MOUNTAIN SKY SUBDIVISION, FILING NO. 1 WITH +/- 45 RESIDENTIAL LOTS

FINAL DRAINAGE REPORT

JUNE 2016

For:
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ENGINEER'S STATEMENT:

I hereby affirm that this report and plan for the Phase III drainage design of the development Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots was prepared by me (or under my direction supervision) in accordance with the provisions of the City of Fort Lupton Storm Drainage Design and Technical Criteria for the owners thereof. I understand that the City of Fort Lupton does not and will not assume liability for drainage facilities designed by others. I am also aware of the previsions of the City CODE as it pertains to the City's review.

_____

Russell L Burrows, P.E. Date
State of Colorado No. 14662
For and on behalf of Calibre Engineering, Inc.

TABLE OF CONTENTS

SCOPE 4
1.0 GENERAL LOCATION AND DESCRIPTION 4
1.1 Location 4
1.2 Description of Property 4
2.0 DRAINAGE BASINS AND SUB-BASINS 5
2.1 Major Basin Description 5
2.2 Sub-Basin Description 5
3.0 DRAINAGE DESIGN CRITERIA 6
3.1 Development Criteria References and Constraints 6
3.2 Hydrologic Criteria 7
3.3 Hydraulic Criteria 7
3.4 Adaptations to Criteria 7
4.0 DRAINAGE FACILITY DESIGN 8
4.1 General Concept 8
4.2 Specific Details 8
Site Runoff 8
Street and Inlet Capacities 10
Storm Drain System 10
Detention Pond 11
5.0 SUMMARY 11
5.1 Compliance with Standards 11
5.2 Drainage Concept 12
5.3 Standard Statement 1 12
6.0 LIST OF REFERENCES 12

APPENDICIES

A. Maps and Exhibits

B. Hydrologic Computations

C. Hydraulic Computations

D. Referenced Criteria

SCOPE

The purpose of this report is to determine the drainage infrastructure for the proposed project with +/- 45 Residential Lots and the detailed concept for the portion of the site which is being developed in Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots. The scope of this report is limited to hydrologic and hydraulic calculations for the major tributary basins, on-site detention pond, on-site infrastructure for Filing No. 1 and a bypass channel for off-site flows which drain to and through the site along the north property line. The infrastructure within Filing No. 1 was sized to convey flows from the ultimate buildout condition for the Mountain Sky subdivision.

1.0 GENERAL LOCATION AND DESCRIPTION

1.1 Location

The project is located as follows:

- Within the southwest quarter of Section 4, Township 1 North, Range 66 West of the 6th Principal Meridian
- Adjacent to the southern and eastern perimeter of Fort Lupton's city limits
- North of Weld CR 12
- South of undeveloped land located south of State Highway 52
- East of Shortline Ditch (runoff from this site currently enters the ditch)
- West of CR 29 ½
- West of an existing levee which passes under W CR 12 and SH 52
- North and west of a single family home, south of a single family home and southeast of a housing sub-division
- See Vicinity Map located in Appendix A

1.2 Description of Property

The following are characteristics of the site:

- As currently platted, the parcel consists of 76.95 acres
- Anadarko will utilize 15.75 acres of the parcel for future oil/gas development which includes 1.25 acres of W CR12 and W CR 29 roads adjacent to the Anadarko Parcel
- Mountain Sky Subdivision proposes to utilize the remaining 61.2 acres of the parcel

- Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots will develop approximately 22 acres including an on-site detention/ water quality pond and a channel to bypass upstream offsite flows
- Site is existing farm land
- Site drains east to the west with existing ground slopes ranging between 1% and 4%
- Site contains soils predominantly in Hydrologic Group B, Sandy Plains (see Soils Map located in Appendix A)
- Roadside drainage ditches are located on the south side of the site adjacent to WCR 12
- An oil and gas well site located along the north property line
- The proposed land use for the site is primarily single family residential
- The project includes the development of land, roadways, parks and utilities within the site, as well as the construction of a drainage system which will include detention and water quality facilities to meet the City of Fort Lupton's onsite drainage requirements
- A Natural Resources Assessment was completed by ERO Resources Corporation on September 30, 2014 which stated ditches and wetland vegetation are potential waters of the U.S. but "because the ditches do not have a surface connection to a known water of the U.S., it is unlikely the Corps would take jurisdiction over the ditches; however, the Corp must make that determination."

2.0 DRAINAGE BASINS AND SUB-BASINS

2.1 Major Basin Description

- The project falls within the study area of the Master Drainage Plan of:
  a) the *City of Fort Lupton Water, Wastewater and Storm Drainage Master Plan, Section 6 Storm Drainage System*
  b) the *DRAFT copy of the City of Fort Lupton Comprehensive Plan* prepared by Clear Water Solutions, Inc.
- Storm runoff from the tributary basins generally flows east to west across the subject site
- Site runoff is ultimately conveyed to South Platte River via downstream ditches, streets, and storm sewer conveyance facilities

2.2 Sub-Basin Description

- According to the *Storm Drainage Master Plan*, the project site is located in the South Drainage Basin which included portions of sections 3, 4, and 5, T. IN., R66W of 6th P.M.
- According to the DRAFT copy of the *City of Fort Lupton Comprehensive Plan, Section 8.0 STORM DRAINAGE SYSTEM* (a copy of pertinent sections of the DRAFT report is located in Appendix D), the project site is located within sub-basin S6. The project site received runoff from sub-basins S6.1 and S6.3 and portions of sub-basins S6.2 and S8 for a total of approximately 1700 acres

- An existing irrigation ditch, Fulton Ditch, located east of the site running in a south-to-north direction, receives runoff from the South, East, and OS Basins. It is assumed that the ditch is running full and that all runoff from the basin flows over the ditch embankment continuing in a westerly direction towards the subject site
- Shortline Ditch, located immediately west of the proposed development, currently receives runoff from all five sub-basins, including the subject site
- Approximately 3 acres consisting of single-family residences, located southeasterly and offsite, historically flows northwesterly onto the proposed site
- The development is within FEMA Flood Insurance Rate Map panels 0802660981C, revised September 28, 1982, and 0802660982C, which is not available for printing. The project is located in Zone C and no mapped 100-year floodplains exist on the site. See FEMA Map Community Panel 080266 0981C in Appendix A
- There are no existing major irrigation facilities located on the Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots property.
- The downstream drainage flow patterns are not anticipated to affect the development of Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots

3.0 DRAINAGE DESIGN CRITERIA

3.1 Development Criteria References and Constraints

- Research was completed in an effort to obtain the DRAFT copy of the *City of Fort Lupton Comprehensive Plan, Section 8.0 STORM DRAINAGE SYSTEM*. The study is currently in progress and calculations are not available at this time
- *City of Fort Lupton Water, Wastewater and Storm Drainage Master Plan, Section 6 Storm Drainage System*, prepared by Rothberg, Tamburini & Winsor, Inc. in 1999, provided major basin and irrigation information as well as future concepts for the project area
- The *City of Fort Lupton Standards and Specifications for the Design and Construction of Public Improvements, 2014 Edition, Chapter 5 Storm Sewer System* provided local criteria
- The *City of Fort Lupton Storm Drainage Design and Technical Criteria* (CRITERIA) shall be the design criteria for the analysis and design of onsite storm drainage facilities
- The *Urban Drainage and Flood Control District's (UDFDC) Urban Storm Drainage Criteria Manual* was also used as a reference and guide for regional criteria
- The *Wastewater and Storm Drainage Master Plan, Section 6, South Drainage Basin* has proposed that all developments within the subject area of the City release storm water only at the 5-year historic level, including the storm generated by the 100-year event

3.2 Hydrologic Criteria

- Design rainfall is from *City of Fort Lupton Storm Drainage Design and Technical Criteria*, *Section 5 RAINFALL*

Event Occurrence	2 YR	5 YR	10 YR	50 YR	100 YR
1-hr. Rainfall Intensity (in/hr)	1.00	1.42	1.68	2.35	2.71

- Peak runoff rates for the final design of the Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots utilize the Rational Method Procedure
- Offisite runoff calculations utilized CUHP/SWMM as presented in the *Mountain Sky Subdivision Preliminary Drainage Report*
- The 5-year storm is the minor event for the development
- The 100-year storm is the major event for the development

3.3 Hydraulic Criteria

- The capacities of existing downstream storm sewer pipes or natural drainage ways should not be impacted by this development once local detention and storm sewer water quality pond facilities are constructed
- Upstream-offsite drainage basin will require similar detention/W.Q. ponds to attenuate peak flows to the 5-year historic release rate
- CUHP/SWMM modeling was used in the *Preliminary Drainage Report* to determine the peak runoff to the proposed onsite bypass channel
- Imperviousness for the future Site Basin was determined at 40% by interpolating the runoff coefficients 5-yr c=0.45 and 100-yr c=0.60
- Per the City of Fort Lupton's CRITERIA, the FAA method for Minor and Major Storm Storage Volumes was utilized to determine onsite detention
- On-site detention design is based upon the 5-year and 100-year storm frequencies with a 5 year historic release rate
- From the *Wastewater and Storm Drainage Master Plan,* the release rate for the major storm of the on-site detention pond has been restricted to the 5-year historic storm peak flow as shown in the *Preliminary Drainage Report*
- The proposed outlet structure constructed during Filing No. 1 will be sized for final build-out conditions for the minor and major storms but the vertical water quality outlet pipe shall be resized and replaced as each filing is constructed
- Since the runoff from the surface area of the proposed bypass channel cannot be captured and treated in the on-site detention pond, the minor and major storm release rates have been reduced proportionally

3.4 Adaptations or Variations of Criteria

- Maximum design depth of ponding in the major storm is greater than the CRITERIA requirement of 5 feet since the major storm is being restricted to the 5-year release rate (maximum ponding depth of one foot is needed to meet the required detention ponding needs for the site)

- Pond bottom sloped at 2% as opposed to CRITERIA's requirement of 3% slope (NOTE: could not achieve desired volume with the 3% criteria)

4.0 DRAINAGE FACILITY DESIGN

4.1 General Concept

- The proposed drainage system will continue to drain the project site from southeast to northwest following the existing drainage pattern
- As described in the *Preliminary Drainage Report*, it is not possible to create a regional detention pond on this site as proposed in the *Wastewater and Storm Drainage Master Plan*
- An on-site detention pond for the project and a bypass channel for offsite runoff considerations is being proposed for final buildout conditions to be installed during the construction of Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots (NOTE: additional ponding and water quality facilities will need to be constructed within upstream reaches as land development occurs)
- Excerpts from referenced criteria and reports are included in Appendix D

4.2 Specific Details

Site Runoff

- Six offsite sub-basins will affect the development of the site
  - OS-E, East Basin (east of site)
  - OS-N, North Basin (north of site)
  - OS, OS Basin (north of Highway 52)
  - OS-S, South Basin (south of CR 12)
  - OS-1, Tributary Area (single family homes southeast of site)
  - OS-2, Future Oil/Gas Development by Anadarko Petroleum Corporation (southwest of site)
- CUHP/SWMM was used in the *Preliminary Drainage Report* to determine the runoff from the larger offsite basins. OS-E, OS-N, OS and OS-S
- Rational Method was used to determine the smaller off-site basins, OS-1 and OS-2
- The offsite basin area and contributing flow is summarized in the following table:

Basin Name	Area (acres)	5-YR Runoff (cfs)	100-YR Runoff (cfs)
OS-E	825	90	643
OS-N	78.4	24	138
OS	110	43	239
OS-S	616	88	603
OS-1	2.66	4.1	10.3
OS-2	13.38	6.1	38.8

- Seven onsite basins:
  - Basin A, developed portion of Filing No. 1
  - Basin B, future filing south of Filing No. 1 draining to park area then pond
  - Basin C, future filing west of Filing No. 1 draining overland to pond
  - Basin D, future filing west of Basin C draining overland to pond
  - Basin E, onsite detention pond area
  - Basin F, onsite channel and drainage to channel to bypass detention pond
  - Basin R, roadside areas along CR12 and CR29 ½

- The onsite sub-basin area and contributing flow is summarized in the following table:

Basin Name	Area (acres)	5-YR Runoff (cfs)	100-YR Runoff (cfs)
A1	2.81	3.7	9.5
A2	0.64	1.1	2.9
A3	3.17	4.5	11.4
A4	1.29	2.3	5.9
A5	0.93	1.7	4.2
B1	0.76	1.9	4.6
B2	3.42	6.2	15.7
B3	0.74	1.3	3.4
B4	1.50	1.4	5.0
B5	1.61	2.5	6.4
B6	2.96	5.0	12.8
B7	2.73	4.2	10.6
B8	1.99	2.9	7.3
B9	3.32	2.9	10.1
C1	1.24	2.3	5.8
C2	2.14	3.6	8.9
C3	1.41	2.3	5.8
C4	2.83	3.9	10.4
D1	1.45	2.7	7.0
D2	3.48	3.2	10.4
D3	1.14	1.9	4.8
D4	1.29	2.1	5.5
E1	0.39	0.8	2.0
E2	2.56	4.0	10.1
F1	0.48	1.2	2.9
F2	8.69	5.9	20.4
P1	6.38	11.7	28.2
R1	0.73	1.9	4.1

R2	0.79	1.7	4.1
R3	0.79	1.9	4.5
R4	0.48	1.3	3.1
R5	1.24	1.1	4.0

- Runoff from the onsite and offsite basins drains either directly or indirectly to the lowpoint of the site at DP34, totalling the above mentioned 1700 acres.
- Sub-basins OS-E, OS-N, OS and OS-S contribute off-site drainage as calculated in the *Mountain Sky Subdivision Preliminary Drainage Report* as displayed in the Overall Drainage Exhibit located in Appendix A of this report
- See Appendix B for composite c-factors, times of concentration and rational method calculations for Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots

Street and Inlet Capacities

- Road capacities for CR29 ½, the entry drive from CR29 ½ and residential streets are enclosed is Appendix C
- Inlet capacity and carry-over calculations can be found in Appendix C

Storm Drain System

- The storm drainage system for Mountain Sky Subdivision, Filing No. 1 with +/- 45 Residential Lots will consist of storm sewer for onsite runoff, a bypass channel for offsite runoff, and culverts under CR29 ½ for the Fulton Ditch and runoff from off-site basin OS-E
- One flared end section (FES) will be installed at DP 25 which ties into one the two inlets (DP 26 and DP 27) not being utilized during this phase
- The FES at DP 25 will capture stormwater runoff from onsite undeveloped areas and route runoff to the pond for water quality and detention
- There will be a storm stub at the Filing No. 1 phase line at DP 17 that will also capture stormwater runoff from the onsite undeveloped areas from the southeastern portion of the site
- The onsite bypass channel is sized to carry the 100-yr undeveloped runoff from off-site basins as determined by the CUHP/SWMM model presented in the *Preliminary Drainage Report*
- Two culverts under CR29 ½ will be constructed during Filing No. 1 (culvert for Fulton Ditch and culvert for the Off-Site East Basin Drainage)
- Flows for the Fulton Ditch were not made available to Calibre – the culvert was sized to match the hydraulic capacity of the existing ditch section
- The Fulton Ditch culvert shall be sized for the current ditch cross section and slope
- The culvert for the OS-E basin runoff is sized to carry the 100-yr undeveloped flow as determined by the CUHP/SWMM model presented in the *Preliminary Drainage Report*

Detention Pond

- The Detention Pond is being constructed for water quality and detention purposes for on-site basins only using the FAA method per the City of Fort Lupton's CRITERIA
- A 3-stage outlet structure and emergency overflow weir will be constructed in the pond (water quality, 5-year release and 100-yr release)
- A 5-year orifice will be constructed for final build-out conditions within the structure to release the 5-year developed runoff at the 5-year historic rate
    - The release rate for the 100-yr runoff is restricted to 5-yr historic flow for captured stormwater by installing a restrictor plate in the outlet structure
    - Even though the 5-year orifice will not be necessary since the restrictor plate is utilized to release runoff at the 5-year historic rate, it is being installed so the restrictor plate can be adjusted during future filing before final buildout conditions
- To avoid multiple modifications to the pond, it has been sized for the future buildout of the entire Mountain Sky Subdivision.
- During the construction of future filings, the water quality outlet pipe and restrictor plate will be replaced for interim conditions until full buildout conditions have been achieved
- Anadarko will be responsible for water quality and detention for their 15.7-acre parcel including half of CR 29 to their parcel. Runoff from Basin OS-2, (future development of Parcel F), will not be captured or treated for water quality
- The Mountain Sky Subdivision parcel consists of 61.2 acres (76.9 acres platted area less Anadarko's 15.7-acre parcel)
- The pond can only capture runoff from 55.25 acres due to grading restrictions related to the 6.4-acre grass-lined bypass channel (Note: 55.25 acres of captured runoff + 6.4 acres of bypass channel is greater than the 61.2-acre subdivision parcel due to capturing stormwater runoff from Basins OS-1, a developed single-family lot currently in use)
- The pond's release rate has been adjusted to reduce the runoff rate below the 5-year historic rate of 0.13 cfs/acre since runoff from the entire Mountain Sky Subdivision cannot be completely captured in the onsite detention pond
- See Appendix C for pond and outlet structure calculations

5.0 SUMMARY

5.1 Compliance with Standards

- This report is in general accordance with the *City of Fort Lupton Storm Drainage Design and Technical Criteria*
- This report is in general accordance, where applicable and not superseded by other criteria, to the *Urban Drainage and Flood Control District's Urban Storm Drainage Criteria Manual* (USDCM)

- This report is in general accordance with FEMA; there are no known regulatory floodplains within the site boundary

5.2 Drainage Concept

- Runoff from the site will be conveyed via onsite drainage swales, a street curb, gutter, and paving, and a storm sewer system to the proposed detention pond
- Runoff from off-site will be directed around or through the site via swales, ditches and channels to the Shortline Ditch which currently receives this upstream runoff
- During future development, it will be possible to pipe the runoff from the proposed channel in a southerly direction to connect to proposed storm sewer in CR12
- Downstream properties should not be affected by the development of the proposed site; the detention pond will provide the appropriate onsite detention to control the major and minor storm releases from the development

5.3 Standard Statement 1

The developer, vis contractual agreements with his consultant(s) is responsible for obtaining any and all permits, licenses, and any other documentation/correspondence that are necessary to address any additional issues such as wetlands, floodplains, irrigation facilities, groundwater dewatering, and protection of existing utilities. See Page 2 for Engineer's signed statement.

