

# PRELIMINARY DRAINAGE REPORT

FOR

## CROSSROADS MIXED USE EL PASO COUNTY, COLORADO

NOVEMBER 2020

Prepared for:  
Crossroads Metropolitan District No. 2  
Mr. Danny Mientka  
90 South Cascade Avenue, Suite 1500  
Colorado Springs, Colorado Springs 80903

Prepared by:



102 E. Pikes Peak, Suite 500  
Colorado Springs, CO 80903  
(719) 955-5485

Project #18-003A

PCD Filing No.:  
SP-20-011

**PRELIMINARY  
DRAINAGE REPORT  
FOR  
CROSSROADS MIXED USE**

**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: \_\_\_\_\_  
Danny Mientka –Owner

DATE: \_\_\_\_\_

ADDRESS: The Equity Group, LLC  
90 South Cascade Avenue, Suite 1500  
Colorado Springs, CO 80903

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: \_\_\_\_\_  
Jennifer Irvine, P.E.  
County Engineer / ECM Administrator

CONDITIONS:

# PRELIMINARY DRAINAGE REPORT FOR CROSSROADS MIXED USE

## TABLE OF CONTENTS

|  |  |
|--|--|
| <p>PURPOSE</p> <p>PROPERTY DESCRIPTION</p> <p>SOILS</p> <p>FLOODPLAIN STATEMENT</p> <p>HYDROLOGIC CALCULATIONS</p> <p>HYDRAULIC CALCULATIONS</p> <p>FOUR STEP PROCESS</p> <p>EXISTING DRAINAGE CONDI</p> <p>PROPOSED DRAINAGE CONI</p> <p>WATERQUALITY PROVISION</p> <p>EROSION CONTROL</p> <p>DRAINAGE &amp; BRIDGE FEES</p> <p>SUMMARY</p> <p>REFERENCES</p> | <div style="border: 1px solid black; background-color: #e0ffff; padding: 5px; margin-bottom: 10px;"> <p>Add a section regarding drainage design criteria. Highlighted section below was not discussed. Report does not identify previous studies (DBPS, Master Plans and PDR). Report does not identify the detention calculation method.</p> </div> <p style="text-align: right;">4</p> <p style="text-align: right;">5</p> <p style="text-align: right;">5</p> <p style="text-align: center;">and their impact on the development.</p> <p><b>3) DRAINAGE DESIGN CRITERIA</b></p> <p><b>a) Development Criteria Reference</b></p> <p>1. Reference all criteria, master plans, and technical information used for report preparation and design; any deviation from such material must be discussed and justified.</p> <p>2. Discussion of previous drainage studies (i.e., PDR, drainage basin planning studies, master plans, flood insurance studies) for the site in question that influence or are influenced by the drainage design and how the studies affect drainage design for the site.</p> <p><b>b) Hydrologic Criteria</b></p> <p>1. Identify design rainfall.</p> <p>2. Identify runoff calculation method.</p> <p>3. Identify design storm recurrence intervals.</p> <p>4. Identify detention discharge and storage calculation method.</p> |
|--|--|

Hydrologic Calculations  
Hydraulic Calculations  
Existing & Proposed Drainage Map  
Preliminary Underground Detention Plans

**PRELIMINARY DRAINAGE REPORT  
FOR  
CROSSROADS MIXED USE**

**Purpose**

revise to "preliminary drainage report"

The purpose of this ~~drainage letter~~ is to identify and analyze the onsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County and City of Colorado Springs Drainage Criteria Manual. The proposed site will be developed into commercial and residential apartment site.

It should be noted that subsequent drainage reports and analysis will be provided in accordance with El Paso County Drainage Criteria when the site plan are developed for the apartment site and the commercial lots. This drainage report is submitted to support the Preliminary Plan. Eventually, a Final Drainage Report, and Construction Drawings will be submitted with a Final Plat.

**Property Description**

Crossroads Mixed Use is located at 0 Meadowbrook Parkway in the southwestern quarter of Section 8, Township 14 South, Range 65 West of the 6<sup>th</sup> P.M. in El Paso County, Colorado. The site is currently undeveloped. The site is bound to the west by undeveloped Softball West Subdivision Filing No.2, to the north by Meadowbrook Crossing Subdivision and proposed Meadowbrook Parkway, and to the east by Hwy 24. The site is currently undeveloped and is covered with native grasses with slopes ranging from 1-20%.

**Soils**

Soils for this project are delineated by the map in the appendix as Blakeland loamy sand (8) and Blendon Sandy Loam (10) which are characterized to be part of Hydrologic Soil Types "A" & "B". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". Vegetation is sparse, consisting of native grasses and weeds.

**Floodplain Statement**

Update FEMA reference to the current version which has an effective date of December 2018

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) No. 08041C0754 F & 08041C0752 F, dated March 17, 1997, Revised to Reflect LOMR Case No 05-08-0368P effective date Aug. 6, 2018, none of the site lies within a designated flood plain. The Sand Creek East Fork Channel is located to the north and west of the site, and to the northwest of the adjacent Meadowbrook Crossing subdivision.

**Hydrologic Calculations**

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.



## 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.

### Four Step Process

Update to discuss  
drainageway (natural  
and/or manmade)

**Step 1** **Employ Runoff Reduction Practices** – Approx. 2.54 acres of the proposed development is being set aside for a Full Spectrum Detention (FSD) Pond. Whenever possible, runoff produced within developable area containing impervious surfaces will be routed through landscaped areas or earthen swales (grass-lined where slope exceeds 2%) to minimize direct connection of impervious surfaces. In the interim runoff will be reduced through the use of temporary sediments ponds and ditch/dikes in the interim condition until the ground has been stabilized with vegetation or permanently developed.

**Step 2** **Stabilize Drainageways** – The site will use a Full Spectrum Detention (FSD) Pond to control developed runoff that is discharging into an existing swale and ultimately into Sand Creek. The FSD outlet structure will be designed to drain the water quality event storm in 40 hours, while reducing the 100 year peak discharge to approximately 90% of the predevelopment conditions. The development of this site is not anticipated to have negative effects on downstream drainageways. In the interim, the site proposes two temporary sedimentation ponds, before discharging runoff to the southwest property corner of the site and onto an adjacent undeveloped property spillways. Thus the development of this project does not anticipate having negative effects on downstream drainageways.

update. Only one  
temporary sediment  
pond is shown on the  
plans.

**Step 3** **Provide Water Quality Capture Volume** – A Full Spectrum Detention Pond is proposed to reduce peak discharge rates and provide water quality treatment. In the interim two (2) temporary Sedimentation Ponds are provided to collect sediment for the disturbed area this will function to maintain existing water quality levels during construction, and prior to permanent development.

to permanent  
identify the specific  
type of permanent  
WQ control measure  
is being used.

**Step 4** **Consider Need for Industrial and Commercial BMP's** – This submittal provides a final grading and erosion control plans with BMPs in place. The proposed project will use straw bales, a vehicle tracking control pad, and concrete washout area, mulching and reseeded to mitigate the potential for erosion across the site. The property owner shall be responsible for the necessary BMPs for the site including staging, storage and stockpile areas as determined by the contractor. Individual lot owners will be responsible for additional permanent BMPs in the future.

Revise Step 4. This should be n/a since no specialized BMPs are required

#### Step 4: Consider Need for Industrial and Commercial BMPs

If a new development or significant redevelopment activity is planned for an industrial or commercial site, the need for specialized BMPs must be considered. Two approaches are described in the New Development BMP Factsheets:

- Covering of Storage/Handling Areas
- Spill Containment and Control

Other Specialized BMPs may also be required

## Existing Drainage Characteristics

Update narrative.  
See comments in the  
existing conditions  
drainage map.

The site is located in the East Fork of Sand Creek basin. In the existing condition, site vegetation is sparse, consisting primarily of native grasses and weeds. The parcel possesses a ridgeline that bisects the parcel, directing runoff to the south and west boundaries, with slopes varying from 1% to 20%. A few small depressions are located on site, near the west boundary. For the purposes of hydrologic analysis, the small depressions are not considered to detain runoff. Ultimately, all runoff from the parcel is conveyed to the west toward existing drainage facilities located under Peterson Road.

**Basin A**, 5.9 acres drains from east to west eventually discharging into the US HWY 24 rights of way at the southern boundary of the site. Peak runoff is estimated at 1.3 cfs and 9.2 cfs at **Design Point 1** in the 5 year and 100 year events respectively.

**Basin B**, 11.0 acres drains from east to west eventually discharging along the western boundary of the site, approximately 250' south of the northern property line. Peak runoff is estimated at 2.2 cfs and 16.5 cfs at **Design Point 2** in the 5 year and 100 year events respectively.

**Basin C**, 13.5 acres drains from northeast to southwest eventually discharging along the western boundary of the site, approximately 200' north of the southern property line. Peak runoff is estimated at 2.9 cfs and 21.5 cfs at **Design Point 3** in the 5 year and 100 year events respectively.

Proposed drainage basin will be reviewed in detail on the resubmittal once the internal site layout is provided.

## Proposed Drainage Characteristics

The proposed site will be subdivided into an apartment site, commercial lots, and a tract for a full spectrum / water quality detention pond or an underground detention system. This will be accomplished by leveling the site from northeast to southwest with proposed slopes ranging from 0.6 to 1.2%. Once a site layout for the apartment site is obtained, and more information is collected for the commercial lots, this drainage report will be updated to include storm piping, inlets and storm sewer manholes.

### Design Point 1

**Basin A** consists of 13.2 acres of proposed commercial development. Runoff within this basin (Q5=46.9, Q100=85.6 cfs) is expected to flow from east to west, and will sheet flow to the southwest corner of Basin A. This flow will continue to the southwest towards downstream infrastructure, into **Basin B**.

### Design Point 2

**Basin D** consists of 2.54 acres of proposed Meadowbrook Parkway. Approximately 90% of this basin consists of asphalt paved surface, while the remaining consists of sidewalk and landscaping. Runoff produced in this basin (Q5=9.7, Q100=17.4 cfs) is routed via curb and gutter to the westside of Basin B. The flows are routed south via a curb cut where it is collected by the proposed grass-lined swale at **Design Point 2**. This swale will redirect the runoff south through

Curb cut does not appear to be a viable design solution since the temporary cul-de-sac will be removed when Meadowbrook Parkway is extended to the west with future development. Revise design.

### Design Point 3

**Basin B** consists of 13.2 acres of proposed apartment site. Runoff produced within this basin (Q5=22.0, Q100=46.8 cfs) flows from east to west, combining with runoff from **Design Point 1** and **Design Point 2**, in the proposed swale on the west side of the basin. The cumulative flows at **Design Point 3** are Q5=66.4 and Q100=127.5 cfs and will be routed to **Design Point 4** a proposed Full Spectrum Detention Pond (FSD) or underground detention system.

### Design Point 4

**Basin C** is comprised of 3.23 acres of proposed pond (Underground Detention) and park site. Runoff within this basin (Q5=1.9, Q100=8.1 cfs) flows from east to west, where it collects with runoff from **Design Point 3** in the proposed FSD pond. Cumulative flows at **Design Point 4** are anticipated to reach rates of 68.2 and 135.1 cfs for the 5 year and 100 year events, respectively.

Elaborate on the underground design. What are design criteria considerations for the underground detention. The stormtech detail did not provide any information regarding the outlet control structure

### Water Quality Provisions and Maintenance

The proposed full spectrum detention (FSD) pond functions to provide water quality treatment for the proposed development. This full spectrum detention pond will function to treat approximately 28.62 acres of tributary area by providing 0.834 acre-feet of storage for the water quality event, 3.220 acre feet of storage at the EURV event storm and 4.164 acre-feet of storage in the 100-year event. The 42' wide emergency spillway is designed with a foot of freeboard in the 100-year event. The results show that the FSD pond remains functional in the 100-year event and the outlet structure is able to discharge flows to the existing swale and ultimately to Sand Creek. The sizing for the full spectrum detention facility has been determined using the guidelines set forth in the Urban Drainage and Flood Control District Criteria Manual. Refer to the UDFCD MHFD-Detention, Version 4.03, Excel Workbook located within the appendix of this report for calculations. A Preliminary design of the underground detention system is provided in the appendix of this report.

The proposed FSD pond or underground detention system will be private and maintained by the property owner or the metropolitan district. Access to the pond shall be granted to the owner/district and El Paso County for access and maintenance of the private WQCV facility. A private maintenance agreement document shall accompany this report submittal.

### Erosion Control

It is the policy of the El Paso County that we submit a grading and erosion control plan with the drainage report. The plan includes proposed silt fence, vehicle traffic control and temporary sediment basins as proposed as erosion control measures. The plan also includes provisions for stockpiling and staging.

Remove or revise first sentence. GEC is required if the applicant is planning to disturb greater than an acre. In this case it is required because the application is requesting pre-development GEC

Only one SB shown on GEC plans. Revise this text accordingly.

Update to identify 2020  
Drainage & Bridge Fees

**Drainage & Bridge Fees:**

|                       |       |   |       |    |           |   |                      |
|-----------------------|-------|---|-------|----|-----------|---|----------------------|
| <b>Drainage Fees:</b> | 28.62 | x | 76.9% | \$ | 19,698.00 | = | \$ 433,528.95        |
| <b>Bridge Fees:</b>   | 28.62 | x | 76.9% | \$ | 8,057.00  | = | <u>\$ 177,324.74</u> |
| <b>Total</b>          |       |   |       |    |           |   | <b>\$ 610,853.69</b> |

Drainage fees shall be paid at the time of platting.

**Summary:**

The construction of this site is for the purposes of creating commercial lots and an apartment site. Currently, no impervious surfaces are being constructed. The site will be graded and all disturbed areas will be seeded and mulched. Post construction runoff will be discharged to downstream property at rates that are below historic discharge rates. Erosion control measures will be implemented to prevent sediment migration. The construction of Crossroads Mixed Use shall not adversely affect adjacent or downstream property. Subsequent drainage reports will be required if and when the site is developed behind the uses defined within this report.

**References:**

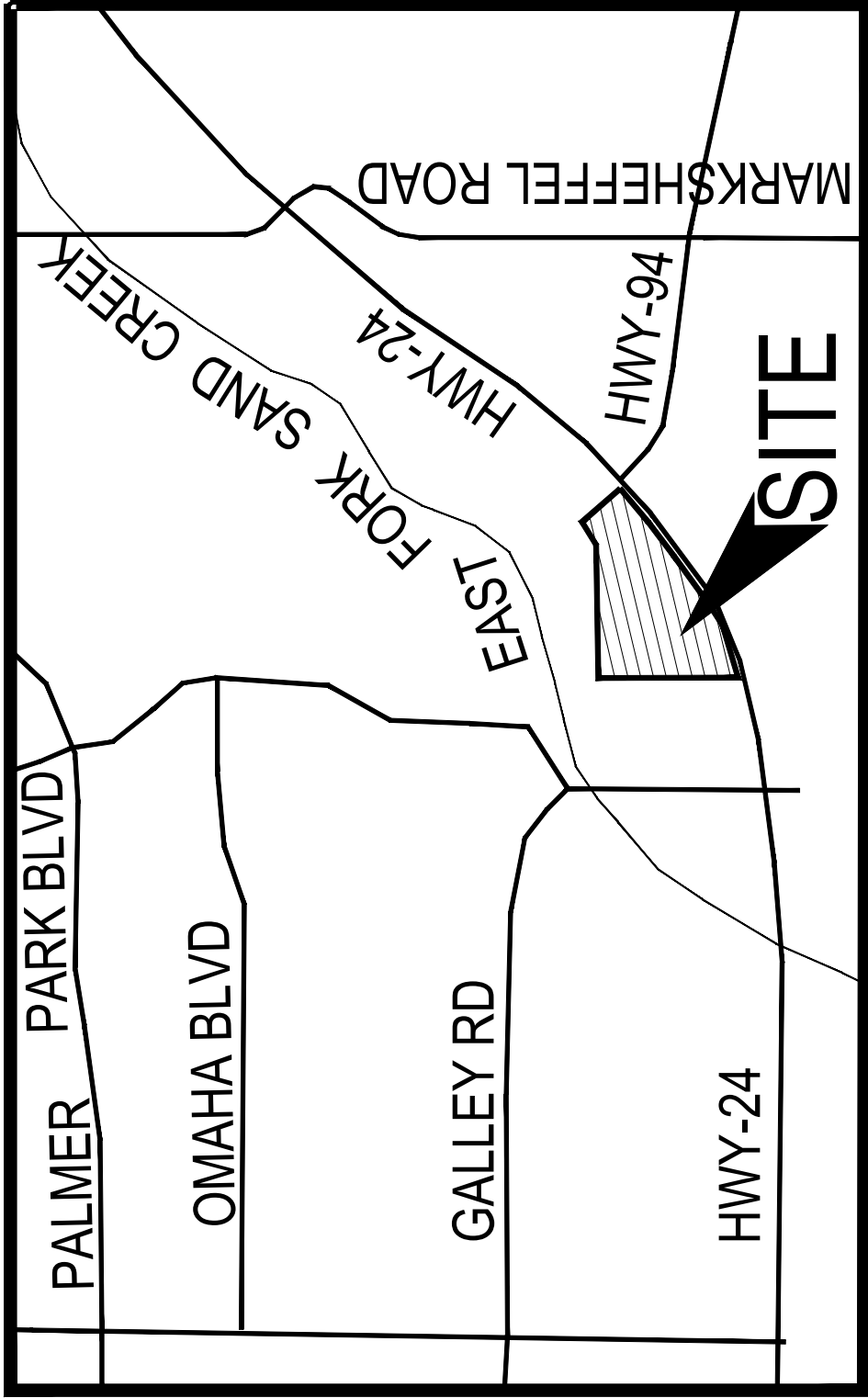
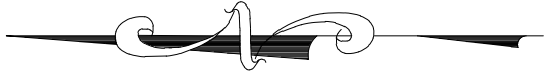
- 1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual".
- 2.) "Urban Storm Drainage Criteria Manual"
- 3.) SCS Soils Map for El Paso County.
- 4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date March 17, 1997.
- 5.) "Final Drainage Report for Claremont Business Park Filing No. 2", dated November 2006, by Matrix Design Group, Inc.

Update the reference to include the drainage reports for the borrow site, sand creek dbps and the adjacent sites (Circle K and Meadowbrook Crossing Subdivision).

Update the drainage report to discuss these previous drainage studies and how it influences and or affect the drainage design for the site. Whether or not this PDR is in conformance with previous studies.

Example: This drainage report's basin D design is not in conformance with the Meadowbrook Crossing Subdivision FDR.

**VICINITY MAP**



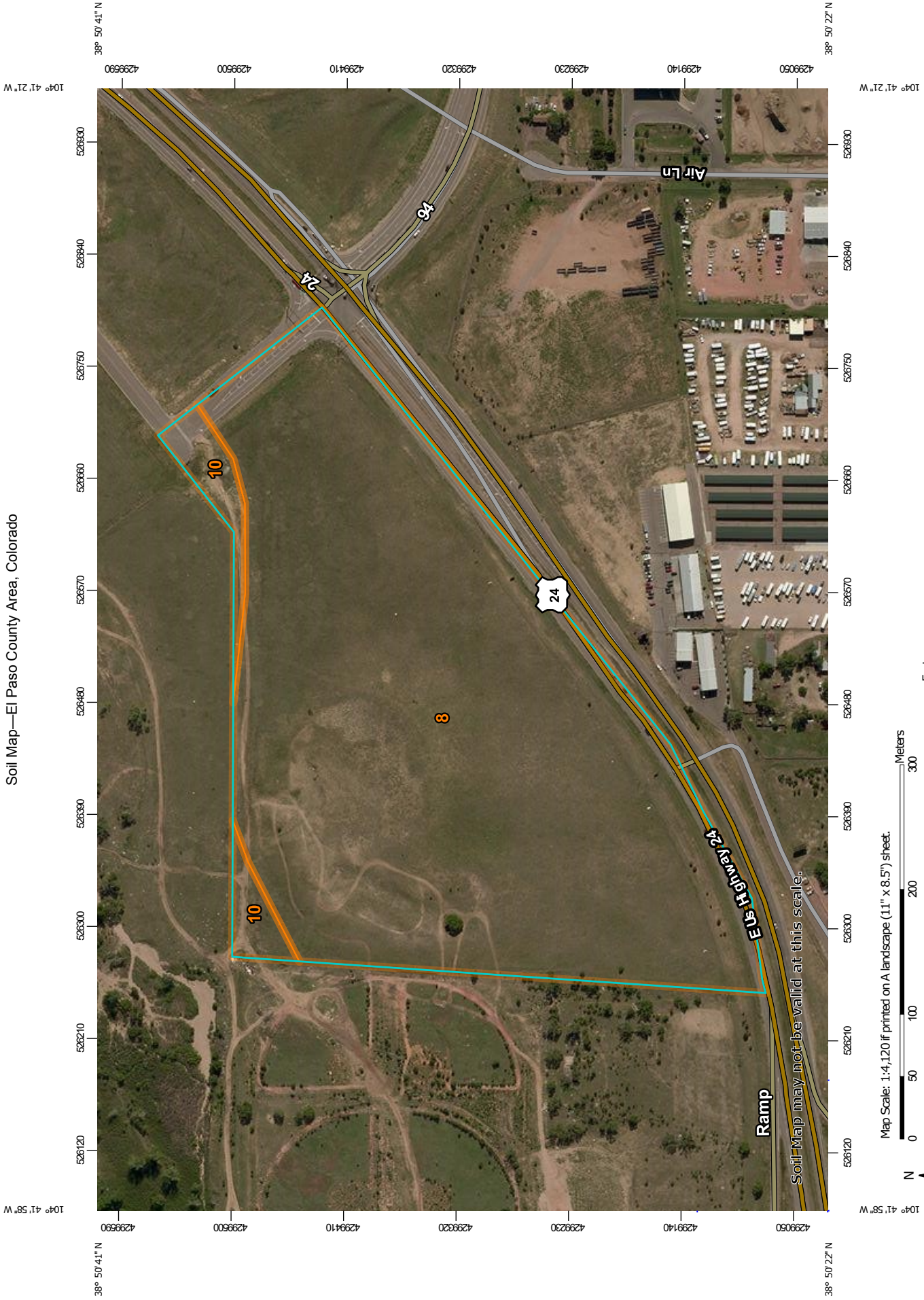
# VICINITY MAP

N.T.S.

**SOILS MAP**



Soil Map—El Paso County Area, Colorado



## MAP LEGEND

- Area of Interest (AOI)
- Area of Interest (AOI)
- Soils**
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points
- Special Point Features**
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features
- Water Features**
- Streams and Canals
- Transportation**
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads
- Background**
- Aerial Photography

## MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: El Paso County Area, Colorado  
 Survey Area Data: Version 15, Oct 10, 2017

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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.

## El Paso County Area, Colorado

### 8—Blakeland loamy sand, 1 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369v

*Elevation:* 4,600 to 5,800 feet

*Mean annual precipitation:* 14 to 16 inches

*Mean annual air temperature:* 46 to 48 degrees F

*Frost-free period:* 125 to 145 days

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Blakeland and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Blakeland

##### Setting

*Landform:* Flats, hills

*Landform position (three-dimensional):* Side slope, talf

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

##### Typical profile

*A - 0 to 11 inches:* loamy sand

*AC - 11 to 27 inches:* loamy sand

*C - 27 to 60 inches:* sand

##### Properties and qualities

*Slope:* 1 to 9 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Somewhat excessively drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum in profile:* 5 percent

*Available water storage in profile:* Low (about 4.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 3e

*Land capability classification (nonirrigated):* 6e

*Hydrologic Soil Group:* A

*Ecological site:* Sandy Foothill (R049BY210CO)

*Hydric soil rating:* No

**FIRM PANEL W/ REVISED LOMR**

Replace the FEMA panel with the latest version which has an effective date of 12/7/2018.  
If the LOMR was incorporated in the latest FEMA FIRM then it does not need to be included.



