



PRELIMINARY/FINAL DRAINAGE REPORT

COLORADO CENTRE FOREIGN TRADE ZONE AND BUSINESS PARK FILING NO. 2

Foreign Trade Zone Blvd. & Import Ct.
Colorado Springs, CO

PREPARED FOR:

**Insurance Auto Auctions, Inc.
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PREPARED BY:

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DATE:

September 10, 2019



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Certification Statements

This report and plan for the drainage design of Colorado Centre Foreign Trade Zone and Business Park Filing No. 2 was prepared by me (of under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the *City of Colorado Springs Drainage Criteria Manual* and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Scott Brown PE
Registered Professional Engineer
State of Colorado No. 45900

_____ Date

Developer's Statement:

Insurance Auto Auctions, Inc. hereby certifies that the drainage facilities for Colorado Centre Foreign Trade Zone and Business Park Filing No. 2 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Insurance Auto Auctions, Inc., guarantee that final drainage design review will absolve Insurance Auto Auctions, Inc. and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Name of Developer

Authorized Signature

_____ Date

Printed Name

Title

Address:

CITY OF COLORADO SPRINGS:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

For City Engineer
Conditions:

_____ Date

I. Introduction

This document is the Preliminary/Final Drainage Report for the proposed development, Colorado Centre Foreign Trade Zone and Business Park Filing No. 2, also known as Insurance Auto Auctions. The property is approximately 46.96 acres of vacant land that will be developed into a vehicle parking lot with a single building. 5.24 acres of the total 46.96 acres will be platted.

The purpose of this Preliminary/Final Drainage Report is to identify on and offsite drainage patterns, locate and identify tributary or downstream drainage features and facilities that impact Insurance Auto Auctions, and to identify which types of drainage facilities will be needed and where they will be located.

II. General Location and Description

A. General Location

Insurance Auto Auctions is located in the Section 4, Township 15 South, Range 65 West of the 6th Principal Meridian, in the City of Colorado Springs, El Paso County, Colorado. The project site is located north of Import Ct., west of Foreign Trade Zone Blvd, and south and east of undeveloped land. The site is located southeast of the Colorado Springs Airport.

A Vicinity Map is included in Appendix A for reference.

B. Description of Property

The site covers an area of approximately 46.96 acres and is comprised of undeveloped land covered mostly by native grasses and weeds. The site generally drains from northwest to southeast, to an existing culvert under Foreign Trade Zone Blvd., at approximately 4%. The northwest corner of the site drains out of the site to the northwest at approximately 3%.

According to the U.S. Department of Agriculture Natural Resources Conservation Service Soil Survey of El Paso County, Colorado the primary (92.8%) soil found is Razor-Midway complex; the remaining soils are Manzanist clay loam (1.4%) and Vona sandy loam (5.8%). Razor-Midway complex is classified as Soil Conservation Service (SCS) hydrologic soil group "D", Manzanist clay loam is classified as SCS hydrologic soil group "C" and Vona sandy loam is classified as SCS hydrologic soil group "A". A map depicting the soil types on the project site is contained in Appendix A for reference.

There are no major drainage ways or irrigation facilities located on the site.

III. Historic Drainage Patterns and Features

The proposed project site is located within the Jimmy Camp Creek Drainage Basin as described in the Jimmy Camp Creek Drainage Basin Planning Study prepared by Kiowa in March 2015 (Jimmy Creek DBPS). The site is also located within the Banning Lewis Ranch master plan area, although no drainage reports that included this site could be located.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map 768 (FIRM Number 08041C0768G), effective date December 7, 2018 the project site lies in Zone X, which is outside of the 100-year and 500-year floodplain. A copy of the FIRM map is included for reference in the Appendix A.

In order to understand the existing hydrology, the project site was modeled in its current condition. A historic basin map has been included in Appendix D and can be used to reference the basins discussed below.

Basin H-1 (5.29 AC, $Q_5 = 1.8$ cfs, $Q_{100} = 11.9$ cfs): is associated with the northwestern corner of the site.. In existing conditions, this basin sheet flows northeast offsite to vacant land.

Basin H-2 (41.66 AC, $Q_5 = 20.5$ cfs, $Q_{100} = 109.7$ cfs): is associated with the undeveloped souther portion of the site. In existing conditions, this basin sheet flows southeast to an existing culvert located under Foreign Trade Blvd.

Basin OS-1 (74.88 AC, $Q_5 = 19.4$ cfs, $Q_{100} = 130.2$ cfs): is associated with undeveloped land to the west of the site. In existing conditions, this runoff flows east through the proposed Insurance Auto Auctions site. The extents and existing contours for this basin are shown on the exhibit included in Appendix D.

IV. Drainage Design Criteria

A. Development Criteria Reference

The analysis and design of the stormwater management system for this project was prepared in accordance with the criteria set forth in the City of Colorado Springs Drainage Criteria Manual (DCM) Volumes 1 & 2, dated May 2014.

The drainage calculations were based on the City of Colorado Springs drainage criteria manual Figure 6-5 and IDF equations to determine the intensity, and are listed in Table 1 below.

Table 1 - Precipitation Data

Return Period	One Hour Depth (in).
5-year	1.50
100-year	2.52

*The intensities above are calculated using $T_c=5$ minutes

B. Hydrologic Criteria

The rational method was used to calculate peak flows. The rational method has been proven to be accurate for basins of this size and is based on the following formula from the City of Colorado Springs Drainage Criteria Manual Volume 1, Eq 6-5:

$$Q = CIA$$

Where:

- Q = Peak Discharge (cfs)
- C = Runoff Coefficient
- I = Runoff intensity (inches/hour)
- A = Drainage area (acres)

The runoff coefficients are derived from the UD-BMP v3.06 Impervious Reduction Factor (IRF) sheet. In the parking area, only the drive aisles will be paved and the rest of the area will be an angular gravel to allow for infiltration. In this area, all impervious area will be routed through one of the pervious gravel areas, allowing

for a reduction in percent imperviousness. The permeable pavement (PP) option in the IRF spreadsheet was used to calculate the reduction in percent impervious. Runoff coefficients were then determined using Table 6-6, Runoff Coefficients for Rational Method (source: City of Colorado Springs Drainage Criteria Manual, Volume 1) by choosing the closest impervious value to that calculated in the IRF spreadsheet. The IRF sheet and other hydrologic calculation spreadsheets can be found in Appendix B.

Time of Concentration

Time of concentrations have been adapted from the equation 6-7 of The City of Colorado Springs Drainage Criteria Manual, Volume 1 which are as follows:

$$T_c = t_t + t_i$$

Where:

T_c = time of concentration (min)

T_i = overland (initial) flow time (min)

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

Overland (Initial) Flow Time: from equations 6-8 from the City of Colorado Springs Drainage Criteria Manual, Volume 1.

$$t_t = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$

Where:

T_i = overland (initial) flow

C_5 = runoff coefficient for 5-year frequency

L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)

S = average basin slope

Travel Time

$$V = C_v * S_w^{0.5}$$

Where:

V = Velocity (ft/s)

C_v = conveyance coefficient

S_w = watercourse slope (ft/ft)

All of the flows in the Rational Method calculations were routed to account for time of concentration on the surface and travel time in the pipe. As the travel time across a basin or in a pipe increases, the flowrate also decreases.

C. Hydraulic Criteria

There are no pipes or inlets being proposed with this development. All runoff will sheet flow directly to the pond. Riprap will be provided at the inflow locations. Calculations for these "rock chutes" have been included in Appendix C.

The full spectrum detention method (FSD) was used to size the proposed water quality/detention pond. This method attributes two design volumes; one being the Excess Urban Runoff Volume (EURV) and the other

being the 100-year detention volume. This approach includes the Water Quality Capture Volume (WQCV) with the EURV; therefore, no additional volume for the WQCV is required. The required volume calculations as well as the outlet structure design calculations are provided in the Appendix C of this report. The specifics of the pond and its outlet structure will be discussed in further detail later in this report.

V. Proposed Drainage Plan

A. General Description

The proposed drainage system is designed to safely convey the storm runoff generated from the proposed development to the proposed detention pond. The proposed detention pond will provide full spectrum detention which includes water quality and 100-year detention.

Runoff from the site will sheet flow directly to the proposed detention pond. Riprap will be provided at the inflow locations.

The proposed detention pond will outfall to the existing culvert under Foreign Trade Zone Blvd., which is where the site drains to in existing conditions. The release rates from the pond will be at or below historic rates.

B. Four Step Process

The Four Step Process to minimize the adverse impacts of urbanization is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four step process:

1. Employ Runoff Reduction Practices

The proposed development uses Low Impact Development (LID) practices to reduce runoff at the source. Rather than creating point discharges that are directly connected to impervious areas, runoff is routed through pervious areas to promote infiltration. Only drive aisles will be paved, the rest of the parking area will have angular gravel and rocks to allow for infiltration and the paved areas will be routed through these pervious areas when possible. Grass buffers and swales are used where practical.

2. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release

The proposed development utilizes formalized water quality capture volume to slow the release of runoff from the site. The proposed pond will provide EURV volume for the new development which incorporates a 68-72-hour release. This pond will also provide WQCV which will release in no less than 40 hours.

