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Drainage Report Update
Centennial Boulevard Improvement District
URS Project No. 5098



911 S. 8th St., Suite 1
Colorado Springs, CO
80906
(303) 634-6699

911 S. 8th Street
Colorado Springs, CO
80906
(303) 471-0073

July 12, 1985

City of Colorado Springs
Department of Public Works
City Engineering Division
30 S. Nevada, Suite 403
Colorado Springs, CO 80901

Attention Bob Adamczyk

RE: Drainage Report Update
Centennial Boulevard Improvement District
URS Project No. 5098

Gentlemen:

This letter and accompanying drainage plan are intended to serve as an update to the drainage report currently on file for Centennial Boulevard between the North terminus of the existing improved Centennial Boulevard and Vindicator Drive.

This update is necessitated by master plan changes west of Centennial, by facilities constructed or proposed since the initial report, by special design considerations requested by City Engineering, and by more complete information regarding the nature of the proposed Centennial Boulevard.

The site is located in the northwest portion of the City of Colorado Springs, Colorado, in the Douglas Creek drainage basin. The location with respect to the surrounding area is shown on the site map (Fig. 1).

Presently, drainage in the vicinity of the proposed alignment flows from west to east, towards Douglas Creek. Flow is conducted past the existing Centennial Boulevard by a series of metal culverts. A large (2-12 x 6) box culvert has been constructed near the north end of the project, to conduct the Oak Valley Channel beneath the roadway.

Storm sewer outfalls have been constructed east of the existing Centennial Boulevard at the North and South intersections of Rendevous Trail, and at Mule Deer Drive and Atherton Way.

That portion of Centennial Boulevard, within the study area of this report, is not within a presently identified 100-year flood plain. The 100-year flood for the Oak Valley Drainage Channel will be contained within the existing improved channel beneath Centennial Blvd.



Hydrology

A recent drainage report has been completed by URS for Mountain Shadows Filings 8 and 9, which are located adjacent to the west side of the north half of the project. Discharges and facilities from Wickes Road, Tyrone Drive, and Flying "W" Ranch Road were taken from the M.S. 8 and 9 report, and are shown on the drainage plan.

Adjacent drainage reports for various Pinon Valley filings, Centennial Corporate Center, Westlink, Reed Ranch, and Oak Valley Ranch were also investigated during preparation of this update.

Other adjacent areas were reevaluated to reflect changes in runoff created by master plan changes and by more current soil information. The current Mountain Shadows master plan is shown on Fig. 2, and SCS soil map is shown on Fig. 3. Basin designations from the Douglas Creek Drainage Basin report by Leigh Whitehead & Associates were used, with an additional letter designation being added to signify partial basins. For example, C-6A, C-6B, C-6C, etc., represent portions of Master Plan basin C-6. These basin locations relative to Centennial Boulevard are shown on the Drainage plan.

Hydrologic calculations were done using modified SCS methodology as outlined in the Subdivision Policy Manual. A summary of calculations is included with this letter (Figs. 4-9). The flows thus calculated are shown at the corresponding location on the drainage plan.

Facilities Concept

Refer to the Drainage Plan for the following discussion.

Beginning at the North end of the project, a 36" RCP is proposed by others, extending from Vindicator Drive to the North. This will be intercepted by a 42" RCP to be built in Centennial Boulevard which will be constructed to discharge at the downstream end of the existing Oak Valley Channel box culvert. Flows north of the centerline of the intersection of Vindicator and Flying W Ranch Road will be picked up with inlets on the Northeast and Northwest corners of the intersection, placed



radially to be in a partial sump condition. Flow south of the center of the intersection will be carried in the street to the box culvert, and will be discharged to the culvert through grated inlets. Centennial Boulevard will have more than enough capacity to carry 5-year flows under these conditions.

Storm drainage at Wickes Road and Tyrone Drive has been discussed in detail in the Mountain Shadows 8 and 9 reports. The outfall facilities to the Reed Ranch Channel are already in place. We will use these previously constructed facilities and filed drainage reports at these locations.

South of Wickes Road and north of Atherton Way is an area of concern for City public works department, due to large flows in the street during the 100-year storm event. Without the additional measures described below, the 100-year storm event would have a peak discharge of 114 cfs on the southbound lanes of Centennial directly south of Wickes Road. This discharge would have been large enough so that flows would not be contained in the right-of-way.

We will alleviate this condition with facilities between Wickes Road and Tyrone Drive. On the east side of Centennial, 3 surface "chases" from the roadway to the existing Reed Ranch Channel will be constructed. On the west side, two curb inlets will be installed a short distance north of Wickes, to help pick up 100-year discharge carryover from the north. This combination will reduce the 100-year peak directly below Wickes to 56 cfs on the west side of the street. At this discharge, flow depth will be less than 2 inches at the face of the median curb, and the left-hand southbound lane will be passable for emergency and other vehicles. The west sidewalk will be raised to top of median curb elevation between Wickes and Atherton, to ensure the discharge remains within the Right-of-way.

At Atherton, a 36" pipe will be extended across Centennial to intercept flows from the west and discharge them to the existing 36" RCP on the east. Inlets will collect 5-year flows from the west side of Centennial. 5-year flows on the east side of Centennial will be low enough to be carried in the street.

