

Final Drainage Report

El Paso County

Package 2 - Pedestrian Crossings Project

El Paso County

October 30, 2025



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 report has been prepared according to the criteria established by the City/County for drainage reports and said report is in conformity with the 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.

Registered Professional Engineer
State of Colorado
No.



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.

County Engineer

Date

Conditions:

Contents

Introduction	1
Purpose	1
General Location	1
Drainage Design Criteria	3
Hydrologic Criteria	3
Hydraulic Criteria	4
Water Quality Criteria	4
Floodplain	5
Roadway Drainage Analysis	5
Project Description	5
Sub- Basin Delineation	5
Drainage Basin Descriptions	5
Basin 9 - Palmer Park Blvd at Winnebago Road	6
Basin 10 - Security Blvd at Willis Drive	6
Basin 13 - Main Street at Leta Drive	7
Basin 18 - Palmer Park Blvd at Peterson Road	8
Basin 19 - Peterson Road at Piros Drive	9
Intersection Analysis	10
Proposed Conditions Results	11
Conclusion	13
References	14
Appendices	15
Appendix A: Drainage Basin Maps	16
Appendix B: Soil Survey	17
Appendix C: Precipitation Information	18
Appendix D: Rational Method Calculations	19
Appendix E: Hydraulic Results	20

Introduction

Purpose

The purpose of the overall project is to improve pedestrian safety for 24 intersections throughout El Paso County (county) and includes updates to sidewalks and crosswalks. This report focuses on Package 2 the intersections where drainage patterns will be changed due to bump outs, raised cross walks, addition of curb and gutter, etc. The analysis for these intersections checks whether proposed design still meets county criteria or if further changes need to be made.

General Location

The project locations included in the Package 2 analysis are:

- Palmer Park Blvd at Winnebago Road (Basin 9)
- Security Blvd at Willis Drive (Basin 10)
- Main Street at Norman Drive (Basin 12)
- Main Street at Leta Drive (Basin 13)
- Palmer Park Blvd at Peterson Road (Basin 18)
- Peterson Road at Piros Drive (Basin 19)
- Main Street at Marquette Drive (Basin 21)

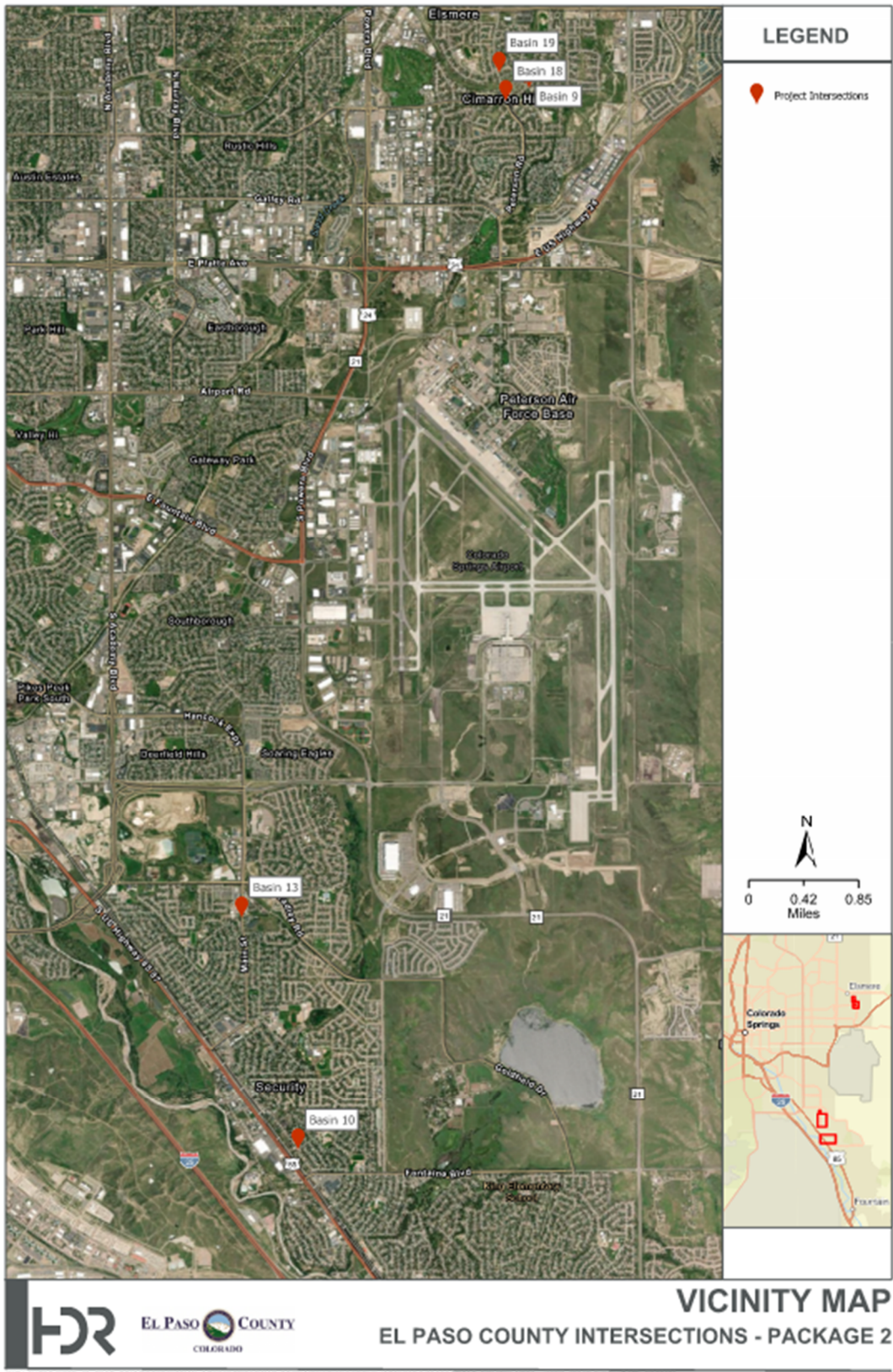


Figure 1: Vicinity Map

Drainage Design Criteria

Pedestrian improvements resulting in potential changes to existing flow patterns for this project will be analyzed against and designed to meet criteria from the El Paso County (EPC) Drainage Criteria Manual (DCM) and Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM). The references used for the on-site drainage, off-site drainage, and water quality are listed below.

- Drainage Criteria Manual, Volume I and Volume II, El Paso County, October 31, 2018.
- Urban Storm Drainage Criteria Manual Volume 2, revised January 2016 and Volume 3, March 2024.
- Drainage Criteria Manual, Volume II, City of Colorado Springs, December 2020.

Hydrologic Criteria

Hydrology will be developed at each site using the rational method. This method is accepted by El Paso County for sites less than 100 acres (Section 5.1 EPC-DCM). Soil information will be obtained from the National Resource Conservation Service (NRCS) Websoil Survey. Rainfall data will be determined by using NOAA Atlas-14 since it is more recent than the Intensity-Frequency Curves (Figure 5-1 EPC-DCM). Hydrologic criteria has been summarized below in Table 6-2.

Table 1: Hydrologic Criteria Summary Table

Hydrology	El Paso County Drainage Criteria Manual
Acceptable Methods	Rational Method for Basins <100acres
Precipitation Data	NOAA Atlas-14
Design Storms	Major: 100-Year Minor: 10-Year
C-Value	Table 5-1

Hydraulic Criteria

A summary of the hydraulic criteria in accordance with the EPC DCM has been outlined below in Table 6-1.

TABLE 2: HYDRAULIC CRITERIA SUMMARY TABLE

Roadway Classification	El Paso County Drainage Criteria Manual
Arterial	Minor: No curb overtopping. Flow may encroach only onto one outside lane in each direction and must leave at least one 12-foot lane free of water in each direction. Major: The depth of water shall not exceed 8 inches at the gutter flow line with no curb overtopping. Residential dwellings, public, commercial, or industrial shall not be inundated at the ground line. (Ch.6, Table 6-1)
Residential/Local	Minor: Minor: No curb overtopping, flow may spread to crown of street or top of curb (whichever is most limiting) Major: Depth of water at gutter flow line shall not exceed 12". Residential dwellings, public, commercial, or industrial shall not be inundated at the ground line. (Ch.6, Table 6-1)
Collector or Minor Arterial	Minor: No curb overtopping. Flow spread must be limited to a maximum 20 foot spread from each curb face. Major: Depth of water at gutter flow line shall not exceed 12". Residential dwellings, public, commercial, or industrial shall not be inundated at the ground line. (Ch.6, Table 6-1)

Water Quality Criteria

Water quality treatment is not anticipated to be needed due to the following exemptions, according to El Paso County Engineering Criteria Manual Appendix I.7. Post-Construction Stormwater Management:

- Each intersection site will involve well below the 1 acre of soil disturbance that is the threshold for water quality treatment. Furthermore, each site is greater than a quarter mile away from each other such that they will not constitute as a larger common plan of development (LCPD) (ie: their respective disturbances would not be additive towards the 1 acre threshold).

Location	Total Proposed Disturbed Area (ac)	Disturbed Area Excluded from WQ per ECM App I.7.1.B.# (ac)	Non-Excluded Disturbances (ac)	Applicable WQ Exclusions (App I.7.1.B.#)	Distance from Nearest Intersection Included with this Project (mi)	Notes
Palmer Park Boulevard at Winnebago Road*	0.059	.059	0.00	3,2	0.13	<0.25 miles from a Package 2 Project
Security Boulevard at Willis Drive	0.110	0.109	0.001	3,2	0.53	
Main Street at Norman Drive	0.211	0.211	0.00	3,2	0.21	<0.25 miles from a Package 1 Project
Main Street at Leta Drive	0.334	0.333	0.001	3,2	0.51	
Palmer Park Boulevard at Peterson Road *	0.046	0.047	0.001	3,2	0.13	<0.25 miles from a Package 2 Project
Peterson Road at Piro Drive*	0.094	0.094	0.00	3,2	0.19	<0.25 miles from a Package 2 Project
Main Street at Marquette Drive	0.049	0.049	0.00	3,2	0.21	<0.25 miles from a Package 1 Project

*These locations are all within ¼ mile of each other, however the sum of all three disturbances are less than one acre

Furthermore, each site is applicable to the following PCM exclusions:

- Site adds less than 1 acre of paved area per mile
- Site adds 8.35 ft or less of paved width at any location throughout the project
- Project increases the width of the existing roadway by less than two times the existing width

In the case that the soil disturbance at a site or sites part of a LCPD exceeds 1 acre and no PCM exclusions apply then none of these exemptions apply at a location, post-construction stormwater management may be required per the El Paso County Post Construction Stormwater Management Applicability Evaluation Form.

Erosion and Stormwater Quality Control Permit (ESQCP) will not be necessary due to disturbance being less than one acre.

Floodplain

Each site will be compared with Flood Insurance Rate Maps found in the FEMA Flood Map Service Center to ensure floodplains are noted and considered in design. No Floodplain impacts are anticipated with this project.

Roadway Drainage Analysis

Project Description

The project consists of various sites located throughout El Paso County. The project scope focuses on pedestrian safety improvements for multiple intersections throughout the county. This analysis focuses on how the pedestrian safety improvements affect drainage patterns and examines whether spread and/or depth have improved or worsened. This project will not address existing drainage issues, but checks that conditions are not worsened.

Sub- Basin Delineation

The sub-basins for project were delineated using El Palso County LiDAR set to a horizontal projection of NAD (1983 2011) State Plane Colorado Central FIPS 0502 Ft US and vertical projection of North American Datum 1988.

Drainage Basin Descriptions

The 10-Year and 100-Year peak discharge events (Minor and Major storm events) were analyzed for each intersection where the proposed designed reduced the travel width of the existing roadway. It is assumed that the longitudinal slope, transverse slope, and gutter pan are the same the existing and proposed conditions with the only alteration coming from a bump out in the sidewalk curb thus reducing the travel lane width.

Basin 9 - Palmer Park Blvd at Winnebago Road

This intersection includes the following basins:

- 9a
 - Subbasin 9a was delineated to examine potential effects of the proposed median. Flow drains to the south curb on Park Blvd at the mid-block crossing near Winnebago Rd and made up primarily of residential homes. The basin slope is approximately 2.7% with an approximate width of 85 feet and length of 1000 feet. The soil type in this subbasin is hydrologic soil group A.
- 9b
 - Subbasin 9a was delineated to examine potential effects of the proposed median. Flow drains to the north curb on Park Blvd at the mid-block crossing near Winnebago Rd and made up primarily of residential homes. The basin slope is approximately 2.1% with an approximate width of 625 feet and length of 875 feet. The soil type in this subbasin is hydrologic soil group A.

Basin 10 - Security Blvd at Willis Drive

This intersection includes the following basins:

- 10a
 - Subbasin 10a drains along the southeast bound lane to the south side of the pinch point at Security Blvd at Willis Drive and made up primarily of residential homes. The basin slope is approximately 0.6% with an approximate width of 120 feet and length of 700 feet. The soil type in this subbasin is hydrologic soil group C.
- 10b
 - Subbasin 10b drains through the northwest bound lane to the north corner of Security Blvd at Willis Drive and made up primarily of residential homes. The basin slope is approximately 0.6% with an approximate width of 450 feet and length of 1875 feet. The soil type in this subbasin is hydrologic soil group A.
- 10c
 - Subbasin 10c drains through the north west lane to the east corner of Security Blvd at Willis Drive and made up primarily of residential homes. The basin slope is approximately 2.3% with an approximate width of 2425 feet and length of 1820 feet. The soil type in this subbasin is hydrologic soil group A.
- 10d
 - Subbasin 10d drains in the southwest lane to the northeast corner of Security Blvd at Willis Drive and made up primarily of residential homes. The basin slope is approximately 2% with an approximate width of 1490 feet and length of 2045 feet. The soil type in this subbasin is hydrologic soil group A.

Basin 12 - Main Street at Norman Drive

This intersection includes the following basins:

- 12a
 - Subbasin 12a drains to the northwest corner in the southbound lane on Main Street at Norman Drive and made up primarily of residential homes. The basin slope is approximately 2.4% with an approximate width of 218 feet and length of 2825 feet. The soil type in this subbasin is hydrologic soil group A.
- 12d
 - Subbasin 12d drains to the northeast corner in the northbound lane on Main Street at Norman Drive and made up primarily of residential homes. The basin slope is approximately 1.8% with an approximate width of 1000 feet and length of 3425 feet. The soil type in this subbasin is hydrologic soil group A.
- 12e
 - Subbasin 12e drains to the northeast corner in the westbound lane on Main Street at Norman Drive and made up primarily of residential homes. The basin slope is approximately 2.4% with an approximate width of 250 feet and length of 900 feet. The soil type in this subbasin is hydrologic soil group A.

Basin 13 - Main Street at Leta Drive

This intersection includes the following basins:

- 13a
 - Subbasin 13a drains to the northeast corner, in the northbound lane of Main Street at Leta Drive and made up primarily of paved streets. The basin slope is approximately 1.7% with an approximate width of 195 feet and length of 290 feet. The soil type in this subbasin is hydrologic soil group A.
- 13b
 - Subbasin 13b drains to the southwest corner of Main Street at Leta Drive and made up primarily of residential homes. The basin slope is approximately 2% with an approximate width of 55 feet and length of 300 feet. The soil type in this subbasin is hydrologic soil group A.
- 13c
 - Subbasin 13c drains to the southeast corner, in the northbound lane of Main Street at Leta Drive and made up primarily of paved streets. The basin slope is approximately 4% with an approximate width of 40 feet and length of 250 feet. The soil type in this subbasin is hydrologic soil group A.
- 13d
 - Subbasin 13d drains to the southeast corner in the eastbound lane of Main Street at Leta Drive and made up primarily of paved streets. The basin slope is approximately 2.8% with an approximate width of 60 feet and length of 200 feet. The soil type in this subbasin is hydrologic soil group A.

Basin 18 - Palmer Park Blvd at Peterson Road

This intersection includes the following basins:

- 18a
 - Subbasin 18a was delineated to examine potential effects of the proposed median. Flow drains to the northwest corner in the southbound lane of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.8% with an approximate width of 60 feet and length of 490 feet. The soil type in this subbasin is hydrologic soil group A.
- 18b
 - Subbasin 18b was delineated to examine potential effects of the proposed median. Flow drains in the northbound lane to the northeast corner of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.8% with an approximate width of 50 feet and length of 500 feet. The soil type in this subbasin is hydrologic soil group A.
- 18c
 - Subbasin 18c was delineated to examine potential effects of the proposed median. Flow drains to the westbound lane toward the northwest corner of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.7% with an approximate width of 70 feet and length of 315 feet. The soil type in this subbasin is hydrologic soil group A.
- 18d
 - Subbasin 18d was delineated to examine potential effects of the proposed median. Flow drains to the southwest corner of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.6% with an approximate width of 70 feet and length of 60 feet. The soil type in this subbasin is hydrologic soil group A.
- 18e
 - Subbasin 18e was delineated to examine potential effects of the proposed median. Flow drains to the northeast corner of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.9% with an approximate width of 25 feet and length of 90 feet. The soil type in this subbasin is hydrologic soil group A.
- 18f
 - Subbasin 18f was delineated to examine potential effects of the proposed median. Flow drains to the northeast corner of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.8% with an approximate width of 50 feet and length of 540 feet. The soil type in this subbasin is hydrologic soil group A.
- 18g
 - Subbasin 18g was delineated to examine potential effects of the proposed median. Flow drains to the southwest corner of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.6%

with an approximate width of 30 feet and length of 100 feet. The soil type in this subbasin is hydrologic soil group A.

- 18h
 - Subbasin 18h was delineated to examine potential effects of the proposed median. Flow drains to the southeast corner of Palmer Park Blvd at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 0.9% with an approximate width of 40 feet and length of 110 feet. The soil type in this subbasin is hydrologic soil group A.

Basin 19 - Peterson Road at Piros Drive

This intersection includes the following basins:

- 19a
 - Subbasin 19a was delineated to examine potential effects of the proposed median. Flow drains to the northeast corner of Piros Dr at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 2.6% with an approximate width of 25 feet and length of 1275 feet. The soil type in this subbasin is hydrologic soil group A.
- 19b
 - Subbasin 19b was delineated to examine potential effects of the proposed median. Flow drains to the southeast corner of Piros Dr at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 2.6% with an approximate width of 25 feet and length of 1360 feet. The soil type in this subbasin is hydrologic soil group A.
- 19c
 - Subbasin 19c was delineated to examine potential effects of the proposed median. Flow drains to the northeast corner of Piros Dr at Peterson Rd and made up primarily of paved streets. The basin slope is approximately 3% with an approximate width of 70 feet and length of 120 feet. The soil type in this subbasin is hydrologic soil group A.

