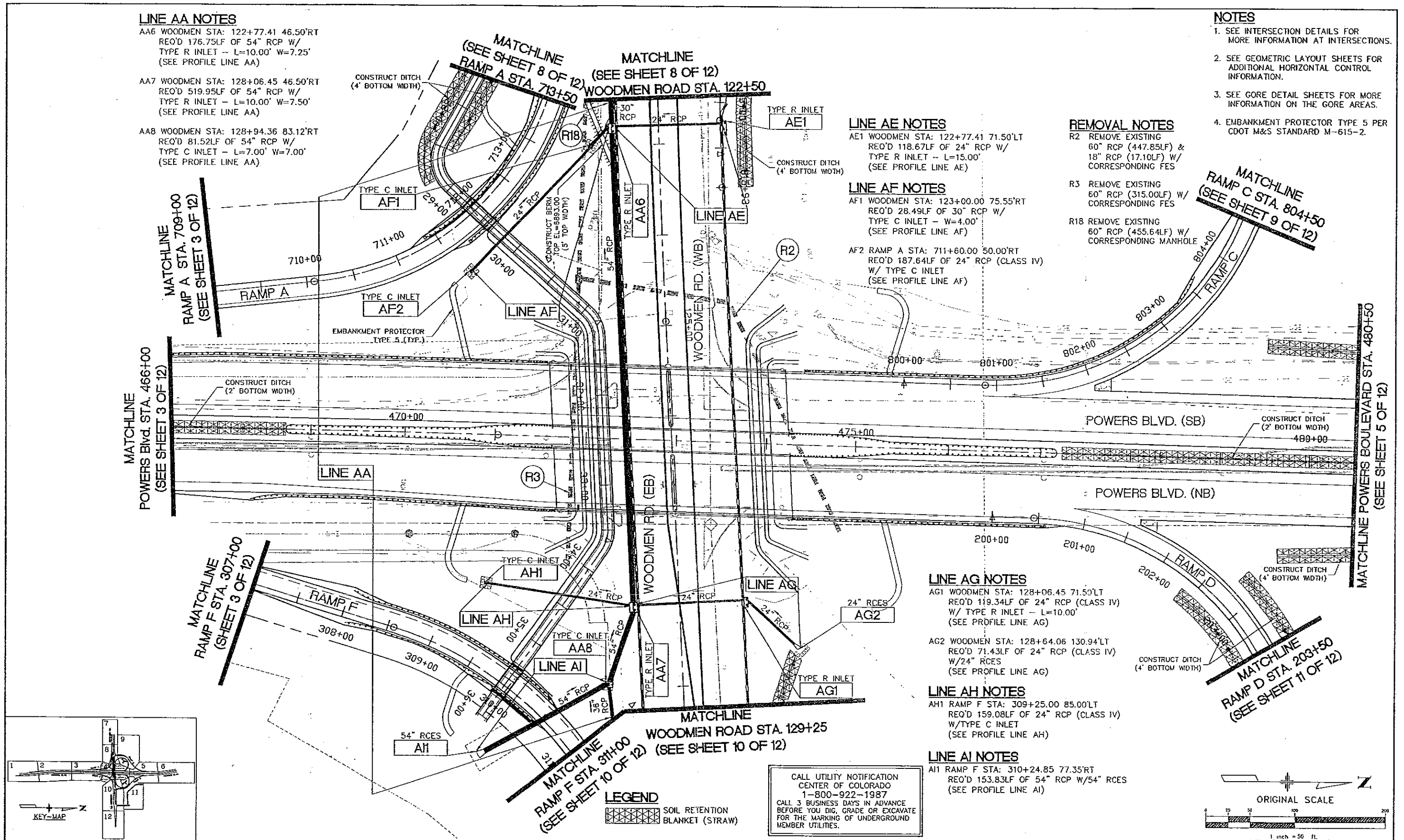
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Detailer:	JJM		
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Project No./Code

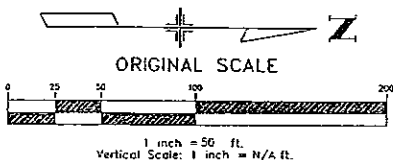
STU R200-097

13129

Sheet Number 258



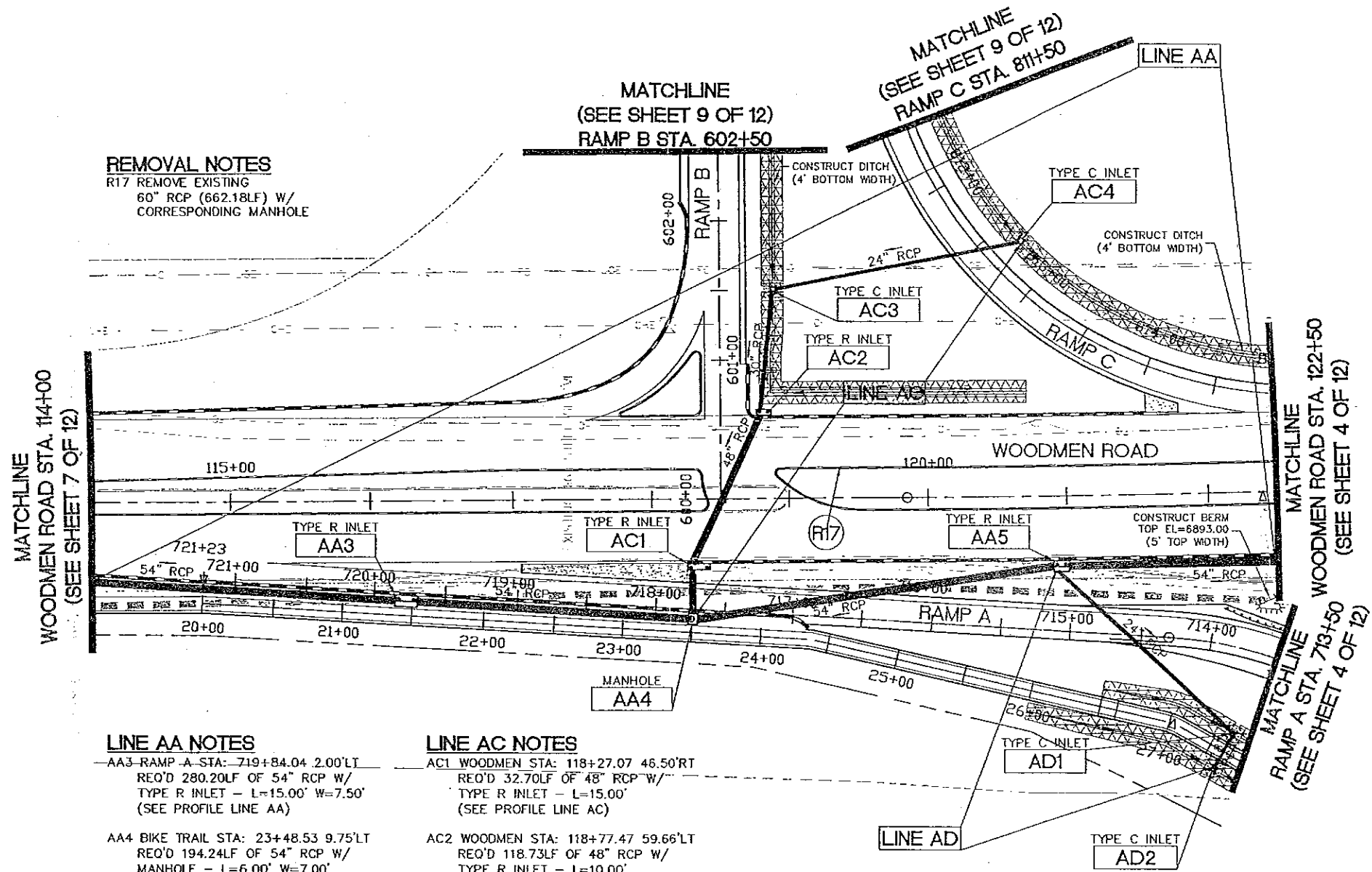
CALL UTILITY NOTIFICATION CENTER OF COLORADO 1-800-922-1987
 CALL 3 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.



CALL UTILITY NOTIFICATION
 CENTER OF COLORADO
 1-800-922-1987
 CALL 3 BUSINESS DAYS IN ADVANCE
 BEFORE YOU DIG, GRADE OR EXCAVATE
 FOR THE MARKING OF UNDERGROUND
 MEMBER UTILITIES.

NOTES

1. SEE INTERSECTION DETAILS FOR MORE INFORMATION AT INTERSECTIONS.
2. SEE GEOMETRIC LAYOUT SHEETS FOR ADDITIONAL HORIZONTAL CONTROL INFORMATION.
3. SEE GORE DETAIL SHEETS FOR MORE INFORMATION ON THE GORE AREAS.



