



INNOVATIVE DESIGN. CLASSIC RESULTS.

**FINAL DRAINAGE REPORT
FOR
JOHNSON ESTATES FILING NO. 1**

DECEMBER 2020

Prepared for:
DELROY JOHNSON
14502 HIGHWAY 83
COLORADO SPRINGS, CO 80921

Prepared by:
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Job No. 2575.00

PCD Project No. MS-21-001



**FINAL DRAINAGE REPORT FOR
JOHNSON ESTATES FILING NO. 1**

DESIGN ENGINEER'S STATEMENT:

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



Marc A. Whorton, Colorado P.E. #37155

5/14/2021

Date

OWNERS/DEVELOPER'S STATEMENT:

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

Name: Delroy Johnson

Title: Owner

Address: 14502 Highway 83

Colorado Springs, CO 80921

EL PASO COUNTY:

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

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

APPROVED
Engineering Department

06/22/2021 8:06:39 AM
dsdnijkamp

EPC Planning & Community
Development Department

Conditions:



FINAL DRAINAGE REPORT FOR JOHNSON ESTATES FILING NO. 1

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HYDROLOGIC / HYDRAULIC CALCULATION
BMP FACILITY CALCULATIONS / DESIGN DETAILS
DRAINAGE MAPS



FINAL DRAINAGE REPORT FOR JOHNSON ESTATES FILING NO. 1

PURPOSE

This document is the Final Drainage Report for Johnson Estates Filing No. 1. The purpose of this report is to address on-site and off-site drainage patterns and improvements required for this Minor Subdivision to minimize impacts to the adjacent properties.

GENERAL DESCRIPTION

The total acreage for the site is 28.653 acres and is located in the county of El Paso within Section 34, Township 11 South, Range 66 West of the Sixth Principal Meridian, El Paso County, Colorado. The site is bounded on the north, west and south by existing platted and unplatted residential properties (RR-5 Zone) and to the east by existing Highway 83. The overall site is proposed for 4 single-family 5-acre minimum lots with a single driveway access from Highway 83. The current zoning of the property is RR-5 (5-acre Residential Zoning). Current access to and from the property exists in the single paved driveway access to Highway 83.

The average soil condition reflects Hydrologic Group "B" (Kettle gravely loamy sand), as determined by the "Soil Survey of El Paso County Area," prepared by the Soil Conservation Service.

EXISTING DRAINAGE CONDITIONS

This property lies within the upper reach of the Black Squirrel Creek Drainage Basin. The Black Squirrel Creek DBPS was prepared by URS Consultants and accepted by El Paso County in 1989. Per the DBPS, this site lies within the minor drainage Basin D shown within the projected 5-acre development land use area. (See map in Appendix). It appears that no major public improvements are proposed for this basin at this time. However, a drainage easement has been provided for this area within the property accounting for the 100-yr. ponding. (See Final Plat and Developed Drainage Map) The existing drainage patterns generally run in a southeasterly direction in several natural drainage corridors at slopes ranging from 2% to 20%. There are several high points throughout the property creating these natural



corridors, one of which is where the property owners current house is located. The majority of the western portion of the property drains into two natural corridors that have some off-site flows from the adjacent rural residential subdivision. These corridors then exit the property along the south boundary. The central portion of the property contains the owner's house along with a paved driveway out to Highway 83. This driveway crosses over a natural drainageway where an existing 18" culvert conveys flows to the southeast side of the driveway and ultimately towards Highway 83. A significant off-site basin to the north drains through the property and towards Highway 83 at the northeast corner. These predeveloped flows will continue to travel in this pattern with no development proposed in this sub-basin and no signs of erosion or sediment transfer on-site. The majority of the property is heavily forested. However, over the past several years, the property owner has provided fire mitigation and thinned out the dense tree areas. The debris from this effort has already been hauled off or chipped up on-site. A healthy layer of pine needles exist on the ground across the majority of the forested area. The small area of the property adjacent to Highway 83 at the northeast corner is covered with native grasses with only sparse evergreen trees. As mentioned earlier, several structures currently exist on the property including the owner's home and several out buildings (garage and sheds) and a cleared level area previously used as an informal ice rink.

Design Point H1 ($Q_5 = 6$ cfs and $Q_{100} = 41$ cfs) consists of pre-development flows at the western edge of the property from off-site basins OS-1 and OS-2 along with on-site basins EX-1 and EX-2. These historic flows travel in a southwesterly direction within two well defined natural drainageways towards the south boundary and then head off-site.

Design Point H2 ($Q_5 = 1.2$ cfs and $Q_{100} = 8$ cfs) consists of pre-development flows from Basin EX-3 within the middle portion of the site. These historic flows travel in a southerly direction within a natural drainageway towards the south boundary.

Design Point H3 ($Q_5 = 0.2$ cfs and $Q_{100} = 1.1$ cfs) consists of pre-development flows from Basin EX-4. These historic flows sheet flow in a southerly direction towards the south boundary. No development proposed within this basin.



Design Point H4 ($Q_5 = 0.8$ cfs and $Q_{100} = 5$ cfs) consists of pre-development flows from Basin EX-7. These historic flows sheet flow in a southerly direction towards the south boundary. No development proposed within this basin.

Design Point H5 ($Q_5 = 2$ cfs and $Q_{100} = 11$ cfs) consists of pre-development flows from Basins EX-5 and EX-8. These historic flows travel in a southeasterly, crossing the existing driveway within an existing 18" culvert and then towards Highway 83.

Design Point H6 ($Q_5 = 18$ cfs and $Q_{100} = 124$ cfs) consists of pre-development flows from on-site Basin EX-6 and the significant off-site Basin OS-3. These off-site historic flows (rural, forested 5-acre residential land-use) travel in a southeasterly direction and enter the site, along the north boundary. (See Appendix for DBPS Map) These flows continue to sheet flow across the site at the northeast corner towards Highway 83. It appears that any minor ponding would take place in the northeast corner of the property and then spill through the existing 24" culvert to the north towards the dual 60" CMP culverts that cross Highway 83. There is no evidence in the field of any overtopping of Highway 83 at this location. We have coordinated with CDOT for the revision to the access permit to allow for these additional proposed homes and no drainage issues were mentioned prior to the revised access permit approval. (See Appendix for revised CDOT Access Permit) No development is proposed within this on-site Basin G, however, the appropriate drainage easement is provided on the Final Plat within Lot 1 for these off-site flows. These pre-development flows will continue to travel in this historic pattern.

DEVELOPED DRAINAGE CONDITIONS

There are three additional lots planned off of the proposed driveway extension to the west. This will continue to be the only driveway access (private road) to the multiple proposed lots from Highway 83. (See Appendix for the revised CDOT Access Permit) Three waivers were approved on November 10, 2020



(WV-20-001) for this property as follows: (See Appendix for BOCC Resolution)

- Waiver 1: Waiver for private road (per definition, a driveway cannot serve more than 3 lots – LDC 8.4.4.E.2) Proposing 4 lots
- Waiver 2: Waiver for private roads to meet County standards (LDC 8.4.4.E.3) Proposing private road design criteria similar to driveway criteria
- Waiver 3: Minimum lot frontage (8.4.3.C.2.E) Not all lots will have direct frontage to Highway 83 based on shape of property and limited access allowed to Highway 83.

The attached developed conditions drainage map contains several design points related to the proposed paved driveway extension and associated minor BMP facilities. The UD-BMP ver. 3.07 Runoff Reduction spreadsheet (See Appendix) shows that this development has a 100% WQCV reduction and therefore no WQCV design facilities are required. Also, per ECM I.7.1.B.5 (exclusion for large lot single family sites) and the paved driveway extension is less than 1.0 ac. of disturbance, again WQCV is not required for this development. Driveway culverts planned have been designed for the 100-yr. developed flows. All these facilities will be private with ownership and maintenance per the proposed covenants established with the Final Plat. (All lot owners are responsible for their fair share of the maintenance associated with the paved driveway. Individual lot owners are responsible for the driveway culverts within their property.)

Design Point D1 ($Q_5 = 7$ cfs and $Q_{100} = 41$ cfs) consists of developed flows from off-site Basins OS-1 and OS-2 and on-site basins A, B1 and B2. These developed flows continue to travel in a southeasterly direction within a natural drainageway towards the south boundary and then head off-site. These natural drainageways will be contained within drainage easements as shown on the Final Plat and Drainage Map. Two proposed homesites with associated paved driveways and a fire turn-around are proposed within these basins. Due to the large forested tributary area and minimal introduction of impervious improvements on the 5 ac. lots (See Appendix for Runoff Reduction spreadsheet mentioned above), there is no significant increase from the pre-developed flows ($Q_5 = 6$ cfs and $Q_{100} = 41$ cfs).



The anticipated driveways to lots 2 and 3 cross this natural drainage corridor. Dual 18" culverts with 7.5'x10' Type VL rip-rap dissipaters are designed at each driveway crossing. See Appendix for culvert and rip-rap calculations. However, the property owners of these lots may provide an alternative low water "texas crossing" and assume risk of flooding over the driveway.

Design Point D2 ($Q_5 = 1.3$ cfs and $Q_{100} = 8$ cfs) consists of developed flows from Basins C and D. These on-site developed flows travel in a southerly direction within a natural drainageway towards the south boundary and then off-site. Due to the minimal introduction of impervious improvements within this tributary area and no development proposed in Basin C, there is no significant increase from the pre-developed flows ($Q_5 = 1.2$ cfs and $Q_{100} = 8$ cfs). As mentioned previously, per the Runoff Reduction spreadsheet, WQCV is not required for this development. (See Appendix) The driveway in this area is planned to have a 2% cross slope to the north, thus creating a low point just north of the driveway. A 12" PVC culvert will be installed under the driveway to handle the minimal developed flow from Basin D. A permanent rock check dam will be installed downstream of this outfall to help mitigate any sediment loads from the proposed driveway extension.

Design Point D3 ($Q_5 = 0.2$ cfs and $Q_{100} = 1.1$ cfs) consists of developed flows from Basin E. These on-site developed flows continue to sheet flow towards the south boundary. No development is proposed within this Basin and thus, there is no significant change from the pre-developed flows of ($Q_5 = 0.2$ cfs and $Q_{100} = 1.1$ cfs).

Design Point D4 ($Q_5 = 0.8$ cfs and $Q_{100} = 5$ cfs) consists of developed flows from Basin H. These on-site developed flows continue to sheet flow towards the south boundary. No development is proposed within this Basin and thus, there is no significant change from the pre-developed flows of ($Q_5 = 0.8$ cfs and $Q_{100} = 5$ cfs).



Design Point D5 ($Q_5 = 2$ cfs and $Q_{100} = 9$ cfs) consists of developed flows from Basins F and I. These on-site developed flows continue to travel in a southeasterly direction within a natural drainage corridor towards Highway 83. With the reduction in tributary area due to the extension of the driveway, the developed flows at this location are at or below the pre-development conditions. (See Appendix for Runoff Reduction spreadsheet mentioned above) Therefore, no further improvements within this basin are proposed at this time. The driveway in this area is planned to have a 2% cross slope to the south, thus sheet flowing into the natural drainage corridor towards the existing 18" driveway culvert.

Design Point D6 ($Q_5 = 18$ cfs and $Q_{100} = 124$ cfs) consists of developed flows from Basins OS-3 and G. These off-site pre-developed flows continue to sheet flow through the site towards Highway 83. No development is proposed within Basin G, thus there is no significant change from the pre-developed flows of ($Q_5 = 18$ cfs and $Q_{100} = 124$ cfs).

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. Individual on-site developed basin design used for culvert sizing and system routing was calculated using the Rational Method. The UD-BMP ver. 3.07 Runoff Reduction spreadsheet was used to calculate the site runoff reduction. BMP design was calculated using the Urban Storm Drainage Criteria Manual for a Sediment Basin (SC-7).

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements. This site adheres to this **Four Step Process** as follows:



1. **Employ Runoff Reduction Practices:** Development of project site is proposed large lot single family residential (5.0 ac. min.) with homes and associated landscaping. Proposed impervious areas (roof tops, patios) will sheet flow across landscaped ground and through large open areas within the lots across natural vegetation to slow runoff and increase time of concentration prior to being conveyed to the proposed public roads and adjacent properties. This will minimize directly connected impervious areas within the project site.
2. **Stabilize Drainageways:** This site will utilize roadside ditches along the driveway extension. These facilities will then direct the on-site development flows to the multiple natural ravines on-site. Based upon the proposed large lot, forested rural residential nature, there is no significant change from the pre-developed flows and thus no impact to downstream drainageways is anticipated.
3. **Provide Water Quality Capture Volume (WQCV):** As mentioned previously, UD-BMP ver. 3.07 Runoff Reduction spreadsheet (See Appendix) shows that this development has a 100% WQCV reduction and therefore no WQCV design facilities are required. Also, per ECM I.7.1.B.5 (exclusion for large lot single family sites) and the paved driveway extension is less than 1.0 ac. of disturbance, again WQCV is not required for this development. Given these factors, there is no significant change from historic to developed flows leaving this site.
4. **Consider need for Industrial and Commercial BMPs:** No industrial or commercial uses are proposed within this development. However, a site-specific storm water quality and erosion control plan and narrative is being submitted concurrently with this report and development. Details such as site-specific construction BMP's are detailed in this plan and narrative to protect receiving waters. Roadside ditch stabilization, in the form of erosion control blanketing (as specified on the plans) are also proposed. The described BMP's will be constructed by the developer upon approval by El Paso County Staff.



FLOODPLAIN STATEMENT

No portion of this site is located within a FEMA floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Numbers 08041C 0295G, with effective date of December 7, 2018 (See Appendix).

EROSION CONTROL PLAN

The Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate be submitted with the Final Drainage Report. We respectfully request that the Erosion Control Plan and cost estimate be submitted in conjunction with the Grading and Erosion Control Plan and construction assurances posted prior to obtaining a grading permit.

