DRAINAGE LETTER REPORT

for

1450 VALLEY STREET – WAREHOUSE BUILDING
LOT 2, BLOCK 2, CIMARRON INDUSTRIAL NO. 2

Prepared for:

Hammers Construction Inc.
1411 Woolsey Heights
Colorado Springs, CO 80915

October 26, 2022
Revised January 20, 2023
Revised March 6, 2023

Prepared by:

JPS ENGINEERING

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JPS Project No. 062201
PCD File No. PPR-22-058

1450 VALLEY STREET – WAREHOUSE BUILDING
LOT 2, BLOCK 2, CIMARRON INDUSTRIAL NO. 2
DRAINAGE REPORT STATEMENTS

1. Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports a report is in conformity with the master plan for the drainage basin. I accept respo for liability caused by negligent acts, errors or omissions on my part in preparing report:

COLORADO REGISTERED PROFESSIONAL ENGINEER
JOHN P. SCHWAB
3/28/23
29891

John P. Schwab Colorado P.E. No. 29891

2. Developer's Statement:

I, the developer, have read and will comply with all the requirements specified in this drainage report and plan.

By: ______________________ 4/3/23

Printed Name: Phillip Holli-Arcus Date
Title: Project Manger
Hammers Construction, Inc., 1411 Woolsey Heights, Colorado Springs, CO 80915

3. El Paso County Statement:

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

Approved
By: Elizabeth Nijkamp, PE
Date:04/17/2023
El Paso County Department of Public Works

County Engineer / ECM Administrator

Conditions:

1450 VALLEY STREET – LOT 2, BLOCK 2, CIMARRON INDUSTRIAL NO. 2
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APPENDICES

I. INTRODUCTION

A. Property Location and Description

Carson Investment Properties LLC (Owner) is planning to construct a new 18,800 square-foot commercial warehouse building on the south side of the developed 2.6-acre lot at 1450 Valley Street in El Paso County. The property is platted as Lot 2, Block 1, Cimarron Industrial No. 2 (El Paso County Assessor's Parcel No. 54072-03-013), located along the west side of Valley Street, south of Omaha Boulevard. The property is currently developed with an existing manufacturing building on the north side of the site (Tumbleweed Tiny House Company) and existing asphalt parking and storage areas on the south side of the property.

The site is zoned Industrial (I-2), and the property adjoins developed commercial / industrial properties on all sides. Valley Street is a fully improved local public road along the east boundary of the site. An existing public drainage channel (Outlot B, Cimarron Industrial No. 2) adjoins the west boundary of the property. Existing commercial buildings are located along the north boundary of the site (Lot 1, Block 1, Cimarron Industrial No. 2) and the south boundary of the site (Lot 1, Boatman Subdivision).

The proposed Site Development Plan consists of a new 18,800 square-foot single-story Warehouse Building with associated parking and site improvements. Access will be provided by the existing driveway connections to Valley Street along the eastern site boundary of the site.

The total disturbed area associated with this project is approximately 0.97 acres. Recognizing that the land disturbance is under one acre, permanent water quality facilities are not required as the project is not classified as an "applicable construction activity" in accordance with Section I.6.1 of the El Paso County Engineering Criteria Manual (ECM).

B. Scope

In support of the Site Development Plan submittal to El Paso County, this report is intended to meet the requirements of a Drainage Letter Report in accordance with El Paso County drainage criteria. This report will provide a summary of site drainage issues impacting the proposed development. The report is based on the guidelines and criteria presented in the City of Colorado Springs and El Paso County "Drainage Criteria Manual."

C. References

City of Colorado Springs & El Paso County "Drainage Criteria Manual, Volumes 1 and 2," revised May, 2014.

El Paso County "Engineering Criteria Manual," December 13, 2016.

II. EXISTING AND PROPOSED DRAINAGE CONDITIONS

According to the Natural Resources Conservation Service (NRCS) Soil Survey for this site, on-site soils are comprised of “Blendon sandy loam” soils, and these well drained soils are classified as hydrologic soils group “B” (high infiltration rate; see Appendix A).

Existing Site Drainage Conditions

No subdivision drainage report was found on file for “Cimarron Industrial No. 2.” As shown on the enclosed “Existing Conditions Drainage Plan” (Figure EX1), the majority of the existing Lot 2 site has been delineated as Basin A (2.45 acres), and surface drainage from Basin A sheet flows southwesterly to Design Point #1 at the southwest corner of the property. The site is not impacted by any significant off-site drainage. Existing peak flows at Design Point #1 are calculated as Q_5 = 9.0 cfs and Q_{100} = 17.2 cfs.

Drainage at the southwest corner of the site (Design Point #1) is intended to flow into the adjoining concrete-lined public drainage channel along the west boundary of the property. As noted in the survey and visual inspection of the property, there is currently a significant eroded area in the southwest corner of the property, which needs to be repaired.

