

JERNIGAN ESTATES

TOWN OF COPPER CANYON, TEXAS

DRAINAGE STUDY

PROJECT NUMBER: PRB-23001
DESIGNED BY: ERIN STOREY, PE, CFM

DATE: MARCH 2024



MCADAMS
201 COUNTRY VIEW DRIVE
ROANOKE, TEXAS 76262
TBPE FIRM # 19762



1	NARRATIVE
2	EXHIBITS
3	DIGITAL DATA

JERNIGAN ESTATES

Drainage Study

General Description & Background

Jernigan Estates is a proposed 7 lot single family residential subdivision of approximately 13.2 acres along Jernigan Road. Six new lots are proposed, and one existing lot is to remain resulting in seven new platted lots. Associated infrastructure (paving, drainage, water) is proposed to serve the development. The site is located approximately 950 feet north of the intersection of Jernigan Road and Rolling Acres Drive in the Town of Copper Canyon, Denton County, TX. A site map is included in Exhibit 1.

This report contains:

- Hydrologic calculations detailing the 2-year, 10-year, and 100-year storm events (24-hour event for each) for the pre and proposed project conditions.
- Detention facility and outlet calculations for the detention area spanning the site and adjacent property.

Calculation Methodology

- HEC-HMS Version 4.10, by the U.S. Army Corps of Engineers, was used for hydrology calculations.
- PondPack Version V10.02.00.01 was used to determine outlet rating curves for the existing and proposed outlet control weirs.
- The time of concentration was calculated using the SCS TR-55 Segmental Approach. The T_c flow paths are divided into three segments: overland flow, concentrated flow, and channel flow. The travel time is then computed for each segment, from which the overall time of concentration is determined by taking the sum of each segmental time.
- Using the Web Soil Survey, the contributing basin soils were determined to be from hydrologic soil groups (HSG) 'B', 'C' and 'D' soils. Since the method chosen to compute the post development peak flow rate is dependent upon the HSG, care was taken when selecting the appropriate Soil Conservation Service Curve Number (SCS CN). Within the sub-basin, an approximate proportion of each soil group was determined using Web Soil Survey Maps. Once an approximate proportion was determined, a composite SCS CN was computed for each land cover condition.

Existing Hydrology

- Existing land cover is based on the existing condition within the contributing area.
- Existing Basin A is approximately 109 acres of open space/rural residential and this report estimates the basin is about 5% impervious or about 5.5 acres.
- Within the basin, the predominant soil is Type B, with Type C and Type D soil making up less than 20% of the overall basin.
- The CN for existing Basin A is calculated to be 65.4.
- The calculated time of concentration is 32.5 minutes.

- Soils mapping, CN calculations, Tc calculations, and rainfall data are included in Exhibit 2. Basin mapping is included in Exhibit 3.

Proposed Hydrology

- Proposed project land cover is based on the offsite existing condition and onsite project area comprised of minimum 2-acre residential lots.
- Proposed Project Basin A is 109 acres, and the 13.2-acre onsite area is assumed to be 12% impervious which is consistent with the Town of Copper Canyon's Engineering Design Manual for this type of land use.
- The proposed project land use breakdown is 5.5 acres of offsite impervious, 13.2 acres of 2-acre lot residential, and 90.3 acres of offsite open space.
- The proposed project CN is calculated to be 65.8.
- The calculated time of concentration is 32.5 minutes – no change from pre project.
- Soils mapping, CN calculations, Tc calculations, and rainfall data are included in Exhibit 2. Basin mapping is included in Exhibit 3.

Poindexter Branch Master Drainage Study Discussion

- With reference to TNP's Poindexter Branch Master Drainage Study (PBMDs), the project site is included in Basin P17. P17 is 138 acres with a CN of 65.1 and a Tc of 37.3 min.
- The CN values calculated in this study are consistent with the PBMDs values, however, the larger values calculated in this study are attributed to the higher concentration of Type C and Type D soils with the smaller 109-acre subbasin.
- The calculated Tc for this study is consistent with TNP'S overall P-17 basin Tc of 37.3 minutes. From this study's outfall (labelled SP A), the flow travels approximately 1870 feet to the outfall of P17. At an assumed 5 feet per second, another 6.2 minutes of concentrated flow would be added to the 32.5 minutes resulting in a total Tc of about 38.7 minutes which is consistent with TNP's 37.3-minute Tc. Differences are attributed to variations in flow path length, topography, and slope used by each engineer.
- See Exhibit 4 for selected references from the PBMDs study.

Detention Discussion

Existing Geometry

- There is an onsite pond (Pond 1) in the northwest corner of the property, however, there is no engineered outfall structure regulating the pond.
- There is an offsite pond (Pond 2) on the northern adjacent property that also outfalls to the study point. Pond 2 does not have an engineered outlet structure.
- While the ponding areas are located on separate parcels, effectively Pond 2 drains into Pond 1 before the Pond 2 weir engages. The 612 contour is shared across the common property line and the 611 contour is just at the common property line. Functionally, there is one pond outfalling on two separate parcels. For labelling and discussion purposes of this study the ponds are labelled Pond 1 and Pond 2.

- Based on field topography, Pond 1 begins overtopping around elevation 611.40 and flows northwest to the study point. To estimate outflow, a broad crested weir was approximated near the existing berm. Assumed weir geometry for the existing condition of Pond 1 is shown in Exhibit 5.
- Based on field topography, Pond 2 pond begins overtopping around elevation 612.7 and flows southwest to the study point. Assumed weir geometry for the existing condition of Pond 2 is shown in Exhibit 5. Existing weir plan view locations are called out in Exhibit 3.
- Between elevation 611.40 and elevation 612.7, Pond 1 weir regulates outflow and water surface elevation. No outflow from Pond 2 is anticipated.
- At elevation 612.7, the Pond 2 weir engages and between elevation 612.7 and 613 both weirs are assumed to regulate outflow and water surface elevation.
- The modelling in this study assumes one pond with two broad crested weirs at different elevations. As previously stated, Bentley PondPack was used to generate the rating curve for the irregular weir configuration. The PondPack calculations for the existing weir geometry used in the HMS model are included in Exhibit 6.

Proposed Geometry

- To mitigate increases in peak flow, volume will be added onsite to Pond 1 and an outlet control structure will be constructed.
- A 35-foot broad crest weir is proposed to regulate outflow and water surface elevations between elevation 610.9 and 612.7.
- As in the pre project case, the Pond 2 weir engages and between elevation 612.7 and 613 and between these elevations both weirs are assumed to regulate outflow and water surface elevation.
- No offsite grading is proposed and no improvements for Pond 2 weir are proposed.
- Bentley PondPack was used to generate the rating curve for the proposed condition weir configuration. The PondPack calculations for the proposed weir geometry used in the HMS model are included in in Exhibit 7.
- A copy of the civil plans showing details related to the control structure is provided in Exhibit 8.
- In the proposed condition, the flow pattern to the study point is unchanged. In the proposed condition, the flow path from Pond 1 is approximately 50 feet shorter but no significant change in flow depth or velocity are anticipated as the proposed flow crosses the property line onto the adjacent property. See Exhibit 9 for a cross section showing a pre and proposed comparison of computed flow velocity and depth near the property line.

Summary of Results

The chart below provides a summary of the pre and post development flow rates at the study point and pre and proposed pond water surface elevations.

	Pre	Post
2 Year (cfs)	41.6	41.5
2 Year Pond Water Surface Elevation (ft)	611.9	611.4
10 Year (cfs)	148.1	139.7

10 Year Pond Water Surface Elevation (ft)	612.3	612.1
100 Year (cfs)	365.9	327.3
100 Year Pond Water Surface Elevation (ft)	612.9	612.8

Conclusion

If the development is built as proposed within this report, then the requirements set forth in Town of Copper Canyon Engineering Design Manual will be met. However, modifications to the proposed development may require that this analysis be revised. Modifications that would require this analysis to be revised include:

1. The percent impervious of the drainage area through the site varies significantly from that used in this report.
2. Offsite grading in the detention area significantly changes how the detention pond functions.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

EXHIBIT 1



M:\Projects\PRB\PRB23001\04-Production\Water Resources\Stormwater Management\Prelim Sizing\Current Drawings\PRB23001.dwg, 3/4/2024 8:14:38 AM, Erin Storey



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JERNIGAN ESTATES
SITE LOCATION MAP
545 JERNIGAN ROAD
COPPER CANYON, TEXAS, 75077

PLAN INFORMATION

PROJECT NO.	PRB-23001
FILENAME	EXHIBIT 1
CHECKED BY	EKS
DRAWN BY	EKS
SCALE	NTS
DATE	03.04.2024

EXHIBIT 2

a pervious area CN of 61, the composite CN obtained from Figure 2.1.5-3 is 68. The CN difference between 70 and 68 reflects the difference in percent impervious area.