Follows Conditional Case No.: 17-08-0333R



# Federal Emergency Management Agency

Washington, D.C. 20472

## LETTER OF MAP REVISION DETERMINATION DOCUMENT

| COMMUNITY AND REVISION INFORMATION                |  | PROJECT DESCRIPTION   | BASIS OF REQUEST   |
|---|--|---|--|
| COMMUNITY   | El Paso County<br>Colorado<br>(Unincorporated Areas) | CHANNELIZATION<br>DROP STRUCTURES   | FLOODWAY<br>HYDRAULIC ANALYSIS<br>UPDATED TOPOGRAPHIC DATA |
|   | COMMUNITY NO.: 080059                                |   |  |
| IDENTIFIER  | East Fork Sand Creek LOMR                            | APPROXIMATE LATITUDE AND LONGITUDE: 38.845, -104.695<br>SOURCE: USGS QUADRANGLE DATUM: NAD 83             |  |
| ANNOTATED MAPPING ENCLOSURES                      |  | ANNOTATED STUDY ENCLOSURES  |  |
| TYPE: FIRM* NO.: 08041C0752F DATE: March 17, 1997 |  | DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999<br>PROFILE: 211P, 212P<br>FLOODWAY DATA TABLE: 5 |  |

Enclosures reflect changes to flooding sources affected by this revision.

\* FIRM - Flood Insurance Rate Map

### FLOODING SOURCE AND REVISED REACH

Sand Creek East Fork - from approximately 820 feet to approximately 2,990 feet upstream of Peterson Boulevard

### SUMMARY OF REVISIONS

| Flooding Source      | Effective Flooding | Revised Flooding | Increases | Decreases |
|----------------------|--------------------|------------------|-----------|-----------|
| Sand Creek East Fork | Floodway           | Floodway         | YES       | YES       |
|                      | BFEs*              | BFEs             | YES       | YES       |
|                      | Zone AE            | Zone AE          | YES       | YES       |
|                      | Zone X (unshaded)  | Zone X (shaded)  | YES       | NONE      |

\* BFEs - Base Flood Elevations

### DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on our website at <https://www.fema.gov/national-flood-insurance-program>.

Patrick "Rick" F. Sacbbit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration



# Federal Emergency Management Agency

Washington, D.C. 20472

## LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

### COMMUNITY INFORMATION

#### APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

#### COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on our website at <https://www.fema.gov/national-flood-insurance-program>.

A handwritten signature in black ink, appearing to read "Rick F. Sacbbit".

Patrick "Rick" F. Sacbbit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration



# Federal Emergency Management Agency

Washington, D.C. 20472

## LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson  
Director, Mitigation Division  
Federal Emergency Management Agency, Region VIII  
Denver Federal Center, Building 710  
P.O. Box 25267  
Denver, CO 80225-0267  
(303) 235-4830

### STATUS OF THE COMMUNITY NFIP MAPS

We are processing a revised FIRM and FIS report for El Paso County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which present information from the effective FIRMs and FIS reports for your community and incorporated communities in El Paso County, were submitted to your community for review on November 22, 2017. We will incorporate the modifications made by this LOMR into the countywide FIRM and FIS report before they become effective.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on our website at <https://www.fema.gov/national-flood-insurance-program>.

A handwritten signature in black ink, appearing to read "Rick F. Sacbbit".

Patrick "Rick" F. Sacbbit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency  
Washington, D.C. 20472

**LETTER OF MAP REVISION  
DETERMINATION DOCUMENT (CONTINUED)**

**PUBLIC NOTIFICATION OF REVISION**

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below, and through FEMA's Flood Hazard Mapping website at [https://www.floodmaps.fema.gov/fhm/bfe\\_status/bfe\\_main.asp](https://www.floodmaps.fema.gov/fhm/bfe_status/bfe_main.asp)

LOCAL NEWSPAPER

Name: *Colorado Springs Gazette*

Dates: March 30, 2018 and April 6, 2018

Within 90 days of the second publication in the local newspaper, any interested party may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on our website at <https://www.fema.gov/national-flood-insurance-program>.

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Patrick "Rick" F. Sacbbit, P.E., Branch Chief  
Engineering Services Branch  
Federal Insurance and Mitigation Administration



| FLOODING SOURCE             |                       | FLOODWAY     |                            |                                 | BASE FLOOD WATER SURFACE ELEVATION |                       |                      |          |
|-----------------------------|-----------------------|--------------|----------------------------|---------------------------------|------------------------------------|-----------------------|----------------------|----------|
| CROSS SECTION               | DISTANCE <sup>1</sup> | WIDTH (FEET) | SECTION AREA (SQUARE FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY                         | WITHOUT FLOODWAY FEET | WITH FLOODWAY (NGVD) | INCREASE |
| <b>Sand Creek East Fork</b> |                       |              |                            |                                 |                                    |                       |                      |          |
| A                           | 1,100                 | 100          | 455                        | 11.9                            | 6,038.7                            | 6,038.7               | 6,038.7              | 0.0      |
| B                           | 2,400                 | 100          | 446                        | 12.2                            | 6,054.3                            | 6,054.3               | 6,054.3              | 0.0      |
| C                           | 3,330                 | 100          | 450                        | 12.0                            | 6,069.9                            | 6,069.9               | 6,069.9              | 0.0      |
| D                           | 4,240                 | 100          | 449                        | 12.1                            | 6,085.1                            | 6,085.1               | 6,085.1              | 0.0      |
| E                           | 4,870                 | 102          | 446                        | 12.0                            | 6,095.1                            | 6,095.1               | 6,095.1              | 0.0      |
| F                           | 6,188                 | 70           | 489                        | 10.9                            | 6,118.5                            | 6,118.5               | 6,118.5              | 0.0      |
| G                           | 7,403                 | 71           | 396                        | 13.5                            | 6,136.0                            | 6,136.0               | 6,136.0              | 0.0      |
| H                           | 7,931                 | 148          | 507                        | 10.5                            | 6,158.8                            | 6,158.8               | 6,158.8              | 0.0      |
| I                           | 8,943                 | 98           | 444                        | 12.0                            | 6,169.0                            | 6,169.0               | 6,169.0              | 0.0      |
| J                           | 9,666                 | 86           | 423                        | 12.6                            | 6,177.0                            | 6,177.0               | 6,177.0              | 0.0      |
| K                           | 10,721                | 81           | 415                        | 12.8                            | 6,193.3                            | 6,193.3               | 6,193.3              | 0.0      |
| L                           | 11,347                | 166          | 526                        | 10.1                            | 6,207.3                            | 6,207.3               | 6,207.3              | 0.0      |
| M                           | 11,375                | 173          | 632                        | 8.4                             | 6,207.9                            | 6,207.9               | 6,207.9              | 0.0      |
| N                           | 12,610                | 367          | 699                        | 7.6                             | 6,228.8                            | 6,228.8               | 6,228.8              | 0.1      |
| O                           | 13,720                | 188          | 570                        | 10.0                            | 6,241.7                            | 6,241.7               | 6,241.7              | 0.0      |
| P                           | 14,805                | 125          | 479                        | 11.1                            | 6,257.9                            | 6,257.9               | 6,257.9              | 0.0      |
| Q                           | 14,885                | 125          | 601                        | 8.9                             | 6,259.9                            | 6,259.9               | 6,259.9              | 1.0      |
| R                           | 15,850                | 228          | 582                        | 9.2                             | 6,268.7                            | 6,268.7               | 6,268.7              | 0.0      |
| S                           | 16,325                | 300          | 678                        | 7.9                             | 6,277.3                            | 6,277.3               | 6,277.5              | 0.2      |
| T                           | 16,995                | 321          | 690                        | 7.7                             | 6,291.4                            | 6,291.4               | 6,292.0              | 0.6      |
| U                           | 17,065                | 326          | 667                        | 8.0                             | 6,291.4                            | 6,291.4               | 6,292.1              | 0.7      |
| V                           | 17,915                | 388          | 1,601                      | 3.3                             | 6,293.4                            | 6,293.4               | 6,294.0              | 0.6      |
| W                           | 19,110                | 158          | 697                        | 7.7                             | 6,309.5                            | 6,309.5               | 6,309.5              | 0.0      |
| X                           | 20,730                | 103          | 575                        | 11.7                            | 6,327.8                            | 6,327.8               | 6,328.4              | 0.6      |
| Y                           | 22,560                | 142          | 506                        | 11.0                            | 6,348.8                            | 6,348.8               | 6,349.4              | 0.6      |
| Z                           | 23,060                | 145          | 503                        | 11.0                            | 6,358.0                            | 6,358.0               | 6,358.0              | 0.0      |
| AA                          | 24,835                | 418          | 3,156                      | 7.0                             | 6,383.5                            | 6,383.5               | 6,383.5              | 0.0      |
| AB                          | 26,470                | 132          | 452                        | 10.0                            | 6,402.7                            | 6,402.7               | 6,402.7              | 0.0      |
| AC                          | 27,715                | 112          | 419                        | 10.8                            | 6,416.6                            | 6,416.6               | 6,416.6              | 0.0      |

REVISED BY LOMR DATED MAY 23, 2007

REVISED BY LOMR DATED OCTOBER 07, 2004

REVISED DATA

REVISED BY LOMR DATED DECEMBER 13, 2006

<sup>1</sup> Feet Above Confluence with Sand Creek

REVISED BY LOMR DATED OCTOBER 30, 2006

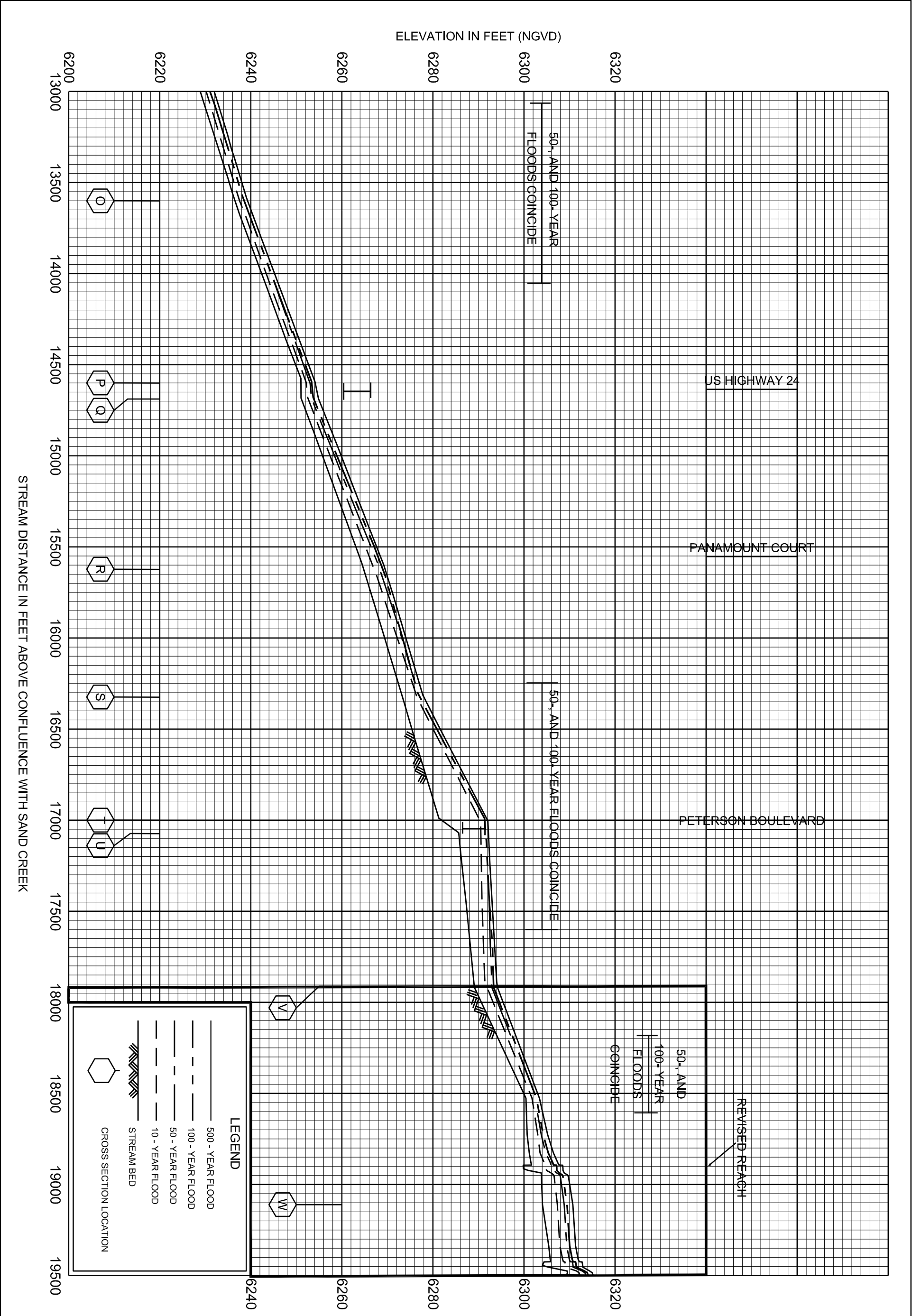
REVISED TO REFLECT LOMR EFFECTIVE: August 6, 2018

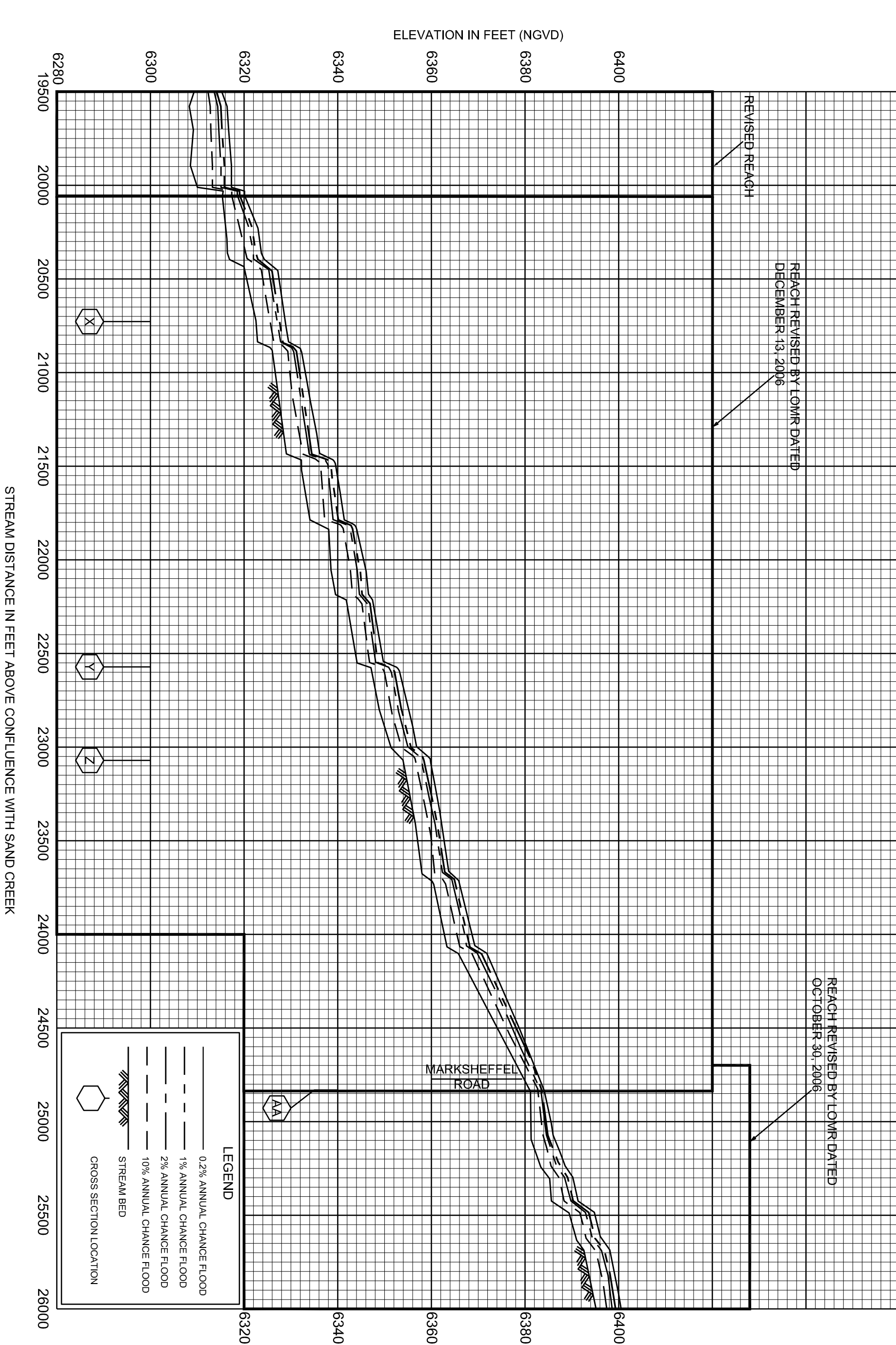
T  
A  
B  
L  
E  
  
5

FEDERAL EMERGENCY MANAGEMENT AGENCY  
EL PASO COUNTY, CO  
AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK EAST FORK





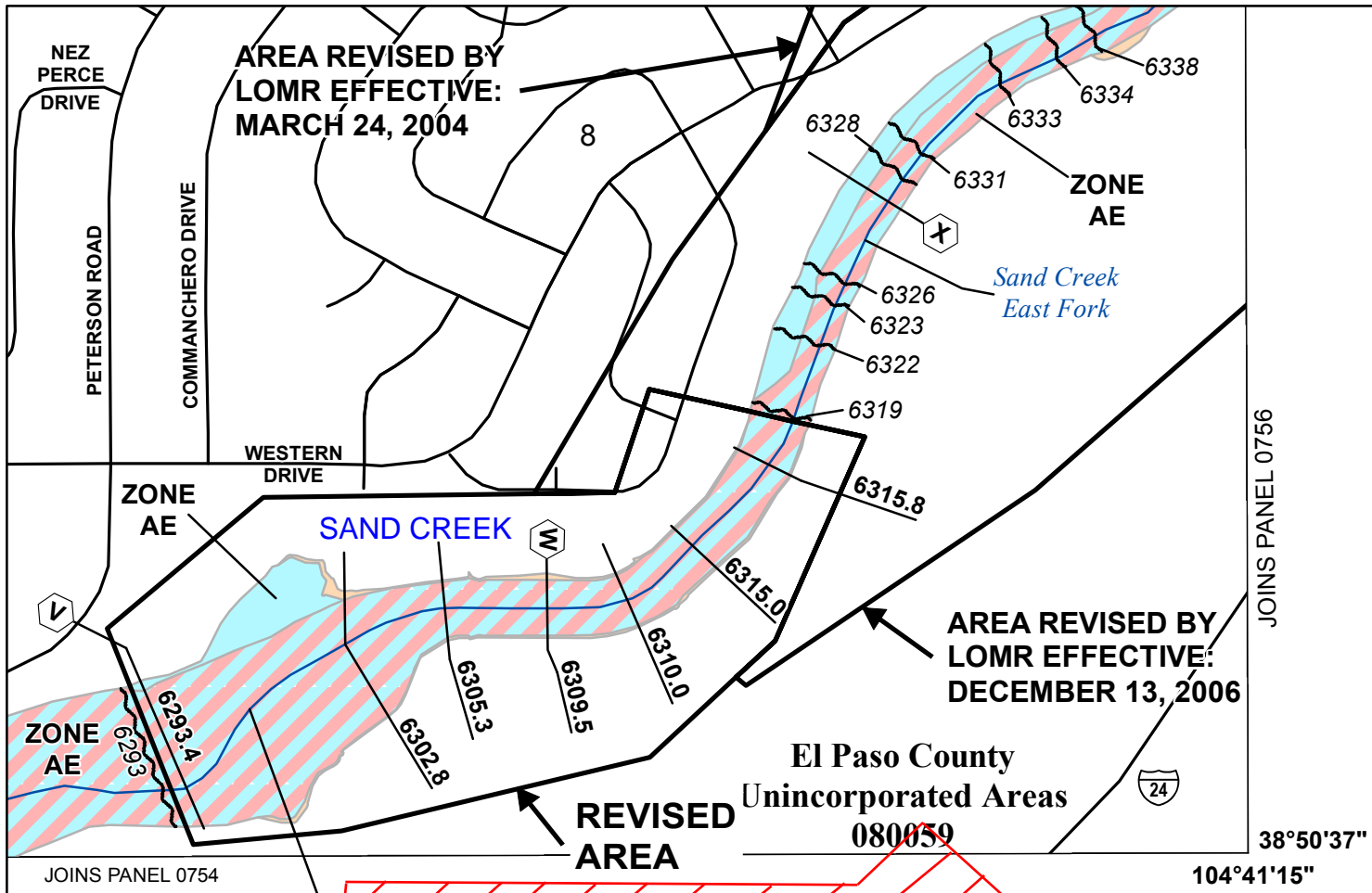
FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO  
AND INCORPORATED AREAS

FLOOD PROFILES

REVISED TO  
REFLECT LOMR  
EFFECTIVE: August 6, 2018

SAND CREEK EAST FORK



AREA REVISED BY LOMR EFFECTIVE: MARCH 24, 2004

AREA REVISED BY LOMR EFFECTIVE: DECEMBER 13, 2006

El Paso County  
Unincorporated Areas  
080059

PROJECT SITE

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 A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**

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

**SCALE**

Map Projection:  
Universal Transverse MercatorNAD 1983 UTM Zone 13N  
Western Hemisphere; Vertical Datum: NGVD 29

1 inch = 500 feet      1:6,000

0 250 500 1,000 Feet

0 62.5 125 250 Meters

**FEMA**  
National Flood Insurance Program

**NATIONAL FLOOD INSURANCE PROGRAM  
FLOOD INSURANCE RATE MAP**

EL PASO COUNTY, COLORADO  
and Incorporated Areas

PANEL 752 OF 1300

Panel Contains:

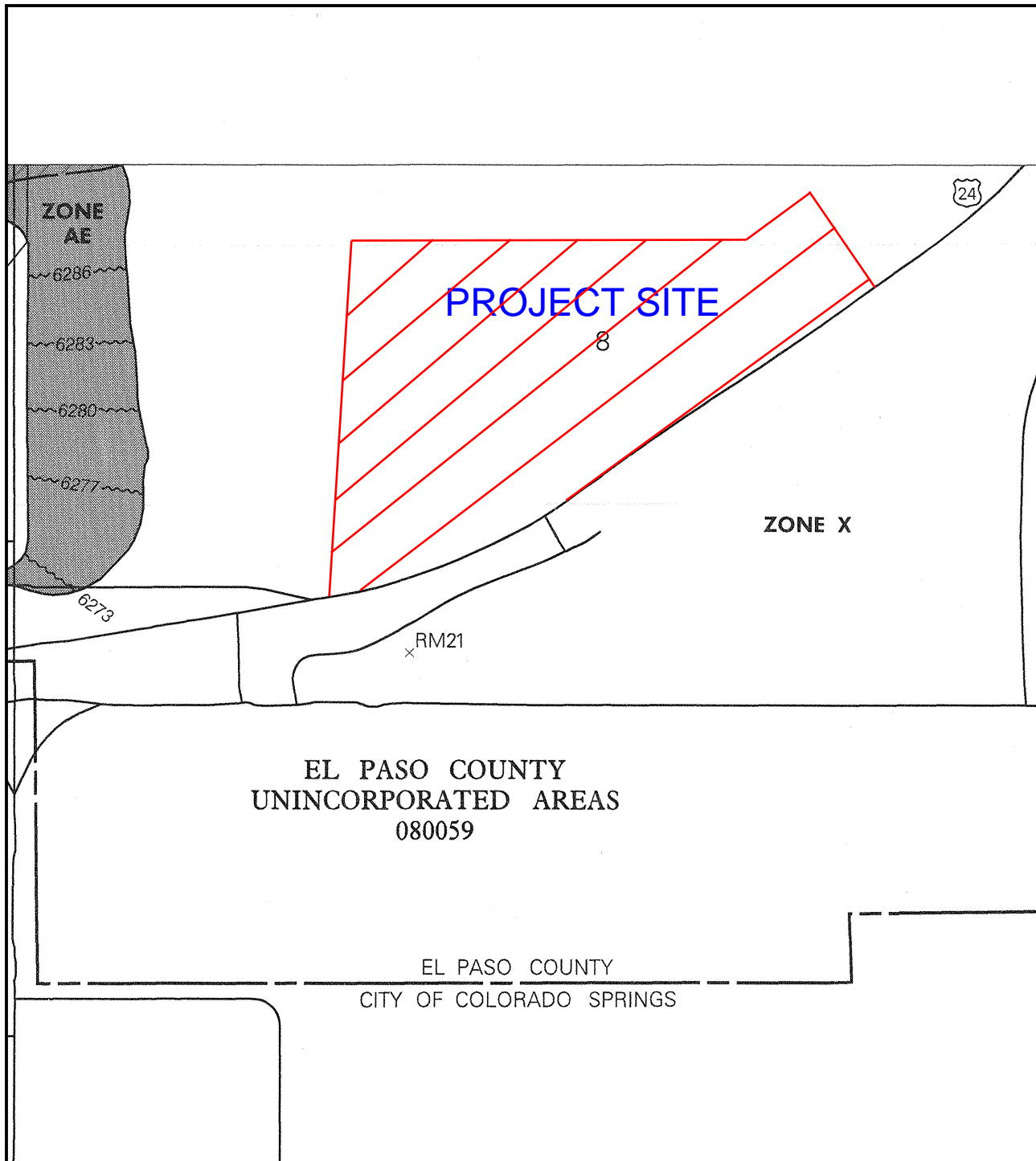
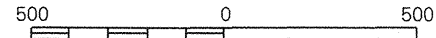
| COMMUNITY                            | NUMBER | PANEL | SUFFIX |
|--------------------------------------|--------|-------|--------|
| COLORADO SPRINGS, CITY OF            | 080060 | 0752  | F      |
| EL PASO COUNTY, UNINCORPORATED AREAS | 080059 | 0752  | F      |

**REVISED TO REFLECT LOMR EFFECTIVE: August 6, 2018**

MAP NUMBER  
08041C0752 F  
EFFECTIVE DATE  
MARCH 17, 1997



APPROXIMATE SCALE IN FEET



**NATIONAL FLOOD INSURANCE PROGRAM**

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

**PANEL 754 OF 1300**  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

| CONTAINS:<br>COMMUNITY                  | NUMBER | PANEL | SUFFIX |
|---|--------|-------|--------|
| COLORADO SPRINGS, CITY OF               | 080060 | 0754  | F      |
| EL PASO COUNTY,<br>UNINCORPORATED AREAS | 080059 | 0754  | F      |

**MAP NUMBER**  
**08041C0754 F**

**EFFECTIVE DATE:**  
**MARCH 17, 1997**



Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)



# Federal Emergency Management Agency

Washington, D.C. 20472

JAN 30 2007

CERTIFIED MAIL  
RETURN RECEIPT REQUESTED

The Honorable Lionel Rivera  
Mayor, City of Colorado Springs  
P.O. Box 1575  
Colorado Springs, CO 80901

IN REPLY REFER TO:

Case No.: 05-08-0368P  
Community Name: City of Colorado Springs, CO  
Community No.: 080060  
Effective Date of **MAY 23 2007**  
This Revision:

Dear Mayor Rivera:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Sincerely,

Patrick, F. Sacibit, P.E., CFM, Project Engineer .  
Engineering Management Section  
Mitigation Division

For: William R. Blanton Jr., CFM, Chief  
Engineering Management Section  
Mitigation Division

List of Enclosures:

Letter of Map Revision Determination Document  
Annotated Flood Insurance Rate Map  
Annotated Flood Insurance Study Report

cc: The Honorable Sallie Clark  
Chair, El Paso County  
Board of Commissioners

Regional Floodplain Administrator  
Pikes Peak Regional Building Department

J. F. Sato and Associates, Inc.

Engineering and Surveying, Inc.



