

**PRELIMINARY DRAINAGE REPORT
FOR
SOLACE APARTMENTS**

**Prepared For:
Jackson Dearborn Partners
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**January 23, 2020
Project No. 25174.00**

**Prepared By:
JR Engineering, LLC
5475 Tech Center Drive
Colorado Springs, CO 80919
719-593-2593**

Add PCD File No. SP201

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso 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.

Mike Bramlett, Colorado P.E. # 32314
For and On Behalf of JR Engineering, LLC

Date

DEVELOPER'S STATEMENT:

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

Business Name: Jackson Dearborn Partners

By: _____

Title: _____

Address: 404 S. Wells Street
Chicago, IL 60607

El Paso County:

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

Jennifer Irvine, P.E.
County Engineer/ ECM Administrator

Date

Conditions:



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PURPOSE

This document is the Preliminary Drainage report for the Solace Apartments. The purpose of this report is to:

1. Identify on-site and off-site drainage patterns.
2. Recommend storm water facilities to collect and convey storm runoff from the proposed development to appropriate discharge and/or detention locations.
3. Recommend water quality and detention facilities to control discharge release rates to below historic.
4. Demonstrate compliance with surrounding major drainage basin planning studies, master development drainage plans and flood insurance studies.

GENERAL LOCATION AND DESCRIPTION

Location

The proposed Solace Apartments, known as “Solace” from herein, is a parcel of land located in Section 7, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. Solace is a 28.99 acre, urban, multifamily-development and is comprised of 16 apartment dwellings and associated infrastructure. Solace will be split into two phases for construction, phase one contains most of the site with phase two containing the northern most section of the development. See appendix A for a site plan exhibit showing the Solace phasing. Solace is bound by existing industrial developments to the North and vacant land to the West. Galley Road bounds the property to the south and existing light industrial businesses to the east. A vicinity map of the area is presented in Appendix A.

Currently, there is one major Drainageway that runs along Solace: Sand Creek (Center Tributary) Drainageway. This Drainageway was analyzed, both hydrologically and hydraulically, in the following reports:

- Sand Creek Drainage Basin Planning Study (KEC), January 1993.
- Flood Insurance Study– El Paso County, Colorado & Incorporated Areas Vol 7 of 8, December 2018.
- Sand Creek channel Improvement Design Report for Solace Apartments (JR), December 2019.
- LOMR- Case No. 05-08-0368P Federal Emergency Management Agency, May 23, 2007.

The impact of this Drainageway and planning studies on the proposed development will be discussed later in the report.

Description of Property

Solace is currently unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, Solace slopes from northwest to southeast.

Per an NRCS web soil survey of the area, Solace is made up of Type B soils with a very small percentage of Type A in the northwest corner of the property. This Type B soil is a Blendon sandy loam. This soil type has a moderate infiltration rate when thoroughly wet. It also consists of moderately deep or deep, moderately well drained or well drained soil. A soil survey map has been presented in Appendix A.

Floodplain Statement

Based on the FEMA FIRM Map number 08041C0558G, dated December 7, 2018, a portion of the existing drainage way lies within Zone AE and Zone X. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The FIRM Map has been presented in Appendix A.

DRAINAGE BASINS AND SUBBASINS

Existing Major Basin Descriptions

Solace lies within Sand Creek Drainage Basin based on the “*Sand Creek Drainage Basin Planning Study*” prepared by Kiowa Engineering in January 1993.

The Sand Creek Drainage Basin covers approximately 54 square miles in unincorporated El Paso County, CO. The Sand Creek Drainage Basin is tributary to Fountain Creek. In its existing condition, the basin is comprised of rolling rangeland with fair to good vegetative cover associated with Colorado’s semi-arid climate. The natural Drainage way within the site limits is typically deep and narrow with a well-defined flow path in most areas. Anticipated land use for the basin includes multifamily residential and open space.

As part of its drainage research, JR Engineering reviewed the following drainage studies, reports and LOMRs:

- Sand Creek Drainage Basin Planning Study prepared by Kiowa Engineering Corporation in January 1993.
- Flood Insurance Study– El Paso County, Colorado, & Incorporated Areas Vol 7, December 2018.
- LOMR- Case No. 05-08-0368P Federal Emergency Management Agency, May 23, 2007.
- Sand Creek channel Improvement Design Report for Solace Apartments (JR), December 2019

The *Sand Creek Drainage Basin Planning Study* was used to establish a stormwater management plan for the existing and future stormwater infrastructure needs within the Sand Creek Drainage Basin. Based on provided drainage maps and analysis, in its existing condition, the Sand Creek Drainageway contains a 100-year flow of 720-960 cfs along Solace's east property line. The major Sand Creek Drainageway conveys the stormwater south along the eastern property line where it ultimately outfalls into the Fountain Creek. JR Engineering has performed checks on these flow rates to verify their validity. Basin calculations show that the 720-960 cfs are still valid for this existing condition.

FEMA prepared a revised FIS for El Paso County Colorado, Volume 7 of 8, dated December 7, 2018. The effective floodplain for the site is shown on the FIRM 08041C0752G, revised to reflect LOMR, dated December 7, 2018. The study area of the FIS where the Sand Creek Drainageway crosses Galley Road, was found to overtop the culverts and flow onto the road. According to the FIS, this crossing has a 10% annual chance of flooding and is located in Zone AE of the FIRM. The *Sand Creek Drainage Basin LOMR* was executed on May 23, 2007. The LOMR revised the flood zone or the area south of Galley Road. See FIRM Map Panel 08041C0752G for limits of LOMR study and revised flood zones, presented in Appendix D.

Existing drainage map was not provided. Further review of the existing sub-basin paragraphs will be done when map is provided in the re-submittal.

Existing Sub-basin Drainage

On-site, existing basin drainage patterns are generally from northwest to southeast by way of on-site swales. Existing on-site areas flow directly into the Sand Creek Drainageway. As seen in the existing drainage map, the site can be broken into two basins, A and B.

Basin A contains a total of 23.98 acres and is broken down into three sub-basins, A1, A2, and A3. Sub-basin A1 is 14.75 acres and consists of the western portion of the site. It drains via overland flow southwest into the Sand Creek Drainageway. Sub-basin A2 is 3.79 acres and drains south via overland flow offsite and onto Galley Road, where it runs east in the existing curb and gutter and into the Sand Creek Drainageway. Sub-basin A3 is 5.44 Acres and drains south offsite and onto Galley Road where it drains east via the existing curb and gutter to the Sand Creek Drainageway. As seen on the existing drainage map.

Basin B consists only of Sub-basin B1, a total of 4.84 acres that drains overland southwest and offsite into an existing retention pond on the northeast corner of the intersection of Galley Road and Powers Blvd. The basin is located on the western portion of the site.

Proposed Sub-basin Drainage

The proposed Solace basin delineation is as follows;

Basin A contains a total of 8.84 acres. This basin represents the north eastern portion of the proposed development. This basin is primarily multifamily residential and minor open space, and stormwater runoff is conveyed via private streets. Runoff is captured via a series of on-grade and sump inlets.

The drainage plan indicates Basin A-2. Revise the map/narrative accordingly

Be sure to account for upstream flow on Paonia st. (see comment on drainage plan).

elaborate that the conveyance swale at the toe of the berm is to be within your property.

Please indicate the flow going into the drainageway. How does it compare to existing conditions since now its concentrated flow. Indicate any improvements necessary at this location of the sand creek drainageway

Runoff is then piped to a proposed onsite Pond A. From the detention pond, the treated flows are then released directly into the Sand Creek Drainageway.

Basin B contains a total of 19.29 acres. This basin represents the south western portion of the proposed development. This basin is primarily multifamily residential and minor open space, and stormwater runoff is conveyed via private streets. Runoff is captured via a series of on-grade and sump inlets. Runoff is then piped to a proposed onsite Pond B. From the detention pond, the treated flows are then released directly into the Sand Creek Drainageway.

Basin OS consists of Sub-Basins OS1-OS2 combining for a total of 22.64 acres. This basin represents the developed land located to the north of the proposed development's property line, where the site ties in to Paonia Street. These sub-basins are primarily light industrial sites and open space, and stormwater runoff is conveyed via overland flow and local roads. Runoff from Sub-Basin OS1 is captured by the local street Paonia Street, where the runoff is conveyed to the south where it will come onto the proposed Solace site. A Type R inlet is proposed to capture this offsite flow at the north property line. Once this existing flow has been captured, the runoff will be piped directly into the existing Sand Creek Drainageway. Sub-basin OS2 is capture by an existing swale along N. Powers Boulevard. The Solace Apartment site has a 5' berm that is proposed along the northern property line. This berm will prevent any drainage from this basin to reach the site. A summary table of proposed basin parameters and flow rates is presented in Appendix B.

See Table 3 below for the proposed pond parameters.

Please elaborate on your existing and proposed sub-basin description providing discussion on flow rates and design points (developed and existing). Further break down your sub-basins as necessary. Also indicate the ultimate Qs entering the sand creek drainage way and at the culverts at Galley Rd. See comments on the drainage plan.

There is little, to no open space in this basin. See comment on drainage plan and revise accordingly.

Table 3: Pond Summary

Tributary Sub-Basin	Pond Name	Tributary Acres	Comp % Imperv.	MO Volume (ac-ft)	Detention Volume (ac-ft)	Provided Volume (ac-ft)
A	POND A	8.84	51.0	0.154	0.838	2.453
B	POND B	19.29	43.8	0.305	1.641	4.465

Existing Major Drainageway – Sand Creek

the report is dated 2019

The Sand Creek channel conveys an existing 720-960 cfs along the sites eastern property line. In order to maintain the drainage patterns on the site, 2 detention ponds have been proposed to release developed flows, at or below historic rates. Based on the results of the "Sand Creek Channel Analysis Report for Solace Apartments" prepared by JR Engineering in January 2020, the existing channel sections will need protection from erosion as a result of the Solace development. This report analyzed the existing conditions to ensure that the Sand Creek channel is stable and velocities do not exceed allowable limits. Based on the results of this report, it was found that the channel in its current conditions is inadequate, as velocities in the channel exceeded allowable limits and overtopping occurs at the Galley Road. The report recommended several improvements to ensure channel stability, including channel lining such as riprap to protect from the high velocities, widening

Please provide a statement indication that the Future Final Drainage report will provide a more detailed basin breakdown and calculate the runoff at each of the inlets and storm sewers. Also the final drainage report will provide the final design of the two full spectrum detention/water quality facilities.

Sand Creek Center Tributary Channel Analysis..... is the title of the report. Please revise

Preliminary Drainage Report
Solace Apartments

The channel hydraulics are in Appendix B of the channel analysis report. Please revise.

the channel to increase capacity and decrease velocity & adding check/ drop structures to reduce velocities. The report also indicates that improvements are not necessary at the Galley Road crossing as overflow structures are currently in place to convey any overtopping flows. Channel hydraulic analysis sheets are presented in Appendix D. A drainage map for the Solace site can be found in Appendix E.

Add a narrative explaining why the report used the UDFCD Table 6-4 for computing the runoff coefficient versus the County's current criteria.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the “*City of Colorado Spring/El Paso County Drainage Criteria Manual*” Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the “*Urban Storm Drainage Criteria Manual*” Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the “*Colorado Springs Drainage Criteria Manual (CCSDCM)*”, dated May 2014, as adopted by El Paso County.

Chapter 6 as Chapter 13 is full spectrum detention.

Hydrologic Criteria

All hydrologic data was obtained from the “*El Paso Drainage Criteria Manual*” Volumes 1 and 2, and the “*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*” Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Rational Method calculations were prepared, in accordance with Section 13.3.2.1. of the CCSDCM, for the sub-basins that directly impact the sizing of the proposed storm sewer outfalls. Rational method calculations are presented in Appendix B.

Given the split flow further upstream between the channel and paonia st. A 2D model may be required with the final drainage report.

Mile High Flood District’s MHFD-Detention, Version 4.00 workbook was used for pond sizing. Required detention volumes and allowable release rates were designed per USDCM and CCS/EPCDCM. Pond sizing spreadsheets are presented in Appendix C.

Hydraulic Criteria

GeoHECRAS was used as the primary analysis method for the site in the *Sand Creek Channel Analysis Report for Solace Apartments*. GeoHECRAS was used to model existing flows within the Sand Creek Drainageway. This model was used to verify flood plains and analyze any overtopping that may occur within the project site. The 100-year water surface profiles for the model were analyzed from the north property line of the site to the area just south of the Galley Road Crossing.

DRAINAGE FACILITY DESIGN

General Concept

The proposed stormwater conveyance system was designed to convey the developed Solace runoff to two proposed full spectrum water quality and detention ponds via private storm sewer. The proposed ponds were designed to release at less than historic rates to minimize adverse impacts downstream.

Is Pond A going to be designed/constructed with Phase 1 based on buildout condition of Phase 2? Add a narrative on the construction for the two ponds with respect to the planned phasing of the development.

Treated water will outfall directly into the Sand Creek Drainageway, where it will eventually outfall into Fountain Creek. A proposed drainage pond and channel outfall locations and imp

The pond bottom appears to be at the same elevation as the channel bottom. Provide a general concept regarding how you plan to approach the pond outfall design with respect to potential backflow effect from the adjacent channel. The detention pond must still meet the release time with respect to senate bill 15-212.

Specific Details

Four Step Process to Minimize Adverse Impacts of Urbanization

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume (WQCV), and consider the need for Industrial Commercial BMP's.

Step 1, Reducing Runoff Volumes: The development of the project site is a proposed multifamily development with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes.

Step 2, Stabilize Drainageways: Solace utilizes private storm sewer throughout the project site. This private storm sewer directs the on-site development flows to the multiple detention ponds within the project that release at or below historic rates into the Sand Creek Drainageway. Sand Creek (Center Tributary) Drainageway is stabilized downstream of the development. Based upon the proposed reduction in released flows compared to the pre-developed flows, no impact to downstream is anticipated.

Include discussion of the sand creek drainageway and how it will be stabilized.

Step 3, Provide WQCV: Runoff from this development is treated through capture and slow release of the WQCV in multiple full spectrum water quality and detention ponds that are designed per current El Paso County drainage criteria.

Identify the specific BMP used. Extended Detention Basin.

Step 4, Consider the need for Industrial and Commercial BMP's: No industrial or commercial uses are proposed within this development. However, a site specific storm water quality and erosion control plan and narrative are prepared in conjunction with this report. Site specific temporary source control BMPs as well as permanent BMP's are detailed in this plan and narrative to protect receiving waters.

Water Quality

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full spectrum water quality and detention are provided for all developed basins. Outlet structure release rates shall be limited to less than historic rates to minimize adverse impacts to downstream stormwater facilities. Complete pond and outlet structure designs shall be completed with the final drainage report.

Erosion Control Plan

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate must be submitted with each Final Drainage Report. The Erosion Control Plan for Solace will be submitted once the preliminary phase for Solace is complete.

O&M was not submitted with this preliminary plan application. O&M will be required at the final plat application. Please revise to state that it shall be submitted with the final drainage report.

Operation & Maintenance

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. All proposed drainage structures within the any platted County ROW will be owned and maintained by El Paso County. All proposed drainage structures within the property or tracts will be owned and maintained by the property owner. Vegetation in the natural and improved portions of Sand Creek Drainageway is the responsibility of El Paso County. This includes all mowing, seeding and weed control activities. An Inspection & Maintenance Plan is submitted concurrently with this drainage report that details the required maintenance activities and intervals to ensure proper function of all stormwater infrastructure.

Provide explanation/justification how these 2 ponds meet all the criteria for credit/reimbursement. List each criteria in ECM Appendix L 3.10.4a with your justification under each criteria.

Drainage & Bridge Fees

The site lies within the Sand Creek Drainage Basin and fees to be determined at time of final plat.

State the FSD ponds are private and will be owned/maintained by the property owner.

2020 DRAINAGE AND BRIDGE FEES – Solace Apartments				
Impervious Acres (ac)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Solace Drainage Fee	Solace Bridge Fee
12.26	\$19,698	\$8,057	\$241,498	\$98,779

The Solace development will receive partial credits for the 2 proposed full spectrum detention ponds and full credit for any channel improvements. From the “Sand Creek (Center Tributary) Channel Analysis”, by JR Engineering, the preliminary estimated channel improvements will cost \$565,950. Based on this estimated cost, it is presumed that no drainage basin fees will be necessary.

SUMMARY

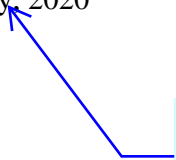
storm sewers

The proposed development remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements, including culverts, detention ponds and existing drainageways. The proposed development will not adversely affect the offsite major Drainageways or surrounding development. In order to safely convey flows through the Sand Creek Drainageway, channel improvements will be necessary to ensure channel stability and prevent channel degradation. Riprap will be required to armor the channel and stabilize the slopes during a major storm event. These improvements will ensure the drainageway functions properly as a primary drainage conveyance system for the Solace Apartments. These improvements to the Sand Creek Drainageway will be implemented with the final drainage report. This preliminary report meets the latest El Paso County Drainage Criteria requirements for this site.

Indicate the improvements to the channel listed in the Sand Creek DBPS. Also indicate the estimated cost of those improvements listed in the DBPS.