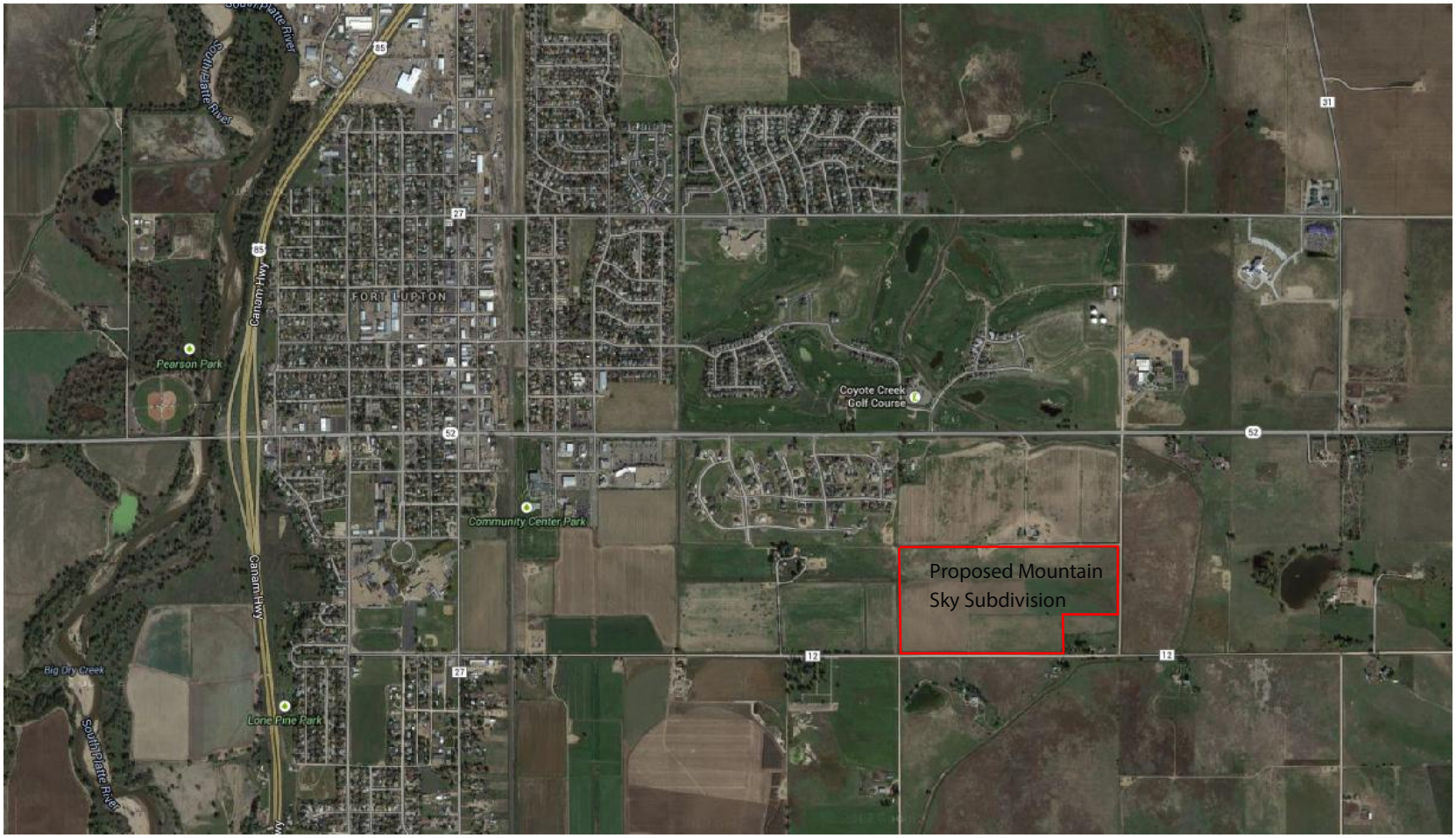
6.0 LIST OF REFERENCES

1. *City of Fort Lupton Storm Drainage Design and Technical Criteria* (CRITERIA)
2. DRAFT copy of the *City of Fort Lupton Comprehensive Plan, Section 8.0 STORM DRAINAGE SYSTEM*, prepared by Clear Water Solutions, Inc., 2014
3. *City of Fort Lupton Water, Wastewater and Storm Drainage Master Plan, Section 6 Storm Drainage System*, prepared by Rothberg, Tamburini & Winsor, Inc., 1999
4. *City of Fort Lupton Standards and Specifications for the Design and Construction of Public Improvements, 2014 Edition, Chapter 5 Storm Sewer System*
5. *Urban Storm Drainage Criteria Manual, Volumes 1, 2 & 3*, Urban Drainage Flood Control District

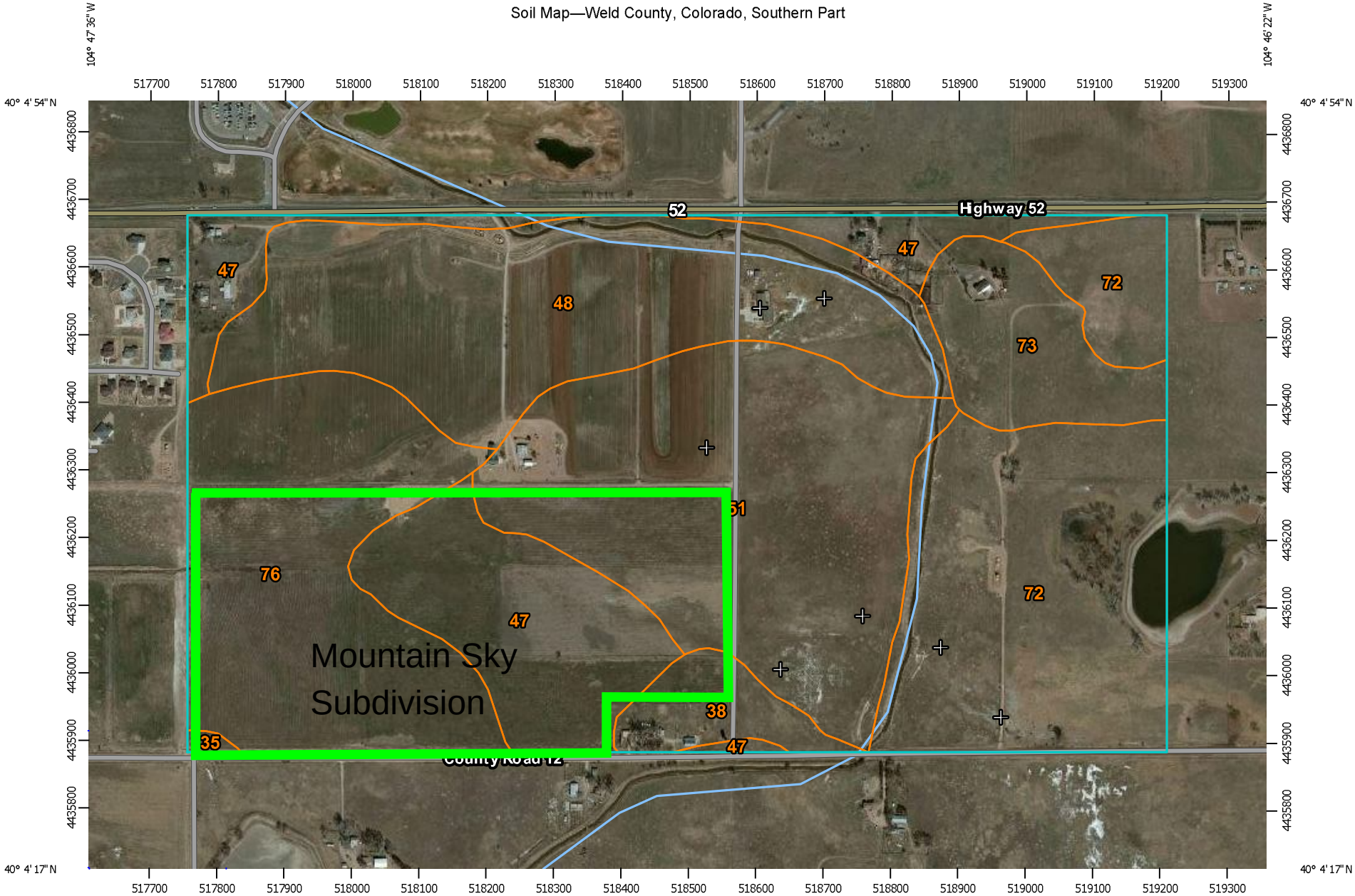
APPENDIX A

MAPS AND EXHIBITS

VICINITY MAP



Soil Map—Weld County, Colorado, Southern Part



Map Scale: 1:7,990 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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

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: http://websoilsurvey.nrcs.usda.gov
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: Weld County, Colorado, Southern Part
Survey Area Data: Version 12, Jan 3, 2014

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

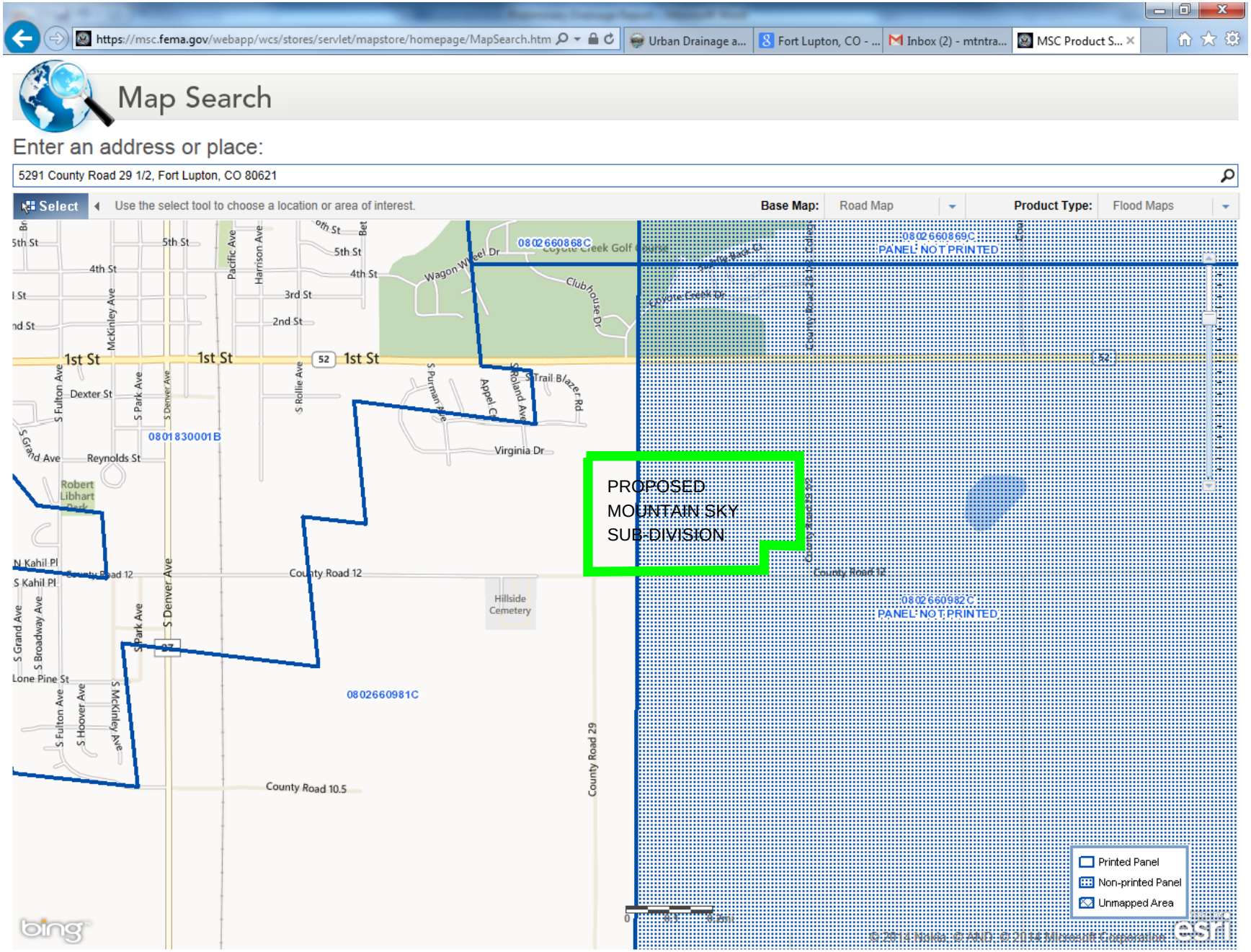
Date(s) aerial images were photographed: Apr 22, 2011—Apr 13, 2012

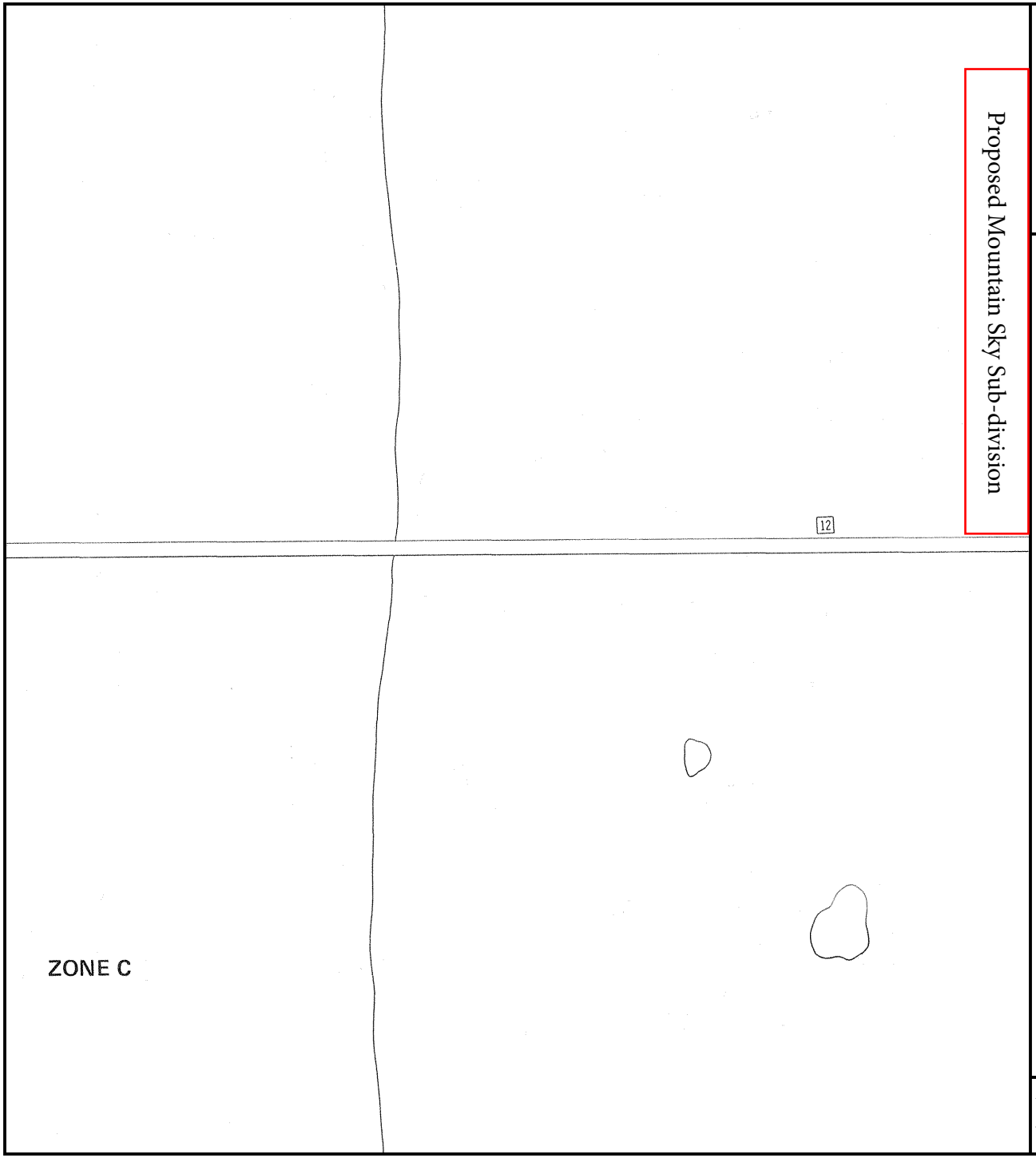
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Weld County, Colorado, Southern Part (CO618)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
35 Hydrologic Soil Group D	Loup-Boel loamy sands, 0 to 3 percent slopes	0.5	0.2%
38 Hydrologic Soil Group C	Nelson fine sandy loam, 3 to 9 percent slopes	7.8	2.7%
47 Hydrologic Soil Group B	Olney fine sandy loam, 1 to 3 percent slopes	38.1	13.3%
48 Hydrologic Soil Group B	Olney fine sandy loam, 3 to 5 percent slopes	57.2	20.0%
51 Hydrologic Soil Group B	Otero sandy loam, 1 to 3 percent slopes	61.8	21.6%
72 Hydrologic Soil Group B	Vona loamy sand, 0 to 3 percent slopes	56.0	19.6%
73 Hydrologic Soil Group B	Vona loamy sand, 3 to 5 percent slopes	15.9	5.5%
76 Hydrologic Soil Group B	Vona sandy loam, 1 to 3 percent slopes	49.0	17.1%
Totals for Area of Interest		**286.2**	**100.0%**

FEMA MAP PANELS





APPROXIMATE SCALE

500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

WELD COUNTY, COLORADO
UNINCORPORATED AREA

PANEL 981 OF 1075
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
080266 0981 C

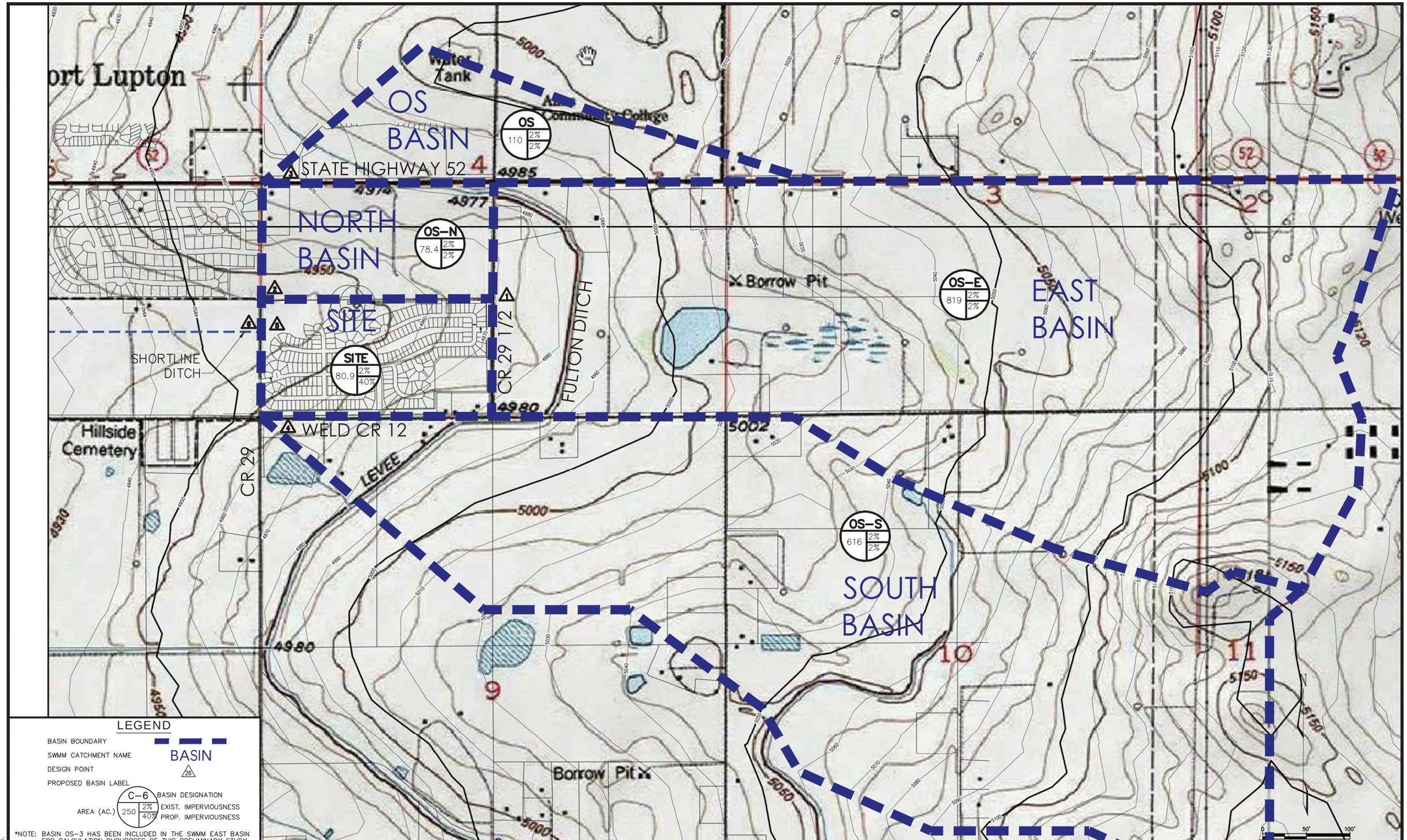
MAP REVISED:
SEPTEMBER 28, 1982

federal emergency management agency

federal insurance administration

"F" FRAME

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



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DATE	REVISION DESCRIPTION
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	4
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	2
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Drawing Name: 11OD.dwg
Job Number:
Prepared For: ROKEH CONSULTING, LLC

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1 inch = 500 ft. Horizontal
1 inch = 0 ft Vertical

Designer	Drafter	Checked
TAW	TAW	GVM

NORTH

Calibre
Calibre Engineering, Inc.
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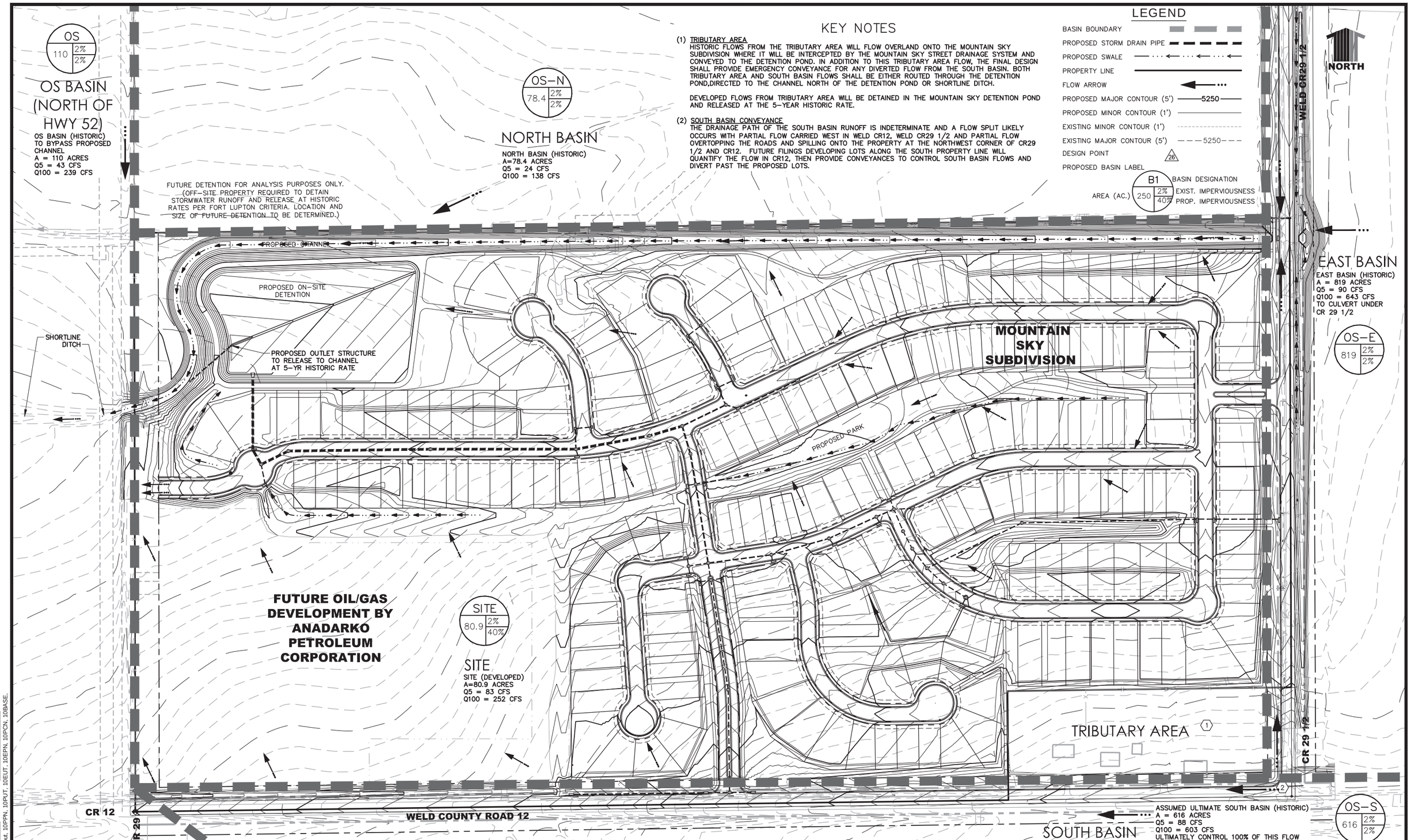
Highlands Ranch, CO 80129 (303) 730-0434
www.calibre-engineering.com
Construction Management Civil Engineering Surveying

MOUNTAIN SKY SUBDIVISION
DRAINAGE ANALYSIS
OVERALL DRAINAGE MAP

Sheet E-OD 1 of 2

Date 23 FEBRUARY 2016



KEY NOTES

(1) TRIBUTARY AREA
HISTORIC FLOWS FROM THE TRIBUTARY AREA WILL FLOW OVERLAND ONTO THE MOUNTAIN SKY SUBDIVISION WHERE IT WILL BE INTERCEPTED BY THE MOUNTAIN SKY STREET DRAINAGE SYSTEM AND CONVEYED TO THE DETENTION POND. IN ADDITION TO THIS TRIBUTARY AREA FLOW, THE FINAL DESIGN SHALL PROVIDE EMERGENCY CONVEYANCE FOR ANY DIVERTED FLOW FROM THE SOUTH BASIN. BOTH TRIBUTARY AREA AND SOUTH BASIN FLOWS SHALL BE EITHER ROUTED THROUGH THE DETENTION POND,DIRECTED TO THE CHANNEL NORTH OF THE DETENTION POND OR SHORTLINE DITCH.