Basin 21 - Main Street at Marquette Drive

This intersection includes the following basins:

- 21a
 - Subbasin 21a was delineated to examine potential effects of the proposed bump out. Flow drains in the southwest bound lane to the crosswalk on Main Street near Marquette Drive and made up primarily of residential homes. The basin slope is approximately 1.0% with an approximate width of 375 feet and length of 470 feet. The soil type in this subbasin is hydrologic soil group A and group B.

Intersection Analysis

Proposed pedestrian improvements were analyzed at locations where bump outs and/or medians resulted in reduction of roadway width. The proposed design's spread and depth results were initially checked against El Paso County Criteria using Bentley FlowMaster by modeling a standard gutter channel. Spread was measured from the edge of pavement to the crown and depth was measured at the gutter flowline.

For proposed design, curb and gutter dimensions were assumed to be Type A standard dimensions from El Paso County's Roadway Criteria.

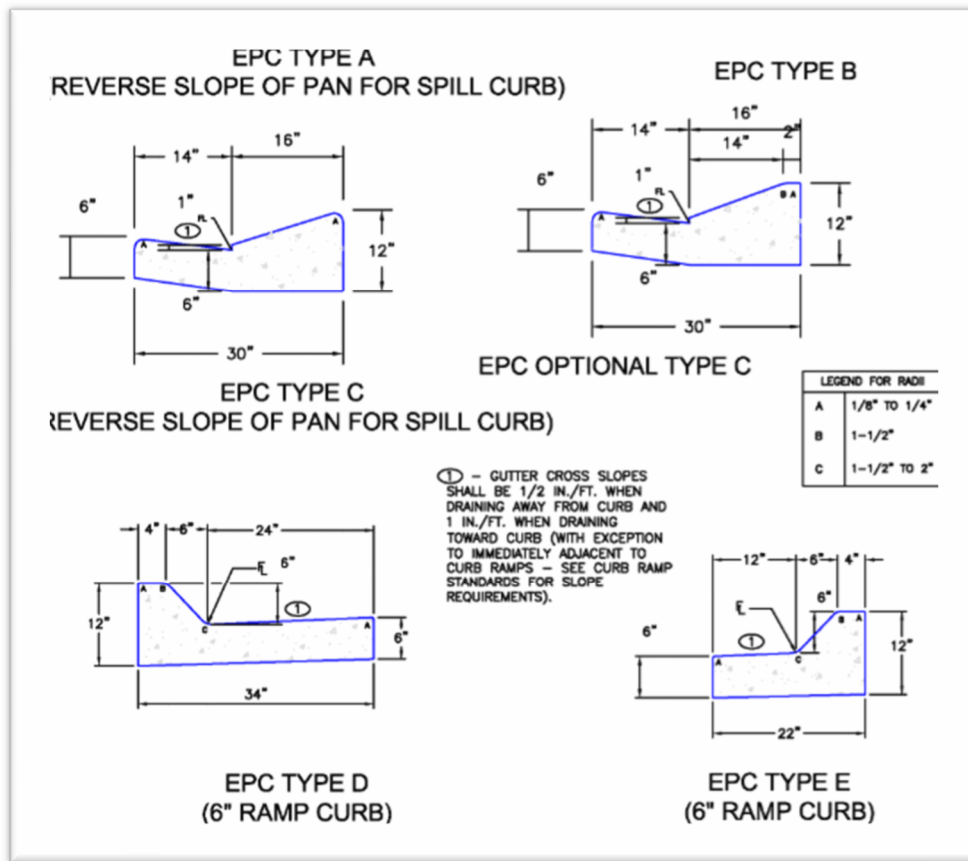


Figure 2: Standard El Paso County Curb and Gutter

Any locations where the proposed spread and depth met the criteria were considered acceptable. In situations where the criteria was not met, a secondary analysis that utilized a more detailed model of the roadway cross section was created in FlowMaster to verify the initial result and to compare the existing conditions versus proposed conditions. The results evaluated whether the proposed design improved or worsened the spread and depth or if conditions remained the same.

Proposed Conditions Results

24 design points over 7 intersections were examined where spread and depth were analyzed and checked against El Paso County’s Drainage Criteria. A detailed analysis of all design points can be seen in Appendix D and Appendix E.

In the minor, 10-year storm event, 5 design points did not pass the initial curb and gutter analysis and were further evaluated in more detail. In the major, 100-year storm event, 4 design points did not pass the initial curb and gutter analysis and were further evaluated in more detail. Spread and Depth results for the secondary analysis can be found in Tables 3 through 6 below.

Once the proposed design for these design points were modeled in more detail, they were compared to the existing conditions. Some results show that spread and depth do not meet criteria, however they do show either improved conditions or conditions that remained the same, therefore the results are acceptable. Two results from the 100-year storm analysis at design points 10c and 12d show slightly worsened conditions, however the change is less than 1 inch and therefore can be considered negligible.

TABLE 3: 10-YEAR SPREAD RESULTS FOR PROPOSED LOCATIONS NOT MEETING CRITERIA STANDARDS

Intersection and Proposed Structure	Basin ID	Discharge (cfs)	Existing Distance from Edge of Road to Crown (ft)	Existing Spread (ft)	Proposed Distance from Edge of Road to Crown (ft)	Proposed Spread (ft)	Spread Criteria Overage (ft)	Street Type and Spread Criteria
Palmer Park Boulevard at Winnebago Rd Median	9b	18.3	30.4	10.5	27.85	10.5	No	Arterial Must leave one Max 18.4’
Security Blvd at Willis Drive Bump out	10b	17.2	18.7	11.2	18.6	9.0	No	Collector or Minor Arterial Max 20’
Security Blvd at Willis Drive Median	10c	136.5	18.5	18.5	15	15.3	No*	Collector or Minor Arterial Max 20’
Security Blvd at Willis Drive Bump out	10d	46.8	18.5	18.5	13.6	15.3	No*	Collector or Minor Arterial Max 20’
Main Street at Norman Drive Median	12a	16.9	30.4	18.3	28.0	17.8	No	Collector or Minor Arterial Max 20’ spread
Main Street at Norman Drive Median	12d	199.1	32.0	32.0	28.0	28.0	Yes**	Collector or Minor Arterial Max 20’ spread

* Spread exceeds criteria, but matches or improves existing conditions.

+ Spread overtops crown

TABLE 4: 10-YEAR DEPTH RESULTS FOR PROPOSED LOCATIONS NOT MEETING CRITERIA STANDARDS

Intersection and Proposed Structure	Basin ID	Discharge (cfs)	Existing Depth at Flowline (in)	Proposed Depth at Flowline (in)	Depth Criteria Overage (in)	Street Type and Depth Criteria
Palmer Park Boulevard at Winnebago Rd Median	9b	18.3	10.3	10.3	Yes**	Arterial Max 6" depth
Security Blvd at Willis Drive Median	10b	17.2	4.5	4.3	No	Collector or Minor Arterial Max 6" depth
Security Blvd at Willis Drive Median	10c	136.5	9.9	9.9	Yes**	Collector or Minor Arterial Max 6" depth
Security Blvd at Willis Drive Bump out	10d	46.8	4.3	4.4	No	Collector or Minor Arterial Max 6" depth
Main Street at Norman Drive Median	12a	16.9	7.5	7.4	Yes**	Collector or Minor Arterial Max 6"
Main Street at Norman Drive Median	12d	199.1	17.6	17.5	Yes**	Collector or Minor Arterial Max 6"

* Depth exceeds criteria, but matches or improves existing conditions.

+ Depth overtops back of curb

TABLE 5: 100-YEAR SPREAD RESULTS FOR PROPOSED LOCATIONS NOT MEETING CRITERIA STANDARDS

Intersection And Proposed Structure	Basin ID	Discharge (cfs)	Existing Distance from Edge of Road to Crown (ft)	Existing Spread (ft)	Proposed Distance from Edge of Road to Crown (ft)	Proposed Spread (ft)	Spread Criteria Overage (ft)	Street Type and Spread Criteria
Palmer Park Blvd at Winnebago Rd Median	9b	42.05	30.4	20.4	27.85	20.6	No	Arterial
Palmer Park Blvd at Peterson Rd Median	18c	7.73	31.0	7.3	18.6	7.3	No	Arterial
Security Blvd at Willis Drive Median	10c	305.6	18.5	18.5	15.0	15.0	Yes*	Collector or Minor Arterial Max 20'
Main Street at Norman Dr Bump out	12d	404.8	32.0	32	27.5	32	Yes**	Collector or Minor Arterial Max 12"

* Spread exceeds criteria, but matches or improves existing conditions.

+ Spread overtops crown

TABLE 6: 100-YEAR DEPTH RESULTS FOR PROPOSED LOCATIONS NOT MEETING CRITERIA STANDARDS

Intersection And Proposed Structure	Basin ID	Discharge (cfs)	Existing Depth at Flowline (in)	Proposed Depth at Flowline (in)	Depth Criteria Overage (in)	Street Type and Depth Criteria
Palmer Park Blvd at Winnebago Rd Median	9b	42.1	12.4	12.4	Yes**	Arterial Max 6"
Palmer Park Blvd at Peterson Rd Median	18c	7.7	5.9	5.9	No	Arterial Max 6"
Security Blvd at Willis Drive Median	10c	305.6	13.4	14.2	Yes**	Collector or Minor Arterial Max 12"
Main Street at Norman Dr - Bump out	12d	404.8	16.0	16.9	Yes***	Collector or Minor Arterial Max 12"

* *Depth exceeds criteria, but matches or improves existing conditions.*

***Depth exceeds criteria, but the increase from existing conditions is considered negligible*

* *Depth overtops back of curb*

Conclusion

This project is focused on the improvements to existing pedestrian facilities including work such as sidewalks, cross walks, curb ramps, and medians that generally have minimal stormwater impacts. Due to concrete bump out structures and medians, roadway travel lanes were reduced at multiple locations which were the major focuses for this analysis.

In proposed conditions, runoff will drain around the bump outs via standard curb and gutter. In most locations, the proposed results meet criteria for the 10-year and 100-year storm events. Two 100-year results at design points 10c and 12d show slightly worsened conditions, however the change is less than 1 inch and therefore negligible. Other locations which do not meet criteria in proposed conditions show improved or unchanged results for depth and spread, therefore the proposed improvements are acceptable.

References

1. Colorado Department of Transportation, 2019 Drainage Design Manual, <https://www.codot.gov/business/hydraulics/drainage-design-manual>
2. El Paso County, Drainage Criteria Manual, Version: Oct. 31, 2018 (Current), <https://publicworks.elpasoco.com/stormwater/>
3. El Paso County, Engineering Criteria Manual, Version: Oct. 14, 2020 (Current), <https://publicworks.elpasoco.com/stormwater/>
4. Mile High Flood District, Detention Design – MHFD-Detention v4.04, Feb. 2021, <https://mhfd.org/resources/software>

Appendices

Appendix A: Drainage Basin Maps

Appendix B: Soil Survey

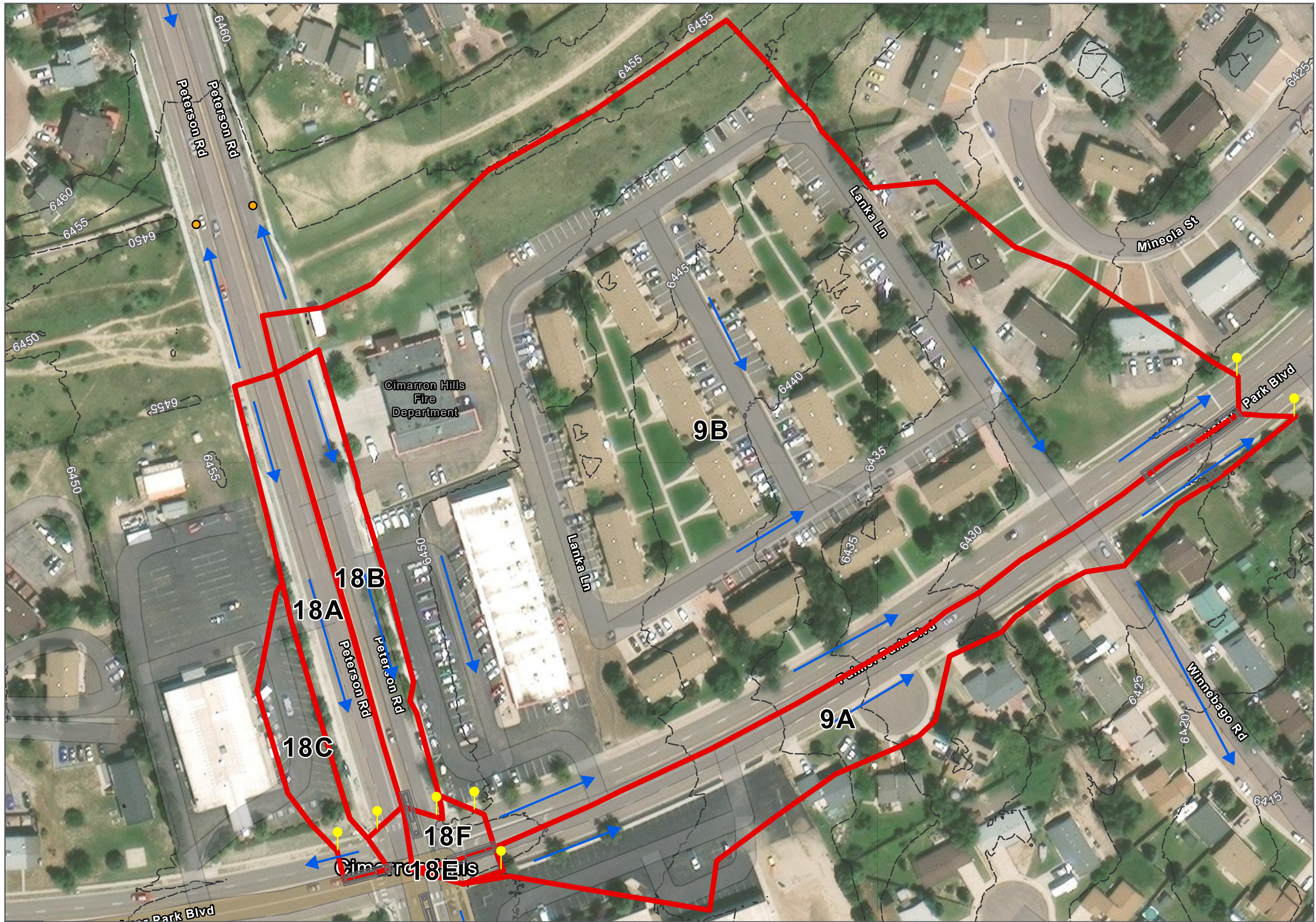
Appendix C: Precipitation Information

Appendix D: Rational Method Calculations

Appendix E: Flow Master Results



Appendix A: Drainage Basin Maps

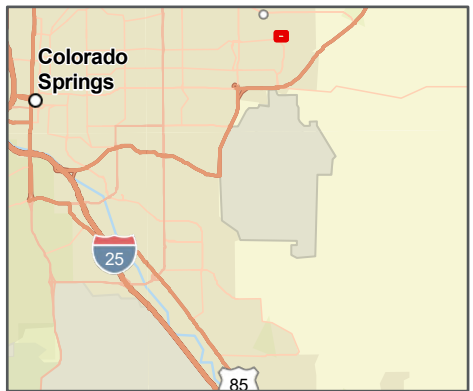
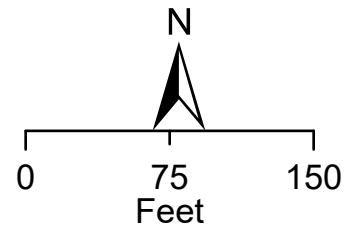


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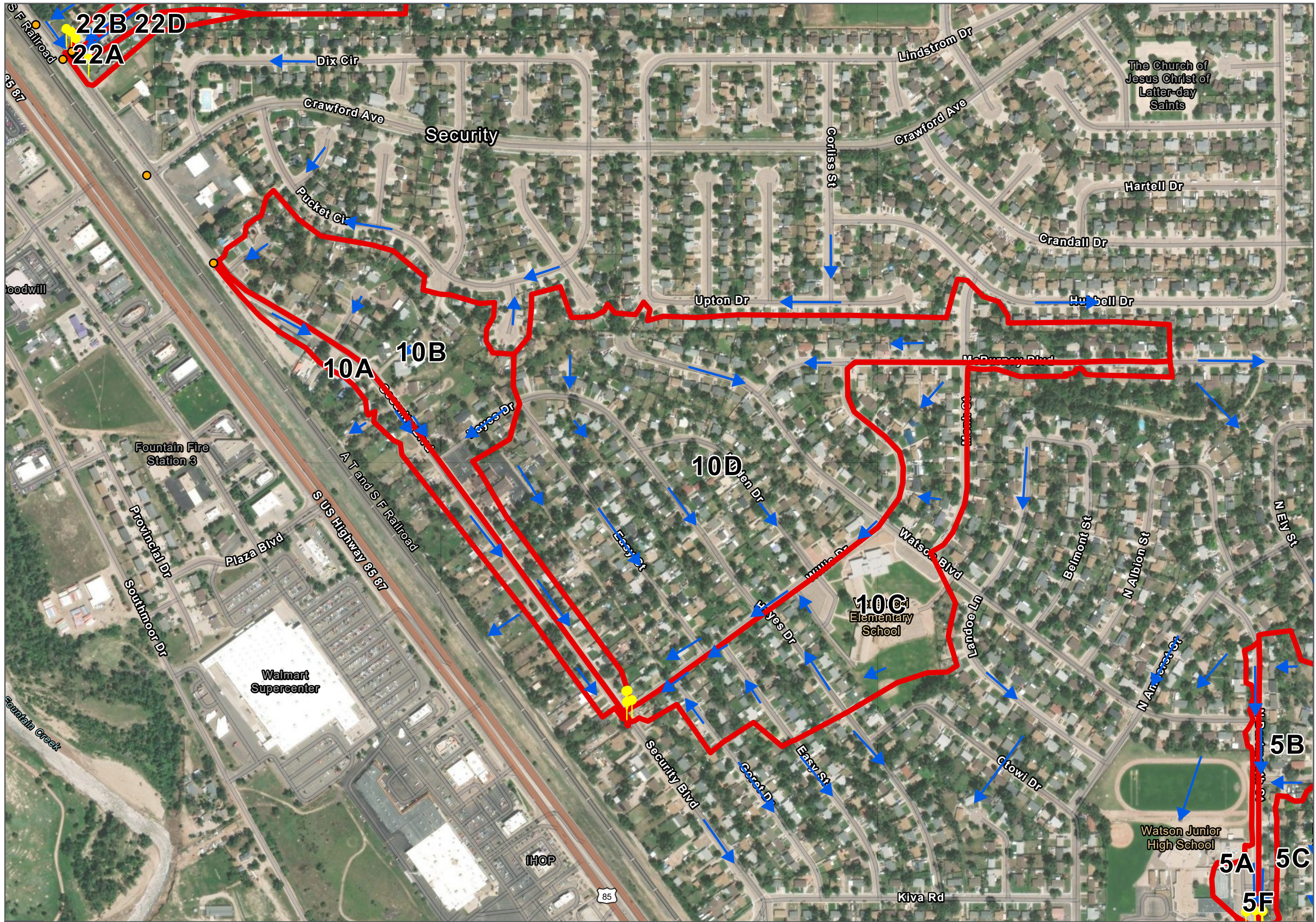
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- Subbasin
- ➔ Flow Arrows
- Existing Inlet
- Existing 5' Contours
- Design Linework

