DRAINAGE LETTER

ROLLING THUNDER BUSINESS PARK FILLING NO. 2

A REPLAT OF LOTS 2 AND 3, ROLLING THUNDER BUSINESS PARK
County File No.s: SF 209 and PRP2010

January 22, 2020

Revised
July 24, 2020

Revised
August 21, 2020

prepared for

2C Construction and Consulting, Inc.

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

OLIVER E. WATTS, PE-LS
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Celebrating over 41 years in business

July 24, 2020

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

ATTN: *Jennifer Irvine, P.E.*

SUBJECT: Drainage Letter
Rolling Thunder Business Park, Filing No. 2

Gentlemen

Transmitted herewith for your review and approval is the drainage letter for the Rolling Thunder Business Park, Filing No. 2, which is a replat of Lots 2 and 3, Rolling Thunder Business Park. It has been revised per the reviews by Mr. Daniel Torres, 5-11-20 and 7-31-20.

There will be no change in the approved runoff as a result of this subdivision. 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
- Computations, 1 sheet
- FEMA Flood Panel 08041C0752 G, December 7, 2018
- Soils Map and Interpretation Sheet
- Backup Information, 4 pages
- Drainage Plan and Computations, Subdivision Report, 2 pages
- Drainage Plan, Dwg No. 19-5348-07

Rolling Thunder Business Park Filling No. 2
Drainage Letter

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   Colo. PE-LS No. 9853

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.

2C Construction and Consulting, Inc.

By: ____
3430 Sloan Peak Heights
Colorado Springs, CO 80922
499-2377

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

Conditions:

4. LOCATION AND DESCRIPTION:
The Rolling Thunder Business Park, Filing No. 2 is located on the South side of Woodmen Road just east of Falcon Meadows Boulevard, as shown on the enclosed drainage plan. It is a replat of Lot 2 and 3, Rolling Thunder Business Park and lies in the NE1/4 of Section 11, Township 13 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The total size of the subdivision is 1.02 acres. The purpose of the subdivision is to combine the two existing lots and construct a commercial building as shown on the enclosed drainage plan.

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. 08041C0752 G, dated December 7, 2018, a copy of which is enclosed for reference.

> The attached FEMA FIRM map indicates the panel no. as: 08041C0535G
> Please revise

6. CRITERIA:
Runoff is computed as prescribed by the City/County Drainage Criteria Manual, using the rational method for areas the size of this subdivision. Computations are enclosed for reference and review.

The area has bee mapped by the USDA/SCS, and soils type in this are is the Blakeland Series, having hydrologic group "A". A soils map and interpretation sheet are enclosed for reference.

> Please state whether or not these flows are less than the flows designed in the previously approved drainage reports.

7. DESCRIPTION OF RUNOFF:
As stated above, this Site was previously platted as the Rolling Thunder Business Park. At that time a drainage report, prepared by Springs Engineering, Charlene Sammons, PE 36727, was submitted and approved by El Paso County, Colorado on 10-16-08. A copy of the approved drainage plan and the pertinent computations are enclosed. This lot has been zoned for industrial or commercial uses since that time, and runoff was computed on that basis. The subdivision lays South of Woodmen on the North side of Maltese Drive. Runoff is divided by a high point in the existing curb and gutter where shown on the drainage plan.

Basins O-1 and O-2 are the inflows to the subdivision from adjacent Woodmen Road, south of the centerline of the pavement. 0.5 cfs / 0.9 cfs (5-year / 100-year runoffs) will flow into the subdivision in each basin. This will combine with the runoff from each half of the development and exit to the West and East long the north curb line of Maltese Drive. The combined runoff exiting the subdivision is 1.6/3.3 cfs westerly and 1.9/4.0 cfs easterly, well within the capacity of the roadway. The westerly runoff will flow to the existing detention pond lying South of the Cul-de-sac where shown on the enclosed subdivision drainage report. The easterly portion will run to the easterly cul-de-sac on Maltese Point and then into the Southeast detention pond shown on the enclosed subdivision drainage plan. This routing exists and according to the approved plans, and approved facilities are more than adequate, as discussed in the four step process below. The runoff is unchanged from that developed by the existing zoning at the time of the original subdivision, and no harm will be incurred to downstream facilities.

> See comment "A" on the next page.

The runoff coefficients used in this report are taken from the enclosed criteria. We are submitting separately the detailed coordinate geometry computations for the percent impervious value of the subdivision, which is 73.4%. A value of 75% was conservatively used for the enclosed computations. The original subdivision computations are enclosed, which shows that the "C" values used were 0.90 and 0.95 for the 5 and 100- year storms, respectively. These extremely high

> Please also provide the % impervious that Corresponds to these coefficients so that the reader can easily compare the proposed impervious to the previously approved impervious for the site.

values would not represent the presence of any landscaping or native grasses that will remain on the site, and are not realistic for any current commercial development.

west?

FOUR STEP PROCESS

Step1 Employ Runoff Reduction Practices – Runoff from the west half of the proposed building rooftop will be directed to the west and Maltese Point. Runoff will then travel east, down Maltese. Runoff from the east half of the proposed building rooftop will be directed to the east and into Maltese Point. Runoff will join with the west half runoff then travel east, down Maltese. Due to the proposed improvements in relation to the size of the property, provides little to no opportunity for runoff reduction practice.

Step 2 Stabilize Drainageways –The development of this project does not anticipate having any negative effects on downstream drainageways.

Step 3 Provide Water Quality Capture Volume – The existing Storm Water Quality Facilities were previous designed by Springs Engineering. Due to the configuration of the proposed lots north of the pond, and already existing changes to the pond geometry due to erosion, the existing Storm Water Quality Facility was reshaped with 3:1 side slopes for the development of Lots 9 and 10, by M & S Civil Consultants per their drainage report, prepared by Virgil Sanchez PE 37160 and approved by the County 1-17-19. Their proposed reshaping is minor in nature and increase the capacity from 0.17 Ac*ft to 0.21 Ac*ft. This reshaping did not have any negative effects on the performance of the existing Storm Water Quality Facility.