Mule Deer Drive will be treated in a similar manner, but the existing manhole will be removed and reset to the east, to provide better clearance over the existing sanitary sewer. This will also provide a better entrance angle for the 36" RCP incoming from the south in Centennial.



A 24" RCP has been proposed, but not constructed, along Pinon Valley Industrial Park Filing 9, to the south of the site. The developer of Pinon Valley Industrial Park Filing 9 will be responsible for coordinating construction of this pipe. We propose to extend a 24" RCP south of the improvement district limits to a 45 degree bend which will extend to a proposed manhole. The manhole will be in alignment with the above mentioned 24" RCP along Pinon Valley Industrial Park Filing 9. A new 24" RCP will extend north from this manhole and will connect with a 30" RCP cross pipe from the west at the proposed R & D entrance. A 36" RCP will flow north from this junction to the Mule Deer Drive system. Drainage improvements described in this report will accommodate planned drainage facilities south of the district, as shown above. The construction of Centennial Boulevard District improvements will not adversely impact or cause to change existing drainage characteristics south of the Start of the Project.

Financial Data

A cost summary sheet for Centennial Boulevard is included with this letter (Fig. 10). Total costs for drainage improvements is \$257,172 including engineering and contingencies. All of these costs are for public improvements. Private facilities will not be constructed as part of the Centennial Boulevard Improvement District, and are not included in these costs. As public improvements, all of these costs are to be reimbursable to members of the district in the same proportion as their obligation for construction of said improvements, which is based upon the front footage of their property adjacent to Centennial Boulevard. Each participants front footage and percentage are listed below:

	Frontage	%
	-----	-----
Ridge Development Co., Ltd.	7110.69	49.8015
Barney, Inc.	2520.75	17.6547
Raymond Construction Co.	1605.18	11.2423
Department of Parks & Recreation	1546.45	10.8310
Thompson Properties	1494.99	10.4705
	-----	-----
	14,278.06	100.0000

These improvements are all associated with Centennial Boulevard and will be located in the ROW for Centennial Boulevard. The land involved is now either public right-of-way or will be deeded to the City as additional right-of-way. No drainage fees will



Centennial Boulevard

July 12, 1985

Page 5

be paid on the original 60' ROW for Centennial Boulevard as it was excluded from the original calculations for the Douglas Creek Basin and, therefore, is not subject to drainage fees.

Drainage fees on the additional 20' ROW on each side of Centennial Boulevard have been or will be paid by each district member when their properties are platted or by way of deduction from credits they may have established within this basin prior to or concurrently with allocation of credits for improvements installed as part of the construction of Centennial Boulevard.

We hope this letter presents the current status of drainage improvements for the site in an understandable form. Should questions arise concerning this letter or should additional information be needed, please contact us at your convenience.

Respectfully submitted,

URS COMPANY

A handwritten signature in cursive script that reads 'Stephen C. Behrens'.

Stephen C. Behrens, P. E.

SCB/rw

Encl.

URS

Centennial Boulevard

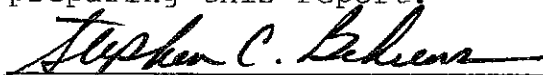
July 12, 1985

Page 6

Drainage Update Letter and Plan Centennial Boulevard.

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 the negligent acts, errors or omissions on my part in preparing this report.

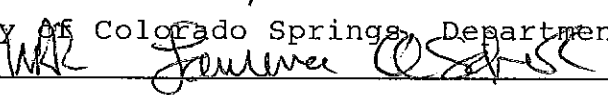

Stephen C. Behrens, P.E. Colorado 11447

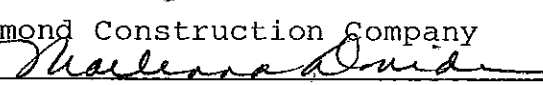



District Participants' Statement:

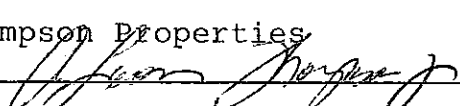
The undersigned and/or their representatives have read and will comply with the requirements of this report.

Barney, Inc. 
by: _____ DATE 7-12-85

City of Colorado Springs, Department of Parks and Recreation
by:  DATE 7-16-85

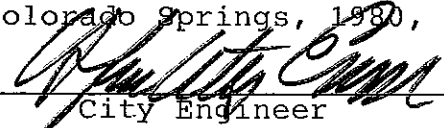
Raymond Construction Company
by:  DATE 7-12-85

Ridge Development Company, LTD.
by:  DATE 7-12-85

Thompson Properties
by:  DATE 7/17/85

City of Colorado Springs:

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

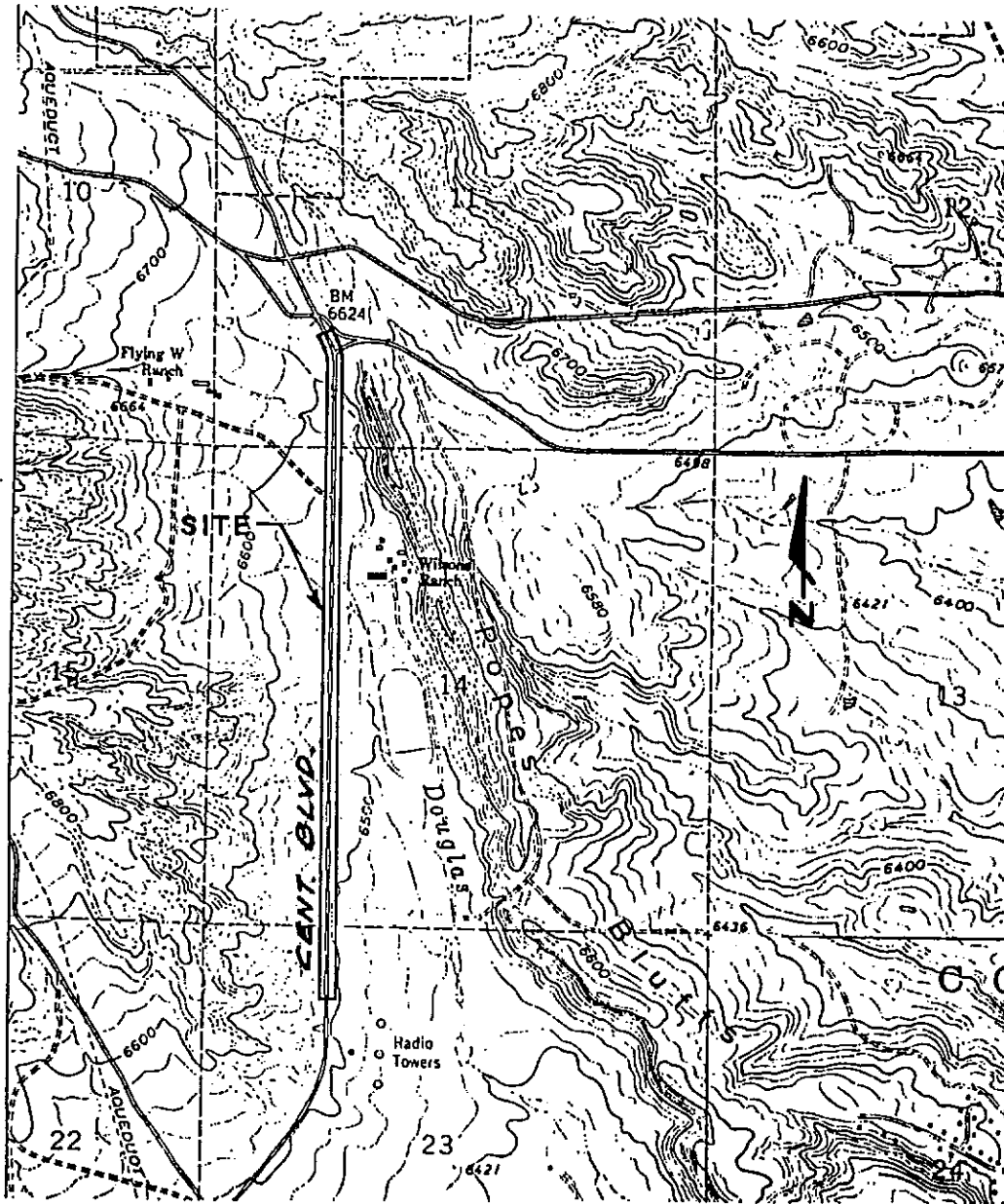


City Engineer

10/3/85
DATE

IF STREET DEDICATIONS ARE MADE IN LIEU OF PLATTING, BASIN FEES OR CREDITS DUE WILL BE ESTABLISHED AT THE TIME OF DEDICATION.

