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Approved. S.J.
4-1-71

REVISED DRAINAGE STUDY

M. J. BROCK DEVELOPMENT

- Prepared by -
MEURER, SERAFINI AND MEURER, INC.
Consulting Engineers
2901 West 19th Avenue
Denver, Colorado 80204

April, 1971 Job #90003

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MEURER, SERAFINI AND MEURER, INC.

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Denver, Colorado 80204

Civil Engineers
Structural Engineers
Land Surveyors

Phone: 433-7321

April, 1971

REVISED DRAINAGE STUDY

M. J. BROCK DEVELOPMENT

LOCATION

This drainage study is for the M. J. Brock Development located in portions of Sections 31 and 32, Township 14 South, Range 66 West and in portions of Sections 5 and 6, Township 15 South, Range 66 West of the Sixth Principal Meridian, El Paso County, Colorado. The total drainage area is approximately 235 acres, of which approximately 70 acres are offsite drainage from the west.

CRITERIA

Flood drainage is designed using the "rational method" to determine the quantity of runoff water.

Rational Formula: $Q = Aci$

"Q" = Runoff, or peak discharge from the watershed from a maximum storm in c.f.s.

"c" = The runoff coefficient

"i" = Values of "i" are the rainfall intensity-duration (in inches per hour)

"A" = The tributary area in acres.

This study involves runoff calculations for a 50 year storm frequency. All runoff will be contained within the streets (top of curb to top of curb). Well before the runoff exceeds the top of curb, storm inlets and a storm drain system have been designed to relieve the street excess.

This drainage study has been prepared in conjunction with Hartzell-Pfeiffenberger & Associates' construction plans for Cheyenne Mountain Boulevard, and the final design for the storm sewer system in Cheyenne Mountain Boulevard in more detail can be found on said plans. Where there is any storm sewer required outside the right of way of Cheyenne Mountain Boulevard, final construction plans

will be prepared when final approval for the filing is requested.

A "c" value of 0.5 was used throughout the proposed development. This assumes totally developed land for the entire area. The runoff for the offsite area was based on a basin study prepared by Hartzell-Pfeiffenberger & Associates for the City of Colorado Springs. The portion of that runoff from the basin which is directly attributable to this subdivision was used after converting it to a 50 year storm figure. This runoff is all directed to an existing 24 inch culvert under State Highway 115, which will probably have to be increased in the future, then through a natural draw to an existing 60 inch R.C.P. under Cheyenne Mountain Boulevard, and then continuing Northeasterly and Easterly in the natural swale for approximately 650 feet, and then through a proposed 54 inch R.C.P. storm sewer along the north boundary of the property, exiting at the northeast corner of the property.

Assuming that the approximately 650 foot natural swale is left completely natural (no overlot grading done in this area), it is understood that the City of Colorado Springs will accept maintenance responsibility for the proposed 54 inch R.C.P. storm sewer and the open swale if, when this area is platted, a maintenance access way and easement is provided for the City maintenance equipment to reach said swale and 54 inch R.C.P. If any overlot grading takes place within this swale area, then the open swale shall be riprapped in accordance with City specifications, and a typical cross section and profile of said swale must be approved by the City before they accept maintenance of this swale, and the proposed 54 inch R.C.P.

Parkdale Lane, which is located in the northwest portion of the site, is proposed to drain into the bulb of the cul-de-sac as shown on the enclosed drawing; and a storm culvert is proposed to carry the runoff at the end of this cul-de-sac between property lines into the above-mentioned natural swale. West-cliff Circle has a natural low point in its most Northerly location. Inlets and a culvert between property lines are also proposed here, to carry this flow down into the 54 inch R.C.P. along the north boundary of this property. Grass swales between the houses which border the proposed storm culverts in the above two instances

are to be provided in the event of an exceptionally heavy storm or in the event storm drain inlets or culverts become plugged, to prevent damage to said houses.