REFERENCES:

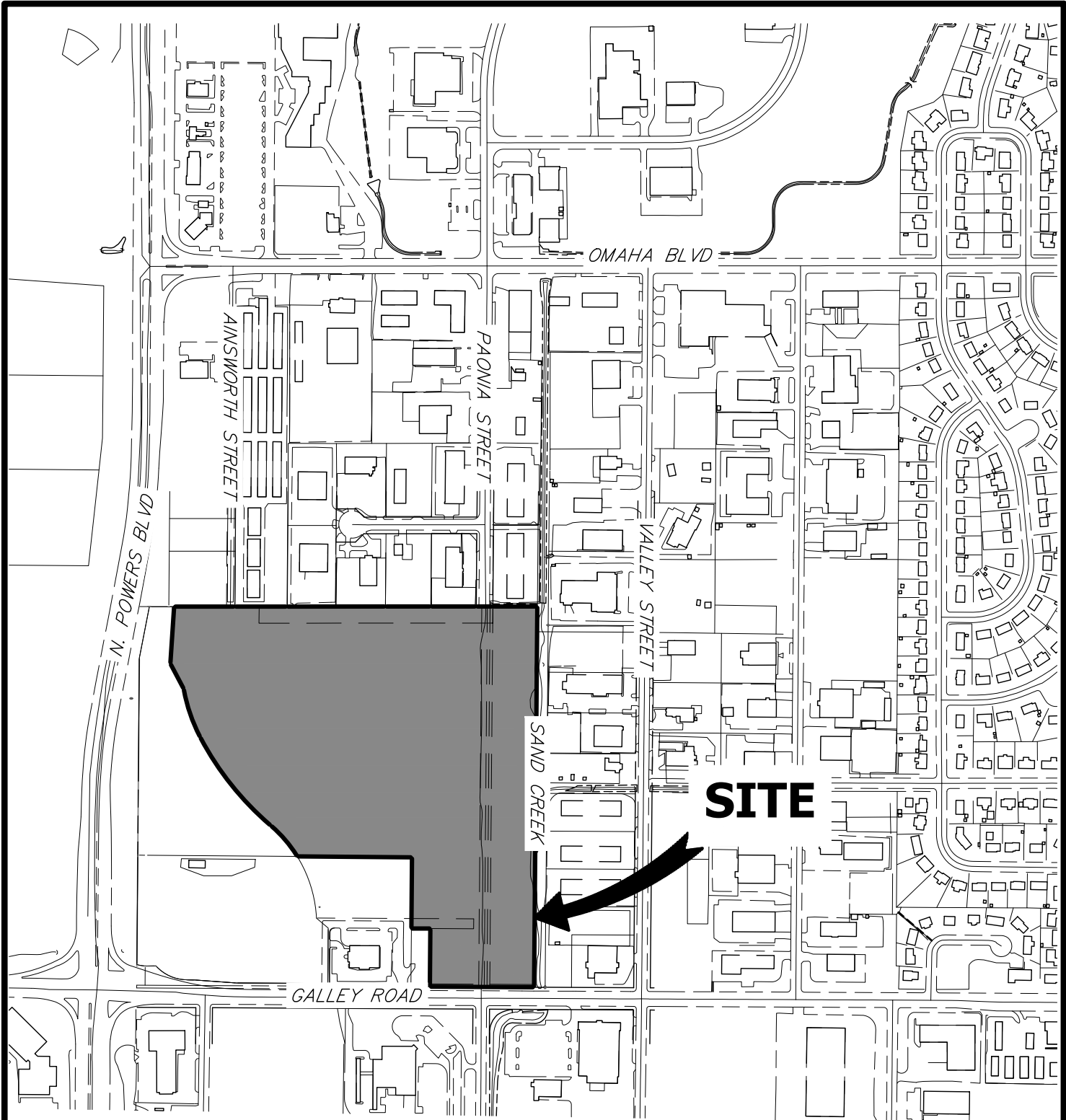
1. El Paso County Drainage Criteria Manual Volume 1, El Paso County, CO, 1994.
2. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.
3. Flood Insurance Study- El Paso County, Colorado & Incorporated Areas Vol 7 of 8, Federal Emergency Management Agency, December 7, 2018.
4. Sand Creek Drainage Basin Planning Study, Kiowa Engineering, January 1993.
5. Sand Creek Drainage Basin LOMR, Federal Emergency Management Agency, May 23, 2007.
6. Sand Creek (Center Tributary) Channel Analysis Report for Solace Apartments, JR Engineering, January, 2020



January 3, 2019 indicated on the cover sheet of the submitted report.

APPENDIX A
FIGURES AND EXHIBITS

X:\2510000.all\2517400\Drawings\Blocks\Vicinity Map - Drainage.dwg, 8.5x11 Portrait, 12/17/2019 11:14:34 AM, PhillipsJ



SITE



ORIGINAL SCALE: 1" = 500'

VICINITY MAP
 SOLACE APARTMENTS
 JOB NO. 15504.03
 4/27/2018



Centennial 303-740-9393 • Colorado Springs 719-593-2593
 Fort Collins 970-491-9888 • www.jrengineering.com

POWERS BLVD. COLORADO SPRINGS CONCEPTUAL SITE PLAN PHASED OPT 3

NOVEMBER 15, 2019

PROJECT BREAKDOWN:

PHASE ONE:

ONE BEDROOM UNITS - 60 UNITS
TWO BEDROOM UNITS - 168 UNITS
THREE BEDROOM UNITS - 6 UNITS

TOTAL UNITS = 234 UNITS

PHASE TWO:

ONE BEDROOM UNITS - 48 UNITS
TWO BEDROOM UNITS - 60 UNITS
THREE BEDROOM UNITS - 6 UNITS

TOTAL UNITS = 114 UNITS

TOTAL PROJECT:

ONE BEDROOM UNITS - 108 UNITS
TWO BEDROOM UNITS - 228 UNITS
THREE BEDROOM UNITS - 12 UNITS

TOTAL UNITS = 348 UNITS

PHASE ONE PARKING REQUIREMENTS:

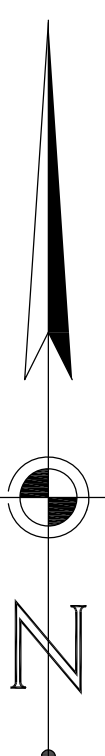
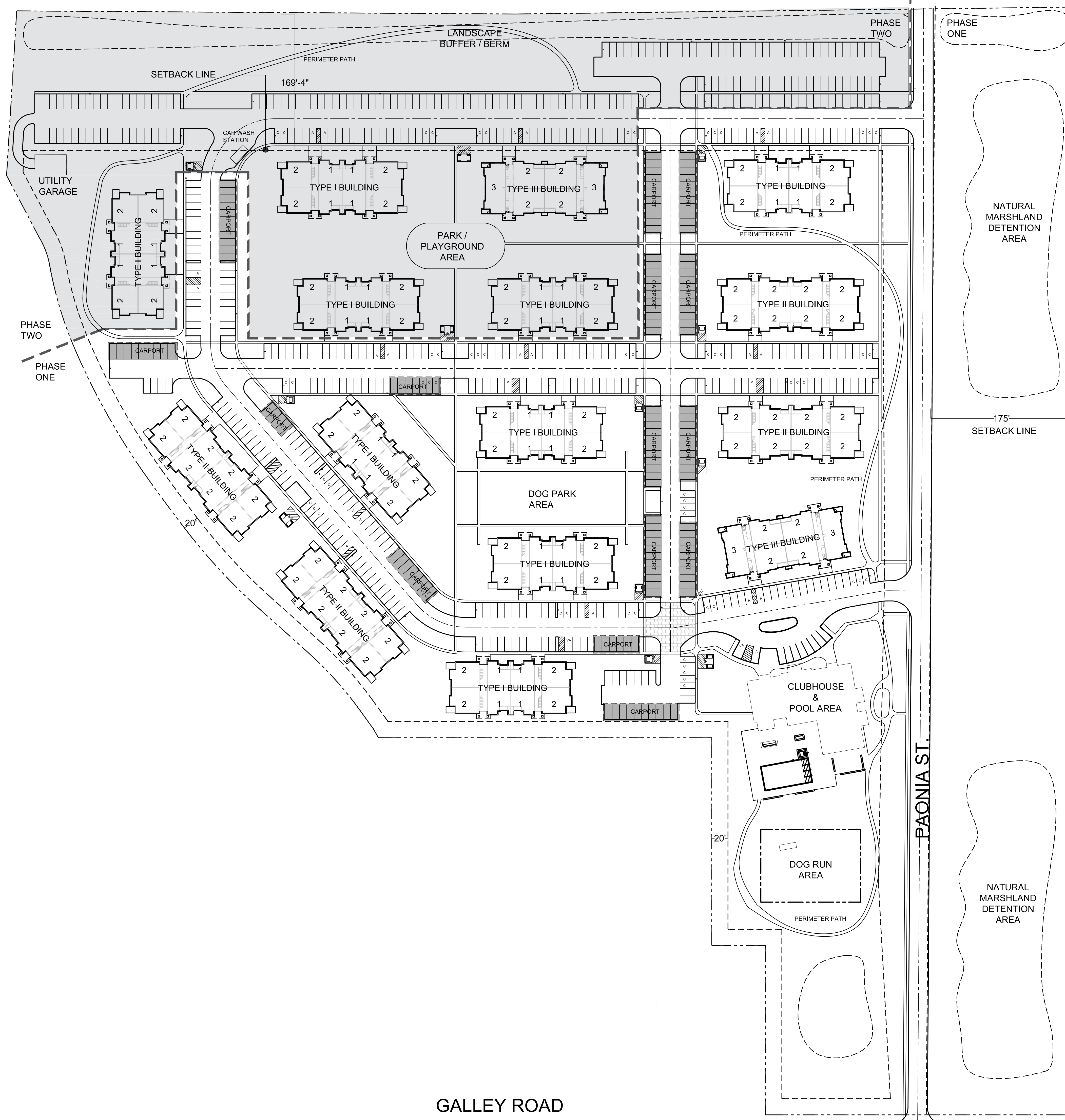
ONE BEDROOM 1.5 PER UNIT	=	90 SPACES
TWO BEDROOM 1.7 PER UNIT	=	286 SPACES
THREE BEDROOM 2 PER UNIT	=	12 SPACES
VISITOR 3 PER TOTAL UNITS	=	78 SPACES
TOTAL PARKING REQ'D	=	466 SPACES
ACCESSIBLE SPOTS REQ'D	=	9 SPACES
ACCESSIBLE SPOTS PROV.	=	16 SPACES

TOTAL PARKING PROVIDED = 466 SPACES

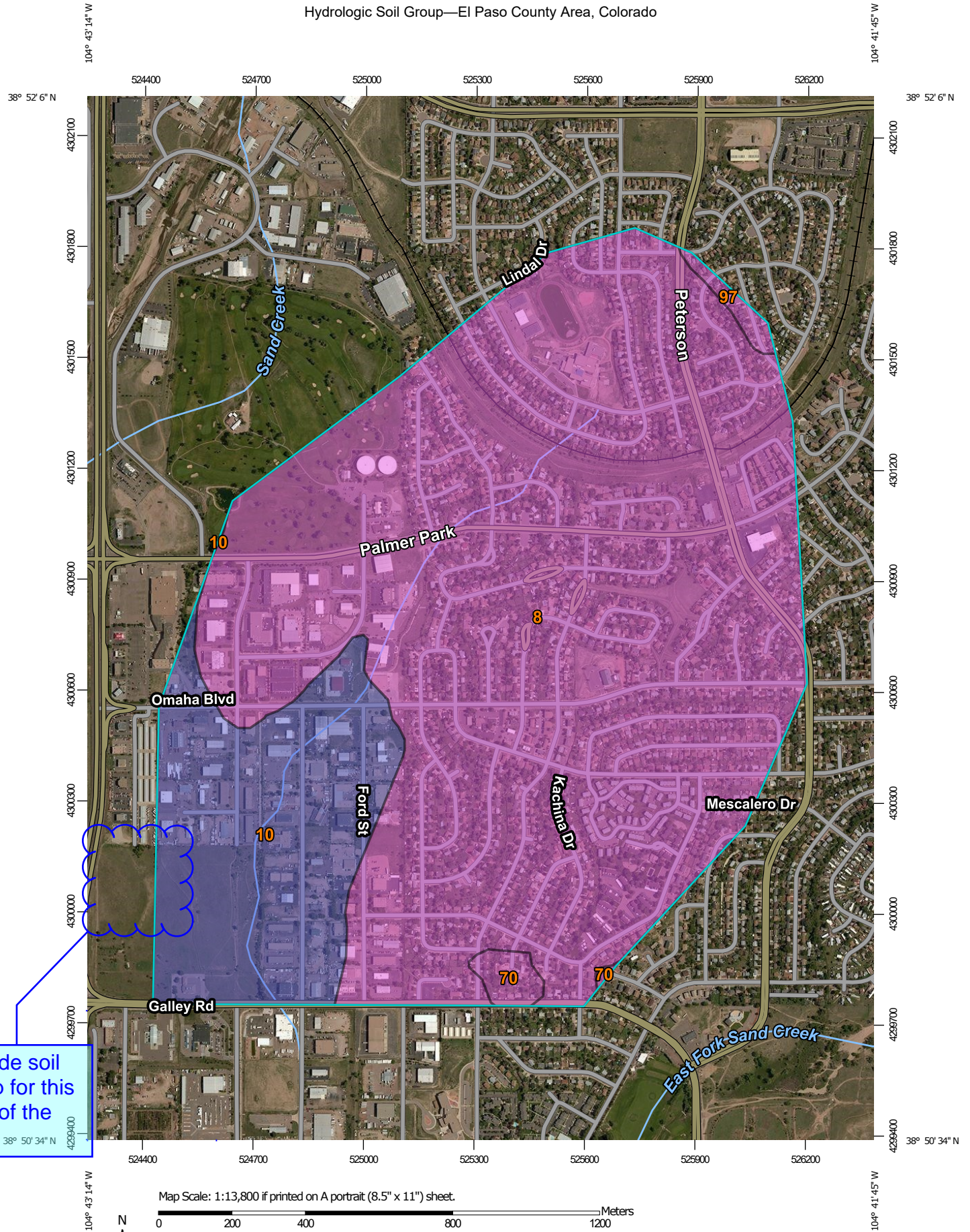
PHASE TWO PARKING REQUIREMENTS:

ONE BEDROOM 1.5 PER UNIT	=	72 SPACES
TWO BEDROOM 1.7 PER UNIT	=	102 SPACES
THREE BEDROOM 2 PER UNIT	=	12 SPACES
VISITOR 3 PER TOTAL UNITS	=	38 SPACES
TOTAL PARKING REQ'D	=	224 SPACES
ACCESSIBLE SPOTS REQ'D	=	5 SPACES
ACCESSIBLE SPOTS PROV.	=	10 SPACES

TOTAL PARKING PROVIDED = 224 SPACES



Hydrologic Soil Group—El Paso County Area, Colorado



Provide soil group for this area of the site.



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines

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

Soil Rating Points






-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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 17, Sep 13, 2019

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	565.8	80.8%
10	Blendon sandy loam, 0 to 3 percent slopes	B	124.2	17.7%
70	Pits, gravel	A	6.1	0.9%
97	Truckton sandy loam, 3 to 9 percent slopes	A	4.0	0.6%
Totals for Area of Interest			700.2	100.0%

Description

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

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

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

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

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

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

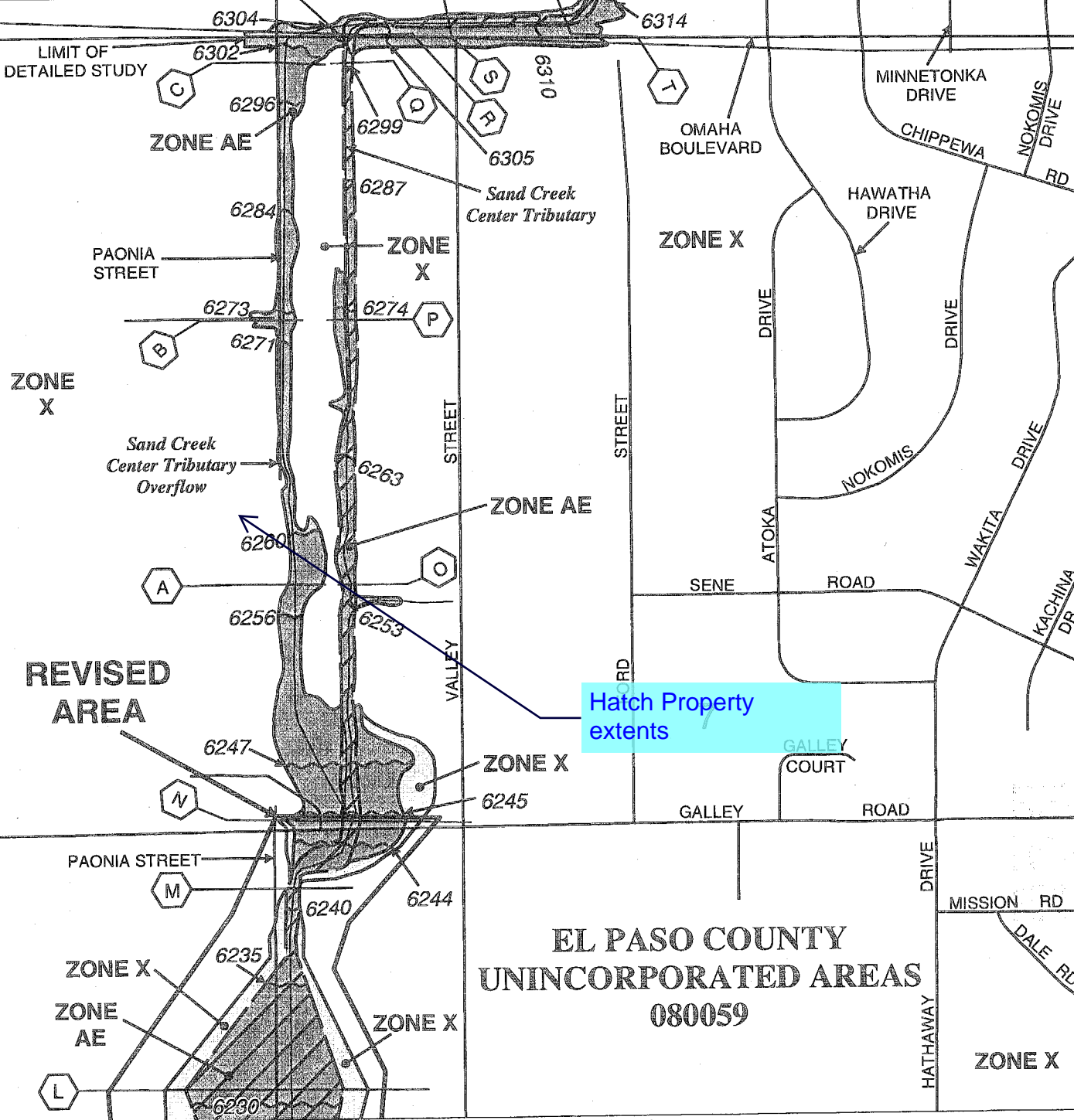
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

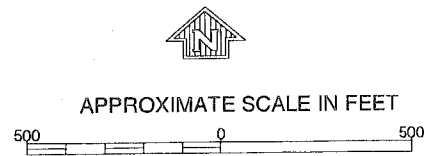
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



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



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS

PANEL 752 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080090	0752	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0752	F

MAY 28 2007



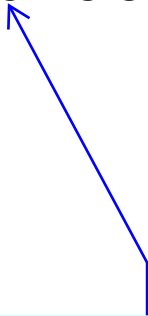
MAP NUMBER
08041C0752 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

APPENDIX B

HYDROLOGIC/ HYDRAULIC CALCULATIONS



Hydraulic calculations
and pond design will
be reviewed with the
final drainage report

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Solace
 Location: El Paso County

Project Name: Solace Apartments
 Project No.: 25174.00
 Calculated By: JBP
 Checked By: _____
 Date: 12/18/19

Basin ID	Total Area (ac)	Commercial/ Pond			Roads			Open Space			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
A1	8.84	90%	0.52	5.3%	100%	3.79	42.9%	5%	4.96	2.8%	51.0%
A2	19.29	90%	1.03	4.8%	100%	6.92	35.9%	5%	12.06	3.1%	43.8%
OS1	14.10	80%	14.10	80.0%	100%	0.00	0.0%	5%	0.00	0.0%	80.0%
OS2	8.50	90%	8.50	90.0%	100%	0.00	0.0%	5%	0.00	0.0%	90.0%
TOTAL	50.73										62.9%

The areas do not add up to the total areas indicated on the column to the left. Revise accordingly.