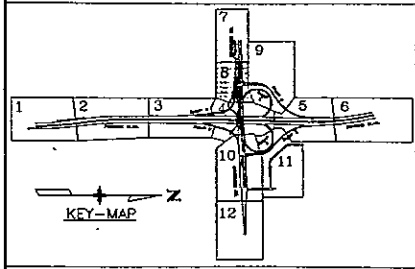
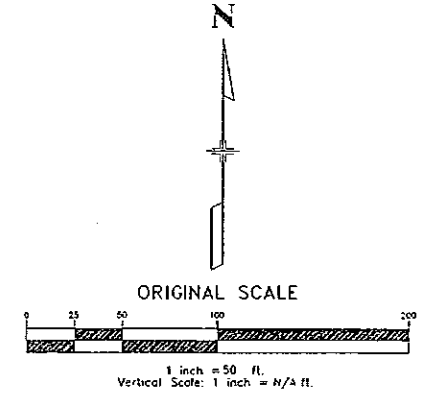
REMOVAL NOTES
 R17 REMOVE EXISTING
 60" RCP (662.18LF) W/
 CORRESPONDING MANHOLE

LINE AA NOTES
 AA3 RAMP A STA: 719+84.04 2.00'LT
 REQ'D 280.20LF OF 54" RCP W/
 TYPE R INLET - L=15.00' W=7.50'
 (SEE PROFILE LINE AA)
 AA4 BIKE TRAIL STA: 23+48.53 9.75'LT
 REQ'D 194.24LF OF 54" RCP W/
 MANHOLE - L=6.00' W=7.00'
 (SEE PROFILE LINE AA)
 AA5 WOODMEN STA: 120+91.45 46.50'RT
 REQ'D 261.75LF OF 54" RCP W/
 TYPE R INLET - L=15.00' W=7.25'
 (SEE PROFILE LINE AA)

LINE AC NOTES
 AC1 WOODMEN STA: 118+27.07 46.50'RT
 REQ'D 32.70LF OF 48" RCP W/
 TYPE R INLET - L=15.00'
 (SEE PROFILE LINE AC)
 AC2 WOODMEN STA: 118+77.47 59.66'LT
 REQ'D 118.73LF OF 48" RCP W/
 TYPE R INLET - L=10.00'
 (SEE PROFILE LINE AC)
 AC3 RAMP B STA: 601+51.00 39.00'RT
 REQ'D 85.38LF OF 30" RCP W/
 TYPE C INLET - L=3.75' W=4.25'
 (SEE PROFILE LINE AC)
 AC4 RAMP C STA: 812+68.78 26.43'LT
 REQ'D 179.89LF OF 24" RCP W/
 TYPE C INLET - L=4.50'
 (SEE PROFILE LINE AC)

LINE AD NOTES
 AD1 BIKE TRAIL STA: 27+44.29 15.00'LT
 REQ'D 169.61LF OF 24" RCP W/
 TYPE C INLET
 (SEE PROFILE LINE AD)
 AD2 BIKE TRAIL STA: 27+44.29 15.00'RT
 REQ'D 27.00LF OF 18" RCP W/
 TYPE C INLET
 (SEE PROFILE LINE AD)

LEGEND
 SOIL RETENTION
 BLANKET (STRAW)



Computer File Information	
Creation Date:	12/30/02 Initials: JJM
Last Modification Date:	3/18/03 Initials: JJM
Full Path:	\\6742618\CAD\plansh\
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Acad. Ver. LDQ2	Scale: 1"=50' Units: Feet

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As Constructed		DRAINAGE PLAN WOODMEN ROAD	
No Revisions:		Designer: EDE	Structure Numbers
Revised:		Detailer: JJM	
Void:		SheetSubset:	Subset Sheets: 8 of 12

Project No./Code	
STU R200-097	
13129	
Sheet Number	262

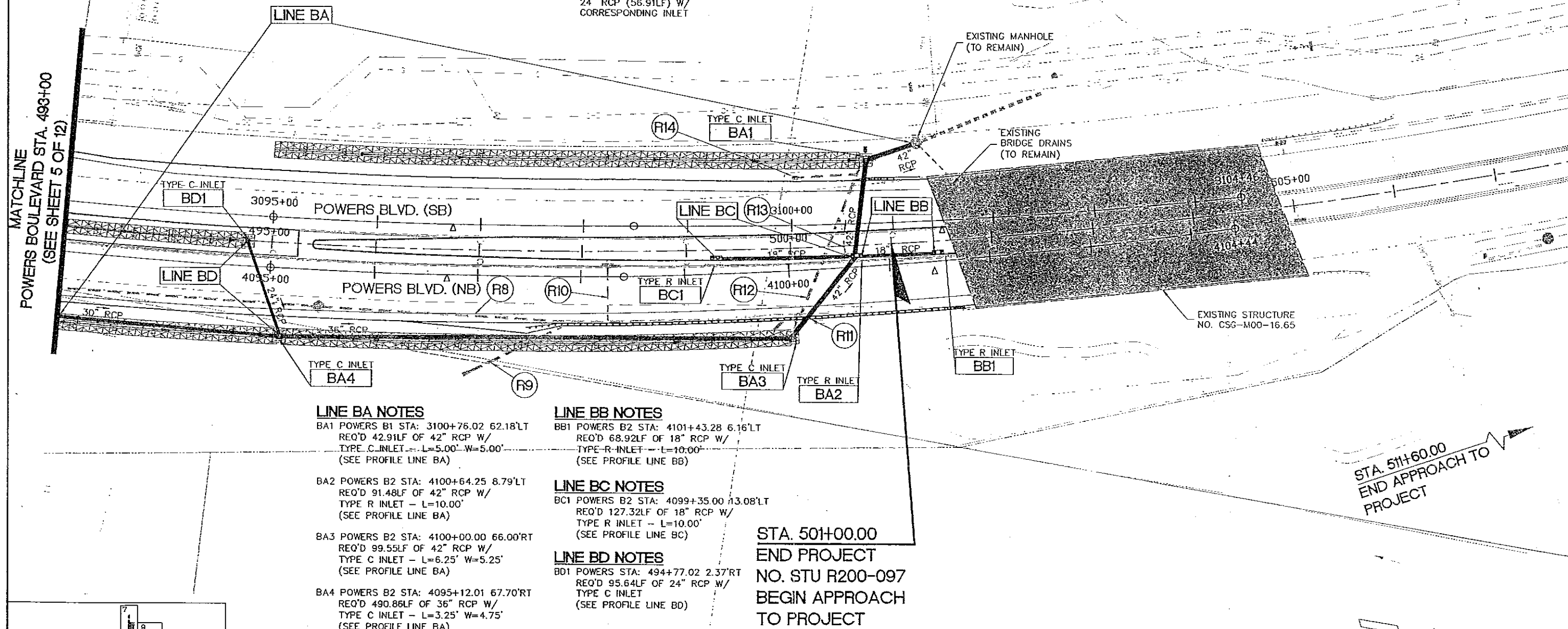
CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987
CALL 3 BUSINESS DAYS IN ADVANCE
BEFORE YOU DIG, GRADE OR EXCAVATE
FOR THE MARKING OF UNDERGROUND
MEMBER UTILITIES.

REMOVAL NOTES

- R8 REMOVE EXISTING
24" RCP (230.47LF)
36" RCP (229.53LF)
42" RCP (9.49LF) W/
CORRESPONDING MANHOLE
- R9 REMOVE EXISTING
30" RCP (106.50LF) W/
CORRESPONDING FES
- R10 REMOVE EXISTING
18" RCP (55.49LF) W/
CORRESPONDING INLET
- R11 REMOVE EXISTING
18" RCP (11.35LF) W/
CORRESPONDING INLET
- R12 REMOVE EXISTING
42" RCP (224.82LF) W/
CORRESPONDING MANHOLE
- R13 REMOVE EXISTING
18" RCP (34.46LF) W/
CORRESPONDING INLET
- R14 REMOVE EXISTING
24" RCP (56.91LF) W/
CORRESPONDING INLET

NOTES

1. SEE INTERSECTION DETAILS FOR MORE INFORMATION AT INTERSECTIONS.
2. SEE GEOMETRIC LAYOUT SHEETS FOR ADDITIONAL HORIZONTAL CONTROL INFORMATION.
3. SEE GORE DETAIL SHEETS FOR MORE INFORMATION ON THE GORE AREAS.



