FINAL

DRAINAGE PLAN AND REPORT

HANCOCK SUBDIVISION II

A PROPOSED 2-LOT RE-SUBDIVISION AT 15220 LEATHER CHAPS
Lot 39 Chaparral Hills
Northeast Quarter of Section 36, Township 11 South, Range 67 West, of the 6th P.M., County of El Paso, State of Colorado

PCD File: VR254

November 20, 2023

Revised
December 31, 2024

Prepared for
Bill Hancock
15220 Leather Chaps Drive
Colorado Springs, CO 80921-2419

Oliver E. Watts, Consulting Engineer, Inc.
Colorado Springs, Colorado

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Celebrating over 44 years in business

November 20, 2023

El Paso County Planning and Community Development
2880 International Circle
Colorado Springs, CO 80910

ATTN: *Joshua Palmer, P.E.*

SUBJECT: Final Drainage Plan and Report
Hancock Subdivision II

Transmitted herewith for your review and approval is the drainage plan and report for the proposed Hancock Subdivision II at 15220 Leather Chap Drive in El Paso County. This report will accompany the minor subdivision submittal.

Please contact me if I may provide any further information.

Oliver E. Watts, Consulting Engineer, Inc.

BY: _____
Oliver E. Watts, President

Table of Contents

1. 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 County for drainage reports and said report is in conformity with the applicable 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.

Oliver E. Watts, Consulting Engineer, Inc.

OLIVER E. WATTS REGISTERED 9853 P.E. & L.S. STATE OF COLORADO

12/31/24

Oliver E. Watts Colo. PE-LS No. 9853 date

2. OWNERS / DEVELOPER'S STATEMENT:

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

Bill Hancock

By: X Bill Hancock

15220 Leather Chaps Drive
Colorado Springs, CO 80921-2419

EL PASO COUNTY:

Filed in accordance with the requirements of the El Paso Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

Joshua Palmer, P.E., date
County Engineer / ECM Administrator

Conditions:

4. LOCATION and DESCRIPTION:
The proposed Hancock Subdivision is located at 15220 Leather Chaps Drive, being Lot 39 Chaparral Hills It is located in the Northeast quarter of Section 36,Township 11 South, Range 67 West, of the 6th P.M., County of El Paso, State of Colorado. The site is zoned RR-2.5 and is 5.051 acres total. We propose to resubdivide the property into two, single family, residential lots The site has an existing single family home on proposed Lot 2; 2.525 acres. Proposed Lot 1 (west) is 2.526 acres and will have a single family home constructed on it.

The site, other than the home is covered native grasses with some scrub oak adjacent to Leather Chaps Drive. The terrain slopes from the northwest to the south, east and southeast. Access for the site is from Leather Chaps Drive on the east (for proposed Lot 2) and Struthers Loop on the south (for proposed Lot 1).

The property is in the Jackson Creek drainage basin.

5. FLOOD PLAIN STATEMENT:
This subdivision is not within the limits of a flood plain or flood hazard area, according to FEMA map panel number 08041C0287 G, dated December 7, 2018, a copy of which is enclosed for reference.

6. METHOD AND CRITERIA:
The method used for all computations is that specified in the City-County Drainage Criteria Manual, using the rational method for areas of the size of the development. All computations are enclosed for reference and review.

The soils in the subdivision have been mapped by the local USDA/SCS office, and a soils map and interpretation sheet are enclosed for reference. All soils in this area are of the Peyton and Tomah complexes, being in hydrologic group "B".

7. DESCRIPTION OF RUNOFF:
EXISTING DRAINAGE CONDITIONS

Offsite basin O-1 is a small 0.13 acre range land area that will drain 0.13 cfs / 0.38 cfs (5-year / 100-year) runoff into the northeast portion of the subdivision. Basin A is an open, well drained range land parcel containing and existing residence and related improvements. This will become Lot 2 of the subdivision. The runoff will combine with that of basin O-1 for a total of 1.4 cfs / 5.3 cfs that will outfall into and existing 18-inch cmp culvert at the intersection of Leather Chaps and Struthers Loop roads. The culvert has adequate capacity for the design runoff and will continue to operate under 0.24' of headwater.

Offsite basin O-2 consists of the southerly portion of the property north of the subdivision, consisting of open range land. It will drain 0.4 cfs / 3.5 cfs into the northern boundary of proposed Lot 1. It will combine with the 2.54 acre basin B, which is essentially open range land. The total runoff will be 0.9 cfs / 7.2 cfs along the northwest line of Lot 1 in a sheet flow condition with no specific defined drainage path. It will outfall into the adjacent vacant Lot 38 and westerly portion of Struthers Loop.