3. Stabilize Drainageways

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Since the release rates from the proposed development will be less than or equal to the site's historic release rates, and the site will have no impact on Jimmy Camp Creek. There are no other requirements for this site in the DBPS. There is an existing culvert under Foreign Trade Zone Blvd., which is 6-24" CMP pipes. This proposed site will release at or below historic rates and the existing culvert is adequately sized and protected to account for this runoff.

4. Implement Site Specific and Other Source Control BMPs

Source control BMPs protect the release of pollutants from outdoor storage areas. Trash enclosures will be provided near the building. The biggest source control BMP is public education which can be found on the City of Colorado Springs website and discuss topics such as: pet waste, car washing, lawn care, fall leaves, and snow melt and deicer.

C. Proposed Basins

The general location and description of each proposed basin is described below. The major and minor basins and their proposed size, shape, and orientation can be seen on the proposed drainage maps found in Appendix D. Hydrology calculations are included in Appendix B.

Basin A-1 (43.63 AC, $Q_5 = 64.1$ cfs, $Q_{100} = 142.9$ cfs): a basin defining a majority of the site which includes the entire parking area, a portion of the proposed building, some landscape around the perimeter of the site, and two large paved areas for the load out area and drop zones. Runoff will generally sheet flow southeast through the site, directly into the proposed detention pond. A majority of the flow will enter the pond at Design Point 1, so riprap will be provided along the slope of the pond at this point.

Basin A-2 (1.15 AC, $Q_5 = 1.7$ cfs, $Q_{100} = 4.7$ cfs): a basin defining a small portion of the site on the southern end including a small parking lot near the building, a portion of the proposed building, and landscape area. Runoff will generally sheet flow east through the site and will be conveyed with curb and gutter directly into the proposed detention pond. Runoff will enter the pond at Design Point 2, so riprap will be provided along the slope of the pond at this point.

Basin A-3 (2.17 AC, $Q_5 = 1.7$ cfs, $Q_{100} = 9.5$ cfs): a basin defining the proposed full spectrum detention pond and associated landscaping. Runoff will flow into the pond and collect at the proposed outlet structure.

Basin OS-1 (74.88 AC, $Q_5 = 19.4$ cfs, $Q_{100} = 130.2$ cfs): is associated with undeveloped land to the west of the site. This basin matches the historic basin OS-1. In existing conditions, this runoff flows east through the proposed Insurance Auto Auctions site. The extents and existing contours for this basin are shown on the exhibit included in Appendix D. The proposed detention pond has not been designed to provide full spectrum detention for this basin. When this area develops, it will need to provide its own full spectrum detention and release flows around the Insurance Auto Auction site.

Basin OS-2 (0.14 AC, $Q_5 = 0.3$ cfs, $Q_{100} = 0.7$ cfs): a basin defining a landscape area and a portion of the drive entrances along Import Ct. Runoff will sheet flow into Import Ct. where existing curb and gutter will convey the runoff to one of the existing inlets in Foreign Trade Blvd.

D. Detention and Water Quality

The proposed detention pond is located on the southeast corner of the site. It will be privately owned and maintained and will provide water quality and detention for the entire site, but not for the offsite tributary area. The pond's total tributary area is 46.95 acres with a percent impervious of 57.40%. Calculations for this tributary area are included on the IRF sheet in Appendix B. The pond has been designed to be a full spectrum extended detention basin. The UDFCD UD-Detention v3.07 spreadsheet was utilized to determine the total volume required and design the EURV and WQ release. The 1.72 acre-feet of EURV

volume will release in 68-72 hours while the 0.89 acre-feet of water quality volume releases in 40 hours. The 100-year detention volume of the pond is 2.08 acre-feet. The 100-year release will be controlled with a weir. The weir was sized using Bentley FlowMaster and calculations are provided in Appendix C. The weir will be 100-ft long and will also serve as the emergency spillway and release of the offsite flows. The first approximately 0.5-ft will control the 100-year release, and the next approximately 1-ft will control the emergency overflow and also the un-detained undeveloped offsite basin. The pond has a total required volume of 4.69 acre-ft.

The pond will outfall into a channel where flow will then enter the existing culvert under Foreign Trade Zone Blvd. The pond will release at or below historic rates. Riprap protection will be provided at the pond outfall location to protect the downstream infrastructure.

All pond calculations have been included in Appendix C.

VI. Basin Fees & Cost Estimate

The project is located in the Jimmy Camp Creek Drainage Basin. The "2019 Drainage, Bridge and Pond Fees" table, effective January 1, 2019, identifies the following fees associated with the basin. These fees are due prior to plat recordation. Only a small portion of the site, along the southeast corner, is being platted at this time. Fees are due for only the portion of the site that is being platted.

Basin Fees 2019	Total Area (Acres)	Basin Fee (per Acre)	Total Cost
Drainage Fee	5.24	\$7,975	\$41,789
Pond Facility Fee	5.24	\$2,599	\$13,619
Total			\$55,408

Items listed in the construction cost estimate below are public or private as denoted. All items are non-reimbursable.

Private Cost Estimate				
Item	Quantity	Unit	Unit Cost	Cost
Pond (Private)	1	EA	\$30,000	\$30,000
Sub-Total				\$30,000
Contingency			10%	\$3,000
Grand Total				\$33,000

VII. Conclusions

This report for Insurance Auto Auctions has been prepared using the criteria and methods described in the City of Colorado Springs Drainage Criteria Manual Volumes 1 & 2. The downstream facilities within Foreign Trade Zone Blvd. are adequate to convey the runoff and emergency overflow proposed from the site. The site runoff will not adversely affect the downstream and surrounding developments. This report is in general conformance with all previously prepared reports that included this site.

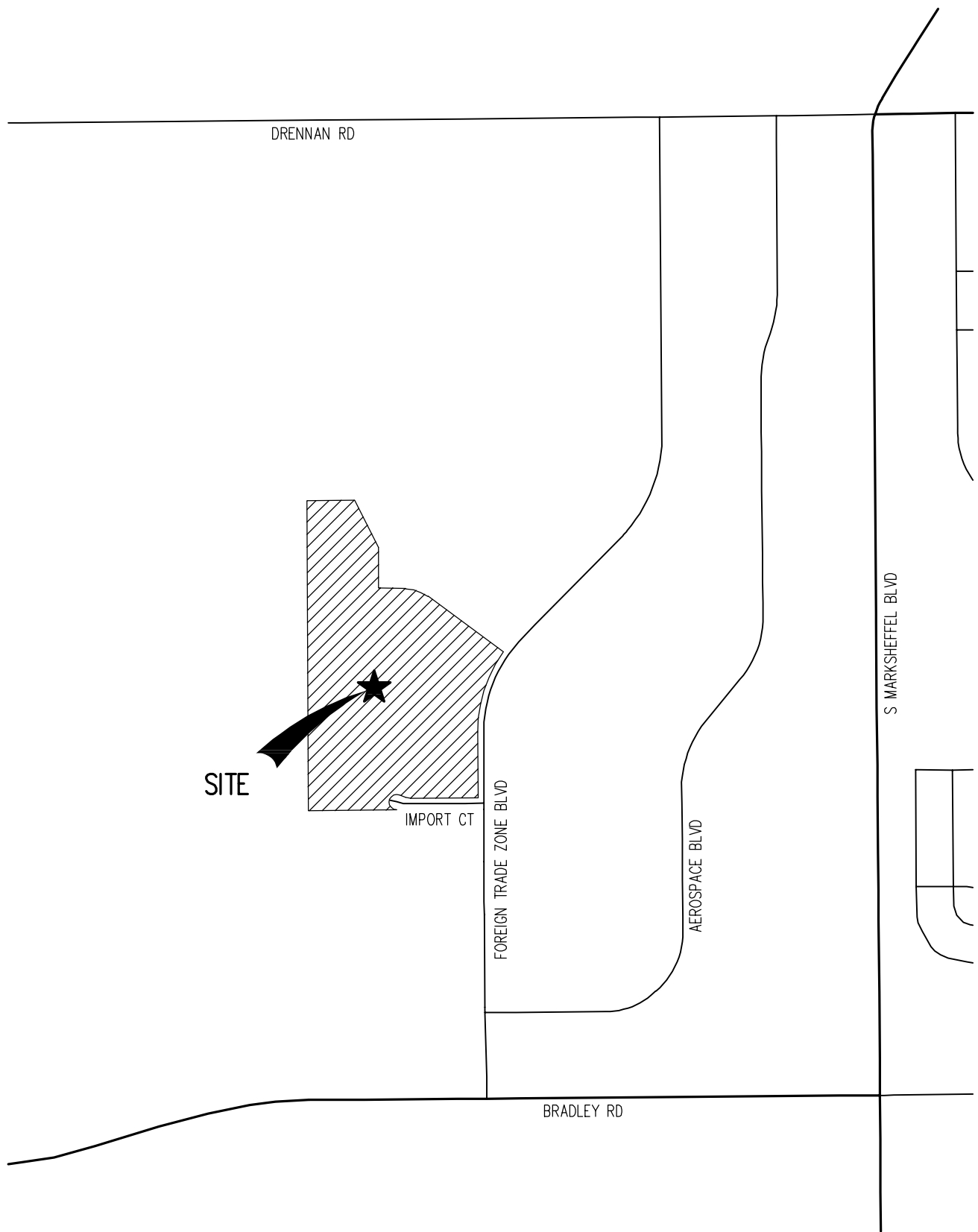
VIII. References

1. *Drainage Criteria Manual Volumes 1 & 2*, City of Colorado Springs, dated May 2014.
2. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, latest revision.
3. Flood Insurance Rate Map (FIRM), El Paso County, Colorado and Incorporated Areas. Map Numbers 08041C0768G, December 7, 2018 (Federal Emergency Management Agency).
4. Soil Survey of El Paso County, Colorado, Natural Resource Conservation Service, Sept 22, 2015.
5. "Jimmy Camp Creek Drainage Basin Planning Study", March 2015, Kiowa Engineering Corporation.