Table 2.1.5-1 Runoff Curve Numbers¹					
<u>Cover Description</u>		<u>Curve numbers for hydrologic soil groups</u>			
<i>Cover type and hydrologic condition</i>	<i>Average percent impervious area²</i>	A	B	C	D
Cultivated Land:					
Without conservation treatment		72	81	88	91
With conservation treatment		62	71	78	81
Pasture or range land:					
Poor condition		68	79	86	89
Good condition		39	61	74	80
Meadow:					
Good condition		30	58	71	78
Wood or forest land:					
Thin stand, poor cover		45	66	77	83
Good cover		25	55	70	77
Open space (lawns, parks, golf courses, cemeteries, etc.)³					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved; curbs and storm drains (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Urban districts:					
Commercial and business	85%	89	92	94	95
Industrial	72%	81	88	91	93

<u>Cover Description</u>	<i>Average percent impervious area²</i>	<u>Curve numbers for hydrologic soil groups</u>			
		A	B	C	D
<i>Cover type and hydrologic condition</i>					
Residential districts by average lot size:					
1/8 acre or less (town house)	65%	77	85	90	92
1/4 acre	38%	61	75	83	87
1/3 acre	30%	57	72	81	86
1/2 acre	25%	54	70	80	85
1 acre	20%	51	68	79	84
2 acres	12%	46	65	77	82
Developing urban areas and newly graded areas (previous areas only, no vegetation)		77	86	91	94

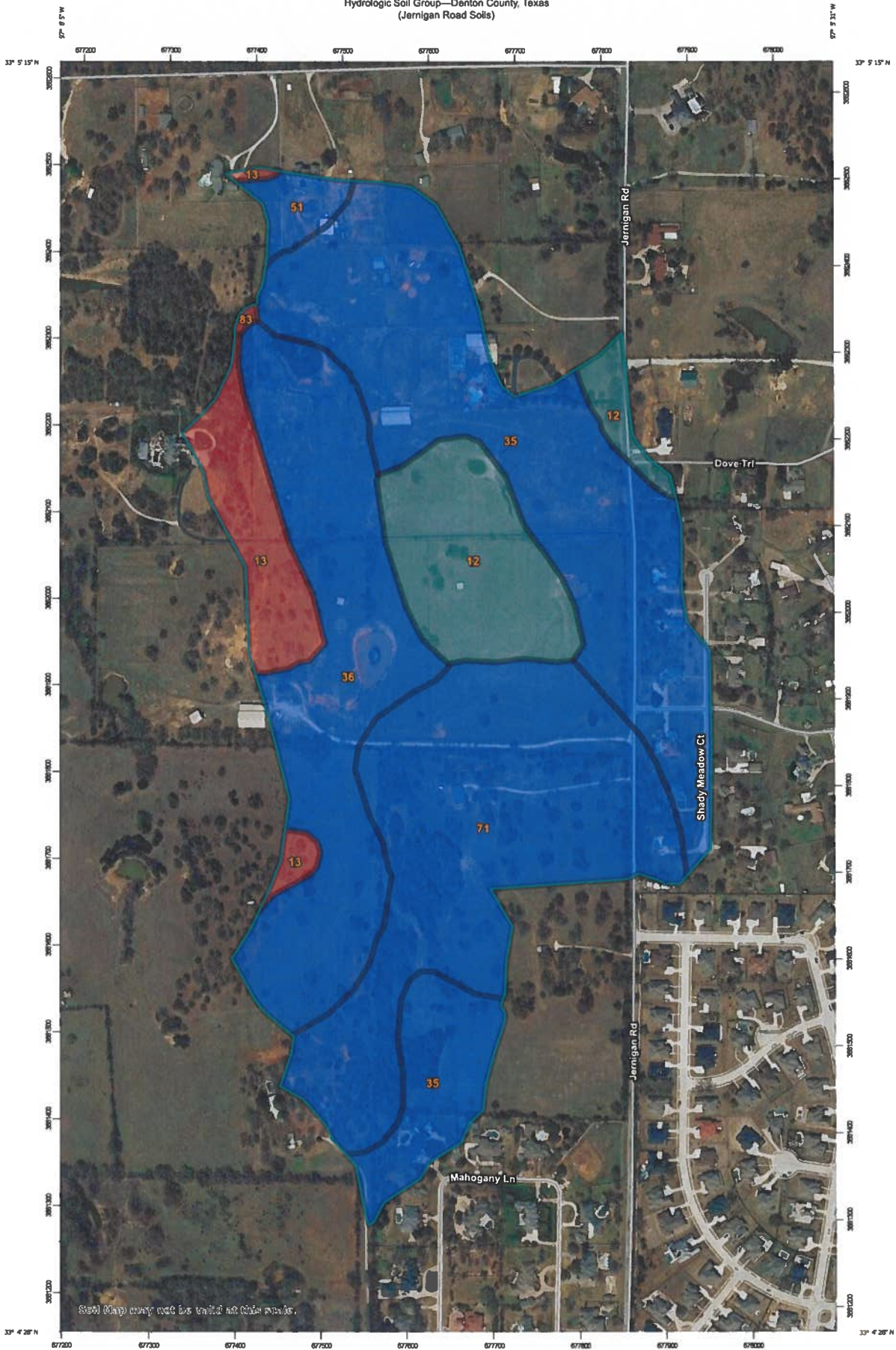
¹ Average runoff condition, and $I_a = 0.2S$

² The average percent impervious area shown was used to develop the composite CNs. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. If the impervious area is not connected, the SCS method has an adjustment to reduce the effect.

³ CNs shown are equivalent to those of pasture. Composite CNs may be computed for other combinations of open space cover type.

Table 5.3 Denton County Rainfall Data								
Coefficients		Return Period (Years)						
		1	2	5	10	25	50	100
e	0.82089	0.80553	0.79891	0.78388	0.76912	0.76817	0.75660	
b	43.381	50.455	65.467	70.683	78.538	89.853	95.776	
d	T8	9	11	11	11	12	12	
Hours	Minutes	Rainfall Intensity (inches per hour)						
0.083	5	5.28	6.02	7.15	8.04	9.31	10.19	11.23
	6	4.97	5.70	6.81	7.67	8.89	9.76	10.75
	7	4.70	5.41	6.50	7.33	8.50	9.36	10.32
	8	4.46	5.15	6.23	7.03	8.16	9.00	9.93
	9	4.24	4.92	5.98	6.75	7.84	8.67	9.57
	10	4.04	4.71	5.75	6.50	7.55	8.36	9.24
	11	3.87	4.52	5.54	6.27	7.29	8.08	8.93
	12	3.71	4.34	5.35	6.05	7.04	7.82	8.65
	13	3.56	4.18	5.17	5.85	6.82	7.58	8.39
	0.250	14	3.43	4.04	5.00	5.67	6.61	7.36
15		3.31	3.90	4.85	5.50	6.41	7.14	7.91
16		3.19	3.77	4.70	5.34	6.23	6.95	7.70
17		3.09	3.66	4.57	5.19	6.05	6.76	7.50
18		2.99	3.55	4.44	5.05	5.89	6.59	7.31
19		2.90	3.44	4.32	4.91	5.74	6.43	7.13
20		2.81	3.35	4.21	4.79	5.60	6.27	6.96
21		2.73	3.26	4.11	4.67	5.46	6.12	6.80
22		2.66	3.17	4.01	4.56	5.34	5.99	6.65
23		2.59	3.09	3.91	4.45	5.21	5.85	6.50
0.500	24	2.52	3.02	3.82	4.35	5.10	5.73	6.36
	25	2.46	2.95	3.74	4.26	4.99	5.61	6.23
	26	2.40	2.88	3.66	4.17	4.89	5.50	6.11
	27	2.34	2.81	3.58	4.08	4.79	5.39	5.99
	28	2.29	2.75	3.51	4.00	4.69	5.28	5.88
	29	2.24	2.69	3.44	3.92	4.60	5.18	5.77
	30	2.19	2.64	3.37	3.85	4.51	5.09	5.66
	31	2.14	2.58	3.31	3.77	4.43	5.00	5.56
	32	2.10	2.53	3.24	3.71	4.35	4.91	5.47
	33	2.06	2.49	3.18	3.64	4.28	4.83	5.38
0.750	34	2.02	2.44	3.13	3.58	4.20	4.75	5.29
	35	1.98	2.39	3.07	3.51	4.13	4.67	5.20
	36	1.94	2.35	3.02	3.46	4.06	4.59	5.12
	37	1.91	2.31	2.97	3.40	4.00	4.52	5.04
	38	1.87	2.27	2.92	3.35	3.94	4.45	4.96
	39	1.84	2.23	2.88	3.29	3.88	4.38	4.89
	40	1.81	2.19	2.83	3.24	3.82	4.32	4.82
	41	1.78	2.16	2.79	3.19	3.76	4.26	4.75
	42	1.75	2.13	2.74	3.15	3.71	4.20	4.68
	43	1.72	2.09	2.70	3.10	3.65	4.14	4.62
1	44	1.69	2.06	2.66	3.06	3.60	4.08	4.56
	45	1.67	2.03	2.63	3.01	3.55	4.02	4.50
	46	1.64	2.00	2.59	2.97	3.50	3.97	4.44
	47	1.62	1.97	2.55	2.93	3.46	3.92	4.38
	48	1.59	1.94	2.52	2.89	3.41	3.87	4.32
	49	1.57	1.92	2.49	2.85	3.37	3.82	4.27
	50	1.55	1.89	2.45	2.82	3.33	3.77	4.22
	51	1.53	1.86	2.42	2.78	3.28	3.73	4.17
	52	1.51	1.84	2.39	2.75	3.24	3.68	4.12
	53	1.49	1.82	2.36	2.71	3.21	3.64	4.07
2	54	1.47	1.79	2.33	2.68	3.17	3.60	4.02
	55	1.45	1.77	2.30	2.65	3.13	3.55	3.98
	56	1.43	1.75	2.28	2.62	3.09	3.51	3.93
	57	1.41	1.73	2.25	2.59	3.06	3.48	3.89
	58	1.39	1.71	2.22	2.56	3.03	3.44	3.85
	59	1.37	1.69	2.20	2.53	2.99	3.40	3.81
	60	1.36	1.67	2.17	2.50	2.96	3.36	3.77
	120	0.81	1.01	1.33	1.55	1.85	2.11	2.38
	180	0.59	0.74	0.99	1.15	1.38	1.58	1.79
	360	0.34	0.43	0.58	0.68	0.83	0.95	1.09
720	0.19	0.25	0.34	0.40	0.49	0.57	0.65	
1440	0.11	0.14	0.20	0.23	0.29	0.33	0.39	