DRAINAGE & BRIDGE FEES

This site lies within the Black Squirrel Creek drainage basin. The total acreage for the property is 28.65 acres. The percent imperviousness for this subdivision is calculated as follows:

RR-5 Zone Area

(Per El Paso County Percent Impervious Chart for 5.0 ac. lots: 7%)

$$28.65 \text{ ac.} \times 7\% = \mathbf{2.01 \text{ Impervious Ac.}}$$

The following calculations are based on the 2021 drainage/bridge fees for the Black Squirrel Creek Drainage Basin:

FEE TOTALS (prior to reduction):

Bridge Fees	\$565.00 x 2.01 Impervious Ac.	=	<u>\$ 1,135.65</u>
Drainage Fees	\$ 8,968.00 x 2.01 Impervious Ac.	=	<u>\$ 18,025.68</u>

Per the ECM L.3.10.2a, this development requests a 25% reduction of drainage fees based on the low density lots proposed (5 ac. min lot size). This reduction is as follows:



Low Density Lot Reduction (25%) \$ 18,025.68 x 25% = \$ 4,506.42

FEE TOTALS (with reduction):

Bridge Fees \$ 1,135.65

Drainage Fees \$ 13,519.26

SUMMARY

This proposed development remains consistent with pre-development drainage conditions. The UD-BMP ver. 3.07 Runoff Reduction spreadsheet (See Appendix) shows that this development has a 100% WQCV reduction and therefore no WQCV design facilities are required. Also, per ECM I.7.1.B.5 (exclusion for large lot single family sites) and the paved driveway extension is less than 1.0 ac. of disturbance, again WQCV is not required for this development. Given these factors, there is no significant change from historic to developed flows leaving this site and the proposed development will not adversely impact surrounding developments.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC



Marc A. Whorton, P.E.
Project Manager

mw/257500/Reports/FDR.doc



REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual Vol. 1&2, as revised in November 1991 and 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual Vol. 1&2 as revised in May 2014 and updated by El Paso County in Oct. 2018.
2. Black Squirrel Creek Drainage Basin Planning Study (DBPS), by URS Consultants, approved by El Paso County, Jan. 1989.
3. Soil Survey of El Paso County Area, Colorado Soil Conservation Service, June 1981.
4. El Paso County Engineering Criteria Manual (ECM) updated Oct. 2020.



APPENDIX

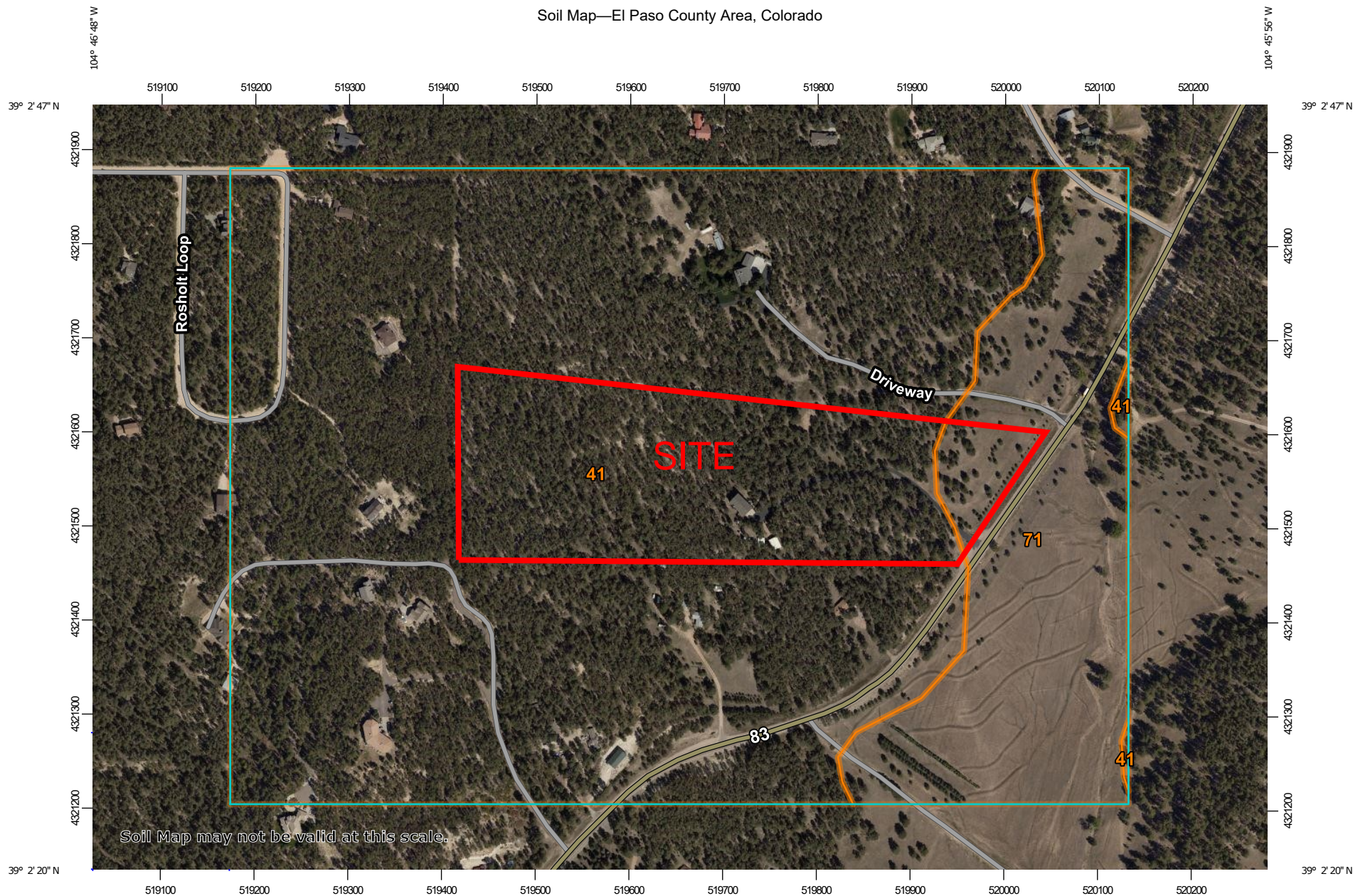
VICINITY MAP



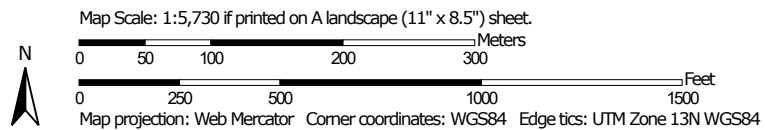
NTS

SOILS MAP (S.C.S SURVEY)

Soil Map—El Paso County Area, Colorado



Soil Map may not be valid at this scale.



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey


11/18/2020
Page 1 of 3


MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	130.6	81.2%
71	Pring coarse sandy loam, 3 to 8 percent slopes	30.2	18.8%
Totals for Area of Interest		160.8	100.0%

El Paso County Area, Colorado

41—Kettle gravelly loamy sand, 8 to 40 percent slopes

Map Unit Setting

National map unit symbol: 368h

Elevation: 7,000 to 7,700 feet

Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 85 percent

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

Description of Kettle

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand

Bt - 16 to 40 inches: gravelly sandy loam

C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 8 to 40 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): High
(2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

El Paso County Area, Colorado

41—Kettle gravelly loamy sand, 8 to 40 percent slopes

Map Unit Setting

National map unit symbol: 368h

Elevation: 7,000 to 7,700 feet

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Minor Components

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 18, Jun 5, 2020

FEMA MAP

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 **floodways** 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 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 zones zones 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, NIMS12
National Geodetic Survey
SSMC-3, #9202
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 Sprng Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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.

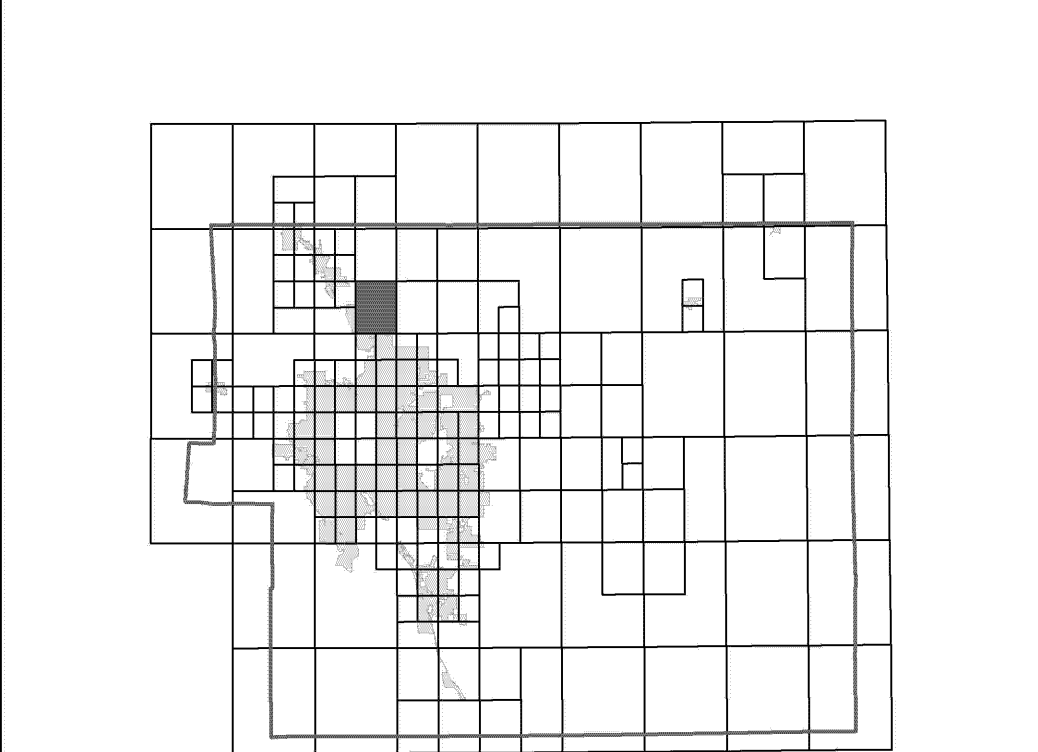
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

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/nfp/>.

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	

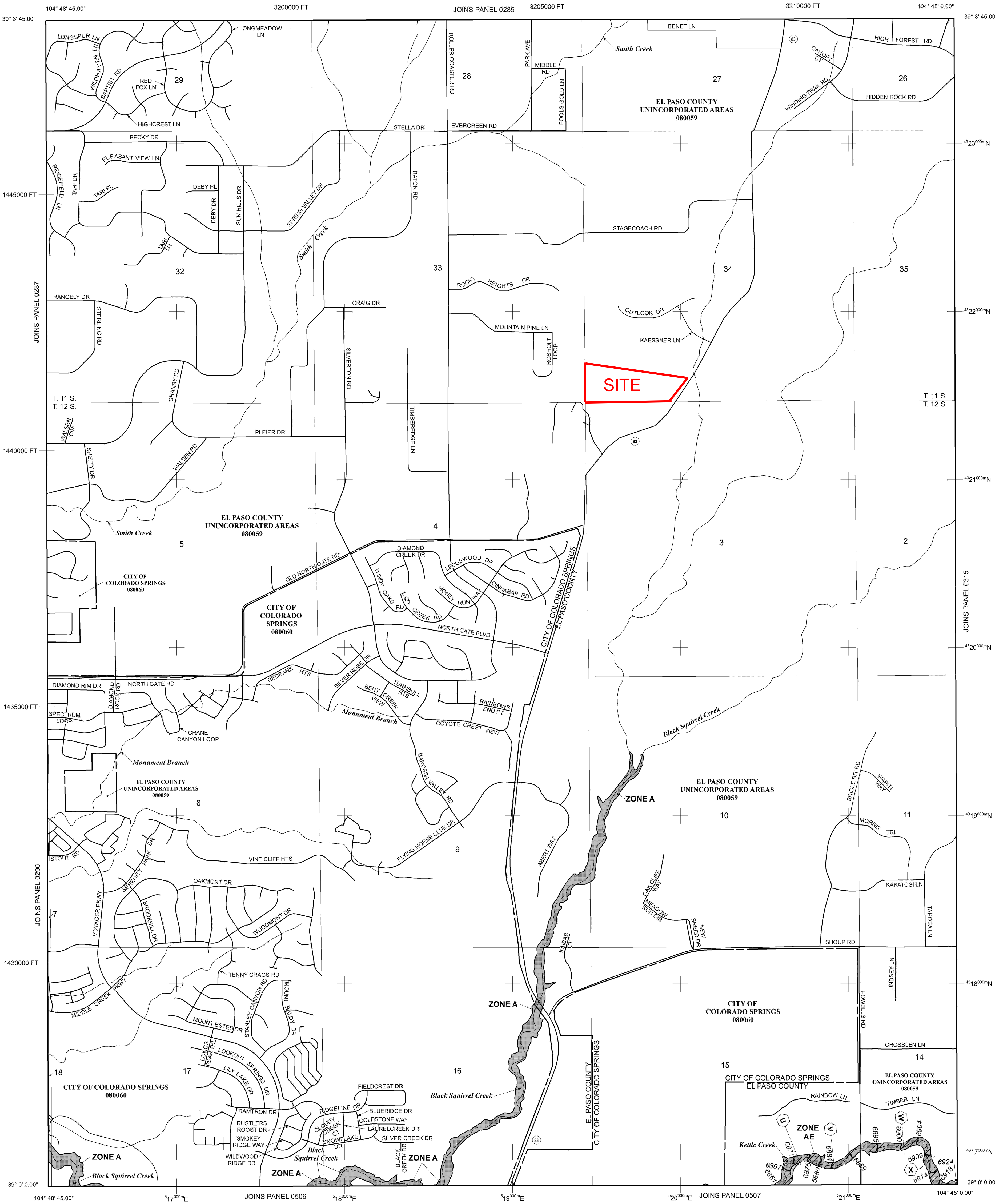
Panel Location Map



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 11 SOUTH, RANGE 66 WEST, AND TOWNSHIP 12 SOUTH, RANGE 66 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 equalled 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 Zones A, AE, AH, AO, AR, A99, V, 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. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); 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 of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that 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 less than 1 foot or with drainage areas less than 1 square mile; 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* (EL 987)
Base Flood Elevation value where uniform within zone; elevation in feet*

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

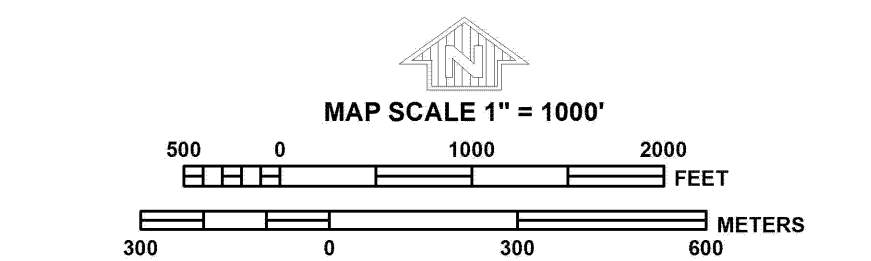
Cross section line
Transect line
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
1000-meter Universal Transverse Mercator grid ticks, zone 13
5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
Bench mark (see explanation in Notes to Users section of this FIRM panel)
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 1-800-638-6620.