Step4 Consider Need for Industrial and Commercial BMP's – This submittal provides a final grading and erosion control plans with BMPs in place. The proposed project will use silt fence, a vehicle tracking control pad, and concrete washout area, reseeding/landscaping to mitigate the potential for erosion across the site.

7. FEES:

This Site has been previously platted; therefore fees are not due at this time. The above analysis with the existing approved subdivision report indicates that the impervious ratios proposed are far less than those previously used. The fees collected for the subdivision are far greater than required for the proposed development.

COMMENT "A"
-Please elaborate on your description of the developed runoff. Describe how the runoff will exit the site onto Maltese Point. For example, it appears that flow within the slope easement is being diverted to the east and west. Please describe your intent in the narrative. Describe the flows from the roof top. You indicate that one half goes to the east and the other to the west. Are roof drains going to convey the flow? is the westerly roof runoff being conveyed to the landscape area? where is the easterly roof runoff conveyed to? will it be conveyed to the parking lot? It appears that there are curb openings at the southerly parking area but there is no mention of them in the narrative. Please include in the narrative. Once your flows exit the site how are they conveyed to the ponds. It appears that the westerly flow would be collected by an inlet per the site development plan (PPR1835)for Peak Gymnastics. Please state that. Indicate how the easterly flows will be conveyed to the pond.

Only one of the receiving ponds is discussed. Please provide discussion of the pond to the east. What are the conditions of the easterly existing pond? Is any maintenance or retrofitting required prior to your discharge into the pond? Please address.

Please provide a conclusions section and state whether or not the existing ponds where designed to accept your developed flows and state whether or not the development will adversely affect the downstream or surrounding properties. Also state whether or not you are in conformance with the previously approved final drainage report.

MAJOR BASIN	SUB BASIN	AREA		BASIN		T_c MIN	I		SOIL GRP	DEV. TYPE	C		FLOW		RETURN PERIOD -years-	
		PLANIM READ	ACRES	LENGTH -FT.-	HEIGHT -FT.-		in./hr.						qp -CFS-	qp -CFS-		
FALCON	O-1	COGO	0.098	38	1	0.8			A	A/C	0.90	0.96			5	100
		30%	<u>0.030</u>	+10	3	+0.1				R/L	0.09	0.36				
			0.128			0.87	5.1	9.0		MIX	0.710	0.819	0.5	0.9		
	A		0.112	25	5	3.0				L/S						
	V=2.72	1.86%	<u>0.338</u>	+215	4	+2.7				IMP						
			0.450			5.7	5.0	8.5		75%	0.554	0.672	1.2	2.6		
	O-1 + A		0.578			6.6	4.8	8.1		MIX	0.588	0.705	1.6	3.3		
	O-2		0.098	38	1	0.8			A	A/C	0.90	0.96				
			<u>0.030</u>							R/L	0.096	0.36				
			0.128			0.9	5.1	9.0		MIX	0.710	0.819	0.5	0.9		
	B		0.151	25	5	3.0				L/S						
	V=2.64	1.74%	<u>0.414</u>	+235	4	+1.5				IMP						
			0.565			4.5				73%	0.528	0.651	1.5	3.3		
	O-2 + B		0.693			5.4	5.0	8.5		MIX	0.561	0.682	1.9	4.0		

HYDROLOGICAL COMPUTATION – BASIC DATA
PROJ: ROLLING THUNDER BUS PK F#2 BY: O.E. WATTS
RATIONAL METHOD DATE: 1/22/20

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

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 D*

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 1/22/2020 at 12:00:29 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.

OLIVER E. WATTS
CONSULTING ENGINEER, INC.
COLORADO SPRINGS

ROLLING THUDER BUSINESS PARK
FILING NO. 2
SOILS MAP
1"=2000'

