

PRELIMINARY/FINAL DRAINAGE REPORT

FOR

**LOTS 3 & 4 - ROCKY MOUNTAIN
INDUSTRIAL PARK FILING NO. 1A**

EL PASO COUNTY, COLORADO

October 2025

Prepared for:
Colorado River Landscaping, LLC

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Prepared by:



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Project #70-140
PCD Filing No.: PPR241

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DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the 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.

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc



DEVELOPER'S STATEMENT

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

BY: EDUARDO HERNANDEZ H
Eduardo Hernandez – Owner

DATE: 9/29/25

ADDRESS: Colorado River Landscaping, LLC
2170 Capital Drive
Colorado Springs, CO 80951

EL PASO COUNTY'S STATEMENT

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

BY: _____ DATE: 2/25/26
 Digitally signed by Charlene Durham, P.E.
Charlene Durham, P.E. Reason: Authorized Signatory as County Engineer designee
Date: 2026.02.25 12:19:51-07'00'
Joshua Palmer, P.E.
County Engineer / ECM Administrator

CONDITIONS:

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**PRELIMINARY/FINAL DRAINAGE REPORT
FOR
LOTS 3 & 4 ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A**

Purpose

This Preliminary/Final Drainage Report for Lots 3 & 4 of Rocky Mountain Industrial Park Filing No. 1A is in support of a Site Development Plan submittal, necessitated by El Paso County, to bring the subject site in compliance with El Paso County Code. As it exists the properties are being utilized for equipment and material storage associated with an existing landscaping business. This report functions to identify the existing drainage conditions and recommend proposed drainage improvements which are intended to safely convey runoff through the development, while minimizing impacts to downstream facilities and adjacent properties.

Project Location and Description

Lots 3 & 4 Rocky Mountain Industrial Filing Park No 1A, is located in Section 2, of Township 13 South, Range 65 West of the Sixth Principal Meridian, City of Colorado Springs, El Paso County, Colorado. Lot 3 (2.09 acres) and Lot 4 (1.40 acres) are currently undeveloped but are presently being utilized to store vehicles and materials that coincide with a landscaping business. The existing development is bound to the north by existing Sandy Court (80' Public ROW), to the east by an undeveloped parcel of land and East Highway 24, to the south by Lot 7 Block 1, Rocky Mountain Industrial Park Filing No. 1, and to the west by existing Capital Drive (80' Public ROW). The subject site is currently zoned as I-3 Heavy Industrial (per Zone Map 533, EPC Development Services Department).

Most of the existing Lots 3 & 4 consist of exposed soils and gravels associated with a non-paved parking area, possessing limited ground cover. The site has been previously graded (over lot) with the development of the parent subdivision. Generally, the site slopes from northwest to southeast at average slopes between 2% and 10%. The site lies within the Sand Creek Drainage Basin. With the exception of a riprap lined channel along the east property line and a existing earthen swale along the south property line, no formal drainage facilities or improvements are onsite. No known irrigation systems or wells are present.

Soils

Soils in the project area have been determined to be Blendon Sandy Loam (10), which is characterized to be part of Hydrologic Soil Types "B" as determined from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) "Web Soils Survey". A soils map illustrating the site location and soil types is provided in the appendix of this report.

An infiltration rate test, “Infiltration Rate Testing (Percolation Test Method) 8115 and 8145 Sandy Court, Lots 3 and 4, Rocky Mountain Industrial Park, filing 1A” was completed by Entech Engineering, Inc., dated January 7, 2025. Per the report, there were two test locations (the western infiltration (PH-1) and the eastern infiltration (PH-2)). Soils encountered consisted of sand with silt to silty sand. No bedrock was encountered and groundwater was not encountered in any of the holes drilled up to 15 feet. For the western infiltration (PH-1), the average percolation rate was 32 minutes/inch and corresponds to an adjusted infiltration rate of 0.354 inches/hour. For the eastern infiltration (PH-2), the average percolation rate was minutes/inch and corresponds to an adjusted infiltration rate of 1.861 inches/hour. The Infiltration Rate Testing Report can be found in the appendix of this report.

Floodplain Statement

The Sand Creek East Fork Channel is located to the east of Lots 3 & 4 of the Rocky Mountain Industrial Park Filing No. 1A. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) No. 08041C0756 G, effective date December 7th, 2018, a small portion of Lot 4 lies within Zone A. It should be noted that there is a LOMR, (effective February 6th, 2025) in process that will slightly alter the existing floodplain and place it with a Zone AE. A copy of the annotated maps can be found in the appendix. In addition, the two floodplain lines (effective/soon to be effective) are reflected on the drainage maps also found in the appendix.

Previous Studies

The area which encompasses Lots 3 and 4 of Rocky Mountain Industrial Park Filing 1A has been previously studied. Below is a short outline of the assumptions regarding the lands of the subject site and those based upon the previously assembled and approved drainage reports and how the assumptions within them impact the subject site.

“Preliminary/Final Drainage Report Jackson Office Warehouse & Storage Building Development Rocky Mountain Industrial Park Filing No. 1A, prepared by Associated Design Professionals, Inc, dated May 2, 2018.

- Discusses development located to the north of subject site
- No detention provided
- Water quality provided via 1400 cf Sand Filter Basin
- Based upon proposed development re-establishes developed flow at NE Corner of subject site at existing riprap lined channel DP6, CA5=, CA100=, TC=20.5 mins (Q5=52.4 cfs Q100=122.0 cfs), used in this analysis.

“Drainage letter for Rocky Mountain Industrial Park Filing 1A, prepared by Land Development Consultants, Inc., approved January 26, 2010.

- Supports the replat of the existing lot into 4 lots, henceforth to be known as Rocky Mountain Industrial Park No. 1A, Lots 1-4.
- Indicates that runoff from Lots 1 and 2 are to be collected within the existing street and

directed to an existing Type R Inlet at the terminus of Sandy Court and piped to an existing (south draining) riprap channel.

- The flows from lots 3 and 4, which are considered previously developed (as the result of overlot grading) are conveyed via sheet flow to an existing grass lined channel along the south boundary which drains to the aforementioned riprap channel.
- Per the report, drainage basin fees for the lots were paid with the initial filing.

“Final Drainage Plan and Erosion Control Plan, Rocky Mountain Industrial Park Filing 1, prepared by Kiowa Engineering Corporation, approved February 15, 2002.

- Initially analyzed the 7.5 acres industrial commercial lot *(Lot 7), drainage basins 3 & 4 (totaling 8.5 acres) of which the subject sites are a portion of.
- North lots to drain to inlet/overflow swale at end of Sandy Court.
- Recommended a 10' wide 3:1, “VL” riprap lined channel along the eastern boundary of the lots 3 and 4.
- Recommended a 4' wide 3:1, “VL” riprap lined channel along the southern boundary of the lots 4, 5 and 6.
- Estimated the peak flow at the confluence of the two channels (at Design Point 4) to be $Q_5=101.4\text{cfs}$ and $Q_{100}=166.0\text{ cfs}$.

“Sand Creek Drainage Basin Planning Study, Preliminary Design Report”, prepared by Kiowa Engineering Corporation, dated January 1993, revised March 1996.

- Establishes that the subject site falls within the East Fork Sand Creek Drainage Basin, a portion of the larger Sand Creek Watershed
- Establishes that there are no requirements for major infrastructure improvements and subsequently no drainage-improvement related reimbursements with the development of this parcel

Drainage Criteria

Hydrologic Calculations

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1. of Chapter 13 of the DCM as revised in May 2014. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals. The Mile High Flood District UD-BMP version 3.07 was utilized to size the proposed water quality treatment facility. In the proposed condition a design volume of 2,674 cu ft is required. In the future condition a design volume of 2,935 cu ft is required. Infiltration rates for the underground Xfiltration vault were based upon the “Infiltration Rate Testing (Percolation Test Method) 8115 and 8145 Sandy Court, Lots 3 and 4, Rocky Mountain Industrial Park, filing 1A” was completed by Entech Engineering, Inc., dated January 7, 2025.

Hydraulic Calculations

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets are included in the appendix of this report.

Historic/Pre-development Drainage Characteristics

It should be noted that the subject site was developed in 2017 without approvals. Due to the site being developed, the historic conditions were analyzed using the existing conditions survey data. The following paragraphs outline the historic/pre-developed site characteristics. In the historic condition, the two lots (3 and 4) are undeveloped and generally slope from northwest to southeast. Runoff from Lot 4, and a portion of the adjacent right of way is collected by an existing private swale located along the shared southern property line. The trapezoidal shaped earthen grass lined swale, which lies within an existing 30' drainage easement, conveys runoff easterly at slightly less than a one percent grade. The far east portion of Lot 3 drains easterly to an existing riprap lined channel that parallels the eastern boundary. The trapezoidal shaped conveyance channel, with an approximate bottom width of 10'w, 3:1 side slopes, and 2' of depth, (also lying within an existing 30'wide drainage easement) functions to convey offsite drainage from approximately 38 acres to the north through the subject site in accordance with the subdivision overall drainage plan. Ultimately, the combined drainage from the site and offsite flows discharges into the East Fork of Sand Creek approximately 100 feet south of the southeast corner of Lot 3. Due to its proximity, a portion of the East Fork of Sand Creek Channel's 100-year FEMA regulatory floodplain impacts a portion of Lot 3. The subsequent paragraphs further describe the drainage patterns and the associated runoff developed in the existing condition.

Design Point 1

Offsite **Basin OS1** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.04 acres which grass covered right of way located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin A**.

Basin A ($Q_5=0.4$ cfs, $Q_{100}=2.6$ cfs) consists of 1.15 acres of undeveloped land covered primarily in sparse native grasses and vegetation located within the western portion of Lot 4. Flows from **Basin OS1** combine with the flows from this basin and continue overland to the southeast.

Off-site **Basin OS4** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.07 acres of grass covered rights of way immediately adjacent to the west property line of Lot 4. Runoff from this basin is conveyed south and east as sheet flow toward **Basin A**.

Off-site **Basin OS5** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.11 acres of undeveloped property located to the south of the subject site. Runoff produced within the basin combines with flows produced within **Basins OS1, A, and OS4** within an existing earthen swale located along the south property line of Lot 4. The combined runoff at **Design Point 1** (east lot of Lot 4) is calculated to reach peak flow rates of $Q_5=0.4$ cfs, $Q_{100}=3.1$ cfs. From here, flows continue east, along the southern boundary of Lot 3.

Design Point 2

Offsite **Basin OS2** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.03 acres which includes grass covered right of way located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin B**.

Basin B ($Q_5=0.1$ cfs, $Q_{100}=0.5$ cfs) consists of 0.25 acres of undeveloped land covered primarily in sparse native grasses and vegetation located within the western portion of Lot 4. Flows from **Basin OS1** combine with the flows from this basin and continue overland to the southeast.

Offsite **Basin OS3** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.05 acres which includes portions of the grass covered right of way located to the north of Lot 3. Flows from this basin are conveyed south as sheet flow toward **Basin C**.

Basin C ($Q_5=0.3$ cfs, $Q_{100}=2.5$ cfs) consists of 1.16 acres of undeveloped land covered primarily in sparse native grasses and vegetation located within the western portion of Lot 3. Flows from **Basin OS3** combine with the flows from this basin and continue overland to the southeast.

Basin D ($Q_5=0.1$ cfs, $Q_{100}=0.7$ cfs) consists of 0.34 acres of undeveloped land covered primarily in sparse native grasses and vegetation located within the eastern portion of Lot 3. Runoff from Basin D is conveyed as sheet flow to the southeast.

Off-site **Basin OS6** ($Q_5=0.0$ cfs, $Q_{100}=0.3$ cfs) consists of 0.17 acres of undeveloped property located to the south of the subject site. Runoff produced within the basin combines with flows produced within **Basins B, OS2, OS3, C, OS6 and DP1** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 2** is calculated to reach peak flow rates of $Q_5=1.0$ cfs, $Q_{100}=7.5$ cfs. From here, flows continue east, along the southern boundary of Lot 3.

Design Point 3

Design Point 3 is located at the northeast corner of Lot 3. The contributing area and calculated runoff reaching this location was determined, most recently, within the Preliminary/Final Drainage Report Jackson Office Warehouse & Storage Building Development Rocky Mountain Industrial Park Filing No. 1A, prepared by Associated Design Professionals, Inc, dated May 2, 2018. Per the report runoff collected by the inlet within the adjacent street and the flow from the offsite watershed located to the north of the subject site values of $CA_5=18.23$ and $CA_{100}=24.28$ at a time of concentration of 20.5 mins. Per M&S historic conditions rational calculation these values result in peak runoff rates of $Q_5=55.6$ cfs, $Q_{100}=124.4$ cfs. Flows reaching **DP3** enter Lot 3 and continue south within an existing type 'VL' riprap lined swale.

Design Point 4

Basin E ($Q_5=0.3$ cfs, $Q_{100}=1.4$ cfs), consists of 0.60 acres of undeveloped land covered primarily in sparse native grasses and vegetation located within the eastern portion of Lot 3. Flows from the

basin are conveyed as sheet flow to the existing riprap lined channel that parallels the eastern boundary.

Off-site **Basin OS7** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.02 acres of undeveloped property located near the southeast corner of Lot 3. Runoff produced within the basin combines with flows produced within **Basins E, DP2, and DP3** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 4** is calculated to reach peak flow rates of $Q_5=52.3$ cfs, $Q_{100}=121.4$ cfs.

Existing Drainage Characteristics

In the existing condition, the two lots (3 and 4) are being used to store vehicles and materials associated with a landscaping company. The storage yards generally lack vegetation and consist of exposed gravels and sands and silts typical of a non-paved parking lot. Runoff from the area, and a portion of the adjacent right of way drains north to south and are collected by an existing private swale located along the shared southern property line. The trapezoidal shaped earthen grass lined swale, which lies within an existing 30' drainage easement, conveys runoff easterly at slightly less than a one percent grade. The exception being the far east portion of Lot 3 which drains easterly to an existing riprap lined channel that parallels the eastern boundary. The trapezoidal shaped conveyance channel, with an approximate bottom width of 10'w, 3:1 side slopes, and 2' of depth, (also lying within an existing 30'w drainage easement) functions to convey offsite drainage from approximately 38 acres to the north through the subject site in accordance with the subdivision overall drainage plan. Ultimately, the combined drainage from the site and offsite flows discharges into the East Fork of Sand Creek approximately 100 feet south of the southeast corner of Lot 3. Due to its proximity, a portion of the East Fork of Sand Creek Channel's 100-year FEMA regulatory floodplain impacts a portion of Lot 3. The subsequent paragraphs further describe the drainage patterns and the associated runoff developed in the existing condition.

Design Point 1

Offsite **Basin OS1** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.04 acres which includes a portion of an existing gravel entrance as well as portions of the grass covered right of way located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin A**.

Basin A ($Q_5=3.1$ cfs, $Q_{100}=6.2$ cfs) consists of 1.15 acres of a portion of existing parking/storage area located within the western portion of Lot 4. Flows from **Basin OS1** combine with the flows from this basin and continue overland to the southeast.

Off-site **Basin OS4** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.07 acres of grass covered rights of way immediately adjacent to the west property line of Lot 4. Runoff from this basin is conveyed south and east as sheet flow toward **Basin A**.

Off-site **Basin OS5** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.11 acres of undeveloped property located to the south of the subject site. Runoff produced within the basin combines with flows produced within **Basins OS1, A, and OS4** within an existing earthen swale located along the south property line of Lot 4. The combined runoff at **Design Point 1** (east lot of Lot 4) is calculated to

reach peak flow rates of $Q_5=3.2$ cfs, $Q_{100}=6.8$ cfs. From here, flows continue east, along the southern boundary of Lot 3.

Design Point 2

Offsite **Basin OS2** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.03 acres which includes a portion of an existing gravel entrance as well as portions of the grass covered right of way located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin B**.

Basin B ($Q_5=0.6$ cfs, $Q_{100}=1.3$ cfs) consists of 0.25 acres of existing parking/storage area located within the western portion of Lot 4. Flows from **Basin OS1** combine with the flows from this basin and continue overland to the southeast.

Offsite **Basin OS3** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.05 acres which includes portions of the grass covered right of way located to the north of Lot 3. Flows from this basin are conveyed south as sheet flow toward **Basin C**.

Basin C ($Q_5=3.1$ cfs, $Q_{100}=6.1$ cfs) consists of 1.16 acres of existing parking/storage area located within the western portion of Lot 3. Flows from **Basin OS3** combine with the flows from this basin and continue overland to the southeast.

Basin D ($Q_5=0.8$ cfs, $Q_{100}=1.7$ cfs) consists of 0.34 acres of existing parking/storage area located within the eastern portion of Lot 3. Runoff from Basin D is conveyed as sheet flow to the southeast.

Off-site **Basin OS6** ($Q_5=0.0$ cfs, $Q_{100}=0.3$ cfs) consists of 0.17 acres of undeveloped property located to the south of the subject site. Runoff produced within the basin combines with flows produced within **Basins B, OS2, OS3, C, OS6 and DP1** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 2** is calculated to reach peak flow rates of $Q_5=7.7$ cfs, $Q_{100}=16.3$ cfs. From here, flows continue east, along the southern boundary of Lot 3.

Design Point 3

Design Point 3 is located at the northeast corner of Lot 3. The contributing area and calculated runoff reaching this location was determined, most recently, within the Preliminary/Final Drainage Report Jackson Office Warehouse & Storage Building Development Rocky Mountain Industrial Park Filing No. 1A, prepared by Associated Design Professionals, Inc, dated May 2, 2018. Per the report runoff collected by the inlet within the adjacent street and the flow from the offsite watershed located to the north of the subject site values of $CA_5=18.23$ and $CA_{100}=24.28$ at a time of concentration of 20.5 mins. Per M&S existing conditions rational calculation these values result in peak runoff rates of $Q_5=55.6$ cfs, $Q_{100}=124.4$ cfs. Flows reaching **DP3** enter Lot 3 and continue south within an existing type 'VL' riprap lined swale.

Design Point 4

Basin E ($Q_5=1.2$ cfs, $Q_{100}=2.6$ cfs), consists of 0.60 acres of existing parking storage area located within the eastern portion of Lot 3. Flows from the basin are conveyed as sheet flow to the existing riprap lined channel that parallels the eastern boundary.

Off-site **Basin OS7** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.02 acres of undeveloped property located near the southeast corner of Lot 3. Runoff produced within the basin combines with flows produced within **Basins E, DP2, and DP3** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 4** is calculated to reach peak flow rates of $Q_5=57.1$ cfs, $Q_{100}=126.9$ cfs

Proposed Drainage Characteristics

Limited site improvements are required to the site to bring Lots 3 and 4 into compliance, which includes the installation of landscaping, and the installation of Type 1 curb and gutter around the perimeter of the site to direct a large quantity of developed runoff to a newly constructed water quality vault. Runoff will leave the property at the southeast corner of the site as in the historic condition. No proposed grading is planned to occur within the effective 100-year floodplain as the result of these improvements.

Design Point 1

Offsite **Basin OS1** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.04 acres which includes a portion of an existing gravel entrance as well as portions of existing grass covered right of way located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin A**.

Basin A ($Q_5=2.9$ cfs, $Q_{100}=5.7$ cfs) consists of 1.08 acres of heavy industrial area located within the western portion of Lot 4. Flows from **Basin OS1** combine with the flows from this basin and continue overland to the southeast. Runoff produced within the basin combines with flows produced within **Basins OS1** within the proposed curb and gutter located along the west and south property line of Lot 4. The combined runoff at **Design Point 1** is calculated to reach peak flow rates of $Q_5=2.9$ cfs, $Q_{100}=5.8$ cfs. Runoff reaching **DP1** continue east into Lot 3 (**Design Point 2**).

Design Point 2

Offsite **Basin OS2** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.03 acres which includes a portion of an existing gravel entrance as well as portions of existing grass covered right of way and proposed landscaping located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin B**.

Basin B ($Q_5=0.6$ cfs, $Q_{100}=1.3$ cfs) consists of 0.25 acres of heavy industrial area located within the western portion of Lot 4.

Basin C ($Q_5=0.6$ cfs, $Q_{100}=1.2$ cfs) consists of 0.23 acres of heavy industrial area within the western portion of Lot 3. Runoff produced within the basin combines with flows produced within **Basins OS2, B, and DP1**, are routed within a proposed curb and gutter located along the south property line of Lot 4 to a proposed 10' Type R at-grade inlet located at **Design Point 2 (DP2)**. The combined runoff at **DP2** is calculated to reach peak flow rates of $Q_5=4.0$ cfs, $Q_{100}=8.1$ cfs. The captured flow will be routed by an 18" HP pipe to the Xfiltration vault located at the southeast corner of Lot 3. In the event of clogging, tailwater buildup or inlet failure runoff will be routed to a 15' inlet located at **Design Point 4** or will overtop the curb and outfall onto a 3 foot wide river rock armored slope and be routed to **Design Point 5**.

Design Point 3

Off-site **Basin OS4** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.07 acres of existing grass covered right of way immediately adjacent to the west property line of Lot 4. Runoff from this basin is conveyed south and east as sheet flow toward **Basin E**.

Basin E ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.07 acres of proposed landscaping and existing grass covered area located within the west portion of Lot 4 that will continue to drain in a historic nature to the existing swale located along the southern property line in **Basin OS5**. Basin E will be part of the 20% of total site Water Quality exclusion not to exceed one acre per El Paso County Engineering Criteria Manual Chapter 3.2.5.

Off-site **Basin OS5** ($Q_5=0.0$ cfs, $Q_{100}=0.3$ cfs) consists of 0.11 acres of undeveloped offsite property of grass covered area located to the south of the subject site. Runoff produced within the basin combines with flows produced within **Basins OS4** and **E** within an existing earthen swale located along the south property line of Lot 4. The combined runoff at **Design Point 3** is calculated to reach peak flow rates of $Q_5=0.1$ cfs, $Q_{100}=0.6$ cfs. Runoff reaching **DP5** continue east, along the southern boundary of Lot 3 to **Design Point 5**.

Design Point 4/ WQCV Facility Design

Offsite **Basin OS3** ($Q_5=0.1$ cfs, $Q_{100}=0.2$ cfs) consists of 0.05 acres which includes portions of proposed landscaping, a proposed access with curb and gutter and existing grass covered right of way located to the north of Lot 3. The future access is to be accounted for in with the development of Lot 3 and with a future drainage report. Flows from this basin are conveyed south as sheet flow toward **Basin D**.

Basin D ($Q_5=3.2$ cfs, $Q_{100}=6.3$ cfs) consists of approximately 1.26 acres which includes existing parking storage area located within Lot 3. The basins will house an Xfiltration WQ vault at the southeast corner of Lot 3. Runoff from **OS3**, **Basin D** and flowby from **DP2** will combine and be routed via curb and gutter to a 15' Type R sump inlet located at **Design Point 4 (DP4)**. The combined runoff at **DP4** is calculated to reach peak flow rates of $Q_5=2.8$ cfs, $Q_{100}=6.9$ cfs. The captured flow will be routed by an 18" HP pipe to the Xfiltration vault located at the southeast corner of Lot 3. In the event of clogging, tailwater buildup or inlet failure runoff will overtop the curb and outfall onto a proposed 12' wide by 38' long type VL riprap spillway and be routed to **Design Point 5**.

The Xfiltration vault has been designed for the site to provide water quality capture volume for the existing site. Due to limited vertical differential that exists between the site and outfall options the water quality event will fully infiltrate through the substrate and subsurface soils, while storm events in excess of the water quality event will be discharged over the proposed 6" curb located at a low point into the existing earthen swale that parallels the southern boundary.

Based upon a contributory area of 131,552 sq feet (or 3.02 acres) and an anticipated impervious percentage of 76% the Mile High Flood District UD-BMP (proposed), Version 3.07 worksheet calculates a 0.24 watershed inches, 2,674 (design) cubic feet of water quality storage.

The proposed Xfiltration Vault designed by Contech, is a 72" diameter by 107' long CMP vault, see appendix for detail sheets. The vault will provide a design WQCV volume of 3024 cubic feet. Storm

events in excess of the water quality event will be discharged over the proposed 6" curb located at a low point into the existing earthen swale that parallels the southern boundary. The overflow will overtop the 6" concrete curb in lieu of a cutoff wall and the 'VL' riprap rundown will provide erosion control in events in excess of the water quality storm event.

In house calculations provide locations where a proposed 3.5' wide Type VL~D50=9 inch, riprap apron will protect the slope from erosion when the 100 year event overtops the 6 inch curb. These locations are called out on the proposed and future drainage maps provided in the appendix. Calculations for the riprap are also provided in the appendix.

To confirm the infiltration capacity of the existing soils onsite, Entech Engineering was hired to perform percolation tests in the area of the Xfiltration vault. These tests were completed on December 13, 2024 and show the existing soil has an infiltration rate of 1.86 in/hr (~1.9 in/hr) at location PH-2 (refer to boring locations on proposed drainage map).

All calculations for the Xfiltration vault and the percolation testing results can be seen in the appendix of this report.

Design Point 5

Basin F (Q5=0.5 cfs, Q100=1.0 cfs), consists of 0.19 acres of existing parking storage area located within the eastern portion of Lot 3 and along the south side of the proposed water quality vault. Flows from the basin are conveyed as sheet flow to the existing earthen swale that parallels the south boundary. Basin F will be part of the 20% of total site Water Quality exclusion not to exceed one acre per El Paso County Engineering Criteria Manual Chapter 3.2.5.

Off-site **Basin OS6** (Q5=0.1 cfs, Q100=0.4 cfs) consists of 0.17 acres of undeveloped property located near the southeast corner of Lot 3. Runoff produced within the basin combines with flows produced within **DP3**, and flowby **DP4** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 5** is calculated to reach peak flow rates of Q5=1.2 cfs, Q100=6.8 cfs

Design Point 6

Design Point 6 is located at the northeast corner of Lot 3. The contributing area and calculated runoff reaching this location was determined, most recently, within the Preliminary/Final Drainage Report Jackson Office Warehouse & Storage Building Development Rocky Mountain Industrial Park Filing No. 1A, prepared by Associated Design Professionals, Inc, dated May 2, 2018. Per the report runoff collected by the inlet within the adjacent street and the flow from the offsite watershed located to the north of the subject site values of CA5=18.23 and CA100=24.28 at a time of concentration of 20.5 mins. Per M&S existing conditions rational calculation these values result in peak runoff rates of Q5=55.6 cfs, Q100=124.4 cfs. Flows reaching **DP7** enter Lot 3 and continue south within an existing type 'VL' riprap lined swale.

Design Point 7

Basin G (Q5=0.8 cfs, Q100=1.8 cfs), consists of 0.41 acres of existing parking storage area located within the eastern portion of Lot 3. Flows from the basin are conveyed as sheet flow to the existing

riprap lined channel that parallels the eastern boundary. Basin G will be part of the 20% of total site Water Quality exclusion not to exceed one acre per El Paso County Engineering Criteria Manual Chapter 3.2.5.

Off-site **Basin OS7** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.02 acres of undeveloped property located near the southeast corner of Lot 3. Runoff produced within the basin combines with flows produced within **DP6, and DP5** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 7** is calculated to reach peak flow rates of $Q_5=57.4$ cfs, $Q_{100}=132.1$ cfs

Future Detailed Drainage Discussion

It should be noted that although no development or additional impervious surfaces are to be added to bring the site into compliance, as described in the proposed detailed drainage discussion, the future condition drainage analysis has been conducted using heavy industrial development coefficients of $C_5=0.73$, $C_{100}=0.81$, in areas where development is currently permitted (outside of the 100-yr floodplain). These runoff coefficients assume 90% imperviousness with landscaped areas, parking areas, drive aisles, and buildings. The site is currently zoned as I-3 Heavy Industrial, so runoff coefficients were based upon a land use of industrial-heavy areas as. There is no known future development at this time. In the proposed condition, as no development is being proposed, the drainage analysis was conducted using existing condition coefficients of $C_5=0.73$, $C_{100}=0.81$, in areas where there is gravel. This was done at the request of the developer which will allow for the design of a water quality treatment facility and conveyance structures that will be of sufficient size to accommodate future development. The subsequent paragraphs will further detail the drainage conditions and peak flow rates associated with the developed property.