Hydrologic Soil Group—Denton County, Texas
(Jernigan Road Soils)




































Map Scale: 1:4,100 if printed on B portrait (11" x 17") sheet.

0 50 100 200 300 Meters

0 150 300 600 900 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

 Area of Interest (AOI)	 C
 Area of Interest (AOI)	 C/D
Soils	 D
Soil Rating Polygons	 Not rated or not available
 A	Water Features
 A/D	 Streams and Canals
 B	Transportation
 B/D	 Rails
 C	 Interstate Highways
 C/D	 US Routes
 D	 Major Roads
 Not rated or not available	 Local Roads
Soil Rating Lines	Background
 A	 Aerial Photography
 A/D	
 B	
 B/D	
 C	
 C/D	
 D	
 Not rated or not available	
Soil Rating Points	
 A	
 A/D	
 B	
 B/D	

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Denton County, Texas
Survey Area Data: Version 20, Aug 31, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 3, 2022—Mar 31, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
12	Birome fine sandy loam, 3 to 5 percent slopes	C	11.9	11.0%
13	Birome-Rayex-Aubrey complex, 2 to 15 percent slopes	D	6.7	6.2%
35	Gasil fine sandy loam, 1 to 3 percent slopes	B	35.7	32.9%
36	Gasil fine sandy loam, 3 to 8 percent slopes	B	23.6	21.8%
51	Konsil fine sandy loam, 3 to 8 percent slopes	B	1.8	1.7%
71	Silawa loamy fine sand, 2 to 5 percent slopes	B	28.6	26.4%
83	Wilson clay loam, 0 to 1 percent slopes	D	0.1	0.1%
Totals for Area of Interest			108.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	2ac Residential
A	98	39	46
B	98	61	65
C	98	74	77
D	98	80	82

Assume:

HSG 'A' =	0.0%
HSG 'B' =	82.7%
HSG 'C' =	11.0%
HSG 'D' =	6.3%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	64	Assume good condition
2ac Residential	67	Assumes 12% impervious

II. PRE-DEVELOPMENT

Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	0	0.00	-
Onsite open	64	574,992	13.20	Assume good condition
Offsite impervious	98	239,580	5.50	-
Offsite open	64	3,933,468	90.30	Assume good condition

Total area =	109.00	acres
	4,748,040	sf
Composite SCS CN =	65.4	
% Impervious =	5.0%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length = 100 ft
 Top Elev = 672.00 ft
 Bot Elev = 671.00 ft
 Height = 1 ft
 Slope = 0.0100 ft/ft
 Manning's n = 0.24 dense grasses
 P (2-year/24-hour) = 3.36 inches (Apex, NC)
 Segment Time = 18.35 minutes

Segment 2: Concentrated Flow

Length = 600 ft
 Top Elev = 671.00 ft
 Bot Elev = 653.00 ft
 Height = 18 ft
 Slope = 0.0300 ft/ft
 Paved ? = No
 Velocity = 2.79 ft/sec
 Segment Time = 3.58 minutes

Segment 4: Channel Flow

Length = 3175 ft
 Top Elev = 653.00 ft
 Bot Elev = 609.00 ft
 Height = 44 ft
 Slope = 0.0139 ft/ft
 Manning's n = 0.035 natural channel
 Flow Area = 9.00 sf (assume 3'w x 3'h channel)
 Wetted Perimeter = 9.00 lf (assume 3' x 3' channel)
 Channel Velocity = 5.01 ft/sec
 Segment Time = 10.56 minutes

Time of Concentration =	32.49	minutes
SCS Lag Time =	19.49	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	5.65	minutes (= 0.29 * SCS Lag)

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	2ac Residential
A	98	39	46
B	98	61	65
C	98	74	77
D	98	80	82

Assume:

HSG 'A' =	0.0%
HSG 'B' =	82.7%
HSG 'C' =	11.0%
HSG 'D' =	6.3%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	64	Assume good condition
2ac Residential	67	Assumes 12% impervious

II. PRE-DEVELOPMENT

Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	0	0.00	-
Onsite 2ac Residential	67	574,992	13.20	Assumes 12% impervious
Offsite impervious	98	239,580	5.50	-
Offsite open	64	3,933,468	90.30	Assume good condition

Total area =	109.00	acres
	4,748,040	sf
Composite SCS CN =	65.8	
% Impervious =	6.5%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length = 100 ft
 Top Elev = 672.00 ft
 Bot Elev = 671.00 ft
 Height = 1 ft
 Slope = 0.0100 ft/ft
 Manning's n = 0.24 dense grasses
 P (2-year/24-hour) = 3.36 inches (Apex, NC)
 Segment Time = 18.35 minutes