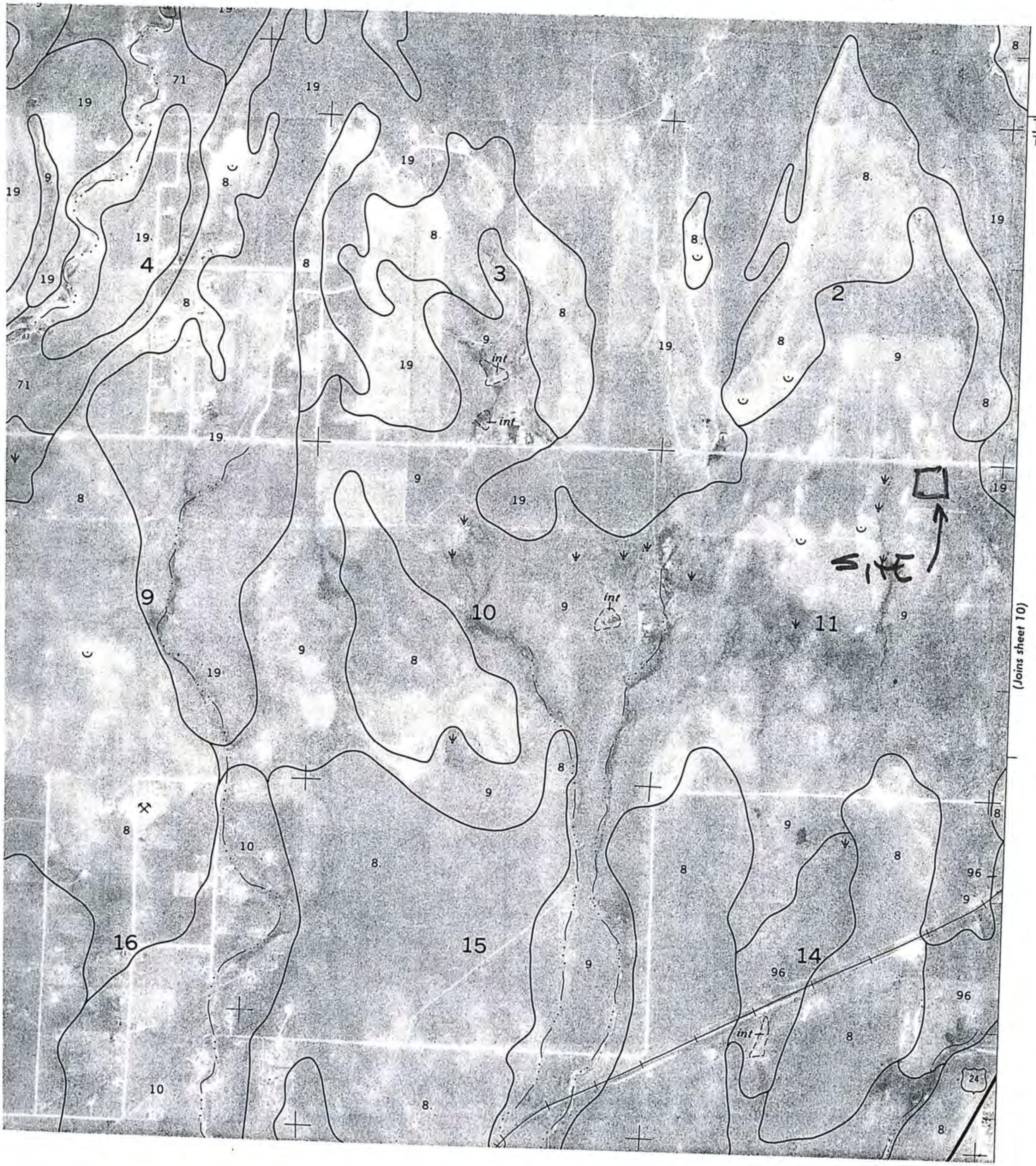


TABLE 16.--SOIL AND WATER FEATURES

[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	Hydro-logic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					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.

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.

$$t_c = t_i + t_t$$ (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.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$ (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).

$$V = C_v S_w^{0.5}$$ (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.