Design Point 1

Offsite **Basin OS1** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.04 acres which includes a portion of an existing gravel entrance as well as portions of the grass covered right of way located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin A**.

Basin A ($Q_5=3.7$ cfs, $Q_{100}=6.9$ cfs) consists of 1.08 acres of heavy industrial area located within the western portion of Lot 4. Flows from **Basin OS1** combine with the flows from this basin and continue overland to the southeast. Runoff produced within the basin combines with flows produced within **Basins OS1** within the proposed curb and gutter located along the west and south property line of Lot 4. The combined runoff at **Design Point 1** is calculated to reach peak flow rates of $Q_5=3.8$ cfs, $Q_{100}=7.1$ cfs. Runoff reaching **DP1** continue east into Lot 3 (**Design Point 2**).

In house calculations provide locations where a proposed 3.5' wide Type VL~D50=9 inch, riprap apron will protect the slope from erosion when the 100 year event overtops the 6 inch curb and will be routed to **Design Point 5** via an existing swale. This location is approximately 52 feet west of the Lot 4/Lot 3 lot line and will continue east and tie into the proposed spillway at **Design Point 4**. Calculations for the riprap are provided in the appendix.

Design Point 2

Offsite **Basin OS2** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.03 acres which includes a portion of an existing gravel entrance as well as portions of existing grass covered right of way and proposed landscaping located to the north of Lot 4. Flows from this basin are conveyed south as sheet flow toward **Basin B**.

Basin B ($Q_5=0.9$ cfs, $Q_{100}=1.6$ cfs) consists of 0.25 acres of heavy industrial area located within the western portion of Lot 4.

Basin C ($Q_5=0.8$ cfs, $Q_{100}=1.5$ cfs) consists of 0.23 acres of heavy industrial area within the western portion of Lot 3. Runoff produced within the basin combines with flows produced within **Basins OS2, B, and DP1**, are routed within a proposed curb and gutter located along the south property line of Lot 4 to a proposed 10' Type R at-grade inlet located at **Design Point 2 (DP2)**. The combined runoff at **DP2** is calculated to reach peak flow rates of $Q_5=5.1$ cfs, $Q_{100}=9.5$ cfs. The captured flow will be routed by an 18" HP pipe to the Xfiltration vault located at the southeast corner of Lot 3. In the event of clogging, tailwater buildup or inlet failure runoff will be routed to a 15' inlet located at **Design Point 4** and will overtop the curb at **Design Point 2** and outfall onto a 3.5 foot wide Type VL riprap apron and be routed to **Design Point 5**. Calculations for riprap apron provided in the Appendix.

Design Point 3

Off-site **Basin OS4** ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.07 acres of existing grass covered right of way immediately adjacent to the west property line of Lot 4. Runoff from this basin is conveyed south and east as sheet flow toward **Basin E**.

Basin E ($Q_5=0.0$ cfs, $Q_{100}=0.2$ cfs) consists of 0.07 acres of proposed landscaping and existing grass covered area located within the west portion of Lot 4 that will continue to drain in a historic nature to the existing swale located along the southern property line in **Basin OS5**. Basin E will be part of the 20% of total site Water Quality exclusion not to exceed one acre per El Paso County Engineering Criteria Manual Chapter 3.2.5.

Off-site **Basin OS5** ($Q_5=0.0$ cfs, $Q_{100}=0.3$ cfs) consists of 0.11 acres of undeveloped offsite property located to the south of the subject site. Runoff produced within the basin combines with flows produced within **Basins OS4 and E** within an existing earthen swale located along the south property line of Lot 4. The combined runoff at **Design Point 3** is calculated to reach peak flow rates of $Q_5=0.1$ cfs, $Q_{100}=0.6$ cfs. Runoff reaching **DP3** continue east, along the southern boundary of Lot 3 to **Design Point 5**.

Design Point 4/ WQCV Facility Design

Offsite **Basin OS3** ($Q_5=0.1$ cfs, $Q_{100}=0.2$ cfs) consists of 0.05 acres which includes portions of proposed landscaping, a proposed access with curb and gutter and existing grass covered right of way located to the north of Lot 3. The future access is to be accounted for in with the development of Lot 3 and with a future drainage report. The future access will not be built with this submittal. Flows from this basin are conveyed south as sheet flow toward **Basin D**.

Basin D ($Q_5=4.1$ cfs, $Q_{100}=7.7$ cfs) consists of approximately 1.26 acres which includes existing parking storage area located within Lot 3. The basins will house an Xfiltration WQ vault to the southeast corner of Lot 3. Runoff from **OS3**, **Basin D** and flowby from **DP2** will combine and be routed via curb and gutter to a 15' Type R sump inlet located at **Design Point 4 (DP4)**. The combined runoff at **DP4** is calculated to reach peak flow rates of $Q_5=3.7$ cfs, $Q_{100}=8.6$ cfs. The captured flow will be routed by an 18" HP pipe to the Xfiltration vault located at the southeast corner of Lot 3. In the event of clogging, tailwater buildup or inlet failure runoff will overtop the curb and outfall onto a proposed 12' wide by 38' long type VL riprap spillway and be routed to **Design Point 5**. Weir and trapezoidal riprap calculations provided in the Appendix.

The Xfiltration vault has been designed for the site to provide water quality capture volume for the existing site. Due to limited vertical differential that exists between the site and outfall options the water quality event will fully infiltrate through the substrate and subsurface soils, while storm events in excess of the water quality event will be discharged over the proposed 6" curb located at a low point into the existing earthen swale that parallels the southern boundary.

Based upon a contributory area of 131,552 sq feet (or 3.02 acres) and an anticipated impervious percentage of 81% the Mile High Flood District UD-BMP (future), Version 3.07 worksheet calculates a 0.27 watershed inches, 2,935 (design) cubic feet of water quality storage.

The 72" diameter by 107' long CMP Xfiltration vault will treat WQCV and provide WQ storage of 3,024 cubic feet and is capable of producing effluent quality with a median Total Suspended Solids (TSS) of 30mg/L Effluent control. Right volume cylinder equation used to determine volume of cylinder. If Stormwater Control Measures (SCM) material is not filter-compatible with the subgrade, a minimum 6-inch transition filter shall be used as SCM material. Storm events in excess of the water quality event will be discharged over the proposed 6" curb located at a low point into the existing earthen swale that parallels the southern boundary. The overflow will overtop the 6" concrete curb in lieu of a cutoff wall and the 'VL' riprap rundown will provide erosion control in events in excess of the water quality storm event.

In house calculations provide locations where a proposed 3.5' wide Type VL~D50=9 inch, riprap apron will protect the slope from erosion when the 100 year event overtops the 6 inch curb. These locations are called out on the proposed and future drainage maps provided in the appendix. Calculations for the riprap are also provided in the appendix.

To confirm the infiltration capacity of the existing soils onsite, Entech Engineering was hired to perform percolation tests in the area of the planned sand filter basin. These tests were completed on December 13, 2024 and show the existing soil has an infiltration rate of 1.86 in/hr (~1.9 in/hr) at location PH-2 (refer to boring locations on proposed drainage map).

All calculations for the Xfiltration vault and the percolation testing results can be seen in the appendix of this report.

Design Point 5

Basin F ($Q_5=0.5$ cfs, $Q_{100}=1.0$ cfs), consists of 0.19 acres of existing parking storage area located within the eastern portion of Lot 3 and along the south side of the proposed water quality vault. Flows from the basin are conveyed as sheet flow to the existing earthen swale that parallels the south boundary. Basin F will be part of the 20% of total site Water Quality exclusion not to exceed one acre per El Paso County Engineering Criteria Manual Chapter 3.2.5.

Off-site **Basin OS6** ($Q_5=0.1$ cfs, $Q_{100}=0.4$ cfs) consists of 0.17 acres of undeveloped property located near the southeast corner of Lot 3. Runoff produced within the basin combines with flows produced within **DP3**, and flowby **DP4** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 5** is calculated to reach peak flow rates of $Q_5=1.7$ cfs, $Q_{100}=8.0$ cfs

Design Point 6

Design Point 6 is located at the northeast corner of Lot 3. The contributing area and calculated runoff reaching this location was determined, most recently, within the Preliminary/Final Drainage Report Jackson Office Warehouse & Storage Building Development Rocky Mountain Industrial Park Filing No. 1A, prepared by Associated Design Professionals, Inc, dated May 2, 2018. Per the report runoff collected by the inlet within the adjacent street and the flow from the offsite watershed located to the north of the subject site values of $CA_5=18.23$ and $CA_{100}=24.28$ at a time of concentration of 20.5 mins. Per M&S existing conditions rational calculation these values result in peak runoff rates of $Q_5=55.6$ cfs, $Q_{100}=124.4$ cfs. Flows reaching **DP7** enter Lot 3 and continue south within an existing type 'VL' riprap lined swale.

Design Point 7

Basin G ($Q_5=0.8$ cfs, $Q_{100}=1.8$ cfs), consists of 0.41 acres of existing parking storage area located within the eastern portion of Lot 3. Flows from the basin are conveyed as sheet flow to the existing riprap lined channel that parallels the eastern boundary. Basin G will be part of the 20% of total site Water Quality exclusion not to exceed one acre per El Paso County Engineering Criteria Manual Chapter 3.2.5.

Off-site **Basin OS7** ($Q_5=0.0$ cfs, $Q_{100}=0.1$ cfs) consists of 0.02 acres of undeveloped property located near the southeast corner of Lot 3. Runoff produced within the basin combines with flows produced within **DP6**, and **DP5** within an existing earthen swale located along the south property line of Lot 4. The combined runoff within the existing swale at **Design Point 7** is calculated to reach peak flow rates of $Q_5=57.9$ cfs, $Q_{100}=133.2$ cfs

Four Step Process

Step 1 Employ Runoff Reduction Practices – Whenever possible, runoff produced within developable area containing impervious surfaces will be routed through landscaped areas to minimize direct connection of impervious surfaces.

Step 2 Stabilize Drainageways – The development of this site is not anticipated to have negative effects on downstream drainage ways since flows released will be near historic rates. Fees previously paid (at the time of platting) are utilized to stabilize drainageways.

Step 3 Implement PCMs that provide a water quality capture volume with slow release. – A total of 128,067 sq feet (2.94 ac) is being captured and treated for this development. Approximately 23,958 sq feet (0.55 acres) of the site will be part of the 20% total site Water Quality exclusion not to exceed one acre per El Paso County Engineering Criteria Manual Chapter 3.2.5. A portion of the site lies within the Sand Creek Drainage Basin. The onsite water quality treatment for the 2.94 acres of area is being provided via a proposed private 72” diameter by 107’ long CMP Xfiltration vault (by Contech) or approved equal. Offsite basins are landscaped which will provide infiltration and are within public domain. The runoff historically is routed offsite.

Step 4 Consider Need for Selecting Industrial and Commercial BMP’s – The proposed development will implement a Stormwater Management Plan including property housekeeping practices, spill containment procedures, and coverage of storage/handling areas. Specialized PCM’s are not required since the vertical development of the commercial areas are unknown at this time.

Water Quality Provisions and Maintenance

The on-site proposed Xfiltration vault functions to provide water quality for the existing development. The vault will be privately owned and maintained by the owner of Lot 3 and 4 (currently same owner).

Erosion Control

It is the policy of the El Paso County that M&S Civil Consultants submit a grading and erosion control plan with the drainage report. The site plan will include proposed silt fence, vehicle tracking control, inlet protection and a concrete wash area as proposed erosion control measures.

2024 Drainage & Bridge Fees

The site is located within the Sand Creek Drainage Basin. The total disturbance in the basin is estimated at approximately 0.28 acres. Since the property has been previously platted as a portion of Rocky Mountain Industrial Park Filing No. 1, no drainage basin fees are required.

Construction Cost Estimate

Item	Amount	Unit	Unit Cost	Total Cost
Overflow Rip Rap	48	CY	\$ 65.00	\$ 3,120.00
10’ Type R	1	EA	\$ 6,700.00	\$ 6,700.00
15’ Type R	1	EA	\$ 7,700.00	\$ 7,700.00
Concrete Curb	762	LF	\$ 55.00	\$ 41,910.00
18” HP	71	LF	\$ 68.00	\$ 4,828.00
Xfiltration WQCVVault	1	EA	\$ 40,000.00	\$ 40,000.00
TOTAL COST:	\$			104,258.00

Comparative Analysis

In the historic/pre-developed condition, drainage reaching **DP4** at the southeast corner of the site is **Q5=52.3 cfs, Q100=121.4 cfs**. In the existing condition drainage reaching **Design Point 4** at the southeast corner of the site is **Q5=57.1 cfs, Q100=126.9 cfs**. In the proposed condition drainage reaching **Design Point 7** totals **Q5=57.4 cfs, Q100=132.1 cfs** an increase of 5.1 cfs and 10.7 cfs in the 5- and 100-year storm event from the historic/pre-developed condition, respectively. In the future condition drainage reaching **Design Point 7** has been estimated to total **Q5=57.9 cfs, Q100=133.2 cfs** an increase of 5.6 cfs in the 5-year event and an increase of 11.4 cfs in the 100-year storm event from the historic/pre-developed condition.

An increase in runoff is anticipated in the proposed and future conditions from the historic/pre-developed condition. The anticipated minor increases in runoff remain in compliance with the Final Drainage Report/Proposed Drainage Plan for Rocky Mountain Industrial Park by Kiowa Engineering Corporation which anticipated **Q5=101.4 cfs, Q100=186.0 cfs** at the same location (refer to background information in appendix). No negative impacts to either water quality or to the downstream improvements or facilities are anticipated as a result of the development.

Summary

Lot 3 and 4 of Rocky Mountain Industrial Park Filing No. 1A, consist of equipment and material storage associated with an existing landscaping business. The owner of the property has been asked to bring the development up to El Paso County Code by adding landscaping and implementing water quality detention storage.

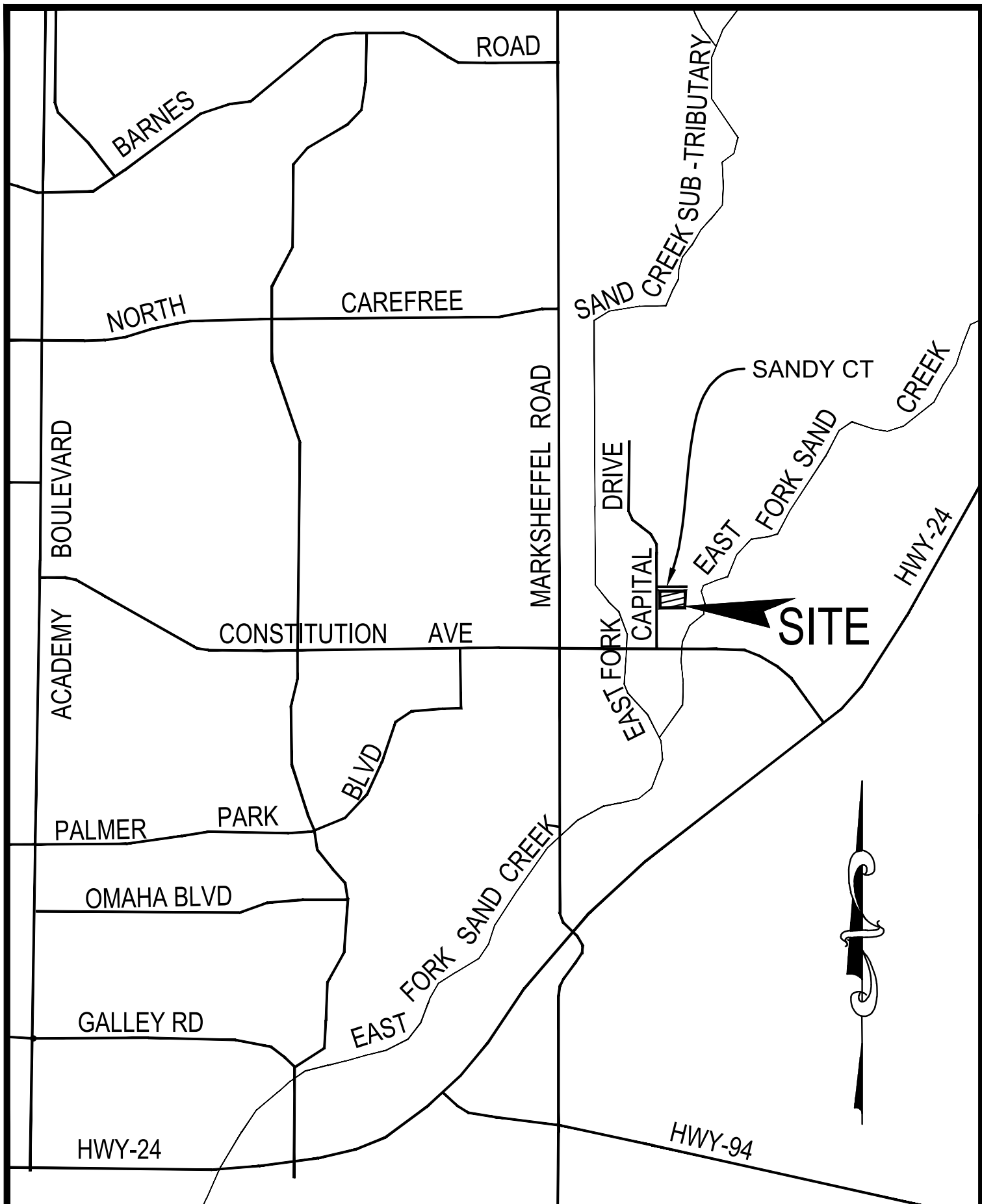
Based on the analysis, the 5-year & 100-year post-development stormwater peak flow rates will be slightly higher than the pre-developed stormwater peak flow rates but less than those planned for within the sites master development drainage plan. An Xfiltration WQCV vault will be implemented into the site to capture and infiltrate runoff generated from the existing development. Runoff will continue to leave the site through historic drainageways. Development of the site should not adversely impact surrounding or downstream properties or negatively impact water quality.

References

- 1.) "Design Criteria Manual, Volume 1", Revised January 2021, City of Colorado Springs.
- 2.) "Design Criteria Manual, Volume 2", Revised December 2020, City of Colorado Springs.
- 3.) "Web Soils Survey", United States Department of Agriculture, National Resources Conservation Service, <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>
- 4.) FEMA Flood Map Service Center, Federal Emergency Management Agency
<https://msc.fema.gov/portal>
- 5.) "Urban Storm Drainage Criteria Manual, Vol. 1, Revised August 2018, Mile High Flood District.
- 6.) "Urban Storm Drainage Criteria Manual, Vol. 2, Revised September 2017, Mile High Flood District
- 7.) "Final Drainage Plan and Erosion Control Plan, Rocky Mountain Industrial Park Filing 1, prepared by Kiowa Engineering Corporation, approved February 15, 2002
- 8.) "Preliminary/Final Drainage Report Jackson Office Warehouse & Storage Building Development Rocky Mountain Industrial Park Filing No. 1A, prepared by Associated Design Professionals, Inc, dated May 2, 2018.
- 9.) "Sand Creek Drainage Basin Planning Study, Preliminary Design Report", prepared by Kiowa Engineering Corporation, dated January 1993, revised March 1996.
- 10.) "Surface Mining Water Diversion Design Manual", prepared for U.S. Department of the Interior Office of Surface Mining, dated September 1982.
- 11.) "Manning's n Values" Reference Tables for Manning's n values for channels, closed conduits flowing partially full, and corrugated metal pipes. (Chow 1959).

APPENDIX

VICINITY MAP



VICINITY MAP

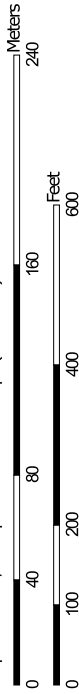
N.T.S.

SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado
(70140 Shapefile)



Map Scale: 1:2,880 if printed on A landscape (11" x 8.5") sheet.



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



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

12/5/2024
Page 1 of 4

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

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

C

 C

C/D

 C/D

D

 D

Not rated or not available

 Not rated or not available

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 22, Sep 3, 2024

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	29.1	100.0%
Totals for Area of Interest			29.1	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

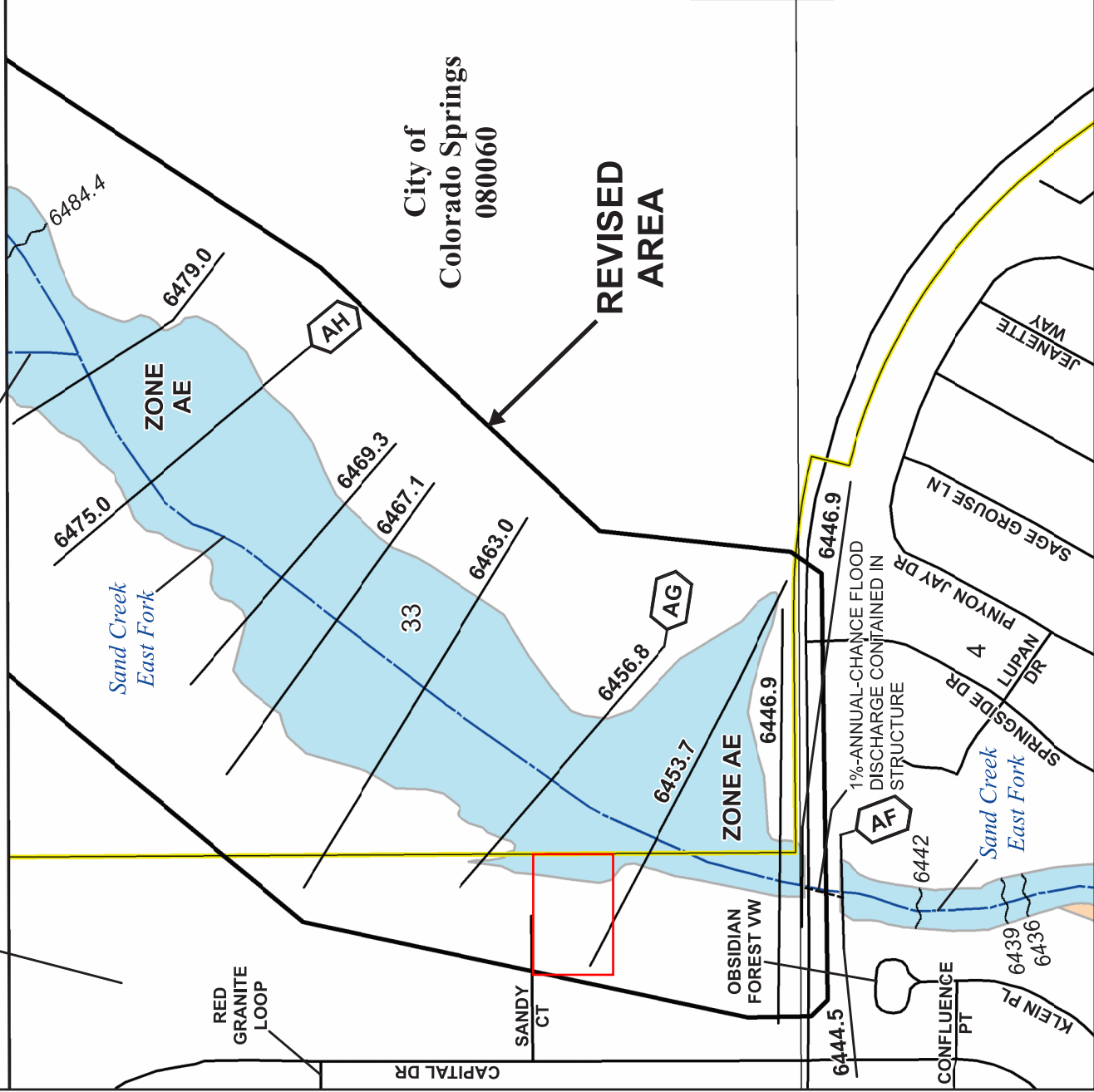
Tie-break Rule: Higher

FIRM PANELS

**El Paso County
Unincorporated Areas
080059**

*Sand Creek East Fork
Old Flowpath Lower*

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13
SOUTH, RANGE 65 WEST AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.