**Federal Emergency Management Agency**  
Washington, D.C. 20472

**LETTER OF MAP REVISION  
DETERMINATION DOCUMENT**

| COMMUNITY AND REVISION INFORMATION  |  | PROJECT DESCRIPTION  | BASIS OF REQUEST  |
|---|--|--|---|
| COMMUNITY   | City of Colorado Springs<br>El Paso County<br>Colorado | CHANNELIZATION<br>CULVERT  | FLOODWAY<br>HYDRAULIC ANALYSIS<br>NEW TOPOGRAPHIC DATA<br>BASEMAP CHANGES |
|   | COMMUNITY NO.: 080060                                  |  |   |
| IDENTIFIER  | Sand Creek Center Tributary and East Fork LOMR         | APPROXIMATE LATITUDE & LONGITUDE: 38.830, -104.720<br>SOURCE: USGS QUADRANGLE      DATUM: NAD 27                             |   |
| ANNOTATED MAPPING ENCLOSURES  |  | ANNOTATED STUDY ENCLOSURES   |   |
| TYPE: FIRM*      NO.: 08041C0753 F      DATE: March 17, 1997<br>TYPE: FIRM      NO.: 08041C0754 F      DATE: March 17, 1997 |  | DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999<br>PROFILE(S): 205P, 206P, 209P, and 210P<br>FLOODWAY DATA TABLE: 5 |   |

Enclosures reflect changes to flooding sources affected by this revision.

\* FIRM - Flood Insurance Rate Map; \*\* FBFM - Flood Boundary and Floodway Map; \*\*\* FHBM - Flood Hazard Boundary Map

**FLOODING SOURCE(S) & REVISED REACH(ES)**

See Page 2 for Additional Flooding Sources

Sand Creek Center Tributary – from just upstream of Airport Road to approximately 1,350 feet upstream of East Frontage Road

**SUMMARY OF REVISIONS**

| Flooding Source             | Effective Flooding | Revised Flooding | Increases | Decreases |
|-----------------------------|--------------------|------------------|-----------|-----------|
| Sand Creek Center Tributary | Zone AE            | Zone AE          | YES       | YES       |
|                             | Floodway           | Floodway         | YES       | YES       |
|                             | BFEs*              | BFEs             | YES       | YES       |
|                             | Zone X (shaded)    | Zone X (shaded)  | YES       | YES       |

\* BFEs - Base Flood Elevations

**DETERMINATION**

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Patrick F. Sacbbit, P.E., CFM, Project Engineer  
Engineering Management Section  
Mitigation Division



Federal Emergency Management Agency  
Washington, D.C. 20472

**LETTER OF MAP REVISION  
DETERMINATION DOCUMENT (CONTINUED)**

**OTHER FLOODING SOURCES AFFECTED BY THIS REVISION**

**FLOODING SOURCE(S) & REVISED REACH(ES)**

Sand Creek East Fork – from approximately 970 feet downstream of Powers Boulevard to just downstream of Stewart Avenue

**SUMMARY OF REVISIONS**

| <b>Flooding Source</b> | <b>Effective Flooding</b> | <b>Revised Flooding</b> | <b>Increases</b> | <b>Decreases</b> |
|------------------------|---------------------------|-------------------------|------------------|------------------|
| Sand Creek East Fork   | Zone AE                   | Zone AE                 | YES              | YES              |
|                        | Floodway                  | Floodway                | YES              | YES              |
|                        | BFEs*                     | BFEs                    | YES              | YES              |
|                        | Zone X (shaded)           | Zone X (shaded)         | YES              | YES              |

\* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Patrick F. Sacbibit, P.E., CFM, Project Engineer  
Engineering Management Section  
Mitigation Division





Federal Emergency Management Agency  
Washington, D.C. 20472

**LETTER OF MAP REVISION  
DETERMINATION DOCUMENT (CONTINUED)**

**OTHER COMMUNITIES AFFECTED BY THIS REVISION**

**CID Number:** 080059      **Name:** El Paso County, Colorado

**AFFECTED MAP PANELS**

|            |                   |                      |
|------------|-------------------|----------------------|
| TYPE: FIRM | NO.: 08041C0752 F | DATE: March 17, 1997 |
| TYPE: FIRM | NO.: 08041C0753 F | DATE: March 17, 1997 |
| TYPE: FIRM | NO.: 08041C0754 F | DATE: March 17, 1997 |

**AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT**

DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999  
PROFILE(S): 206P  
FLOODWAY DATA TABLE: 5

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Patrick F. Sacbibit, P.E., CFM, Project Engineer  
Engineering Management Section  
Mitigation Division



# Federal Emergency Management Agency

Washington, D.C. 20472

## LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

### COMMUNITY INFORMATION

#### APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

#### COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

A handwritten signature in black ink, appearing to read "P. Sacbibit".

Patrick F. Sacbibit, P.E., CFM, Project Engineer  
Engineering Management Section  
Mitigation Division



# Federal Emergency Management Agency

Washington, D.C. 20472

## LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson  
Director, Federal Insurance and Mitigation Division  
Federal Emergency Management Agency, Region VIII  
Denver Federal Center, Building 710  
P.O. Box 25267  
Denver, CO 80225-0267  
(303) 235-4830

### STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

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Patrick F. Sacbibit, P.E., CFM, Project Engineer  
Engineering Management Section  
Mitigation Division



# Federal Emergency Management Agency

Washington, D.C. 20472

## LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

### PUBLIC NOTIFICATION OF REVISION

#### PUBLIC NOTIFICATION

| FLOODING SOURCE             | LOCATION OF REFERENCED ELEVATION                        | BFE (FEET NGVD 29) |         | MAP PANEL NUMBER(S) |
|-----------------------------|---|--------------------|---------|---------------------|
|                             |   | EFFECTIVE          | REVISED |                     |
| Sand Creek Center Tributary | Approximately 150 feet upstream of Airport Road         | 6,109              | 6,108   | 08041C0753 F        |
|                             | Approximately 1,250 feet upstream of East Frontage Road | 6,168              | 6,164   | 08041C0753 F        |
| Sand Creek East Fork        | Approximately 810 feet downstream of Powers Boulevard   | 6,099              | 6,096   | 08041C0753 F        |
|                             | Approximately 140 feet downstream of Stewart Avenue     | 6,206              | 6,205   | 08041C0754 F        |

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below.

LOCAL NEWSPAPER      Name: *El Paso County News*  
    Dates: 02/14/2007                      02/21/2007

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at <http://www.fema.gov/nfip>.

Patrick F. Sacbibit, P.E., CFM, Project Engineer  
 Engineering Management Section  
 Mitigation Division

| FLOODING SOURCE      |                       | FLOODWAY     |                         |                                 | BASE FLOOD WATER SURFACE ELEVATION |                  |               | INCREASE |
|----------------------|-----------------------|--------------|-------------------------|---------------------------------|------------------------------------|------------------|---------------|----------|
| CROSS SECTION        | DISTANCE <sup>1</sup> | WIDTH (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY                         | WITHOUT FLOODWAY | WITH FLOODWAY |          |
|                      |                       |              |                         |                                 |                                    | FEET             | (NGVD)        |          |
| Sand Creek East Fork |                       |              |                         |                                 |                                    |                  |               |          |
| A                    | 1,100                 | 100          | 455                     | 11.9                            | 6,038.7                            | 6,038.7          | 6,038.7       | 0.0      |
| B                    | 2,400                 | 100          | 446                     | 12.2                            | 6,054.3                            | 6,054.3          | 6,054.3       | 0.0      |
| C                    | 3,330                 | 100          | 450                     | 12.0                            | 6,069.9                            | 6,069.9          | 6,069.9       | 0.0      |
| D                    | 4,240                 | 100          | 449                     | 12.1                            | 6,085.1                            | 6,085.1          | 6,085.1       | 0.0      |
| E                    | 4,870                 | 102          | 446                     | 12.0                            | 6,095.1                            | 6,095.1          | 6,095.1       | 0.0      |
| F                    | 6,188                 | 70           | 489                     | 10.9                            | 6,118.5                            | 6,118.5          | 6,118.5       | 0.0      |
| G                    | 7,403                 | 71           | 396                     | 13.5                            | 6,136.0                            | 6,136.0          | 6,136.0       | 0.0      |
| H                    | 7,931                 | 148          | 507                     | 10.5                            | 6,158.8                            | 6,158.8          | 6,158.8       | 0.0      |
| I                    | 8,943                 | 98           | 444                     | 12.0                            | 6,169.0                            | 6,169.0          | 6,169.0       | 0.0      |
| J                    | 9,666                 | 86           | 423                     | 12.6                            | 6,177.0                            | 6,177.0          | 6,177.0       | 0.0      |
| K                    | 10,721                | 81           | 415                     | 12.8                            | 6,193.3                            | 6,193.3          | 6,193.3       | 0.0      |
| L                    | 11,347                | 166          | 526                     | 10.1                            | 6,207.3                            | 6,207.3          | 6,207.3       | 0.0      |
| M                    | 11,375                | 173          | 632                     | 8.4                             | 6,207.9                            | 6,207.9          | 6,207.9       | 0.0      |
| N                    | 12,610                | 367          | 699                     | 7.6                             | 6,228.8                            | 6,228.8          | 6,228.9       | 0.1      |
| O                    | 13,720                | 188          | 570                     | 10.0                            | 6,241.7                            | 6,241.7          | 6,241.7       | 0.0      |
| P                    | 14,805                | 125          | 479                     | 11.1                            | 6,257.9                            | 6,257.9          | 6,257.9       | 0.0      |
| Q                    | 14,885                | 125          | 601                     | 8.9                             | 6,259.9                            | 6,259.9          | 6,259.9       | 1.0      |
| R                    | 15,850                | 228          | 582                     | 9.2                             | 6,268.7                            | 6,268.7          | 6,268.7       | 0.0      |
| S                    | 16,325                | 300          | 678                     | 7.9                             | 6,277.3                            | 6,277.3          | 6,277.5       | 0.2      |
| T                    | 16,995                | 321          | 690                     | 7.7                             | 6,291.4                            | 6,291.4          | 6,292.0       | 0.6      |
| U                    | 17,065                | 326          | 667                     | 8.0                             | 6,291.4                            | 6,291.4          | 6,292.1       | 0.7      |
| V                    | 17,915                | 388          | 1,598                   | 3.3                             | 6,293.4                            | 6,293.4          | 6,294.0       | 0.6      |
| W                    | 18,995                | 367          | 683                     | 7.8                             | 6,307.2                            | 6,307.2          | 6,307.6       | 0.4      |
| X                    | 20,525                | 413          | 706                     | 7.5                             | 6,326.4                            | 6,326.4          | 6,327.1       | 0.7      |
| Y                    | 22,125                | 255          | 620                     | 8.6                             | 6,348.7                            | 6,348.7          | 6,348.8       | 0.1      |
| Z                    | 23,105                | 397          | 706                     | 7.6                             | 6,359.9                            | 6,359.9          | 6,359.9       | 0.0      |
| AA                   | 24,835                | 431          | 705                     | 7.4                             | 6,383.7                            | 6,383.7          | 6,383.7       | 0.0      |
| AB                   | 26,505                | 353          | 667                     | 7.8                             | 6,401.0                            | 6,401.0          | 6,401.5       | 0.5      |

Revised Data

Revised by LOMR dated OCT 07 2004

<sup>1</sup> Feet above confluence with Sand Creek

FLOODWAY DATA

FEDERAL EMERGENCY MANAGEMENT AGENCY  
**EL PASO COUNTY, CO**  
 AND INCORPORATED AREAS

SAND CREEK EAST FORK

MAY 29 2007

TABLE 5

| FLOODING SOURCE             |                       | FLOODWAY     |                         |                                 | BASE FLOOD WATER SURFACE ELEVATION |                  |               | INCREASE |
|-----------------------------|-----------------------|--------------|-------------------------|---------------------------------|------------------------------------|------------------|---------------|----------|
| CROSS SECTION               | DISTANCE <sup>1</sup> | WIDTH (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET PER SECOND) | REGULATORY                         | WITHOUT FLOODWAY | WITH FLOODWAY |          |
| Sand Creek Center Tributary | 940                   | 40           | 92                      | Revised Data<br>8.6             | 6,106.5                            | 6,106.5          | 6,106.5       | 0.0      |
| A                           | 990                   | 40           | 118                     | 6.7                             | 6,107.2                            | 6,107.2          | 6,107.2       | 0.0      |
| B                           | 2,238                 | 91           | 120                     | 6.6                             | 6,120.2                            | 6,120.2          | 6,120.2       | 0.0      |
| C                           | 3,948                 | 46           | 95                      | 8.0                             | 6,138.3                            | 6,138.3          | 6,138.3       | 0.0      |
| D                           | 4,547                 | 170          | 159                     | 4.8                             | 6,147.4                            | 6,147.4          | 6,147.4       | 0.0      |
| E                           | 5,539                 | 52           | 97                      | 7.8                             | 6,156.8                            | 6,156.8          | 6,156.8       | 0.0      |
| F                           | 7,191                 | 63           | 104                     | 7.3                             | 6,176.2                            | 6,176.2          | 6,176.2       | 0.0      |
| G                           | 7,940                 | 52           | 98                      | 7.8                             | 6,189.6                            | 6,189.6          | 6,189.6       | 0.0      |
| H                           | 8,527                 | 40           | 67                      | 5.7                             | 6,197.6                            | 6,197.6          | 6,197.6       | 0.0      |
| I                           | 9,366                 | 17           | 42                      | 9.0                             | 6,213.4                            | 6,213.4          | 6,213.4       | 0.0      |
| J                           | 10,055                | 232          | 278                     | 4.0                             | 6,221.9                            | 6,221.9          | 6,221.9       | 0.0      |
| K                           | 10,627                | 539          | 469                     | 2.4                             | 6,230.6                            | 6,230.6          | 6,230.6       | 0.0      |
| L                           | 11,321                | 31           | 79                      | 9.1                             | 6,241.1                            | 6,241.1          | 6,241.1       | 0.0      |
| M                           | 11,648                | 60           | 99                      | 7.3                             | 6,244.6                            | 6,244.6          | 6,245.4       | 0.8      |
| N                           | 12,840                | 29           | 85                      | 9.6                             | 6,253.8                            | 6,253.8          | 6,253.8       | 0.0      |
| O                           | 13,730                | 27           | 83                      | 9.9                             | 6,273.6                            | 6,273.6          | 6,273.6       | 0.0      |
| P                           | 14,592                | 26           | 68                      | 9.3                             | 6,299.7                            | 6,299.7          | 6,299.7       | 0.0      |
| Q                           | 14,670                | 40           | 61                      | 6.9                             | 6,304.2                            | 6,304.2          | 6,305.2       | 1.0      |
| R                           | 15,050                | 20           | 63                      | 10.1                            | 6,307.6                            | 6,307.6          | 6,308.1       | 0.5      |
| S                           | 15,460                | 25           | 68                      | 9.5                             | 6,310.8                            | 6,310.8          | 6,311.4       | 0.6      |
| T                           | 15,750                | 20           | 41                      | 7.8                             | 6,319.6                            | 6,319.6          | 6,319.6       | 0.0      |
| U                           | 16,670                | 20           | 39                      | 8.1                             | 6,346.0                            | 6,346.0          | 6,346.0       | 0.0      |
| V                           |                       |              |                         |                                 |                                    |                  |               |          |

<sup>1</sup> Feet Above confluence with Sand Creek East Fork

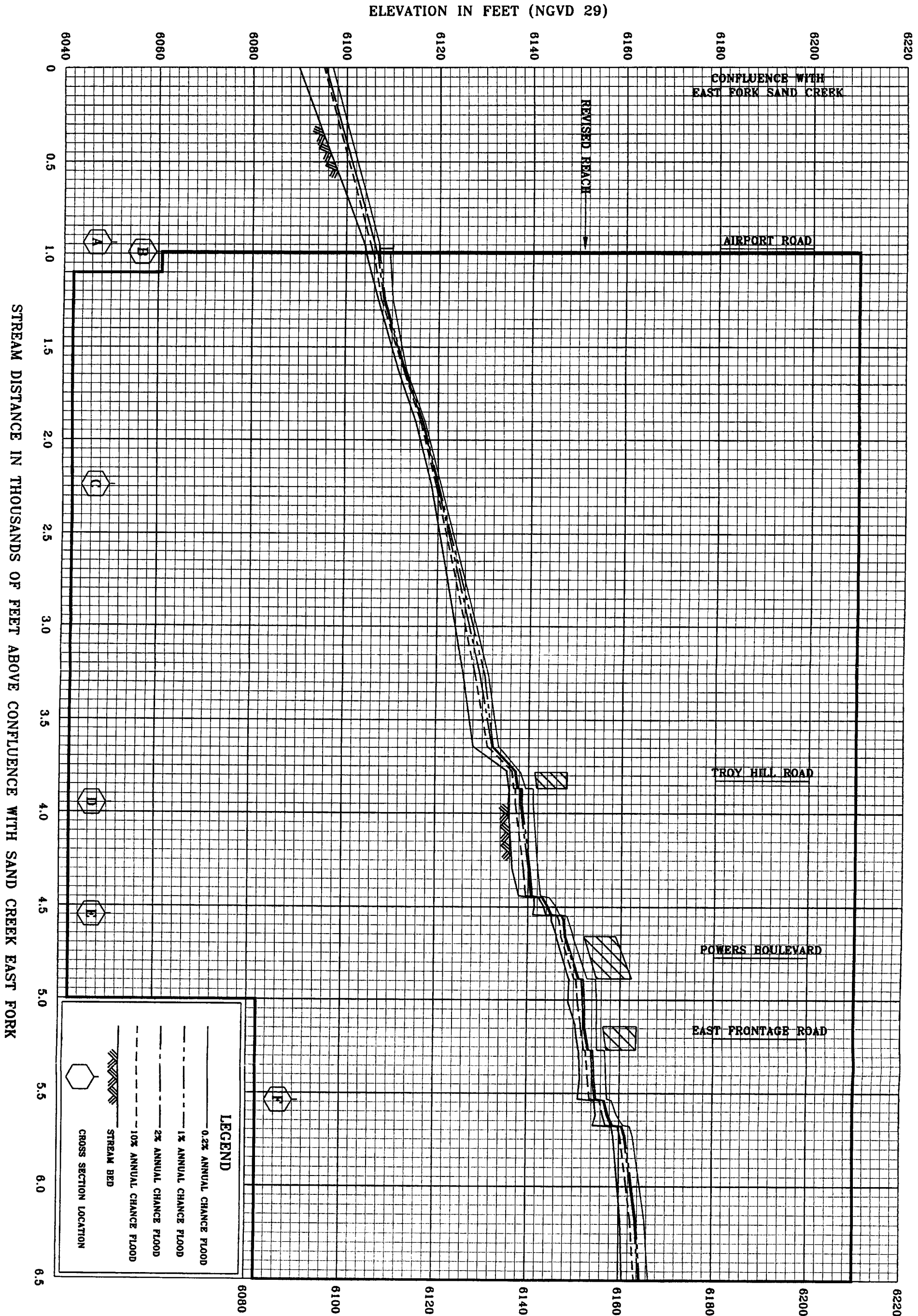
FEDERAL EMERGENCY MANAGEMENT AGENCY  
**EL PASO COUNTY, CO**  
 AND INCORPORATED AREAS