DEVELOPED FLOWS FROM TRIBUTARY AREA WILL BE DETAINED IN THE MOUNTAIN SKY DETENTION POND AND RELEASED AT THE 5-YEAR HISTORIC RATE.

(2) SOUTH BASIN CONVEYANCE
THE DRAINAGE PATH OF THE SOUTH BASIN RUNOFF IS INDETERMINATE AND A FLOW SPLIT LIKELY OCCURS WITH PARTIAL FLOW CARRIED WEST IN WELD CR12, WELD CR29 1/2 AND PARTIAL FLOW OVERTOPPING THE ROADS AND SPILLING ONTO THE PROPERTY AT THE NORTHWEST CORNER OF CR29 1/2 AND CR12. FUTURE FILINGS DEVELOPING LOTS ALONG THE SOUTH PROPERTY LINE WILL QUANTIFY THE FLOW IN CR12, THEN PROVIDE CONVEYANCES TO CONTROL SOUTH BASIN FLOWS AND DIVERT PAST THE PROPOSED LOTS.

LEGEND

- BASIN BOUNDARY
- PROPOSED STORM DRAIN PIPE
- PROPOSED SWALE
- PROPERTY LINE
- FLOW ARROW
- PROPOSED MAJOR CONTOUR (5') — 5250
- PROPOSED MINOR CONTOUR (1')
- EXISTING MINOR CONTOUR (1')
- EXISTING MAJOR CONTOUR (5') — 5250
- DESIGN POINT — 26
- PROPOSED BASIN LABEL — B1 — BASIN DESIGNATION
- AREA (AC.) — 250 — 2% EXIST. IMPERVIOUSNESS — 40% PROP. IMPERVIOUSNESS

PATH: P:\EQUINOX MTN SKY\CADD\CIVIL\DRN\12DR-PR.DWG
PLOTTED BY: Tracey Wise PLOT DATE: 2/19/2016 12:18 PM
XREFS: w-PUT-Full Buildout, 10PPN, 10PUT, 10EUT, 10EPN, 10PCN, 10BASE,

DATE	REVISION DESCRIPTION
	6
	5
	4
	3
	2
	1

Drawing Name: 12DR-PR.dwg
Job Number: EQNX MTN SKY
Prepared For: EQUINOX LAND GROUP

0 50 100 200
1 inch = 100 ft. Horizontal
1 inch = 0 ft Vertical

Designer	Drafter	Checked
TAW	TAW	GLP

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www.calibre-engineering.com
Construction Management Civil Engineering Surveying

MOUNTAIN SKY SUBDIVISION
DRAINAGE ANALYSIS
PROPOSED OVERALL SITE DRAINAGE

Sheet P-OD 2 of 2
Date 23 FEBRUARY 2016

KEY NOTES

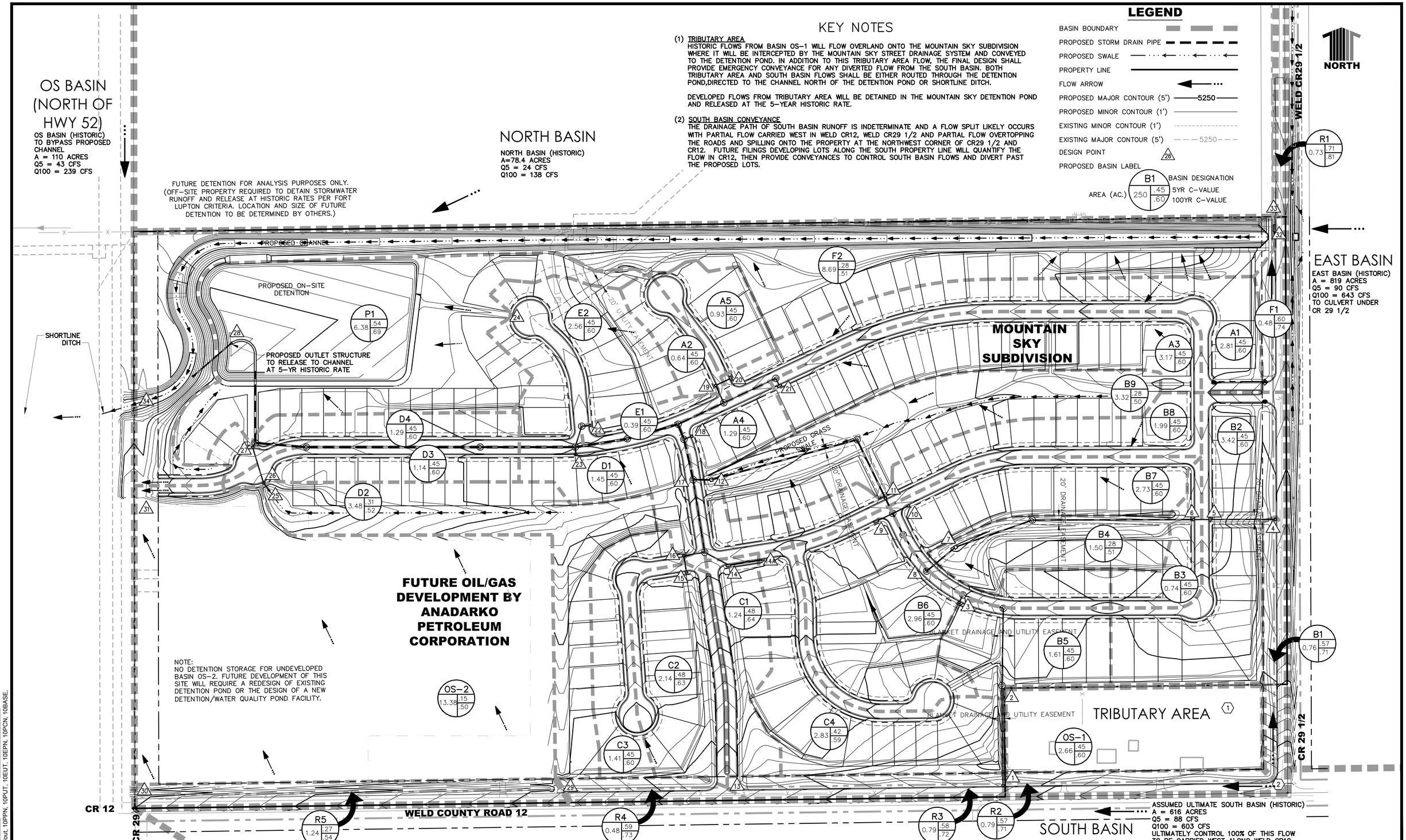
(1) TRIBUTARY AREA
HISTORIC FLOWS FROM BASIN OS-1 WILL FLOW OVERLAND ONTO THE MOUNTAIN SKY SUBDIVISION WHERE IT WILL BE INTERCEPTED BY THE MOUNTAIN SKY STREET DRAINAGE SYSTEM AND CONVEYED TO THE DETENTION POND. IN ADDITION TO THIS TRIBUTARY AREA FLOW, THE FINAL DESIGN SHALL PROVIDE EMERGENCY CONVEYANCE FOR ANY DIVERTED FLOW FROM THE SOUTH BASIN. BOTH TRIBUTARY AREA AND SOUTH BASIN FLOWS SHALL BE EITHER ROUTED THROUGH THE DETENTION POND,DIRECTED TO THE CHANNEL NORTH OF THE DETENTION POND OR SHORTLINE DITCH.

DEVELOPED FLOWS FROM TRIBUTARY AREA WILL BE DETAINED IN THE MOUNTAIN SKY DETENTION POND AND RELEASED AT THE 5-YEAR HISTORIC RATE.

(2) SOUTH BASIN CONVEYANCE
THE DRAINAGE PATH OF SOUTH BASIN RUNOFF IS INDETERMINATE AND A FLOW SPLIT LIKELY OCCURS WITH PARTIAL FLOW CARRIED WEST IN WELD CR12, WELD CR29 1/2 AND PARTIAL FLOW OVERTOPPING THE ROADS AND SPILLING ONTO THE PROPERTY AT THE NORTHWEST CORNER OF CR29 1/2 AND CR12. FUTURE FILINGS DEVELOPING LOTS ALONG THE SOUTH PROPERTY LINE WILL QUANTIFY THE FLOW IN CR12, THEN PROVIDE CONVEYANCES TO CONTROL SOUTH BASIN FLOWS AND DIVERT PAST THE PROPOSED LOTS.

LEGEND

- BASIN BOUNDARY
- PROPOSED STORM DRAIN PIPE
- PROPOSED SWALE
- PROPERTY LINE
- FLOW ARROW
- PROPOSED MAJOR CONTOUR (5') — 5250
- PROPOSED MINOR CONTOUR (1')
- EXISTING MINOR CONTOUR (1')
- EXISTING MAJOR CONTOUR (5') — 5250
- DESIGN POINT (26)
- PROPOSED BASIN LABEL: B1 — BASIN DESIGNATION; AREA (AC.) 250; .45 5YR C-VALUE; .60 100YR C-VALUE



DATE	REVISION DESCRIPTION
	6
	5
	4
	3
	2
	1

Drawing Name: 20DR-P-OD.dwg
Job Number: EQNX MTN SKY
Prepared For: EQUINOX LAND GROUP
Designer: TAW | Drafter: TAW | Checked: GLP
0 50 100 200
1 inch = 100 ft. Horizontal
1 inch = 0 ft Vertical

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MOUNTAIN SKY SUBDIVISION
DRAINAGE ANALYSIS
PROPOSED OVERALL SITE DRAINAGE

Sheet **P-OD** 2 of 2
Date 12 FEBRUARY 2016

PATH: P:\EQUINOX MTN SKY\CADD\CIVIL\DRN\20DR-P-OD.DWG
PLOTTED BY: Tyler Robinson PLOT DATE: 6/29/2016 3:01 PM
XREFS: w-PUT-Full Buildout, 10PPN, 10PUT, 10EUT, 10EPN, 10PCN, 10BASE,
P:\EQUINOX MTN SKY\CADD\CIVIL\DRN\20DR-P-OD.dwg, 6/29/2016 3:01:05 PM, TRobinson, 1:1

APPENDIX B

HYDROLOGIC COMPUTATIONS

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COMPOSITE 'C' FACTORS - EXISTING CONDITIONS

PROJECT: EQUINOX MTN SKY LOCATION: CITY OF FORT LUPTON DATE : 2/5/2016

BASIN	AREAS (ACRES)							SOIL	UNDEV			PAVED			GRAVEL ROAD			SINGLE FAMILY			DRIVES & WALKS			LAWN & PARK			COMP. C FACTOR		
DESIGNATION	UNDEV	PAVED	GRAVEL ROAD	SINGLE FAMILY	DRIVES & WALKS	LAWN & PARK	TOTAL	TYPE	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR
A1	60.38	0.00	0.00	0.00	0.00	0.00	60.38	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	2.00	0.15	0.50
OS-1	0.00	0.00	0.00	3.65	0.00	0.00	3.65	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
OS-2	14.95	0.00	0.00	0.00	0.00	0.00	14.95	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	2.00	0.15	0.50
R1	0.00	0.00	0.08	0.00	0.00	0.00	0.08	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
R2	0.00	0.00	0.84	0.00	0.00	0.00	0.84	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
R3	0.00	0.00	0.79	0.00	0.00	0.00	0.79	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
OS-E	825	0.00	0.00	0.00	0.00	0.00	825	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	2.00	0.15	0.50
OS-N	78.4	0.00	0.00	0.00	0.00	0.00	78.4	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	2.00	0.15	0.50
OS	110	0.00	0.00	0.00	0.00	0.00	110	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	2.00	0.15	0.50
OS-S	616	0.00	0.00	0.00	0.00	0.00	616	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	2.00	0.15	0.50
	1,705	**0.00**	**1.71**	**3.65**	**0.00**	**0.00**	**1,710**		**2**	**0.15**	**0.50**	**100**	**0.88**	**0.93**	**40**	**0.45**	**0.60**	**40**	**0.45**	**0.60**	**96**	**0.87**	**0.89**	**7**	**0.18**	**0.45**	**2.12**	**0.15**	**0.50**

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TIME OF CONCENTRATION - EXISTING CONDITIONS

PROJECT: EQUINOX MTN SKY PHASE III LOCATION: CITY OF FORT LUPTON DATE: 2/5/2016

BASIN DATA			INIT./OVERLAND TIME (Ti)			TRAVEL TIME (Tt)										TOTAL	Tc Check		FINAL Tc
DESIGNATION	C_5	AREA (AC)	LENGTH (FT)	SLOPE %	Ti (Min.)*	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	Ti+Tt(Min.)	LENGTH (FT)	Urbanized Basins Tc = (L/180) + 10	(minutes)
A1	0.15	60.4	225	2.2	19.7	GRASS	1260	1.4	1.8	11.8	GRASS	1470	1.10	1.6	15.6	47.1	2955.00	26.4	26.4
OS-1	0.45	3.65	50	3.0	5.7	GRASS	150	3.0	2.6	1.0						6.7	200.00	11.1	6.7
OS-2	0.15	15.0	120	3.0	13.0	GRASS	700	2.0	2.1	5.5						18.5	820.00	14.6	14.6
R1	0.45	0.08	50	2.0	6.6	GRASS	600	2.0	2.1	4.7	GRASS	370	1.00	1.5	4.1	15.4	1020.00	15.7	15.4
R2	0.45	0.84	50	2.0	6.6	GRASS	600	2.0	2.1	4.7						11.3	650.00	13.6	11.3
R3	0.45	0.79	50	2.0	6.6	GRASS	600	2.0	2.1	4.7						11.3	650.00	13.6	11.3
		76.96																	

FORMULAS:

* $Ti = 1.8*(1.1-C_5)L^{1/2}/S^{1/3}$

** V=Cv(Sw^1/2)
where Cv=15 for grassed waterways and 20 for paved areas

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

DESIGN STORM: 5-YEAR EXISTING

PROJECT: EQUINOX MTN SKY

LOCATION: CITY OF FORT LUPTON

STRUCTURE			DIRECT RUNOFF						TOTAL RUNOFF								
STRUCTURE	DESIGN POINT	BASINS AND DESIGN POINT	AREA (AC)	COEFF. (C)	Tc (Min.)	Summation C*A	I (in./hr.)	RATIONAL Q (cfs)	PIPE SIZE (in)	Q IN PIPE U/S (cfs)	Q in CHANNEL (cfs)	SLOPE (%)	LENGTH (ft)	VELOCITY (fps)	Tt (min)		REMARKS
	1	OS-E	825								90						OVERLAND FLOW FROM CUHP/SWMM
	2	OS-N	78								24						OVERLAND FLOW FROM CUHP/SWMM
	3	OS	110								43						OVERLAND FLOW FROM CUHP/SWMM
	4	OS-S	616								88						OVERLAND FLOW FROM CUHP/SWMM
	5	OS-1	3.65	0.45	6.7	1.64	4.5	7.4									SINGLE FAMILY HOME
	6	OS-2	14.95	0.15	14.6	2.24	3.4	7.6									UNDEVELOPED
	10	A1	60.38	0.15	26.4	9.06	2.5	22.6									UNDEVELOPED
	11	R1	0.08	0.45	15.4	3.89	3.3	12.8									EXIST. ROADSIDE DITCH
	12	R2	0.84	0.45	11.3	0.38	3.8	1.4									EXIST. ROADSIDE DITCH
	13	R3	0.79	0.45	11.3	4.26	3.8	16.0									EXIST. ROADSIDE DITCH

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

DESIGN STORM: 100-YEAR EXISTING

PROJECT: EQUINOX MTN SKY

LOCATION: CITY OF FORT LUPTON

STRUCTURE			DIRECT RUNOFF						TOTAL RUNOFF								
STRUCTURE	DESIGN POINT	BASINS AND DESIGN POINT	AREA (AC)	COEFF. (C)	Tc (Min.)	Summation C*A	I (in./hr.)	RATIONAL Q (cfs)	PIPE SIZE (in)	Q IN PIPE U/S (cfs)	Q in CHANNEL (cfs)	SLOPE (%)	LENGTH (ft)	VELOCITY (fps)	Tt (min)		REMARKS
	1	OS-E	825								643						OVERLAND FLOW FROM CUHP/SWMM
	2	OS-N	78								138						OVERLAND FLOW FROM CUHP/SWMM
	3	OS	110								239						OVERLAND FLOW FROM CUHP/SWMM
	4	OS-S	616								603						OVERLAND FLOW FROM CUHP/SWMM
	5	OS-1	3.65	0.50	6.7	1.83	8.7	16.0									SINGLE FAMILY HOME
	6	OS-2	14.95	0.60	14.6	8.97	6.5	58.7									UNDEVELOPED
	10	A1	60.38	0.50	26.4	30.19	4.9	147.3									UNDEVELOPED
	11	R1	0.08	0.60	15.4	10.80	6.4	68.8									EXIST. ROADSIDE DITCH
	12	R2	0.84	0.60	11.3	0.50	7.3	3.7									EXIST. ROADSIDE DITCH
	13	R3	0.79	0.60	11.3	11.30	7.3	82.3									EXIST. ROADSIDE DITCH

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COMPOSITE 'C' FACTORS - FILING NO. 1