PANEL 0295G

FIRM

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

PANEL 295 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0295	G
EL PASO COUNTY	080059	0295	G

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



MAP NUMBER
08041C0295G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

REVISED CDOT ACCESS PERMIT



COLORADO DEPARTMENT OF TRANSPORTATION			CDOT Permit No.
STATE HIGHWAY ACCESS PERMIT			220062
Permit Fee	Date of Transmittal	Region / Section / Patrol / Name	State Highway No / Mp / Side
\$50.00	July 15, 2020	2 / 04 / 39 Bradley Bauer	083A / 23.770 / Left
			Local Jurisdiction
			El Paso County

The Permittee(s):
 Delroy Johnson
 14502 HWY 83
 Colorado Springs, Colorado 80921
 719-352-9833 djohnson@nor-wood.com

The Applicant(s):

is hereby granted permission to have an access to the state highway at the location noted below. The access shall be constructed, maintained and used in accordance with this permit, including the State Highway Access Code and any attachments, terms, conditions and exhibits. This permit may be revoked by the Issuing Authority if at any time the permitted access and its use violate any parts of this permit. The issuing authority, the Department and their duly appointed agents and employees shall be held harmless against any action for personal injury or property damage sustained by reason of the exercise of the permit.

Location:

14502 HWY 83, Colorado Springs
 West side of State Highway 83, a distance of 1,200 feet South from MP 24

Access to Provide Service to: (Land Use Code)	(Size)	(Units)
210 - Single-Family Detached Housing Lot 1 Main Home	4214	SqFt
210 - Single-Family Detached Housing Lot 5 - proposed	2500	SqFt
210 - Single-Family Detached Housing Lot 4 - proposed	2500	SqFt
210 - Single-Family Detached Housing Lot 3 - proposed	2500	SqFt
210 - Single-Family Detached Housing Lot 2 - proposed	2500	SqFt
997 - Agriculture 5 lots - Lot 1 6.67 - Lots 2-5 4-5 acres	28.69	Acres

Additional Information:

Please see attached Terms & Conditions

MUNICIPALITY OR COUNTY APPROVAL

Required only when the appropriate local authority retains issuing authority.

Signature	Print Name	Date	Title
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Upon the signing of this permit the permittee agrees to the terms and conditions and referenced attachments contained herein. All construction shall be completed in an expeditious and safe manner and shall be finished within 45 days from Initiation. The permitted access shall be completed in accordance with the terms and conditions of the permit prior to being used.

The permittee shall notify Teresa Guagliardo with the Colorado Department of Transportation, at 719-248-0318 at least 48 hours prior to commencing construction within the State Highway right-of-way.

The person signing as the permittee must be the owner or legal representative of the property served by the permitted access and have full authority to accept the permit and its terms and conditions.

Permittee Signature: <i>Delroy Johnson</i>	Print Name Delroy Johnson	Date 7/15/2020 12:19 PM MDT
Co-Permittee Signature: (if applicable)	Print Name	Date

This permit is not valid until signed by a duly authorized representative of the Department.

COLORADO DEPARTMENT OF TRANSPORTATION

Signature <i>Valerie Sword</i>	Print Name Valerie Sword	Title CDOT R2 Permits Manager	Date (of issue) 7/15/2020 12:40 PM MDT
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Copy Distribution:

Required:
 1.Region
 2.Applicant

3.Staff Access Section
 4.Central Files

Make copies as necessary for:
 Local Authority
 MTCE Patrol
 Inspector
 Traffic Engineer

Previous editions are obsolete and may not be used
 Page 1 of 3 CDOT Form #101 5/07

State Highway Access Permit Form 101, Page 2

The following paragraphs are excerpts of the State Highway Access Code. These are provided for your convenience but do not alleviate compliance with all sections of the Access Code. A copy of the State Highway Access Code is available from your local issuing authority (local government) or the Colorado Department of Transportation (Department). When this permit was issued, the issuing authority made its decision based in part on information submitted by the applicant, on the access category which is assigned to the highway, what alternative access to other public roads and streets is available, and safety and design standards. Changes in use or design not approved by the permit or the issuing authority may cause the revocation or suspension of the permit.

APPEALS

1. Should the permittee or applicant object to the denial of a permit application by the Department or object to any of the terms or conditions of a permit placed there by the Department, the applicant and permittee (appellant) have a right to appeal the decision to the [Transportation] Commission [of Colorado]. To appeal a decision, submit a request for administrative hearing to the Transportation Commission of Colorado within 60 days of transmittal of notice of denial or transmittal of the permit for signature. Submit the request to the Transportation Commission of Colorado, 4201 East Arkansas Avenue, Denver, Colorado 80222-3400. The request shall include reasons for the appeal and may include changes, revisions, or conditions that would be acceptable to the permittee or applicant.

2. Any appeal by the applicant or permittee of action by a local issuing authority shall be filed with the local authority and be consistent with the appeal procedures of the local authority.

3. In submitting the request for administrative hearing, the appellant has the option of including within the appeal a request for a review by the Department's internal administrative review committee pursuant to [Code] subsection 2.10. When such committee review is requested, processing of the appeal for formal administrative hearing, 2.9(5) and (6), shall be suspended until the appellant notifies the Commission to proceed with the administrative hearing, or the appellant submits a request to the Commission or the administrative law judge to withdraw the appeal. The two administrative processes, the internal administrative review committee, and the administrative hearing, may not run concurrently.

4. Regardless of any communications, meetings, administrative reviews or negotiations with the Department or the internal administrative review Committee regarding revisions or objections to the permit or a denial, if the permittee or applicant wishes to appeal the Department's decision to the Commission for a hearing, the appeal must be brought to the Commission within 60 days of transmittal of notice of denial or transmittal of the permit.

PERMIT EXPIRATION

1. A permit shall be considered expired if the access is not under construction within one year of the permit issue date or before the expiration of any authorized extension. When the permittee is unable to commence construction within one year after the permit issue date, the permittee may request a one year extension from the issuing authority. No more than two one-year extensions may be granted under any circumstances. If the access is not under construction within three years from date of issue the permit will be considered expired. Any request for an extension must be in writing and submitted to the issuing authority before the permit expires. The request should state the reasons why the extension is necessary, when construction is anticipated, and include a copy of page 1 (face of permit) of the access permit. Extension approvals shall be in writing. The local issuing authority shall obtain the concurrence of the Department prior to the approval of an extension, and shall notify the Department of all denied extensions within ten days. Any person wishing to reestablish an access permit that has expired may begin again with the application procedures. An approved Notice to Proceed, automatically renews the access permit for the period of the Notice to Proceed.

CONSTRUCTION

1. Construction may not begin until a Notice to Proceed is approved. (Code subsection 2.4)

2. The construction of the access and its appurtenances as required by the terms and conditions of the permit shall be completed at the expense of the permittee except as provided in subsection 2.14. All materials used in the construction of the access within the highway right-of-way or on permanent easements, become public property. Any materials removed from the highway right-of-way will be disposed of only as directed by the Department. All fencing, guard rail, traffic control devices and other equipment and materials removed in the course of access construction shall be given to the Department unless otherwise instructed by the permit or the Department inspector.

3. The permittee shall notify the individual or the office specified on the permit or Notice to Proceed at least two working days prior to any construction within state highway right-of-way. Construction of the access shall not proceed until both the access permit and the Notice to Proceed are issued. The access shall be completed in an expeditious and safe manner and shall be finished within 45 days from initiation of construction within the highway right-of-way. A construction time extension not to exceed 30 working days may be requested from the individual or office specified on the permit.

4. The issuing authority and the Department may inspect the access during construction and upon completion of the access to ensure that all terms and conditions of the permit are met. Inspectors are authorized to enforce the conditions of the permit during construction and to halt any activities within state right-of-way that do not comply with the provisions of the permit, that conflict with concurrent highway construction or maintenance work, that endanger highway property, natural or cultural resources protected by law, or the health and safety of workers or the public.

5. Prior to using the access, the permittee is required to complete the construction according to the terms and conditions of the permit. Failure by the permittee to abide by all permit terms and conditions shall be sufficient cause for the Department or issuing authority to initiate action to suspend or revoke the permit and close the access. If in the determination of the Department or issuing authority the failure to comply with or complete the construction requirements of the permit create a highway safety hazard, such shall be sufficient cause for the summary suspension of the permit. If the permittee wishes to use the access prior to completion, arrangements must be approved by the issuing authority and Department and included in the permit. The Department or issuing authority may order a halt to any unauthorized use of the access pursuant to statutory and regulatory powers. Reconstruction or improvement of the access may be required when the permittee has failed to meet required specifications of design or materials. If any construction element fails within two years due to improper construction or material specifications, the permittee shall be responsible for all repairs. Failure to make such repairs may result in suspension of the permit and closure of the access.

6. The permittee shall provide construction traffic control devices at all times during access construction, in conformance with the M.U.T.C.D. as required by section 42-4-104, C.R.S., as amended.

7. A utility permit shall be obtained for any utility work within highway right-of-way. Where necessary to remove, relocate, or repair a traffic control device or public or private utilities for the construction of a permitted access, the relocation, removal or repair shall be accomplished by the permittee without cost to the Department or issuing authority, and at the direction of the Department or utility company. Any damage to the state highway or other public right-of-way beyond that which is allowed in the permit shall be repaired immediately. The permittee is responsible for the repair of any utility damaged in the course of access construction, reconstruction or repair.

8. In the event it becomes necessary to remove any right-of-way fence, the posts on either side of the access shall be securely braced with an approved end post before the fence is cut to prevent any slacking of the remaining fence. All posts and wire removed are Department property and shall be turned over to a representative of the Department.

9. The permittee shall ensure that a copy of the permit is available for review at the construction site at all times. The permit may require the contractor to notify the individual or office specified on the permit at any specified phases in construction to allow the field inspector to inspect various aspects of construction such as concrete forms, subbase, base course compaction, and materials specifications. Minor changes and additions may be ordered by the Department or local authority field inspector to meet unanticipated site conditions.

10. Each access shall be constructed in a manner that shall not cause water to enter onto the roadway or shoulder, and shall not interfere with the existing drainage system on the right-of-way or any adopted municipal system and drainage plan.

11. By accepting the permit, permittee agrees to save, indemnify, and hold harmless to the extent allowed by law, the issuing authority, the Department, its officers, and employees from suits, actions, claims of any type or character brought because of injuries or damage sustained by any person resulting from the permittee's use of the access permit during the construction of the access.

CHANGES IN ACCESS USE AND PERMIT VIOLATIONS

1. It is the responsibility of the property owner and permittee to ensure that the use of the access to the property is not in violation of the Code, permit terms and conditions or the Act. The terms and conditions of any permit are binding upon all assigns, successors-in-interest, heirs and occupants. If any significant changes are made or will be made in the use of the property which will affect access operation, traffic volume and or vehicle type, the permittee or property owner shall contact the local issuing authority or the Department to determine if a new access permit and modifications to the access are required.

2. When an access is constructed or used in violation of the Code, section 43-2-147(5)(c), C.R.S., of the Act applies. The Department or issuing authority may summarily suspend an access permit and immediately order closure of the access when its continued use presents an immediate threat to public health, welfare or safety. Summary suspension shall comply with article 4 of title 24, C.R.S.

MAINTENANCE

1. The permittee, his or her heirs, successors-in-interest, assigns, and occupants of the property serviced by the access shall be responsible for meeting the terms and conditions of the permit, the repair and maintenance of the access beyond the edge of the roadway including any cattle guard and gate, and the removal or clearance of snow or ice upon the access even though deposited on the access in the course of Department snow removal operations. Within unincorporated areas the Department will keep access culverts clean as part of maintenance of the highway drainage system. However, the permittee is responsible for the repair and replacement of any access-related culverts within the right-of-way. Within incorporated areas, drainage responsibilities for municipalities are determined by statute and local ordinance. The Department will maintain the roadway including auxiliary lanes and shoulders, except in those cases where the access installation has failed due to improper access construction and/or failure to follow permit requirements and specifications in which case the permittee shall be responsible for such repair. Any significant repairs such as culvert replacement, resurfacing, or changes in design or specifications, requires authorization from the Department.

