SCANNED

DRAINAGE LETTER

5819 PALMER PARK BLVD.

PART OF LOT 1, POWERS CENTER, FILING NO. 3

September 27, 2018

Revised
November 23, 2018

Revised
December 19, 2018

Prepared for

Ted Vong

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

PCD File No. PPR1847

OLIVER E. WATTS, PE-LS
OLIVER E. WATTS, CONSULTING ENGINEER, INC.
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Celebrating over 39 years in business

December 19, 2018

El Paso County D.O.T.
2880 International Circle
Suite 110
Colorado Springs, CO 80910

ATTN: Jennifer Irvine

SUBJECT: Drainage Letter
5810 Palmer Park Blvd.

Gentlemen

Transmitted herewith for your review and approval is the drainage letter for 5819 Palmer Park Boulevard, which is part of Lot 1, Powers Center Filing No. 3. It is proposed to construct a Short Stop drive-in restaurant in an existing paved parking lot.

There will be no change in the approved runoff as a result of this subdivision. This report has been revised in accordance with your review of November 15, 2018 and December 13, 2018. Please contact our office if we may provide any further information.

Oliver E. Watts, Consulting Engineer, Inc.

BY: ______________________
Oliver E. Watts, President

Encl:
- Drainage Letter 2 pages
- FEMA Firmette 08041C0751 G and 08041C0752 G, December 7, 2018
- Computations, 4 pages
- Backup Information, 6 Pages
- Soils Map and Interpretation sheet
- Drainage Plan, Dwg No. 18-5237-02

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

Oliver E. Watts   Colo. PE-LS No. 9853 12/19/18

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.

Ted Vong

By:______________________________________
1626 E. Pikes Peak Ave.
Colorado Springs, CO 80909

3. 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.

______________________________________   ________________
Jennifer Irvine   date
County Engineer, ECM Administrator

Conditions:

4. LOCATION AND DESCRIPTION:

5819 Palmer Boulevard is located East of Powers Boulevard between Palmer Park Boulevard and Omaha Boulevard, as shown on the enclosed drainage plan. It is proposed that a Short Stop drive-in restaurant will be placed in a portion of the existing parking lot in Lot 1, Powers Center filing No. 3. The total lot will occupy just less that one-half acre, counting the parking required for the restaurant in the existing parking lot. The restaurant itself will occupy less than 3000 feet of the lot.

5. FLOOD PLAIN STATEMENT:

This subdivision is not within the limits of a designated flood plain or flood hazard area, as identified on FEMA panel no. 08041C0751 G, and 08041C0752 G, dated December 7, 2018. A firmette is enclosed for reference.

6. DESCRIPTION OF RUNOFF:

As stated above, this Site was platted as Powers Center Filing no. 3. At that time (November, 2007), a drainage report was submitted by LDC, Inc. and approved by El Paso County, Colorado. The portion of the parking lot to be occupied by the restaurant is totally asphalt paved at this time. The construction of the drive in could arguably have less impervious cover that that of the existing parking, although for the sake of computations the impervious ratio is assumed to be 80% in keeping with the existing zoning. The entire lot area associated with the construction occupies 0.469 acre on an approximate slope of four percent. The runoff from the total disturbed area is computed to be 0.39 cfs / 0.71 cfs. This report is in full compliance with the above reference drainage report.

A sand filter basin is proposed to mitigate the placement of the restaurant, as required by County regulations. Based on the 3998 square foot footprint of the total disturbed area, the required storage is 122 cubic feet. The basin will be placed in an existing parking island in the southwest corner of the site, and is proposed be constructed of vertical masonry walls with the sand filter floor of 62 square feet, as shown in the enclosed computations. 2 grated catch basins and a short segment of 8" PVC will route the runoff to the sand filter basin as shown on the drainage plan. The system will have the capacity to accommodate the full 100-year runoff as shown in the computations.

7. 4 STEP PROCESS

The following process has been followed to minimize adverse impacts of urbanization

Runoff Reduction: The scope of the development has been minimized consistent with zoning requirements to present the minimum footprint in providing a development. The undisturbed portions are to be landscaped or left alone to reduce the impervious percent.