PROJECT: EQUINOX MTN SKY | LOCATION: CITY OF FORT LUPTON | DATE : 6/29/2016

BASIN	AREAS (ACRES)							SOIL	UNDEV			PAVED			GRAVEL ROAD			SINGLE FAMILY			DRIVES & WALKS			LAWN & PARK			COMP. C FACTOR		
DESIGNATION	UNDEV	PAVED	GRAVEL ROAD	SINGLE FAMILY	DRIVES & WALKS	LAWN & PARK	TOTAL	TYPE	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR	%I	5 YR	100 YR
FILING 1																													
A1	0.00	0.00	0.00	2.81	0.00	0.00	2.81	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
A2	0.00	0.00	0.00	0.64	0.00	0.00	0.64	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
A3	0.00	0.00	0.00	3.17	0.00	0.00	3.17	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
A4	0.00	0.00	0.00	1.29	0.00	0.00	1.29	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
A5	0.00	0.00	0.00	0.93	0.00	0.00	0.93	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
B1	0.00	0.34	0.00	0.00	0.08	0.34	0.76	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	57.97	0.57	0.71
B2	0.00	0.00	0.00	3.42	0.00	0.00	3.42	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
B3	0.00	0.00	0.00	0.74	0.00	0.00	0.74	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
B4	0.00	0.00	0.00	0.57	0.00	0.93	1.50	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	19.54	0.28	0.51
B5	0.00	0.00	0.00	1.61	0.00	0.00	1.61	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
B6	0.00	0.00	0.00	2.96	0.00	0.00	2.96	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
B7	0.00	0.00	0.00	2.73	0.00	0.00	2.73	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
B8	0.00	0.00	0.00	1.99	0.00	0.00	1.99	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
B9	0.00	0.00	0.00	1.21	0.00	2.11	3.32	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	19.03	0.28	0.50
C1	0.00	0.24	0.00	0.46	0.11	0.43	1.24	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	45.14	0.48	0.64
C2	0.00	0.24	0.00	1.48	0.11	0.31	2.14	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	44.83	0.48	0.63
C3	0.00	0.00	0.00	1.41	0.00	0.00	1.41	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
C4	0.00	0.00	0.00	2.55	0.00	0.28	2.83	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	36.73	0.42	0.59
D1	0.00	0.00	0.00	1.45	0.00	0.00	1.45	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
D2	0.00	0.00	0.00	1.66	0.00	1.82	3.48	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	22.74	0.31	0.52
D3	0.00	0.00	0.00	1.14	0.00	0.00	1.14	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
D4	0.00	0.00	0.00	1.29	0.00	0.00	1.29	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
E1	0.00	0.00	0.00	0.39	0.00	0.00	0.39	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
E2	0.00	0.00	0.00	2.56	0.00	0.00	2.56	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
F1	0.00	0.25	0.00	0.00	0.04	0.19	0.48	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	62.85	0.60	0.74
F2	0.00	0.00	0.00	1.56	0.64	6.49	8.69	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	19.48	0.28	0.51
OS-1	0.00	0.00	0.00	2.66	0.00	0.00	2.66	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	40.00	0.45	0.60
OS-2	13.38	0.00	0.00	0.00	0.00	0.00	13.38	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	2.00	0.15	0.50
P1	0.00	2.44	0.45	1.60	0.09	1.80	6.38	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	54.43	0.54	0.69
R1	0.00	0.55	0.00	0.00	0.00	0.18	0.73	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	77.07	0.71	0.81
R2	0.00	0.36	0.00	0.00	0.08	0.35	0.79	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	58.39	0.57	0.71
R3	0.00	0.36	0.00	0.00	0.09	0.34	0.79	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	59.52	0.58	0.72
R4	0.00	0.23	0.00	0.00	0.05	0.20	0.48	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	60.83	0.59	0.73
R5	0.74	0.00	0.50	0.00	0.00	0.00	1.24	B	2	0.15	0.50	100	0.88	0.93	40	0.45	0.60	40	0.45	0.60	96	0.87	0.89	7	0.18	0.45	17.32	0.27	0.54
ON SITE	**14.12**	**5.01**	**0.95**	**44.28**	**1.29**	**15.77**	**81.42**		**2**	**0.15**	**0.50**	**100**	**0.88**	**0.93**	**40**	**0.45**	**0.60**	**40**	**0.45**	**0.60**	**96**	**0.87**	**0.89**	**7**	**0.18**	**0.45**	**31.60**	**0.38**	**0.58**
OS-E	825						825																						
OS-N	78.4						78.4																						
OS	110						110																						
OS-S	616						616																						
OFF SITE	**1,629**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1,629**		**2**	**0.15**	**0.50**	**100**	**0.88**	**0.93**	**40**	**0.45**	**0.60**	**40**	**0.45**	**0.60**	**96**	**0.87**	**0.89**	**7**	**0.18**	**0.45**	**2.00**	**0.15**	**0.50**

Calibre

TIME OF CONCENTRATION - FILING NO. 1

PROJECT: EQUINOX MTN SKY | PHASE III | LOCATION: CITY OF FORT LUPTON | DATE: 6/29/2016

FORMULAS:

* $Ti = 1.8*(1.1-C_5)L^{1/2}/S^{1/3}$

** V=Cv(Sw^1/2)

BASIN DATA			INIT./OVERLAND TIME (Ti)			TRAVEL TIME (Tt)										TOTAL	Tc Check		FINAL Tc
DESIGNATION	C_5	AREA (AC)	LENGTH (FT)	SLOPE %	Ti (Min.)*	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	GRASS/ PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	Ti+Tt(Min.)	LENGTH (FT)	Urbanized Basins Tc = (L/180) + 10	(minutes)
FILING 1																			
A1	0.45	2.81	107	2.9	8.4	PAVED	1298	0.9	1.9	11.2						19.6	1405.00	17.8	17.8
A2	0.45	0.64	60	2.5	6.7	PAVED	273	0.7	1.6	2.8						9.5	333.00	11.9	9.5
A3	0.45	3.17	63	2.3	7.0	PAVED	1067	1.0	2.0	8.8						15.8	1130.00	16.3	15.8
A4	0.45	1.29	57	2.5	6.5	PAVED	435	2.0	2.8	2.6						9.1	492.00	12.7	9.1
A5	0.45	0.93	57	2.5	6.5	PAVED	256	0.6	1.6	2.7						9.2	313.00	11.7	9.2
B1	0.57	0.76	26	3.9	3.1	PAVED	563	1.9	2.8	3.4						6.5	589.00	13.3	6.5
B2	0.45	3.42	28	3.8	4.0	PAVED	659	1.2	2.2	5.0						8.9	687.00	13.8	8.9
B3	0.45	0.74	67	2.5	7.1	PAVED	350	2.2	2.9	2.0						9.0	417.00	12.3	9.0
B4	0.28	1.50	104	6.3	8.1	GRASS	473	0.5	1.1	7.4						15.5	577.00	13.2	13.2
B5	0.45	1.61	153	2.5	10.7	PAVED	340	1.6	2.5	2.3						12.9	493.00	12.7	12.7
B6	0.45	2.96	41	2.5	5.5	PAVED	786	1.8	2.7	4.9						10.4	827.00	14.6	10.4
B7	0.45	2.73	75	2.5	7.5	PAVED	646	0.8	1.8	6.1						13.5	721.00	14.0	13.5
B8	0.45	1.99	75	2.5	7.5	PAVED	839	0.8	1.8	7.8						15.2	914.00	15.1	15.1
B9	0.28	3.32	42	2.0	7.6	PAVED	979	1.0	2.0	8.3						15.9	1021.00	15.7	15.7
C1	0.48	1.24	127	4.0	8.0	PAVED	404	2.6	3.2	2.1						10.0	531.00	13.0	10.0
C2	0.48	2.14	187	3.8	9.8	PAVED	425	1.5	2.4	2.9						12.7	612.00	13.4	12.7
C3	0.45	1.41	102	4.4	7.2	PAVED	574	1.1	2.1	4.5						11.7	676.00	13.8	11.7
C4	0.42	2.83	174	4.7	9.6	PAVED	775	1.8	2.7	4.9						14.4	949.00	15.3	14.4
D1	0.45	1.45	50	5.4	4.7	PAVED	468	1.6	2.5	3.1						7.8	518.00	12.9	7.8
D2	0.31	3.48	80	2.2	9.8	GRASS	1227	1.8	2.0	10.3						20.1	1307.00	17.3	17.3
D3	0.45	1.14	57	2.5	6.5	PAVED	517	0.8	1.8	4.8						11.3	574.00	13.2	11.3
D4	0.45	1.29	56	2.5	6.5	PAVED	502	0.8	1.8	4.6						11.0	558.00	13.1	11.0
E1	0.45	0.39	21	2.5	4.0	PAVED	277	0.9	1.9	2.5						6.4	298.00	11.7	6.4
E2	0.45	2.56	216	1.6	14.8	PAVED	338	0.8	1.7	3.3						18.0	554.00	13.1	13.1
F1	0.60	0.48	35	2.0	4.2	PAVED	299	0.7	1.6	3.0						7.2	334.00	11.9	7.2
F2	0.28	8.69	192	7.4	10.5	GRASS	2718	0.7	1.2	36.9						47.4	2910.00	26.2	26.2
OS-1	0.45	2.66	100	1.0	11.7	PAVED	510	1.5	2.4	3.5						15.2	610.00	13.4	13.4
OS-2	0.15	13.38	221	2.6	18.4	GRASS	1024	1.7	2.0	8.7						27.1	1245.00	16.9	16.9
P1	0.54	6.38	167	3.3	8.7	GRASS	553	1.5	1.9	5.0						13.7	720.00	14.0	13.7
R1	0.71	0.73	50	1.9	4.1	PAVED	1219	1.9	2.7	7.5						11.5	1269.00	17.1	11.5
R2	0.57	0.79	31	2.0	4.2	PAVED	584	0.7	1.6	5.9						10.1	615.00	13.4	10.1
R3	0.58	0.79	39	3.4	3.9	PAVED	593	1.2	2.2	4.5						8.4	632.00	13.5	8.4
R4	0.59	0.48	46	3.5	4.1	PAVED	278	1.6	2.5	1.8						6.0	324.00	11.8	6.0
R5	0.27	1.24	52	5.7	6.0	GRASS	952	1.2	1.6	9.8						15.8	1004.00	15.6	15.6

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
DESIGN STORM: 5-YEAR, FILING NO. 1

PROJECT: EQUINOX MTN SKY

LOCATION: CITY OF FORT LUPTON

STRUCTURE			DIRECT RUNOFF						TOTAL RUNOFF								
STRUCTURE	DESIGN POINT	BASINS AND DESIGN POINT	AREA (AC)	COEFF. (C)	Tc (Min.)	Summation C*A	I (in / hr.)	RATIONAL Q (cfs)	PIPE SIZE (in)	Q IN PIPE U/S (cfs)	Q in CHANNEL (cfs)	SLOPE (%)	LENGTH (ft)	VELOCITY (fps)	Tt (min)		REMARKS
I8	20	A1	2.81	0.45	17.8	1.26	3.0	3.7									BASIN
I7	19	A2	0.64	0.45	9.5	0.29	3.9	1.1									BASIN
I24	21	A3	3.17	0.45	15.8	1.43	3.1	4.5									BASIN
I9	18	A4	1.29	0.45	9.1	0.58	4.0	2.3									BASIN
I8	20	A5	0.93	0.45	9.2	0.42	4.0	1.7									BASIN
I22	4	B1	0.76	0.57	6.5	0.43	4.5	1.9									BASIN
I21	5	B2	3.42	0.45	8.9	1.54	4.0	6.2									BASIN
I20	6	B3	0.74	0.45	9.0	0.33	4.0	1.3									BASIN
I19	7	B4	1.50	0.28	13.2	0.42	3.4	1.4									BASIN
I17	3	B5	1.61	0.45	12.7	0.72	3.5	2.5									BASIN
I15	9	B6	2.96	0.45	10.4	1.33	3.8	5.0									BASIN
I16	10	B7	2.73	0.45	13.5	1.23	3.4	4.2									BASIN
I14	11	B8	1.99	0.45	15.1	0.90	3.2	2.9									BASIN
I10	12	B9	3.32	0.28	15.7	0.92	3.2	2.9									BASIN
I13	14	C1	1.24	0.48	10.0	0.59	3.8	2.3									BASIN
I12	15	C2	2.14	0.48	12.7	1.03	3.5	3.6									BASIN
I11	16	C3	1.41	0.45	11.7	0.63	3.6	2.3									BASIN
I25	14A	C4	2.83	0.42	14.4	1.20	3.3	3.9									BASIN
I4	23	D1	1.45	0.45	7.8	0.65	4.2	2.7									BASIN
FES2	25	D2	3.48	0.31	17.3	1.07	3.0	3.2									BASIN
I3	26	D3	1.14	0.45	11.3	0.51	3.7	1.9									BASIN
I2	27	D4	1.29	0.45	11.0	0.58	3.7	2.1									BASIN
I6	22	E1	0.39	0.45	6.4	0.18	4.5	0.8									BASIN
	24	E2	2.56	0.45	13.1	1.15	3.4	4.0									BASIN
I23	32	F1	0.48	0.60	7.2	0.29	4.3	1.2									BASIN
	34	F2	8.69	0.28	26.2	2.43	2.4	5.9									BASIN
	2	OS-1	2.66	0.45	13.4	1.20	3.4	4.1									BASIN
	31	OS-2	13.38	0.15	16.9	2.01	3.0	6.1									BASIN
I1	28	P1	6.38	0.54	13.7	3.47	3.4	11.7									BASIN
	33	R1	0.73	0.71	11.5	0.52	3.6	1.9									BASIN
I18	1	R2	0.79	0.57	10.1	0.45	3.8	1.7									BASIN
	13	R3	0.79	0.58	8.4	0.46	4.1	1.9									BASIN
	29	R4	0.48	0.59	6.0	0.28	4.6	1.3									BASIN
	30	R5	1.24	0.27	15.6	0.34	3.2	1.1									BASIN
		BASIN ROUTING															
I8	20	(A1+A5)			17.8	1.68	3.0	5.0									
I13	14	(C1+R3)			10.0	1.05	3.8	4.0									

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

DESIGN STORM: 100-YEAR DEVELOPED, FILING NO. 1

PROJECT: EQUINOX MTN SKY

LOCATION: CITY OF FORT LUPTON

STRUCTURE			DIRECT RUNOFF						TOTAL RUNOFF								
STRUCTURE	DESIGN POINT	BASINS AND DESIGN POINT	AREA (AC)	COEFF. (C)	Tc (Min.)	Summation C'A	I (in./ hr.)	RATIONAL Q (cfs)	PIPE SIZE (in)	Q IN PIPE U/S (cfs)	Q in CHANNEL (cfs)	SLOPE (%)	LENGTH (ft)	VELOCITY (fps)	Tt (min)		REMARKS
		A1	2.81	0.60	17.8	1.69	5.7	9.5									BASIN
		A2	0.64	0.60	9.5	0.38	7.5	2.9									BASIN
		A3	3.17	0.60	15.8	1.90	6.0	11.4									BASIN
		A4	1.29	0.60	9.1	0.77	7.6	5.9									BASIN
		A5	0.93	0.60	9.2	0.56	7.6	4.2									BASIN
		B1	0.76	0.71	6.5	0.54	8.5	4.6									BASIN
		B2	3.42	0.60	8.9	2.05	7.7	15.7									BASIN
		B3	0.74	0.60	9.0	0.44	7.6	3.4									BASIN
		B4	1.50	0.51	13.2	0.76	6.5	5.0									BASIN
		B5	1.61	0.60	12.7	0.97	6.6	6.4									BASIN
		B6	2.96	0.60	10.4	1.78	7.2	12.8									BASIN
		B7	2.73	0.60	13.5	1.64	6.5	10.6									BASIN
		B8	1.99	0.60	15.1	1.19	6.1	7.3									BASIN
		B9	3.32	0.50	15.7	1.68	6.0	10.1									BASIN
		C1	1.24	0.64	10.0	0.79	7.3	5.8									BASIN
		C2	2.14	0.63	12.7	1.35	6.6	8.9									BASIN
		C3	1.41	0.60	11.7	0.85	6.9	5.8									BASIN
		C4	2.83	0.59	14.4	1.66	6.3	10.4									BASIN
		D1	1.45	0.60	7.8	0.87	8.0	7.0									BASIN
		D2	3.48	0.52	17.3	1.82	5.7	10.4									BASIN
		D3	1.14	0.60	11.3	0.68	7.0	4.8									BASIN
		D4	1.29	0.60	11.0	0.77	7.1	5.5									BASIN
		E1	0.39	0.60	6.4	0.23	8.6	2.0									BASIN
		E2	2.56	0.60	13.1	1.54	6.6	10.1									BASIN
		F1	0.48	0.74	7.2	0.35	8.2	2.9									BASIN
		F2	8.69	0.51	26.2	4.43	4.6	20.4									BASIN
		OS-1	2.66	0.60	13.4	1.60	6.5	10.3									BASIN
		OS-2	13.38	0.50	16.9	6.69	5.8	38.8									BASIN
		P1	6.38	0.69	13.7	4.39	6.4	28.2									BASIN
		R1	0.73	0.81	11.5	0.59	6.9	4.1									BASIN
		R2	0.79	0.71	10.1	0.56	7.3	4.1									BASIN
		R3	0.79	0.72	8.4	0.57	7.8	4.5									BASIN
		R4	0.48	0.73	6.0	0.35	8.8	3.1									BASIN
		R5	1.24	0.54	15.6	0.67	6.0	4.0									BASIN

APPENDIX C

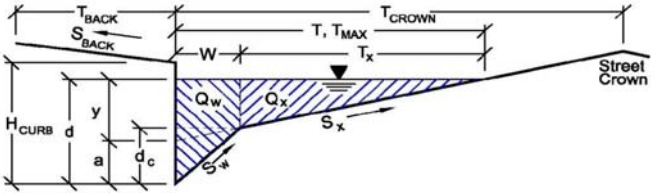
HYDRAULIC COMPUTATIONS

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

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

Project: **Mountain Sky**

Inlet ID: **Street Capacity - Residential**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.007	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.3	7.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.9	3.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.1**	**12.1**	**cfs**
Flow Velocity within the Gutter Section	V =	5.1	5.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.4	2.4	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	17.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.349	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.3	7.3	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.3	7.3	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.9	3.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	0.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.1	12.1	cfs
Average Flow Velocity Within the Gutter Section	V =	5.1	5.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.4	2.4	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.1**	**12.1**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	5.60	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	0.01	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.1**	**12.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

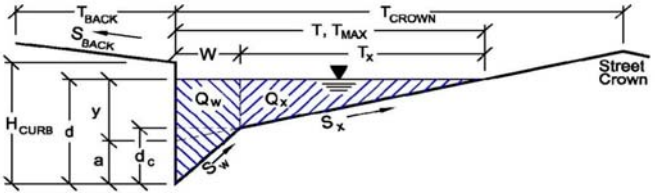
Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

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

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

Project: **Mountain Sky**

Inlet ID: **Street Capacity - Entry Drive**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	1.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	23.5	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	23.5	23.5	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.4	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	5.64	5.64	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.51	1.51	inches
Water Depth at Gutter Flowline	d =	7.15	7.15	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	21.5	21.5	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.251	0.251	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	23.3	23.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	7.8	7.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.2	0.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**31.3**	**31.3**	**cfs**
Flow Velocity within the Gutter Section	V =	7.6	7.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	4.5	4.5	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	20.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	18.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.293	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	11.9	15.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	11.9	15.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	5.5	6.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	17.4	21.2	cfs
Average Flow Velocity Within the Gutter Section	V =	6.6	6.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**17.4**	**21.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	6.36	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**17.4**	**21.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

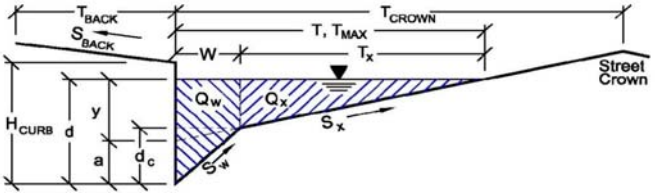
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

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

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

Project: Mountain Sky

Inlet ID: Street Capacity - CR 29 1/2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	31.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.007	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.007	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.02	2.02	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.82	1.82	inches
Water Depth at Gutter Flowline	d =	3.84	3.84	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	22.0	22.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.337	0.337	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	3.8	3.8	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	1.9	1.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**5.7**	**5.7**	**cfs**
Flow Velocity within the Gutter Section	V =	4.1	4.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.3	1.3	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	49.7	121.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	47.7	119.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.140	0.050	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	30.0	343.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	24.2	144.3	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.9	18.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	24.6	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	29.1	186.9	cfs
Average Flow Velocity Within the Gutter Section	V =	5.9	9.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.9	9.8	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**29.1**	**187.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	12.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	2.16	8.16	inches

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**5.7**	**187.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

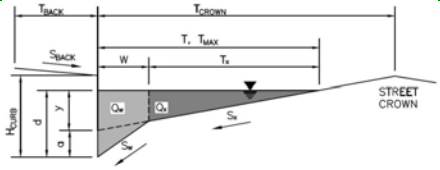
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 2 - DP 28**



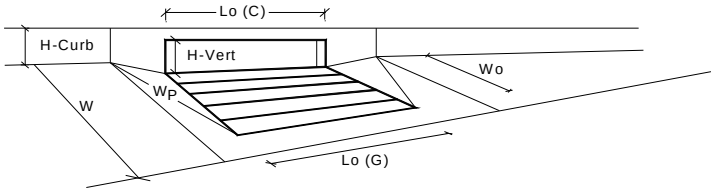
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



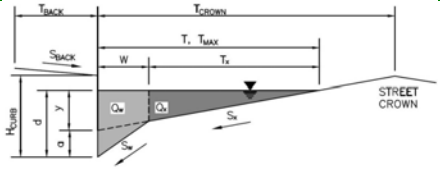
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	2.1	5.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 3 - DP 27**



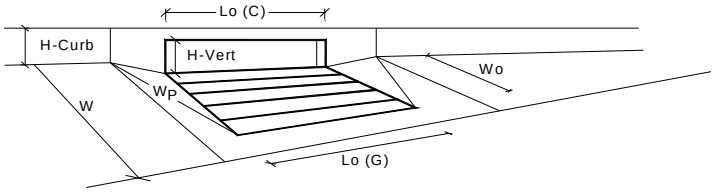
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



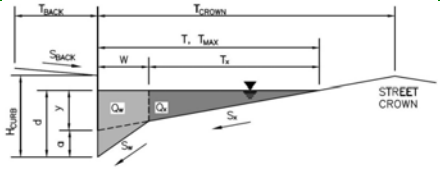
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	1.9	5.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 4 - DP 24**



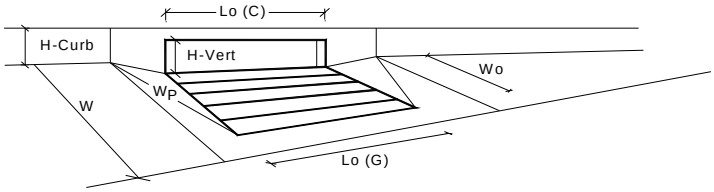
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