LINE BA NOTES

- BA1 POWERS B1 STA: 3100+76.02 62.18'LT
REQ'D 42.91LF OF 42" RCP W/
TYPE C INLET - L=5.00' W=5.00'
(SEE PROFILE LINE BA)
- BA2 POWERS B2 STA: 4100+64.25 8.79'LT
REQ'D 91.48LF OF 42" RCP W/
TYPE R INLET - L=10.00'
(SEE PROFILE LINE BA)
- BA3 POWERS B2 STA: 4100+00.00 66.00'RT
REQ'D 99.55LF OF 42" RCP W/
TYPE C INLET - L=6.25' W=5.25'
(SEE PROFILE LINE BA)
- BA4 POWERS B2 STA: 4095+12.01 67.70'RT
REQ'D 490.86LF OF 36" RCP W/
TYPE C INLET - L=3.25' W=4.75'
(SEE PROFILE LINE BA)

LINE BB NOTES

- BB1 POWERS B2 STA: 4101+43.28 6.16'LT
REQ'D 68.92LF OF 18" RCP W/
TYPE R INLET - L=10.00'
(SEE PROFILE LINE BB)

LINE BC NOTES

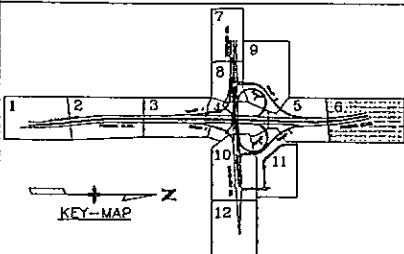
- BC1 POWERS B2 STA: 4099+35.00 13.08'LT
REQ'D 127.32LF OF 18" RCP W/
TYPE R INLET - L=10.00'
(SEE PROFILE LINE BC)

LINE BD NOTES

- BD1 POWERS STA: 494+77.02 2.37'RT
REQ'D 95.64LF OF 24" RCP W/
TYPE C INLET
(SEE PROFILE LINE BD)

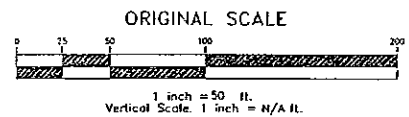
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NO. STU R200-097
BEGIN APPROACH
TO PROJECT

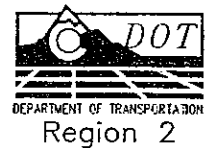
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PROJECT



LEGEND

SOIL RETENTION
BLANKET (STRAW)



Computer File Information		Index of Revisions		 URS 9960 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007 BEG	As Constructed	DRAINAGE PLAN POWERS BOULEVARD		Project No./Code
Creation Date: 12/30/02	Initials: JJM	(R-)			No Revisions:			STU R200-097
Last Modification Date: 3/18/03	Initials: JJM	(R-)			Revised:	Designer: EDE	Structure Numbers:	13129
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Acad. Ver. LDD2	Scale: 1"=50'	Units: Feet	(R-)					

Appendix D

Powerwood TR-20 Calculation

*****80-80 LIST OF INPUT DATA FOR TR-20
HYDROLOGY*****

```

JOB TR-20                                SUMMARY  NOPLOTS
TITLE  POWERWOOD RETAIL DEVELOPMENT - TR20 RUN 24 HR. 100YR. STORM
TITLE  DEVELOPED CONDITIONS W/ 24" OUTLET INPUT : PW100DEV
5 RAINFL 7                                0.5
8      0.0000    0.0040    0.0080    0.0100    0.0140
8      0.0190    0.0220    0.0260    0.0300    0.0450
8      0.0600    0.1000    0.7100    0.7500    0.7750
8      0.8000    0.8200    0.8300    0.8400    0.8500
8      0.8600    0.8700    0.8750    0.8850    0.8900
8      0.9000    0.9050    0.9100    0.9200    0.9250
8      0.9300    0.9350    0.9400    0.9450    0.9500
8      0.9550    0.9600    0.9650    0.9700    0.9730
8      0.9750    0.9800    0.9830    0.9870    0.9900
8      0.9930    0.9960    0.9999    1.0000    1.0000
9 ENDTBL
2 XSECTN 002                                1.0
8      6890.00    0.0    0.00
8      6890.09    10.0    2.90
8      6890.14    20.0    4.40
8      6890.24    50.0    7.64
8      6890.36    100.0    11.70
8      6890.55    200.0    17.70
9 ENDTBL
3 STRUCT 01
8      6880.00    0.0    0.0
8      6882.00    0.2    0.82
8      6884.00    25.0    2.52
8      6886.00    34.0    2.88
8      6888.00    40.0    4.32
8      6890.00    45.0    6.22
8      6892.00    105.0    8.18
9 ENDTBL
6 RUNOFF 1 002    2    0.0481    88.0    0.287    1 1
6 RESVOR 2    01 2    4    6880.0    1 1
  ENDTBL
7 INCREM 6                                0.1
7 COMPUT 7 002    01    0.0    4.40    1.0    7 2    01    01
  ENDCMP 1
  ENDJOB 2

```

0*****END OF 80-80
LIST*****

EXECUTIVE CONTROL OPERATION INCREM
RECORD ID
+

MAIN TIME INCREMENT = .10 HOURS

EXECUTIVE CONTROL OPERATION COMPUT
RECORD ID

+ FROM XSECTION 2
 + TO STRUCTURE 1
 STARTING TIME = .00 RAIN DEPTH = 4.40 RAIN DURATION= 1.00
 RAIN TABLE NO.= 7 ANT. MOIST. COND= 2
 ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .10
 HOURS

OPERATION RUNOFF CROSS SECTION 2

ELEVATION (FEET)	PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
(RUNOFF)	6.03	125.05	
(RUNOFF)	7.45	6.23	
(RUNOFF)	10.37	2.52	
(RUNOFF)	11.48	2.47	
(RUNOFF)	12.48	2.48	
(RUNOFF)	13.99	2.48	

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA = .05 SQ.MI.		
5.00	DISCHG .00 .01	.12 .42	.83 1.38
8.87	37.85 75.73 104.98		
6.00	DISCHG 124.01 119.11	76.58 39.10	22.29 15.08
11.58	8.92 7.27 6.55		
7.00	DISCHG 6.33 6.25	6.22 6.21	6.21 6.21
6.07	5.62 5.26 5.11		
8.00	DISCHG 5.04 4.71	3.80 3.06	2.74 2.60
2.54	2.52 2.51 2.51		
9.00	DISCHG 2.51 2.51	2.51 2.51	2.51 2.51
2.51	2.51 2.51 2.51		
10.00	DISCHG 2.51 2.51	2.52 2.52	2.52 2.51
2.36	1.91 1.55 1.38		
11.00	DISCHG 1.32 1.44	1.87 2.24	2.40 2.47
2.35	1.91 1.55 1.38		
12.00	DISCHG 1.32 1.44	1.88 2.24	2.41 2.47
2.35	1.91 1.55 1.39		
13.00	DISCHG 1.32 1.29	1.27 1.27	1.27 1.27
1.43	1.88 2.25 2.41		
14.00	DISCHG 2.48 2.36	1.92 1.55	1.39 1.32
1.29	1.28 1.27 1.27		
15.00	DISCHG 1.27 1.27	1.27 1.27	1.27 1.27
1.27	1.27 1.27 1.27		
16.00	DISCHG 1.27 1.27	1.27 1.27	1.27 1.27
1.27	1.27 1.27 1.27		
17.00	DISCHG 1.27 1.27	1.27 1.27	1.27 1.27
1.27	1.27 1.27 1.27		
18.00	DISCHG 1.27 1.27	1.27 1.27	1.28 1.28
1.28	1.28 1.28 1.28		
19.00	DISCHG 1.27 1.21	1.03 .88	.81 .79
.74	.65 .57 .54		

20.00	DISCHG	.52	.61	.88	1.10	1.20	1.25
1.20	1.03	.88	.82				
21.00	DISCHG	.79	.81	.89	.97	1.00	1.01
.99	.90	.82	.79				
22.00	DISCHG	.78	.77	.77	.77	.77	.77
.77	.77	.77	.77				
23.00	DISCHG	.77	.80	.88	.95	.98	.99
.87	.53	.24	.12				
24.00	DISCHG	.06	.04	.02	.01	.00	

OPERATION RESVOR STRUCTURE 1

ELEVATION (FEET)	PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
6887.16	6.33	37.49	
6882.14	14.21	1.91	
1			

TR20 XEQ 04-17-03 15:43 POWERWOOD RETAIL DEVELOPMENT - TR20 RUN 24
 HR. 100YR. STORM JOB 1 PASS 1
 REV PC 09/83(.2) DEVELOPED CONDITIONS W/ 24" OUTLET INPUT :
 PW100DEV PAGE 1

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA = .05 SQ.MI.		
5.00	DISCHG .00	.00	.00
.01	.06 .18	9.09	
6.00	DISCHG 21.07	34.61	36.75
35.82	34.95 34.04	29.14	37.46
7.00	DISCHG 24.93	22.81	20.93
15.28	14.21 13.21	12.30	19.26
8.00	DISCHG 11.48	10.73	9.99
7.26	6.72 6.24	5.82	9.25
9.00	DISCHG 5.44	5.11	4.81
3.93	3.77 3.63	3.50	4.55
10.00	DISCHG 3.39	3.29	3.20
2.93	2.84 2.71	2.57	3.12
11.00	DISCHG 2.43	2.31	2.24
2.27	2.25 2.19	2.11	2.22
12.00	DISCHG 2.02	1.95	1.92
2.07	2.08 2.04	1.98	1.93
13.00	DISCHG 1.91	1.84	1.77
1.59	1.60 1.65	1.73	1.72
14.00	DISCHG 1.81	1.88	1.91
1.73	1.68 1.63	1.59	1.89
15.00	DISCHG 1.56	1.52	1.49
1.41	1.39 1.38	1.37	1.47
16.00	DISCHG 1.36	1.35	1.34
1.31	1.31 1.30	1.30	1.33