The east edge of the site has been delineated as Basin B (0.09 acres), and surface drainage from Basin B flows southeasterly into the existing curb and gutter along the west side of Valley Street (Design Point #2) at the southeast corner of the property. Existing peak flows at Design Point #2 are calculated as Q_5 = 0.05 cfs and Q_{100} = 0.2 cfs.

Proposed Site Drainage Conditions

As shown on the enclosed “Developed Drainage Plan” (Figure D1), the developed area of this project is limited to approximately 0.97 acres. Developed drainage from Basin A (2.2 acres) will continue to flow southwesterly across the site by sheet flow and drainage swales to Design Point #1 at the southwest corner of the property. The proposed grading for the new Warehouse building pad will provide positive drainage away from the new building, and a new concrete crosspan will convey developed flows westerly in the parking lot along the north face of the new building.

Recognizing that the proposed Warehouse building will be constructed over an existing paved parking area, there will be no net increase in the site impervious area within Basin A. Developed peak flows at Design Point #1 are calculated as Q_5 = 8.9 cfs and Q_{100} = 16.7 cfs, equivalent to the calculated existing condition peak flows.

A new 10-foot Type R Private Storm Inlet (Inlet A1) will be constructed to capture developed drainage in the southwest corner of the property, and new Private Storm Sewer A1 (18” HDPE) will convey the flow into the existing public drainage channel.

The proposed private inlet and storm sewer connection will restore a stable connection to the existing public drainage channel, providing a suitable outfall for the developed drainage from the majority of this site.

The east edge of the existing site, including the new parking area in the southeast corner of the property, has been delineated as Basin B (0.34 acres), and surface drainage from Basin B will flow southeasterly into Valley Street (Design Point #2) at the southeast corner of the property. A 2-foot concrete curb chase will convey the flow from the southeast parking lot into the existing curb and gutter along the west side of Valley Street (see enclosed hydraulic calculation in Appendix B). Developed peak flows at Design Point #2 are calculated as Q_5 = 1.0 cfs and Q_{100} = 1.9 cfs. While the developed flow at DP2 increases in comparison to the existing flows at Design Point #2 (based on enlargement of Basin B), the developed flows remain negligible in comparison to the existing street capacity of Valley Street.

Valley Street provides an allowable street capacity of Q_5 = 18.0 cfs and Q_{100} = 144.3 cfs, providing a suitable outfall for drainage from the east side of this site. With the small amount of additional developed flow from Design Point #2, there is more than sufficient existing street capacity within Valley Street.

Hydrologic calculations for the site are detailed in the attached spreadsheets (Appendix A), and peak flows are identified on Figures EX1 and D1 (Appendix A).

III. DRAINAGE PLANNING FOUR STEP PROCESS

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls. The Four Step Process has been implemented as follows in the planning of this project:

<u>Step 1: Employ Runoff Reduction Practices</u>

- Minimize Impacts: The proposed site development consists of a new commercial warehouse building on a previously platted and developed industrial lot which has been planned for full industrial development. The proposed warehouse building will be constructed within an existing asphalt-paved parking and storage area. This infill, re-development project will have minimal drainage impacts in comparison to new construction on an undeveloped site.

<u>Step 2: Stabilize Drainageways</u>

- An existing concrete-lined public drainage channel (Sand Creek Center Tributary Channel) adjoins the west boundary of this site.
- The drainage outfall at the southwest corner of this site will be improved with a new storm inlet and storm sewer pipe connection to the existing drainage channel, providing a stabilized connection to repair the existing erosion in the southwest corner of the property.

Step 3: Provide Water Quality Capture Volume (WQCV)

- This site is excluded from permanent Water Quality control measure requirements based on the disturbed area remaining under one acre.

Step 4: Consider Need for Industrial and Commercial BMPs

- The Owner is responsible for maintaining proper housekeeping practices and spill containment procedures.

IV. FLOODPLAIN IMPACTS

Floodplain limits in vicinity of this site are delineated in the applicable Flood Insurance Rate Map, FIRM Panel No. 08041C0752G dated December 7, 2018 (FIRM exhibit enclosed in Appendix A). The Sand Creek Center Tributary Channel flows south within the existing concrete-lined public drainage channel along the west boundary of this site. According to the FEMA floodplain map, the 100-year floodplain limits are contained within the existing channel.

V. STORMWATER DETENTION AND WATER QUALITY

No stormwater detention is required based on the limited impervious area impact of this re-development project. The proposed Warehouse Building will be constructed in an area of the site currently covered with asphalt pavement, so there will be no significant developed drainage impact associated with the project.

As previously discussed, this site is excluded from water quality control measure requirements based on the disturbed area being smaller than one acre.

VI. DRAINAGE BASIN FEES

The site lies within the Sand Creek Drainage Basin. No public drainage improvements are required for development of this project. Required drainage fees have been paid during the previous subdivision platting process, so there are no applicable drainage fees required with the Site Development Plan.