Segment 2: Concentrated Flow

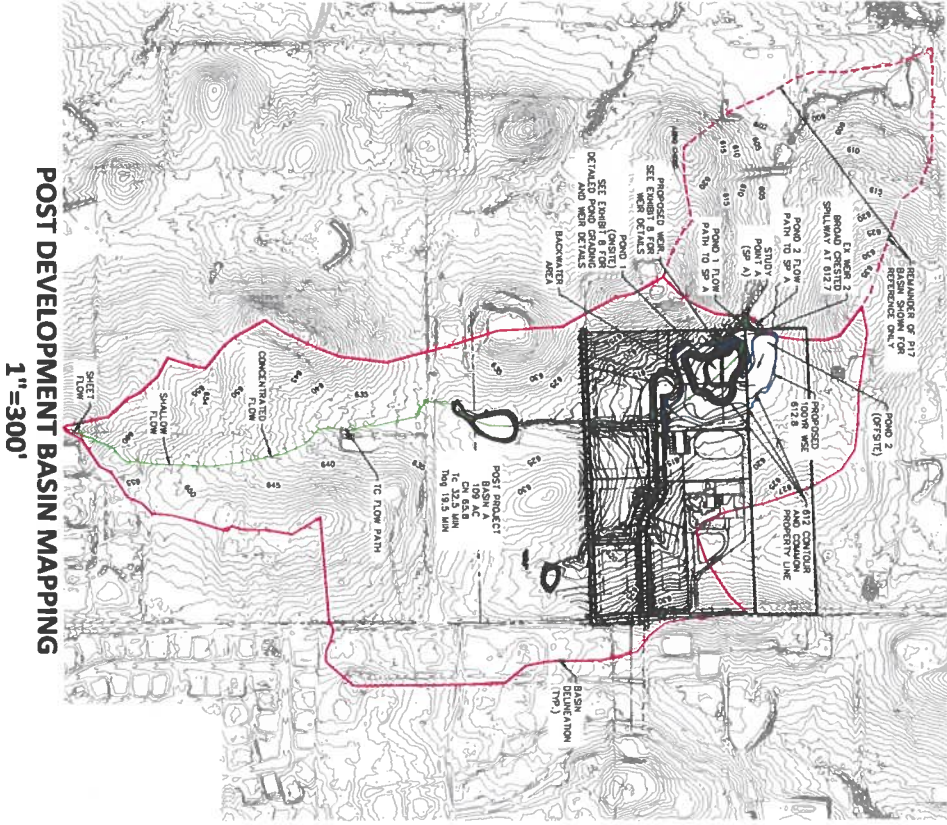
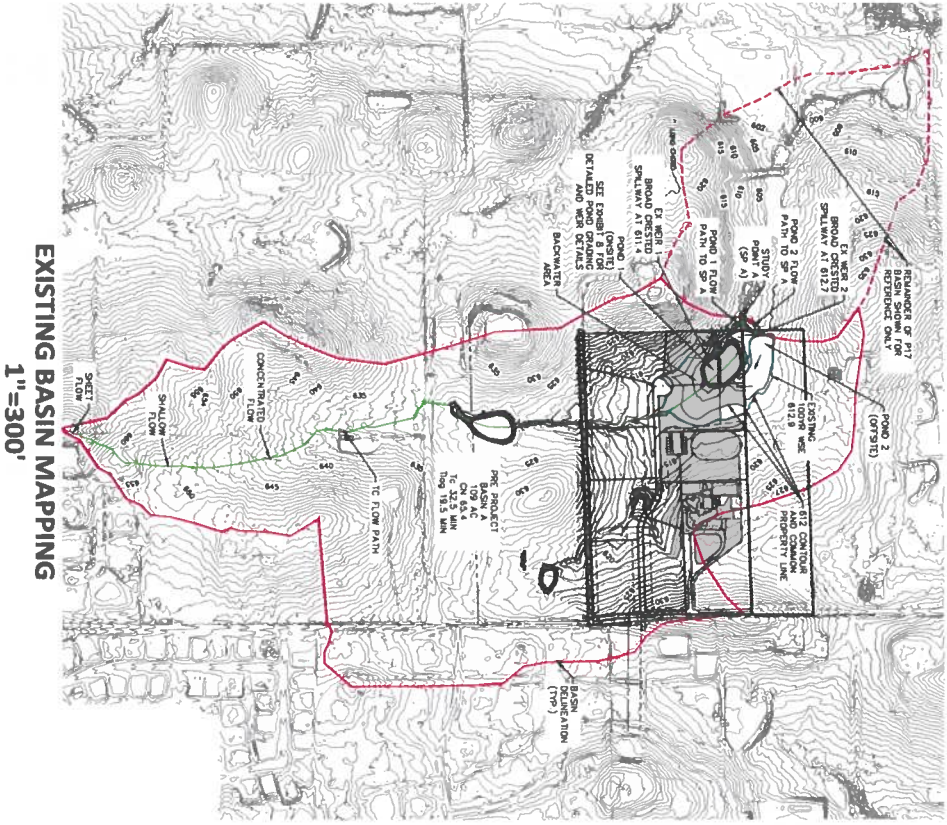
Length = 600 ft
 Top Elev = 671.00 ft
 Bot Elev = 653.00 ft
 Height = 18 ft
 Slope = 0.0300 ft/ft
 Paved ? = No
 Velocity = 2.79 ft/sec
 Segment Time = 3.58 minutes

Segment 4: Channel Flow

Length = 3175 ft
 Top Elev = 653.00 ft
 Bot Elev = 609.00 ft
 Height = 44 ft
 Slope = 0.0139 ft/ft
 Manning's n = 0.035 natural channel
 Flow Area = 9.00 sf (assume 3'w x 3'h channel)
 Wetted Perimeter = 9.00 lf (assume 3' x 3' channel)
 Channel Velocity = 5.01 ft/sec
 Segment Time = 10.56 minutes

Time of Concentration =	32.49	minutes
SCS Lag Time =	19.49	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	5.65	minutes (= 0.29 * SCS Lag)

EXHIBIT 3



PLAN INFORMATION

PROJECT NO.	PHS 23051
FILED NO.	PHS23051.DWG
CHECKED BY	CS
DRAWN BY	CS
SCALE	1" = 300'
DATE	03.24.2024

SHEET

REVISIONS

NO.	DATE	DESCRIPTION

JERNIGAN ESTATES
 FP/ED
 545 JERNIGAN ROAD
 TOWN OF COPPER CANYON, TEXAS, 75077

APPLICANT
 PREGOON BUILDERS, INC.
 4831 LONG HAWK ROAD, SUITE 300
 FLOWER MOUND, TEXAS 75028
 MICHIGAN COUNCILWAY

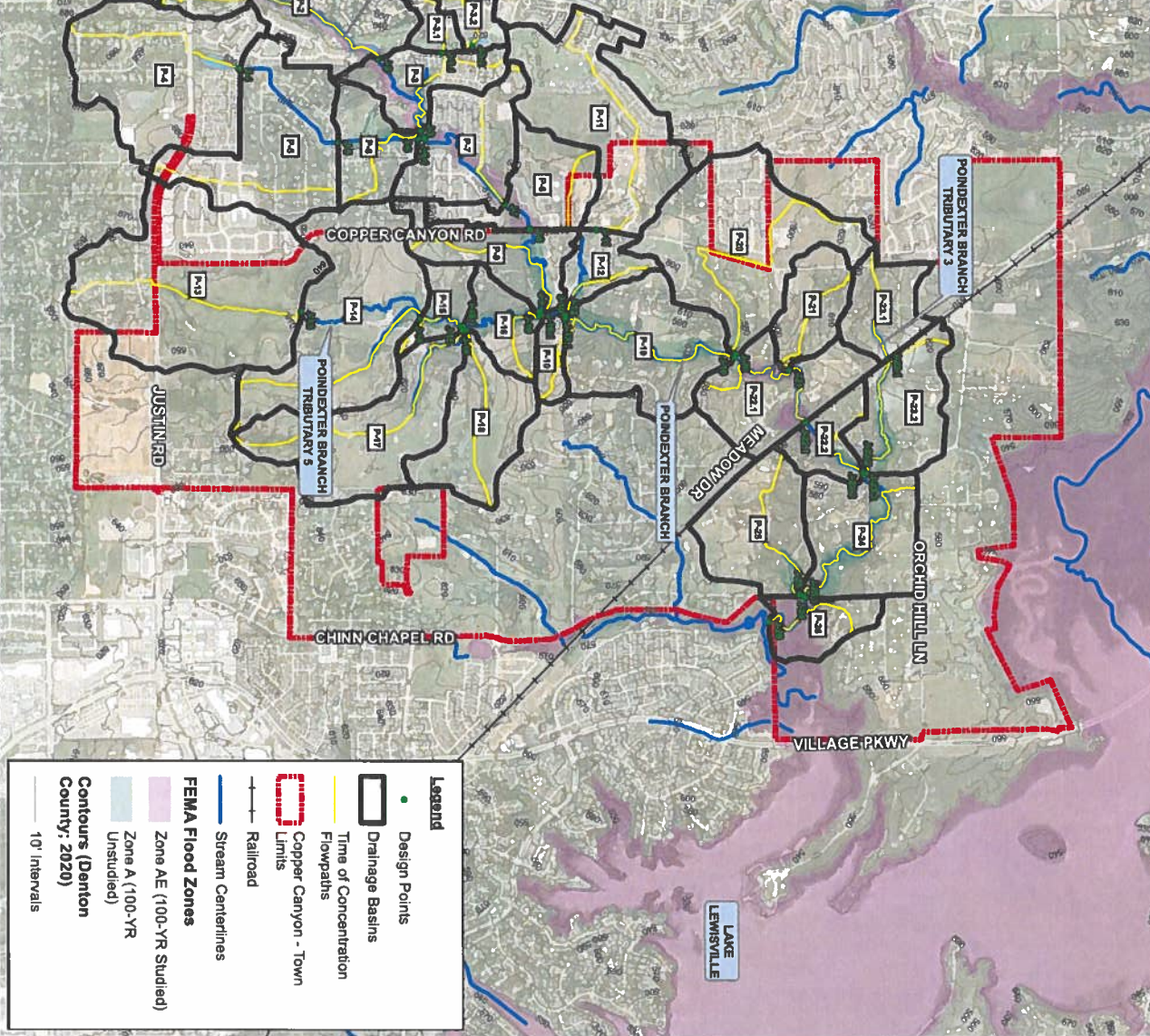
MCADAMAS
 THE JOHN R. MCADAMAS COMPANY, INC.
 10000 W. STATE HIGHWAY 175
 FORT WORTH, TEXAS 76133
 phone: 817.426.9713
 fax: 817.426.9715
 TWP: L170717.PWL: 03/24/2024
 www.mcadamas.com