SPECIAL FLOOD HAZARD AREAS

Without Base Flood Elevation (BFE)
Zone AE, AH, X
With BFE or Depth
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
Future Conditions 1% Annual Chance Flood Hazard
Area with Reduced Flood Risk due to Levee
See Notes, Zone X

Map Projection:
NAD83 UTM Zone 13N
Western Hemisphere; Vertical Datum: NAVD88

1 inch = 500 feet
1:6,000

0 250 500 1,000
0 75 150 300
Feet
Meters

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
And Incorporated Areas

PANEL **756** OF **1300**

Panel Contains:
COMMUNITY
COLORADO SPRINGS,
CITY OF
EL PASO COUNTY

NUMBER
080060
080059

SUFFIX
G
G

FEMA

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

**REVISED TO
REFLECT LOMR
EFFECTIVE: February 6, 2025**

VERSION NUMBER
1.1.1.0

MAP NUMBER
08041C0756G

MAP REVISED
DECEMBER 7, 2018

National Flood Insurance Program

FEMA

HYDROLOGIC CALCULATIONS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Historic Conditions - Area Runoff Coefficient Summary)

			<i>STREETS / ASPHALT DRIVES</i> <i>(0.90-0.96)</i>			<i>GRAVEL AREAS</i> <i>(0.59-0.70)</i>			<i>UNDEVELOPED AREAS</i> <i>(0.08-0.35)</i>			<i>RUNOFF COEFFICIENT</i>	
BASIN	TOTAL AREA (Sq. Ft.)	TOTAL AREA (Acres)	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	C ₅	C ₁₀₀
<i>A</i>	50133.7	1.15	0.00	0.90	0.96	0.00	0.59	0.70	1.15	0.08	0.35	0.08	0.35
<i>B</i>	10859.2	0.25	0.00	0.90	0.96	0.00	0.59	0.70	0.25	0.08	0.35	0.08	0.35
<i>C</i>	50522.9	1.16	0.00	0.90	0.96	0.00	0.59	0.70	1.16	0.08	0.35	0.08	0.35
<i>D</i>	14647.5	0.34	0.00	0.90	0.96	0.00	0.59	0.70	0.34	0.08	0.35	0.08	0.35
<i>E</i>	25927.7	0.60	0.00	0.90	0.96	0.09	0.59	0.70	0.50	0.08	0.35	0.16	0.40
<i>OS1</i>	1631.8	0.04	0.00	0.90	0.96	0.00	0.59	0.70	0.04	0.08	0.35	0.08	0.35
<i>OS2</i>	1479.9	0.03	0.00	0.90	0.96	0.00	0.59	0.70	0.03	0.08	0.35	0.08	0.35
<i>OS3</i>	2365.1	0.05	0.00	0.90	0.96	0.00	0.59	0.70	0.05	0.08	0.35	0.08	0.35
<i>OS4</i>	2841.4	0.07	0.00	0.90	0.96	0.00	0.59	0.70	0.07	0.08	0.35	0.08	0.35
<i>OS5</i>	4889.2	0.11	0.00	0.90	0.96	0.00	0.59	0.70	0.11	0.08	0.35	0.08	0.35
<i>OS6</i>	7294.1	0.17	0.00	0.90	0.96	0.00	0.59	0.70	0.17	0.08	0.35	0.08	0.35
<i>OS7</i>	732.7	0.02	0.00	0.90	0.96	0.01	0.59	0.70	0.01	0.08	0.35	0.42	0.58

Calculated by: GT
Date: 5/22/2025
Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Historic Conditions - Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length	Height	T _c	Length	Slope	Velocity	T _t	TOTAL	CHECK	I ₅	I ₁₀₀	Q ₅	Q ₁₀₀
					(ft)	(ft)	(min)										
A	1.15	0.08	0.35	0.08	40	1.0	8.6	260	1.9%	1.4	3.1	11.7	11.7	3.9	6.5	0.4	2.6
B	0.25	0.08	0.35	0.08	60	1.0	12.1	195	2.1%	1.4	2.3	14.3	11.4	3.6	6.0	0.1	0.5
C	1.16	0.08	0.35	0.08	50	1.0	10.4	215	1.9%	1.4	2.6	13.0	11.5	3.7	6.3	0.3	2.5
D	0.34	0.08	0.35	0.08	75	1.0	14.5	165	2.4%	1.6	1.8	16.3	11.3	3.4	5.7	0.1	0.7
E	0.60	0.16	0.40	0.16	50	0.6	11.3	286	1.7%	1.3	3.6	14.9	11.9	3.5	5.9	0.3	1.4
OS1	0.04	0.08	0.35	0.08	15	0.6	4.5	0	0.0%	0.0	0.0	5.0	10.1	5.2	8.7	0.0	0.1
OS2	0.03	0.08	0.35	0.08	20	0.6	5.7	0	0.0%	0.0	0.0	5.7	10.1	5.0	8.3	0.0	0.1
OS3	0.05	0.08	0.35	0.08	20	0.6	5.7	0	0.0%	0.0	0.0	5.7	10.1	5.0	8.3	0.0	0.2
OS4	0.07	0.08	0.35	0.08	15	0.3	5.7	0	0.0%	0.0	0.0	5.7	10.1	5.0	8.4	0.0	0.2
OS5	0.11	0.08	0.35	0.08	40	0.5	10.8	200	0.8%	0.9	3.8	14.7	11.3	3.6	6.0	0.0	0.2
OS6	0.17	0.08	0.35	0.08	40	0.5	10.8	285	0.7%	0.8	5.7	16.5	11.8	3.4	5.7	0.0	0.3
OS7	0.02	0.42	0.58	0.42	10	0.2	3.1	15	3.7%	1.9	0.1	5.0	10.1	5.2	8.7	0.0	0.1

Calculated by: GT

Date: 5/22/2025

Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Historic Conditions - Basin Routing Summary)

From Area Runoff Coefficient Summary				OVERLAND				PIPE / CHANNEL FLOW				(T _t)	INTENSITY *		TOTAL FLOWS		COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
1	A, OS1, OS4, OS5	0.11	0.48									11.7	3.9	6.5	0.4	3.1	EXISTING EARTHEN SWALE
				Basin A Tc Used													
2	OS2, B, OS3, C, D, OS6, DP1	0.27	1.18				11.7	285	0.7%	0.8	5.7	12.6	3.8	6.4	1.0	7.5	EXISTING EARTHEN SWALE
				DP1 Tc Used													
3	OFFSITE JOW FDR DP6	18.23	24.28									20.5	3.1	5.1	55.6	124.4	OFFSITE FLOW ABOVE LINED CHANNEL
				JOW DP6 Tc Used													
4	DP2, DP3, E, OS7	18.60	25.71				20.5	300	0.5%	1.4	3.5	24.0	2.8	4.7	52.3	121.4	COMBINED FLOW AT SE CORNER (EXISTING SWALE)
				DP3 Used													

Calculated by: GT
Date: 5/22/2025
Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Existing Conditions - Area Runoff Coefficient Summary)

			<i>STREETS / ASPHALT DRIVES (0.90-0.96)</i>			<i>GRAVEL AREAS (0.59-0.70)</i>			<i>UNDEVELOPED AREAS (0.08-0.35)</i>			<i>RUNOFF COEFFICIENT</i>	
BASIN	TOTAL AREA (Sq. Ft.)	TOTAL AREA (Acres)	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	C ₅	C ₁₀₀
<i>A</i>	50133.7	1.15	0.00	0.90	0.96	1.15	0.59	0.70	0.00	0.08	0.35	0.59	0.70
<i>B</i>	10859.2	0.25	0.00	0.90	0.96	0.25	0.59	0.70	0.00	0.08	0.35	0.59	0.70
<i>C</i>	50522.9	1.16	0.00	0.90	0.96	1.16	0.59	0.70	0.00	0.08	0.35	0.59	0.70
<i>D</i>	14647.5	0.34	0.00	0.90	0.96	0.34	0.59	0.70	0.00	0.08	0.35	0.59	0.70
<i>E</i>	25927.7	0.60	0.00	0.90	0.96	0.49	0.59	0.70	0.10	0.08	0.35	0.50	0.64
<i>OS1</i>	1631.8	0.04	0.00	0.90	0.96	0.00	0.59	0.70	0.03	0.08	0.35	0.12	0.38
<i>OS2</i>	1479.9	0.03	0.00	0.90	0.96	0.00	0.59	0.70	0.03	0.08	0.35	0.13	0.39
<i>OS3</i>	2365.1	0.05	0.00	0.90	0.96	0.00	0.59	0.70	0.05	0.08	0.35	0.08	0.35
<i>OS4</i>	2841.4	0.07	0.00	0.90	0.96	0.00	0.59	0.70	0.07	0.08	0.35	0.08	0.35
<i>OS5</i>	4889.2	0.11	0.00	0.90	0.96	0.00	0.59	0.70	0.11	0.08	0.35	0.08	0.35
<i>OS6</i>	7294.1	0.17	0.00	0.90	0.96	0.00	0.59	0.70	0.17	0.08	0.35	0.08	0.35
<i>OS7</i>	732.7	0.02	0.00	0.90	0.96	0.01	0.59	0.70	0.01	0.08	0.35	0.42	0.58

Calculated by: GT
Date: 5/22/2025
Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Existing Conditions - Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	CHECK (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
A	1.15	0.59	0.70	0.59	40	1.0	4.3	260	1.9%	1.4	3.1	7.4	11.7	4.6	7.7	3.1	6.2
B	0.25	0.59	0.70	0.59	60	1.0	6.0	195	2.1%	1.4	2.3	8.3	11.4	4.4	7.4	0.6	1.3
C	1.16	0.59	0.70	0.59	50	1.0	5.2	215	1.9%	1.4	2.6	7.8	11.5	4.5	7.6	3.1	6.1
D	0.34	0.59	0.70	0.59	75	1.0	7.3	165	2.4%	1.6	1.8	9.0	11.3	4.3	7.2	0.8	1.7
E	0.60	0.50	0.64	0.50	50	0.6	7.2	286	1.7%	1.3	3.6	10.8	11.9	4.0	6.7	1.2	2.6
OS1	0.04	0.12	0.38	0.12	15	0.6	4.3	0	0.0%	0.0	0.0	5.0	10.1	5.2	8.7	0.0	0.1
OS2	0.03	0.13	0.39	0.13	20	0.6	5.4	0	0.0%	0.0	0.0	5.4	10.1	5.0	8.5	0.0	0.1
OS3	0.05	0.08	0.35	0.08	20	0.6	5.7	0	0.0%	0.0	0.0	5.7	10.1	5.0	8.3	0.0	0.2
OS4	0.07	0.08	0.35	0.08	15	0.3	5.7	0	0.0%	0.0	0.0	5.7	10.1	5.0	8.4	0.0	0.2
OS5	0.11	0.08	0.35	0.08	40	0.5	10.8	200	0.8%	0.9	3.8	14.7	11.3	3.6	6.0	0.0	0.2
OS6	0.17	0.08	0.35	0.08	40	0.5	10.8	285	0.7%	0.8	5.7	16.5	11.8	3.4	5.7	0.0	0.3
OS7	0.02	0.42	0.58	0.42	10	0.2	3.1	15	3.7%	1.9	0.1	5.0	10.1	5.2	8.7	0.0	0.1

Calculated by: GT

Date: 5/22/2025

Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Existing Conditions - Basin Routing Summary)

From Area Runoff Coefficient Summary				OVERLAND				PIPE / CHANNEL FLOW				(T _t)	INTENSITY *		TOTAL FLOWS		COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
1	A, OS1, OS4, OS5	0.70	0.88									7.4	4.6	7.7	3.2	6.8	EXISTING EARTHEN SWALE
				Basin A Tc Used													
2	OS2, B, OS3, C, D, OS6, DP1	1.75	2.19				7.4	285	0.7%	0.8	5.7	8.3	4.4	7.4	7.7	16.3	EXISTING EARTHEN SWALE
				DP1 Tc Used													
3	OFFSITE JOW FDR DP6	18.23	24.28									20.5	3.1	5.1	55.6	124.4	OFFSITE FLOW ABOVE LINED CHANNEL
				JOW DP6 Tc Used													
4	DP2, DP3, E, OS7	20.29	26.87				20.5	300	0.5%	1.4	3.5	24.0	2.8	4.7	57.1	126.9	COMBINED FLOW AT SE CORNER (EXISTING SWALE)
				DP3 Used													

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<i>Total Weighted Percent Imperviousness (Existing)</i>				
<i>Contributing Basins</i>	<i>Area (Acres)</i>	<i>C_s</i>	<i>Impervious (I)</i>	<i>(Acres)*(I)</i>
<i>A</i>	1.15	0.59	0.80	0.92
<i>B</i>	0.25	0.59	0.80	0.20
<i>C</i>	1.16	0.59	0.80	0.93
<i>D</i>	0.34	0.59	0.80	0.27
<i>E</i>	0.60	0.50	0.70	0.42
<i>OS1</i>	0.04	0.12	0.07	0.00
<i>OS2</i>	0.03	0.13	0.09	0.00
<i>OS3</i>	0.05	0.08	0.00	0.00
<i>Totals</i>	3.62			2.74
<i>Total Imperviousness</i>	0.76			

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Proposed Conditions - Area Runoff Coefficient Summary)

			STREETS / ASPHALT DRIVES (0.90-0.96)				GRAVEL/HEAVY INDUSTRIAL (0.59-0.70/0.73-0.81)				UNDEVELOPED AREAS (0.08-0.35)				RUNOFF COEFFICIENT		
BASIN	TOTAL AREA (Sq. Ft.)	TOTAL AREA (Acres)	AREA (Acres)	C ₂	C ₅	C ₁₀₀	AREA (Acres)	C ₂	C ₅	C ₁₀₀	AREA (Acres)	C ₂	C ₅	C ₁₀₀	C ₂	C ₅	C ₁₀₀
<i>A</i>	47171.0	1.08	0.00	0.89	0.90	0.96	1.08	0.57	0.59	0.70	0.00	0.02	0.08	0.35	0.57	0.59	0.70
<i>B</i>	10807.0	0.25	0.00	0.89	0.90	0.96	0.25	0.57	0.59	0.70	0.00	0.02	0.08	0.35	0.57	0.59	0.70
<i>C</i>	9951.1	0.23	0.00	0.89	0.90	0.96	0.23	0.57	0.59	0.70	0.00	0.02	0.08	0.35	0.57	0.59	0.70
<i>D</i>	55035.8	1.26	0.00	0.89	0.90	0.96	1.26	0.57	0.59	0.70	0.00	0.02	0.08	0.35	0.57	0.59	0.70
<i>E</i>	3010.9	0.07	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.07	0.02	0.08	0.35	0.02	0.08	0.35
<i>F</i>	8113.9	0.19	0.00	0.89	0.90	0.96	0.19	0.57	0.59	0.70	0.00	0.02	0.08	0.35	0.57	0.59	0.70
<i>G</i>	18042.6	0.41	0.00	0.89	0.90	0.96	0.31	0.57	0.59	0.70	0.10	0.02	0.08	0.35	0.44	0.47	0.62
<i>OS1</i>	1631.8	0.04	0.01	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.03	0.02	0.08	0.35	0.18	0.24	0.49
<i>OS2</i>	1479.7	0.03	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.03	0.02	0.08	0.35	0.14	0.20	0.47
<i>OS3</i>	2365.4	0.05	0.01	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.04	0.02	0.08	0.35	0.18	0.23	0.46
<i>OS4</i>	2841.4	0.07	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.07	0.02	0.08	0.35	0.02	0.08	0.35
<i>OS5</i>	4889.4	0.11	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.11	0.02	0.08	0.35	0.02	0.08	0.35
<i>OS6</i>	7275.5	0.17	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.17	0.02	0.08	0.35	0.02	0.08	0.35
<i>OS7</i>	751.4	0.02	0.00	0.89	0.90	0.96	0.01	0.57	0.59	0.70	0.01	0.02	0.08	0.35	0.39	0.42	0.59

Calculated by: GT
Date: 5/16/2025
Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Proposed Conditions - Area Drainage Summary)

From Area Runoff Coefficient Summary					OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY *			TOTAL FLOWS		
BASIN	AREA TOTAL (Acres)	C ₂	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	CHECK (min)	I ₂ (in/hr)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₂ (c.f.s.)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
<i>A</i>	1.08	0.57	0.59	0.70	0.59	40	1.0	4.3	288	1.7%	1.3	3.6	7.9	11.8	3.6	4.5	7.5	2.2	2.9	5.7
<i>B</i>	0.25	0.57	0.59	0.70	0.59	60	1.0	6.0	185	1.6%	1.3	2.4	8.4	11.4	3.5	4.4	7.4	0.5	0.6	1.3
<i>C</i>	0.23	0.57	0.59	0.70	0.59	45	1.0	4.7	189	1.6%	1.3	2.5	7.2	11.3	3.7	4.6	7.7	0.5	0.6	1.2
<i>D</i>	1.26	0.57	0.59	0.70	0.59	50	1.0	5.2	291	1.4%	1.2	4.1	9.3	11.9	3.4	4.2	7.1	2.4	3.2	6.3
<i>E</i>	0.07	0.02	0.08	0.35	0.08	45	1.0	9.5	176	1.7%	1.3	2.2	11.7	11.2	3.2	4.0	6.6	0.0	0.0	0.2
<i>F</i>	0.19	0.57	0.59	0.70	0.59	55	1.0	5.6	183	2.5%	1.6	1.9	7.6	11.3	3.6	4.6	7.6	0.4	0.5	1.0
<i>G</i>	0.41	0.44	0.47	0.62	0.47	40	0.6	6.3	263	1.9%	1.4	3.2	9.5	11.7	3.4	4.2	7.1	0.6	0.8	1.8
<i>OS1</i>	0.04	0.18	0.24	0.49	0.24	15	0.6	3.8	0	0.0%	0.0	0.0	5.0	10.1	4.1	5.2	8.7	0.0	0.0	0.2
<i>OS2</i>	0.03	0.14	0.20	0.47	0.20	20	0.6	5.1	0	0.0%	0.0	0.0	5.1	10.1	4.1	5.2	8.6	0.0	0.0	0.1
<i>OS3</i>	0.05	0.18	0.23	0.46	0.23	20	0.6	4.9	0	0.0%	0.0	0.0	5.0	10.1	4.1	5.2	8.7	0.0	0.1	0.2
<i>OS4</i>	0.07	0.02	0.08	0.35	0.08	35	1.0	7.7	183	1.6%	1.3	2.4	10.1	11.2	3.3	4.1	6.9	0.0	0.0	0.2
<i>OS5</i>	0.11	0.02	0.08	0.35	0.08	45	0.5	11.9	198	1.0%	1.0	3.3	15.2	11.4	3.1	3.9	6.6	0.0	0.0	0.3
<i>OS6</i>	0.17	0.02	0.08	0.35	0.08	40	0.5	10.8	284	0.7%	0.8	5.6	16.5	11.8	3.1	3.9	6.5	0.0	0.1	0.4
<i>OS7</i>	0.02	0.39	0.42	0.59	0.42	30	0.2	7.6	0	0.0%	0.0	0.0	7.6	10.2	3.6	4.5	7.6	0.0	0.0	0.1

Calculated by: GT
Date: 5/16/2025
Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Proposed Conditions - Basin Routing Summary)

From Area Runoff Coefficient Summary					OVERLAND				PIPE / CHANNEL FLOW				(T _r)		INTENSITY *			TOTAL FLOWS			COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₂	CA ₅	CA ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T ₁ (min)	TOTAL (min)	Location	I ₂ (in/hr)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₂ (c.f.s.)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
1	OS1, A	0.62	0.65	0.78									7.9		3.6	4.5	7.5	2.2	2.9	5.8	SHEET FLOW TO CURB AND GUTTER
					Basin A Tc Used																
2	DP1, OS2, B, C	0.90	0.94	1.13				8.4	70	0.5%	0.7	3.5	9.2		3.4	4.3	7.2	3.1	4.0	8.1	PROPOSED 10" Type R Inlet
					Basin B Tc Used																
3	OS4, OS5, E	0.00	0.02	0.09									11.4		3.1	3.9	6.6	0.0	0.1	0.6	EX SWALE
					Basin OS5 Tc Used																
4	FLOWBY DP2, OS3, D	0.73	0.76	1.08				9.2	150	0.5%	0.7	3.5	12.7		3.0	3.8	6.3	2.2	2.8	6.9	PROPOSED 15" Type R Inlet
					DP2 Tc Used																
5	FLOWBY DP4, DP3, OS6, F	0.11	0.37	1.24				11.4	324	0.7%	0.8	6.5	17.8		2.6	3.3	5.5	0.3	1.2	6.8	EXISTING SWALE AT SE CORNER
					DP2 Tc Used																
6	OFFSITE JOW FDR DP6		18.23	24.28									20.5		2.4	3.1	5.1	0.0	55.6	124.4	OFFSITE FLOW ABOVE LINED CHANNEL
					JOW DP6 Tc Used																
7	DP5, DP6, G, OS7	0.30	18.80	25.78									20.5		2.4	3.1	5.1	0.7	57.4	132.1	COMBINED FLOW AT SE CORNER (EXISTING SWALE)
					JOW DP6 Tc Used																

Calculated by: GT
Date: 8/5/2025
Checked by: VAS

FINAL DRAINAGE REPORT LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A (Proposed Conditions - Storm Sewer Routing Summary)									
<i>PIPE RUN</i>	<i>Contributing Pipes/Design Points</i>	<i>Equivalent CA₅</i>	<i>Equivalent CA₁₀₀</i>	<i>Maximum T_C</i>	<i>Intensity*</i>		<i>Flow</i>		PIPE SIZE
					<i>I₅</i>	<i>I₁₀₀</i>	<i>Q₅</i>	<i>Q₁₀₀</i>	
1	DP2	0.94	0.95	9.2	4.3	7.2	4.0	6.8	PROP 18" HP
2	DP4	0.74	1.08	12.7	3.8	6.3	2.8	6.9	PROP 18" HP

* Intensity equations assume a minimum travel time of 5 minutes.
DP - Design Point
EX - Existing Design Point

FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: GT
Date: 8/5/2025
Checked by: VAS

Total Weighted Percent Imperviousness (Proposed)				
Contributing Basins	Area (Acres)	C_s	Impervious (I)	(Acres)*(I)
A	1.08	0.59	0.80	0.87
B	0.25	0.59	0.80	0.20
C	0.23	0.59	0.80	0.18
D	1.26	0.59	0.80	1.01
E	0.07	0.08	0.00	0.00
OS1	0.04	0.24	0.28	0.01
OS2	0.03	0.20	0.20	0.01
OS3	0.05	0.23	0.26	0.01
Totals	3.02			2.29
Total Imperviousness	0.76			

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Future Conditions - Area Runoff Coefficient Summary)

			STREETS / ASPHALT DRIVES (0.90-0.96)				GRAVEL/HEAVY INDUSTRIAL (0.59-0.70/0.73-0.81)				UNDEVELOPED AREAS (0.08-0.35)				RUNOFF COEFFICIENT		
BASIN	TOTAL AREA (Sq. Ft.)	TOTAL AREA (Acres)	AREA (Acres)	C ₂	C ₅	C ₁₀₀	AREA (Acres)	C ₂	C ₅	C ₁₀₀	AREA (Acres)	C ₂	C ₅	C ₁₀₀	C ₂	C ₅	C ₁₀₀
<i>A</i>	47171.0	1.08	0.00	0.89	0.90	0.96	1.08	0.71	0.73	0.81	0.00	0.02	0.08	0.35	0.71	0.73	0.81
<i>B</i>	10807.0	0.25	0.00	0.89	0.90	0.96	0.25	0.71	0.73	0.81	0.00	0.02	0.08	0.35	0.71	0.73	0.81
<i>C</i>	9951.1	0.23	0.00	0.89	0.90	0.96	0.23	0.71	0.73	0.81	0.00	0.02	0.08	0.35	0.71	0.73	0.81
<i>D</i>	55035.8	1.26	0.00	0.89	0.90	0.96	1.26	0.71	0.73	0.81	0.00	0.02	0.08	0.35	0.71	0.73	0.81
<i>E</i>	3010.9	0.07	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.07	0.02	0.08	0.35	0.02	0.08	0.35
<i>F</i>	8113.9	0.19	0.00	0.89	0.90	0.96	0.19	0.57	0.59	0.70	0.00	0.02	0.08	0.35	0.57	0.59	0.70
<i>G</i>	18042.6	0.41	0.00	0.89	0.90	0.96	0.31	0.57	0.59	0.70	0.10	0.02	0.08	0.35	0.44	0.47	0.62
<i>OS1</i>	1631.8	0.04	0.01	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.03	0.02	0.08	0.35	0.18	0.24	0.49
<i>OS2</i>	1479.7	0.03	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.03	0.02	0.08	0.35	0.14	0.20	0.47
<i>OS3</i>	2365.4	0.05	0.01	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.04	0.02	0.08	0.35	0.18	0.23	0.46
<i>OS4</i>	2841.4	0.07	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.07	0.02	0.08	0.35	0.02	0.08	0.35
<i>OS5</i>	4889.4	0.11	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.11	0.02	0.08	0.35	0.02	0.08	0.35
<i>OS6</i>	7275.5	0.17	0.00	0.89	0.90	0.96	0.00	0.57	0.59	0.70	0.17	0.02	0.08	0.35	0.02	0.08	0.35
<i>OS7</i>	751.4	0.02	0.00	0.89	0.90	0.96	0.01	0.57	0.59	0.70	0.01	0.02	0.08	0.35	0.39	0.42	0.59

Calculated by: GT
Date: 5/16/2025
Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Future Conditions - Area Drainage Summary)

From Area Runoff Coefficient Summary					OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY *			TOTAL FLOWS		
BASIN	AREA TOTAL (Acres)	C ₂	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	CHECK (min)	I ₂ (in/hr)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₂ (c.f.s.)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
<i>A</i>	1.08	0.71	0.73	0.81	0.73	40	1.0	3.1	288	1.7%	1.3	3.6	6.8	11.8	3.8	4.7	7.9	2.9	3.7	6.9
<i>B</i>	0.25	0.71	0.73	0.81	0.73	60	1.0	4.4	185	1.6%	1.3	2.4	6.8	11.4	3.8	4.7	7.9	0.7	0.9	1.6
<i>C</i>	0.23	0.71	0.73	0.81	0.73	45	1.0	3.4	189	1.6%	1.3	2.5	5.9	11.3	3.9	4.9	8.2	0.6	0.8	1.5
<i>D</i>	1.26	0.71	0.73	0.81	0.73	50	1.0	3.8	291	1.4%	1.2	4.1	7.9	11.9	3.6	4.5	7.5	3.2	4.1	7.7
<i>E</i>	0.07	0.02	0.08	0.35	0.08	45	1.0	9.5	176	1.7%	1.3	2.2	11.7	11.2	3.2	4.0	6.6	0.0	0.0	0.2
<i>F</i>	0.19	0.57	0.59	0.70	0.59	55	1.0	5.6	183	2.5%	1.6	1.9	7.6	11.3	3.6	4.6	7.6	0.4	0.5	1.0
<i>G</i>	0.41	0.44	0.47	0.62	0.47	40	0.6	6.3	263	1.9%	1.4	3.2	9.5	11.7	3.4	4.2	7.1	0.6	0.8	1.8
<i>OS1</i>	0.04	0.18	0.24	0.49	0.24	15	0.6	3.8	0	0.0%	0.0	0.0	5.0	10.1	4.1	5.2	8.7	0.0	0.0	0.2
<i>OS2</i>	0.03	0.14	0.20	0.47	0.20	20	0.6	5.1	0	0.0%	0.0	0.0	5.1	10.1	4.1	5.2	8.6	0.0	0.0	0.1
<i>OS3</i>	0.05	0.18	0.23	0.46	0.23	20	0.6	4.9	0	0.0%	0.0	0.0	5.0	10.1	4.1	5.2	8.7	0.0	0.1	0.2
<i>OS4</i>	0.07	0.02	0.08	0.35	0.08	35	1.0	7.7	183	1.6%	1.3	2.4	10.1	11.2	3.3	4.1	6.9	0.0	0.0	0.2
<i>OS5</i>	0.11	0.02	0.08	0.35	0.08	45	0.5	11.9	198	1.0%	1.0	3.3	15.2	11.4	3.1	3.9	6.6	0.0	0.0	0.3
<i>OS6</i>	0.17	0.02	0.08	0.35	0.08	40	0.5	10.8	284	0.7%	0.8	5.6	16.5	11.8	3.1	3.9	6.5	0.0	0.1	0.4
<i>OS7</i>	0.02	0.39	0.42	0.59	0.42	30	0.2	7.6	0	0.0%	0.0	0.0	7.6	10.2	3.6	4.5	7.6	0.0	0.0	0.1

Calculated by: GT
Date: 5/16/2025
Checked by: VAS

FINAL DRAINAGE REPORT
LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A
(Future Conditions - Basin Routing Summary)

From Area Runoff Coefficient Summary					OVERLAND				PIPE / CHANNEL FLOW				(T _c)		INTENSITY *			TOTAL FLOWS			COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₂	CA ₅	CA ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T ₁ (min)	TOTAL (min)	Location	I ₂ (in/hr)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₂ (c.f.s.)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
1	OS1, A	0.78	0.80	0.90									6.8		3.8	4.7	7.9	2.9	3.8	7.1	SHEET FLOW TO CURB AND GUTTER
					Basin A Tc Used																
2	DP1, OS2, B, C	1.12	1.15	1.30				6.8	70	0.5%	0.7	1.6	8.4		3.5	4.4	7.4	3.9	5.1	9.5	PROPOSED 10" Type R Inlet
					Basin B Tc Used																
3	OS4, OS5, E	0.00	0.02	0.09									11.4		3.1	3.9	6.6	0.0	0.1	0.6	EX SWALE
					Basin OS5 Tc Used																
4	FLOWBY DP2, OS3, D	0.91	0.97	1.33				8.4	150	0.5%	0.7	3.5	12.0		3.1	3.9	6.5	2.8	3.7	8.6	Proposed 15" Type R Inlet
					DP2 Tc Used																
5	FLOWBY DP4, DP3, OS6, F	0.11	0.52	1.46				11.4	324	0.7%	0.8	6.5	17.8		2.6	3.3	5.5	0.3	1.7	8.0	EXISTING SWALE AT SE CORNER
					DP2 Tc Used																
6	OFFSITE JOW FDR DP6		18.23	24.28									20.5		2.4	3.1	5.1	0.0	55.6	124.4	OFFSITE FLOW ABOVE LINED CHANNEL
					JOW DP6 Tc Used																
7	DP5, DP6, G, OS7	0.30	18.95	26.00									20.5		2.4	3.1	5.1	0.7	57.9	133.2	COMBINED FLOW AT SE CORNER (EXISTING SWALE)
					DP6 Tc Used																

Calculated by: GT
Date: 8/5/2025
Checked by: VAS

FINAL DRAINAGE REPORT LOT 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A (Future Conditions - Storm Sewer Routing Summary)									
PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow		PIPE SIZE
					I_5	I_{100}	Q_5	Q_{100}	
1	DP2	1.12	1.02	8.4	4.4	7.4	4.9	7.5	PROP 18" HP
2	DP4	0.83	1.33	12.0	3.9	6.5	3.2	8.6	PROP 18" HP

* Intensity equations assume a minimum travel time of 5 minutes.
 DP - Design Point
 EX - Existing Design Point

FB- Flow By from Design Point
 INT- Intercepted Flow from Design Point

Calculated by: GT
 Date: 8/5/2025
 Checked by: VAS

<i>Total Weighted Percent Imperviousness (Future)</i>				
<i>Contributing Basins</i>	<i>Area (Acres)</i>	<i>C_s</i>	<i>Impervious (I)</i>	<i>(Acres)*(I)</i>
<i>A</i>	1.08	0.73	0.90	0.97
<i>B</i>	0.25	0.73	0.90	0.22
<i>C</i>	0.23	0.73	0.90	0.21
<i>D</i>	1.26	0.73	0.80	1.01
<i>E</i>	0.07	0.08	0.00	0.00
<i>OS1</i>	0.04	0.24	0.28	0.01
<i>OS2</i>	0.03	0.20	0.20	0.01
<i>OS3</i>	0.05	0.23	0.26	0.01
<i>Totals</i>	3.02			2.45
<i>Total Imperviousness</i>	0.81			

HYDRAULIC CALCULATIONS

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 2

Designer: GT
 Company: M&S Civil Consultants Inc.
 Date: May 27, 2025
 Project: Lot 3/4 Rocky Mountain Industrial Park Filing 1A Proposed Condition
 Location: Sandy Ct/

1. Basin Storage Volume

- A) Effective Imperviousness of Tributary Area, I_e
 (100% if all paved and roofed areas upstream of sand filter)
- B) Tributary Area's Imperviousness Ratio ($i = I_e/100$)
- C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
 $WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$
- D) Contributing Watershed Area (including sand filter area)
- E) Water Quality Capture Volume (WQCV) Design Volume
 $V_{WQCV} = WQCV / 12 * \text{Area}$
- F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume
 (Only if a different WQCV Design Volume is desired)

$I_e = 76.0$ %

$i = 0.760$

WQCV = 0.24 watershed inches

Area = 131,552 sq ft

$V_{WQCV} =$ cu ft

$d_e = 0.43$ in

$V_{WQCV \text{ OTHER}} = 2,674$ cu ft

$V_{WQCV \text{ USER}} =$ cu ft

2. Basin Geometry

- A) WQCV Depth
- B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.
- C) Minimum Filter Area (Flat Surface Area)
- D) Actual Filter Area
- E) Volume Provided

$D_{WQCV} = 1.15$ ft

$Z = 4.00$ ft / ft

$A_{Min} = 1250$ sq ft

$A_{Actual} = 1415$ sq ft

$V_T = 2526$ cu ft **TOTAL VOLUME < DESIGN VOLUME IN 1.G**

3. Filter Material

Choose One
☒ 18" CDOT Class B or C Filter Material
☐ Other (Explain):

4. Underdrain System

- A) Are underdrains provided?
- B) Underdrain system orifice diameter for 12 hour drain time
- i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice
- ii) Volume to Drain in 12 Hours
- iii) Orifice Diameter, 3/8" Minimum

Choose One
☐ YES
☒ NO

$y = \text{N/A}$ ft

$Vol_{12} = \text{N/A}$ cu ft

$D_o = \text{N/A}$ in

Design Procedure Form: Sand Filter (SF)

Sheet 2 of 2

Designer: GT
Company: M&S Civil Consultants Inc.
Date: May 27, 2025
Project: Lot 3/4 Rocky Mountain Industrial Park Filing 1A Proposed Condition
Location: Sandy Ct/

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric

A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?