PROPOSED DRAINAGE CONDITIONS

The area will be graded to conform to the existing topography shown on the drainage plans and existing routing will remain. All runoff will be routed to and contained within the private site, terminating at the historic outfall points. Basins O-1 and A will remain in their existing condition, while Basin B is assumed to develop in a similar manner as existing basin A. The routing will remain unchanged from the existing condition and is computed to become 1.3 cfs / 7.5 cfs, a relatively small increase due to the large lot size.

FOUR STEP PROCESS: The proposed development will disturb less than 1 acre total.

- Step 1: **Employ Runoff Reduction Practices** – Runoff is not anticipated to increase appreciably across both lots. A combined flow from the lots is anticipated to only increase by 0.3 cfs. The existing prairie grass and gentle slopes in the area will provide further runoff reduction.

- Step 2: **Stabilize Drainageways** – The development of this project does not anticipate having any negative effects on downstream drainageways. The existing prairie grass will act as a natural stabilizer, no additional installation is needed.

- Step 3: **Provide Water Quality Capture Volume –** The existing prairie grass is a natural water quality capture and control device. There is no need to install any additional devices.

- Step 4: **Consider Need for Industrial and Commercial BMP's –** The site is a 2 lot residential subdivision across 5 acres. The site is covered with prairie grass and said grass acts as a natural BMP for stormwater runoff. It absorbs the flows and reduces/eliminates potential erosion.

8. COST ESTIMATE:
No storm sewers appear to be required at this time.

9. 2025 FEES:
This site is within the Jackson Creek Drainage Basin. Fees are due. The two, 2.5 acre lots will have 11% impervious area and comprise about one-third of the subdivision, with the remainder being unchanged. .
Basin Fee: $10,556 per impervious acre
Bridge: -0-
Total Fees Estimated: ($ 10,556 at 2.50 acres x 11%) =$2,902.90– 25% (Large Lot Drainage Basin Fee Reduction) = $2,177.17
Bridge Fee: -0-

10. SUMMARY
The proposed Hancock Subdivision II is a 2-lot, minor resubdivision in the RR-2.5 zone. Two thirds

thirds of the subdivision will not be developed further so there will be no change in the historic runoff amounts for this portion, which outfalls into the existing County culvert on Leather Chaps Road and the Westerly portion of Struthers Loop. The existing culvert is in good condition and more than adequate. The runoff for the remaining development is relatively minor and is not concentrated. The existing grasses in the sandy soil will hold this runoff to near historic levels. There will be no adverse effects on downstream or surrounding properties. A culvert for the driveway on Struthers Loop should have an 18" CMP culvert across the drive at the road shoulder.

The drainage analysis has been prepared in accordance with the current El Paso County Drainage Criteria Manuel. Supporting information and calculations are included in this report.

References

1. El Paso County Engineering Criteria Manuel, December 13, 2016

2. City of Colorado Springs Drainage Criteria Manuel, Volumes 1 and 2, May, 2014

MAJOR BASIN	SUB BASIN	AREA 1"=100'		BASIN		Tc MIN	I in./hr.		SOIL GRP	DEV. TYPE	C		FLOW 5-ry	FLOW 100-yr	RETURN PERIOD -years-	
		PLANIM READ	ACRES	LENGTH -FT.-	HEIGHT -FT.-								qp -CFS-	qp -CFS-		
JACKSON CR	O-1	0.55	0.034	100	3	12.8	3.6	6.1	B	PAV'T	0.90	0.90			5	100
			0.092							R/L	0.08	0.35				
		TOTAL	0.126								0.301	0.498	0.13	0.38	5	100
	A	COGO	0.0735	+610	28	+9.5			B	PAV'T	0.90	0.90				
			0.0740	C=5	V=1.07					ROOF	0.73	0.81				
			2.4945							R/L	0.08	0.35				
		TOTAL	2.952							MIX	0.1167	0.370				
O-1 + A	DP1	TOTAL	3.08			22.3	2.8	4.7	B	MIX	0.115	0.369	1.0	5.3	5	100
	O-2	6.34	0.062	100	4	11.7			B	PAV'T	0.90	0.90				
	C=5	V=1.01	1.398	+340	14	+5.6				R/L	0.08	0.35				
		TOTAL	1.46			17.3	3.2	6.4		MIX	0.077	0.373	0.4	3.5	5	100
DEVELOPED	B		0.0740	+450	17	+2.4			B	ROOF	0.73	0.81				
			2.3925							R./L	0.08	0.35				
			0.0735							PAV'T	0.90	0.90				
		TOTAL	2.54							MIX	0.079	0.358				
O-2 + B	DP2	TOTAL	4.00			19.7	3.0	5.0	B	MIX	0.106	0.377	1.3	7.5	5	100

