FINAL DRAINAGE REPORT

Harrison Creek Water Treatment Facility
Water Impoundment

PREPARED FOR

Piceance Energy, LLC
601 28 ¼ Road, Suite D
Grand Junction, CO 81506
970.812.5310
Contact: Wayne Bankert

PREPARED BY

Olsson Associates
760 Horizon Drive, Suite 102
Grand Junction, CO 81506
970.263.7800
Contact: Lorne C. Prescott
Wyatt E. Popp, PE, LEED AP

March 13, 2015

Olsson Associates Project No. 014-0465

OLSSON ASSOCIATES

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ENGINEER'S STATEMENT

I hereby certify that this Final Drainage Report for the design of Piceance Energy, LLC's Harrison Creek Water Treatment Facility Water Impoundment was prepared by me, or under my direct supervision, in accordance with the provisions of the Stormwater Management Manual for the owners thereof. I understand that Mesa County does not and will not assume liability for drainage facilities designed by others.

Wyatt E. Popp, PE
Registered Professional Engineer
State of Colorado No. 38514

3/13/15
Date

OWNER'S STATEMENT

I, _____, hereby certify that the drainage facilities for Harrison Creek Water Treatment Facility – Water Impoundment shall be constructed according to the design presented in this report. I understand that Mesa County does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand that Mesa County reviews drainage plans but cannot, on behalf of Harrison Creek Water Treatment Facility – Water Impoundment, guarantee that final drainage design review will absolve Piceance Energy, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Final Plat and/or Final Development Plan does not imply approval of my engineer's drainage design.

_____

Owner/Developer

_____

Authorized Signature Date

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1.0 INTRODUCTION

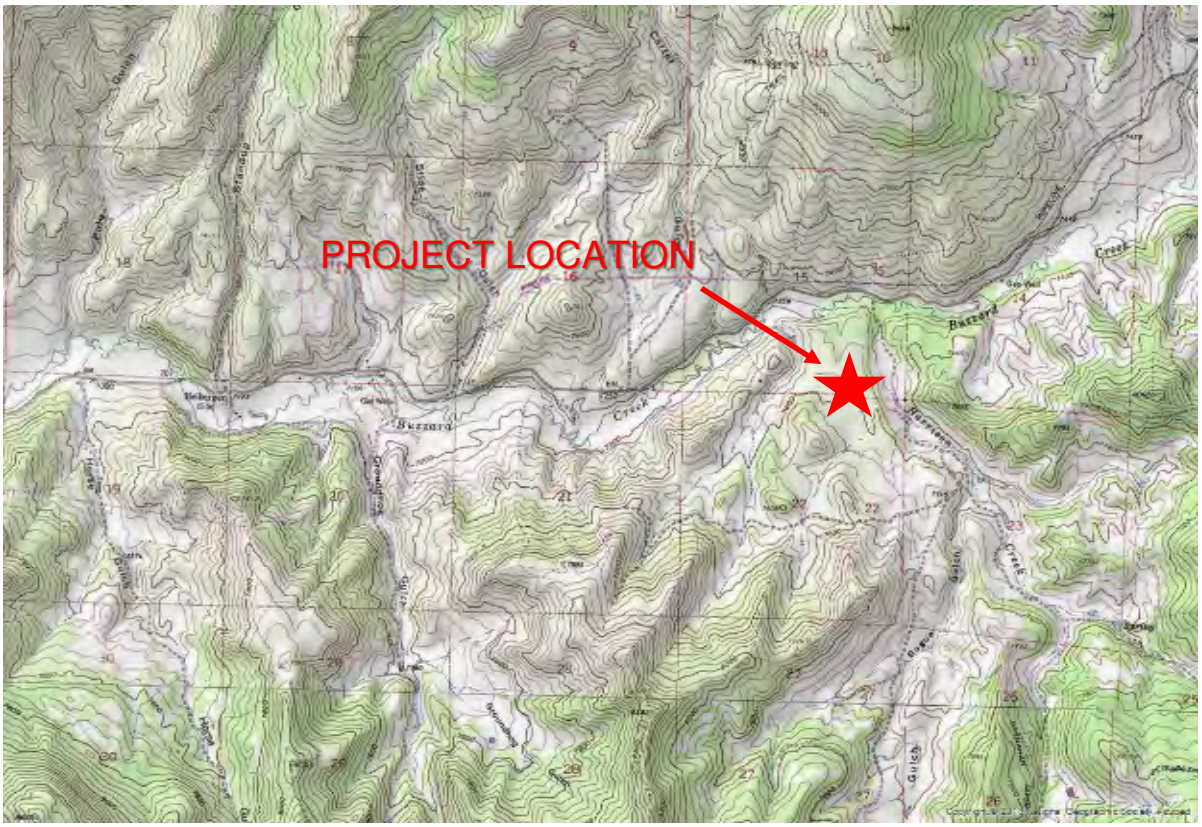
1.1 Background

This Final Drainage Report has been prepared for Piceance Energy, LLC's Harrison Creek Water Treatment Facility, Water Impoundment (the SITE) by Olsson Associates. This report evaluates the SITE's historic drainage patterns, analyzes the change in stormwater quantity associated with existing development, and provides design to alleviate the impacts of modified stormwater runoff patterns due to development.

1.2 Project Location

The SITE is located in the NE ¼ of Section 22 and the SE ¼ of Section 15, Township 9 South, Range 93 West of the 6th Principal Meridian, County of Mesa, State of Colorado. Refer to Figure 1 for project location.

Figure 1. Project Location



The SITE is located north east of Vega State Park, approximately 11.5 miles east of the town of Collbran. County Road 330 is located approximately 0.50 miles north of the SITE, and Harrison Creek Road is located approximately 0.23 miles east of the SITE.

1.3 Project Description

The SITE consists of approximately 35 acres. This area includes four water impoundment ponds graded into mountainous terrain with adjacent pads, the construction of an access road along the east side of the ponds, and the realignment of an access road to well pad BCU 22-3 on the east side of the pond complex. Prior to development, the SITE is covered by native vegetation, and flows from south to north by sheet flow and natural drainage ways. There do not appear to be any drainage or irrigation facilities on the SITE.

According to the NRCS Web Soil Survey, soils in the area of the SITE consist of soils that are classified as hydrologic group Type C. The Hydrologic Soil Group report from the NRCS is included in Appendix A and describes the soils, topography, and slopes on the SITE.

1.4 Previous Investigations

A previous investigation was conducted on a portion of the area encompassed by the SITE. This investigation can be found in "Final Drainage Report – North Vega Water Impoundment" by Olsson Associates dated August 20, 2010.

2.0 DRAINAGE SYSTEM DESCRIPTION

2.1 Existing Drainage Conditions

The SITE drains to a natural drainage way which eventually empties into Buzzard Creek to the North. Refer to the General Location Map in Appendix A for the SITE location relative to the major tributary drainage ways.

The SITE generally slopes from the south to the north at 4%. Refer to the Historic Conditions Drainage Plan in Appendix A for the SITE's historic drainage conditions.

There are 7 drainage basins that contribute to the existing drainage conditions. Refer to Appendix A, Existing Drainage and Proposed Drainage Plan for drainage maps.

Basin OS-1 – This basin consists of the upland area to the southwest of the SITE. This represents a fairly large area that enters the SITE and flows through the SITE to the north.

Basin OS-2 – This basin is the area immediately to the west of the SITE and flows through the SITE to the north.

Basin OS-3 – This basin is the Mega Vega Station to the south of the SITE.

Basin OS-4 – This basin is the area south of the SITE and west of the Mega Vega Station that drains towards the east.

Basin OS-5 – This basin is the area south of the SITE and west of the Mega Vega Station that drains towards the west.

Stormwater on the SITE appears to sheet flow across the SITE and collect in natural drainage ways. The natural drainage ways exit the SITE on the north side and are un-detained. The SITE has historic peak flows that enter the SITE project limits from offsite drainage basins of 86.79 cfs for a 10-yr storm event and 275.5 cfs for a 100-yr storm event (represented by basins OS-1 through OS-6). The SITE has historic peak flows that exit the project limits of 104.84 cfs for a

10-yr storm event and 332.81 cfs for a 100-yr storm event (represented by basins OS-1 through OS-6 plus the addition of EX-1). Refer to Table 1 for summary of flows and Appendix B – Hydrologic Calculations for calculation details.

Table 1. Historic SITE Peak Run-on and Runoff

Drainage Basin	Area (ac)	10-yr Peak Flow (cfs)	100-yr Peak Flow (cfs)
OS-1	165.45	65.81	208.89
OS-2	18.91	11.28	35.80
OS-3	7.84	3.79	12.04
OS-4	5.29	3.37	10.70
OS-5	1.73	1.24	3.93
OS-6	1.98	1.30	4.14
Total flow entering SITE		**86.79**	**275.5**
EX-1	31.68	18.05	57.31
Total flow exiting SITE (Design Point E1)		**104.84[a]**	**332.81[a]**

[a]Allowable 10-yr and 100-yr release rates for the developed SITE.

Per Section 403.7.1 of Mesa County's *Storm Water Management Manual* (the MANUAL), historic peak flow rates presented in Table 1 are equivalent to the allowed SITE release rates for the developed condition during both the minor and major events.

2.2 Master Drainage Plan

To our knowledge, no master drainage studies have analyzed the SITE.

2.3 Offsite Tributary Area

The SITE will not be adversely affected by stormwater from adjacent land, since the water impoundment ponds are self-contained by fill slopes without outlets. The offsite run-on will be diverted around the site by proposed riprap lined drainage swales and released on the north end of the SITE. For the purposes of this study, all adjacent land was assumed to remain undeveloped in the foreseeable future.

During construction, runoff from the SITE should be treated prior to leaving the SITE using methods described in Vol. 3 of the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*, including use of straw bales and/or other methods to provide temporary water quality.

2.4 Proposed Drainage System Description

Eleven distinct drainage basins were used to model the SITE. Refer to Appendix A, Existing Drainage and Proposed Drainage Plan for drainage maps.

Basin A – This basin contains the south portion of the access road to the impoundment ponds. Stormwater from this area will drain to the east into the offsite run-on diversion swale on the

east side of the SITE. At this point, the diversion swale will be conveying the stormwater collected from Basins OS-3, OS-4, and A.

Basin B – This basin contains the north portion of the access road to the impoundment ponds and the area containing the offsite run-on diversion swale northeast of Pond 4. Stormwater from this area will drain to the north and exit the SITE. At this point, the diversion swale will be conveying the stormwater collected from Basins OS-3, OS-4, OS-6, A, B, and H

Basin C – This basin is Pond 1 and will be a self-contained pond lined with an impervious liner. Stormwater captured in the pond will not be discharged from the SITE.

Basin D – This basin is Pond 2 and will be a self-contained pond lined with an impervious liner. Stormwater captured in the pond will not be discharged from the SITE.

Basin E – This basin is Pond 3 and will be a self-contained pond lined with an impervious liner. Stormwater captured in the pond will not be discharged from the SITE.

Basin F – This basin is Pond 4 and will be a self-contained pond lined with an impervious liner. Stormwater captured in the pond will not be discharged from the SITE.

Basin G – This basin is the area between Ponds 1 and 2. Stormwater from this area will drain into a drainage swale that will convey the stormwater to the west into the offsite run-on diversion swale on the west side of the SITE.

Basin H – This basin is the easterly area between Ponds 2 and 3. Stormwater from this area will drain into a drainage swale and through a culvert that will convey the stormwater to the east into the offsite run-on diversion swale on the east side of the STIE.

Basin I – This basin is the westerly area between Ponds 2 and 3. Stormwater from this area will drain into a drainage swale that will convey the stormwater to the west into the offsite run-on diversion swale on the west side of the STIE.

Basin J – This basin is the area between Ponds 3 and 4. Stormwater from this area will drain into a drainage swale that will convey the stormwater to the west into the offsite run-on diversion swale on the west side of the SITE.

Basin K – This basin is the area on the northwest side of Pond 4 and contains the northerly portion of the offsite run-on diversion swale on the west side of the STE. This drainage swale will convey the stormwater collected from Basins OS-1, OS-2, OS-5, G, I, and J.

Refer to Table 2 for summary of flows and Appendix B – Hydrologic Calculations for calculation details.

Table 2. Developed SITE Peak Runoff

Drainage Basin	Area (ac)	10-yr Peak Flow (cfs)	100-yr Peak Flow (cfs)
A	1.41	1.90	4.36
B	3.40	4.11	9.41
C[b]	1.98	6.86	11.72
D[b]	4.34	15.04	25.69
E[b]	4.60	15.92	27.18

F[b]	4.93	17.07	29.15
G	0.98	1.09	2.49
H	0.48	0.76	1.73
I	0.91	1.22	2.78
J	1.06	1.32	2.94
K	1.41	1.73	3.96
SITE release		**12.13**	**27.67**
Offsite diversion		**86.79**	**275.5**
Total release (Design Point 13)		**98.92**	**303.17**

[b]Impoundment pond basins will not release stormwater.

Table 3. SITE Release Comparisons

Design Year	Existing Conditions	Developed Conditions[c]	Meets Criteria
10-yr peak flow (cfs)	104.849	98.92	YES
100-yr peak flow (cfs)	332.81	303.17	YES

[c]Developed conditions include offsite and SITE excluding water impoundment ponds.

Diverted offsite run-on and stormwater collected on the SITE will be discharged in the natural drainage way on the north side of the SITE at rates lower than the existing conditions.

2.5 Drainage Facility Maintenance

The owner shall be responsible for maintaining all on-site drainage facilities. A minor amount of continuous maintenance will be necessary to keep vegetation established and stormwater features working at their original designed capacity. Although the water impoundment facility is not meant for stormwater, the water impoundment ponds should be maintained to remove sediment build-up. In addition, the ponds and SITE should be examined after any significant rainfall event to ensure proper functionality.

3.0 DRAINAGE ANALYSIS AND DESIGN CRITERIA

3.1 Regulations

This report has been prepared in accordance with criteria set forth in the MANUAL and the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*.

3.2 Development Criteria

There are no known constraints placed on the SITE due to floodplain studies, master studies, or adjacent property drainage studies. The SITE will divert all upstream land and adjacent development run-on flows around the SITE and release said flows un-detained.

3.3 Hydrologic Criteria

Hydrologic calculations have been prepared in accordance with criteria set forth in the MANUAL. Refer to Appendix B for all hydrologic calculations.

3.4 Hydraulic Criteria

Hydraulic calculations have been prepared in accordance with criteria set forth in the MANUAL and the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*. Refer to Appendix C for all hydraulic calculations.

3.5 Variance from Criteria

No variances from criteria set forth in the MANUAL are requested at this time.

4.0 POST-CONSTRUCTION STORMWATER MANAGEMENT

4.1 Stormwater Quality Control Measures

The proposed riprap lined drainage swales will provide a means for stormwater to be routed around the SITE during all post-construction storm events. No detention facilities have been incorporated into the SITE.

4.2 Calculations

Calculations for the drainage swale designs can be found in Appendix C.

5.0 CONCLUSIONS

5.1 Compliance with Manual

This report has been prepared in accordance with criteria set forth in the MANUAL and the Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*.

5.2 Design Effectiveness

Proper implementation of the proposed measures outlined in this report will alleviate the direct impacts of stormwater runoff on adjacent, downstream lands. The quantity of stormwater released from the SITE will be equivalent or below the historic conditions.

A registered licensed engineer in the State of Colorado should be consulted for the preparation of construction plans related to the recommendations outlined within this report.

5.3 Areas in Flood Hazard Zone

The SITE is not within a FEMA-designated flood hazard zone. Refer to the FIRM Panels 08077C0275F and 08077C0300F (not published but shown on Map Index 08077CIND0B) in Appendix A for the SITE location relative to designated flood plains.