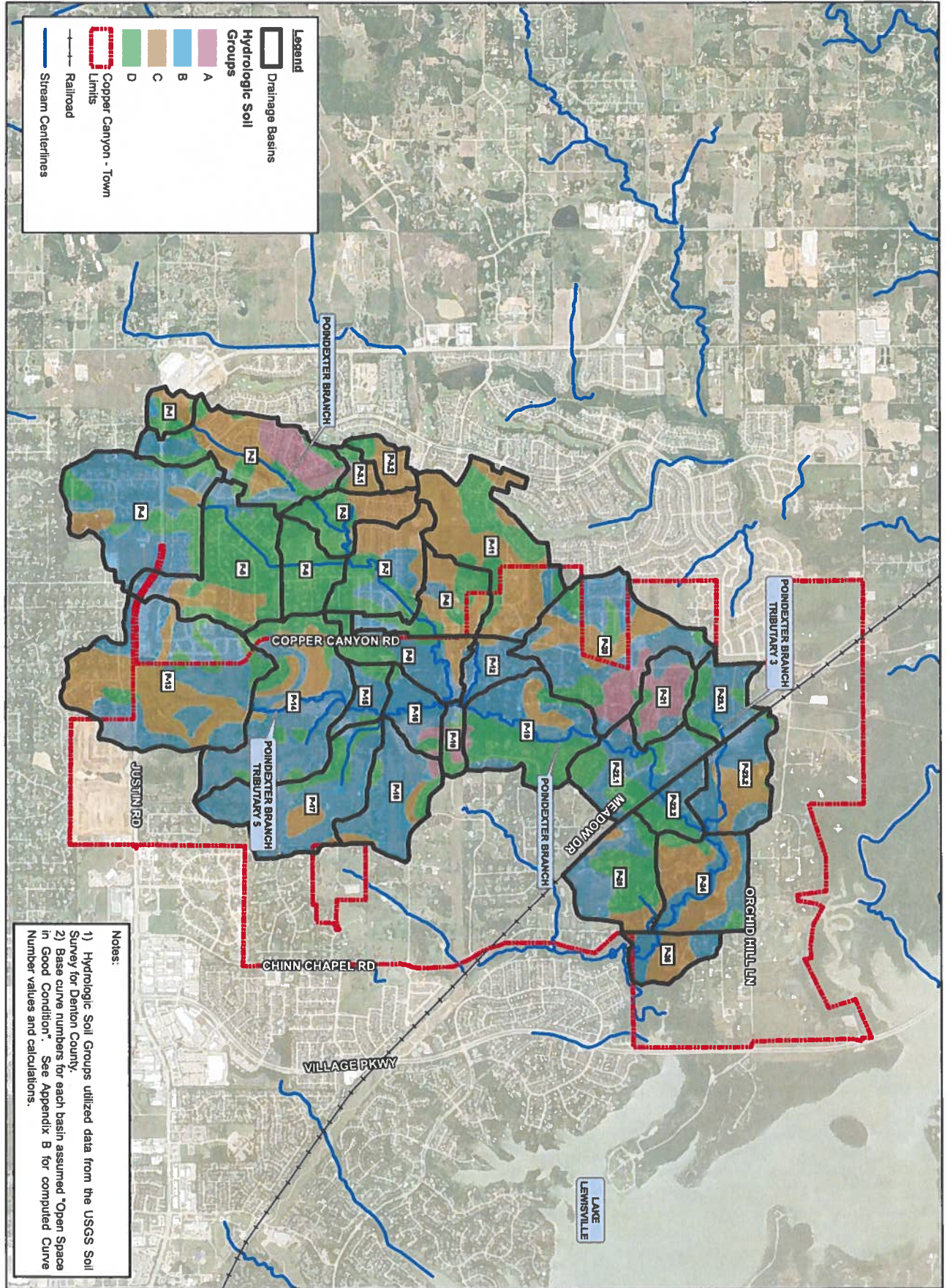


BASIN MAPPING
EX 3

EXHIBIT 4

Hydrologic Parameters - Design Conditions												
Reach	Length (ft)	CW	% Imp.	TC	Time (min)	2-YR	10-YR	25-YR	50-YR	100-YR	500-YR	1000-YR
P-1	217	0.034	75.4	48.4	22.2	33.3	45.1	56.2	68.4	81.5	96.5	113.5
P-2	577	0.090	77.8	34.0	31.2	51.2	102.2	163.6	225.0	272.6	315.5	368.5
P-3	37.2	0.027	71.8	32.3	8.2	38.2	67.9	68.8	99.0	134.4	200.3	304.4
P-4	377.2	0.229	66.4	30.5	11.1	67.2	65.5	103.4	153.2	177.7	208.3	247.7
P-5	345.7	0.229	75.9	33.3	18.8	203.3	308.3	523.3	633.2	725.8	814.3	904.2
P-6	54.5	0.045	80.0	17.8	28.5	17.2	67.6	128.4	218.2	292.2	404.0	533.3
P-7	92.9	0.085	73.3	36.7	28.8	17.2	145.0	258.8	377.2	508.3	644.5	794.7
P-8	72.8	0.134	74.8	25.2	25.2	33.2	218.2	218.2	218.2	218.2	218.2	218.2
P-9	76.7	0.120	80.8	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0
P-10	161.8	0.251	75.3	38.0	34.5	207.2	222.0	408.0	523.4	650.0	798.8	1007.1
P-11	161.8	0.251	75.3	38.0	34.5	207.2	222.0	408.0	523.4	650.0	798.8	1007.1
P-12	38.5	0.055	62.1	12.0	21.8	25.2	64.8	92.6	115.6	140.2	164.5	184.5
P-13	262.4	0.410	67.8	21.1	31.1	130.4	264.1	549.9	733.7	878.5	1008.5	1164.4
P-14	189.6	0.296	67.3	4.6	30.3	130.4	324.2	479.5	575.2	705.1	846.1	1004.1
P-15	45.2	0.040	66.6	11.4	14.9	63.8	88.2	105.2	128.2	158.2	198.2	238.2
P-16	45.2	0.071	61.7	6.5	14.6	63.8	88.2	105.2	128.2	158.2	198.2	238.2
P-17	138.0	0.245	63.1	7.5	37.3	22.4	79.4	208.1	297.1	385.4	474.6	574.6
P-18	68.4	0.129	63.9	4.6	21.8	33.3	53.3	53.3	53.3	53.3	53.3	53.3
P-19	184.3	0.282	74.0	32.2	42.9	127.5	202.0	305.2	408.4	511.6	614.8	718.0
P-20	184.3	0.282	74.0	32.2	42.9	127.5	202.0	305.2	408.4	511.6	614.8	718.0
P-21	52.6	0.082	54.9	10.5	20.2	32.2	70.3	108.6	137.8	176.4	225.2	285.2
P-22	58.7	0.146	64.5	12.0	23.0	33.8	94.3	210.0	288.3	364.1	434.7	505.2
P-23	37.0	0.058	68.9	12.0	19.3	11.6	42.1	58.4	78.3	103.9	130.6	161.8
P-24	52.1	0.081	67.1	12.0	25.2	15.1	47.1	58.4	78.3	103.9	130.6	161.8
P-25	80.9	0.126	65.6	12.0	27.4	16.4	64.1	55.1	215.4	261.3	317.8	374.3
P-26	104.1	0.149	69.2	12.0	26.9	16.1	102.3	228.8	308.5	377.1	465.2	554.5
P-27	43.1	0.097	67.5	7.6	25.8	15.5	68.6	119.9	164.3	216.1	277.2	347.2