HYDROLOGICAL COMPUTATION – BASIC DATA
PROJ: HANCOCK SUB. II BY: O.E. WATTS
RATIONAL METHOD DATE: 11-20-23

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MAJOR BASIN	SUB BASIN	AREA		BASIN		Tc MIN	I in./hr.		SOIL GRP	DEV. TYPE	C		FLOW 5-ry qp -CFS-	FLOW 100-yr qp -CFS-	RETURN PERIOD -years-	
		PLANIM READ	ACRES	LENGTH -FT.-	HEIGHT -FT.-											
JACKSON CREEK	B		2.54	+450	17	+2.4			B	R/L	0.08	0.37			5	100
HISTORIC	DP2	TOTAL	4.00			19.7	3.0	5.0		MIX	0.079	0.358	0.9	7.2	5	100
O-2 + B																

HYDROLOGICAL COMPUTATION–BASIC DATA
PROJ: HANCOCK SUB. II BY: O.E. WATTS
RATIONAL METHOD DATE: 11-20-23

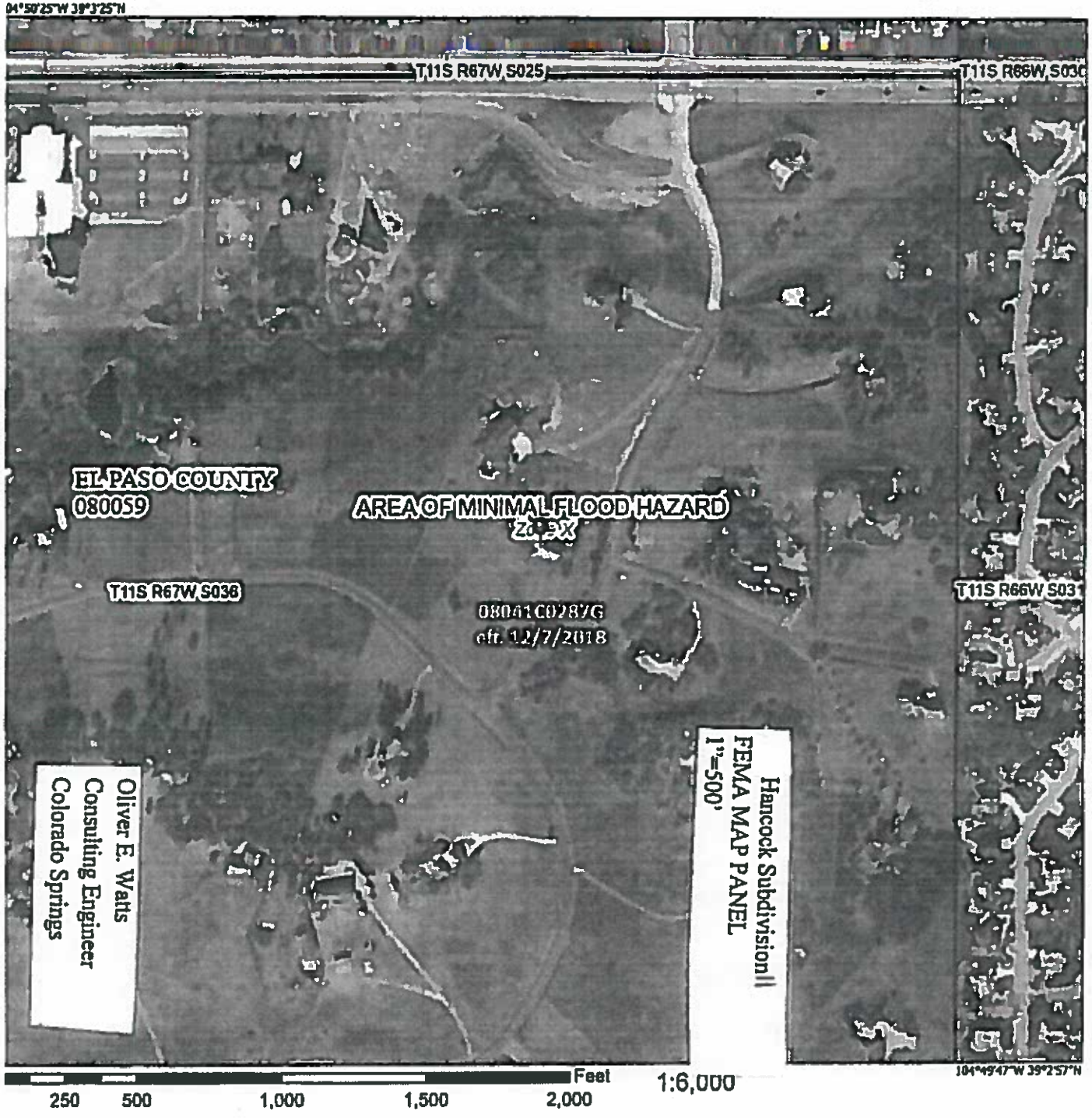
OLIVER E. WATTS, CONSULTING ENGINEER, INC.
614 ELKTON DRIVE COLORADO SPRINGS, CO 80907