5.4 Variance from Manual

No variances from the MANUAL are requested at this time.

6.0 REFERENCES

1) *Stormwater Management Manual*, City of Grand Junction and Mesa County
2) Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual, Vols. 1-3.*

APPENDIX A
MAPS AND EXHIBITS

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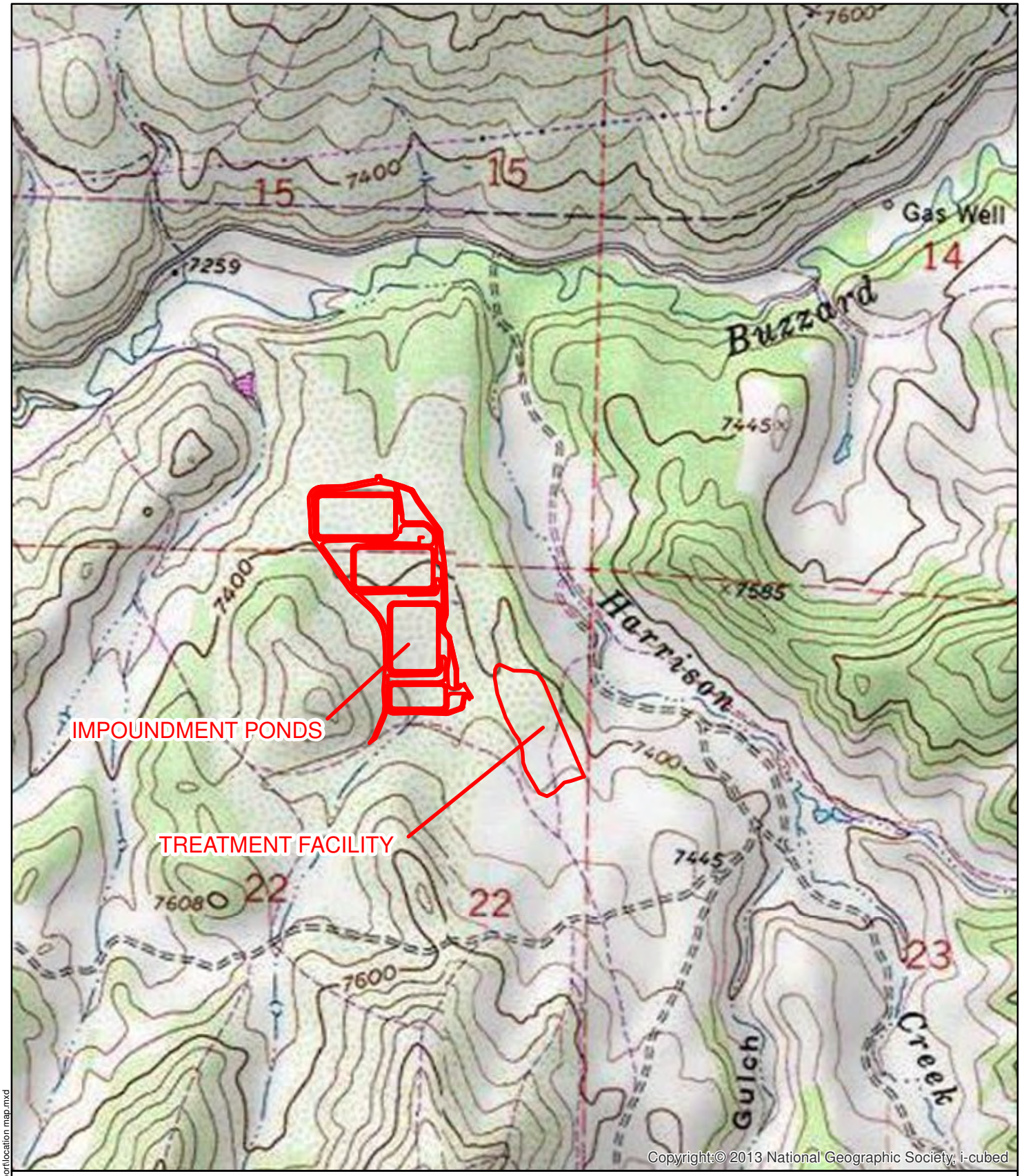

0 500 1,000 2,000 Feet

N

DISCLAIMER : This Geographic Information System (GIS) and its components are designed as a source of reference for answering inquiries, for planning and for modeling. GIS is not intended, nor does it replace legal description information in the chain of title and other information contained in official government records such as the County Clerk and Recorders office or the courts. In addition, the representations of locations in this GIS cannot be substituted for actual legal surveys.

Project Number: 014-0465	Location Map Piceance Energy, LLC Harrison Creek Water Treatment Facility Mesa County, CO Sec 15&22, T9S, R93W, 6th PM	OLSSON ASSOCIATES	Figure **A-1**
Drawn By: ABL		760 Horizon Drive, Suite 102 Grand Junction, CO 81506 P: 970.263.7800 F: 970.263.7456	
Revision Date: 3/5/2015			

F:\Projects\014-0465_LDVP\Design\Drainage Report\location map.mxd

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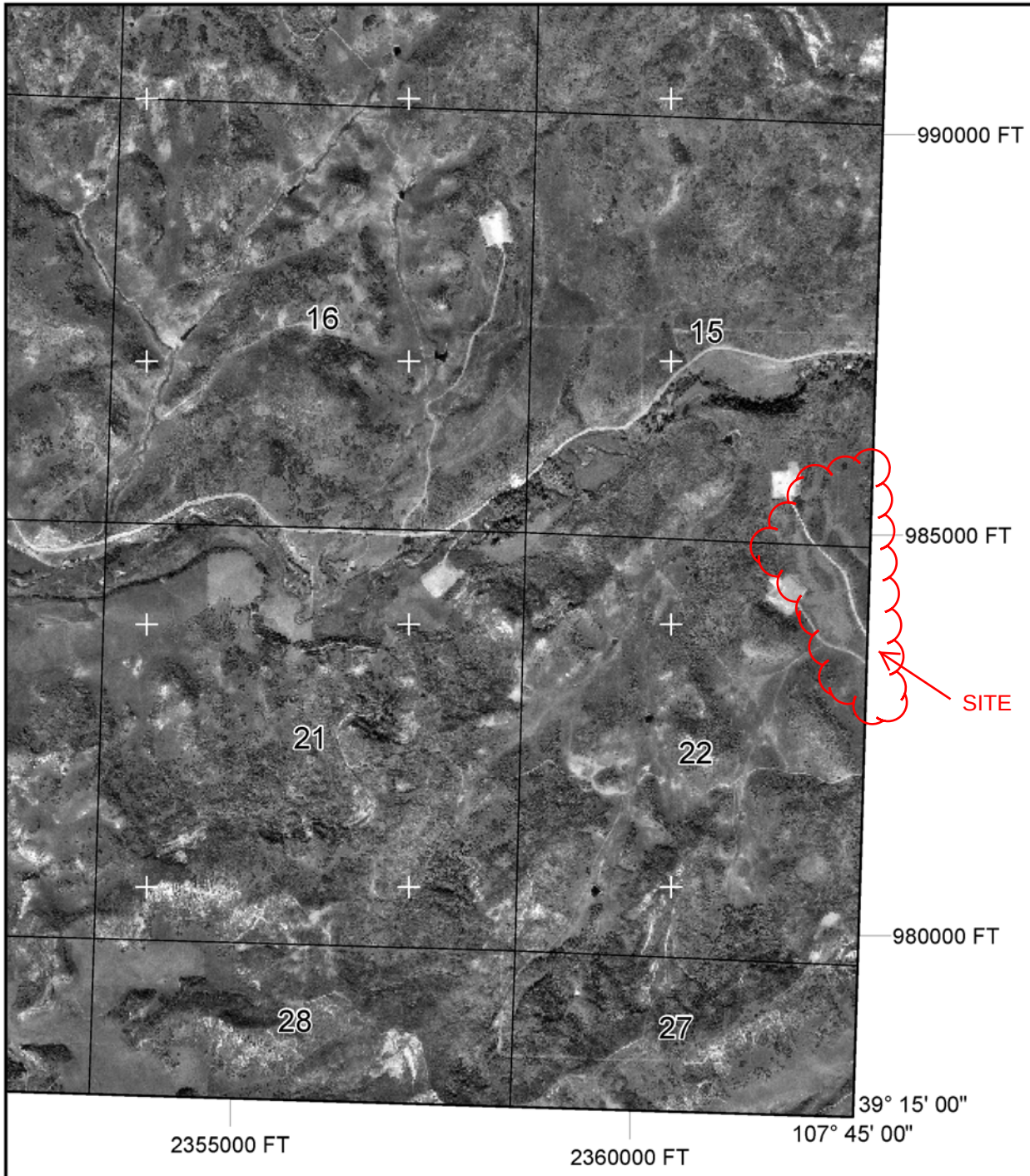

MAP SCALE 1" = 2000'

1000 0 2000 4000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0275F

FIRM

FLOOD INSURANCE RATE MAP
MESA COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 275 OF 1725

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MESA COUNTY	080115	0275	F

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

MAP NUMBER
08077C0275F

EFFECTIVE DATE
JULY 6, 2010

Federal Emergency Management Agency

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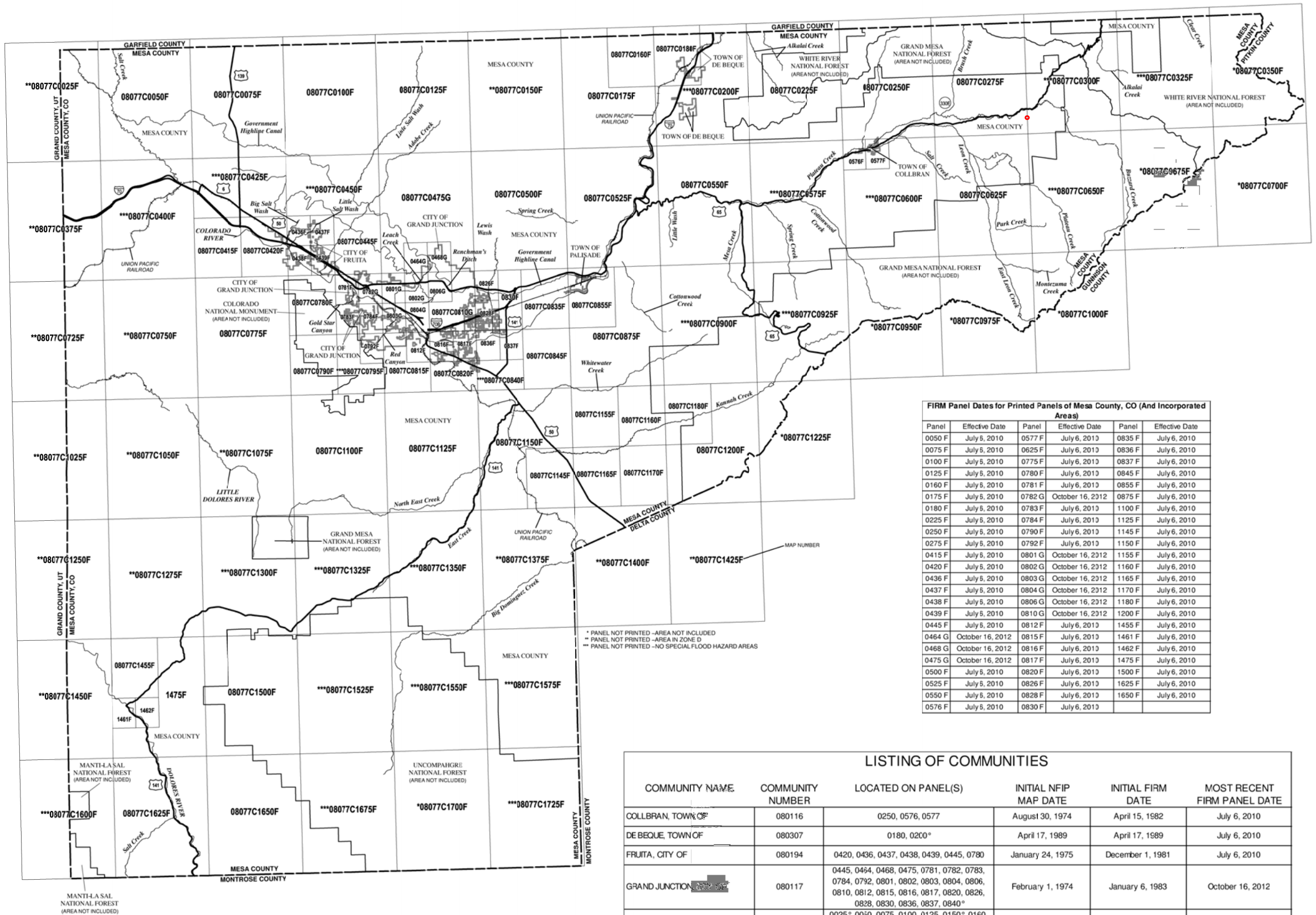


ELEVATION DATUM

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282
(301) 713-3242

MAP DATES

This FIRM Index displays the map date for each FIRM panel at the time that this Index was printed. Because this Index may not be distributed to unaffected communities in subsequent revisions, users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center (MSC) website at http://www.msc.fema.gov or by calling the FEMA Map Information eXchange (FMIX) at 1-877-336-2627.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the website listed above.

FIRM Panel Dates for Printed Panels of Mesa County, CO (And Incorporated Areas)

Panel	Effective Date	Panel	Effective Date	Panel	Effective Date
0050 F	July 5, 2010	0577 F	July 6, 2010	0835 F	July 6, 2010
0075 F	July 5, 2010	0625 F	July 6, 2010	0836 F	July 6, 2010
0100 F	July 5, 2010	0775 F	July 6, 2010	0837 F	July 6, 2010
0125 F	July 5, 2010	0780 F	July 6, 2010	0845 F	July 6, 2010
0160 F	July 5, 2010	0781 F	July 6, 2010	0855 F	July 6, 2010
0175 F	July 5, 2010	0782 G	October 16, 2012	0875 F	July 6, 2010
0180 F	July 5, 2010	0783 F	July 6, 2010	1100 F	July 6, 2010
0225 F	July 5, 2010	0784 F	July 6, 2010	1125 F	July 6, 2010
0250 F	July 5, 2010	0790 F	July 6, 2010	1145 F	July 6, 2010
0275 F	July 5, 2010	0792 F	July 6, 2010	1150 F	July 6, 2010
0415 F	July 5, 2010	0801 G	October 16, 2012	1155 F	July 6, 2010
0420 F	July 5, 2010	0802 G	October 16, 2012	1160 F	July 6, 2010
0436 F	July 5, 2010	0803 G	October 16, 2012	1165 F	July 6, 2010
0437 F	July 5, 2010	0804 G	October 16, 2012	1170 F	July 6, 2010
0438 F	July 5, 2010	0806 G	October 16, 2012	1180 F	July 6, 2010
0439 F	July 5, 2010	0810 G	October 16, 2012	1200 F	July 6, 2010
0445 F	July 5, 2010	0812 F	July 6, 2010	1455 F	July 6, 2010
0464 G	October 16, 2012	0815 F	July 6, 2010	1461 F	July 6, 2010
0468 G	October 16, 2012	0816 F	July 6, 2010	1462 F	July 6, 2010
0475 G	October 16, 2012	0817 F	July 6, 2010	1475 F	July 6, 2010
0500 F	July 5, 2010	0820 F	July 6, 2010	1500 F	July 6, 2010
0525 F	July 5, 2010	0826 F	July 6, 2010	1625 F	July 6, 2010
0550 F	July 5, 2010	0828 F	July 6, 2010	1650 F	July 6, 2010
0576 F	July 5, 2010	0830 F	July 6, 2010		

MAP REPOSITORIES

(Maps available for reference only, not for distribution.)