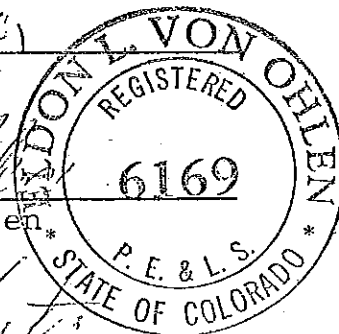
The majority of the on-site drainage flows Easterly, and a large percentage of this drainage is collected in the storm sewer system in Cheyenne Mountain Boulevard as shown on the enclosed storm drainage plan. This all is proposed to be ultimately discharged into the West end of the proposed lake immediately to the East of this property.

Types of curb, pans, directions of flow, inlets, flows, and storm sewer are shown on the attached drainage plan. All final design of storm drainage pipes and appurtenances, including plan and profile sheets, will be shown on the final construction plans.

Prepared by Arthur H. Miller
Arthur H. Miller

Approved by Eldon Von Ohlen
Eldon Von Ohlen

Approved by Jack R. Hartel
for M. J. Brock & Sons



BY YWL DATE 2-19-70 SHEET NO. 30254 OF 5
 CHKD BY AHM DATE APRIL '71 SUBJECT M.J.B. BOX
 REVISION APRIL '71 AHM

DRAINAGE STUDY

STREET	FROM	TO	AREA DESIG.	AREA ACRES	C	EA OR AC	ΣAC	I MIN.	I IN/HR.	Q C.F.S.	S %	L FT.	V F.P.S.	ΔI	ALLOW. Q IN GUTTER STREET	SUR-PLUS Q	D PIPE	NOTES	
			1	6.9	0.5	3.5	3.5	20.3	4.4	15.4	4.3	440			65.6				
				AREA 1											-A to	6' Box take	would be reg'd here	entire flow.	
			2																
			3	3.6	0.5	1.8	1.8	19.2	4.6	8.3	2.8	810			54.8				
			4	3.8	0.5	1.9	1.9	17.6	4.8	9.1	1.9	460			54.8				
			5	0.5	0.5	0.2	0.2	13.3	5.3	1.1	3.0	150			234.5				
		Σ 3,4,5,6	6	1.5	0.5	0.8	4.7	19.4	4.6	21.6	2.4	400			209.8				
		Σ 2,3,4,5,6								293									54" RCP @ 3.84% along N. Brdy
																			FOR THIS ABOVE AREA - SEE DRAINAGE STUDY BY HARTZEL-LEFFIEN-BERGER dated 22 MAR '71
			8	2.2	0.5	1.1	1.1	11.9	5.3	5.8	4.3	400			65.6				
			9	1.6	0.5	0.8	0.8	12.0	5.3	4.2	3.3	310			59.6				
		Σ 7,8,9,10	10	2.0	0.5	1.0	3.5	13.1	5.3	18.5	3.5	470			61.4				
			11	2.9	0.5	1.4	1.4	10.3	5.3	7.4	6.3	610			65.6				
		Σ 10,11					4.9	13.1	5.3	25.9									24" RCP to tie into 54" RCP