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Solace
 Location: El Paso County

Project Name: Solace Apartments
 Project No.: 25174.00
 Calculated By: _____
 Checked By: _____
 Date: 12/18/19

Change to soil group B per soils map.

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Hydrologic Soil Group			Minor Coefficients			Major Coefficients			Basins Total Weighted C ₅	Basins Total Weighted C ₁₀₀
			Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	C _{5,A}	C _{5,B}	C _{5,C/D}	C _{100,A}	C _{100,B}	C _{100,C/D}		
A1	8.84	51.0%	8.84	0.00	0.00	0%	100%	0%	0.36	0.41	0.45	0.51	0.67	0.69	0.41	0.67
A2	19.29	43.8%	19.29	0.00	0.00	2%	98%	0%	0.30	0.35	0.39	0.45	0.63	0.66	0.35	0.63
OS1	14.10	80.0%	14.10	0.00	0.00	2%	98%	0%	0.65	0.68	0.69	0.73	0.80	0.81	0.67	0.80
OS2	8.50	90.0%	8.50	0.00	0.00	2%	98%	0%	0.75	0.77	0.77	0.81	0.85	0.85	0.77	0.85
TOTAL	50.73	62.9%	50.73	0.00	0.00	2%	98%	0%	---	---	---	---	---	---	0.52	0.72

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.302}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.232}$	$C_A = 0.84i^{1.124}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.199}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i+0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i+0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Solace
Location: El Paso County

Project Name: Solace Apartments
Project No.: 25174.00
Calculated By: JBP
Checked By:
Date: 12/18/19

the narrative indicated the majority of the site as soil group B. Revise.

SUB-BASIN DATA						INITIAL/OVERLAND (T _i)			TRAVEL TIME (T _t)					t _c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C ₅	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
A1	8.84	A	51%	0.41	0.67	113	4.9%	7.8	689	1.7%	20.0	2.6	4.4	12.2	802.0	22.8	12.2
A2	19.29	A	44%	0.35	0.63	286	4.4%	14.0	1552	1.0%	20.0	2.0	12.9	27.0	1838.0	35.6	27.0
OS1	14.10	A	80%	0.67	0.80	606	2.5%	14.0	606	2.2%	20.0	3.0	3.4	17.4	1212.0	15.8	15.8
OS2	8.50	A	90%	0.77	0.85	358	2.1%	8.9	727	1.9%	20.0	2.8	4.4	13.3	1085.0	14.8	13.3

NOTES:

$$t_c = t_i + t_t$$

Where:

- t_c = computed time of concentration (minutes)
- t_i = overland (initial) flow time (minutes)
- t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Where:

- t_t = channelized flow time (travel time, min)
- L_t = waterway length (ft)
- S_o = waterway slope (ft/ft)
- V_t = travel time velocity (ft/sec) = K√S_o
- K = NRCS conveyance factor (see Table 6-2).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

- t_i = overland (initial) flow time (minutes)
- C₅ = runoff coefficient for 5-year frequency (from Table 6-4)
- L_i = length of overland flow (ft)
- S_o = average slope along the overland flow path (ft/ft).

Equation 6-4

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

- t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
- L_t = length of channelized flow path (ft)
- i = imperviousness (expressed as a decimal)
- S_t = slope of the channelized flow path (ft/ft).

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Equation 6-5

Per County criteria overland flow length shall be max. 100 ft. for urban land uses. Please revise.

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Solace _____
 Location: El Paso County _____
 Design Storm: 5-Year _____

Project Name: Solace Apartments _____
 Project No.: 25174.00 _____
 Calculated By: JBP _____
 Checked By: _____
 Date: 12/18/19 _____

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	1	A1	8.84	0.41	12.2	3.65	3.83	14.0							14.0	3.65	1.0	18	20	7.9	0.0	Surface runoff from Basin A1, transported by Storm Infrastructure to North Detention Pond	
	2	A2	19.29	0.35	27.0	6.73	2.64	17.8							17.8	6.73	1.0	18	17	10.1	0.0	Surface runoff from Basin A2, transported by Storm Infrastructure to South Detention Pond	
	3	OS1	14.10	0.67	15.8	9.51	3.45	32.8							32.8	9.51	1.0	18	17	18.6	0.0	Surface runoff from Basin OS1, captured by on grade inlet and transferred to Sand Creek	
	4	OS2	8.50	0.77	13.3	6.52	3.71	24.2							24.2	6.52	1.0	18	20	13.7	0.0	Surface runoff from Basin OS2, diverted to swale west of site	

Notes:
 Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Solace _____
 Location: El Paso County _____
 Design Storm: 100-Year _____

Project Name: Solace Apartments _____
 Project No.: 25174.00 _____
 Calculated By: JBP _____
 Checked By: _____
 Date: 12/18/19 _____

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	1	A1	8.84	0.67	12.2	5.89	6.43	37.9							37.9	5.89	1.0	18				Surface runoff from Basin A1, transported by Storm Infrastructure to North Detention Pond	
	2	A2	19.29	0.63	27.0	12.12	4.43	53.7							53.7	12.12	1.0	18				Surface runoff from Basin A2, transported by Storm Infrastructure to South Detention Pond	
	3	OS1	14.10	0.80	15.8	11.29	5.78	65.3							65.3	11.29	1.0	18				Surface runoff from Basin OS1, captured by on grade inlet and transferred to Sand Creek	
	4	OS2	8.50	0.85	13.3	7.21	6.22	44.9							44.9	7.21	1.0	18				Surface runoff from Basin OS2, diverted to swale west of site	

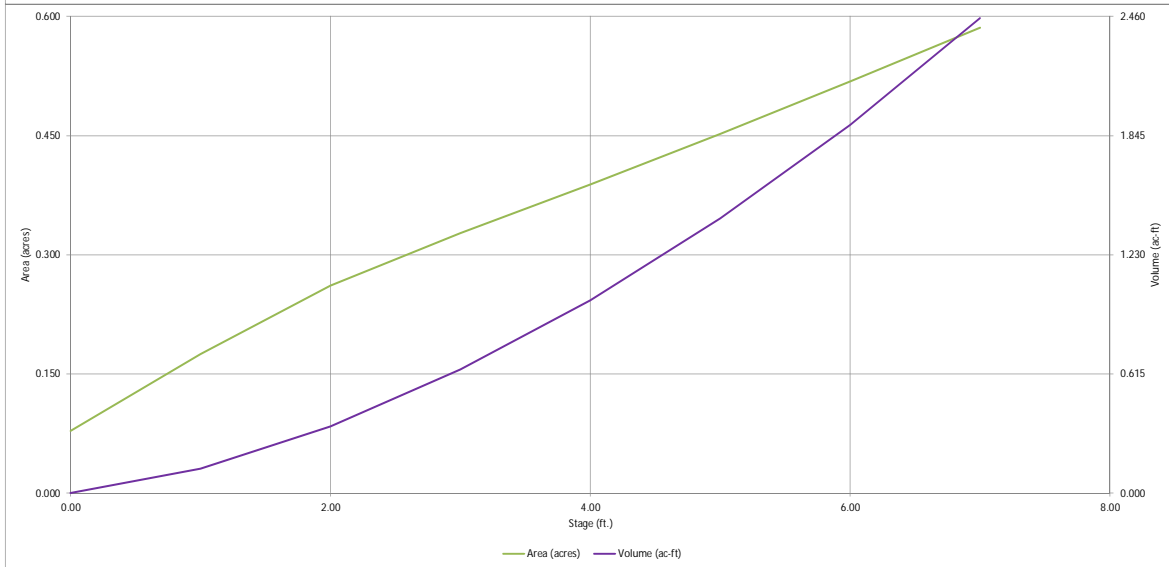
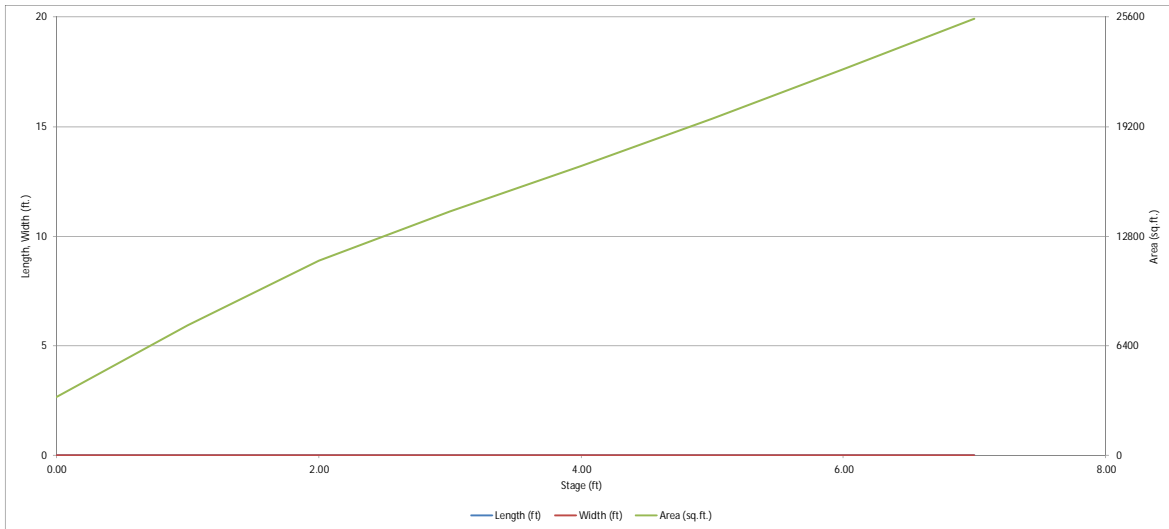
Notes:
 Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

APPENDIX C

WATER QUALITY AND DETENTION CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.00 (December 2019)

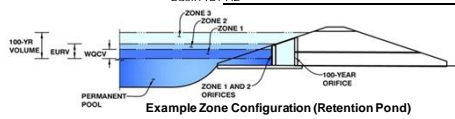


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.00 (December 2019)

Project: Solace Apartments

Basin ID: A2



Example Zone Configuration (Retention Pond)

Watershed Information

Table of watershed information including BMP Type (EDB), Watershed Area (19.29 acres), Watershed Length (1,800 ft), Watershed Length to Centroid (780 ft), Watershed Slope (0.014 ft/ft), Watershed Imperviousness (43.809% percent), and Percentage Hydrologic Soil Groups A, B, and C/D.

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Table of runoff volumes and detention volumes for various return periods (2-yr to 100-yr) and detention durations (2-yr to 100-yr).

Optional User Overrides

Table of optional user overrides for runoff volumes and detention volumes, including a column for inches and a column for acre-feet.

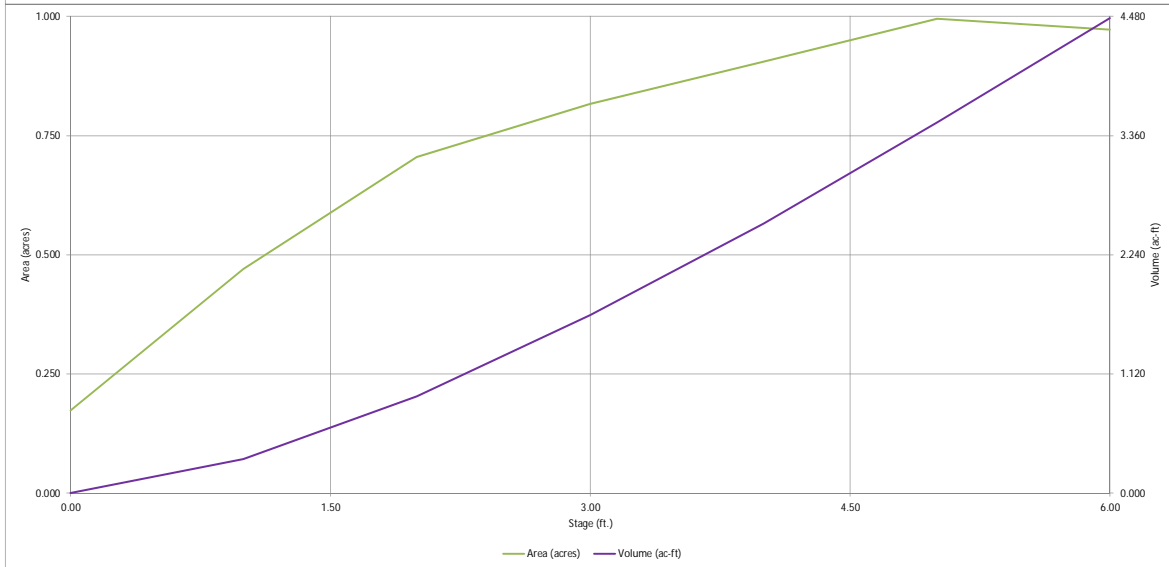
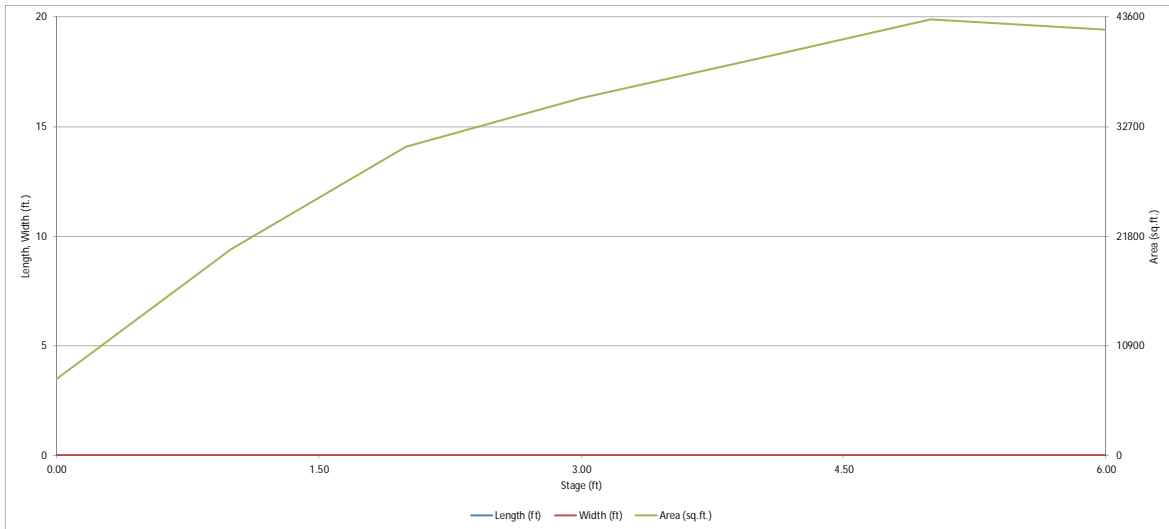
Define Zones and Basin Geometry

Table of basin geometry parameters including zone volumes (Zone 1, Zone 2, Zone 3), total detention volume, initial surcharge volume and depth, total available detention depth, slopes of basin sides, and basin length-to-width ratio.

Main stage-storage table with columns: Stage - Storage Description, Stage (ft), Optional Override Stage (ft), Length (ft), Width (ft), Area (ft^2), Optional Override Area (ft^2), Area (acre), Volume (ft^3), and Volume (ac-ft). It shows data for various elevations (ELEV.) and stage heights.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.00 (December 2019)

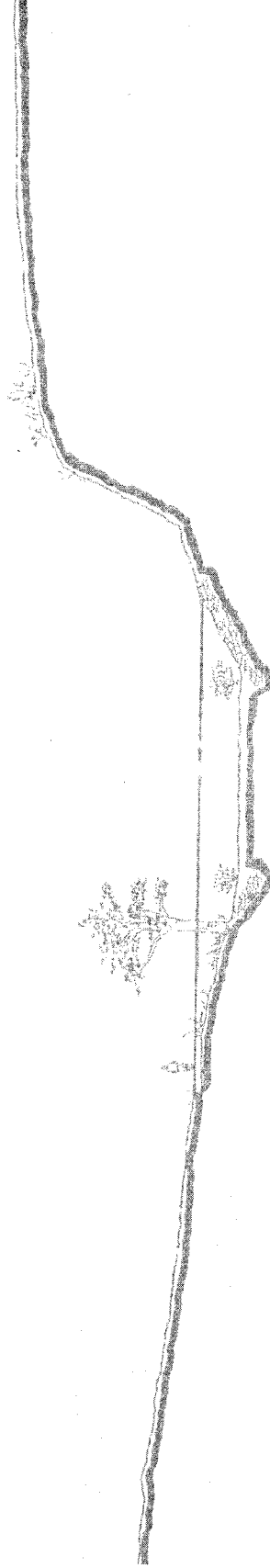


APPENDIX D
REFERENCE MATERIALS

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



PREPARED FOR:

City of Colorado Springs
Department of Comprehensive Planning, Development and Finance
Engineering Division
30 S. Nevada
Colorado Springs, Colorado 80903

PREPARED BY:

Kowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903

SAND CREEK
DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN REPORT

Prepared for:

City of Colorado Springs
Department of Comprehensive Planning, Development And Finance
Engineering Division - MAIL CODE 435
P.O. Box 1575
Colorado Springs, CO 80901-1575

Prepared by:

Kiowa Engineering Corporation
1001 North Weber #200
Colorado Springs, CO 80903

KIOWA Project No. 90.04.09
R185

JANUARY 1993
Revised APRIL 1993
Revised FEBRUARY 1995
Revised APRIL 1995
Revised OCTOBER 1995
Revised March 1996

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Resolution No. 189-95

A RESOLUTION ADOPTING THE SAND CREEK DRAINAGE BASIN PLANNING STUDY AND ESTABLISHING A DRAINAGE FEE, A DETENTION POND CAPITAL FEE, A DETENTION POND LAND FEE, AND AN ARTERIAL BRIDGE FEE FOR THE BASIN.