17.00	DISCHG		1.30	1.29	1.29	1.29	1.29	1.29
1.29	1.28	1.28	1.28					
18.00	DISCHG		1.28	1.28	1.28	1.28	1.28	1.28
1.28	1.28	1.28	1.28					
19.00	DISCHG		1.28	1.27	1.26	1.22	1.18	1.14
1.09	1.05	1.00		.95				
20.00	DISCHG		.90	.86	.85	.87	.90	.94
.97	.98	.98		.97				
21.00	DISCHG		.95	.93	.92	.92	.93	.94
.94	.94	.93		.92				
22.00	DISCHG		.91	.89	.88	.86	.85	.84
.83	.83	.82		.81				
23.00	DISCHG		.81	.81	.81	.82	.84	.85
.86	.84	.79		.72				
24.00	DISCHG		.65	.58	.52	.46	.41	.36
.32	.29	.25		.22				
25.00	DISCHG		.20	.20	.20	.20	.20	.20
.20	.20	.20		.20				
26.00	DISCHG		.20	.20	.20	.19	.19	.19
.19	.19	.19		.19				
27.00	DISCHG		.19	.19	.19	.19	.19	.19
.19	.19	.19		.19				
28.00	DISCHG		.19	.19	.19	.19	.19	.19
.19	.19	.19		.18				
29.00	DISCHG		.18	.18	.18	.18	.18	.18
.18	.18	.18		.18				

EXECUTIVE CONTROL OPERATION ENDCMP
RECORD ID
+

COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL OPERATION ENDJOB
RECORD ID
1

TR20 XEQ 04-17-03 15:43
HR. 100YR. STORM
REV PC 09/83(.2)
PW100DEV

POWERWOOD RETAIL DEVELOPMENT - TR20 RUN 24
JOB 1 SUMMARY
DEVELOPED CONDITIONS W/ 24" OUTLET INPUT :
PAGE 2

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL
INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS)
VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST
POINT.)

SECTION/ PEAK DISCHARGE	STANDARD	RAIN	ANTEC	MAIN	PRECIPITATION
----------------------------	----------	------	-------	------	---------------

STRUCTURE RUNOFF	CONTROL	DRAINAGE	TABLE	MOIST	TIME	-----		
ID	OPERATION	AREA	#	COND	INCREM	BEGIN	AMOUNT	DURATION
AMOUNT	ELEVATION	TIME	RATE	RATE	(HR)	(HR)	(IN)	(HR)
(IN)	(FT)	(HR)	(CFS)	(CSM)				

ALTERNATE	1	STORM	1							
+	XSECTION	2	RUNOFF	.05	7	2	.10	.0	4.40	24.00
3.10	---	6.03		125.05		2599.8				
STRUCTURE	1	RESVOR	.05	7	2	.10	.0	4.40	24.00	
2.81	6887.16	6.33		37.49		779.4				
1										

TR20 XEQ 04-17-03 15:43
 HR. 100YR. STORM
 REV PC 09/83(.2)
 PW100DEV

POWERWOOD RETAIL DEVELOPMENT - TR20 RUN 24
 JOB 1 SUMMARY
 DEVELOPED CONDITIONS W/ 24" OUTLET INPUT :
 PAGE 3

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1
0 STRUCTURE 1	.05	
+		
ALTERNATE 1		37.49
0 XSECTION 2	.05	
+		
ALTERNATE 1		125.05

1END OF 1 JOBS IN THIS RUN

Appendix E
Greenbriar TR-20 Calculation

*****80-80 LIST OF INPUT DATA FOR TR-20
 HYDROLOGY*****

JOB TR-20	TITLE	TITLE	SUMMARY NOPLOTS			
	GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR. 100YR. STORM	DEVELOPED CONDITIONS INPUT : GB100REV				
5	RAINFL 7	0.5				
8		0.0000	0.0040	0.0080	0.0100	0.0140
8		0.0190	0.0220	0.0260	0.0300	0.0450
8		0.0600	0.1000	0.7100	0.7500	0.7750
8		0.8000	0.8200	0.8300	0.8400	0.8500
8		0.8600	0.8700	0.8750	0.8850	0.8900
8		0.9000	0.9050	0.9100	0.9200	0.9250
8		0.9300	0.9350	0.9400	0.9450	0.9500
8		0.9550	0.9600	0.9650	0.9700	0.9730
8		0.9750	0.9800	0.9830	0.9870	0.9900
8		0.9930	0.9960	0.9999	1.0000	1.0000
9	ENDTBL					
2	XSECTN 001	1.0				
8		6880.00	0.0	0.00		
8		6880.53	10.0	0.92		
8		6881.19	50.0	2.88		
8		6881.74	100.0	4.79		
8		6882.85	200.0	8.39		
9	ENDTBL					
2	XSECTN 002	1.0				
8		6943.50	0.0	0.00		
8		6943.98	10.0	0.80		
8		6944.57	50.0	2.49		
8		6945.05	100.0	4.12		
8		6945.89	200.0	7.01		
9	ENDTBL					
2	XSECTN 003	1.0				
8		6954.00	0.0	0.00		
8		6954.67	10.0	1.30		
8		6954.95	20.0	2.12		
8		6955.55	50.0	4.12		
8		6956.39	100.0	7.01		
8		6956.79	120.0	8.22		
9	ENDTBL					
2	XSECTN 004	1.0				
8		6962.00	0.0	0.00		
8		6962.79	10.0	1.47		
8		6963.13	20.0	2.43		
8		6963.94	50.0	4.83		
8		6964.62	70.0	6.55		
9	ENDTBL					
2	XSECTN 005	1.0				
8		6968.00	0.0	0.00		

*****80-80 LIST OF INPUT DATA
 (CONTINUED)*****

8				6968.06	5.0		1.91		
8				6968.09	10.0		2.90		
8				6968.14	20.0		4.40		
8				6968.24	50.0		7.64		
9	ENDTBL								
3	STRUCT		01						
8				6880.00	0.0		0.0		
8				6882.00	17.0		0.81		
8				6884.00	42.0		2.52		
8				6886.00	60.0		4.32		
8				6888.00	72.0		6.21		
8				6890.00	88.0		8.19		
8				6892.00	125.0		10.26		
9	ENDTBL								
6	RUNOFF	1	003	2	0.0173	90.0	0.311	1	1
6	REACH	3	002	2 3	1700.0			1	1
6	RUNOFF	1	002	5	0.0257	90.0	0.303	1	1
6	ADDHYD	4	002	3 5 6				1	1
6	REACH	3	001	6 3	1700.0			1	1
6	RUNOFF	1	001	2	0.0575	87.0	0.208	1	1
6	ADDHYD	4	001	3 2 6				1	1
6	RESVOR	2	01	6 4	6880.0			1	1
	ENDATA								
7	INCREM	6			0.1				
7	COMPUT	7	003	01	0.0	4.40	1.0	7 2	01 01
	ENDCMP	1							
	ENDJOB	2							

0*****END OF 80-80
 LIST*****

EXECUTIVE CONTROL OPERATION INCREM
 RECORD ID

+ MAIN TIME INCREMENT = .10 HOURS

EXECUTIVE CONTROL OPERATION COMPUT
 RECORD ID

+ FROM XSECTION 3
 + TO STRUCTURE 1
 STARTING TIME = .00 RAIN DEPTH = 4.40 RAIN DURATION= 1.00
 RAIN TABLE NO.= 7 ANT. MOIST. COND= 2
 ALTERNATE NO.= 1 STORM NO.= 1 MAIN TIME INCREMENT = .10
 HOURS

OPERATION RUNOFF CROSS SECTION 3

PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
ELEVATION (FEET)		
(RUNOFF)	6.04	46.61

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA =	.02 SQ.MI.	
4.00	DISCHG	.00	.00
.00	.00	.01	
5.00	DISCHG	.03	.22
3.54	14.32	28.36	.40
6.00	DISCHG	39.16	.59
4.73	3.61	2.87	.84
7.00	DISCHG	46.01	9.70
2.25	2.10	1.97	6.39
8.00	DISCHG	2.36	2.30
.95	.93	.92	2.30
9.00	DISCHG	.92	2.29
.92	.92	.93	2.29
10.00	DISCHG	.93	1.04
.88	.73	.59	.97
11.00	DISCHG	.49	1.18
.87	.73	.59	1.04
12.00	DISCHG	.49	.92
.87	.73	.59	.92
13.00	DISCHG	.49	.92
.51	.66	.80	.92
14.00	DISCHG	.90	.92
.48	.47	.47	.92
15.00	DISCHG	.47	.92
.47	.47	.47	.92
16.00	DISCHG	.47	.92
.47	.47	.47	.92
17.00	DISCHG	.47	.92
.47	.47	.47	.92
18.00	DISCHG	.47	.92
.47	.47	.47	.92
19.00	DISCHG	.47	.92
.28	.24	.21	.92
20.00	DISCHG	.19	.92
.44	.39	.33	.92
21.00	DISCHG	.29	.92
.36	.33	.31	.92
22.00	DISCHG	.29	.92
.28	.28	.28	.92
23.00	DISCHG	.28	.92
.33	.21	.11	.92
24.00	DISCHG	.03	.92

*** WARNING REACH 2 ATT-KIN COEFF. (C) GREATER THAN 0.667, CONSIDER REDUCING MAIN TIME INCREMENT ***

OPERATION REACH CROSS SECTION 2

PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK ELEVATION (FEET)
6.04	46.61	6944.52

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA =	.02 SQ.MI.	

