FINAL DRAINAGE MEMO
FOR
LEWIS PALMER MIDDLE SCHOOL
PARKING LOT EXPANSION

MONUMENT, COLORADO

SE ¼ of the SW ¼ of Section 11
Township 11 South, Range 67 West
of the 6th P.M., El Paso County, CO

October 2023

Prepared for:
Lewis-Palmer School District 38
Lewis Palmer Middle School
1776 Woodmoor Drive,
Monument, CO 80132

Prepared by:
Felsburg Holt & Ullevig
Contacts: Kevan Kuhnel, PE
Kevan.Kuhnel@fhueng.com
http://www.fhueng.com/

FHU Reference No. 122227-01

FELSBURG HOLT & ULLEVIG
connecting & enhancing communities

DESIGN 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 letter has been prepared according to the criteria established by the County for drainage letters and said letter 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.

COLORADO LICENSED KEVAN P. KUHNEL 42726 10/11/2023 PROFESSIONAL ENGINEER

____________________________________ 10/11/2023
Kevan P. Kuhnel, PE Date
Colorado P.E. #42726
For and On Behalf of Felsburg Holt & Ullevig

Owner/Developer's Statement:
I, the owner/developer have read and will comply with all of the requirements specified in this drainage letter.

____________________________________ ________________
Chris Coulter, Executive Director of Operations Date
Lewis Palmer School District 38
1776 Woodmoor Drive
Monument, CO 80132

El Paso County:

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

________________________________ ________________
Printed Name: Date
County Engineer/ECM Administrator

Conditions:

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Attn: Daniel Torres, P.E.
Department of Public Works
County of El Paso
Colorado Springs, Colorado

RE: Drainage Letter for Lewis Palmer Middle School Parking Lot Expansion

Dear Mr. Torres,

The purpose of this letter is to show that the proposed parking lot expansion was designed in accordance with the El Paso County Drainage Criteria Manual, **Reference 3**. The existing northern parking lot shall be expanded approximately 50 LF to the east and an existing sidewalk on the south side of the parking lot will also be extended to improve bus circulation and operations. These additions will increase the overall imperviousness of the area. Additional flows created by this increase in impervious area will be captured by an existing D-10-R in the northwestern corner of the parking lot. The increase in flows to the inlet will not adversely affect parking, student drop off/pick up in the parking lot, or the downstream drainageways. The project is funded by Lewis Palmer Middle School.

GENERAL LOCATION AND DESCRIPTION

Location

The project site is located in the northern parking lot of Lewis Palmer Middle School and along Woodmoor Drive. The project includes expanding the existing parking lot approximately 50 LF to the east and extending a sidewalk on the south side of the parking lot to improve bus circulation and operations.

Property Description

The site is bound on the north by Deer Creek Road, on the east by Woodmoor Drive and the Woodmoor Townhouses development, on the south by Willow Park Way, and on the west by Crystal Creek and Monument Hill Church. The limits of construction (LOC) include the entire northern parking lot of Lewis Palmer Middle School and adjacent sidewalks, a portion of the adjacent landscaped area to the east, and a small portion of the landscaped area on the south side of the parking lot, covering approximately 1.18 acres. However, the limits of disturbance area (LDA) is much smaller. This includes roughly the southern half of the landscaped area to the east of the parking lot and a small portion of the landscaped area on the south side of the parking lot, covering 0.46 acres. It is mostly landscaped areas with native grasses and trees with some paved areas from the parking lot and nearby sidewalks. The LDA only includes areas in which there are proposed changes to site grading and soil disturbance with some buffer area around it. The LOC includes areas that will experience construction activities but no soil disturbance. Some activities will take place outside of the LDA but within the LOC. There is approximately 0.72 acres of the project site that is within the LOC but outside the LDA.

SITE DRAINAGE

Existing Conditions – Lewis Palmer Middle School

The existing drainage of the project site at Lewis Palmer Middle School contributes to an existing 10' long D-10-R inlet in the northwestern corner of the northern parking lot. Flows generally drain from east to west in the parking lot with a typical slope of 3.45%. This inlet has adequate capacity for existing runoff conditions and captures all flow that drains to it (see **Appendix C**) and conveys flow to the west via a 18" PVC pipe, where it discharges to Crystal Creek. According to "Preliminary and Final Drainage Study for Patriot Place Subdivision for Lewis Palmer School District 38" by PKM Civil Engineers, Inc.

(**Reference 1**), flows from a portion of the school roof also tie into this same storm line somewhere along the pipe. Little is known about this connecting pipe, nonetheless flow estimates has been accounted for in our hydraulic assessment of the system. See **Appendix B** for hydrology information for all basins, **Appendix C** for all hydraulic computations, and **Appendix F** for drainage maps. See also **Table 1** below.

Basin E01 consists of 1.37 acres of paved area and landscaped areas with native grasses and trees. The basin is bound on the north by the edge of the concrete sidewalk and stairs north of the parking lot and on the south by the edge of the concrete sidewalk south of the parking lot as well as an adjacent hill. The basin is bound on the west by the school and the east by an existing ridge that extends from the track field in the north along the western edge of Woodmoor Drive to the parking lot entrance in the south. The basin generally drains from east to west, with a typical slope of 3.1%. Basin flows are captured by an existing D-10-R inlet and conveyed offsite to Crystal Creek. The local flows are 2.9 CFS and 7.0 CFS.

Basin E02 consists of 0.39 acres of paved roadway and adjacent landscaped area. The basin is bound on the north by the start of the curb and gutter along the western edge of Woodmoor Drive, the east by the crown of Woodmoor Drive, and on the west by the existing ridge that extends from the track field in the north along the western edge of Woodmoor Drive to the parking lot entrance in the south. The basin drains from north to south, with a typical slope of 4.5%. Basin flows drain to the curb and gutter along the western edge of the roadway and are conveyed south further south down the road. The local flows are 1.0 CFS and 2.4 CFS. This basin terminates at the entrance to the northern parking lot and was delineated for the purpose of analyzing flow that is conveyed on the roadway surface at this location. While it appears that the design intent of this area was to convey flow south down Woodmoor Drive, it is suspected that part of this flow turns and enters the northern parking lot. For this analysis, it is assumed that 50% of Basin E02's flow turns and enters the parking lot and contributes to the existing D-10-R located in Basin E01.

Basin E03 consists of 0.24 acres of roof area adjacent to the northern parking lot. The basin is bound on all sides by the roof extents. The basin drains from southwest to northeast, with an estimated slope of 0.5%. Basin flows are collected by a roof drain and tie into the existing storm line from Basin E01, before being discharged to Crystal Creek. The local flows are 1.1 CFS and 1.9 CFS.

Table 1 – Existing Hydrology Tabulations for Lewis Palmer Middle School

Basin Name	Contributing Area	Runoff Coefficients		Time of Concentration	Intensity		Design Storm Flows	
		C_5	C_{100}		i_5	i_{100}	Q_5	Q_{100}
	(ac)	(-)	(-)	(min)	(in/hr)	(in/hr)	(cfs)	(cfs)
E01	1.37	0.48	0.70	8.7	4.34	7.29	2.9	7.0
E02	0.39	0.51	0.72	5.0	5.17	8.68	1.0	2.4
E03	0.24	0.86	0.90	5.0	5.17	8.68	1.1	1.9

Proposed Conditions – Lewis Palmer Middle School

The extension of the parking lot 50 LF to the east into the adjacent open space adds 0.13 acres of imperviousness and increases flows to the existing D-10-R inlet. Grading will minimally change, with the parking lot still flowing to northwest, and the reduced adjacent open area still flowing west toward the parking lot. Because the existing storm system has capacity for the minor flow increases and is expected to cause no adverse effects to the downstream hillside or receiving waterbody, no changes are proposed for the system. See **Table 2** below for changes to basin flows and **Appendix F** for Proposed Drainage maps.