FIGURE 1



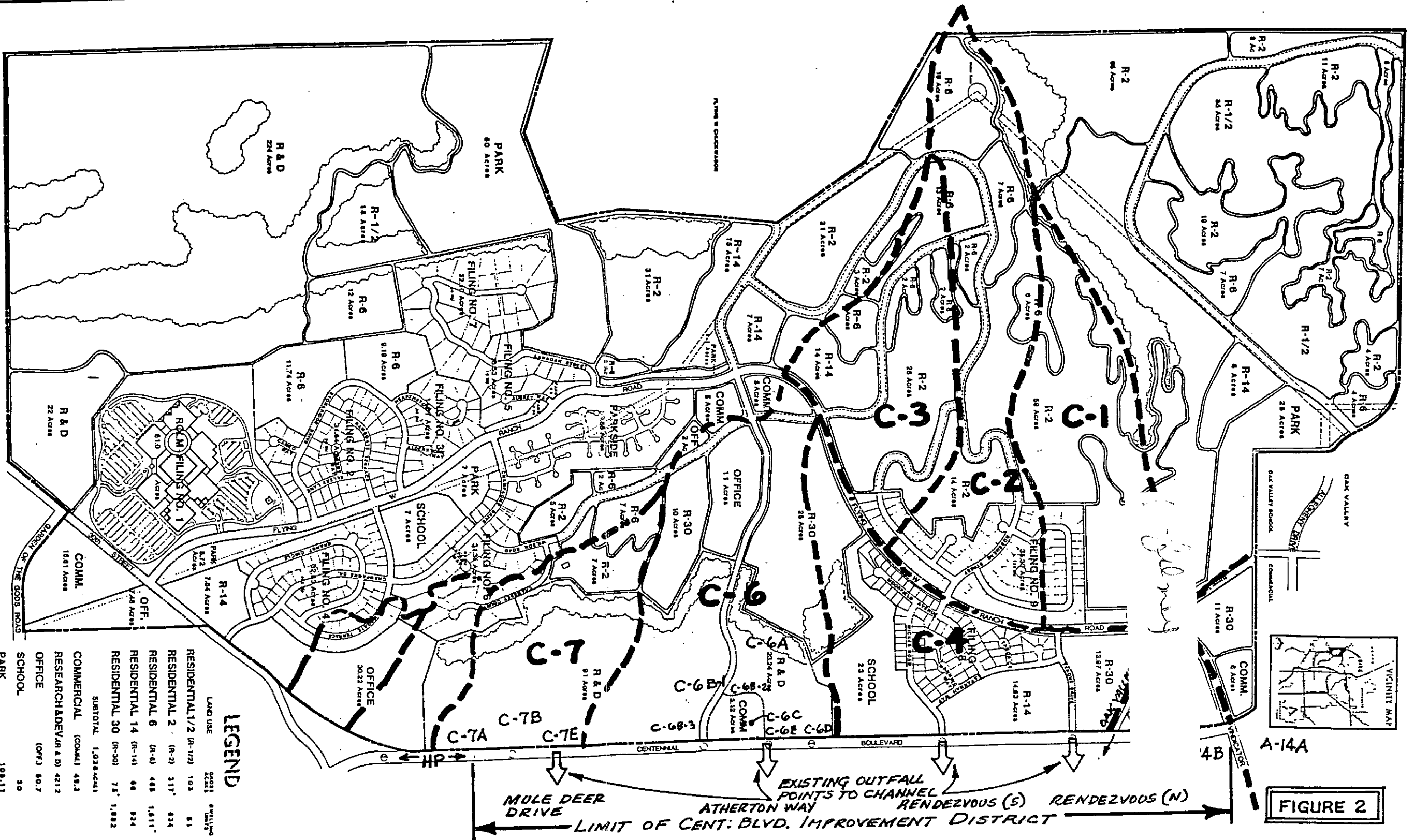


FIGURE 2

MASTER PLAN

PORTION OF SECTIONS 10, 11, 14, 16, AND 21,
T. 18 N., R. 97 W., OF THE 17TH P.M., IN THE
CITY OF COLORADO SPRINGS, COLORADO, AND
COUNCILMAN, AND CONTAINING 1,881.3 ACRES.



- PROVISIONS:**
- The plat herein is subject to all provisions of the Colorado Subdivision Act.
 - The plat herein is subject to all provisions of the Colorado Plat Act.
 - The plat herein is subject to all provisions of the Colorado Plat Act.
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- SYMBOLS:**
- PLATTED OR ZONED LAND
 - PROPOSED LAND
 - RIGHT, SHADOWS & DONORSHIP
 - PARCEL OPEN SPACE
 - PROPOSED ROAD
 - MEAL CUT
 - RIGHT IN - RIGHT OUT

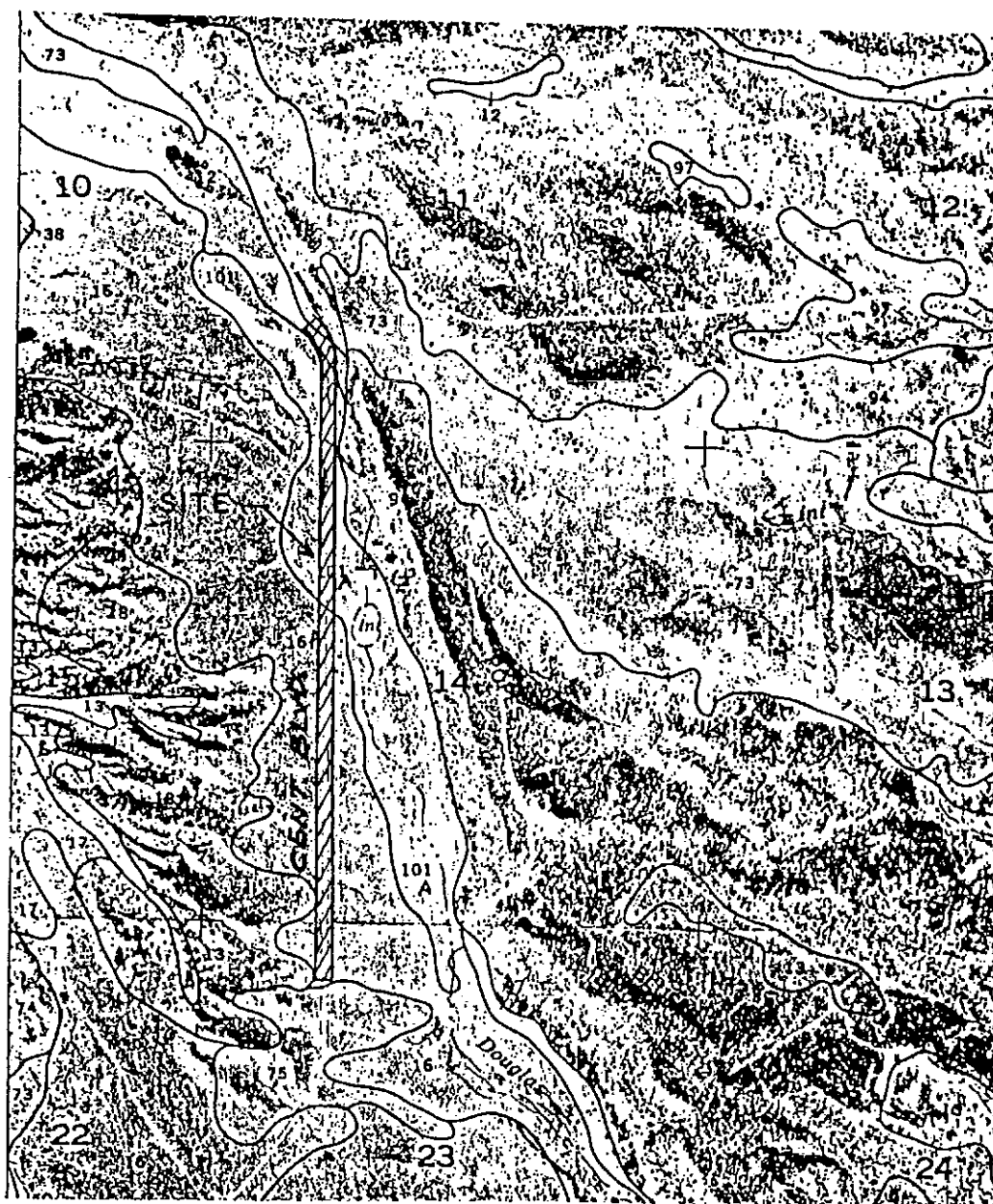
* INCLUDES 719 PLATTED LOTS ON 332 ACRES
(IDENTITY 2,131)
* INCLUDES PARKS OPEN SPACE