STREET AND STORM SEWER CALCULATIONS

STREET	LOCATION	DISTANCE -ft.-	ELEVATION & SLOPE	TOTAL RUNOFF -cfs- 5-yr./100-yr	STREET FLOW / CAPACITY -cfs- 5-yr./100-yr	PIPE FLOW -cfs-	TYPE PIPE, CATCH BASIN & SLOPE %
LEATHER CHAPS	SE CORNER		6890.98				
		40.0	4.08%	0/5.3	N/A	5.3	18" CMP
			6889.35				CAP=56.88S1/2-11.5
							hi=0.21v2 = 0.24'
							WS=3891.22

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Are of 1% annual chance flood with averag depth less than one foot or with draina areas of less than one square mile Zone
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zo

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

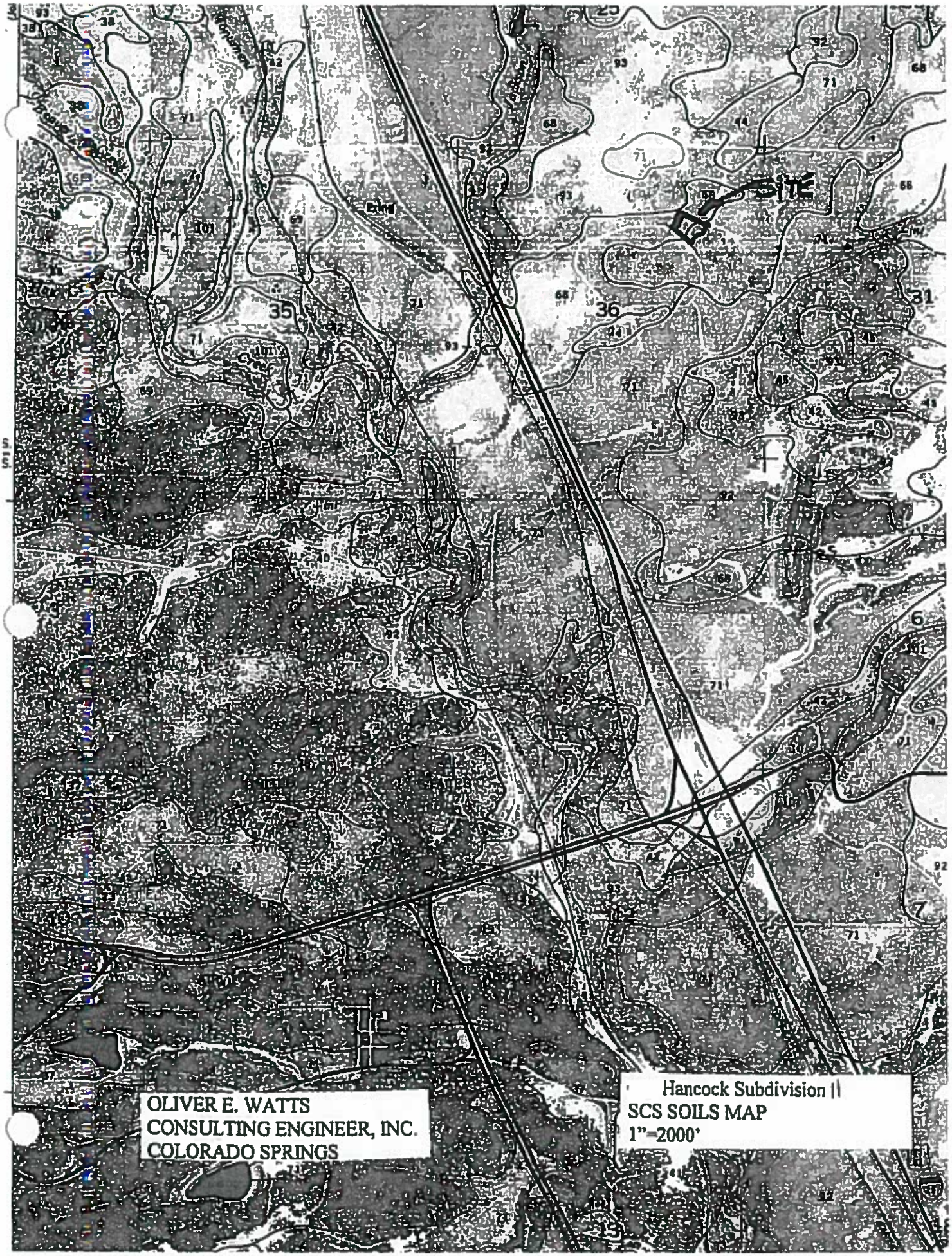
N

The pin displayed on the map is an approximat point selected by the user and does not repres an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/10/2023 at 4:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