VII. SUMMARY

The developed drainage patterns associated with the proposed Warehouse Building project at 1450 Valley Street (Lot , Block 1, Cimarron Industrial No. 2) will remain consistent with the established drainage conditions for this subdivision. The proposed Warehouse Building project is a re-development of a part of the existing paved parking lot within this industrial lot, so there will be no significant impact on existing site drainage conditions.

The project will include construction of a new private storm inlet and storm sewer connection to the adjoining public drainage channel, which will restore proper functioning of the drainage outfall at the southwest corner of this property.

Developed drainage from the majority of the site (Basin A) will flow to the southwest corner of the site where the existing concrete-lined channel provides a suitable ultimate downstream drainage outfall. Developed drainage from the southeast fringe of the site (Basin B) will flow to the southeast corner of the property, where the existing curb and gutter along Valley Street provides a suitable ultimate drainage outfall.

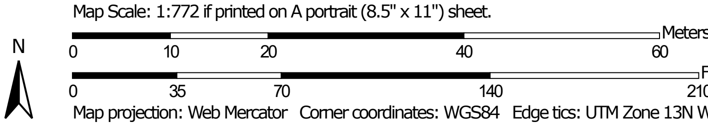
Proper establishment and maintenance of positive drainage within the site, in conjunction with proper erosion control practices, will ensure that this developed site has no significant adverse impact on downstream or surrounding areas.

APPENDIX A

HYDROLOGIC CALCULATIONS

Hydrologic Soil Group—El Paso County Area, Colorado
(1450 Valley Street)

Map Scale: 1:772 if printed on A portrait (8.5" x 11") sheet.



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 Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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: Aug 19, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10	Blendon sandy loam, 0 to 3 percent slopes	B	2.6	100.0%
Totals for Area of Interest			**2.6**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

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

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

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

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

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

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

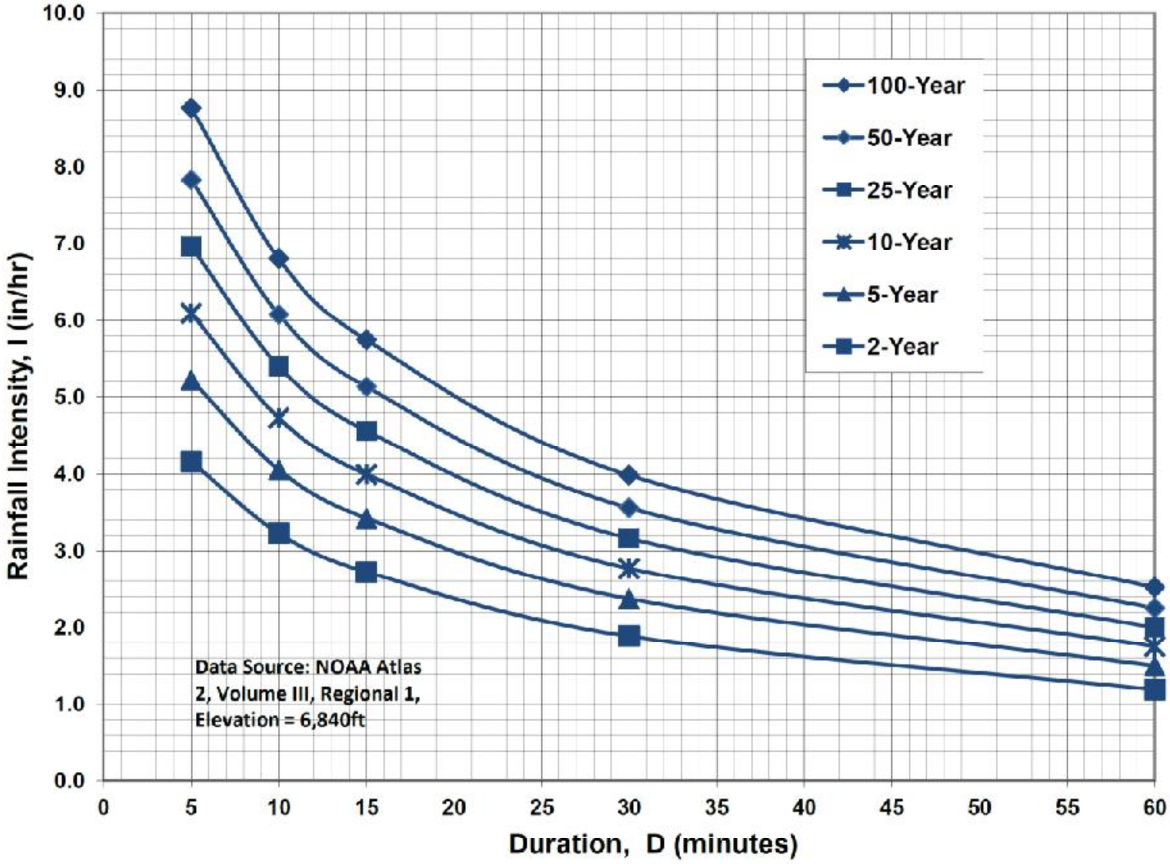
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