Basin P01 consists of 1.39 acres of paved area and landscaped areas with native grasses and trees. The basin is bound on the north by the edge of the concrete sidewalk and stairs north of the parking lot and on the south by the edge of the concrete sidewalk south of the parking lot as well as an adjacent hill. The basin is bound on the west by the school and the east by an existing ridge that extends from the track field in the north along the western edge of Woodmoor Drive to the parking lot entrance in the south. The basin generally drains from east to west, with a typical slope of 4.25%. Basin flows are captured by the existing D-10-R inlet and conveyed offsite to Cystal Creek. Local flows are 3.4 CFS and 7.5 CFS. This is an increase of 0.5 CFS in the minor storm and 0.5 CFS in the major storm. When accounting for the bypass flow from basin P02 (see description below), the required ponding depth for this inlet to capture the flow increase changes from 5.65 inches in existing conditions to 5.77 in proposed conditions. Because the local grading of the inlet and adjacent sidewalk allows for up to approximately 12 inches of ponding before flow is lost to the sports field in the north with even more ponding to pose any flooding issues for the school, the existing inlet is more than capable of handling this minor increase. Furthermore, the total contributing area to Crystal Creek upstream of this system is much larger than this small basin, and thus its peak flows occur significantly later than this basin with a time of concentration of only 8.7 minutes. In summary, no adverse impacts are anticipated downstream due to such a minor increase in flow.

Basin P02 consists of 0.37 acres of paved roadway and adjacent landscaped area. The basin is bound on the north by the start of the curb and gutter along the western edge of Woodmoor Drive, the east by the crown of Woodmoor Drive, and on the west by the existing ridge that extends from the track field in the north along the western edge of Woodmoor Drive to the parking lot entrance in the south. The basin generally drains from north to south, with a typical slope of 4.42%. Basin flows are collected in the curb and gutter along the western edge of the roadway and conveyed further south along the road. The local flows are 1.0 CFS and 2.3 CFS. These flows decreased by 0.0 CFS in the minor storm and 0.1 CFS in the major storm. As previously mentioned, this basin was delineated for the purpose of analyzing flow that is conveyed on the roadway surface at this location. Due to the suspected split in flow at the parking lot entrance, it is estimated that 50% of the basin flows turn into the parking lot and contribute to the D-10-R within basin P01, and 50% of the basin flows continue south along Woodmoor Drive.

Basin P03 is unchanged in proposed conditions and is the same as Basin E03.

Table 2 – Proposed Hydrology Tabulations for Lewis Palmer Middle School

Basin Name	Contributing Area	Runoff Coefficients		Time of Concentration	Intensity		Design Storm Flows	
		C_5	C_{100}		i_5	i_{100}	Q_5	Q_{100}
	(ac)	(-)	(-)	(min)	(in/hr)	(in/hr)	(cfs)	(cfs)
P01	1.39	0.56	0.74	8.7	4.34	7.29	3.4	7.5
P02	0.37	0.52	0.72	5.0	5.17	8.68	1.0	2.3
P03	0.24	0.86	0.90	5.0	5.17	8.68	1.1	1.9

HYDROLOGIC CALCULATIONS

In addition to Tables 1 and 2 provided above, detailed hydrologic calculations can be found in **Appendix B**, soil mapping (**Reference 4**) can be found in **Appendix D**, and the basin delineations are displayed in maps located in **Appendix F**. Local flows for the parking lot and proposed driveway were calculated using the Rational Method as described in Chapter 6 of the Volume 1 update for the El Paso County Drainage Criteria Manual (**Reference 3**). Aside from the assumed spilt flow of basins E02 and P02, no atypical assumptions were made about the hydrology of this site.

HYDRAULIC CALCULATIONS

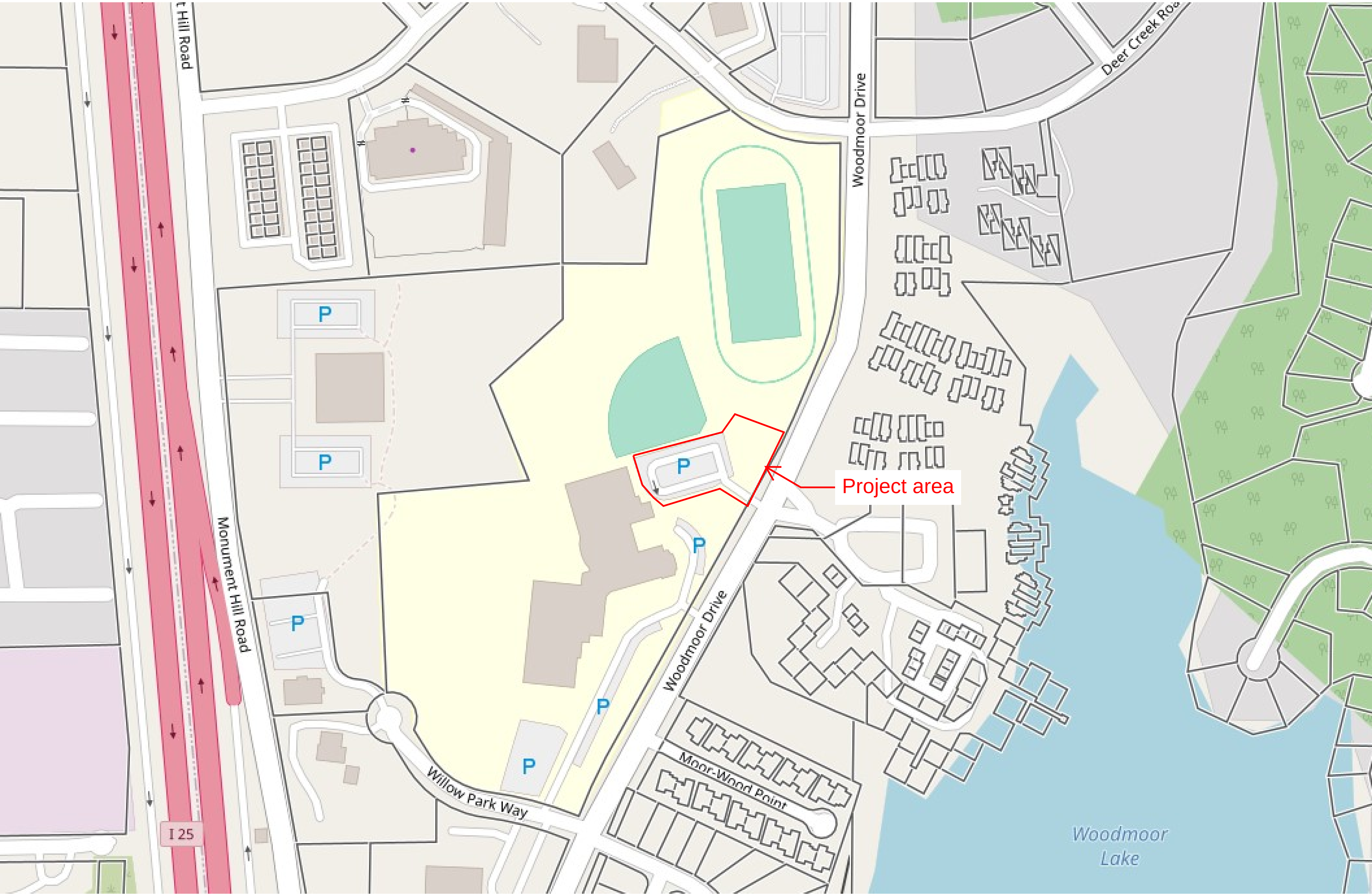
After developing flows for the existing and proposed conditions, capacity for the existing inlet in basins E01 and P01 as well as for the spread of flow on Woodmoor Drive in basins E02 and P02 was analyzed using the Mile High Flood District (MHFD) street capacity and inlet sizing spreadsheet. As previously mentioned, the flow used in assessing the inlet's capacity is conservative as it accounts for 50% of the Woodmoor Drive basin flow turning into the parking lot. A cross section based on survey points was modeled using Flowmaster. A SewerGEMs model was developed for the existing system and evaluates existing and proposed conditions for the 5-year and 100-year storm events. All calculations and model can be found in **Appendix C**. The project site is not in a floodplain, so no permits are required.