4.00	DISCHG		.00	.00	.00	.00	.00	.00
.00	.00	.00	.01					
5.00	DISCHG		.03	.09	.22	.40	.59	.84
3.54	14.32	28.36	39.16					

TR20 XEQ 04-17-03 16:21 GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR.
 100YR. STORM JOB 1 PASS 1
 REV PC 09/83(.2) DEVELOPED CONDITIONS INPUT : GB100REV
 PAGE 1

6.00	DISCHG		46.01	45.21	31.26	16.89	9.70	6.39
4.73	3.61	2.87	2.52					
7.00	DISCHG		2.36	2.32	2.30	2.30	2.29	2.29
2.25	2.10	1.97	1.90					
8.00	DISCHG		1.87	1.76	1.46	1.18	1.04	.97
.95	.93	.93	.92					
9.00	DISCHG		.92	.92	.92	.92	.92	.92
.92	.92	.93	.93					
10.00	DISCHG		.93	.93	.93	.93	.93	.93
.88	.73	.59	.52					
11.00	DISCHG		.49	.52	.66	.80	.87	.90
.87	.73	.59	.52					
12.00	DISCHG		.49	.53	.67	.80	.87	.90
.87	.73	.59	.52					
13.00	DISCHG		.49	.48	.47	.47	.47	.47
.51	.66	.80	.87					
14.00	DISCHG		.90	.87	.73	.59	.52	.49
.48	.47	.47	.47					
15.00	DISCHG		.47	.47	.47	.47	.47	.47
.47	.47	.47	.47					
16.00	DISCHG		.47	.47	.47	.47	.47	.47
.47	.47	.47	.47					
17.00	DISCHG		.47	.47	.47	.47	.47	.47
.47	.47	.47	.47					
18.00	DISCHG		.47	.47	.47	.47	.47	.47
.47	.47	.47	.47					
19.00	DISCHG		.47	.45	.39	.33	.30	.29
.28	.24	.21	.20					
20.00	DISCHG		.19	.22	.31	.39	.43	.45
.44	.39	.33	.30					
21.00	DISCHG		.29	.30	.32	.35	.36	.37
.36	.33	.31	.29					
22.00	DISCHG		.29	.28	.28	.28	.28	.28
.28	.28	.28	.28					
23.00	DISCHG		.28	.29	.32	.34	.36	.36
.33	.21	.11	.05					
24.00	DISCHG		.03	.02	.01	.00		

OPERATION RUNOFF CROSS SECTION 2

PEAK TIME (HRS) PEAK DISCHARGE (CFS) PEAK
 ELEVATION (FEET)

(RUNOFF)		6.03		69.71					
TIME (HRS)		FIRST HYDROGRAPH POINT = .00 HOURS		TIME INCREMENT =					
.10 HOURS		DRAINAGE AREA = .03 SQ.MI.							
4.00	DISCHG	.00	.00	.00	.00	.00	.00	.00	
.00	.00	.00	.02						
5.00	DISCHG	.05	.13	.33	.61	.90	1.22		
5.68	22.16	43.29	59.23						
6.00	DISCHG	69.01	67.27	45.33	23.98	13.75	9.09		
6.81	5.20	4.17	3.68						
7.00	DISCHG	3.50	3.44	3.42	3.41	3.41	3.41	3.41	
3.34	3.11	2.91	2.81						
8.00	DISCHG	2.77	2.60	2.14	1.73	1.53	1.44		
1.40	1.38	1.38	1.37						
9.00	DISCHG	1.37	1.37	1.37	1.37	1.37	1.37	1.37	
1.37	1.37	1.37	1.37						
10.00	DISCHG	1.38	1.38	1.38	1.38	1.38	1.38	1.38	
1.30	1.07	.87	.77						
11.00	DISCHG	.73	.78	1.00	1.20	1.30	1.34		
1.29	1.07	.87	.77						
12.00	DISCHG	.72	.78	1.00	1.20	1.30	1.34		
1.29	1.07	.87	.77						
13.00	DISCHG	.73	.71	.70	.69	.69	.69	.69	
.77	1.00	1.20	1.30						
14.00	DISCHG	1.35	1.29	1.07	.87	.77	.73		
.71	.70	.69	.69						
15.00	DISCHG	.69	.69	.69	.69	.69	.69	.69	
.69	.69	.69	.69						
16.00	DISCHG	.69	.69	.69	.69	.69	.69	.69	
.69	.69	.69	.69						
17.00	DISCHG	.69	.69	.69	.69	.69	.69	.69	
.69	.69	.69	.69						
18.00	DISCHG	.69	.69	.69	.69	.69	.69	.69	
.69	.70	.70	.70						
19.00	DISCHG	.69	.66	.57	.49	.45	.43		
.41	.36	.32	.29						
20.00	DISCHG	.29	.33	.46	.59	.65	.67		
.66	.57	.49	.45						
21.00	DISCHG	.43	.44	.48	.52	.54	.55		
.54	.49	.45	.43						
22.00	DISCHG	.42	.42	.42	.42	.42	.42	.42	
.42	.42	.42	.42						
23.00	DISCHG	.42	.43	.47	.51	.53	.54		
.48	.31	.15	.07						
24.00	DISCHG	.04	.02	.01	.01	.00			

TR20 XEQ 04-17-03 16:21
 100YR. STORM
 REV PC 09/83(.2)
 PAGE 2

GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR.
 JOB 1 PASS 1
 DEVELOPED CONDITIONS INPUT : GB100REV

OPERATION ADDHYD CROSS SECTION 2

ELEVATION (FEET)	PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
6945.19	6.04	116.32	
6943.61	10.38	2.30	
6943.61	11.50	2.24	
6943.61	12.49	2.25	
6943.61	14.00	2.25	

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA =	.04 SQ.MI.	
4.00	DISCHG	.00	.00
.00	.00	.00	.00
5.00	DISCHG	.09	.22
9.23	36.48	71.64	98.39
6.00	DISCHG	115.02	112.48
11.54	8.81	7.04	6.20
7.00	DISCHG	5.86	5.76
5.58	5.22	4.87	4.71
8.00	DISCHG	4.63	4.36
2.35	2.32	2.30	2.30
9.00	DISCHG	2.30	2.30
2.30	2.30	2.30	2.30
10.00	DISCHG	2.30	2.30
2.18	1.80	1.46	1.29
11.00	DISCHG	1.22	1.31
2.16	1.80	1.46	1.29
12.00	DISCHG	1.22	1.31
2.16	1.80	1.46	1.29
13.00	DISCHG	1.22	1.18
1.28	1.66	2.01	2.18
14.00	DISCHG	2.25	2.17
1.19	1.17	1.16	1.16
15.00	DISCHG	1.16	1.16
1.16	1.16	1.16	1.16
16.00	DISCHG	1.16	1.16
1.16	1.16	1.16	1.16
17.00	DISCHG	1.16	1.16
1.16	1.16	1.16	1.16
18.00	DISCHG	1.16	1.16
1.16	1.16	1.16	1.16
19.00	DISCHG	1.16	1.11
.68	.60	.53	.49
20.00	DISCHG	.48	.55
1.10	.96	.82	.75
21.00	DISCHG	.72	.73
.90	.83	.76	.73
22.00	DISCHG	.71	.70
.70	.70	.70	.70

23.00	DISCHG	.70	.72	.79	.85	.88	.90
.81	.52	.26	.13				
24.00	DISCHG	.07	.04	.02	.01	.00	

*** WARNING REACH 1 ATT-KIN COEFF.(C) GREATER THAN 0.667, CONSIDER
REDUCING MAIN TIME INCREMENT ***

OPERATION REACH CROSS SECTION 1

ELEVATION (FEET)	PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
6881.92	6.04	116.32	
6880.12	10.38	2.30	
6880.12	11.50	2.24	
6880.12	12.49	2.25	
6880.12	14.00	2.25	

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA = .04 SQ. MI.		
4.00	DISCHG .00	.00	.00
.00	.00 .03	.00	.00
5.00	DISCHG .09	.55	1.49
9.23	36.48 71.64 98.39	1.01	2.06

1

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GREENBRIAR DEVELOPMENT -- TR20 RUN 24 HR.
JOB 1 PASS 1
DEVELOPED CONDITIONS INPUT : GB100REV

6.00	DISCHG	115.02	112.48	76.59	40.87	23.45	15.48
11.54	8.81	7.04	6.20				
7.00	DISCHG	5.86	5.76	5.72	5.71	5.70	5.70
5.58	5.22	4.87	4.71				
8.00	DISCHG	4.63	4.36	3.60	2.90	2.56	2.41
2.35	2.32	2.30	2.30				
9.00	DISCHG	2.30	2.30	2.30	2.30	2.30	2.30
2.30	2.30	2.30	2.30				
10.00	DISCHG	2.30	2.30	2.30	2.30	2.30	2.30
2.18	1.80	1.46	1.29				
11.00	DISCHG	1.22	1.31	1.66	2.00	2.17	2.24
2.16	1.80	1.46	1.29				
12.00	DISCHG	1.22	1.31	1.67	2.01	2.18	2.25
2.16	1.80	1.46	1.29				
13.00	DISCHG	1.22	1.18	1.17	1.16	1.16	1.16
1.28	1.66	2.01	2.18				
14.00	DISCHG	2.25	2.17	1.80	1.46	1.30	1.22
1.19	1.17	1.16	1.16				