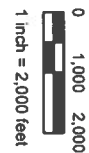


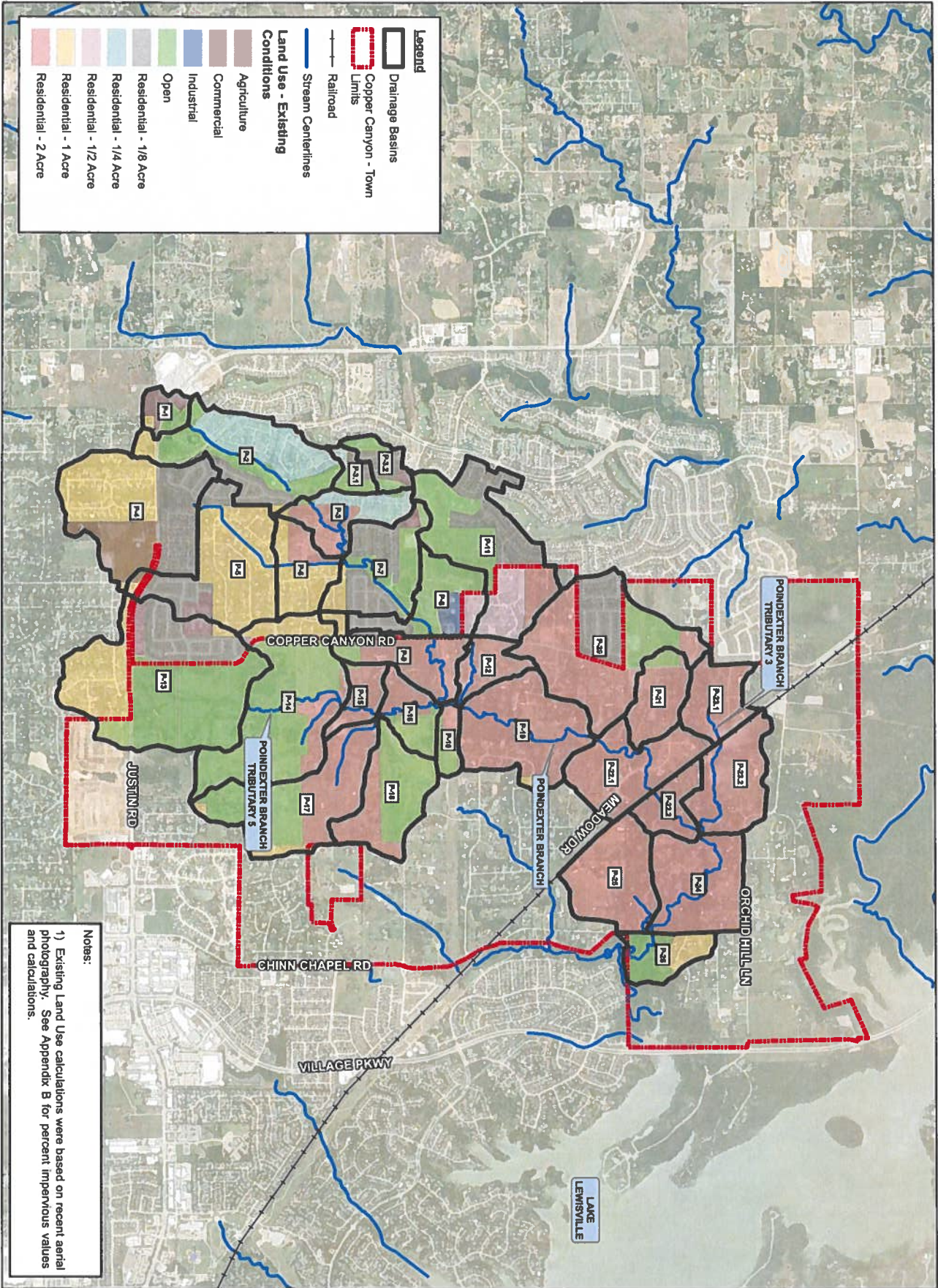
Notes:

- 1) Hydrologic Soil Groups utilized data from the USGS Soil Survey for Denton County.
- 2) Base curve numbers for each basin assumed "Open Space in Good Condition". See Appendix B for computed Curve Number values and calculations.



Copper Canyon, Texas
Poindexter Branch Master Drainage Study
EXHIBIT 3
HYDROLOGIC SOILS MAP
 August 2021

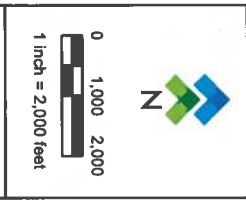


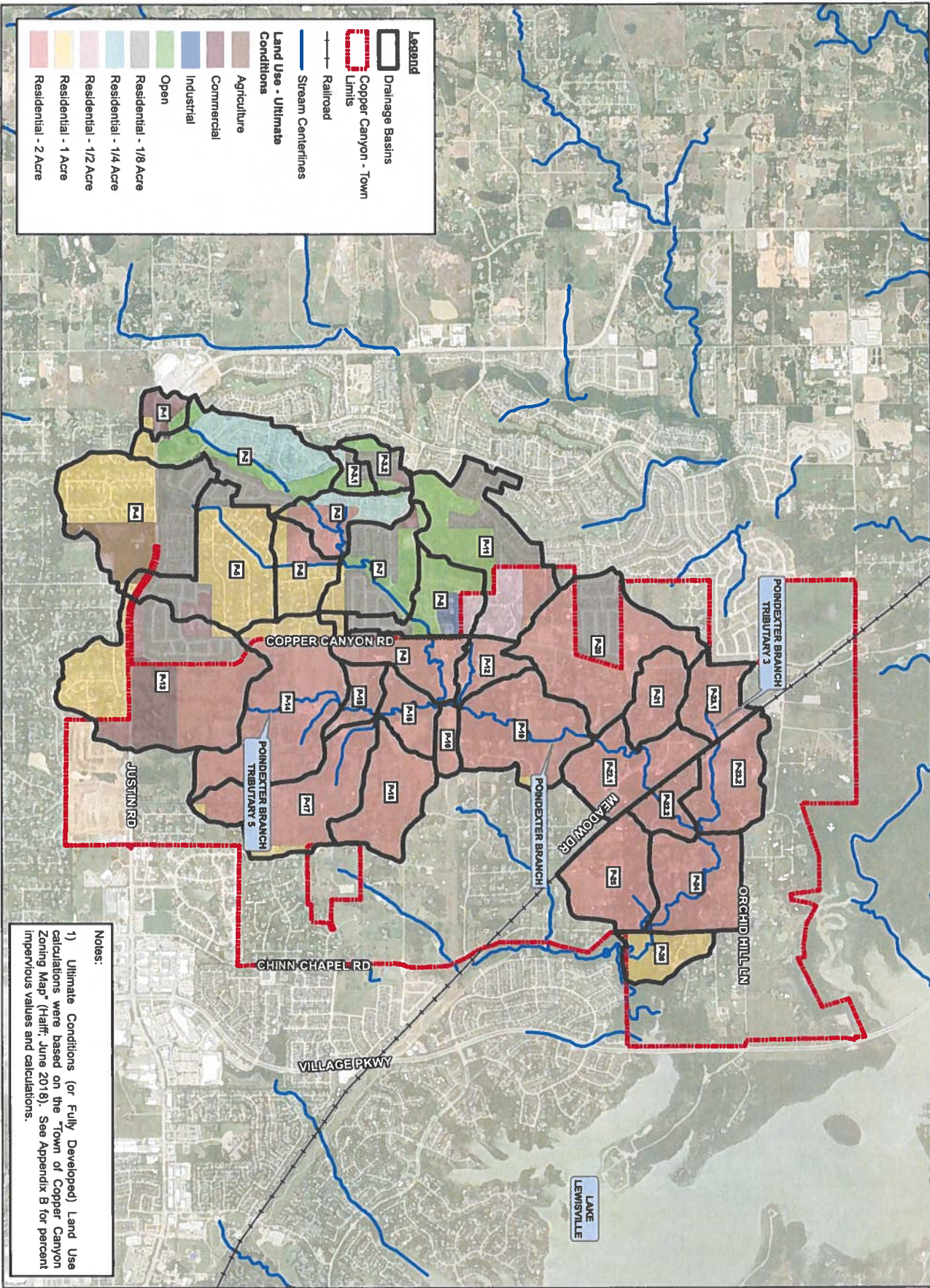


Notes:
 1) Existing Land Use calculations were based on recent aerial photography. See Appendix B for percent impervious values and calculations.



Copper Canyon, Texas
Poindexter Branch Master Drainage Study
EXHIBIT 4
LAND USE MAP - EXISTING CONDITIONS
 August 2021





Legend

- Drainage Basins
- Copper Canyon - Town Limits
- Railroad
- Stream Centerlines
- Land Use - Ultimate Conditions
- Agriculture
- Commercial
- Industrial
- Open
- Residential - 1/8 Acre
- Residential - 1/4 Acre
- Residential - 1/2 Acre
- Residential - 1 Acre
- Residential - 2 Acre

Notes:

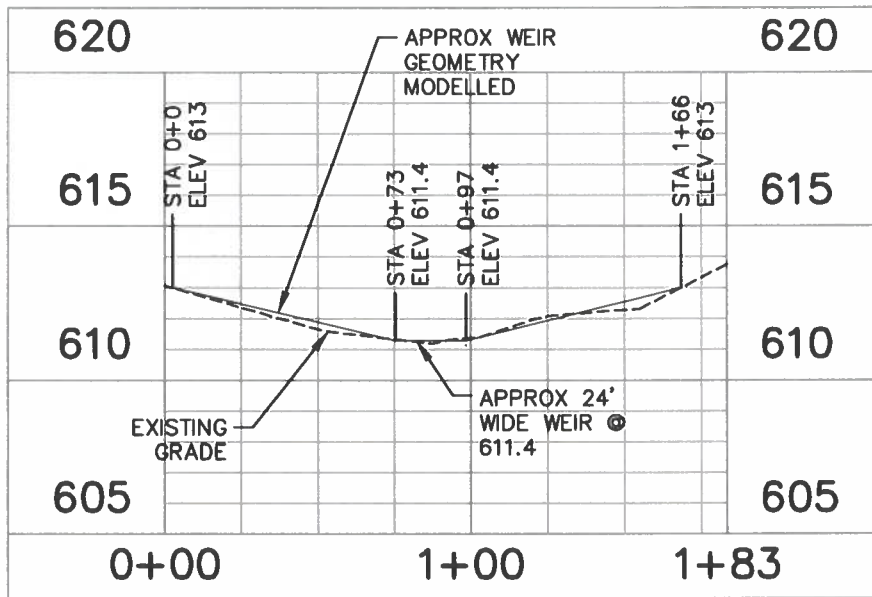
1) Ultimate Conditions (or Fully Developed) Land Use calculations were based on the "Town of Copper Canyon Zoning Map" (Draft, June 2016). See Appendix B for percent imperious values and calculations.