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COLORADO SPRINGS

Hancock Subdivision II
SCS SOILS MAP
1"=2000'

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Manvel: 50	C	None	---	---	>60	---	High.
Manzanola: 51, 52, 53	C	None to rare	---	---	>60	---	Moderate.
Midway: 54	D	None	---	---	10-20	Rippable	Moderate.
Nederland: 55	B	None	---	---	>60	---	Moderate.
Nelson: [1]56:							
Nelson part	B	None	---	---	20-40	Rippable	Low.
Tassel part	D	None	---	---	10-20	Rippable	Low.
Neville: 57	B	None	---	---	>60	---	High.
[1]58:							
Neville part	B	None	---	---	>60	---	High.
Rednun part	C	None	---	---	>60	---	Moderate.
Nunn: 59	C	None	---	---	>60	---	Moderate.
Olney: [1]60, 61	B	None	---	---	>60	---	Moderate.
[1]62:							
Olney part	B	None	---	---	>60	---	Moderate.
Vona part	B	None	---	---	>60	---	Moderate.
Paunsaugunt: [1]63:							
Paunsaugunt part	D	None	---	---	10-20	Hard	Moderate.
Rock outcrop part	D	---	---	---	---	---	---
Penrose: [1]64:							
Penrose part	D	None	---	---	10-20	Rippable	Low.
Manvel part	C	None	---	---	>60	---	High.
Perrypark: 65	B	None	---	---	>60	---	Moderate.
Peyton: 66, 67	B	None	---	---	>60	---	Moderate.
[1]68, [1]69:							
Peytor part	B	None	---	---	>60	---	Moderate.
Pring part	B	None	---	---	>60	---	Moderate.
Pits, gravel: 70	A	---	---	---	---	---	---
Pring: 71, 72	B	None	---	---	>60	---	Moderate.
[illegible]zor: 73, 74	C	None	---	---	20-40	Rippable	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Tomah:							
[1]92, [1]93:							
Tomah part-----	B	None----------	---	---	>60	---	Moderate
Crowfoot part--	B	None----------	---	---	>60	---	Moderate
Travessilla:							
[1]94:							
Travessille part----------	D	None----------	---	---	6-20	Hard	Low.
Rock outcrop part----------	D	---	---	---	---	---	---
Truckton:							
95, 96, 97-------	B	None----------	---	---	>60	---	Moderate
[1]98:							
Truckton part--	B	None----------	---	---	>60	---	Moderate
Blakeland part-	A	None----------	---	---	>60	---	Low.
[1]99, [1]100:							
Truckton part--	B	None----------	---	---	>60	---	Moderate
Bresser part---	B	None----------	---	---	>60	---	Low.
Ustic Torrifluvents:							
101----------	B	Occasional----	Very brief----	Mar-Aug	>60	---	Moderate
Valent:							
102, 103---------	A	None----------	---	---	>60	---	Low.
Vona:							
104, 105---------	B	None----------	---	---	>60	---	Moderate
Wigton:							
106----------	A	None----------	---	---	>60	---	Low.
Wiley:							
107, 108---------	B	None----------	---	---	>60	---	Low.
Yoder:							
109, 110---------	B	None----------	---	---	>60	---	Low.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Imperviousness	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.79	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.03	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.58
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