Intersection Description

Basin 9: Palmer Park Boulevard mid-block crossing near Winnebago Road
 Basin 18: Palmer Park Boulevard at Peterson Road



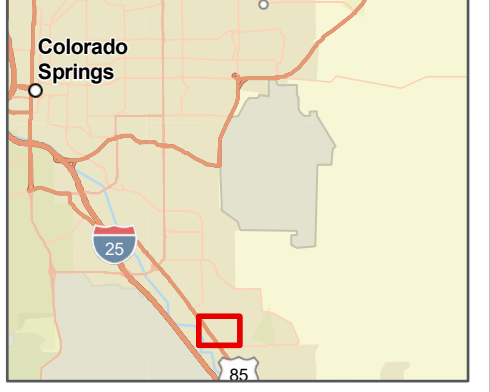
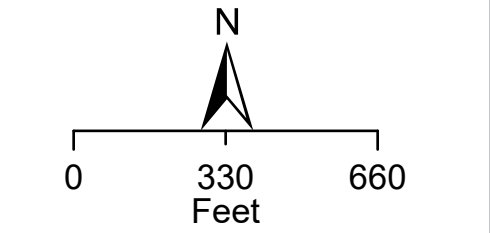
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LEGEND

- ▬ SUBBASIN
- ➔ FLOW ARROW
- Existing Inlet
- Design Linework
- 📍 DesignPoints

Intersection Description
 Security Boulevard at Willis Drive
 (Vennetucci Elementary)



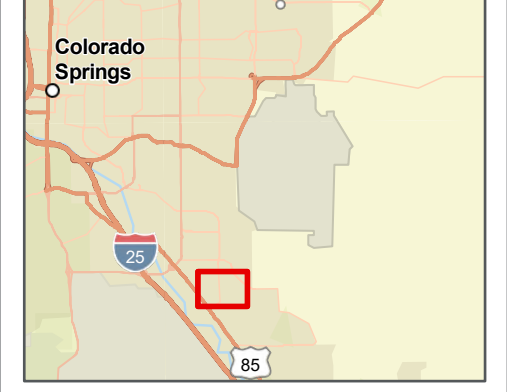
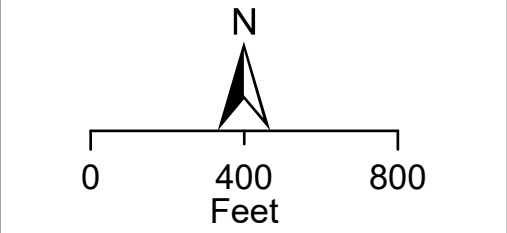
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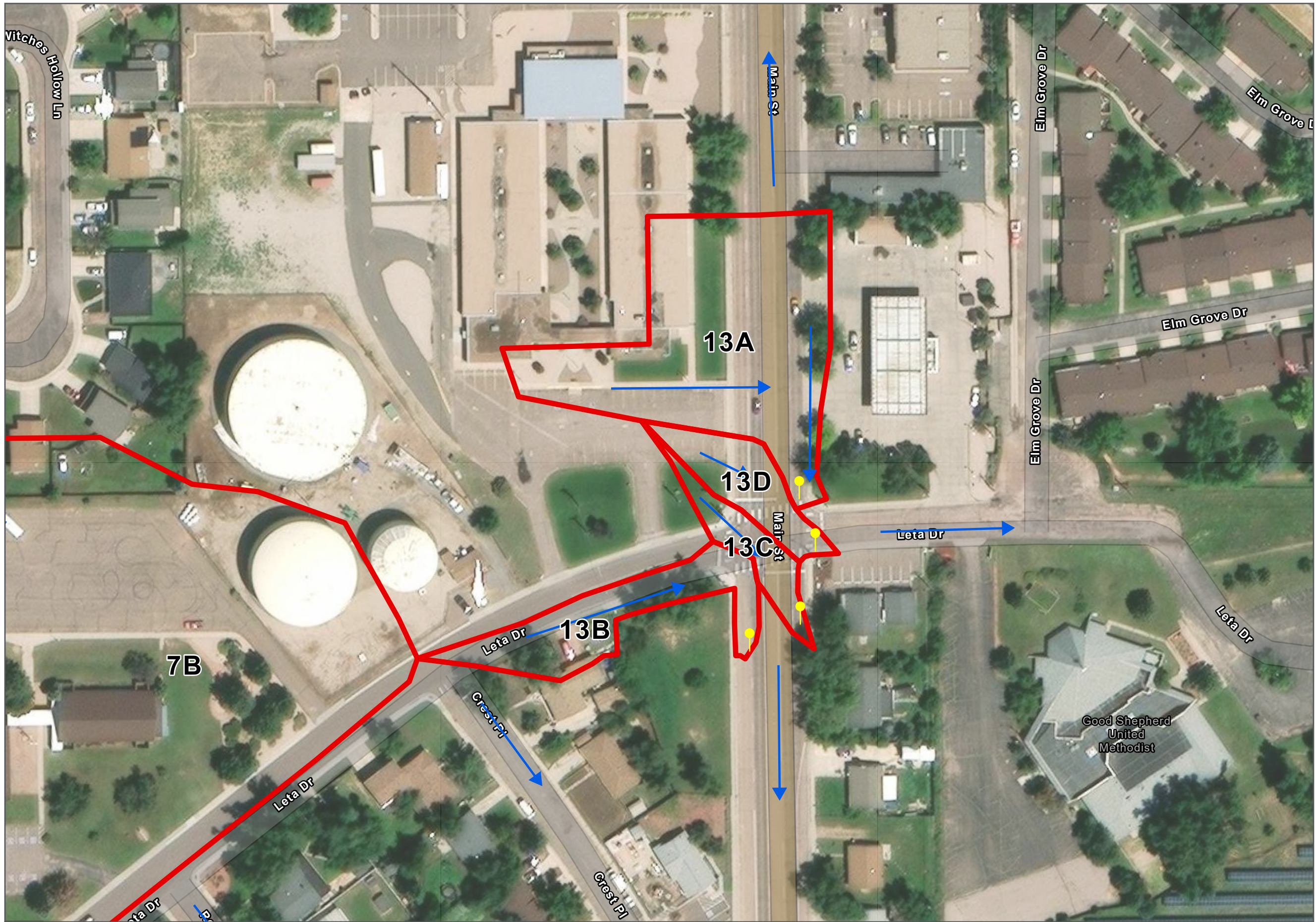
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- DesignPoints
- Subbasin
- Flow Arrows
- Existing Inlet
- Existing 5' Contours

Intersection Description
Main Street and Norman Drive



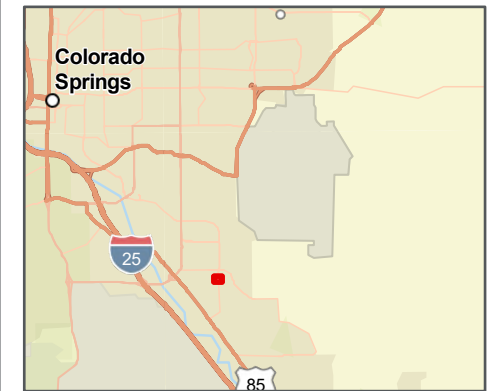
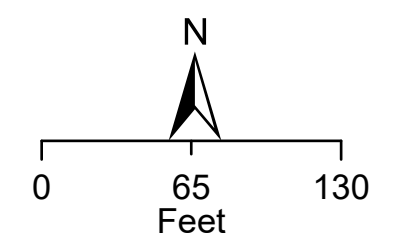
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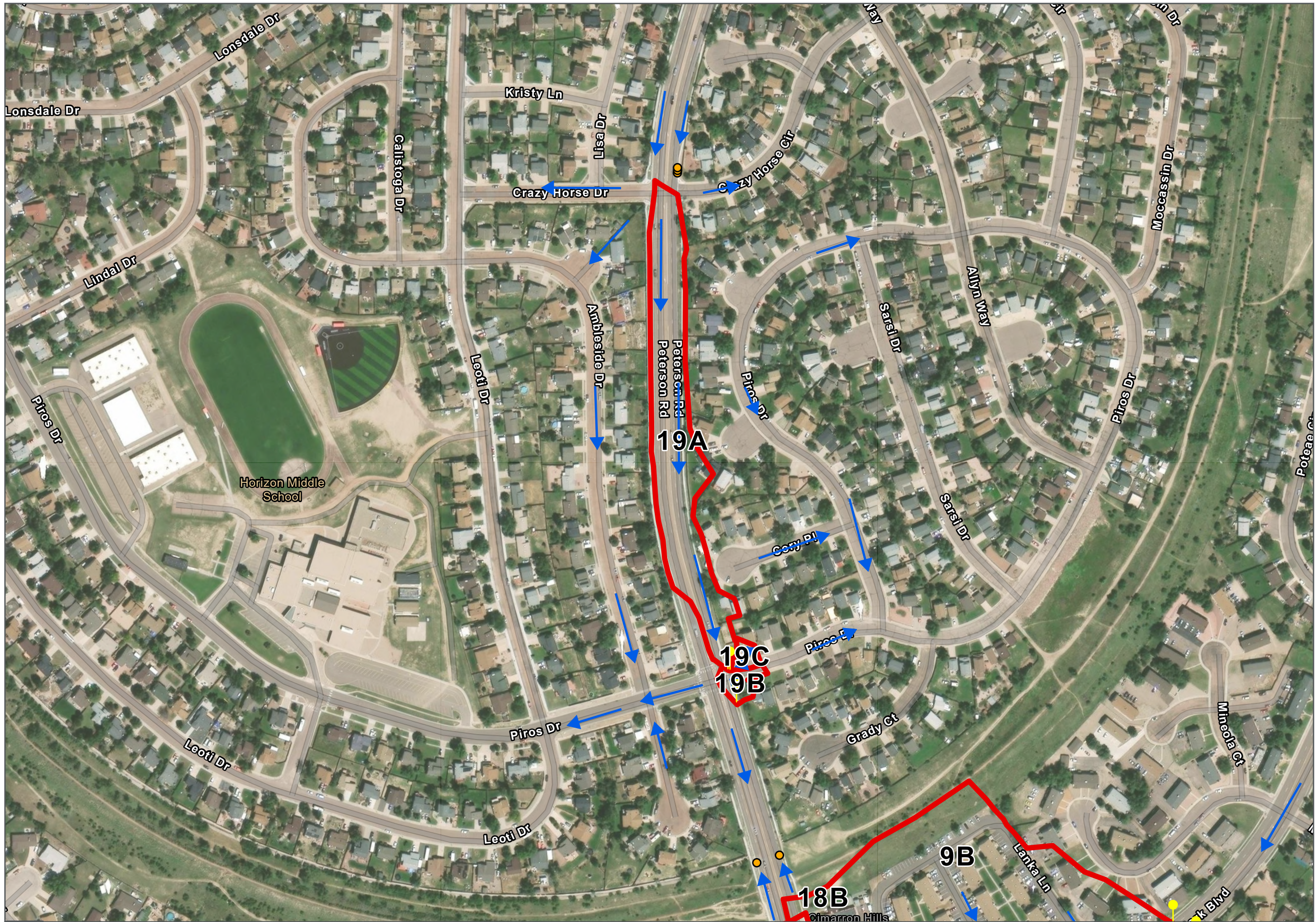
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- ▭ SUBBASIN
- ▶ FLOW ARROW
- Existing Inlet
- Design Linework
- DesignPoints

Intersection Description
Main Street at Leta Drive



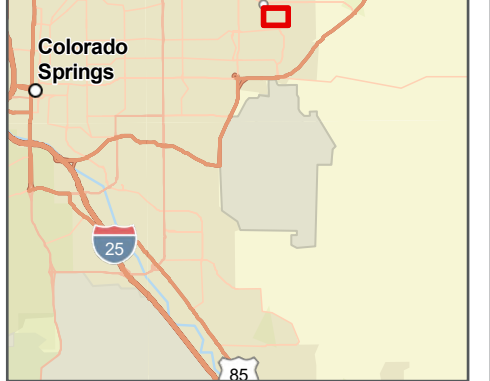
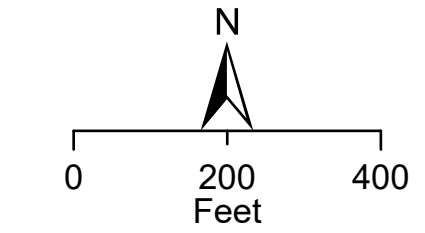
DATA SOURCE:



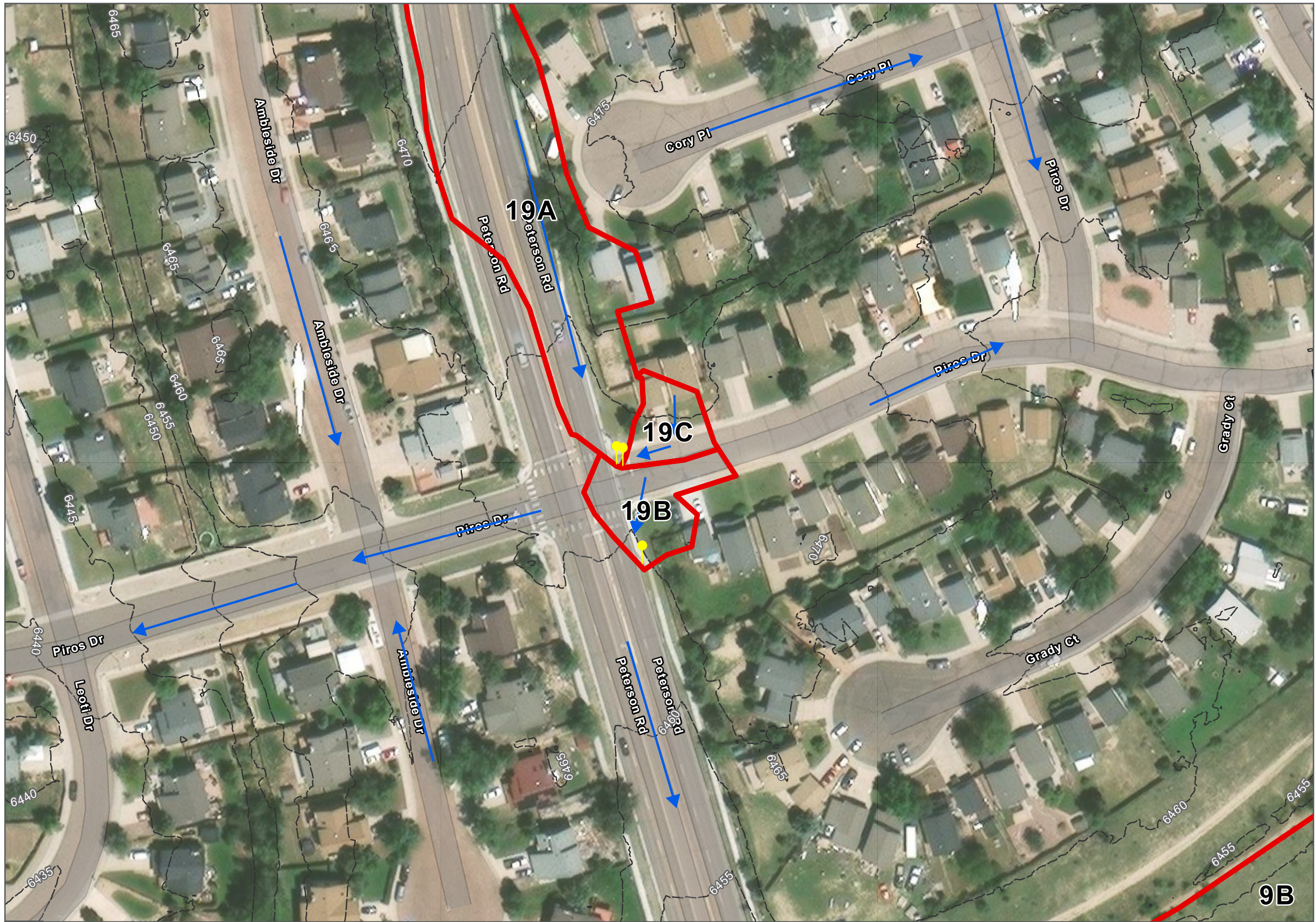
LEGEND

- ▭ SUBBASIN
- ➔ FLOW ARROW
- Existing Inlet
- Design Linework
- DesignPoints

Intersection Description
Piros Dr at Peterson Rd



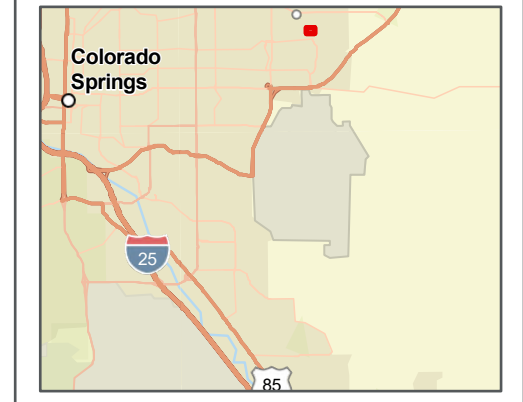
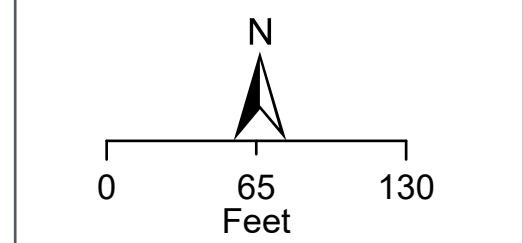
DATA SOURCE:



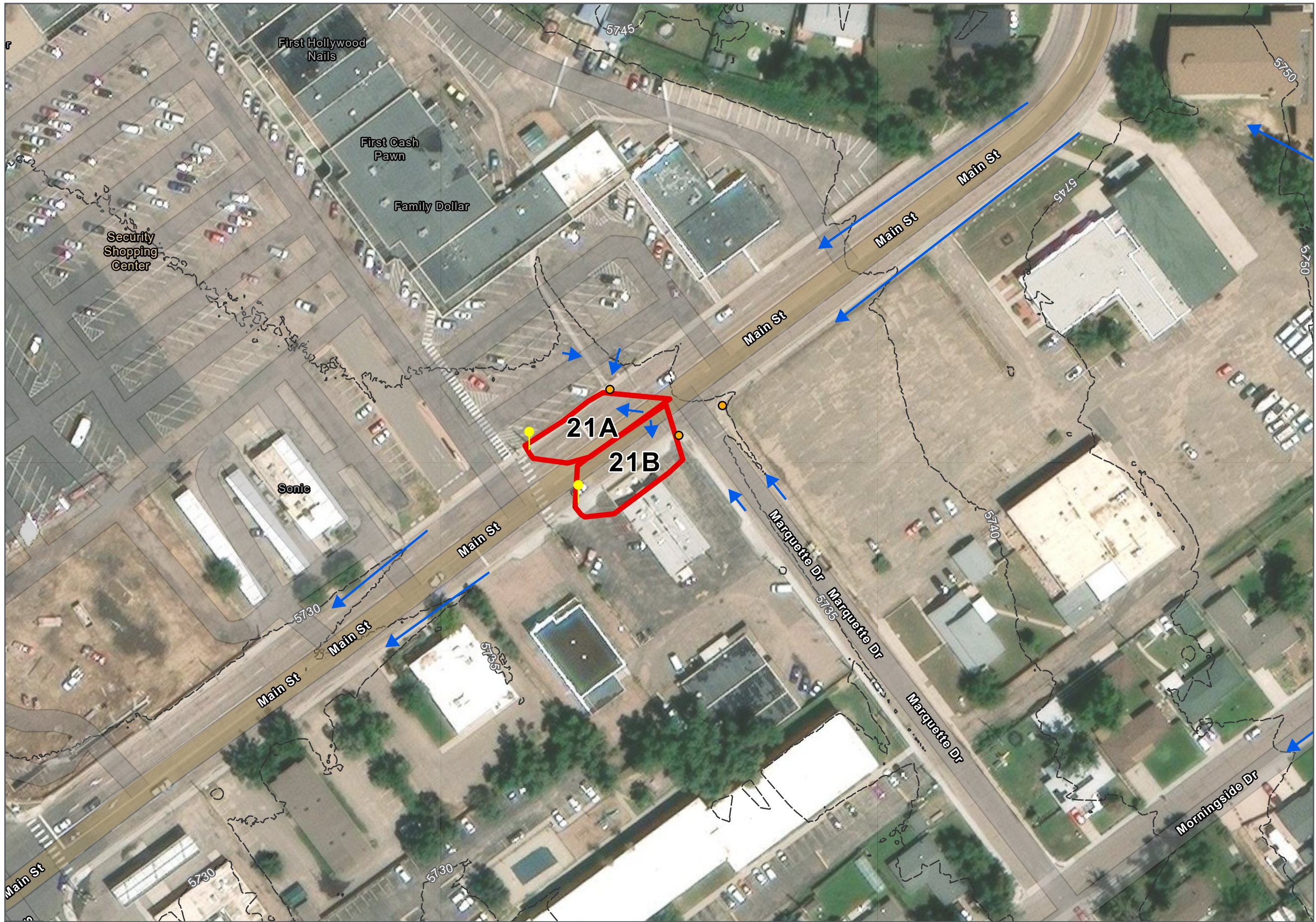
LEGEND

- DesignPoints
- Subbasin
- Flow Arrows
- Existing Inlet
- Existing 5' Contours
- Design Linework

Intersection Description
 Piros Dr at Peterson Rd



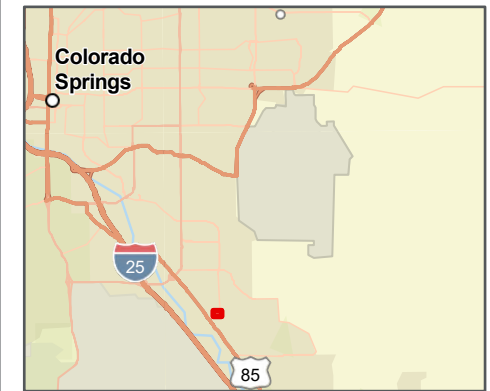
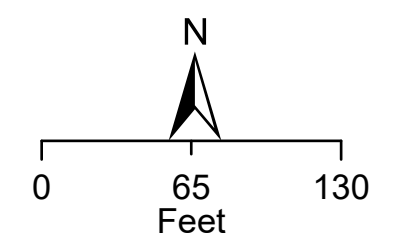
DATA SOURCE:



LEGEND

- DesignPoints
- Subbasin
- ➔ Flow Arrows
- Existing Inlet
- - - Existing 5' Contours

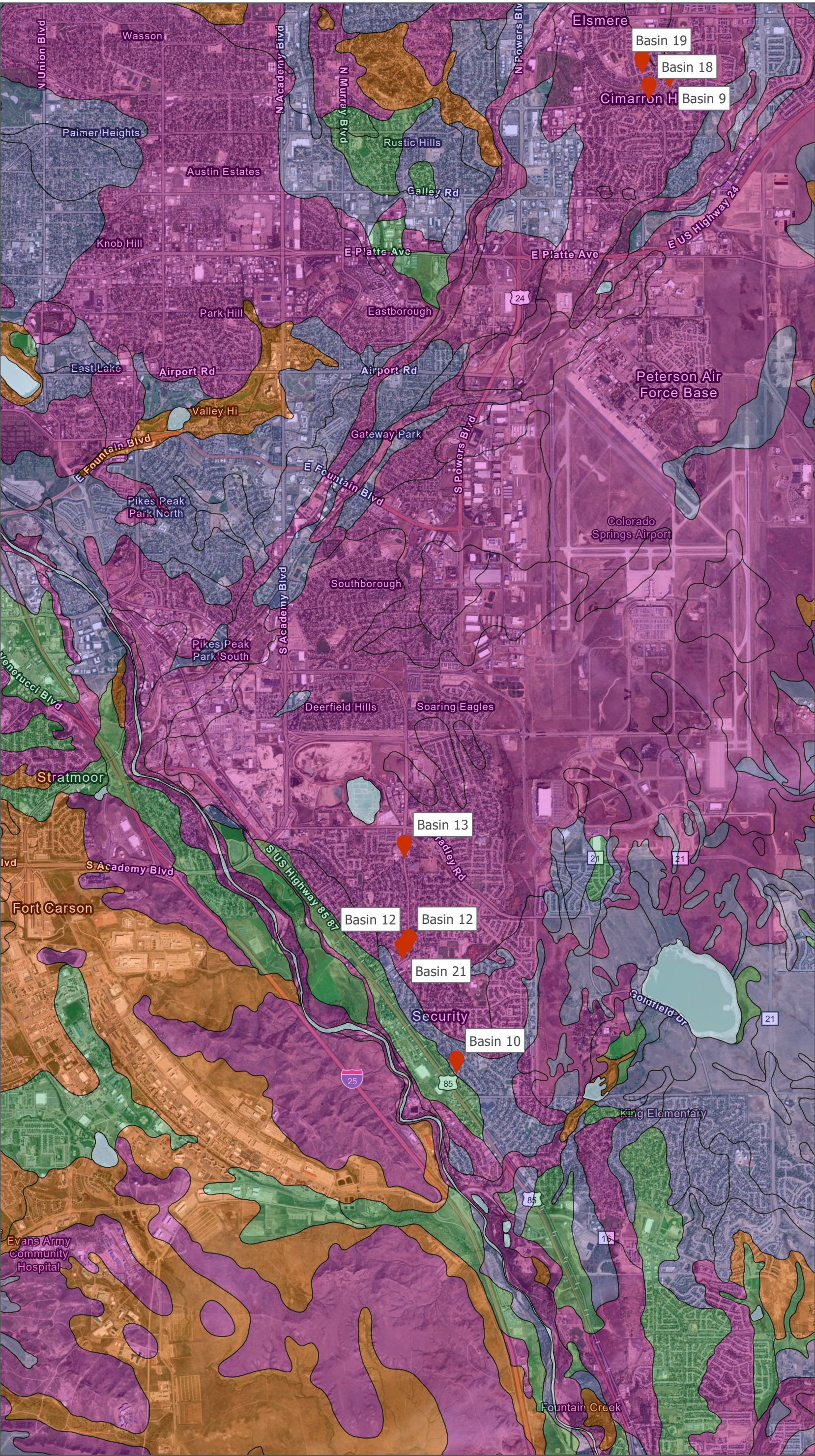
Intersection Description
Main Street and Marquette Drive



DATA SOURCE:



Appendix B: Soil Survey



LEGEND

Project Intersections
 Project Intersections

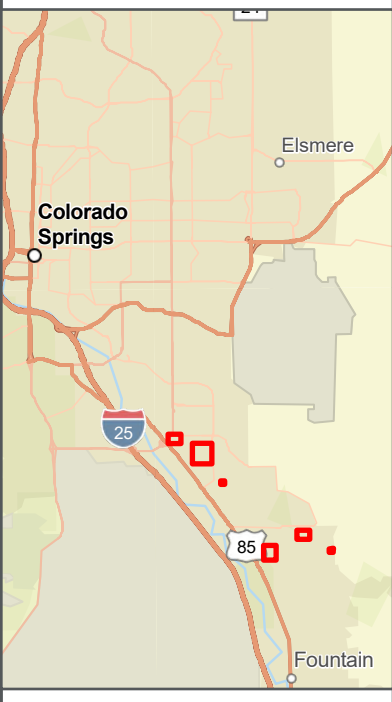
Hydrologic Soil Group

Soil Type

- Water
- A
- B
- C
- D

N

 0 0.5 1
 Miles



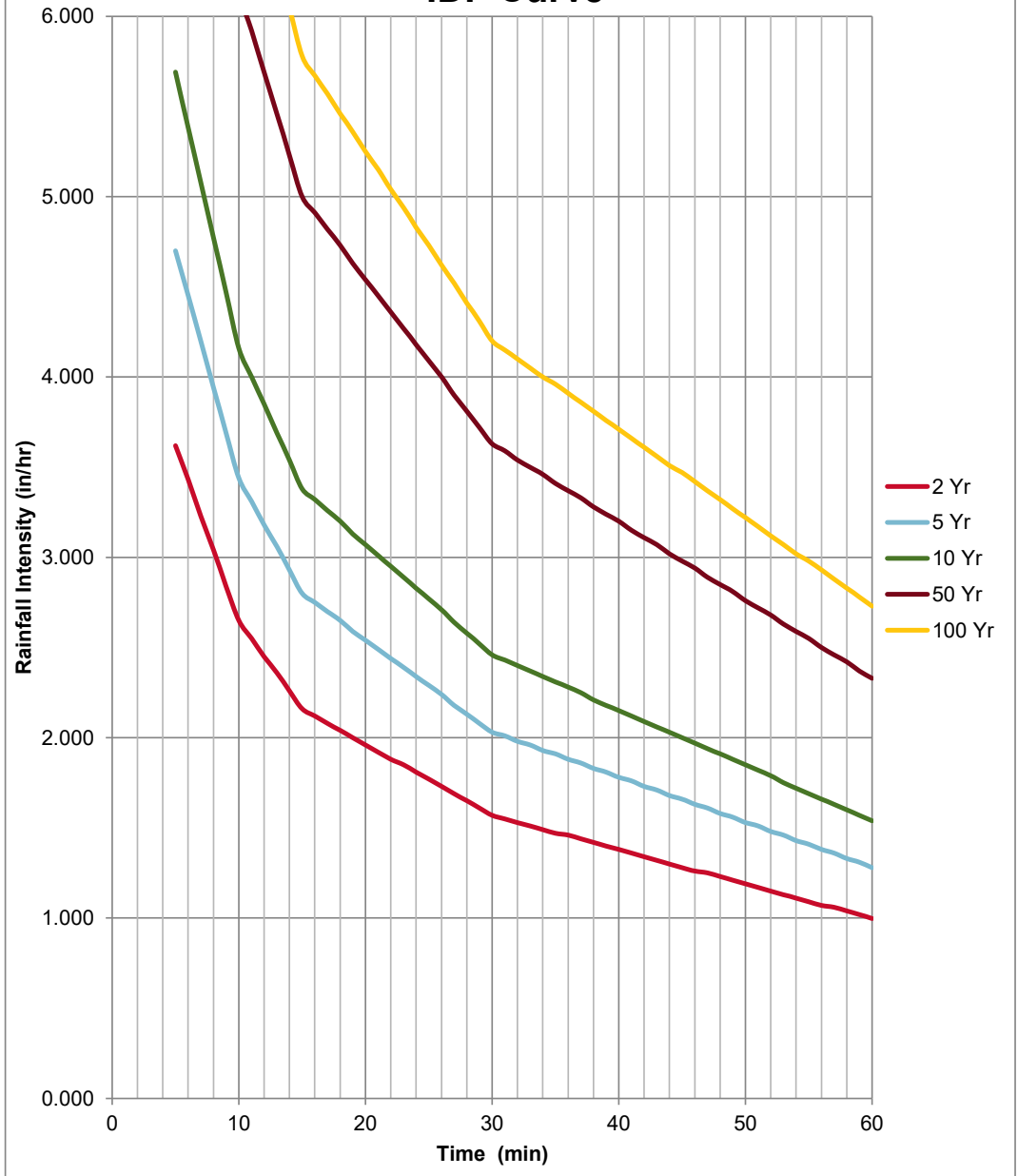


Appendix C: Precipitation Information

Colorado SpringsIDF Computed: **CB** Date: **10/30/2024**
 Checked: _____ Date: _____

Time (min)	(in/hr)				
	2 Yr	5 Yr	10 Yr	50 Yr	100 Yr
5	3.620	4.700	5.690	8.400	9.720
6	3.430	4.450	5.380	7.950	9.200
7	3.230	4.200	5.080	7.500	8.680
8	3.040	3.940	4.770	7.050	8.160
9	2.840	3.690	4.470	6.600	7.640
10	2.650	3.440	4.160	6.150	7.120
11	2.550	3.310	4.000	5.920	6.850
12	2.450	3.180	3.850	5.690	6.580
13	2.360	3.060	3.690	5.460	6.320
14	2.260	2.930	3.540	5.230	6.050
15	2.160	2.800	3.380	5.000	5.780
16	2.120	2.750	3.320	4.910	5.670
17	2.080	2.700	3.260	4.820	5.570
18	2.040	2.650	3.200	4.730	5.460
19	2.000	2.590	3.130	4.630	5.360
20	1.960	2.540	3.070	4.540	5.250
21	1.920	2.490	3.010	4.450	5.150
22	1.880	2.440	2.950	4.360	5.040
23	1.850	2.390	2.890	4.270	4.940
24	1.810	2.340	2.830	4.180	4.830
25	1.770	2.290	2.770	4.090	4.730
26	1.730	2.240	2.710	4.000	4.620
27	1.690	2.180	2.640	3.900	4.520
28	1.650	2.130	2.580	3.810	4.410
29	1.610	2.080	2.520	3.720	4.310
30	1.570	2.030	2.460	3.630	4.200
31	1.550	2.010	2.430	3.590	4.150
32	1.530	1.980	2.400	3.540	4.100
33	1.510	1.960	2.370	3.500	4.050
34	1.490	1.930	2.340	3.460	4.000
35	1.470	1.910	2.310	3.410	3.960
36	1.460	1.880	2.280	3.370	3.910
37	1.440	1.860	2.250	3.330	3.860
38	1.420	1.830	2.210	3.280	3.810
39	1.400	1.810	2.180	3.240	3.760
40	1.380	1.780	2.150	3.200	3.710
41	1.360	1.760	2.120	3.150	3.660
42	1.340	1.730	2.090	3.110	3.610
43	1.320	1.710	2.060	3.070	3.560
44	1.300	1.680	2.030	3.020	3.510
45	1.280	1.660	2.000	2.980	3.470
46	1.260	1.630	1.970	2.940	3.420
47	1.250	1.610	1.940	2.890	3.370
48	1.230	1.580	1.910	2.850	3.320
49	1.210	1.560	1.880	2.810	3.270
50	1.190	1.530	1.850	2.760	3.220
51	1.170	1.510	1.820	2.720	3.170
52	1.150	1.480	1.790	2.680	3.120
53	1.130	1.460	1.750	2.630	3.070
54	1.110	1.430	1.720	2.590	3.020
55	1.090	1.410	1.690	2.550	2.980
56	1.070	1.380	1.660	2.500	2.930
57	1.060	1.360	1.630	2.460	2.880
58	1.040	1.330	1.600	2.420	2.830
59	1.020	1.310	1.570	2.370	2.780
60	0.998	1.280	1.540	2.330	2.730