Choose One

☐ YES
 ☒ NO

6. Inlet / Outlet Works

A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet

Inlet points will be protected by rip rap for energy dissipation. No outlet
structres are provided. Basin will infiltrate and the excess water exit the pond
via the provided spilway.

Notes: _____

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 2

Designer: GT
Company: M&S Civil Consultants Inc.
Date: May 27, 2025
Project: Lot 3/4 Rocky Mountain Industrial Park Filing 1A Future Condition
Location: Sandy Ct

1. Basin Storage Volume

- A) Effective Imperviousness of Tributary Area, I_a
(100% if all paved and roofed areas upstream of sand filter)
- B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)
- C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
 $WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$
- D) Contributing Watershed Area (including sand filter area)
- E) Water Quality Capture Volume (WQCV) Design Volume
 $V_{WQCV} = WQCV / 12 * \text{Area}$
- F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)

$I_a =$ %

$i =$

WQCV = watershed inches

Area = sq ft

$V_{WQCV} =$ cu ft

$d_e =$ in

$V_{WQCV \text{ OTHER}} =$ cu ft

$V_{WQCV \text{ USER}} =$ cu ft

2. Basin Geometry

- A) WQCV Depth
- B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.
- C) Minimum Filter Area (Flat Surface Area)
- D) Actual Filter Area
- E) Volume Provided

$D_{WQCV} =$ ft

$Z =$ ft / ft

$A_{Min} =$ sq ft

$A_{Actual} =$ sq ft

$V_T =$ cu ft TOTAL VOLUME < DESIGN VOLUME IN 1.G

3. Filter Material

Choose One

☒ 18" CDOT Class B or C Filter Material

☐ Other (Explain):

4. Underdrain System

- A) Are underdrains provided?
- B) Underdrain system orifice diameter for 12 hour drain time
- i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice
- ii) Volume to Drain in 12 Hours
- iii) Orifice Diameter, 3/8" Minimum

Choose One

☐ YES

☒ NO

$y =$ ft

$Vol_{12} =$ cu ft

$D_o =$ in

Design Procedure Form: Sand Filter (SF)

Sheet 2 of 2

Designer: GT
Company: M&S Civil Consultants Inc.
Date: May 27, 2025
Project: Lot 3/4 Rocky Mountain Industrial Park Filing 1A Future Condition
Location: Sandy Ct

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric

A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?

Choose One

☐ YES
 ☒ NO

6. Inlet / Outlet Works

A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet

Inlet points will be protected by rip rap for energy dissipation. No outlet
structres are provided. Basin will infiltrate and the excess water exit the pond
provided spilway.

Notes: _____

LOT 3 & 4 ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A

XFILTRATION VAULT

(PROPOSED CONDITIONS)

CALCULATIONS FOR WATER QUALITY CONTROL VOLUME DRAIN TIME REQUIREMENTS (BTM ONLY)

VOLUME OF WQCV EVENT STORM	(cf)	2674	B, PER UD-BMP RUNOFF REDUCTION
INFILTRATION AREA (POND BOTTOM)	(sf)	1415	I, BOTTOM AREA
DESIGN SOIL INFILTRATION RATE	(in/hr)	1.9	R, PER TEST
DRAWDOWN RATE	cfs	0.0622338	A=(I*R)/12/(60*60)
WQCV DESIGN DRAIN TIME	cf/hr	224.04167	D=I*R/12
WQCV DRAIN TIME	(hours)	11.9	

LOT 3 & 4 ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A

XFILTRATION VAULT

(FUTURE CONDITIONS)

CALCULATIONS FOR WATER QUALITY CONTROL VOLUME DRAIN TIME REQUIREMENTS (BTM ONLY)

VOLUME OF WQCV EVENT STORM	(cf)	2935	B, PER UD-BMP RUNOFF REDUCTION
INFILTRATION AREA (POND BOTTOM)	(sf)	1415	I, BOTTOM AREA
DESIGN SOIL INFILTRATION RATE	(in/hr)	1.9	R, PER TEST
DRAWDOWN RATE	cfs	0.0622338	A=(I*R)/12/(60*60)
WQCV DESIGN DRAIN TIME	cf/hr	224.04167	D=I*R/12
WQCV DRAIN TIME	(hours)	13.1	

THIS SHEET TO BE USED IN CONJUNCTION WITH THE ENTECH ENGINEERING, INC.,
INFILTRATION RATE TESTING REPORT FOR REQUIRED DRAIN TIME.

* The required filter bed area should be calculated using the principles of Darcy's Law, which relates the velocity of porous media flow to the hydraulic head and hydraulic conductivity of the filter medium:

$$A_f = \frac{(WQV)(d)}{[(k)(t)(h+d)]} \quad A_f = \frac{(2935 \text{ cu ft } (1 \text{ ft}))}{[(3.8 \text{ ft/day})(12 \text{ hr})(3 \text{ ft} + 1 \text{ ft})]}$$

where:

A_f	= filter bed surface area (ft ²)	16.1 sq ft
WQV	= water quality volume (ft ³)	2935 cu ft
d	= filter bed depth (ft)	1 ft
k	= hydraulic conductivity of filter media (ft/day)	3.8 ft/day (Infiltration rate of 1.9 in/hr provided by Entech)
t	= time for the water quality volume to drain from the system (24 hours)	12 hr
h	= average height of water above filter bed during water quality design storm	6 ft dia, avg height 3 ft

* A typical hydraulic conductivity value for medium sand is 3.5 feet per day. Laboratory analysis is recommended to determine the hydraulic conductivity of the actual filter media.

REFERENCE

<https://ctstormwatermanual.nemo.uconn.edu/11-design-guidance/filtering-practices-2004/>

INLET MANAGEMENT

Worksheet Protected

PROPOSED CONDITION

INLET NAME	DP2	DP4
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	4.0	2.8
Major Q_{Known} (cfs)	8.1	6.9

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

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	
Major Bypass Flow Received, Q_b (cfs)	0.0	

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

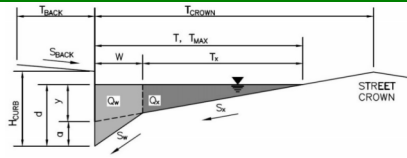
Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	4.0	2.8
Major Total Design Peak Flow, Q (cfs)	8.1	6.9
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	1.3	N/A

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

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

Project: **LOTS 3 & 4 ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A**Inlet ID: **DP2****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Warning 01 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} =$

$H_{CURB} =$ inches
 $T_{CROWN} =$ ft
 $W =$ ft
 $S_x =$ ft/ft
 $S_w =$ ft/ft
 $S_o =$ ft/ft
 $n_{STREET} =$

Max. Allowable Spread for Minor & Major Storm

Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$			ft
$d_{MAX} =$			inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

Minor Storm	Major Storm

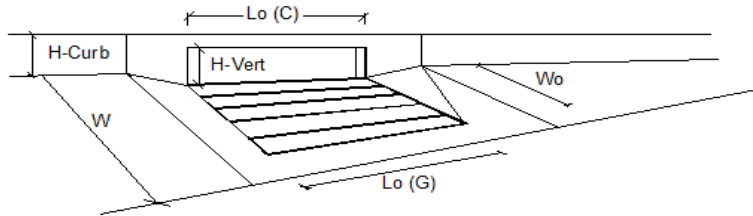
 cfs

WARNING: MINOR STORM max. allowable capacity is less than the design peak flow of 4.00 cfs on sheet 'Inlet Management'**WARNING: MAJOR STORM max. allowable capacity is less than the design peak flow of 8.10 cfs on sheet 'Inlet Management'****Warning 01: Manning's n-value does not meet the USDCM recommended design range.**

N-value acquired from Mannings n (Chow, 1959).

INLET ON A CONTINUOUS GRADE

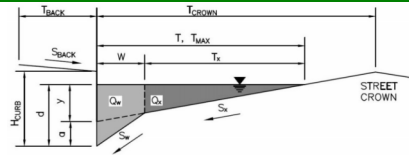
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a _{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L _o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W _o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C _f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C _f (C) =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM					
Total Inlet Interception Capacity		Q =	4.0	6.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q _s =	0.0	1.3	cfs
Capture Percentage = Q _i /Q _a		C% =	100	84	%

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

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

Project: **LOTS 3 & 4 ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A**Inlet ID: **DP4****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} =$

$H_{CURB} =$ inches
 $T_{CROWN} =$ ft
 $W =$ ft
 $S_x =$ ft/ft
 $S_y =$ ft/ft
 $S_0 =$ ft/ft
 $n_{STREET} =$

Warning 01

Max. Allowable Spread for Minor & Major Storm

Warning 02

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$			ft
$d_{MAX} =$			inches

☐ ☐

MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$Q_{allow} =$

Minor Storm	Major Storm
SUMP	SUMP

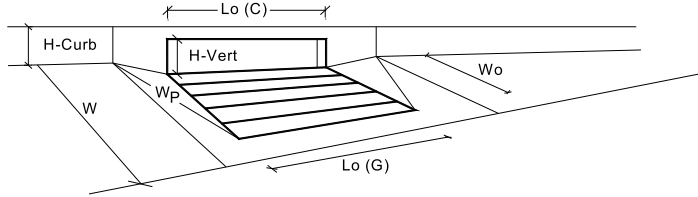
 cfs

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

N-value acquired from Mannings n (Chow, 1959).

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR	
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 =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.2	6.3	inches
Grate Information		MINOR		MAJOR	
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_r (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) =	5.00	5.00	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		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} =	0.18	0.36	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.65	0.81	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		Q_s =	3.2	11.2	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK REQUIRED}$ =	2.8	6.9	cfs

INLET MANAGEMENT

Worksheet Protected

FUTURE CONDITION

INLET NAME	DP2	DP4
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{Known} (cfs)	5.1	3.7
Major Q_{Known} (cfs)	9.5	8.6

Bypass (Carry-Over) Flow from Upstream

Inlets must be organized from upstream (left) to downstream (right) in order for bypass flow to be calculated.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	
Major Bypass Flow Received, Q_b (cfs)	0.0	

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

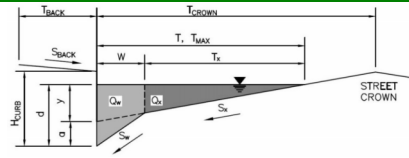
Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	5.1	3.7
Major Total Design Peak Flow, Q (cfs)	9.5	8.6
Minor Flow Bypassed Downstream, Q_b (cfs)	0.2	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	2.0	N/A

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

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

Project: **LOTS 3 & 4 ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A**Inlet ID: **DP2****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} =$

$H_{CURB} =$ inches
 $T_{CROWN} =$ ft
 $W =$ ft
 $S_x =$ ft/ft
 $S_y =$ ft/ft
 $S_0 =$ ft/ft
 $n_{STREET} =$

Warning 01

Max. Allowable Spread for Minor & Major Storm

Warning 02

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$			ft
$d_{MAX} =$			inches
	☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

Minor Storm	Major Storm

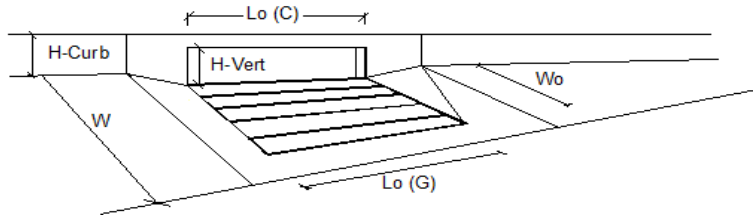
 cfs

WARNING: MINOR STORM max. allowable capacity is less than the design peak flow of 5.10 cfs on sheet 'Inlet Management'**WARNING: MAJOR STORM max. allowable capacity is less than the design peak flow of 9.50 cfs on sheet 'Inlet Management'****Warning 01: Manning's n-value does not meet the USDCM recommended design range.**

N-value acquired from Mannings n (Chow, 1959).

INLET ON A CONTINUOUS GRADE

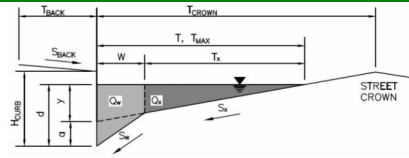
MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR		MAJOR
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')		a _{LOCAL} =	3.0	3.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2
Length of a Single Unit Inlet (Grate or Curb Opening)		L _o =	5.00	5.00 ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W _o =	N/A	N/A ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C _f (G) =	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C _f (C) =	0.10	0.10
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM			MINOR	MAJOR
Total Inlet Interception Capacity		Q =	4.9	7.5 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q _s =	0.2	2.0 cfs
Capture Percentage = Q _i /Q _a		C% =	97	79 %

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

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

Project: **LOTS 3 & 4 ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A**Inlet ID: **DP4****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} =$

$H_{CURB} =$ inches
 $T_{CROWN} =$ ft
 $W =$ ft
 $S_x =$ ft/ft
 $S_y =$ ft/ft
 $S_0 =$ ft/ft
 $n_{STREET} =$

Warning 01

Max. Allowable Spread for Minor & Major Storm

Warning 02

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$			ft
$d_{MAX} =$			inches
	☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$Q_{allow} =$

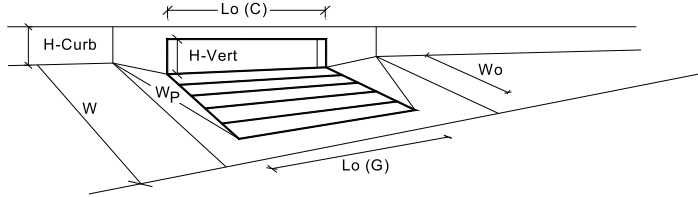
Minor Storm	Major Storm	
SUMP	SUMP	cfs

Warning 01: Manning's n-value does not meet the USDCM recommended design range.

N-value acquired from Mannings n (Chow, 1959).

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Warning 1

Design Information (Input)		MINOR		MAJOR	
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} =	1.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	4.2	6.3	inches
Grate Information		MINOR		MAJOR	
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _r (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) =	5.00	5.00	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		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} =	0.18	0.36	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	0.65	0.81	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		Q _s =	3.2	11.2	cfs
WARNING: Inlet Capacity < Q Peak for Minor Storm		Q _{PEAK REQUIRED} =	3.7	8.6	cfs

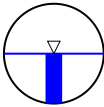
Warning 1: Dimension entered is not a typical dimension for inlet type specified.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

Printable Subtitle

Inputs			Results		
			Flow depth, y	0.7500	ft ▾
Pipe diameter, d ₀	18	in ▾	Flow area, a	0.8836	ft^2 ▾
Manning roughness, n	0.013		Pipe area, a ₀	1.7672	ft^2 ▾
Pressure slope (possibly ? equal to pipe slope), S ₀	0.0173	rise/run ▾	Relative area, a/a ₀	0.5000	fraction ▾
Relative flow depth, y/d ₀	50	% ▾	Wetted perimeter, P _w	2.3562	ft ▾
			Hydraulic radius, R _h	0.3750	ft ▾
			Top width, T	1.5000	ft ▾
			Velocity, v	7.8179	ft/sec ▾
			Velocity head, h _v	0.9499	ft H2O ▾
			Froude number, F	1.80	
			Average shear stress (tractive force), tau	0.4050	psf ▾
			Flow, Q (See notes)	6.9075	cfs ▾
			Full flow, Q ₀	13.8150	cfs ▾
			Ratio to full flow, Q/Q ₀	0.5000	fraction ▾



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or [see my 2-minute tutorial](#) for standard culvert headwater calculations using HY-8.

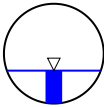
Proposed DP2 Q100= 6.8 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

Printable Subtitle

Inputs			Results	
			Flow depth, y	0.4950 ft ▾
Pipe diameter, d ₀	18	in ▾	Flow area, a	0.5086 ft^2 ▾
Manning roughness, n	0.013		Pipe area, a0	1.7672 ft^2 ▾
Pressure slope (possibly ? equal to pipe slope), S ₀	0.0656	rise/run ▾	Relative area, a/a0	0.2878 fraction ▾
Relative flow depth, y/d ₀	33	% ▾	Wetted perimeter, P _w	1.8358 ft ▾
			Hydraulic radius, R _h	0.2770 ft ▾
			Top width, T	1.4106 ft ▾
			Velocity, v	12.4408 ft/sec ▾
			Velocity head, h _v	2.4055 ft H2O ▾
			Froude number, F	3.66
			Average shear stress (tractive force), tau	1.1345 psf ▾
			Flow, Q (See notes)	6.3269 cfs ▾
			Full flow, Q0	26.9016 cfs ▾
			Ratio to full flow, Q/Q0	0.2352 fraction ▾



Notes:

This is the flow and depth inside an *infinitely long* pipe.

Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or [see my 2-minute tutorial](#) for standard culvert headwater calculations using HY-8.

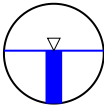
Proposed DP4 Q100= 6.9 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

Printable Subtitle

Inputs			Results		
			Flow depth, y	0.7950	ft ▾
Pipe diameter, d ₀	18	in ▾	Flow area, a	0.9510	ft^2 ▾
Manning roughness, n	0.013		Pipe area, a ₀	1.7672	ft^2 ▾
Pressure slope (possibly ? equal to pipe slope), S ₀	0.0173	rise/run ▾	Relative area, a/a ₀	0.5382	fraction ▾
Relative flow depth, y/d ₀	53	% ▾	Wetted perimeter, P _w	2.4462	ft ▾
			Hydraulic radius, R _h	0.3888	ft ▾
			Top width, T	1.4973	ft ▾
			Velocity, v	8.0082	ft/sec ▾
			Velocity head, h _v	0.9967	ft H2O ▾
			Froude number, F	1.77	
			Average shear stress (tractive force), tau	0.4199	psf ▾
			Flow, Q (See notes)	7.6158	cfs ▾
			Full flow, Q ₀	13.8150	cfs ▾
			Ratio to full flow, Q/Q ₀	0.5513	fraction ▾



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or [see my 2-minute tutorial](#) for standard culvert headwater calculations using HY-8.

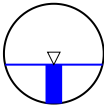
Future DP2 Q100= 7.5 cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Printable Title

Printable Subtitle

Inputs			Results		
			Flow depth, y	0.5850	ft ▾
Pipe diameter, d ₀	18	in ▾	Flow area, a	0.6381	ft^2 ▾
Manning roughness, n	0.013		Pipe area, a ₀	1.7672	ft^2 ▾
Pressure slope (possibly ? equal to pipe slope), S ₀	0.0656	rise/run ▾	Relative area, a/a ₀	0.3611	fraction ▾
Relative flow depth, y/d ₀	39	% ▾	Wetted perimeter, P _w	2.0235	ft ▾
			Hydraulic radius, R _h	0.3153	ft ▾
			Top width, T	1.4632	ft ▾
			Velocity, v	13.5629	ft/sec ▾
			Velocity head, h _v	2.8589	ft H2O ▾
			Froude number, F	3.62	
			Average shear stress (tractive force), tau	1.2914	psf ▾
			Flow, Q (See notes)	8.6540	cfs ▾
			Full flow, Q ₀	26.9016	cfs ▾
			Ratio to full flow, Q/Q ₀	0.3217	fraction ▾



Notes:

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to get the headwater depth or [see my 2-minute tutorial](#) for standard culvert headwater calculations using HY-8.

Future DP4 Q100= 8.6 cfs

Figure 13-12c. Emergency Spillway Protection

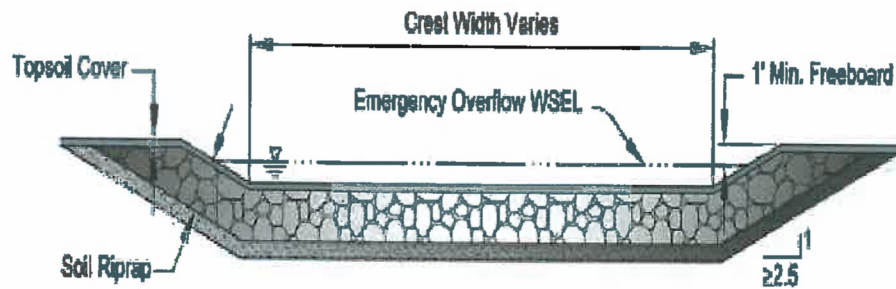
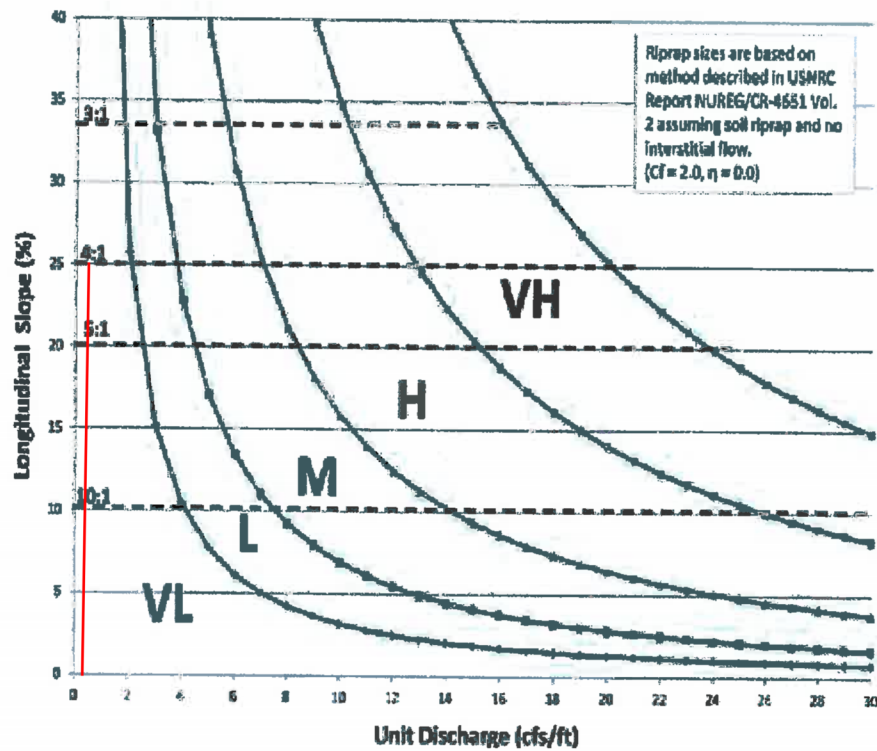


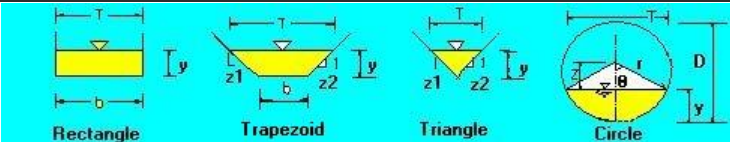
Figure 13-12d. Riprap Types for Emergency Spillway Protection



Q100 = 8.6 cfs/38' Riprap length = 0.23

4:1 slope

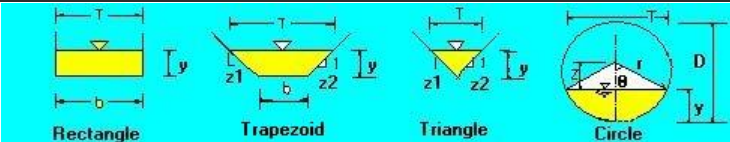
Use Type 'VL' riprap 1.0' thick

The open channel flow calculator					
Select Channel Type: Trapezoid ▼					
Velocity(V)&Discharge(Q) ▼		Select unit system: Feet(ft) ▼			
Channel slope: 0.17 ft/ft	Water depth(y): .17 ft	Bottom width(b) 32.64 ft			
Flow velocity 5.2959 ft/s	LeftSlope (Z1): 4 to 1 (H:V)	RightSlope (Z2): 4 to 1 (H:V)			
Flow discharge 29.9978 ft^3/s	Input n value 0.035 or select n with stones and weeds: 0.035 ▼				
Calculate!		Status: Calculation finished		Reset	
Wetted perimeter 34.04 ft	Flow area 5.66 ft^2	Top width(T) 34 ft			
Specific energy 0.61 ft	Froude number 2.29		Flow status Supercritical flow		
Critical depth 0.29 ft	Critical slope 0.027 ft/ft		Velocity head 0.44 ft		

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RIPRAP SPILLWAY SHEET

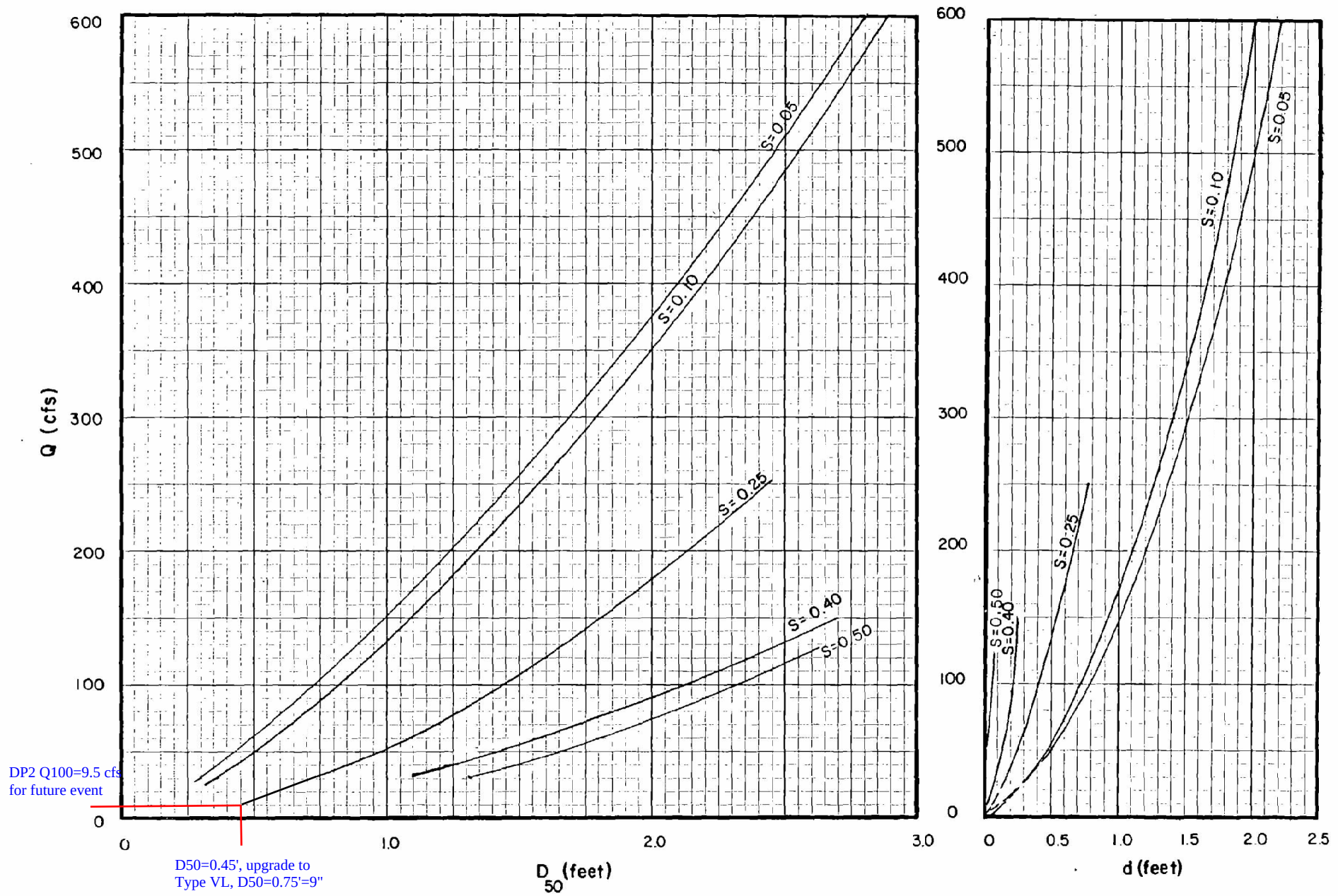
Q100= 8.6 cfs (actual) < 30.0 cfs (design)

The open channel flow calculator			
Select Channel Type: Trapezoid ▼			
Velocity(V)&Discharge(Q) ▼	Select unit system: Feet(ft) ▼		
Channel slope: 0.005 ft/ft	Water depth(y): .17 ft	Bottom width(b): 32.64 ft	
Flow velocity: 2.264 ft/s	LeftSlope (Z1): 33 to 1 (H:V)	RightSlope (Z2): 33 to 1 (H:V)	
Flow discharge: 14.7214 ft^3/s	Input n value: 0.013 or select n		
Calculate!	Status: Calculation finished		Reset
Wetted perimeter: 43.87 ft	Flow area: 6.5 ft^2	Top width(T): 43.86 ft	
Specific energy: 0.25 ft	Froude number: 1.04		Flow status: Supercritical flow
Critical depth: 0.17 ft	Critical slope: 0.0045 ft/ft	Velocity head: 0.08 ft	

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CONCRETE CURB CREST AT SPILLWAY
 Q100= 8.6 cfs (actual) < 15 cfs (design)

3.5' WIDE RIPRAP SHEET

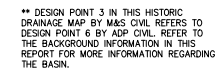


5.18

Figure 5.5. Steep slope riprap design, trapezoidal channel, 2:1 sideslopes, 10 ft base width.