Copper Canyon, Texas
PoinDEXTER Branch Master Drainage Study
EXHIBIT 5
LAND USE MAP - ULTIMATE CONDITIONS
 August 2021

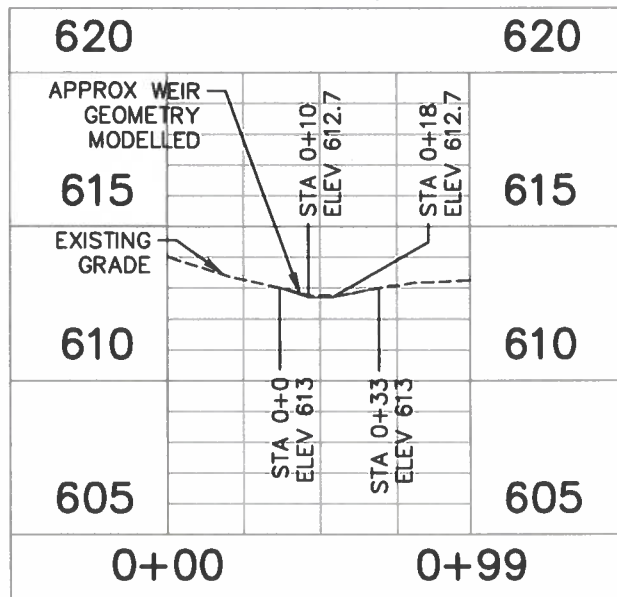


EXHIBIT 5

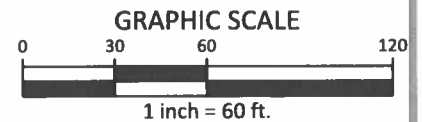


WEIR 1

NOTES:
SEE EXHIBIT 3 FOR
WEIR LOCATIONS.



WEIR 2



M:\Projects\PRB\PRB23001\04-Production\Water Resources\Stormwater Management\Prelim Sizing\Current Drawings\PRB23001 DCS-for outfall analysis.dwg, 3/4/2024 3:35:28 PM, Erin Storey



The John R. McAdams Company, Inc.
201 Country View Drive
Roanoke, TX 76262

phone 940.240.1012
TBPE FIRM # 19762

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JERNIGAN ESTATES
EXISTING WEIR GEOMETRY
545 JERNIGAN ROAD
COPPER CANYON, TEXAS, 75077

PLAN INFORMATION

PROJECT NO. PRB-23001
FILENAME EXHIBIT 5
CHECKED BY EKS
DRAWN BY EKS
SCALE 1"=60'(H), 1"=6'(V)
DATE 03.04.2024

EXHIBIT 6

Existing Pond Data			
Elev (ft)	Area (sf)	Area (ac)	Vol (cf)
611	46397	1.1	0
611	75331	1.7	0
612	118731	2.7	58218
613	176038	4.0	205603

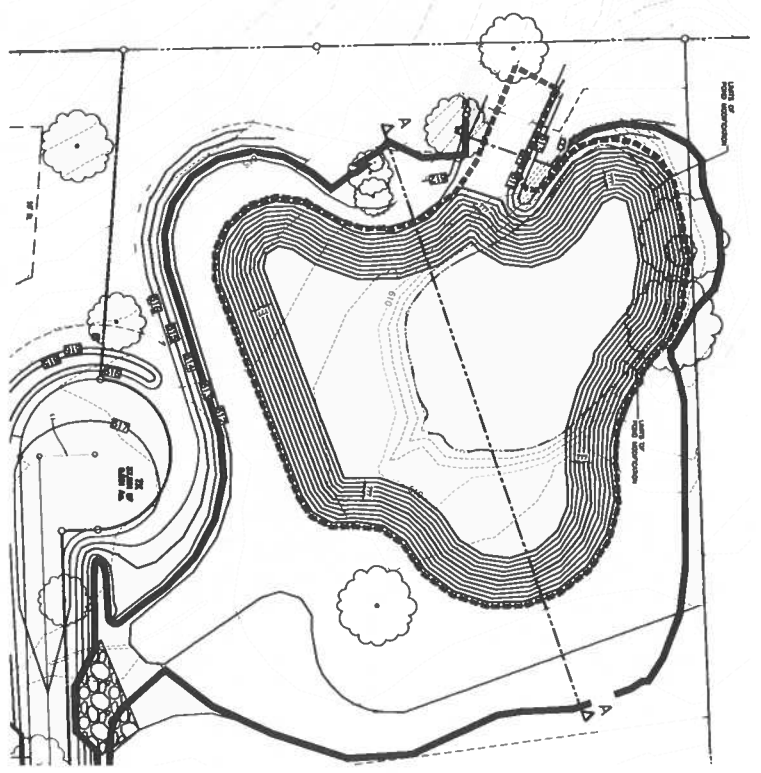
Existing Condition Rating Curve from Pond Pack			
Elev (ft)	Flow (cfs)	storage (cf)	storage (ac ft)
611.40	0.00	0.00	0.00
611.45	0.86	4851.54	0.11
611.50	2.57	9703.08	0.22
611.55	5.00	14554.62	0.33
611.60	8.12	19406.16	0.45
611.65	11.94	24257.70	0.56
611.70	16.47	29109.24	0.67
611.75	21.73	33960.78	0.78
611.80	27.74	38812.32	0.89
611.85	34.52	43663.86	1.00
611.90	42.10	48515.40	1.11
611.95	50.49	53366.94	1.23
612.00	59.71	58218.48	1.34
612.05	69.80	65587.71	1.51
612.10	80.76	72956.93	1.67
612.15	92.62	80326.16	1.84
612.20	105.40	87695.38	2.01
612.25	119.13	95064.61	2.18
612.30	133.81	102433.83	2.35
612.35	149.47	109803.06	2.52
612.40	166.13	117172.28	2.69
612.45	183.81	124541.51	2.86
612.50	202.53	131910.73	3.03
612.55	222.30	139279.96	3.20
612.60	243.14	146649.18	3.37
612.65	265.07	154018.41	3.54
612.70	288.11	161387.63	3.70
612.75	312.59	168756.86	3.87
612.80	338.61	176126.08	4.04
612.85	366.20	183495.31	4.21
612.90	395.40	190864.53	4.38
612.95	426.26	198233.76	4.55
613.00	458.84	205602.98	4.72

EXHIBIT 7

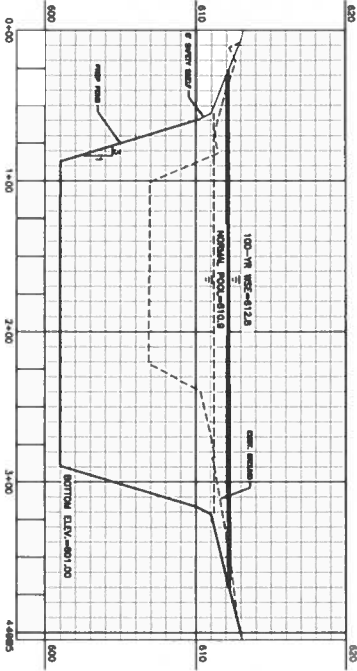
Proposed Pond Data			
elev (ft)	area (sf)	area (ac)	vol (cf)
611	65762	1.5	0
611	78022	1.8	25162
612	152961	3.5	111781
613	182366	4.2	279444

Proposed Condition Rating Curve from Pond Pack			
Elev (ft)	Flow (cfs)	storage (cf)	storage (ac ft)
610.90	0.00	0.00	0.000000
610.95	1.15	3594.57	0.082520
611.00	3.25	7189.14	0.165040
611.05	6.00	10783.71	0.247560
611.10	9.29	14378.29	0.330080
611.15	13.03	17972.86	0.412600
611.20	17.21	21567.43	0.495120
611.25	21.78	25162.00	0.577640
611.30	26.72	30936.60	0.710207
611.35	32.03	36711.20	0.842773
611.40	37.67	42485.80	0.975340
611.45	43.64	48260.40	1.107906
611.50	49.94	54035.00	1.240473
611.55	56.55	59809.60	1.373039
611.60	63.46	65584.20	1.505606
611.65	70.68	71358.80	1.638173
611.70	78.19	77133.40	1.770739
611.75	85.99	82908.00	1.903306
611.80	94.08	88682.60	2.035872
611.85	102.44	94457.20	2.168439
611.90	111.09	100231.80	2.301006
611.95	120.02	106006.40	2.433572
612.00	129.21	111781.00	2.566139
612.05	138.68	120164.15	2.758589
612.10	148.42	128547.30	2.951040
612.15	158.43	136930.45	3.143491
612.20	168.71	145313.60	3.335941
612.25	179.24	153696.75	3.528392
612.30	190.05	162079.90	3.720843
612.35	201.11	170463.05	3.913293
612.40	212.44	178846.20	4.105744
612.45	224.03	187229.35	4.298194
612.50	235.87	195612.50	4.490645
612.55	247.98	203995.65	4.683096
612.60	260.34	212378.80	4.875546
612.65	272.97	220761.95	5.067997
612.70	285.84	229145.10	5.260448
612.75	299.30	237528.25	5.452898
612.80	313.41	245911.40	5.645349
612.85	328.19	254294.55	5.837800
612.90	343.66	262677.70	6.030250
612.95	359.85	271060.85	6.222701
613.00	376.81	279444.00	6.415152