COLLBRAN, TOWN OF:
Town Hall
1010 High Street
Collbran, Colorado 81624

DE BEQUE, TOWN OF:
Town Hall
381 Minter Avenue
De Beque, Colorado 81630

FRUITA, CITY OF:
City Hall
325 East Aspen Avenue
Fruita, Colorado 81521

GRAND JUNCTION, CITY OF:
City Hall
250 North Fifth Street
Grand Junction, Colorado 81501

MESA COUNTY
(UNINCORPORATED AREAS):
County Commission Office
544 Rood Avenue
Grand Junction, Colorado 81501

PALISADE, TOWN OF:
Town Hall
175 East Third Street
Palisade, Colorado 81526

BASE MAP SOURCE

Base map information on this FIRM was derived from multiple sources. Data was provided by Mesa County GIS Dept., derived from ½ ft digital orthophotos, dated March 2010. Additional imagery was provided by the US Dept of Agriculture, derived from 1 meter digital orthophotos dated 2009.

NOTE TO USER

Future revisions to this FIRM Index will only be issued to communities that are located on FIRM panels being revised. This FIRM Index therefore remains valid for FIRM panels dated October 16, 2012 or earlier. Please refer to the "MOST RECENT FIRM PANEL DATE" column in the Listing of Communities table to determine the most recent FIRM Index date for each community.

LISTING OF COMMUNITIES

COMMUNITY NAME	COMMUNITY NUMBER	LOCATED ON PANEL(S)	INITIAL NFIP MAP DATE	INITIAL FIRM DATE	MOST RECENT FIRM PANEL DATE
COLLBRAN, TOWN OF	080116	0250, 0576, 0577	August 30, 1974	April 15, 1982	July 6, 2010
DE BEQUE, TOWN OF	080307	0180, 0200*	April 17, 1989	April 17, 1989	July 6, 2010
FRUITA, CITY OF	080194	0420, 0436, 0437, 0438, 0439, 0445, 0780	January 24, 1975	December 1, 1981	July 6, 2010
GRAND JUNCTION, CITY OF	080117	0445, 0464, 0468, 0475, 0781, 0782, 0783, 0784, 0792, 0801, 0802, 0803, 0804, 0806, 0810, 0812, 0815, 0816, 0817, 0820, 0826, 0828, 0830, 0836, 0837, 0840*	February 1, 1974	January 6, 1983	October 16, 2012
MESA COUNTY (UNINCORPORATED AREAS)	080115	0025*, 0050, 0075, 0100, 0125, 0150*, 0160, 0175, 0180, 0200*, 0225, 0250, 0275, 0300*, 0325*, 0350*, 0375*, 0400*, 0415, 0420, 0425*, 0436, 0437, 0438, 0439, 0445, 0450*, 0464, 0468, 0475, 0500, 0525, 0550, 0575*, 0576, 0577, 0600*, 0625, 0650*, 0725*, 0750*, 0775, 0780, 0781, 0782, 0783, 0784, 0790, 0792, 0795*, 0801, 0802, 0803, 0804, 0810, 0812, 0815, 0816, 0817, 0820, 0826, 0828, 0830, 0835, 0836, 0837, 0840*, 0845, 0855, 0875, 0900*, 0925*, 1025*, 1050*, 1075*, 1100, 1125, 1145, 1150, 1155, 1160, 1165, 1170, 1180, 1200, 1250*, 1275*, 1300*, 1325*, 1350*, 1375*, 1400*, 1425*, 1450*, 1455, 1461, 1462, 1475, 1500, 1525*, 1550*, 1575*, 1600*, 1625, 1650, 1675*, 1725*	October 18, 1974	July 3, 1978	October 16, 2012
PALISADE, CITY OF	080198	0835, 0855	August 13, 1976	February 5, 1986	July 6, 2010

*Panel Not Printed

NFIP

MAP INDEX

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MESA COUNTY, COLORADO
AND INCORPORATED AREAS

(SEE LISTING OF COMMUNITIES TABLE)

MAP INDEX

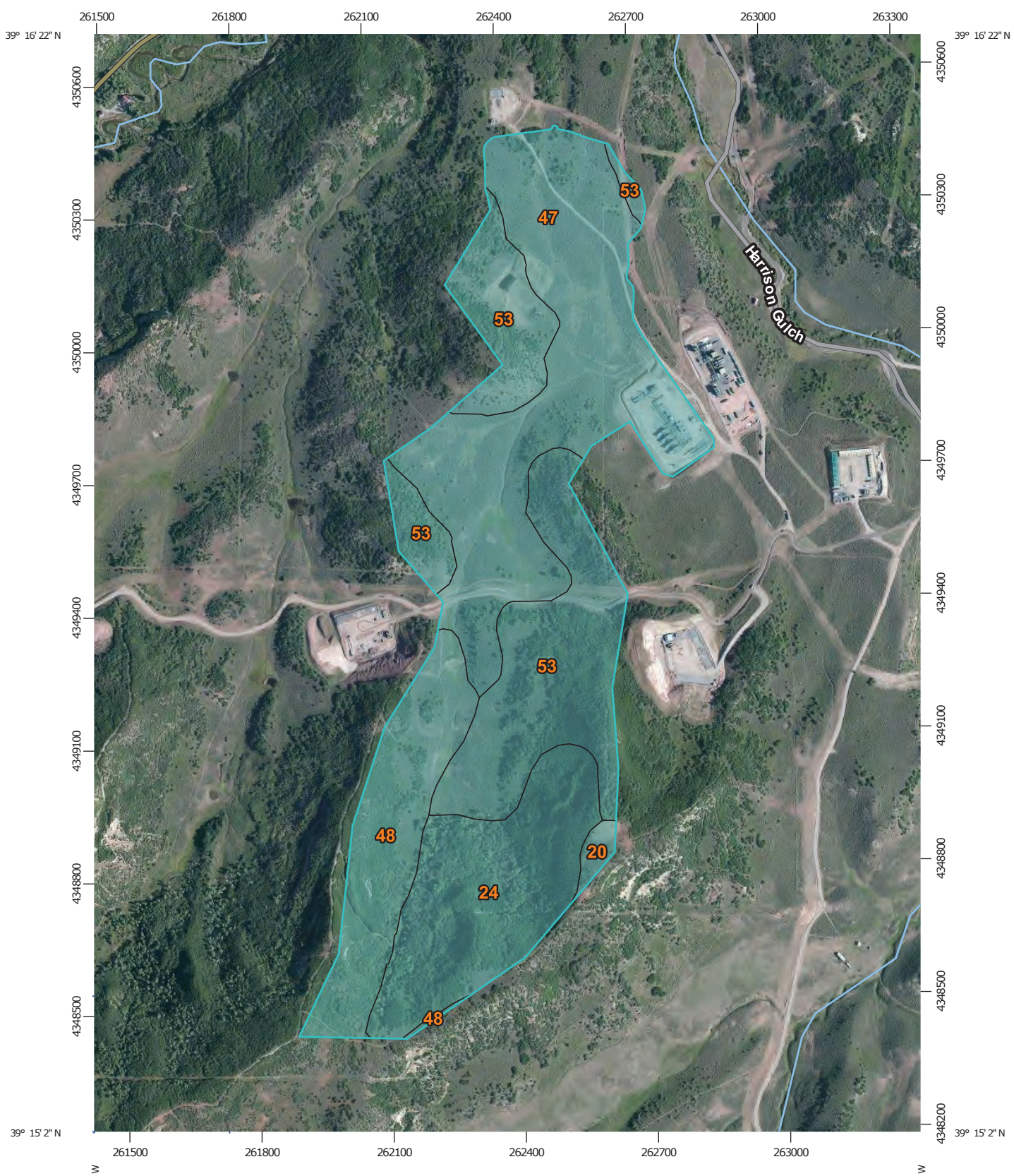
PANELS PRINTED: 50, 75, 100, 125, 160, 175, 180, 225, 250, 275, 415, 420, 436, 437, 438, 439, 445, 464, 468, 475, 500, 525, 550, 576, 577, 625, 775, 780, 781, 782, 783, 784, 790, 792, 801, 802, 803, 804, 806, 810, 812, 815, 816, 817, 820, 826, 828, 830, 835, 836, 837, 845, 855, 875, 1100, 1125, 1145, 1150, 1155, 1163, 1165, 1170, 1180, 1200, 1455, 1461, 1462, 1475, 1500, 1625, 1650

MAP NUMBER
08077CIND0B

MAP REVISED
OCTOBER 16, 2012

Federal Emergency Management Agency

Hydrologic Soil Group—Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties
(hcwtf)



Map Scale: 1:12,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 150 300 600 900

Feet
0 500 1000 2000 3000

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

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: 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: Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties
Survey Area Data: Version 7, Sep 22, 2014

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

Date(s) aerial images were photographed: Aug 7, 2011—Sep 3, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Douglas-Plateau Area, Colorado, Parts of Garfield and Mesa Counties (CO682)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
20	Cerro silty clay loam, 12 to 25 percent slopes	C	2.0	0.9%
24	Cochetopa-Clayburn complex, 12 to 40 percent slopes	C	43.6	19.3%
47	Hesperus-Empedrado, moist-Pagoda complex 5 to 35 percent slopes	C	81.1	35.8%
48	Hesperus-Empedrado, moist-Pagoda complex, 35 to 55 percent slopes	C	33.0	14.6%
53	Pagoda-Hesperus complex, 12 to 40 percent slopes	C	66.8	29.5%
Totals for Area of Interest			**226.7**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES:
1. NO BUILDING, STRUCTURE, OR FILL WILL BE PLACED IN THE DETENTION AREAS AND NO CHANGES OR ALTERATIONS AFFECTING THE HYDRAULIC CHARACTERISTICS OF THE DETENTION AREAS WILL BE MADE WITHOUT THE APPROVAL OF THE COUNTY.
2. MAINTENANCE AND OPERATION OF THE DETENTION AND WATER QUALITY AREAS IS THE RESPONSIBILITY OF THE PROPERTY OWNER. IF OWNER FAILS IN THIS RESPONSIBILITY, THE COUNTY HAS THE RIGHT TO ENTER THE PROPERTY, MAINTAIN THE DETENTION AREAS, AND BE REIMBURSED FOR COSTS INCURRED.
3. DETENTION POND VOLUMES, ALL DRAINAGE APPURTENANCES, AND BASIN BOUNDARIES SHALL BE VERIFIED. AS-BUILD DRAWINGS SHALL BE PREPARED BY A REGISTERED PROFESSIONAL ENGINEER PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY FOR ANY STRUCTURE WITHIN THE DEVELOPMENT.
4. PERMISSION TO REPRODUCE THESE PLANS IS HEREBY GIVEN TO MESA COUNTY FOR COUNTY PURPOSES ASSOCIATED WITH PLAN REVIEW, APPROVAL, PERMITTING, INSPECTION AND CONSTRUCTION OF WORK.

N

0' 50' 100' 200'
SCALE IN FEET

DRAINAGE BOUNDARY
7400 EXISTING MAJOR CONTOUR
EXISTING DRAINAGE FLOW DIRECTION

XX BASIN DESIGNATION
X.XX .XX 10-YR RUNOFF COEFF.
.XX 100-YR RUNOFF COEFF.
BASIN AREA IN AC.

X DESIGN POINT DESIGNATOR

OLSSON ASSOCIATES
780 Horizon Drive, Suite 102
Grand Junction, CO 81506
TEL 970.263.7800 www.olssonassociates.com

COLORADO REGISTERED PROFESSIONAL ENGINEER 38514 2/19/15

811 Know what's below. Call before you dig.
CALL 811 SEVENTY-TWO HOURS PRIOR TO DIGGING, GRADING OR EXCAVATING FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

REV. NO.	DATE	REVISIONS DESCRIPTION
		REVISIONS

HARRISON CREEK WATER TREATMENT FACILITY
WATER IMPOUNDMENT

DRAINAGE BASIN PLAN
EXISTING SITE

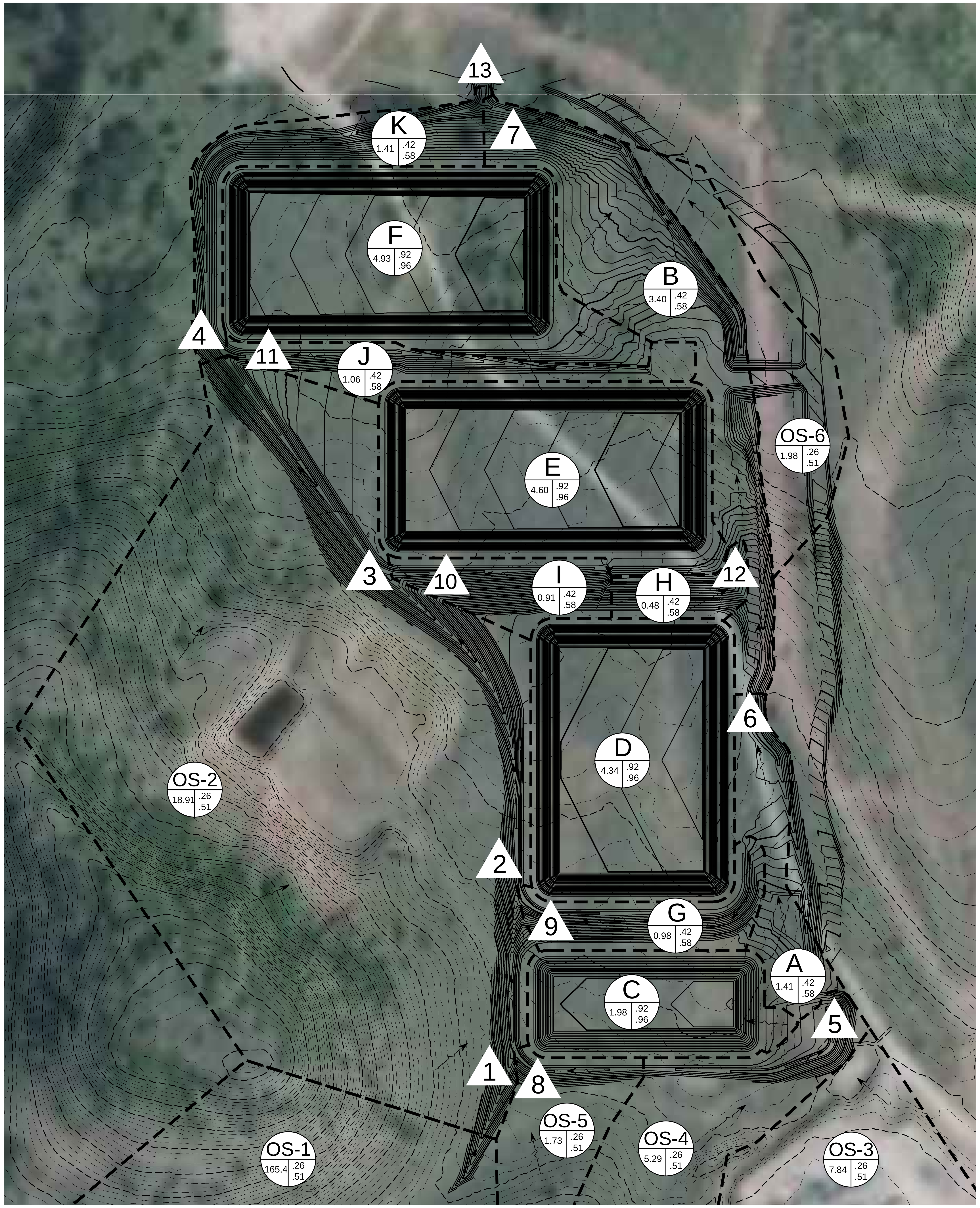
MESA COUNTY, COLORADO

2015

drawn by:	ABL
checked by:	WEP
approved by:	WEP
QA/QC by:	WEP
project no.:	014-0465
drawing no.:	
date:	03-13-2015