REFERENCES

1. PKM Civil Engineers, Inc., Preliminary and Final Drainage Study for Patriot Place Subdivision for Lewis Palmer School District 38, 1993, (PKM, 1993)
2. Federal Emergency Management Agency Flood Insurance Rate Map Community Panel Number 08041C0276G, Effective Date December 7, 2018 (FEMA, 2018)
3. Drainage Criteria Manual, City of Colorado Springs, Volumes 1 and 2, 2018 (COS, 2021 & 2020)
4. Soil Survey of Lewis Palmer Middle School, Colorado, U.S. Department of Agriculture, Soil Conservation Service, November 1974, (USDA, 1974)

APPENDIX A – VICINITY MAPS


Deer Creek Rd
Creek Rd
Woodmoor Dr
Deer Creek
Crystal Creek
Woodmoor Dr
25
Monument Hill Rd
Project area
Crystal Creek
25
Moorwood Pt
Willow Park Way
Crystal Creek
Lake Ln
Park Way
300ft



Project area
Woodmoor Drive
Deer Creek Road
Monument Hill Road
Willow Park Way
Moor-Wood Point
I 25
Woodmoor Lake
P

APPENDIX B – HYDROLOGY CALCULATIONS

COEFFICIENTS OF DEVELOPMENT
EXISTING HYDROLOGY

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION

Project #: 122227-01

Date: 11-Oct-23

File: 122227_Exisitng Hydrology.xlsx

BASIN	AREA Acres	IMPERVIOUSNESS						SOIL TYPE			RUNOFF COEFF.				
		Open % Imp. 2 Acres	Residential % Imp. 50 Acres	Business % Imp. 95 Acres	Paved % Imp. 100 Acres	Comp. % Imp.	Effective %Imp	A Percent of Total Area	B Percent of Total Area	C/D Percent of Total Area	2 YEAR	5 YEAR	10 YEAR	50 YEAR	100 YEAR
E01	1.37	0.58	0.00	0.00	0.79	58.51	58.51	0.0	100.0	0.0	0.45	0.48	0.53	0.66	0.70
E02	0.39	0.15	0.00	0.00	0.24	62.31	62.31	0.0	100.0	0.0	0.48	0.51	0.56	0.68	0.72
E03	0.24	0.00	0.00	0.00	0.24	100.00	100.00	0.0	100.0	0.0	0.84	0.86	0.87	0.89	0.90

TIME OF CONCENTRATION
EXISTING HYDROLOGY

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION
Project #: 122227-01
Date: 11-Oct-23
File: 122227_Exisitng Hydrology.xlsx

Equation:
$t_i=0.395(1.1-C_5)L^{0.5}/S^{0.33}$
$V=C_V S_W^{0.5}$
$t_t=L_W/(60V)$

SURFACE TYPES
A=Forest with ground litter & meadow
B=Fallow or minimum tillage cultivation
C= Short grass pasture & lawns
D=Nearly bare ground
E=Grassed waterway
F=Paved area (sheet flow) & shallow gutter flow
G=Riprap (not buried)

Surface Type	Factor
A	2.50
B	5.00
C	7.00
D	10.00
E	15.00
F	20.00
G	6.50

SUB-BASIN DATA			INITIAL/OVERLAND FLOW TIME (t_i)				CHANNELIZED FLOW TIME (t_t)					T_C	T_C Check (Urban)		BASIN DEFINITION	FINAL
BASIN	C5	C5 INITIAL	AREA (AC)	LENGTH, L_i (FT)	SLOPE, S_i (%)	t_i (MIN)	LENGTH, L_W (FT)	SLOPE, S_W (%)	SURF. TYPE	VEL. (F/S)	t_t (MIN)	t_i+t_t (MIN)	$L_T = L_W$ (FT)	L_T/180+10 (MIN)	URBAN OR NON-URBAN	T_C (MIN)
E01	0.48	0.08	1.37	100	15.70	7.4	262	3.11	F	3.5	1.2	8.7	362.01	12.0	URBAN	8.7
E02	0.51	0.90	0.39	35	5.20	1.2	318	4.45	F	4.2	1.3	5.0	353.1	12.0	URBAN	5.0
E03	0.86	0.90	0.24	100	0.50	4.5	33	0.50	F	1.4	0.4	5.0	132.7	10.7	URBAN	5.0

STORM DRAINAGE SYSTEM DESIGN
EXISTING HYDROLOGY
(RATIONAL METHOD PROCEDURE)
5-YEAR EVENT

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION
Project #: 122227-01
Date: 11-Oct-23
File: 122227_Exisitng Hydrology.xlsx

Q=C*I*A

NETWORK CONNECTION	DIRECT RUNOFF								REMARKS
	AREA DESIG.	AREA (AC)	Open % Imp.	COEF.	tc (MIN)	C*A (AC)	I (IN/HR)	Q (CFS)	
	E01	1.37	58.51	0.48	8.7	0.66	4.34	2.9	
	E02	0.39	62.31	0.51	5.0	0.20	5.17	1.0	
	E03	0.24	100.00	0.86	5.0	0.21	5.17	1.1	

STORM DRAINAGE SYSTEM DESIGN
EXISTING HYDROLOGY
(RATIONAL METHOD PROCEDURE)
100-YEAR EVENT

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION
Project #: 122227-01
Date: 11-Oct-23
File: 122227_Exisitng Hydrology.xlsx

Q=C*I*A

NETWORK CONNECTION	DIRECT RUNOFF								REMARKS
	AREA DESIG.	AREA (AC)	Open % Imp.	COEF.	tc (MIN)	C*A (AC)	I (IN/HR)	Q (CFS)	
	E01	1.37	58.51	0.70	8.7	0.96	7.29	7.0	
	E02	0.39	62.31	0.72	5.0	0.28	8.68	2.4	
	E03	0.24	100.00	0.90	5.0	0.22	8.68	1.9	

COEFFICIENTS OF DEVELOPMENT
PROPOSED HYDROLOGY

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION

Project #: 122227-01

Date: 11-Oct-23

File: 122227_Proposed Hydrology.xlsx

BASIN	AREA Acres	IMPERVIOUSNESS						SOIL TYPE			RUNOFF COEFF.				
		Open % Imp. 2 Acres	Residential % Imp. 50 Acres	Business % Imp. 95 Acres	Paved % Imp. 100 Acres	Comp. % Imp.	Effective %Imp	A Percent of Total Area	B Percent of Total Area	C/D Percent of Total Area	2 YEAR	5 YEAR	10 YEAR	50 YEAR	100 YEAR
P01	1.39	0.47	0.00	0.00	0.92	66.86	66.86	0.0	100.0	0.0	0.52	0.56	0.60	0.70	0.74
P02	0.37	0.14	0.00	0.00	0.23	62.92	62.92	0.0	100.0	0.0	0.49	0.52	0.57	0.68	0.72
P03	0.24	0.00	0.00	0.00	0.24	100.00	100.00	0.0	100.0	0.0	0.84	0.86	0.87	0.89	0.90

TIME OF CONCENTRATION
PROPOSED HYDROLOGY

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION
Project #: 122227-01
Date: 11-Oct-23
File: 122227_Proposed Hydrology.xlsx