*For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

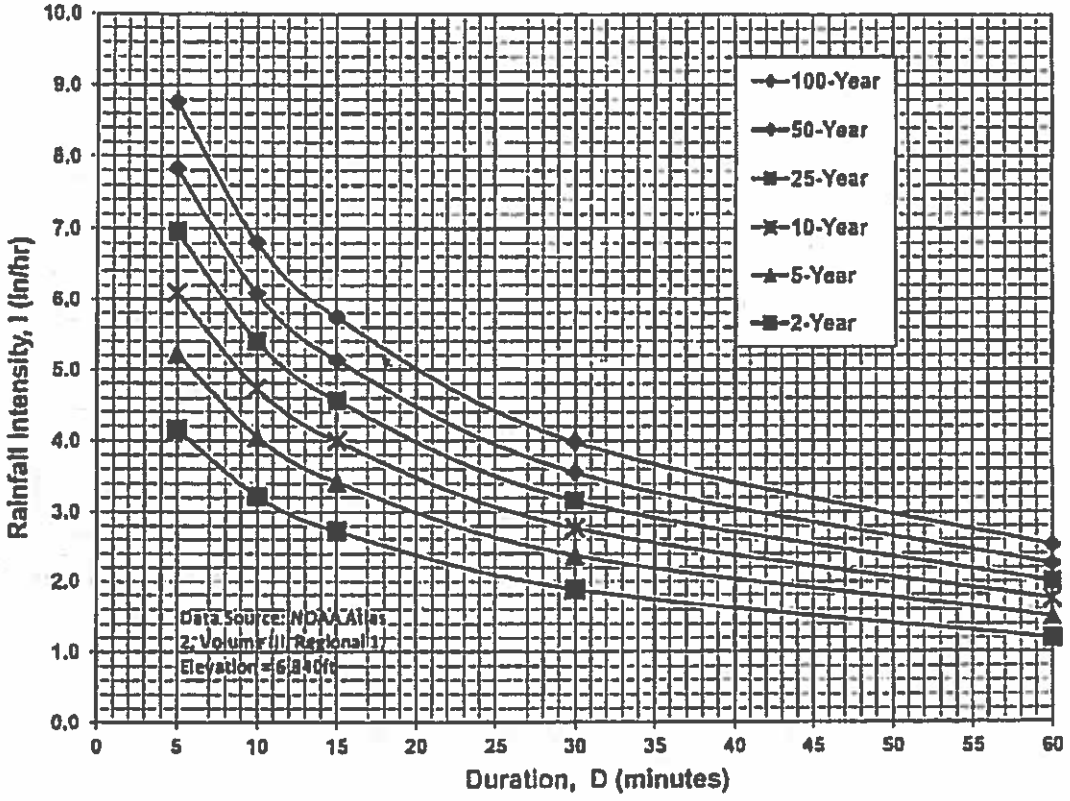
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