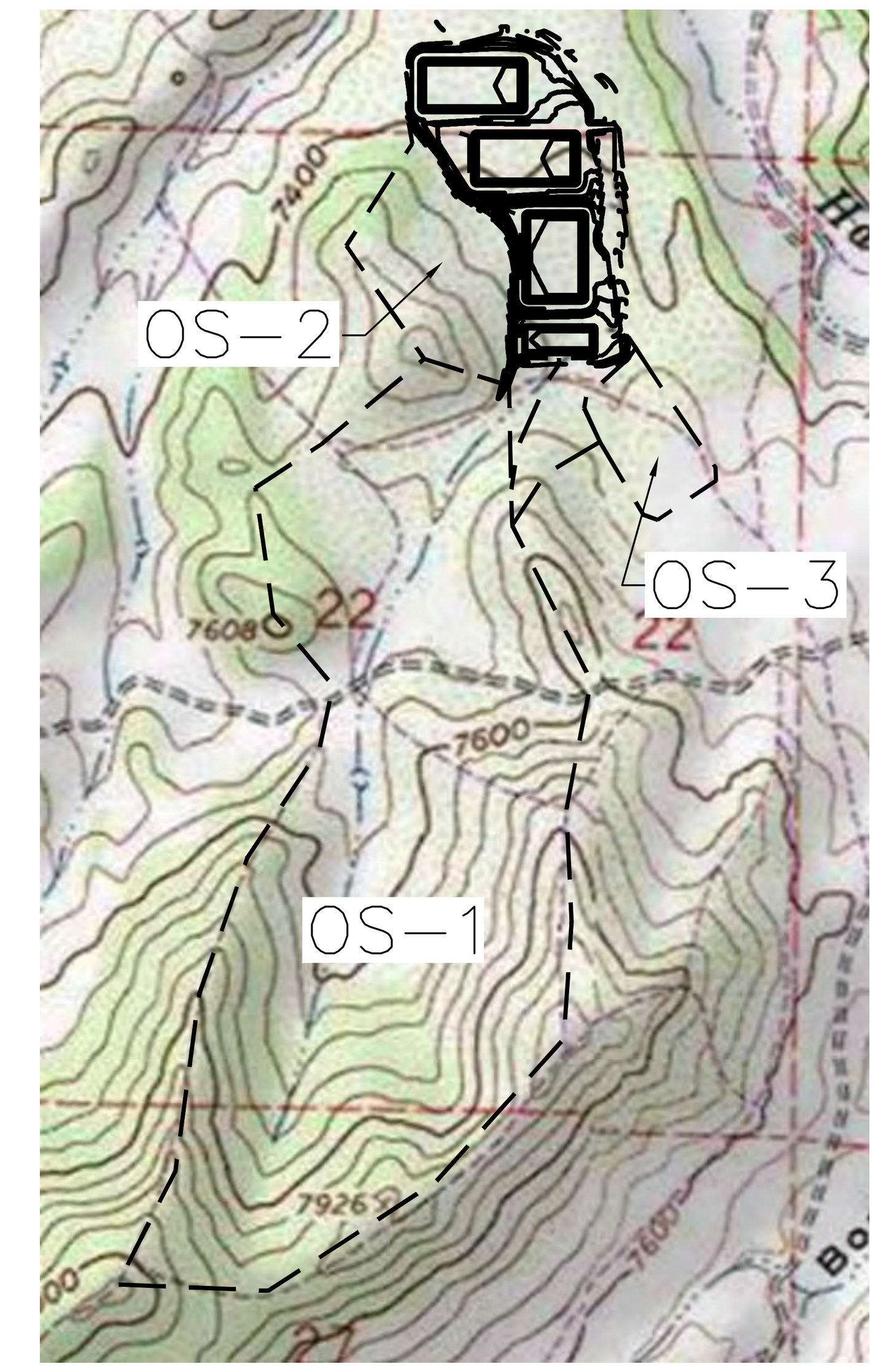
SHEET
A-8

DWG: F:\Projects\014-0465_LDVP\Final_Plans\14-0465 DRNG - EXISTING.dwg USER: alheritier
DATE: Mar 11, 2015 1:32pm XREFS: 14-0465 PBASE



N

0' 50' 100' 200'
SCALE IN FEET



OVERALL DRAINAGE AREA MAP

N

0' 500' 1000' 2000'
SCALE IN FEET

NOTES:
1. NO BUILDING, STRUCTURE, OR FILL WILL BE PLACED IN THE DETENTION AREAS AND NO CHANGES OR ALTERATIONS AFFECTING THE HYDRAULIC CHARACTERISTICS OF THE DETENTION AREAS WILL BE MADE WITHOUT THE APPROVAL OF THE COUNTY.
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3. DETENTION POND VOLUMES, ALL DRAINAGE APPURTENANCES, AND BASIN BOUNDARIES SHALL BE VERIFIED. AS-BUILD DRAWINGS SHALL BE PREPARED BY A REGISTERED PROFESSIONAL ENGINEER PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY FOR ANY STRUCTURE WITHIN THE DEVELOPMENT.
4. PERMISSION TO REPRODUCE THESE PLANS IS HEREBY GIVEN TO MESA COUNTY FOR COUNTY PURPOSES ASSOCIATED WITH PLAN REVIEW, APPROVAL, PERMITTING, INSPECTION AND CONSTRUCTION OF WORK.

DRAINAGE BOUNDARY
7400 PROPOSED MAJOR CONTOUR
PROPOSED DRAINAGE FLOW DIRECTION
XX X.XX .XX .XX — BASIN DESIGNATION, 10-YR RUNOFF COEFF., 100-YR RUNOFF COEFF., BASIN AREA IN AC.
X — DESIGN POINT DESIGNATOR

OLSSON® ASSOCIATES
760 Horizon Drive, Suite 102
Grand Junction, CO 81506
TEL 970.263.7800 www.olssonassociates.com

REV. NO.	DATE	REVISIONS DESCRIPTION

REVISIONS

HARRISON CREEK WATER TREATMENT FACILITY
WATER IMPOUNDMENT

DRAINAGE BASIN PLAN
PROPOSED SITE

MESA COUNTY, COLORADO

2015

drawn by:	ABL
checked by:	WEP
approved by:	WEP
QA/QC by:	WEP
project no.:	014-0465
drawing no.:	
date:	03-13-2015

SHEET
A-9

DWG: F:\Projects\014-0465_LDVP\Final_Plans\14-0465_DRNG.dwg
DATE: Mar 11, 2015 1:30pm XREFS: 14-0465 PBASE USER: alheritier

APPENDIX B
HYDROLOGIC CALCULATIONS

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CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: EX-1

I. Catchment Hydrologic Data

Catchment ID = EX-1
Area = 31.68 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

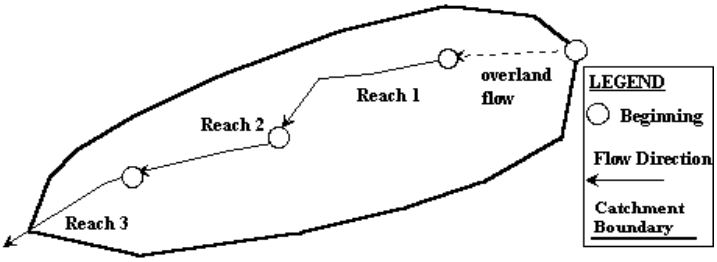
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.26
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0460	300	0.16	N/A	0.28	17.71
1	0.0350	1,548		10.00	1.87	13.79
2						
3						
4						
5						
	Sum	1,848				

Computed Tc = 31.50
Regional Tc = 20.27
User-Entered Tc = 20.27

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 1.70 inch/hr — Peak Flowrate, Qp = 14.09 cfs
Rainfall Intensity at Regional Tc, I = 2.18 inch/hr — Peak Flowrate, Qp = 18.05 cfs
Rainfall Intensity at User-Defined Tc, I = 2.18 inch/hr — Peak Flowrate, Qp = 18.05 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: EX-1

I. Catchment Hydrologic Data

Catchment ID =	EX-1	
Area =	31.68	Acres
Percent Imperviousness =	2.00	%
NRCS Soil Type =	C	A, B, C, or D

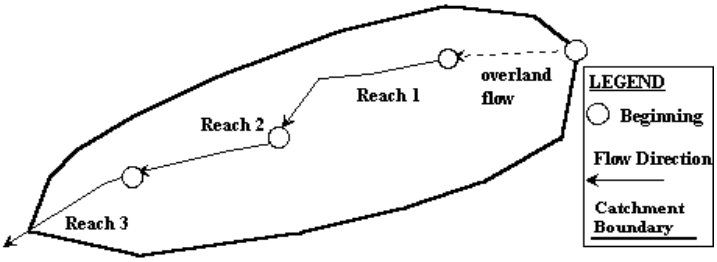
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.80	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.51	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.16	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0460	300	0.16	N/A	0.28	17.71
1	0.0350	1,548		10.00	1.87	13.79
2						
3						
4						
5						
	Sum	1,848				

Computed Tc =	31.50
Regional Tc =	20.27
User-Entered Tc =	20.27

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	2.78	inch/hr	Peak Flowrate, Qp =	44.72 cfs
Rainfall Intensity at Regional Tc, I =	3.57	inch/hr	Peak Flowrate, Qp =	57.31 cfs
Rainfall Intensity at User-Defined Tc, I =	3.57	inch/hr	Peak Flowrate, Qp =	57.31 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: A

I. Catchment Hydrologic Data

Catchment ID = A
Area = 1.41 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

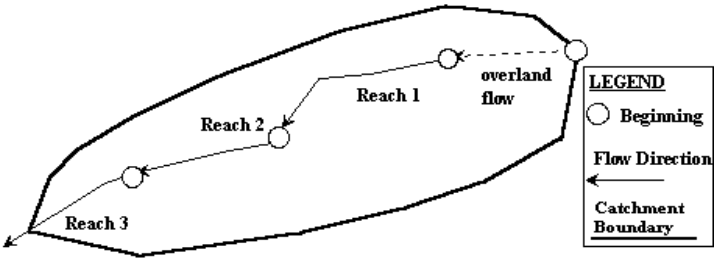
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.42
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.1700	91	0.35	N/A	0.30	5.08
1	0.0360	543		15.00	2.85	3.18
2						
3						
4						
5						
	Sum	634				

Computed Tc = 8.26
Regional Tc = 13.52
User-Entered Tc = 8.26

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.24 inch/hr — Peak Flowrate, Qp = 1.90 cfs
Rainfall Intensity at Regional Tc, I = 2.66 inch/hr — Peak Flowrate, Qp = 1.56 cfs
Rainfall Intensity at User-Defined Tc, I = 3.24 inch/hr — Peak Flowrate, Qp = 1.90 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: A

I. Catchment Hydrologic Data

Catchment ID =	A	
Area =	1.41	Acres
Percent Imperviousness =	40.00	%
NRCS Soil Type =	C	A, B, C, or D

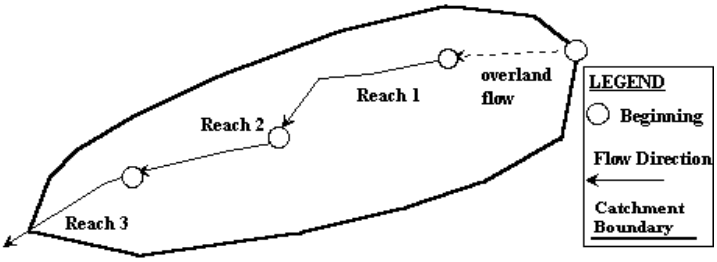
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.80	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C =	0.58	
Overide Runoff Coefficient, C =		(enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 =	0.35	
Overide 5-yr. Runoff Coefficient, C =		(enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.1700	91	0.35	N/A	0.30	5.08
1	0.0360	543		15.00	2.85	3.18
2						
3						
4						
5						
	Sum	634				

Computed Tc =	8.26
Regional Tc =	13.52
User-Entered Tc =	8.26

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.30	inch/hr	Peak Flowrate, Qp =	4.36 cfs
Rainfall Intensity at Regional Tc, I =	4.35	inch/hr	Peak Flowrate, Qp =	3.57 cfs
Rainfall Intensity at User-Defined Tc, I =	5.30	inch/hr	Peak Flowrate, Qp =	4.36 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: B

I. Catchment Hydrologic Data

Catchment ID = B
Area = 3.40 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

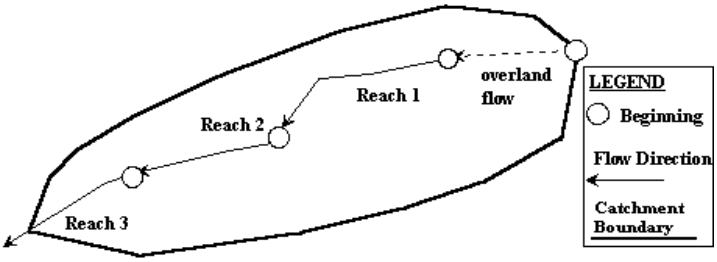
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.42
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.1400	33	0.35	N/A	0.17	3.26
1	0.0360	1,326		15.00	2.85	7.77
2						
3						
4						
5						
	Sum	1,359				

Computed Tc = 11.03
Regional Tc = 17.55
User-Entered Tc = 11.03

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.90 inch/hr — Peak Flowrate, Qp = 4.11 cfs
Rainfall Intensity at Regional Tc, I = 2.35 inch/hr — Peak Flowrate, Qp = 3.32 cfs
Rainfall Intensity at User-Defined Tc, I = 2.90 inch/hr — Peak Flowrate, Qp = 4.11 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: B

I. Catchment Hydrologic Data

Catchment ID = B
Area = 3.40 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

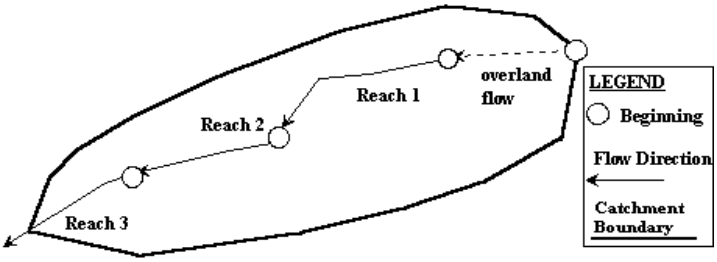
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.58
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.1400	33	0.35	N/A	0.17	3.26
1	0.0360	1,326		15.00	2.85	7.77
2						
3						
4						
5						
	Sum	1,359				

Computed Tc = 11.03
Regional Tc = 17.55
User-Entered Tc = 11.03

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 4.75 inch/hr — Peak Flowrate, Qp = 9.41 cfs
Rainfall Intensity at Regional Tc, I = 3.84 inch/hr — Peak Flowrate, Qp = 7.61 cfs
Rainfall Intensity at User-Defined Tc, I = 4.75 inch/hr — Peak Flowrate, Qp = 9.41 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: C

I. Catchment Hydrologic Data

Catchment ID = C
Area = 1.98 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