STREET	FROM	TO	AREA DESIG.	AREA ACRES	C	ΣA OR AC	ΣAC	I ₁ MIN.	I IN/HR.	Q C.F.S.	S %	L FT.	V F.P.S.	ΔI	ALLOW. Q IN GUTTER	SUR- PLUS Q	D, PIPE	NOTES
			12	0.5	0.5	0.2	0.2	15.6	5.2	1.0	1.7	190			176.5			
			13	2.6	0.5	1.3	1.3	14.2	5.3	6.9	1.2	340			47.6			
		Σ12,13,14	14	0.8	0.5	0.4	1.9	16.1	5.1	9.7	6.1	290			270.8			
			15	5.8	0.5	2.9	2.9	19.1	4.6	13.3	2.6	1040			52.8			
			16	1.5	0.5	0.8	0.8	9.5	5.3	4.2	1.8	150			44.0			
		Σ14,15,16,17	17	0.9	0.5	0.4	6.0	19.6	4.5	27.0	5.7	300			270.8			
			18	7.8	0.5	3.9	3.9	17.3	4.9	19.1	3.9	800			64.8			
			19	0.8	0.5	0.4	0.4	13.0	5.3	2.1	5.7	180			32.8			
		Σ19,20	20	1.1	0.5	0.6	1.0	14.7	5.3	5.3	2.5	310			51.8			
		Σ18,20,21	21	10.3	0.5	5.2	10.1	20.2	4.4	44.4	0.7	930			69.8			8" CURB 20CFS IN ST 1.2 CFS IN ST 3" FOR JULES BEHND INTERSEC 1071 W/ 113
			22	1.9	0.5	1.0	1.0	9.9	5.3	5.3	0.5	160			23.2			
		Σ17,21,22,23	23	0.7	0.5	0.4	17.5	20.6	4.4	77.0	6.2	270			270.8			21" RCP @ 6.4% 40CFS IN PIPE 37CFS IN STREET
			24	4.9	0.5	2.5	2.5	12.9	5.3	13.2	1.6	480			41.6			
			25	2.0	0.5	1.0	1.0	13.6	5.3	5.3	0.6	340			25.4			
		Σ25,26	26	3.0	0.5	1.5	2.5	14.7	5.3	13.2	3.5	700			61.4			
			27	4.9	0.5	2.4	2.4	17.0	5.0	12.0	3.1	1050			57.8			

BY VWL DATE 9-18-70
 CHD BY AHM DATE APRIL 71
 SUBJECT M. J. BRACE
 REVISED APRIL 71
 SHEET NO. 2 OF 5
 JOB NO. 39264

DRAINAGE STUDY

STREET	FROM	TO	AREA DESIG.	AREA ACRES	C	EA OR AC	ΣAC	t ₁ MIN.	I IN/HR.	Q C.F.S.	S %	L FT.	V F.P.S.	Δt	ALLOW. Q IN GUTTER	SUR- PLUS Q	D, PIPE	NOTES
		Σ26,27,28	28	1.9	0.5	1.0	5.9	17.9	4.9	28.9	4.9	400			65.6			
		Σ23,24,28,29	29	0.6	0.5	0.3	26.2	21.0	4.3	112.6	5.8	290			270.8			21" RCP @ 5.94% 70 CFS IN PIPE 42 CFS IN STREET
			30	4.0	0.5	2.0	2.0	12.0	5.3	10.6	4.8	590			65.6			
			31	5.9	0.5	3.0	3.0	11.8	5.3	15.9	5.2	890			65.6			
		Σ29,30,31,32	32	0.8	0.5	0.4	31.6	21.5	4.3	135.8	4.4	290			270.8			35" RCP @ 3.33% 97 CFS IN PIPE 38 CFS IN ST.
			33	1.2	0.5	0.6	0.6	17.8	5.3	3.2	5.7	190			22.2			
		Σ33,34	34	5.2	0.5	2.6	3.2	18.4	4.7	15.0	1.4	1050			38.8			
		Σ34,35	35	0.9	0.5	0.4	3.6	18.9	4.6	16.5	6.0	250			65.6			
			36	2.1	0.5	1.0	1.0	6.3	5.3	5.3	6.0	420			65.6			
		Σ35,36,37	37	1.7	0.5	0.8	5.4	19.3	4.6	24.8	2.9	260			55.8			
			38	3.0	0.5	1.5	1.5	19.1	4.6	6.9	1.5	400			40.2			
			39	0.4	0.5	0.2	0.2	8.4	5.3	1.1	2.1	290			23.8			
			40	0.8	0.5	0.4	0.4	11.3	5.3	2.1	1.6	300			20.8			
		Σ39,40,41	41	1.9	0.5	2.0	2.6	12.4	5.3	13.8	0.8	380			29.4			
		Σ38,41,42	42	1.2	0.5	0.6	4.7	19.5	4.5	21.1	0.8	260			29.4			
		Σ37,42,43	43	3.2	0.5	1.6	11.7	20.1	4.5	52.6	2.3	360			126.6			8" CORU