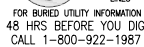
DRAINAGE MAPS

MAY 2025



DESIGN POINT SUMMARY				
DESIGN POINT	Q _s	Q ₁₀₀	BASIN(S)/ DESIGN PT(S)	STRUCTURE
1	0.4	3.1	A, OS1, OS4, OS5	EX EARTHEN SWALE/SOUTH PL
2	1.0	7.5	OS2, B, OS3, C, D, OS6, DP1	EX EARTHEN SWALE/SOUTH PL
3	55.6	124.4	OFFSITE JWD FDR DP6	COMBINED FLOW AT NE CORNER/SWAL
4	52.3	121.4	DP2, DP3, E, OF7	COMBINED FLOW AT SE CORNER/SWAL

THE HISTORIC DRAINAGE CONDITIONS WERE ANALYZED USING THE EXISTING CONDITIONS SURVEY INFORMATION AS M&S CIVIL DOES NOT HAVE THE PRE-DEVELOPED SURVEY INFORMATION FOR LOTS 3 AND 4. C VALUES OF 0.08 AND 0.35 WERE UTILIZED IN THE CALCULATIONS.



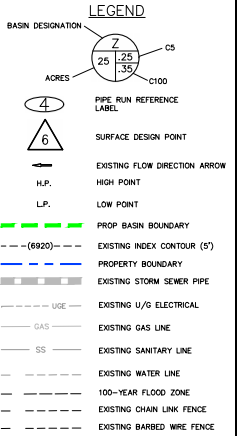
PROJECT NO. 70-140	SCALE: HORIZONTAL: 1"=50'	DATE: 05/22/2025	
DESIGNED BY: GT	VERTICAL: N/A	SHEET 1 OF 1	HDM
DRAWN BY: GT			
CHECKED BY: VAS			

LOTS 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A

CITY OF COLORADO SPRINGS, STATE OF COLORADO

EXISTING DRAINAGE MAP

MAY 2025



ABBREVIATION LEGEND

CL: CENTERLINE

C&G: CURB AND GUTTER

EL: ELEVATION

CONST: CONSTRUCTION

STM: STORM SEWER

PUB: PUBLIC

EX/EXIST: EXISTING

STA: STATION

NTS: NOT TO SCALE

PROP: PROPOSED

SAN: SANITARY SEWER

PVT: PRIVATE

U/G: UNDERGROUND

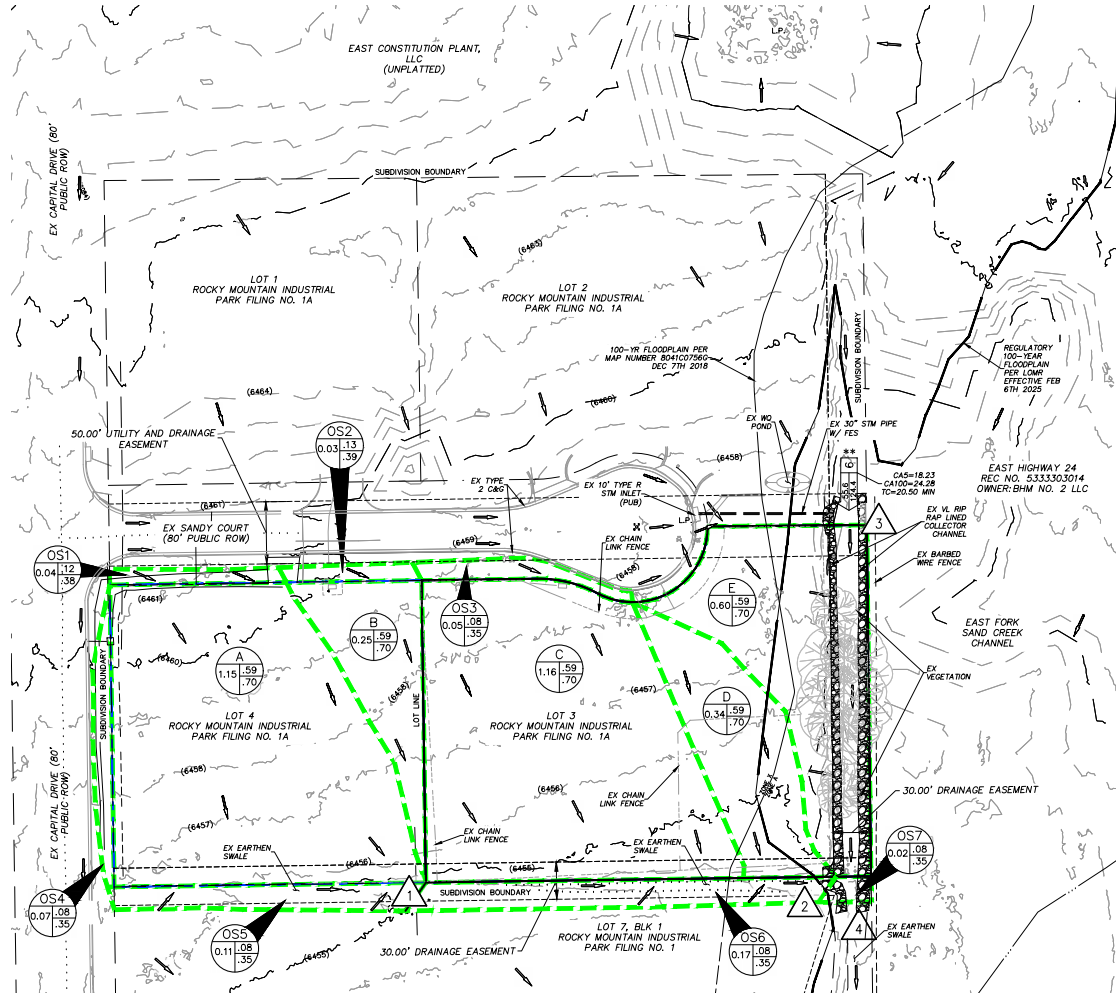
FES: FLARED END SECTION

WQ: WATER QUALITY

PP: POLYPROPYLENE PIPE

ROW: RIGHT OF WAY

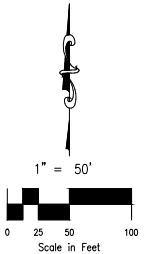
CDOT: COLORADO DEPARTMENT OF TRANSPORTATION



** DESIGN POINT 3 IN THIS EXISTING DRAINAGE MAP BY M&S CIVIL REFERS TO DESIGN POINT 6 BY ADP CIVIL. REFER TO THE BACKGROUND INFORMATION IN THIS REPORT FOR MORE INFORMATION REGARDING THE BASIN.

BASIN	AREA (ACRES)	Q _s	Q ₁₀₀
A	1.15	3.1	6.2
B	0.25	0.6	1.3
C	1.16	3.1	6.1
D	0.34	0.8	1.7
E	0.60	1.2	2.6
OS1	0.04	0.0	0.1
OS2	0.03	0.0	0.1
OS3	0.05	0.0	0.2
OS4	0.07	0.0	0.2
OS5	0.11	0.0	0.2
OS6	0.17	0.0	0.3
OS7	0.02	0.0	0.1

DESIGN POINT	Q _s	Q ₁₀₀	BASIN(S)/ DESIGN PT(S)	STRUCTURE
1	3.2	6.8	A, OS1, OS4, OS5	EX EARTHEN SWALE/SOUTH PL
2	7.7	16.3	OS2, B, OS3, C, D, OS6, DP1	EX EARTHEN SWALE/SOUTH PL
3	55.6	124.4	OFFSITE JOW FOR DPS	COMBINED FLOW AT NE CORNER/SWALE
4	57.1	126.9	DP2, DP3, E, OS7	COMBINED FLOW AT SE CORNER/SWALE



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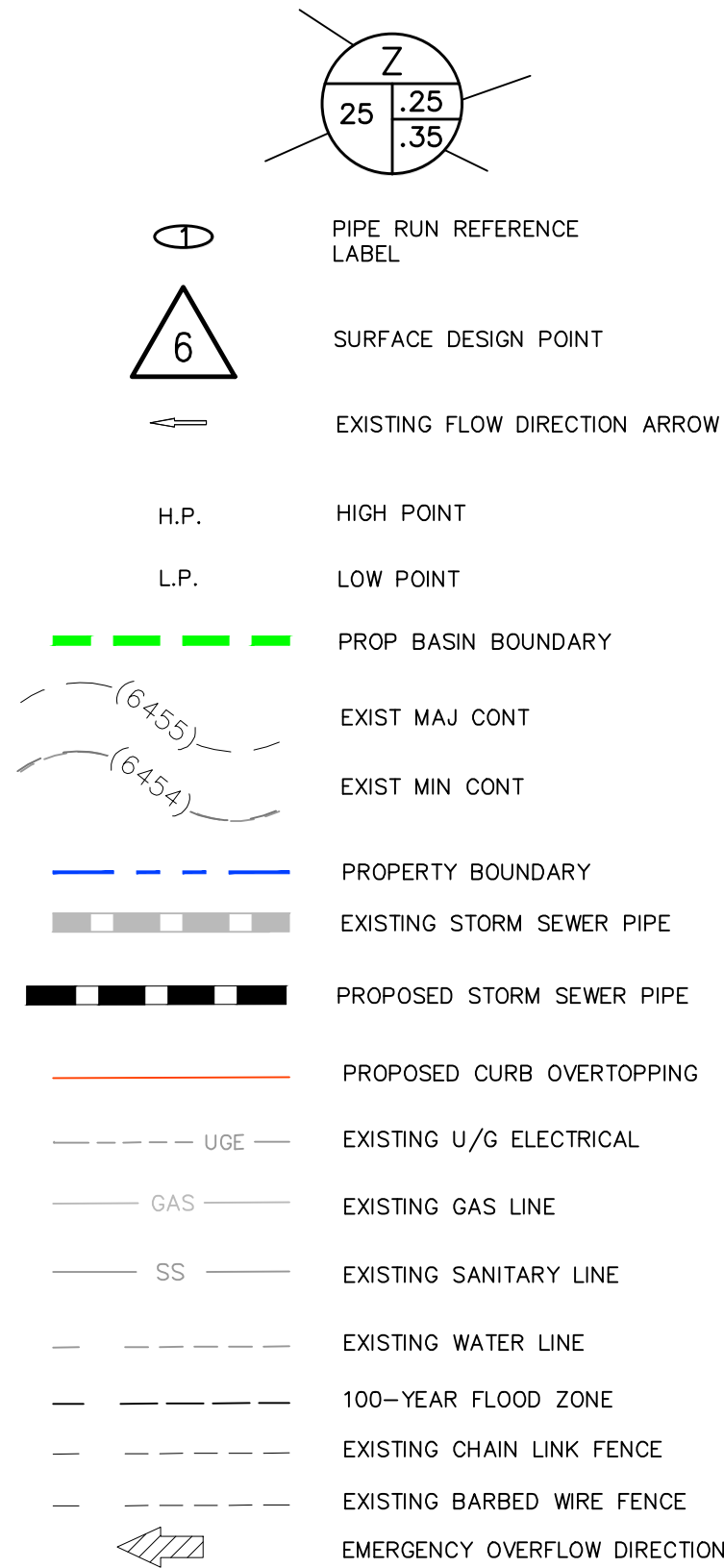
LOTS 3 & 4-ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A			
EXISTING DRAINAGE MAP			
PROJECT NO. 70-140	SCALE: HORIZONTAL: 1"=50'	DATE: 05/22/2025	EDM
DRAWN BY: GT	VERTICAL: N/A	SHEET 1 OF 1	
CHECKED BY: VAS			

LOTS 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A

EL PASO COUNTY, STATE OF COLORADO PROPOSED DRAINAGE MAP

OCTOBER 2025

LEGEND



** DESIGN POINT 6 IN THIS PROPOSED DRAINAGE MAP BY M&S CIVIL REFERS TO DESIGN POINT 3 BY ADP CIVIL. REFER TO THE BACKGROUND INFORMATION IN THIS REPORT FOR MORE INFORMATION REGARDING THE BASIN.

BASIN SUMMARY				
BASIN	AREA (ACRES)	Q ₂	Q ₅	Q ₁₀₀
A	1.08	2.2	2.9	5.7
B	0.25	0.5	0.6	1.3
C	0.23	0.5	0.6	1.2
D	1.26	2.4	3.2	6.3
E	0.07	0.0	0.0	0.2
F	0.19	0.4	0.5	1.0
G	0.41	0.6	0.8	1.8
OS1	0.04	0.0	0.0	0.2
OS2	0.03	0.0	0.0	0.1
OS3	0.05	0.0	0.1	0.2
OS4	0.07	0.0	0.0	0.2
OS5	0.11	0.0	0.0	0.3
OS6	0.17	0.0	0.1	0.4
OS7	0.02	0.0	0.0	0.1

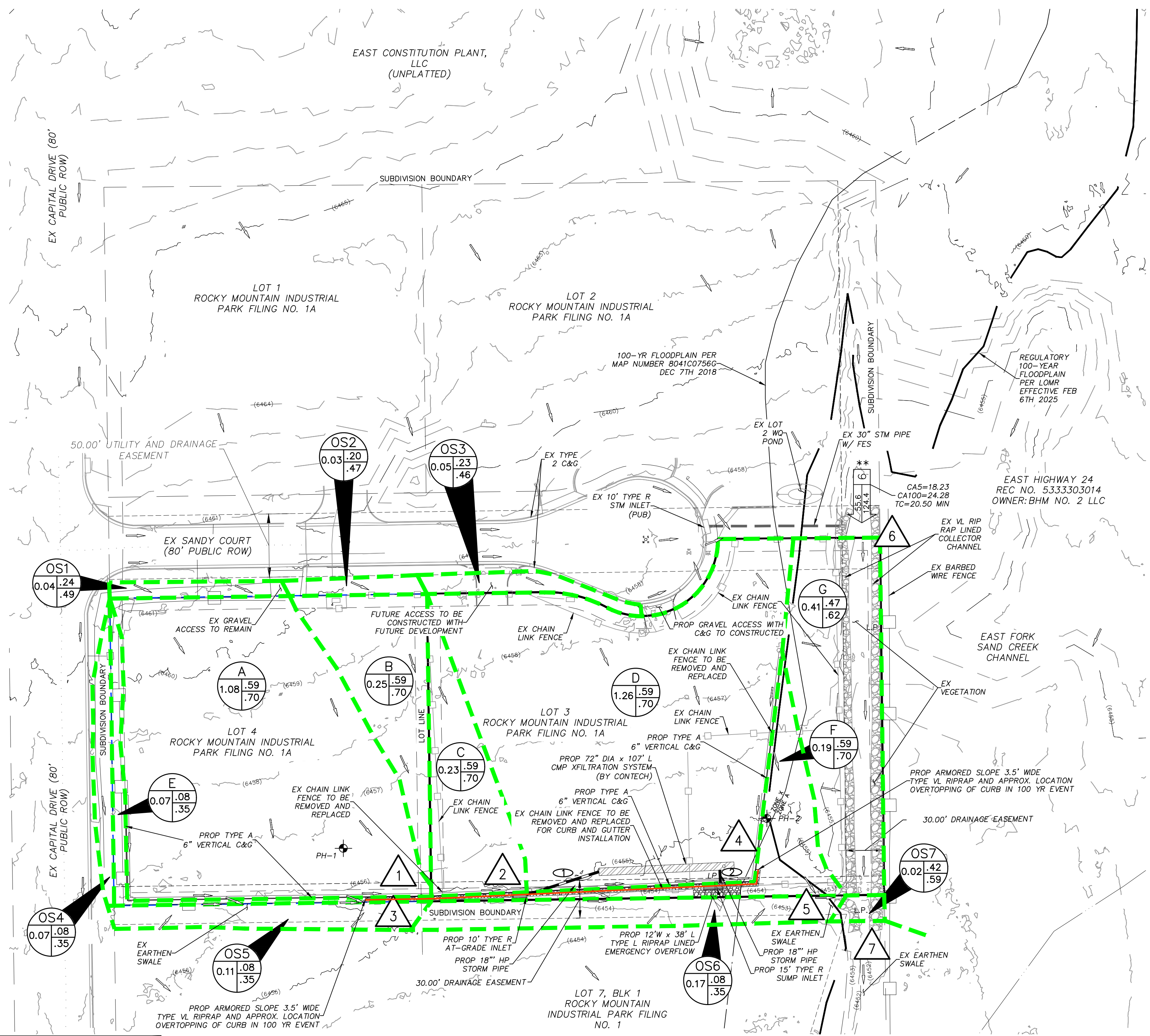
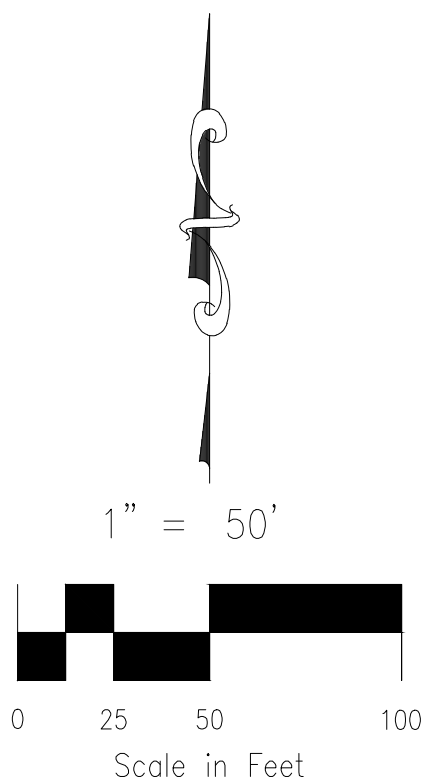
ABBREVIATION LEGEND

CL CENTERLINE
C&G CURB AND GUTTER
EL ELEVATION
CONST CONSTRUCTION
STM STORM SEWER
PUB PUBLIC
EX/EXIST EXISTING
STA STATION
NTS NOT TO SCALE
PROP PROPOSED
SAN SANITARY SEWER
PVT PRIVATE
U/G UNDERGROUND
FES FLARED END SECTION
WQ WATER QUALITY
PP POLYPROPYLENE PIPE
ROW RIGHT OF WAY
CDOT COLORADO DEPARTMENT OF TRANSPORTATION

DESIGN POINT SUMMARY						
DESIGN POINT	Q ₂	Q ₅	Q ₁₀₀	BASIN(S)/ DESIGN PT(S)	STRUCTURE	
1	2.2	2.9	5.8	OS1, A	SHEET FLOW TO EXISTING CURB & GUTTER	
2	3.1	4.0	8.1	DP1, OS2, B, C	PROP 10' TYPE R INLET	
3	0.0	0.1	0.6	OS4, OS5, E	EX EARTHEN SWALE	
4	2.2	2.8*	6.9	FLOWBY DP2, OS3, D	PROP 15' TYPE R INLET	
5	0.3	1.2	6.8	FLOWBY DP4, DP3, OS6, F	EXISTING EARTHEN SWALE AT SE CORNER	
6	0.0	55.6	124.4	OFFSITE JOW FDR DP6	OFFSITE FLOW ABOVE LINED CHANNEL	
7	0.7	57.4	132.1	DP5, DP6, G, OS7	COMBINED FLOW AT SE CORNER (EXISTING SWALE)	

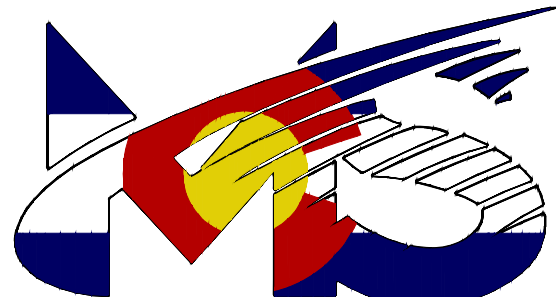
STORM SEWER SUMMARY				
PIPE RUN	Q ₅	Q ₁₀₀	PIPE SIZE	CONTRIBUTING DESIGN POINTS
1	4.0	6.8	18" HP	DP 2
2	2.8	6.9	18" HP	DP 4

XFILTRATION WQCV DATA	
72" DIA x 107' LONG CMP	
XFILTRATION SYSTEM	
TOTAL STORAGE PROVIDED 3024 CU-FT	
WQ VOL REQ = 0.061 AC-FT~2674 CU-FT	



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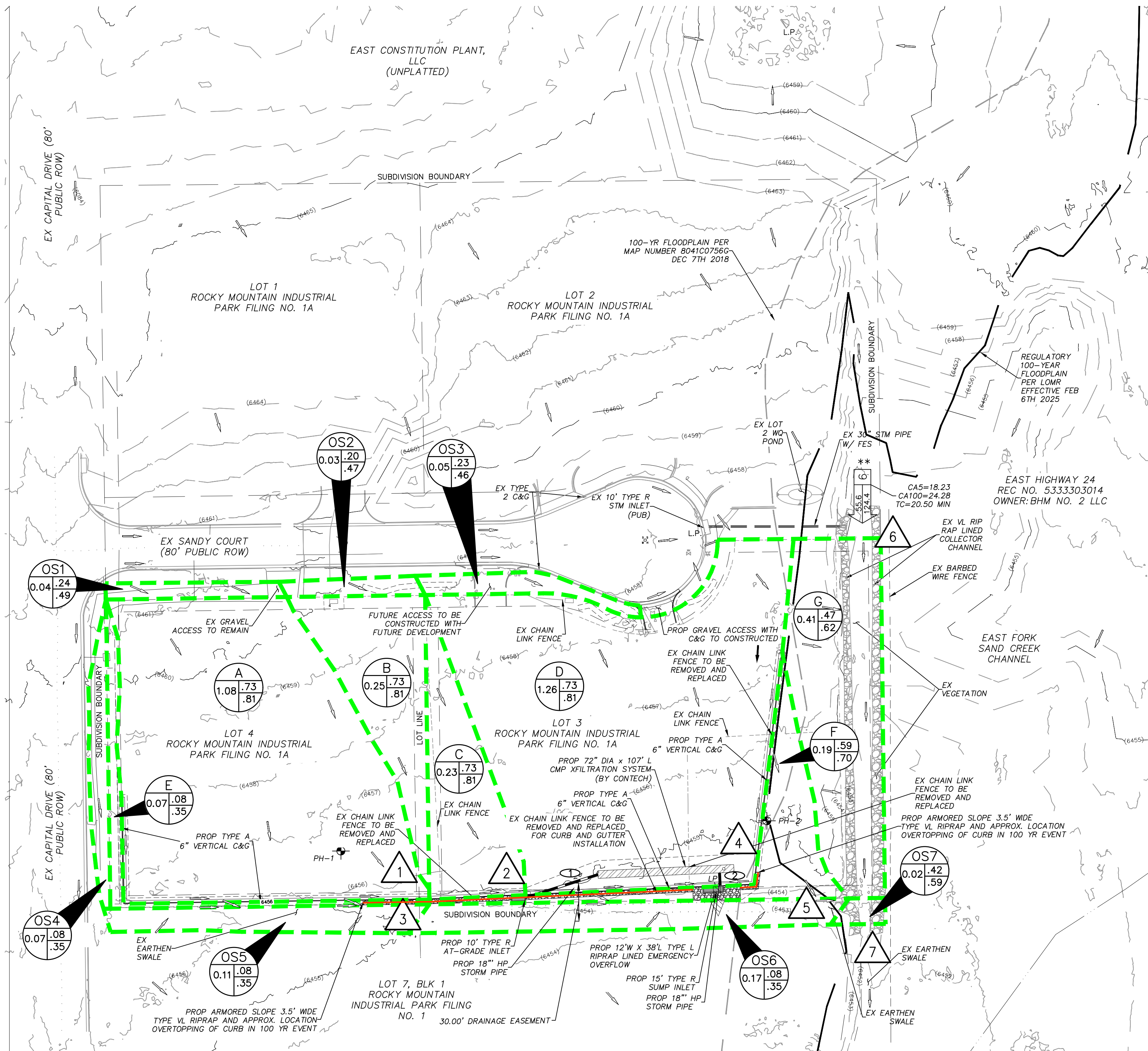
PROPOSED DRAINAGE MAP

PROJECT NO. 70-140	SCALE: HORIZONTAL: 1"=50' VERTICAL: N/A	DATE: 09/24/2025
DESIGNED BY: GT	DRAWN BY: VAS	CHECKED BY: VAS
SHEET 1 OF 1		PDM

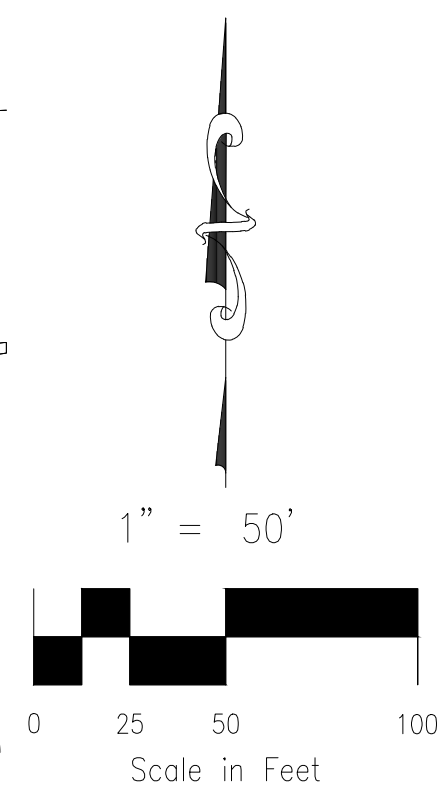
LOTS 3 & 4 - ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A

EL PASO COUNTY, STATE OF COLORADO FUTURE DRAINAGE MAP

OCTOBER 2025



** DESIGN POINT 6 IN THIS FUTURE DRAINAGE MAP BY M&S CIVIL REFERS TO DESIGN POINT 3 BY ADP CIVIL. REFER TO THE BACKGROUND INFORMATION IN THIS REPORT FOR MORE INFORMATION REGARDING THE BASIN.