Colorado Springs IDF Curve





NOAA Atlas 14, Volume 8, Version 2
 Location name: Colorado Springs, Colorado, USA*
 Latitude: 38.7345°, Longitude: -104.6996°
 Elevation: 5843 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael Si, Laurent, Carl Trypa, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	3.01 (2.48-3.72)	3.62 (2.98-4.46)	4.70 (3.85-5.82)	5.69 (4.63-7.07)	7.16 (5.66-9.38)	8.40 (6.44-11.1)	9.72 (7.16-13.2)	11.1 (7.84-15.6)	13.2 (8.86-19.0)	14.8 (9.62-21.5)
10-min	2.21 (1.82-2.72)	2.65 (2.18-3.27)	3.44 (2.83-4.26)	4.16 (3.39-5.18)	5.24 (4.15-6.87)	6.15 (4.72-8.15)	7.12 (5.24-9.68)	8.16 (5.74-11.4)	9.64 (6.48-13.9)	10.8 (7.04-15.8)
15-min	1.80 (1.48-2.21)	2.16 (1.78-2.66)	2.80 (2.30-3.46)	3.38 (2.76-4.21)	4.26 (3.37-5.58)	5.00 (3.84-6.62)	5.78 (4.26-7.87)	6.63 (4.66-9.29)	7.84 (5.27-11.3)	8.81 (5.73-12.8)
30-min	1.31 (1.08-1.61)	1.57 (1.29-1.94)	2.03 (1.67-2.52)	2.46 (2.00-3.06)	3.09 (2.45-4.05)	3.63 (2.78-4.81)	4.20 (3.10-5.72)	4.82 (3.39-6.75)	5.70 (3.83-8.22)	6.40 (4.16-9.32)
60-min	0.851 (0.701-1.05)	0.998 (0.821-1.23)	1.28 (1.05-1.58)	1.54 (1.26-1.92)	1.96 (1.56-2.60)	2.33 (1.80-3.11)	2.73 (2.02-3.74)	3.18 (2.24-4.48)	3.83 (2.58-5.54)	4.36 (2.84-6.35)
2-hr	0.524 (0.434-0.641)	0.605 (0.501-0.742)	0.767 (0.633-0.943)	0.928 (0.761-1.15)	1.19 (0.958-1.57)	1.42 (1.11-1.89)	1.68 (1.26-2.30)	1.97 (1.41-2.77)	2.40 (1.64-3.47)	2.76 (1.81-3.99)
3-hr	0.383 (0.319-0.467)	0.436 (0.362-0.532)	0.547 (0.452-0.669)	0.662 (0.545-0.815)	0.855 (0.695-1.13)	1.03 (0.809-1.38)	1.23 (0.927-1.68)	1.46 (1.05-2.05)	1.80 (1.23-2.59)	2.08 (1.37-3.00)
6-hr	0.219 (0.184-0.266)	0.247 (0.206-0.299)	0.308 (0.256-0.374)	0.373 (0.309-0.456)	0.484 (0.397-0.640)	0.587 (0.464-0.780)	0.705 (0.536-0.960)	0.841 (0.609-1.18)	1.04 (0.722-1.50)	1.21 (0.807-1.74)
12-hr	0.121 (0.102-0.146)	0.139 (0.117-0.167)	0.174 (0.146-0.210)	0.211 (0.176-0.256)	0.272 (0.223-0.355)	0.327 (0.260-0.430)	0.389 (0.297-0.524)	0.460 (0.335-0.637)	0.565 (0.394-0.803)	0.653 (0.438-0.929)
24-hr	0.068 (0.057-0.081)	0.079 (0.067-0.095)	0.101 (0.085-0.121)	0.121 (0.102-0.147)	0.154 (0.127-0.199)	0.183 (0.146-0.238)	0.215 (0.165-0.286)	0.251 (0.183-0.343)	0.302 (0.212-0.425)	0.345 (0.233-0.487)
2-day	0.038 (0.032-0.045)	0.045 (0.038-0.054)	0.058 (0.049-0.069)	0.069 (0.059-0.083)	0.087 (0.072-0.110)	0.102 (0.082-0.131)	0.119 (0.091-0.156)	0.136 (0.100-0.185)	0.162 (0.114-0.225)	0.182 (0.124-0.256)
3-day	0.027 (0.023-0.032)	0.032 (0.028-0.038)	0.041 (0.035-0.049)	0.049 (0.042-0.059)	0.062 (0.051-0.078)	0.072 (0.058-0.092)	0.083 (0.064-0.109)	0.095 (0.070-0.129)	0.113 (0.080-0.157)	0.127 (0.087-0.178)
4-day	0.022 (0.019-0.026)	0.026 (0.022-0.030)	0.032 (0.028-0.038)	0.039 (0.033-0.046)	0.048 (0.040-0.061)	0.056 (0.045-0.071)	0.065 (0.050-0.085)	0.074 (0.055-0.100)	0.088 (0.062-0.121)	0.099 (0.068-0.138)
7-day	0.015 (0.013-0.017)	0.017 (0.015-0.020)	0.021 (0.018-0.025)	0.025 (0.021-0.030)	0.031 (0.025-0.038)	0.035 (0.029-0.045)	0.041 (0.032-0.053)	0.046 (0.035-0.062)	0.054 (0.039-0.075)	0.061 (0.042-0.085)
10-day	0.012 (0.010-0.014)	0.013 (0.012-0.016)	0.016 (0.014-0.019)	0.019 (0.017-0.023)	0.024 (0.020-0.029)	0.027 (0.022-0.034)	0.031 (0.024-0.040)	0.035 (0.026-0.047)	0.041 (0.029-0.056)	0.046 (0.032-0.063)
20-day	0.007 (0.006-0.009)	0.009 (0.008-0.010)	0.011 (0.009-0.013)	0.012 (0.011-0.015)	0.015 (0.012-0.018)	0.017 (0.014-0.021)	0.019 (0.015-0.024)	0.021 (0.016-0.028)	0.024 (0.017-0.033)	0.027 (0.019-0.037)
30-day	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.010)	0.010 (0.008-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.015 (0.011-0.019)	0.016 (0.012-0.021)	0.018 (0.013-0.025)	0.020 (0.014-0.027)
45-day	0.005 (0.004-0.005)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.011)	0.010 (0.008-0.013)	0.011 (0.009-0.014)	0.012 (0.009-0.016)	0.014 (0.010-0.019)	0.015 (0.010-0.020)
60-day	0.004 (0.003-0.005)	0.005 (0.004-0.005)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.006-0.009)	0.009 (0.007-0.011)	0.009 (0.007-0.012)	0.010 (0.008-0.013)	0.011 (0.008-0.015)	0.012 (0.009-0.017)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.



Appendix D: Rational Method Calculations

El Paso County Intersection Improvements
Priority Intersections

Computed: CMB Date: 11/22/2024
Checked: LVS Date: 11/22/2024

Basin ID	Description	Hydr Soils Group	Total Area (ac)	Composite C		Streets (paved)			Industrial (Light areas)			Business (Neighborhood Area)			Undeveloped Areas or Parks			1/4 acre		
				C ₁₀	C ₁₀₀	C ₁₀	C ₁₀₀	Area (ac)	C ₁₀	C ₁₀₀	Area (ac)	C ₁₀	C ₁₀₀	Area (ac)	C ₁₀	C ₁₀₀	Area (ac)	C ₁₀	C ₁₀₀	Area (ac)
9a	Palmer Park Boulevard mid-block crossing near Winnebago Rd S Curb	A	1.55	0.90	0.95	0.90	0.95	1.55	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
9b	Palmer Park Boulevard mid-block crossing near Winnebago Rd N Curb	A	10.67	0.36	0.50	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	10.67
10a	Security Boulevard at Willis Drive (Vennetucci Elementary) S pinch point	C	5.47	0.36	0.50	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	5.47
10b	Security Boulevard at Willis Drive (Vennetucci Elementary) N corner, NWB	A	18.01	0.36	0.50	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	18.01
12a	Main Street at Norman Drive NW corner, SB	A	17.98	0.36	0.50	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	17.98
12d	Main Street at Norman Drive NE corner, NB	A	68.51	1.07	1.28	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	62.83	0.30	0.55	5.68	0.36	0.50	68.51
12e	Main Street at Norman Drive NE corner, WB	A	4.66	0.36	0.50	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	4.66
13a	Main Street at Leta Drive NE corner, NB	A	0.89	0.70	0.80	0.90	0.95	0.00	0.70	0.80	0.89	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
13b	Main Street at Leta Drive SW corner, SB	A	0.28	0.90	0.95	0.90	0.95	0.28	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
13c	Main Street at Leta Drive SE corner, NB	A	0.11	0.90	0.95	0.90	0.95	0.11	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
13d	Main Street at Leta Drive SE corner, EB	A	0.16	0.70	0.80	0.90	0.95	0.00	0.70	0.80	0.16	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18a	Palmer Park Blvd at Peterson Rd N median - SB	A	0.60	0.90	0.95	0.90	0.95	0.60	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18b	Palmer Park Blvd at Peterson Rd N median - NB	A	0.54	0.90	0.95	0.90	0.95	0.54	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18c	Palmer Park Blvd at Peterson Rd W median - WB	A	0.31	0.90	0.95	0.90	0.95	0.31	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18d	Palmer Park Blvd at Peterson Rd W median - EB	A	0.06	0.90	0.95	0.90	0.95	0.06	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18e	Palmer Park Blvd at Peterson Rd E median - EB	A	0.04	0.90	0.95	0.90	0.95	0.04	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18f	Palmer Park Blvd at Peterson Rd E median - WB	A	0.11	0.90	0.95	0.90	0.95	0.11	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18g	Palmer Park Blvd at Peterson Rd S median - SB	A	0.08	0.90	0.95	0.90	0.95	0.08	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
18h	Palmer Park Blvd at Peterson Rd S median - NB	A	0.07	0.90	0.95	0.90	0.95	0.07	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
19a	Piros Dr at Peterson Rd NE corner, NB	A	2.82	0.90	0.95	0.90	0.95	2.82	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
19b	Piros Dr at Peterson Rd SE corner, SB	A	0.17	0.90	0.95	0.90	0.95	0.17	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
19c	Piros Dr at Peterson Rd NE corner, SWB	A	0.10	0.90	0.95	0.90	0.95	0.10	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.00
21a	Main Street mid-block crossing near Marquette Drive SB	A	0.09	0.36	0.50	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.09
21b	Main Street mid-block crossing near Marquette Drive NB	A	0.11	0.36	0.50	0.90	0.95	0.00	0.70	0.80	0.00	0.75	0.80	0.00	0.30	0.55	0.00	0.36	0.50	0.11

Basin ID	Description	C ₁₀	Area (ac)	INITIAL/OVERLAND FLOW (t)				TRAVEL TIME (t)						Total t _c = t _i + t _e (min)	Tc CHECK (Urbanized basins)			FINAL Tc (min)					
				Length (ft)	Start Elevation (ft)	End Elevation (ft)	Slope (%)	t (min)	Length (ft)	Start Elevation (ft)	End Elevation (ft)	S _w (ft/ft)	Type of Land Surface			Urban (Yes/No)	Total Length		Regional T _c max (min)	T _c max > t _c			
													Code		Description						Convey Coef (C _v)	Velocity (ft/s)	Travel Time (min)
9a	Palmer Park Boulevard mid-block crossing near Winnebago Rd S Curb	0.90	1.55	60	6450.6	6449.3	2.123	2.26	910	6449.3	6422.8	0.029	6	Paved areas and swales	20.00	3.42	4.44	6.70	Yes	970	15.39	Check	6.70
9b	Palmer Park Boulevard mid-block crossing near Winnebago Rd N Curb	0.36	10.67	38	6450.6	6449.5	2.968	5.96	920	6449.5	6423.0	0.029	6	Paved areas and swales	20.00	3.39	4.52	10.48	Yes	958	15.32	Check	10.48
10a	Security Boulevard at Willis Drive (Vennetucci Elementary) S pinch point	0.36	5.47	34	5711.0	5710.0	2.943	5.65	2745	5710.0	5694.7	0.006	6	Paved areas and swales	20.00	1.49	30.64	36.29	Yes	2779	25.44	Regional Tc	25.44
10b	Security Boulevard at Willis Drive (Vennetucci Elementary) N corner, NWB	0.36	18.01	250	5723.6	5712.5	4.453	13.37	2795	5712.5	5694.9	0.006	6	Paved areas and swales	20.00	1.59	29.35	42.72	Yes	3045	26.92	Regional Tc	26.92
12a	Main Street at Norman Drive NW corner, SB	0.36	17.98	65	5836.4	5833.9	3.915	7.11	3790	5833.9	5742.2	0.024	6	Paved areas and swales	20.00	3.11	20.31	27.42	Yes	3855	31.42	Check	27.42
12d	Main Street at Norman Drive NE corner, NB	1.07	68.51	41	5816.6	5815.7	2.355	0.25	4120	5815.7	5742.6	0.018	6	Paved areas and swales	20.00	2.66	25.77	28.02	Yes	4161	33.12	Check	28.02
12e	Main Street at Norman Drive NE corner, WB	0.36	4.66	95	5771.0	5769.4	1.643	11.45	1215	5769.4	5742.3	0.022	6	Paved areas and swales	20.00	2.99	6.77	18.22	Yes	1310	17.28	Regional Tc	17.28
13a	Main Street at Leta Drive NE corner, NB	0.70	0.89	155	5852.9	5849.0	2.509	6.87	220	5849.0	5845.3	0.017	6	Paved areas and swales	20.00	2.81	1.41	8.28	Yes	375	12.08	Check	8.28
13b	Main Street at Leta Drive SW corner, SB	0.90	0.28	60	5851.0	5850.0	1.612	2.47	335	5850.0	5843.5	0.019	6	Paved areas and swales	20.00	2.79	2.00	4.48	Yes	395	12.19	Check	5.00
13c	Main Street at Leta Drive SE corner, NB	0.90	0.11	45	5852.2	5851.0	2.691	1.81	215	5851.0	5842.5	0.040	6	Paved areas and swales	20.00	3.98	0.90	2.71	Yes	260	11.44	Check	5.00
13d	Main Street at Leta Drive SE corner, EB	0.70	0.16	110	5852.2	5847.0	4.742	4.69	135	5847.0	5843.4	0.027	6	Paved areas and swales	20.00	3.28	0.69	5.38	Yes	245	11.36	Check	5.38
18a	Palmer Park Blvd at Peterson Rd N median - SB	0.90	0.60	35	6454.8	6454.2	1.717	1.85	490	6454.2	6450.5	0.007	6	Paved areas and swales	20.00	1.73	4.73	6.58	Yes	525	12.92	Check	6.58
18b	Palmer Park Blvd at Peterson Rd N median - NB	0.90	0.54	20	6454.9	6454.3	3.072	1.15	500	6454.3	6450.3	0.008	6	Paved areas and swales	20.00	1.78	4.69	5.84	Yes	520	12.89	Check	5.84
18c	Palmer Park Blvd at Peterson Rd W median - WB	0.90	0.31	145	6453.0	6452.0	0.715	5.03	150	6452.0	6451.0	0.006	6	Paved areas and swales	20.00	1.60	1.57	6.60	Yes	295	11.64	Check	6.60
18d	Palmer Park Blvd at Peterson Rd W median - EB	0.90	0.06	22	6454.8	6450.4	20.041	0.65	49	6450.4	6450.2	0.004	6	Paved areas and swales	20.00	1.21	0.68	1.33	Yes	71	10.39	Check	5.00
18e	Palmer Park Blvd at Peterson Rd E median - EB	0.90	0.04	42	6450.9	6450.0	2.220	1.86	46	6450.0	6449.6	0.008	6	Paved areas and swales	20.00	1.81	0.42	2.29	Yes	88	10.49	Check	5.00
18f	Palmer Park Blvd at Peterson Rd E median - WB	0.90	0.11	55	6451.0	6450.0	1.869	2.26	55	6450.0	6449.5	0.009	6	Paved areas and swales	20.00	1.88	0.49	2.74	Yes	110	10.61	Check	5.00
18g	Palmer Park Blvd at Peterson Rd S median - SB	0.90	0.08	34	6451.3	6450.4	2.659	1.58	80	6450.4	6450.3	0.001	6	Paved areas and swales	20.00	0.63	2.10	3.08	Yes	114	10.63	Check	5.00
18h	Palmer Park Blvd at Peterson Rd S median - NB	0.90	0.07	25	6451.1	6451.0	0.384	2.57	120	6451.0	6450.0	0.008	6	Paved areas and swales	20.00	1.81	1.10	3.67	Yes	145	10.81	Check	5.00
19a	Piros Dr at Peterson Rd NE corner, NB	0.90	2.82	75	6501.4	6499.9	2.001	2.58	1270	6499.9	6466.7	0.026	6	Paved areas and swales	20.00	3.23	6.55	9.13	Yes	1345	17.47	Check	9.13
19b	Piros Dr at Peterson Rd SE corner, SB	0.90	0.17	34	6488.4	6488.0	1.052	2.14	120	6488.0	6464.0	0.033	6	Paved areas and swales	20.00	3.65	0.55	2.69	Yes	154	10.86	Check	5.00
19c	Piros Dr at Peterson Rd NE corner, SWB	0.90	0.10	95	6471.1	6468.2	3.016	2.53	55	6468.2	6466.8	0.025	6	Paved areas and swales	20.00	3.17	0.29	2.82	Yes	150	10.83	Check	5.00
21a	Main Street mid-block crossing near Marquette Drive SB	0.36	0.09	60	5735.0	5734.0	1.667	9.06	76	5734.0	5732.0	0.026	6	Paved areas and swales	20.00	3.24	0.39	9.45	Yes	136	10.76	Check	9.45
21b	Main Street mid-block crossing near Marquette Drive NB	0.36	0.11	25	5735.0	5734.0	4.000	4.38	91	5734.0	5732.0	0.022	6	Paved areas and swales	20.00	2.96	0.51	4.89	Yes	116	10.64	Check	5.00