BY VMC DATE 9-18-70 SUBJECT REVISION APRIL 1971
 CHKD BY AHM
 DRAINAGE STUDY
 SHEET NO. 3 OF 5
 JOB NO. 39264

STREET	FROM	TO	AREA DESIG.	AREA ACRES	C	EA OR AC	ΣAC	I ₁ MIN.	I IN/HR.	Q C.F.S.	S %	L FT.	V F.P.S.	ΔI	ALLOW. Q IN GUTTER	SUR- PLUS Q	D, PIPE	NOTES
			44	9.2	0.5	4.6	4.6	18.6	4.7	21.6	2.9	1010			55.8			
		Σ43,44,45	45	1.8	0.5	0.9	17.2	21.2	4.3	74.0	3.1	400			147.0			3" CURB 16 CFS IN 56 CFS IN PIPE STREET
			46	2.5	0.5	1.2	1.2	12.7	5.3	6.4	6.6	230			65.6			
		Σ45,46,47	47	2.3	0.5	1.2	19.6	21.9	4.2	82.3	1-2	380			91.4			3" CURB PROVIDE PICK UP DRAINAGE CHRY. MTR INLETS TO 66 CFS ENTERS BLVD.
			48	4.2	0.5	2.1	2.1	11.4	5.3	11.1	5.5	720			65.6			
		Σ32,47,48,49	49	0.8	0.5	0.4	53.7	23.4	4.0	214.8	0.8	360			121.1			48 ROP @ 1.33% 166 CFS IN PIPE 45 CFS IN STREET
			50	2.5	0.5	1.2	1.2	12.2	5.3	6.4	2.0	140			46.4			
		Σ49,50,51	51	1.3	0.5	0.6	55.5	26.0	3.8	210.8	0.5	500			35.7			PROVIDE 48" PIPE TO TAKE ALL RUNOFF FROM 50' STORM TO LAKE COMING FROM WEST.
			52	1.0	0.5	0.5	0.5	11.2	5.3	2.6	3.8	280			64.0			
		Σ52,53	53	4.4	0.5	2.2	2.7	12.5	5.3	14.3	5.4	670			65.6			
		Σ53,54	54	0.6	0.5	0.3	3.0	13.2	5.3	15.9	3.2	320			242.2			
		Σ52-55	55	3.5	0.5	1.8	5.7	13.5	5.3	30.2	4.2	380			65.6			PICK UP ALL FLOW IN PIPE AS SHOWN
			56	0.6	0.5	0.3	0.3	9.5	5.3	1.6	0.5	120			23.2			
		Σ56,57	57	0.5	0.5	0.2	0.5	12.9	5.3	2.6	2.1	290			23.8			
			58	1.1	0.5	0.6	0.6	11.3	5.3	3.2	1.6	360			20.8			