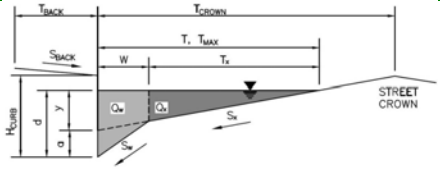
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	2.7	6.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 5 - DP 22**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

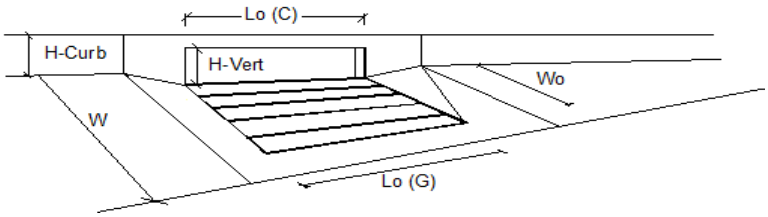
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.9**	**13.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE



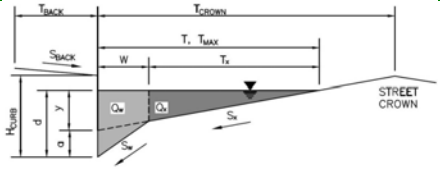
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.6**	**1.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**91**	**%**

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 6 - DP 23**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

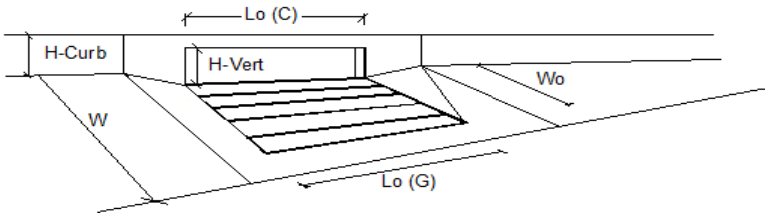
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.9**	**13.7**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE



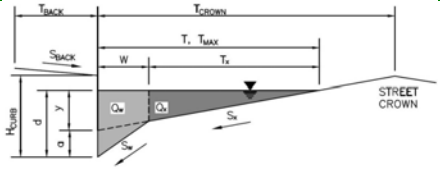
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.8**	**2.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**77**	**%**

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 7 - DP 19**



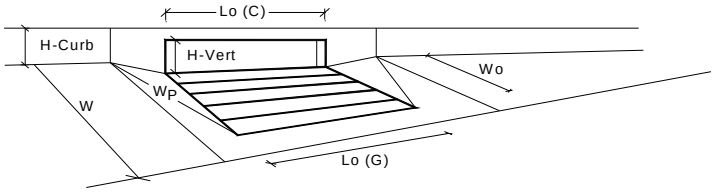
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



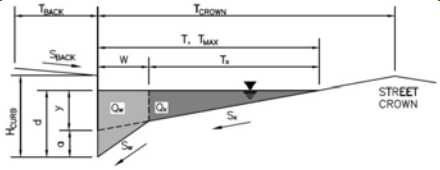
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	1.1	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 8 - DP 20**



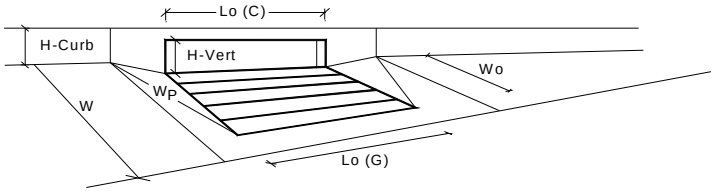
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



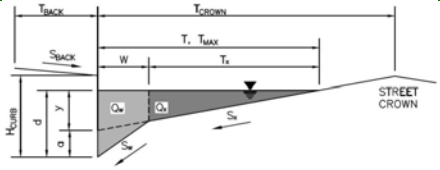
		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.2	5.6	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.49	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.88	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.6**	**6.9**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	5.0	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 9 - DP 18**



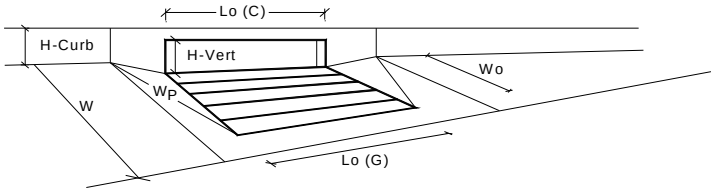
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

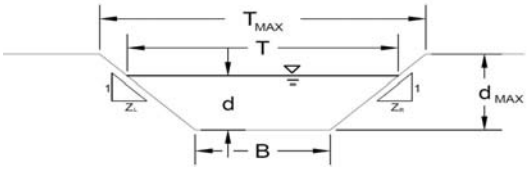


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	2.4	10.0	cfs

AREA INLET IN A SWALE

Equinox Mountain Sky

Inlet 10 - DP 12



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	A	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0110	ft/ft
Bottom Width	B =	10.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- ○ Non-Cohesive
- ◉ Cohesive
- ○ Paved

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**20.00**	**40.00**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**2.00**	**feet**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**4.9**	**21.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.00**	**2.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.9**	**10.0**	**cfs**
Water Depth	**d =**	**0.70**	**1.50**	**feet**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

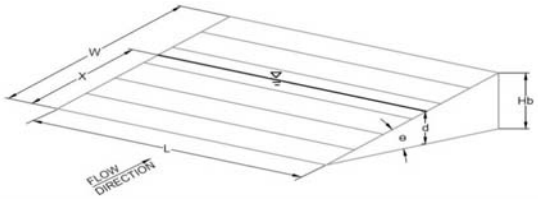
Equinox Mountain Sky

Inlet 10 - DP 12

Inlet Design Information (Input)

Type of Inlet: CDOT Type C

Inlet Type = CDOT Type C



Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	feet
Length of Grate	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

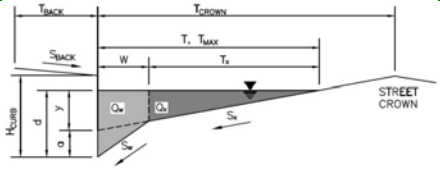
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.70	1.50	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.8**	**19.8**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 11 - DP 16**



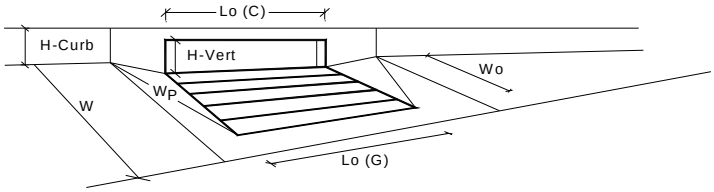
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



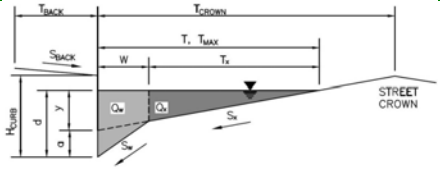
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	2.3	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 12 - DP 15**



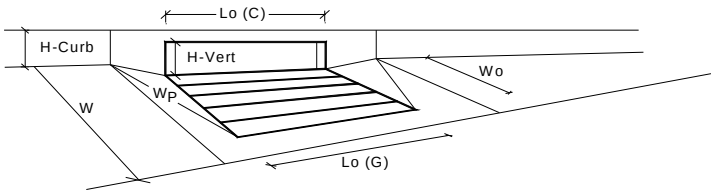
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



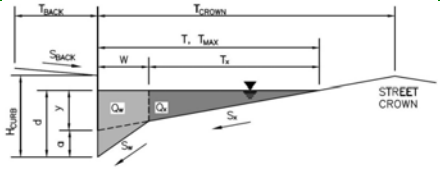
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	3.6	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 13**



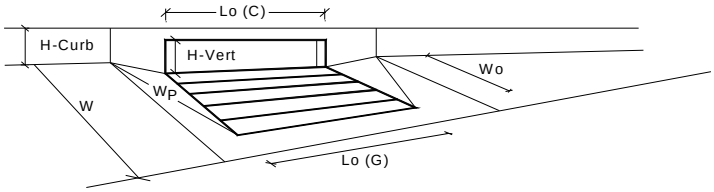
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



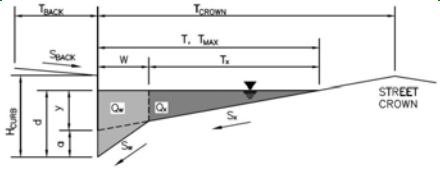
		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening				
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.2	5.6	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.49	0.53	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.88	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.6**	**6.9**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	5.4	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 14 - DP 11**



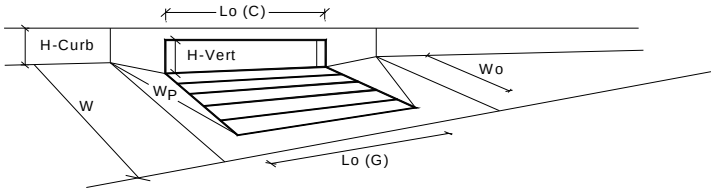
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



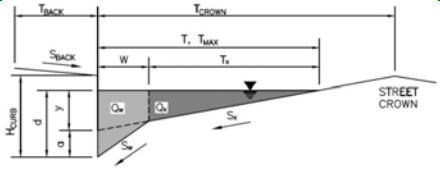
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	2.9	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 15 - DP 9**



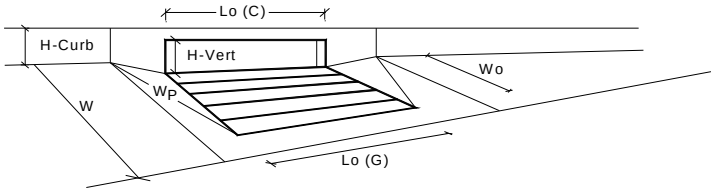
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



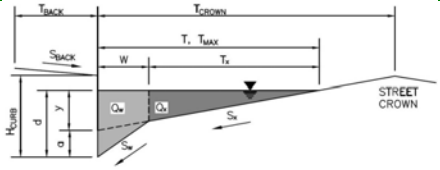
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.49	0.53	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.88	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**5.6**	**6.9**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	5.4	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 16 - DP10**



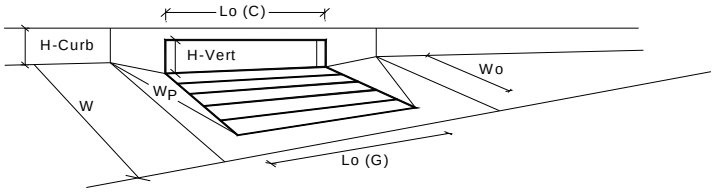
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



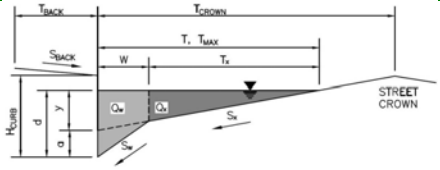
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.4	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.28	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.69	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**4.2**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	4.2	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 17 - DP 3**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.032	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

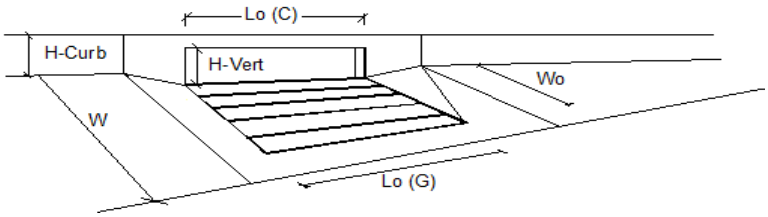
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**7.3**	**19.4**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE



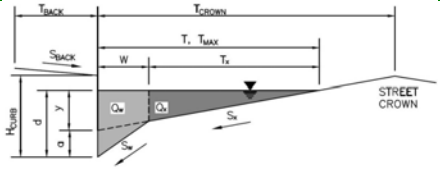
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.1**	**3.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.4**	**1.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**84**	**61**	**%**

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 18 - DP 1**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

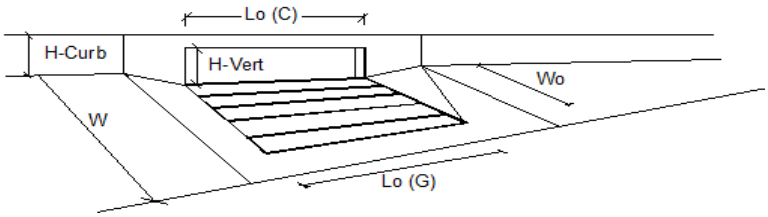
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.7	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.3	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**17.0**	**32.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

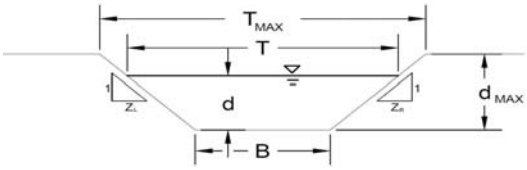


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**2.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**89**	**53**	**%**

AREA INLET IN A SWALE

Equinox Mountain Sky

Inlet 19 - DP 7



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	A	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	8.00	ft/ft
Right Side Slope	Z2 =	8.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**15.00**	**30.00**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**2.00**	**feet**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**1.4**	**8.0**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.69**	**1.63**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.4**	**5.0**	**cfs**
Water Depth	**d =**	**0.68**	**1.29**	**feet**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

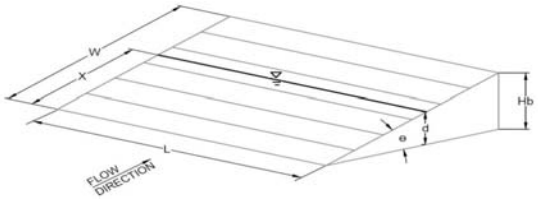
Equinox Mountain Sky

Inlet 19 - DP 7

Inlet Design Information (Input)

Type of Inlet: CDOT Type C

Inlet Type = CDOT Type C



Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	feet
Length of Grate	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

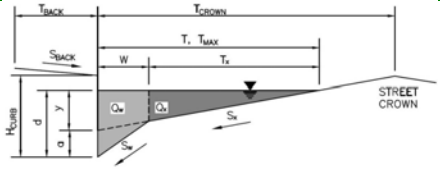
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.68	1.29	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.4**	**18.4**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 20 - DP 6**



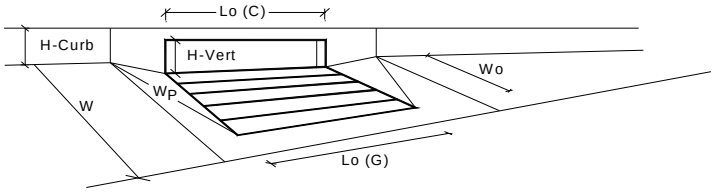
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



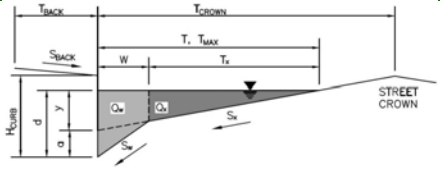
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.2	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.27	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.67	0.72	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**3.9**	**4.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	1.3	5.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 21 - DP 5**



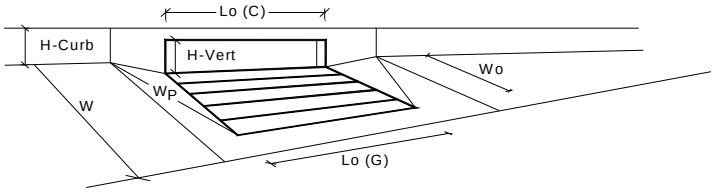
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



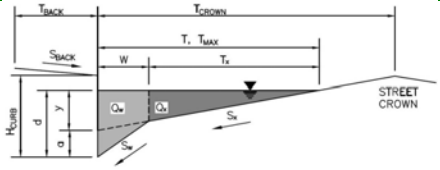
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')		a_{local} =	5.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.6	5.6	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.30	0.30	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.53	0.53	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.91	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**6.9**	**6.9**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm		$Q_{PEAK\ REQUIRED}$ =	6.5	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 22 - DP 4**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.008	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

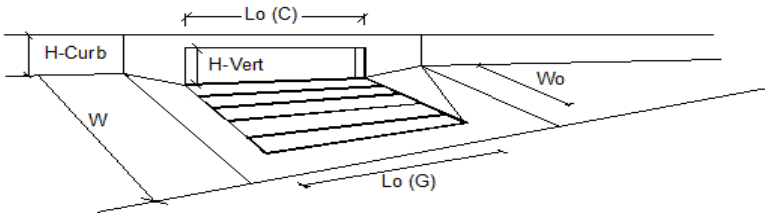
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.7	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.3	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**15.2**	**29.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE



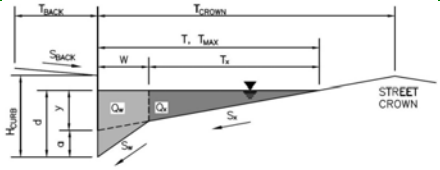
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.6**	**3.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.3**	**6.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**85**	**36**	**%**

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 23 - DP 33**



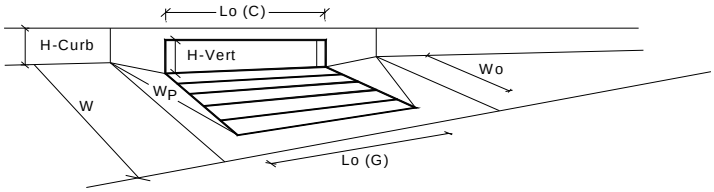
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.7	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.3	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION



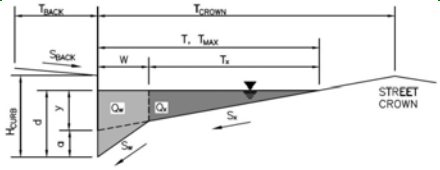
		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.3	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.44	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.69	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.86	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**16.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.2	10.0	cfs

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 24 - DP 21**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.007	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

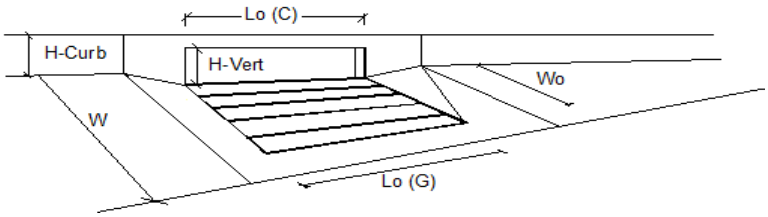
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**3.5**	**12.1**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE



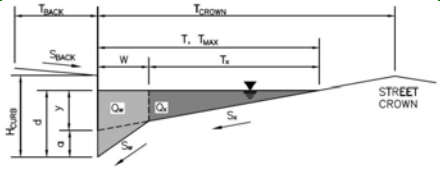
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR STORM'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.4**	**7.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**2.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**72**	**%**

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

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

Project: **Equinox Mountain Sky**

Inlet ID: **Inlet 25 - DP 14A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	4.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

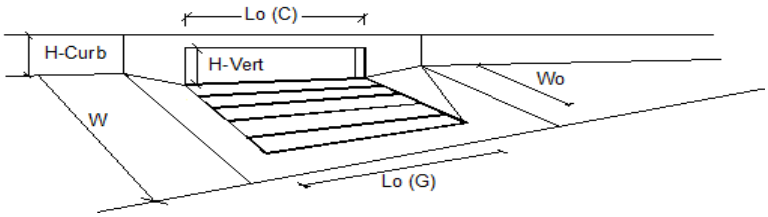
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.3	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	5.6	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**4.1**	**14.4**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

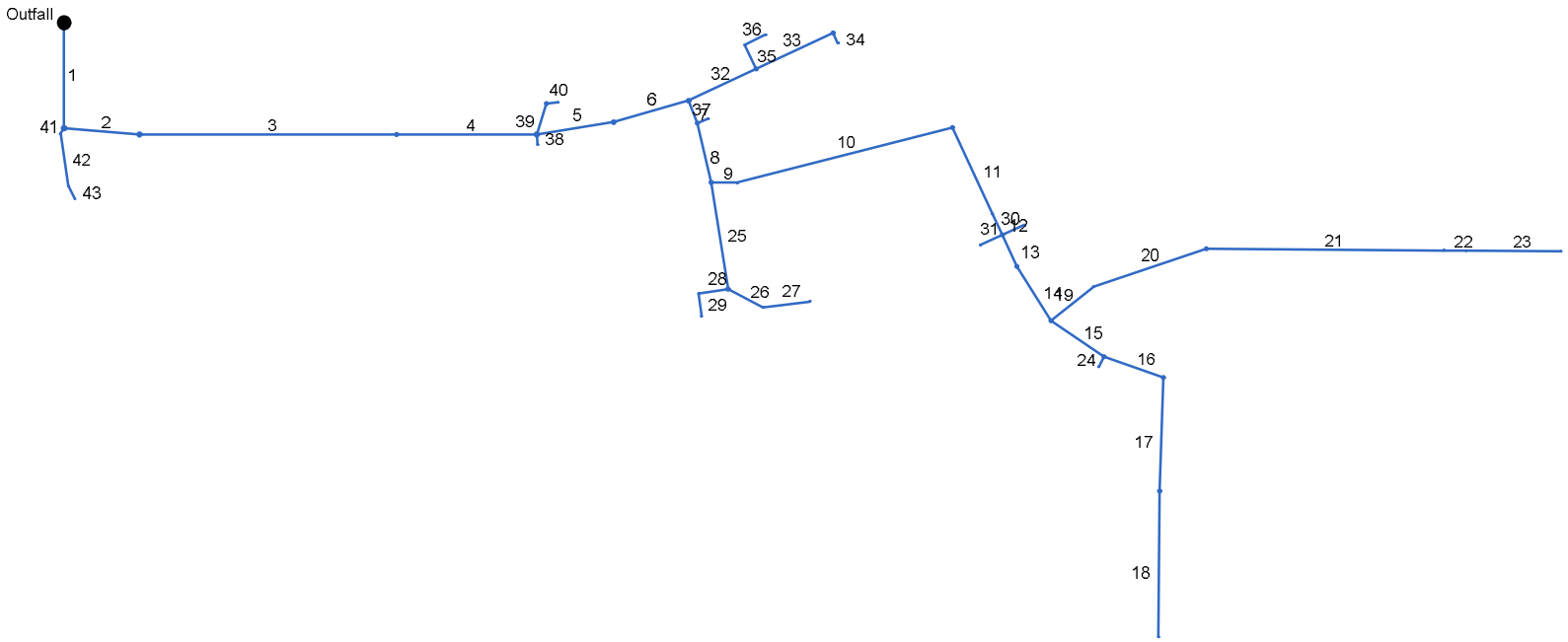
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	5.0	5.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.7**	**4.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.2**	**6.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**68**	**40**	**%**

