

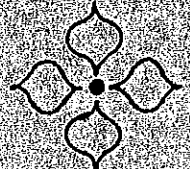
Planning & Development
105 West Costilla
Colorado Springs, CO 80903

LOCAL MASTER DRAINAGE REPORT
AND
LOCAL SUBDIVISION NO. 2
DRAINAGE REPORT

RETURN WITHIN 2 WEEKS TO:
CITY OF COLORADO SPRINGS
STORM WATER & SUBDIVISION
101 W. COSTILLA, SUITE 113
COLORADO SPRINGS, CO 80903
(719) 578-8212

APRIL, 1978

ARCHITECTS
ENGINEERS
PLANNERS
SURVEYORS



r. keith hook & associates. inc.

DRAINAGE REPORT

LOOART SUBDIVISION NO. 2

MARCH, 1978

R. KEITH HOOK & ASSOCIATES, INC.
2545 East Platte Place
Colorado Springs, Colorado 80909

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r. keith hook & associates, inc.

TEL. (303) 473-5653 • 2545 EAST PLATTE PLACE • COLORADO SPRINGS, COLORADO 80909

March 28, 1978

Department of Public Works
City Engineer
P. O. Box 1575
Colorado Springs, CO 80901

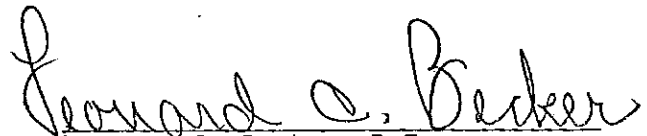
ATTN: Mr. Don Jeffries

Dear Mr. Jeffries:

Transmitted herewith is the Drainage Report and Plan for Looart Subdivision No. 2. This Subdivision is located in the North portion of the City of Colorado Springs in El Paso County, Colorado. The Subdivision is in a portion of the Cottonwood Creek Drainage Basin.

Sincerely,

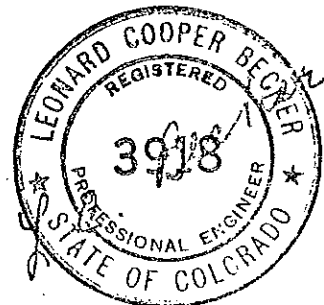
R. KEITH HOOK & ASSOCIATES, INC.



Leonard C. Becker, P.E.
Executive Vice President/Director
Engineering Department

LCB/jml

Enclosure



ARCHITECTS
ENGINEERS
PLANNERS
SURVEYORS

CERTIFICATIONS

I, Leonard C. Becker, a Registered Engineer in the State of Colorado, hereby certify that the attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. I further certify that said drainage report is in accordance with all City of Colorado Springs Ordinances and Specifications and criteria.

Leonard C Becker

Leonard C. Becker
Registered Engineer
State of Colorado No. 3918

The Developer has read and will comply with all of the requirements specified in this drainage report as approved by the City Engineer.

BY: *Gary A. Loo* DATED: *4/13/78*
TITLE: _____

APPROVED:

DEPARTMENT OF PUBLIC WORKS

BY: *D. Jeffries* DATED: *4/24/78*

LOOART SUBDIVISION NO. 2
MASTER PLAN DRAINAGE REPORT

I. General Description

Looart Subdivision No. 2 is a commercial development located in a portion of the Southwest quarter of Section 8, Township 13 South, Range 66 West of the 6th Principal Meridian in the Northeast portion of the City of Colorado Springs, El Paso County, Colorado, containing 66.3 Acres more or less.

This Subdivision is bordered on the West by the Atchison, Topeka, and Santa Fe Railway right of way, on the North by Woodmen Valley Road, on the East by Yorkshire Subdivision, and on the South by unplatted area.

The entire Subdivision is located within the boundaries of the Cottonwood Creek Drainage Basin. General terrain within the Subdivision slopes Southwest toward Cottonwood Creek.

Projected growth within the Subdivision has been established in three phases. When complete, development will consist of one main production/warehouse complex, office building and parking lots with all necessary access roads.

II. Exterior Drainage

Exterior drainage enters the Subdivision from two sources.

Drainage from a small portion of Falcon Estates Filing No. 1 enters the Subdivision at the Northeast corner of the site from a 24" CMP placed by El Paso County in the mid 1960's. Flow is estimated at 25 cfs.