BASIN SUMMARY				
BASIN	AREA (ACRES)	Q ₂	Q ₅	Q ₁₀₀
A	1.08	2.9	3.7	6.9
B	0.25	0.7	0.9	1.6
C	0.23	0.6	0.8	1.5
D	1.26	3.2	4.1	7.7
E	.07	0.0	0.0	0.2
F	.19	0.4	0.5	1.0
G	0.41	0.6	0.8	1.8
OS1	0.04	0.0	0.0	0.2
OS2	0.03	0.0	0.0	0.1
OS3	0.05	0.0	0.1	0.2
OS4	0.07	0.0	0.0	0.2
OS5	0.11	0.0	0.0	0.3
OS6	0.17	0.0	0.1	0.4
OS7	0.02	0.0	0.0	0.1

DESIGN POINT SUMMARY				
DESIGN POINT	Q ₂	Q ₅	Q ₁₀₀	STRUCTURE
1	2.9	3.8	7.1	OS1, A
2	3.9	5.1	9.5	DP1, OS2, B, C
3	0.0	0.1	0.6	OS4, OS5, E
4	2.8	3.7	8.6	FLOWBY DP2, OS3, D
5	0.3	1.7	8.0	FLOWBY DP4, DP3, OS6, F
6	0.0	55.6	124.4	OFFSITE JOW FDR DP6
7	0.7	57.9	133.2	DP5, DP6, G, OS7

STORM SEWER SUMMARY				
PIPE RUN	Q ₅	Q ₁₀₀	PIPE SIZE	CONTRIBUTING DESIGN POINTS
1	4.9	7.5	18" HP	DP 2
2	3.2	8.6	18" HP	DP 4

XFILTRATION WQCV DATA
72" DIA x 107' LONG CMP
XFILTRATION SYSTEM
TOTAL STORAGE PROVIDED 3024 CU-FT
WQ VOL REQ = 0.067 AC-FT~2935 CU-FT

LEGEND

BASIN DESIGNATION
ACRES
PIPE RUN REFERENCE LABEL
SURFACE DESIGN POINT
EXISTING FLOW DIRECTION ARROW
H.P. HIGH POINT
L.P. LOW POINT
PROP BASIN BOUNDARY
EXIST MAJ CONT
EXIST MIN CONT
PROPERTY BOUNDARY
EXISTING STORM SEWER PIPE
PROPOSED STORM SEWER PIPE
PROPOSED CURB OVERTOPPING
EXISTING U/G ELECTRICAL
EXISTING GAS LINE
EXISTING SANITARY LINE
EXISTING WATER LINE
100-YEAR FLOOD ZONE
EXISTING CHAIN LINK FENCE
EXISTING BARBED WIRE FENCE
EMERGENCY OVERTOPPING DIRECTION

ABBREVIATION LEGEND

CL CENTERLINE
C&G CURB AND GUTTER
EL ELEVATION
CONST CONSTRUCTION
STM STORM SEWER
PUB PUBLIC
EX/EXIST EXISTING
STA STATION
NTS NOT TO SCALE
PROP PROPOSED
SAN SANITARY SEWER
PVT PRIVATE
U/G UNDERGROUND
FES FLARED END SECTION
WQ WATER QUALITY
PP POLYPROPYLENE PIPE
ROW RIGHT OF WAY
CDOT COLORADO DEPARTMENT OF TRANSPORTATION

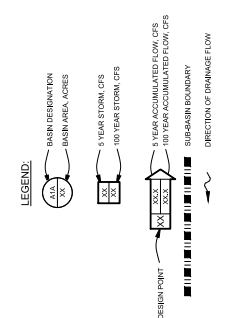


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PHONE: 719.955.5485

LOTS 3 & 4-ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A				
FUTURE DRAINAGE MAP				
PROJECT NO. 70-140	SCALE: HORIZONTAL: 1"=50' VERTICAL: N/A	DATE: 09/24/2025		
DESIGNED BY: SPM	DRAWN BY: SPM	CHECKED BY: VAS	SHEET 1 OF 1	FDM



BACKGROUND



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599

January 7, 2025

Colorado River Landscaping, LLC
8115 Sandy Court
Colorado Springs, Colorado 80939

Attn: Eduardo Hernandez

Re: Infiltration Rate Testing (Percolation Test Method)
8115 and 8145 Sandy Court
Lots 3 and 4, Rocky Mountain Industrial Park, Filing 1A
Colorado Springs, Colorado
Entech Job No. 241962

Dear Mr. Hernandez:

As requested, personnel of Entech Engineering, Inc. performed percolation testing at the above referenced site to evaluate the site soils to determine the infiltration rates for the proposed infiltration basins.

The testing was performed on December 13, 2024. The test locations are shown on Figure 1. The western infiltration (PH-1) and the eastern infiltration (PH-2) percolation test results, infiltration rates, and laboratory test results are shown in Figures 2 through 8. Soils encountered in the profile and percolation holes consisted of sand with silt to silty sand. Bedrock was not encountered in PH-1 or PH-2. Groundwater was not encountered in any of the holes drilled up to 15 feet.

Western Infiltration – 8115 Sandy Court

The average percolation rate was 32 minutes/inch for PH-1. The percolation rates correspond to adjusted an infiltration rate of 0.354 inches/hour.

Eastern Infiltration – 8145 Sandy Court

The average percolation rate was 2 minutes/inch for PH-2. The percolation rates correspond to adjusted an infiltration rate of 1.861 inches/hour.

We trust that this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Zachary C. Gutierrez E.I.T.
Geotechnical Engineering Staff

Reviewed by:



Digitally signed by Joseph C. Goode III
Date: 01/08/25

Joseph C. Goode III, P.E.
Sr. Engineer

ZCG:JCG/III

Encl.

F:\AA Projects\2024\241962-Colorado River Landscaping, LLC-8145 Sandy Ct-Geotech Infiltration\09-Reports\241962 Infiltration.docx



PERCOLATION HOLE 1
 DATE DRILLED 12/13/2024
 REMARKS

DRY TO 15', 12/13/24

FILL 0-3', SAND, SILTY, BROWN,
 MEDIUM DENSE, MOIST

SAND, SILTY, BROWN to LIGHT
 BROWN, MEDIUM DENSE to
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %
5			22	4.5
5			11	6.1
10			44	7.3
15			32	8.2
20				

PERCOLATION HOLE 2
 DATE DRILLED 12/13/2024
 REMARKS

DRY TO 15', 12/13/24

FILL 0-2', SAND, SILTY, TAN

SAND, WITH SILT, LIGHT BROWN,
 MEDIUM DENSE to LOOSE, DRY
 to MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %
5			28	2.0
5			9	2.0
10			13	3.0
15			19	13.5
20				



TEST BORING LOGS
 8115 AND 8145 SANDY COURT
 COLORADO RIVER LANDSCAPING

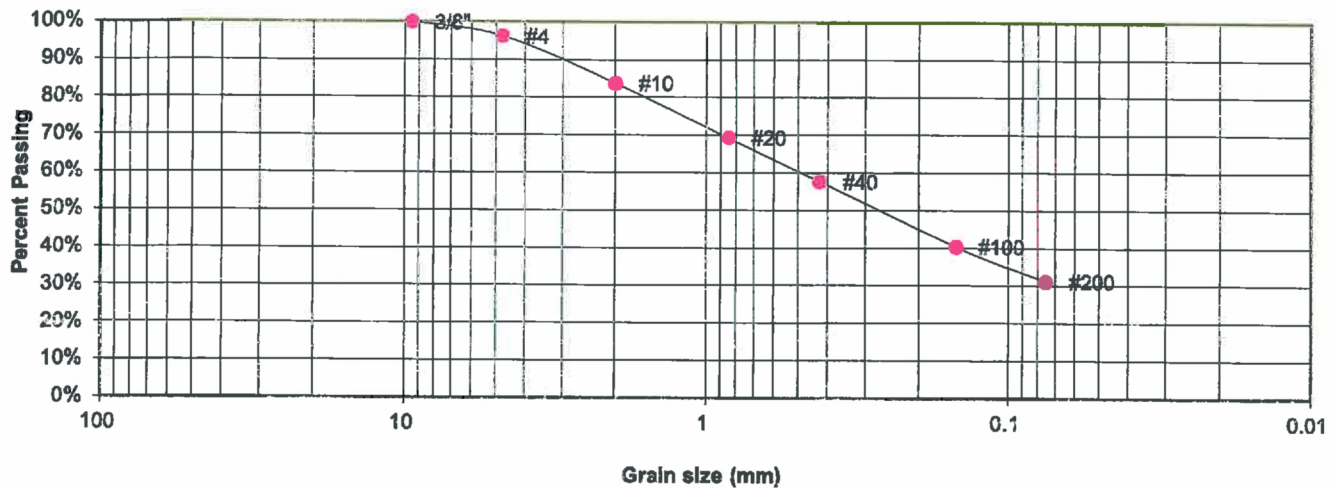
JOB NO.
 241962
FIG. 2

TEST BORING
DEPTH (FT)

PH-1
2-3

SOIL DESCRIPTION SAND, SILTY

**Sieve Analysis
Grain Size Distribution**



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.3%
10	83.8%
20	69.3%
40	57.7%
100	40.4%
200	31.2%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM



ENTECH
ENGINEERING, INC.

LABORATORY TEST RESULTS

8115 AND 8145 SANDY COURT
COLORADO RIVER LANDSCAPING

JOB NO.
241962

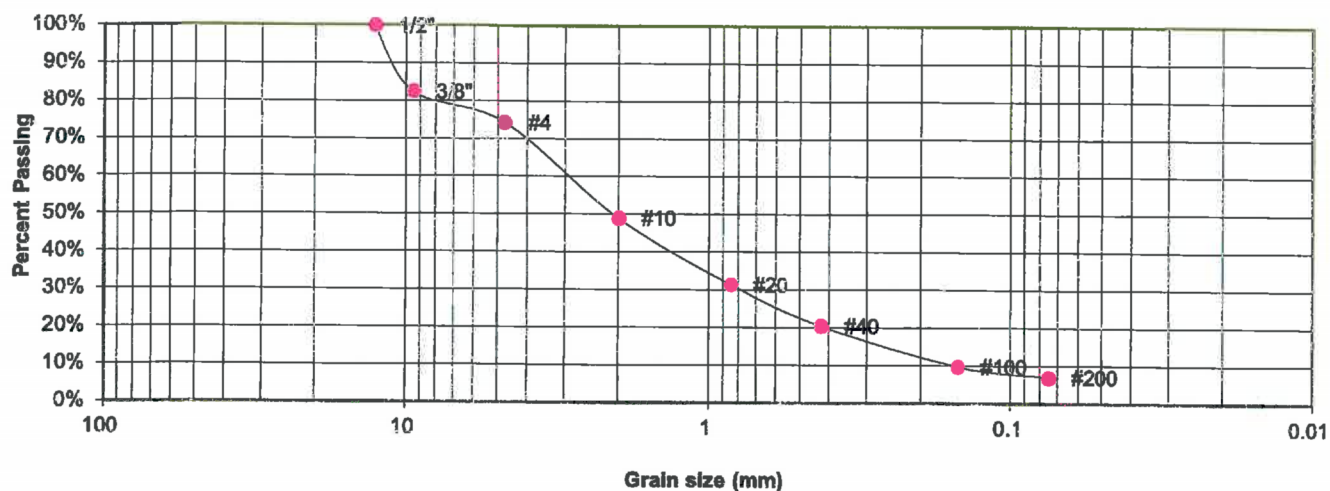
FIG. 3

TEST BORING
DEPTH (FT)

PH-2
2-3

SOIL DESCRIPTION SAND, WITH SILT

Sieve Analysis
Grain Size Distribution



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	82.4%
4	74.3%
10	48.9%
20	31.4%
40	20.4%
100	9.7%
200	7.0%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM



LABORATORY TEST RESULTS

8115 AND 8145 SANDY COURT
COLORADO RIVER LANDSCAPING

JOB NO.
241962

FIG. 4

Client: Colorado River Landscaping, LLC
Test Location: 8115 Sandy Court

Job Number: 241962

PERCOLATION HOLES

Date Holes Prepared: 12/13/2024

Hole No. 1

Depth: 51"

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	10	1/8
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 2

Depth: 56"

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	10	2
2	10	1 1/4
3	10	1

Perc Rate (min./in.): 10

Average Perc Rate (min./in.) 32

Hole No. 3

Depth: 63"

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	10	2 1/4
2	10	1 3/4
3	10	1 3/4

Perc Rate (min./in.): 6

PROFILE HOLE

Date Profile Hole Completed: 12/13/2024

Depth

0-3'

3-5'

Visual Classification

Fill, sand, silty, brown

Sand, silty, brown

Remarks

No Bedrock

No Groundwater

22 Blows / ft. @ 2'

11 Blows / ft. @ 4'

44 Blows / ft. @ 9'

Observer: Stuart Wood

By:



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PERCOLATION TEST RESULTS

JOB NO.
241962

FIG. 5

Client: Colorado River Landscaping, LLC
Test Location: 8115 Sandy Court

Job Number: 241962

Infiltration Rate (I) = Percolation Rate (P) / Reduction Factor(R_f)
I=P/R_f

$R_f = [(2d_1 - \Delta d) / \text{dia}] + 1$

d_1 = initial water depth (in.)

Δd = final water level drop (in.)

dia = diameter of the percolation hole (in.)

Test No. P1 (PH-1)

Perc Rate 0.75 in/hr
diameter 8

P1 (inches)
 $d_1 =$ 51.0
 $\Delta d =$ 1/8
 $R_f =$ 13.7

Test No. P2 (PH-1)

Perc Rate 6.00 in/hr
diameter 8

P2 (inches)
 $d_1 =$ 56.0
 $\Delta d =$ 1
 $R_f =$ 14.9

Test No. P3 (PH-1)

Perc Rate 10.00 in/hr
diameter 8

P2 (inches)
 $d_1 =$ 63.0
 $\Delta d =$ 1 3/4
 $R_f =$ 16.5

I = 0.055 in/hr

I = 0.403 in/hr

I = 0.605 in/hr

I AVG= 0.354 in/hr



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INFILTRATION TEST RESULTS

JOB NO.
240644

FIG. 6

Client: Colorado River Landscaping, LLC
Test Location: 8145 Sandy Court

Job Number: 241962

PERCOLATION HOLES

Date Holes Prepared: 12/13/2024

Hole No. 4

Depth: 54"

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	10	2 1/2
2	10	2 1/2
3	10	2 1/4

Perc Rate (min./in.): 4

Hole No. 5

Depth: 44"

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	10	7
2	10	5
3	10	6

Perc Rate (min./in.): 2

Average Perc Rate (min./in.) 3

Hole No. 6

Depth: 56"

<u>Trial</u>	<u>Time (min.)</u>	<u>Water Level Change (in.)</u>
1	10	6 1/4
2	10	7
3	10	6 1/2

Perc Rate (min./in.): 2

PROFILE HOLE

Date Profile Hole Completed: 12/13/2024

Depth

0-2'
2-15'

Visual Classification

Fill, sand, silty, brown
Sand, with silt, brown

28 Blows / ft. @ 2'

9 Blows / ft. @ 4'

13 Blows / ft. @ 9'

Remarks

No Bedrock
No Groundwater

Observer: Stuart Wood

By:



ENTECH
ENGINEERING, INC.

PERCOLATION TEST RESULTS

JOB NO.
241962

FIG. 7

Client: Colorado River Landscaping, LLC
Test Location: 8145 Sandy Court

Job Number: 241962

Infiltration Rate (I) = Percolation Rate (P) / Reduction Factor(R_f)
I=P/R_f

$R_f = [(2d_1 - \Delta d) / \text{dia}] + 1$

d₁ = initial water depth (in.)

Δd = final water level drop (in.)

dia = diameter of the percolation hole (in.)

Test No. P4 (PH-2)

Perc Rate 15.00 in/hr
diameter 8

P1 (inches)
d₁ = 54.0
Δd = 2 1/4
R_f = 14.2

Test No. P5 (PH-2)

Perc Rate 30.00 in/hr
diameter 8

P2 (inches)
d₁ = 44.0
Δd = 6
R_f = 11.3

Test No. P6 (PH-2)

Perc Rate 30.00 in/hr
diameter 8

P2 (inches)
d₁ = 56.0
Δd = 6 1/2
R_f = 14.2

I = 1.055 in/hr

I = 2.667 in/hr

I = 2.115 in/hr

I AVG= 1.861 in/hr



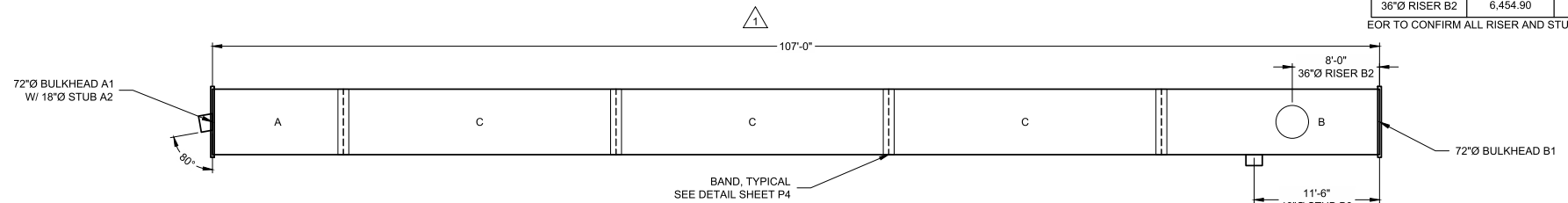
INFILTRATION TEST RESULTS

**JOB NO.
240644**

FIG. 8



NORTH ARROW PROVIDED FOR
REFERENCE ONLY.
REFER TO ENGINEERED SITE PLANS FOR
EXACT LOCATION AND ORIENTATION



STUB INFORMATION		
PIECE	STUB INVERT	SYSTEM INVERT
18"Ø STUB A2	6,448.80	6,445.30
18"Ø STUB B3	6,448.80	6,445.30

RISER INFORMATION		
PIECE	RIM ELEV.	SYSTEM INVERT
36"Ø RISER B2	6,454.90	6,445.30

EOR TO CONFIRM ALL RISER AND STUB ELEVATIONS

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE.
- ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD (EOR) PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2 $\frac{3}{8}$ " x $\frac{1}{2}$ " CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE AS REQUIRED, BY CONTRACTOR.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- ALL ACCESS CASTINGS ARE THE RESPONSIBILITY OF THE CONTRACTOR AND ARE NOT SUPPLIED BY CONTECH.
- BULKHEADS SHALL BE CONSTRUCTED USING 12 GAGE OR HEAVIER MATERIAL, WITH BOTH THE WATER AND SOIL SIDE FINAL COATINGS MATCHING THE SPECIFIED CMP COATING. BULKHEAD PLATES MUST BE FULLY WELDED TO THE CONNECTING PIPE. THE DESIGN OF BULKHEADS SHALL ADHERE TO CHAPTER 8 OF THE NCSPA CSP DESIGN MANUAL, MEETING THE HEIGHT OF COVER DESIGN REQUIREMENTS WITH APPROPRIATE REINFORCEMENTS OR A MINIMUM REQUIRED PLATE THICKNESS. ADDITIONALLY, REINFORCING MEMBERS SHALL BE POST-COATED WITH ZINC RICH PAINT IN ACCORDANCE WITH AASHTO M36 FOR GALVANIZED AND ALUMINUM CMP SYSTEMS, OR AASHTO M245 FOR POLYMER CMP SYSTEMS.

THE UNDERSIGNED HEREBY APPROVES THE ATTACHED
(6) PAGES INCLUDING THE FOLLOWING:

- PIPE STORAGE = 3,024 CF
- MAINLINE PIPE GAGE = 16
- WALL TYPE = SOLID
- DIAMETER = 72"
- FINISH = ALT2 W/ POLYMER COATING
- CORRUGATION = 5x1

CUSTOMER

DATE

ASSEMBLY

SCALE: 1" = 10'

LOADING: H20

PIPE INV. = 6445.30 $\pm$

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CONTECH
CMP DETENTION SYSTEMS

CONTECH
PROPOSAL
DRAWING

72"Ø UNDERGROUND DETENTION SYSTEM - 852685-010
ROCKY MOUNTAIN INDUSTRIAL PARK
COLORADO SPRINGS, CO
SITE DESIGNATION: XFILTRAITON SYSTEM

PROJECT No.: 852685	SEQ. No.: 010	DATE: 7/31/2025
DESIGNED: TRC	DRAWN: TRC	
CHECKED: TRC	APPROVED: TRC	
SHEET NO.: P1	OF	6



PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-15
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

2. ON-SITE GEOTECHNICAL ENGINEER SHALL MAKE RECOMMENDATIONS FOR BACKFILL AND SHALL PROVIDE TESTING.

CONSTRUCTION LOADING DIAGRAM
NOT TO SCALE

SCOPE

MATERIAL

PIPE

HANDLING AND ASSEMBLY

MATERIAL SPECIFICATION
NOT TO SCALE

CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS.
FOLLOW THE MANUFACTURER'S OR NCSPA'S GUIDELINES.

(B)			
(C)			
(D)			
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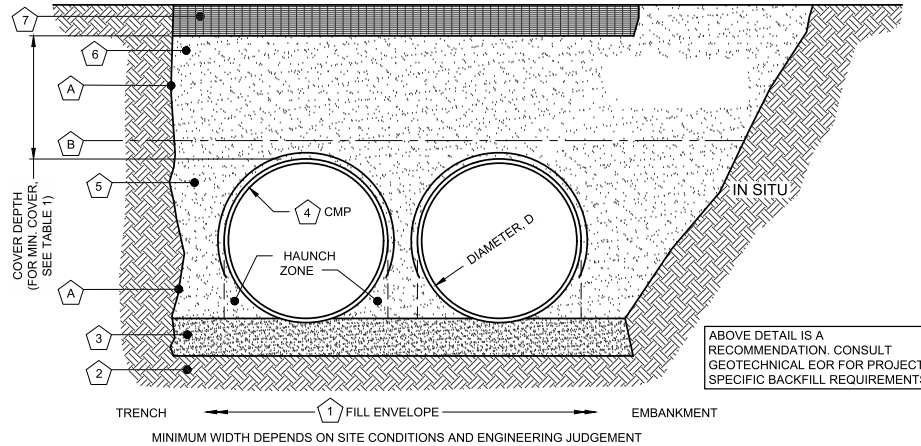
72"Ø UNDERGROUND DETENTION SYSTEM - 852685-010
 ROCKY MOUNTAIN INDUSTRIAL PARK
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852685	010	7/31/2025
DESIGNED:	DRAWN:	
TRC	TRC	
CHECKED:	APPROVED:	
TRC	TRC	
SHEET NO.:		
P2	OF	6

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



INSTALLATION NOTES

- WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
- OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.

NOTE:

1. AVOID PARKING OF VEHICLES OVER 50,000 LBS/AXLE OF XFILTRATION WQ STORAGE PIPE.

2. ON-SITE GEOTECHNICAL ENGINEER SHALL MAKE RECOMMENDATIONS FOR BACKFILL AND SHALL PROVIDE TESTING.

TABLE 2:

XFILTRATION® JOINT STANDARD BACKFILL SPECIFICATIONS			
MATERIAL LOCATION		MATERIAL SPECIFICATION	DESCRIPTION
FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
FOUNDATION	AASHTO 26.5.2 - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
BEDDING	AASHTO M 43: 3, 357, 4, 467, 5, 56, 57	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
CORRUGATED METAL PIPE			
BACKFILL	FREE-DRAINING, ANGULAR, WASHED-STONE PER AASHTO M 43: 3, 357, 4, 467, 5, 56, 57 OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING, WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. **IN AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	
COVER MATERIAL	UP TO MIN. COVER - AASHTO M 145: A-1, A-2, A-3 ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS SEE SHEET P2 FOR PIPE SPAN/AXLE LOAD TABLE	
RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION WHEN STONE BEDDING IS USED. IF NO STONE BEDDING IS USED, THEN SIDE GEOTEXTILE IS REQUIRED. PROPOSED FOR THIS SITE.	
GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.
- APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL
NOT TO SCALE

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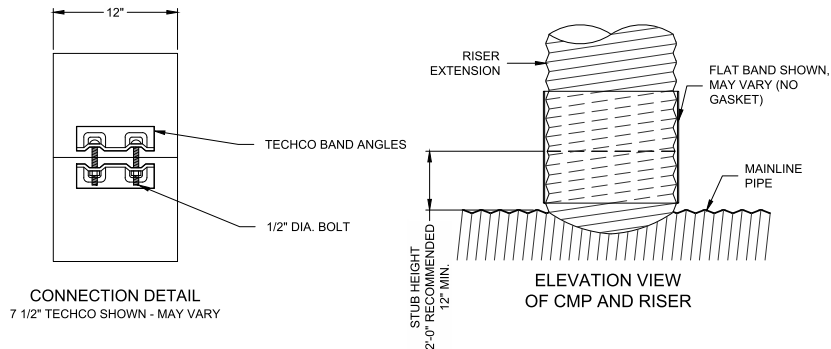
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DRAWING

72"Ø UNDERGROUND DETENTION SYSTEM - 852685-010
ROCKY MOUNTAIN INDUSTRIAL PARK
COLORADO SPRINGS, CO
SITE DESIGNATION: XFILTRAITON SYSTEM

PROJECT No.: 852685	SEQ. No.: 010	DATE: 7/31/2025
DESIGNED: TRC	DRAWN: TRC	
CHECKED: TRC	APPROVED: TRC	
SHEET NO.: P3	OF	6

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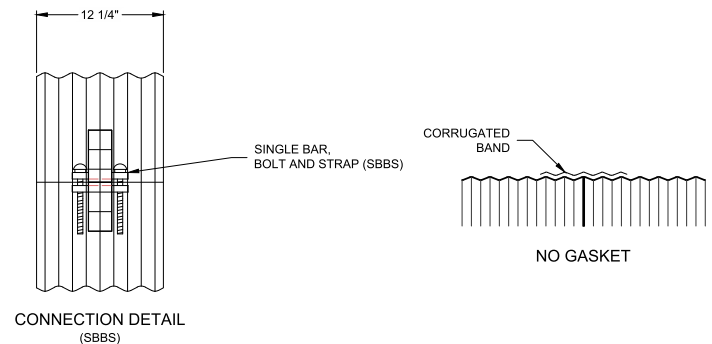


PLAIN END CMP RISER PIPE

GENERAL NOTES:

1. DELIVERED BAND STYLE AND FASTENER TYPE MAY VARY BY FABRICATION PLANT.
2. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
3. BAND MATERIAL AND GAGE TO BE SAME AS RISER MATERIAL.
4. IF RISER HAS A HEIGHT OF COVER OF 10' OR MORE, USE A SLIP JOINT.
5. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
 - 12" THRU 48" 1-PIECE
 - 54" 2-PIECES
6. ALL RISER JOINT COMPONENTS WILL BE FIELD ASSEMBLED.
7. MANHOLE RISERS IN APPLICATIONS WHERE TRAFFIC LOADS ARE IMPOSED REQUIRE SPECIAL DESIGN CONSIDERATIONS.
8. DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES.