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

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

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

1450 VALLEY STREET
COMPOSITE RUNOFF COEFFICIENTS

EXISTING CONDITIONS

5-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.45	1.93	BUILDING / PAVEMENT	0.90	0.52	LANDSCAPE	0.08				0.726
B	0.09	0.005	BUILDING / PAVEMENT	0.90	0.09	LANDSCAPE	0.08				0.126

100-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.45	1.93	BUILDING / PAVEMENT	0.96	0.52	LANDSCAPE	0.35				0.831
B	0.09	0.005	BUILDING / PAVEMENT	0.96	0.09	LANDSCAPE	0.35				0.384

EXISTING CONDITIONS IMPERVIOUS AREAS

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A	2.45	1.93	BUILDING / PAVEMENT	100	0.52	LANDSCAPE	0				78.776
B	0.09	0.005	BUILDING / PAVEMENT	100	0.09	LANDSCAPE	0				5.556

1450 VALLEY STREET
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

5-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.22	1.89	BUILDING / PAVEMENT	0.90	0.33	LANDSCAPE	0.08				0.778
B	0.32	0.21	BUILDING / PAVEMENT	0.90	0.11	LANDSCAPE	0.08				0.618

100-YEAR C-VALUES

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.22	1.89	BUILDING / PAVEMENT	0.96	0.33	LANDSCAPE	0.35				0.869
B	0.32	0.21	BUILDING / PAVEMENT	0.96	0.11	LANDSCAPE	0.35				0.750

DEVELOPED CONDITIONS IMPERVIOUS AREAS

BASIN	TOTAL AREA (AC)	AREA (AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A	2.22	1.89	BUILDING / PAVEMENT	100	0.33	LANDSCAPE	0				85.135
B	0.32	0.21	BUILDING / PAVEMENT	100	0.11	LANDSCAPE	0				65.625

1450 VALLEY STREET
RATIONAL METHOD

EXISTING CONDITION FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR	C 100-YEAR	Overland Flow LENGTH (FT)	Overland Flow SLOPE (FT/FT)	Overland Flow Tco (1) (MIN)	Channel flow CHANNEL LENGTH (FT)	Channel flow CONVEYANCE COEFFICIENT C	Channel flow SLOPE (FT/FT)	Channel flow SCS (2) VELOCITY (FT/S)	Channel flow Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	INTENSITY (5) 5-YR (IN/HR)	INTENSITY (5) 100-YR (IN/HR)	PEAK FLOW Q5 (6) (CFS)	PEAK FLOW Q100 (6) (CFS)
A	1	2.45	0.726	0.831	40	0.050	2.5	530	20	0.023	3.03	2.9	5.4	5.4	5.04	8.46	8.97	17.23
B	2	0.09	0.126	0.384	40	0.020	9.0	210	15	0.015	1.84	1.9	10.9	10.9	4.01	6.73	0.05	0.23

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR	C 100-YEAR	Overland Flow LENGTH (FT)	Overland Flow SLOPE (FT/FT)	Overland Flow Tco (1) (MIN)	Channel flow CHANNEL LENGTH (FT)	Channel flow CONVEYANCE COEFFICIENT C	Channel flow SLOPE (FT/FT)	Channel flow SCS (2) VELOCITY (FT/S)	Channel flow Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	INTENSITY (5) 5-YR (IN/HR)	INTENSITY (5) 100-YR (IN/HR)	PEAK FLOW Q5 (6) (CFS)	PEAK FLOW Q100 (6) (CFS)
A	1	2.22	0.778	0.869	40	0.050	2.2	530	20	0.023	3.03	2.9	5.1	5.1	5.14	8.63	8.88	16.65
B	2	0.32	0.618	0.750	40	0.020	4.4	210	15	0.015	1.84	1.9	6.3	6.3	4.81	8.08	0.95	1.94

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
I_5 = -1.5 * ln(Tc) + 7.583
I_{100} = -2.52 * ln(Tc) + 12.735
6) Q = CiA

APPENDIX B

HYDRAULIC CALCULATIONS

1450 VALLEY STREET
STORM INLET SIZING SUMMARY

	BASIN FLOW			INLET FLOW						
INLET	DP	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET FLOW % OF BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)		INLET CONDITION / TYPE	INLET SIZE (FT)	INLET CAPACITY (CFS)
A1	1	8.9	16.7	100	8.9	16.7		SUMP TYPE R	10'	25.5