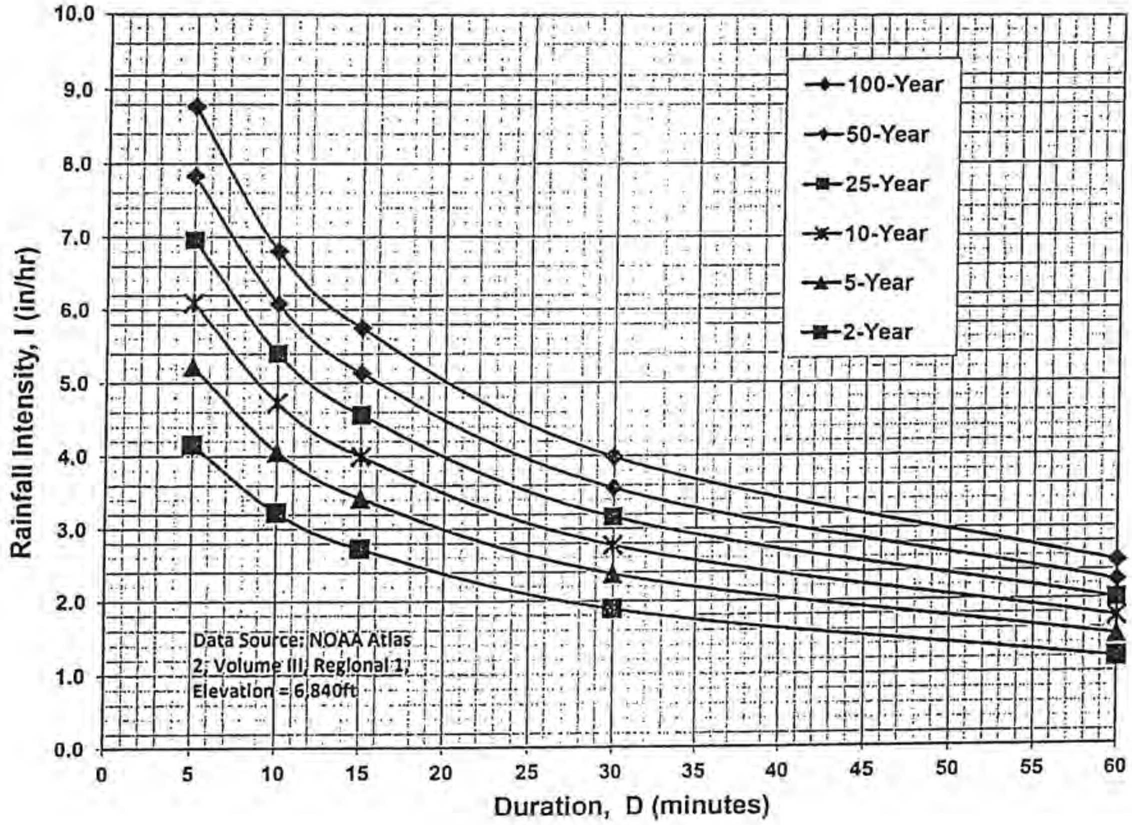
3.2.4 Minimum Time of Concentration

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

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

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

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

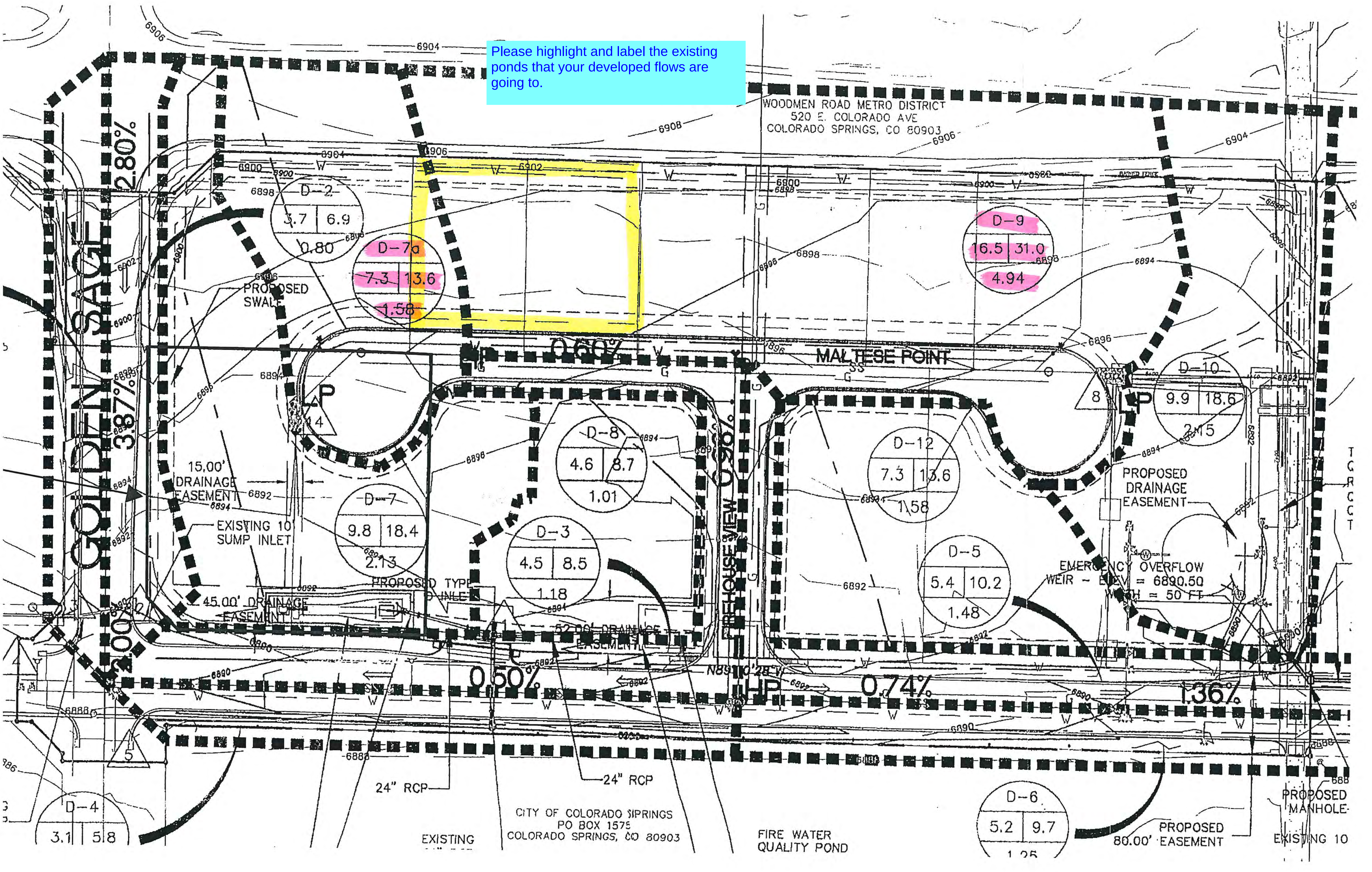
$I_{10} = -1.75 \ln(D) + 8.847$

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

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

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

Please highlight and label the existing ponds that your developed flows are going to.