Entering the Subdivision from the East is 135 cfs gathered mainly from areas of Yorkshire Subdivision. This flow enters a detention pond located along the Eastern border of the Subdivision, which is bordered on the West by a built up dike system which then redirects the flow south toward Cottonwood Creek. No deviating from this natural water-course is planned in the Development of the Subdivision. Minor repairs of the existing dike system will be needed.

All channels will need to be constructed with seeded slopes and beds with soil erosion mesh applied. All maintenance of drainage facilities will be conducted by the Owner.

Drainage entering the Subdivision from Falcon Estates No. 1 will be added to the Subdivision runoff and redirected to the South. The water will then be deposited in a channel which will transport the flow around to the south boundary and then west to the point of exit from the site.

Another major channel will intercept flow along the North side of the proposed production/warehouse facility and transport the runoff west and then south to the point of exit from the site.

Existing drainage patterns are from the Northeast to the Southwest. This Subdivision will retain the natural direction and will allow drainage to continue its natural course after moving through a hand placed rip-rap section at the exit site to dissipate hydraulic energy.

III. Interior Drainage

Parking lots will be drained with the use of curb cuts with aprons which will allow the runoff to flow directly into either a channel or a pipe section.

One major section of storm sewer will be utilized with slotted inlets to drain the truck loading dock area. This sewer will transport drainage along with the runoff from the employee parking lots south where it will be delivered to the major channel running along the southern boundary of the Subdivision.

Roof drains will collect the roof runoff to one of four common points and then will discharge into either the section of storm sewer or a portion of the major channel.

Two standard curb openings (4' DIOR) will be utilized to drain the future Southern employee parking lot and will deposit the runoff directly into the storm sewer.

Drainage under access roads is through minor CMP culverts as shown on the Drainage Plan.

IV. Drainage Report - Phase I

Structures and grading for Phase I development of the Subdivision will be as shown on the Drainage Plan Phase I.

The proposed storm sewer servicing the employee parking lot and the truck loading dock will only be partially installed. The effluent will be discharged into a temporary channel which will take the place of the second phase storm sewer.

One 18" CMP will be installed to facilitate drainage under the primary access road as shown.

Total platted area is 26.7 acres more or less.

V. Cost Estimates

MASTER DRAINAGE PLAN

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. RCP Storm Drain Pipe				
18"	50	L.F.	\$ 13.00	\$ 650.00
27"	280	L.F.	26.00	7,280.00
30"	120	L.F.	34.00	4,080.00
2. CMP Storm Drain Pipe				
18"	465	L.F.	12.00	5,580.00
33"	60	L.F.	17.00	1,020.00
3. 24" Slotted Drain, Smooth Flow (Plus Flaired intake structure)	280	L.F.	45.00	12,600.00
4. 4" Perforated Pipe	380	L.F.	7.00	2,660.00
5. Curb Openings 4' D10R	2	EA.	1,150.00	2,300.00
6. 2' x 2' Grated Inlet	1	EA.	800.00	800.00
7. Drainage Channels	3840	L.F.	14.00	53,760.00
			TOTAL CONSTRUCTION	\$ 90,730.00
			Contingencies @ 10%	9,073.00
			Engineering & Inspection	7,980.00
			Total Project	\$107,783.00
8. Drainage Fees	65	AC.	\$1,035.00	\$ 67,275.00
9. Credit Items				
a. Drainage Channels	3840	L.F.	14.00	- \$ 53,760.00
b. CMP Culverts				
18"	80	L.F.	12.00	- 960.00
33"	60	L.F.	17.00	- 1,020.00
			TOTAL EXPENDITURES	\$119,318.00

} 55,740

DRAINAGE PLAN - PHASE I

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. 24" slotted drain Smooth Flow (Plus Flaired Intake Structure)	165	L.F.	\$ 45.00	\$ 7,425.00
2. CMP Storm Drain Pipe 18"	230	L.F.	12.00	2,760.00
30"	100	L.F.	24.00	2,400.00
3. Drainage Channels	2760	L.F.	14.00	38,640.00
TOTAL				\$51,225.00
Contingencies @ 10%				5,120.00
Engineering & Inspection				4,505.00
Total Project				\$60,850.00
4. Drainage Fees	26.7	AC.	\$1,035.00	\$27,634.50
5. Credit Items				
a. Drainage Channels	2760	L.F.	14.00	- 38,640.00
b. CMP 18"	80	L.F.	12.00	- 960.00
Total Expenditures				\$48,884.50