15.00	DISCHG		1.16	1.16	1.16	1.16	1.16	1.16
1.16	1.16	1.16	1.16	1.16				
16.00	DISCHG		1.16	1.16	1.16	1.16	1.16	1.16
1.16	1.16	1.16	1.16	1.16				
17.00	DISCHG		1.16	1.16	1.16	1.16	1.16	1.16
1.16	1.16	1.16	1.16	1.16				
18.00	DISCHG		1.16	1.16	1.16	1.16	1.16	1.16
1.16	1.16	1.16	1.16	1.16				
19.00	DISCHG		1.16	1.11	.96	.82	.75	.72
.68	.60	.53	.49					
20.00	DISCHG		.48	.55	.77	.98	1.08	1.13
1.10	.96	.82	.75					
21.00	DISCHG		.72	.73	.80	.87	.90	.92
.90	.83	.76	.73					
22.00	DISCHG		.71	.70	.70	.70	.70	.70
.70	.70	.70	.70					
23.00	DISCHG		.70	.72	.79	.85	.88	.90
.81	.52	.26	.13					
24.00	DISCHG		.07	.04	.02	.01	.00	

OPERATION RUNOFF CROSS SECTION 1

ELEVATION (FEET)	PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
(RUNOFF)	5.99	157.48	
(RUNOFF)	7.45	7.36	
(RUNOFF)	10.37	2.97	
(RUNOFF)	11.46	3.00	
(RUNOFF)	12.46	3.01	
(RUNOFF)	13.96	3.02	
(RUNOFF)	23.45	1.21	

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA = .06 SQ.MI.		
5.00	DISCHG .00 .00	.05	.35 .82 1.47
16.28	65.61 110.80 139.84		
6.00	DISCHG 157.11 128.22	55.47	24.86 15.56 12.68
10.73	8.48 7.64 7.39		
7.00	DISCHG 7.31 7.30	7.30	7.31 7.32 7.32
6.97	6.28 6.00 5.92		
8.00	DISCHG 5.89 5.17	3.77	3.20 3.02 2.97
2.96	2.95 2.95 2.96		
9.00	DISCHG 2.96 2.96	2.96	2.96 2.96 2.96
2.96	2.96 2.97 2.97		
10.00	DISCHG 2.97 2.97	2.97	2.97 2.97 2.97
2.61	1.90 1.61 1.53		
11.00	DISCHG 1.50 1.86	2.56	2.85 2.94 2.96
2.61	1.91 1.62 1.53		

12.00	DISCHG		1.51	1.86	2.57	2.86	2.95	2.97
2.62	1.91	1.62	1.53					
13.00	DISCHG		1.51	1.50	1.50	1.50	1.50	1.50
1.86	2.58	2.87	2.96					
14.00	DISCHG		2.98	2.63	1.91	1.63	1.54	1.51
1.50	1.50	1.50	1.50					
15.00	DISCHG		1.50	1.50	1.50	1.50	1.50	1.50
1.50	1.50	1.50	1.50					
16.00	DISCHG		1.50	1.50	1.50	1.50	1.50	1.50
1.50	1.50	1.50	1.50					
17.00	DISCHG		1.50	1.51	1.51	1.51	1.51	1.51
1.51	1.51	1.51	1.51					
18.00	DISCHG		1.51	1.51	1.51	1.51	1.51	1.51
1.51	1.51	1.51	1.51					
19.00	DISCHG		1.51	1.36	1.07	.96	.92	.91
.83	.69	.63	.61					
20.00	DISCHG		.61	.83	1.26	1.43	1.49	1.50
1.36	1.08	.96	.92					

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GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR.
 JOB 1 PASS 1
 DEVELOPED CONDITIONS INPUT : GB100REV

21.00	DISCHG		.91	.98	1.12	1.18	1.20	1.21
1.14	.99	.93	.92					
22.00	DISCHG		.91	.91	.91	.91	.91	.91
.91	.91	.91	.91					
23.00	DISCHG		.91	.98	1.10	1.16	1.17	1.18
.90	.35	.13	.06					
24.00	DISCHG		.04	.02	.01	.00		

OPERATION ADDHYD CROSS SECTION 1

ELEVATION (FEET)	PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
6883.65	6.00	272.14	
6880.58	7.45	13.08	
6880.28	10.37	5.27	
6880.28	11.47	5.23	
6880.28	12.47	5.25	
6880.28	13.97	5.26	
6880.14	18.86	2.67	
6880.11	23.45	2.11	

TIME (HRS)	FIRST HYDROGRAPH POINT = .00 HOURS				TIME INCREMENT =			
.10 HOURS	DRAINAGE AREA = .10 SQ.MI.							
4.00	DISCHG	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.03					
5.00	DISCHG	.09	.22	.60	1.36	2.31	3.53	
25.50	102.09	182.44	238.23					
6.00	DISCHG	272.13	240.70	132.06	65.73	39.02	28.16	
22.27	17.29	14.68	13.59					
7.00	DISCHG	13.18	13.06	13.02	13.02	13.02	13.02	
12.56	11.50	10.88	10.63					
8.00	DISCHG	10.52	9.53	7.37	6.10	5.59	5.38	
5.30	5.27	5.26	5.25					
9.00	DISCHG	5.25	5.25	5.26	5.26	5.26	5.26	
5.26	5.26	5.26	5.27					
10.00	DISCHG	5.27	5.27	5.27	5.27	5.27	5.27	
4.79	3.71	3.07	2.81					
11.00	DISCHG	2.72	3.16	4.23	4.85	5.11	5.21	
4.77	3.70	3.08	2.82					
12.00	DISCHG	2.72	3.17	4.24	4.86	5.12	5.22	
4.78	3.71	3.08	2.83					
13.00	DISCHG	2.72	2.68	2.66	2.66	2.65	2.66	
3.15	4.24	4.87	5.14					
14.00	DISCHG	5.23	4.79	3.72	3.09	2.83	2.73	
2.69	2.67	2.66	2.66	2.66	2.66	2.66	2.66	
15.00	DISCHG	2.66	2.66	2.66	2.66	2.66	2.66	
2.66	2.66	2.66	2.66	2.66	2.66	2.66	2.66	
16.00	DISCHG	2.66	2.66	2.66	2.66	2.66	2.66	
2.66	2.67	2.67	2.67	2.67	2.67	2.67	2.67	
17.00	DISCHG	2.67	2.67	2.67	2.67	2.67	2.67	
2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	
18.00	DISCHG	2.67	2.67	2.67	2.67	2.67	2.67	
2.67	2.67	2.67	2.67	2.67	2.67	2.67	2.67	
19.00	DISCHG	2.67	2.47	2.04	1.78	1.67	1.63	
1.52	1.29	1.16	1.11					
20.00	DISCHG	1.09	1.37	2.03	2.41	2.57	2.63	
2.46	2.03	1.78	1.68					
21.00	DISCHG	1.64	1.72	1.93	2.06	2.11	2.13	
2.04	1.82	1.69	1.64					
22.00	DISCHG	1.62	1.61	1.61	1.61	1.61	1.61	
1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	
23.00	DISCHG	1.61	1.70	1.89	2.01	2.06	2.07	
1.71	.88	.39	.19					
24.00	DISCHG	.11	.07	.03	.01	.00	.00	

OPERATION RESVOR STRUCTURE 1
1

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GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR.
JOB 1 PASS 1
DEVELOPED CONDITIONS INPUT : GB100REV

ELEVATION (FEET)	PEAK TIME (HRS)	PEAK DISCHARGE (CFS)	PEAK
6889.12	6.29	80.99	
6880.51	12.64	4.36	
6880.48	14.17	4.12	
6880.31	18.95	2.67	
6880.22	23.56	1.84	

TIME (HRS)	FIRST HYDROGRAPH POINT =	.00 HOURS	TIME INCREMENT =
.10 HOURS	DRAINAGE AREA = .10 SQ. MI.		
5.00	DISCHG .01 .03	.09	.24 .49 .88
3.06	12.75 28.72 47.17		
6.00	DISCHG 62.37 72.37	79.73	80.97 79.12 76.18
72.89	69.99 67.23 64.51		
7.00	DISCHG 61.90 59.07	55.42	52.05 48.96 46.10
43.46	40.51 37.17 34.16		
8.00	DISCHG 31.47 29.03	26.69	24.41 22.30 20.38
18.67	17.14 15.30 13.70		
9.00	DISCHG 12.35 11.22	10.27	9.47 8.79 8.23
7.76	7.36 7.02 6.74		
10.00	DISCHG 6.51 6.31	6.14	6.00 5.89 5.79
5.67	5.44 5.11 4.77		
11.00	DISCHG 4.45 4.21	4.13	4.19 4.32 4.45
4.54	4.49 4.31 4.10		
12.00	DISCHG 3.88 3.73	3.73	3.86 4.04 4.22
4.35	4.33 4.18 3.98		
13.00	DISCHG 3.79 3.62	3.47	3.34 3.23 3.14
3.10	3.19 3.41 3.67		
14.00	DISCHG 3.91 4.08	4.11	4.00 3.83 3.66
3.51	3.38 3.27 3.17		
15.00	DISCHG 3.09 3.02	2.96	2.91 2.87 2.84
2.81	2.79 2.77 2.75		
16.00	DISCHG 2.74 2.72	2.72	2.71 2.70 2.69
2.69	2.69 2.68 2.68		
17.00	DISCHG 2.68 2.68	2.67	2.67 2.67 2.67
2.67	2.67 2.67 2.67		
18.00	DISCHG 2.67 2.67	2.67	2.67 2.67 2.67
2.67	2.67 2.67 2.67		
19.00	DISCHG 2.67 2.65	2.59	2.48 2.36 2.25
2.14	2.02 1.90 1.77		
20.00	DISCHG 1.67 1.60	1.61	1.71 1.83 1.96
2.05	2.08 2.05 2.00		
21.00	DISCHG 1.95 1.90	1.89	1.91 1.93 1.96
1.98	1.97 1.94 1.90		
22.00	DISCHG 1.85 1.82	1.78	1.76 1.73 1.71
1.70	1.68 1.67 1.66		
23.00	DISCHG 1.65 1.65	1.67	1.72 1.77 1.82
1.83	1.74 1.57 1.36		
24.00	DISCHG 1.17 1.00	.84	.71 .60 .50
.42	.36 .30 .25		