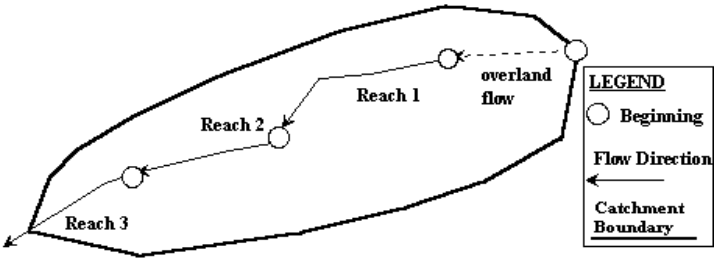
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.92
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2500	54	0.90	N/A	0.96	0.94
1	0.0110	341		20.00	2.10	2.71
2						
3						
4						
5						
	Sum	395				

Computed Tc = 3.65
Regional Tc = 12.19
User-Entered Tc = 5.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 4.07 inch/hr — Peak Flowrate, Qp = 7.39 cfs
Rainfall Intensity at Regional Tc, I = 2.78 inch/hr — Peak Flowrate, Qp = 5.04 cfs
Rainfall Intensity at User-Defined Tc, I = 3.78 inch/hr — Peak Flowrate, Qp = 6.86 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: C

I. Catchment Hydrologic Data

Catchment ID = C
Area = 1.98 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

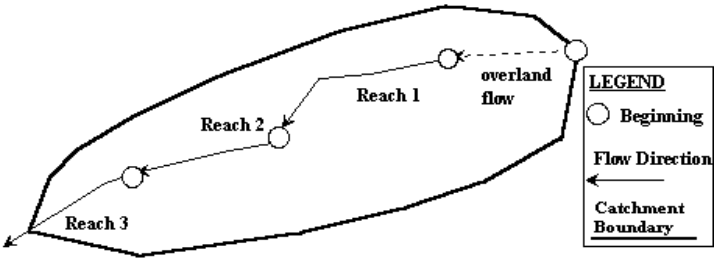
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.96
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2500	54	0.90	N/A	0.96	0.94
1	0.0110	341		20.00	2.10	2.71
2						
3						
4						
5						
	Sum	395				

Computed Tc = 3.65
Regional Tc = 12.19
User-Entered Tc = 5.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 6.67 inch/hr — Peak Flowrate, Qp = 12.62 cfs
Rainfall Intensity at Regional Tc, I = 4.55 inch/hr — Peak Flowrate, Qp = 8.61 cfs
Rainfall Intensity at User-Defined Tc, I = 6.19 inch/hr — Peak Flowrate, Qp = 11.72 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: D

I. Catchment Hydrologic Data

Catchment ID = D
Area = 4.34 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

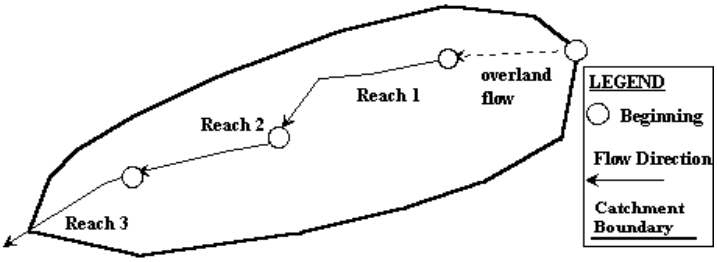
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.92
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2600	51	0.90	N/A	0.95	0.90
1	0.0100	372		20.00	2.00	3.10
2						
3						
4						
5						
	Sum	423				

Computed Tc = 4.00
Regional Tc = 12.35
User-Entered Tc = 5.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.99 inch/hr — Peak Flowrate, Qp = 15.88 cfs
Rainfall Intensity at Regional Tc, I = 2.77 inch/hr — Peak Flowrate, Qp = 10.99 cfs
Rainfall Intensity at User-Defined Tc, I = 3.78 inch/hr — Peak Flowrate, Qp = 15.04 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: D

I. Catchment Hydrologic Data

Catchment ID = D
Area = 4.34 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

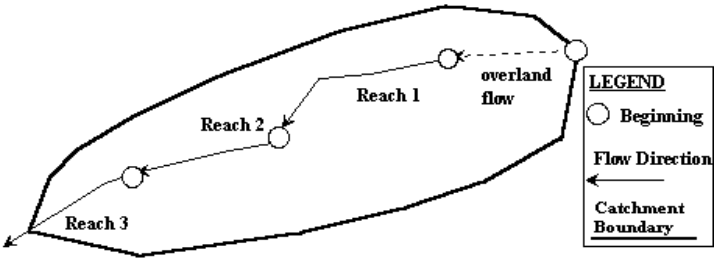
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.96
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2600	51	0.90	N/A	0.95	0.90
1	0.0100	372		20.00	2.00	3.10
2						
3						
4						
5						
	Sum	423				

Computed Tc = 4.00
Regional Tc = 12.35
User-Entered Tc = 5.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 6.54 inch/hr — Peak Flowrate, Qp = 27.12 cfs
Rainfall Intensity at Regional Tc, I = 4.53 inch/hr — Peak Flowrate, Qp = 18.78 cfs
Rainfall Intensity at User-Defined Tc, I = 6.19 inch/hr — Peak Flowrate, Qp = 25.69 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: E

I. Catchment Hydrologic Data

Catchment ID = E
Area = 4.60 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

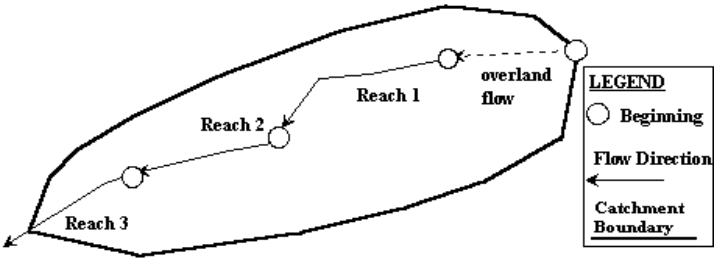
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.92
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2500	48	0.90	N/A	0.91	0.88
1	0.0110	522		20.00	2.10	4.15
2						
3						
4						
5						
	Sum	570			Computed Tc =	5.03
					Regional Tc =	13.17
					User-Entered Tc =	5.03

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.78 inch/hr — Peak Flowrate, Qp = 15.92 cfs
Rainfall Intensity at Regional Tc, I = 2.69 inch/hr — Peak Flowrate, Qp = 11.33 cfs
Rainfall Intensity at User-Defined Tc, I = 3.78 inch/hr — Peak Flowrate, Qp = 15.92 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: E

I. Catchment Hydrologic Data

Catchment ID = E
Area = 4.60 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

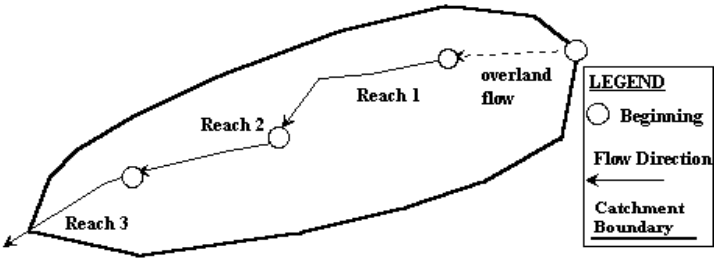
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.96
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2500	48	0.90	N/A	0.91	0.88
1	0.0110	522		20.00	2.10	4.15
2						
3						
4						
5						
	Sum	570				

Computed Tc = 5.03
Regional Tc = 13.17
User-Entered Tc = 5.03

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 6.18 inch/hr — Peak Flowrate, Qp = 27.18 cfs
Rainfall Intensity at Regional Tc, I = 4.40 inch/hr — Peak Flowrate, Qp = 19.34 cfs
Rainfall Intensity at User-Defined Tc, I = 6.18 inch/hr — Peak Flowrate, Qp = 27.18 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: F

I. Catchment Hydrologic Data

Catchment ID = F
Area = 4.93 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

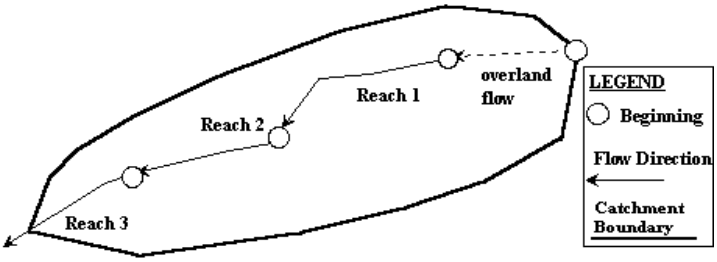
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.92
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2600	48	0.90	N/A	0.92	0.87
1	0.0110	522		20.00	2.10	4.15
2						
3						
4						
5						
	Sum	570			Computed Tc =	5.02
					Regional Tc =	13.17
					User-Entered Tc =	5.02

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.78 inch/hr — Peak Flowrate, Qp = 17.07 cfs
Rainfall Intensity at Regional Tc, I = 2.69 inch/hr — Peak Flowrate, Qp = 12.14 cfs
Rainfall Intensity at User-Defined Tc, I = 3.78 inch/hr — Peak Flowrate, Qp = 17.07 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: F

I. Catchment Hydrologic Data

Catchment ID = F
Area = 4.93 Acres
Percent Imperviousness = 100.00 %
NRCS Soil Type = C A, B, C, or D

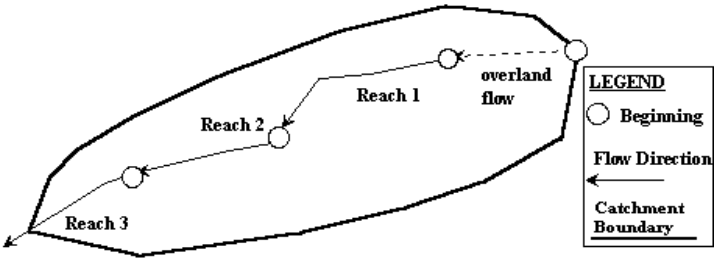
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.96
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.90
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2600	48	0.90	N/A	0.92	0.87
1	0.0110	522		20.00	2.10	4.15
2						
3						
4						
5						
	Sum	570			Computed Tc =	5.02
					Regional Tc =	13.17
					User-Entered Tc =	5.02

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 6.18 inch/hr — Peak Flowrate, Qp = 29.15 cfs
Rainfall Intensity at Regional Tc, I = 4.40 inch/hr — Peak Flowrate, Qp = 20.73 cfs
Rainfall Intensity at User-Defined Tc, I = 6.18 inch/hr — Peak Flowrate, Qp = 29.15 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: G

I. Catchment Hydrologic Data

Catchment ID = G
Area = 0.98 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

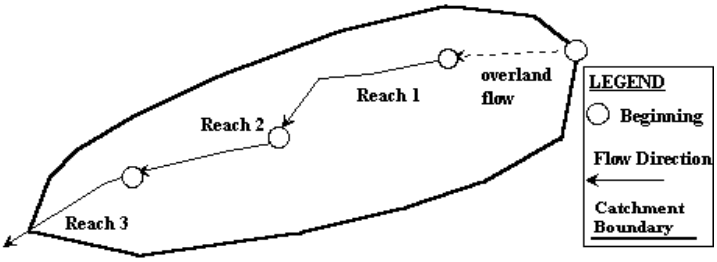
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.42
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0950	79	0.35	N/A	0.23	5.74
1	0.0060	533		15.00	1.16	7.65
2						
3						
4						
5						
	Sum	612				

Computed Tc = 13.38
Regional Tc = 13.40
User-Entered Tc = 13.38

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.67 inch/hr — Peak Flowrate, Qp = 1.09 cfs
Rainfall Intensity at Regional Tc, I = 2.67 inch/hr — Peak Flowrate, Qp = 1.09 cfs
Rainfall Intensity at User-Defined Tc, I = 2.67 inch/hr — Peak Flowrate, Qp = 1.09 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: G

I. Catchment Hydrologic Data

Catchment ID = G
Area = 0.98 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

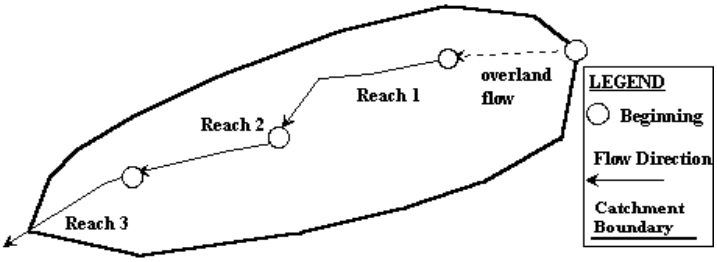
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.58
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0950	79	0.35	N/A	0.23	5.74
1	0.0060	533		15.00	1.16	7.65
2						
3						
4						
5						
	Sum	612				

Computed Tc = 13.38
Regional Tc = 13.40
User-Entered Tc = 13.38

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 4.37 inch/hr — Peak Flowrate, Qp = 2.49 cfs
Rainfall Intensity at Regional Tc, I = 4.36 inch/hr — Peak Flowrate, Qp = 2.49 cfs
Rainfall Intensity at User-Defined Tc, I = 4.37 inch/hr — Peak Flowrate, Qp = 2.49 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: H

I. Catchment Hydrologic Data

Catchment ID = H
Area = 0.48 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

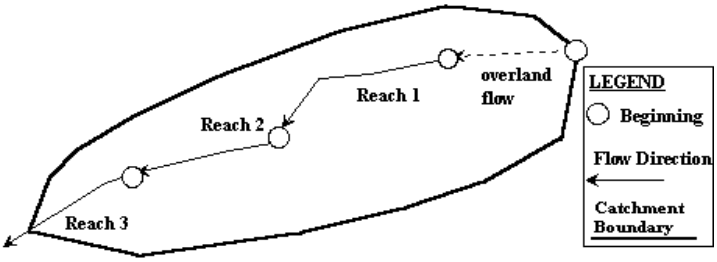
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.42
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3000	69	0.35	N/A	0.31	3.67
1	0.0500	248		15.00	3.35	1.23
2						
3						
4						
5						
	Sum	317				

Computed Tc = 4.90
Regional Tc = 11.76
User-Entered Tc = 5.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.80 inch/hr — Peak Flowrate, Qp = 0.76 cfs
Rainfall Intensity at Regional Tc, I = 2.82 inch/hr — Peak Flowrate, Qp = 0.56 cfs
Rainfall Intensity at User-Defined Tc, I = 3.78 inch/hr — Peak Flowrate, Qp = 0.76 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: H

I. Catchment Hydrologic Data

Catchment ID = H
Area = 0.48 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

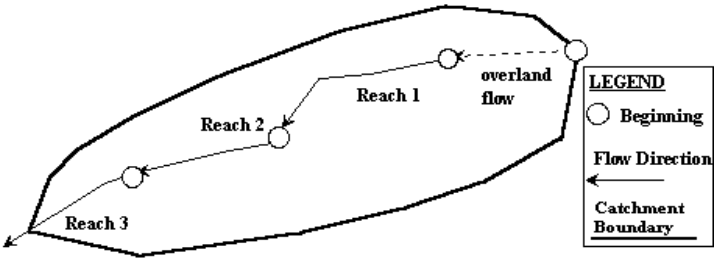
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.58
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3000	69	0.35	N/A	0.31	3.67
1	0.0500	248		15.00	3.35	1.23
2						
3						
4						
5						
	Sum	317				

Computed Tc = 4.90
Regional Tc = 11.76
User-Entered Tc = 5.00

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 6.22 inch/hr — Peak Flowrate, Qp = 1.74 cfs
Rainfall Intensity at Regional Tc, I = 4.62 inch/hr — Peak Flowrate, Qp = 1.29 cfs
Rainfall Intensity at User-Defined Tc, I = 6.19 inch/hr — Peak Flowrate, Qp = 1.73 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: I