FLOODWAY DATA

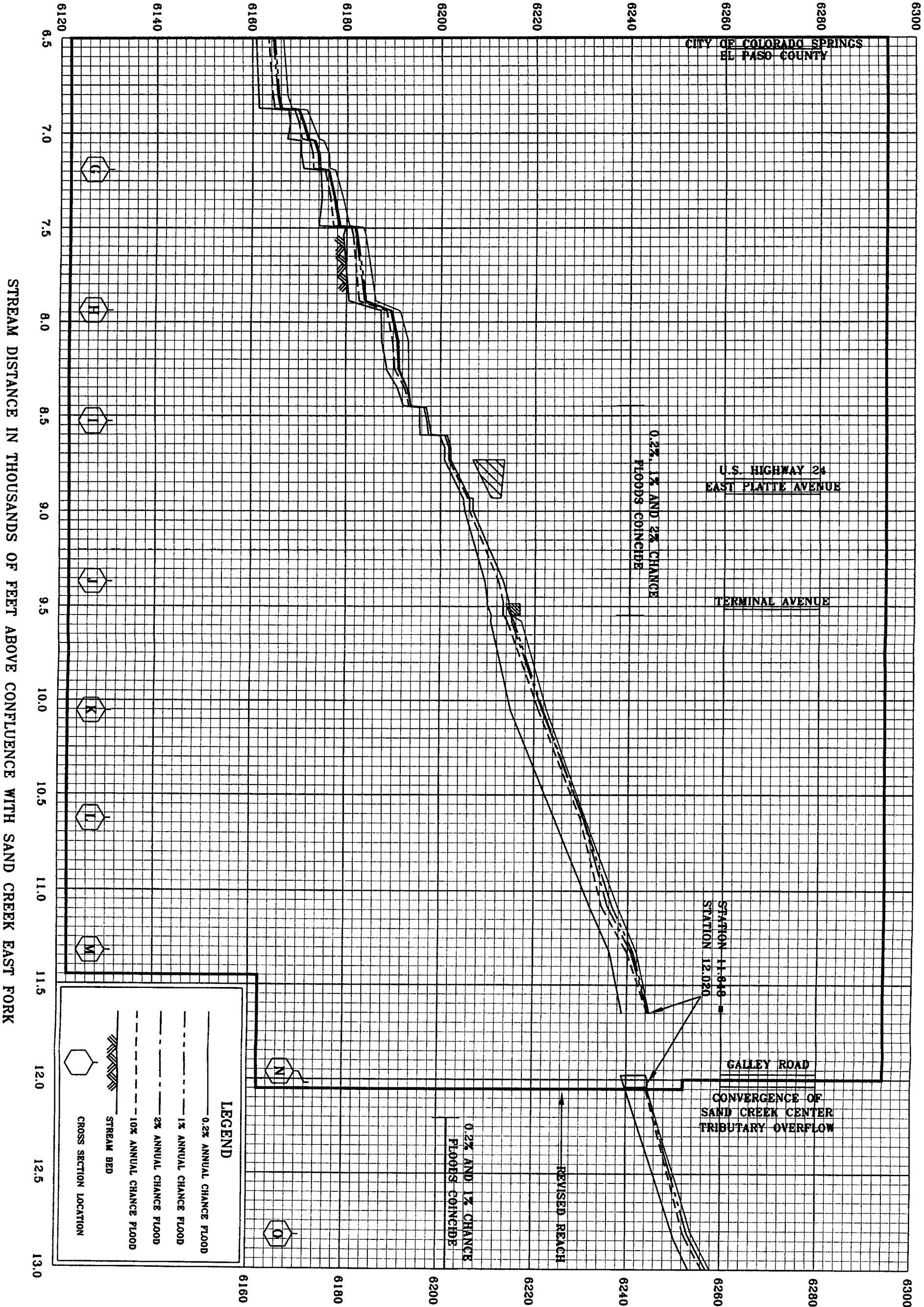
MAY 23 2007

Sand Creek Center Tributary

TABLE 5



ELEVATION IN FEET (NGVD 29)



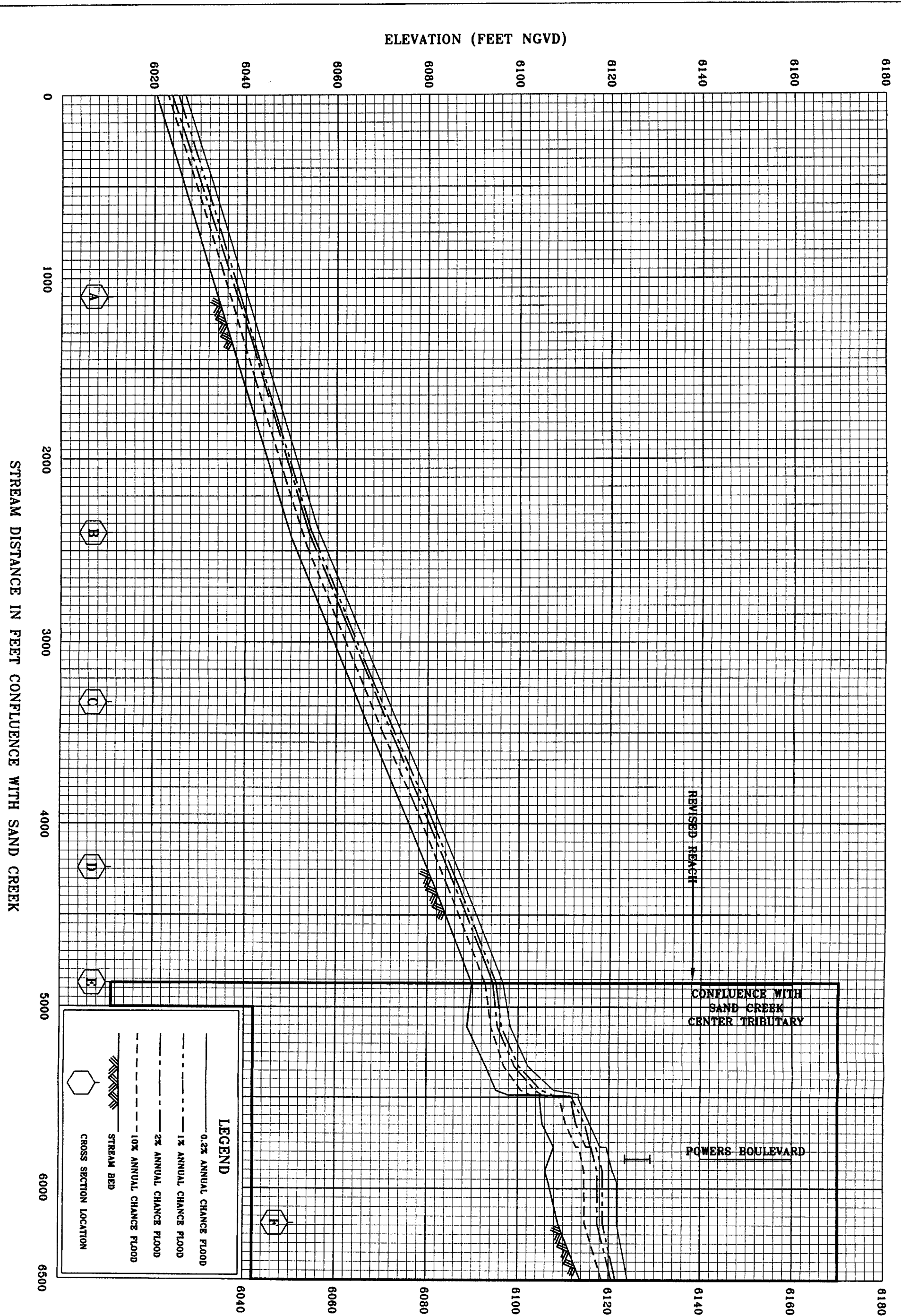
FEDERAL EMERGENCY MANAGEMENT AGENCY  
 EL PASO COUNTY, CO  
 AND INCORPORATED AREAS

FLOOD PROFILES

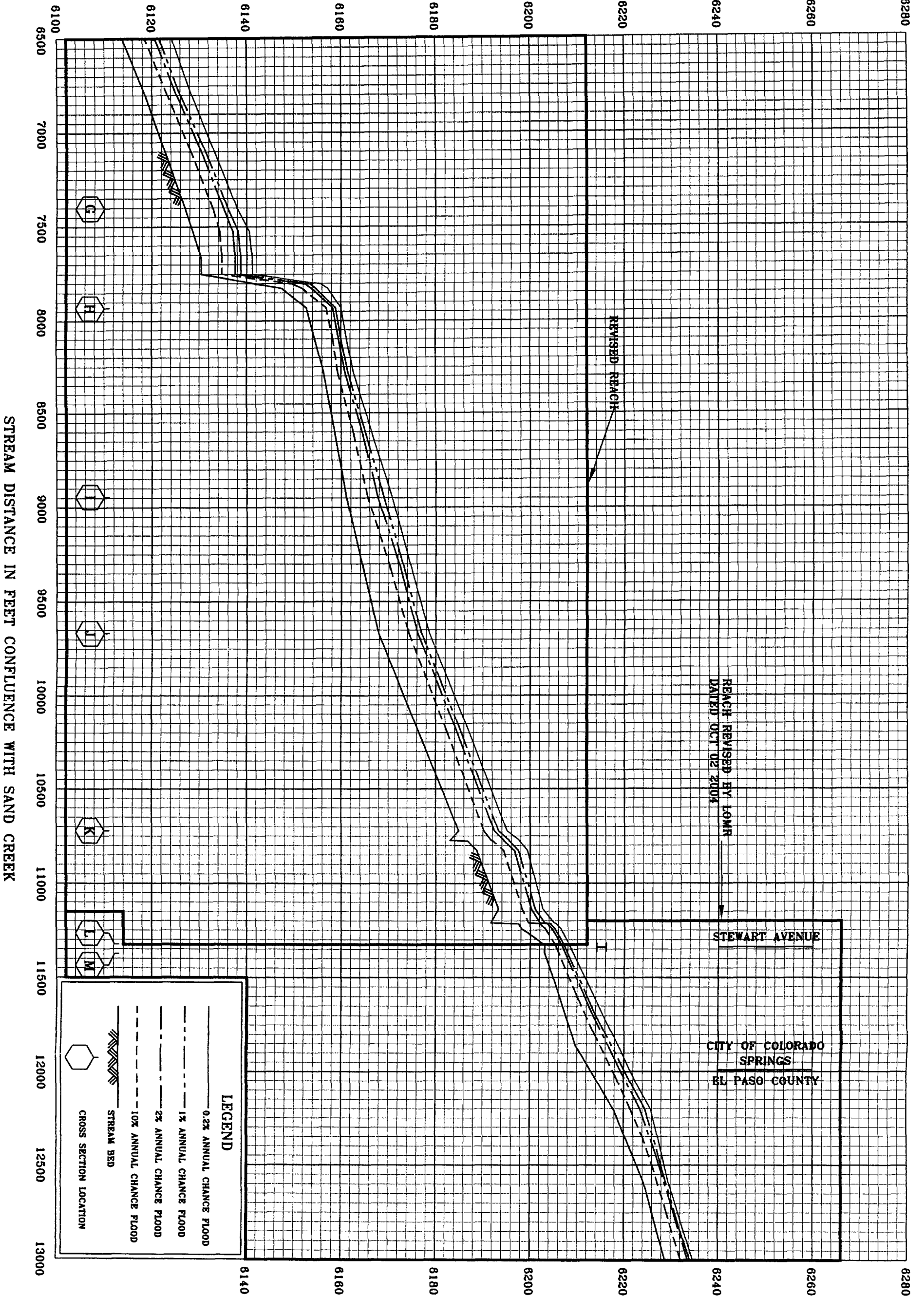
SAND CREEK CENTER TRIBUTARY

206P





ELEVATION (FEET NGVD)



FEDERAL EMERGENCY MANAGEMENT AGENCY  
EL PASO COUNTY, CO  
AND INCORPORATED AREAS




### FLOOD PROFILES

SAND CREEK EAST FORK

210P

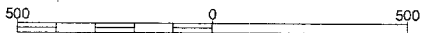
**EL PASO COUNTY  
UNINCORPORATED AREAS  
080059**

Legend

-  1% annual chance (100-Year) Floodplain
-  1% annual chance (100-Year) Floodway
-  0.2% annual chance (500-Year) Floodplain



APPROXIMATE SCALE IN FEET



NATIONAL FLOOD INSURANCE PROGRAM

**FIRM  
FLOOD INSURANCE RATE MAP**

EL PASO COUNTY,  
COLORADO  
AND INCORPORATED AREAS

PANEL 753 OF 1300  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:  
COMMUNITY NUMBER PANEL SUFFIX

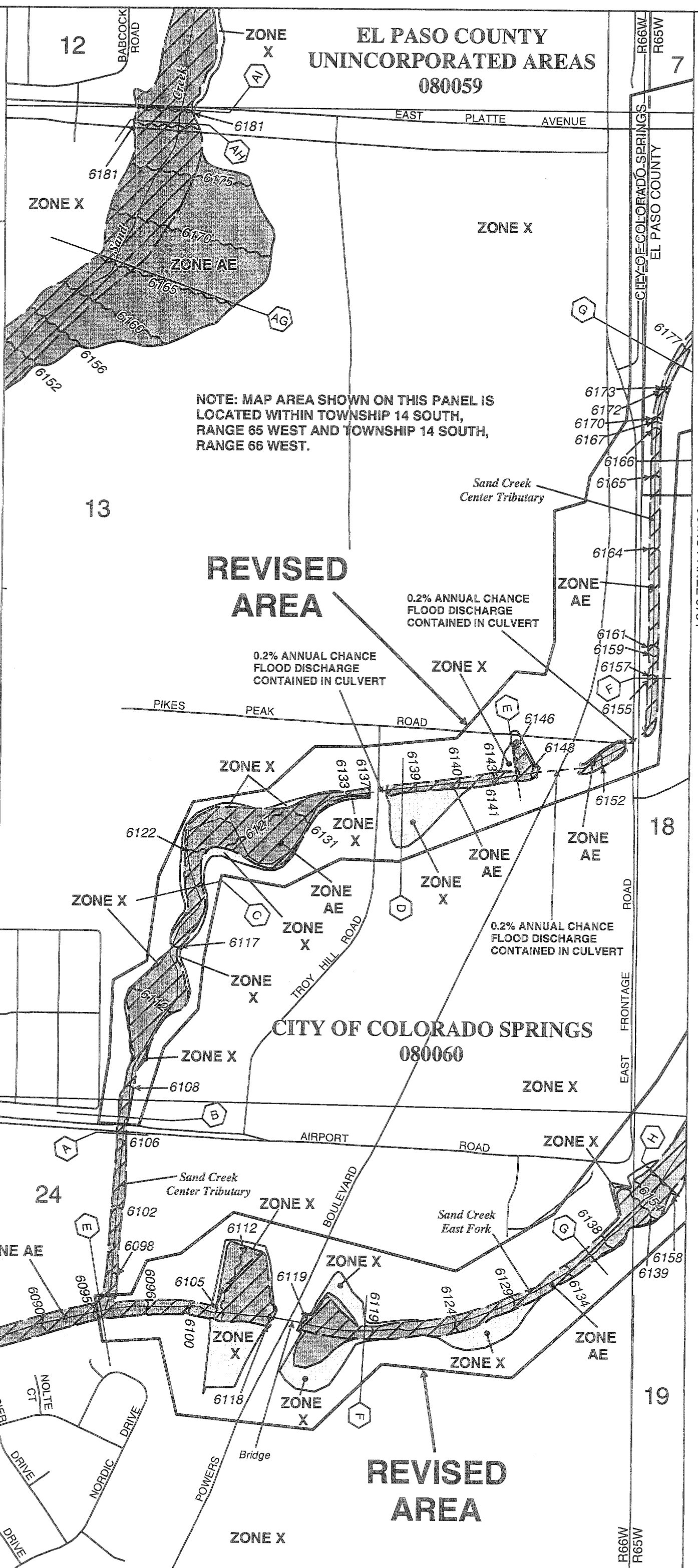
|   |        |      |   |
|---|--------|------|---|
| COLORADO SPRINGS, CITY OF               | 080060 | 0753 | F |
| EL PASO COUNTY,<br>UNINCORPORATED AREAS | 080059 | 0753 | F |

MAP NUMBER  
08041C0753 F

EFFECTIVE DATE:  
MARCH 17, 1997



Federal Emergency Management Agency



NOTE: MAP AREA SHOWN ON THIS PANEL IS  
LOCATED WITHIN TOWNSHIP 14 SOUTH,  
RANGE 65 WEST AND TOWNSHIP 14 SOUTH,  
RANGE 66 WEST.

**REVISED  
AREA**

0.2% ANNUAL CHANCE  
FLOOD DISCHARGE  
CONTAINED IN CULVERT

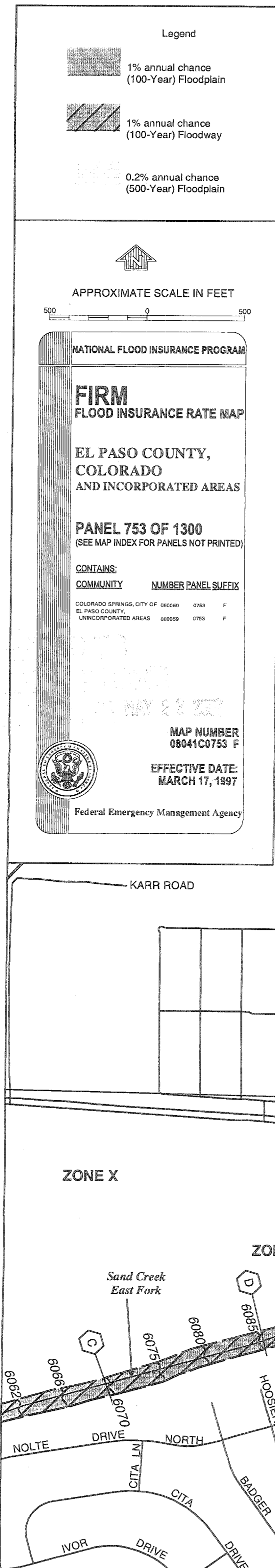
0.2% ANNUAL CHANCE  
FLOOD DISCHARGE  
CONTAINED IN CULVERT

0.2% ANNUAL CHANCE  
FLOOD DISCHARGE  
CONTAINED IN CULVERT

**CITY OF COLORADO SPRINGS  
080060**

**REVISED  
AREA**




JOINS PANEL 0754



104°43'07"  
38°50'37"

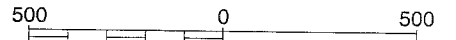
JOINS PANEL 0752

# EL PASO COUNTY UNINCORPORATED AREAS 080059

- Legend**
-  1% annual chance (100-Year) Floodplain
  -  1% annual chance (100-Year) Floodway
  -  0.2% annual chance (500-Year) Floodplain



APPROXIMATE SCALE IN FEET



NATIONAL FLOOD INSURANCE PROGRAM

## FIRM FLOOD INSURANCE RATE MAP

EL PASO COUNTY,  
COLORADO  
AND INCORPORATED AREAS

PANEL 754 OF 1300  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

| COMMUNITY                               | NUMBER | PANEL SUFFIX |
|---|--------|--------------|
| COLORADO SPRINGS, CITY OF               | 080090 | 0754 F       |
| EL PASO COUNTY,<br>UNINCORPORATED AREAS | 080059 | 0754 F       |

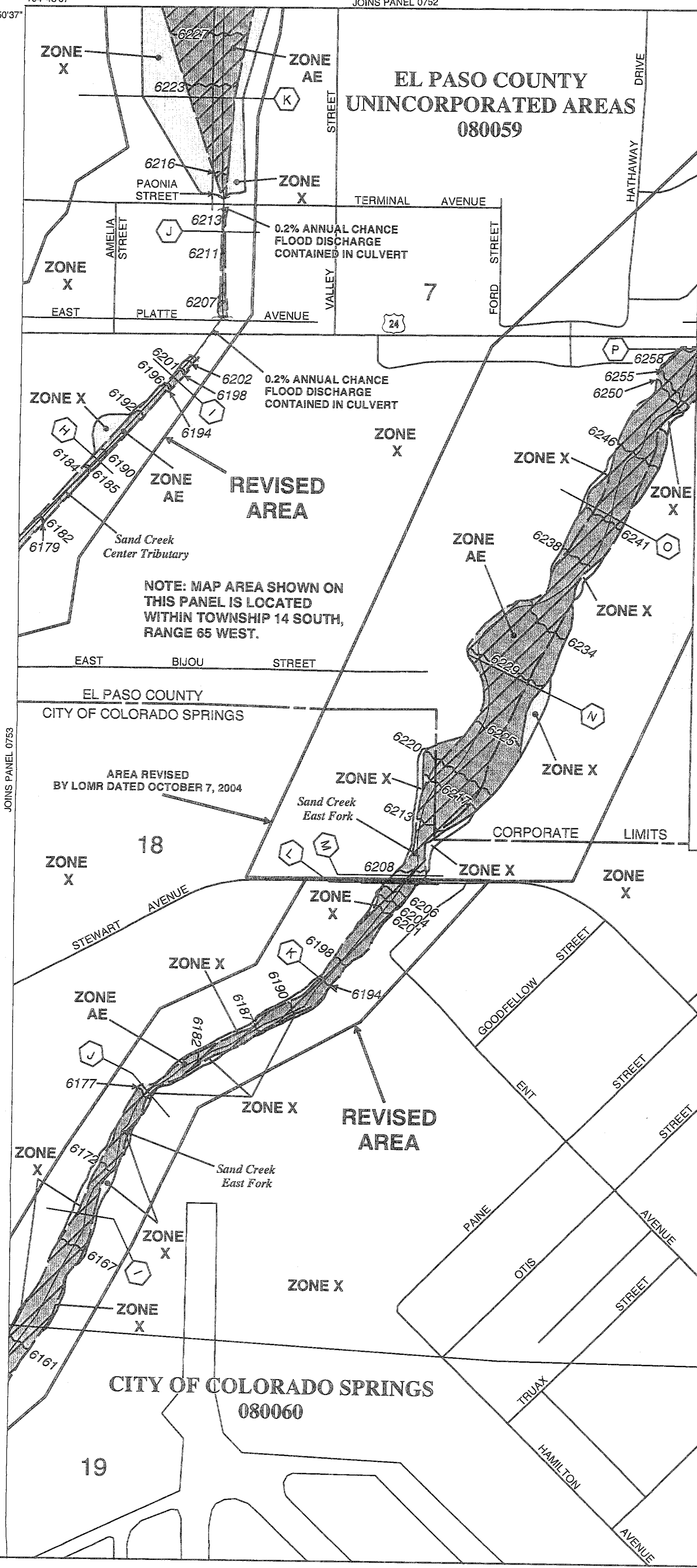
MAY 23 2007

MAP NUMBER  
08041C0754 F  
EFFECTIVE DATE:  
MARCH 17, 1997



Federal Emergency Management Agency

JOINS PANEL 0753



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

AREA REVISED  
BY LOMR DATED OCTOBER 7, 2004

CITY OF COLORADO SPRINGS  
080060

## **HYDROLOGIC CALCULATIONS**

***Crossroads Mixed Use***  
***PRELIMINARY DRAINAGE REPORT***  
***(Existing Area Runoff Coefficient Summary)***

| BASIN    | TOTAL AREA<br>(SF) | TOTAL AREA<br>(Acres) | STREETS / DEVELOPED |                |                  | OVERLAND / DEVELOPED |                |                  | WEIGHTED           |                    |
|----------|--------------------|-----------------------|---------------------|----------------|------------------|----------------------|----------------|------------------|--------------------|--------------------|
|          |                    |                       | AREA<br>(Acres)     | C <sub>5</sub> | C <sub>100</sub> | AREA<br>(Acres)      | C <sub>5</sub> | C <sub>100</sub> | C <sub>5</sub>     | C <sub>100</sub>   |
| <i>A</i> | 256383.3           | 5.89                  | 0.00                | 0.90           | 0.96             | 5.89                 | 0.08           | 0.35             | <b><i>0.08</i></b> | <b><i>0.35</i></b> |
| <i>B</i> | 478377.5           | 10.98                 | 0.00                | 0.90           | 0.96             | 16.14                | 0.08           | 0.35             | <b><i>0.08</i></b> | <b><i>0.35</i></b> |
| <i>C</i> | 585927.5           | 13.45                 | 0.00                | 0.90           | 0.96             | 5.68                 | 0.08           | 0.35             | <b><i>0.08</i></b> | <b><i>0.35</i></b> |



***Crossroads Mixed Use***  
***PRELIMINARY DRAINAGE REPORT***  
***(Existing Area Drainage Summary)***

| <i>From Area Runoff Coefficient Summary</i> |                               |                           |                        | <b>OVERLAND</b>      |                        |                        |                                | <b>STREET / CHANNEL FLOW</b> |                      |                           |                                | <b>Time of Travel (T<sub>t</sub>)</b> | <b>INTENSITY *</b>               |                                    | <b>TOTAL FLOWS</b>                |                                     |
|---|-------------------------------|---------------------------|------------------------|----------------------|------------------------|------------------------|--------------------------------|------------------------------|----------------------|---------------------------|--------------------------------|---------------------------------------|----------------------------------|------------------------------------|-----------------------------------|-------------------------------------|
| <b>BASIN</b>                                | <b>AREA TOTAL<br/>(Acres)</b> | <b>C<sub>s</sub></b>      | <b>C<sub>100</sub></b> | <b>C<sub>s</sub></b> | <b>Length<br/>(ft)</b> | <b>Height<br/>(ft)</b> | <b>T<sub>c</sub><br/>(min)</b> | <b>Length<br/>(ft)</b>       | <b>Slope<br/>(%)</b> | <b>Velocity<br/>(fps)</b> | <b>T<sub>t</sub><br/>(min)</b> | <b>TOTAL<br/>(min)</b>                | <b>I<sub>5</sub><br/>(in/hr)</b> | <b>I<sub>100</sub><br/>(in/hr)</b> | <b>Q<sub>5</sub><br/>(c.f.s.)</b> | <b>Q<sub>100</sub><br/>(c.f.s.)</b> |
|   |                               | <i>From DCM Table 5-1</i> |                        |                      |                        |                        |                                |                              |                      |                           |                                |                                       |                                  |                                    |                                   |                                     |
| <b>A</b>                                    | 5.89                          | 0.08                      | 0.35                   | 0.08                 | 300                    | 9                      | 22.2                           | 500                          | 2.0%                 | 2.0                       | 4.2                            | 26.4                                  | 2.7                              | 4.5                                | 1.3                               | 9.2                                 |
| <b>B</b>                                    | 10.98                         | 0.08                      | 0.35                   | 0.08                 | 300                    | 13                     | 19.7                           | 1350                         | 1.6%                 | 2.6                       | 8.8                            | 28.5                                  | 2.6                              | 4.3                                | 2.2                               | 16.5                                |
| <b>C</b>                                    | 13.45                         | 0.08                      | 0.35                   | 0.08                 | 300                    | 11                     | 20.8                           | 750                          | 1.7%                 | 2.6                       | 4.7                            | 25.5                                  | 2.7                              | 4.6                                | 2.9                               | 21.5                                |

\* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CW  
Date: 9/16/2020  
Checked by: VAS

**Crossroads Mixed Use**  
**PRELIMINARY DRAINAGE REPORT**  
**(Existing Basin Routing Summary)**

| <i>From Area Runoff Coefficient Summary</i> |                     |                 |                   | <b>OVERLAND</b> |                |                |                         | <b>PIPE / CHANNEL FLOW</b> |              |                   |                         | <b>Time of Travel (T<sub>t</sub>)</b> | <b>INTENSITY *</b>        |                             | <b>TOTAL FLOWS</b>         |                              | COMMENTS |
|---|---------------------|-----------------|-------------------|-----------------|----------------|----------------|-------------------------|----------------------------|--------------|-------------------|-------------------------|---------------------------------------|---------------------------|-----------------------------|----------------------------|------------------------------|----------|
| DESIGN POINT                                | CONTRIBUTING BASINS | CA <sub>5</sub> | CA <sub>100</sub> | C <sub>s</sub>  | Length<br>(ft) | Height<br>(ft) | T <sub>c</sub><br>(min) | Length<br>(ft)             | Slope<br>(%) | Velocity<br>(fps) | T <sub>t</sub><br>(min) | TOTAL<br>(min)                        | I <sub>5</sub><br>(in/hr) | I <sub>100</sub><br>(in/hr) | Q <sub>5</sub><br>(c.f.s.) | Q <sub>100</sub><br>(c.f.s.) |          |
| 1   | A                   | 0.47            | 2.06              | 0.08            | 300            | 9              | 22.2                    | 500                        | 2.0%         | 2.0               | 4.2                     | 26.4                                  | 2.7                       | 4.5                         | 1.3                        | 9.2                          |          |
| 2   | B                   | 0.88            | 3.84              | 0.08            | 300            | 13             | 19.7                    | 1350                       | 1.6%         | 2.6               | 8.8                     | 28.5                                  | 2.6                       | 4.3                         | 2.2                        | 16.5                         |          |
| 3   | C                   | 1.08            | 4.71              | 0.08            | 300            | 11             | 20.8                    | 750                        | 1.7%         | 2.6               | 4.7                     | 25.5                                  | 2.7                       | 4.6                         | 2.9                        | 21.5                         |          |

Calculated by: CW  
Date: 9/16/2020  
Checked by: VAS



**CROSSROADS MIXED USE**  
**PRELIMINARY DRAINAGE CALCULATIONS**  
*(Area Runoff Coefficient Summary)*

| BASIN                  | TOTAL AREA<br>(Sq Ft) | TOTAL AREA<br>(Acres) | STREETS / DEVELOPED |                |                  | OVERLAND / DEVELOPED |                |                  | OVERLAND / UNDEVELOPED |                |                  | WEIGHTED       |                  |
|------------------------|-----------------------|-----------------------|---------------------|----------------|------------------|----------------------|----------------|------------------|------------------------|----------------|------------------|----------------|------------------|
|                        |                       |                       | AREA<br>(Acres)     | C <sub>5</sub> | C <sub>100</sub> | AREA<br>(Acres)      | C <sub>5</sub> | C <sub>100</sub> | AREA<br>(Acres)        | C <sub>5</sub> | C <sub>100</sub> | C <sub>5</sub> | C <sub>100</sub> |
| <b>PROPOSED BASINS</b> |                       |                       |                     |                |                  |                      |                |                  |                        |                |                  |                |                  |
| <i>A</i>               | 575430                | 13.21                 | 0.00                | 0.90           | 0.96             | 13.21                | 0.81           | 0.88             | 0.00                   | 0.08           | 0.35             | <b>0.81</b>    | <b>0.88</b>      |
| <i>B</i>               | 573251                | 13.16                 | 0.00                | 0.90           | 0.96             | 13.16                | 0.49           | 0.62             | 0.00                   | 0.08           | 0.35             | <b>0.49</b>    | <b>0.62</b>      |
| <i>C</i>               | 140812                | 3.23                  | 0.00                | 0.90           | 0.96             | 3.23                 | 0.16           | 0.41             | 0.00                   | 0.08           | 0.35             | <b>0.16</b>    | <b>0.41</b>      |
| <i>D</i>               | 110741                | 2.54                  | 2.54                | 0.90           | 0.96             | 0.00                 | 0.45           | 0.59             | 0.00                   | 0.08           | 0.35             | <b>0.90</b>    | <b>0.96</b>      |

Calculated by: GT  
Date: 11/21/2020  
Checked by: VAS

**CROSSROADS MIXED USE  
PRELIMINARY DRAINAGE REPORT  
(Area Drainage Summary)**

| <i>From Area Runoff Coefficient Summary</i> |                               |                                   |                        | <b>OVERLAND</b>      |                        |                        |                                | <b>STREET / CHANNEL FLOW</b> |                      |                           |                                | <b>Time of Travel (T<sub>t</sub>)</b> |                        | <b>INTENSITY #</b>               |                                    | <b>TOTAL FLOWS</b>                |                                     |
|---|-------------------------------|-----------------------------------|------------------------|----------------------|------------------------|------------------------|--------------------------------|------------------------------|----------------------|---------------------------|--------------------------------|---------------------------------------|------------------------|----------------------------------|------------------------------------|-----------------------------------|-------------------------------------|
| <b>BASIN</b>                                | <b>AREA TOTAL<br/>(Acres)</b> | <b>C<sub>5</sub></b>              | <b>C<sub>100</sub></b> | <b>C<sub>5</sub></b> | <b>Length<br/>(ft)</b> | <b>Height<br/>(ft)</b> | <b>T<sub>c</sub><br/>(min)</b> | <b>Length<br/>(ft)</b>       | <b>Slope<br/>(%)</b> | <b>Velocity<br/>(fps)</b> | <b>T<sub>t</sub><br/>(min)</b> | <b>TOTAL<br/>(min)</b>                | <b>CHECK<br/>(min)</b> | <b>I<sub>5</sub><br/>(in/hr)</b> | <b>I<sub>100</sub><br/>(in/hr)</b> | <b>Q<sub>5</sub><br/>(c.f.s.)</b> | <b>Q<sub>100</sub><br/>(c.f.s.)</b> |
|   |                               | <small>From DCM Table 5-1</small> |                        |                      |                        |                        |                                |                              |                      |                           |                                |                                       |                        |                                  |                                    |                                   |                                     |
| <b>Proposed Area Drainage Summary</b>       |                               |                                   |                        |                      |                        |                        |                                |                              |                      |                           |                                |                                       |                        |                                  |                                    |                                   |                                     |
| <b>A</b>                                    | 13.21                         | 0.81                              | 0.88                   | 0.81                 | 100                    | 6.5                    | 2.8                            | 1021                         | 1.2%                 | 3.0                       | 5.6                            | 8.4                                   | 16.2                   | 4.4                              | 7.4                                | <b>46.9</b>                       | <b>85.6</b>                         |
| <b>B</b>                                    | 13.16                         | 0.49                              | 0.62                   | 0.49                 | 100                    | 1.5                    | 9.6                            | 1174                         | 1.2%                 | 3.0                       | 6.5                            | 16.1                                  | 17.1                   | 3.4                              | 5.7                                | <b>22.0</b>                       | <b>46.8</b>                         |
| <b>C</b>                                    | 3.23                          | 0.16                              | 0.41                   | 0.16                 | 100                    | 1.5                    | 14.8                           | 589                          | 2.5%                 | 1.1                       | 9.2                            | 24.1                                  | 13.8                   | 3.6                              | 6.1                                | <b>1.9</b>                        | <b>8.1</b>                          |
| <b>D</b>                                    | 2.54                          | 0.90                              | 0.96                   | 0.90                 | 40                     | 0.8                    | 1.8                            | 1344                         | 1.3%                 | 3.0                       | 7.4                            | 9.2                                   | 17.7                   | 4.3                              | 7.1                                | <b>9.7</b>                        | <b>17.4</b>                         |

# Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: GT  
Date: 11/21/2020  
Checked by: VAS

**CROSSROADS MIXED USE  
PRELIMINARY DRAINAGE REPORT  
(Basin Routing Summary)**

| <i>From Area Runoff Coefficient Summary</i>    |                     |                 |                   | <b>OVERLAND</b> |                |                |                         | <b>PIPE / CHANNEL FLOW</b> |              |                   |                         | <b>Time of Travel (T<sub>t</sub>)</b> | <b>INTENSITY *</b> |                  | <b>TOTAL FLOWS</b> |                  | COMMENTS |
|--|---------------------|-----------------|-------------------|-----------------|----------------|----------------|-------------------------|----------------------------|--------------|-------------------|-------------------------|---------------------------------------|--------------------|------------------|--------------------|------------------|----------|
| DESIGN POINT                                   | CONTRIBUTING BASINS | CA <sub>5</sub> | CA <sub>100</sub> | C <sub>5</sub>  | Length<br>(ft) | Height<br>(ft) | T <sub>C</sub><br>(min) | Length<br>(ft)             | Slope<br>(%) | Velocity<br>(fps) | T <sub>t</sub><br>(min) | TOTAL<br>(min)                        | I <sub>5</sub>     | I <sub>100</sub> | Q <sub>5</sub>     | Q <sub>100</sub> |          |
|  |                     |                 |                   |                 |                |                |                         |                            |              |                   |                         |                                       | (in/hr)            | (in/hr)          | (c.f.s.)           | (c.f.s.)         |          |
| <b>PROPOSED DRAINAGE BASIN ROUTING SUMMARY</b> |                     |                 |                   |                 |                |                |                         |                            |              |                   |                         |                                       |                    |                  |                    |                  |          |
| 1  | A                   | 10.70           | 11.62             | Basin A Tc used |                |                |                         |                            |              |                   |                         | 8.4                                   | 4.4                | 7.4              | 46.9               | 85.6             | FSD POND |
| 2  | D                   | 2.29            | 2.44              | Basin D Tc used |                |                |                         |                            |              |                   |                         | 9.2                                   | 4.3                | 7.1              | 9.7                | 17.4             |          |
| 3  | B, DP1, DP2         | 19.44           | 22.22             | Basin B Tc used |                |                |                         |                            |              |                   |                         | 16.1                                  | 3.4                | 5.7              | 66.4               | 127.5            |          |
| 4  | C, DP3              | 19.95           | 23.55             | Basin B Tc used |                |                |                         |                            |              |                   |                         | 16.1                                  | 3.4                | 5.7              | 68.2               | 135.1            |          |

# Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: GT  
 Date: 11/21/2020  
 Checked by: VAS

**CROSSROADS MIXED USE  
PRELIMINARY DRAINAGE CALCULATIONS  
(Storm Sewer Routing Summary)**

| <i>PIPE<br/>RUN<br/>Point(s)</i> | <i>Contributing<br/>Pipes/Design Points</i> | <i>Equivalent<br/>CA<sub>5</sub></i> | <i>Equivalent<br/>CA<sub>100</sub></i> | <i>Maximum<br/>T<sub>c</sub></i> | <i>Intensity#</i>    |                        | <i>Flow</i>          |                        | PIPE SIZE |
|----------------------------------|---|--------------------------------------|--|----------------------------------|----------------------|------------------------|----------------------|------------------------|-----------|
|                                  |   |                                      |  |                                  | <i>I<sub>5</sub></i> | <i>I<sub>100</sub></i> | <i>Q<sub>5</sub></i> | <i>Q<sub>100</sub></i> |           |
| <i>I</i>                         | <b>DP4</b>                                  | SEE MHFD POND SHEETS FOR RELEASE     |  |                                  |                      |                        | <i>1.0</i>           | <i>21.5</i>            | 30" RCP   |

# 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: 11/21/2020

Checked by: VAS

## **HYDRAULIC CALCULATIONS**

| <i>Weighted Percent Imperviousness of WQ Pond 1</i> |                     |                      |                         |                    |
|---|---------------------|----------------------|-------------------------|--------------------|
| <i>Contributing Basins</i>                          | <i>Area (Acres)</i> | <i>C<sub>s</sub></i> | <i>Impervious % (I)</i> | <i>(Acres)*(I)</i> |
| <i>A</i>  | 13.21               | 0.81                 | 95                      | 1254.96            |
| <i>B</i>  | 13.16               | 0.49                 | 70                      | 921.20             |
| <i>C</i>  | 3.23                | 0.16                 | 13                      | 42.02              |
| <i>D</i>  | 2.54                | 0.90                 | 100                     | 254.23             |
| <b><i>Totals</i></b>                                | <b>32.14</b>        |                      |                         | <b>2472.41</b>     |
| <b><i>Imperviousness of WQ Pond 1</i></b>           | <b>76.9</b>         | <b>%</b>             |                         |                    |

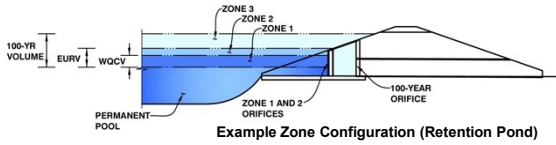


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.03 (May 2020)*

**Project: CROSSROADS MIXED USE**

**Basin ID: POND 1**



**Example Zone Configuration (Retention Pond)**

|                          | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type          |
|--------------------------|----------------------|--------------------------|----------------------|
| Zone 1 (WQCV)            | 3.37                 | 0.830                    | Orifice Plate        |
| Zone 2 (EURV)            | 5.25                 | 2.385                    | Orifice Plate        |
| Zone 3 (100-year)        | 6.21                 | 1.406                    | Weir&Pipe (Restrict) |
| <b>Total (all zones)</b> |                      | <b>4.621</b>             |                      |

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

|                                   |     |  |
|-----------------------------------|-----|--|
| Underdrain Orifice Invert Depth = | N/A | ft (distance below the filtration media surface) |
| Underdrain Orifice Diameter =     | N/A | inches   |

|                                      |     |                 |
|--------------------------------------|-----|-----------------|
| Calculated Parameters for Underdrain |     |                 |
| Underdrain Orifice Area =            | N/A | ft <sup>2</sup> |
| Underdrain Orifice Centroid =        | N/A | feet            |

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

|  |       |   |
|--|-------|---|
| Invert of Lowest Orifice =                 | 0.00  | ft (relative to basin bottom at Stage = 0 ft) |
| Depth at top of Zone using Orifice Plate = | 5.25  | ft (relative to basin bottom at Stage = 0 ft) |
| Orifice Plate: Orifice Vertical Spacing =  | 20.40 | inches  |
| Orifice Plate: Orifice Area per Row =      | N/A   | inches  |

|                                 |     |                 |
|---------------------------------|-----|-----------------|
| Calculated Parameters for Plate |     |                 |
| WQ Orifice Area per Row =       | N/A | ft <sup>2</sup> |
| Elliptical Half-Width =         | N/A | feet            |
| Elliptical Slot Centroid =      | N/A | feet            |
| Elliptical Slot Area =          | N/A | ft <sup>2</sup> |

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

|                                | Row 1 (required) | Row 2 (optional)  | Row 3 (optional)  | Row 4 (optional)  | Row 5 (optional)  | Row 6 (optional)  | Row 7 (optional)  | Row 8 (optional)  |
|--------------------------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Stage of Orifice Centroid (ft) | 0.00             | 1.70              | 3.40              |                   |                   |                   |                   |                   |
| Orifice Area (sq. inches)      | 1.50             | 6.30              | 12.00             |                   |                   |                   |                   |                   |
|                                | Row 9 (optional) | Row 10 (optional) | Row 11 (optional) | Row 12 (optional) | Row 13 (optional) | Row 14 (optional) | Row 15 (optional) | Row 16 (optional) |
| Stage of Orifice Centroid (ft) |                  |                   |                   |                   |                   |                   |                   |                   |
| Orifice Area (sq. inches)      |                  |                   |                   |                   |                   |                   |                   |                   |

User Input: Vertical Orifice (Circular or Rectangular)

|   |              |              |   |
|---|--------------|--------------|---|
|   | Not Selected | Not Selected |   |
| Invert of Vertical Orifice =                  | N/A          | N/A          | ft (relative to basin bottom at Stage = 0 ft) |
| Depth at top of Zone using Vertical Orifice = | N/A          | N/A          | ft (relative to basin bottom at Stage = 0 ft) |
| Vertical Orifice Diameter =                   | N/A          | N/A          | inches  |

|  |     |                 |
|--|-----|-----------------|
| Calculated Parameters for Vertical Orifice |     |                 |
| Vertical Orifice Area =                    | N/A | ft <sup>2</sup> |
| Vertical Orifice Centroid =                | N/A | feet            |

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

|                                       | Zone 3 Weir | Not Selected |   |
|---------------------------------------|-------------|--------------|---|
| Overflow Weir Front Edge Height, Ho = | 5.26        | N/A          | ft (relative to basin bottom at Stage = 0 ft) |
| Overflow Weir Front Edge Length =     | 8.00        | N/A          | feet  |
| Overflow Weir Grate Slope =           | 0.00        | N/A          | H:V   |
| Horiz. Length of Weir Sides =         | 2.90        | N/A          | feet  |
| Overflow Grate Open Area % =          | 70%         | N/A          | %, grate open area/total area                 |
| Debris Clogging % =                   | 50%         | N/A          | %   |

|  |       |     |
|--|-------|-----|
| Calculated Parameters for Overflow Weir      |       |     |
| Height of Grate Upper Edge, H <sub>u</sub> = | 5.26  | N/A |
| Overflow Weir Slope Length =                 | 2.90  | N/A |
| Grate Open Area / 100-yr Orifice Area =      | 8.57  | N/A |
| Overflow Grate Open Area w/o Debris =        | 16.24 | N/A |
| Overflow Grate Open Area w/ Debris =         | 8.12  | N/A |

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

|   |                   |              |  |
|---|-------------------|--------------|--|
|   | Zone 3 Restrictor | Not Selected |  |
| Depth to Invert of Outlet Pipe =            | 0.25              | N/A          | ft (distance below basin bottom at Stage = 0 ft) |
| Outlet Pipe Diameter =                      | 30.00             | N/A          | inches   |
| Restrictor Plate Height Above Pipe Invert = | 12.30             | N/A          | inches   |

|   |      |                 |
|---|------|-----------------|
| Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate |      |                 |
| Outlet Orifice Area =   | 1.89 | ft <sup>2</sup> |
| Outlet Orifice Centroid =                                       | 0.60 | feet            |
| Half-Central Angle of Restrictor Plate on Pipe =                | 1.39 | radians         |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

|                                     |       |   |
|-------------------------------------|-------|---|
| Spillway Invert Stage =             | 5.91  | ft (relative to basin bottom at Stage = 0 ft) |
| Spillway Crest Length =             | 32.00 | feet  |
| Spillway End Slopes =               | 4.00  | H:V   |
| Freeboard above Max Water Surface = | 1.00  | feet  |

|                                    |      |         |
|------------------------------------|------|---------|
| Calculated Parameters for Spillway |      |         |
| Spillway Design Flow Depth =       | 0.99 | feet    |
| Stage at Top of Freeboard =        | 7.90 | feet    |
| Basin Area at Top of Freeboard =   | 1.71 | acres   |
| Basin Volume at Top of Freeboard = | 7.36 | acre-ft |