5. Credit Items
a. Drainage Channels
b. CMP 18"

39,600
Part of master
drainage plan

VI CALCULATIONS

A. Example Calculations

1. Hydrograph Determination - SCS Modified Method

$$Q_p = q_p A Q \quad \text{where}$$

Q_p = Peak Discharge, cfs

q_p = Peak Flow, CSM/in

A = Basin Area, sq.mi.

Q = Runoff depth, inches

All data drawn from the City of Colorado Springs Determination of Storm Runoff Criteria - March 1977

2. Storm Sewer Sizing: Mannings Equation

$$Q = 1.49 A R^{2/3} S^{1/2} \quad \text{where}$$

Q = Capacity, cfs

n = Roughness coefficient; .013 for concrete pipe
.024 for CMP, 2-2/3" x 1/2"

A = Area of flow, ft²

R = Hydraulic Radius

S = Slope

3. Culvert Sizing - Reference pp 430-439, "Design of Small Dams"; U.S. Bureau of Reclamation

B. Hydrograph Calculations: See Attached Appendix I

Soil Conservation Service - CSER SYNTHETIC HYDROGRAPH CALCULATIONS

Drawn by rad ser

Date February 23, 1978

JOB NO.: 770356 PROJECT: LOOART SUBDIVISION NO. 2

Sheet 1 of 3

Basin	AREA			Length of Water Course	Elevation Difference	Time of Concentration (hrs)	Time to Peak Flow (hrs)	Direct Runoff Q, inches	Peak Runoff Rate Q _p , cfs	Curve Number	Peak Discharge CSM/in	
	Sq. In.	Acres Prelim. Adjusted	Sq. Miles									
1	69.2	5.72	5.52	.00863	730	24	0.08	3.05	0.58	6.4	79	1280
2	44	3.64	3.51	.00549	1120	7	0.20	3.12	0.58	3.34	79	1050
3	12	0.99	0.96	.00149	330	7	0.05	3.03	0.58	1.1	79	1280
4	45.5	3.76	3.63	.00567	700	16	0.09	3.05	0.58	4.2	79	1280
5	30.5	2.52	2.43	.00380	640	11	0.09	3.05	0.62	3.0	80	1280
6	9.6	0.79	0.76	.0019	395	12	0.05	3.03	0.14	0.2	64	1280
7	9.8	0.81	0.78	.00122	625	25	0.06	3.04	1.05	1.6	88	1280
8	6	0.50	0.48	.00075	460	22	0.05	3.03	0.10	0.1	61	1280
9	9.2	0.76	0.73	.00115	360	22	0.04	3.02	0.10	0.1	61	1280
10	19.8	1.63	1.57	.00246	900	22	0.10	3.06	1.67	5.3	96	1280
11	10.3	0.85	0.82	.00128	430	21	0.04	3.03	0.14	0.2	64	1280
12	7.3	0.60	0.58	.00090	230	10	0.03	3.02	0.11	0.1	62	1280
13	40.6	3.36	3.24	.00507	500	23	0.05	3.03	1.33	8.6	92	1280
14	21.3	1.76	1.70	.00265	340	17	0.04	3.02	0.92	3.1	86	1280
15	6.6	0.55	0.53	.00083	320	11	0.04	3.02	0.11	0.1	62	1280
16	36.7	3.03	2.92	.00457	1360	48	0.12	3.07	0.23	1.3	68	1225
17	10.1	0.83	0.80	.00125	630	10	0.09	3.06	0.62	1.0	80	1280
18	15.2	1.26	1.22	.00190	300	6	0.05	3.03	0.82	2.0	84	1280
19	8.2	0.68	0.66	.00103	340	8	0.05	3.03	0.92	1.2	86	1280