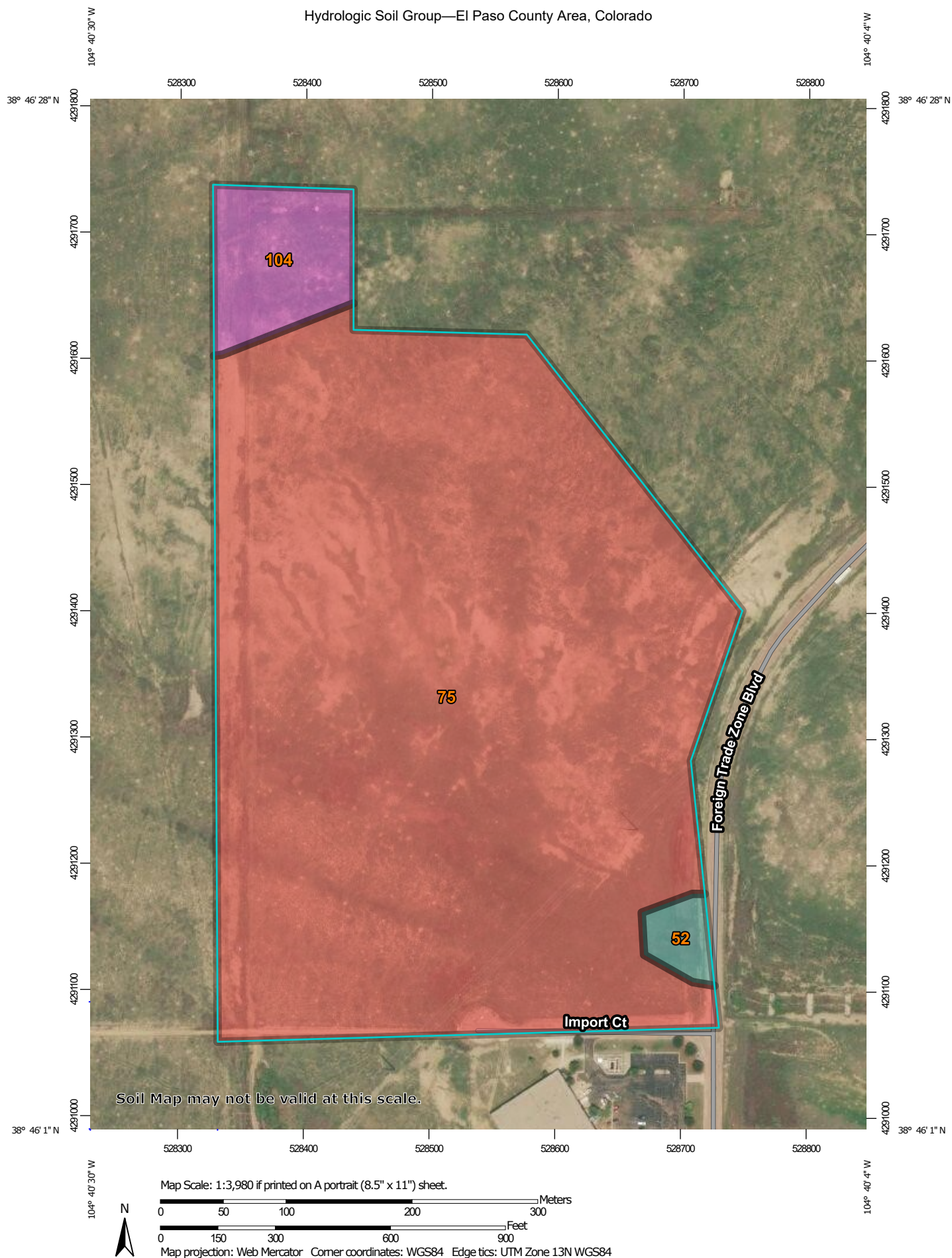
APPENDIX A

Figures and Exhibits






Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines


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

Soil Rating Points



 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Apr 12, 2017—Nov 17, 2017

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
52	Manzanst clay loam, 0 to 3 percent slopes	C	0.7	1.4%
75	Razor-Midway complex	D	50.2	92.8%
104	Vona sandy loam, warm, 0 to 3 percent slopes	A	3.1	5.8%
Totals for Area of Interest			54.1	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **Floodway** have been determined, users are encouraged to consult the **Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations** tables contained within the **Flood Insurance Study (FIS)** report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only to landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid projection or UTM zone codes used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NNGS12
National Geodetic Survey
SSM-C-3, #0002
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at <http://www.ngs.noaa.gov/>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date stream channel configurations and floodplain delineations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

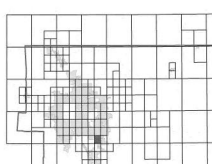
Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.fema.gov/business/mfp>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/mfp>.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).



Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST, AND TOWNSHIP 16 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, AR, AV, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system no longer in existence; Zone AR indicates that the former flood control system is being retained to provide protection from the 1% annual chance or greater flood.
- ZONE AV** Area to be protected from 1% annual chance flood by a Federal Flood protection system under construction; no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel or a stream plus any adjacent floodplain areas that must be kept free of encroachments, or use the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of 0.5 to 1 foot or with zones shallower than 1 foot; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
Base Flood Elevation line and value, elevation in feet.
Base Flood Elevation value where uniform within zone; elevation in feet.

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) (SPROCK 050).
1000-meter Universal Transverse Mercator grid ticks, zone 13.

5000-foot grid ticks: Colorado State Plane coordinate system, central zone 10 (SPROCK 050).
Lambert Conformal Conic Projection

Bench mark (see explanation in Notes to Users section of this FIRM panel)

1:1.5 River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

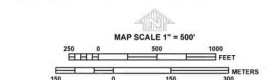
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6635.



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0768G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 768 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS	NUMBER	PANEL	SUFFIX
COMMUNITY	0800	0768	A
EL PASO COUNTY	0800	0768	0

Notice to User: The Map Number shown below should be used when citing map sheets. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0768G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

APPENDIX B

Hydrologic Calculations



COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: _____
Location: CO, Colorado Springs

Project Name: Insurance Auto Auctions
Project No.: IAA01.20
Calculated By: CMV
Checked By: SMB
Date: 9/4/19

Basin ID	Total Area (ac)	Paved Roads			Gravel			Lawns			Roofs			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
H-1	5.29													2.00
H-2	41.66													2.00
OS-1	74.88													2.00

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

---Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
---Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
---Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		

Max Intensity for Optional User Defined Storm

0

Designer: Casey Visscher

Company: Galloway & Co.

Date: September 4, 2019

Project: Insurance Auto Auctions

Location: Colorado Springs, CO

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A-1	A-2	A-3														
Receiving Pervious Area Soil Type	Silty Clay Loam	Silty Clay Loam	Silty Clay Loam														
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	43.630	1.150	2.170														
Directly Connected Impervious Area (DCIA, acres)	0.120	0.480	0.000														
Unconnected Impervious Area (UIA, acres)	15.760	0.000	0.000														
Receiving Pervious Area (RPA, acres)	26.470	0.000	0.000														
Separate Pervious Area (SPA, acres)	1.280	0.670	2.170														
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	PP	PP	PP														

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	43.630	1.150	2.170														
Directly Connected Impervious Area (DCIA, %)	0.3%	41.7%	0.0%														
Unconnected Impervious Area (UIA, %)	36.1%	0.0%	0.0%														
Receiving Pervious Area (RPA, %)	60.7%	0.0%	0.0%														
Separate Pervious Area (SPA, %)	2.9%	58.3%	100.0%														
A_u (RPA / UIA)	1.680	0.000	0.000														
I_u Check	0.370	1.000	1.000														
f / I for WQCV Event:	0.5	0.5	0.5														
f / I for 5-Year Event:	0.3	0.3	0.3														
f / I for 100-Year Event:	0.2	0.2	0.2														
f / I for Optional User Defined Storm CUHP:																	
IRF for WQCV Event:	0.00	0.00	0.00														
IRF for 5-Year Event:	0.90	1.00	1.00														
IRF for 100-Year Event:	0.95	1.00	1.00														
IRF for Optional User Defined Storm CUHP:																	
Total Site Imperviousness: I_{total}	60.7%	41.7%	0.0%														
Effective Imperviousness for WQCV Event:	0.3%	41.7%	0.0%														
Effective Imperviousness for 5-Year Event:	32.9%	41.7%	0.0%														
Effective Imperviousness for 100-Year Event:	34.5%	41.7%	0.0%														
Effective Imperviousness for Optional User Defined Storm CUHP:																	

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT*: Reduce Detention By:	42.9%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:																	

Total Site Imperviousness:

57.4%

Total Site Effective Imperviousness for WQCV Event:

1.3%

Total Site Effective Imperviousness for 5-Year Event:

31.6%

Total Site Effective Imperviousness for 100-Year Event:

33.1%

Total Site Effective Imperviousness for Optional User Defined Storm CUHP:

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

---Design Storm: 1-Hour Rain Depth	WQCV Event	0.60	inches
---Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
---Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		

Max Intensity for Optional User Defined Storm

0

Designer: Casey Visscher

Company: Galloway & Co.