12" RISER BAND DETAIL NOT TO SCALE



2 2/3"x1/2" RIVETED PIPE

GENERAL NOTES:

1. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
2. BAND MATERIALS AND/OR COATING CAN VARY BY LOCATION. CONTACT YOUR CONTECH REPRESENTATIVE FOR AVAILABILITY.
3. BANDS ARE SHAPED TO MATCH THE PIPE-ARCH WHEN APPLICABLE.
4. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
 - 12" THRU 48" 1-PIECE
 - 54" THRU 96" 2-PIECES
 - 102" THRU 144" 3-PIECES
5. BAND FASTENERS ARE ATTACHED WITH SPOT WELDS, RIVETS OR HAND WELDS.
6. ALL CMP IS REROLLED TO HAVE ANNULAR END CORRUGATIONS OF 2 2/3"x1/2"
7. DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
8. ORDER SHALL DESIGNATE GASKET OPTION, IF REQUIRED (SEE DETAILS ABOVE).

5-C BAND DETAIL NOT TO SCALE

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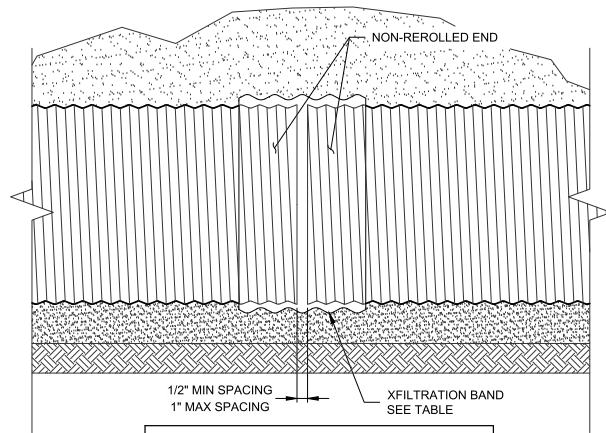


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72"Ø UNDERGROUND DETENTION SYSTEM - 852685-010
ROCKY MOUNTAIN INDUSTRIAL PARK
COLORADO SPRINGS, CO
SITE DESIGNATION: XFILTRAITON SYSTEM

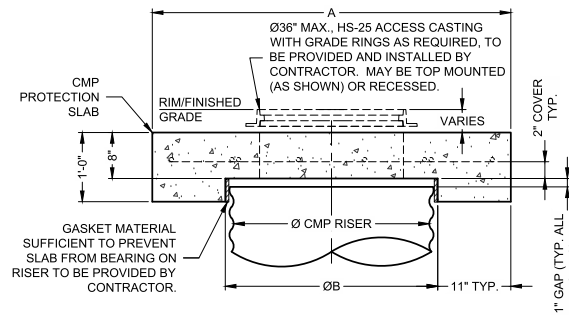
PROJECT No.: 852685	SEQ. No.: 010	DATE: 7/31/2025
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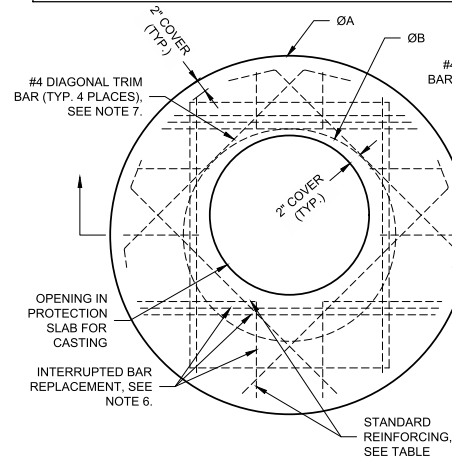
XFILTRATION BAND		
DIAMETER	BAND	FASTENER
12"Ø TO 60"Ø	5-C OR H-12	STD. PLANT FASTENER WITH NO GASKET
66"Ø TO 96"Ø	5-C OR H-12	STD. PLANT FASTENER WITH NO GASKET
102"Ø +	5-C, 10-C OR H-12	STD. PLANT FASTENER WITH NO GASKET

XFILTRATION JOINT DETAIL
NOT TO SCALE

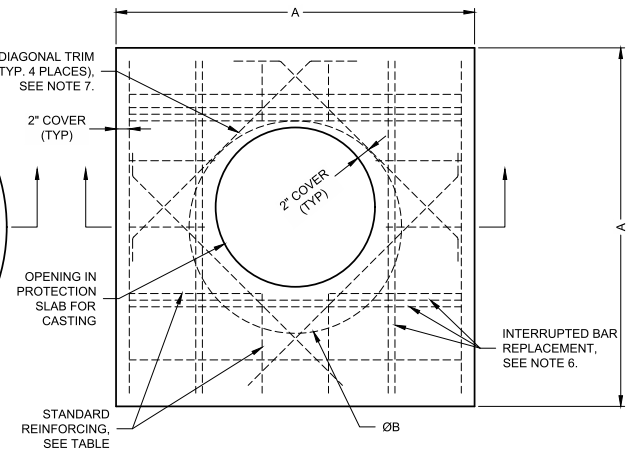


SECTION VIEW

ACCESS CASTING NOT SUPPLIED BY CONTECH



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

REINFORCING TABLE				
Ø CMP RISER	A	Ø B	REINFORCING	**BEARING PRESSURE (PSF)
24"	Ø 4' 4"x4'	26"	#5 @ 10" OCEW #5 @ 10" OCEW	2,540 1,900
30"	Ø 4'-6" 4'-6" x 4'-6"	32"	#5 @ 10" OCEW #5 @ 9" OCEW	2,260 1,670
36"	Ø 5' 5' x 5'	38"	#5 @ 9" OCEW #5 @ 8" OCEW	2,060 1,500
42"	Ø 5'-6" 5'-6" x 5'-6"	44"	#5 @ 8" OCEW #5 @ 8" OCEW	1,490 1,370
48"	Ø 6' 6' x 6'	50"	#5 @ 7" OCEW #5 @ 7" OCEW	1,210 1,270

** ASSUMED SOIL BEARING CAPACITY

NOTES:

- DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION AND ACI 350.
- DESIGN LOAD HS25.
- EARTH COVER = 1' MAX.
- CONCRETE STRENGTH = 4,000 psi
- REINFORCING STEEL = ASTM A615, GRADE 60.
- PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
- TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
- PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
- DETAIL DESIGN BY DELTA ENGINEERS, ARCHITECTS AND LAND SURVEYORS, ENDWELL, NY.
- THIS DETAIL REFLECTS CAST-IN-PLACE MANHOLE CAP PROTECTION SLAB. PRECAST MANHOLE CAP AVAILABLE IN SELECT MARKETS UNDER SEPARATE SUBMITTAL & DESIGN.

CAST-IN-PLACE MANHOLE CAP DETAIL
NOT TO SCALE

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MARK	DATE	REVISION DESCRIPTION	BY



9100 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

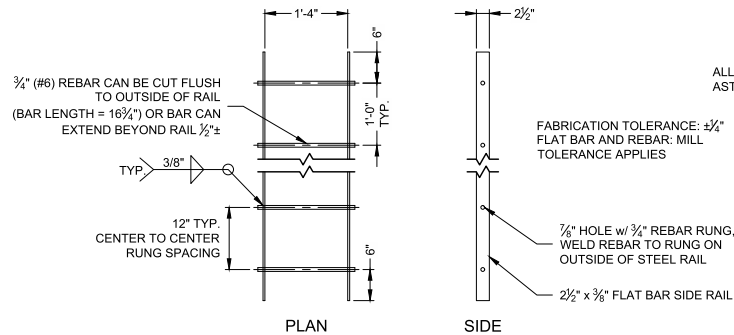


CONTECH
PROPOSAL
DRAWING

72"Ø UNDERGROUND DETENTION SYSTEM - 852685-010
ROCKY MOUNTAIN INDUSTRIAL PARK
COLORADO SPRINGS, CO
SITE DESIGNATION: XFILTRAITON SYSTEM

PROJECT No.: 852685	SEQ. No.: 010	DATE: 7/31/2025
DESIGNED: TRC	DRAWN: TRC	
CHECKED: TRC	APPROVED: TRC	
SHEET NO.: P5	OF	6

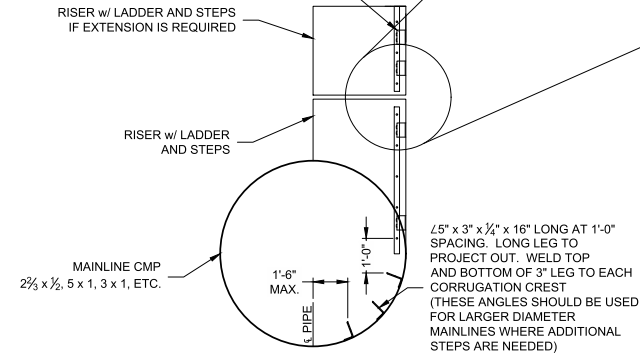
\\KINETIC-NET\CONTECH\ENGINEERING\PROJECTS\ACTIVE\852685-010-CMP DETENTION\DRAWINGS\852685-010-CMP CONF.A6.DWG 9/24/2025 4:57 PM



- NOTES:
1. LADDERS CAN BE MADE IN 20'-0" STANDARD LENGTHS AND CUT TO FIT
 2. ALL MATERIAL TO MEET ASTM A36
 3. LADDER TO BE HOT DIPPED GALVANIZED PER ASTM A-123 AFTER FABRICATION IS COMPLETE

STANDARD LADDER DETAIL
NOT TO SCALE
PART NO. HALAGVL16

PROVIDE MINIMUM OF 4 ATTACHMENT ANGLES (2 ON EITHER SIDE OF LADDER RAIL) TO CONNECT LADDER TO RISER EXTENSION



NOTE:
THIS DRAWING IS INTENDED TO APPLY TO LADDERS INSTALLED IN RISERS HAVING A DIAMETER OF 30" OR LARGER. DUE TO SPACE CONSTRAINTS AND LIMITED ACCESSIBILITY, THE PRACTICALITY AND SUITABILITY OF UTILIZING RISERS SMALLER THAN 30" DIAMETER AND/OR INCORPORATING LADDERS IN THESE SMALLER DIAMETER RISERS SHOULD BE ADDRESSED BY THE OWNER AND PROJECT ENGINEER

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MARK	DATE	REVISION DESCRIPTION	BY

CONTECH
ENGINEERED SOLUTIONS LLC
A QUANTA COMPANY

9100 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH
CMP DETENTION SYSTEMS

CONTECH
PROPOSAL
DRAWING

72"Ø UNDERGROUND DETENTION SYSTEM - 852685-010
ROCKY MOUNTAIN INDUSTRIAL PARK
COLORADO SPRINGS, CO
SITE DESIGNATION: XFILTRAITON SYSTEM

PROJECT No.: 852685	SEQ. No.: 010	DATE: 7/31/2025
DESIGNED: TRC	DRAWN: TRC	
CHECKED: TRC	APPROVED: TRC	
SHEET NO.: P6	OF	6



2850 Serendipity Circle West
Colorado Springs, CO 80917

Phone: 719-528-6133
Fax: 719-528-6848

Surveying • Planning • Engineering • Landscape Architecture

www ldc-inc.com

December 29, 2008
Revised March 18, 2009

**El Paso County Development Services
2880 International Circle
Colorado Springs, CO 80910**

Rocky Mountain Industrial Park, Filing 1A, Final Plat (07072)

Dear Sir/Madam:

RECEIVED

MAR 18 2009

EPC DEVELOPMENT SERVICES

VERSION # 3
DATE 3/19/09

Please consider this letter the Final Drainage Report for Rocky Mountain Industrial Park, Filing 1A.

For clarification, please note that this Filing 1A is a Replat of Lot 1, Rocky Mountain Industrial Park Filing No.1. This Filing 1A is wholly within drainage basins 3 & 4, which are depicted in the final drainage report for Rocky Mountain Industrial Park Filing No.1, prepared by Kiowa Engineering Corporation, dated August 2001 and revised February 7, 2002. A lot line vacation was subsequently done which created one lot from the previous 6 lots abutting Sandy Court. A site development plan (PPR-08-007) for this one lot was subsequently prepared, depicting a future layout of 4 lots, was approved, and is supported with a drainage letter by LDC, Inc. dated February 13, 2008. See also (3) *attached exhibits*.

This current action, Filing 1A, is the anticipated replatting from one to four lots, identified hereinafter as lots 1 through 4.

This site is located in the West one-half of Section 33, Township 13 South, Range 65 West of the 6th P.M., El Paso County, Colorado. This 7.94 acre site is zoned I-3 and currently has (1) developed lot located on the Northwest portion of the site and (3) remaining vacant lots with the proposed Replat.

EXISTING DRAINAGE:

Currently, storm water runoff from this Filing 1A site is a combination of fully developed and partially developed conditions. Completion of construction for the previously approved "Ewing Irrigation" wholesale business, within Lot 1, conforms to the drainage letter from LDC, Inc., dated February 13, 2008, that was approved with the Site Development Plan (PPR-08-007), as well as the approved drainage report prepared by Kiowa Engineering Corporation, dated February 2002. The flows from this fully developed lot 1 site, added to the flows from lot 2, which is considered partially developed as a result of previous overlot grading with now-established vegetative cover, are conveyed by the existing street section to a Type R inlet at the terminus of Sandy Ct., and thence via pipe to an existing south draining rip-rap channel. The flows from lots 3 and 4, which are also considered partially developed as a result of previous overlot grading with now-established vegetative cover, are conveyed via sheetflow to the existing grass lined channel to the south, which then flows into the aforementioned rip-rap channel.

PROPOSED DRAINAGE:

No site development is proposed with this Final Plat and therefore existing drainage conditions will not be affected. Any future development will need to meet all El Paso County requirements, including those referenced in the ECM and DCM, and as noted on the proposed Plat.

FLOODPLAIN STATEMENT:

This site is located in the Sand Creek Drainage Basin and a portion of this property is located in the 100-year, Zone A, floodplain per Flood Insurance Rate Map Panel No. 08041C0756F, effective date March 17, 1997 and as modified by LOMR No. 04-08-0062P effective date November 18, 2004.

IMPROVEMENTS:

No improvements are proposed with this Plat. At the time of site development on the remaining (3) lots, it is noted on the Plat that any future site development will require an updated Drainage letter. The letter will need to address the need for drainage improvements as required by the El Paso County Engineering Criteria Manual and Drainage Criteria Manual.

DRAINAGE FEES:

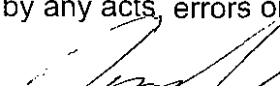
Drainage Basin fees were paid with the initial filing, this replat to 4 lots will result in a decreased density from the initial filing of 6 lots, so no additional fees are required.

EROSION CONTROL:

Erosion control, as required by the El Paso County ECM and DCM will need to be addressed with any future Site Development.

Engineer's Statement

This 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 El Paso County for drainage reports and said drainage report is in conformity with the Master Plan of the Drainage Basin. I accept responsibility for any liability caused by any acts, errors or omissions on my part in preparing this report.


David C. Ewald, P.E.

For and on behalf of LDC,



3/10/2009
DATE

Developer's Statement

The developer has read and will comply with all of the requirements specified in this report and plan.

Ewing Irrigation Products, Inc.
(Business Name)

Raynor W. York
BY

President
TITLE

3441 E. Harbourn Dr P.O. Box 87
ADDRESS
85034

El Paso County

Filed in accordance with Section 51.1 of the El Paso County Land Development Code.

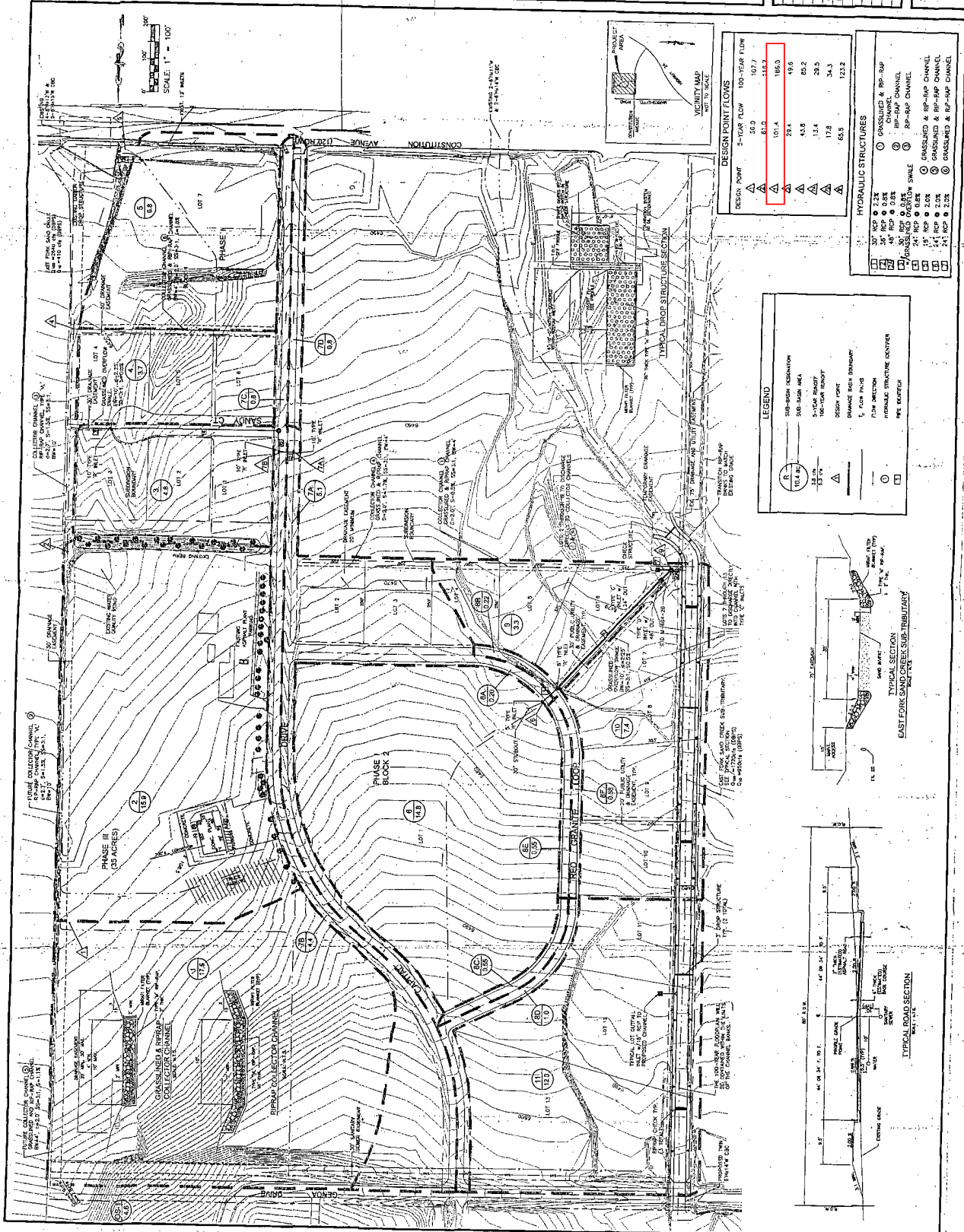
Max Z. Butschke P.E.
for Andy Bracken
County Engineer / ECM Administrator

1/26/10
DATE

ROCKY MOUNTAIN INDUSTRIAL PARK Final Drainage Report Proposed Drainage Plan COLORADO SPRINGS, COLORADO

Kiowa Engineering Corporation
2814 International Circle
Colorado Springs, Colorado
80910-3127
(719) 630-7342

Fig. 2



DESIGN POINT FLOWS

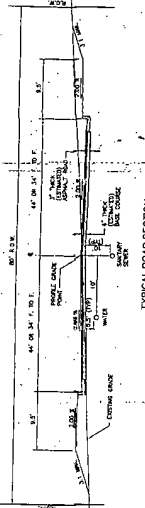
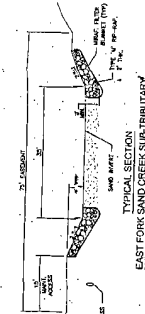
DESIGN POINT	5-YEAR FLOW	100-YEAR FLOW
1	58.0	107.7
2	81.2	118.7
3	101.4	166.0
4	29.4	49.6
5	43.8	65.2
6	13.4	28.5
7	17.8	34.3
8	65.5	123.2

HYDRAULIC STRUCTURES

STRUCTURE	DESIGN FLOW	DESIGN POINT
30' RCP @ 2.0%	107.7	1
48' RCP @ 0.8%	118.7	2
48' RCP @ 0.8%	166.0	3
30' RCP @ 0.8%	49.6	4
30' RCP @ 0.8%	65.2	5
30' RCP @ 0.8%	28.5	6
30' RCP @ 0.8%	34.3	7
30' RCP @ 2.0%	123.2	8

LEGEND

30' RCP @ 2.0%	30' RCP @ 2.0%
48' RCP @ 0.8%	48' RCP @ 0.8%
30' RCP @ 0.8%	30' RCP @ 0.8%
100' CANAL	100' CANAL
DESIGN POINT	DESIGN POINT
BRIDGE	BRIDGE
1" FLOW PIPE	1" FLOW PIPE
HYDRAULIC STRUCTURE	HYDRAULIC STRUCTURE
PROPERTY LINE	PROPERTY LINE



COLLECTOR CHANNEL (3)
RIP-RAP CHANNEL, TYPE 'VL'
d=27', S=1.5%, SS=3:1,
BW=10'

EAST FORK SAND CREEK
Q₁₀₀ = 2640 cfs (DBPS)
Q₁₀ = 410 cfs (DBPS)

EXISTING CANYON
DROP STRUCTURE

30' DRAINAGE
EASEMENT

30' DRAINAGE
EASEMENT

GRASSLINED OVERFLOW
SWALE
BW=10', d=2.25',
SS=3:1, S=0.5%

SUBDIVISION
BOUNDARY

COLLECTOR CHANNEL (6)
GRASSLINED & RIP-RAP CHANNEL
BW=4', d=2.0', SS=3:1, S=1.0%

Block 1

PHASE II

LOT 7

SANDY CT.

10' TYPE
'R' INLET

10' TYPE
'R' INLET

DRAINAGE EASEMENT

30' DRAINAGE
EASEMENT

EXISTING WATER
QUALITY POND

EXISTING BERM

EXISTING
ASPHALT PLANT
PARKING

LOT 2

5
6.8

4
3.7

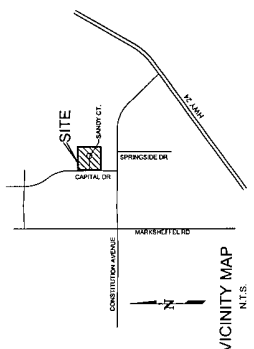
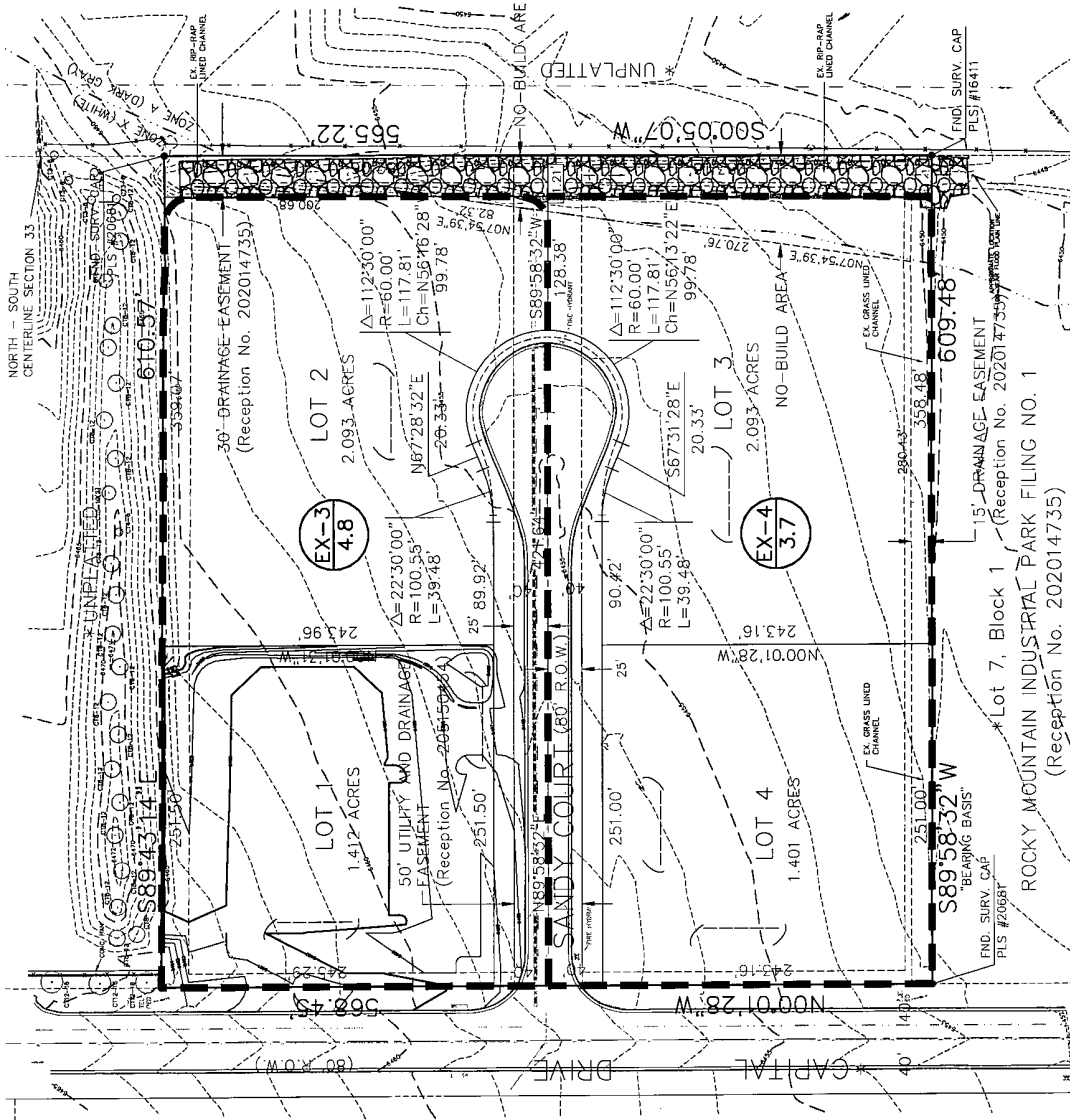
3
4.8

7C
0.8

7A
5.1

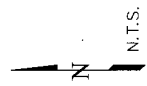
7D
0.8

Portion of Rocky Mtn. Industrial Park Filing No.1
Approved Drainage Plan



DRAINAGE PLAN LEGEND	
	BASIN BOUNDARY
	EXISTING DRAINAGE
	BASIN TAG

- NOTES:
1. NO PROPOSED CHANGES AS REPLANTED
 2. REFERENCE APPROVED DRAINAGE LETTER FOR EWING IRRIGATION SITE DEVELOPMENT PLAN (PPR-08-007) DATED FEBRUARY 13, 2008 BY LDC, INC.