Treat and Slowly Release: The above described sand filter basin is to be provided to provide water quality treatment and a reduced rate of discharge from the development. The runoff will be totally contained within the sand filter basin and released into the underlying soil cover.

Channel Stabilizing: The site will be graded to route the runoff over improved parking, street and curb installations to provide stabilization. Discharge from the site will be in accordance with the above mentioned drainage report. There will be no adverse affect on downstream developments as a result of this subdivision

Source Controls: This is a minimum sized commercial site, so source control problems will be a minimum. During construction, standard site specific state of the art BMP's will be employed to minimize and mitigate erosive problems.

There will be no increase in runoff or damage to downstream structures as a result of this construction.

8. FEES:
This Site has been previously platted and there is no increase in the amount of impervious cover; therefore fees are not due.

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, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- 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 D*

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

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
- 513 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 approximate point selected by the user and does not represer 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 12/18/2018 at 4:19:30 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.

MAJOR BASIN	SUB BASIN	AREA		BASIN		Tc MIN	I		SOIL GRP	DEV. TYPE	C		FLOW		RETURN PERIOD	
		SF	ACRES	LENGTH	HEIGHT								qp	qp		
EXISTING	A	2029	0.047			Min	5.2	8.8	B	80%	0.81	0.88	0.20	0.36	5	100
	B	1969	0.045			Min	5.2	8.8	B	80%	0.81	0.88	0.19	0.35	5	100
	TOTAL	3998	0.092										0.39	0.71	5	100

HYDROLOGICAL COMPUTATION – BASIC DATA
PROJ: 5819 PALMER PARK BLVD. BY: O.E. WATTS
RATIONAL METHOD DATE: 9/27/18 11/24/18 12-19-18

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

STREET AND STORM SEWER CALCULATIONS

STREET	LOCATION	DISTANCE	ELEVATION & SLOPE	TOTAL RUNOFF	STREET FLOW / CAPACITY	PIPE FLOW	TYPE PIPE, CATCH BASIN & SLOPE %
PRIVATE	BASIN A		08.0/07.0	0.36	0.36		GRATED INLET hi=0.09’
		26.79’	3.57%			0.36	8” PVC, CAP=3.2
	JUNCTION		06.10				
	BASIN B		07.82/06.82	0.35	0.35		GRATED INLET, hi=0.09
		14.34’	5.02%			0.35	8” PVC, CAP =3.5
	JUNCTION		06.10				
		25.13’	3.37%	0.71		0.71	8” PVC, CAP = 3.5
	BASIN						

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.06, November 2016)

3/4

Designer: O.E. Watts
Company: OEW Cons. Engr. Inc
Date: September 27, 2018 November 24, 2018 December 19, 2018
Project: 5819 Palmer Park
Location:

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a = 80.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.800
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time $WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$	WQCV = 0.26 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area = 3,998 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume V_{WQCV} = WQCV / 12 * Area	V_{WQCV} = 88 cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.60 in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = 122 cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = ____ cu ft
2. Basin Geometry	
A) WQCV Depth	D_{WQCV} = 2.0 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z = 0.00 ft / ft
C) Minimum Filter Area (Flat Surface Area)	A_{Min} = 40 sq ft
D) Actual Filter Area	A_{Actual} = 62 sq ft
E) Volume Provided	V_T = 124 cu ft
3. Filter Material	Choose One: ◉ 18" CDOT Class B or C Filter Material; ○ Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One: ○ YES; ◉ NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = N/A ft
ii) Volume to Drain in 12 Hours	Vol_{12} = N/A cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = N/A in

Design Procedure Form: Sand Filter (SF)

4/4

Designer:	**O.E. Watts**
Company:	**OEW Cons. Engr. Inc**
Date:	**September 27, 2018 November 24, 2018 December 19, 2018**
Project:	**5819 Palmer Park**
Location:	

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric

   A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?

Choose One

○ YES ◉ NO

6-7. Inlet / Outlet Works

   A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet

Notes:

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	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	0.80	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	0.05	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	0.59
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.

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

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.

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

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).

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

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.