WHEREAS, the City Engineering Division of the City of Colorado Springs Department of Planning and Development has reviewed the Sand Creek Drainage Basin Planning Study as prepared by Kiowa Engineering Corporation, Colorado Springs, Colorado dated November 2, 1995, and

WHEREAS, the City/County Drainage Board has recommended approval of the above study at their November 2, 1995, meeting;

WHEREAS, the Sand Creek Drainage Basin includes unplatted land within the City limits;

NOW THEREFORE, BE IT RESOLVED by the City Council of the City of Colorado Springs:

Section 1. That the Sand Creek Drainage Basin Planning Study, dated November 1995, by Kiowa Engineering Corporation is adopted for use. City Engineering will utilize that study to assist in evaluating subdivision drainage reports.

Section 2. That a Sand Creek Drainage Basin Fee be established as \$4,895/acre, that a Sand Creek Detention Pond Capital Fee be established as \$1,213/acre, that a Sand Creek Detention Pond Land Fee be established as \$167/acre, and that a Sand Creek Arterial Bridge Fee be established as \$323/acre, as part of.

Dated at Colorado Springs, Colorado, this _____ 28th _____ day of _____ November _____, 1995.


Mayor

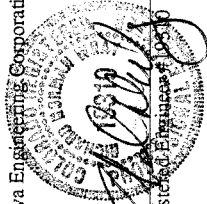
ATTEST:


City Clerk

ENGINEER'S STATEMENT:

The attached SAND CREEK DRAINAGE BASIN PLANNING STUDY 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 City for drainage reports. I accept responsibility for any liability caused by any negligent acts, errors and omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1011 North Weber St., Suite 200, Colorado Springs, CO 80903



Registered Engineer No. 10530
Date: 7/26/96

I. INTRODUCTION

Authorization

The preliminary design of the drainageway and roadway crossing facilities within the Sand Creek Drainage Basin was authorized under the terms of Agreement Number 90-85 between the City of Colorado Springs (City) and Kiowa Engineering Corporation. The agreement was approved by the Colorado Springs City Council, April 10, 1990. Subsequent to this agreement, a change order to the contract to allow for the inclusion of technical information contained in the draft East Fork Sand Creek Drainage Basin Planning Study was approved July, 1993.

Purpose and Scope

The purpose of the study is to identify feasible stormwater management plans to satisfy the existing and future needs within the Sand Creek Drainage Basin. The Sand Creek basin is to be referred to throughout this study and is inclusive of the Sand Creek mainstem and East Fork Sand Creek watersheds. The specific scope of work for this study included the following tasks:

1. Meet with the City to: insure compliance with the services required by this agreement, obtain existing data and general information from participating entities, solicit desires of participating entities and other interested agencies or groups in order to develop alternate plans, procure current information relative to development plans in the basin, procure information relative to right-of-way limitations, proposed stormwater projects, potential hazards due to flooding, and avoid duplication of effort whenever possible by utilizing existing information available from other agencies.
2. Contact the City, County, individuals, and other agencies who have knowledge and/or interest in the study area.
3. Utilize City policies and criteria and applicable information wherever possible.
4. Perform hydraulic and hydrologic analyses within the study area.
5. Identify environmental setting of basin.
6. Identify existing and potential drainage and/or flooding problems.
7. Develop improvement alternatives to reduce existing and potential flooding problems, and to mitigate the impact of stormwater runoff upon environmentally significant areas along the drainageway(s).
8. Examine the operation and maintenance aspects of feasible alternatives.

9. Conduct an economic analysis of each alternative.
10. Recommend and prepare a preliminary design for a selected alternative plan.
11. Develop drainage and bridge fees for the basin.
12. Prepare a written report discussing all items examined in the study.
13. Conduct presentations to public and private entities in order to define project goals, and to involve agencies with specific interest to help define feasible alternatives.

Summary of Data Obtained

Listed below are the technical reports collected for the review as part of preparing this study:

1. Soil Survey for El Paso County, Colorado, dated June 1981.
2. "City of Colorado Springs/El Paso County Drainage Criteria Manual", prepared by City of Colorado Springs, El Paso County, and HDR Infrastructure, Inc., dated May 1987.
3. "Flood Insurance Studies for Colorado Springs, and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), revised 1989.
4. Flood Insurance Restudy, Hydrology Report and Hydrologic Analyses, prepared by RCI, Inc., 1989.
5. Sand Creek Drainage Basin Planning Study prepared by Simons, Li & Associates, Inc., dated July, 1985.
6. Flood Hazard Analysis, Sand Creek, City of Colorado Springs and El Paso County, Colorado, prepared by the Soil Conservation Service, dated December, 1973.
7. Banning-Lewis Ranch Master Drainage Plan, prepared by MSM Consultants, Inc., dated June 1981.
8. Sand Creek Drainage Basin Study, prepared by United Planning and Engineering Company, October, 1977.
9. Draft East Fork Sand Creek Drainage Basin Planning Study, prepared by Kiowa Engineering Corporation, January, 1989.
10. Drainage Basin Inventory, Sand Creek Drainage Basin, prepared by Oliver E. Watts, P.E., June 1990.

In addition to the above listed reports there were a number of drainage study reports, sketch plans, preliminary and final design drawings, land use and zoning maps, development

plans, and existing drainage facility maps that were collected from the City, County, and other local agencies.

Reports which were prepared previous to the preliminary design report include the "Sand Creek Drainage Basin Planning Study Hydrology Report," and the "Sand Creek Drainage Basin Planning Study Development of Alternatives Report." These reports were prepared as part of the overall planning effort and have been referred to throughout this report. The Hydrology Report summarized peak flow data for existing and future basin development conditions without improvements in the basin, and established the base line hydrologic conditions from which the alternative planning then proceeded. The Development of Alternatives report evaluated the various combinations of drainageway improvements for the basin, taking into account environmental, cost, construction, right-of-way, maintenance and implementation factors for each feasible alternate plan. These reports are on file with the City Engineering Division, as well as technical addenda for each report. Both of these reports covered only the mainstem of the Sand Creek Basin. The similar information prepared for the draft East Fork Sand Creek Drainage Basin Planning Study has been summarized in this preliminary design report.

Mapping and Surveying

Mapping used in the planning effort for the mainstem of Sand Creek consisted of USGS 7-1/2 minute quadrangles, and 2-foot contour interval, 1-inch to 200-foot scale planimetric topographic maps. For the area of the basin north of Woodmen Road, aerial topographic mapping was compiled in May 1990. For the balance of the basin, the City of Colorado Springs Department of Public Utilities provided topographic mapping compiled from aerial photographs dated 1989. This mapping has been prepared as part of the Facility Inventory Management System (FIMS). The aerial topographic mapping was used in the drainage inventory, hydrologic/hydraulic analyses, and in the alternative planning phases of this project. All topographic mapping was based upon USGS vertical datum.

For the East Fork Sand Creek basin, mapping from the FIMS office and two-foot contour interval topography prepared in 1987 for the Banning-Lewis Ranch property were used in the preparation of the preliminary design. Where topographic mapping was not available, USGS quadrangle maps were used.

Stream cross-section data was obtained from the aerial mapping described above. These sections were verified against the cross-sections compiled in the 1986 City of Colorado Springs Flood Insurance Study (FIS), wherever possible.

Drainageway site inspections were conducted throughout the study area, and photographs were taken documenting the key drainage features.

The following general conditions have been placed upon the use of the FIMS topographic mapping:

-- Use of these products is restricted to the project for which the FIMS products are provided.

-- Only the body content found within the headline of the borrowed maps may appear in any report/publication developed for your study. Also, the labeling that appears on any photographs provided shall not appear in any such report/publication.

-- All FIMS' products provided to contractors involved in the subject study shall be retrieved by your department upon conclusion of the study and either returned to FIMS or destroyed.

-- The report(s) developed in which the FIMS' products are used shall include the following disclaimer statement:

"The maps and photographs included in this report were developed for purposes of the Colorado Springs Department of Utilities and are for internal use only. The Colorado Springs Department of Utilities makes no warranty, expressed or implied, as to the completeness, accuracy, or content of such products or any reproductions thereof. Any other use is not recommended and occurs at the risk of the user; such user is solely responsible and/or liable for the use of such products.

Original maps and photographs are the property of the Colorado Springs Department of Utilities. All rights are reserved. These maps and photographs or any associated record may not, wholly or in part, be reproduced, stored, or transmitted in any form or by any means, electronic, mechanical, photocopying, or otherwise, without the express prior written permission of the Colorado Springs Department of Utilities.

Regardless of the existence of purpoed copies of these official maps and photographs which may from time to time be made or published, there is only one set of official maps and photographs, which are those kept and maintained by the Colorado Springs Department of Utilities."

Project Coordination

Throughout the course of the study, meetings were held with representatives of City, County, State, and Federal agencies with an interest in drainageway planning in general. The primary reason for the coordination effort was to obtain technical information and to identify concerns with regard to the development of drainageway facilities within the basin. During the course of preparing the Development of Alternatives report, the planning constraints and concepts were discussed with the agencies and interested individuals and their input used to refine the feasible alternatives and to eventually identify a recommended drainageway plan for further design evaluation. The complete mailing list and project correspondence is contained in Appendix A of this report.

Coordination with a similar list of agencies and individuals was conducted during the preparation of the draft East Fork Sand Creek Drainage Basin Planning study. This study was authorized and conducted for Artes Properties, Inc. Meetings with state and federal agencies, the City and the County were involved in a series of meetings during the development of the alternative planning concepts and the preliminary design for the East Fork Sand Creek basin.

Acknowledgements

During the preparation of the study, several government agencies and interested individuals were routinely involved in the coordination activities. Representatives from the Colorado Division of Wildlife, U.S. Army Corps of Engineers (COE), and various City Departments provided valuable commentary during the development of the alternative plans. A listing of the individuals and agencies routinely coordinated with during the study has been presented below:

<u>Name</u>	<u>Agency</u>
Alan Morrice	El Paso County Department of Public Works
John Fisher	El Paso County Land Use Department
Sue Johnson	El Paso County Parks Department
Rick O'Connor	El Paso County Planning Department
Hugh King	City of Colorado Springs Street Division
Gary Haynes	City Engineering Division
Bruce Thorson	City Engineering Division
Ken Sampley	City Engineering Division
Steve Jacobsen	City Engineering Division
Christine Lytle	City Engineering Division
Bruce Goforth	Colorado Division of Wildlife
Dan Bunting	Regional Building Department
Sarah Fowler	Environmental Protection Agency
John Liou	Federal Emergency Management Agency
Dave Frick	RCI, Inc., Fort Collins, Colorado
Bill Noonan	U.S. Fish and Wildlife
Anita Culp	U.S. Army Corps of Engineers
John Maynard	Aiken/Audobon Society
John Covert	Palmer Foundation
Peter Kernikump	City Planning Department
Jim Rees	Department of Planning and Development
Fred Mais	City Parks and Recreation
Diana Medina	City of Colorado Springs
Dan Tippie	Department of Public Utilities Gas Division
Russ Nicklin	City of Colorado Springs
Wes Tyson	Department of Public Utilities Wastewater Division
	Department of Public Utilities Water Division
	City Attorney's Office

II. STUDY AREA DESCRIPTION

The Sand Creek drainage basin is a left-bank tributary to the Fountain Creek lying in the west-central portions of El Paso County. Sand Creek's drainage area at Fountain Creek is approximately 54 square miles of which approximately 18.8 square miles are inside the City of Colorado Springs corporate limits. The basin is divided into five major sub-basins, the Sand Creek mainstem, the East Fork Sand Creek, the Central Tributary to East Fork, the West Fork, and the East Fork Subtributary. Figure II-1 shows the location of the Sand Creek basin.

Basin Description

The Sand Creek basin covers a total of 54 square miles in unincorporated El Paso County and Colorado Springs, Colorado. Of this total, approximately 28 square miles is encompassed by the Sand Creek basin, and 26 square miles for the East Fork Sand Creek basin. The basin trends in generally a south to southwesterly direction, entering the Fountain Creek approximately two miles upstream of the Academy Boulevard bridge over Fountain Creek. Two main tributaries drain the basin, those being the mainstem of Sand Creek and East Fork Sand Creek. Development presence is most evident along the mainstem. At this time, approximately 25 percent of the basin is developed. This alternative evaluation focuses upon the Sand Creek basin only.

The maximum basin elevation is approximately 7,620 feet above mean sea level, and falls to approximately 5,790 feet at the confluence with Fountain Creek. The headwaters of the basin originate in the conifer covered areas of The Black Forest. The middle eastern portions of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates.

Climate

This area of El Paso County can be described, in general as high plains, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry. Precipitation ranges from 14 to 16 inches per year, with the majority of this precipitation occurring in spring and summer in the form of rainfall. Thunderstorms are common during the summer months, and are typified by quick-moving low pressure cells which draw moisture from the Gulf of Mexico into the region. Average temperatures range from about 30°F in the winter

to 75° in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

Soils and Geology

Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium and residuum, derived from sedimentary rock. The soils have high to moderate infiltration rates, and are extremely susceptible to wind and water erosion where poor vegetation cover exists. In undeveloped areas, the predominance of Type A and B soils give this basin a lower runoff per unit area as compared to basins with soils dominated by Types C and D. Presented on Figure II-2 is the Hydrologic Soil distribution map for the Sand Creek basin.

Property Ownership and Impervious Land Densities

Property ownership along the major drainageway within the Sand Creek basin vary from public to private. Along the developed reaches, drainage right-of-ways and greenbelts have been dedicated during the development of the adjacent residential and commercial land. Where development has not occurred, the drainageways remain under private ownership with no delineated drainage right-of-way or easements. There are several public parks which abut the mainstem of Sand Creek. Roadway and utility easements abutting or crossing the major drainageways occur most frequently in the developed portions of the basin.

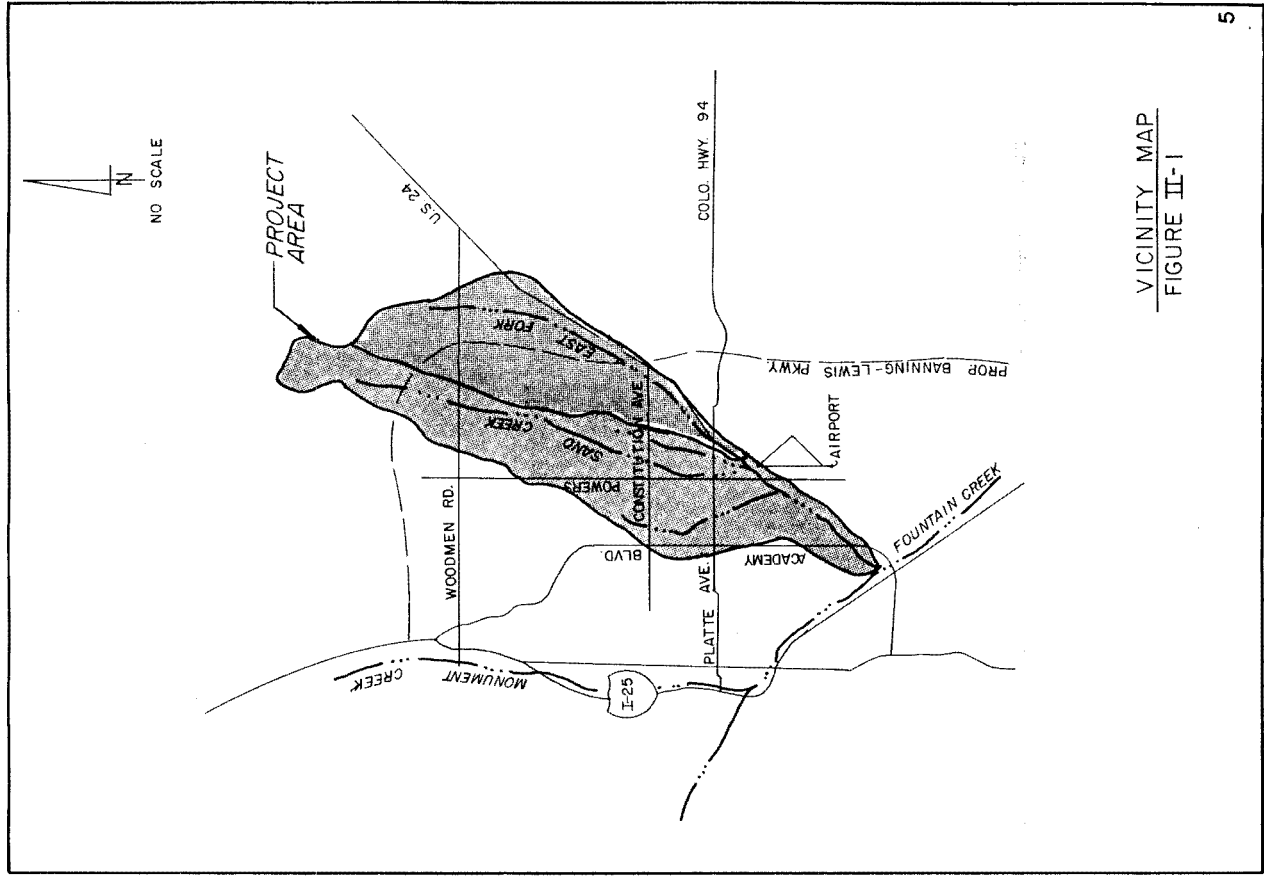
Land use information for the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure II-3 is the proposed land use map used in the evaluation of impervious land densities discussed in the hydrologic section of this report. Figure II-3 is not intended to reflect the future zoning or land use policies of the City or the County.