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: New.stm	Number of lines: 43	Date: 6/29/2016

Storm Sewers v10.40

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Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	48	71.50	4939.39	4942.42	3.03	8.47	7.00	1.11	4943.53	0.000	164.887	4940.21	4942.77	2.56**	8.48	8.44	1.11	4943.88	0.000	0.000	n/a	1.00	1.11
2	42	64.30	4940.31	4942.77	2.46	7.22	8.90	1.18	4943.95	0.000	117.722	4940.90	4943.41	2.51**	7.39	8.70	1.18	4944.59	0.000	0.000	n/a	0.15	n/a
3	42	64.30	4941.00	4943.44	2.44*	7.17	8.96	1.18	4944.62	0.000	400.000	4943.00	4945.51	2.51**	7.39	8.70	1.18	4946.69	0.000	0.000	n/a	0.15	n/a
4	42	64.30	4943.10	4945.54	2.44*	7.17	8.96	1.18	4946.72	0.000	218.610	4944.19	4946.70	2.51**	7.39	8.70	1.18	4947.88	0.000	0.000	n/a	1.00	n/a
5	42	60.80	4944.29	4946.70	2.41	7.08	8.59	1.12	4947.82	0.000	121.352	4944.90	4947.34	2.44**	7.17	8.48	1.12	4948.46	0.000	0.000	n/a	0.15	0.17
6	42	60.80	4945.00	4947.35	2.34*	6.85	8.87	1.12	4948.46	0.000	121.352	4945.61	4948.05	2.44**	7.17	8.48	1.12	4949.17	0.000	0.000	n/a	1.00	1.12
7	36	50.20	4946.11	4948.05	1.94	4.83	10.39	1.15	4949.20	0.000	37.323	4946.48	4948.79	2.30**	5.82	8.62	1.15	4949.94	0.000	0.000	n/a	1.00	n/a
8	36	47.90	4946.68	4948.88	2.20*	5.55	8.64	1.10	4949.98	0.000	94.940	4947.21	4949.46	2.25**	5.69	8.42	1.10	4950.56	0.000	0.000	n/a	0.98	n/a
9	30	34.10	4947.41	4949.91	2.50*	4.91	6.95	0.75	4950.66	0.589	40.714	4947.62	4950.11	2.50	4.91	6.95	0.75	4950.86	0.575	0.582	0.237	0.50	0.38
10	30	31.20	4947.81	4950.49	2.50	4.01	6.36	0.63	4951.12	0.493	345.947	4951.21	4953.11 j	1.90**	4.01	7.79	0.94	4954.06	0.574	0.534	n/a	0.99	n/a
11	30	31.20	4951.42	4953.11	1.70	3.55	8.80	0.94	4954.06	0.000	148.522	4952.63	4954.53	1.90**	4.01	7.79	0.94	4955.48	0.000	0.000	n/a	0.50	n/a
12	30	28.30	4952.83	4954.68	1.85*	3.90	7.25	0.82	4955.50	0.501	36.833	4953.01	4954.87	1.86	3.91	7.24	0.81	4955.68	0.499	0.500	0.184	1.00	0.81
13	30	19.10	4953.21	4955.68	2.47	3.03	3.90	0.62	4956.30	0.000	54.528	4953.48	4954.96	1.48**	3.03	6.31	0.62	4955.58	0.000	0.000	n/a	0.15	0.09
14	30	19.10	4953.68	4955.09	1.41*	2.85	6.71	0.62	4955.71	0.000	99.728	4954.18	4955.66	1.48**	3.03	6.31	0.62	4956.28	0.000	0.000	n/a	1.00	0.62
15	18	8.30	4955.18	4955.81	0.64*	0.71	11.64	0.54	4956.35	0.000	99.728	4958.97	4960.08	1.11**	1.41	5.89	0.54	4960.62	0.000	0.000	n/a	0.99	n/a
16	18	5.80	4959.17	4960.08	0.91	1.13	5.15	0.40	4960.48	0.000	97.931	4963.58	4964.51	0.93**	1.15	5.05	0.40	4964.90	0.000	0.000	n/a	0.96	n/a
17	18	5.80	4963.78	4964.51	0.73	0.85	6.84	0.40	4964.90	0.000	177.367	4966.62	4967.55	0.93**	1.15	5.05	0.40	4967.94	0.000	0.000	n/a	0.15	n/a
18	18	1.70	4966.82	4967.55	0.73	0.50	2.00	0.18	4967.73	0.000	228.336	4975.38	4975.87 j	0.49**	0.50	3.39	0.18	4976.05	0.000	0.000	n/a	1.00	n/a
19	24	10.80	4954.48	4955.66	1.18	1.92	5.59	0.49	4956.15	0.000	85.226	4954.90	4956.08 j	1.18**	1.92	5.62	0.49	4956.57	0.000	0.000	n/a	0.60	0.29
20	24	9.40	4955.10	4956.15	1.05*	1.67	5.62	0.44	4956.60	0.000	185.294	4956.03	4957.13	1.09**	1.76	5.34	0.44	4957.57	0.000	0.000	n/a	0.38	0.17
21	24	9.40	4956.23	4957.28	1.05*	1.67	5.62	0.44	4957.72	0.000	369.061	4958.07	4959.17	1.09**	1.76	5.34	0.44	4959.61	0.000	0.000	n/a	0.50	0.22

Project File: 5 Year Analysis.stm | Number of lines: 43 | Run Date: 6/29/2016

Notes: * depth assumed.; ** Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box

Storm Sewers v10.40

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Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
22	18	8.10	4958.27	4959.51	1.24*	1.56	5.19	0.42	4959.93	0.500	35.333	4958.45	4959.68	1.24	1.56	5.19	0.42	4960.10	0.501	0.501	0.177	0.50	0.21
23	18	1.90	4958.65	4959.89	1.25	0.54	1.21	0.19	4960.08	0.000	146.950	4967.10	4967.62 j	0.52**	0.54	3.50	0.19	4967.81	0.000	0.000	n/a	1.00	0.19
24	18	2.50	4959.17	4960.08	0.91	0.66	2.22	0.22	4960.31	0.000	17.668	4960.05	4960.65 j	0.60**	0.66	3.80	0.22	4960.88	0.000	0.000	n/a	1.00	n/a
25	24	13.80	4948.21	4949.46	1.26	2.08	6.64	0.60	4950.06	0.000	169.313	4953.44	4954.78	1.34**	2.23	6.19	0.60	4955.37	0.000	0.000	n/a	1.00	n/a
26	18	7.90	4953.94	4954.86	0.92*	1.14	6.95	0.51	4955.38	0.000	61.433	4954.55	4955.64	1.09**	1.37	5.76	0.51	4956.16	0.000	0.000	n/a	0.95	n/a
27	18	3.90	4954.75	4955.64	0.89	0.89	3.56	0.30	4955.94	0.000	73.145	4955.48	4956.24 j	0.75**	0.89	4.38	0.30	4956.53	0.000	0.000	n/a	1.00	n/a
28	18	5.90	4953.94	4954.78	0.84	1.01	5.82	0.40	4955.18	0.000	46.000	4954.40	4955.34	0.94**	1.16	5.08	0.40	4955.74	0.000	0.000	n/a	1.50	n/a
29	18	3.60	4954.60	4955.34	0.74	0.84	4.17	0.28	4955.62	0.000	35.333	4954.95	4955.68 j	0.72**	0.84	4.26	0.28	4955.96	0.000	0.000	n/a	1.00	0.28
30	18	4.20	4954.01	4955.68	1.50	1.77	2.38	0.09	4955.77	0.136	37.667	4954.20	4955.70	1.50	1.77	2.38	0.09	4955.79	0.134	0.135	0.051	1.00	0.09
31	18	5.00	4954.01	4955.68	1.50	1.77	2.83	0.12	4955.81	0.193	37.667	4954.20	4955.76	1.50	1.77	2.83	0.12	4955.88	0.193	0.193	0.073	1.00	0.12
32	24	10.60	4946.61	4948.05	1.44	1.90	4.38	0.48	4948.53	0.000	116.102	4947.19	4948.36	1.17**	1.90	5.58	0.48	4948.84	0.000	0.000	n/a	1.00	0.48
33	18	4.50	4947.69	4948.36	0.67	0.76	5.92	0.33	4948.69	0.000	132.280	4949.01	4949.83	0.81**	0.98	4.60	0.33	4950.15	0.000	0.000	n/a	1.00	0.33
34	18	4.50	4949.21	4949.87	0.66*	0.74	6.06	0.33	4950.19	0.000	17.000	4949.38	4950.19	0.81**	0.98	4.60	0.33	4950.52	0.000	0.000	n/a	1.00	0.33
35	18	6.10	4947.39	4948.37	0.98*	1.22	5.01	0.39	4948.76	0.500	41.500	4947.60	4948.57	0.98	1.22	5.02	0.39	4948.96	0.503	0.501	0.208	1.50	0.59
36	18	5.00	4947.80	4949.16	1.36	1.05	2.97	0.35	4949.51	0.000	35.333	4947.98	4948.84	0.86**	1.05	4.78	0.35	4949.19	0.000	0.000	n/a	1.00	n/a
37	18	2.30	4947.48	4948.79	1.30	0.62	1.41	0.21	4949.00	0.000	17.667	4947.66	4948.23	0.57**	0.62	3.71	0.21	4948.45	0.000	0.000	n/a	1.00	n/a
38	24	2.70	4945.47	4946.70	1.23	0.74	1.33	0.21	4946.91	0.000	15.850	4945.55	4946.13	0.57**	0.74	3.64	0.21	4946.33	0.000	0.000	n/a	1.00	n/a
39	18	0.80	4945.23	4946.70	1.48	0.29	0.45	0.12	4946.82	0.000	50.286	4945.48	4945.81	0.33**	0.29	2.75	0.12	4945.93	0.000	0.000	n/a	0.94	n/a
40	18	0.80	4945.68	4946.00	0.32*	0.28	2.91	0.12	4946.12	0.000	17.667	4945.77	4946.10	0.33**	0.29	2.75	0.12	4946.22	0.000	0.000	n/a	1.00	n/a
41	24	7.20	4940.90	4942.77	1.87	1.48	2.36	0.37	4943.14	0.000	10.121	4940.95	4941.90	0.95**	1.48	4.88	0.37	4942.27	0.000	0.000	n/a	1.10	n/a
42	18	5.10	4941.15	4942.02	0.87*	1.06	4.80	0.36	4942.38	0.496	82.824	4941.56	4942.43	0.87**	1.07	4.78	0.36	4942.79	0.491	0.493	0.409	0.55	0.20

Project File: 5 Year Analysis.stm | Number of lines: 43 | Run Date: 6/29/2016

Notes: * depth assumed.; ** Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box

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Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
43	18	3.20	4941.76	4942.63	0.87	0.78	3.02	0.26	4942.89	0.000	22.034	4941.87	4942.55	0.68**	0.78	4.10	0.26	4942.81	0.000	0.000	n/a	1.00	0.26

Project File: 5 Year Analysis.stm | Number of lines: 43 | Run Date: 6/29/2016

Notes: * depth assumed.; ** Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box

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Hydraflow HGL Computation Procedure

General Procedure:

Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

Col. 13 The elevation of the upstream invert.

Col. 14 Elevation of the hydraulic grade line at the upstream end.

Col. 15 The upstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 16 Cross-sectional area of the flow at the upstream end.

Col. 17 The velocity of the flow at the upstream end, (Col. 3 / Col. 16).

Col. 18 Velocity head (Velocity squared / 2g).

Col. 19 The elevation of the energy grade line at the upstream end, HGL + Velocity head, (Col. 14 + Col. 18) .

Col. 20 The friction slope at the upstream end (the S or Slope term in Manning's equation).

Col. 21 The average of the downstream and upstream friction slopes.

Col. 22 Energy loss. Average Sf/100 x Line Length (Col. 21/100 x Col. 12). Equals (EGL upstream - EGL downstream) +/- tolerance.

Col. 23 The junction loss coefficient (K).

Col. 24 Minor loss. (Col. 23 x Col. 18). Is added to upstream HGL and used as the starting HGL for the next upstream line(s).

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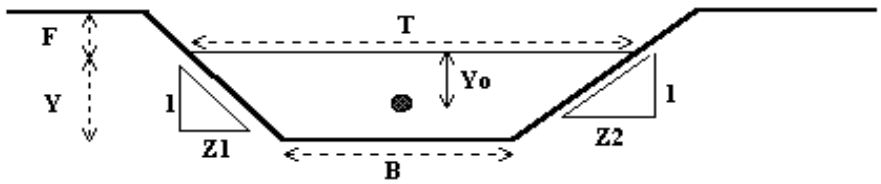
Critical Flow Analysis - Trapezoidal Channel

Project:	**Mountain Sky Subdivision**
Channel ID:	**Channel along North PL: 5-yr Storm**

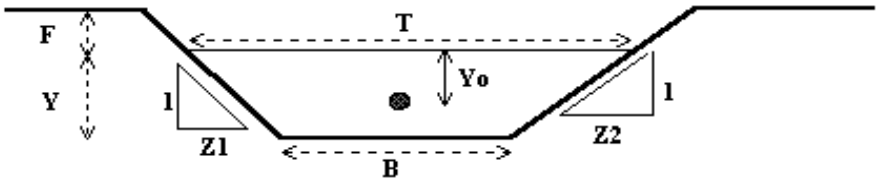


Design Information (Input)			
Bottom Width	B =	15.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Design Discharge	Q =	**114.00**	cfs

Critical Flow Condition (Calculated)			
Critical Flow Depth	**Y =**	**1.12**	ft
Critical Flow Area	A =	20.56	sq ft
Critical Top Width	T =	21.72	ft
Critical Hydraulic Depth	D =	0.95	ft
Critical Flow Velocity	V =	5.54	fps
Froude Number	**Fr =**	**1.00**	
Critical Wetted Perimeter	P =	22.08	ft
Critical Hydraulic Radius	R =	0.93	ft
Critical (min) Specific Energy	Esc =	1.60	ft
Centroid on the Critical Flow Area	Yoc =	0.49	ft
Critical (min) Specific Force	Fsc =	1.86	kip

Normal Flow Analysis - Trapezoidal Channel

Project: Mountian Sky Subdivision
Channel ID: Channel along North PL: 100-year Storm



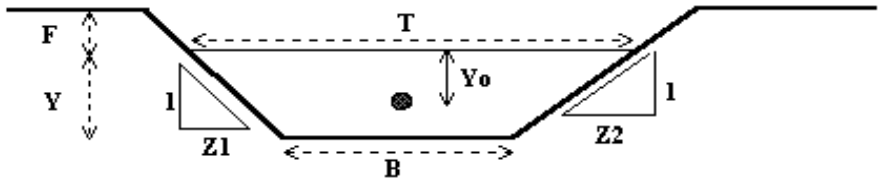
Design Information (Input)			
Channel Invert Slope	So =	0.0060	ft/ft
Manning's n	n =	0.035	
Bottom Width	B =	15.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**4.27**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**781.05**	cfs
Froude Number	**Fr =**	**0.68**	
Flow Velocity	**V =**	**6.59**	fps
Flow Area	A =	118.55	sq ft
Top Width	T =	40.59	ft
Wetted Perimeter	P =	41.97	ft
Hydraulic Radius	R =	2.82	ft
Hydraulic Depth	D =	2.92	ft
Specific Energy	Es =	4.94	ft
Centroid of Flow Area	Yo =	1.80	ft
Specific Force	Fs =	23.29	kip

Q = OS-E + OS-N
Q = 643 + 138 cfs
Q = 781 cfs
Fr < 0.8
V < 7 fps

Critical Flow Analysis - Trapezoidal Channel

Project:	**Mountain Sky Subdivision**
Channel ID:	**Channel along North PL: 100-yr Storm**



Design Information (Input)			
Bottom Width	B =	15.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Design Discharge	Q =	**722.87**	cfs

Critical Flow Condition (Calculated)			
Critical Flow Depth	**Y =**	**3.31**	ft
Critical Flow Area	A =	82.69	sq ft
Critical Top Width	T =	34.89	ft
Critical Hydraulic Depth	D =	2.37	ft
Critical Flow Velocity	V =	8.74	fps
Froude Number	**Fr =**	**1.00**	
Critical Wetted Perimeter	P =	35.97	ft
Critical Hydraulic Radius	R =	2.30	ft
Critical (min) Specific Energy	Esc =	4.50	ft
Centroid on the Critical Flow Area	Yoc =	1.22	ft
Critical (min) Specific Force	Fsc =	18.54	kip

Worksheet for Swale North of OS2 - 5YR Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01500	ft/ft
Left Side Slope	33.00	ft/ft (H:V)
Right Side Slope	33.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	2.70	ft^3/s

Results

Normal Depth	0.14	ft
Flow Area	2.00	ft^2
Wetted Perimeter	19.08	ft
Hydraulic Radius	0.10	ft
Top Width	19.08	ft
Critical Depth	0.12	ft
Critical Slope	0.02924	ft/ft
Velocity	1.35	ft/s
Velocity Head	0.03	ft
Specific Energy	0.17	ft
Froude Number	0.74	
Flow Type	Subcritical	

Minor Storm
Q = Basins
D1 + D2
Q = 2.7 cfs
D = 0.14 ft
V < 5 fps
Fr < 0.8

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.14	ft
Critical Depth	0.12	ft
Channel Slope	0.01500	ft/ft

Worksheet for Swale North of OS2 - 100YR Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01500	ft/ft
Left Side Slope	33.00	ft/ft (H:V)
Right Side Slope	33.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	17.10	ft^3/s

Results

Normal Depth	0.35	ft
Flow Area	7.56	ft^2
Wetted Perimeter	33.14	ft
Hydraulic Radius	0.23	ft
Top Width	33.13	ft
Critical Depth	0.32	ft
Critical Slope	0.02204	ft/ft
Velocity	2.26	ft/s
Velocity Head	0.08	ft
Specific Energy	0.43	ft
Froude Number	0.83	
Flow Type	Subcritical	

Major Storm
Q = Basins
D1 + D2
Q = 17.1 cfs
D = 0.35 ft
V < 5 fps
Fr < 0.8

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.35	ft
Critical Depth	0.32	ft
Channel Slope	0.01500	ft/ft

Worksheet for OS-E Swale - 5YR Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00800	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	5.20	ft
Discharge	90.00	ft^3/s

Results

Normal Depth	1.77	ft
Flow Area	18.66	ft^2
Wetted Perimeter	16.42	ft
Hydraulic Radius	1.14	ft
Top Width	15.84	ft
Critical Depth	1.56	ft
Critical Slope	0.01347	ft/ft
Velocity	4.82	ft/s
Velocity Head	0.36	ft
Specific Energy	2.14	ft
Froude Number	0.78	
Flow Type	Subcritical	

Minor Storm
Q = 90 cfs
D = 1.77 ft
V < 5 fps
Fr < 0.8

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.77	ft
Critical Depth	1.56	ft
Channel Slope	0.00800	ft/ft

Worksheet for OS-E Swale - 100YR Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00800	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	5.20	ft
Discharge	321.50	ft^3/s

Results

Normal Depth	3.22	ft
Flow Area	47.81	ft^2
Wetted Perimeter	25.55	ft
Hydraulic Radius	1.87	ft
Top Width	24.51	ft
Critical Depth	2.97	ft
Critical Slope	0.01134	ft/ft
Velocity	6.73	ft/s
Velocity Head	0.70	ft
Specific Energy	3.92	ft
Froude Number	0.85	
Flow Type	Subcritical	

Major Storm
Q = 643/2
Q = 321.5 cfs
D = 3.22 ft
V < 7 fps
Fr = 0.85

GVF Input Data

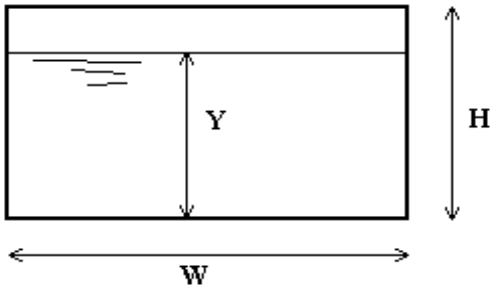
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.22	ft
Critical Depth	2.97	ft
Channel Slope	0.00800	ft/ft