25.00	DISCHG	.21	.18	.15	.13	.11	.09
.07	.06	.05	.04				
26.00	DISCHG	.04	.03	.03	.02	.02	.02
.01	.01	.01	.01				

EXECUTIVE CONTROL OPERATION ENDCMP

RECORD ID

+

COMPUTATIONS COMPLETED FOR PASS 1

EXECUTIVE CONTROL OPERATION ENDJOB

RECORD ID

1

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GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR.

100YR. STORM

JOB 1 SUMMARY

REV PC 09/83(.2)

DEVELOPED CONDITIONS INPUT : GB100REV

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SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED

(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS)

VALUES INDICATES A FLAT TOP HYDROGRAPH

A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ PEAK DISCHARGE STRUCTURE RUNOFF	STANDARD CONTROL	DRAINAGE AREA	RAIN TABLE	ANTEC MOIST	MAIN TIME	PRECIPITATION			
ID	OPERATION	#	COND	INCREM	BEGIN	AMOUNT	DURATION		
AMOUNT	ELEVATION	RATE	RATE	RATE	(HR)	(IN)	(HR)		
(IN)	(FT)	(CFS)	(CSM)	(CSM)	(HR)	(IN)	(HR)		
ALTERNATE	1	STORM	1						
XSECTION	3	RUNOFF	.02	7	2	.10	.0	4.40	24.00
3.30	---	6.04	46.61	2694.3					
XSECTION	2	REACH	.02	7	2	.10	.0	4.40	24.00
3.30	6944.52	6.04	46.61	2694.3					
XSECTION	2	RUNOFF	.03	7	2	.10	.0	4.40	24.00
3.30	---	6.03	69.71	2712.4					
XSECTION	2	ADDHYD	.04	7	2	.10	.0	4.40	24.00
3.30	6945.19	6.04	116.32	2705.0					
XSECTION	1	REACH	.04	7	2	.10	.0	4.40	24.00
3.30	6881.92	6.04	116.32	2705.0					

XSECTION	1	RUNOFF	.06	7	2	.10	.0	4.40	24.00
3.01	---	5.99	157.48	2738.7					
XSECTION	1	ADDHYD	.10	7	2	.10	.0	4.40	24.00
3.14	6883.65	6.00	272.14	2707.9					
STRUCTURE	1	RESVOR	.10	7	2	.10	.0	4.40	24.00
3.13	6889.12	6.29	80.99	805.8					

1

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GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR.
 JOB 1 SUMMARY
 DEVELOPED CONDITIONS INPUT : GB100REV

SUMMARY TABLE 2 - SELECTED MODIFIED ATT-KIN REACH ROUTINGS IN ORDER OF STANDARD EXECUTIVE CONTROL INSTRUCTIONS

(A STAR(*) AFTER VOLUME ABOVE BASE(IN) INDICATES A HYDROGRAPH TRUNCATED AT A VALUE EXCEEDING BASE + 10% OF PEAK

A QUESTION MARK(?) AFTER COEFF.(C) INDICATES PARAMETERS OUTSIDE ACCEPTABLE LIMITS, SEE PREVIOUS WARNINGS)

HYDROGRAPH INFORMATION

ROUTING PARAMETERS

PEAK

+

ITER-	Q AND A	PEAK	S/Q	ATT-	OUTFLOW+	VOLUME	MAIN
+				TRAVEL	TRAVEL TIME		

+

XSEC REACH	INFLOW	OUTFLOW	INTERV.AREA	BASE-	ABOVE	TIME
ATION EQUATION	LENGTH	RATIO @PEAK	KIN STOR-	KINE-		

+

ID	LENGTH	PEAK	TIME	PEAK	TIME	PEAK	TIME	FLOW	BASE	INCR	#
COEFF	POWER	FACTOR	O/I	(K)	COEFF	AGE	MATIC				
(X)	(M)	(K*)	(Q*)	(SEC)	(C)	(HR)	(HR)	(CFS)	(IN)	(HR)	

ALTERNATE 1 STORM 1

+

13.7											
+ 2	1700	46	6.0	46	6.0			0	3.30	.10	0
1.42	.007	1.000	61	1.00?	.00	.00					
+						115	6.0				

11.5											
+ 1	1700	115	6.0	115	6.0			0	3.30	.10	0
1.37	.007	1.000	58	1.00?	.00	.00					
+						272	6.0				

1

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 100YR. STORM
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GREENBRIAR DEVELOPMENT - TR20 RUN 24 HR.
 JOB 1 SUMMARY
 DEVELOPED CONDITIONS INPUT : GB100REV

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.....
0 STRUCTURE 1	.10	1
+		
ALTERNATE 1		80.99
0 XSECTION 1	.10	
+		
ALTERNATE 1		272.14
0 XSECTION 2	.04	
+		
ALTERNATE 1		116.32
0 XSECTION 3	.02	
+		
ALTERNATE 1		46.61

1END OF 1 JOBS IN THIS RUN

Appendix F

Design Charts

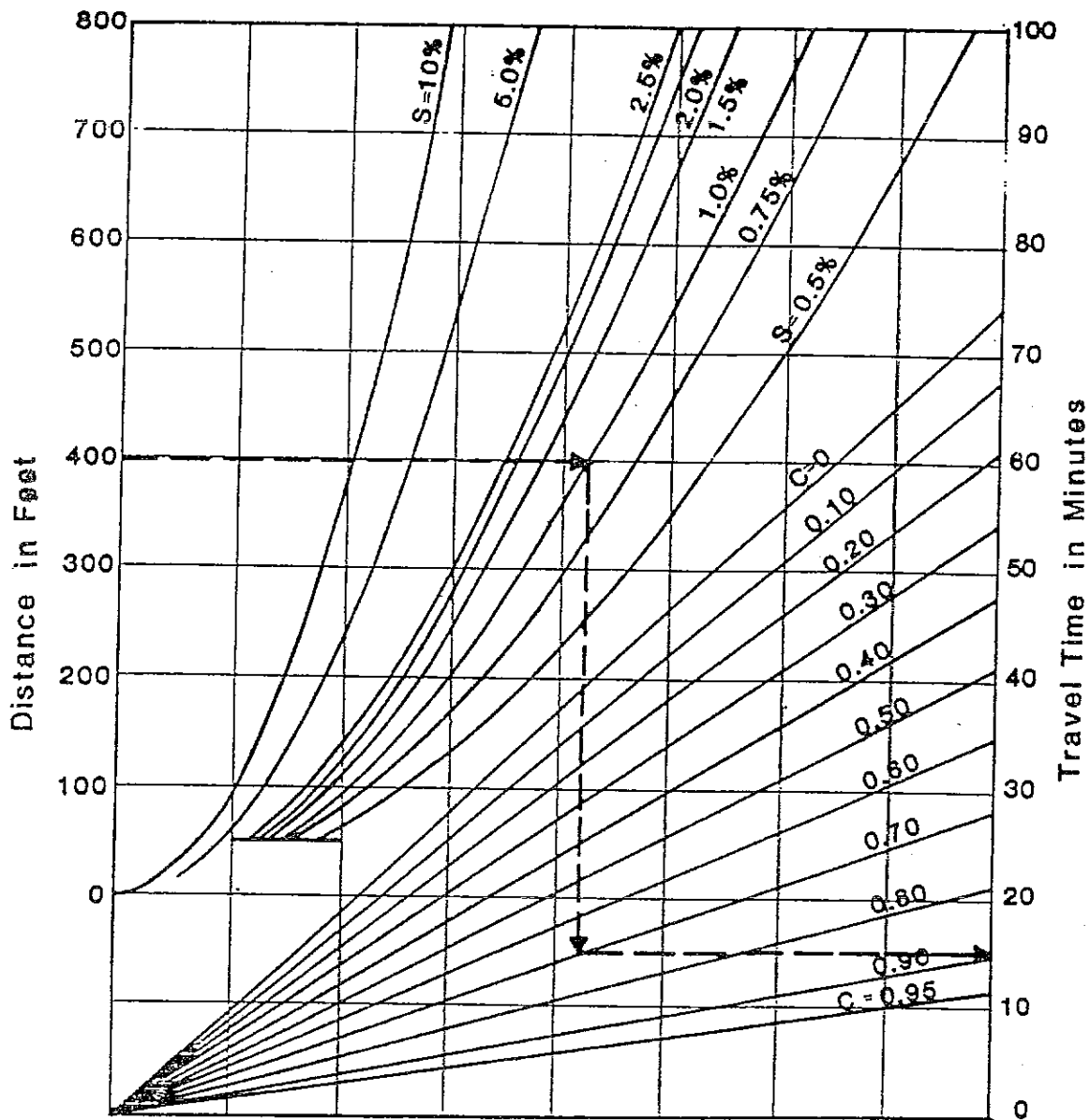
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY			
		10		100	
		A&B*	C&D*	A&B*	C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