Date: September 4, 2019

Project: Insurance Auto Auctions

Location: Colorado Springs, CO

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	OS-2																	
Receiving Pervious Area Soil Type	Silty Clay Loam																	
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.140																	
Directly Connected Impervious Area (DCIA, acres)	0.050																	
Unconnected Impervious Area (UIA, acres)	0.000																	
Receiving Pervious Area (RPA, acres)	0.000																	
Separate Pervious Area (SPA, acres)	0.090																	
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	V																	

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.140																	
Directly Connected Impervious Area (DCIA, %)	35.7%																	
Unconnected Impervious Area (UIA, %)	0.0%																	
Receiving Pervious Area (RPA, %)	0.0%																	
Separate Pervious Area (SPA, %)	64.3%																	
A_u (RPA / UIA)	0.000																	
I_u Check	1.000																	
f / I for WQCV Event:	0.5																	
f / I for 5-Year Event:	0.3																	
f / I for 100-Year Event:	0.2																	
f / I for Optional User Defined Storm CUHP:																		
IRF for WQCV Event:	0.00																	
IRF for 5-Year Event:	1.00																	
IRF for 100-Year Event:	1.00																	
IRF for Optional User Defined Storm CUHP:																		
Total Site Imperviousness: I_{total}	35.7%																	
Effective Imperviousness for WQCV Event:	35.7%																	
Effective Imperviousness for 5-Year Event:	35.7%																	
Effective Imperviousness for 100-Year Event:	35.7%																	
Effective Imperviousness for Optional User Defined Storm CUHP:																		

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:																		

Total Site Imperviousness:

35.7%

Total Site Effective Imperviousness for WQCV Event:

35.7%

Total Site Effective Imperviousness for 5-Year Event:

35.7%

Total Site Effective Imperviousness for 100-Year Event:

35.7%

Total Site Effective Imperviousness for Optional User Defined Storm CUHP:

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: _____
Location: CO, Colorado Springs

Project Name: Insurance Auto Auctions
Project No.: IAA01.20
Calculated By: CMV
Checked By: SMB
Date: 9/10/19

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					T _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C ₁₀₀	C ₅	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	C _v	VEL. (FPS)	T _t (MIN)	COMP. T _c (MIN)	TOTAL LENGTH (FT)	Urbanized T _c (MIN)	
H-1	5.29	A	2.00	0.36	0.09	300	3.0	22.2	250	3.0	15.0	2.6	1.6	23.8	550.0	13.1	13.1
H-2	41.66	D	2.00	0.51	0.16	300	5.9	16.5	1530	3.8	15.0	2.9	8.7	25.2	1830.0	20.2	20.2
OS-1	74.88	A	2.00	0.36	0.09	300	3.0	22.2	2050	3.0	15.0	2.6	13.2	35.4	2350.0	23.1	23.1
A-1	43.63	D	60.70	0.65	0.49	100	0.5	14.1	1920	3.8	20.0	3.9	8.2	22.3	2020.0	21.2	21.2
A-2	1.15	D	41.70	0.58	0.35	100	4.5	8.3	315	3.1	20.0	3.5	1.5	9.8	415.0	12.3	9.8
A-3	2.17	D	0.00	0.50	0.15	137	25.0	7.0						7.0	137.0	10.8	7.0
OS-2	0.14	D	35.70	0.58	0.35	10	25.0	1.5	25	0.5	15.0	1.1	0.4	1.9	35.0	10.2	5.0

NOTES:

$T_i = (0.395 * (1.1 - C_s) * (L)^{0.5} / ((S)^{0.33}))$, S in ft/ft

$T_t = L / 60V$ (Velocity From Fig. 501)

Velocity $V = C_v * S^{0.5}$, S in ft/ft

T_c Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

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

Subdivision: _____
Location: CO, Colorado Springs _____
Design Storm: 5-Year _____

Project Name: Insurance Auto Auctions
Project No.: IAA01.20
Calculated By: CMV
Checked By: SMB
Date: 9/10/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	H1	H-1	5.29	0.09	13.1	0.48	3.73	1.8													Flows northeast, offsite
	H2	H-2	41.66	0.16	20.2	6.67	3.08	20.5													Flows southeast to existing culvert under FTZ Blvd.
									20.2	7.15	3.08	22.0									Total historic runoff from site
	OS1	OS-1	74.88	0.09	23.1	6.74	2.88	19.4													Flows from offsite into west side of site
	H2								23.1	13.41	2.88	38.6									Total flow to existing culvert
	1	A-1	43.63	0.49	21.2	21.38	3.00	64.1													Flows directly into Pond
	2	A-2	1.15	0.35	9.8	0.40	4.16	1.7													Flows directly into Pond
	3	A-3	2.17	0.15	7.0	0.33	4.67	1.5													Flows directly into Pond
	3								23.1	28.85	2.88	83.1									Total flow to Pond (Basins A-1, A-2, A-3, OS-1)
		OS-2	0.14	0.35	5.0	0.05	5.17	0.3													Flows offsite into Import Ct.

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

Subdivision: _____
Location: CO, Colorado Springs _____
Design Storm: 100-Year _____

Project Name: Insurance Auto Auctions _____
Project No.: IAA01.20 _____
Calculated By: CMV _____
Checked By: SMB _____
Date: 9/10/19 _____

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
	H1	H-1	5.29	0.36	13.1	1.90	6.26	11.9													Flows northeast, offsite
	H2	H-2	41.66	0.51	20.2	21.25	5.16	109.7													Flows southeast to existing culvert under FTZ Blvd.
									20.2	23.15	5.16	119.5									Total historic runoff from site
	OS1	OS-1	74.88	0.36	23.1	26.96	4.83	130.2													Flows from offsite into west side of site
	H2								23.1	48.21	4.83	232.9									Total flow to existing culvert
	1	A-1	43.63	0.65	21.2	28.36	5.04	142.9													Flows directly into Pond
	2	A-2	1.15	0.58	9.8	0.67	6.98	4.7													Flows directly into Pond
	3	A-3	2.17	0.50	7.0	1.09	7.84	8.5													Flows directly into Pond
	3								23.1	57.08	4.83	275.7									Total flow to Pond (Basins A-1, A-2, A-3, OS-1)
		OS-2	0.14	0.58	5.0	0.08	8.68	0.7													Flows offsite into Import Ct.

APPENDIX C

Hydraulic Calculations



DETENTION POND TRIBUTARY AREAS

Subdivision: _____
Location: CO, Colorado Springs

Project Name: Insurance Auto Auctions
Project No.: IAA01.20
Calculated By: CMV
Checked By: SMB
Date: 9/10/19

Detention Pond

Basin	Area	% Imp
A-1	43.63	60.7
A-2	1.15	41.7
A-3	2.17	0.0
Total	46.95	57.4

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Basin ID: Proposed Full Spectrum Detention Basin

ZONE 3



Example 2.10 (continued)

Selected BMP Type = **EDB**

Watershed Area	46.95	acres
Watershed Length	2,110	ft
Watershed Slope	0.037	ft/ft
Watershed Imperviousness	57.40%	percent
Percentage Hydrologic Soil Group A	5.6%	percent
Percentage Hydrologic Soil Group B	0.0%	percent
Percentage Hydrologic Soil Groups C/D	94.4%	percent
Desired WQCV Drain Time	40.0	hours
Location for 1-hr Rainfall Depth =	Use Input	
Water Quality Capture Volume (WQCV)	0.891	acre-feet
Excess Urban Runoff Volume (EURV)	2.614	acre-feet
2-y Runoff Volume ($P_1 = 1.19$ in.)	2.431	1.19 inches
5-y Runoff Volume ($P_1 = 1.5$ in.)	3.491	1.50 inches
10-y Runoff Volume ($P_1 = 1.75$ in.)	4.379	1.75 inches
25-y Runoff Volume ($P_1 = 2$ in.)	5.752	2.00 inches
50-y Runoff Volume ($P_1 = 2.25$ in.)	6.834	2.25 inches
100-y Runoff Volume ($P_1 = 2.52$ in.)	8.173	2.52 inches
500-y Runoff Volume ($P_1 = 3.49$ in.)	12.126	3.49 inches
Approximate 2-yr Detention Volume	2.281	acre-feet
Approximate 5-yr Detention Volume	3.290	acre-feet
Approximate 10-yr Detention Volume	3.764	acre-feet
Approximate 25-yr Detention Volume	4.066	acre-feet
Approximate 50-yr Detention Volume	4.215	acre-feet
Approximate 100-yr Detention Volume	4.694	acre-feet

Water Quality Capture Volume (WQCV) =	0.891	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	2.614	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	2.431	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	3.491	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	4.379	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	5.752	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	6.834	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	8.173	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.49 in.) =	12.126	acre-feet	3.49 inches