## Routed Hydrograph Results

*The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

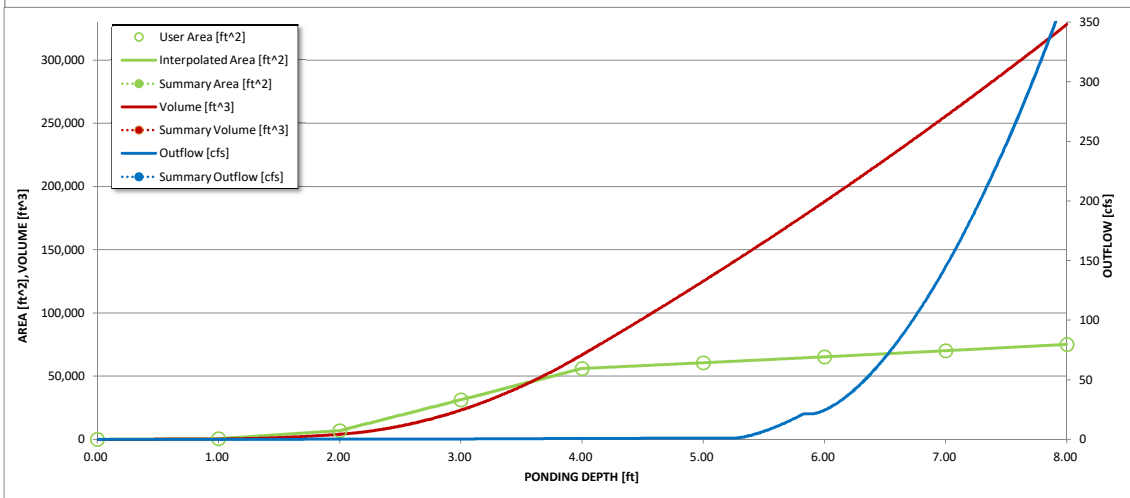
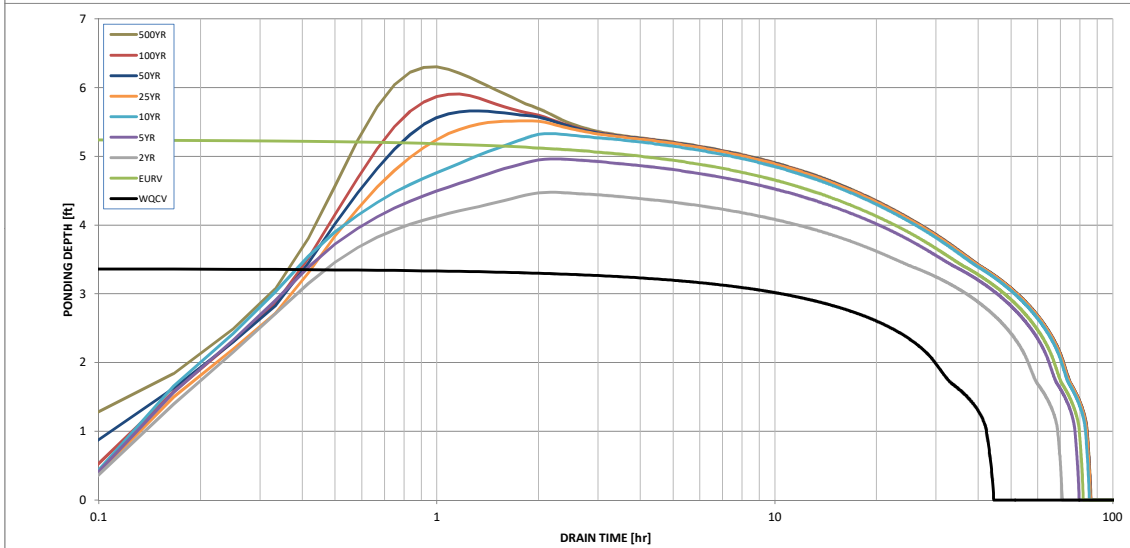
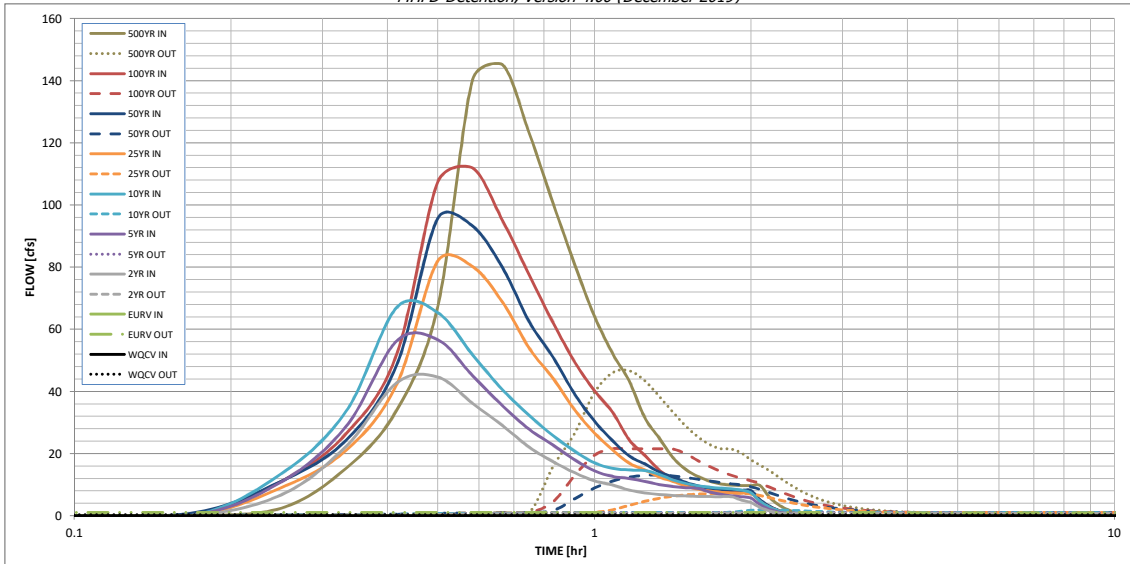
|   | WQCV  | EURV  | 2 Year | 5 Year | 10 Year         | 25 Year         | 50 Year         | 100 Year       | 500 Year |
|---|-------|-------|--------|--------|-----------------|-----------------|-----------------|----------------|----------|
| Design Storm Return Period                    | N/A   | N/A   | 1.19   | 1.50   | 1.75            | 2.00            | 2.25            | 2.52           | 3.14     |
| One-Hour Rainfall Depth (in)                  | 0.830 | 3.215 | 2.281  | 2.964  | 3.512           | 4.165           | 4.804           | 5.552          | 7.204    |
| CUHP Runoff Volume (acre-ft)                  | N/A   | N/A   | 2.281  | 2.964  | 3.512           | 4.165           | 4.804           | 5.552          | 7.204    |
| Inflow Hydrograph Volume (acre-ft)            | N/A   | N/A   | 0.3    | 0.6    | 0.8             | 7.1             | 14.2            | 23.2           | 41.3     |
| CUHP Predevelopment Peak Q (cfs)              | N/A   | N/A   | N/A    | N/A    | N/A             | N/A             | N/A             | N/A            | N/A      |
| OPTIONAL Override Predevelopment Peak Q (cfs) | N/A   | N/A   | N/A    | N/A    | N/A             | N/A             | N/A             | N/A            | N/A      |
| Predevelopment Unit Peak Flow, q (cfs/acre)   | N/A   | N/A   | 0.01   | 0.02   | 0.02            | 0.22            | 0.44            | 0.72           | 1.29     |
| Peak Inflow Q (cfs)                           | N/A   | N/A   | 44.6   | 56.4   | 67.7            | 82.0            | 95.7            | 111.9          | 145.1    |
| Peak Outflow Q (cfs)                          | 0.4   | 1.1   | 0.9    | 1.0    | 1.9             | 7.2             | 13.0            | 21.5           | 46.6     |
| Ratio Peak Outflow to Predevelopment Q        | N/A   | N/A   | N/A    | 1.8    | 2.5             | 1.0             | 0.9             | 0.9            | 1.1      |
| Structure Controlling Flow                    | Plate | Plate | Plate  | Plate  | Overflow Weir 1 | Overflow Weir 1 | Overflow Weir 1 | Outlet Plate 1 | Spillway |
| Max Velocity through Grate 1 (fps)            | N/A   | N/A   | N/A    | N/A    | 0.4             | 0.4             | 0.7             | 1.3            | 1.3      |
| Max Velocity through Grate 2 (fps)            | N/A   | N/A   | N/A    | N/A    | N/A             | N/A             | N/A             | N/A            | N/A      |
| Time to Drain 97% of Inflow Volume (hours)    | 38    | 67    | 58     | 65     | 70              | 69              | 68              | 67             | 65       |
| Time to Drain 99% of Inflow Volume (hours)    | 42    | 74    | 65     | 72     | 77              | 77              | 75              | 74             | 73       |
| Maximum Ponding Depth (ft)                    | 3.37  | 5.25  | 4.48   | 4.96   | 5.33            | 5.52            | 5.66            | 5.90           | 6.30     |
| Area at Maximum Ponding Depth (acres)         | 0.93  | 1.42  | 1.34   | 1.39   | 1.42            | 1.45            | 1.46            | 1.49           | 1.53     |
| Maximum Volume Stored (acre-ft)               | 0.834 | 3.220 | 2.147  | 2.814  | 3.320           | 3.592           | 3.796           | 4.164          | 4.768    |

Revise. Must be at or below predevelopment



# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.00 (December 2019)*



| S-A-V-D Chart Axis Override | X-axis | Left Y-Axis | Right Y-Axis |
|-----------------------------|--------|-------------|--------------|
| minimum bound               |        |             |              |
| maximum bound               |        |             |              |

**CROSSROADS MIXED USE**  
**EMERGENCY SPILLWAY CALCULATIONS FSD POND**

| <b>Horizontal Broad-Crested Weir (Eqn 12-20 UDFCD)</b> |       |     |           |        |         |
|--|-------|-----|-----------|--------|---------|
| Variable   |       |     | Solve For |        |         |
| <i>C</i>   | 3.00  |     | L (ft)    | H (ft) | Q (cfs) |
| <i>L</i>   | 42.00 | ft  | 0.0       | 0.0    | 126.0   |
| <i>H</i>   | 1.00  | ft  |           |        |         |
| <i>Q</i>   |       | cfs |           |        |         |

| <b>Sloping Broad-Crested Weir (Eqn 12-21 UDFCD)</b> |      |     |           |        |         |
|---|------|-----|-----------|--------|---------|
| Variable  |      |     | Solve For |        |         |
| <i>C</i>  | 3.00 |     | Z (ft)    | H (ft) | Q (cfs) |
| <i>Z</i>  | 4.00 | ft  | 0.0       | 0.0    | 4.8     |
| <i>H</i>  | 1.00 | ft  |           |        |         |
| <i>Q</i>  |      | cfs |           |        |         |

|                |               |
|----------------|---------------|
| <b>Total Q</b> | <b>135.60</b> |
|----------------|---------------|

Equation 12-20

$$Q = C_{BCW} L H^{1.5}$$

Equation 12-21

$$Q = \left(\frac{2}{5}\right) C_{BCW} Z H^{2.5}$$

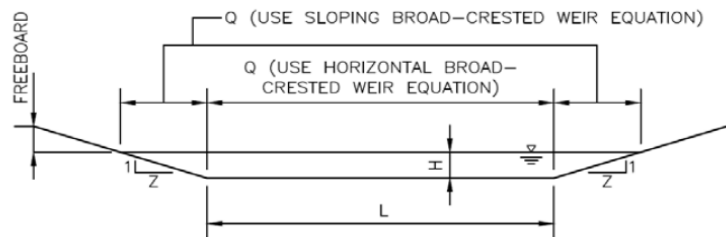
Where:

*Q* = discharge (cfs)

*C<sub>BCW</sub>* = broad-crested weir coefficient (This ranges from 2.6 to 3.0. A value of 3.0 is often used in practice.) See Hydraulic Engineering Circular No. 22 for additional information.

*L* = broad-crested weir length (ft)

*H* = head above weir crest (ft)



**Figure 12-20. Sloping broad-crest weir**

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Got It!



Partially FULL Pipe Flow Calculator and Equations

- [Fluid Flow Table of Contents](#)
- [Hydraulic and Pneumatic Knowledge](#)
- [Fluid Power Equipment](#)

This engineering calculator determines the Flow within a partially full pipe (&e1/2 full) using the Manning equation. This calculator can also be used for uniform flow in a pipe, but the Manning roughness coefficient needs to be considered to be variable, dependent upon the depth of flow.

Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V for pipes more than half full

Instructions: Enter values in blue boxes. Calculations in yellow

Inputs

Pipe Diameter, **D** =  in  
 Depth of flow, **y** =  in  
 (must have  $y \geq D/2$ )

Full Pipe Manning roughness, **n<sub>full</sub>** =   
 Channel bottom slope, **S** =  ft/ft

Calculations

Pipe Diameter, **D** =  ft  
 Pipe Radius, **r** =  ft

Circ. Segment Height, **h** =  ft

Central Angle, **q** =  radians  
 Cross-Section Area, **A** =  ft<sup>2</sup>

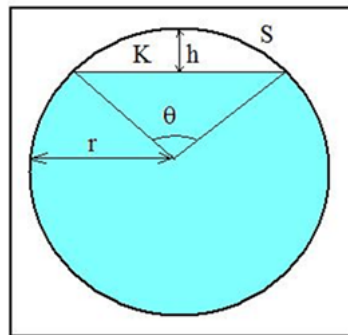
Wetted Perimeter, **P** =  ft  
 Hydraulic Radius, **R** =  ft  
 Discharge, **Q** =  cfs  
 Ave. Velocity, **V** =  ft/sec

pipe % full  $[(A/A_{full}) * 100\%]$  =

Update. UD Detention has a restrictor plate 12" above the pipe invert

Calculations

$n/n_{full}$  =   
 Partially Full Manning roughness, **n** =



Partially Full Pipe Flow Parameters (More Than Half Full)

$r = D/2$

$h = 2r - y$

(hydraulic radius)

$R = A/P$

(Manning Equation)

$Q = (1.49/n)(A)(R^{2/3})(S^{1/2})$

$V = Q/A$  P

$\theta = 2 \arccos \left( \frac{r-h}{r} \right)$

$A = \pi r^2 - \frac{r^2(\theta - \sin \theta)}{2}$

$P = 2\pi r - r * \theta$

Equation used for  $n/n_{full}$ :  $n/n_{full} = 1.25 - (y/D - 0.5) * 0.5$  (for  $0.5 \leq y/D \leq 1$ )

30" RCP OUTFALL PIPE

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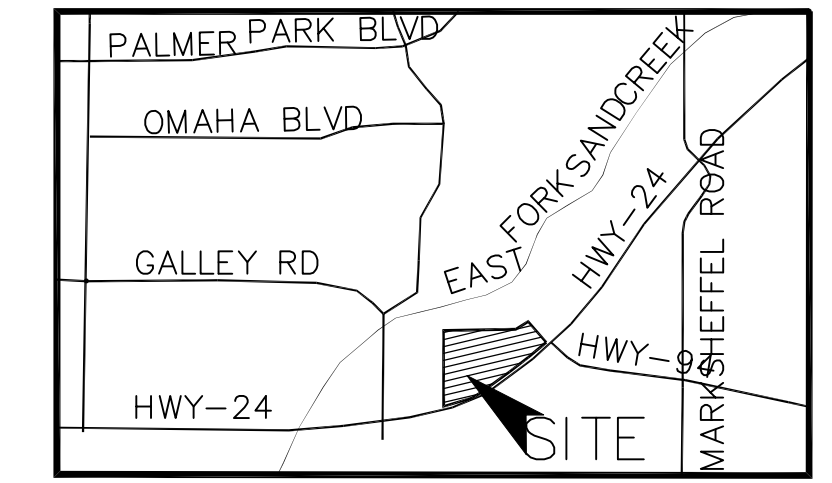
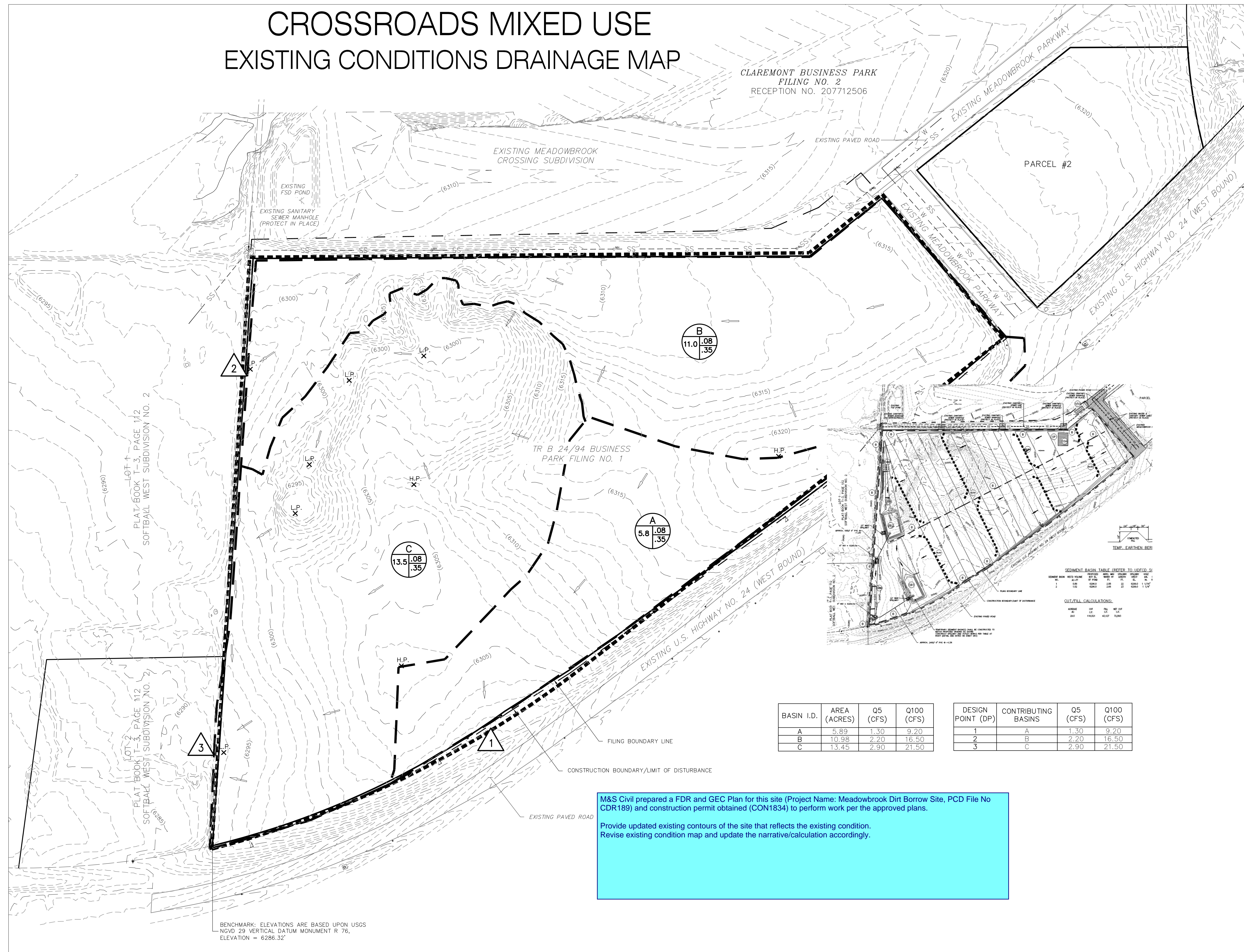
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**EXISTING AND PROPOSED  
DRAINAGE MAPS**



# CROSSROADS MIXED USE EXISTING CONDITIONS DRAINAGE MAP

CLAREMONT BUSINESS PARK  
FILING NO. 2  
RECEPTION NO. 207712506



VICINITY MAP  
N.T.S.

### LEGEND

- BASIN DESIGNATION: 25 ACRES
- SURFACE DESIGN POINT
- CURRENT DEVELOPMENT BASIN BOUNDARY
- EXISTING CONTOUR
- PROP CONTOUR
- EXISTING STORM SEWER PIPE
- EXISTING FLOW DIRECTION
- FLOW DIRECTION
- H.P. HIGH POINT
- L.P. LOW POINT

| BASIN I.D. | AREA (ACRES) | Q5 (CFS) | Q100 (CFS) |
|------------|--------------|----------|------------|
| A          | 5.89         | 1.30     | 9.20       |
| B          | 10.98        | 2.20     | 16.50      |
| C          | 13.45        | 2.90     | 21.50      |

| DESIGN POINT (DP) | CONTRIBUTING BASINS | Q5 (CFS) | Q100 (CFS) |
|-------------------|---------------------|----------|------------|
| 1                 | A                   | 1.30     | 9.20       |
| 2                 | B                   | 2.20     | 16.50      |
| 3                 | C                   | 2.90     | 21.50      |

M&S Civil prepared a FDR and GEC Plan for this site (Project Name: Meadowbrook Dirt Borrow Site, PCD File No CDR189) and construction permit obtained (CON1834) to perform work per the approved plans.

Provide updated existing contours of the site that reflects the existing condition.  
Revise existing condition map and update the narrative/calculation accordingly.

BENCHMARK: ELEVATIONS ARE BASED UPON USGS  
NGVD 29 VERTICAL DATUM MONUMENT R 76.  
ELEVATION = 6286.32'

EXISTING DRAINAGE MAP  
CROSSROADS MIXED USE  
JOB NO. 18-003  
DATE PREPARED: SEPTEMBER 18, 2020  
DATE REVISED:

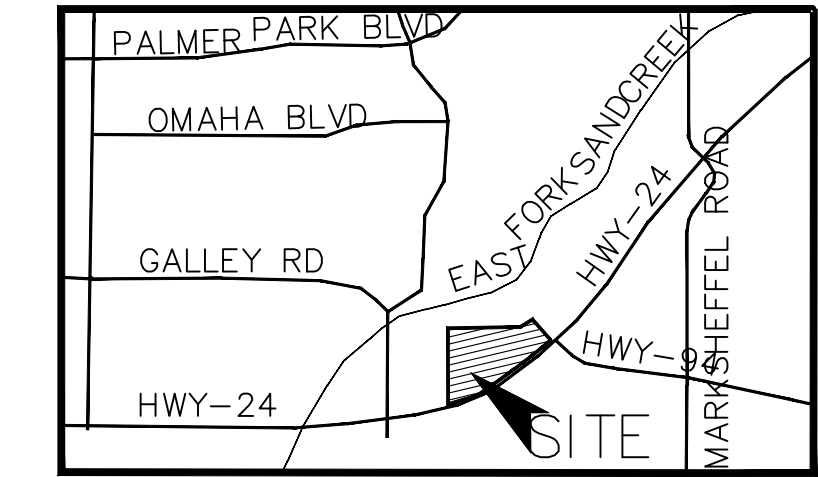
102 E PIKES PEAK AVE., STE 500  
COLORADO SPRINGS, CO  
80903  
PHONE: 719.955.5485

CIVIL CONSULTANTS, INC.



# CROSSROADS MIXED USE PROPOSED CONDITIONS DRAINAGE MAP

EXISTING MEADOWBROOK  
CROSSING FILING NO. 1  
REC. #218714112



VICINITY MAP  
N.T.S.

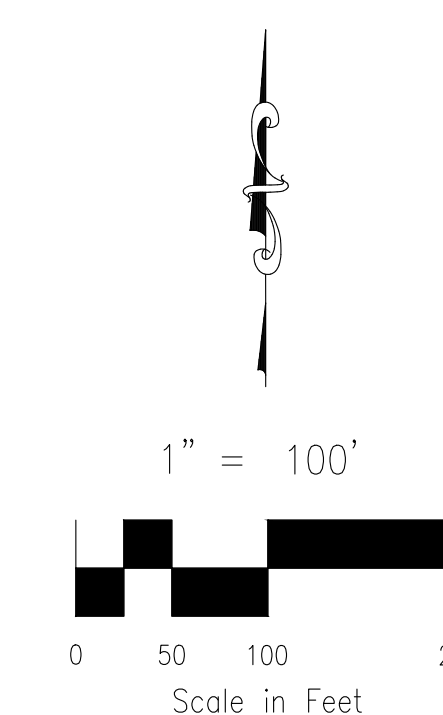
### LEGEND

- BASIN DESIGNATION
- ACRES
- 1 SURFACE DESIGN POINT
- BASIN BOUNDARY
- PROP MAJ CONT
- PROP MIN CONT
- EXIST MAJ CONT
- EXIST MIN CONT
- PROPOSED STORM SEWER PIPE
- EXISTING FLOW DIRECTION ARROW
- H.P. HIGH POINT
- L.P. LOW POINT
- PROPOSED SWALE
- EXISTING SWALE
- SITE BOUNDARY
- R.O.W./EASEMENT
- LOT LINE
- ST STORM SEWER LINE
- UE EX. UNDERGROUND ELECTRIC LINE
- SS EX. SANITARY SEWER LINE
- WL EX. WATER LINE
- ST EX. STORM SEWER LINE
- 9 LOT NUMBER
- ICV EX. IRRIGATION VALVE
- SI EX. STORM INLET
- GC EX. GAS TEST NODE
- TEL EX. TELEPHONE PEDESTAL
- EV EX. ELECTRIC VAULT
- SM EX. SANITARY MANHOLE
- WV EX. WATER VALVE
- PROPOSED RIPRAP
- EMERGENCY OVERFLOW DIRECTION

| BASIN I.D. | AREA (ACRES) | Q5 (CFS) | Q100 (CFS) |
|------------|--------------|----------|------------|
| A          | 13.2         | 46.9     | 85.6       |
| B          | 13.2         | 22.0     | 46.8       |
| C          | 3.23         | 1.9      | 8.1        |
| D          | 2.54         | 9.7      | 17.4       |

| DESIGN POINT | Q5   | Q100  | BASIN(S)    | STRUCTURE |
|--------------|------|-------|-------------|-----------|
| 1            | 46.9 | 85.6  | A           |           |
| 2            | 9.7  | 17.4  | D           |           |
| 3            | 66.4 | 127.5 | B, DP1, DP2 |           |
| 4            | 68.2 | 135.1 | C, DP3      | FSD POND  |

add a 4a for Pond release rate at design point 4



PROPOSED DRAINAGE MAP  
CROSSROADS MIXED USE  
JOB NO. 18-003  
DATE PREPARED: NOVEMBER 21, 2020  
DATE REVISED:



102 E PIKES PEAK AVE, SUITE 500  
COLORADO SPRINGS, CO 80903  
PHONE: 719.955.5465

update to match the preliminary site plan that shows a temporary cul-de-sac and update the narrative.