Design Storm: 10-yr

Basin Description	DIRECT RUNOFF							REMARKS
	AREA DESIGN (name)	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	
(1)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Palmer Park Boulevard mid-block crossing near Winnebago Rd S Curb	9a	1.550	0.900	6.70	1.39	5.17	7.21	Basin 9a = 9a+18e = 7.41 cfs
Palmer Park Boulevard mid-block crossing near Winnebago Rd N Curb	9b	10.669	0.360	10.48	3.84	4.08	15.69	Basin 9b = 9b+18b = 18.32 cfs
Security Boulevard at Willis Drive (Vennetucci Elementary) S pinch point	10a	5.465	0.360	25.44	1.97	2.74	5.40	
Security Boulevard at Willis Drive (Vennetucci Elementary) N corner, NWB	10b	18.011	0.360	26.92	6.48	2.65	17.16	
Main Street at Norman Drive NW corner, SB	12a	17.984	0.360	27.42	6.47	2.61	16.93	
Main Street at Norman Drive NE corner, NB	12d	68.510	1.073	26.02	73.49	2.71	199.06	
Main Street at Norman Drive NE corner, WB	12e	4.655	0.360	17.28	1.68	3.24	5.44	
Main Street at Leta Drive NE corner, NB	13a	0.891	0.700	8.28	0.62	4.69	2.92	
Main Street at Leta Drive SW corner, SB	13b	0.280	0.900	5.00	0.25	5.69	1.44	
Main Street at Leta Drive SE corner, NB	13c	0.114	0.900	5.00	0.10	5.69	0.58	
Main Street at Leta Drive SE corner, EB	13d	0.162	0.700	5.38	0.11	5.57	0.63	
Palmer Park Blvd at Peterson Rd N median - SB	18a	0.603	0.900	6.58	0.54	5.21	2.83	
Palmer Park Blvd at Peterson Rd N median - NB	18b	0.538	0.900	5.84	0.48	5.43	2.63	
Palmer Park Blvd at Peterson Rd W median - WB	18c	0.312	0.900	6.60	0.28	5.20	1.46	Basin 18c = 18c+18a = 4.28663 cfs
Palmer Park Blvd at Peterson Rd W median - EB	18d	0.064	0.900	5.00	0.06	5.69	0.33	
Palmer Park Blvd at Peterson Rd E median - EB	18e	0.039	0.900	5.00	0.04	5.69	0.20	
Palmer Park Blvd at Peterson Rd E median - WB	18f	0.108	0.900	5.00	0.10	5.69	0.55	Basin 18f = Basin 18f+18b = 3.18326 cfs
Palmer Park Blvd at Peterson Rd S median - SB	18g	0.079	0.900	5.00	0.07	5.69	0.40	Basin 18g = 18g+18d = 0.73147 cfs
Palmer Park Blvd at Peterson Rd S median - NB	18h	0.074	0.900	5.00	0.07	5.69	0.38	
Piros Dr at Peterson Rd NE corner, NB	19a	2.821	0.900	9.13	2.54	4.43	11.25	
Piros Dr at Peterson Rd SE corner, SB	19b	0.172	0.900	5.00	0.15	5.69	0.88	Basin 19b = 19b+19a+19c = 12.6443 cfs
Piros Dr at Peterson Rd NE corner, SWB	19c	0.101	0.900	5.00	0.09	5.69	0.51	
Main Street mid-block crossing near Marquette Drive SB	21a	0.085	0.360	9.45	0.03	4.33	0.13	
Main Street mid-block crossing near Marquette Drive NB	21b	0.110	0.360	5.00	0.04	5.69	0.23	

- (1) Basin Description linked to C-Value Sheet
- (2) Basin Design Point (not designated)
- (3) Enter the Basin Name from C Value Sheet
- (4) Basin Area linked to C-Value Sheet
- (5) Composite C linked to C-Value Sheet
- (6) Time of Concentration linked to C-Value Sheet

- (7) =Column 4 x Column 5
- (8) = $28.5^P / (10 + \text{Column } 6)^{0.786}$
- (9) =Column 7 x Column 8
- (10) =Column 6 + Column 21
- (11) Add the Basin Areas (7) to get the combined basin AC
- (12) = $28.5^P / (10 + \text{Column } 10)^{0.786}$

Design Storm: 100-yr

Basin Description	DIRECT RUNOFF							REMARKS
	Basin ID	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	
(1)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Palmer Park Boulevard mid-block crossing near Winnebago Rd S Curb	9a	1.550	0.950	6.70	1.47	8.84	13.01	Basin 9a = 9a+18e = 13.37 cfs
Palmer Park Boulevard mid-block crossing near Winnebago Rd N Curb	9b	10.669	0.500	10.48	5.33	6.99	37.30	Basin 9b = 9b+18b = 42.05 cfs
Security Boulevard at Willis Drive (Vennetucci Elementary) S pinch point	10a	5.465	0.500	25.44	2.73	4.68	12.79	
Security Boulevard at Willis Drive (Vennetucci Elementary) N corner, NWB	10b	18.011	0.500	26.92	9.01	4.53	40.78	
Main Street at Norman Drive NW corner, SB	12a	17.984	0.500	27.42	8.99	4.47	40.23	
Main Street at Norman Drive NE corner, NB	12d	68.510	1.279	26.02	87.64	4.62	404.75	
Main Street at Norman Drive NE corner, WB	12e	4.655	0.500	17.28	2.33	5.54	12.89	
Main Street at Leta Drive NE corner, NB	13a	0.891	0.800	8.28	0.71	8.01	5.71	
Main Street at Leta Drive SW corner, SB	13b	0.280	0.950	5.00	0.27	9.72	2.59	
Main Street at Leta Drive SE corner, NB	13c	0.114	0.950	5.00	0.11	9.72	1.05	
Main Street at Leta Drive SE corner, EB	13d	0.162	0.800	5.38	0.13	9.52	1.24	
Palmer Park Blvd at Peterson Rd N median - SB	18a	0.603	0.950	6.58	0.57	8.90	5.10	
Palmer Park Blvd at Peterson Rd N median - NB	18b	0.538	0.950	5.84	0.51	9.28	4.75	
Palmer Park Blvd at Peterson Rd W median - WB	18c	0.312	0.950	6.60	0.30	8.89	2.63	Basin 18c = 18c+18a = 7.73397 cfs
Palmer Park Blvd at Peterson Rd W median - EB	18d	0.064	0.950	5.00	0.06	9.72	0.59	
Palmer Park Blvd at Peterson Rd E median - EB	18e	0.039	0.950	5.00	0.04	9.72	0.36	
Palmer Park Blvd at Peterson Rd E median - WB	18f	0.108	0.950	5.00	0.10	9.72	1.00	Basin 18f = Basin 18f+18b = 5.74408 cfs
Palmer Park Blvd at Peterson Rd S median - SB	18g	0.079	0.950	5.00	0.07	9.72	0.73	Basin 18g = 18g+18d = 1.31897 cfs
Palmer Park Blvd at Peterson Rd S median - NB	18h	0.074	0.950	5.00	0.07	9.72	0.68	
Piros Dr at Peterson Rd NE corner, NB	19a	2.821	0.950	9.13	2.68	7.57	20.30	
Piros Dr at Peterson Rd SE corner, SB	19b	0.172	0.950	5.00	0.16	9.72	1.58	Basin 19b = 19b+19a+19c = 22.8138 cfs
Piros Dr at Peterson Rd NE corner, SWB	19c	0.101	0.950	5.00	0.10	9.72	0.93	
Main Street mid-block crossing near Marquette Drive SB	21a	0.085	0.500	9.45	0.04	7.41	0.31	
Main Street mid-block crossing near Marquette Drive NB	21b	0.110	0.500	5.00	0.06	9.72	0.53	

- (1) Basin Description linked to C-Value Sheet
- (2) Basin Design Point (not designated)
- (3) Enter the Basin Name from C Value Sheet
- (4) Basin Area linked to C-Value Sheet
- (5) Composite C linked to C-Value Sheet
- (6) Time of Concentration linked to C-Value Sheet

- (7) =Column 4 x Column 5
- (8) = $28.5 \cdot P / (10 + \text{Column } 6)^{0.786}$
- (9) =Column 7 x Column 8
- (10) =Column 6 + Column 21
- (11) Add the Basin Areas (7) to get the combined basin AC
- (12) = $28.5 \cdot P / (10 + \text{Column } 10)^{0.786}$



Appendix E: Hydraulic Results

Project: El Paso County Intersections
 Calculations by: Will Simmons
 Date: 11/20/2024
 Flow Master Results - Proposed Minor Storm, EPC Intersections
 Design Event: Minor, 10-year storm
 Solve For: Spread
 Manning Coefficient: 0.016

Design assumptions:
 Gutter Width: 1.2 feet
 Gutter Cross Slope: 0.083 ft/ft
 Curb Height: 6 inches

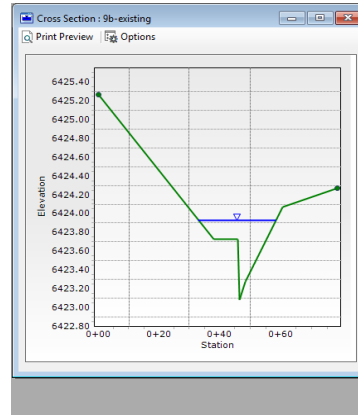
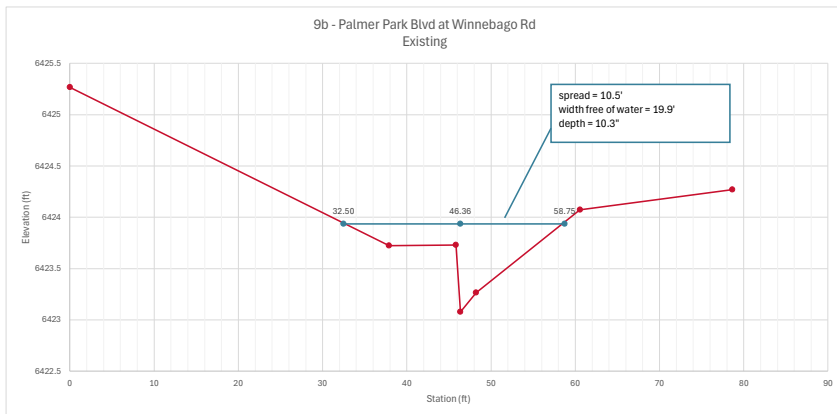
Basin ID	Description	Road Long. Slope	Discharge (cfs)	Road Cross Slope (ft/ft)	Depth Above Curb (in)	Depth (in)	Spread (ft)	Total Lane Width (ft)	Lane Free of Water Width (ft)	Street Type	Meets Criteria per Street Type
9b	Palmer Park Boulevard mid-block crossing near Winnebago Rd	0.01	18.3	0.03	0.7	6.7	16.5	36	19.5	Arterial	YES
9a	Palmer Park Boulevard mid-block crossing near Winnebago Rd	0.01	7.4	0.03	-1.0	5.0	11.7	25	13.3	Arterial	YES
21b	Main Street mid-block crossing near Marquette Drive	0.03	0.2	0.02	-4.6	1.4	2.0	27	25	Residential/Local	YES
21a	Main Street mid-block crossing near Marquette Drive	0.03	0.1	0.02	-4.9	1.1	1.1	27	25.9	Residential/Local	YES
19c	Piros Dr at Peterson Rd	0.03	0.5	0.02	-4.5	1.5	24.7	12	-12.7	Residential/Local	YES
19b	Piros Dr at Peterson Rd	0.03	12.6	0.02	-1.5	4.5	15.0	35	20	Collector or Minor Arterial	YES
19a	Piros Dr at Peterson Rd	0.02	11.3	0.03	-0.9	5.1	12.0	21	9	Collector or Minor Arterial	YES
18h	Palmer Park Blvd at Peterson Rd	0.005	0.4	0.01	-4.0	2.0	7.6	35	27.4	Collector or Minor Arterial	YES
18g	Palmer Park Blvd at Peterson Rd	0.005	0.7	0.005	-3.9	2.1	16.1	24	7.9	Collector or Minor Arterial	YES
18d	Palmer Park Blvd at Peterson Rd	0.005	0.3	0.03	-3.9	2.1	3.7	35	31.3	Arterial	YES
18c	Palmer Park Blvd at Peterson Rd	0.005	4.3	0.04	-1.0	5.0	9.1	24	14.9	Arterial	YES
18b	Palmer Park Blvd at Peterson Rd	0.02	2.6	0.03	-2.7	3.3	7.2	23	15.8	Collector or Minor Arterial	YES
18a	Palmer Park Blvd at Peterson Rd	0.01	2.8	0.02	-2.6	3.4	10.3	34	23.7	Collector or Minor Arterial	YES
13d	Main Street at Leta Drive	0.04	0.6	0.04	-4.1	1.9	2.6	14	11.4	Residential/Local	YES
13c	Main Street at Leta Drive	0.02	0.6	0.02	-4.1	1.9	4.3	28	23.7	Collector or Minor Arterial	YES
13b	Main Street at Leta Drive	0.02	1.4	0.02	-3.5	2.5	6.7	12	5.3	Collector or Minor Arterial	YES
13a	Main Street at Leta Drive	0.02	2.9	0.02	-2.9	3.1	9.1	12	2.9	Collector or Minor Arterial	YES
12e	Main Street at Norman Drive	0.08	5.4	0.01	-3.3	2.7	13.5	16	2.5	Residential/Local	YES
12d	Main Street at Norman Drive	0.005	199.1	0.03	11.4	17.4	46.3	20	-26.3	Collector or Minor Arterial	FAIL
12a	Main Street at Norman Drive	0.005	16.9	0.05	2.5	8.5	13.3	21	7.7	Collector or Minor Arterial	FAIL
10d	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.01	46.8	0.02	2.2	8.2	30.4	13.5	-16.9	Residential/Local	FAIL
10c	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.005	136.5	0.03	9.2	15.2	40.2	16	-24.2	Collector or Minor Arterial	FAIL
10b	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.01	17.2	0.03	0.6	6.6	16.1	19	2.9	Collector or Minor Arterial	FAIL
10a	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.005	5.4	0.02	-1.5	4.5	15.2	16	0.8	Collector or Minor Arterial	YES

Project: El Paso County Intersections
 Calculations by: Will Simmons
 Date: 11/20/2024
 Flow Master Results - Proposed Major Storm, EPC Intersections
 Design Event: Major, 100-year storm
 Solve For: Spread
 Manning Coefficient: 0.016

Design assumptions:
 Gutter Width: 1.2 feet
 Gutter Cross Slope: 0.083 ft/ft
 Curb Height: 6 inches

Checked: EVS 11/25/2024

Basin ID	Description	Road Long. Slope (ft/ft)	Discharge (cfs)	Road Cross Slope (ft/ft)	Depth Above Curb (in)	Depth (in)	Spread (ft)	Total Lane Width (ft)	Lane Free of Water Width (ft)	Street Type	Meets Criteria per Street Type
9b	Palmer Park Boulevard mid-block crossing near Winnebago Rd	0.01	42.1	0.03	2.9	8.9	22.7	36	13.3	Arterial	FAIL
9a	Palmer Park Boulevard mid-block crossing near Winnebago Rd	0.01	13.4	0.03	0.0	6.0	14.7	25	10.3	Arterial	YES
21b	Main Street mid-block crossing near Marquette Drive	0.03	0.5	0.02	-4.2	1.8	57.1	27	-30.1	Residential/Local	YES
21a	Main Street mid-block crossing near Marquette Drive	0.03	0.2	0.02	-4.5	1.5	2.6	27	24.4	Residential/Local	YES
19c	Piros Dr at Peterson Rd	0.03	0.9	0.02	-4.4	1.6	3.7	12	8.3	Residential/Local	YES
19b	Piros Dr at Peterson Rd	0.03	22.8	0.02	-0.6	5.4	18.8	35	16.2	Collector or Minor Arterial	YES
19a	Piros Dr at Peterson Rd	0.02	20.3	0.03	0.2	6.2	15.1	21	5.9	Collector or Minor Arterial	YES
18h	Palmer Park Blvd at Peterson Rd	0.005	0.7	0.01	-3.7	2.3	10	35	25	Collector or Minor Arterial	YES
18g	Palmer Park Blvd at Peterson Rd	0.005	1.3	0.005	-3.6	2.4	20.7	24	3.3	Collector or Minor Arterial	YES
18d	Palmer Park Blvd at Peterson Rd	0.005	0.6	0.03	-3.5	2.5	4.8	35	30.2	Arterial	YES
18c	Palmer Park Blvd at Peterson Rd	0.005	7.7	0.04	0.1	6.1	11.4	24	12.6	Arterial	FAIL
18b	Palmer Park Blvd at Peterson Rd	0.02	4.8	0.03	-2.0	4.0	9.1	23	13.9	Collector or Minor Arterial	YES
18a	Palmer Park Blvd at Peterson Rd	0.01	5.1	0.02	-2.0	4.0	13	34	21	Collector or Minor Arterial	YES
13d	Main Street at Leta Drive	0.04	1.2	0.04	-3.7	2.3	3.6	14	10.4	Residential/Local	YES
13c	Main Street at Leta Drive	0.02	1.1	0.02	-3.7	2.3	5.8	28	22.2	Collector or Minor Arterial	YES
13b	Main Street at Leta Drive	0.02	2.6	0.02	-3.0	3.0	8.6	12	3.4	Collector or Minor Arterial	YES
13a	Main Street at Leta Drive	0.02	5.9	0.02	-1.0	5.0	5.1	12	6.9	Collector or Minor Arterial	YES
12e	Main Street at Norman Drive	0.08	12.9	0.01	-2.6	3.4	19.2	16	-3.2	Residential/Local	YES
12d	Main Street at Norman Drive	0.005	404.8	0.03	16.5	22.5	60.4	20	-40.4	Collector or Minor Arterial	FAIL
12a	Main Street at Norman Drive	0.005	40.2	0.05	5.6	11.6	18.5	21	2.5	Collector or Minor Arterial	YES
10d	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.01	111.1	0.02	5.0	11.0	42.1	13.5	-28.6	Residential/Local	YES
10c	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.005	305.6	0.03	14.3	20.3	54.4	16	-38.4	Collector or Minor Arterial	FAIL
10b	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.01	40.8	0.03	2.8	8.8	22.4	19	-3.4	Collector or Minor Arterial	YES
10a	Security Boulevard at Willis Drive (Vennetucci Elementary)	0.005	12.8	0.02	0.0	6.0	21.2	16	-5.2	Collector or Minor Arterial	YES



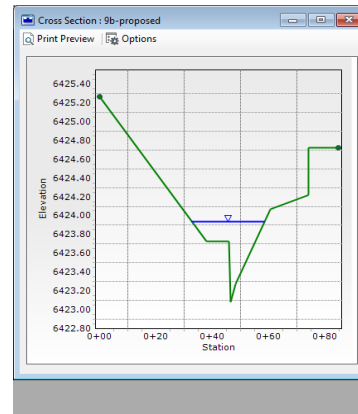
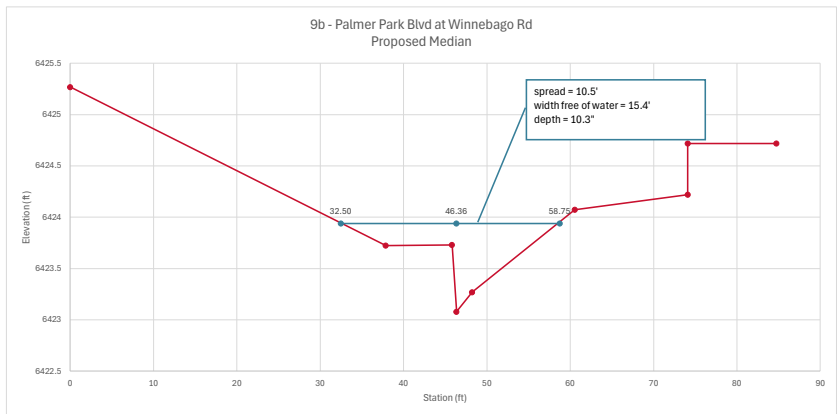
Worksheet : 9b-existing

Uniform Flow **Gradually Varied Flow** Messages

Solve For: Normal Depth Friction Method: Manning Formula

Roughness Coefficient: 0.016	Flow Area: 7.3 ft ²
Channel Slope: 0.004 ft/ft	Wetted Perimeter: 26.01 ft
Elevation: 6,423.93 ft	Hydraulic Radius: 3.4 in
Elevation Range: 6,423.08 to 6,425.27 ft	Top Width: 25.66 ft
Discharge: 18.32 cfs	Normal Depth: 10.3 in
	Critical Depth: 9.8 in
	Critical Slope: 0.006 ft/ft
	Velocity: 2.51 ft/s
	Velocity Head: 0.10 ft
	Specific Energy: 0.96 ft
	Froude Number: 0.832
	Flow Type: Subcritical

Calculation Successful.