BOX CONDUIT FLOW (Normal & Critical Depth Computation)

Project: **Mountain Sky Subdivision**
Box ID: **Culvert under CR 29 1/2**



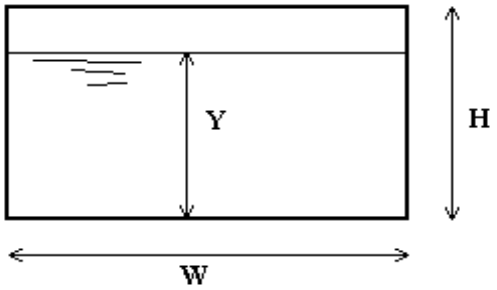
Design Information (Input)			
Box conduit invert slope	So =	0.0060	ft/ft
Box Manning's n-value	n =	0.0120	
Box Width	W =	11.00	ft
Box Height	H =	7.00	ft
Design discharge	**Q =**	**90.00**	**cfs**

Full-flow capacity (Calculated)			
Full-flow area	Af =	77.00	sq ft
Full-flow wetted perimeter	Pf =	36.00	ft
Full-flow capacity	Qf =	1229.41	cfs
Calculations of Normal Flow Condition			
Normal flow depth (<H)	Yn =	0.97	ft
Flow area	An =	10.65	sq ft
Wetted perimeter	Pn =	12.94	ft
Flow velocity	Vn =	8.45	fps
Discharge	Qn =	90.01	cfs
Percent Full	Flow =	7.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.51	supercritical
Calculation of Critical Flow Condition			
Critical flow depth	Yc =	1.28	ft
Critical flow area	Ac =	14.04	sq ft
Critical flow velocity	Vc =	6.41	fps
Critical Depth Froude Number	Fr_c =	1.00	

Minor Storm
Box Culvert
Q = 90 cfs
V = 8.45 cfs

BOX CONDUIT FLOW (Normal & Critical Depth Computation)

Project: Mountain Sky Subdivision
Box ID: Culvert under CR 29 1/2



Design Information (Input)			
Box conduit invert slope	So =	0.0060	ft/ft
Box Manning's n-value	n =	0.0120	
Box Width	W =	11.00	ft
Box Height	H =	7.00	ft
Design discharge	**Q =**	**643.00**	**cfs**

Box Culvert to carry Major Storm
Q = 643 cfs
V = 16.2 cfs

Full-flow capacity (Calculated)			
Full-flow area	Af =	77.00	sq ft
Full-flow wetted perimeter	Pf =	36.00	ft
Full-flow capacity	Qf =	1229.41	cfs
Calculations of Normal Flow Condition			
Normal flow depth (<H)	Yn =	3.61	ft
Flow area	An =	39.75	sq ft
Wetted perimeter	Pn =	18.23	ft
Flow velocity	Vn =	16.17	fps
Discharge	Qn =	643.02	cfs
Percent Full	Flow =	52.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.50	supercritical
Calculation of Critical Flow Condition			
Critical flow depth	Yc =	4.73	ft
Critical flow area	Ac =	52.08	sq ft
Critical flow velocity	Vc =	12.35	fps
Critical Depth Froude Number	Fr_c =	1.00	

Calibre

FULL BUILDOUT CONDITIONS

Desgin Area = 61.22 acres

Actual Basin Area = 55.27 acres

Weighted Runoff Coefficient C_5 (5-year) = 0.45 Adjusted 5yr Release = 0.12 cfs / acre Actual Release Rate = Actual Area / Design Area * Design Release Rate

Weighted Runoff Coefficient C_{100} (100-year) = 0.60 Adjusted 100yr Release = 0.12 cfs / acre Design Release Rate = 0.13 cfs / acre

DETENTION POND - FAA METHOD

LOCATION: EQUINOX MTN SKY CITY OF: CITY OF FORT LUPTON DATE: 2/19/2016

TIME (MIN)	RAINFALL INTENSITY (IN/HR)		C x A		INFLOW VOLUME (FT^3)		RELEASE RATE (CFS)		OUTFLOW VOLUME (FT^3)		REQUIRED VOLUME (FT^3)		REQUIRED VOLUME (AC-FT)	
	5YR	100YR	5 YR	100 YR	5 YR	100 YR	5 YR	100 YR	5YR	100YR	5 YR	100 YR	5 YR	100 YR
(1)	(2)	(2)	(3)	(3)	(4)	(4)	(5)	(5)	(6)	(6)	(7)	(7)	(8)	(8)
5	4.92	9.48	24.87	33.16	36,710	94,313	6.49	6.49	1,946	1,946	34,765	92,367	0.80	2.12
10	3.84	7.32	24.87	33.16	57,304	145,648	6.49	6.49	3,891	3,891	53,413	141,756	1.23	3.25
15	3.24	6.16	24.87	33.16	72,525	183,850	6.49	6.49	5,837	5,837	66,688	178,013	1.53	4.09
20	2.80	5.45	24.87	33.16	83,568	216,879	6.49	6.49	7,783	7,783	75,785	209,097	1.74	4.80
25	2.50	4.85	24.87	33.16	93,268	241,254	6.49	6.49	9,729	9,729	83,540	231,525	1.92	5.32
30	2.24	4.28	24.87	33.16	100,282	255,480	6.49	6.49	11,674	11,674	88,608	243,806	2.03	5.60
35	2.08	3.95	24.87	33.16	108,639	275,079	6.49	6.49	13,620	13,620	95,019	261,459	2.18	6.00
40	1.91	3.70	24.87	33.16	114,011	294,479	6.49	6.49	15,566	15,566	98,445	278,913	2.26	6.40
45	1.78	3.45	24.87	33.16	119,532	308,904	6.49	6.49	17,511	17,511	102,021	291,393	2.34	6.69
50	1.65	3.22	24.87	33.16	123,114	320,345	6.49	6.49	19,457	19,457	103,657	300,888	2.38	6.91
55	1.54	3.00	24.87	33.16	126,397	328,304	6.49	6.49	21,403	21,403	104,994	306,901	**2.41**	**7.05**
60	1.42	2.71	24.87	33.16	127,143	323,528	6.49	6.49	23,349	23,349	103,795	300,180	2.38	6.89

(4) = (3) x (2) x (1) x 60

(5) = allowable detention pond release rate

(6) = (5) x (1) x 60

(7) = (4) - (6)

Pond to be constructed for full build-out conditions w/ reduced release rate, Volume = 7.05 ac-ft

FILING NO. 1

Desgin Area = 61.22 acres

Actual Basin Area = 55.25 acres

Weighted Runoff Coefficient C_5 (5-year) = 0.22 Adjusted 5yr Release = 0.12 cfs / acre Actual Release Rate = Actual Area / Design Area * Design Release Rate

Weighted Runoff Coefficient C_{100} (100-year) = 0.52 Adjusted 100yr Release = 0.12 cfs / acre Design Release Rate = 0.13 cfs / acre

DETENTION POND - FAA METHOD

LOCATION: EQUINOX MTN SKY CITY OF: CITY OF FORT LUPTON DATE: 2/19/2016

TIME (MIN)	RAINFALL INTENSITY (IN/HR)		C x A		INFLOW VOLUME (FT^3)		RELEASE RATE (CFS)		OUTFLOW VOLUME (FT^3)		REQUIRED VOLUME (FT^3)		REQUIRED VOLUME (AC-FT)	
	5YR	100YR	5 YR	100 YR	5 YR	100 YR	5 YR	100 YR	5YR	100YR	5 YR	100 YR	5 YR	100 YR
(1)	(2)	(2)	(3)	(3)	(4)	(4)	(5)	(5)	(6)	(6)	(7)	(7)	(8)	(8)
5	4.92	9.48	12.07	28.50	17,821	81,060	6.48	6.48	1,945	1,945	15,876	79,114	0.36	1.82
10	3.84	7.32	12.07	28.50	27,819	125,181	6.48	6.48	3,891	3,891	23,928	121,290	0.55	2.78
15	3.24	6.16	12.07	28.50	35,208	158,015	6.48	6.48	5,836	5,836	29,372	152,179	0.67	3.49
20	2.80	5.45	12.07	28.50	40,569	186,403	6.48	6.48	7,781	7,781	32,788	178,622	0.75	4.10
25	2.50	4.85	12.07	28.50	45,278	207,352	6.48	6.48	9,727	9,727	35,551	197,625	0.82	4.54
30	2.24	4.28	12.07	28.50	48,683	219,579	6.48	6.48	11,672	11,672	37,011	207,907	0.85	4.77
35	2.08	3.95	12.07	28.50	52,740	236,424	6.48	6.48	13,617	13,617	39,122	222,807	0.90	5.11
40	1.91	3.70	12.07	28.50	55,348	253,098	6.48	6.48	15,563	15,563	39,785	237,535	0.91	5.45
45	1.78	3.45	12.07	28.50	58,028	265,496	6.48	6.48	17,508	17,508	40,520	247,988	0.93	5.69
50	1.65	3.22	12.07	28.50	59,767	275,329	6.48	6.48	19,453	19,453	40,314	255,876	0.93	5.87
55	1.54	3.00	12.07	28.50	61,361	282,170	6.48	6.48	21,399	21,399	39,962	260,771	**0.92**	**5.99**
60	1.42	2.71	12.07	28.50	61,723	278,066	6.48	6.48	23,344	23,344	38,379	254,722	0.88	5.85

(4) = (3) x (2) x (1) x 60

(5) = allowable detention pond release rate

(6) = (5) x (1) x 60

(7) = (4) - (6)

Filing No. 1 required volume w/ reduced release rate, Volume = 5.99 ac-ft

FULL BUILDOUT CONDITIONS

PROJECT: EQUINOX MOUNTIAN SKY
SUBJECT: PROPOSED POND VOLUME

DATE: 2/19/2016
BY: TAW

Volume Equation:

Vol = 1/3h(A1+A2+(A1*A2)^1/2

V = Volume in cubic feet (cu-ft)
h = Contour Interval in feet (ft.)
A1,A2 = Area enclosed by successive Contours in square feet (sq-ft)

Required Detention Volume:

Area = 55.27 acres
Imperviousness, I = 40%
WQCV = 0.180 watershed inches
WQ Design Volume = 0.99 ac-ft'
V(5yr Stm)= 2.41 ac-ft
V(100yr Stm)= 4.18 ac-ft with release rate at 100yr Historic Rate Pond Height = 4.90 feet
V(100yr Stm)= 7.05 ac-ft with release rate at 5yr Historic Rate Pond Height = 6.13 feet

WQCV = 1.0 (0.91I^3 - 1.19I^2 + 0.78I)
WQ Design Volume = (WQCV / 12 * Area * 1.2)
WQ Inv. In = 4937.52

Contour Elev. (ft.)	Area (sf)	Area (ac)	A1+A2 (ac)	(A1xA2)^1/2 (ac)	(A1+A2) + (A1+A2)^1/2 (ac)	h (ft)	h/3 (ft)	Volume (ac-ft)	Accumul. Volume (ac-ft)
4938	1437	0.03							0.00
			0.32	0.10	0.41	1.00	0.33	0.14	
4939	12395	0.28							0.14
			1.01	0.46	1.47	1.00	0.33	0.49	
4940	31816	0.73							0.63
			2.07	0.99	3.06	1.00	0.33	1.02	
4941	58520	1.34							1.65
			3.30	1.62	4.92	1.00	0.33	1.64	
4942	85057	1.95							3.29
			4.30	2.14	6.44	1.00	0.33	2.15	
4943	102229	2.35							5.44
			4.99	2.49	7.48	1.00	0.33	2.49	
4944	115081	2.64							7.93
			5.50	2.75	8.25	1.00	0.33	2.75	
4945	124433	2.86							10.68
			Water Quality Water Surface Elevation =				**4941.46**		
			Minor Storm Water Surface Elevation =				**4942.42**		
			Major Storm Water Surface Elevation =				**4943.65**		

FILING NO. 1 ONLY

PROJECT: EQUINOX MOUNTIAN SKY
SUBJECT: PROPOSED POND VOLUME

DATE: 2/19/2016
BY: TAW

Volume Equation:

Vol = 1/3h(A1+A2+(A1*A2)^1/2

V = Volume in cubic feet (cu-ft)
h = Contour Interval in feet (ft.)
A1,A2 = Area enclosed by successive Contours in square feet (sq-ft)

Required Detention Volume:

Area = 55.25 acres
Imperviousness, I = 11%
WQCV = 0.072 watershed inches
WQ Design Volume = 0.40 ac-ft'
V(5yr Stm)= 0.92 ac-ft
V(100yr Stm)= 2.94 ac-ft with release rate at 100yr Historic Rate Pond Height = 4.47 feet
V(100yr Stm)= 5.99 ac-ft with release rate at 5yr Historic Rate Pond Height = 5.70 feet

$WQCV = 1.0\ (0.91I^3 - 1.19I^2 + 0.78I)$
WQ Design Volume = (WQCV / 12 * Area * 1.2)
Inv. In = 4937.52

Contour Elev. (ft.)	Area (sf)	Area (ac)	A1+A2 (ac)	(A1xA2)^1/2 (ac)	(A1+A2) + (A1+A2)^1/2 (ac)	h (ft)	h/3 (ft)	Volume (ac-ft)	Accumul. Volume (ac-ft)
4938	1437	0.03							0.00
			0.32	0.10	0.41	1.00	0.33	0.14	
4939	12395	0.28							0.14
			1.01	0.46	1.47	1.00	0.33	0.49	
4940	31816	0.73							0.63
			2.07	0.99	3.06	1.00	0.33	1.02	
4941	58520	1.34							1.65
			3.30	1.62	4.92	1.00	0.33	1.64	
4942	85057	1.95							3.29
			4.30	2.14	6.44	1.00	0.33	2.15	
4943	102229	2.35							5.44
			4.99	2.49	7.48	1.00	0.33	2.49	
4944	115081	2.64							7.93
			5.50	2.75	8.25	1.00	0.33	2.75	
4945	124433	2.86							10.68
			Water Quality Water Surface Elevation =				**4940.55**		
			Minor Storm Water Surface Elevation =				**4941.84**		
			Major Storm Water Surface Elevation =				**4943.22**		

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: Mountain Sky Subdivision
Basin ID: Filing No. 1 Water Quality Pipe

WQCV Design Volume (Input):

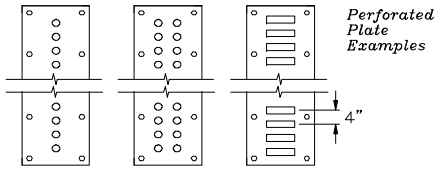
Catchment Imperviousness, I_a =	10.8	percent
Catchment Area, A =	55.25	acres
Depth at WQCV outlet above lowest perforation, H =	2.3	feet
Vertical distance between rows, h =	4.00	inches
Number of rows, NL =	6.00	
Orifice discharge coefficient, C_o =	0.65	
Slope of Basin Trickle Channel, S =	0.010	ft / ft
Time to Drain the Pond =	40	hours

Diameter of holes, D =	1.444	inches
Number of holes per row, N =	1	
OR		
Height of slot, H =		inches
Width of slot, W =		inches

WQ pipe sized for Filing No. 1 only
Outlet Structure sized for Full Buildout conditions

Watershed Design Information (Input):

Percent Soil Type A =		%
Percent Soil Type B =	100	%
Percent Soil Type C/D =		%



Outlet Design Information (Output):

Water Quality Capture Volume, WQCV =	0.18	watershed inches
Water Quality Capture Volume (WQCV) =	0.83	acre-feet
Design Volume (WQCV / 12 * Area * 1.2) Vol =	**0.99**	**acre-feet**
Outlet area per row, Ao =	1.64	square inches
Total opening area at each row based on user-input above, Ao =	1.64	square inches
Total opening area at each row based on user-input above, Ao =	0.011	square feet

3

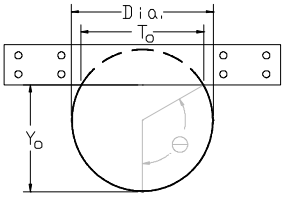
	Central Elevations of Rows of Holes in feet																								Σ Flow
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	
	4938.00	4938.33	4938.67	4939.00	4939.33	4939.67																			
	Collection Capacity for Each Row of Holes in cfs																								
4938.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000																			**0.00**
4938.33	0.0342	0.0034	0.0000	0.0000	0.0000	0.0000																			**0.04**
4938.67	0.0484	0.0344	0.0000	0.0000	0.0000	0.0000																			**0.08**
4939.00	0.0593	0.0485	0.0341	0.0000	0.0000	0.0000																			**0.14**
4939.33	0.0685	0.0594	0.0483	0.0342	0.0034	0.0000																			**0.21**
4939.67	0.0765	0.0685	0.0592	0.0484	0.0344	0.0000																			**0.29**
4940.00	0.0838	0.0766	0.0684	0.0593	0.0485	0.0340																			**0.37**
4940.33	0.0906	0.0839	0.0765	0.0685	0.0594	0.0483																			**0.43**
4940.67	0.0968	0.0906	0.0838	0.0765	0.0685	0.0592																			**0.48**
4941.00	0.1027	0.0969	0.0905	0.0838	0.0766	0.0684																			**0.52**
4941.33	0.1082	0.1027	0.0968	0.0906	0.0839	0.0765																			**0.56**
4941.67	0.1135	0.1083	0.1026	0.0968	0.0906	0.0838																			**0.60**
4942.00	0.1186	0.1136	0.1082	0.1027	0.0969	0.0905																			**0.63**
4942.33	0.1234	0.1186	0.1135	0.1082	0.1027	0.0967																			**0.66**
4942.67	0.1281	0.1235	0.1185	0.1135	0.1083	0.1026																			**0.69**
4943.00	0.1326	0.1281	0.1234	0.1186	0.1136	0.1082																			**0.72**
4943.33	0.1369	0.1326	0.1280	0.1234	0.1186	0.1135																			**0.75**
4943.67	0.1411	0.1370	0.1325	0.1281	0.1235	0.1185																			**0.78**
4944.00	0.1452	0.1412	0.1369	0.1326	0.1281	0.1234																			**0.81**
4944.33	0.1492	0.1453	0.1411	0.1369	0.1326	0.1280																			**0.83**
4944.67	0.1531	0.1492	0.1452	0.1411	0.1370	0.1325																			**0.86**
4945.00	0.1569	0.1531	0.1492	0.1452	0.1412	0.1369																			**0.88**
4945.33	0.1605	0.1569	0.1530	0.1492	0.1453	0.1411																			**0.91**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																			**#N/A**
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	

RESTRICTOR PLATE SIZING FOR CIRCULAR VERTICAL ORIFICES

Project: **Mountain Sky Subdivision**

Basin ID: **Filing No. 1**

X

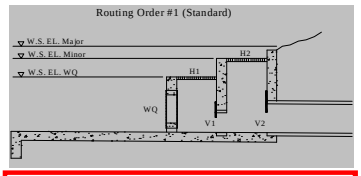


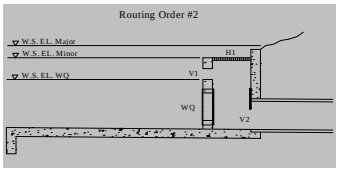
Restrictor Plate sized for Filing No. 1 Release Rate 100-Year runoff reduced to 5-Year Historic Rate

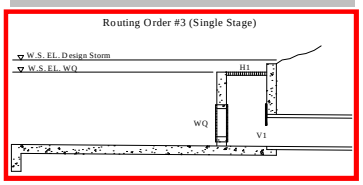
		#1 Vertical Orifice	#2 Vertical Orifice	
Sizing the Restrictor Plate for Circular Vertical Orifices or Pipes (Input)				
Water Surface Elevation at Design Depth	Elev: WS =		4,943.22	feet
Pipe/Vertical Orifice Entrance Invert Elevation	Elev: Invert =		4,937.50	feet
Required Peak Flow through Orifice at Design Depth	Q =		6.48	cfs
Pipe/Vertical Orifice Diameter (inches)	Dia =		24.0	inches
Orifice Coefficient	C_o =		0.65	
Full-flow Capacity (Calculated)				
Full-flow area	Af =		3.14	sq ft
Half Central Angle in Radians	Theta =		3.14	rad
Full-flow capacity	Qf =		35.6	cfs
	Percent of Design Flow =		549%	
Calculation of Orifice Flow Condition				
Half Central Angle (0<Theta<3.1416)	Theta =		0.99	rad
Flow area	A_o =		0.53	sq ft
Top width of Orifice (inches)	T_o =		20.07	inches
Height from Invert of Orifice to Bottom of Plate (feet)	Y_o =		0.45	feet
Elevation of Bottom of Plate	Elev Plate Bottom Edge =		4,937.95	feet
Resultant Peak Flow Through Orifice at Design Depth	Q_o =		6.5	cfs
Width of Equivalent Rectangular Vertical Orifice	**Equivalent Width =**		**1.18**	**feet**

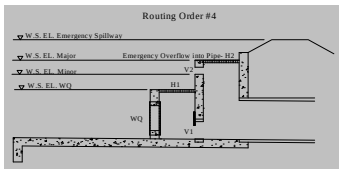
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: **Mountain Sky Subdivision**
Basin ID: **Final Developed Conditions with Filing No. 1 WQ and 100YR Release Rate**









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =					inches
OR							
Rectangular Opening:	Width in Feet	W =	2.92		1.83	1.18	ft.
	Length (Height for Vertical)	L or H =	2.92		0.50	0.45	ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	50		100	100	%
	Orifice Coefficient	C_o =	0.65		0.65	0.65	
	Weir Coefficient	C_w =	2.65				
	Orifice Elevation (Bottom for Vertical)	E_o =	4942.42		4,941.59	4,937.50	ft.