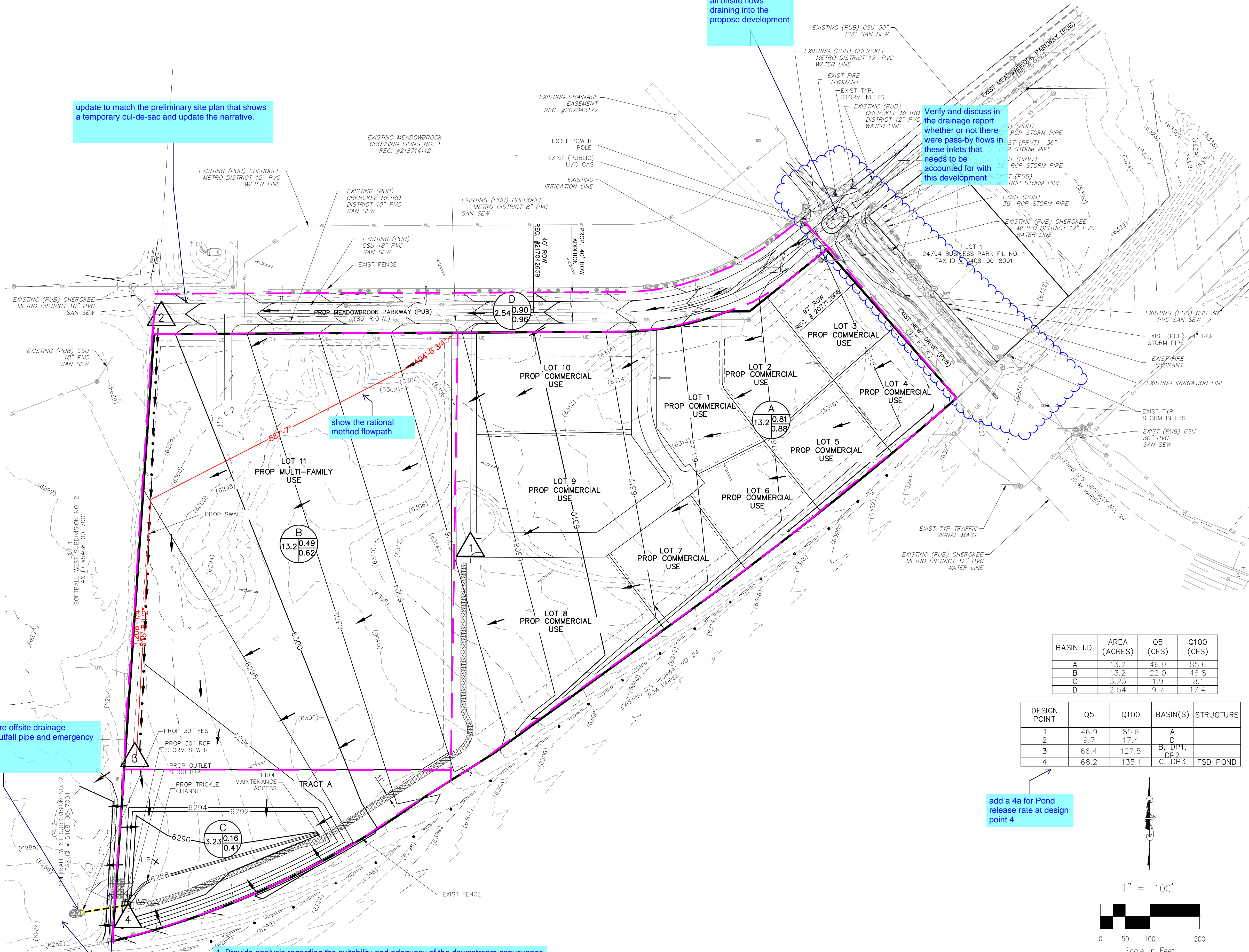
Identify and include all offsite flows draining into the propose development

Verify and discuss in the drainage report whether or not there were pass-by flows in these inlets that needs to be accounted for with this development

show the rational method flowpath

Applicant needs to acquire offsite drainage easement for the pond outfall pipe and emergency overflow path.

1. Provide analysis regarding the suitability and adequacy of the downstream conveyance between the pond outfall and East Fork Sand Creek (to include the emergency overflow path). The developed condition is a change in the characteristics from sheet flow in the historic condition to concentrated flow.
2. Show the flowpath from the pond outfall to East Fork Sand Creek







ADVANCED DRAINAGE SYSTEMS, INC.

SiteASSIST<sup>™</sup>  
by StormTech<sup>®</sup>  
FOR STORMTECH  
INSTRUCTIONS,  
DOWNLOAD THE  
INSTALLATION APP



this does not match the deviation request  
which proposed MC-3500

Update this report or the deviation  
request so the proposed product is  
consistent.

# Cross Roads - MC-4500

Colorado

## STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500 OR APPROVED EQUAL.
2. CHAMBERS SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
5. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
  - a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY AASHTO FOR THERMOPLASTIC PIPE.
  - b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
  - c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

## IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS.  
  
STORMTECH RECOMMENDS 3 BACKFILL METHODS:
  - STONESHOOTER LOCATED OFF THE CHAMBER BED.
  - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
  - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 3/4-2" (20-50 mm) MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" (300 mm) BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

## NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 CHAMBERS IS LIMITED:
  - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
  - NO RUBBER Tired LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
  - WEIGHT LIMITS FOR CONSRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

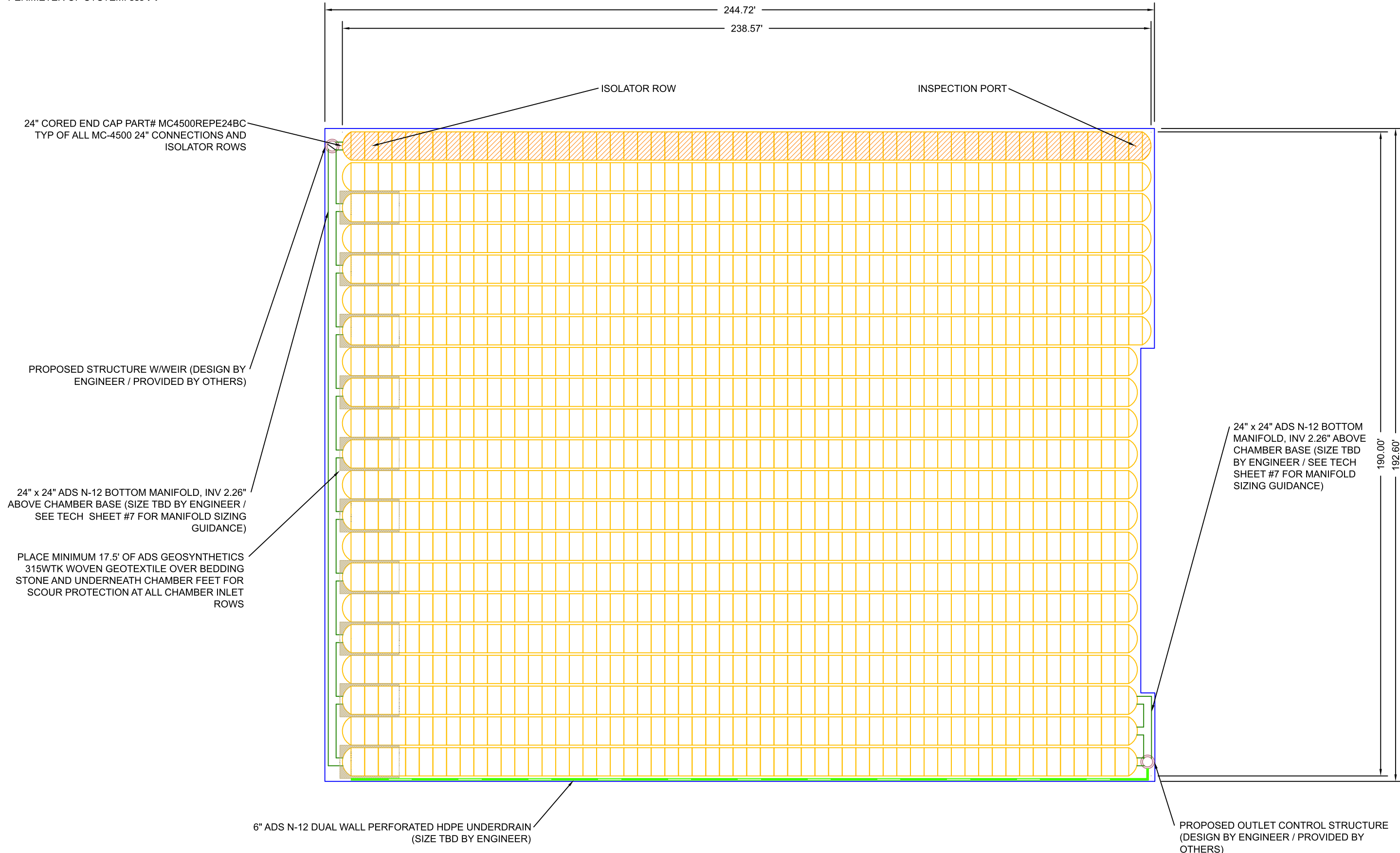
**USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.**

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

**CONCEPTUAL LAYOUT**

(1204) STORMTECH MC-4500 CHAMBERS  
 (42) STORMTECH MC-4500 END CAPS  
 INSTALLED WITH 12 " COVER STONE, 9 " BASE STONE, 40% STONE VOID  
**INSTALLED SYSTEM VOLUME: 204007 CF**  
 AREA OF SYSTEM: 46728 FT<sup>2</sup>  
 PERIMETER OF SYSTEM: 883 FT

**COMPUTER GENERATED CONCEPTUAL LAYOUT - NOT FOR CONSTRUCTION**



|                       |              |
|-----------------------|--------------|
| Cross Roads - MC-4500 |              |
| Colorado              |              |
| DATE: 10/23/2020      | DRAWN: ef    |
| PROJECT #: Tool       | CHECKED: --- |

| REV | DRW | CHK | DESCRIPTION |
|-----|-----|-----|-------------|
|     |     |     |             |
|     |     |     |             |
|     |     |     |             |
|     |     |     |             |

**StormTech**  
 Detention - Retention - Water Quality  
 70 NWWOOD ROAD, SUITE 3 | ROCKY HILL, CT | 06067  
 860-529-8188 | 866-892-2694 | WWW.STORMTECH.COM

**ADS**  
 ADVANCED DRAINAGE SYSTEMS, INC.  
 4640 TRUEMAN BLVD  
 HILLIARD, OH 43026  
 1-800-733-7473

**NOT TO SCALE**

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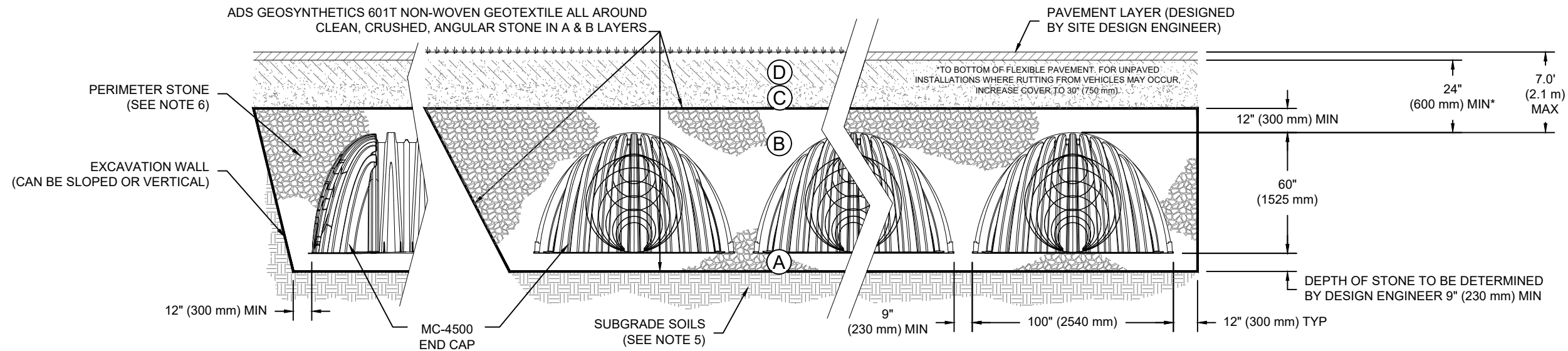


## ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

| MATERIAL LOCATION | DESCRIPTION  | AASHTO MATERIAL CLASSIFICATIONS   | COMPACTION / DENSITY REQUIREMENT  |   |
|-------------------|--|---|---|---|
| D                 | <b>FINAL FILL:</b> FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER  | N/A   | PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.   |   |
| C                 | <b>INITIAL FILL:</b> FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER. | AASHTO M145 <sup>1</sup><br>A-1, A-2-4, A-3<br><br>OR<br>AASHTO M43 <sup>1</sup><br>3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10 | BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. |   |
| B                 | <b>EMBEDMENT STONE:</b> FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.  | CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)  | AASHTO M43 <sup>1</sup><br>3, 4   | NO COMPACTION REQUIRED.   |
| A                 | <b>FOUNDATION STONE:</b> FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.   | CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)  | AASHTO M43 <sup>1</sup><br>3, 4   | PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. <sup>2,3</sup> |

**PLEASE NOTE:**

- THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
- STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
- WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



**NOTES:**

- MC-4500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
- THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
- THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
- PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
- ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

|                                   |                  |           |              |
|-----------------------------------|------------------|-----------|--------------|
| Cross Roads - MC-4500<br>Colorado | DATE: 10/23/2020 | DRAWN: ef | CHECKED: --- |
| DESCRIPTION                       | CHK              | DRW       | REV          |
| PROJECT #                         | TOOL             |           |              |

**StormTech**  
Detention/Retention/Water Quality

70 INWOOD ROAD, SUITE 3 | ROCKY HILL, CT | 06067  
860-525-8188 | 888-892-2694 | WWW.STORMTECH.COM

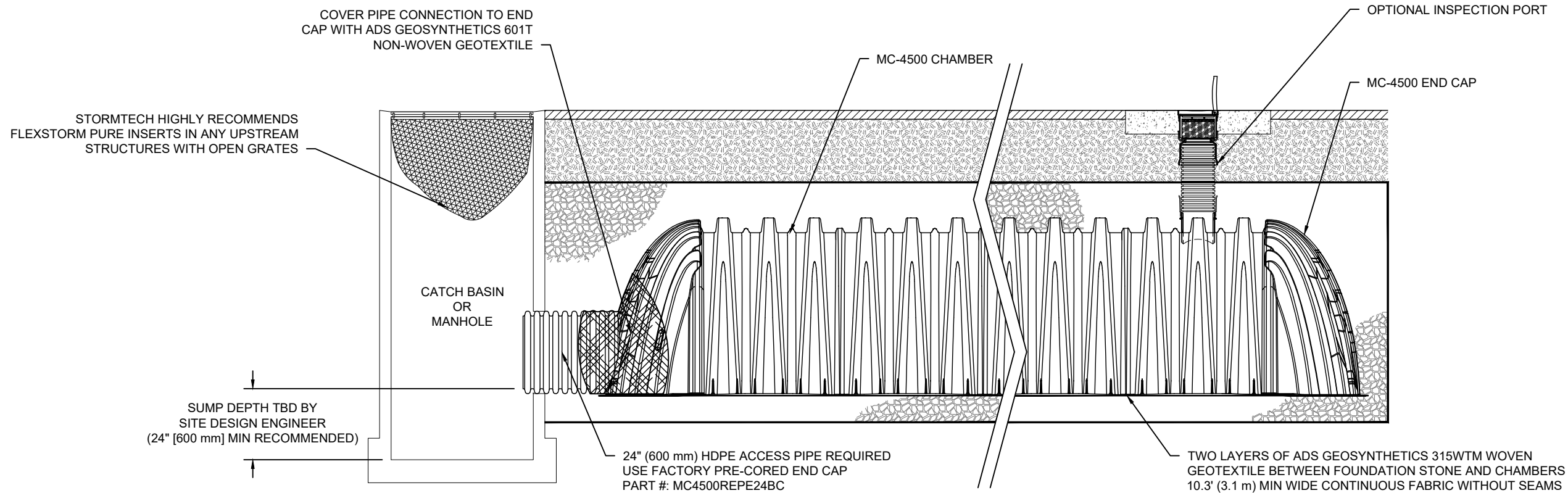
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1-800-733-7473

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SHEET

3 OF 6



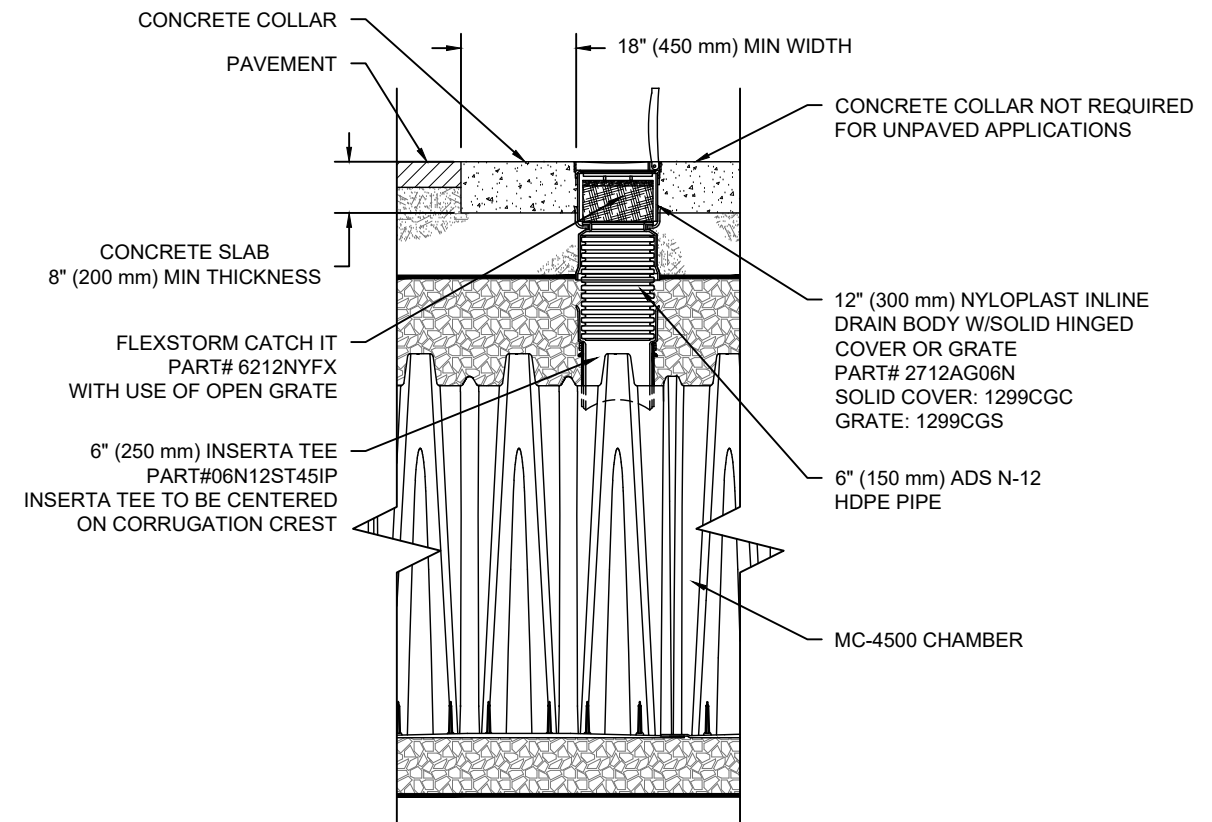
**MC-4500 ISOLATOR ROW DETAIL**  
NTS

**INSPECTION & MAINTENANCE**

- STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
    - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
    - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
    - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
    - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
    - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
  - B. ALL ISOLATOR ROWS
    - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
    - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
      - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
      - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
    - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
  - B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
  - C. VACUUM STRUCTURE SUMP AS REQUIRED
- STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.
- STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

**NOTES**

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



**MC-4500 6" INSPECTION PORT DETAIL**  
NTS

|                       |  |                  |           |              |
|-----------------------|--|------------------|-----------|--------------|
| Cross Roads - MC-4500 |  | DATE: 10/23/2020 | DRAWN: ef | CHECKED: --- |
| Colorado              |  | PROJECT #: Tool  |           |              |

| REV | DRW | CHK | DESCRIPTION |
|-----|-----|-----|-------------|
|     |     |     |             |
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|     |     |     |             |

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**ADS**  
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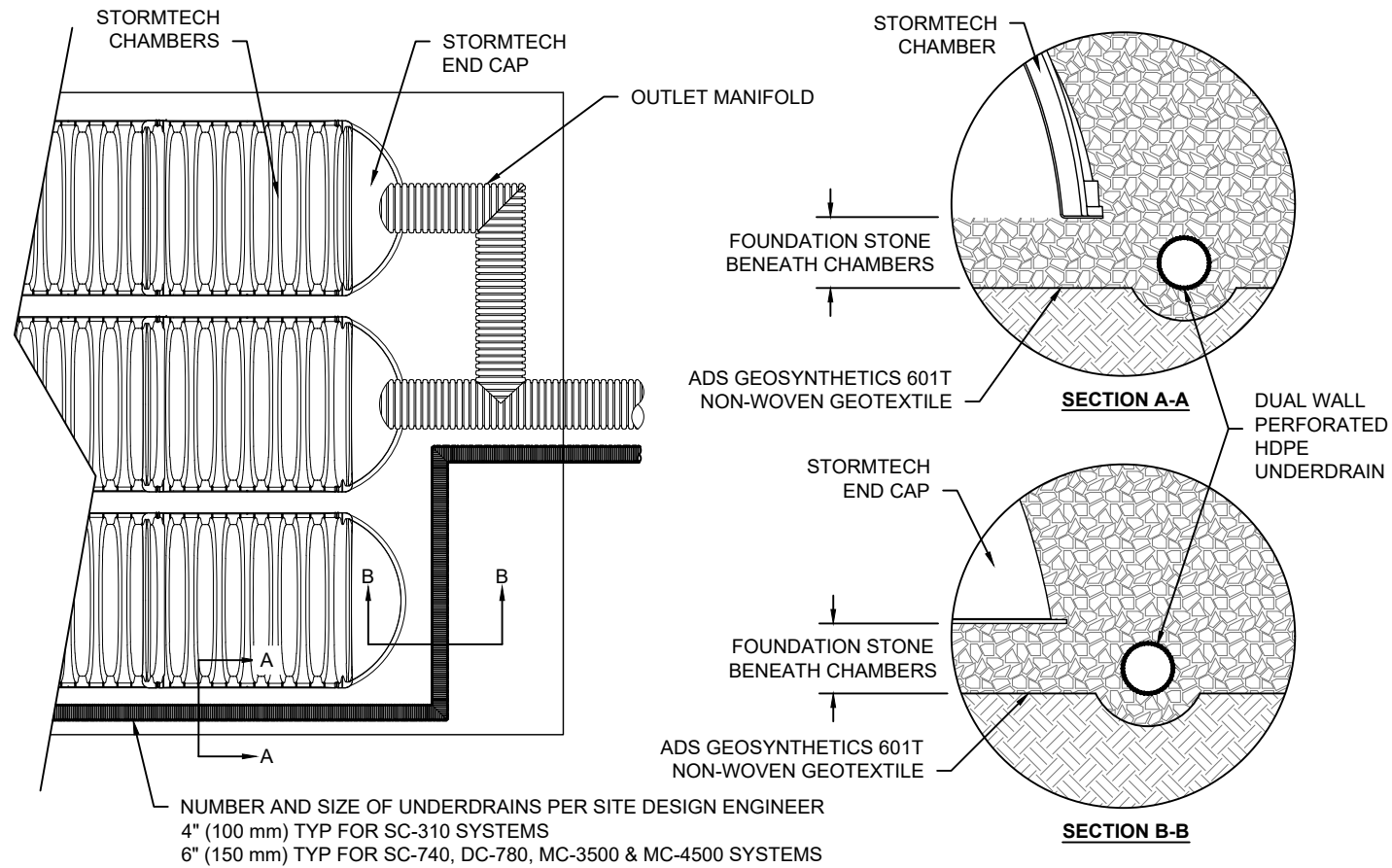
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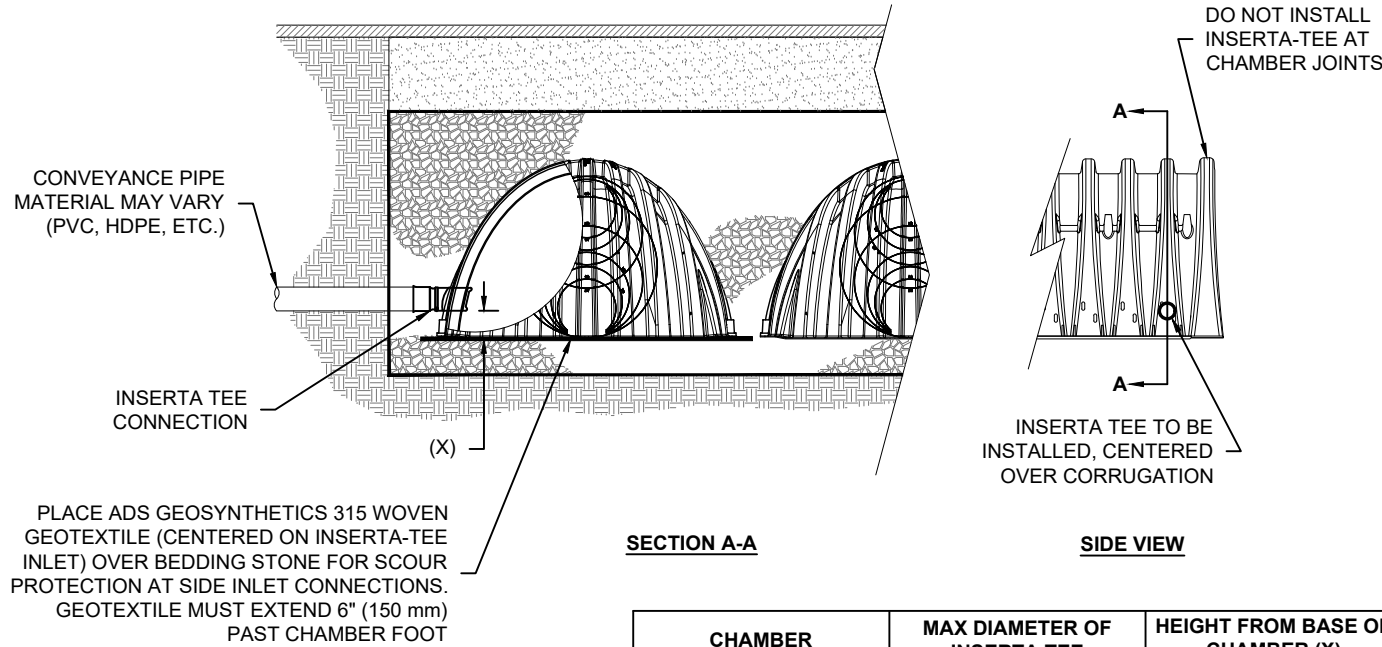
**UNDERDRAIN DETAIL**