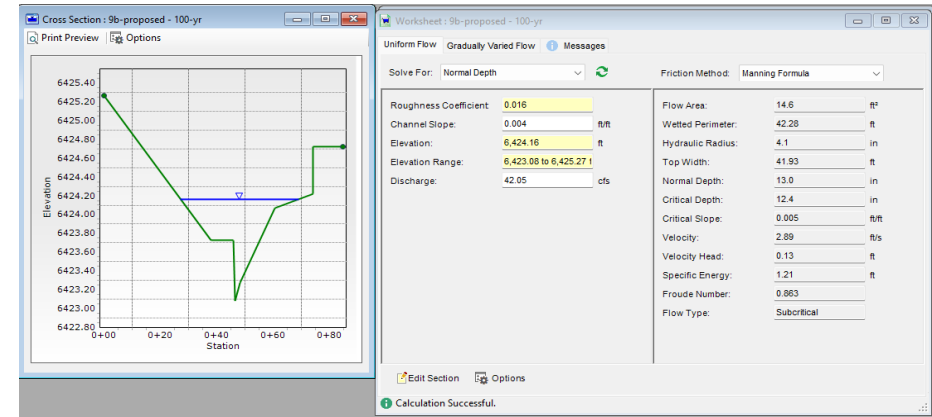
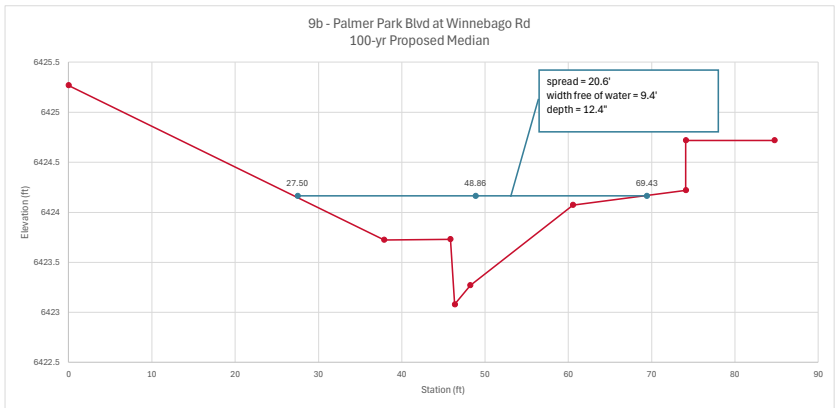
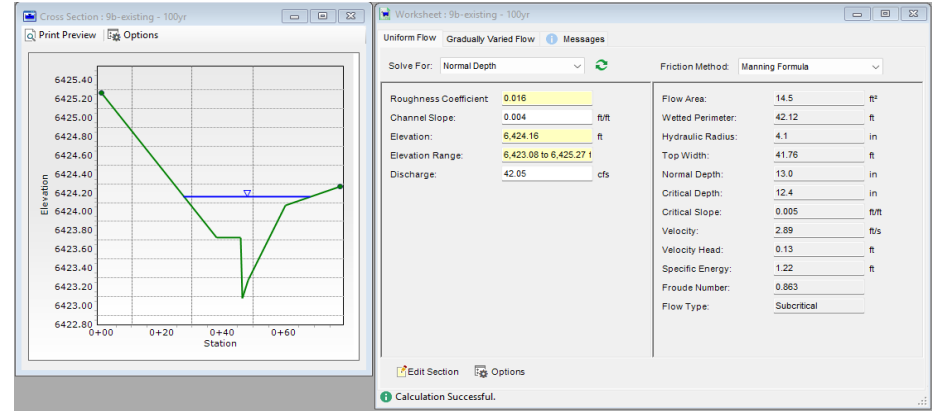
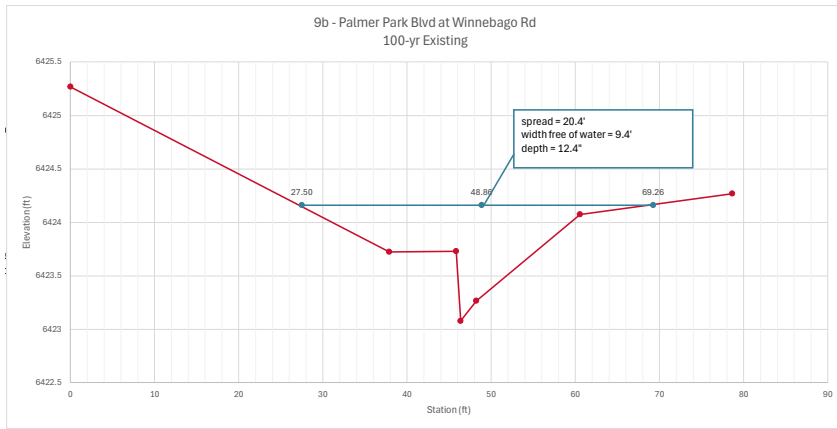
Worksheet : 9b-proposed

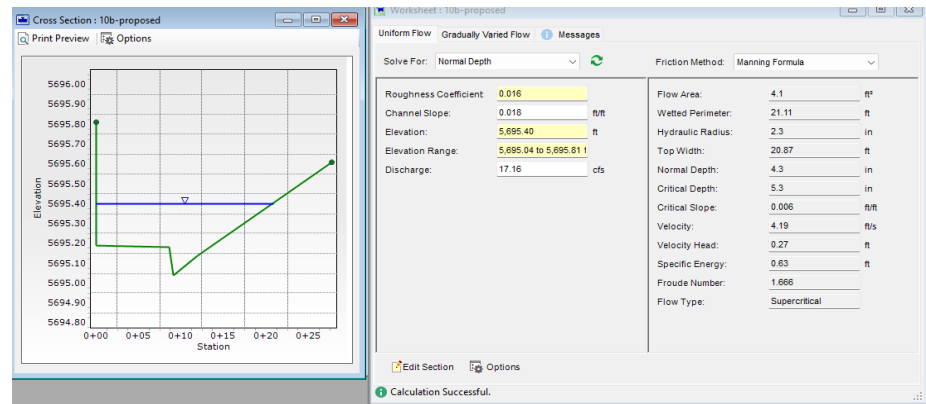
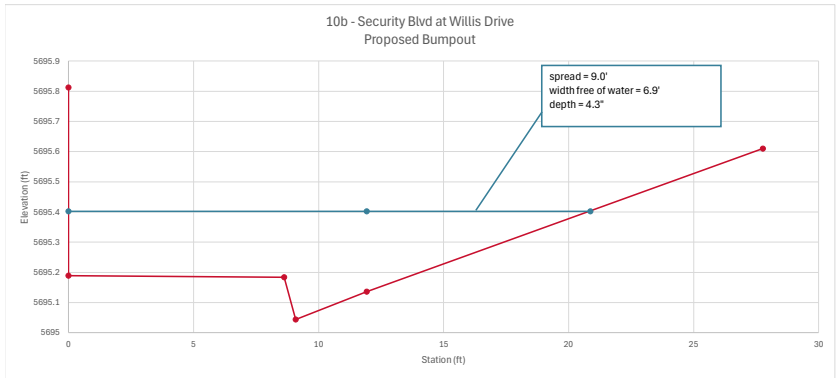
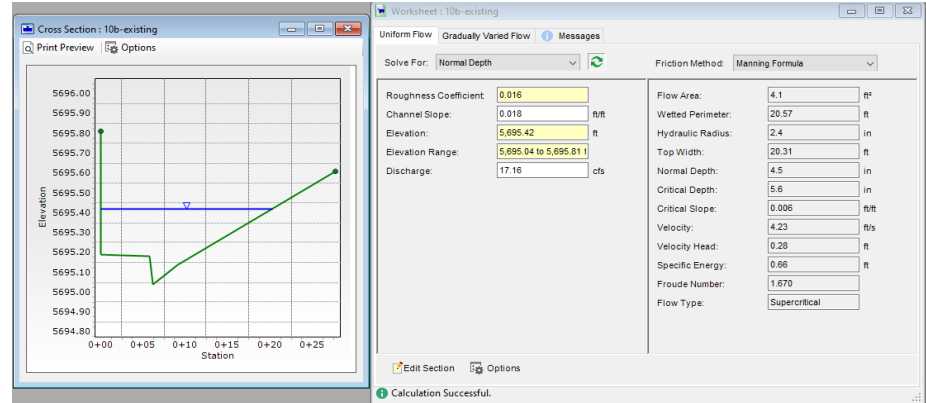
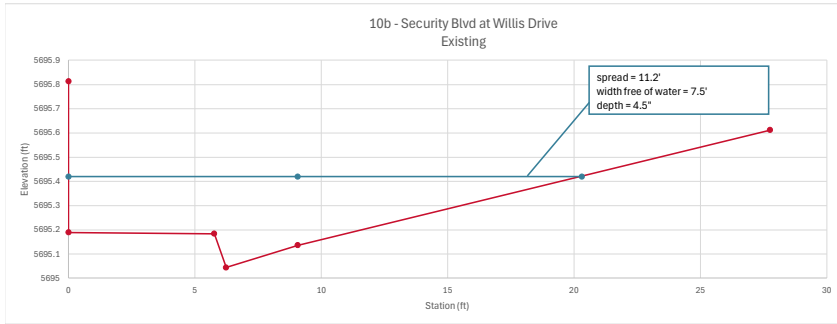
Uniform Flow **Gradually Varied Flow** Messages

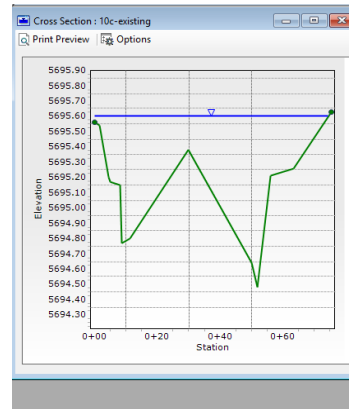
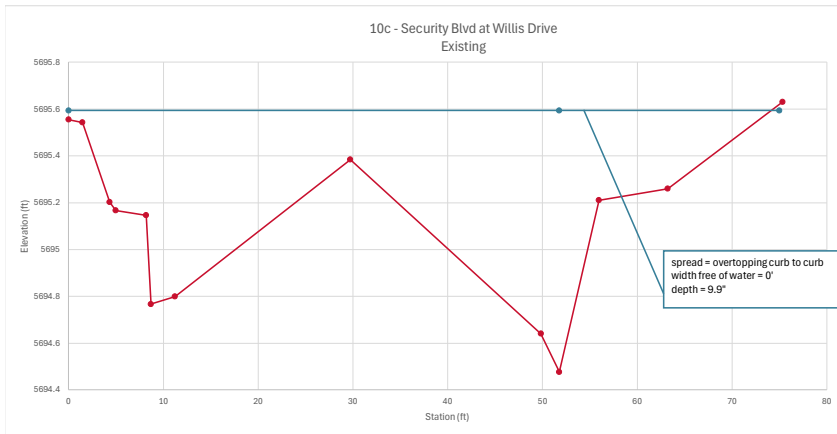
Solve For: Normal Depth Friction Method: Manning Formula

Roughness Coefficient: 0.016	Flow Area: 7.3 ft ²
Channel Slope: 0.004 ft/ft	Wetted Perimeter: 26.06 ft
Elevation: 6,423.94 ft	Hydraulic Radius: 3.4 in
Elevation Range: 6,423.08 to 6,425.27 ft	Top Width: 25.71 ft
Discharge: 18.32 cfs	Normal Depth: 10.3 in
	Critical Depth: 9.8 in
	Critical Slope: 0.006 ft/ft
	Velocity: 2.51 ft/s
	Velocity Head: 0.10 ft
	Specific Energy: 0.95 ft
	Froude Number: 0.832
	Flow Type: Subcritical

Calculation Successful.







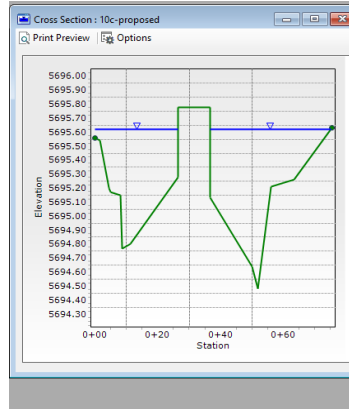
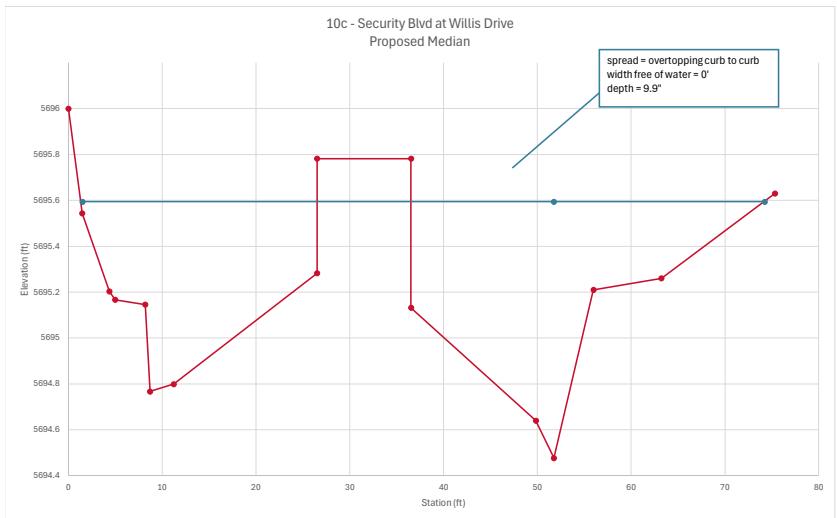
Worksheet: 10c-existing

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Normal Depth | Friction Method: Manning Formula

Roughness Coefficient: 0.016	Flow Area: 35.5 ft ²
Channel Slope: 0.005 ft/ft	Wetted Perimeter: 74.50 ft
Elevation: 5,695.60 ft	Hydraulic Radius: 5.7 in
Elevation Range: 5,694.48 to 5,695.63 ft	Top Width: 74.21 ft
Discharge: 141.91 cfs	Normal Depth: 13.4 in
	Critical Depth: 13.5 in
	Critical Slope: 0.005 ft/ft
	Velocity: 4.00 ft/s
	Velocity Head: 0.25 ft
	Specific Energy: 1.37 ft
	Froude Number: 1.021
	Flow Type: Supercritical

Calculation Successful.



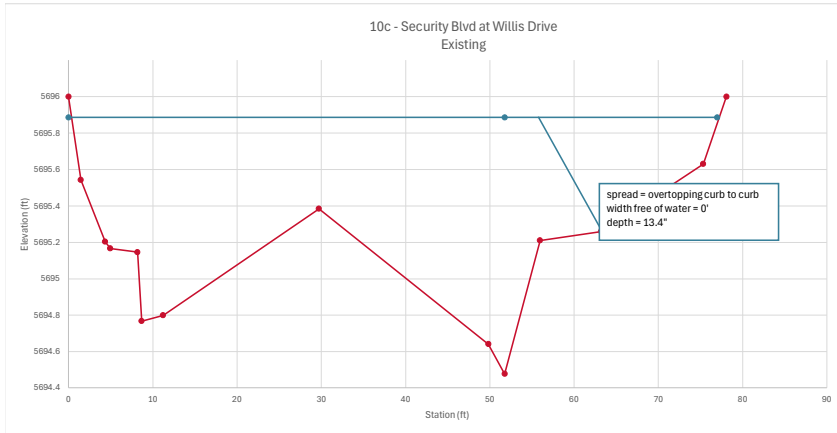
Worksheet: 10c-proposed

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Normal Depth | Friction Method: Manning Formula

Roughness Coefficient: 0.016	Flow Area: 33.8 ft ²
Channel Slope: 0.005 ft/ft	Wetted Perimeter: 66.68 ft
Elevation: 5,695.62 ft	Hydraulic Radius: 6.1 in
Elevation Range: 5,694.48 to 5,695.78 ft	Top Width: 64.95 ft
Discharge: 141.91 cfs	Normal Depth: 13.7 in
	Critical Depth: 13.8 in
	Critical Slope: 0.005 ft/ft
	Velocity: 4.20 ft/s
	Velocity Head: 0.27 ft
	Specific Energy: 1.42 ft
	Froude Number: 1.028
	Flow Type: Supercritical

Calculation Successful.