PRELIMINARY/FINAL DRAINAGE REPORT

FOR

JACKSON OFFICE WAREHOUSE & STORAGE BUILDINGS DEVELOPMENT ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A, LOT 2

Prepared For:

**Jackson Developmental Solutions, LLC
55963 Maroon Mesa Drive
Colorado Springs, CO 80918**

Prepared By:

**Associated Design Professionals, Inc.
3520 Austin Bluffs Parkway Suite 102
Colorado Springs, CO 80918
719.266-5212**

ADP Project No.170602

May 2, 2018

PCD File No. PPR-17-057



PRELIMINARY/FINAL DRAINAGE REPORT
JACKSON OFFICE WAREHOUSE & STORAGE BUILDINGS DEVELOPMENT
ROCKY MOUNTAIN INDUSTRIAL PARK FILING NO. 1A, LOT 2

PROJECT DESCRIPTION

This drainage report is for the development of the Rocky Mountain Industrial Park Filing No. 1A, Lot 2. The currently vacant 2.09 acre site is located north of Constitution Avenue and east of Capital Drive on the north side of Sandy Court at the end of the cul-de-sac. It is further described as a portion of Section 33, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado.

All of this lot is located in Sand Creek drainage basin. An existing storm sewer is located within Sandy Court which empties into an existing riprap lined channel located along the east edge of the property.

SOILS

The soil on the site can be described as having a rapid permeability, medium-surface runoff, and moderate to high hazard of erosion. The soils within the site are Blendon sandy loams. These soils are classified as Hydrologic Group 'B'.

FLOODPLAIN STATEMENT

A small portion of the developed site is located within a designated FEMA 100-year floodplain according to the information published in the Federal Emergency Management Agency Flood Plain Map N. 08041C0756F, dated March 17, 1997, LOMR 04-08-0062P dated November 18, 2004. This area falls within the existing riprap channel.

METHOD OF COMPUTATION

The methodology utilized for this report is in accordance with the *City Drainage Criteria Manual, Volumes 1*, dated May 2014. The Rational Method for computation of runoff was used for determining Sub-Basin flows.

$Q = c i a$

Where Q = maximum rate of runoff in cubic feet per second
 c = runoff coefficient representing drainage area characteristics
 i = average rainfall intensity, in inches per hour, for the duration
 required for the runoff to become established
 a = drainage basin size in acres

EXISTING DRAINAGE CONDITIONS

The existing site has been overlaid grades and is covered with rangeland. The site slopes in a southeasterly direction with most flows directed onto Sandy Court where they are intercepted by an existing 10' sump window inlet. The inlet flows into a 30" RCP storm sewer which empties into the east tributary of Sand Creek. The remainder of the site drains directly into the riprap-lined collector channel which will be privately maintained by the property owner. This channel then flows into the east fork of Sand Creek.

No flows enter the site from the east; however, flows from the north do enter the site as delineated in the Final Drainage Report for the Rocky Mountain Industrial Park Filing No. 1 by

Kiowa Engineering Corporation. These flows enter the site within a 10' wide channel with estimated flows of 51.0 cfs for the 5-year storm and 116.7 cfs for the 100-year storm at DP1. The off-site sub-basin OS1 only drains the existing landscape area and produces flows of 0.2 cfs for the 5-year storm and 1.1 cfs for the 100-year storm. Sub-basin AEX drains to the western portion of the undeveloped site. It produces flows of 0.8 cfs and 5.7 cfs respectively. These flows combine with the flows from OS1 at DP2 to produce flows to Sandy Court of 0.8 cfs for the 5-year storm and 6.3 cfs for the 100-year storm. These flows combine with the flows from DP1 at DP2 to produce total flows of 51.0 cfs for the 5-year storm and 116.7 cfs for the 100-year storm.

The estimated runoff amounts produced for the project under existing conditions are shown in Table 1 below.

TABLE 1 – EXISTING CONDITIONS		
Sub-Basin	Q₅CFS	Q₁₀₀ CFS
OS1	0.2	1.1
AEX	0.8	5.7
DP1	50.2	116.8
DP2 (OS1 + AEX)	0.8	6.3
DP3(DP1+DP2)	49.5	118.4

DEVELOPED DRAINAGE CONDITIONS

The development of this site includes the addition of two (2) 5,067 sf office/warehouse buildings in the center of the site and a 3,000 sf vehicle storage building in the northwest corner of the site.

The lower portion of the lot will be paved with asphalt while the upper portion will be covered with gravel. The site will be regraded to direct the flows around the proposed office/warehouse buildings.

Flows from the northern area will be directed to curbs and cross pans in the southern area and directed into a sand filter water quality basin.

As stated in the previous section, a small amount of off-site flow enters the site from a grass-covered berm on the north side of the site. Sub-basin OS1 drains the western part of this berm and produces flows of 0.1 cfs for the 5-year storm and 0.7 cfs for the 100-year storm. These flows drain onto Sub-basin A1.

The western portion of the developed site is designated as Sub-basin A1. This sub-basin will produce flows of 2.5 cfs and 5.2 cfs respectively. These flows combine with the flows from OS1 at DP2 to produce flows of 2.6 cfs for the 5-year storm and 5.7 cfs for the 100-year storm. Flows from DP1 continue to the east and into Sub-basin A2.

Sub-basin OS2 drains the eastern part of this berm and produces flows of 0.1 cfs for the 5-year storm and 0.4 cfs for the 100-year storm. These flows drain onto Sub-basin A2.

The eastern portion of the developed site is designated as Sub-basin A2. This sub-basin will produce flows of 2.1 cfs and 4.2 cfs respectively. These flows combine with the flows from OS2 at DP3 to produce flows of 2.1 cfs for the 5-year storm and 4.6 cfs for the 100-year storm.

Flows from DP3 combine with the flows from DP2 at DP4 to produce total flows into the sand filter basin of 4.7 cfs for the 5-year storm and 10.2 cfs for the 100-year storm.

No flows enter the site from the east; however, flows from the north do enter the site as delineated in the Final Drainage Report for the Rocky Mountain Industrial Park by Kiowa Engineering Corporation. These flows enter the site within a 10' wide channel with estimated flows of 51.0 cfs for the 5-year storm and 116.7 cfs for the 100-year storm at DP1.

Sub-basin B drains the eastern swale and the landscape area south of the developed site. This area produces flows of 0.3 cfs and 1.1 cfs respectively. These flows combine with the flows from DP4 at DP5 to produce total site flows of 4.9 cfs for the 5-year storm and 11.2 cfs for the 100-year storm. These flows combine with the off-site flows from DP1 at DP6 to produce total site flows of 52.4 cfs for the 5-year storm and 122.0 cfs for the 100-year storm.

Table 2 shows the estimated runoff which will be produced for the project under developed conditions.

TABLE 2 –PHASE I DEVELOPED CONDITIONS		
Sub-Basin	Q₅CFS	Q₁₀₀ CFS
OS1	0.1	0.7
OS2	0.1	0.4
A1	2.5	5.2
A2	2.1	4.2
B	0.3	1.1
DP1	50.2	116.8
DP2 (OS1 + A1)	2.6	5.7
DP3 (OS2 + A2)	2.1	4.6
DP4 (DP2 + DP3)	4.7	10.2
DP5 (DP4 + B)	4.9	11.2
DP6(DP1+DP5)	52.4	122.0

WATER QUALITY

Water quality for the site will be achieved through a 1,400 cf sand filter basin (SFB) with a four-inch slotted underdrain tied into a "Type C" inlet with an 18" HDPE pipe outlet. This SFB will be privately owned and maintained by the property owner.

DETENTION

A Regional Detention Facility is proposed to be built upstream of the Rocky Mountain Industrial Park. This facility will be designed to account for the proposed flows within the proposed development within the industrial development according to the Hydrology Analysis section of the Final Drainage Report for the Rocky Mountain Industrial Park Filing No. 1 by Kiowa Engineering Corporation. No detention was proposed or exists within the existing subdivision, only Water Quality basins.

PRIVATE DRAINAGE FACILITIES

Item	Unit	Quantity	Unit Cost	Total Cost
18" HDPE FES	EA	1	\$400	\$ 400
18" HDPE	LF	15	\$40	\$ 600
Outlet Structure	EA	1	\$5,000	\$5,000

Emergency Spillway	EA	1	\$1,500	<u>\$1,500</u>
			Sub-Total	\$7,500
			15% Contingency & Engineering	<u>\$1,125</u>
			TOTAL	\$8,625

DRAINAGE BASIN FEES

The entire project was previously platted and lies within the Sand Creek Drainage Basin; therefore, no fees are due.

CONCLUSION

The proposed development and subsequent lot developments follow the “Four Step Process” as mandated by the EPA as follows:

Step 1: Runoff has been reduced by disconnecting impervious areas where possible, eliminating “unnecessary” impervious areas and encouraging infiltration into suitable soils.

Step 2: All drainageways, ditches and channels have been stabilized by the following methods:

- Tributaries have been left in their relatively natural state where possible.
- New drainageways and swales have been stabilized with either riprap or erosion control fabric depending on the erosion potential.
- No new roadside ditches are proposed for the development.

Step 3: The proposed development will disturb approximately 2.0 acres.

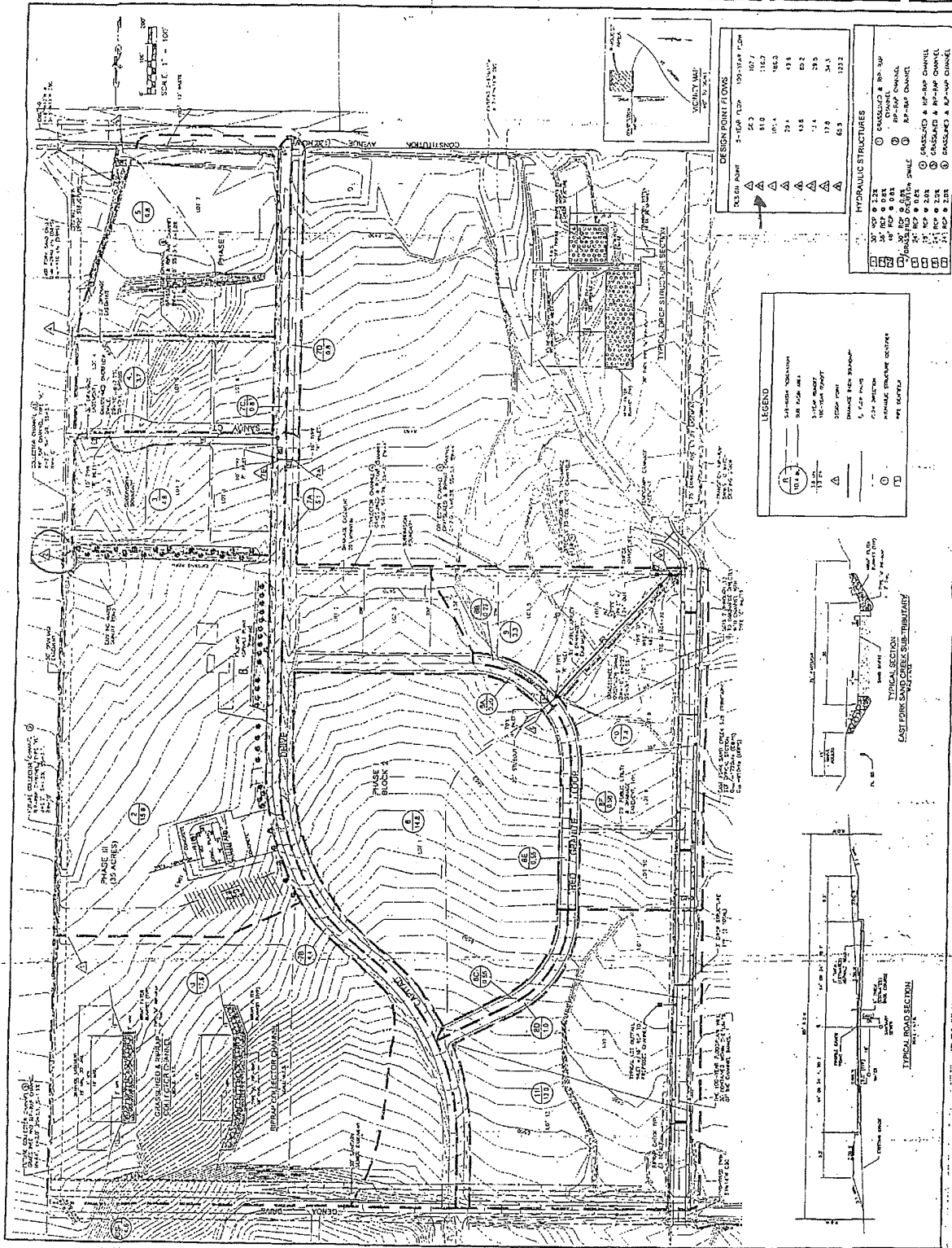
Step 4: The development of this project will not affect sensitive waters.

The development of this site will have little impact on downstream properties once the water quality is constructed.

REFERENCES

1. City of Colorado Springs and El Paso County (1994). *Drainage Criteria Manual Volume 1* (DCM).
2. City of Colorado Springs and El Paso County (1994). *Drainage Criteria Manual Volume II* (DCM).
3. Soil Survey of El Paso County Area, Colorado by USDA, NRCS.
4. *El Paso County (January 2006) Engineering Criteria Manual*.
5. Urban Drainage and Flood Control District (June 2011). *Urban Storm Drainage Criteria Manual, Volume 1-3*.
6. Rocky Mountain Industrial Park Filing No. 1 Final Drainage Plan by Kiowa Engineering Corporation, dated February 2002.
7. Rocky Mountain Industrial Park Filing No. 1A by Land Development Consultants, Inc., dated March, 2009.

Fig. 2.



8140 SANDY CT																					
PROJ. #170703																					
DRAINAGE CALCULATION SHEET																					
file:sandy ct dr																					
06/02/18																					
AREA	AREA	C5	C100	C5 X A	C100 X A	Initial TC		Travel Time			length		vel.	AREA							
DESIG.	(acre)	(5 yr)	(100 yr)			L (ft)	Slope (%)	ti (min)	L (ft)	Slope (%)	V (fps)	Tt (min)	TC (min)	I5 (in/hr)	I100 (in/hr)	Q5 (cfs)	Q100 (cfs)	L (feet)	V (fps)	^i (min)	DESIG.
EXISTING CONDITIONS																					
DP1	33.40	0.51	0.68	17.03	22.71								19.60	2.95	5.14	50.17	116.84	270	5.00	0.90	DP1
OS1	0.35	0.08	0.35	0.03	0.12	50	25.00	4.66	0	2.50	1.70	0.00	5.00	5.19	9.06	0.15	1.11	350	1.50	3.89	OS1
Aex	2.09	0.08	0.35	0.17	0.73	20	25.00	2.95	350	1.70	1.20	4.86	7.81	4.47	7.80	0.75	5.71				Aex
DP2	2.44			0.20	0.85								8.89	4.25	7.42	0.83	6.34				DP2
DP3	35.84			17.23	23.57								20.50	2.88	5.02	49.54	118.36				DP3
DEVELOPED CONDITIONS																					
DP1	33.40	0.51	0.68	17.03	22.71								19.60	2.95	5.14	50.17	116.84	270	5.00	0.90	DP1
OS1	0.22	0.08	0.35	0.02	0.08	50	25.00	4.66	0	2.50	1.70	0.00	5.00	5.19	9.06	0.09	0.70	260	1.00	4.33	OS1
A1	0.97	0.62	0.74	0.60	0.71	60	2.50	5.12	260	1.00	1.00	4.33	9.45	4.15	7.24	2.50	5.16				A1
DP2	1.19			0.62	0.79								9.45	4.15	7.24	2.57	5.72				DP2
OS2	0.13	0.06	0.35	0.01	0.05	50	25.00	4.66	0	2.50	1.70	0.00	5.00	5.19	9.06	0.05	0.41	300	1.00	5.00	OS2
A2	0.78	0.65	0.76	0.51	0.59	60	2.50	4.79	300	1.00	1.00	5.00	9.79	4.09	7.14	2.08	4.23				A2
DP3	0.91			0.52	0.64								9.79	4.09	7.14	2.12	4.56	125	1.50	1.39	DP3
DP4	2.10			1.14	1.43								9.79	4.09	7.14	4.66	10.20				DP4
B	0.34	0.16	0.41	0.06	0.14	15	2.50	5.02	280	2.50	1.70	2.75	7.77	4.48	7.82	0.25	1.09				B
DP5	2.44			1.20	1.57								9.79	4.09	7.14	4.89	11.19				DP5
DP6	35.84			18.23	24.28								20.50	2.88	5.02	52.42	121.95				DP6
IMPERVIOUS AREA CALC																					
Imperv %																					
UNDEV	0																				
LOOSE GRAVEL	80																				
PAVED PARKING	100																				
BUILDINGS	100																				
Imperious Area Description																					
Area	Landscape	Building	Paved	Loose	Total																
OS1	0.22	0.22	0	0	0																
OS2	0.13	0.13	0	0	0																
A1	0.97	0.18	0.19	0.20	0.41	73.1															
A2	0.78	0.10	0.12	0.23	0.33	78.6															
Total	2.10				63.0																
Ponding Elev = 6453.45 - 6452.85																					
Max Ponding Depth = 0.65' = 7.8"																					
Q = 11.2 cfs																					
Ponding Depth = 6.75' (Per Figure 8-10)																					

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 2

Designer: Michael A Bartusek
 Company: Associated Design Professionals
 Date: March 27, 2018
 Project: Jackson Office/Warehouse Storage Buildings Development
 Location: Rocky Mountain Industrial Park Fil 1A Lot 2

1. Basin Storage Volume

- A) Effective Imperviousness of Tributary Area, I_a
(100% if all paved and roofed areas upstream of sand filter)
- B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)
- C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time
 $WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$
- D) Contributing Watershed Area (including sand filter area)
- E) Water Quality Capture Volume (WQCV) Design Volume
 $V_{WQCV} = WQCV / 12 * \text{Area}$
- F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)

$I_a =$ 63.0 %

$i =$ 0.630

WQCV = 0.20 watershed inches

Area = 91,475 sq ft

$V_{WQCV} =$ 1,504 cu ft

$d_e =$ 0.40 in

$V_{WQCV \text{ OTHER}} =$ 1,399 cu ft

$V_{WQCV \text{ USER}} =$ 1,400 cu ft

2. Basin Geometry

- A) WQCV Depth
- B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.
- C) Minimum Filter Area (Flat Surface Area)
- D) Actual Filter Area
- E) Volume Provided

$D_{WQCV} =$ 1.4 ft

$Z =$ 4.00 ft / ft

$A_{Min} =$ 720 sq ft

$A_{Actual} =$ 792 sq ft

$V_T =$ 1400 cu ft

3. Filter Material

- Choose One _____
- ☒ 18" CDOT Class B or C Filter Material
- ☐ Other (Explain): _____

4. Underdrain System

- A) Are underdrains provided?
- B) Underdrain system orifice diameter for 12 hour drain time
- i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice
- ii) Volume to Drain in 12 Hours
- iii) Orifice Diameter, 3/8" Minimum

- Choose One _____
- ☒ YES
- ☐ NO

$y =$ 1.8 ft

$Vol_{12} =$ 1,400 cu ft

$D_o =$ 7 / 8 in

Design Procedure Form: Sand Filter (SF)

Sheet 2 of 2

Designer: Michael A Bartusek
 Company: Associated Design Professionals
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 Location: Rocky Mountain Industrial Park Fil 1A Lot 2

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric

A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?

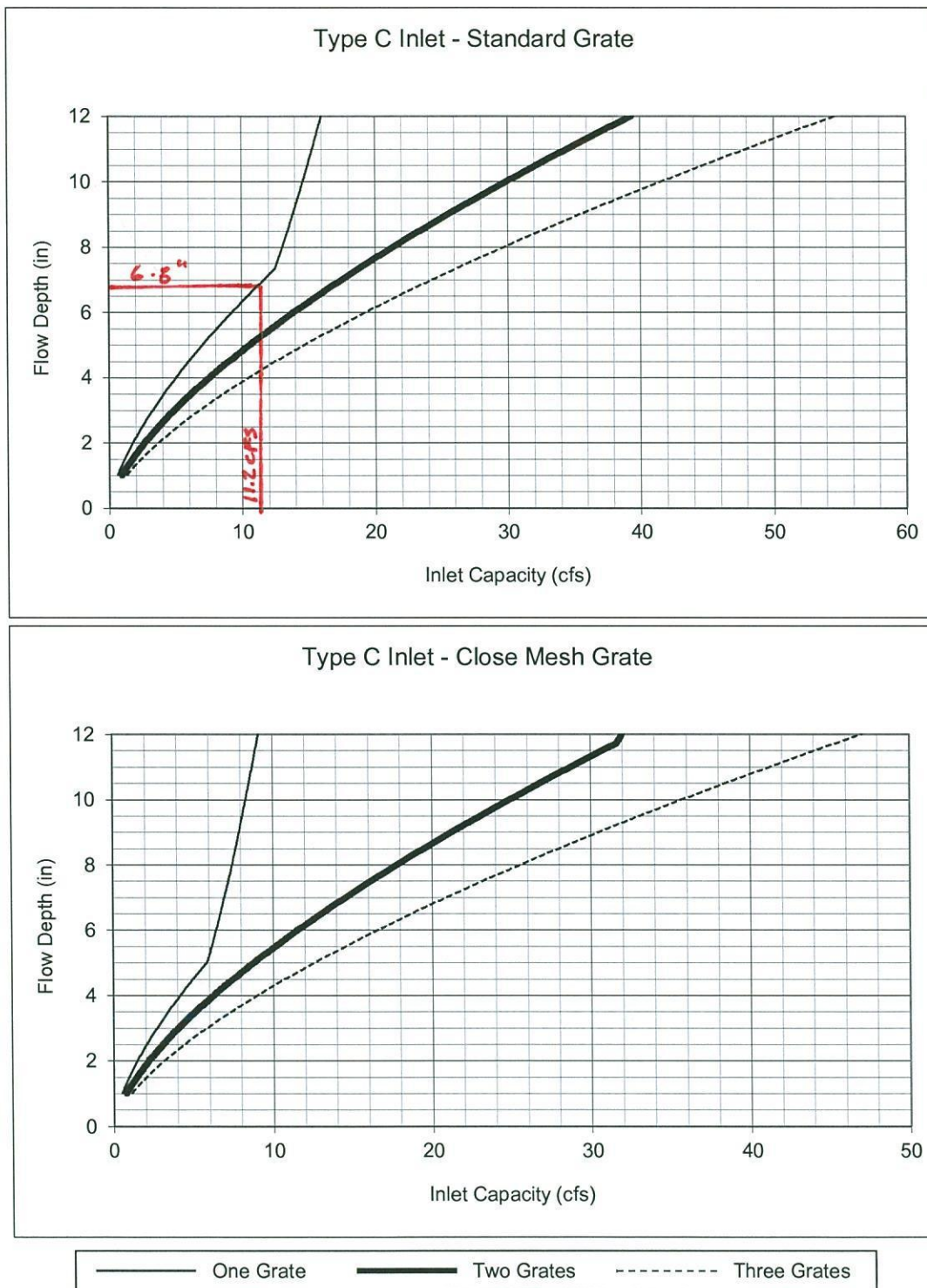
Choose One _____
☐ YES ☒ NO

6-7. Inlet / Outlet Works

A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet

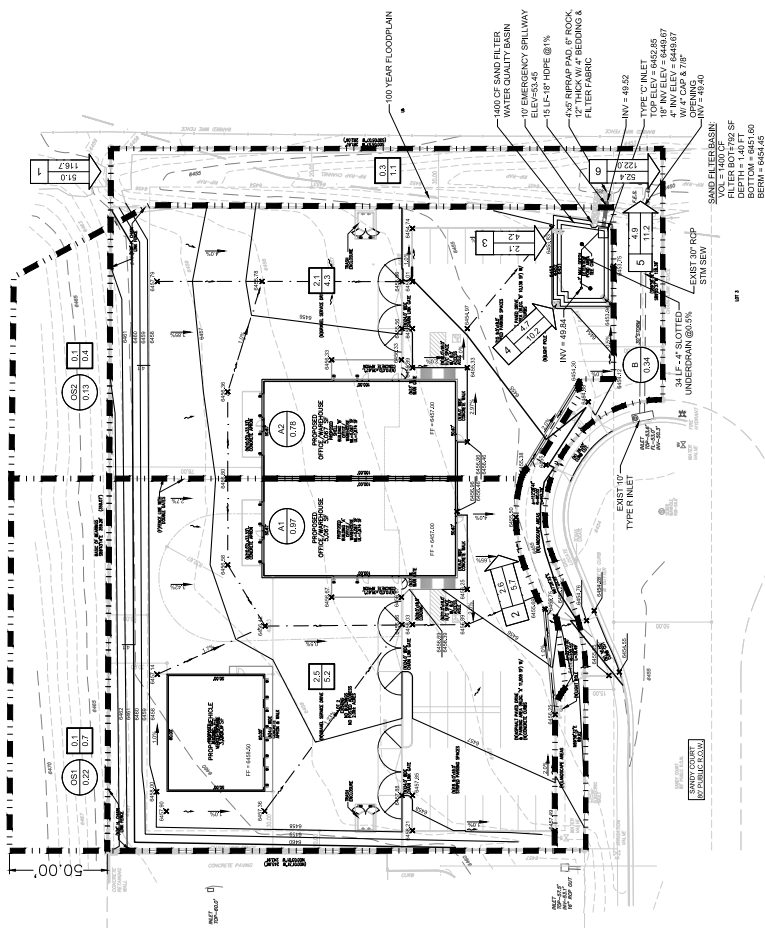
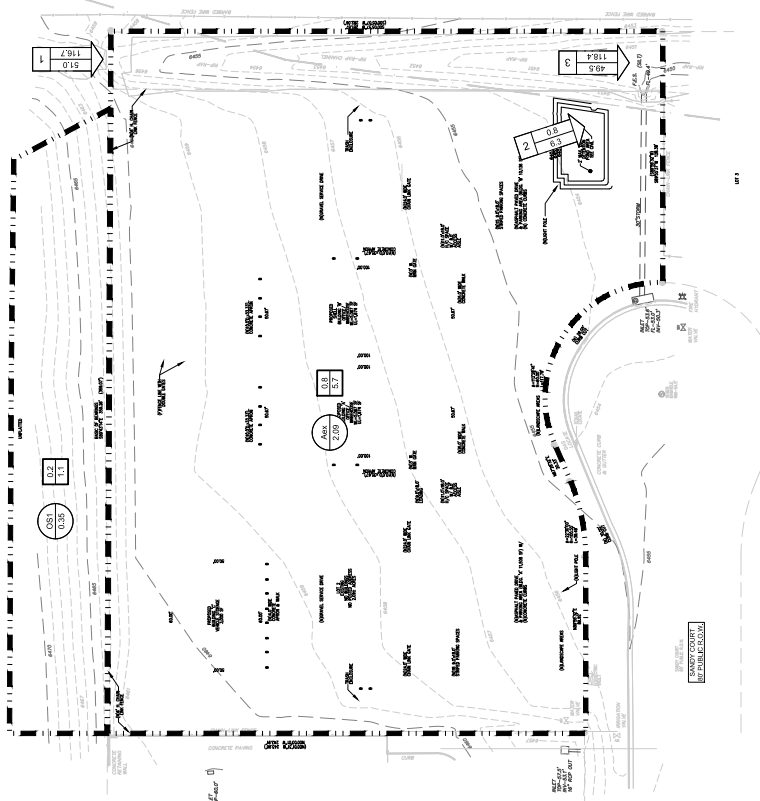
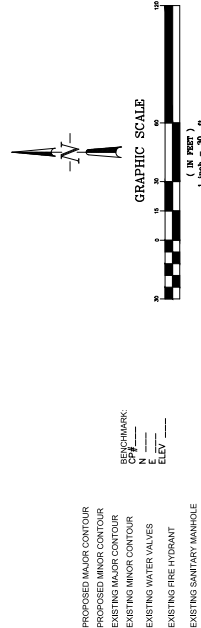
Riprap rundowns into basin with riprap emergency spillway.
Type C inlet w/18" HDPE pie outlet structure.

Notes: _____

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet

Notes:

1. The standard inlet parameters must apply to use these charts.

PROPOSED CONDITIONS

EXISTING CONDITIONS