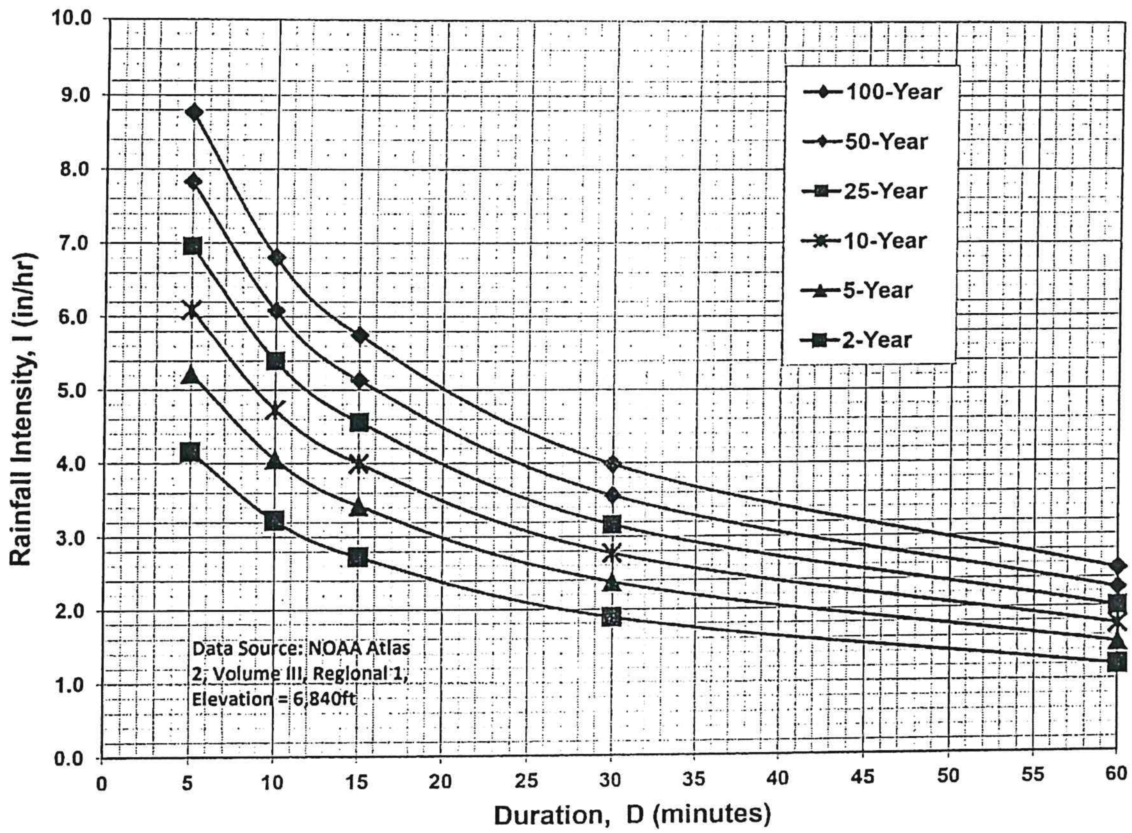
3.2.4 Minimum Time of Concentration

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

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

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

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

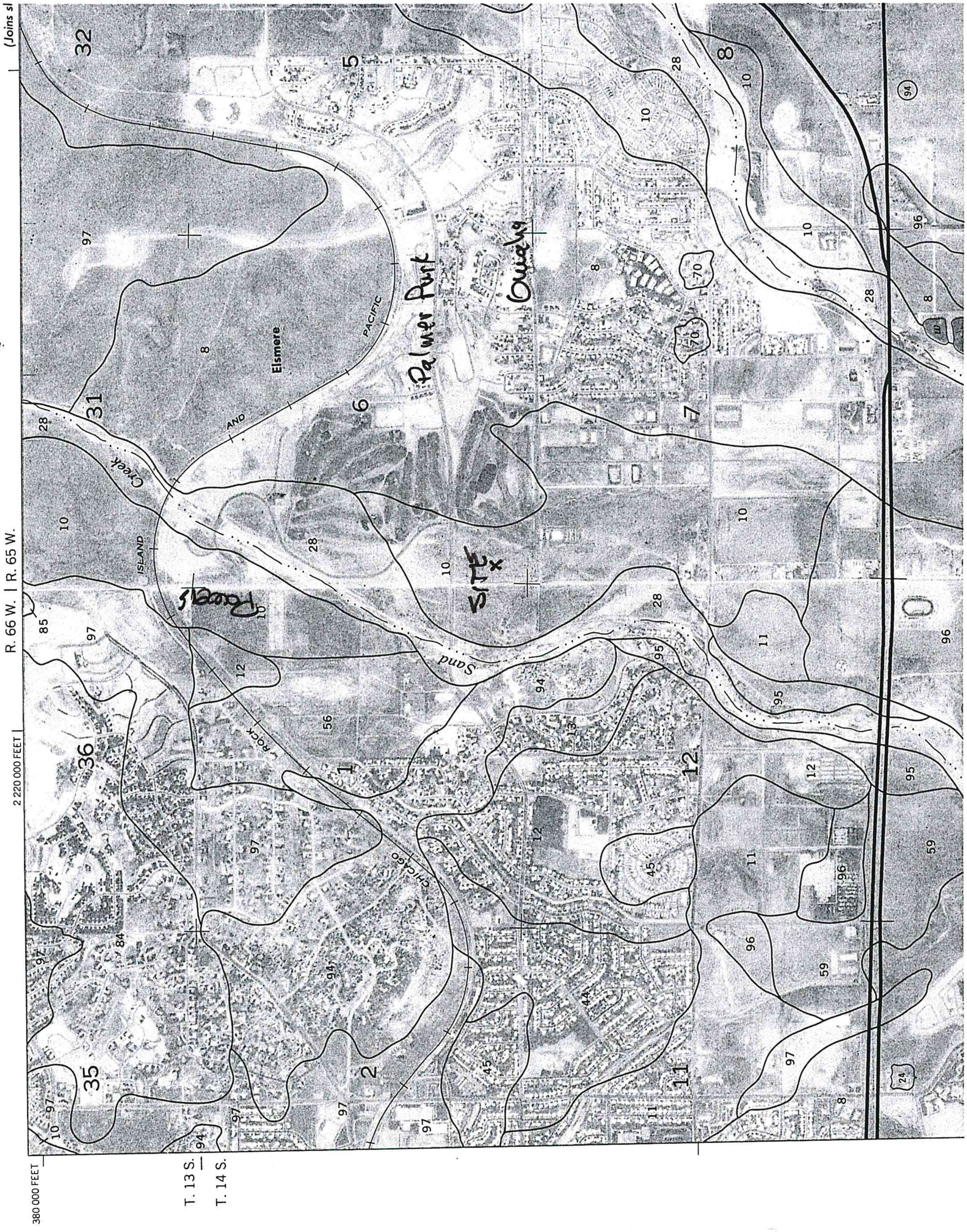
$I_{10} = -1.75 \ln(D) + 8.847$

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

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

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

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



OLIVER E. WATTS
CONSULTING ENGINEER, INC.
COLORADO SPRINGS

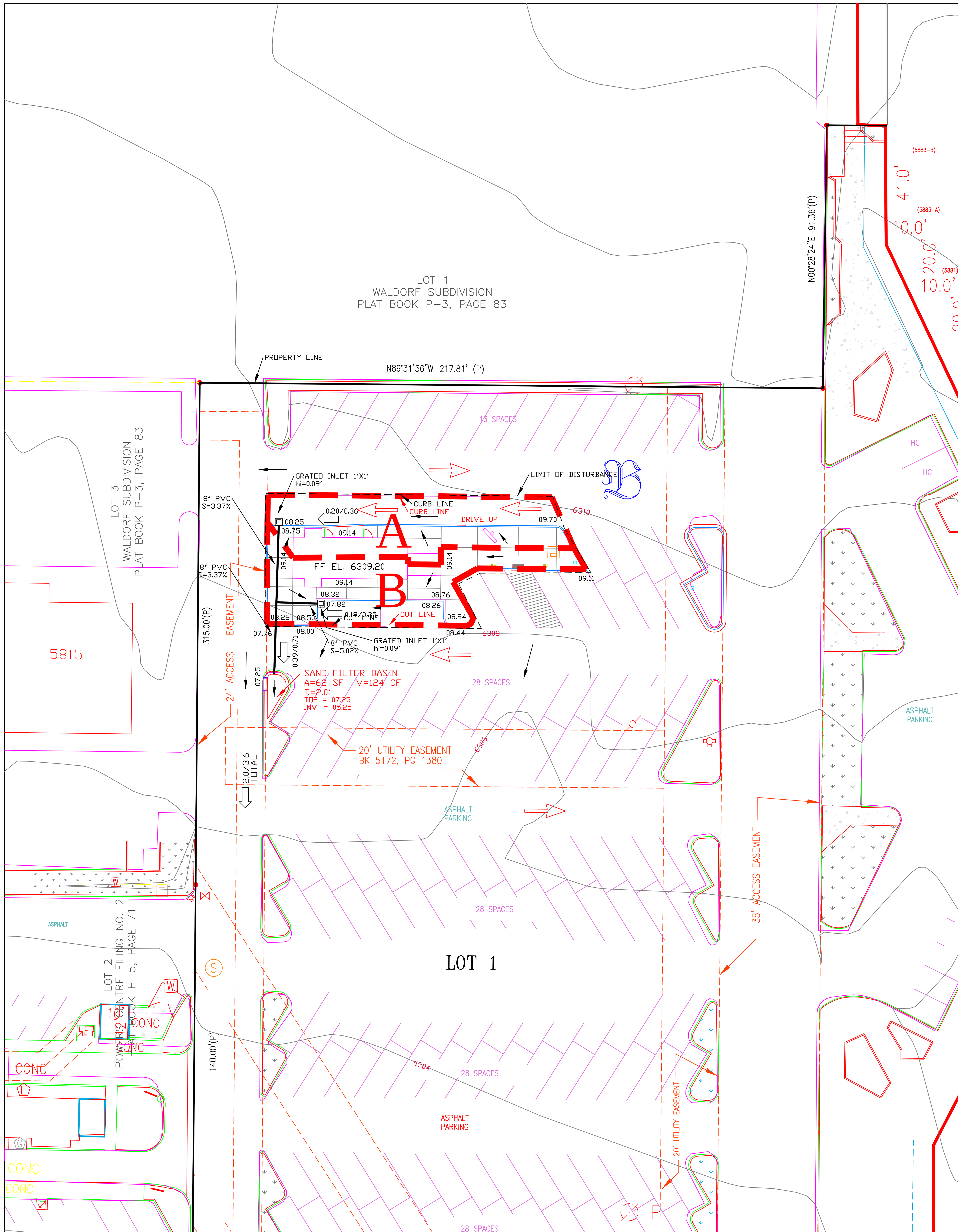