July 15, 2020
Access Permit No. 220062
Delroy Johnson | 14502 HWY 83 EPC

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1. A NOTICE TO PROCEED TO CONSTRUCTION, CDOT Form 1265, is required before beginning the construction of the access or any activity in the highway right-of-way. The NOTICE TO PROCEED will be issued upon receipt of this signed permit with appropriate fee.
2. The access is located on the Left side of State Highway 83, a distance of 1,200 feet South from milepost 24 (MP 23.77).
3. This section of highway is a Category R-A highway. The information submitted with the application requires the following highway improvements be designed and installed:
 - a. A 36" x 36" R1-1 STOP sign shall be place at the egress access for all exiting vehicular movements onto to HWY 24.
4. The Permittee/Applicant shall provide the Department with the following submittals, documents, plans and other items for review prior to the issuance of a NOTICE TO PROCEED to construction:
 - a) A written request for a NOTICE TO PROCEED including the access permit number listed above.
 - b) Cost estimate for the improvements of the highway.
5. This Access Permit is issued to allow access to State Highway 83 for a change in use of the property. The previous permit CDOT Access Permit 294019 was to serve one (1) single family dwelling on 28.6 acres. The access will now serve five (5) single family dwellings on the same 28.6 acres.
6. It is important to note that an increase in traffic due to new development, a future widening of SH 83 will likely occur. A reservation of right-of-way, 50 feet from the existing property line should be reserved for the future construction of additional through lanes.
7. Under no circumstances shall the construction of a private driveway by a private interest interfere with the completion of a public highway construction project. The private interest shall coordinate work the CDOT resident engineer named below.
8. The Permittee is responsible for wind and air borne erosion control measures during the construction phase. The developer is responsible for MS4 compliance; best management practice during construction should include clean project entry. The project landfall must be shaped and armored in such a way that no head-cutting will occur. No construction traffic is allowed to enter the highway along pioneered pathways through the ditches.
9. Equipment and vehicles cannot be parked in the clear zone; this includes when occupied by construction personnel; the clear zone shall be kept clear of vehicles, equipment and stockpile to prevent accidents.
10. No additional access will be allowed to State Highway 83 along property boundary.
11. The Permittee shall refer to all additional standard requirements attached to this permit. This includes CDOT Form 101b, enclosed additional terms, conditions, exhibits, and noted attachments.
12. The following criteria were used to establish this Access Permit:
 - a) The Application for Access Permit (CDOT Form 137) dated May 29, 2020 and accepted by the regional office on June 2, 2020 and all attachments.
 - b) State Highway Access Code, Volume 2, CCR-601-1; Effective date March 2002
 - c) The State Highway Access Category Assignment Schedule, as revised.
 - d) The Colorado Department of Transportation (CDOT) M&S Standard Plans
 - e) Vicinity Map
 - f) Attached Details
 - g) Exhibit A, "Seeding Requirements"
 - h) Environmental Clearances Information Summary

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13. The Permittee is required to comply with the Americans with Disabilities Act Accessibility Guidelines (ADAAG) that have been adopted by the U.S. Architectural and Transportation Barriers Compliance Board (Access Board), and incorporated by the U.S. Attorney General as a federal standard. These guidelines are defining traversable slope requirements and prescribing the use of a defined pattern of truncated domes as detectable warnings at street crossings. The new Standards Plans and can be found on the Design and Construction Project Support web page at: <https://www.codot.gov/business/designsupport/standard-plans>.
14. It is the responsibility of the Permittee/applicant to determine which environmental clearances and/or regulations apply to the project, and to obtain any clearances that are required directly from the appropriate agency. Please refer to or request a copy of the "CDOT Environmental Clearance Information Summary" for details. FAILURE TO COMPLY WITH REGULATORY REQUIREMENTS MAY RESULT IN SUSPENSION OR REVOCATION OF YOUR CDOT PERMIT, OR ENFORCEMENT ACTIONS BY OTHER AGENCIES.
15. ALL discharges are subject to the provisions of the Colorado Water Quality Control Act and the Colorado Discharge Permit Regulations. Prohibited discharges include substances such as: wash water, paint, automotive fluids, solvents, oils or soaps.
16. Unless otherwise identified by CDOT or the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division (WQCD) as significant sources of pollutants to the waters of the State, the following discharges to storm water systems are allowed without a Colorado Discharge Permit System permit: landscape irrigation, diverted stream flows, uncontaminated ground water infiltration to separate storm sewers, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, footing drains; water line flushing, flows from riparian habitats and wetlands, and flow from firefighting activities. However, construction activities may require a Construction Stormwater Permit. Contact the CDOT R2 Water Quality Specialist, Troy Rice at 719-227-3260.
17. This Access Permit is issued in accordance with the 1998 State Highway Access Code (2CCR 601-1), and is based in part upon the information submitted by the Permittee. This Access Permit is only for the use and purpose stated in the Application and on the Permit. Any changes, based upon existing and/or anticipated future conditions in traffic volumes, drainage, types of traffic, or other operational aspects may render this permit void, requiring a new Application for Access Permit to be submitted for review by the Department and/or Issuing Authority.
18. If necessary, minor changes, corrections and/or additions to the Permit may be ordered by the Department Inspector, other Department representative, or the local authority, to meet unanticipated site conditions. Changes may not be in violation of the State Highway Access Code. All major changes to the permit must be approved in writing by the Department prior to commencement of any work on or within the State Highway right-of-way.
19. All work is to conform to the plans referenced by this permit on file with the Colorado Department of Transportation or as modified by this Permit or a valid Notice to Proceed. If discrepancies arise, this permit and the valid Notice to Proceed shall take precedence over the plans. The Department plan review is only for the general conformance with the Department's design and code requirements. The Department is not responsible for the accuracy and adequacy of the design, dimensions, elevations or any other elements, which shall be confirmed and correlated at the work site. The Department through the approval of this document assumes no responsibility for the completeness and/or accuracy of the plans.
20. The Department standards, specifications, and regulations shall override the design plans incorporated in this permit should an oversight, omission, or conflict occur. The Department assumes no liability or responsibility whatsoever for the accuracy, completeness or correctness of

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Delroy Johnson | 14502 HWY 83 EPC

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the Permittee's design plans. Any design plan errors are the sole responsibility of the Permittee and/or the engineer.

21. The access shall be completed in an expeditious and safe manner and shall be finished within 45 days from initiation of construction within State Highway right-of-way.
22. Backing maneuvers within and into the State Highway right-of-way are strictly prohibited. All vehicles shall enter and exit the highway right-of-way in a forward movement. Backing into the right-of-way shall be considered a violation of the Terms and Conditions of the Access Permit and may result in the revocation of the Permit by the Department and/or Issuing Authority.
23. This access will be allowed a full movement. However, left turn movements in and out of this access may be prohibited at some future date.
24. The Permittee is responsible for obtaining any necessary additional federal, state and/or local government agency permits or clearances required for construction of the access. Approval of this access permit does not constitute verification of this action by the Permittee.
25. Whenever there is work within the highway right of way, the Permittee shall develop and implement a traffic control plan. This plan shall utilize traffic control devices as necessary to ensure the safe and expeditious movement of traffic around and through the work site as well as ensure the safety of the work force. A certified Traffic Control Supervisor or a Professional Traffic Engineer may prepare the traffic control plan. The plan shall be in conformance with the latest Manual on Uniform Traffic Control Devices (MUTCD) and other applicable standards. The plan must be submitted and approved by the Senior Maintenance Supervisor listed below five working days prior to beginning construction within the highway right of way. The approved traffic control plan will be attached to the Permit and the NOTICE TO PROCEED TO CONSTRUCTION and must be available on site throughout the duration of the construction. All work that requires traffic control shall be supervised by a registered professional traffic engineer or by a certified traffic control supervisor. The contractor in accordance with the Department Standards shall certify flagging personnel, when required.
26. If any traffic control devices are evident within 50 feet of the construction area, the Permittee/Contractor must contact Mr. Jimmy Biren, Asst. Traffic Operations Engineer, in Pueblo. Mr. Biren can be contacted in Pueblo at (719) 546-5404.
27. Five working days prior to beginning construction, the Permittee/Contractor must contact Mr. Brad Bauer, Senior Maintenance Supervisor, to coordinate the construction. Mr. Bauer can be contacted in Colorado Springs at 719-227-3203. Failure to comply with this requirement may result in the revocation of this permit.
28. Work shall BEGIN AFTER 8:30 a.m. and all equipment shall be off the right-of-way BEFORE 3:30 p.m. each day. No work is allowed within the highway right-of-way on weekends or State/Federal holidays. No construction vehicles shall be parked, or construction materials stockpiled on the highway right-of-way overnight. No private vehicles may be parked on the highway right-of-way at any time during construction.
29. Two-way traffic shall be maintained throughout the work area at all times.
30. The Annual Average Daily Traffic (AADT) volumes using this access shall not exceed 50 trips.
31. All costs associated with the installation of this access are the responsibility of the Permittee. This includes the design, construction, utility relocation, testing of materials and inspection.
32. Reconstruction or improvements to the access may be required when the Permittee has failed to meet the required design and/or materials specifications. If any construction element fails within

July 15, 2020
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Delroy Johnson | 14502 HWY 83 EPC

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two years due to improper construction or material specifications, the Permittee shall be responsible for all repairs. Failure to make such repairs may result in the revoking of the permit and closure of the access.

33. Signing and striping are the responsibilities of the Permittee. All signs shall be manufactured in accordance with the Manual on Uniform Traffic Control Devices (M.U.T.C.D.). The sheeting for the signs shall be highway intensity sheeting (ASTM Type III retro reflective sheeting). The Department shall approve the striping.
34. All workers within the State Highway right of way shall comply with their employer's safety and health policies/procedures and all applicable US Occupational Safety and Health Administration (OSHA) regulations- including but not limited to the applicable sections of 29 CFR Part 1910 - Occupational Safety and Health Standards and 29 CFR Part 1926 - Safety and Health Regulations for Construction.
35. Personal protective equipment (e.g. head protection, footwear, high visibility apparel, safety glasses, hearing protection, respirators, gloves, etc.) shall be worn as appropriate for the work being performed and as specified in regulation. At a minimum, all workers in the State Highway right of way, except when in their vehicles, shall wear the following personal protective equipment:
- a) Head protection that complies with the ANSI Z89.1-2014 standard;
 - b) At all construction sites or whenever there is danger of injury to feet, workers shall comply with OSHA's PPE requirements for foot protection per 29 CFR 1910.136, 1926.95, and 1926.96. If required, such footwear shall meet the requirements of ASTM F 2412-05 and ASTM F 2413-05;
 - c) High visibility apparel as specified in the Traffic Control provisions of this permit (at a minimum, ANSI/ISEA 107-1999, Class 2).
 - d) Where any of the above-referenced ANSI standards have been revised, the most recent version of the standard shall apply.
36. The Permittee is responsible for any utilities and/or traffic control devices disrupted by the construction of this access and all expense incurred for repair. There are existing utilities on the highway right-of-way by permit. Owners of those utilities must be contacted. Any work necessary to protect existing permitted utilities, such as encasements, bulwarks, etc. will be the responsibility of the Permittee.
- a) The Permittee is hereby advised that other utilities may exist within the proposed permit area. Permittee shall implement any and all measures to protect any existing utilities from damage.
 - b) Non-Destructive Air-vacuum Excavation (potholing) to expose the utilities being surveyed to determine their exact depth and location maybe necessary before any work commences. A core hole saw cut is the recommended method of entry through pavement for potholing. Flowfill is required for backfill of the core hole under the pavement or on the roadway.
 - c) The vacuum excavation technique is used not only to expose utilities but also for other uses that are benefited by the non-invasive/non-destructive, environmentally friendly technology such as dewatering or drill fluid/saw cutting fluid removal.
 - d) The Contractor shall utilize a spotter to assist in the visual inspection of all excavation work as it progresses near existing CDOT Intelligent Transportation Systems fiber optic line conduits, pull boxes and manholes. The Contractor shall provide a spotter to aid equipment operators when construction activities are near marked or unmarked fiber lines.
 - e) The spotter shall observe all excavation work as it progresses to ensure that no damage occurs to existing underground fiber lines. When the spotter has visual sight of the underground conduit, the spotter shall notify the equipment operator of the proximity to the conduit and begin to guide the excavation work. The spotter shall guide all excavation work around the conduit to ensure no damage occurs.
37. The Permittee is hereby advised that other utilities may exist within the proposed permit area. Permittee shall implement any and all measures to protect any existing utilities from damage.

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38. The Permittee is responsible for any utilities and/or traffic control devices disrupted by the construction of this access and all expense incurred for repair. There are existing utilities on the highway right-of-way by permit. Owners of those utilities must be contacted. Any work necessary to protect existing permitted utilities, such as encasements, bulwarks, etc. will be the responsibility of the Permittee.
39. It is the responsibility of the permittee to comply with the Subsurface Utility Engineering (SUE) requirements as defined in the ASCE 38 (American Society for Civil Engineering).
40. Additional CDOT permits are required for work involving water, sanitary sewer, gas, electrical, telephone and landscaping within the right-of-way.
41. Any damage to existing highway facilities shall be repaired immediately at no cost to the Department and prior to continuing other work. Any mud or other material tracked or otherwise deposited on the roadway shall be removed daily or as ordered by the Department inspector.
42. The Department Inspector or the Issuing Authority may suspend any work due to noncompliance with the provisions of this permit, adverse weather or traffic conditions, concurrent highway construction or maintenance in conflict with permit work or any condition deemed unsafe for workers or the general public. The work may be resumed upon notice from the Department Inspector or Issuing Authority.
43. The Permittee shall maintain adequate, unobstructed sight distance in both directions from the access. When determining the distance between accesses, the point of tangent shall be used where a radius is present, or the beginning of the curb cut. The minimum sight distance that shall be maintained along the highway for the access shall be 550 feet. The minimum sight distance that shall be maintained for the vehicle entering the highway shall be 550 feet.
44. Any landscaping or potentially obstructing objects such as but not limited to advertising signs, structures, trees, and bushes, shall be designed, placed, and maintained at a height not to interfere with the sight distance needed by any vehicle using the access. Planting of tree(s), which will be over 4 inches in caliper at maturity, will not be allowed within 30 feet of the edge of the traveled way. All other objects shall not exceed a total height of thirty inches from the top of final grade. The Department will require any object or landscaping that becomes unsightly or is considered to be a traffic hazard to be removed by the Permittee at no cost to the Department.
45. The equivalent turning radii of the access shall accommodate the turning radius of the largest vehicle using the access on a daily basis. Where roadway shoulders are present, the radius is measured to the edge of the closest lane. Where roadway shoulders are not present, the minimum access radii is 25 feet.
46. The access width shall be 24 feet wide.
47. The radii of the access shall be large enough to accommodate the largest vehicle using the access on a daily basis without encroaching on the adjacent travel lane.
48. Valley gutters are not allowed.
49. The access shall be surfaced upon completion of earthwork construction and prior to being used. The access shall be surfaced from the highway roadway to the right-of-way line.
 - a) The access with greater than 20 AADT shall have a hard surface pavement for a minimum distance of 20 feet from the traveled way. The first 20 feet of the access shall be surfaced with 6 inches of compacted Hot Mix Asphalt Type SX(100)PG64-22 and 12 inches of Aggregate Base Course (Class 6). The remainder of the access within the highway right-of-way shall be surfaced with 12 inches of Aggregate Base Course (Class 6).