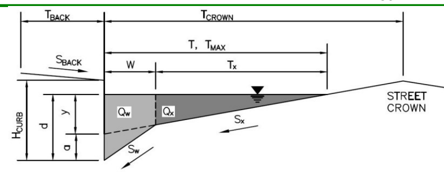
Version 4.05 Released March 2017

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

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

Project: 1450 Valley Street - Inlet A1

Inlet ID: Inlet A1



Gutter Geometry (Enter data in the blue cells)

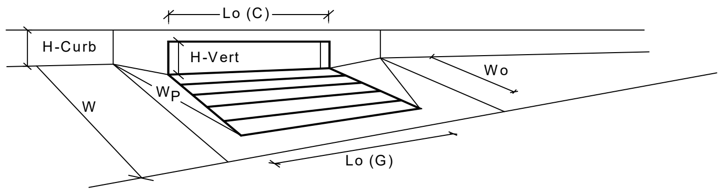
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	4.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	50.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	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} =	50.0	50.0	ft
Warning 02	Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	7.0	12.0	inches
	Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	7.0	12.0	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
Area Opening 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} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	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} =	0.42	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.66	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.99	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**12.2**	**25.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	8.8	16.6	cfs

1450 VALLEY STREET
STORM SEWER SIZING SUMMARY

	PIPE FLOW				PIPE CAPACITY		
PIPE	INLET	Q5 FLOW (CFS)	Q100 FLOW (CFS)		PIPE SIZE	MIN. PIPE SLOPE	FULL PIPE CAPACITY (CFS)
A1	A1	8.9	16.7		18	4.1%	16.7

ASSUMPTIONS:

1. STORM DRAIN PIPE ASSUMED TO BE RCP OR HDPE

Hydraulic Analysis Report

Project Data

Project Title: Project - 1450 Valley Street - SD

Designer: JPS

Project Date: Tuesday, October 25, 2022

Project Units: U.S. Customary Units

Notes:

Channel Analysis: SD-A1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0410 ft/ft

Manning's n: 0.0130

Depth: 1.0000 ft

Result Parameters

Flow: 16.6729 cfs

Area of Flow: 1.2515 ft^2

Wetted Perimeter: 2.8659 ft

Hydraulic Radius: 0.4367 ft

Average Velocity: 13.3222 ft/s

Top Width: 1.4142 ft

Froude Number: 2.4957

Critical Depth: 1.4348 ft

Critical Velocity: 9.5803 ft/s

Critical Slope: 0.0219 ft/ft

Critical Top Width: 0.61 ft

Calculated Max Shear Stress: 2.5584 lb/ft^2

Calculated Avg Shear Stress: 1.1172 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: Project - 1450 Valley Street - Curb Chase

Designer: JPS

Project Date: Monday, March 6, 2023

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis-Curb Chase-DP2

Notes:

Input Parameters

Channel Type: Rectangular

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0260 ft/ft

Manning's n: 0.0130

Flow: 1.9000 cfs

Result Parameters

Depth: 0.1805 ft

Area of Flow: 0.3609 ft^2

Wetted Perimeter: 2.3609 ft

Hydraulic Radius: 0.1529 ft

Average Velocity: 5.2644 ft/s

Top Width: 2.0000 ft

Froude Number: 2.1839

Critical Depth: 0.3038 ft

Critical Velocity: 3.1275 ft/s

Critical Slope: 0.0052 ft/ft

Critical Top Width: 2.00 ft

Calculated Max Shear Stress: 0.2928 lb/ft^2

Calculated Avg Shear Stress: 0.2480 lb/ft^2

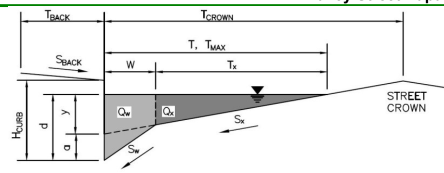
Version 4.05 Released March 2017

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

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

Project: Valley Street - Urban Local Street Capacity

Inlet ID: Valley Street Capacity



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.017	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} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**18.0**	**144.3**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