Equation:
$t_i=0.395(1.1-C_5)L^{0.5}/S^{0.33}$
$V=C_V S_W^{0.5}$
$t_t=L_W/(60V)$

SURFACE TYPES

A=Forest with ground litter & meadow
B=Fallow or minimum tillage cultivation
C= Short grass pasture & lawns
D=Nearly bare ground
E=Grassed waterway
F=Paved area (sheet flow) & shallow gutter flow
G=Riprap (not buried)

Surface Type	Factor
A	2.50
B	5.00
C	7.00
D	10.00
E	15.00
F	20.00
G	6.50

SUB-BASIN DATA			INITIAL/OVERLAND FLOW TIME (t_i)				CHANNELIZED FLOW TIME (t_t)					T_C	T_C Check (Urban)		BASIN DEFINITION	FINAL
BASIN	C5	C5 INITIAL	AREA (AC)	LENGTH, L_i (FT)	SLOPE, S_i (%)	t_i (MIN)	LENGTH, L_W (FT)	SLOPE, S_W (%)	SURF. TYPE	VEL. (F/S)	t_t (MIN)	t_i+t_t (MIN)	$L_T = L_W$ (FT)	$L_T/180+10$ (MIN)	URBAN OR NON-URBAN	T_C (MIN)
P01	0.56	0.08	1.39	100	16.70	7.3	272	2.65	F	3.3	1.4	8.7	372.17	12.1	URBAN	8.7
P02	0.52	0.90	0.37	35	5.20	1.2	318	4.45	F	4.2	1.3	5.0	353.1	12.0	URBAN	5.0
P03	0.86	0.90	0.24	100	0.50	4.5	33	0.50	F	1.4	0.4	5.0	132.7	10.7	URBAN	5.0

STORM DRAINAGE SYSTEM DESIGN
PROPOSED HYDROLOGY
(RATIONAL METHOD PROCEDURE)
5-YEAR EVENT

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION
Project #: 122227-01
Date: 11-Oct-23
File: 122227_Proposed Hydrology.xlsx

Q=C*I*A

NETWORK CONNECTION	DIRECT RUNOFF								REMARKS
	AREA DESIG.	AREA (AC)	Open % Imp.	COEF.	tc (MIN)	C*A (AC)	I (IN/HR)	Q (CFS)	
	P01	1.39	66.86	0.56	8.7	0.77	4.34	3.4	
	P02	0.37	62.92	0.52	5.0	0.19	5.17	1.0	
	P03	0.24	100.00	0.86	5.0	0.21	5.17	1.1	

STORM DRAINAGE SYSTEM DESIGN
PROPOSED HYDROLOGY
(RATIONAL METHOD PROCEDURE)
100-YEAR EVENT

Project: LEWIS PALMER MIDDLE SCHOOL PARKING LOT EXPANSION
Project #: 122227-01
Date: 11-Oct-23
File: 122227_Proposed Hydrology.xlsx

Q=C*I*A

NETWORK CONNECTION	DIRECT RUNOFF								REMARKS
	AREA DESIG.	AREA (AC)	Open % Imp.	COEF.	tc (MIN)	C*A (AC)	I (IN/HR)	Q (CFS)	
	P01	1.39	66.86	0.74	8.7	1.03	7.29	7.5	
	P02	0.37	62.92	0.72	5.0	0.27	8.68	2.3	
	P03	0.24	100.00	0.90	5.0	0.22	8.68	1.9	

APPENDIX C –HYDRAULIC CALCULATIONS

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

Existing Conditions

INLET NAME	INLET1	Woodmoor
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	In Sump	On Grade
Inlet Type	Colorado Springs D-10-R	

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.9	1.0
Major Q_{Known} (cfs)	7.0	2.4

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for b

Receive Bypass Flow from:	User-Defined	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.5	0.0
Major Bypass Flow Received, Q_b (cfs)	1.2	0.0

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.4**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**8.2**	**2.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A
C_5	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A
Overland Flow Time, Ti	N/A	N/A
Channel Travel Time, Tt	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A
Regional T_c	N/A	N/A
Recommended T_c	N/A	N/A
T_c selected by User	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

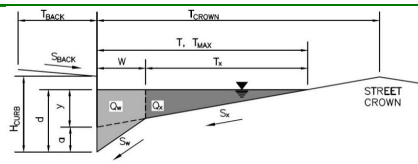
C	N/A	N/A
C_5	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A
Overland Flow Time, Ti	N/A	N/A
Channel Travel Time, Tt	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A
Regional T_c	N/A	N/A
Recommended T_c	N/A	N/A
T_c selected by User	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Lewis Palmer Middle School Parking Lot Expansion

Inlet ID: INLET1



Gutter Geometry:

Description	Symbol	Value	Unit
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.024	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	25.8	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0226	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.0666	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

Description	Symbol	Minor Storm	Major Storm	Unit
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	25.8	25.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.65	5.65	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

Description	Symbol	Minor Storm	Major Storm	Unit
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	7.00	7.00	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.6	1.6	inches
Gutter Depression ($d_C - (W * S_x * 12)$)	a =	1.06	1.06	inches
Water Depth at Gutter Flowline (y + a)	d =	8.05	8.05	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	23.8	23.8	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.214	0.214	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

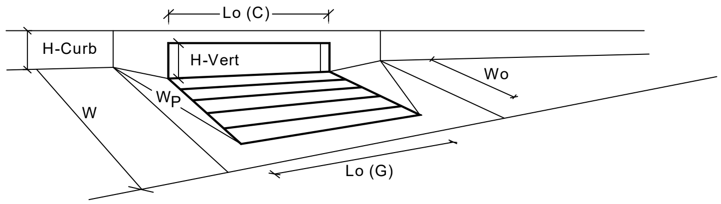
Maximum Capacity for 1/2 Street based on Allowable Depth

Description	Symbol	Minor Storm	Major Storm	Unit
Theoretical Water Spread	T_{TH} =	16.9	16.9	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	14.9	14.9	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.326	0.326	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section ($Q_d - Q_X$)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

Description	Symbol	Minor Storm	Major Storm	Unit
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



		MINOR	MAJOR	
Design Information (Input) — Colorado Springs D-10-R				
Type of Inlet	Type =	Colorado Springs D-10-R		
Warning 1 Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	6.00	6.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.7	5.7	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.34	0.34	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.91	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.2**	**8.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.4	8.2	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

Proposed Conditions

INLET NAME	INLET1	Woodmoor
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	In Sump	On Grade
Inlet Type	Colorado Springs D-10-R	

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.4	1.0
Major Q_{Known} (cfs)	7.5	2.3

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for b

Receive Bypass Flow from:	User-Defined	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.5	0.0
Major Bypass Flow Received, Q_b (cfs)	1.2	0.0

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.9**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**8.7**	**2.3**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A
C_5	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A
Overland Flow Time, Ti	N/A	N/A
Channel Travel Time, Tt	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A
Regional T_c	N/A	N/A
Recommended T_c	N/A	N/A
T_c selected by User	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

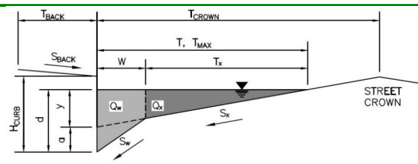
C	N/A	N/A
C_5	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A
Overland Flow Time, Ti	N/A	N/A
Channel Travel Time, Tt	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A
Regional T_c	N/A	N/A
Recommended T_c	N/A	N/A
T_c selected by User	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Lewis Palmer Middle School Parking Lot Expansion

Inlet ID: INLET1



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.024		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	25.8		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.0226		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.0666		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	25.8	25.8	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.77	5.77	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