6819 PALMER PARK BLVD
SCS SOILS MAP
1"=2000'

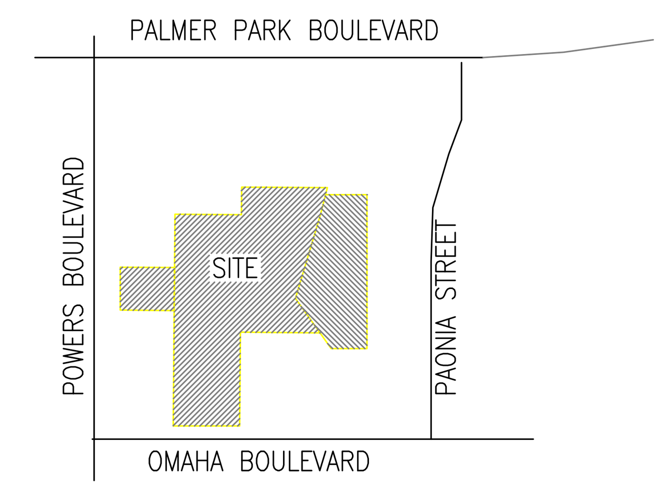
TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See "flooding" in Glossary for definition of terms as "rare," "brief," and "very brief." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action
					In		
Alamosa: 1	C	Frequent	Brief	May-Jun	>60	---	High.
Ascalon: 2, 3	B	None	---	---	>60	---	Moderate.
Badland: 4	D	---	---	---	---	---	---
Bijou: 5, 6, 7	B	None	---	---	>60	---	Low.
Blakeland: 8	A	None	---	---	>60	---	Low.
[1]9: Blakeland part	A	None	---	---	>60	---	Low.
Fluvaquentic Haplaquolls part	D	Common	Very brief	Mar-Aug	>60	---	High.
Blendon: 10	B	None	---	---	>60	---	Moderate.
Bresser: 11, 12, 13	B	None	---	---	>60	---	Low.
Brussett: 14, 15	B	None	---	---	>60	---	Moderate.
Chaseville: 16, 17	A	None	---	---	>60	---	Low.
[1]18: Chaseville part	A	None	---	---	>60	---	Low.
Midway part	D	None	---	---	10-20	Rippable	Moderate.
Columbine: 19	A	None to rare	---	---	>60	---	Low.
Connerton: [1]20: Connerton part	B	None	---	---	>60	---	High.
Rock outcrop part	D	---	---	---	---	---	---
Cruckton: 21	B	None	---	---	>60	---	Moderate.
Cushman: 22, 23	C	None	---	---	20-40	Rippable	Moderate.
[1]24: Cushman part	C	None	---	---	20-40	Rippable	Moderate.
Kutch part	C	None	---	---	20-40	Rippable	Moderate.
Elbeth: 25, 26	B	None	---	---	>60	---	Moderate.
[1]27: Elbeth part	B	None	---	---	>60	---	Moderate.