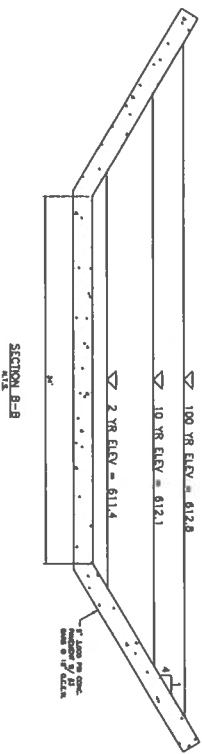
EXHIBIT 8



WEST POND CROSS SECTION A-A



WT	WVEL	POST
2	611.8	611.4
10	612.3	612.3
100	612.9	621.8



FOR DETAILED HYDRAULIC AND HYDROLOGY INFORMATION PLEASE SEE DRAINAGE STUDY FOR JERNIGAN ESTATES DONE BY MCDAMS DATED MARCH 4th, 2024.

BENCHMARKS:

TBM #1 MAGNALL WITH SHINER POUND ON THE EAST SIDE OF JERNIGAN ROAD, LOCATED APPROXIMATELY 280' SOUTH OF THE INTERSECTION OF DOVE TRAIL AND THE INTERSECTION OF ROLLING ACRES DRIVE AND JERNIGAN ROAD, N: 7081815.339 E: 2399310.941 ELEVATION: 636.85

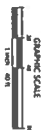
TBM #2 MAGNALL WITH SHINER (MCDAMS) SET IN A DRIVEWAY ENTRANCE FOR THE NORTH EAST CORNER OF THE INTERSECTION OF HWY 1280' SOUTH OF THE INTERSECTION OF LONESOME DOVE LAKE AND JERNIGAN ROAD, N: 7081383.010 E: 2399235.287 ELEVATION: 634.172

GENERAL NOTES:

1. THE TOWN OF COPPER CANYON ENGINEERING STANDARDS APPLY WHETHER INDICATED ON THESE PLANS OR NOT.
2. VEGETATION CALCULATIONS BASED ON Q₁₀, C₁, H₁, C₃ INFORMATION PLEASE SEE DRAINAGE STUDY FOR MARCH 4th, 2024.

LEGEND

- 30" PROPOSED MAIN CHANNEL
- 24" PROPOSED SWALE CHANNEL
- 5' EXISTING CHANNEL
- PROPOSED 100-YR VEGETATION



INCLUDED FOR REFERENCE ONLY WITH THIS DRAINAGE STUDY. PLEASE SEE CIVIL SET FOR CONSTRUCTION PLAN.



The Town of Copper Canyon, Inc.
 4931 LONG PINE ROAD, SUITE 300
 FLOWER MOUND, TEXAS 75028
 (817) 572-4847
 www.townofcoppercanyon.com

APPLICANT
 MCDAMS BUILDERS, INC.
 4931 LONG PINE ROAD, SUITE 300
 FLOWER MOUND, TEXAS 75028
 MCDAMS@MCDAMS.COM

JERNIGAN ESTATES
 FP/ED
 545 JERNIGAN ROAD
 TOWN OF COPPER CANYON, TEXAS, 75077



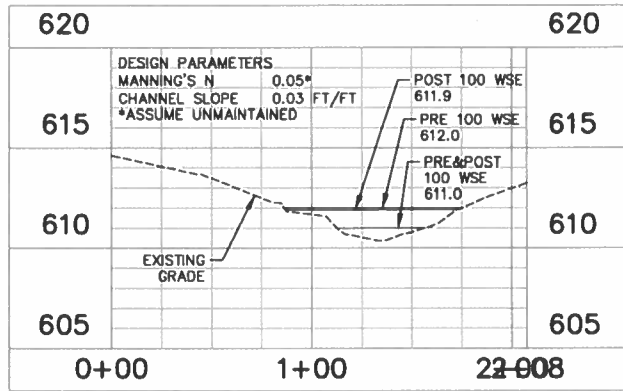
REVISIONS
 03/04/2024
 AS BUILT

PLAN INFORMATION
 PROJECT NO: 24-17-001
 FILENAME: 24-17-001-01-FLOOD.DWG
 CHECKED BY: DJ
 DRAWN BY: DJ
 SCALE: 1" = 40'
 DATE: 03.04.2024
 SHEET

POND GRADING PLAN

C3.09

EXHIBIT 9



A-A

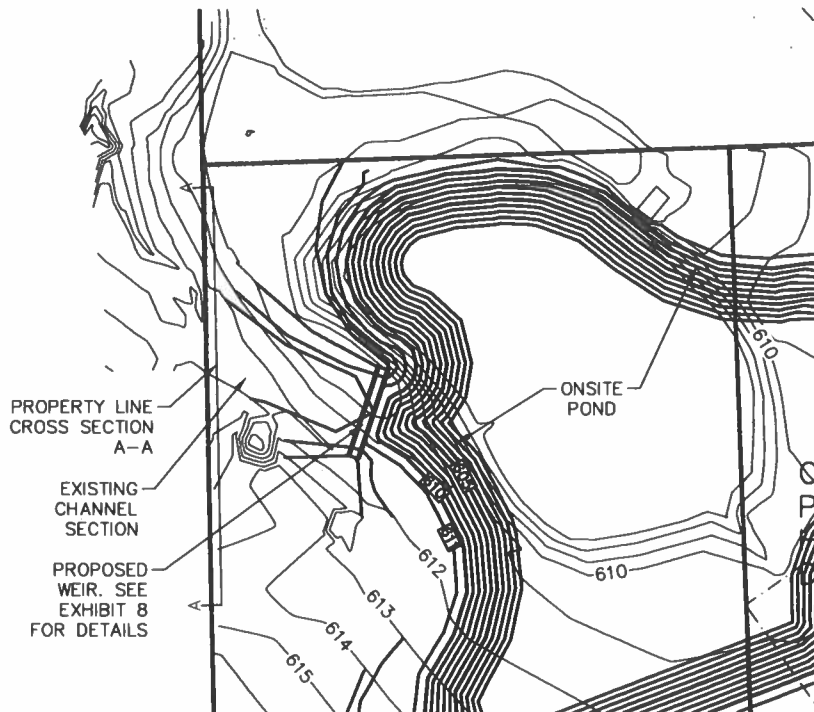
	PRE Q (CFS)	POST Q (CFS)
2 YR	41.6	41.5
10 YR	148.19	139.7
100 YR	365.9	327.3

	PRE WSE (FT)	POST WSE (CFS)
2 YR	611.0	611.0
10 YR	611.5	611.4
100 YR	612.0	611.9

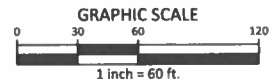
	PRE V (FPS)	POST V (FPS)
2 YR	2.7	2.7
10 YR	3.9	3.8
100 YR	4.7	4.5

**THE FLOW FROM WEIR 2 IS INSIGNIFICANT (<3CFS) WITH RESPECT TO WEIR 1 FLOW. TO SIMPLIFY THIS ANALYSIS THE CALCULATED STUDY POINT PEAK FLOW HAS BEEN APPLIED TO THIS CROSS SECTION.

SECTION A-A PROFILE



SECTION A-A PLAN



M:\Projects\PRB\PRB23001\04-Production\Water Resources\Stormwater Management\Prelim Sizing\Current Drawings\PRB23001 DCS for outfall analysis.dwg, 3/4/2024 3:38:44 PM, Erin Storey



The John R. McAdams Company, Inc.
 201 Country View Drive
 Roanoke, TX 76262
 phone 940.240.1012
 TBPE FIRM # 19762
 www.mcadamsco.com

JERNIGAN ESTATES
 EXISTING WEIR GEOMETRY
 545 JERNIGAN ROAD

PLAN INFORMATION
 PROJECT NO. PRB-23001
 FILENAME EXHIBIT 9
 CHECKED BY EKS
 DRAWN BY EKS
 SCALE 1"=60'(H), 1"=60'(M)
 DATE 03.04.2024

DIGITAL DATA