RIDGE DEVELOPMENT CO., LTD.
P. O. BOX 7711
COLORADO SPRINGS, COLORADO 80933 (303) 694-0227



Holan E. Schipper, Inc.
Land Planners
Landscape Architects
Urban Designers
911 SOUTH EIGHTH STREET
COLORADO SPRINGS
COLORADO 80906

FIGURE 3
SCS SOIL SURVEY MAP



PROJECT NAME CENTENNIAL URS NO. 5098

CALCULATIONS BY RLB DATE 4/19/85
7/12/85

BASIN	LAND USE	SCS SOIL GROUP	(A) PERCENT	(B) CURVE NO.	(A) x (B)	COMPOSITE CURVE NO.
A-14A	Open	A	100	68		68
A-14B	Park	A	100	68		68
C-6	School - Park	A	37	70	25.9	74.8
	R-30	A	32	77	24.6	
	R & D	A	26	76	19.8	
	Commercial	A	5	89	4.5	
C-6B (Gravel Pit Rd.)	Roadway	A	25.3	98	24.8	81.6
	R & D	A	74.7	76	56.8	
C-6C	Commercial	A	100	89		89
C-6D	School/Park	A	100	70		70
C-6E	R & D	A	100	76		76
C-6A (Remainder of Atherton Basin)	School - Park		31	70	21.7	75.6
	R & D		28	76	21.3	
	R 30		36	77	27.7	
	Street		5	98	4.9	
C-7	Office	A	11.8	89	10.5	75.9
	R-30	A	9.0	77	7.0	
	R-6	A	6.4	70	4.5	
	R-2	A	6.4	54	3.5	
	R & D	A	66.4	76	50.4	

COMPOSITE CURVE NUMBER CALCULATIONS

PROJECT NAME Centennial URS NO. 5098
CALCULATIONS BY RUB DATE 4/20/85

BASIN	LAND USE	SCS SOIL GROUP	(A) PERCENT	(B) CURVE NO.	(A) x (B)	COMPOSITE CURVE NO.
C-7A	R&D *	A	100	76		76
C-7B	R&D	A	100	76		76
C-7C	R&D	A	100	76		76
C-7D	R&D	A	100	76		76
C-7E	R&D	A	100	76		76
C-7 + C-8	Basin C-7 Basin C-8	A A	84.0 16.0	76 73	63.8 11.7	75.5
<p>* R&D assumed 60% Impervious 40% Landscaped</p> <p>0.60 x 100 = 60 0.40 x 39 = 16 CN = 76</p>						

COMPOSITE CURVE NUMBER CALCULATIONS

R D Z O E L C O N D I T I O N S U M M A R Y

BASIN	AREA, Ac	Tc (HR)	Qp (CSM/IN)	SCS SOIL GROUP	CURVE NO.	RUNOFF		PEAK DISCHARGE	
						5 YEAR	100 YEAR	5 YEAR	100 YEAR
A-4A	5.14	4.1	1280	A	68	0.23	0.90	2.36 cfs	9.25 cfs
A-4B	9.9	4.1	1280	A	68	0.23	0.90	4.6 cfs	17.8 cfs
C-6	82	.212	1055	A	75	0.43	1.30	58.1 cfs	175.7 cfs
C-6A	57	.212	1055	A	75	0.43	1.30	40.4 cfs	122 cfs
C-6B-1	2.4	4.1	1280	A	98	1.87	3.27	9.0 cfs	15.7 cfs
C-6B-2	2.4	4.1	1280	A	98	1.87	3.27	9.0 cfs	15.7 cfs
C-6B-3	3.9	4.1	1280	A	82	0.71	1.78	5.5 cfs	13.9 cfs
C-6C	5	4.1	1280	A	89	1.12	2.36	11.2 cfs	23.6 cfs
C-6D	6	4.1	1280	A	70	0.28	1.01	6.7 cfs	24.0 cfs
C-6E	8	4.1	1280	A	76	0.47	1.36	7.5 cfs	22 cfs
C-7	110	.18	1100	A	76	0.47	1.36	88.9 cfs	257 cfs
C-7A	30	0.1	1280	A	76	0.47	1.36	28.2 cfs	82 cfs
C-7B	68	.18	1100	A	76	0.47	1.36	55 cfs	159 cfs