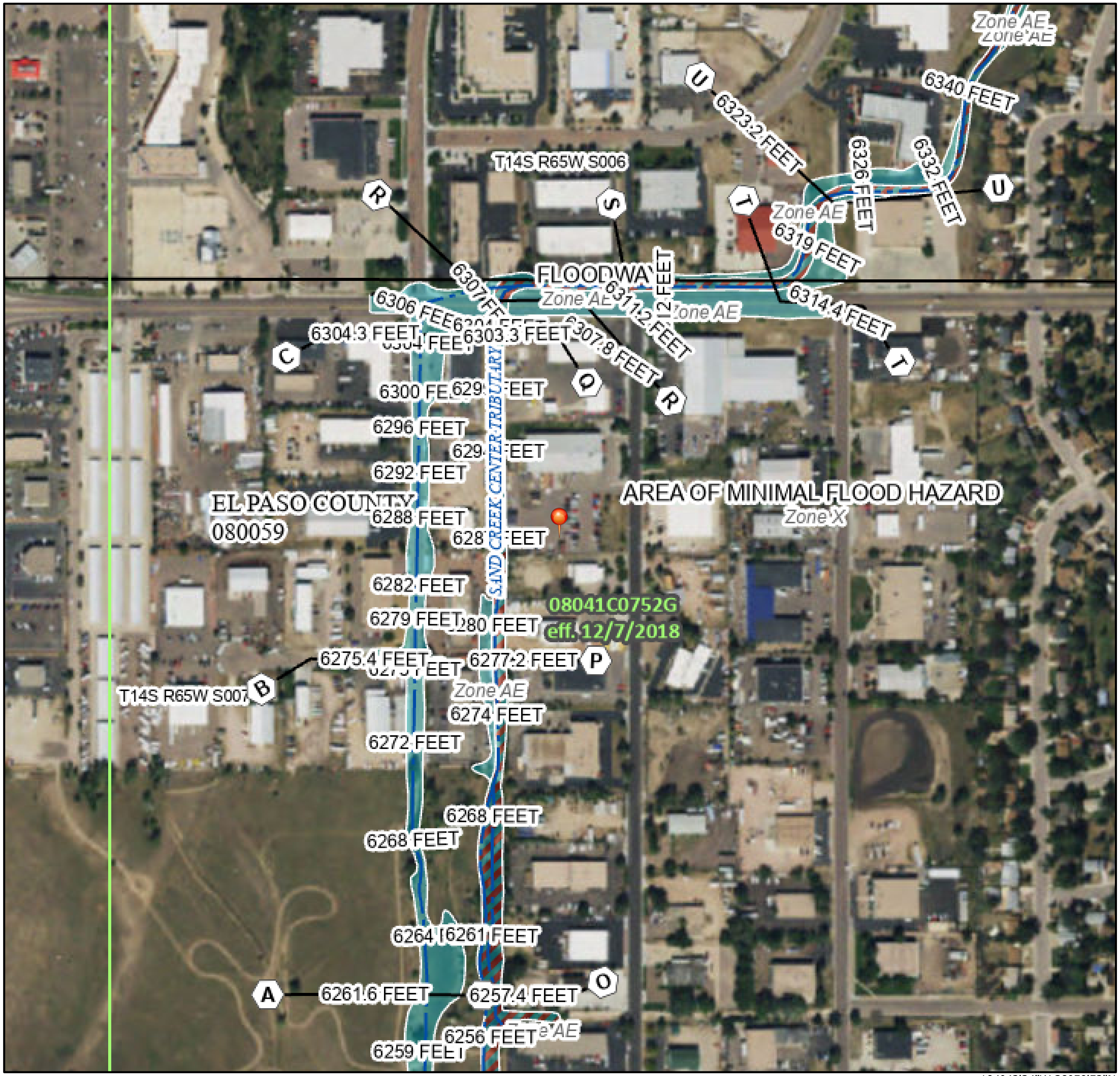
APPENDIX C

FIGURES

National Flood Hazard Layer FIRMette

FEMA

104°43'11"W 38°51'20"N



104°42'34"W 38°50'52"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

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

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

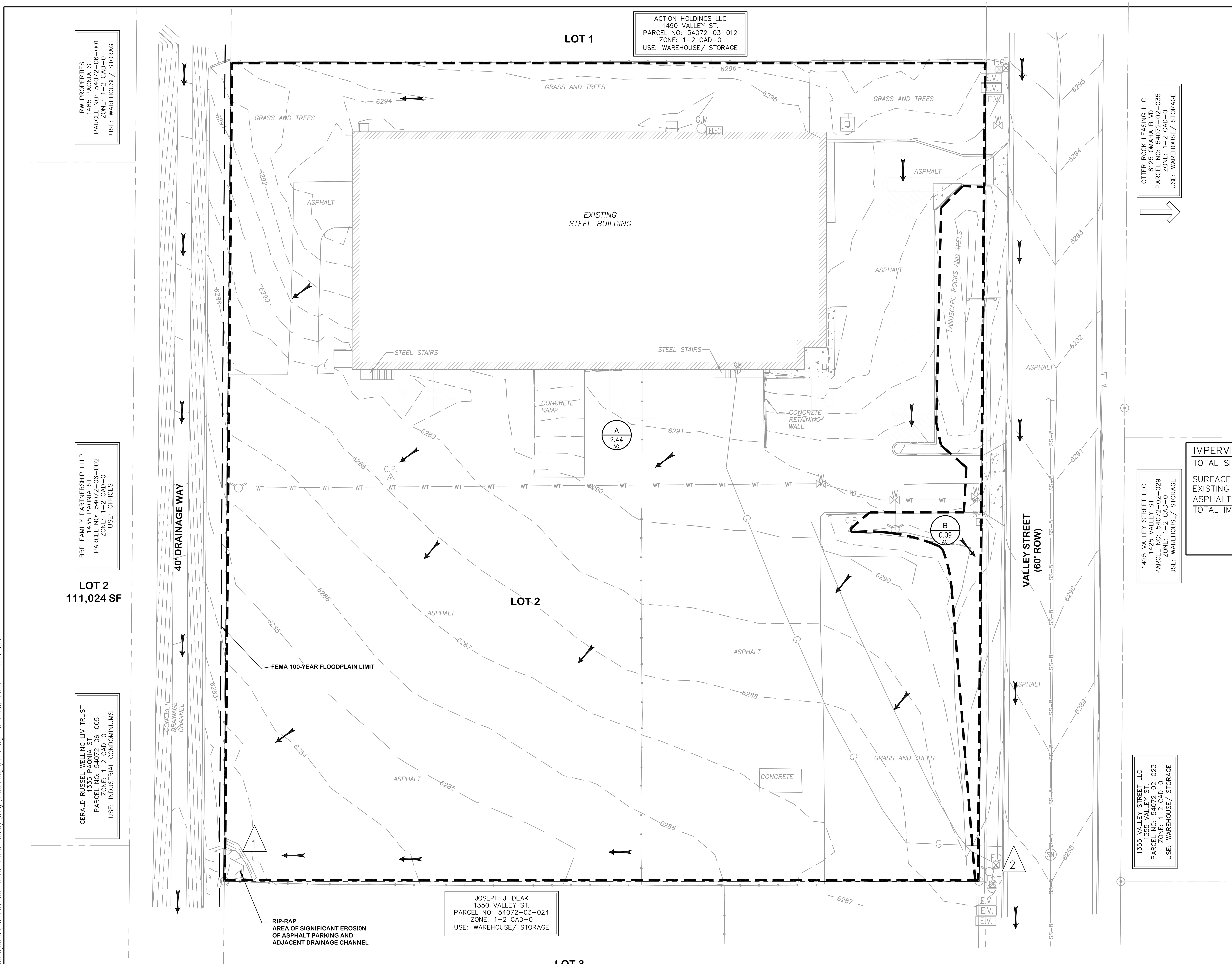
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/24/2022 at 5:09 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



LEGEND

- FEMA 100-YEAR FLOODWAY
- FEMA 100-YR FLOODPLAIN
- PROPERTY LINE
- DRAINAGE BASIN BOUNDARY
- 6255 PROPOSED CONTOUR
- 6255 EXISTING CONTOUR
- FLOWLINE
- FLOW DIRECTION ARROW
- DESIGN POINT
- BASIN DESIGNATION
- BASIN AREA (ACRES)

IMPERVIOUS AREA CALCULATIONS:

TOTAL SITE AREA = 2.54 AC.

SURFACE TYPE	AREA
EXISTING BUILDING	20,120 SF
ASPHALT / PAVEMENT	64,011 SF
TOTAL IMPERVIOUS AREA	84,131 SF

= 1.93 AC

= 76.0%

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
1	9.0	17.2
2	0.05	0.2

BENCHMARK:

BM#1
FIMS MONUMENT F81, LOCATED ON THE NORTH SIDE OF EAST PLAT AVE. 50' WEST OF FORD STREET.
ELEV.=6275.86' (NAVD88)
BM#2
CONTROL POINT 101
ELEV.=6292.09' (NAVD88)