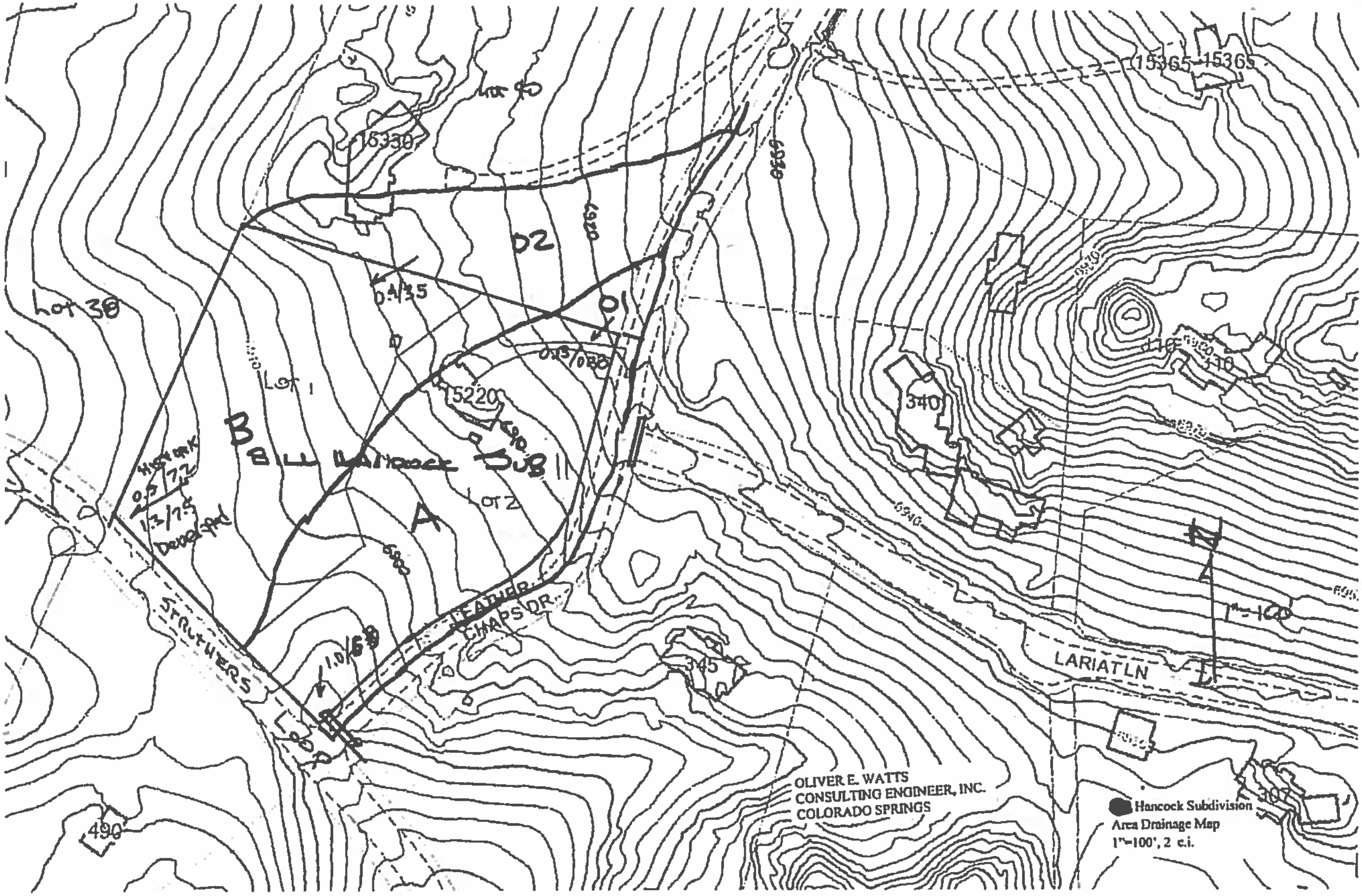
$I_{2} = -1.19 \ln(D) + 6.035$

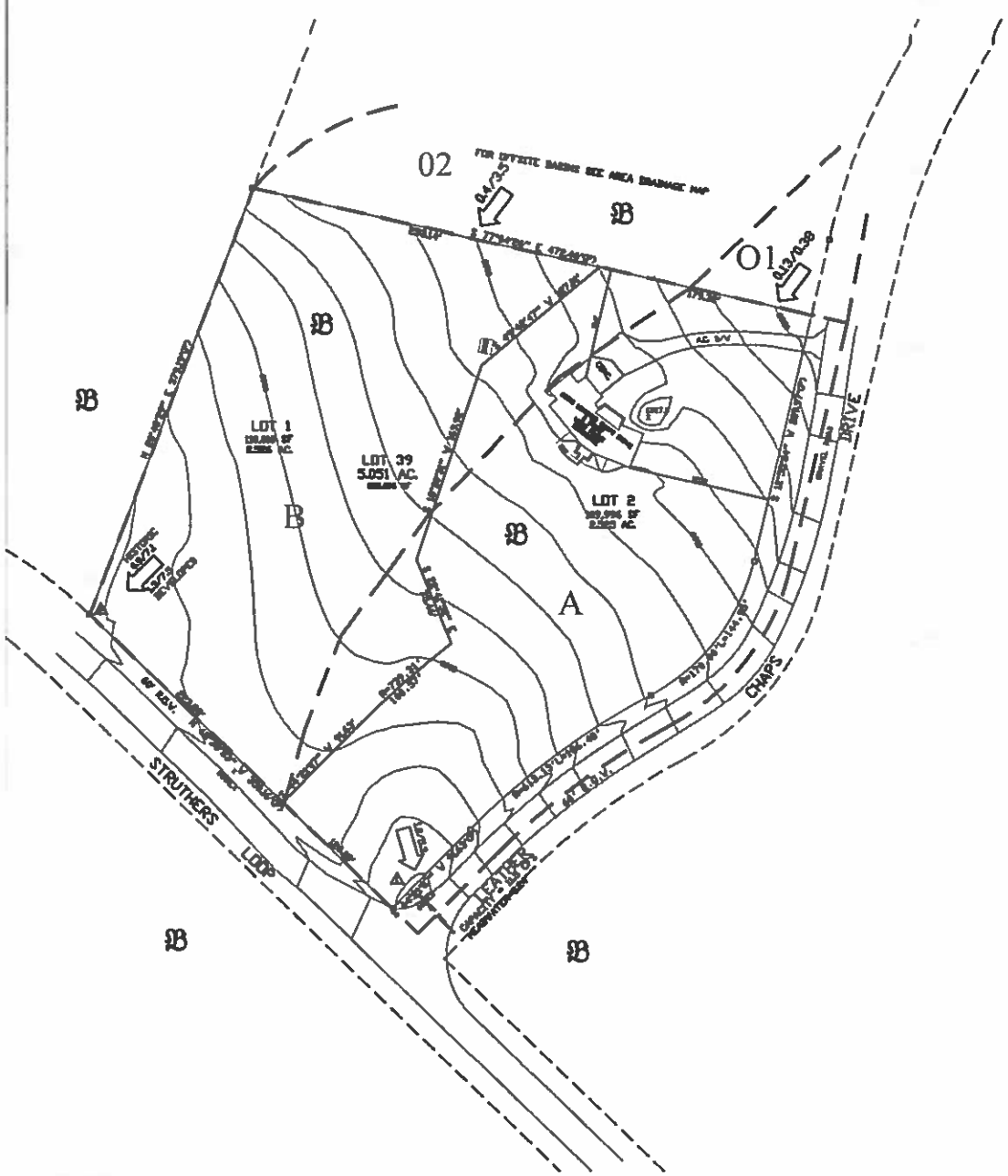
Note: Values calculated by equations may not precisely duplicate values read from figure.