Fig. 6

Mailing Address:
3955 East Exposition Avenue • Suite 300 • Denver, Colorado 80209 • 303/744-1861

PROJECT NAME Centennial URS NO. 5098

CALCULATIONS BY RLB DATE 5/13/85
6-27-85
7-12-85



RUNOFF COMPUTATION SUMMARY

PROJECT NAME Centennial URS NO. 5098
 CALCULATIONS BY RLB DATE 5/13/85
6-27-85
7-12-85

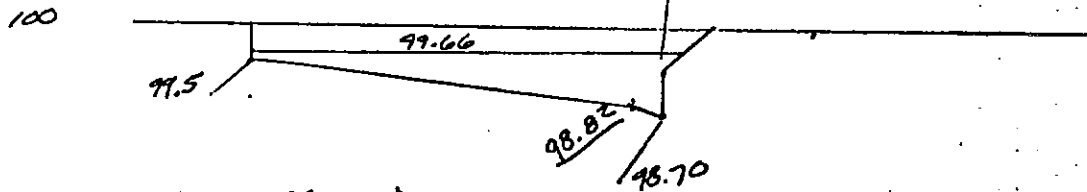
BASIN	AREA	Tc (HR)	Qp (CSM/IN)	SCS SOIL GROUP	CURVE NO.	RUNOFF		PEAK DISCHARGE	
						5 YEAR	100 YEAR	5 YEAR	100 YEAR
C-7C	3	4.1	1280	A	76	.47	1.36	2.8	8.2
C-7D	3	4.1	1280	A	76	.47	1.36	2.8	8.2
C-7E	6	4.1	1280	A	76	.47	1.36	5.6	16.3

NOTE:

- 1) FLOWS FROM WEST OF TYRONE DRIVE & WICKES RD. WERE OBTAINED FROM THE DRAINAGE REPORT FOR MOUNTAIN SHADOWS FLG. NO. 8 & 9.
- 2) FLOWS SHOWN AT THE SOUTH END OF THE PROJECT WERE OBTAINED FROM THE DOUGLAS CREEK MASTER DRAINAGE REPORT & THE ORIGINAL CENTENNIAL BOULEVARD DRAINAGE REPORT.

Check depth of flow in Centennial between Rendezvous S. and Atherton.