Stage-Storage Calculation

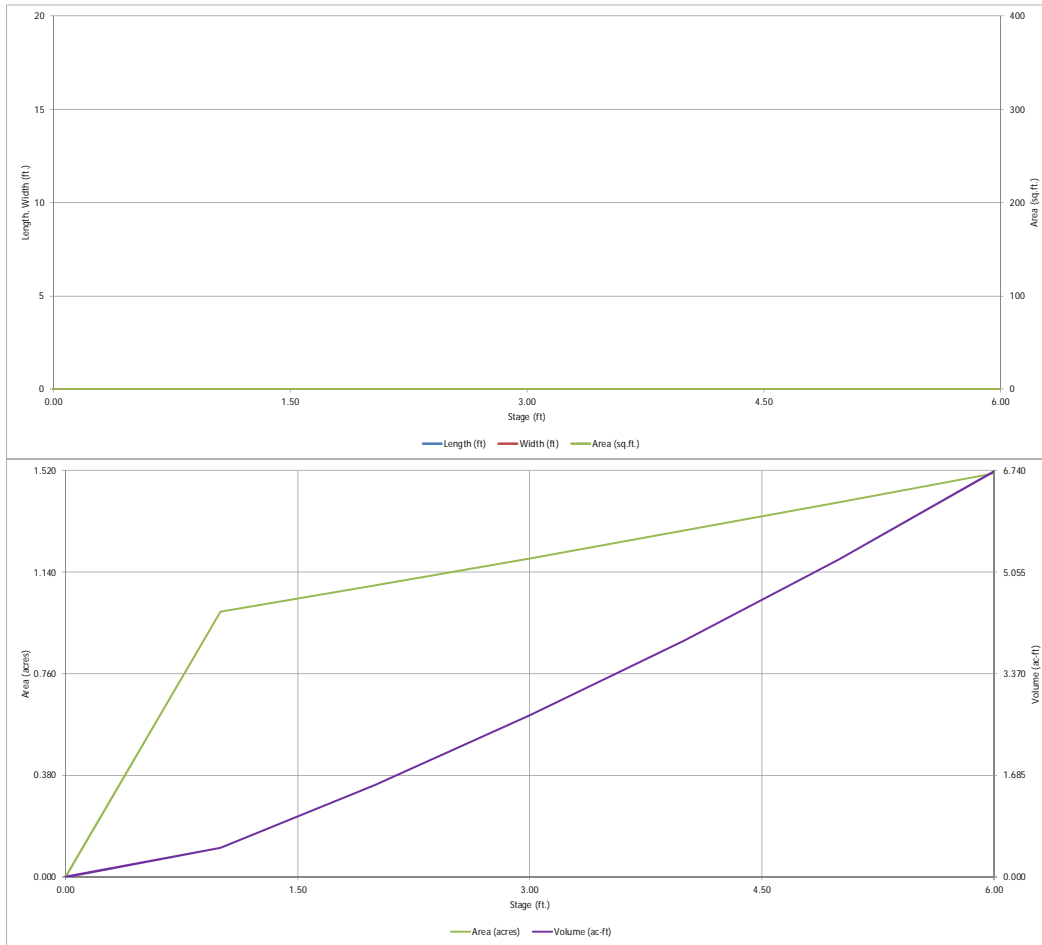
Zone 1 Volume ($WOCV_1$)	0.891	acre-feet	Total detention vol is less than 100-year volume.
Zone 2 Volume ($EURV - Zone 1$)	1.723	acre-feet	
Select Zone 3 Storage Volume (Optional)		acre-feet	
Total Detention Basin Volume	2.614	acre-feet	
Initial Surcharge Volume (ISV)	US6F	ft ³	
Initial Surcharge Depth (ISD)	US6F	ft	
Total Available Detention Depth ($H_{T(ASD)}$)	US6F	ft	
Depth of Trickle Channel (H_{TC})	US6F	ft	
Slope of Trickle Channel (S_{TC})	US6F	ft/ft	
Slopes of Main Basin Sides (S_{BASIN})	US6F	H:V	
Basin Length-to-Width Ratio ($R_{L/W}$)	US6F		
Initial Surcharge Area (A_{IS})	US6F	ft ²	
Surcharge Volume Length (L_{IS})	US6F	ft	
Surcharge Volume Width (W_{IS})	US6F	ft	
Depth of Basin Floor ($H_{(L=0)}$)	US6F	ft	
Length of Basin Floor ($L_{(L=0)}$)	US6F	ft	
Width of Basin Floor ($W_{(L=0)}$)	US6F	ft	
Area of Basin Floor ($A_{(L=0)}$)	US6F	ft ²	
Volume of Basin Floor ($V_{(L=0)}$)	US6F	ft ³	
Depth of Main Basin ($H_{(MAX)}$)	US6F	ft	
Length of Main Basin ($L_{(MAX)}$)	US6F	ft	
Width of Main Basin ($W_{(MAX)}$)	US6F	ft	
Area of Main Basin ($A_{(MAX)}$)	US6F	ft ²	
Volume of Main Basin ($V_{(MAX)}$)	US6F	ft ³	
Calculated Total Basin Volume (V_{TOTAL})	US6F	acre-feet	

Zone 2 Volume (EURV - Zone 1) =	1.723	acre-feet	Total detention volume is less than 100-year volume.
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	2.614	acre-feet	

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

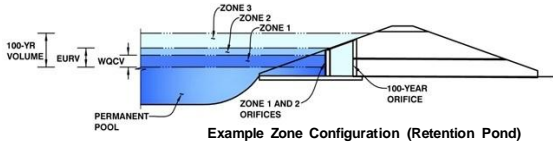


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Insurance Auto Auctions

Basin ID: Proposed Full Spectrum Detention Basin



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.53	0.891	Orifice Plate
Zone 2 (EURV)	3.29	1.723	Orifice Plate
Zone 3			Not Utilized
		2.614	Total

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.10	2.20					
Orifice Area (sq. inches)	7.50	7.50	7.50					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Slope = H:V (enter zero for flat grate)
Horiz. Length of Weir Sides = feet
Overflow Grate Open Area % = %
Debris Clogging % = %

Calculated Parameters for Overflow Weir

Height of Grate Upper Edge, H₁ = feet
Over Flow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area = should be ≥ 4
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

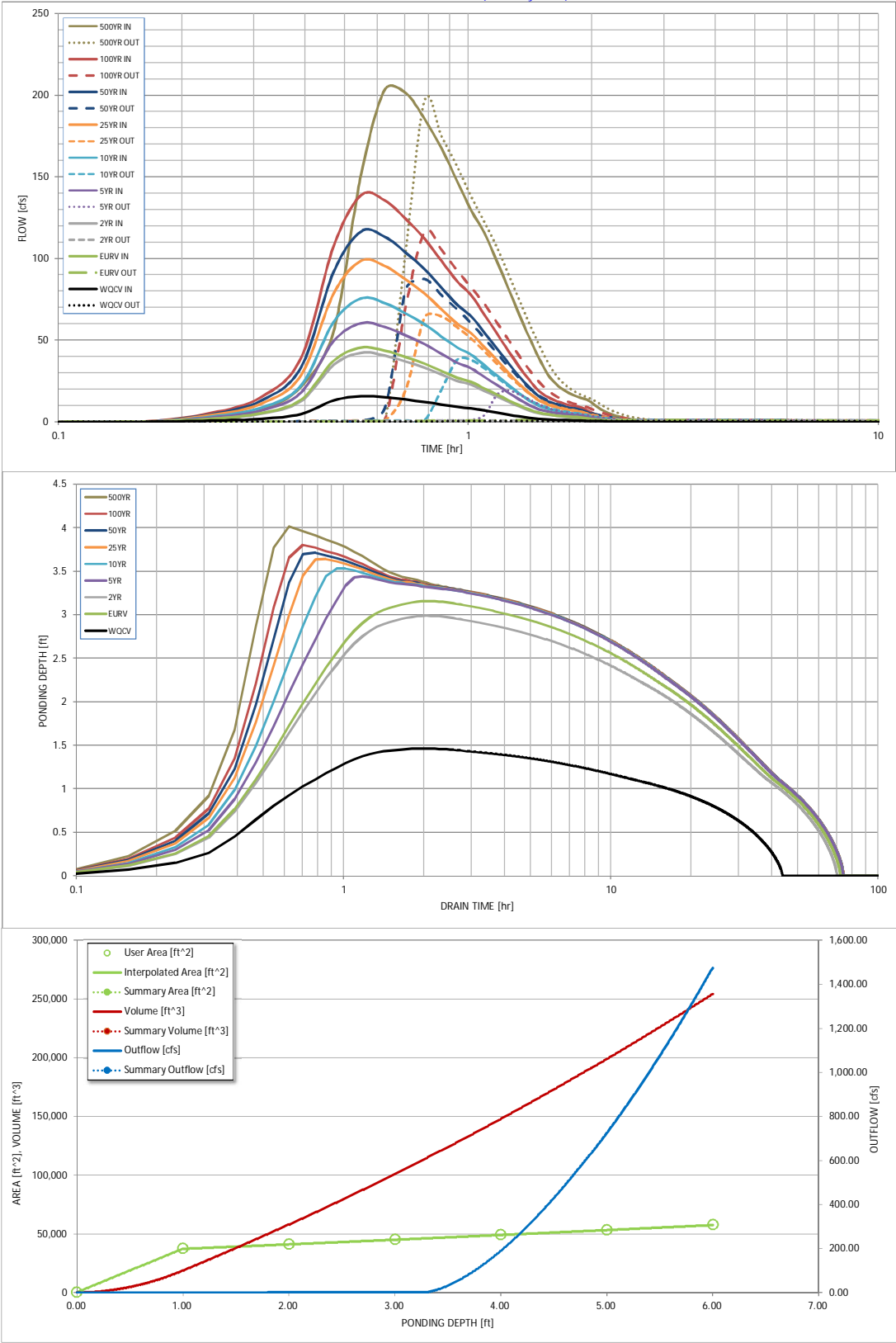
Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.49
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.49
Calculated Runoff Volume (acre-ft) =	0.891	2.614	2.431	3.491	4.379	5.752	6.834	8.173	12.126
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.890	2.614	2.430	3.491	4.380	5.752	6.832	8.169	12.125
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.13	0.35	0.80	1.07	1.40	2.28
Predevelopment Peak Q (cfs) =	0.0	0.0	0.7	6.0	16.3	37.7	50.2	65.9	107.1
Peak Inflow Q (cfs) =	15.7	45.5	42.3	60.5	75.6	98.7	116.7	138.8	203.5
Peak Outflow Q (cfs) =	0.5	1.1	1.0	19.1	37.9	64.5	87.4	116.3	196.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.2	2.3	1.7	1.7	1.8	1.8
Structure Controlling Flow =	Plate	Plate	Plate	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.1	0.2	0.3	0.4	0.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	41	65	63	65	63	60	59	56	50
Time to Drain 99% of Inflow Volume (hours) =	42	69	67	70	69	68	67	66	64
Maximum Ponding Depth (ft) =	1.46	3.16	2.99	3.44	3.53	3.64	3.72	3.80	4.02
Area at Maximum Ponding Depth (acres) =	0.89	1.05	1.03	1.07	1.08	1.09	1.10	1.11	1.13
Maximum Volume Stored (acre-ft) =	0.829	2.467	2.291	2.775	2.871	2.980	3.068	3.167	3.401