SOIL CONSERVATION SERVICE - USER SYNTHETIC HYDROGRAPH CALCULATIONS

Calc. by rad ser

Date February 23, 1978

JOB NO.: 770356 PROJECT: LOOART SUBDIVISION NO. 2

Sheet 2 of 3

Basin	AREA			Length of Water Course	Elevation Difference	Time of Concentration (hrs)	Time to Peak Flow (hrs)	Direct Runoff Q, inches	Peak Runoff Rate Q _p , cfs	Curve No.	Peak Discharge CSM/in	
	Sq. in.	Acres Prelim.	Adjusted									Sq. Miles
20	9	0.74	0.71	.00112	310	13	0.04	3.02	0.62	0.9	80	1280
21	17	1.40	1.35	.00211	300	6	0.05	3.03	1.87	5.1	98	1280
22	17	1.40	1.35	.00211	300	6	0.05	3.03	1.87	5.1	98	1280
23	17	1.40	1.35	.00211	300	6	0.05	3.03	1.87	5.1	98	1280
24	17	1.40	1.35	.00211	300	6	0.05	3.03	1.87	5.1	98	1280
25	4.1	0.34	0.33	.00051	155	3.1	0.03	3.02	1.87	1.2	98	1280
26	26	2.15	2.07	.00324	390	27	0.04	3.02	0.23	1.0	68	1280
27	7	0.58	0.56	.00087	420	26	0.04	3.02	0.23	0.3	68	1280
28	5.8	0.48	0.46	.00072	700	20	0.08	3.05	0.23	0.2	68	1280
29	13.7	1.13	1.09	.00170	400	16	0.05	3.03	0.23	0.5	68	1280
30	3	0.25	0.24	.00038	140	3	0.03	3.02	0.62	0.3	80	1280
31	1.8	0.15	0.14	.00023	75	1.5	0.02	3.01	1.87	0.5	98	1280
32	3.8	0.31	0.30	.00047	520	19	0.06	3.03	0.28	0.2	70	1280
33	17.2	1.42	1.37	.00214	110	14	0.01	3.01	0.62	1.7	80	1280
34	14.5	1.20	1.16	.00181	290	60	0.02	3.01	0.62	1.4	80	1280
35	14.6	1.21	1.17	.00182	200	46	0.01	3.01	0.62	1.4	80	1280
36	0.8	0.07	0.07	.00011	50	1	0.01	3.01	1.87	0.3	98	1280
37	12.3	1.02	0.98	.00154	330	7	0.05	3.03	1.87	3.7	98	1280
38	14.2	1.17	1.13	.00176	220	54	0.01	3.01	0.62	1.4	80	1280

SOIL CONSERVATION SERVICE - USDA SYNTHETIC HYDROGRAPH CALCULATIONS

Calc. by D. G. R.

Date February 23, 1978

Sheet 3 of 3

JOB NO.: 770356

PROJECT: LOOART SUBDIVISION NO. 2

Basin	AREA			Length of Water Course	Elevation Difference	Time of Concentration (hrs)	Time to Peak Flow (hrs)	Direct Runoff Q, inches	Peak Runoff Rate Q_p , cfs	Curve No.	Peak Discharge CSM/in	
	Sq. In.	Acres Prelim. Adjusted	Sq. Miles									
39	55	4.55	4.39	.00686	560	57	0.04	3.02	0.62	3.1	80	1280
40	31.7	2.62	2.53	.00395	780	29	0.08	3.05	0.62	3.1	80	1280
41	5.5	0.45	0.43	.00068	320	12	0.04	3.02	1.87	1.6	98	1280
42	11.2	0.93	0.90	.00140	450	20	0.05	3.03	1.87	3.4	98	1280
43	8.5	0.70	0.68	.00106	315	19	0.03	3.02	1.87	2.5	98	1280
44	7.5	0.62	0.60	.00093	360	9	0.05	3.03	1.87	2.2	98	1280
45	9	0.74	0.71	.00112	260	5	0.04	3.03	1.87	2.7	98	1280
46	9	0.74	0.71	.00112	240	8	0.03	3.02	1.87	2.7	98	1280
47	13.7	1.13	1.09	.00170	320	6	0.05	3.03	1.87	4.1	98	1280
48	3.3	0.27	0.26	.00041	370	7	0.06	3.04	1.49	0.8	94	1280
49	49.5	4.09	3.95	.00617	840	28	0.09	3.05	0.10	0.8	61	1280
TOTAL		68.7	66.3									