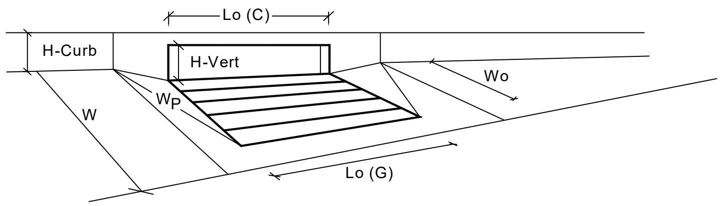
Maximum Capacity for 1/2 Street based On Allowable Spread		Minor Storm	Major Storm	
Water Depth without Gutter Depression ($T * S_x * 12$)	y =	7.00	7.00	inches
Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)	d_C =	1.6	1.6	inches
Gutter Depression (d_C - ($W * S_x * 12$))	a =	1.06	1.06	inches
Water Depth at Gutter Flowline (y + a)	d =	8.05	8.05	inches
Allowable Spread for Discharge outside the Gutter Section (T - W)	T_X =	23.8	23.8	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.214	0.214	
Discharge outside the Gutter Section, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_T - Q_X - Q_{BACK})	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.4	17.4	ft
Theoretical Spread for Discharge outside the Gutter Section (T - W)	$T_{X\,TH}$ =	15.4	15.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)	E_O =	0.318	0.318	
Theoretical Discharge outside the Gutter Section, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	SUMP	SUMP	cfs
Average Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Safety Factor for Minor/Major Storm depth reduction, d $\geq$ 6"	R =	SUMP	SUMP	
Max Flow based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLEE IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Warning 1 Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	6.00	6.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.8	5.8	inches
Grate Information			MINOR	MAJOR	Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.35	0.35	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.92	0.92	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**8.7**	**8.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	3.9	8.7	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

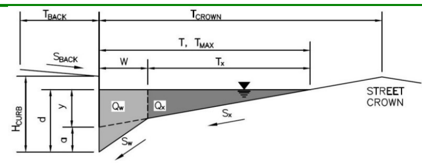
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Lewis Palmer Middle School Parking Lot Expansion

Inlet ID: Woodmoor



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =			ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =			ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =			
Height of Curb at Gutter Flow Line	H_{CURB} =	7.32		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	28.0		ft
Gutter Width	W =	2.08		ft
Street Transverse Slope	S_X =	0.051		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.052		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.042		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	28.0	28.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.1	4.1	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**7.8**	**7.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.00 cfs on sheet 'Inlet Management'

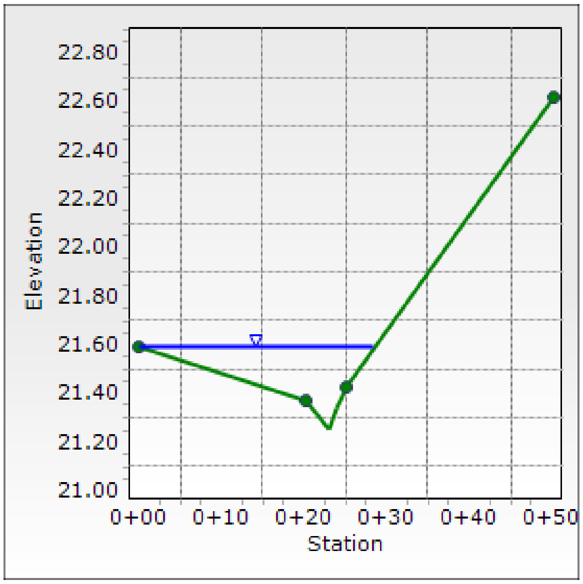
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.30 cfs on sheet 'Inlet Management'

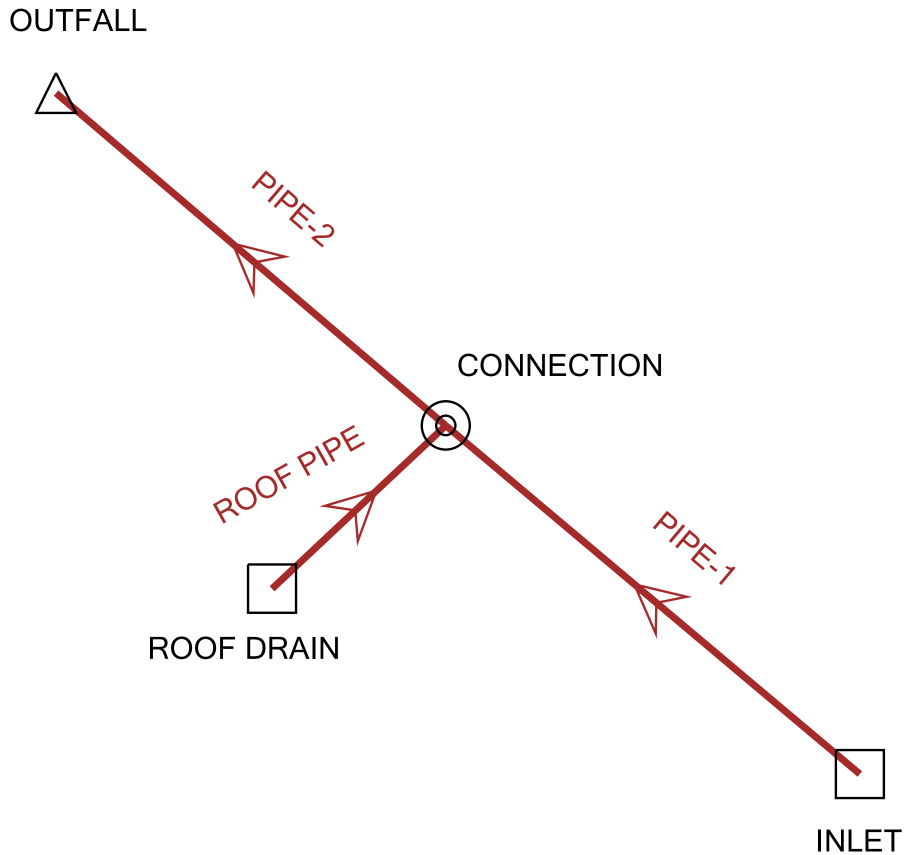
Cross Section for Cross Section at Woodmoor Dr Parking Lot Entrance

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

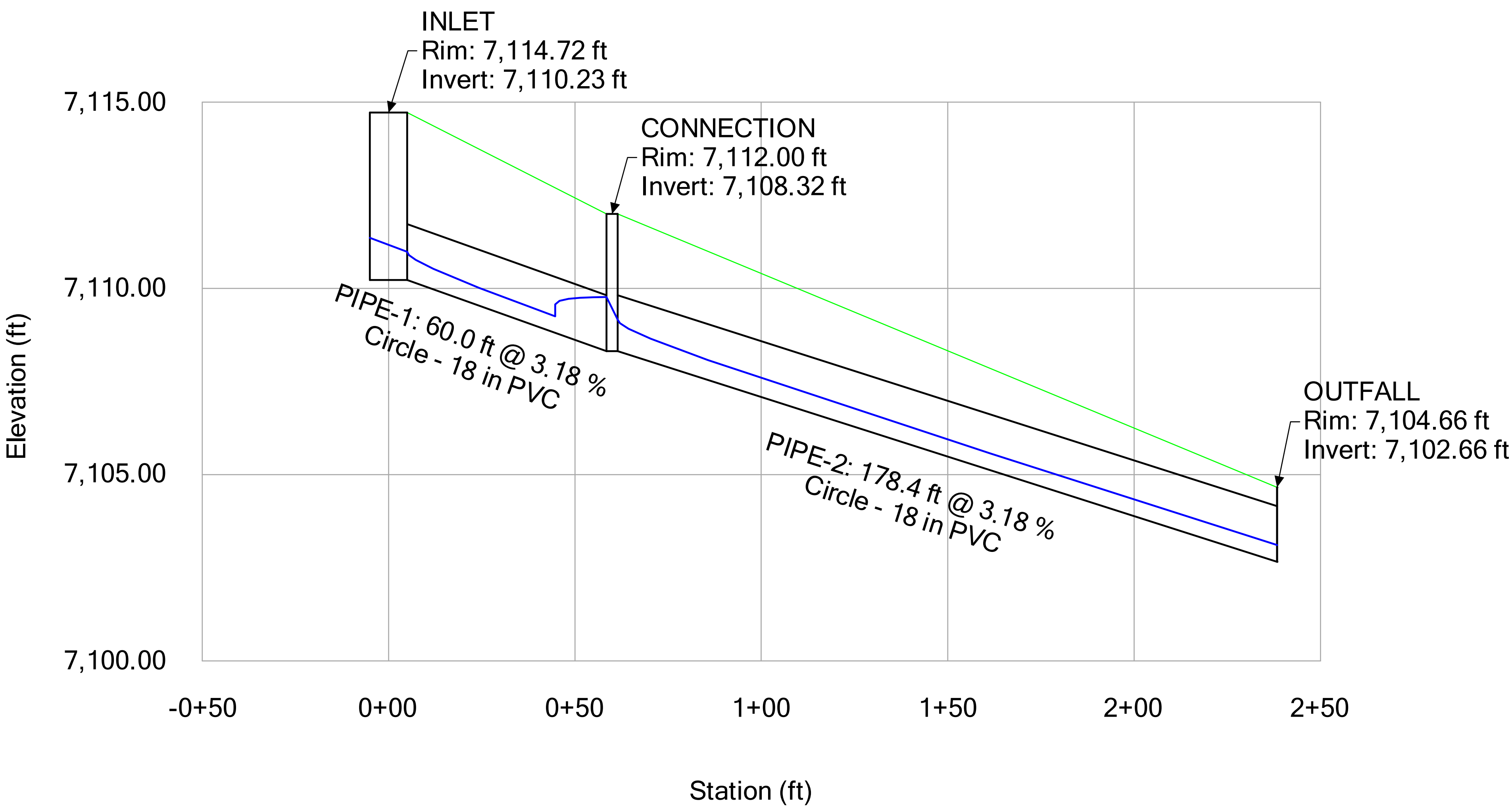
Input Data	
Channel Slope	4.20 %
Normal Depth	4.1 in
Discharge	18.95 cfs