Assume Raised Sidewalk,
Flow 2" above Median Curb Flowline 99.36

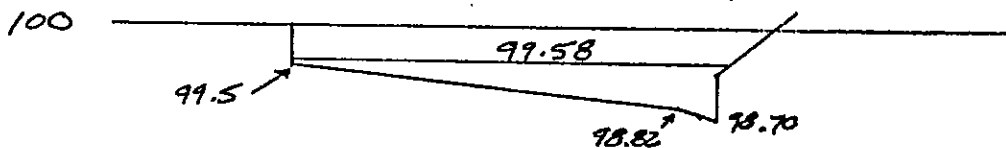


$$A \approx \frac{0.16 + 0.96}{2} (33) = 18.5$$

$$P \approx 35 \quad R = 0.53$$

$$Q = \frac{1.49}{0.02} (18.5) (0.53)^{2/3} (0.005)^{1/2} = 63.8 \text{ cfs}$$

Flow 1' Above Median Curb Flowline



$$A \approx \frac{0.08 + 0.89}{2} \times 33 = 15.8 \quad P = 35' \pm$$

$$R = 0.453$$

$$Q = \frac{1.49}{0.02} (15.8) (0.453)^{2/3} (0.005)^{1/2} = 49.1$$

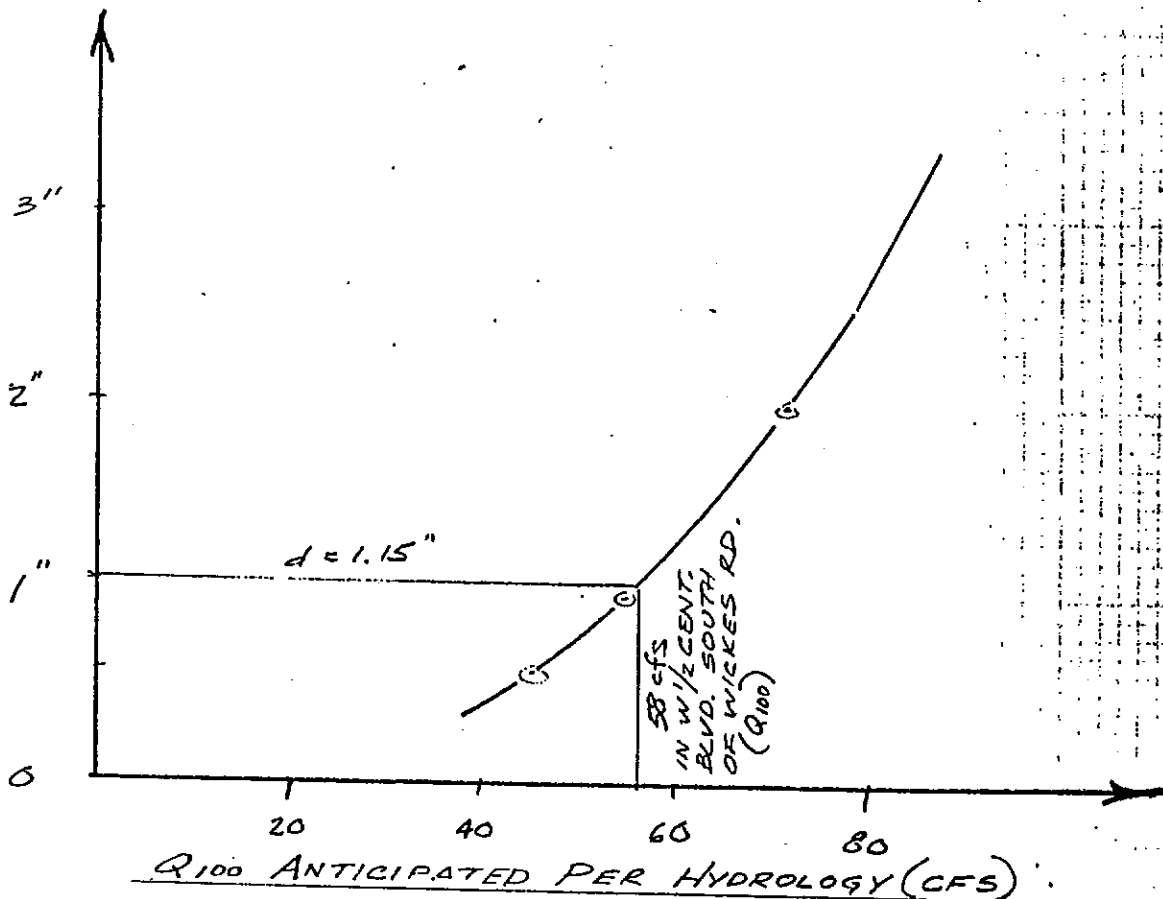
URS NO. 5098 BY RLB DATE 6-27-85 PAGE 2 OF
 CLIENT Centennial Group PROJECT Centennial Blvd.
 SUBJECT Drainage

Proposed grade on centennial south of Reed Ranch is 0.62% rather than 0.59%. Check capacities for 0.62% grade.

① $d = 0.05'$ $A = 15.4$ $R = .355$
 $Q = \frac{1.49}{0.02} (15.4) (.355)^{2/3} (.0062)^{1/2} = 45.3$

② $d = 0.08$ $A = 15.8$ $P = 35'$ $R = .453$
 $Q = \frac{1.49}{.02} (15.8) (.453)^{2/3} (.0062)^{1/2} = 54.7$

③ $d = 0.16$ $A = 18.5$ $R = 0.53$
 $Q = \frac{1.49}{0.02} (18.5) (0.53)^{2/3} (.0063)^{1/2} = 71.6$





911 S. 8th St., Suite 1
Colorado Springs, CO
80906
(303) 634-6699

Fig. 10

URS-1 5098

PAGE 1 OF 1

BY RLB

DATE 5/30/85

CHECKED BY

DATE 6/27/85

CLIENT Centennial Blvd. Group PROJECT Centennial Blvd. Imp. Dist.