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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

100-year Detention

Project Description

Solve For Headwater Elevation

Input Data

Discharge	119.50	ft³/s
Crest Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Weir Coefficient	3.00	US
Crest Length	100.00	ft

Results

Headwater Elevation	0.54	ft
Headwater Height Above Crest	0.54	ft
Tailwater Height Above Crest	0.00	ft
Equal Side Slopes	0.25	ft/ft (H:V)
Flow Area	54.21	ft²
Velocity	2.20	ft/s
Wetted Perimeter	101.12	ft
Top Width	100.27	ft

Emergency Overflow + Offsite

Project Description

Solve For Headwater Elevation

Input Data

Discharge	275.70	ft³/s
Crest Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Weir Coefficient	3.00	US
Crest Length	100.00	ft

Results

Headwater Elevation	0.95	ft
Headwater Height Above Crest	0.95	ft
Tailwater Height Above Crest	0.00	ft
Equal Side Slopes	0.25	ft/ft (H:V)
Flow Area	94.75	ft²
Velocity	2.91	ft/s
Wetted Perimeter	101.95	ft
Top Width	100.47	ft

Rock Chute Design Calculations NORTH

(Version 4.02 - 11/04/09, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Insurance Auto Auctions
Designer: CMV
Date: 9/4/2019

County: El Paso
Checked by: _____
Date: _____

I. Calculate the normal depth in the inlet channel.

High Flow
 $y_n = 0.86$ ft.
 Area = 58.9 ft²
 $Q_{high} = 208.0$ cfs

Low Flow
 $y_n = 0.46$ ft. (Normal depth)
 Area = 31.1 ft² (Flow area in channel)
 $Q_{low} = 73.8$ cfs (Capacity in channel)

II. Calculate the critical depth in the chute.

High Flow
 $y_c = 0.67$ ft.
 Area = 45.6 ft²
 $Q_{high} = 208.0$ cfs
 $H_{ce} = 1.00$ ft.
 $h_{cv} = 0.33$ ft.
 $10y_c = 6.73$ ft.
 $0.715y_c = 0.48$ ft.

Low Flow
 $y_c = 0.34$ ft. (Critical depth in chute)
 Area = 22.5 ft² (Flow area in channel)
 $Q_{low} = 73.8$ cfs (Capacity in channel)
 $H_{ce} = 0.51$ ft. (Total minimum specific energy head)
 $h_{cv} = 0.17$ ft. (Velocity head corresponding to y_c)
 --- (Required inlet apron length)
 $0.715y_c = 0.24$ ft. (Depth of flow over the weir crest or brink)

III. Calculate the tailwater depth in the outlet channel.

High Flow
 $Tw = 0.57$ ft.
 Area = 38.3 ft²
 $Q_{high} = 208.0$ cfs
 $H_2 = 0.00$ ft.

Low Flow
 $Tw = 0.31$ ft. (Tailwater depth)
 Area = 20.3 ft² (Flow area in channel)
 $Q_{low} = 73.8$ cfs (Capacity in channel) $5.00 = H_{drop}$
 $H_2 = 0.00$ ft. (Downstream head above weir crest,
 $H_2 = 0$, if $H_2 < 0.715y_c$, neglect velocity head)

IV. Calculate the head for a trapezoidal shaped broad-crested weir.

$C_d = 1.00$

$C_{vn} = 0.581$

(Discharge coefficient for rectangular & v-notch broad-crested weirs, respectively)

High Flow
 $H_p = 0.99$ ft.
 Area = 68.5 ft²
 $V_i = 0.00$ fps
 $h_{pv} = 0.00$ ft.
 $Q_{high} = 208.0$ cfs

0.87 ft. (Weir head)
 59.3 ft² (Flow area in channel)
3.51 fps (Approach velocity)
 0.19 ft. (Velocity head corresponding to H_p)
 208.0 cfs (Capacity in channel)

Trial and error procedure solving simultaneously for velocity and head

Low Flow
 $H_p = 0.51$ ft.
 Area = 33.9 ft²
 $V_i = 0.00$ fps
 $h_{pv} = 0.00$ ft.
 $Q_{low} = 73.8$ cfs

0.44 ft. (Weir head)
 29.2 ft² (Flow area in channel)
2.53 fps (Approach velocity)
 0.10 ft. (Velocity head corresponding to H_p)
 73.8 cfs (Capacity in channel)

Trial and error procedure solving simultaneously for velocity and head

Rock Chute Design Calculations NORTH

(Version 4.02 - 11/04/09, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Insurance Auto Auctions
Designer: CMV
Date: 9/4/2019

County: El Paso
Checked by: _____
Date: _____

V. Calculate the rock chute parameters (w/o a factor of safety applied).

<u>High Flow</u>	<u>Low Flow</u>
$q_t = 0.29$ cms/m	$q_t = 0.10$ cms/m (Equivalent unit discharge)
$D_{50} \text{ (mm)} = 141.59 \rightarrow (5.57 \text{ in.})$	$D_{50} = 82.29$ mm (Median <u>angular</u> rock size)
$n = 0.045$	$n = 0.042$ (Manning's roughness coefficient)
$z_1 = 0.44$ ft.	$z_1 = 0.23$ ft. (Normal depth in the chute)
$A_1 = 29.3$ ft ²	$A_1 = 14.9$ ft ² (Area associated with normal depth)
Velocity = 7.09 fps	Velocity = 4.95 fps (Velocity in chute slope)
$z_{\text{mean}} = 0.43$ ft.	$z_{\text{mean}} = 0.22$ ft. (Mean depth)
$F_1 = 1.91$	$F_1 = 1.84$ (Froude number)
$L_{\text{rock apron}} = 6.97$ ft.	---- (Length of rock outlet apron = $15 \cdot D_{50}$)

VI. Calculate the height of hydraulic jump height (conjugate depth).

<u>High Flow</u>	<u>Low Flow</u>
$z_2 = 0.98$ ft.	$z_2 = 0.49$ ft. (Hydraulic jump height)
$Q_{\text{high}} = 208.0$ cfs	$Q_{\text{low}} = 73.8$ cfs (Capacity in channel)
$A_2 = 67.3$ ft ²	$A_2 = 32.5$ ft ² (Flow area in channel)

VII. Calculate the energy lost through the jump (absorbed by the rock).

<u>High Flow</u>	<u>Low Flow</u>
$E_1 = 1.22$ ft.	$E_1 = 0.61$ ft. (Total energy <u>before</u> the jump)
$E_2 = 1.12$ ft.	$E_2 = 0.57$ ft. (Total energy <u>after</u> the jump)
$R_E = 7.81$ %	$R_E = 6.72$ % (Relative loss of energy)

Calculate Quantities for Rock Chute

<u>-----Rock Riprap Volume-----</u>	
<u>Area Calculations</u>	<u>Length @ Rock CL</u>
$h = 0.98$	Inlet = 6.96
$x_1 = 4.60$	Outlet = 8.15
$L = 4.04$	Slope = 35.56
$A_s = 4.51$	2.5:1 Lip = -0.12
$x_2 = 4.47$	Total = 50.56 ft.
$A_b = 77.88$	<u>Rock Volume</u>
$A_b + 2 \cdot A_s = 86.90$ ft ²	162.72 yd ³

<u>-----Bedding Volume-----</u>	
<u>Area Calculations</u>	<u>Bedding Thickness</u>
$h = 2.10$	$t_1, t_2 = 6.00$ in.
$x_1 = 2.06$	
$L = 8.66$	
$A_s = 4.33$	<u>Length @ Bed CL</u>
$x_2 = 2.00$	Total = 50.54 ft.
$A_b = 33.70$	<u>Bedding Volume</u>
$A_b + 2 \cdot A_s = 42.36$ ft ²	79.29 yd ³

<u>-----Geotextile Quantity-----</u>	
<u>Width</u>	<u>Length @ Bot. Rock</u>
$2 \cdot \text{Slope} = 17.32$	Total = 50.55 ft.
Bottom = 65.27	<u>Geotextile Area</u>
Total = 82.59 ft.	463.87 yd ²

- Note:** 1) The radius is not considered when calculating quantities of riprap, bedding, or geotextile.
 2) The geotextile quantity does not include overlapping (18-in. min.) or anchoring material (18-in. min. along sides, 24-in. min. on ends).