REFERENCE : Wright - McLaughlin Engineers, Urban Storm Drainage Criteria Manual, Vol. 1,
 Denver Regional Council of Governments, Denver, Co. 1977



HDR Infrastructure, Inc.
 A Centerra Company

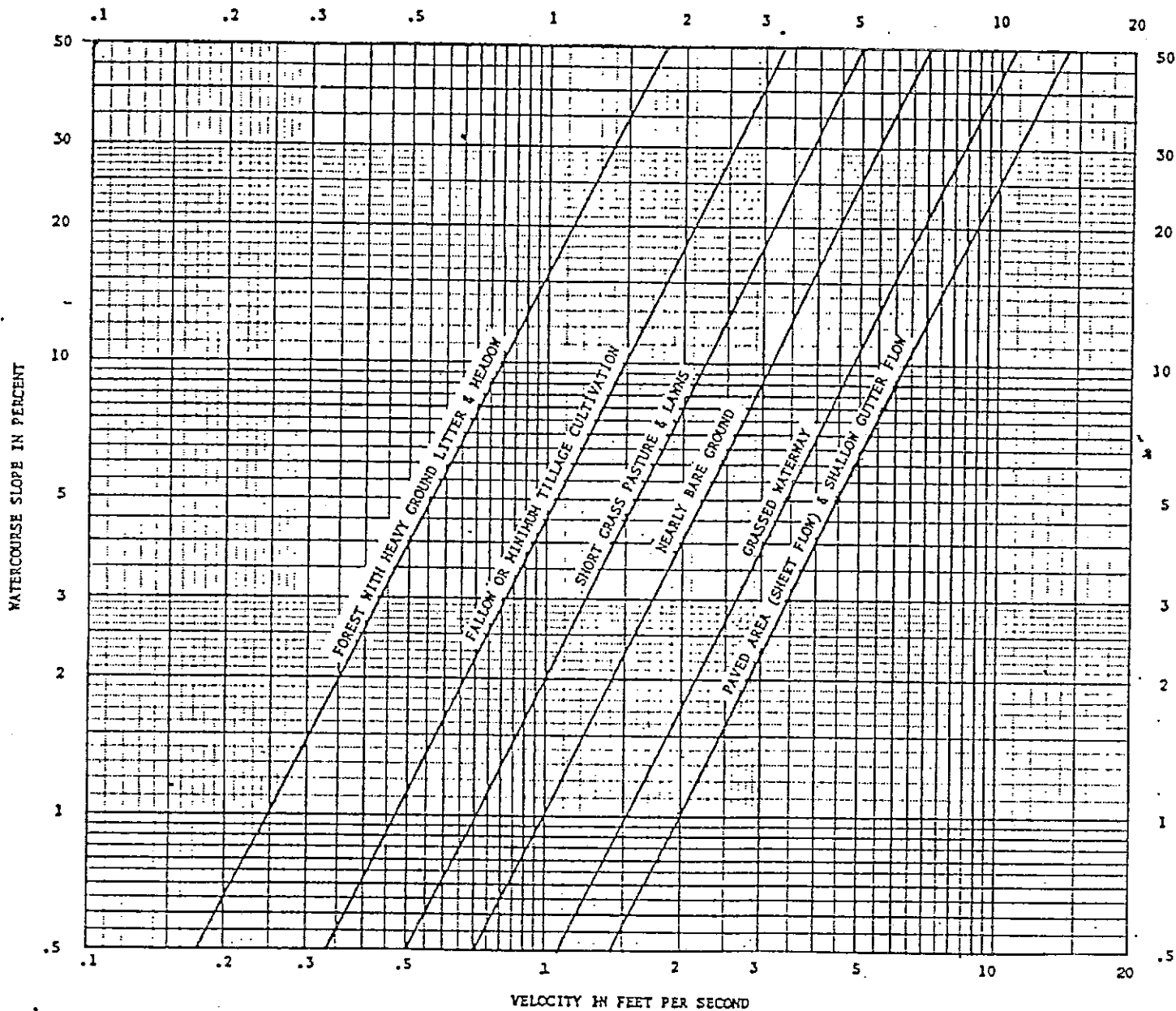
The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

Overland Flow Curves

5-10

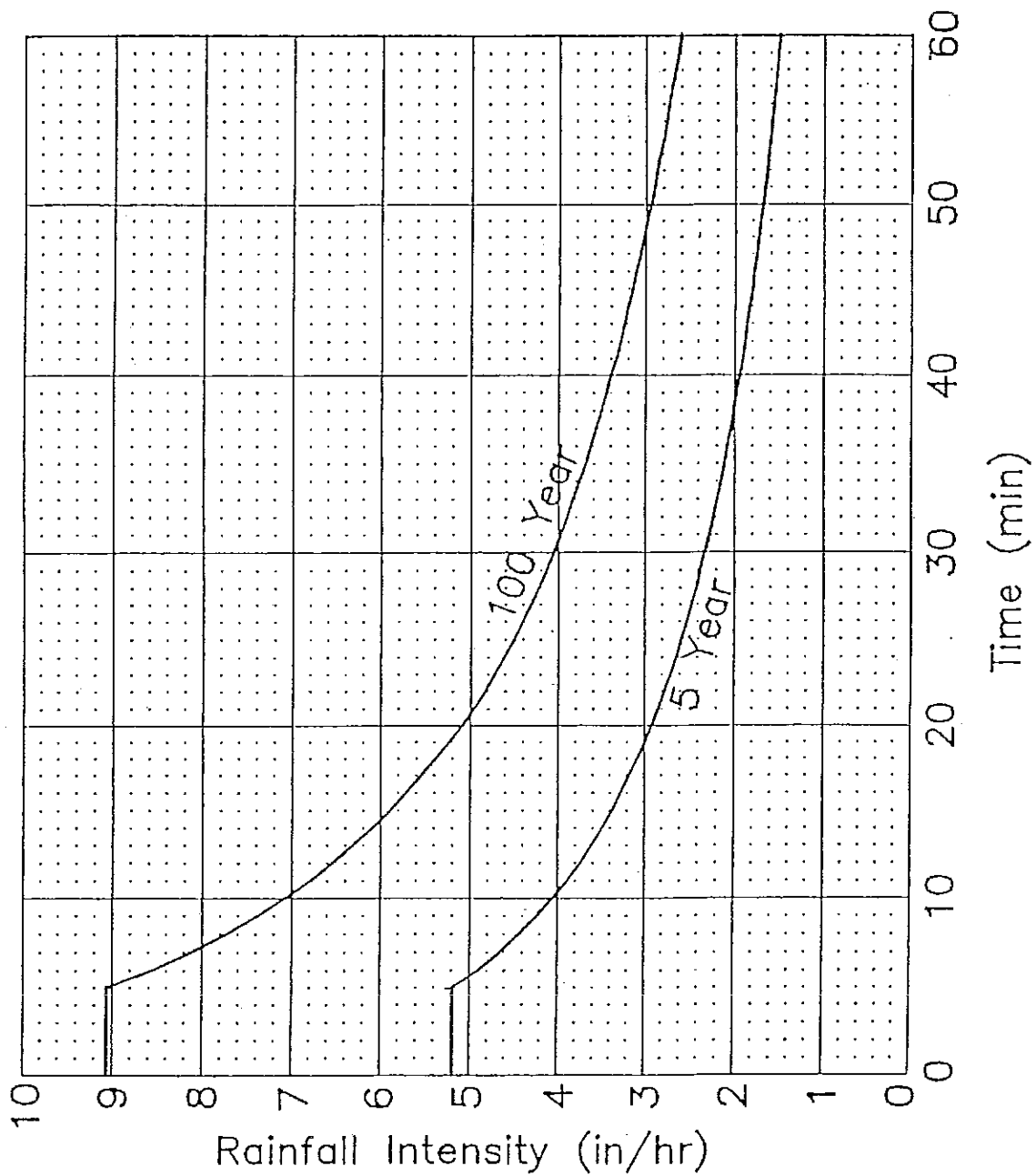
Date
 OCT. 1987

Figure
 5-2



---Average velocities for estimating travel time for overland flow.

FIGURE 4



$$i_t = \frac{36.4 * i_{60}}{t^{0.83} + 6.72}$$

5 Year: $i_{60} = 1.50$
 100 Year: $i_{60} = 2.62$

RE: Based upon Pikes Peak Area Council of Governments
 Areawide Urban Runoff Control Manual.

The City of Colorado Springs / El Paso County
 Drainage Criteria Manual

Storm Rainfall
 Time Intensity - Frequency Curves

Date:

MAR. 1995

Figure:

5 - 1