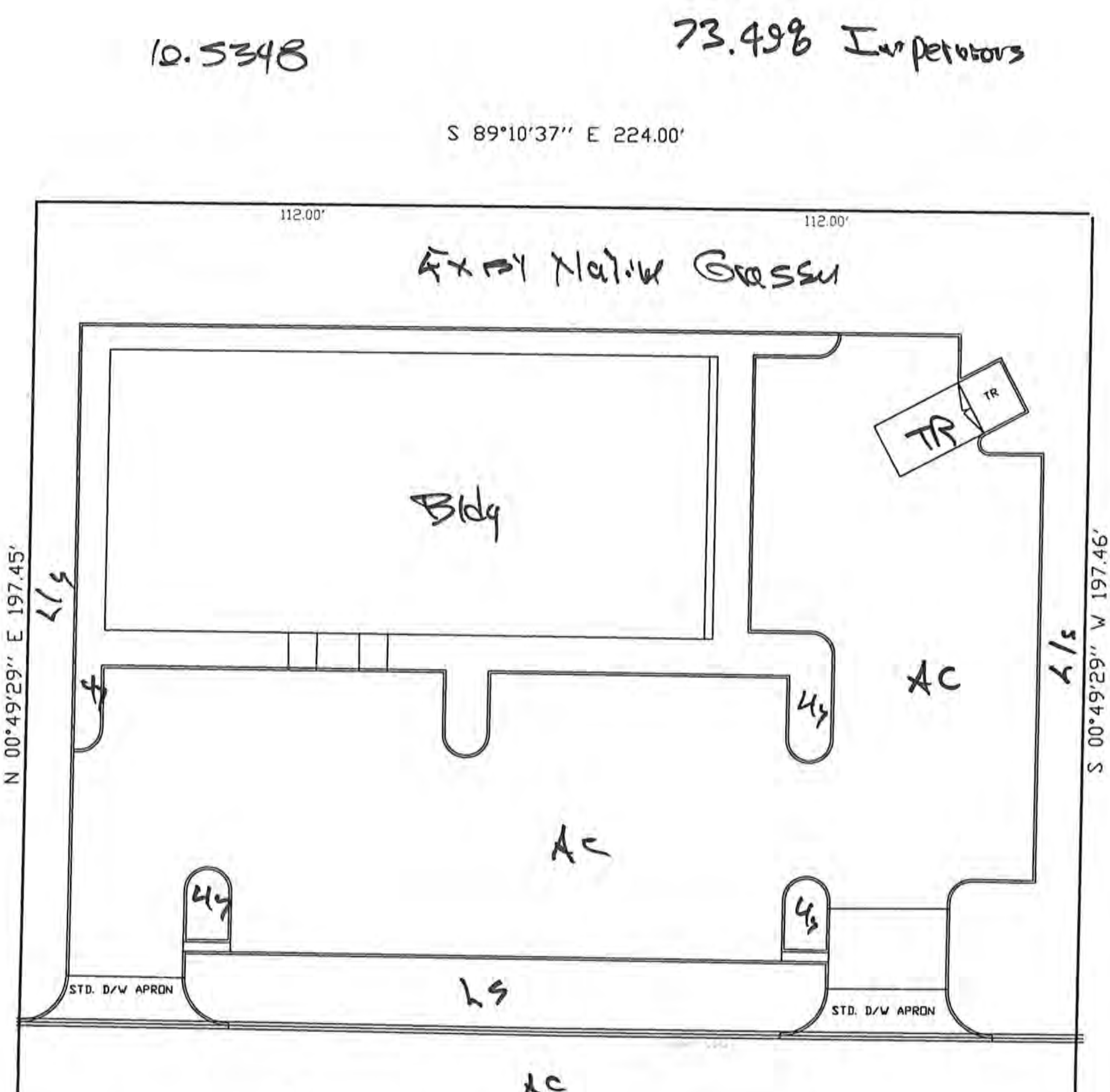


ROLLING THUNDER BUSINESS PARK - FDR - DEVELOPED CONDITIONS
(RATIONAL METHOD Q=CIA)

BASIN	TOTAL FLOWS Q2 (c.f.s.)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)	CA(equiv.) 2 YR	5 YR	100 YR	AREA TOTAL (Ac)	WEIGHTED C_5	C_{100}	OVERLAND C_5	Length (ft)	Slope (ft)	Tco (min)	CHANNEL Length (ft)	Slope (%)	Velocity (fps)	Tcc (min)	Tc TOTAL (min)	INTENSITY I_2 (in/hr)	I_5 (in/hr)	I_{100} (in/hr)
D-1	2.3	3.2	6.1	0.6	0.63	0.67	0.70	0.90	0.95	0.90	5	2.0%	0.7	500	3.5%	3.7	2.2	5.0	3.7	5.1	9.1
D-2	2.7	3.7	6.9	0.7	0.72	0.76	0.80	0.90	0.95	0.90	5	2.0%	0.7	500	3.5%	3.7	2.2	5.0	3.7	5.1	9.1
D-3	3.3	4.5	8.5	1.1	1.06	1.12	1.18	0.90	0.95	0.90	40	2.0%	1.9	715	0.7%	1.7	7.1	9.0	3.1	4.3	7.6
D-4	2.2	3.1	5.8	0.7	0.67	0.71	0.74	0.90	0.95	0.90	5	2.0%	0.7	560	0.5%	1.4	6.6	7.3	3.3	4.6	8.2
D-5	3.9	5.4	10.2	1.3	1.33	1.41	1.48	0.90	0.95	0.90	40	2.0%	1.9	1,000	1.0%	2.0	8.3	10.2	3.0	4.1	7.2
D-6	3.8	5.2	9.7	1.1	1.12	1.19	1.25	0.90	0.95	0.90	5	2.0%	0.7	775	1.0%	2.0	6.5	7.1	3.4	4.6	8.2
D-7	7.1	9.8	18.4	1.9	1.92	2.02	2.13	0.90	0.95	0.90	40	2.0%	1.9	515	3.1%	3.5	2.4	5.0	3.7	5.1	9.1
D-7a	5.3	7.3	13.6	1.4	1.42	1.50	1.58	0.90	0.95	0.90	40	2.0%	1.9	285	4.3%	4.1	1.2	5.0	3.7	5.1	9.1
D-8	3.4	4.6	8.7	0.9	0.91	0.96	1.01	0.90	0.95	0.90	5	2.0%	0.7	245	1.2%	2.2	1.8	5.0	3.7	5.1	9.1
D-9	12.0	16.5	31.0	4.4	4.45	4.69	4.94	0.90	0.95	0.90	300	2.0%	5.2	715	0.6%	1.5	7.7	12.8	2.7	3.7	6.6
D-10	7.2	9.9	18.6	1.9	1.94	2.04	2.15	0.90	0.95	0.90	60	2.0%	2.3	300	2.0%	2.8	1.8	5.0	3.7	5.1	9.1
D-11	5.9	8.2	19.4	1.6	1.60	2.13	5.33	0.30	0.40	0.90	60	2.0%	2.3	500	2.8%	3.3	2.5	5.0	3.7	5.1	9.1
D-12	5.3	7.3	13.6	1.4	1.42	1.50	1.58	0.90	0.95	0.90	10	2.0%	0.9	250	1.6%	2.5	1.6	5.0	3.7	5.1	9.1
Offsite	68.8	94.7	194.5	32.5	32.50	37.50	50.00	0.65	0.75	0.35	100	2.0%	11.2	1,500	1.5%	2.4	10.2	21.4	2.1	2.9	5.2
Formula:		C*I*A	C*I*A		Q/I	Q/I	86.95						*1			*2 20	*3	Tco+Tcc	*4 1.09	*5 1.5	*6 2.67

1* Tco = 1.87*(1.1-C5)*(L^0.5)*((S*100)^-0.33) (DCM page 5-11)
2* Vc = 20*S^0.5 (USDCM RO-4)
3* Tcc = 1/V*L/60
4* I_2 = (26.65*1.09)/(10+Tc)^0.76 (City Letter of 1/7/2003)
5* I_5 = (26.65*1.50)/(10+Tc)^0.76 (City Letter of 1/7/2003)
6* I_{100} =(26.65*2.67)/(10+Tc)^0.76 (City Letter of 1/7/2003)