The land use information within the Banning-Lewis Ranch property was obtained from Aries Properties during the time the draft East Fork Sand Creek Drainage Basin Planning Study was being prepared. The land use information was again reviewed with the City of Colorado Springs Department of Planning and was found to be appropriate for use in the estimation of hydrology for the East Fork Basin. The location of future arterial streets and roadways within

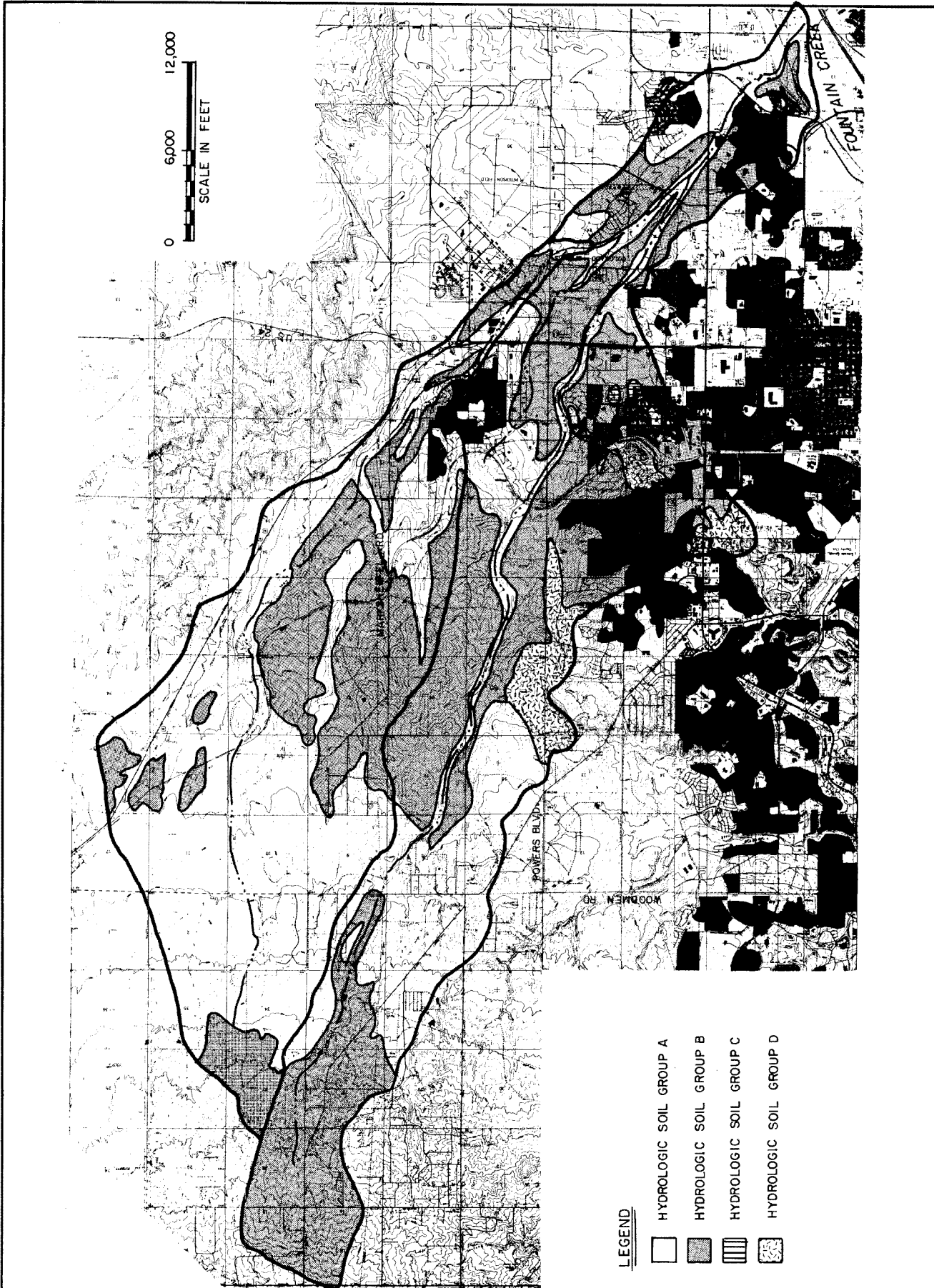
the Banning Lewis property were obtained from the Banning-Lewis Ranch master plan. The location of roadways offsite from the Banning Lewis-Ranch were obtained from the El Paso County Major Transportation Plan dated 1988.

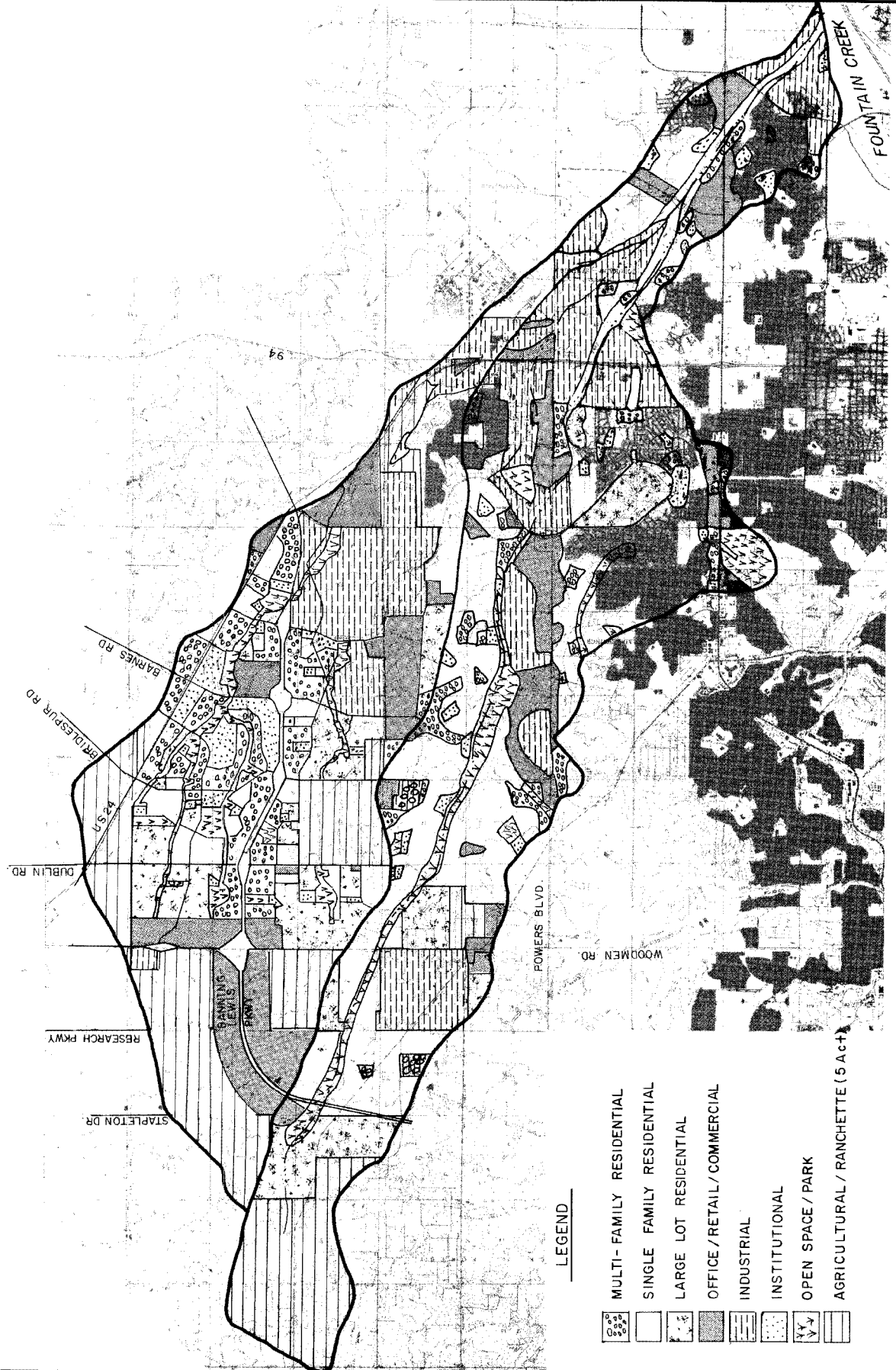
Park Land and Open Space

An inventory of park land and public open space was prepared. Many times, the combination of the drainageway and adjacent park lands can be used to visually extend the limits of a park or open space. The drainageway can also act to link parks and other land uses within the basin if multiple use trails are incorporated into the channel section(s). The Sand Creek drainageway has been identified as a major trail corridor within the City of Colorado Springs Trails Plan. Park land designated within the Banning-Lewis Ranch master plan were taken into account during the siting of stormwater facilities within the Banning-Lewis property.



VICINITY MAP
FIGURE II-1





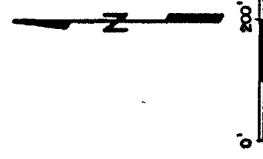
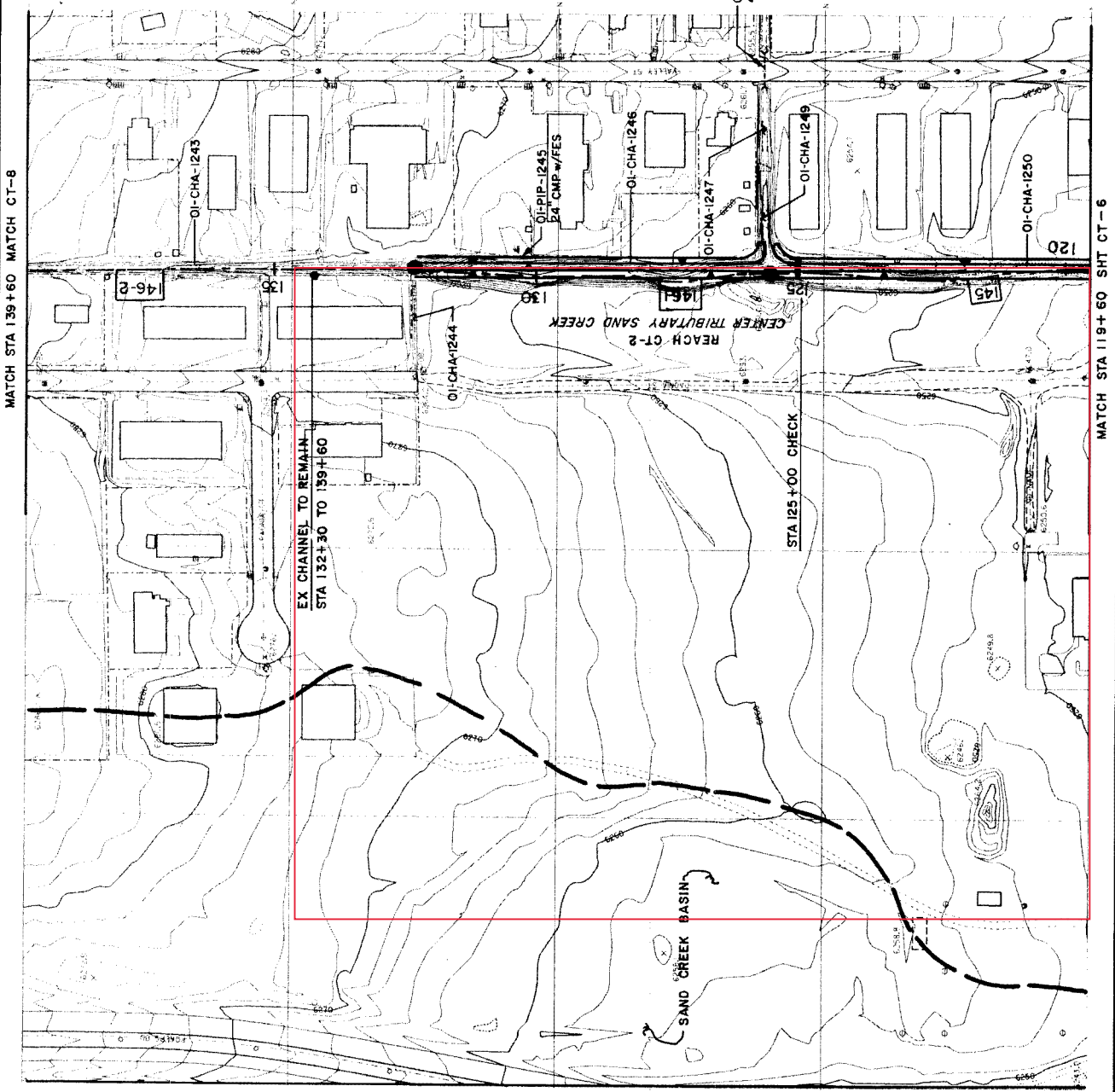
LEGEND

- MULTI-FAMILY RESIDENTIAL
- SINGLE FAMILY RESIDENTIAL
- LARGE LOT RESIDENTIAL
- OFFICE / RETAIL / COMMERCIAL
- INDUSTRIAL
- INSTITUTIONAL
- OPEN SPACE / PARK
- AGRICULTURAL / RANCHETTE (5 ac+)

THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

CHANNEL IMPROVEMENTS		CHANNEL TYPE
SEGMENT NO.	BOTTOM WIDTH (FT)	
145	16	100-YEAR CONC. CHANNEL, 4' DEPTH
146-1	10	
146-2	N/A	EXISTING CHANNEL TO REMAIN

FOR PROFILE SEE SHEETS CTP-2 AND CTP-3

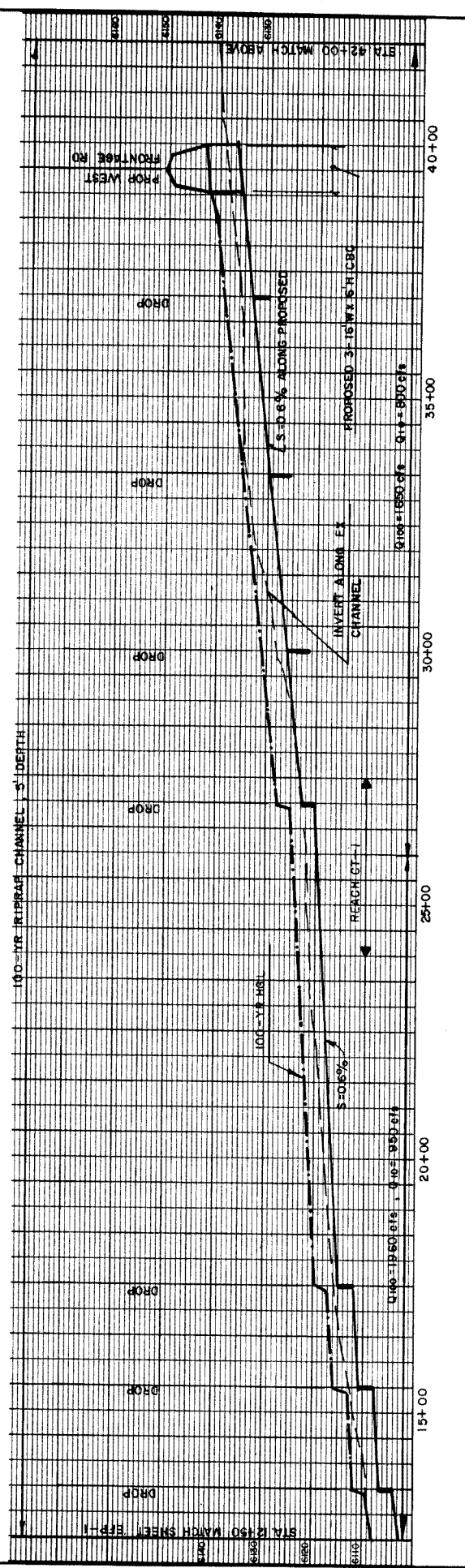
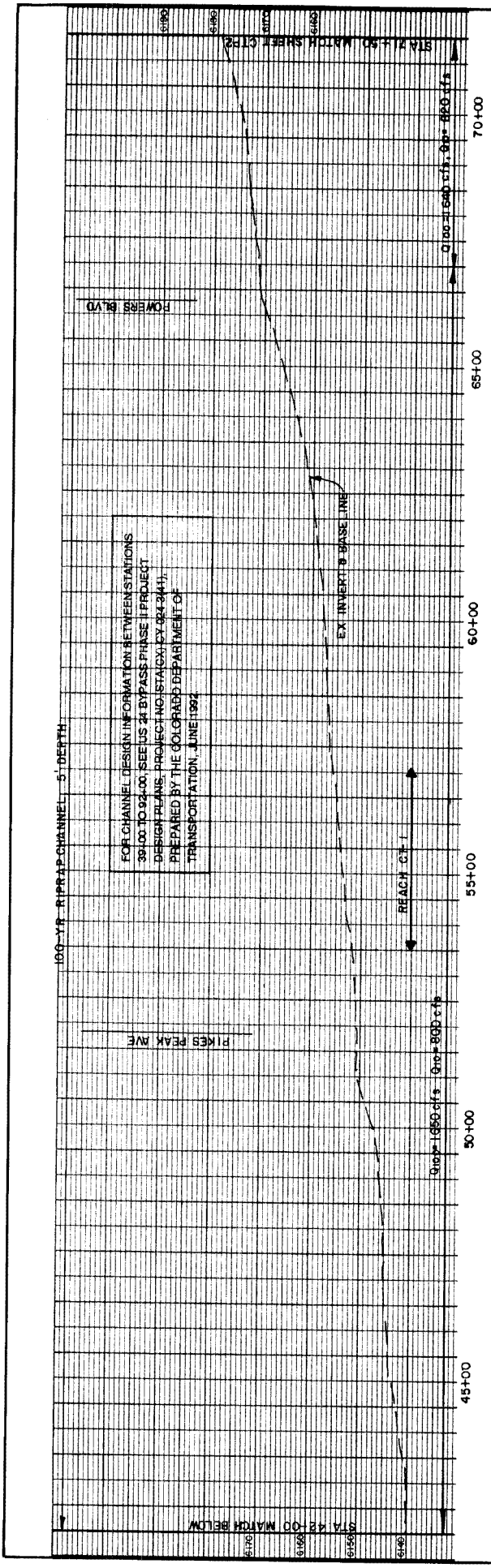


Kiowa Engineering Corporation
 419 W. Blou Street
 Colorado Springs, Colorado
 80905-1308