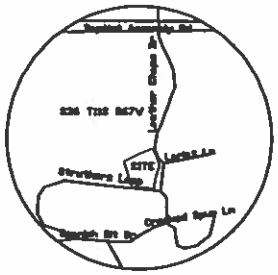
$$Q=\frac{0.463}{n} D^{8/3} S^{\frac{1}{2}} \qquad Q=KS^{\frac{1}{2}}$$

.R N.-	AREA -FT^2-	D 8/3 -FT-	K			
			N=0.010	N=0.013	N=0.024	N=0.026
2	0.02182	0.008413	0.3895	---	---	---
4	0.08727	0.053420	2.4733	---	---	---
6	0.19630	0.157500	7.2922	5.609	---	---
8	0.34910	0.339200	15.7050	12.081	---	---
0	0.54540	0.615000	28.4745	21.903	---	---
2	0.78540	1.000000	46.3000	35.615	---	---
5	1.22720	1.813100	83.9465	64.574	---	---
8	1.76710	2.948300	136.5100	105.000	56.88	52.50
1	2.40530	4.447400	205.9100	158.400	85.80	79.20
4	3.14160	6.349600	293.9900	226.140	122.49	113.07
7	3.97610	8.692700	402.4700	309.590	167.70	154.79
0	4.90870	11.512600	533.0300	410.030	222.10	205.02
3	5.93960	14.844100	---	528.680	---	---
6	7.06860	18.720800	866.7700	666.700	361.20	333.30
9	8.29580	23.175100	---	825.400	---	---
2	9.62110	28.238900	---	1005.000	544.80	502.50
8	12.56640	40.317500	---	1436.000	777.80	718.00
4	15.90430	55.195000	---	1966.000	1065.00	983.00
0	19.63500	73.100400	---	2604.000	1410.00	1302.00
6	23.75830	94.254200	---	3357.000	1818.00	1678.00
2	28.27430	118.869400	---	4234.000	2293.00	2117.00
	33.18310	147.152900	---	5241.000	2839.00	2620.00
4	38.48450	179.306000	---	6386.000	3459.00	3193.00
0	44.17860	215.524500	---	7676.000	4158.00	3838.00
6	50.26550	256.000000	---	9118.000	4939.00	4559.00
8	63.61730	350.466600	---	12480.000	6761.00	6140.00
0	78.53980	464.158900	---	16530.000	8954.00	8265.00

Oliver E. Watts
Consulting Engineer
Colorado Springs


OLIVER E. WATTS
CONSULTING ENGINEER, INC.
COLORADO SPRINGS
Hancock Subdivision
Area Drainage Map
1"=100', 2 c.i.
LARIATLN
LEATHER CHAPS DR.
STRUTHERS LOOP
D2
D1
A
B
Lot 38
Lot 1
Lot 2
340
345
490
307
6940
6930
6920
1"=100





VICINITY MAP

N

Scale 1" = 50'

Contour Interval 2'

LEGEND

- FOUND #4 REBAR
- FOUND 1-1/4" INCH CAP, WESTE ON #5 REBAR
- GAS METER
- VAULT
- ELECTRIC METER
- TELEPHONE PEDESTAL
- ELECTRIC VAULT

LEGEND

- B/S/100-4 — RUNOFF IN CFS 5-YEAR/100-YEAR
- A — LIMIT OF DRAINAGE BASIN AND DESIGNATION
- EXISTING STORM SEWER AS LABELED
- B — LIMIT OF SOILS TYPE AND GROUP

DRAINAGE BASIN SUMMARY

BASIN	AREA +AC-	RUNOFF IN CFS 5-YEAR	RUNOFF IN CFS 100-YEAR
O-1	0.126	0.13	0.38
O-2	1.46	0.4	3.5
A	2.55	—	—
B	0.54	—	—
DESIGN POINTS - HISTORIC			
△	3.68	1.0	5.3
△	4.00	1.3	7.5
DESIGN POINTS - DEVELOPED			
O-1 + A △	2.68	1.0	5.3
O-2 + B △	4.00	0.9	7.2

		9-6-02 REVISED AS REQUESTED	DEV	OLIVER E. WATTS CONSULTING ENGINEER COLORADO SPRINGS	15220 LEATHER CHAPS LOT 39 CHAPARRAL HILLS EL PASO COUNTY	DRAINAGE PLAN	1 of 1