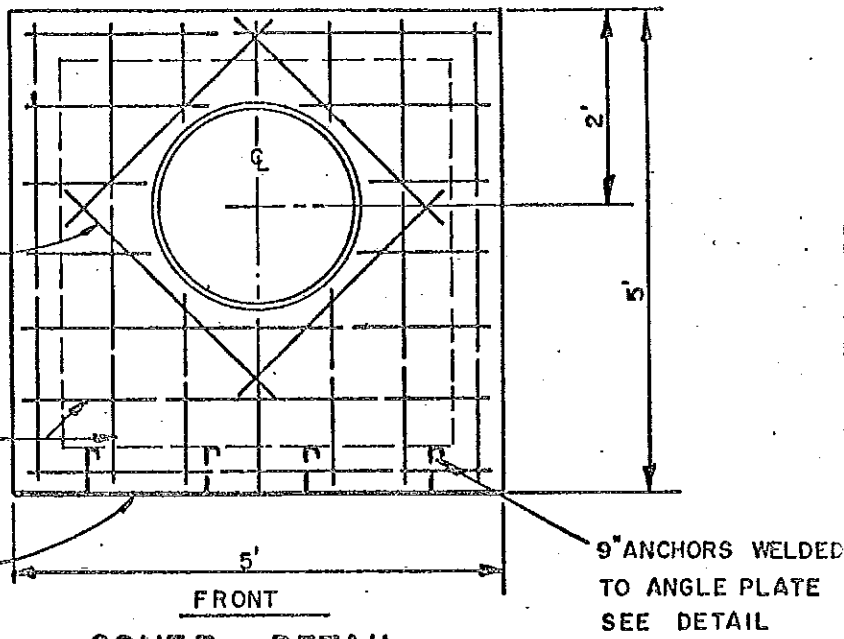
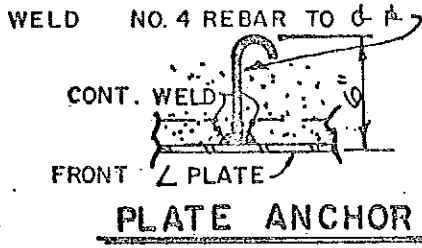
BY V.W.L. DATE 9-19-70
 CHECKED BY AHM DATE
 SUBJECT M.J. BROOK
 REVISION MATE " 71 AHM
 DRAINAGE STUDY
 SHEET NO. 4 OF 5
 JOB NO. 39264

8" CURB - FULL STORM V

S %	34' RESIDENTIAL		36' RESIDENTIAL		40' RESIDENTIAL	
	FPS	CFS	FPS	CFS	FPS	CFS
0.5	2.08	28.9	4.02	29.5	3.90	30
.6	4.46	31.7	4.41	32.3	4.27	33
.7	4.82	34.2	4.76	34.9	4.61	35
.8	5.15	36.6	5.09	37.3	4.93	38
.9	5.47	38.8	5.40	39.6	5.23	40
1.0	5.76	40.9	5.70	41.7	5.51	42
.1	6.05	42.9	5.97	43.8	5.78	44
.2	6.31	44.8	6.23	45.7	6.03	46
.3	6.57	46.6	6.49	47.6	6.28	48
.4	6.82	48.4	6.73	49.3	6.52	50
.5	7.06	50.1	6.97	51.1	6.75	52
.6	7.29	51.7	7.20	52.8	6.97	53
.7	7.52	53.3	7.42	54.4	7.18	55
.8	7.73	54.9	7.64	56.0	7.39	57
.9	7.94	56.4	7.84	57.5	7.59	58
2.0	8.15	57.8	8.05	59.0	7.79	60
.1	8.35	59.3	8.25	60.4	7.98	61
.2	8.55	60.7	8.44	61.9	8.17	63
.3	8.74	62.1	8.63	63.3	8.36	64
.4	8.93	63.4	8.82	64.6	8.53	66
.5	9.11	64.7	9.00	65.9	8.71	67
.6	9.29	65.9	9.18	67.2	8.88	68
.7	9.47	67.2	9.35	68.5	9.05	70
.8	9.64	68.4	9.52	69.8	9.22	71
.9	9.82	69.6	9.69	71.0	9.38	72
3.0	9.98	70.9	9.86	72.2	9.54	73
.1	10.15	72.0	10.02	73.5	9.70	75
.2	10.31	73.2	10.18	74.6	9.86	76
.3	10.47	74.3	10.34	75.8	10.01	77
.4	10.63	75.4	10.50	76.9	10.16	78
.5	10.78	76.5	10.65	78.0	10.31	79
.6	10.93	77.6	10.80	79.1	10.45	80
.7	11.09	78.7	10.95	80.3	10.61	81
.8	11.23	79.7	11.09	81.3	10.74	82
.9	11.38	80.8	11.24	82.4	10.88	84
4.0	11.52	81.8	11.38	83.4	11.02	85
.1	11.67	82.8	11.53	84.5	11.16	86
.2	11.81	83.8	11.66	85.5	11.29	87
.3	11.95	84.8	11.81	86.5	11.43	88
.4	12.09	85.8	11.94	87.5	11.56	89
.5	12.22	86.8	12.07	88.5	11.69	90
.6	12.36	87.7	12.21	89.5	11.82	91
.7	12.50	88.7	12.34	90.4	11.95	92
.8	12.63	89.6	12.47	91.4	12.07	93
.9	12.76	90.6	12.60	92.4	12.20	94
5.0	12.89	91.5	12.73	93.3	12.32	95