I. Catchment Hydrologic Data

Catchment ID = I
Area = 0.91 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

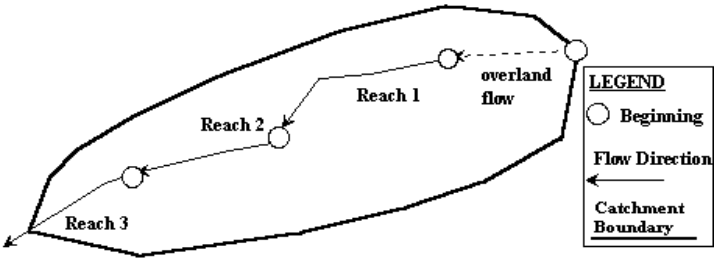
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	10	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.10	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.42
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3000	90	0.35	N/A	0.36	4.19
1	0.0100	388		15.00	1.50	4.31
2						
3						
4						
5						
	Sum	478				

Computed Tc = 8.50
Regional Tc = 12.66
User-Entered Tc = 8.50

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	3.21	inch/hr	Peak Flowrate, Qp =	1.22 cfs
Rainfall Intensity at Regional Tc, I =	2.74	inch/hr	Peak Flowrate, Qp =	1.04 cfs
Rainfall Intensity at User-Defined Tc, I =	3.21	inch/hr	Peak Flowrate, Qp =	1.22 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: I

I. Catchment Hydrologic Data

Catchment ID = I
Area = 0.91 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

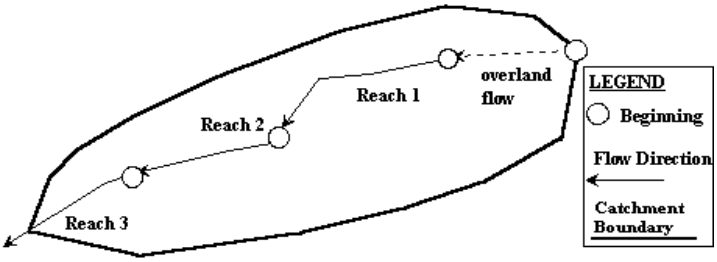
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.80	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.58
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3000	90	0.35	N/A	0.36	4.19
1	0.0100	388		15.00	1.50	4.31
2						
3						
4						
5						
	Sum	478				

Computed Tc = 8.50
Regional Tc = 12.66
User-Entered Tc = 8.50

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	5.25	inch/hr	Peak Flowrate, Qp = 2.78 cfs
Rainfall Intensity at Regional Tc, I =	4.48	inch/hr	Peak Flowrate, Qp = 2.37 cfs
Rainfall Intensity at User-Defined Tc, I =	5.25	inch/hr	Peak Flowrate, Qp = 2.78 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: J

I. Catchment Hydrologic Data

Catchment ID = J
Area = 1.09 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

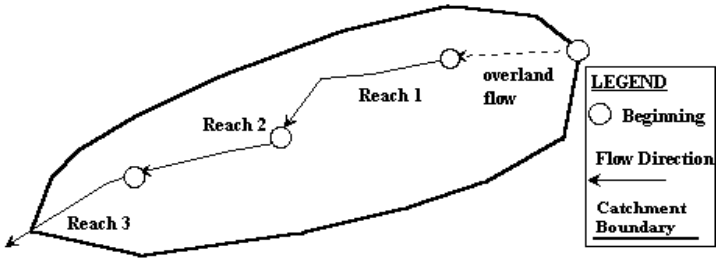
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.42
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3330	36	0.35	N/A	0.23	2.56
1	0.0100	289		15.00	1.50	3.21
2	0.0266	263		15.00	2.45	1.79
3	0.0100	306		15.00	1.50	3.40
4						
5						
	Sum	894				

Computed Tc = 10.96
Regional Tc = 14.97
User-Entered Tc = 10.96

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.91 inch/hr — Peak Flowrate, Qp = 1.32 cfs
Rainfall Intensity at Regional Tc, I = 2.53 inch/hr — Peak Flowrate, Qp = 1.15 cfs
Rainfall Intensity at User-Defined Tc, I = 2.91 inch/hr — Peak Flowrate, Qp = 1.32 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: J

I. Catchment Hydrologic Data

Catchment ID = J
Area = 1.06 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

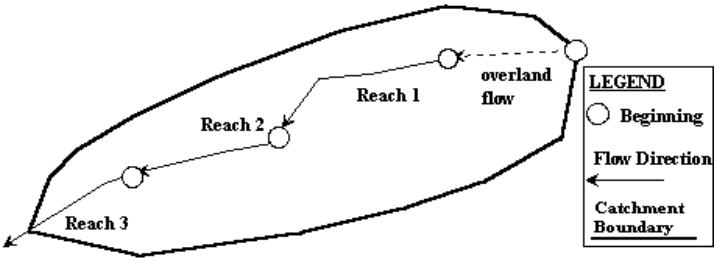
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.80	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.58
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3330	36	0.35	N/A	0.23	2.56
1	0.0100	289		15.00	1.50	3.21
2	0.0266	263		15.00	2.45	1.79
3	0.0100	306		15.00	1.50	3.40
4						
5						
	Sum	894				

Computed Tc = 10.96
Regional Tc = 14.97
User-Entered Tc = 10.96

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	4.76	inch/hr	Peak Flowrate, Qp =	2.94	cfs
Rainfall Intensity at Regional Tc, I =	4.15	inch/hr	Peak Flowrate, Qp =	2.56	cfs
Rainfall Intensity at User-Defined Tc, I =	4.76	inch/hr	Peak Flowrate, Qp =	2.94	cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: K

I. Catchment Hydrologic Data

Catchment ID = K
Area = 1.41 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

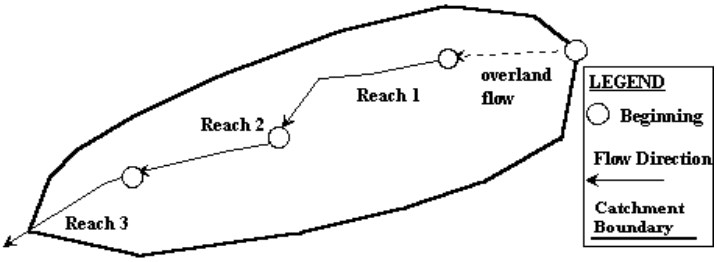
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	10	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.10	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.42
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3200	41	0.35	N/A	0.25	2.77
1	0.0160	899		15.00	1.90	7.90
2						
3						
4						
5						
	Sum	940				

Computed Tc = 10.66
Regional Tc = 15.22
User-Entered Tc = 10.66

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	2.94	inch/hr	Peak Flowrate, Qp = 1.73 cfs
Rainfall Intensity at Regional Tc, I =	2.51	inch/hr	Peak Flowrate, Qp = 1.48 cfs
Rainfall Intensity at User-Defined Tc, I =	2.94	inch/hr	Peak Flowrate, Qp = 1.73 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: K

I. Catchment Hydrologic Data

Catchment ID = K
Area = 1.41 Acres
Percent Imperviousness = 40.00 %
NRCS Soil Type = C A, B, C, or D

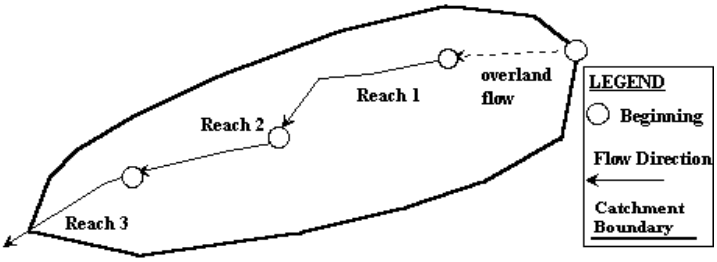
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.80	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.58
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.35
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3200	41	0.35	N/A	0.25	2.77
1	0.0160	899		15.00	1.90	7.90
2						
3						
4						
5						
	Sum	940				

Computed Tc = 10.66
Regional Tc = 15.22
User-Entered Tc = 10.66

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	4.81	inch/hr	Peak Flowrate, Qp = 3.96 cfs
Rainfall Intensity at Regional Tc, I =	4.12	inch/hr	Peak Flowrate, Qp = 3.38 cfs
Rainfall Intensity at User-Defined Tc, I =	4.81	inch/hr	Peak Flowrate, Qp = 3.96 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-1

I. Catchment Hydrologic Data

Catchment ID = OS-1
Area = 165.45 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

For catchments larger than 90 acres, CUHP hydrograph and routing are recommended.

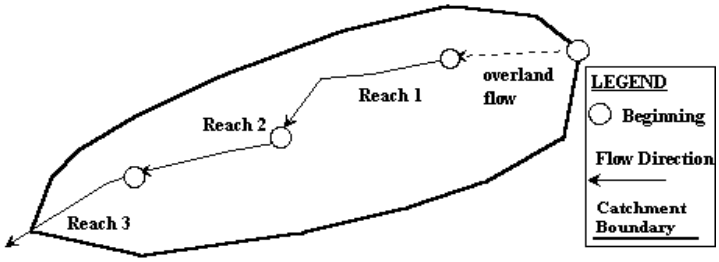
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	10	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.10	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.26
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2700	300	0.16	N/A	0.51	9.87
1	0.0970	5,224		10.00	3.11	27.96
2						
3						
4						
5						
	Sum	5,524				

Computed Tc = 37.83
Regional Tc = 40.69
User-Entered Tc = 37.83

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	1.52	inch/hr	Peak Flowrate, Qp =	65.81 cfs
Rainfall Intensity at Regional Tc, I =	1.45	inch/hr	Peak Flowrate, Qp =	62.88 cfs
Rainfall Intensity at User-Defined Tc, I =	1.52	inch/hr	Peak Flowrate, Qp =	65.81 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-1

I. Catchment Hydrologic Data

Catchment ID = OS-1
Area = 165.45 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

For catchments larger than 90 acres, CUHP hydrograph and routing are recommended.

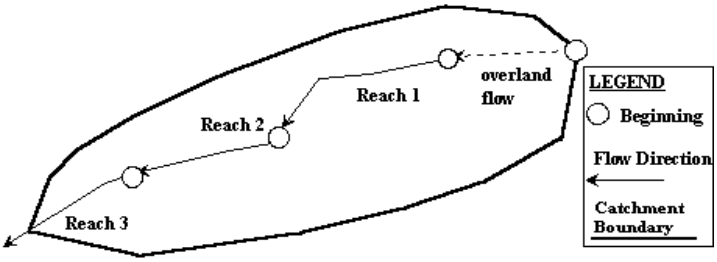
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.90		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.80	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.51
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2700	300	0.16	N/A	0.51	9.87
1	0.0970	5,224		10.00	3.11	27.96
2						
3						
4						
5						
	Sum	5,524				

Computed Tc = 37.83
Regional Tc = 40.69
User-Entered Tc = 37.83

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	2.49	inch/hr	Peak Flowrate, Qp =	208.89 cfs
Rainfall Intensity at Regional Tc, I =	2.38	inch/hr	Peak Flowrate, Qp =	199.57 cfs
Rainfall Intensity at User-Defined Tc, I =	2.49	inch/hr	Peak Flowrate, Qp =	208.89 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-2

I. Catchment Hydrologic Data

Catchment ID = OS-2
Area = 18.91 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

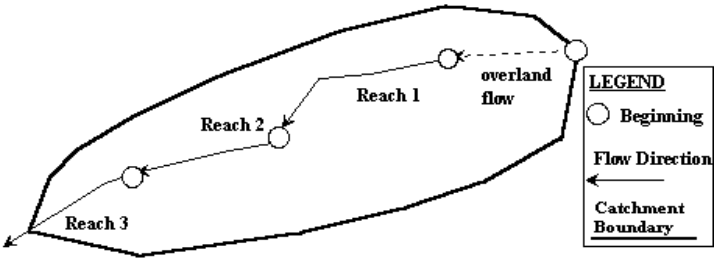
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.26
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3100	300	0.16	N/A	0.53	9.43
1	0.1580	178		10.00	3.97	0.75
2	0.0350	1,413		15.00	2.81	8.39
3						
4						
5						
	Sum	1,891				

Computed Tc = 18.57
Regional Tc = 20.51
User-Entered Tc = 18.57

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.28 inch/hr — Peak Flowrate, Qp = 11.28 cfs
Rainfall Intensity at Regional Tc, I = 2.17 inch/hr — Peak Flowrate, Qp = 10.71 cfs
Rainfall Intensity at User-Defined Tc, I = 2.28 inch/hr — Peak Flowrate, Qp = 11.28 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-2

I. Catchment Hydrologic Data

Catchment ID = OS-2
Area = 18.91 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

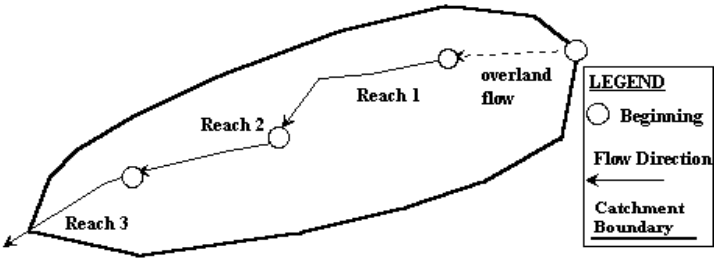
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.51
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.3100	300	0.16	N/A	0.53	9.43
1	0.1580	178		10.00	3.97	0.75
2	0.0350	1,413		15.00	2.81	8.39
3						
4						
5						
	Sum	1,891				

Computed Tc = 18.57
Regional Tc = 20.51
User-Entered Tc = 18.57

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.73 inch/hr — Peak Flowrate, Qp = 35.80 cfs
Rainfall Intensity at Regional Tc, I = 3.54 inch/hr — Peak Flowrate, Qp = 34.00 cfs
Rainfall Intensity at User-Defined Tc, I = 3.73 inch/hr — Peak Flowrate, Qp = 35.80 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-3

I. Catchment Hydrologic Data

Catchment ID = OS-3
Area = 7.84 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

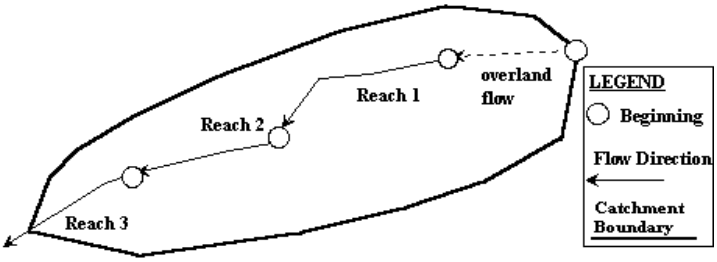
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.26
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0270	300	0.16	N/A	0.24	21.11
1	0.0270	608		10.00	1.64	6.17
2						
3						
4						
5						
	Sum	908			Computed Tc =	27.28
					Regional Tc =	15.04
					User-Entered Tc =	27.28

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 1.85 inch/hr — Peak Flowrate, Qp = 3.79 cfs
Rainfall Intensity at Regional Tc, I = 2.53 inch/hr — Peak Flowrate, Qp = 5.19 cfs
Rainfall Intensity at User-Defined Tc, I = 1.85 inch/hr — Peak Flowrate, Qp = 3.79 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-3

I. Catchment Hydrologic Data

Catchment ID = OS-3
Area = 7.84 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