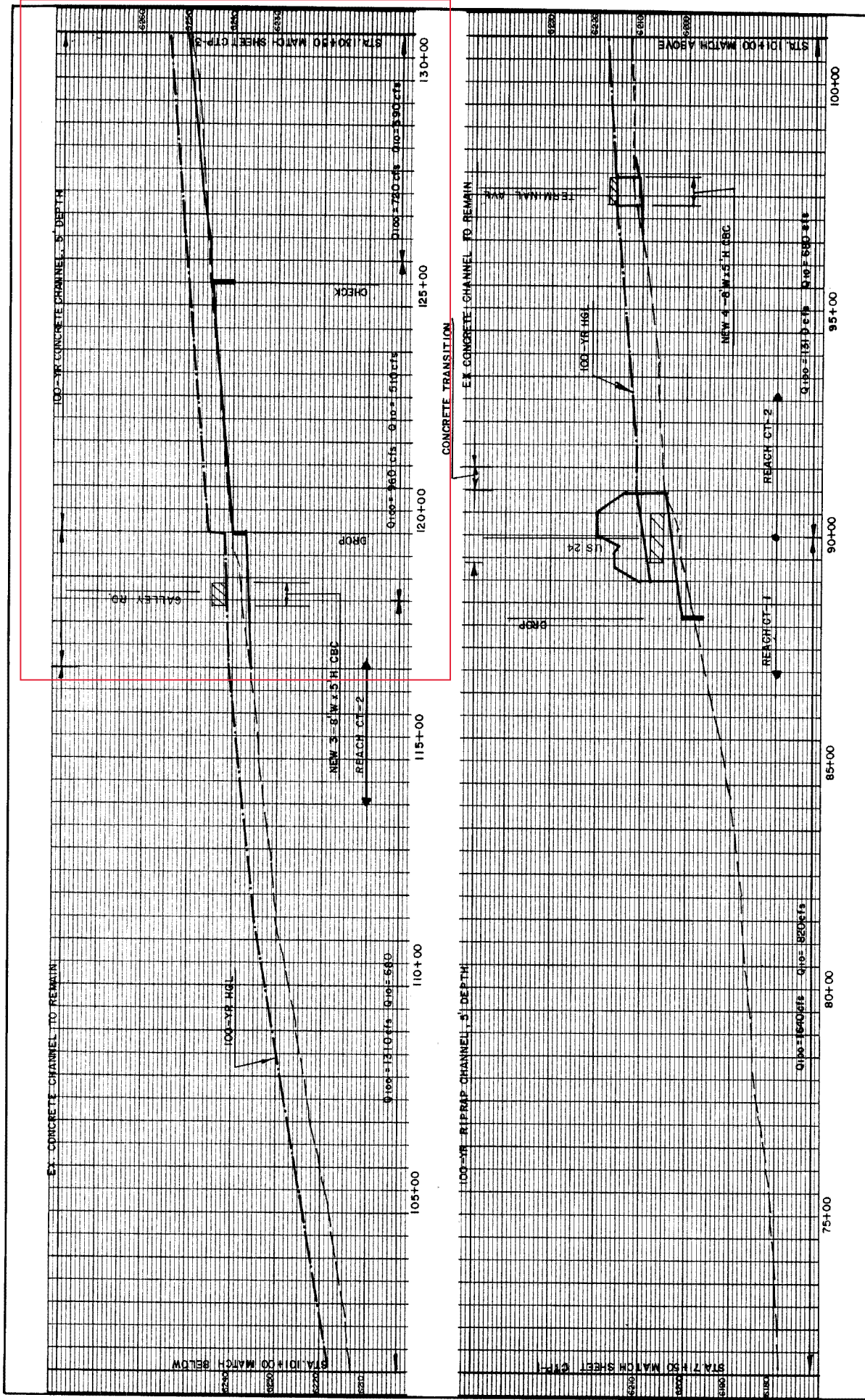
SAND CREEK DRAINAGE
 BASIN PLANNING STUDY
 PRELIMINARY DESIGN PLANS

Project No.	90-04-09
Date	9/7/92
Design	EAJ
Check	DMW
Revised	

CT-7



Kiowa Engineering Corporation DESIGNED BY: _____ DATE: _____ DRAWN BY: _____ DATE: 7/92 REVISIONS: _____ DATE: _____	SAND CREEK DRAINAGE BASIN PLANNING STUDY PRELIMINARY DESIGN PROFILES	CITY OF COLORADO SPRINGS EL PASO COUNTY, COLORADO	CENTER TRIBUTARY SAND CREEK Station 12+50 to 71+50	CTP-1



DESIGNED BY: DATE: _____
 DRAWN BY: DATE: 7/92
 REVISED: DATE: _____

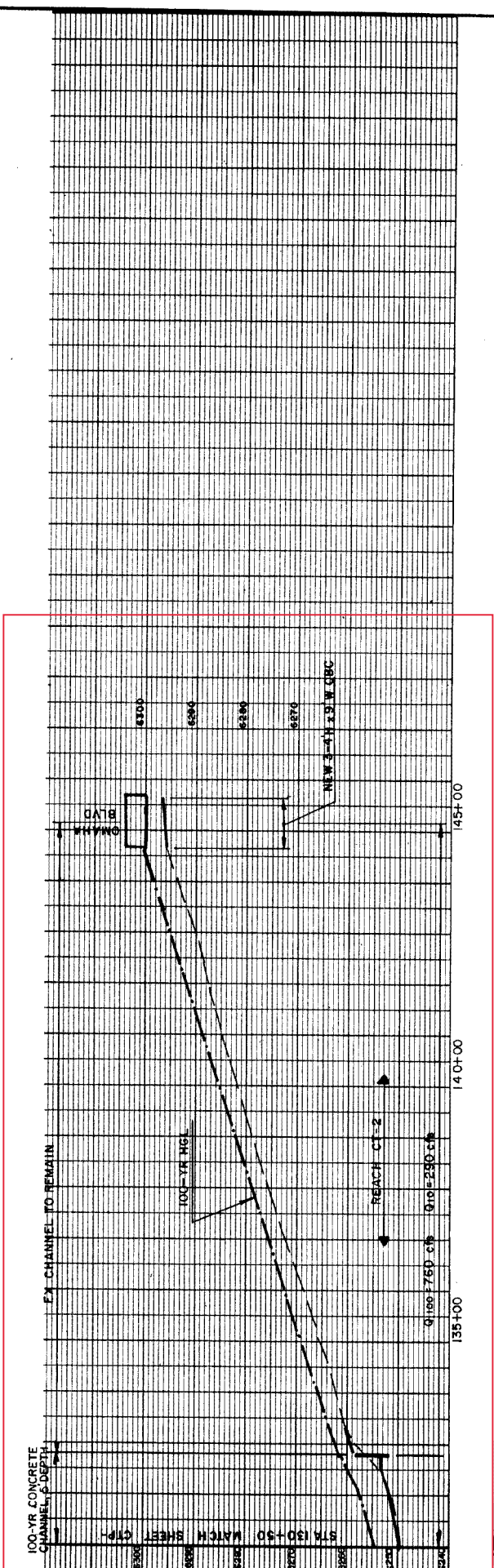
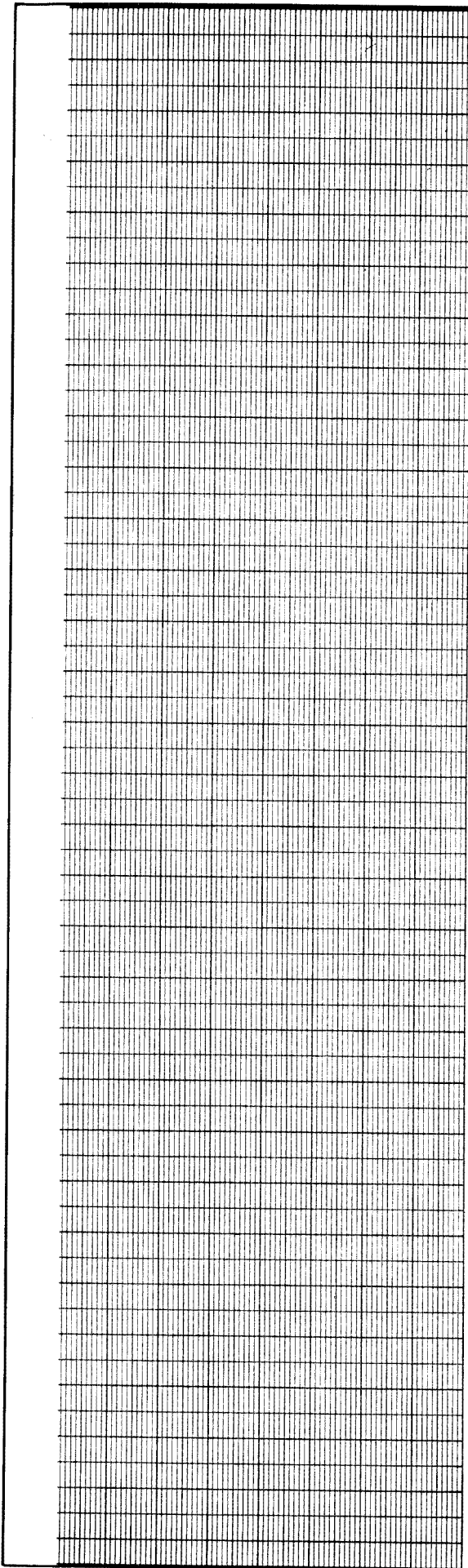
Kiowa Engineering Corporation

SAND CREEK DRAINAGE BASIN PLANNING STUDY
 PRELIMINARY DESIGN PROFILES

CITY OF COLORADO SPRINGS
 EL PASO COUNTY, COLORADO

CENTER TRIBUTARY SAND CREEK
 Station 71+50 to 130+50

CTP-2



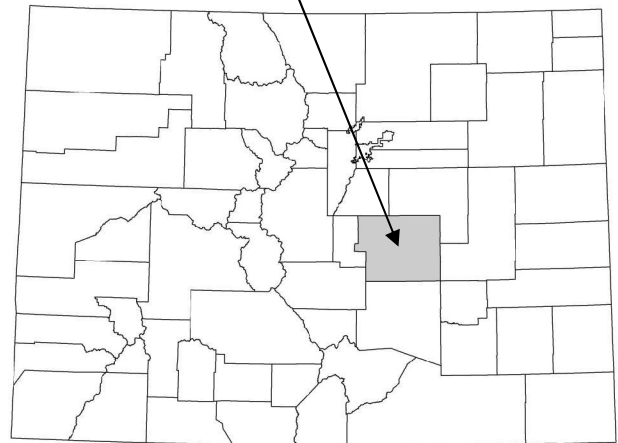
100-YR CONCRETE CHANNEL FLOOD DEPTH
 EX CHANNEL TO REMAIN
 100-YR MFL
 REACH CT=2
 135+00 140+00 145+00
 STA 130+50 MATCH CTP
 8240 8250 8260 8270 8280 8290 8300 8310 8320 8330 8340 8350 8360 8370 8380 8390 8400 8410 8420 8430 8440 8450 8460 8470 8480 8490 8500
 DESIGNED BY DATE 7/92
 CHECKED BY DATE 7/92
 REVISION DATE
 Kiowa Engineering Corporation
 SAND CREEK DRAINAGE BASIN PLANNING STUDY
 PRELIMINARY DESIGN PROFILES
 CITY OF COLORADO SPRINGS
 EL PASO COUNTY, COLORADO
 CENTER TRIBUTARY SAND CREEK
 Station 130+50 to 144+50
 CTP-3

FLOOD INSURANCE STUDY



EL PASO COUNTY, COLORADO, AND INCORPORATED AREAS

El Paso County



COMMUNITY NAME	COMMUNITY NUMBER
CALHAN, TOWN OF	080192
COLORADO SPRINGS, CITY OF	080060
EL PASO COUNTY (UNINCORPORATED AREAS)	080059
FOUNTAIN, CITY OF	080061
GREEN MOUNTAIN FALLS, TOWN OF	080062
MANITOU SPRINGS, CITY OF	080063
MONUMENT, TOWN OF	080064
PALMER LAKE, TOWN OF	080065
RAMAH, TOWN OF	080066

Revised: December 7, 2018



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
08041CV007A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

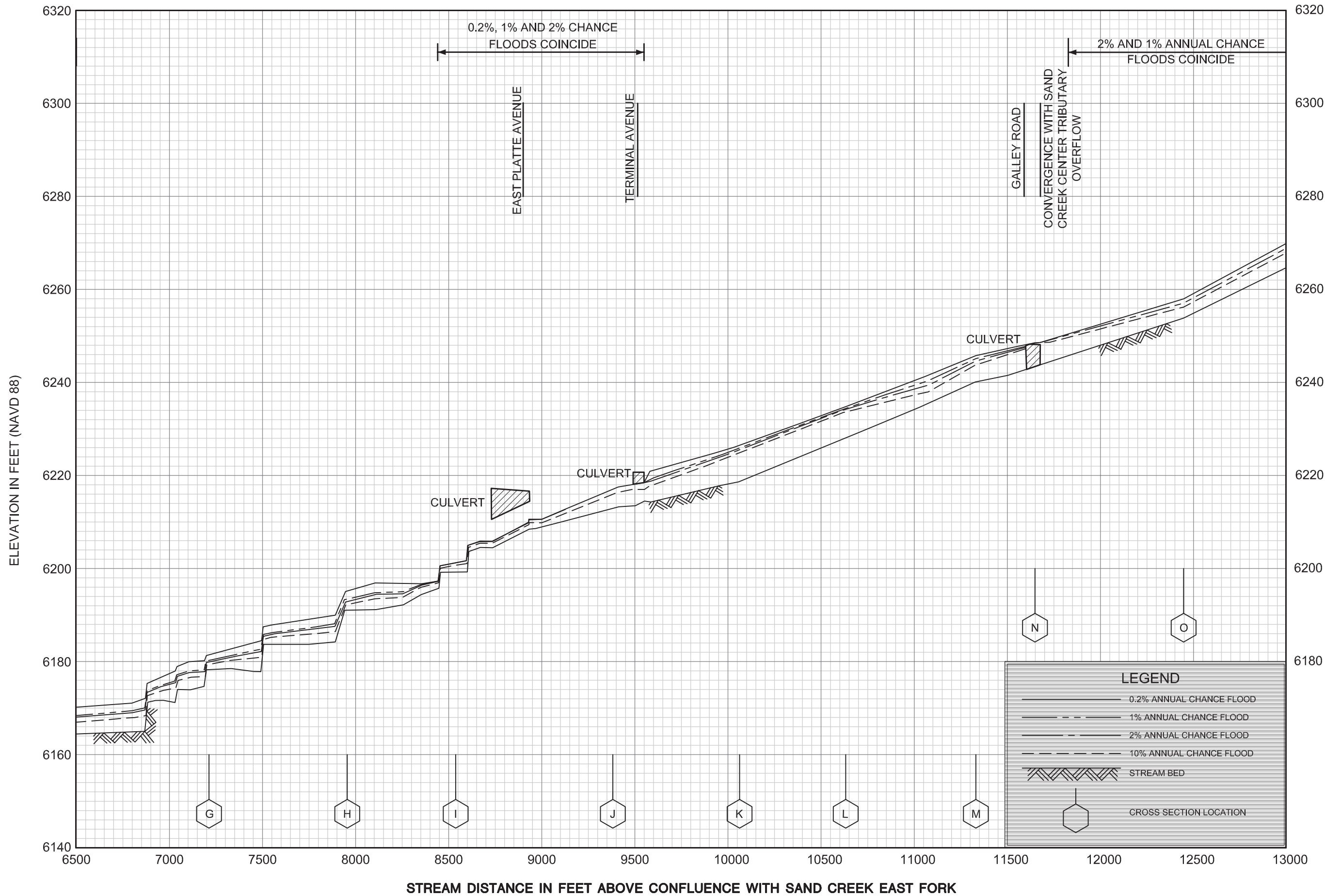
Part or all of this FIS report may be revised and republished at any time. In addition, part of this FIS report may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS report components.

This FIS report was revised on December 7, 2018. Users should refer to Section 10.0, Revisions Description, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this report should be aware that the information presented in Section 10.0 superseded information in Sections 1.0 through 9.0 of this FIS report.

Initial Countywide FIS Report Effective Date: March 17, 1997

First Revised Countywide FIS Report Effective Date: August 23, 1999 - to add base flood elevations, to add special flood hazard areas, and to change special flood hazard areas.

Second Revised Countywide FIS Report Effective Date: December 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.



FLOOD PROFILES

SAND CREEK CENTER TRIBUTARY

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



Federal Emergency Management Agency

Washington, D.C. 20472

JAN 30 2007

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Sallie Clark
Chair, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

IN REPLY REFER TO:

Case No.: 05-08-0368P
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of
This Revision: **MAY 23 2007**

Dear Ms. Clark:

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. Sacbibit, 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 Lionel Rivera
Mayor, City of Colorado Springs

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	El Paso County Colorado (Unincorporated Areas)	CHANNELIZATION CULVERT	FLOODWAY HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA BASEMAP CHANGES
	COMMUNITY NO.: 080059		
IDENTIFIER	Sand Creek Center Tributary and East Fork LOMR	APPROXIMATE LATITUDE & LONGITUDE: 38.846, -104.720 SOURCE: USGS QUADRANGLE DATUM: NAD 27	
ANNOTATED MAPPING ENCLOSURES		ANNOTATED STUDY ENCLOSURES	
TYPE: FIRM*	NO.: 08041C0752 F DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999	
TYPE: FIRM	NO.: 08041C0753 F DATE: March 17, 1997	PROFILE(S): 206P	
TYPE: FIRM	NO.: 08041C0754 F DATE: March 17, 1997	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)

Sand Creek Center Tributary – from approximately 1,350 feet upstream of East Frontage Road to just upstream of Galley 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	NONE	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. 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: 080060 **Name:** City of Colorado Springs, Colorado

AFFECTED MAP PANELS

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): 205P, 206P, 209P, and 210P
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. 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)

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>.