DRAWN BY: O.E. WATTS DATE: 1-21-20 DWG. NO.: 19-5348-07 SURVEYED BY: OEW, ESW, 6-26-19	APPROVED BY: PROJ. NO. DWG.	REVISIONS	OLIVER E. WATTS CONSULTING ENGINEER COLORADO SPRINGS	PROJECT 10634 & 10658 MALTESE POINT LOTS 2 & 3, ROLLING THUNDER BUSINESS PARK EL PASO COUNTY	SHT. NAME DRAINAGE PLAN	SHT. NO. 1 OF 1


10.5348
73.498
S 89°10'37'' E 224.00'
112.00'
112.00'
Bldg
TR
TR
AC
Ac
LS
STD. D/W APRON
STD. D/W APRON
N 00°49'29'' E 197.45'
S 00°49'29'' W 197.46'
AC
112.00'
112.00'
N 89°10'31'' W 224.00'

User Name: OLIVER E. WATTS
Project: 19-5348 10634&58 MAL SURVEY

Total Sub

Calculate Area by EPoly

Direction	Distance	Northing	Easting	Node #
Beginning Point		5199.3163	4999.0375	n/a
S 89° 10' 37" E	224.00	5196.0986	5223.0144	n/a
S 00° 49' 29" W	197.46	4998.6626	5220.1722	n/a
N 89° 10' 31" W	224.00	5001.8867	4996.1954	n/a
N 00° 49' 29" E	197.45	5199.3163	4999.0375	n/a

Area: 44229.5298 Square Feet
1.0154 Acres
Perimeter: 842.91 Feet

Total Impervious 34825 1040
(-) 2362 3776
32462 7264 sf = 73.40 %

User Name: OLIVER E. WATTS
Project: 19-5348 10634&58 MAL SURVEY

PERVIOUS IG 601

Calculate Area by EPoly

		Northing	Easting	Node #
Beginning Point		5023.2579	5110.1215	n/a

Direction	Distance	Northing	Easting	Node #
S 89° 25' 54" E	51.33	5022.7486	5161.4520	n/a

Radial Dir. In	Radius	Radius Pt North	Radius Pt East	Rad #
N 22° 22' 25" W	10.00	5031.9959	5157.6456	n/a
Delta Angle	**Arc Length**	**Tangent**	**Chord Direction**	
66° 48' 06"CCW	11.66	6.59	N 34° 13' 32" E	
Chord Length	**Middle Ordinate**	**External**	**D.O.C. Arc**	
11.01	1.65	1.98	212° 57' 28"	
Radial Dir. Out	**Radius**	**P.T. North**	**P.T. East**	**Node #**
S 89° 10' 31" E	10.00	5031.8519	5167.6445	n/a

Direction	Distance	Northing	Easting	Node #
N 00° 49' 29" E	18.71	5050.5646	5167.9139	n/a

Radial Dir. In	Radius	Radius Pt North	Radius Pt East	Rad #
N 89° 10' 31" W	5.00	5050.6366	5162.9144	n/a
Delta Angle	**Arc Length**	**Tangent**	**Chord Direction**	
90° 00' 00"CCW	7.85	5.00	N 44° 10' 31" W	
Chord Length	**Middle Ordinate**	**External**	**D.O.C. Arc**	
7.07	1.46	2.07	65° 54' 56"	
Radial Dir. Out	**Radius**	**P.T. North**	**P.T. East**	**Node #**
N 00° 49' 29" E	5.00	5055.6361	5162.9864	n/a

Radial Dir. In	Radius	Radius Pt North	Radius Pt East	Rad #
S 00° 49' 29" W	5.00	5050.6366	5162.9144	n/a
Delta Angle	**Arc Length**	**Tangent**	**Chord Direction**	
90° 00' 00"CCW	7.85	5.00	S 45° 49' 29" W	
Chord Length	**Middle Ordinate**	**External**	**D.O.C. Arc**	
7.07	1.46	2.07	65° 54' 56"	
Radial Dir. Out	**Radius**	**P.T. North**	**P.T. East**	**Node #**

N 89° 10' 31" W	5.00	5050.7086	5157.9149	n/a
Direction	**Distance**	**Northing**	**Easting**	**Node #**
S 00° 49' 29" W	13.00	5037.7099	5157.7278	n/a
Direction	**Distance**	**Northing**	**Easting**	**Node #**
N 89° 10' 31" W	117.00	5039.3940	5040.7399	n/a
Direction	**Distance**	**Northing**	**Easting**	**Node #**
N 00° 49' 29" E	13.00	5052.3926	5040.9270	n/a
Radial Dir. In	**Radius**	**Radius Pt North**	**Radius Pt East**	**Rad #**
N 89° 10' 31" W	5.00	5052.4646	5035.9276	n/a
Delta Angle	**Arc Length**	**Tangent**	**Chord Direction**	
90° 00' 00"CCW	7.85	5.00	N 44° 10' 31" W	
Chord Length	**Middle Ordinate**	**External**	**D.O.C. Arc**	
7.07	1.46	2.07	65° 54' 56"	
Radial Dir. Out	**Radius**	**P.T. North**	**P.T. East**	**Node #**
N 00° 49' 29" E	5.00	5057.4641	5035.9995	n/a
Radial Dir. In	**Radius**	**Radius Pt North**	**Radius Pt East**	**Rad #**
S 00° 49' 29" W	5.00	5052.4646	5035.9276	n/a
Delta Angle	**Arc Length**	**Tangent**	**Chord Direction**	
90° 00' 00"CCW	7.85	5.00	S 45° 49' 29" W	
Chord Length	**Middle Ordinate**	**External**	**D.O.C. Arc**	
7.07	1.46	2.07	65° 54' 56"	
Radial Dir. Out	**Radius**	**P.T. North**	**P.T. East**	**Node #**
N 89° 10' 31" W	5.00	5052.5366	5030.9281	n/a
Direction	**Distance**	**Northing**	**Easting**	**Node #**
S 00° 49' 29" W	18.64	5033.8982	5030.6598	n/a
Radial Dir. In	**Radius**	**Radius Pt North**	**Radius Pt East**	**Rad #**
S 89° 10' 31" E	10.00	5033.7543	5040.6587	n/a