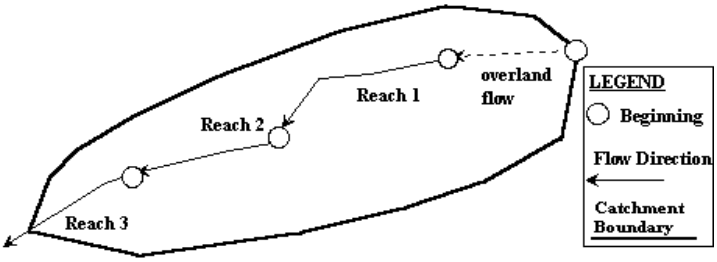
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.51
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0270	300	0.16	N/A	0.24	21.11
1	0.0270	608		10.00	1.64	6.17
2						
3						
4						
5						
	Sum	908				

Computed Tc = 27.28
Regional Tc = 15.04
User-Entered Tc = 27.28

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.03 inch/hr — Peak Flowrate, Qp = 12.04 cfs
Rainfall Intensity at Regional Tc, I = 4.14 inch/hr — Peak Flowrate, Qp = 16.46 cfs
Rainfall Intensity at User-Defined Tc, I = 3.03 inch/hr — Peak Flowrate, Qp = 12.04 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-4

I. Catchment Hydrologic Data

Catchment ID = OS-4
Area = 5.29 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

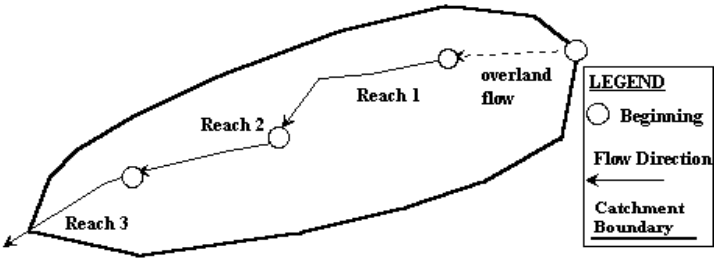
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.26
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2500	300	0.16	N/A	0.49	10.13
1	0.1320	666		10.00	3.63	3.06
2	0.0100	276		15.00	1.50	3.07
3						
4						
5						
	Sum	1,242				

Computed Tc = 16.25
Regional Tc = 16.90
User-Entered Tc = 16.25

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.44 inch/hr — Peak Flowrate, Qp = 3.37 cfs
Rainfall Intensity at Regional Tc, I = 2.39 inch/hr — Peak Flowrate, Qp = 3.31 cfs
Rainfall Intensity at User-Defined Tc, I = 2.44 inch/hr — Peak Flowrate, Qp = 3.37 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-4

I. Catchment Hydrologic Data

Catchment ID = OS-4
Area = 5.29 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

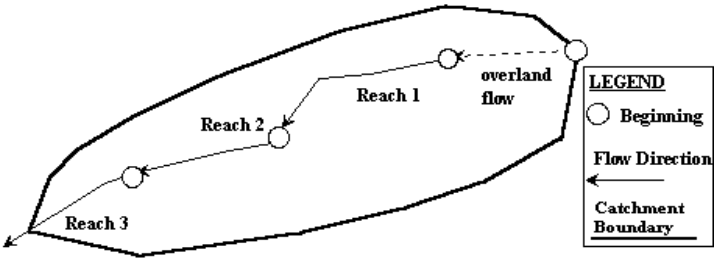
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.51
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2500	300	0.16	N/A	0.49	10.13
1	0.1320	666		10.00	3.63	3.06
2	0.0100	276		15.00	1.50	3.07
3						
4						
5						
	Sum	1,242				

Computed Tc = 16.25
Regional Tc = 16.90
User-Entered Tc = 16.25

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 3.99 inch/hr — Peak Flowrate, Qp = 10.70 cfs
Rainfall Intensity at Regional Tc, I = 3.91 inch/hr — Peak Flowrate, Qp = 10.50 cfs
Rainfall Intensity at User-Defined Tc, I = 3.99 inch/hr — Peak Flowrate, Qp = 10.70 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-5

I. Catchment Hydrologic Data

Catchment ID = OS-5
Area = 1.73 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

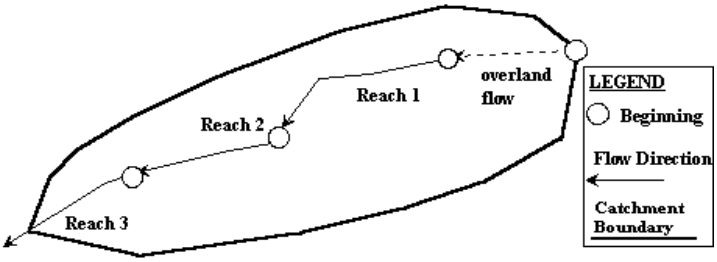
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.26
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2000	300	0.16	N/A	0.46	10.90
1	0.1500	307		10.00	3.87	1.32
2	0.0100	39		15.00	1.50	0.43
3						
4						
5						
	Sum	646				

Computed Tc = 12.66
Regional Tc = 13.59
User-Entered Tc = 12.66

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.74 inch/hr — Peak Flowrate, Qp = 1.24 cfs
Rainfall Intensity at Regional Tc, I = 2.65 inch/hr — Peak Flowrate, Qp = 1.20 cfs
Rainfall Intensity at User-Defined Tc, I = 2.74 inch/hr — Peak Flowrate, Qp = 1.24 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-5

I. Catchment Hydrologic Data

Catchment ID = OS-5
Area = 1.73 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

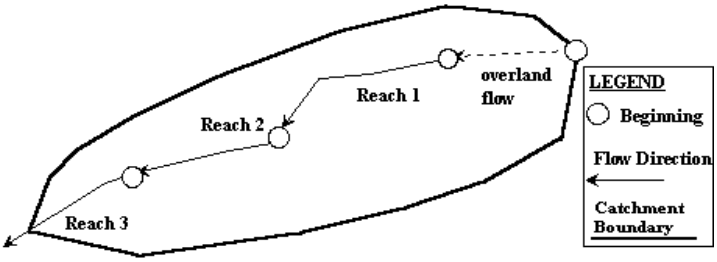
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.51
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.2000	300	0.16	N/A	0.46	10.90
1	0.1500	307		10.00	3.87	1.32
2	0.0100	39		15.00	1.50	0.43
3						
4						
5						
	Sum	646				

Computed Tc = 12.66
Regional Tc = 13.59
User-Entered Tc = 12.66

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 4.48 inch/hr — Peak Flowrate, Qp = 3.93 cfs
Rainfall Intensity at Regional Tc, I = 4.34 inch/hr — Peak Flowrate, Qp = 3.81 cfs
Rainfall Intensity at User-Defined Tc, I = 4.48 inch/hr — Peak Flowrate, Qp = 3.93 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-6

I. Catchment Hydrologic Data

Catchment ID = OS-6
Area = 1.98 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

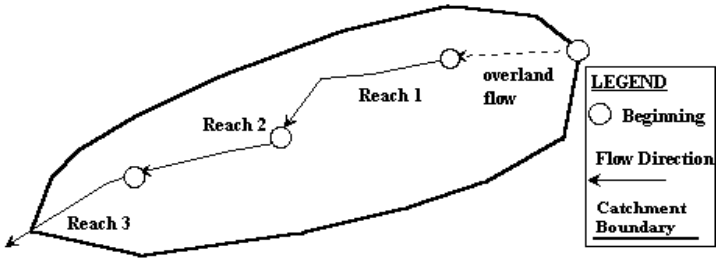
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 10 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.10 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.26
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.1400	205	0.16	N/A	0.34	10.14
1	0.0210	655		15.00	2.17	5.02
2						
3						
4						
5						
	Sum	860				

Computed Tc = 15.16
Regional Tc = 14.78
User-Entered Tc = 15.16

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.52 inch/hr — Peak Flowrate, Qp = 1.30 cfs
Rainfall Intensity at Regional Tc, I = 2.55 inch/hr — Peak Flowrate, Qp = 1.32 cfs
Rainfall Intensity at User-Defined Tc, I = 2.52 inch/hr — Peak Flowrate, Qp = 1.30 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: Harrison Creek Water Management Facilily
Catchment ID: OS-6

I. Catchment Hydrologic Data

Catchment ID = OS-6
Area = 1.98 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

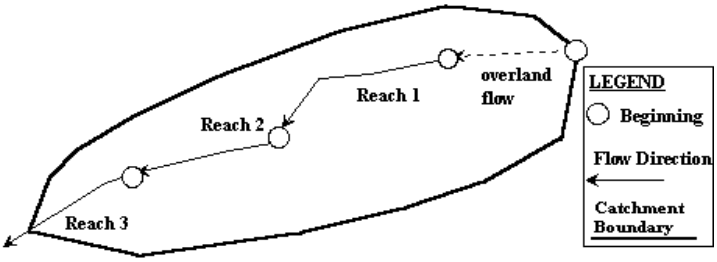
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 100 years (input return period for design storm)
C1 = 28.90 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.80 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.51
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.1400	205	0.16	N/A	0.34	10.14
1	0.0210	655		15.00	2.17	5.02
2						
3						
4						
5						
	Sum	860				

Computed Tc = 15.16
Regional Tc = 14.78
User-Entered Tc = 15.16

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 4.12 inch/hr — Peak Flowrate, Qp = 4.14 cfs
Rainfall Intensity at Regional Tc, I = 4.17 inch/hr — Peak Flowrate, Qp = 4.19 cfs
Rainfall Intensity at User-Defined Tc, I = 4.12 inch/hr — Peak Flowrate, Qp = 4.14 cfs

APPENDIX C
HYDRAULIC CALCULATIONS

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Worksheet for Design Point 1 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	248.62	ft³/s

Results

Normal Depth	4.26	ft
Flow Area	67.31	ft²
Wetted Perimeter	29.96	ft
Hydraulic Radius	2.25	ft
Top Width	28.58	ft
Critical Depth	2.90	ft
Critical Slope	0.06217	ft/ft
Velocity	3.69	ft/s
Velocity Head	0.21	ft
Specific Energy	4.47	ft
Froude Number	0.42	
Flow Type	Subcritical	

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	4.26	ft
Critical Depth	2.90	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 1 Channel

GVF Output Data

Critical Slope	0.06217	ft/ft

Messages

Notes

1% SLOPE -> NORMAL DEPTH 3.19 => FREEBOARD 4.19 => WIDTH 12.57

Worksheet for Design Point 10 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	2.78	ft³/s

Results

Normal Depth	0.37	ft
Flow Area	1.52	ft²
Wetted Perimeter	5.33	ft
Hydraulic Radius	0.28	ft
Top Width	5.21	ft
Critical Depth	0.27	ft
Critical Slope	0.03015	ft/ft
Velocity	1.83	ft/s
Velocity Head	0.05	ft
Specific Energy	0.42	ft
Froude Number	0.60	
Flow Type	Subcritical	

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	0.37	ft
Critical Depth	0.27	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 10 Channel

GVF Output Data

Critical Slope	0.03015	ft/ft

Messages

Notes

3 foot bottom => 0.22 normal depth => 1.22 deep => 3.66 wide each side

Worksheet for Design Point 11 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	2.94	ft³/s

Results

Normal Depth	0.38	ft
Flow Area	1.58	ft²
Wetted Perimeter	5.41	ft
Hydraulic Radius	0.29	ft
Top Width	5.28	ft
Critical Depth	0.28	ft
Critical Slope	0.02987	ft/ft
Velocity	1.87	ft/s
Velocity Head	0.05	ft
Specific Energy	0.43	ft
Froude Number	0.60	
Flow Type	Subcritical	

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	0.38	ft
Critical Depth	0.28	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 11 Channel

GVF Output Data

Critical Slope	0.02987	ft/ft

Messages

Notes

3 foot bottom => 0.22 normal depth => 1.22 deep => 3.66 wide each side

Worksheet for Design Point 12 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	1.73	ft³/s

Results

Normal Depth	0.34	ft
Flow Area	1.39	ft²
Wetted Perimeter	5.18	ft
Hydraulic Radius	0.27	ft
Top Width	5.06	ft
Critical Depth	0.20	ft
Critical Slope	0.03267	ft/ft
Velocity	1.25	ft/s
Velocity Head	0.02	ft
Specific Energy	0.37	ft
Froude Number	0.42	
Flow Type	Subcritical	

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	0.34	ft
Critical Depth	0.20	ft
Channel Slope	0.00500	ft/ft

Worksheet for Design Point 12 Channel

GVF Output Data

Critical Slope	0.03267	ft/ft

Messages

Notes

3 foot bottom => 0.22 normal depth => 1.22 deep => 3.66 wide each side

Worksheet for Design Point 5 Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024	
Channel Slope	0.01000	ft/ft
Diameter	2.50	ft
Discharge	22.74	ft³/s

Results

Normal Depth	2.11	ft
Flow Area	4.41	ft²
Wetted Perimeter	5.81	ft
Hydraulic Radius	0.76	ft
Top Width	1.82	ft
Critical Depth	1.62	ft
Percent Full	84.3	%
Critical Slope	0.01839	ft/ft
Velocity	5.15	ft/s
Velocity Head	0.41	ft
Specific Energy	2.52	ft
Froude Number	0.58	
Maximum Discharge	23.90	ft³/s
Discharge Full	22.22	ft³/s
Slope Full	0.01048	ft/ft
Flow Type	SubCritical	

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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	84.26	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Point 5 Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.11	ft
Critical Depth	1.62	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01839	ft/ft

Messages

Notes

10.81 cfs from basin 6 (100 yr event). 9.88 cfs from pond in basin 11 (10yr release from pond - by others)

Worksheet for Design Point 7 Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024	
Channel Slope	0.01000	ft/ft
Diameter	4.00	ft
Discharge	42.38	ft³/s

Results

Normal Depth	2.10	ft
Flow Area	6.70	ft²
Wetted Perimeter	6.49	ft
Hydraulic Radius	1.03	ft
Top Width	3.99	ft
Critical Depth	1.95	ft
Percent Full	52.6	%
Critical Slope	0.01304	ft/ft
Velocity	6.32	ft/s
Velocity Head	0.62	ft
Specific Energy	2.73	ft
Froude Number	0.86	
Maximum Discharge	83.69	ft³/s
Discharge Full	77.80	ft³/s
Slope Full	0.00297	ft/ft
Flow Type	SubCritical	

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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.61	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Point 7 Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.10	ft
Critical Depth	1.95	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01304	ft/ft

Worksheet for Design Point 12 Pipe

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024	
Channel Slope	0.02100	ft/ft
Diameter	1.00	ft
Discharge	1.73	ft³/s

Results

Normal Depth	0.57	ft
Flow Area	0.46	ft²
Wetted Perimeter	1.71	ft
Hydraulic Radius	0.27	ft
Top Width	0.99	ft
Critical Depth	0.56	ft
Percent Full	56.9	%
Critical Slope	0.02216	ft/ft
Velocity	3.75	ft/s
Velocity Head	0.22	ft
Specific Energy	0.79	ft
Froude Number	0.97	
Maximum Discharge	3.01	ft³/s
Discharge Full	2.80	ft³/s
Slope Full	0.00804	ft/ft
Flow Type	SubCritical	

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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	56.91	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Point 12 Pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.57	ft
Critical Depth	0.56	ft
Channel Slope	0.02100	ft/ft
Critical Slope	0.02216	ft/ft

Worksheet for Design Point 13 Box Culvert

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01000	ft/ft
Height	4.00	ft
Bottom Width	5.00	ft
Discharge	303.17	ft³/s

Results

Normal Depth	3.98	ft
Flow Area	19.92	ft²
Wetted Perimeter	12.97	ft
Hydraulic Radius	1.54	ft
Top Width	5.00	ft
Critical Depth	4.85	ft
Percent Full	99.6	%
Critical Slope	0.00613	ft/ft
Velocity	15.22	ft/s
Velocity Head	3.60	ft
Specific Energy	7.58	ft
Froude Number	1.34	
Discharge Full	245.24	ft³/s
Slope Full	0.00654	ft/ft
Flow Type	Supercritical	