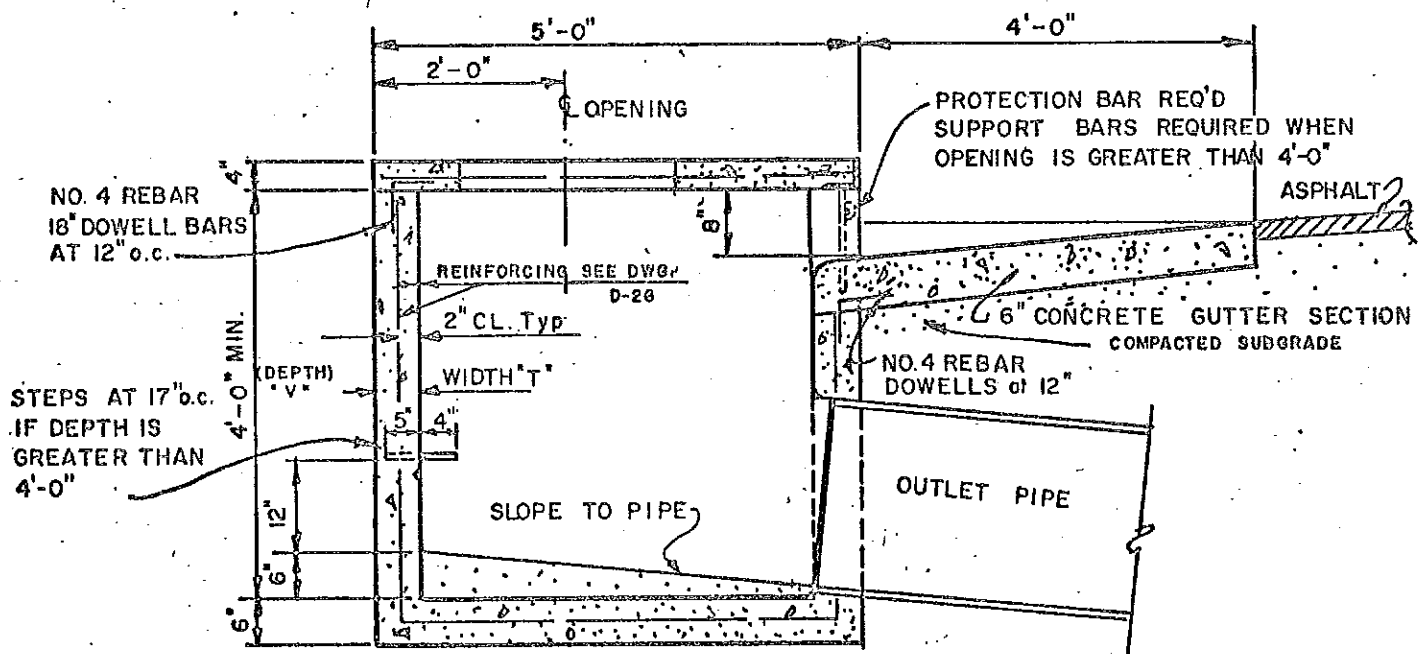
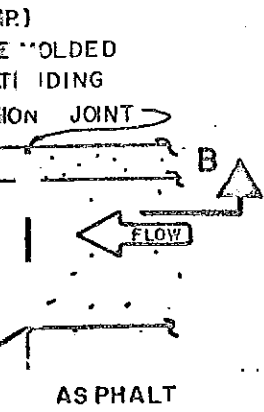
6" RAMP CURB-FULL STOP