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- b) If patching is required due to saw cutting, 6 inches of Hot Mix Asphalt Type SX(100)PG64-22 shall be used. The material will be placed in 3 lifts.
 - c) If hard surfacing (concrete or bituminous pavement) abuts existing pavement, the existing pavement shall be saw cut and removed a minimum of one (1) foot back from the existing edge of pavement.
 - d) Compaction of Hot Mix Asphalt shall be in accordance to section 401.17 of the Department's standard specifications. Compaction of the Aggregate Base Course shall comply with section 304.06.
 - e) Compaction of sub-grade, embankments and backfills shall be in accordance to section 203.07 of the Department's standard specification.
 - f) Placement of base course materials shall be in accordance with section 304.04 of the standard specifications. Compaction shall be in conformance with AASHTO procedure T-99.
 - g) If frost, water or moisture is present in the sub-grade, no surfacing materials shall be placed until all frost, water or moisture is gone or removed.
50. For any access that is not a curb cut, including streets and private access using curb returns, the first 20 feet beyond the closest highway lane, including speed change lanes or the distance to the side drain, whichever is greater, shall slope down and away from the highway at a two percent grade to ensure proper drainage control.
51. Within the right-of-way, maximum grades shall be limited to ten per cent for low volume field and residential access.
- 52.** An access that has a gate across it shall be designed so that the longest vehicle using it can clear the roadway when the gate is closed.
53. It is the responsibility of the Permittee to prevent all livestock from entering the State Highway right of way at this access location. Any livestock that does enter the highway right of way shall be the sole responsibility of the Permittee.
54. Any current or proposed cattle guard shall be maintained fully within the property boundaries and all repairs are the sole responsibility of the property owner.
55. In the event it becomes necessary to remove any right-of-way fence, the posts on either side of the entrance shall be securely braced with an approved end post before the fence is cut to prevent any slacking of the remaining fence. This shall be in conformance with the Department's Standard M-607-1.
56. All right-of-way fence posts and wire removed are Department property and shall be turned over to a representative of the Department.
57. Installation of any traffic control device necessary for the safe and proper operation and control of the access shall be required by the permit at the cost of the Permittee.
58. All traffic control devices within the highway or other public right-of-way or access that serve the general public shall conform to the M.U.T.C.D.
59. Prior to removing any existing highway signs within the limits of the construction activities, the Permittee must contact Mr. Walter Garcia in Pueblo. Mr. Garcia can be contacted at (719) 546-5767.
60. Physical separation and delineation along a property frontage such as curb and gutter or fencing, may be required when necessary to ensure that access will be limited to permitted locations.

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- a) Survey markers or monuments must be preserved in their original positions. Notify Mr. Dennis Pirtle, CDOT Land Surveyor, at (719) 546-5746 immediately upon damage to or discovery of any such markers or monuments at the work site.
 - b) Any survey markers or monuments disturbed during the execution of this permit shall be repaired and/or replaced immediately to the satisfaction of the CDOT Land Surveyor at the expense of the Permittee.
 - c) All survey procedures and minimum tolerances shall be in conformance with the Department Survey Manual and the "Manual of Instruction for the Survey of Public Lands of the United States" 1972 and section 38-53-101 et seq, C.R.S.
 - d) Monuments shall conform to Department Standard M-629-1.
61. Each access shall be constructed in a manner that shall not cause water to enter onto the roadway or shoulder, and shall not interfere with the existing drainage system in the right-of-way or any adopted municipal system and drainage plan.
62. The highway drainage system is for the protection of the state highway right-of-way, structures, and appurtenances. It is not designed nor intended to serve the drainage requirement of abutting or other properties beyond undeveloped historical flow. Drainage to the state highway right-of-way shall not exceed the undeveloped historical rate of flow.
63. This Permit hereby replaces all previous access permit(s) for this ownership, which now become null and void.
64. No interference with traffic will be allowed after 12:00 Noon the day before a 3- or 4-day holiday weekend, as listed under 108.06 of the Standard Specifications for Road and Bridge Construction.
65. Traffic control and work hours on state highways, interstates and freeways will be allowed as determined by the CDOT Inspector for this permit and area only.
66. CDOT retains the right to perform any necessary maintenance work in this area.
67. Notify the Department of Transportation Inspector, Ms. Teresa Guagliardo (teresa.guagliardo@state.co.us) in Pueblo at (719) 248-0318 upon completion of the access construction for a final inspection and to request a Letter of Acceptance. Please note that there is a 2-year warranty period for all construction elements. The 2-year warranty period begins with the date of the acceptance letter.
68. A Fully Executed Complete Copy of this Permit and a valid Notice to Proceed to Construction must be on the job site with the contractor at all times during the construction. Failure to comply with this or any other construction requirement may result in the immediate suspension of the work by order of the Department Inspector or the Issuing Authority.
69. READ ALL ADDITIONAL STANDARD REQUIREMENTS ON THE ATTACHED FORM 101 AND OTHER TERMS AND CONDITIONS ON THESE ATTACHED SHEETS. A COPY OF THIS PERMIT MUST BE ON THE JOB SITE WITH THE CONTRACTOR. Call for an inspection of forms at least one working day prior to placing any concrete. The Colorado Department of Transportation inspection is not an approval of the grade or alignment of the work. The contractor and/or engineer are responsible for the proper grade and alignment. Minor changes or additions may be ordered by the field inspector to meet field conditions. Any survey markers or monuments disturbed during the execution of this permit shall be repaired immediately at the expense of the permittee. Minimum cover for buried utilities shall be 48 inches.

HYDROLOGIC/HYDRAULIC CALCULATIONS

For Colorado Springs and much of the Fountain Creek watershed, the 1-hour depths are fairly uniform and are summarized in Table 6-2. Depending on the location of the project, rainfall depths may be calculated using the described method and the NOAA Atlas maps shown in Figures 6-6 through 6-17.

Table 6-2. Rainfall Depths for Colorado Springs

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	1.19	1.70	2.10
5	1.50	2.10	2.70
10	1.75	2.40	3.20
25	2.00	2.90	3.60
50	2.25	3.20	4.20
100	2.52	3.50	4.60

Where $Z = 6,840 \text{ ft}/100$

These depths can be applied to the design storms or converted to intensities (inches/hour) for the Rational Method as described below. However, as the basin area increases, it is unlikely that the reported point rainfalls will occur uniformly over the entire basin. To account for this characteristic of rain storms an adjustment factor, the Depth Area Reduction Factor (DARF) is applied. This adjustment to rainfall depth and its effect on design storms is also described below. The UDFCD UD-Rain spreadsheet, available on UDFCD's website, also provides tools to calculate point rainfall depths and Intensity-Duration-Frequency curves² and should produce similar depth calculation results.

2.2 Design Storms

Design storms are used as input into rainfall/runoff models and provide a representation of the typical temporal distribution of rainfall events when the creation or routing of runoff hydrographs is required. It has long been observed that rainstorms in the Front Range of Colorado tend to occur as either short-duration, high-intensity, localized, convective thunderstorms (cloud bursts) or longer-duration, lower-intensity, broader, frontal (general) storms. The significance of these two types of events is primarily determined by the size of the drainage basin being studied. Thunderstorms can create high rates of runoff within a relatively small area, quickly, but their influence may not be significant very far downstream. Frontal storms may not create high rates of runoff within smaller drainage basins due to their lower intensity, but tend to produce larger flood flows that can be hazardous over a broader area and extend further downstream.

- **Thunderstorms:** Based on the extensive evaluation of rain storms completed in the Carlton study (Carlton 2011), it was determined that typical thunderstorms have a duration of about 2 hours. The study evaluated over 300,000 storm cells using gage-adjusted NEXRAD data, collected over a 14-year period (1994 to 2008). Storms lasting longer than 3 hours were rarely found. Therefore, the results of the Carlton study have been used to define the shorter duration design storms.

To determine the temporal distribution of thunderstorms, 22 gage-adjusted NEXRAD storm cells were studied in detail. Through a process described in a technical memorandum prepared by the City of Colorado Springs (City of Colorado Springs 2012), the results of this analysis were interpreted and normalized to the 1-hour rainfall depth to create the distribution shown in Table 6-3 with a 5 minute time interval for drainage basins up to 1 square mile in size. This distribution represents the rainfall

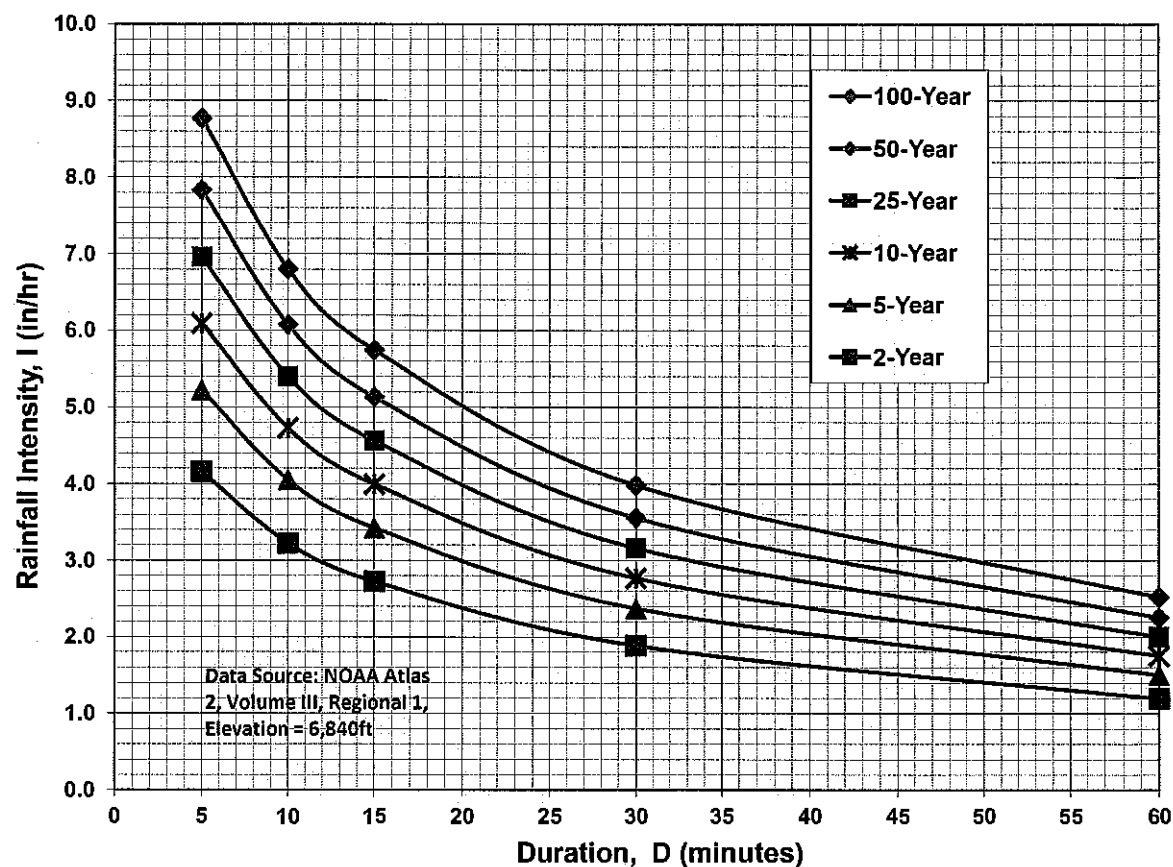
Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

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

3.2 Time of Concentration

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

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

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency**IDF Equations**

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

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

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

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

$$I_5 = -1.50 \ln(D) + 7.583$$

$$I_2 = -1.19 \ln(D) + 6.035$$

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

JOB NAME: JOHNSON ESTATES FILING NO. 1
 JOB NUMBER: 2575.00
 DATE: 12/10/20
 CALCULATED BY: MAW

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / DRIVEWAYS				LANDSCAPE/UNDEVELOPED AREAS				WEIGHTED			WEIGHTED CA		
		AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)
EX-1	2.6	0.00	0.89	0.90	0.96	2.60	0.02	0.08	0.35	0.02	0.08	0.35	0.05	0.21	0.91
EX-2	6.6	0.00	0.89	0.90	0.96	6.60	0.02	0.08	0.35	0.02	0.08	0.35	0.13	0.53	2.31
EX-3	3.9	0.03	0.89	0.90	0.96	3.87	0.02	0.08	0.35	0.03	0.09	0.35	0.10	0.34	1.38
EX-4	0.4	0.01	0.89	0.90	0.96	0.39	0.02	0.08	0.35	0.04	0.10	0.37	0.02	0.04	0.15
EX-5	4.3	0.10	0.89	0.90	0.96	4.20	0.02	0.08	0.35	0.04	0.10	0.36	0.17	0.43	1.57
EX-6	6.0	0.08	0.89	0.90	0.96	5.92	0.02	0.08	0.35	0.03	0.09	0.36	0.19	0.55	2.15
EX-7	2.1	0.07	0.89	0.90	0.96	2.03	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.23	0.78
EX-8	2.0	0.07	0.89	0.90	0.96	1.93	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.22	0.74

JOB NAME: JOHNSON ESTATES FILING NO. 1
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$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L}}{S^{0.33}} \quad V = C_v S_w^{0.5} \quad T_c = L/V$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)* $t_c = \frac{L}{180} + 10$	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