NTS



**INSERTA TEE DETAIL**

NTS



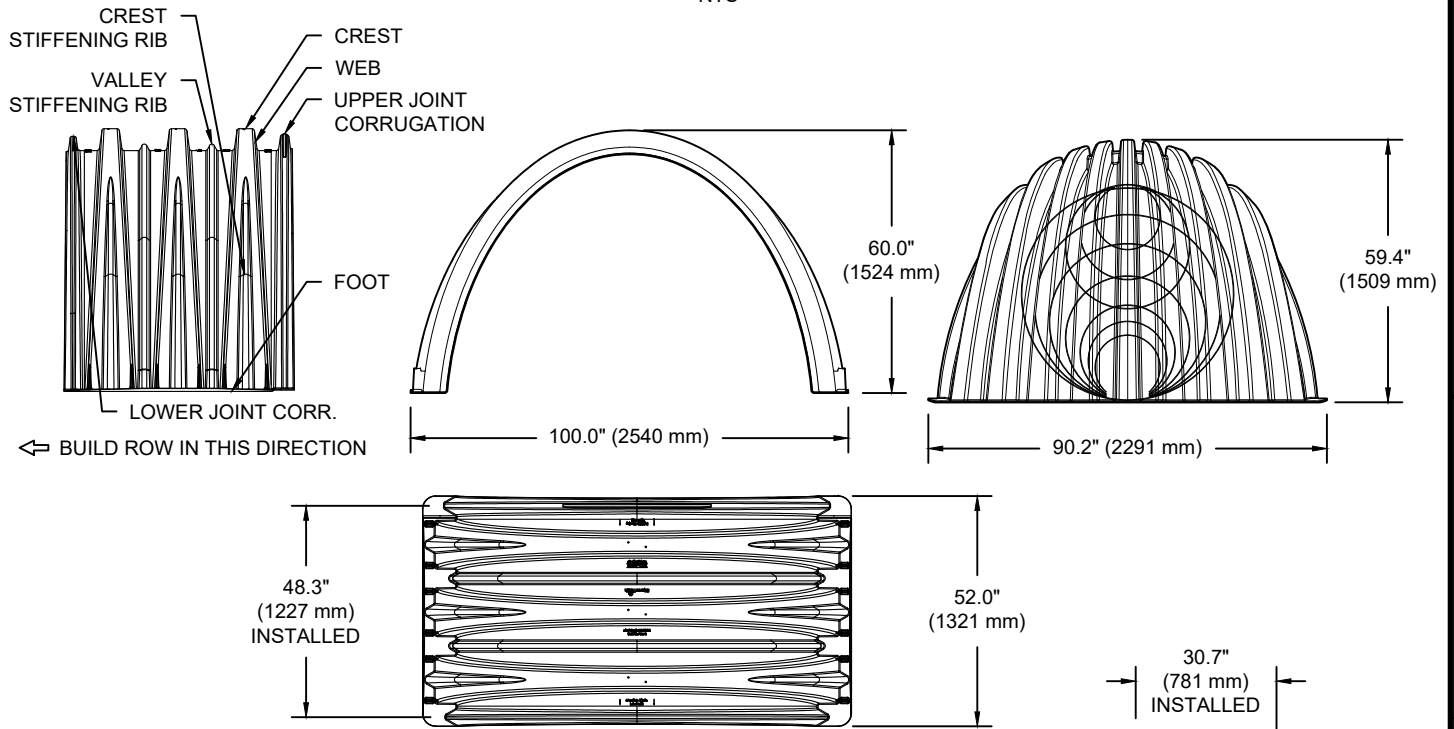
| CHAMBER | MAX DIAMETER OF INSERTA TEE | HEIGHT FROM BASE OF CHAMBER (X) |
|---------|-----------------------------|---------------------------------|
| SC-310  | 6" (150 mm)                 | 4" (100 mm)                     |
| SC-740  | 10" (250 mm)                | 4" (100 mm)                     |
| DC-780  | 10" (250 mm)                | 4" (100 mm)                     |
| MC-3500 | 12" (300 mm)                | 6" (150 mm)                     |
| MC-4500 | 12" (300 mm)                | 8" (200 mm)                     |

INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON

**NOTE:**  
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

**MC-4500 TECHNICAL SPECIFICATION**

NTS



**NOMINAL CHAMBER SPECIFICATIONS**

|                                 |                        |                               |
|---------------------------------|------------------------|-------------------------------|
| SIZE (W X H X INSTALLED LENGTH) | 100.0" X 60.0" X 48.3" | (2540 mm X 1524 mm X 1227 mm) |
| CHAMBER STORAGE                 | 106.5 CUBIC FEET       | (3.01 m <sup>3</sup> )        |
| MINIMUM INSTALLED STORAGE*      | 162.6 CUBIC FEET       | (4.60 m <sup>3</sup> )        |
| WEIGHT                          | 130.0 lbs.             | (59.0 kg)                     |

**NOMINAL END CAP SPECIFICATIONS**

|                                 |                       |                              |
|---------------------------------|-----------------------|------------------------------|
| SIZE (W X H X INSTALLED LENGTH) | 90.2" X 59.4" X 30.7" | (2291 mm X 1509 mm X 781 mm) |
| END CAP STORAGE                 | 35.7 CUBIC FEET       | (1.01 m <sup>3</sup> )       |
| MINIMUM INSTALLED STORAGE*      | 108.7 CUBIC FEET      | (3.08 m <sup>3</sup> )       |
| WEIGHT                          | 135.0 lbs.            | (61.2 kg)                    |

\*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"  
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

| PART #         | STUB          | B                | C             |
|----------------|---------------|------------------|---------------|
| MC4500REPE06T  | 6" (150 mm)   | 42.54" (1.081 m) | ---           |
| MC4500REPE06B  | ---           | ---              | 0.86" (22 mm) |
| MC4500REPE08T  | 8" (200 mm)   | 40.50" (1.029 m) | ---           |
| MC4500REPE08B  | ---           | ---              | 1.01" (26 mm) |
| MC4500REPE10T  | 10" (250 mm)  | 38.37" (975 mm)  | ---           |
| MC4500REPE10B  | ---           | ---              | 1.33" (34 mm) |
| MC4500REPE12T  | 12" (300 mm)  | 35.69" (907 mm)  | ---           |
| MC4500REPE12B  | ---           | ---              | 1.55" (39 mm) |
| MC4500REPE15T  | 15" (375 mm)  | 32.72" (831 mm)  | ---           |
| MC4500REPE15B  | ---           | ---              | 1.70" (43 mm) |
| MC4500REPE18TC | 18" (450 mm)  | 29.36" (746 mm)  | ---           |
| MC4500REPE18BC | ---           | ---              | 1.97" (50 mm) |
| MC4500REPE24TC | 24" (600 mm)  | 23.05" (585 mm)  | ---           |
| MC4500REPE24BC | ---           | ---              | 2.26" (57 mm) |
| MC4500REPE30BC | 30" (750 mm)  | ---              | 2.95" (75 mm) |
| MC4500REPE36BC | 36" (900 mm)  | ---              | 3.25" (83 mm) |
| MC4500REPE42BC | 42" (1050 mm) | ---              | 3.55" (90 mm) |

NOTE: ALL DIMENSIONS ARE NOMINAL

CUSTOM PRECURED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm) THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

Cross Roads - MC-4500  
Colorado

DESCRIPTION

REV

CHK

DRW

DATE

DRAWN

PROJECT #

TOOL

DATE

DRAWN

CHECKED

---

---

**StormTech**  
Retention/Retention Water Quality  
70 INWOOD ROAD, SUITE 3 | ROCKY HILL, CT | 06067  
860-525-8188 | 888-892-2694 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD  
HILLIARD, OH 43026  
1-800-733-7473

**ADS**  
ADVANCED DRAINAGE SYSTEMS, INC.

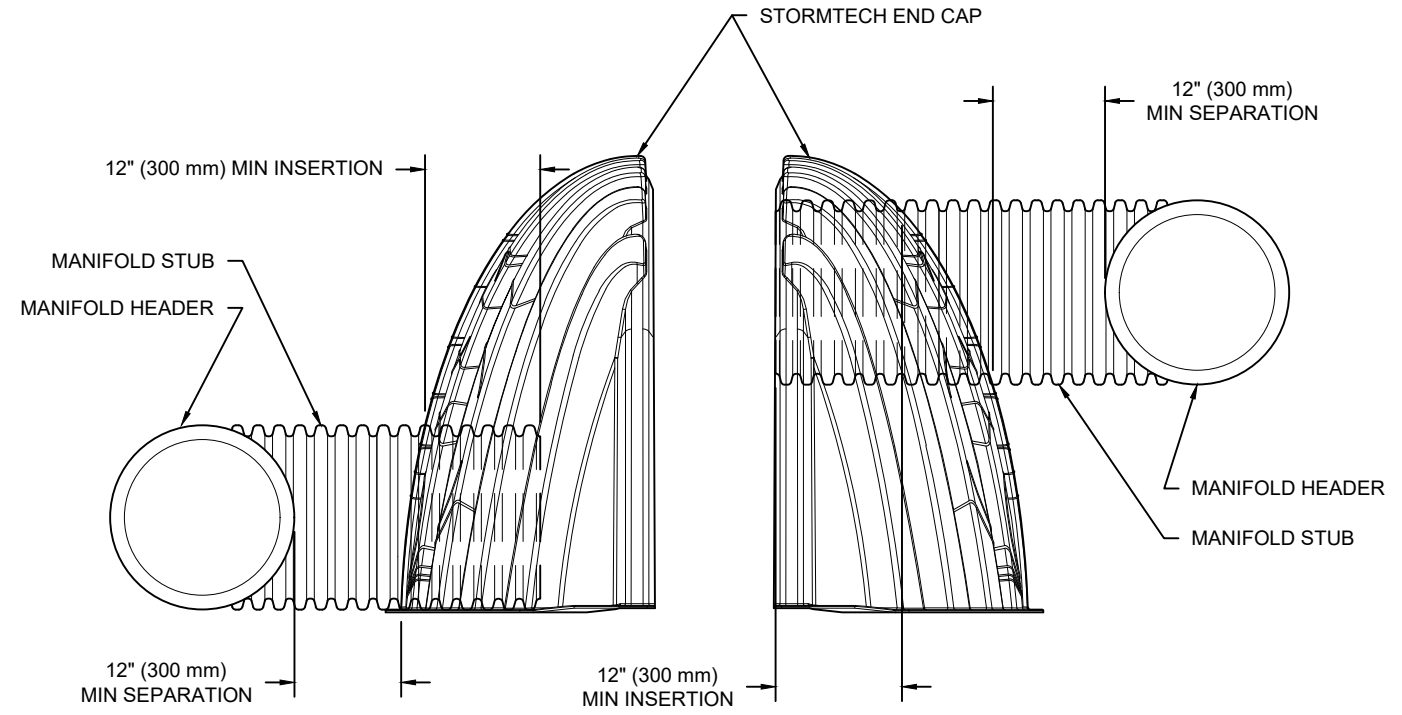
SHEET

5 OF 6

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

**MC-SERIES END CAP INSERTION DETAIL**

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

**ADS**  
ADVANCED DRAINAGE SYSTEMS, INC.  
4640 TRUEMAN BLVD  
HILLIARD, OH 43026  
1-800-733-7473

**StormTech**  
Detention/Retention/Water Quality  
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06867  
860-528-8188 | 888-892-2694 | WWW.STORMTECH.COM

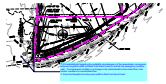
| REV | DRW | CHK | DESCRIPTION |
|-----|-----|-----|-------------|
|     |     |     |             |
|     |     |     |             |
|     |     |     |             |

|                       |              |
|-----------------------|--------------|
| Cross Roads - MC-4500 |              |
| Colorado              |              |
| DATE: 10/23/2020      | DRAWN: ef    |
| PROJECT #: Tool       | CHECKED: --- |

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

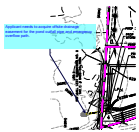
# drainage V\_1 engr comments.pdf Markup Summary

dsdlaforce (34)



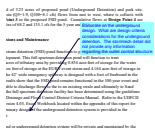
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**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 1:02:32 PM  
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**Space:**

1. Provide analysis regarding the suitability and adequacy of the downstream conveyance between the pond outfall and East Fork Sand Creek (to include the emergency overflow path). The developed condition is a change in the characteristics from sheet flow in the historic condition to concentrated flow.  
2. Show the flowpath from the pond outfall to East Fork Sand Creek



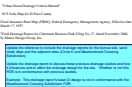
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**Date:** 1/25/2021 1:02:53 PM  
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**Space:**

Applicant needs to acquire offsite drainage easement for the pond outfall pipe and emergency overflow path.



**Subject:** Callout  
**Page Label:** 7  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 1:06:40 PM  
**Status:**  
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Elaborate on the underground design. What are design criteria considerations for the underground detention. The stormtech detail did not provide any information regarding the outlet control structure

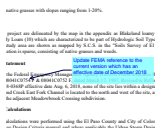


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**Author:** dsdlaforce  
**Date:** 1/25/2021 1:19:42 PM  
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Update the reference to include the drainage reports for the borrow site, sand creek dbps and the adjacent sites (Circle K and Meadowbrook Crossing Subdivision).

Update the drainage report to discuss these previous drainage studies and how it influences and or affect the drainage design for the site. Whether or not this PDR is in conformance with previous studies.

Example: This drainage report's basin D design is not in conformance with the Meadowbrook Crossing Subdivision FDR.



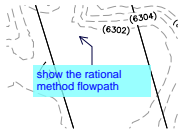
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**Lock:** Unlocked  
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**Date:** 1/25/2021 1:20:09 PM  
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Update FEMA reference to the current version which has an effective date of December 2018



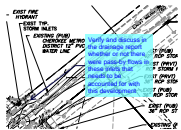
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**Date:** 1/25/2021 1:33:11 PM  
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**Layer:**  
**Space:**

1,208'-1/4"



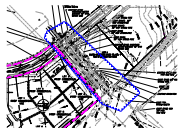
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show the rational method flowpath



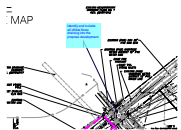
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**Author:** dsdlaforce  
**Date:** 1/25/2021 1:39:20 PM  
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**Space:**

Verify and discuss in the drainage report whether or not there were pass-by flows in these inlets that needs to be accounted for with this development



**Subject:** Cloud  
**Page Label:** [1] DM  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 1:39:56 PM  
**Status:**  
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**Space:**

Identify and include all offsite flows draining into the propose development



**Subject:** Callout  
**Page Label:** 46  
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**Author:** dsdlaforce  
**Date:** 1/25/2021 1:48:36 PM  
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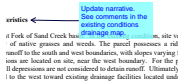
Update. UD Detention has a restrictor plate 12" above the pipe invert



**Subject:** Callout  
**Page Label:** 59  
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**Author:** dsdlaforce  
**Date:** 1/25/2021 1:51:01 PM  
**Status:**  
**Color:** ■  
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**Space:**

this does not match the deviation request which proposed MC-3500

Update this report or the deviation request so the proposed product is consistent.



**Subject:** Callout  
**Page Label:** 6  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 10:08:48 AM  
**Status:**  
**Color:** ■  
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**Space:**

Update narrative. See comments in the existing conditions drainage map.



**Subject:** Text Box  
**Page Label:** 48  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 10:11:53 AM  
**Status:**  
**Color:** ■  
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**Space:**

M&S Civil prepared a FDR and GEC Plan for this site (Project Name: Meadowbrook Dirt Borrow Site, PCD File No CDR189) and construction permit obtained (CON1834) to perform work per the approved plans.

Provide updated existing contours of the site that reflects the existing condition.  
 Revise existing condition map and update the narrative/calculation accordingly.



**Subject:** Highlight  
**Page Label:** 6  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 10:20:02 AM  
**Status:**  
**Color:** ■  
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**Space:**

Once a site layout for the apartment site is obtained, and more information is collected for the commercial lots, this drainage report will be updated to include storm piping, inlets and storm sewer manholes



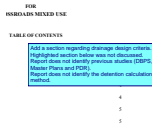
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**Subject:** Image  
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**Space:**



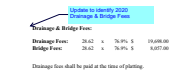


**Subject:** Highlight  
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**Subject:** Text Box  
**Page Label:** 3  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 10:40:01 AM  
**Status:**  
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**Space:**

Add a section regarding drainage design criteria. Highlighted section below was not discussed. Report does not identify previous studies (DBPS, Master Plans and PDR). Report does not identify the detention calculation method.



**Subject:** Callout  
**Page Label:** 8  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 12:06:39 PM  
**Status:**  
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**Space:**

Update to identify 2020 Drainage & Bridge Fees

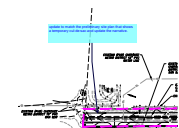


**Subject:** Callout  
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**Author:** dsdlaforce  
**Date:** 1/25/2021 12:08:10 PM  
**Status:**  
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**Layer:**  
**Space:**

Remove or revise first sentence. GEC is required if the applicant is planning to disturb greater than an acre. In this case it is required because the application is requesting pre-development GEC



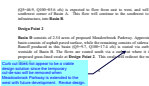
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**Subject:** Callout  
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**Date:** 1/25/2021 12:14:17 PM  
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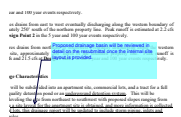
update to match the preliminary site plan that shows a temporary cul-de-sac and update the narrative.





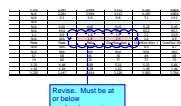
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**Lock:** Unlocked  
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**Date:** 1/25/2021 12:15:58 PM  
**Status:**  
**Color:** ■  
**Layer:**  
**Space:**

Curb cut does not appear to be a viable design solution since the temporary cul-de-sac will be removed when Meadowbrook Parkway is extended to the west with future development. Revise design.



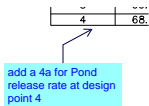
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**Date:** 1/25/2021 12:19:52 PM  
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**Space:**

Proposed drainage basin will be reviewed in detail on the resubmittal once the internal site layout is provided.



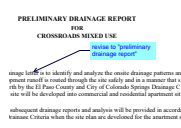
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**Color:** ■  
**Layer:**  
**Space:**

Revise. Must be at or below predevelopment



**Subject:** Callout  
**Page Label:** [1] DM  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 12:58:18 PM  
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**Color:** ■  
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**Space:**

add a 4a for Pond release rate at design point 4



**Subject:** Callout  
**Page Label:** 4  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 9:32:30 AM  
**Status:**  
**Color:** ■  
**Layer:**  
**Space:**

revise to "preliminary drainage report"

his drainage letter is development runoff i; set forth by the El P

**Subject:** Line  
**Page Label:** 4  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 9:32:34 AM  
**Status:**  
**Color:** ■  
**Layer:**  
**Space:**

FIRM PANEL W/ REVISED LOMR  
Replace the FEMA panel with the latest version which has an effective date of 12/7/2018. If the LOMR was incorporated in the latest FEMA FIRM then it does not need to be included.

**Subject:** Text Box  
**Page Label:** 7  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 9:40:19 AM  
**Status:**  
**Color:** ■  
**Layer:**  
**Space:**

Replace the FEMA panel with the latest version which has an effective date of 12/7/2018. If the LOMR was incorporated in the latest FEMA FIRM then it does not need to be included.

Example: Runoff from the roof of the building will be collected in a gutter and discharged into a storm drain. The gutter and storm drain are shown in the plan view. The gutter and storm drain are shown in the plan view. The gutter and storm drain are shown in the plan view.

**Subject:** Cloud  
**Page Label:** 5  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 9:49:19 AM  
**Status:**  
**Color:** ■  
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**Space:**

Update to discuss drainageway (natural and/or manmade)

Peace County and City of Colorado Springs Storm Drainage Design  
1 data sheets are included in the appendix of this report.  
SP Provision: **Drainageway (Natural)**  
Example: Runoff from the roof of the building will be collected in a gutter and discharged into a storm drain. The gutter and storm drain are shown in the plan view. The gutter and storm drain are shown in the plan view. The gutter and storm drain are shown in the plan view.

**Subject:** Callout  
**Page Label:** 5  
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**Date:** 1/25/2021 9:50:07 AM  
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**Space:**

Example: Runoff from the roof of the building will be collected in a gutter and discharged into a storm drain. The gutter and storm drain are shown in the plan view. The gutter and storm drain are shown in the plan view. The gutter and storm drain are shown in the plan view.

**Subject:** Callout  
**Page Label:** 5  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 9:51:21 AM  
**Status:**  
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**Layer:**  
**Space:**

update. Only one temporary sediment pond is shown on the plans.

Full Spectrum Detection Pond is to be installed in the storm drain (2) enter the disturbed area this will maintain. And prior to construction identify the specific type of permanent WQ control measure to be installed.

**Subject:** Callout  
**Page Label:** 5  
**Lock:** Unlocked  
**Author:** dsdlaforce  
**Date:** 1/25/2021 9:51:30 AM  
**Status:**  
**Color:** ■  
**Layer:**  
**Space:**

identify the specific type of permanent WQ control measure is being used.

**Greese (4)**

Project #18-003A


PCD Filing No.:  
SP-20-011

**Subject:** SW - Text Box  
**Page Label:** 1  
**Lock:** Unlocked  
**Author:** GREese  
**Date:** 12/28/2020 1:00:06 PM  
**Status:**  
**Color:** ■  
**Layer:**  
**Space:**

PCD Filing No.:  
SP-20-011

using control plan and control without any, tracking and controlling the material on the site. This project is responsible for the site, including mapping, storage and control areas as discussed by the comments of the project and the project manager. The site is the same.


The 12/28/2020 12:35:56 PM  
The 12/28/2020 12:35:56 PM  
The 12/28/2020 12:35:56 PM  
The 12/28/2020 12:35:56 PM

**Subject:** Image  
**Page Label:** 5  
**Lock:** Unlocked  
**Author:** GReese  
**Date:** 12/28/2020 12:35:56 PM  
**Status:**  
**Color:**   
**Layer:**  
**Space:**

Temporary Implementation Plans are provided to collect baseline to measure existing water quality, which allows development.

Step 4 - Consider need for additional and future BMPs and erosion control plans with BMPs to place them. Step 4 - Consider existing erosion control and measures to mitigate the potential for erosion across the site. This is necessary to plan for the site including mapping, storage, a contractor. If you have any questions, please contact the project manager.


Step 4 - Consider need for additional and future BMPs and erosion control plans with BMPs to place them. Step 4 - Consider existing erosion control and measures to mitigate the potential for erosion across the site. This is necessary to plan for the site including mapping, storage, a contractor. If you have any questions, please contact the project manager.

**Subject:** SW - Comment  
**Page Label:** 5  
**Lock:** Unlocked  
**Author:** GReese  
**Date:** 12/28/2020 12:37:39 PM  
**Status:**  
**Color:**   
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**Space:**

Revise Step 4. This should be n/a since no specialized BMPs are required

Control

The 12/28/2020 3:04:19 PM  
The 12/28/2020 3:04:19 PM  
The 12/28/2020 3:04:19 PM  
The 12/28/2020 3:04:19 PM

**Subject:** SW - Comment  
**Page Label:** 7  
**Lock:** Unlocked  
**Author:** GReese  
**Date:** 12/28/2020 3:04:19 PM  
**Status:**  
**Color:**   
**Layer:**  
**Space:**

Only one SB shown on GEC plans. Revise this text accordingly.