Calculation of Collection Capacity:

	Net Opening Area (after Trash Rack Reduction)	A_o =	4.26		0.92	0.53	sq. ft.
	OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
	Perimeter as Weir Length	L_w =	8.76	ft.			
	OPTIONAL: User-Overide Weir Length	L_w =		ft.			
	Top Elevation of Vertical Orifice Opening, Top =				4942.09	4937.95	ft.
	Center Elevation of Vertical Orifice Opening, Cen =				4941.84	4937.73	ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	4938.00	0.00	0.00	0.00	0.00	0.00	0.00	1.45	**0.00**	
	4939.00	0.14	0.00	0.00	0.00	0.00	0.00	3.12	**0.00**	
	4940.00	0.36	0.00	0.00	0.00	0.00	0.00	4.17	**0.00**	
	4941.00	0.57	0.00	0.00	0.00	0.00	0.00	5.00	**0.00**	
	4942.00	0.70	0.00	0.00	0.00	0.00	1.77	5.72	**0.70**	
	4943.00	0.81	10.25	16.94	0.00	0.00	5.14	6.35	**5.14**	Release Rate=
4943.64	4944.00	0.91	46.10	27.95	0.00	0.00	7.01	6.93	**7.01**	6.48
	4945.00	1.00	96.20	35.72	0.00	0.00	8.48	7.46	**8.48**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	
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		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	
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		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	
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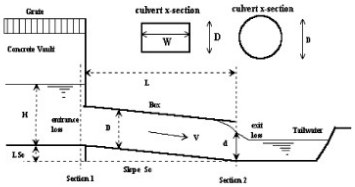
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	**#N/A**	

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Mountain Sky Subdivision
Basin ID: Final Developed Conditions with Filing No. 1 WQ and 100YR Release Rate

Status: Culvert Data is valid!



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D =	24	in.
Circular Culvert: Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:			
Box Culvert: Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Box Culvert: Barrel Width (Span) in Feet	Width (Span) =		ft.
Box Culvert: Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 deg. Flared Wingwall	
Number of Barrels	No =	1	
Inlet Elevation at Culvert Invert	I_{elev} =	4937.50	ft. elev.
Outlet Elevation at Culvert Invert	O_{elev} =	4936.00	ft. elev.
Culvert Length in Feet	L =	127.2	ft.
Manning's Roughness	n =	0.0120	
Bend Loss Coefficient	K_b =	0.00	
Exit Loss Coefficient	K_x =	1.00	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	
Friction Loss Coefficient	K_f =	
Sum of All Loss Coefficients	K_s =	
Orifice Inlet Condition Coefficient	C_d =	
Minimum Energy Condition Coefficient	KE_{low} =	

Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
4938.00	0.00			0.00		
4939.00	0.00			0.00		
4940.00	0.00			0.00		
4941.00	0.00			0.00		
4942.00	0.00			0.70		
4943.00	0.00			5.14		
4944.00	0.00			7.01		
4945.00	0.00			8.48		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
0.00	0.00			#N/A		
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0.00	0.00			#N/A		
0.00	0.00			#N/A		

PROJECT:	CITY OF FORT LUPTON	JOB NO.	EQUINOX MTN SKY
SUBJECT:	POND VOLUMES	DATE:	2/19/2016
		BY:	TAW

Floor of Outlet Structure	=	4937.49 ft		
WQCV Water Surface Elev.	=	4941.46 ft		
5 Year Water Surface Elev.	=	4942.42 ft	Q(5)=	6.49 cfs
100 Year Water Surface Elev.	=	4943.65 ft	Q(100)	6.49 cfs

Outlet Structure sized for Full Buildout Conditions:
1) 5-Year Orifice
2) 100-Year Min. Pipe Dia.
3) Outlet Grate Design
4) Emergency Overflow Weir

ORIFICE DESIGN-5 YEAR STORM

Invert Elev.: 4941.46 ft

Allow. Release Rate: **6.49** cfs

$Q=C_d*A(2gh)^{1/2}$

Where:				
Q=	**6.49**	cfs	Release Rate
C_d=	0.65		Orifice Coefficient
A=	1.81	ft^2	Area
g=	32.20	ft/sec^2	Gravitational constant
h=	0.47	ft	Head on Orifice Measured from Centerline

Rectangular (wxl) = **11 1/2** in x **16 13/16** in

ORIFICE DESIGN-100 YEAR STORM

Invert Elev.: 4937.49 ft

Outlet Pipe Diameter = 18 in

$Q=C_d*A(2gh)^{1/2}$

Where:				
Q=	**6.49**	cfs	Allow. Release Rate
C_d=	0.65		Orifice Coefficient
A=	1.48	ft^2	Area
g=	32.20	ft/sec^2	Gravitational constant
h=	5.41	ft	Head on Orifice Measured from Centerline

Orifice Diameter= **16 1/2** in
or see UDFCD Restrictor Plate Worksheet

OUTLET GRATE DESIGN

Required Grate Capacity= 2 times the 100 Year Release Rate ($Q=2xQ_{100}$)= 6.5 cfs

$Q=C_d*A(2gh)^{1/2}$

Where:			
Q=	12.97	cfs	Design Flow
C_d=	0.65		Orifice Coefficient
A=	8.52	ft^2	Area of Single Type 'C' Inlet Grate
g=	32.20	ft/sec^2	Gravitational constant
h=	4.22	ft	Head on Grate Measured from 100 Year Water Surface to Top of Grate

Number of Inlets (n): $n=\frac{Q}{C_d*A(2gh)^{1/2}}$ n= 0.14 **Use** **1** **Type 'C' Inlet**

WEIR DESIGN EMERGENCY OVERFLOW

Required Weir Capacity=Two times 100-Year Developed Flow Rate
Freeboard Elev.= 4945.00 ft
Weir Invert Elev.= 4943.93 ft = Top of 100 W.S. ELEV

100-Year Flow Rate: 127 cfs
Release Rate (Q_{100})= 254 cfs

Required Release= 254 cfs 2 Times the 100 Year Developed Flow Rate

$Q=C*L*h^{(3/2)}$

Where:					
Q=	254.00	cfs	Design Flow		
C=	3.10		Weir Coefficient		
h=	1.00	ft	Weir Height		
L=	81.9	ft	Length of Weir	**Use**	**81.9**

RIPRAP SIZING

$$\frac{VS^{0.17}}{d50^{0.5}\,(Gs-1)^{0.66}} = 4.5$$

Gs = 2.65

Riprap Sizing at Swales

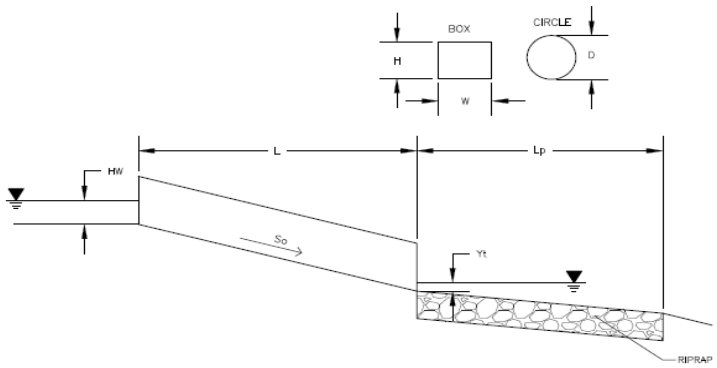
Swale	Calc'd d50 (ft)	Design Equation	Design d50 (in)	Riprap Type
N of OS2	0.03	2.65	6	VL
OS-E swale	0.33	2.65	6	VL

Swale	Slope	Vminor (fps)
N of OS2	1.5%	1.35
OS-E swale	0.8%	4.82

Location	Design d50 (in)	Riprap Type	Length (ft)	Width (ft)	Depth (in)
N of OS2	6	VL	6	4.5	10.5
OS-E Swale	6	VL	6	17	10.5
CR 29 1/2 Culvert	6	VL	21	15	10.5
Outfall for Outlet Structure	6	VL	6	6	10.5

Determination of Culvert Headwater and Outlet Protection

Project: Mountain Sky
Basin ID: CR29 1/2 Box Culvert Outlet protection



Soil Type:
Choose One:
- (●) Sandy
- ( ) Non-Sandy

Supercritical Flow! Using Ha to calculate protection type.

Minor Storm
Box Culvert
Q = 90 cfs
Riprap =
Type VL
L = 21 ft
W = 15 ft

Design Information (Input):

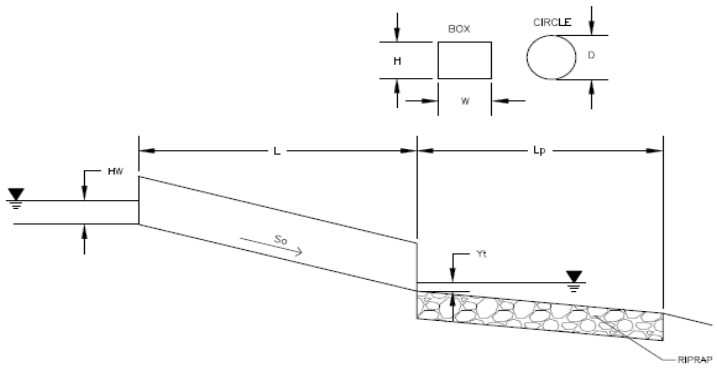
Design Discharge	Q =	90	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =		inches
Inlet Edge Type (Choose from pull-down list)			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =	7	ft
Barrel Width (Span) in Feet	Width (Span) =	11	ft
Inlet Edge Type (Choose from pull-down list)		Square Edge w/ 90-15 Deg. Headwall	
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	4963	ft
Outlet Elevation **OR** Slope	So =	0.006	ft/ft
Culvert Length	L =	62	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =	4964	ft
Max Allowable Channel Velocity	V =	12	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	1.37	ft
Flow Area at Max Channel Velocity	A_t =	7.50	ft^2
Culvert Cross Sectional Area Available	A =	77.00	ft^2
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.12	
Sum of All Losses Coefficients	k_s =	1.62	ft
Culvert Normal Depth	Y_n =	0.97	ft
Culvert Critical Depth	Y_c =	1.28	ft
Tailwater Depth for Design	d =	4.14	ft
Adjusted Diameter **OR** Adjusted Rise	H_a =	3.98	ft
Expansion Factor	1/(2*tan(Θ)) =	6.65	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/WH^1.5 =	0.44	$ft^{0.5}/s$
Froude Number	Fr =	1.51	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/H =	0.34	
Inlet Control Headwater	HW_I =	2.18	ft
Outlet Control Headwater	HW_O =	3.80	
Design Headwater Elevation	**HW =**	**4,966.80**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/H =**	**0.54**	
Minimum Theoretical Riprap Size	d_{50} =	2	in
Nominal Riprap Size	d_{50} =	6	in
UDFCD Riprap Type	**Type =**	**VL**	
Length of Protection	**L_p =**	**21**	**ft**
Width of Protection	**T =**	**15**	**ft**

Determination of Culvert Headwater and Outlet Protection

Project: Mountain Sky
Basin ID: CR29 1/2 Box Culvert Outlet protection



Soil Type:
Choose One:
- (●) Sandy
- ( ) Non-Sandy

Supercritical Flow! Using Ha to calculate protection type.

Major Storm
Box Culvert
Q = 643 cfs
Riprap =
Type VL
L = 21 ft
W = 15 ft

Design Information (Input):

Design Discharge	Q =	643	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =		inches
Inlet Edge Type (Choose from pull-down list)			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =	7	ft
Barrel Width (Span) in Feet	Width (Span) =	11	ft
Inlet Edge Type (Choose from pull-down list)		Square Edge w/ 90-15 Deg. Headwall	
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	4963	ft
Outlet Elevation **OR** Slope	So =	0.006	ft/ft
Culvert Length	L =	62	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =	4967.3	ft
Max Allowable Channel Velocity	V =	12	ft/s

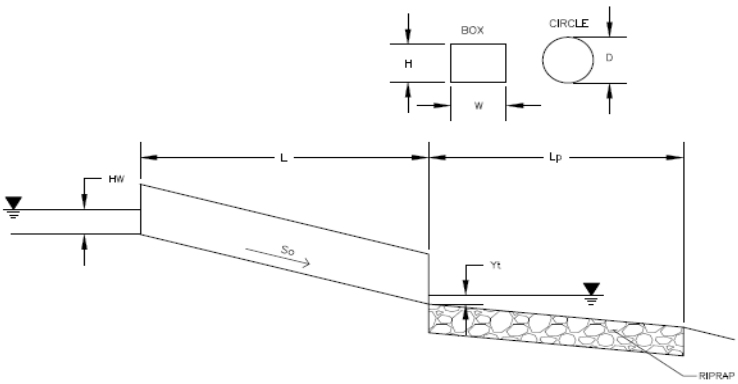
Required Protection (Output):

Tailwater Surface Height	Y_t =	4.67	ft
Flow Area at Max Channel Velocity	A_t =	53.58	ft^2
Culvert Cross Sectional Area Available	A =	77.00	ft^2
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	0.12	
Sum of All Losses Coefficients	k_s =	1.62	ft
Culvert Normal Depth	Y_n =	3.61	ft
Culvert Critical Depth	Y_c =	4.73	ft
Tailwater Depth for Design	d =	5.87	ft
Adjusted Diameter **OR** Adjusted Rise	H_a =	5.31	ft
Expansion Factor	1/(2*tan(Θ)) =	6.65	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/WH^1.5 =	3.16	$ft^{0.5}/s$
Froude Number	Fr =	1.50	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/H =	0.88	
Inlet Control Headwater	HW_I =	8.13	ft
Outlet Control Headwater	HW_O =	7.25	
Design Headwater Elevation	**HW =**	**4,971.13**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/H =**	**1.16**	
Minimum Theoretical Riprap Size	d_{50} =	5	in
Nominal Riprap Size	d_{50} =	6	in
UDFCD Riprap Type	**Type =**	**VL**	
Length of Protection	**L_p =**	**21**	**ft**
Width of Protection	**T =**	**15**	**ft**

Determination of Culvert Headwater and Outlet Protection

Project: Mountain Sky

Basin ID: Riprap at Outlet Structure Outfall



Soil Type:
Choose One:
- (●) Sandy
- ( ) Non-Sandy

Design Information (Input):

Design Discharge	Q =	6.49	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	24	inches
Inlet Edge Type (Choose from pull-down list)		1.1 : 1 Beveled Edge	
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Barrel Width (Span) in Feet	Width (Span) =		ft.
Inlet Edge Type (Choose from pull-down list)		Square Edge w/ 90-15 Deg. Headwall	
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	4937.5	ft
Outlet Elevation **OR** Slope	Elev OUT =	4936	ft
Culvert Length	L =	127.2	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Y_t =		ft.

Required Protection (Output):

Tailwater Surface Height	Y_t =	0.80	ft
Max Allowable Channel Velocity	V =	5.00	ft/s
Flow Area at Max Channel Velocity	A_t =	1.30	ft^2
Culvert Cross Sectional Area Available	A =	3.14	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	1.34	
Sum of All Losses Coefficients	k_s =	2.54	ft
Culvert Normal Depth	Y_n =	0.67	ft
Culvert Critical Depth	Y_c =	0.90	ft
Tailwater Depth for Design	d =	1.45	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	1.34	ft
Expansion Factor	1/(2*tan(Θ)) =	6.56	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	1.15	$ft^{0.5}/s$
Tailwater/Diameter **OR** Tailwater/Rise	Yt/D =	0.40	
Inlet Control Headwater	HW_I =	1.27	ft
Outlet Control Headwater	HW_O =	0.12	ft
Design Headwater Elevation	**HW =**	**4,938.77**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.64**	
Minimum Theoretical Riprap Size	d_{50} =	2	in
Nominal Riprap Size	d_{50} =	6	in
UDFCD Riprap Type	**Type =**	**VL**	
Length of Protection	**L_p =**	**6**	**ft**

APPENDIX D

REFERENCED CRITERIA

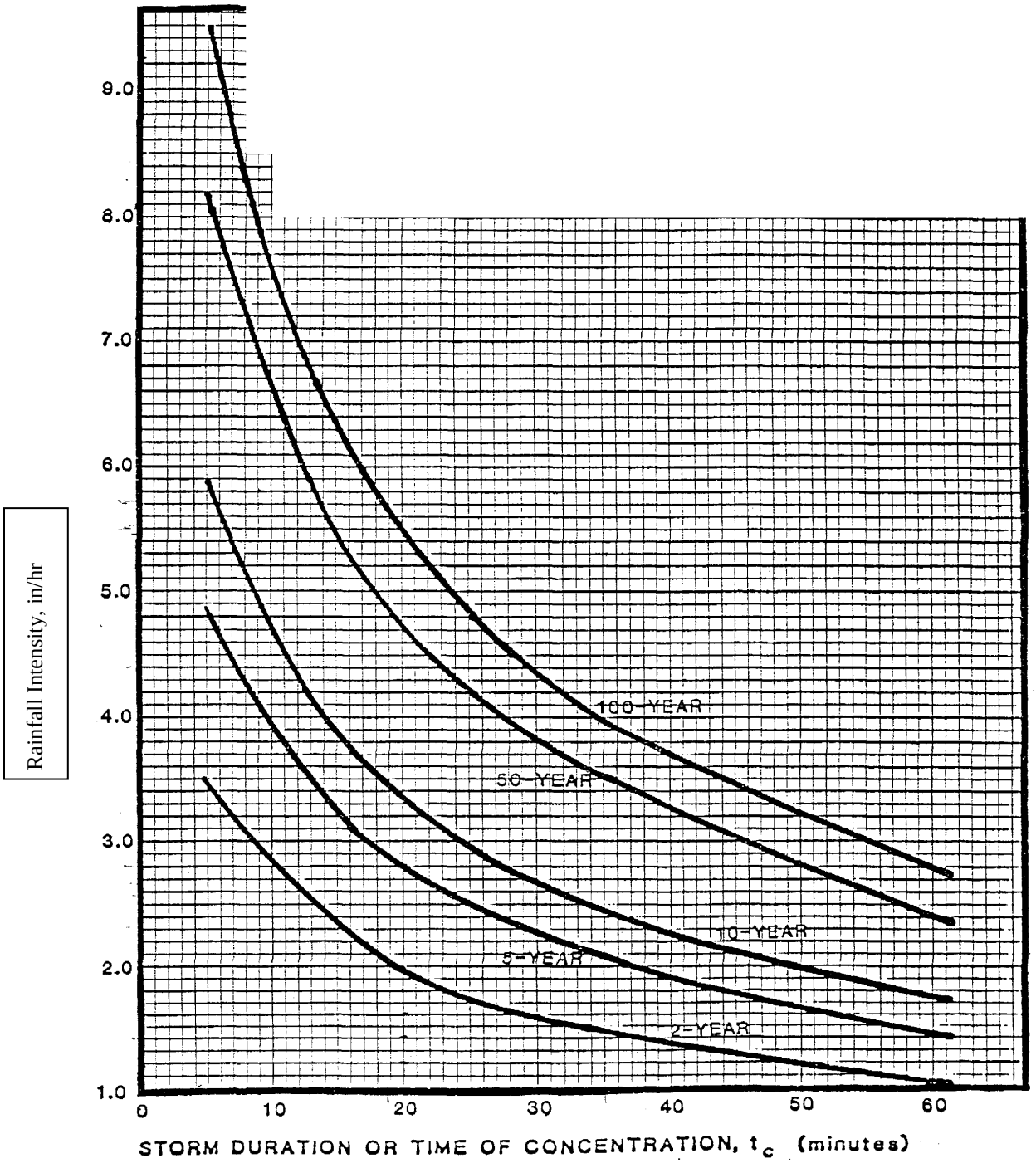
Table 602
Recommended Runoff Coefficients and Percent Impervious

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients			
		2-yr	5-yr	10-yr	100-yr
Business					
Commercial	95	.87	.87	.88	.89
Neighborhood	70	.60	.65	.70	.80
Residential					
Single-family	*	.40	.45	.50	.60
Multi-unit (detached)	50	.45	.50	.60	.70
Multi-unit (attached)	70	.60	.65	.70	.80
½ acre lot or larger	*	.30	.35	.40	.60
Apartments	70	.65	.70	.70	.80
Industrial					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
Parks, Cemeteries	7	.10	.18	.25	.45
Playgrounds	13	.15	.20	.30	.50
Schools	50	.45	.50	.60	.70
Railroad yard areas	20	.20	.25	.35	.45
Undeveloped Areas					
Historic Flow Analysis	2	.05	.15	.25	.50
Streets					
Paved	100	.87	.88	.90	.93
Gravel (packed)	40	.40	.45	.50	.60
Drive and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawn, sandy soil	7	.10	.18	.25	.45
Lawn, Clayey soil	7	.10	.18	.25	.45

* See Figure 603 for percent impervious.

Note: These Rational Method formula coefficients may not be valid for large basins.

Figure 501
Time-Intensity-Frequency Curves
for the Rational Method



Reference: WRC Engineering, Inc. TM-1, November 1986