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

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	TOTAL AREA (AC)	WEIGHTED			OVERLAND				STREET / CHANNEL FLOW				Tc TOTAL (min)	INTENSITY			TOTAL FLOWS		
		CA(2)	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)		I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
EX-1	2.6	0.05	0.21	0.91	0.08	170	13	12.3	290	5.5%	1.6	2.9	15.2	2.80	3.50	5.87	0.1	0.7	5
EX-2	6.6	0.13	0.53	2.31	0.08	300	19	17.3	590	5.0%	1.6	6.3	23.6	2.27	2.84	4.77	0.3	1.5	11
EX-3	3.9	0.10	0.34	1.38	0.08	300	38	13.8	230	6.5%	1.8	2.1	15.9	2.74	3.43	5.76	0.3	1.2	8
EX-4	0.4	0.02	0.04	0.15	0.08	120	17	8.4					8.4	3.50	4.39	7.37	0.1	0.2	1.1
EX-5	4.3	0.17	0.43	1.57	0.08	300	24	16.1	400	5.5%	1.6	4.1	20.1	2.46	3.08	5.17	0.4	1.3	8
EX-6	6.0	0.19	0.55	2.15	0.08	300	12	20.2	350	6.0%	1.7	3.4	23.6	2.27	2.84	4.77	0.4	2	10
EX-7	2.1	0.10	0.23	0.78	0.08	280	24	15.2					15.2	2.80	3.50	5.88	0.3	0.8	5
EX-8	2.0	0.10	0.22	0.74	0.08	300	10	21.4					21.4	2.39	2.99	5.01	0.2	0.6	4

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FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Outfall / Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
H1	OS-1, OS-2, EX-1 and EX-2 (24.3 AC.)	2.14	8.65	23.6	2.84	4.77	6	41	
H2	EX-3 (3.9 AC.)	0.34	1.38	15.9	3.43	5.76	1.2	8	
H3	EX-4 (0.4 AC.)	0.04	0.15	8.4	4.39	7.37	0.2	1.1	
H4	EX-7 (2.1 AC.)	0.23	0.78	15.2	3.50	5.88	0.8	5	
H5	EX-5, EX-8 (6.3 AC.)	0.64	2.31	24.1	2.81	4.71	2	11	
H6	EX-6, OS-3 (111 AC.)	9.68	39.45	45.1	1.87	3.13	18	124	

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FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / DRIVEWAYS				LANDSCAPE/UNDEVELOPED AREAS				WEIGHTED			WEIGHTED CA		
		AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)
OS-1	8.6	0.14	0.89	0.90	0.96	8.46	0.02	0.08	0.35	0.03	0.09	0.36	0.29	0.80	3.10
OS-2	6.5	0.10	0.89	0.90	0.96	6.40	0.02	0.08	0.35	0.03	0.09	0.36	0.22	0.60	2.34
OS-3	105.0	0.90	0.89	0.90	0.96	104.10	0.02	0.08	0.35	0.03	0.09	0.36	2.88	9.14	37.30
A	2.6	0.10	0.89	0.90	0.96	2.50	0.02	0.08	0.35	0.05	0.11	0.37	0.14	0.29	0.97
B1	5.0	0.10	0.89	0.90	0.96	4.90	0.02	0.08	0.35	0.04	0.10	0.36	0.19	0.48	1.81
B2	1.6	0.08	0.89	0.90	0.96	1.52	0.02	0.08	0.35	0.06	0.12	0.38	0.10	0.19	0.61
C	3.6	0.00	0.89	0.90	0.96	3.60	0.02	0.08	0.35	0.02	0.08	0.35	0.07	0.29	1.26
D	0.3	0.09	0.89	0.90	0.96	0.21	0.02	0.08	0.35	0.28	0.33	0.53	0.08	0.10	0.16
E	0.4	0.01	0.89	0.90	0.96	0.39	0.02	0.08	0.35	0.04	0.10	0.37	0.02	0.04	0.15
F	2.6	0.39	0.89	0.90	0.96	2.21	0.02	0.08	0.35	0.15	0.20	0.44	0.39	0.53	1.15
G	7.6	0.20	0.89	0.90	0.96	7.40	0.02	0.08	0.35	0.04	0.10	0.37	0.33	0.77	2.78
H	2.1	0.07	0.89	0.90	0.96	2.03	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.23	0.78
I	2.0	0.07	0.89	0.90	0.96	1.93	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.22	0.74

JOB NAME: JOHNSON ESTATES FILING NO. 1
 JOB NUMBER: 2575.00
 DATE: 12/10/20
 CALC'D BY: MAW

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)* $t_c = \frac{L}{180} + 10$	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

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

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L}}{S^{0.33}} \quad V = C_v S_w^{0.5} \quad T_c = L/V$$

FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY

BASIN	TOTAL AREA (AC)	WEIGHTED			OVERLAND				STREET / CHANNEL FLOW				Tc TOTAL (min)	INTENSITY			TOTAL FLOWS		
		CA(2)	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)		I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)
OS-1	8.6	0.29	0.80	3.10	0.08	300	20	17.1	200	6.0%	1.7	1.9	19.0	2.53	3.17	5.32	0.7	3	16
OS-2	6.5	0.22	0.60	2.34	0.08	300	19	17.3	270	5.5%	1.6	2.7	20.1	2.46	3.08	5.17	0.5	2	12
OS-3	105	2.88	9.14	37.30	0.08	300	18	17.7	2300	5.0%	1.6	24.5	42.1	1.58	1.97	3.31	5	18	123
A	2.6	0.14	0.29	0.97	0.08	170	13	12.3	290	5.5%	1.6	2.9	15.2	2.80	3.50	5.87	0.4	1.0	6
B1	5.0	0.19	0.48	1.81	0.08	300	19	17.3	590	5.0%	1.6	6.3	23.6	2.27	2.84	4.77	0.4	1	9
B2	1.6	0.10	0.19	0.61	0.08	210	30	11.1	100	10.0%	2.2	0.8	11.8	3.09	3.87	6.50	0.3	1	4
C	3.6	0.07	0.29	1.26	0.08	300	38	13.8	230	6.5%	1.8	2.1	15.9	2.74	3.43	5.76	0.2	1.0	7
D	0.3	0.08	0.10	0.16	0.08	140	22	8.8					8.8	3.45	4.32	7.26	0.3	0.4	1.2
E	0.4	0.02	0.04	0.15	0.08	120	17	8.4					8.4	3.50	4.39	7.37	0.1	0.2	1.1
F	2.6	0.39	0.53	1.15	0.08	300	26	15.6	320	3.8%	1.4	3.9	19.5	2.50	3.12	5.24	1.0	2	6
G	7.6	0.33	0.77	2.78	0.08	300	12	20.2	350	6.0%	2.4	2.4	22.6	2.33	2.91	4.88	0.8	2	14
H	2.1	0.10	0.23	0.78	0.08	280	24	15.2					15.2	2.80	3.50	5.88	0.3	0.8	5
I	2.0	0.10	0.22	0.74	0.08	300	10	21.4					21.4	2.39	2.99	5.01	0.2	0.6	4

JOB NAME: JOHNSON ESTATES FILING NO. 1
 JOB NUMBER: 2575.00
 DATE: 12/10/20
 CALCULATED BY: MAW

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Outfall / Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
D1	OS-1, OS-2, A, B1, B2 (24.3 AC.)	2.37	8.82	24.6	2.78	4.66	7	41	
D2	C and D (3.9 AC.)	0.39	1.42	15.9	3.43	5.76	1.3	8	
D3	E (0.4 AC.)	0.04	0.15	8.4	4.39	7.37	0.2	1.1	
D4	H (2.1 AC.)	0.23	0.78	15.2	3.50	5.88	0.8	5	
D5	F and I (4.6 AC.)	0.75	1.89	23.5	2.84	4.77	2	9	
D6	G and OS-3 (112.6 AC.)	9.91	40.08	45.8	1.84	3.10	18	124	

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: Marc A. Whorton, P.E.
Company: Classic Consulting
Date: April 7, 2021
Project: Johnson Estates Filing No. 1
Location: El Paso County

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth 0.53 inches
Depth of Average Runoff Producing Storm, d_6 = 0.42 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA						
Area ID	B1	B2	D	F	G						
Downstream Design Point ID	D1	D1	D2	D5	D6						
Downstream BMP Type	None	None	None	None	None						
DCIA (ft ²)	--	--	--	--	--						
UIA (ft ²)	5,713	3,566	3,250	18,162	1,565						
RPA (ft ²)	23,450	3,623	6,915	56,030	24,685						
SPA (ft ²)	--	--	--	--	--						
HSG A (%)	0%	0%	0%	0%	0%						
HSG B (%)	100%	100%	100%	100%	100%						
HSG C/D (%)	0%	0%	0%	0%	0%						
Average Slope of RPA (ft/ft)	0.030	0.020	0.050	0.020	0.030						
UIA:RPA Interface Width (ft)	80.00	25.00	30.00	70.00	45.00						

CALCULATED RUNOFF RESULTS

Area ID	B1	B2	D	F	G						
UIA:RPA Area (ft ²)	29,163	7,189	10,165	74,192	26,250						
L / W Ratio	4.56	11.50	11.29	15.14	12.96						
UIA / Area	0.1959	0.4960	0.3197	0.2448	0.0596						
Runoff (in)	0.00	0.00	0.00	0.00	0.00						
Runoff (ft ³)	0	0	0	0	0						
Runoff Reduction (ft ³)	205	128	116	651	56						

CALCULATED WQCV RESULTS

Area ID	B1	B2	D	F	G						
WQCV (ft ³)	233	145	132	739	64						
WQCV Reduction (ft ³)	233	145	132	739	64						
WQCV Reduction (%)	100%	100%	100%	100%	100%						
Untreated WQCV (ft ³)	0	0	0	0	0						

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	D1	D2	D5	D6							
DCIA (ft ²)	0	0	0	0							
UIA (ft ²)	9,279	3,250	18,162	1,565							
RPA (ft ²)	27,073	6,915	56,030	24,685							
SPA (ft ²)	0	0	0	0							
Total Area (ft ²)	36,352	10,165	74,192	26,250							
Total Impervious Area (ft ²)	9,279	3,250	18,162	1,565							
WQCV (ft ³)	378	132	739	64							
WQCV Reduction (ft ³)	378	132	739	64							
WQCV Reduction (%)	100%	100%	100%	100%							
Untreated WQCV (ft ³)	0	0	0	0							

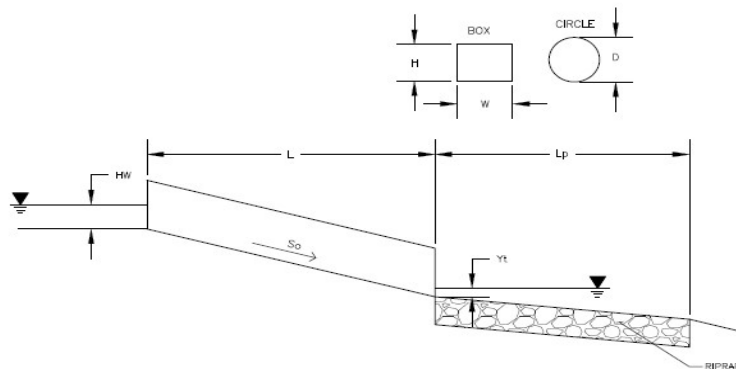
CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft ²)	146,959
Total Impervious Area (ft ²)	32,256
WQCV (ft ³)	1,313
WQCV Reduction (ft ³)	1,313
WQCV Reduction (%)	100%
Untreated WQCV (ft ³)	0

Determination of Culvert Headwater and Outlet Protection

Project: **JOHNSON ESTATES FILING NO. 1**

Basin ID: **DRIVEWAY CULVERT (LOT 2)**



Soil Type:

Choose One:

- ☒ Sandy
☐ Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

Design Discharge

Q = 21 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Grooved End Projection

Box Culvert:

Barrel Height (Rise) in Feet

Height (Rise) =

Barrel Width (Span) in Feet

Width (Span) =

Inlet Edge Type (Choose from pull-down list)

1.5 : 1 Bevel w/ 18-34 Deg. Flared Wingwall

Number of Barrels

No = 2

Inlet Elevation

Elev IN = 7277.5 ft

Outlet Elevation **OR** Slope

Elev OUT = 7277 ft

Culvert Length

L = 20 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Elev Y_t =

Max Allowable Channel Velocity

V = 5 ft/s

Required Protection (Output):

Tailwater Surface Height

Y_t = 0.60 ft

Flow Area at Max Channel Velocity

A_t = 2.10 ft²

Culvert Cross Sectional Area Available

A = 1.77 ft²

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.36

Sum of All Losses Coefficients

k_s = 1.56

Culvert Normal Depth

Y_n = 0.86 ft

Culvert Critical Depth

Y_c = 1.25 ft

Tailwater Depth for Design

d = 1.37 ft

Adjusted Diameter **OR** Adjusted Rise

D_a = 1.18 ft

Expansion Factor

1/(2*tan(Θ)) = 5.16

Flow/Diameter^{2.5} **OR** Flow/(Span * Rise^{1.5})

Q/D^{2.5} = 3.81 ft^{0.5}/s

Froude Number

Fr = 2.08

Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise

Y_t/D = 0.51

Supercritical!