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Project: 19-5348 10634&58 MAL SURVEY

Calculate Area by EPoly

Delta Angle	Arc Length	Tangent	Chord Direction	
67° 43' 09"CCW	11.82	6.71	S 33° 02' 06" E	
Chord Length	Middle Ordinate	External	D.O.C. Arc	
11.14	1.70	2.04	212° 57' 28"	
Radial Dir. Out	Radius	P.T. North	P.T. East	Node #
S 23° 06' 20" W	10.00	5024.5564	5036.7345	n/a

Direction	Distance	Northing	Easting	Node #
S 89° 08' 39" E	1.64	5024.5318	5038.3790	n/a

Direction	Distance	Northing	Easting	Node #
S 89° 08' 39" E	5.02	5024.4569	5043.3963	n/a

Direction	Distance	Northing	Easting	Node #
S 88° 58' 14" E	66.74	5023.2579	5110.1215	n/a

Area: 2362.3776 Square Feet
0.0542 Acres
Perimeter: 359.98 Feet

User Name: OLIVER E. WATTS
Project: 19-5348 10634&58 MAL SURVEY

OUTSIDE IMPERVIOUS

Calculate Area by EPoly

```
                                     Northing          Easting Node #
---------------- -------------- -------------- -------------- ------
 Beginning Point                     5173.3767       5008.1650 n/a

        Direction       Distance        Northing         Easting Node #
----------------- -------------- -------------- -------------- ------
   S 00° 49' 29" W        139.13       5034.2639       5006.1625 n/a

  Radial Dir. In        Radius Radius Pt North  Radius Pt East Rad  #
----------------- -------------- -------------- -------------- ------
 N 89° 10' 31" W          9.50       5034.4006       4996.6635 n/a
     Delta Angle     Arc Length        Tangent Chord Direction
----------------- -------------- -------------- -------------- ------
76° 42' 53" CW           12.72            7.52 S 39° 10' 55" W
    Chord Length Middle Ordinate       External       D.O.C. Arc
----------------- -------------- -------------- -------------- ------
           11.79           2.05            2.61    243° 06' 48"
 Radial Dir. Out         Radius     P.T. North      P.T. East Node #
----------------- -------------- -------------- -------------- ------
 S 12° 27' 38" E          9.50       5025.1244       4998.7133 n/a

  Radial Dir. In        Radius Radius Pt North  Radius Pt East Rad  #
----------------- -------------- -------------- -------------- ------
 N 12° 27' 38" W          9.50       5034.4006       4996.6635 n/a
     Delta Angle     Arc Length        Tangent Chord Direction
----------------- -------------- -------------- -------------- ------
13° 17' 07" CW            2.20            1.11 S 84° 10' 55" W
    Chord Length Middle Ordinate       External       D.O.C. Arc
----------------- -------------- -------------- -------------- ------
            2.20           0.06            0.06    243° 06' 48"
 Radial Dir. Out         Radius     P.T. North      P.T. East Node #
----------------- -------------- -------------- -------------- ------
 S 00° 49' 29" W          9.50       5024.9016       4996.5267 n/a

        Direction       Distance        Northing         Easting Node #
----------------- -------------- -------------- -------------- ------
   S 00° 51' 21" W          1.24       5023.6571       4996.5082 n/a

        Direction       Distance        Northing         Easting Node #
----------------- -------------- -------------- -------------- ------
   S 00° 49' 23" W         21.77       5001.8867       4996.1954 n/a

        Direction       Distance        Northing         Easting Node #
----------------- -------------- -------------- -------------- ------
   S 89° 10' 31" E        224.00       4998.6626       5220.1722 n/a

        Direction       Distance        Northing         Easting Node #
----------------- -------------- -------------- -------------- ------
```

```
  N 00° 49' 29" E          23.68      5022.3416       5220.5131 n/a

        Direction        Distance      Northing         Easting Node #
----------------- --------------- --------------- --------------- ------
  N 89° 37' 41" W          20.09      5022.4720       5200.4210 n/a

 Radial Dir. In            Radius Radius Pt North  Radius Pt East Rad  #
----------------- --------------- --------------- --------------- ------
 N 13° 32' 43" E          9.50      5031.7077       5202.6461 n/a
     Delta Angle       Arc Length        Tangent  Chord Direction
----------------- --------------- --------------- --------------- ------
77° 16' 46" CW           12.81           7.59 N 37° 48' 54" W
    Chord Length Middle Ordinate        External       D.O.C. Arc
----------------- --------------- --------------- --------------- ------
           11.86            2.08            2.66    243° 06' 48"
 Radial Dir. Out           Radius     P.T. North      P.T. East Node #
----------------- --------------- --------------- --------------- ------
 N 89° 10' 31" W          9.50      5031.8445       5193.1470 n/a

        Direction        Distance      Northing         Easting Node #
----------------- --------------- --------------- --------------- ------
  N 00° 49' 29" E          18.36      5050.1976       5193.4112 n/a

 Radial Dir. In            Radius Radius Pt North  Radius Pt East Rad  #
----------------- --------------- --------------- --------------- ------
 S 89° 10' 31" E          4.50      5050.1328       5197.9108 n/a
     Delta Angle       Arc Length        Tangent  Chord Direction
----------------- --------------- --------------- --------------- ------
90° 00' 00" CW            7.07           4.50 N 45° 49' 29" E
    Chord Length Middle Ordinate        External       D.O.C. Arc
----------------- --------------- --------------- --------------- ------
            6.36            1.32            1.86    193° 14' 22"
 Radial Dir. Out           Radius     P.T. North      P.T. East Node #
----------------- --------------- --------------- --------------- ------
 N 00° 49' 29" E          4.50      5054.6324       5197.9755 n/a

        Direction        Distance      Northing         Easting Node #
----------------- --------------- --------------- --------------- ------
  S 89° 10' 31" E          13.50      5054.4380       5211.4742 n/a

        Direction        Distance      Northing         Easting Node #
----------------- --------------- --------------- --------------- ------
  N 00° 49' 29" E          91.00      5145.4286       5212.7840 n/a

        Direction        Distance      Northing         Easting Node #
----------------- --------------- --------------- --------------- ------
  N 89° 10' 31" W          11.57      5145.5952       5201.2105 n/a
```