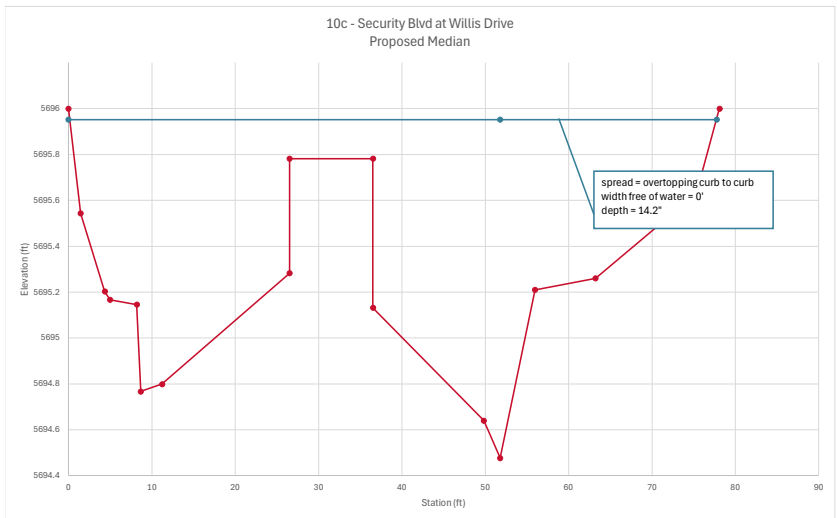
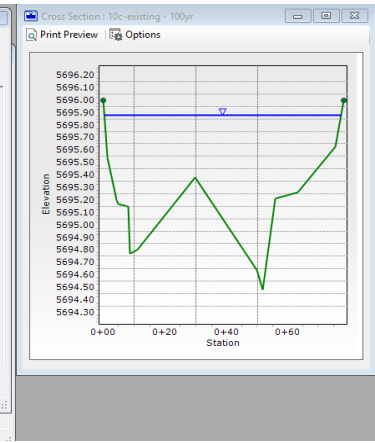
Worksheet: 10c-existing - 100yr

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Normal Depth | Friction Method: Manning Formula

Roughness Coefficient:	0.016	Flow Area:	57.0	ft²
Channel Slope:	0.005	Wetted Perimeter:	77.16	ft
Elevation:	5,695.88	Hydraulic Radius:	8.9	in
Elevation Range:	5,694.48 to 5,696.00	Top Width:	78.84	ft
Discharge:	305.60	Normal Depth:	16.9	in
		Critical Depth:	17.5	in
		Critical Slope:	0.004	ft/ft
		Velocity:	5.36	ft/s
		Velocity Head:	0.45	ft
		Specific Energy:	1.85	ft
		Froude Number:	1.088	
		Flow Type:	Supercritical	

Calculation Successful.



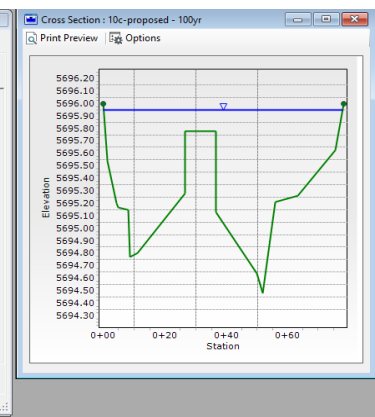
Worksheet: 10c-proposed - 100yr

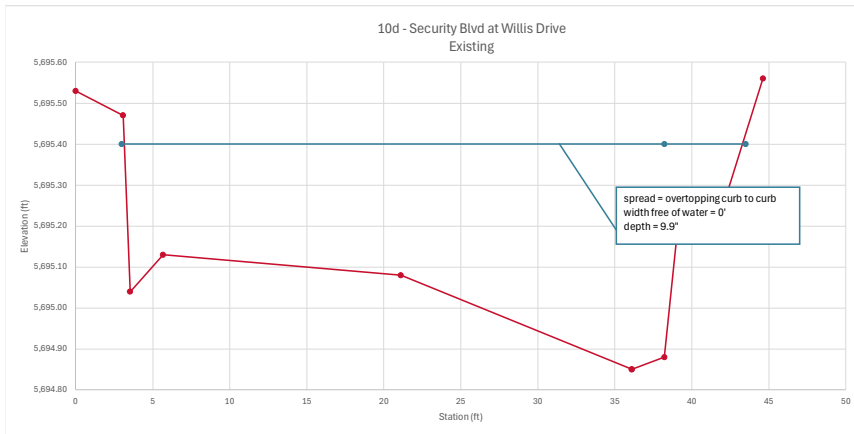
Uniform Flow | Gradually Varied Flow | Messages

Solve For: Normal Depth | Friction Method: Manning Formula

Roughness Coefficient:	0.016	Flow Area:	57.5	ft²
Channel Slope:	0.005	Wetted Perimeter:	79.08	ft
Elevation:	5,695.95	Hydraulic Radius:	8.7	in
Elevation Range:	5,694.48 to 5,696.00	Top Width:	77.60	ft
Discharge:	305.60	Normal Depth:	17.7	in
		Critical Depth:	18.3	in
		Critical Slope:	0.004	ft/ft
		Velocity:	5.31	ft/s
		Velocity Head:	0.44	ft
		Specific Energy:	1.92	ft
		Froude Number:	1.088	
		Flow Type:	Supercritical	

Calculation Successful.





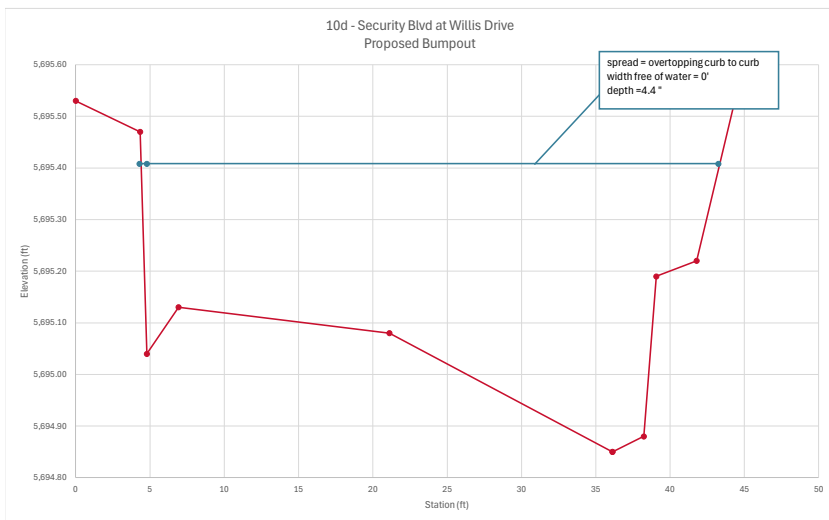
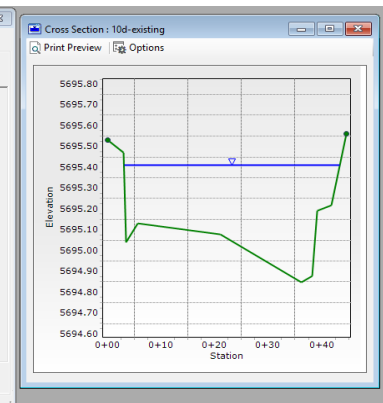
Worksheet: 10d-existing

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Normal Depth | Friction Method: Manning Formula

Roughness Coefficient:	0.016	Flow Area:	14.3	ft²	
Channel Slope:	0.005	ft/ft	Wetted Perimeter:	40.44	ft
Elevation:	5,695.41	ft	Hydraulic Radius:	4.2	in
Elevation Range:	5,694.85 to 5,695.56	ft	Top Width:	40.22	ft
Discharge:	46.80	cts	Normal Depth:	6.6	in
			Critical Depth:	6.6	in
			Critical Slope:	0.005	ft/ft
			Velocity:	3.28	ft/s
			Velocity Head:	0.17	ft
			Specific Energy:	0.72	ft
			Froude Number:	0.971	
			Flow Type:	Subcritical	

Calculation Successful.



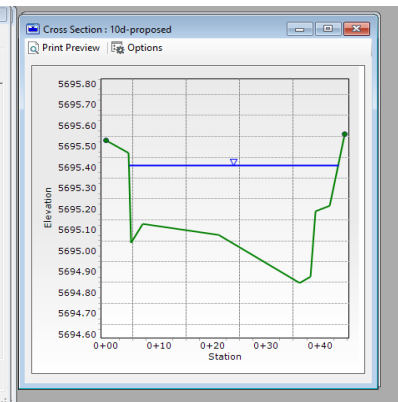
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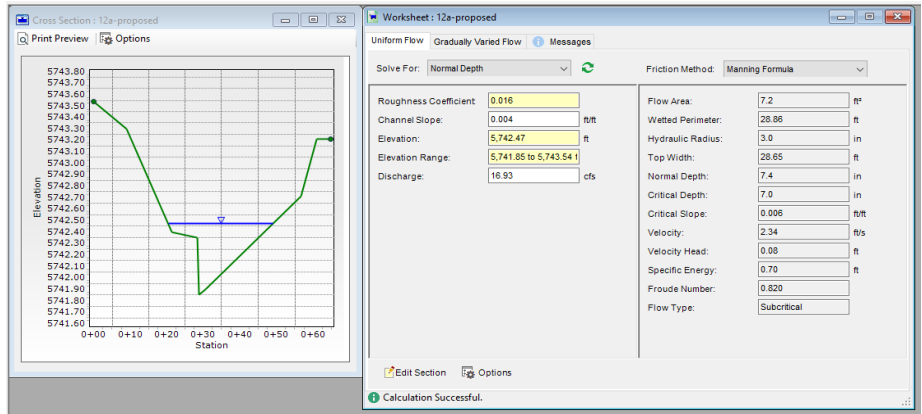
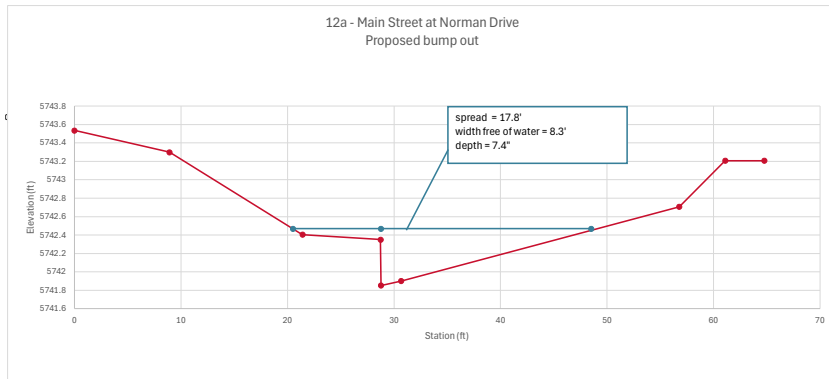
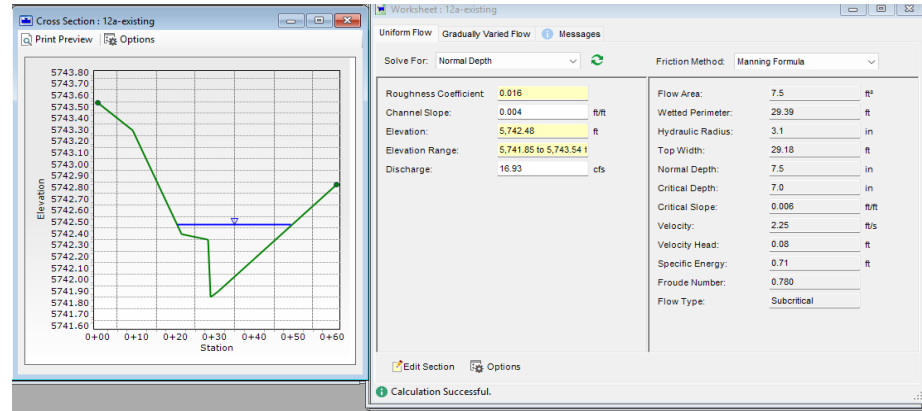
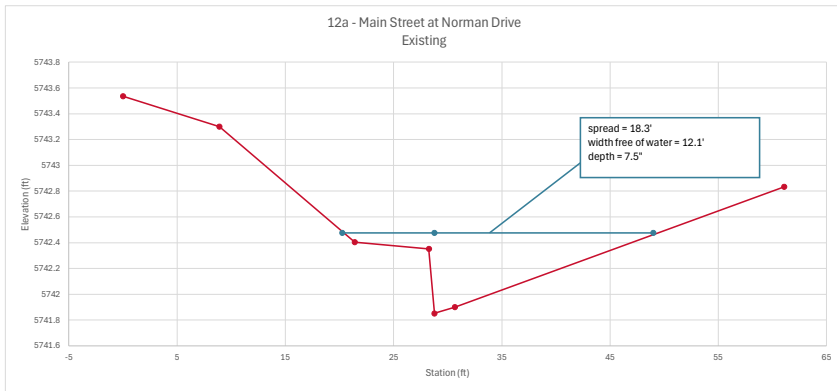
Uniform Flow | Gradually Varied Flow | Messages

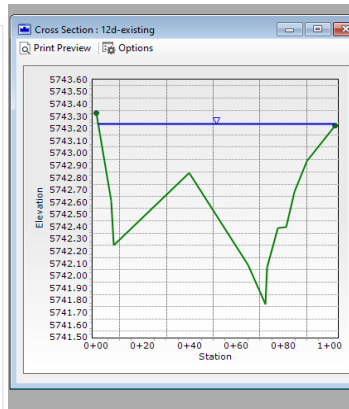
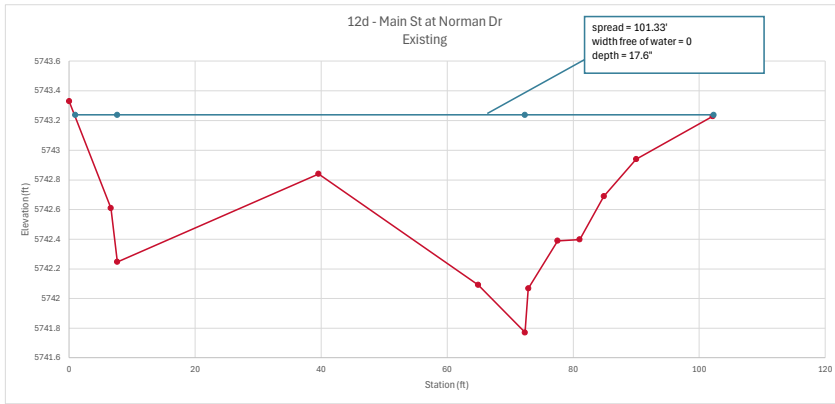
Solve For: Normal Depth | Friction Method: Manning Formula

Roughness Coefficient:	0.016	Flow Area:	14.1	ft²	
Channel Slope:	0.005	ft/ft	Wetted Perimeter:	39.23	ft
Elevation:	5,695.41	ft	Hydraulic Radius:	4.3	in
Elevation Range:	5,694.85 to 5,695.56	ft	Top Width:	39.01	ft
Discharge:	46.80	cts	Normal Depth:	6.7	in
			Critical Depth:	6.6	in
			Critical Slope:	0.005	ft/ft
			Velocity:	3.32	ft/s
			Velocity Head:	0.17	ft
			Specific Energy:	0.73	ft
			Froude Number:	0.974	
			Flow Type:	Subcritical	

Calculation Successful.







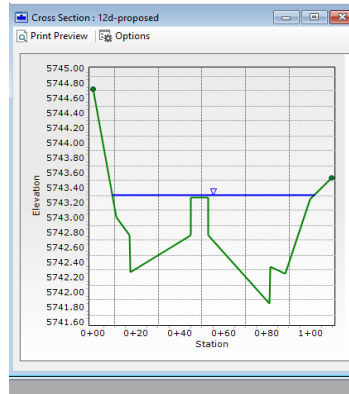
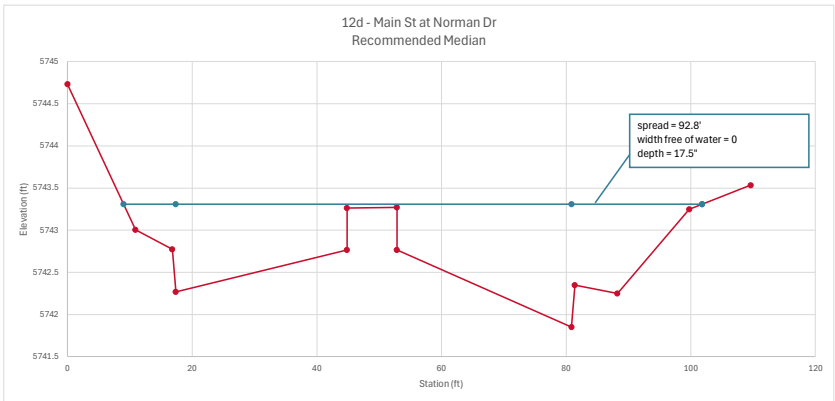
Worksheet: 12d-existing

Uniform Flow Gradually Varied Flow Messages

Solve For: Normal Depth Friction Method: Manning Formula

Roughness Coefficient	0.016	Flow Area:	69.3	ft ²
Channel Slope:	0.002	Wetted Perimeter:	101.58	ft
Elevation:	5,743.24	Hydraulic Radius:	8.2	in
Elevation Range:	5,741.77 to 5,743.33	Top Width:	101.33	ft
Discharge:	215.99	Normal Depth:	17.6	in
		Critical Depth:	15.4	in
		Critical Slope:	0.005	ft/ft
		Velocity:	3.11	ft/s
		Velocity Head:	0.15	ft
		Specific Energy:	1.62	ft
		Froude Number:	0.664	
		Flow Type:	Subcritical	

Calculation Successful.



Worksheet: 12d-proposed

Uniform Flow Gradually Varied Flow Messages

Solve For: Normal Depth Friction Method: Manning Formula

Roughness Coefficient	0.016	Flow Area:	67.3	ft ²
Channel Slope:	0.002	Wetted Perimeter:	94.31	ft
Elevation:	5,743.31	Hydraulic Radius:	8.6	in
Elevation Range:	5,741.85 to 5,744.73	Top Width:	92.81	ft
Discharge:	215.99	Normal Depth:	17.5	in
		Critical Depth:	14.8	in
		Critical Slope:	0.004	ft/ft
		Velocity:	3.21	ft/s
		Velocity Head:	0.16	ft
		Specific Energy:	1.62	ft
		Froude Number:	0.664	
		Flow Type:	Subcritical	

Calculation Successful.