SUBJECT Drainage Plan Cost

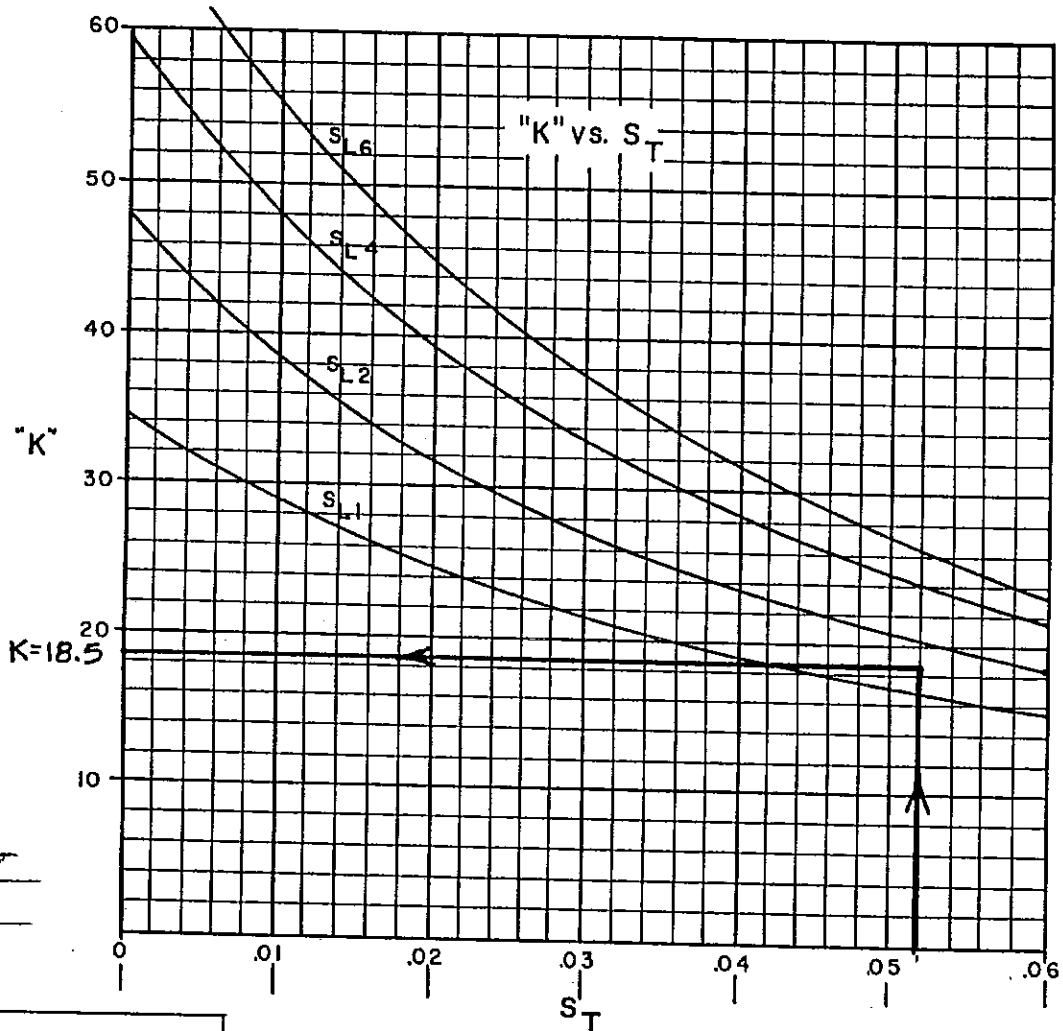
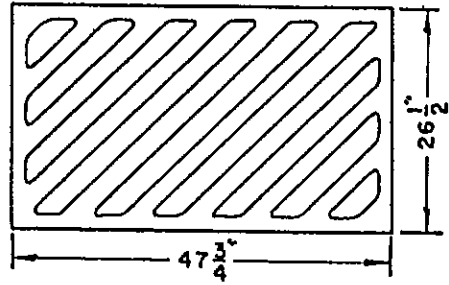
COST ESTIMATE

ITEM NO.	ITEM DESCRIPTION	APPROX. QUANTITY	UNIT	UNIT COST	ITEM COST	TOTAL COST
	Reinforced Concrete Pipe					
	18"	700	LF	37	25,900	
	24" (INCLUDES 50 LF 50" OF "START OF PROJECT")	700	LF	40	28,000	
	30"	260	LF	48	12,480	
	36"	852	LF	55	46,860	
	42"	600	LF	65	39,000	
	30" End Section	3	EA	350	1050	
	36" End Section	1	EA	500	500	
	SUBTOTAL					\$153,790
	Manholes					
	NEW (Avg.)	8	EA	1800	14,400	
	Reset	3	EA	1200	3600	
	SUBTOTAL					\$18,000
	Inlets					
	D10R (Avg)	11	EA	2,420	26,620	
	Radius (Avg)	2	EA	3000	6000	
	Grated- Box Culvert	2	EA	3000	6000	
	SUBTOTAL					\$38,620
	Curb Chass 6'	3	EA	2000	6000	\$6,000
	Guardrail at Oak Valley Channel					
	Valley Channel	500	LF	12.50	6250	\$6,250
	Total					\$222,660
	5% CONTINGENCIES					+ 11,133
	10% ENGINEERING					233,793
						+ 23,379
						\$257,172

Final Total → **\$257,172**

FIGURE 11

FLOW →



GRATED INLET CAPACITIES

for:

INLETS OVER BOX
 CULVERT @ STA.
 70+11.6
 @ OAK VALLEY CHANNEL

S_T = TRANSVERSE GUTTER SLOPE = $\frac{5}{8}$ "/FT = .052

S_L = LONGITUDINAL GUTTER SLOPE = 1.5%

K = GRATE INLET COEFFICIENT

© 1980 Neenah Foundry Co.

WEST SIDE CENT. BLVD.	EAST SIDE CENT. BLVD.
<p>5-YR. STM INLET GRATE CAPACITY $Q = KD^{5/3}$ $D = 0.29'$ $Q = 18.5(.29)^{5/3} = 2.35$ cfs per inlet x 2 = 4.70 cfs.</p>	<p>5-YR. STM INLET GRATE CAPACITY $Q = KD^{5/3}$ $D = 0.23'$ $Q = 18.5(.23)^{5/3} = 1.6$ cfs per inlet x 2 = 3.20 cfs.</p>
<p>100-YR. STM INLET GRATE CAPACITY $Q = KD^{5/3}$ $D = .5'$ $Q = 18.5(.5)^{5/3} = 5.8$ cfs per inlet x 2 = 11.6 cfs.</p>	<p>100-YR. STM INLET GRATE CAPACITY $Q = KD^{5/3}$ $D = .43'$ $Q = 18.5(.43)^{5/3} = 4.53$ cfs per inlet x 2 = 9.1 cfs.</p>