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Project: 19-5348 10634&58 MAL SURVEY

Calculate Area by EPoly

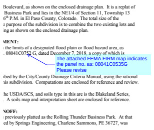
Radial Dir. In	Radius	Radius Pt North	Radius Pt East	Rad #
N 00° 49' 29" E	2.00	5147.5950	5201.2393	n/a
Delta Angle	**Arc Length**	**Tangent**	**Chord Direction**	
151° 34' 16" CW	5.29	7.90	N 13° 23' 23" W	
Chord Length	**Middle Ordinate**	**External**	**D.O.C. Arc**	
3.88	1.51	6.14	344° 47' 20"	
Radial Dir. Out	**Radius**	**P.T. North**	**P.T. East**	**Node #**
N 27° 36' 15" W	2.00	5149.3673	5200.3126	n/a

Direction	Distance	Northing	Easting	Node #
N 62° 23' 45" E	10.47	5154.2209	5209.5948	n/a
N 27° 36' 15" W	13.00	5165.7411	5203.5711	n/a
S 62° 23' 45" W	9.66	5161.2646	5195.0101	n/a
N 00° 49' 29" E	9.42	5170.6851	5195.1457	n/a
N 89° 10' 31" W	26.03	5171.0597	5169.1205	n/a
N 89° 10' 31" W	160.97	5173.3767	5008.1650	n/a

Area: 34825.1040 Square Feet
0.7995 Acres
Perimeter: 834.00 Feet

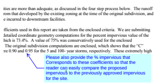
Drainage Report_v2_redlines.pdf Markup Summary

Callout (6)



Subject: Callout
Page Label: 4
Author: Daniel Torres
Date: 9/17/2020 9:12:19 AM
Status:
Color:
Layer:
Space:

The attached FEMA FIRM map indicates the panel no. as: 08041C0535G
Please revise



Subject: Callout
Page Label: 4
Author: Daniel Torres
Date: 9/17/2020 9:12:34 AM
Status:
Color:
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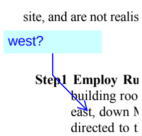
Space:

Please also provide the % impervious that Corresponds to these coefficients so that the reader can easily compare the proposed impervious to the previously approved impervious for the site.



Subject: Callout
Page Label: 5
Author: Daniel Torres
Date: 9/17/2020 9:32:28 AM
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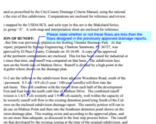
west?



Subject: Callout
Page Label: 4
Author: Daniel Torres
Date: 9/18/2020 3:13:45 PM
Status:
Color:
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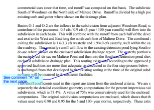
Space:

Please state whether or not these flows are less than the flows designed in the previously approved drainage reports.



Subject: Callout
Page Label: 4
Author: Daniel Torres
Date: 9/18/2020 3:19:40 PM
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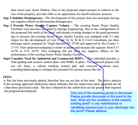
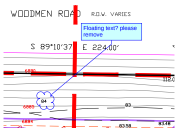
See comment "A" on the next page.



Subject: Callout
Page Label: 5
Author: Daniel Torres
Date: 9/18/2020 3:34:57 PM
Status:
Color:
Layer:
Space:

Only one of the receiving ponds is discussed. Please provide discussion of the pond to the east. What are the conditions of the easterly existing pond? Is any maintenance or retrofitting required prior to your discharge into the pond? Please address.

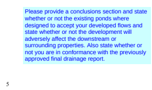
Cloud+ (1)



Subject: Cloud+
Page Label: 16
Author: Daniel Torres
Date: 9/17/2020 9:51:52 AM
Status:
Color:
Layer:
Space:

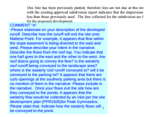
Floating text? please remove

Text Box (4)



Subject: Text Box
Page Label: 5
Author: Daniel Torres
Date: 9/18/2020 3:35:00 PM
Status:
Color:
Layer:
Space:

Please provide a conclusions section and state whether or not the existing ponds where designed to accept your developed flows and state whether or not the development will adversely affect the downstream or surrounding properties. Also state whether or not you are in conformance with the previously approved final drainage report.



Subject: Text Box
Page Label: 5
Author: Daniel Torres
Date: 9/18/2020 3:36:39 PM
Status:
Color:
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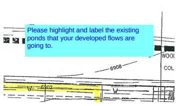
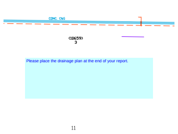
COMMENT "A"
-Please elaborate on your description of the developed runoff. Describe how the runoff will exit the site onto Maltese Point. For example, it appears that flow within the slope easement is being diverted to the east and west. Please describe your intent in the narrative. Describe the flows from the roof top. You indicate that one half goes to the east and the other to the west. Are roof drains going to convey the flow? is the westerly roof runoff being conveyed to the landscape area? where is the easterly roof runoff conveyed to? will it be conveyed to the parking lot? It appears that there are curb openings at the southerly parking area but there is no mention of them in the narrative. Please include in the narrative. Once your flows exit the site how are they conveyed to the ponds. It appears that the westerly flow would be collected by an inlet per the site development plan (PPR1835)for Peak Gymnastics. Please state that. Indicate how the easterly flows will be conveyed to the pond.



Subject: Text Box
Page Label: 14
Author: Daniel Torres
Date: 9/18/2020 4:08:17 PM
Status:
Color:
Layer:
Space:

Please highlight and label the existing ponds that your developed flows are going to.



Subject: Text Box
Page Label: 16
Author: Daniel Torres
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Please place the drainage plan at the end of your report.