Inlet Control Headwater

HW_i = 2.13 ft

Outlet Control Headwater

HW_o = 1.73 ft

Design Headwater Elevation

HW = 7,279.63 ft

Headwater/Diameter **OR** Headwater/Rise Ratio

HW/D = 1.42

Minimum Theoretical Riprap Size

d₅₀ = 5 in

Nominal Riprap Size

d₅₀ = 6 in

UDFCD Riprap Type

Type = VL

Length of Protection

L_p = 11 ft

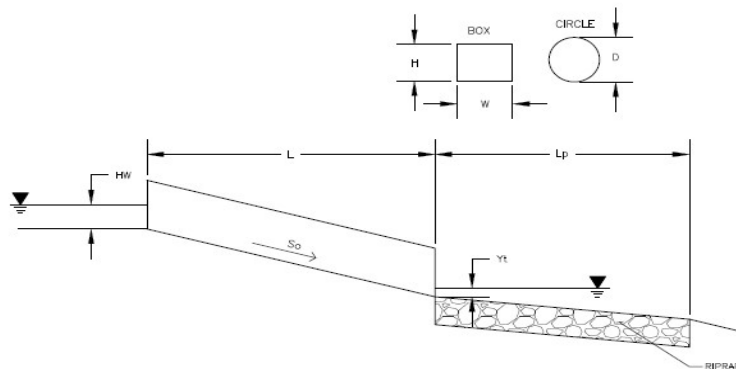
Width of Protection

T = 4 ft

Determination of Culvert Headwater and Outlet Protection

Project: **JOHNSON ESTATES FILING NO. 1**

Basin ID: **DRIVEWAY CULVERT (LOT 3)**



Soil Type:

Choose One:

- ☒ Sandy
☐ Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

Design Information (Input):

Design Discharge

Q = 20 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Grooved End Projection

Box Culvert:

Barrel Height (Rise) in Feet

Height (Rise) =

Barrel Width (Span) in Feet

Width (Span) =

Inlet Edge Type (Choose from pull-down list)

1.5 : 1 Bevel w/ 18-34 Deg. Flared Wingwall

Number of Barrels

No = 2

Inlet Elevation

Elev IN = 7288.5 ft

Outlet Elevation **OR** Slope

Elev OUT = 7288 ft

Culvert Length

L = 20 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Elev Y_t =

Max Allowable Channel Velocity

V = 5 ft/s

Required Protection (Output):

Tailwater Surface Height

Y_t = 0.60 ft

Flow Area at Max Channel Velocity

A_t = 2.00 ft²

Culvert Cross Sectional Area Available

A = 1.77 ft²

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.36

Sum of All Losses Coefficients

k_s = 1.56

Culvert Normal Depth

Y_n = 0.84 ft

Culvert Critical Depth

Y_c = 1.22 ft

Tailwater Depth for Design

d = 1.36 ft

Adjusted Diameter **OR** Adjusted Rise

D_a = 1.17 ft

Expansion Factor

1/(2*tan(Θ)) = 5.40

Flow/Diameter^{2.5} **OR** Flow/(Span * Rise^{1.5})

Q/D^{2.5} = 3.63 ft^{0.5}/s

Froude Number

Fr = 2.10

Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise

Y_t/D = 0.51

Supercritical!

Inlet Control Headwater

HW_i = 2.03 ft

Outlet Control Headwater

HW_o = 1.64 ft

Design Headwater Elevation

HW = 7,290.53 ft

Headwater/Diameter **OR Headwater/Rise Ratio**

HW/D = 1.35

Minimum Theoretical Riprap Size

d₅₀ = 5 in

Nominal Riprap Size

d₅₀ = 6 in

UDFCD Riprap Type

Type = VL

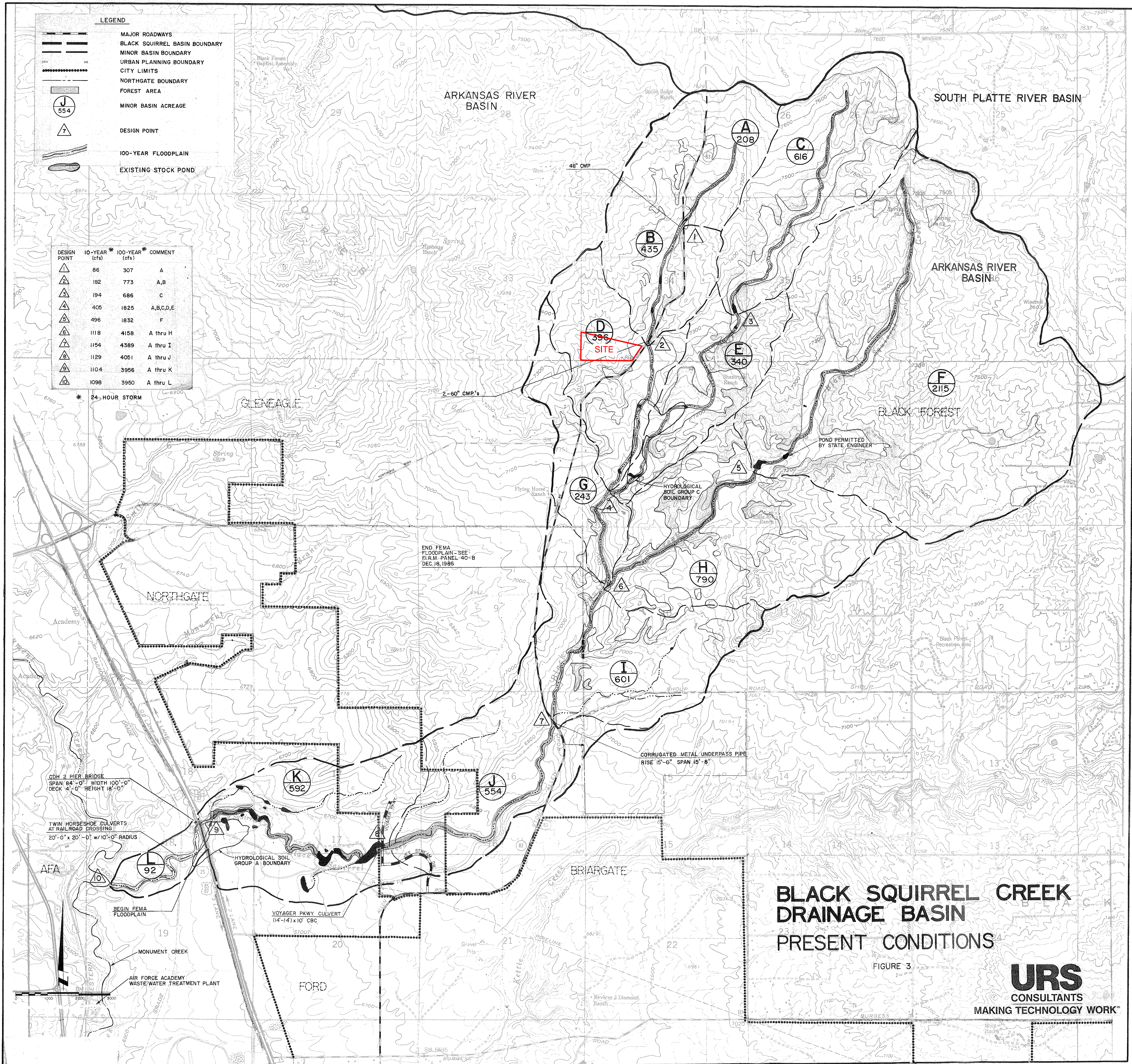
Length of Protection

L_p = 10 ft

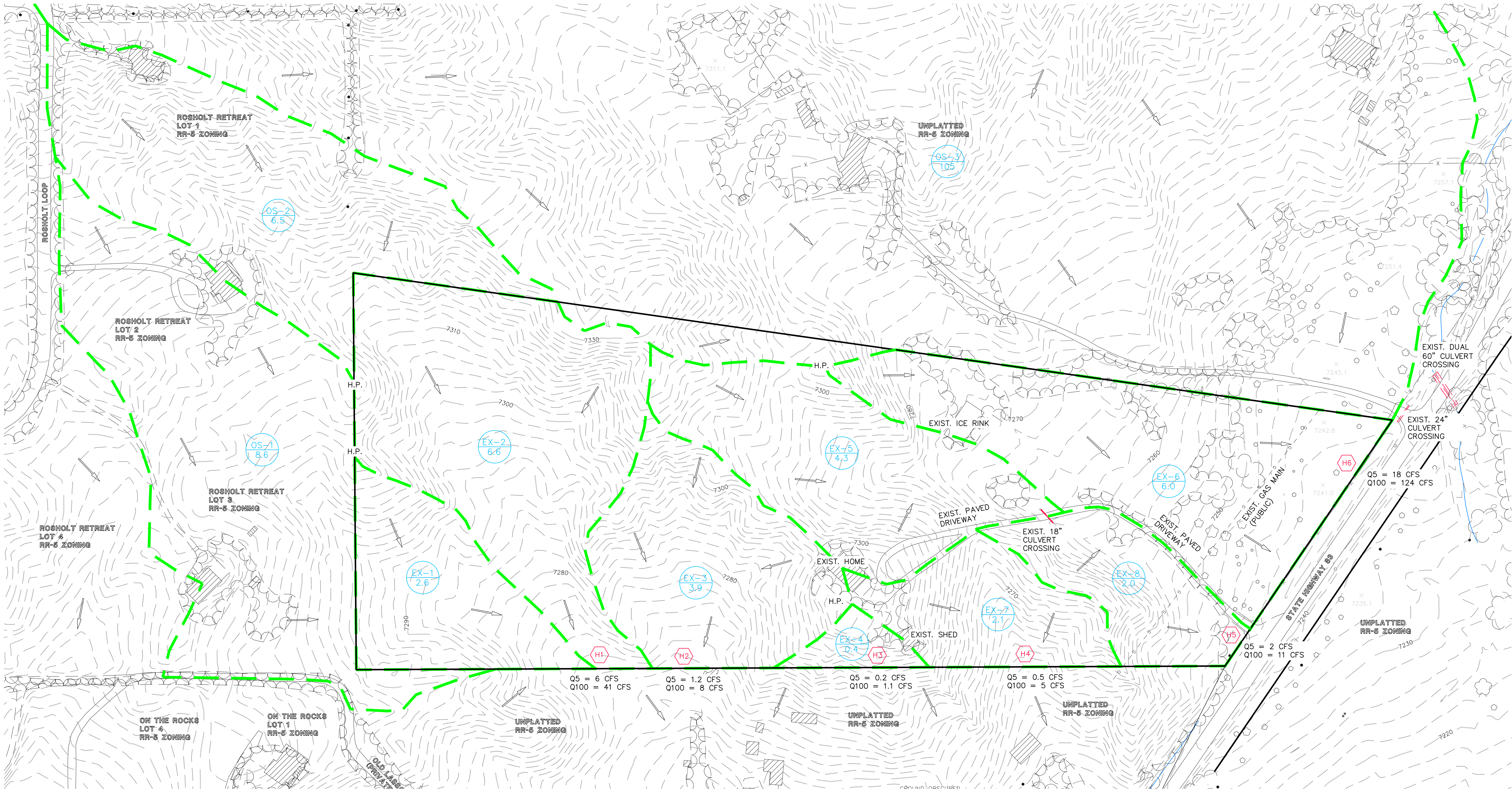
Width of Protection

T = 4 ft

DRAINAGE MAPS



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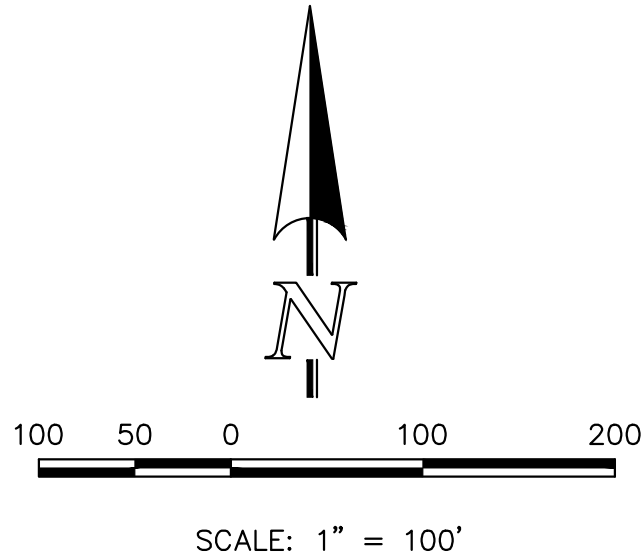


FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY															
BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / DRIVEWAYS				LANDSCAPE/UNDEVELOPED AREAS				WEIGHTED			WEIGHTED CA		
		AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)
EX-1	2.6	0.00	0.89	0.90	0.96	2.60	0.02	0.08	0.35	0.02	0.08	0.35	0.05	0.21	0.91
EX-2	6.6	0.00	0.89	0.90	0.96	6.60	0.02	0.08	0.35	0.02	0.08	0.35	0.13	0.53	2.31
EX-3	3.9	0.03	0.89	0.90	0.96	3.87	0.02	0.08	0.35	0.03	0.09	0.35	0.10	0.34	1.38
EX-4	0.4	0.01	0.89	0.90	0.96	0.39	0.02	0.08	0.35	0.04	0.10	0.37	0.02	0.04	0.15
EX-5	4.3	0.10	0.89	0.90	0.96	4.20	0.02	0.08	0.35	0.04	0.10	0.36	0.17	0.43	1.57
EX-6	6.0	0.08	0.89	0.90	0.96	5.92	0.02	0.08	0.35	0.03	0.09	0.36	0.19	0.55	2.15
EX-7	2.1	0.07	0.89	0.90	0.96	2.03	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.23	0.78
EX-8	2.0	0.07	0.89	0.90	0.96	1.93	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.22	0.74

		FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY																	
BASIN	TOTAL AREA (AC)	WEIGHTED			OVERLAND			STREET / CHANNEL FLOW			Tc	INTENSITY			TOTAL FLOWS				
		CA(2)	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Slope (%)	Velocity (fps)		Tc (min)	I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)	
EX-1	2.6	0.05	0.21	0.91	0.08	170	13	12.3	290	5.5%	1.6	2.9	15.2	2.80	3.50	5.87	0.1	0.7	5
EX-2	6.6	0.13	0.53	2.31	0.08	300	19	17.3	590	5.0%	1.6	6.3	23.6	2.27	2.84	4.77	0.3	1.5	11
EX-3	3.9	0.10	0.34	1.38	0.08	300	38	13.8	230	6.5%	1.8	2.1	15.9	2.74	3.43	5.76	0.3	1.2	8
EX-4	0.4	0.02	0.04	0.15	0.08	120	17	8.4					8.4	3.50	4.39	7.37	0.1	0.2	1.1
EX-5	4.3	0.17	0.43	1.57	0.08	300	24	16.1	400	5.5%	1.6	4.1	20.1	2.46	3.08	5.17	0.4	1.3	8
EX-6	6.0	0.19	0.55	2.15	0.08	300	12	20.2	350	6.0%	1.7	3.4	23.6	2.27	2.84	4.77	0.4	2	10
EX-7	2.1	0.10	0.23	0.78	0.08	280	24	15.2					15.2	2.80	3.50	5.88	0.3	0.8	5
EX-8	2.0	0.10	0.22	0.74	0.08	300	10	21.4					21.4	2.39	2.99	5.01	0.2	0.6	4

FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY									
Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Outfall / Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
H1	OS-1, OS-2, EX-1 and EX-2 (24.3 AC.)	2.14	8.65	23.6	2.84	4.77	6	41	
H2	EX-3 (3.9 AC.)	0.34	1.38	15.9	3.43	5.76	1.2	8	
H3	EX-4 (0.4 AC.)	0.04	0.15	8.4	4.39	7.37	0.2	1.1	
H4	EX-7 (2.1 AC.)	0.23	0.78	15.2	3.50	5.88	0.8	5	
H5	EX-5, EX-8 (6.3 AC.)	0.64	2.31	24.1	2.81	4.71	2	11	
H6	EX-6, OS-3 (111 AC.)	9.68	39.45	45.1	1.87	3.13	18	124	

LEGEND	
DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
BASIN BOUNDARY	
EXIST./PROP. STORM SEWER	
PROPERTY BOUNDARY	
EXIST. FLOW ARROW	
BASIN IDENTIFIER	H-1 10.0
AREA IN ACRES	D2
DESIGN POINT	
EXISTING TREES / SHRUBS	
EXISTING FORESTED AREA OUTLINE	



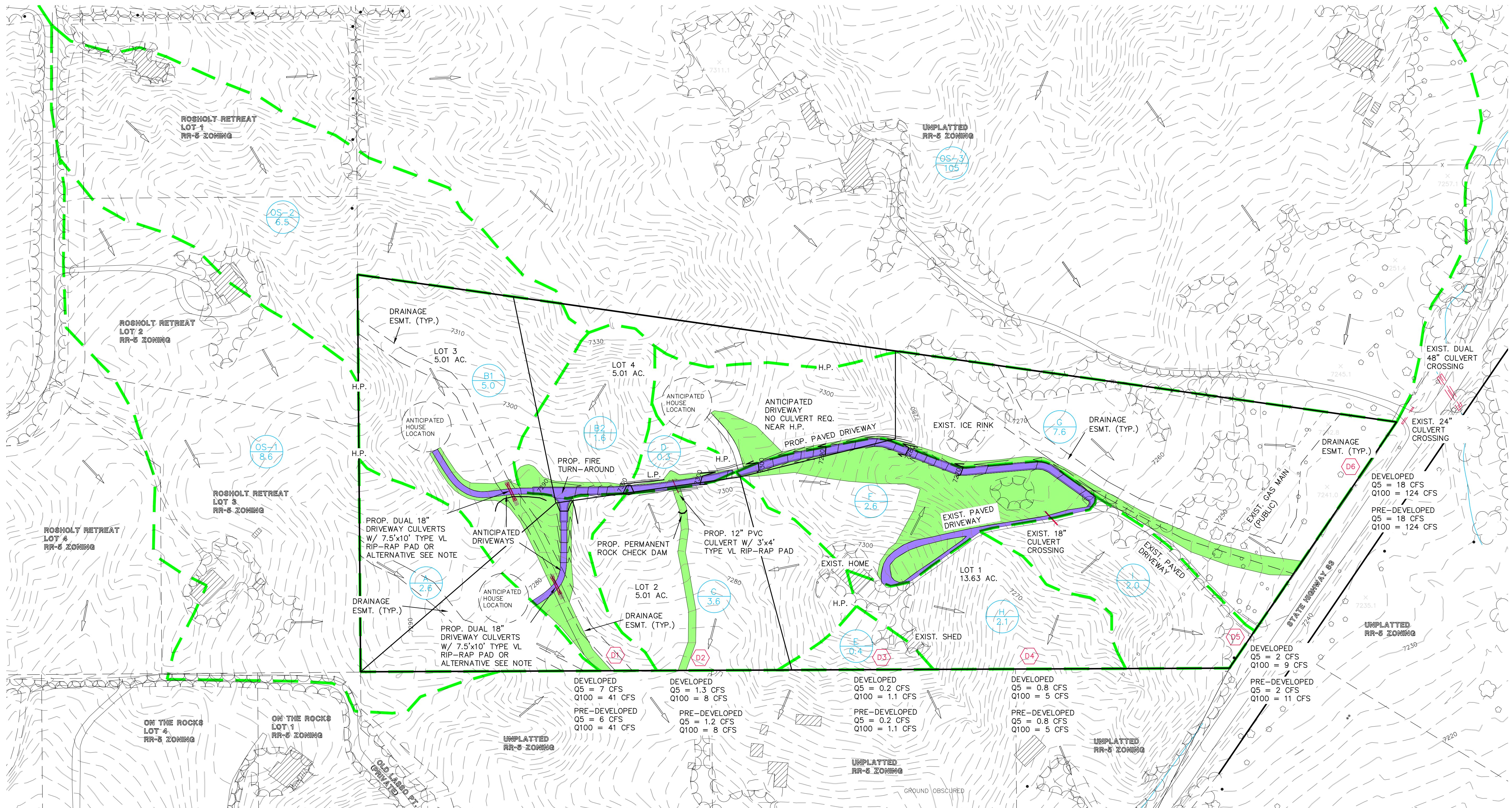
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903

(719)785-0790
(719)785-0799 (Fax)

JOHNSON ESTATES FILING NO. 1 FINAL DRAINAGE REPORT PRE-DEVELOPED DRAINAGE MAP			
DESIGNED BY	MAW	SCALE	DATE
DRAWN BY	MAW	(H) 1"= 100'	SHEET 1 OF 2
CHECKED BY		(V) 1"= N/A	JOB NO. 2575.00



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FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY															
BASIN	TOTAL AREA (AC)	IMPERVIOUS AREA / DRIVEWAYS				LANDSCAPE/UNDEVELOPED AREAS				WEIGHTED			WEIGHTED CA		
		AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)
OS-1	8.6	0.14	0.89	0.90	0.96	8.46	0.02	0.08	0.35	0.03	0.09	0.36	0.29	0.80	3.10
OS-2	6.5	0.10	0.89	0.90	0.96	6.40	0.02	0.08	0.35	0.03	0.09	0.36	0.22	0.60	2.34
OS-3	105.0	0.90	0.89	0.90	0.96	104.10	0.02	0.08	0.35	0.03	0.09	0.36	2.88	9.14	37.30
A	2.6	0.10	0.89	0.90	0.96	2.50	0.02	0.08	0.35	0.05	0.11	0.37	0.14	0.29	0.97
B1	5.0	0.10	0.89	0.90	0.96	4.90	0.02	0.08	0.35	0.04	0.10	0.36	0.19	0.48	1.81
B2	1.6	0.08	0.89	0.90	0.96	1.52	0.02	0.08	0.35	0.06	0.12	0.38	0.10	0.19	0.61
C	3.6	0.00	0.89	0.90	0.96	3.60	0.02	0.08	0.35	0.02	0.08	0.35	0.07	0.29	1.26
D	0.3	0.09	0.89	0.90	0.96	0.21	0.02	0.08	0.35	0.28	0.33	0.53	0.08	0.10	0.16
E	0.4	0.01	0.89	0.90	0.96	0.39	0.02	0.08	0.35	0.04	0.10	0.37	0.02	0.04	0.15
F	2.6	0.39	0.89	0.90	0.96	2.21	0.02	0.08	0.35	0.15	0.20	0.44	0.39	0.53	1.15
G	7.6	0.20	0.89	0.90	0.96	7.40	0.02	0.08	0.35	0.04	0.10	0.37	0.33	0.77	2.78
H	2.1	0.07	0.89	0.90	0.96	2.03	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.23	0.78
I	2.0	0.07	0.89	0.90	0.96	1.93	0.02	0.08	0.35	0.05	0.11	0.37	0.10	0.22	0.74

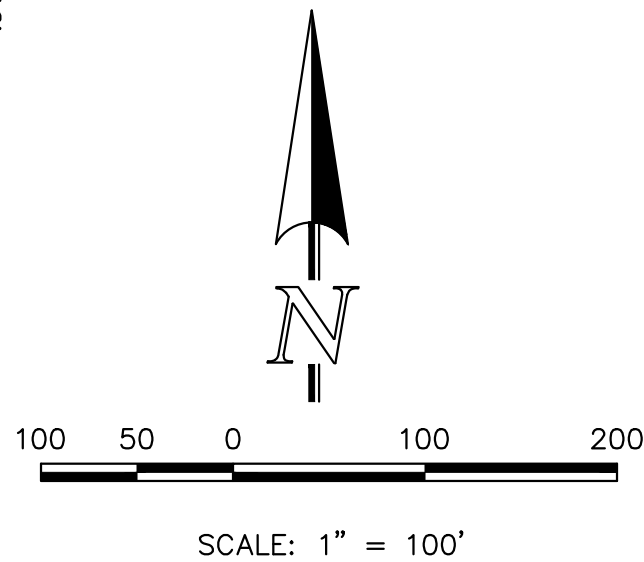
FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY									
Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Outfall / Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
D1	OS-1, OS-2, A, B1, B2 (24.9 AC.)	2.37	8.82	24.6	2.78	4.98	7	41	
D2	C and D (3.9 AC.)	0.39	1.42	15.9	3.43	5.76	1.3	8	
D3	E (0.4 AC.)	0.04	0.15	8.4	4.39	7.37	0.2	1.1	
D4	H (2.1 AC.)	0.23	0.78	15.2	3.50	5.88	0.6	5	
D5	F and I (4.6 AC.)	0.75	1.89	23.5	2.84	4.77	2	9	
D6	G and OS-3 (112.6 AC.)	9.91	40.08	45.8	1.84	3.10	18	124	

DRIVEWAY CULVERT NOTE:
PROPERTY OWNERS OF LOTS 2&3 MUST INSTALL DUAL CULVERTS FOR THEIR DRIVEWAY AS NOTED ABOVE OR PROVIDE ALTERNATIVE LOW WATER "TEXAS CROSSING" AND ASSUME RISK OF MINOR FLOODING OVER DRIVEWAY

		FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY																	
BASIN	TOTAL AREA (AC)	WEIGHTED			OVERLAND			STREET / CHANNEL FLOW				Tc	INTENSITY			TOTAL FLOWS			
		CA(2)	CA(5)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (f/s)		Tc (min)	TOTAL (in/hr)	I(2) (in/hr)	I(5) (in/hr)	I(100) (in/hr)	Q(2) (cfs)	Q(5) (cfs)
OS-1	8.6	0.29	0.80	3.10	0.08	300	20	17.1	200	6.0%	1.7	1.9	19.0	2.53	3.17	5.32	0.7	3	16
OS-2	6.5	0.22	0.60	2.34	0.08	300	19	17.3	270	5.5%	1.8	2.7	20.1	2.46	3.08	5.17	0.5	2	12
OS-3	105	2.88	9.14	37.30	0.08	300	18	17.7	2300	5.0%	1.6	24.5	42.1	1.58	1.97	3.31	5	18	123
A	2.8	0.14	0.29	0.97	0.08	170	13	12.3	280	5.5%	1.6	2.9	15.2	2.80	3.50	5.87	0.4	1.0	6
B1	5.0	0.19	0.48	1.81	0.08	300	19	17.3	590	5.0%	1.6	8.3	23.6	2.27	2.84	4.77	0.4	1	9
B2	1.6	0.10	0.19	0.61	0.08	210	30	11.1	100	10.0%	2.2	0.8	11.8	3.09	3.67	6.50	0.3	1	4
C	3.6	0.07	0.29	1.26	0.08	300	38	13.8	230	6.5%	1.8	2.1	15.9	2.74	3.43	5.76	0.2	1.0	7
D	0.3	0.08	0.10	0.16	0.08	140	22	8.8					8.8	3.45	4.32	7.26	0.3	0.4	1.2
E	0.4	0.02	0.04	0.15	0.08	120	17	8.4					8.4	3.50	4.39	7.37	0.1	0.2	1.1
F	2.6	0.39	0.53	1.15	0.08	300	26	15.6	320	3.8%	1.4	3.9	19.5	2.50	3.12	5.24	1.0	2	6
G	7.6	0.33	0.77	2.78	0.08	300	12	20.2	360	6.0%	2.4	2.4	22.8	2.33	2.91	4.88	0.8	2	14
H	2.1	0.10	0.23	0.78	0.08	280	24	15.2					15.2	2.80	3.50	5.88	0.3	0.8	5
I	2.0	0.10	0.22	0.74	0.08	300	10	21.4					21.4	2.39	2.99	5.01	0.2	0.6	4

LEGEND	
DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
BASIN BOUNDARY	
EXIST./PROP. STORM SEWER	
PROPOSED LOT LINE	
EXIST. FLOW ARROW	
BASIN IDENTIFIER	H-1 10.0
AREA IN ACRES	D2
DESIGN POINT	
EXISTING TREES / SHRUBS	
EXISTING FORESTED AREA OUTLINE	

RUNOFF REDUCTION SURFACE TYPES	
UNCONNECTED IMPERVIOUS AREA (UIA)	
RECEIVING PERVIOUS AREA (RPA)	
SEE RUNOFF REDUCTION CALCULATIONS IN APPENDIX	



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JOHNSON ESTATES FILING NO. 1 FINAL DRAINAGE REPORT DEVELOPED DRAINAGE MAP			
DESIGNED BY	MAW	SCALE	DATE 12-10-20
DRAWN BY	MAW	(H) 1"= 100'	SHEET 2 OF 2
CHECKED BY		(V) 1"= N/A	JOB NO. 2575.00