Cross section represents maximum flow conveyed by section at center of parking lot entrance. Split flow is anticipated north of this location.




OUTFALL
PIPE-2
CONNECTION
ROOF PIPE
PIPE-1
ROOF DRAIN
INLET

Profile Report
Engineering Profile - Existing System (122227_HYDR_Existing Pipe Network Model.stsw)



Scenario: 5-YR Proposed
Current Time Step: 0.0 h
FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Headloss Method	Headloss Coefficient (Standard)	External CA (acres)	External Tc (min)	Flow (Total Out) (cfs)
INLET	7,114.72	7,110.23	Standard	1.25	0.89	8.7	3.9
ROOF DRAIN	7,115.57	7,110.57	Standard	1.25	0.21	5.0	1.1

S:\122227-01 Lewis Palmer Middle School\04_CIVIL\CADD\Hydraulics\Program-Data\SewerGEMs\122227_HYDR_Existing Pipe Network Model.stsw

Scenario: 5-YR Proposed
Current Time Step: 0.000 h
FlexTable: Conduit Table

Label	Section Type	Diameter (in)	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Manning's n	Flow (cfs)	Velocity (ft/s)
PIPE-1	Circle	18	7,110.23	7,108.32	60.0	3.18	7,110.98	7,109.77	0.010	3.89	10.09
PIPE-2	Circle	18	7,108.32	7,102.66	178.4	3.18	7,109.17	7,103.11	0.010	4.79	10.70
ROOF PIPE	Circle	10	7,110.57	7,108.32	25.0	8.98	7,111.04	7,109.77	0.010	1.09	10.75

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Scenario: 5-YR Proposed
Current Time Step: 0.0 h
FlexTable: Outfall Table

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
OUTFALL	7,104.66	7,102.66	Free Outfall	7,103.11	4.7

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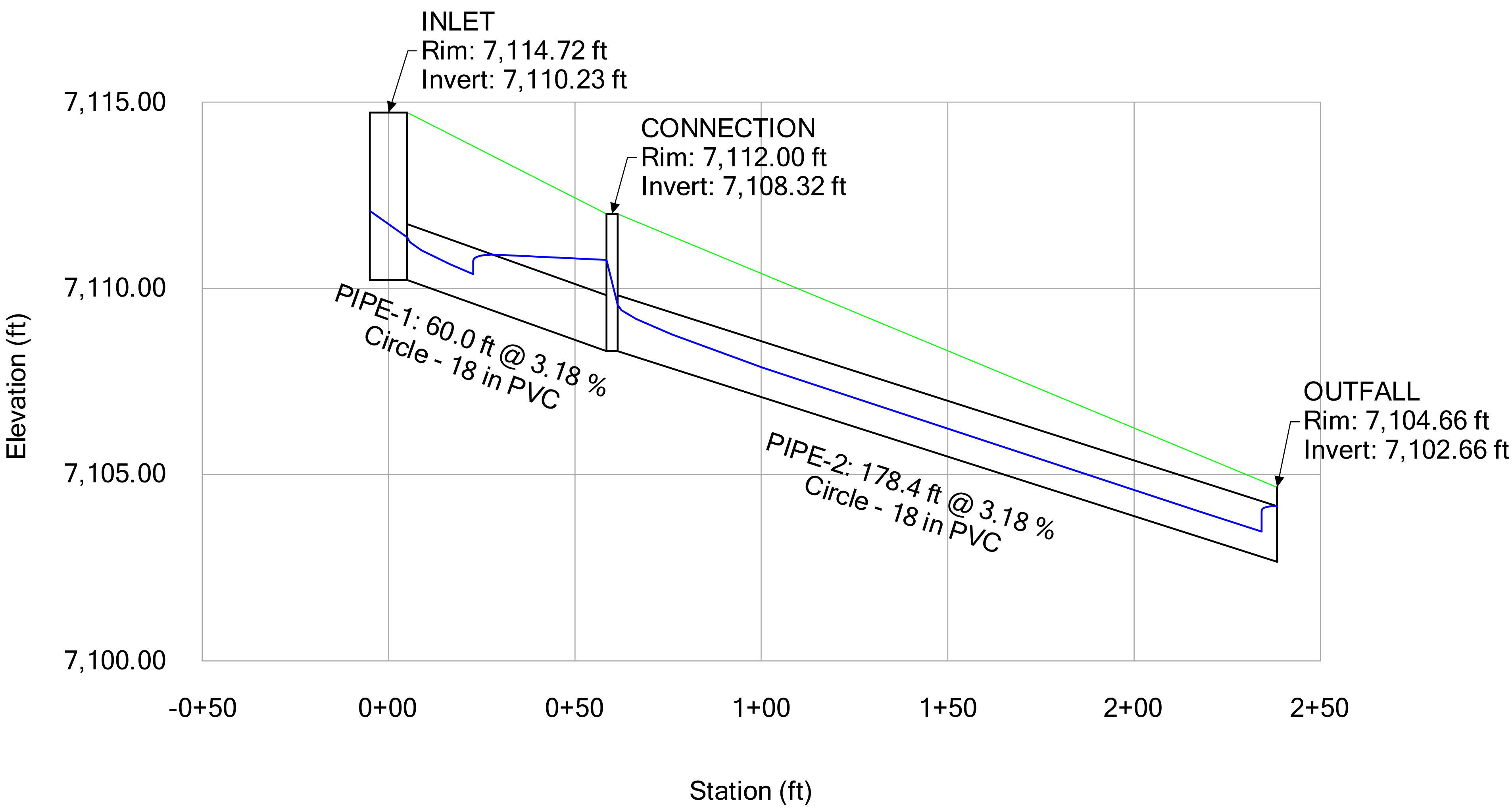
Profile Report

Engineering Profile - Existing System (122227_HYDR_Existing Pipe Network Model.stsw)