NEW WAREHOUSE BUILDING - 1450 VALLEY STREET

LOT 2, BLOCK 1, CIMARRON INDUSTRIAL NO. 2

EXISTING CONDITIONS DRAINAGE PLAN

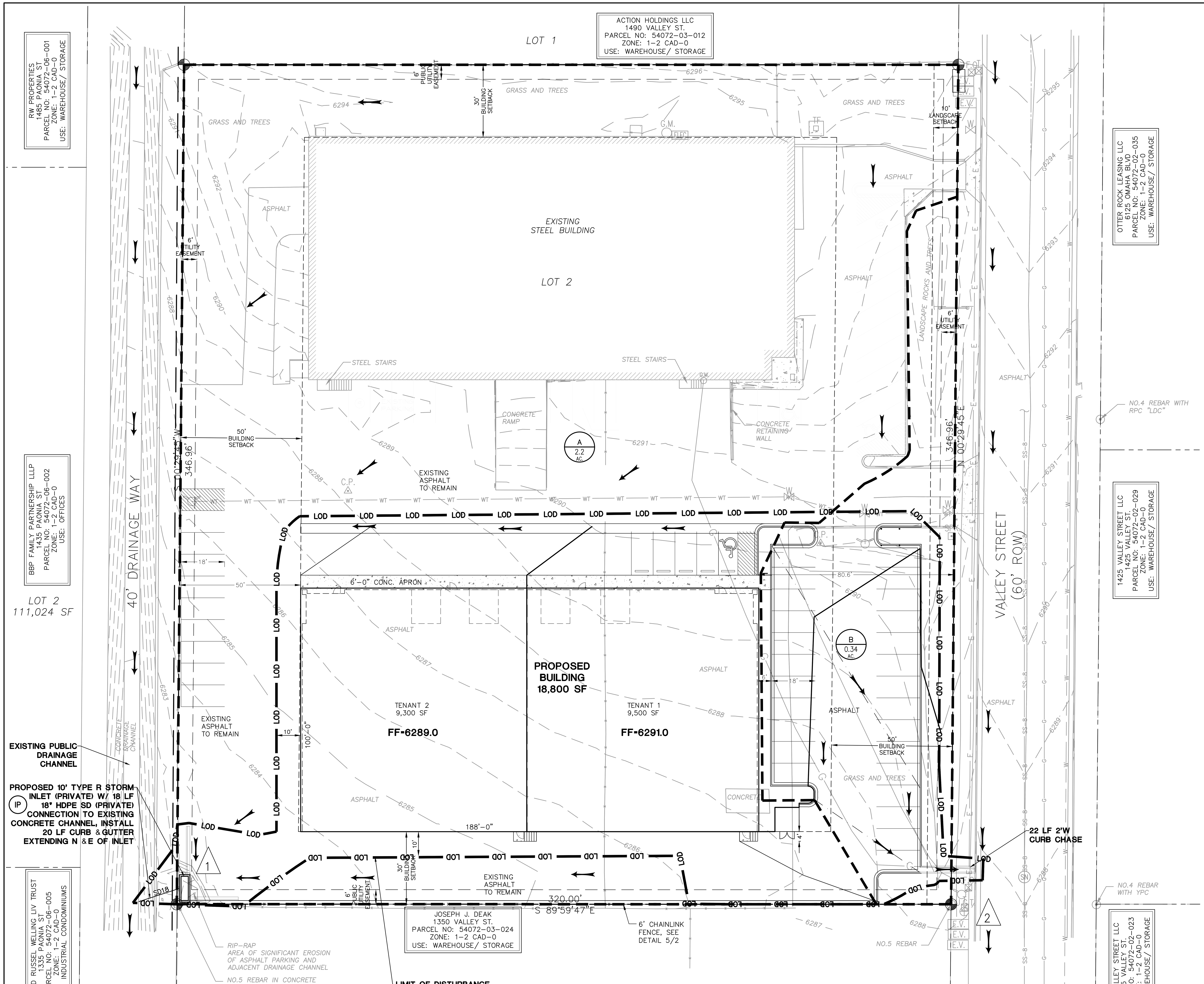
JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

NO.	REVISION	BY	DATE

HORZ. SCALE: 1"=20'	DRAWN: PV
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: RIDGELINE	CHECKED: JPS
CREATED: 10/05/22	LAST MODIFIED: 10/26/22
PROJECT NO: 062201	MODIFIED BY: PV

SHEET: **EX1**



LEGEND

- FEMA 100-YEAR FLOODWAY
- FEMA 100-YR FLOODPLAIN
- PROPERTY LINE
- DRAINAGE BASIN BOUNDARY
- 6255 PROPOSED CONTOUR
- 6255 EXISTING CONTOUR
- FLOWLINE
- FLOW DIRECTION ARROW
- 1 DESIGN POINT
- A BASIN DESIGNATION
- XX AC BASIN AREA (ACRES)

IMPERVIOUS AREA CALCULATIONS:

TOTAL BASIN SITE AREA = 2.54 AC.

SURFACE TYPE	AREA
EXISTING BUILDING	20,120 SF
PROPOSED BUILDING	18,800 SF
ASPHALT / PAVEMENT	52,589 SF
TOTAL IMPERVIOUS AREA	91,509 SF = 2.1 AC
	= 82.7%

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
1	8.9	16.7
2	1.0	1.9

BENCHMARK:

BM#1
FIMS MONUMENT F81, LOCATED ON THE NORTH SIDE OF EAST PLAT AVE. 50' WEST OF FORD STREET.
ELEV.=6275.86' (NAVD88)
BM#2
CONTROL POINT 101
ELEV.=6292.09' (NAVD88)

NEW WAREHOUSE BUILDING - 1450 VALLEY STREET
LOT 2, BLOCK 1, CIMARRON INDUSTRIAL NO. 2

DEVELOPED DRAINAGE PLAN

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NO.	REVISION	BY	DATE
1			
2			
3			
4			

HORZ. SCALE: 1"=20'	DRAWN: PV
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: RIDGELINE	CHECKED: JPS
CREATED: 10/05/22	LAST MODIFIED: 03/06/23
PROJECT NO: 062201	MODIFIED BY: PV
SHEET:	D1