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)

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 1,350 feet upstream of East Frontage Road	6,170	6,165	08041C0753 F
	Just downstream of Terminal Avenue	6,216	6,213	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

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE CITY OF COLORADO SPRINGS AND THE UNINCORPORATED AREAS OF EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the City of Colorado Springs and in the unincorporated areas of El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in these communities is appropriate. The modified Base Flood Elevations (BFEs) revise the FIRM for the communities.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate new topographic data for Sand Creek Center Tributary from just upstream of Airport Road to just upstream of Galley Road and for Sand Creek East Fork from approximately 970 feet downstream of Powers Boulevard to just downstream of Stewart Avenue. This has resulted in a revised delineation of the regulatory floodway, increases and decreases in SFHA width, and increased and decreased BFEs for both aforementioned flooding sources. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Sand Creek Center Tributary:		
¹ Approximately 150 feet upstream of Airport Road	6,109	6,108
¹ Approximately 1,250 feet upstream of East Frontage Road	6,168	6,164
² Approximately 1,350 feet upstream of East Frontage Road	6,170	6,165
² Just downstream of Terminal Avenue	6,216	6,213
Sand Creek East Fork:		
¹ Approximately 810 feet downstream of Powers Boulevard	6,099	6,096
¹ Approximately 140 feet downstream of Stewart Avenue	6,206	6,205

*National Geodetic Vertical Datum, rounded to nearest whole foot

¹City of Colorado Springs

²Unincorporated areas of El Paso County

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Division reconsider the determination. Any request for reconsideration must be based on knowledge of

changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Division's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Sallie Clark
Chair, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

OR

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

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

¹ Feet above confluence with Sand Creek

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

FLOODWAY DATA

SAND CREEK EAST FORK

TABLE 5

FLOODING SOURCE		FLOODWAY				BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY FEET (NGVD)	WITH FLOODWAY FEET (NGVD)	INCREASE
Sand Creek Center Tributary								
A	940	40	92	8.6	6,106.5	6,106.5	6,106.5	0.0
B	990	40	118	6.7	6,107.2	6,107.2	6,107.2	0.0
C	2,238	91	120	6.6	6,120.2	6,120.2	6,120.2	0.0
D	3,948	46	95	8.0	6,138.3	6,138.3	6,138.3	0.0
E	4,547	170	159	4.8	6,147.4	6,147.4	6,147.4	0.0
F	5,539	52	97	7.8	6,156.8	6,156.8	6,156.8	0.0
G	7,191	63	104	7.3	6,176.2	6,176.2	6,176.2	0.0
H	7,940	52	00	7.8	6,189.6	6,189.6	6,189.6	0.0
I	8,527	40		7.8	6,197.6	6,197.6	6,197.6	0.0
J	9,366	17	42	9.0	6,213.4	6,213.4	6,213.4	0.0
K	10,055	232	278	4.0	6,221.9	6,221.9	6,221.9	0.0
L	10,627	539	469	2.4	6,230.6	6,230.6	6,230.6	0.0
M	11,321	31	79	9.1	6,241.1	6,241.1	6,241.1	0.0
N	11,648	60	99	7.3	6,244.6	6,244.6	6,244.6	0.8
O	12,840	29	85	9.6	6,253.8	6,253.8	6,253.8	0.0
P	13,730	27	83	9.9	6,273.6	6,273.6	6,273.6	0.0
Q	14,592	26	68	9.3	6,299.7	6,299.7	6,299.7	0.0
R	14,670	40	61	6.9	6,304.2	6,304.2	6,305.2	1.0
S	15,050	20	63	10.1	6,307.6	6,307.6	6,308.1	0.5
T	15,460	25	68	9.5	6,310.8	6,310.8	6,311.4	0.6
U	15,750	20	41	7.8	6,319.6	6,319.6	6,319.6	0.0
V	16,670	20	39	8.1	6,346.0	6,346.0	6,346.0	0.0

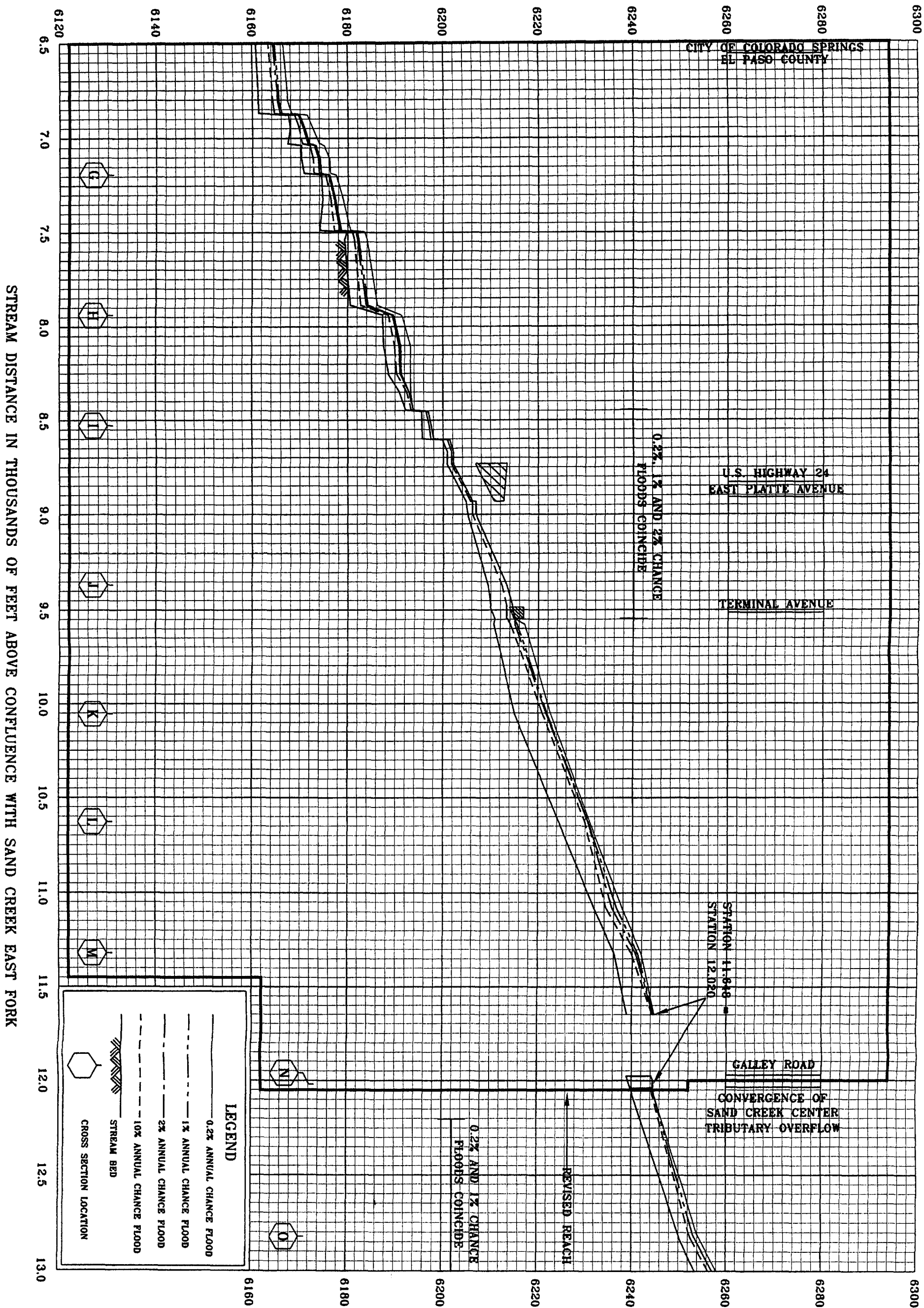
Revised Data

Flow rate = 792 cfs

Flow rate = 822 cfs

¹ Feet Above confluence with Sand Creek East Fork

ELEVATION IN FEET (NGVD 29)



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

FLOOD PROFILES

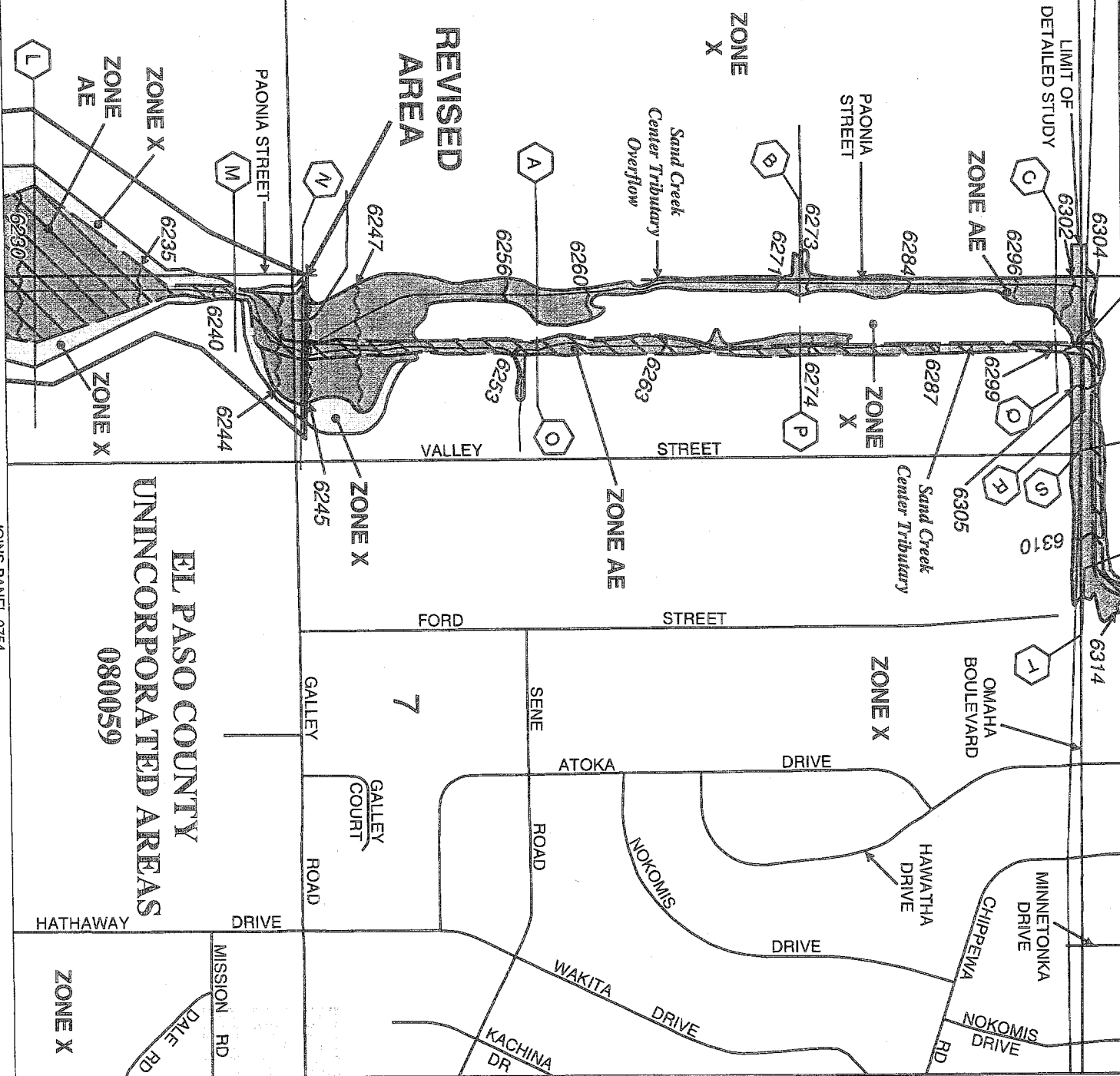
SAND CREEK CENTER TRIBUTARY

MAY 23 2007

206P

38°50'37"

104°43'07"

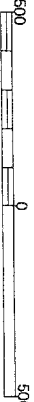


EL PASO COUNTY
UNINCORPORATED AREAS
080059

- 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
UNINCORPORATED AREAS

PANEL 752 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080059 0752 F
EL PASO COUNTY UNINCORPORATED AREAS 080059 0752 F



Federal Emergency Management Agency




MAP NUMBER
08041C0752 F
EFFECTIVE DATE:
MARCH 17, 1997

MAY 29 2007

JOINS PANEL 0754

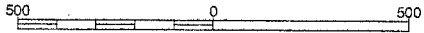
**EL PASO COUNTY
UNINCORPORATED AREAS
080059**

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, UNINCORPORATED AREAS	080059	0753	F

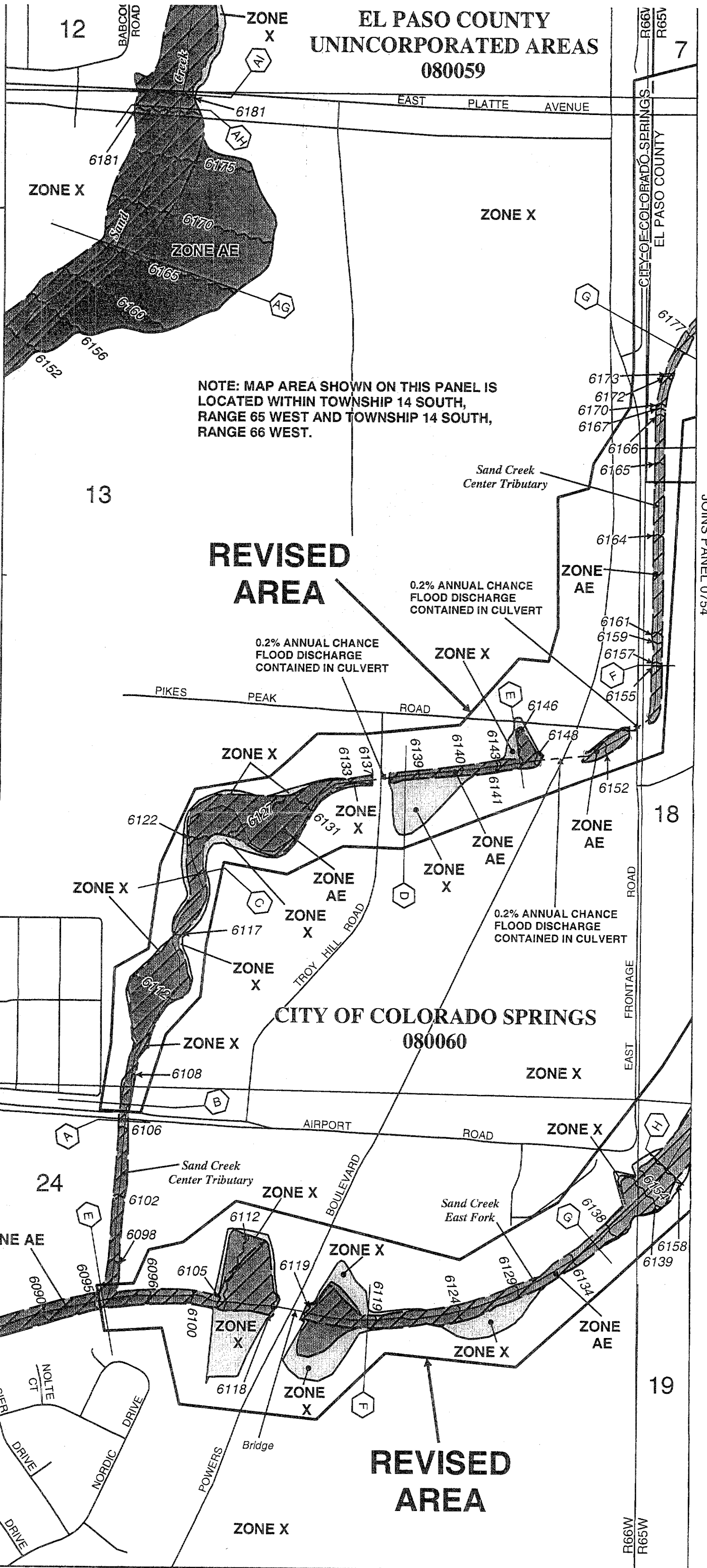
REVISED TO
REFLECT LOMR
EFFECTIVE MAY 23 2007

MAP NUMBER
08041C0753 F

EFFECTIVE DATE:
MARCH 17, 1997



Federal Emergency Management Agency






JOINS PANEL 0754

R66W
R65W

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
500 0 500

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	080060	0754 F
	EL PASO COUNTY, UNINCORPORATED AREAS	080059	0754 F

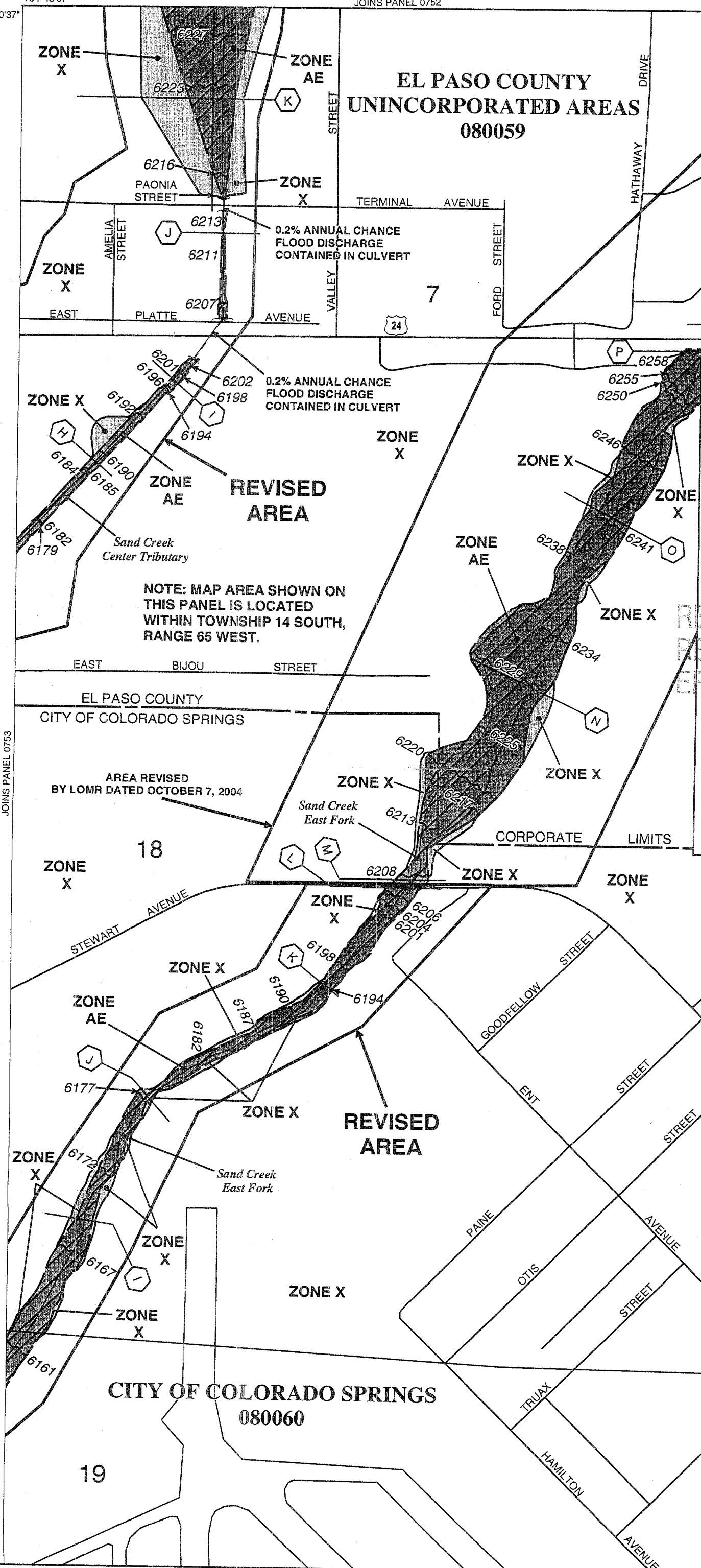
REVISED TO
REFLECT LOMR
EFFECTIVE MAY 23 2007