Rock Chute Design Calculations SOUTH

(Version 4.02 - 11/04/09, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Insurance Auto Auctions
Designer: CMV
Date: 9/4/2019

County: El Paso
Checked by: _____
Date: _____

I. Calculate the normal depth in the inlet channel.

<u>High Flow</u>			<u>Low Flow</u>		
$y_n =$	0.88	ft.	$y_n =$	0.31	ft. (Normal depth)
Area =	20.7	ft ²	Area =	6.5	ft ² (Flow area in channel)
$Q_{high} =$	69.8	cfs	$Q_{low} =$	11.4	cfs (Capacity in channel)

II. Calculate the critical depth in the chute.

<u>High Flow</u>			<u>Low Flow</u>		
$y_c =$	0.69	ft.	$y_c =$	0.21	ft. (Critical depth in chute)
Area =	15.7	ft ²	Area =	4.4	ft ² (Flow area in channel)
$Q_{high} =$	69.8	cfs	$Q_{low} =$	11.4	cfs (Capacity in channel)
$H_{ce} =$	1.00	ft.	$H_{ce} =$	0.32	ft. (Total minimum specific energy head)
$h_{cv} =$	0.31	ft.	$h_{cv} =$	0.11	ft. (Velocity head corresponding to y_c)
$10y_c =$	6.89	ft.	---	---	(Required inlet apron length)
$0.715y_c =$	0.49	ft.	$0.715y_c =$	0.15	ft. (Depth of flow over the weir crest or brink)

III. Calculate the tailwater depth in the outlet channel.

<u>High Flow</u>			<u>Low Flow</u>		
$T_w =$	0.59	ft.	$T_w =$	0.20	ft. (Tailwater depth)
Area =	13.2	ft ²	Area =	4.2	ft ² (Flow area in channel)
$Q_{high} =$	69.8	cfs	$Q_{low} =$	11.4	cfs (Capacity in channel)
$H_2 =$	0.00	ft.	$H_2 =$	0.00	ft. (Downstream head above weir crest, $H_2 = 0$, if $H_2 < 0.715y_c$, <u>neglect velocity head</u>)

IV. Calculate the head for a trapezoidal shaped broad-crested weir.

$C_d =$ 1.00			$C_{vn} =$ 0.581 (Discharge coefficient for rectangular & v-notch broad-crested weirs, respectively)		
<u>High Flow</u>			<u>Low Flow</u>		
$H_p =$	0.99	ft.	$H_p =$	0.89	ft. (Weir head)
Area =	23.7	ft ²	Area =	20.9	ft ² (Flow area in channel)
$V_i =$	0.00	fps	$V_i =$	3.34	fps (Approach velocity)
$h_{pv} =$	0.00	ft.	$h_{pv} =$	0.17	ft. (Velocity head corresponding to H_p)
$Q_{high} =$	69.8	cfs	$Q_{low} =$	69.8	cfs (Capacity in channel)
<i>Trial and error procedure solving simultaneously for velocity and head</i>					
<u>Low Flow</u>			<u>Low Flow</u>		
$H_p =$	0.31	ft.	$H_p =$	0.27	ft. (Weir head)
Area =	6.7	ft ²	Area =	5.8	ft ² (Flow area in channel)
$V_i =$	0.00	fps	$V_i =$	1.97	fps (Approach velocity)
$h_{pv} =$	0.00	ft.	$h_{pv} =$	0.06	ft. (Velocity head corresponding to H_p)
$Q_{low} =$	11.4	cfs	$Q_{low} =$	11.4	cfs (Capacity in channel)

Trial and error procedure solving simultaneously for velocity and head

Rock Chute Design Calculations SOUTH

(Version 4.02 - 11/04/09, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Insurance Auto Auctions
Designer: CMV
Date: 9/4/2019

County: El Paso
Checked by: _____
Date: _____

V. Calculate the rock chute parameters (w/o a factor of safety applied).

<u>High Flow</u>	<u>Low Flow</u>
$q_t = 0.30$ cms/m	$q_t = 0.05$ cms/m (Equivalent unit discharge)
$D_{50} \text{ (mm)} = 144.31 \rightarrow (5.68 \text{ in.})$	$D_{50} = 56.82$ mm (Median <u>angular</u> rock size)
$n = 0.046$	$n = 0.040$ (Manning's roughness coefficient)
$z_1 = 0.45$ ft.	$z_1 = 0.14$ ft. (Normal depth in the chute)
$A_1 = 9.8$ ft ²	$A_1 = 3.0$ ft ² (Area associated with normal depth)
Velocity = 7.12 fps	Velocity = 3.85 fps (Velocity in chute slope)
$z_{\text{mean}} = 0.42$ ft.	$z_{\text{mean}} = 0.14$ ft. (Mean depth)
$F_1 = 1.95$	$F_1 = 1.81$ (Froude number)
$L_{\text{rock apron}} = 7.10$ ft.	---- (Length of rock outlet apron = $15 \cdot D_{50}$)

VI. Calculate the height of hydraulic jump height (conjugate depth).

<u>High Flow</u>	<u>Low Flow</u>
$z_2 = 1.00$ ft.	$z_2 = 0.30$ ft. (Hydraulic jump height)
$Q_{\text{high}} = 69.8$ cfs	$Q_{\text{low}} = 11.4$ cfs (Capacity in channel)
$A_2 = 23.9$ ft ²	$A_2 = 6.4$ ft ² (Flow area in channel)

VII. Calculate the energy lost through the jump (absorbed by the rock).

<u>High Flow</u>	<u>Low Flow</u>
$E_1 = 1.24$ ft.	$E_1 = 0.37$ ft. (Total energy <u>before</u> the jump)
$E_2 = 1.13$ ft.	$E_2 = 0.35$ ft. (Total energy <u>after</u> the jump)
$R_E = 8.73$ %	$R_E = 6.31$ % (Relative loss of energy)

Calculate Quantities for Rock Chute

<u>-----Rock Riprap Volume-----</u>	
<u>Area Calculations</u>	<u>Length @ Rock CL</u>
$h = 1.00$	Inlet = 6.96
$x_1 = 4.67$	Outlet = 9.15
$L = 4.12$	Slope = 64.02
$A_s = 4.67$	2.5:1 Lip = -0.12
$x_2 = 4.53$	Total = 80.01 ft.
$A_b = 28.12$	<u>Rock Volume</u>
$A_b + 2 \cdot A_s = 37.47$ ft²	111.02 yd ³

<u>-----Bedding Volume-----</u>	
<u>Area Calculations</u>	<u>Bedding Thickness</u>
$h = 2.13$	$t_1, t_2 = 6.00$ in.
$x_1 = 2.06$	
$L = 8.78$	
$A_s = 4.39$	<u>Length @ Bed CL</u>
$x_2 = 2.00$	Total = 80.00 ft.
$A_b = 11.20$	<u>Bedding Volume</u>
$A_b + 2 \cdot A_s = 19.98$ ft²	59.21 yd ³

<u>-----Geotextile Quantity-----</u>	
<u>Width</u>	<u>Length @ Bot. Rock</u>
$2 \cdot \text{Slope} = 17.56$	Total = 80.00 ft.
Bottom = 20.28	<u>Geotextile Area</u>
Total = 37.84 ft.	336.38 yd ²

- Note:** 1) The radius is not considered when calculating quantities of riprap, bedding, or geotextile.
 2) The geotextile quantity does not include overlapping (18-in. min.) or anchoring material (18-in. min. along sides, 24-in. min. on ends).