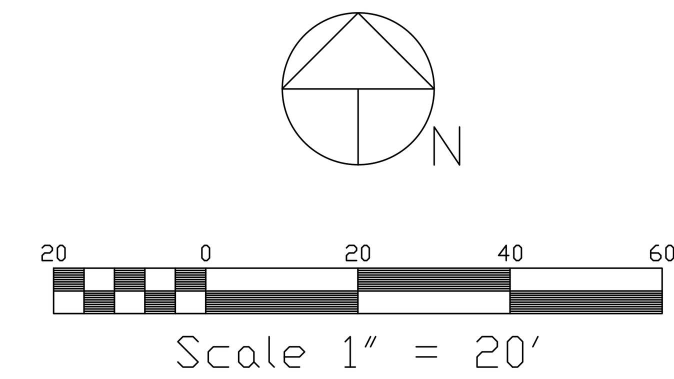
See footnote at end of table.





VICINITY MAP

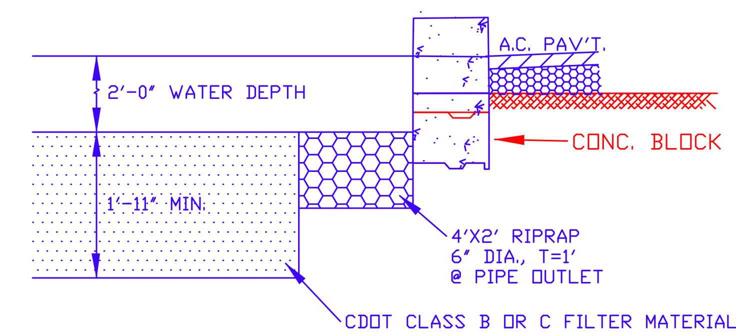
N.T.S.



CONTOUR LEGEND:

ORIGINAL CONTOURS:

FINISH CONTOURS:



SAND FILTER SECTION

1/2" = 1'-0"

LEGEND:

10.5/20.4 RUNOFF IN CFS 5-YEAR/100-YEAR

A LIMIT OF DRAINAGE BASIN AND DESIGNATION

PROPOSED STORM SEWER AS LABELED

B LIMIT OF SOILS TYPE AND GROUP

DRAWN BY: O.E. WATTS	APPROVED BY:	REVISIONS 11-24-18 CITY REVIEW COMMENTS	OEW
DATE: 9-27-18	PROJ. NO.	12-19-18 CITY REVIEW COMMENTS	OEW
DWG. NO.: 18-5237-02	DWG.		
TOPOGRAPHY BY: CITY FIMS BASE PLAN BY: JOHN NELSON			

OLIVER E. WATTS
CONSULTING ENGINEER
COLORADO SPRINGS

PROJECT
5819 PALMER PARK BLVD.
LOT 1, POWERS CENTER FIL. NO. 3
EL PASO COUNTY

SHT. NAME

DRAINAGE PLAN

SHT. NO.
1
OF
1