Scenario: 100-YR Proposed
Current Time Step: 0.0 h
FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Headloss Method	Headloss Coefficient (Standard)	External CA (acres)	External Tc (min)	Flow (Total Out) (cfs)
INLET	7,114.72	7,110.23	Standard	1.25	1.19	8.7	8.7
ROOF DRAIN	7,115.57	7,110.57	Standard	1.25	0.22	5.0	1.9

S:\122227-01 Lewis Palmer Middle School\04_CIVIL\CADD\Hydraulics\Program-Data\SewerGEMs\122227_HYDR_Existing Pipe Network Model.stsw

Scenario: 100-YR Proposed
Current Time Step: 0.000 h
FlexTable: Conduit Table

Label	Section Type	Diameter (in)	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Manning's n	Flow (cfs)	Velocity (ft/s)
PIPE-1	Circle	18	7,110.23	7,108.32	60.0	3.18	7,111.37	7,110.77	0.010	8.74	12.63
PIPE-2	Circle	18	7,108.32	7,102.66	178.4	3.18	7,109.56	7,104.16	0.010	10.32	13.20
ROOF PIPE	Circle	10	7,110.57	7,108.32	25.0	8.98	7,111.19	7,110.77	0.010	1.92	12.65

S:\122227-01 Lewis Palmer Middle School\04_CIVIL\CADD\Hydraulics\Program-Data\SewerGEMs\122227_HYDR_Existing Pipe Network Model.stsw

Scenario: 100-YR Proposed
Current Time Step: 0.0 h
FlexTable: Outfall Table

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
OUTFALL	7,104.66	7,102.66	Crown	7,104.16	10.2

S:\122227-01 Lewis Palmer Middle School\04_CIVIL\CADD\Hydraulics\Program-Data\SewerGEMs\122227_HYDR_Existing Pipe Network Model.stsw

APPENDIX D – SOIL SURVEY

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Paso County Area, Colorado

August 29, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:963 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 10, 20, 40, 60

Feet: 0, 45, 90, 180, 270

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

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: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71	Pring coarse sandy loam, 3 to 8 percent slopes	1.6	100.0%
Totals for Area of Interest		**1.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

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APPENDIX E – FEMA FIRM PANEL

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

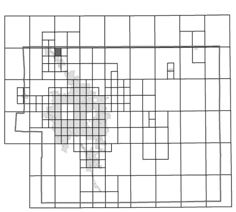
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

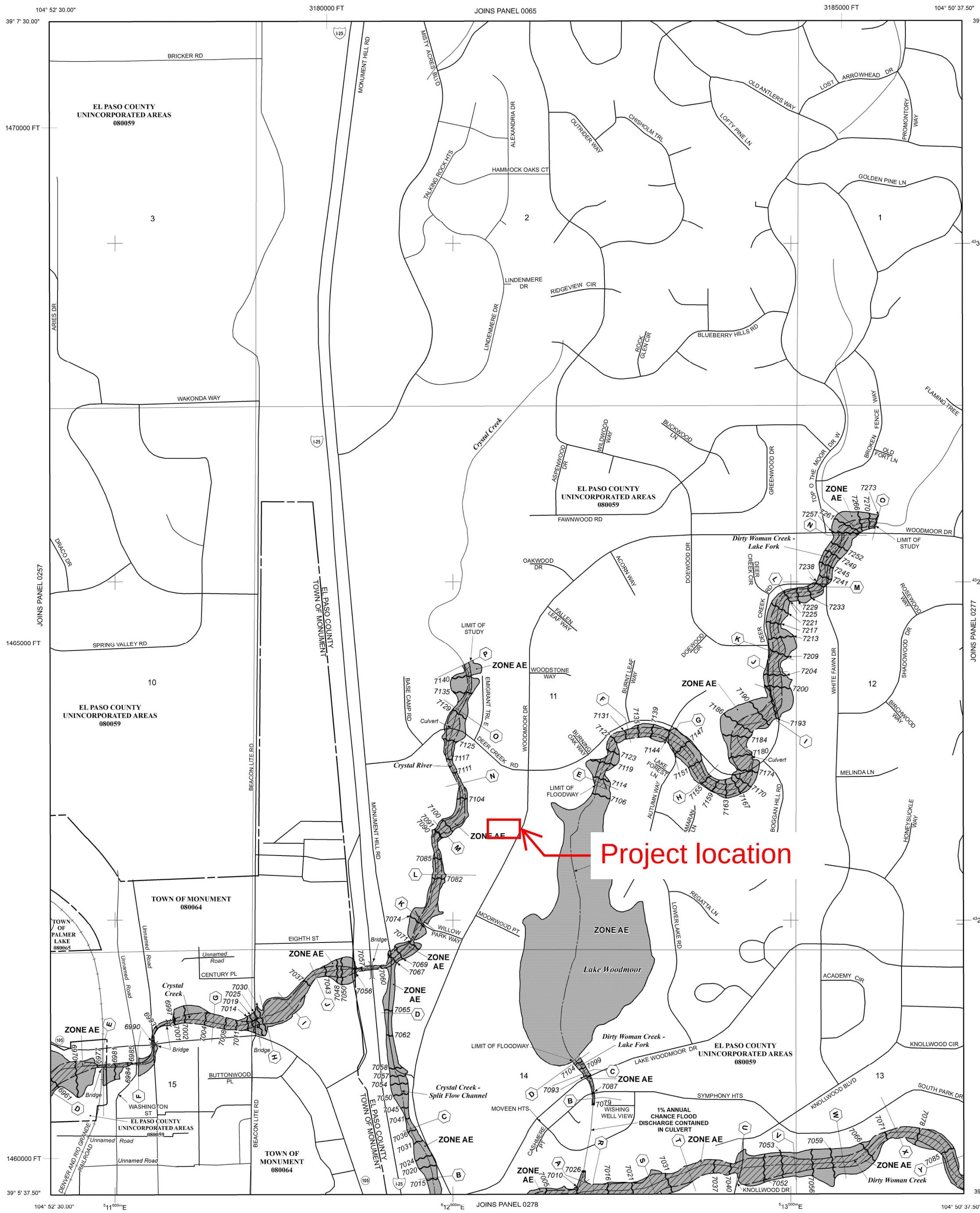
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)———(A)	Cross section line
(23)--------(23)	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0276G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 276 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0276	G
MONUMENT, TOWN OF	080064	0276	G
PALMER LAKE, TOWN OF	080065	0276	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