S %	34' RESIDENTIAL		(36') RESIDENTIAL		40' RESIDE	
	FPS	CFS	FPS	CFS	FPS	
0.5	2.85	11.7	2.77	11.0	2.62	
.6	3.12	12.9	3.04	12.7	2.87	
.7	3.37	13.9	3.28	13.7	3.10	
.8	3.60	14.8	3.51	14.7	3.31	
.9	3.82	15.7	3.72	15.6	3.51	
1.0	4.03	16.6	3.92	16.4	3.70	
.1	4.22	17.4	4.11	17.2	3.89	
.2	4.41	18.2	4.29	18.0	4.06	
.3	4.59	18.9	4.47	18.7	4.22	
.4	4.76	19.6	4.64	19.4	4.38	
.5	4.93	20.3	4.80	20.1	4.54	
.6	5.09	21.0	4.96	20.8	4.69	
.7	5.25	21.6	5.11	21.4	4.83	
.8	5.40	22.3	5.26	22.0	4.97	
.9	5.55	22.9	5.40	22.6	5.10	
2.0	5.69	23.5	5.54	23.2	5.24	
.1	5.83	24.0	5.68	23.8	5.37	
.2	5.97	24.6	5.81	24.3	5.49	
.3	6.11	25.2	5.95	24.9	5.62	
.4	6.24	25.7	6.07	25.4	5.74	
.5	6.37	26.2	6.20	25.9	5.86	
.6	6.49	26.8	6.32	26.4	5.97	
.7	6.61	27.3	6.44	27.0	6.09	
.8	6.74	27.8	6.56	27.4	6.20	
.9	6.86	28.3	6.68	27.9	6.31	
3.0	6.97	28.7	6.79	28.4	6.42	
.1	7.09	29.2	6.90	28.9	6.52	
.2	7.20	29.7	7.01	29.4	6.63	
.3	7.32	30.1	7.12	29.8	6.73	
.4	7.42	30.6	7.23	30.3	6.83	
.5	7.53	31.0	7.33	30.7	6.93	
.6	7.64	31.5	7.44	31.1	7.03	
.7	7.75	31.9	7.54	31.6	7.13	
.8	7.85	32.3	7.64	32.0	7.22	
.9	7.95	32.8	7.74	32.4	7.32	
4.0	8.05	33.2	7.84	32.8	7.41	
.1	8.15	33.6	7.94	33.2	7.50	
.2	8.25	34.0	8.03	33.6	7.59	
.3	8.35	34.4	8.13	34.0	7.68	
.4	8.45	34.8	8.22	34.4	7.77	
.5	8.54	35.2	8.31	34.8	7.86	
.6	8.64	35.6	8.41	35.2	7.95	
.7	8.73	36.0	8.50	35.6	8.03	
.8	8.82	36.3	8.59	35.9	8.12	
.9	8.91	36.7	8.68	36.3	8.20	



COVER DETAIL

1/2" = 1'-0"



SECTION A - A

1/2" = 1'-0"

THIS DWG. REPLACES CATCH BASIN NO'S. 12 & 3 AS SHOWN ON DWG'S. D-10, D-11 & D-12

I.D. OUTLET IN.	CAPACITY		BOX REQ'D. FT.	THROAT OPENING
	C.M.P.	R.C.P.		
18	5.6cfs	10cfs	4	4' x 8"
21	8.4	155	6	6' x 8"
24	12	22	8	8' x 8"
27	16	30	10	10' x 8"
30	22	40	12	12' x 8"
36	35	51	16	16' x 8"
42	52	—	16	16' x 8"

CITY OF COLORADO SPRINGS, COLO.

STANDARD CATCH BASIN DETAILS

APPROVED BY: *R.A. Martin*
CITY ENGINEER

SCALE: AS SHOWN	DATE: JAN. 1970	DWN. BY: R.A. MARTIN	DWG. NO: D-10R
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