POND - NORTH FOREBAY CALCULATIONS

1) WQCV (inches) = $a(.91I^3 - 1.19I^2 + .78I)$

I = impervious percentage =

34%

a = Coefficient corresponding to WQCV drain time =

1 (40 hours)

WQCV (inches) = 0.16 inches

2) WQCV (ac-ft) = (WQCV (inches))/12 x A

Area = tributary area =

81.07 acres

WQCV (ac-ft) = 1.10

WQCV (cubic feet) = 47,748

3) Forebay Volume

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Volume = 2% of WQCV and be 18" depth since watershed up to 5 impervious acres

Forebay Volume = 2% of WQCV = 955 cubic feet

with pond depth at 1.5', Forebay Area = 636.6 sq-ft (minimum)

4) Forebay Discharge

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Discharge = 2% of 100-yr Flow into pond

Q100 = 142.9 cfs

Forebay discharge = 2.86 cfs

POND - SOUTH FOREBAY CALCULATIONS

1) WQCV (inches) = $a(.91I^3 - 1.19I^2 + .78I)$

I = impervious percentage =

3%

a = Coefficient corresponding to WQCV drain time =

1 (40 hours)

WQCV (inches) = 0.02 inches

2) WQCV (ac-ft) = (WQCV (inches))/12 x A

Area = tributary area =

38.59 acres

WQCV (ac-ft) = 0.08

WQCV (cubic feet) = 3,310

3) Forebay Volume

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Volume = 2% of WQCV and be 18" depth since watershed up to 5 impervious acres

Forebay Volume = 2% of WQCV = 66 cubic feet

with pond depth at 1.5', Forebay Area = 44.1 sq-ft (minimum)

4) Forebay Discharge

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Discharge = 2% of 100-yr Flow into pond

Q100 = 4.7 cfs

Forebay discharge = 0.09 cfs

APPENDIX D

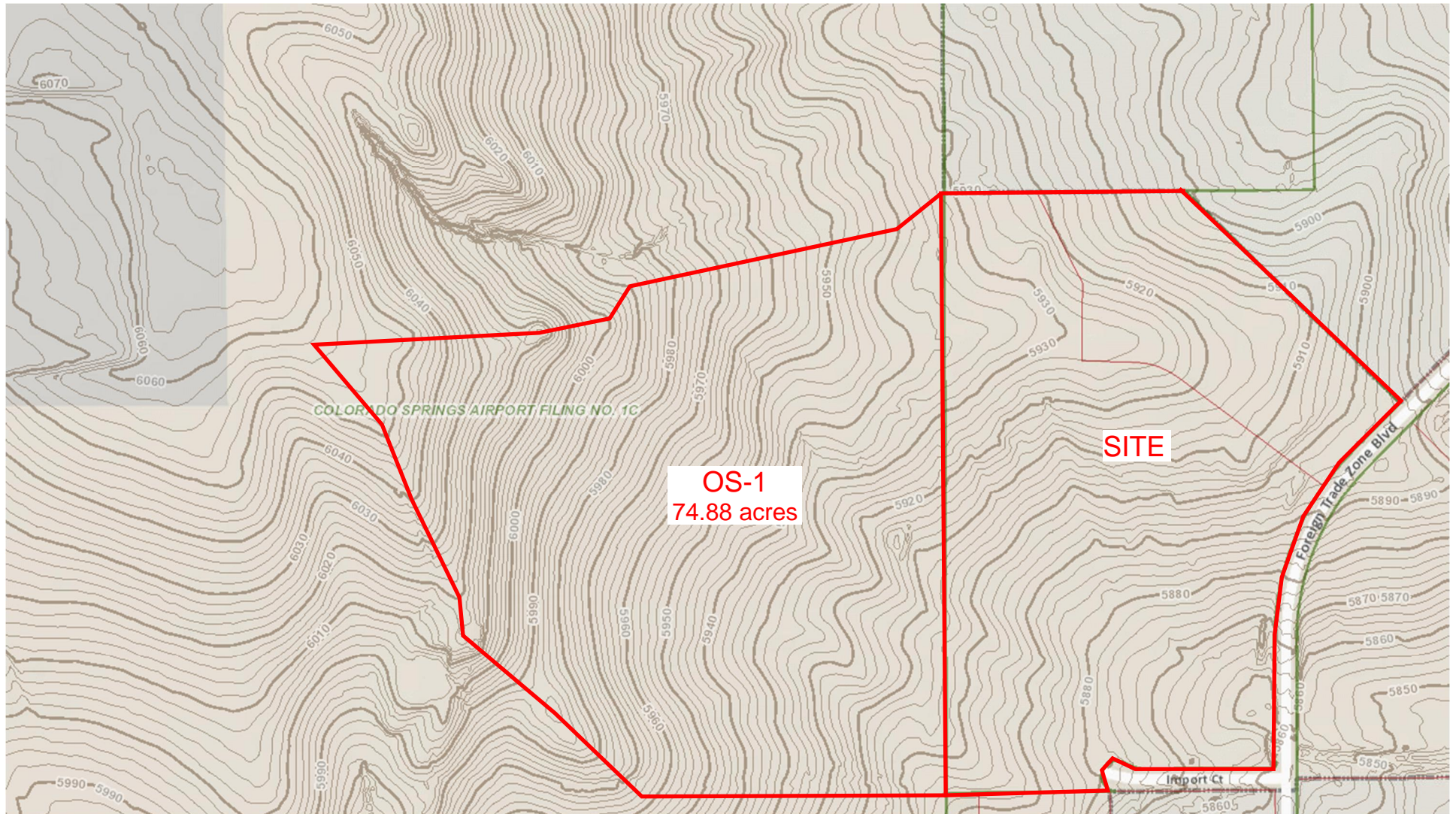
Drainage Maps



Insurance Auto Auctions

Colorado Springs, CO

Offsite Basin



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INSURANCE AUTO AUCTIONS, INC.
DRAINAGE MAP

NWC IMPORT CT. & FOREIGN TRADE ZONE BLVD.
COLORADO SPRINGS, CO

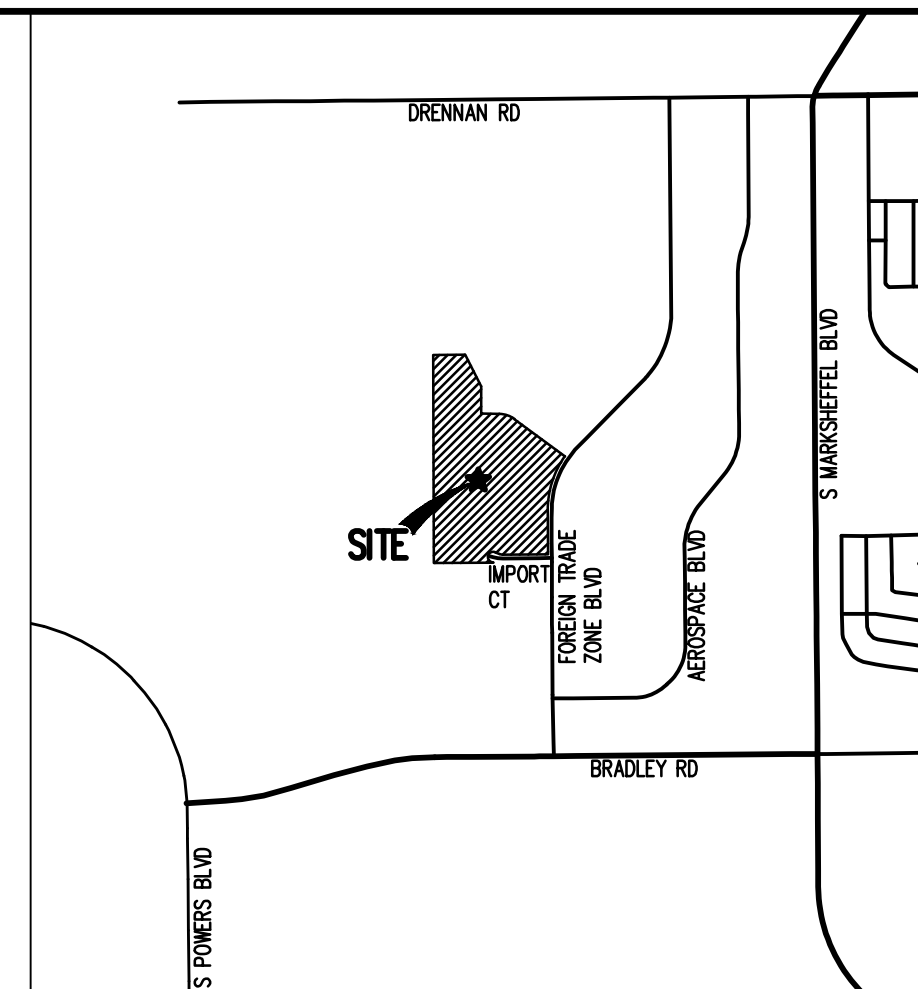
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Project No:	IAA001
Drawn By:	CMV
Checked By:	SME
Date:	09/06/19

PROPOSED DRAINAGE MAP

DR-2

SHEET 2 OF 2



VICINITY MAP
N.T.S.

DRAINAGE LEGEND

-
- PROPERTY LINE
- EXISTING EASEMENT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- BASIN BOUNDARY LINE
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- EXISTING STORM SEWER
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin	Q ₅	Q ₁₀₀
ID	(cfs)	(cfs)
A-1	64.1	142.9
A-2	1.7	4.7
A-3	1.5	8.5
OS-1	19.4	130.2
OS-2	0.3	0.7

DESIGN POINT SUMMARY TABLE

Design Point	Q ₅ (cfs)	Q ₁₀₀ (cfs)
1	64.1	142.9
2	1.7	4.7
3	83.1	275.7