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



Federal Emergency Management Agency

JOINS PANEL 0753

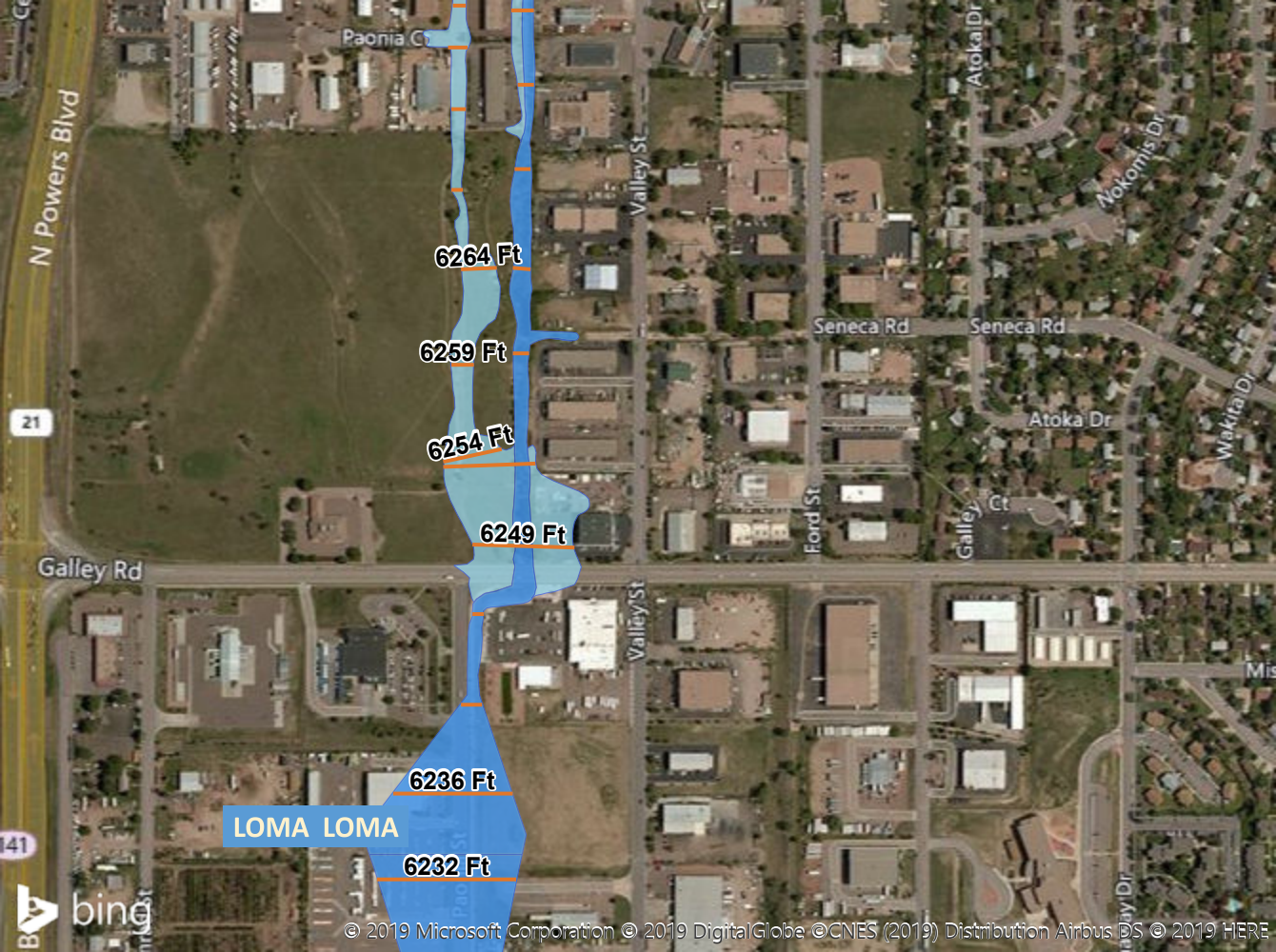


NOTE: MAP AREA SHOWN ON
THIS PANEL IS LOCATED
WITHIN TOWNSHIP 14 SOUTH,
RANGE 65 WEST.

AREA REVISED
BY LOMR DATED OCTOBER 7, 2004

CITY OF COLORADO SPRINGS
080060

19



Paonia Ct

N Powers Blvd

21

6264 Ft

6259 Ft

6254 Ft

6249 Ft

6236 Ft

LOMA LOMA

6232 Ft

Valley St

Seneca Rd

Seneca Rd

Galley Ct

Atoka Dr

Atoka Dr

Nokomis Dr

Wakita Dr

Valley St

Ford St

Mis

Wakita Dr



**SAND CREEK CHANNEL
IMPROVEMENT DESIGN REPORT
FOR
SOLACE APARTMENTS**

**Prepared For:
Jackson Dearborn Partners
404 S. Wells Street, Suite 400
Chicago, IL 60607
(734) 216-2577**

**December 19, 2019
Project No. 25174.00**

**Prepared By:
JR Engineering, LLC
5475 Tech Center Drive
Colorado Springs, CO 80919
719-593-2593**

CONTENTS

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DEVELOPMENT CRITERIA REFERENCE	3
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APPENDICES

- A. Figures and Exhibits
- B. Hydraulic Calculations
- C. Reference Material

OVERVIEW

This report was prepared to provide design information for the existing Sand Creek Drainageway as part of the Solace Apartment development. This document is the Channel Drainage report for the Solace Apartments. The Sand Creek Drainageway has been studied as part of a Flood Insurance Study (FIS) for El Pas County Colorado, Volume 7 of 8, revised December 7, 2018 and Sand Creek Drainage Basin Planning Study, dated January 1993. Existing flow rates from the Sand Creek Planning Study were used as the basis for the design of the existing channel condition.

GENERAL LOCATION AND DESCRIPTION

Location

The proposed Solace Apartments, known as “Solace” from herein, is a parcel of land located in Section 7, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. Solace is a 28.99 acre, urban, multifamily-development and is comprised of 16 apartment dwellings and associated infrastructure. Solace is bound by existing industrial developments to the North and vacant land to the West. Galley Road bounds the property to the south and existing light industrial businesses to the east. A vicinity map of the area is presented in Appendix A.

Description of Property

Solace is currently unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, Solace slopes from northwest to southeast.

Per an NRCS web soil survey of the area, Solace is made up of Type B soils with a very small percentage of Type A in the northwest corner of the property. This Type B soil is a blendon sandy loam. This soil type has a moderate infiltration rate when thoroughly wet. It also consists of moderately deep or deep, moderately well drained or well drained soil. A soil survey map has been presented in Appendix A.

Floodplain Statement

Based on the FEMA FIRM Map number 08041C0558G, dated December 7, 2018, a portion of the existing drainageway lies within Zone AE and Zone X. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The FIRM Map has been presented in Appendix A.

PREVIOUS SAND CREEK STUDIES

Solace lies within Sand Creek Drainage Basin based on the “*Sand Creek Drainage Basin Planning Study*” prepared by Kiowa Engineering in January 1993.

The Sand Creek Drainage Basin covers approximately 54 square miles in unincorporated El Paso County, CO. The Sand Creek Drainage Basin is tributary to Fountain Creek. In its existing condition, the basin is comprised of rolling rangeland with fair to good vegetative cover associated with Colorado's semi-arid climate. The natural Drainageway within the site limits is typically deep and narrow with a well-defined flow path in most areas. Anticipated land use for the basin includes multifamily residential and open space.

As part of its drainage research, JR Engineering reviewed the following drainage studies, reports and LOMRs:

- Sand Creek Drainage Basin Planning Study prepared by Kiowa Engineering Corporation in January 1993.
- Flood Insurance Study– El Paso County, Colorado & Incorporated Areas Vol 7 of 8, December 2018.
- LOMR- Case No. 05-08-0368P Federal Emergency Management Agency, May 23, 2007.

The *Sand Creek Drainage Basin Planning Study* was used to establish a stormwater management plan for the existing and future stormwater infrastructure needs within the Sand Creek Drainage Basin. Based on provided drainage maps and analysis, in its existing condition, the Sand Creek Drainageway contains a 100-year flow of 720-900 cfs along Solace's east property line. The major Sand Creek Drainageway conveys the stormwater south along the eastern property line where it ultimately outfalls into the Fountain Creek. JR Engineering has performed checks on these flow rates to verify their validity. Basin calculations show that the 720-900 cfs are still valid for this existing condition.

FEMA prepared a revised FIS for El Paso County Colorado, Volume 7 of 8, dated December 7, 2018. The effective floodplain for the site is shown on the FIRM 08041C0752F, revised to reflect LOMR, dated May 23, 2007. The study area of the FIS where the Sand Creek Drainageway crosses Galley Road, was found to overtop the culverts and flow onto the road. According to the FIS, this crossing has a 10% annual chance of flooding and is located in Zone AE of the FIRM. This location is a Special Flood Hazard Area (SFHA) inundated by the 100-year flood, Zone AE (base flood elevations determined). The *Sand Creek Drainage Basin LOMR* was executed on May 23, 2007. The LOMR revised the flood zone or the area south of Galley Road. See FIRM Map Panel 08041C0752F for limits of LOMR study and revised flood zones, presented in Appendix C



appendix D

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

Storm drainage analysis techniques were taken from the “*City of Colorado Spring/El Paso County Drainage Criteria Manual*” Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the “*Urban Storm Drainage Criteria Manual*” Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the “*Colorado Springs Drainage Criteria Manual (CCSDCM)*”, dated May 2014, as adopted by El Paso County.

Hydrologic Criteria

The hydrologic analysis for this project is based on the *Sand Creek Drainage Basin Planning Study*. The flow rates for the 100-yr storm event were taken from CTP-2 & CTP-3 of this study. The Baseline Flows from this study are included in Appendix C

appendix D

Hydraulic Criteria

GeoHECRAS was used as the primary analysis method for the site. GeoHECRAS was used to model existing flows within the Sand Creek Drainageway. This model was used to verify flood plains and analyze any overtopping that may occur within the project site. The 100-year water surface profiles for the model were analyzed from the north property line of the site to the area just south of the Galley Road Crossing. Hydraulic computations for the models are contained in Appendix B.

Appendix B of the Sand Creek- Center Tributary Channel Analysis Report

SUMMARY

The existing Sand Creek drainageway site remains consistent with pre-development drainage conditions and previous studies. The inundation at Galley Road will pose an issue for future developments and may require culvert modification in this area to eliminate chances of flooding. Velocities in the drainageway are also of concern and may require riprap lining to ensure the Sand Creek Drainageway remains stable during a 100-yr event. The final drainage report for the Solace development will need to address these concerns and propose possible remedies to prevent erosion of the channel and scour of the culverts at Galley Road. This report meets the latest El Paso County Drainage Criteria requirements for this site.

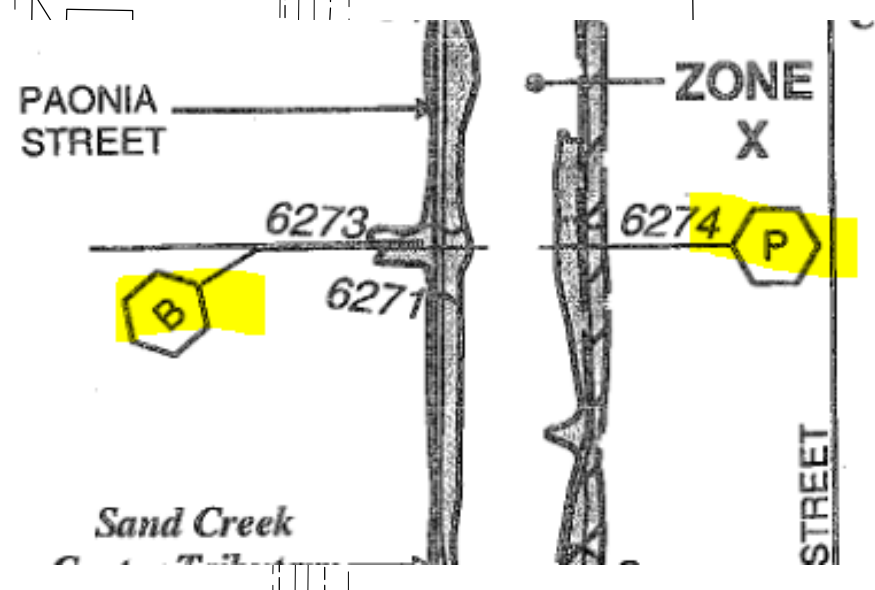
REFERENCES:

1. City of Colorado Springs Drainage Criteria Manual Volume 1, City of Colorado Springs, CO, May 2014.
2. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.
3. Flood Insurance Study- El Paso County, Colorado & Incorporated Areas Vol 7 of 8, Federal Emergency Management Agency, December 7, 2018.
4. Sand Creek Drainage Basin Planning Study, Kiowa Engineering, January 1993.
5. Sand Creek Drainage Basin LOMR, Federal Emergency Management Agency, May 23, 2007.

APPENDIX E
DRAINAGE MAPS & PLANS

Provide a design point for the FEMA FIS flows and provide a narrative.

Sand Creek Center Tributary	940	40	92	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	2,294	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	5,339	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	52	6.0	6,189.6	6,189.6	6,189.6	0.0
H	8,527	40	40	6.0	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	10,065	232	278	4.0	6,221.9	6,221.9	6,221.9	0.0



Per GIS aeriels, the properties in this area are all developed with the exception of a small lot at the southern end (near design point 4). Revise the % impervious accordingly for this basin as necessary. Is the developed flow of this area still going to design point 4?

provide sub-basin for the east side of paonia and area tributary to it.

Add design Point at the discharge location in both existing and proposed drainage map

Please provide a preliminary design of the channel improvements to include the drop and check structures.

Provide a design point at this confluence and associated narrative to explain the flow that is coming into the channel from the east.

Add design point summary table

Please provide additional contour labels throughout the plan.

This area is not captured by your ponds. Per ECM appendix I, 100% of the applicable development site shall be captured. Indicate in the narrative how this area will be captured. It appears that your sub-basin needs to be broken down further with more specifics in your narrative. Revise the sub-basin and narrative as necessary.

Provide Q in and Q out at each of the ponds

Please label as either existing or proposed.

Provide Ultimate DP at the existing culver location for both existing and proposed drainage map

Identify the existing overflow structure.

LEGEND:

- PROPOSED STORM SEWER
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- DESIGN POINT
- HIGH POINT
- LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- A = BASIN DESIGNATION
B = AREA IN ACRES
C = PERCENT IMPERVIOUS



DRAINAGE MAP
SOLACE APARTMENT
JOB NO. 25174.00
1/21/19
SHEET 1 OF 1

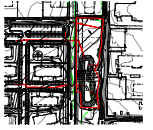


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X:\251006\ar2517400\Drawings\Sheet\Drainage\Drainage Map.dwg, 24:05 Title Porat, 1/21/2019 2:08:34 PM, Phillip

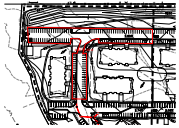
Drainage Report-Prelim_V1.pdf Markup Summary

Area Measurement (6)



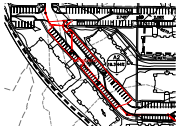
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Author: Daniel Torres
Date: 4/1/2020 2:23:47 PM
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84,259.5 sf



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Date: 4/1/2020 2:23:47 PM
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43,071.53 sf



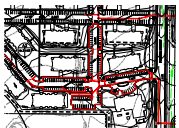
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21,160.91 sf



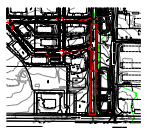
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22,972.72 sf



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53,745.22 sf



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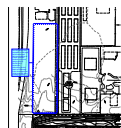
44,219.81 sf

Cloud+ (7)



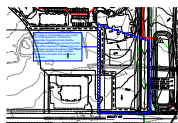
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Page Label: 15
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Author: Daniel Torres
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Provide soil group for this area of the site.



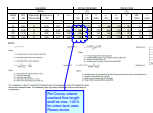
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Per GIS aerials, the properties in this area are all developed with the exception of a small lot at the southern end (near design point 4). Revise the % impervious accordingly for this basin as necessary. Is the developed flow of this area still going to design point 4?



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This area is not captured by your ponds. Per ECM appendix I, 100% of the applicable development site shall be captured. Indicate in the narrative how this area will be captured. It appears that your sub-basin needs to be broken down further with more specifics in your narrative. Revise the sub-basin and narrative as necessary.



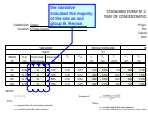
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Per County criteria overland flow length shall be max. 100 ft. for urban land uses. Please revise.



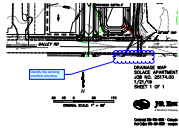
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The areas do not add up to the total areas indicated on the column to the left. Revise accordingly.



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the narrative indicated the majority of the site as soil group B. Revise.



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Identify the existing overflow structure.

Highlight (2)

line,
and open
Sub-Basin

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open

where the
space, and
OS1 is ca

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space,

Image (2)



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Author: dsdlaforce
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Text Box (4)

Colorado Springs, CO 80919
719-593-2593

Add PCD File No. SP201

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Author: Daniel Torres
Date: 4/1/2020 2:23:03 PM
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Add PCD File No. SP201

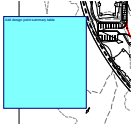
Figure 8: When a proposed or existing site within a basin or sub-basin is proposed, the result will be a proposed design and design point summary table. The design point summary table will be provided along with the author's report. The design point summary table will be provided in a separate sheet.

Please elaborate on your existing and proposed sub-basin design points providing discussion on flow rates and design points (developed and existing). Further break down your sub-basins as necessary. Also indicate the ultimate Qs entering the sand creek drainage way and at the culverts at Galley Rd. See comments on the drainage plan.

Design Point	Flow Rate (cfs)	Design Point Elevation (ft)
1	100	1000
2	200	1000
3	300	1000
4	400	1000
5	500	1000

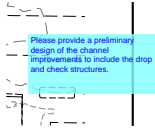
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Please elaborate on your existing and proposed sub-basin description providing discussion on flow rates and design points (developed and existing). Further break down your sub-basins as necessary. Also indicate the ultimate Qs entering the sand creek drainage way and at the culverts at Galley Rd. See comments on the drainage plan.



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Add design point summary table



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Please provide a preliminary design of the channel improvements to include the drop and check structures.