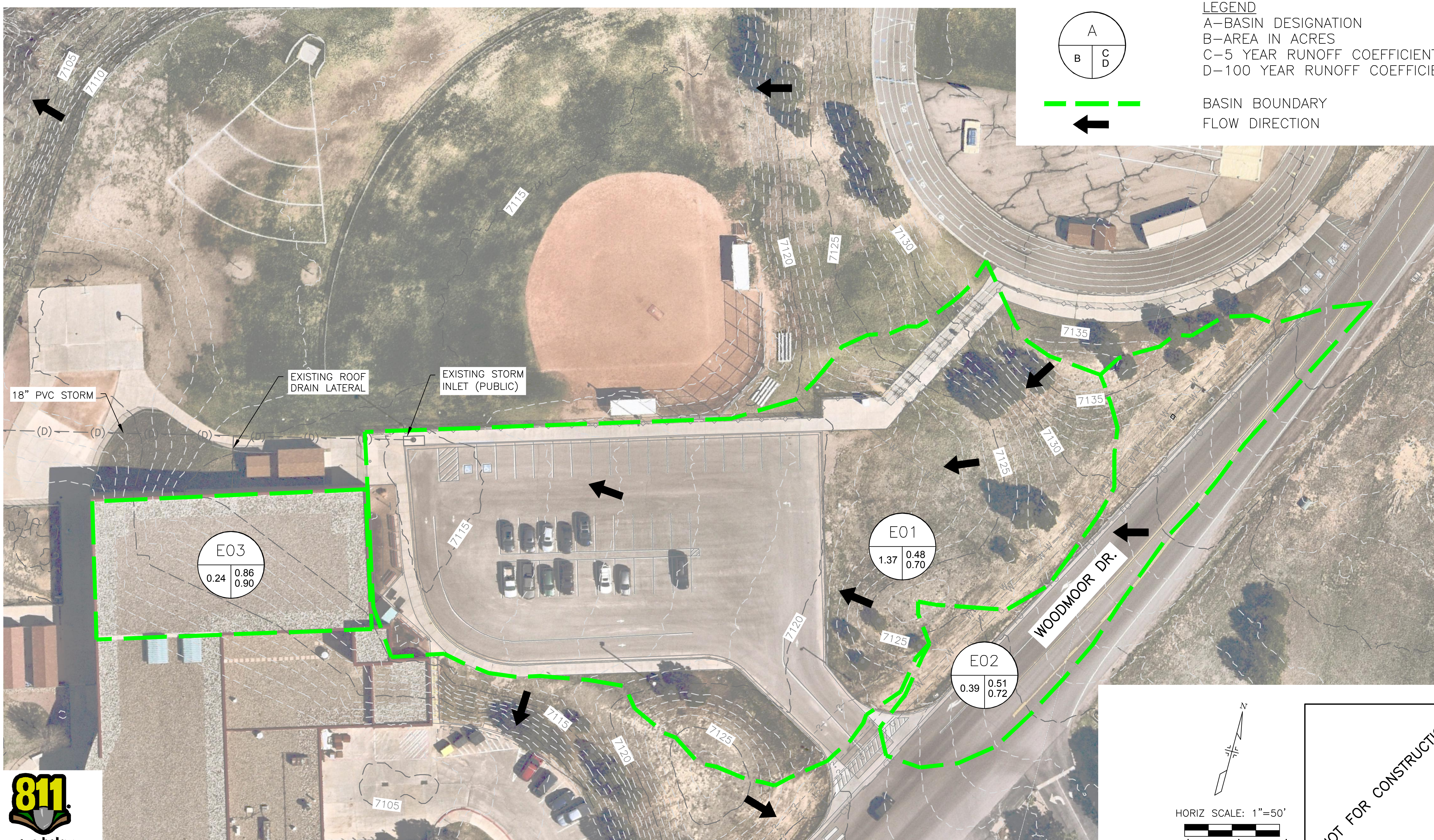
Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0276G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

APPENDIX F – DRAINAGE MAPS



Print Date: 10/12/2023

File Name: 122227-01_Existing Basin Maps.dwg

Horizontal Scale: 1" = 50' Vertical Scale: N/A

FELSBURG HOLT & ULLEVIG

3 South Tejon Street, Suite 300
Colorado Springs, CO 80903
Phone: 719.314.1800
www.FHUENG.com

R-X

Sheet Revisions

Date	Comments	Initials

LEWIS-PALMER SCHOOL DISTRICT 38

As Constructed

No Revisions:

Revised:

Void:

LEWIS–PALMER MIDDLE SCHOOL
EXISTING BASIN MAP

Designer: KPK

Detailer: DCB

Subset: DRAINAGE

Structure Numbers

Sheets: EBM–01

Project No./Code: 122227–01

Sheet Number

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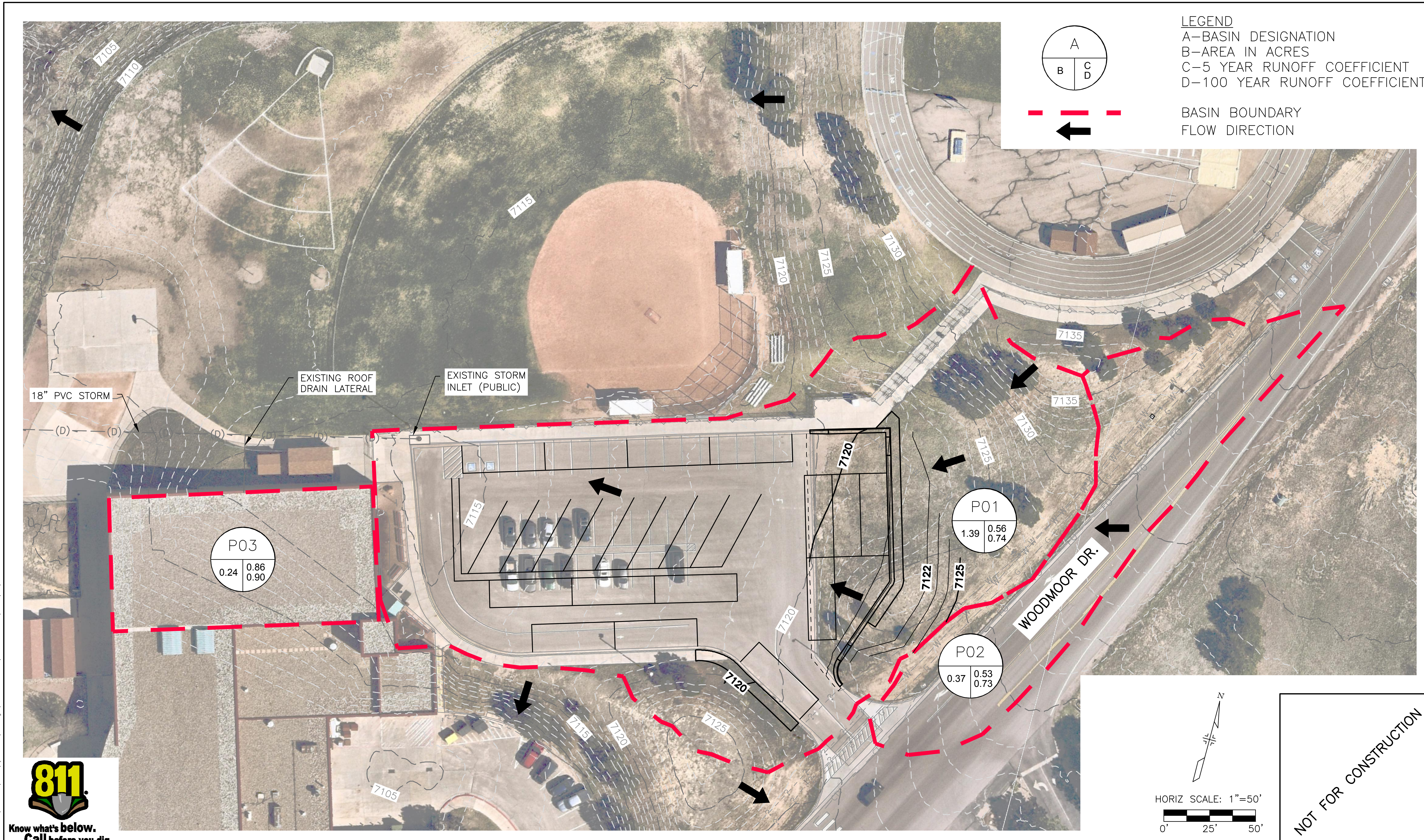

Print Date: 10/12/2023
File Name: 122227-01_Proposed Basin Maps.dwg
Horizontal Scale: 1" = 50' Vertical Scale: N/A

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Sheet Revisions

(R–X)	Date	Comments	Initials

As Constructed
No Revisions:
Revised:
Void:

LEWIS–PALMER MIDDLE SCHOOL
PROPOSED BASIN MAP

Designer:	KPK	Structure Numbers	
Detailer:	DCB		
Subset:	DRAINAGE	Sheets:	PBM–01

Project No./Code
122227-01
Sheet Number

S:\122227-01 Lewis Palmer Middle School\04_CIVIL\CADD\Hydraulics\Drawings\122227-01_Proposed Basin Maps, 10/12/2023 11:06:53 AM, Jordan Martin