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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	99.61	%
Downstream Velocity	Infinity	ft/s

Worksheet for Design Point 13 Box Culvert

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	3.98	ft
Critical Depth	4.85	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00613	ft/ft

Worksheet for Design Point 2 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	251.11	ft³/s

Results

Normal Depth	4.28	ft
Flow Area	67.81	ft²
Wetted Perimeter	30.07	ft
Hydraulic Radius	2.25	ft
Top Width	28.68	ft
Critical Depth	2.92	ft
Critical Slope	0.06209	ft/ft
Velocity	3.70	ft/s
Velocity Head	0.21	ft
Specific Energy	4.49	ft
Froude Number	0.42	
Flow Type	Subcritical	

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	4.28	ft
Critical Depth	2.92	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 2 Channel

GVF Output Data

Critical Slope	0.06209	ft/ft

Messages

Notes

1% SLOPE -> NORMAL DEPTH 3.19 => FREEBOARD 4.19 => WIDTH 12.57

Worksheet for Design Point 3 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	253.89	ft^3/s

Results

Normal Depth	4.30	ft
Flow Area	68.37	ft^2
Wetted Perimeter	30.20	ft
Hydraulic Radius	2.26	ft
Top Width	28.80	ft
Critical Depth	2.93	ft
Critical Slope	0.06200	ft/ft
Velocity	3.71	ft/s
Velocity Head	0.21	ft
Specific Energy	4.51	ft
Froude Number	0.42	
Flow Type	Subcritical	

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	4.30	ft
Critical Depth	2.93	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 3 Channel

GVF Output Data

Critical Slope	0.06200	ft/ft

Messages

Notes

1% SLOPE -> NORMAL DEPTH 3.19 => FREEBOARD 4.19 => WIDTH 12.57

Worksheet for Design Point 4 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	260.79	ft^3/s

Results

Normal Depth	4.35	ft
Flow Area	69.76	ft^2
Wetted Perimeter	30.50	ft
Hydraulic Radius	2.29	ft
Top Width	29.09	ft
Critical Depth	2.97	ft
Critical Slope	0.06178	ft/ft
Velocity	3.74	ft/s
Velocity Head	0.22	ft
Specific Energy	4.57	ft
Froude Number	0.43	
Flow Type	Subcritical	

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	4.35	ft
Critical Depth	2.97	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 4 Channel

GVF Output Data

Critical Slope	0.06178	ft/ft

Messages

Notes

Worksheet for Design Point 5 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	22.74	ft³/s

Results

Normal Depth	1.09	ft
Flow Area	6.85	ft²
Wetted Perimeter	9.90	ft
Hydraulic Radius	0.69	ft
Top Width	9.55	ft
Critical Depth	0.90	ft
Critical Slope	0.02202	ft/ft
Velocity	3.32	ft/s
Velocity Head	0.17	ft
Specific Energy	1.26	ft
Froude Number	0.69	
Flow Type	Subcritical	

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	1.09	ft
Critical Depth	0.90	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 5 Channel

GVF Output Data

Critical Slope	0.02202	ft/ft

Messages

Notes

BASIN A AND OS-3

Worksheet for Design Point 6 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01230	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	27.10	ft³/s

Results

Normal Depth	1.55	ft
Flow Area	11.92	ft²
Wetted Perimeter	12.83	ft
Hydraulic Radius	0.93	ft
Top Width	12.33	ft
Critical Depth	0.99	ft
Critical Slope	0.08354	ft/ft
Velocity	2.27	ft/s
Velocity Head	0.08	ft
Specific Energy	1.64	ft
Froude Number	0.41	
Flow Type	Subcritical	

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	1.55	ft
Critical Depth	0.99	ft
Channel Slope	0.01230	ft/ft

Worksheet for Design Point 6 Channel

GVF Output Data

Critical Slope	0.08354	ft/ft

Messages

Notes

BASIN M + A + OS-3 + G(10)+M+N+O+L(10)+ADDED OS TO N

Worksheet for Design Point 7 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	42.38	ft³/s

Results

Normal Depth	2.00	ft
Flow Area	17.95	ft²
Wetted Perimeter	15.63	ft
Hydraulic Radius	1.15	ft
Top Width	14.98	ft
Critical Depth	1.24	ft
Critical Slope	0.07862	ft/ft
Velocity	2.36	ft/s
Velocity Head	0.09	ft
Specific Energy	2.08	ft
Froude Number	0.38	
Flow Type	Subcritical	

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	2.00	ft
Critical Depth	1.24	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 7 Channel

GVF Output Data

Critical Slope	0.07862	ft/ft

Messages

Notes

BASIN M + A + OS-3 + G(10)+M+N+O+L(10)+ADDED OS TO N

Worksheet for Design Point 8 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	3.93	ft^3/s

Results

Normal Depth	0.45	ft
Flow Area	1.93	ft^2
Wetted Perimeter	5.81	ft
Hydraulic Radius	0.33	ft
Top Width	5.67	ft
Critical Depth	0.33	ft
Critical Slope	0.02851	ft/ft
Velocity	2.04	ft/s
Velocity Head	0.06	ft
Specific Energy	0.51	ft
Froude Number	0.62	
Flow Type	Subcritical	

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	0.45	ft
Critical Depth	0.33	ft
Channel Slope	0.01000	ft/ft

Worksheet for Design Point 8 Channel

GVF Output Data

Critical Slope	0.02851	ft/ft

Messages

Notes

3 foot bottom => 0.22 normal depth => 1.22 deep => 3.66 wide each side

Worksheet for Design Point 9 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	2.49	ft³/s

Results

Normal Depth	0.42	ft
Flow Area	1.79	ft²
Wetted Perimeter	5.65	ft
Hydraulic Radius	0.32	ft
Top Width	5.52	ft
Critical Depth	0.25	ft
Critical Slope	0.03071	ft/ft
Velocity	1.39	ft/s
Velocity Head	0.03	ft
Specific Energy	0.45	ft
Froude Number	0.43	
Flow Type	Subcritical	

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	0.42	ft
Critical Depth	0.25	ft
Channel Slope	0.00500	ft/ft

Worksheet for Design Point 9 Channel

GVF Output Data

Critical Slope	0.03071	ft/ft

Messages

Notes

3 foot bottom => 0.22 normal depth => 1.22 deep => 3.66 wide each side

APPENDIX D

STORMWATER MANAGEMENT MANUAL

DRAINAGE REPORT CHECKLIST

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Table 302
Stormwater Management Manual
Drainage Report Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided with report. If applicant believes information is not required, indicate with "n/a" and attach separate sheet with explanation
2. The reviewer will determine if information labeled "n/a" is required and whether information must be submitted.
3. Those items noted with an "asterisk" are not typically required for conceptual/ preliminary report. Applicant shall confirm this with local jurisdiction.
4. Submit three (3) copies of report and include copy of check list bound with report.

TITLE PAGE

A. Type of report (Conceptual/Preliminary or Final Drainage Report).
B. Project Name.
C. Preparer name, firm, address, number, and date.
D. Professional Engineer's seal of preparer.
E. Certifications (see SWMM Section 303.1)

I. INTRODUCTION

A. Background
- ✓ 1. Identify report preparer and purpose.
- N/A 2. Identify date of letter with previous County comments.

B. Project Location
- ✓ 1. Identify Township, Range, and Section.
- N/A 2. Identify adjacent street and subdivision names.
- ✓ 3. Reference to General Location Map.

C. Property Description
- ✓ 1. Identify area in acres of entire contiguous ownership.
- ✓ 2. Describe existing ground cover, vegetation, soils, topography and slopes.
- ✓ 3. Describe existing drainage facilities, such as channels, detention areas, or structures.
- ✓ 4. Describe existing irrigation facilities, such as ditches, head-gates, or diversions.
- ✓ 5. Identify proposed types of land use and encumbrances.

D. Previous Investigations
- ✓ 1. Identify drainage master plans that include the project area, including floodplain studies.
- N/A 2. Identify drainage reports for adjacent development.

II. DRAINAGE SYSTEM DESCRIPTION

A. Existing Drainage Conditions
- ✓ 1. Describe existing topography and provide map with contours extending a minimum of 100 feet beyond property limits.
- ✓ 2. Identify major drainageway or outfall drainageway and describe map showing location of proposed development within the drainageways.
- ✓ 3. Identify pre-developed drainage patterns and describe map showing pre-developed sub-basins and concentrated discharge locations. Provide calculations of pre-developed peak flows entering and leaving the site.

B. Master Drainage Plan
- N/A 1. Describe location of the project relative to a previously prepared master drainage plan, including drainage plans prepared for adjacent development.

C. Offsite Tributary Area

✓ 1. Identify all offsite drainage basins that are tributary to the project.
✓ 2. Identify assumptions regarding existing and future land use and effects of offsite detention on peak flows.

D. Proposed Drainage System Description

✓ 1. Identify how offisite stormwater is collected and conveyed through the site and ultimately to the receiving water(s).
✓ 2. Identify sub-basins and describe, in general terms, how onsite stormwater is collected and conveyed through the site for each location where stormwater is discharged from the site.
N/A * 3. Describe detention volumes, release rates and pool elevations.
N/A * 4. Identify the difference in elevation between pond invert and the groundwater table.
✓ 5. Describe how stormwater is discharged from the site, including both concentrated and dispersed discharges and rates.
N/A 6. Describe stormwater quality facilities.
N/A * 7. Describe maintenance access aspects of design.
N/A * 8. Describe easements and tracts for drainage purposes, including limitation on use.

E. Drainage Facility Maintenance

✓ * 1. Identify responsible parties for maintenance of each drainage and water quality facility.
✓ * 2. Identify general maintenance activities and schedules.

III. DRAINAGE ANALYSIS AND DESIGN CRITERIA

A. Regulations

✓ 1. Identify that analysis and design was prepared in accordance with the provisions of the Manual.
✓ 2. Identify other regulations or criteria which have been used to prepare analysis and design.

B. Development Criteria

✓ 1. Identify drainage constraints placed on the project, such as by a major drainage study, floodplain study or other drainage reports relevant to the project.
✓ 2. Identify drainage constraints placed on the project, such as from major street alignments, utilities, existing structures, and other developments.

C. Hydrologic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

✓ 1. Identify developed storm runoff peak flows and volumes and how they were determined, including rainfall intensity or design storm.
✓ 2. Identify which storm events were used for minor and major flood analysis and design.
N/A 3. Identify how and why any other deviations from the Manual occurred.

D. Hydraulic Criteria

(If Manual was followed without deviation, then a statement to that effect is all that is required. Otherwise provide the following information where the criteria used deviates from the Manual.)

N/A * 1. Identify type(s) of streets within and adjacent to development and source for allowable street capacity.
N/A * 2. Identify which type(s) of storm inlets were analyzed or designed and source for allowable capacity.
3. Identify which type of storm sewers which were analyzed or designed and

N/A * Manning's n-values used.

4. Identify which method was used to determine detention volume requirements and how allowable release rates were determined. N/A *

5. Identify how the capacity of open channels and culverts were determined. ✓ *

6. Identify any special analysis or design requirements not contained with the Manual. N/A *

7. Identify how and why any other deviations from the Manual occurred. N/A

E. Variance from Criteria

1. Identify any provisions of the Manual for which a variance is requested. ✓

2. Identify pre-existing conditions which cause the variance request. N/A

***IV. POST CONSTRUCTION STORMWATER MANAGEMENT. See Manual Section 1600 for requirements.**

Note: This section of the Final Drainage Report identifies additional information required by Mesa County's, City of Grand Junction's, and Town of Palisade's, Permit for Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4s), permit No. COR-090000. The Final Drainage Plan and the Construction SWMP (see SWMM Section 1500) meets the requirements of the MS4s Permit. In general, this section identifies permanent BMP practices to control the discharge of pollutants after construction is complete.

*A. Stormwater Quality Control Measures

1. Describe the post-construction BMPs to control discharge of pollutants from the project site. ✓ *

2. If compensating detention is provided, discuss practices to address water quality from area not tributary to detention area. N/A *

3. If underground detention is proposed, discuss how water quality facilities will be provided on the surface. N/A *

4. If proprietary BMPs are proposed, provide the justification and sizing requirements (see SWMM Section 1603.3). N/A

*B. Calculations

1. Provide methods and calculations for WQCV, sediment storage, and water quality outlet structure. N/A

V. CONCLUSIONS

A. Compliance with Manual

Compliance with Manual and other approved documents, such as drainage plans and floodplain studies. ✓

B. Design Effectiveness

Effectiveness of drainage design to control impacts of storm runoff. ✓

C. Areas in Flood Hazard Zone

Meet requirements of Floodplain Regulations: Mesa County Land Development Code, Section 7.13; City of Grand Junction Zoning and Development Code, Section 7.1. ✓

D. Variances from Manual

Applicant shall identify any requested variances and provide basis for approving variance. If no variances are requested, applicant shall state that none are requested. N/A

VII. REFERENCES

Provide a reference list of all criteria, master plans, drainage reports, and technical information used. ✓

TABLES

Include copy of all tables prepared for report. ✓

FIGURES

A. General Location Map (See Section 303.2a) ✓

✓ B. Flood Plain Information
✓ C. Drainage Plan (See Section 303.2b)
✓ D. Other pertinent figures.

APPENDICIES

A. DESIGN CHARTS

1. Provide copy of all design charts (i.e.: tables, figures, charts from other criteria) used for the report. ✓

B. HYDROLOGIC CALCULATIONS (see Manual Sections 600 and 700)

1. Land use assumptions for off-site runoff calculations. ✓
2. Time of concentration and runoff coefficients for pre-existing and post development conditions. ✓
3. Pre-developed hydrologic computations. ✓
4. Developed conditions hydrologic computations. ✓

C. HYDRAULIC CALCULATIONS

1. Capacity of existing channels, streets, storm sewers, inlets, culverts and other facilities. ✓
2. Calculations for existing storm sewer and open channel. N/A
3. Irrigation ditch flows and ditch system capacity. N/A
4. Detention pond design (see Manual, Section 1400 for requirements). N/A *
   a. Storage volume, release rates, and pool elevations for 10-year and 100-year storm. N/A *
   b. Outlet structure dimensions, orifice diameter, weir lengths, pipe headwater and other data. N/A *
   c. Outlet velocity and energy dissipation requirements. N/A *
   d. Routing of outlet flows and emergency spillway flows. N/A *
5. Street capacity calculations, if data in Manual not used (see Section 1100). N/A *
6. Storm inlet capacity calculations, if data in Manual not used (see Section 1100). N/A *
7. Storm sewer capacity calculations, if data in Manual not used (see Section 1000). ✓ *
8. Channel capacity calculations, if data in Manual not used (see Section 800). ✓ *
9. Culvert capacity calculations (see Manual, Section 1200). ✓ *
10. Other hydraulic structure calculations (see Manual, Section 900).

D. STORMWATER QUALITY CALCULATIONS

1. Water Quality Capture Volume (WQCV). N/A
2. Storage volume for sediment volume and pool elevations for WQCV. N/A *
3. Outlet calculations for required area per row, diameter of individual holes, number of holes per row, and number of holes per column. N/A *

CERTIFICATION – PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE ✓

ACKNOWLEDGEMENTS

Drainage Report checklist was prepared by: Alex Lheritier

Table 303
Stormwater Management Manual

Drainage Plan Checklist

Instructions:
1. Applicant to identify with a "check-mark" if information is provided. If applicant believes information is not required, indicate with "n/a".
2. County will determine if information labeled "n/a" is required and whether information must be submitted.

I. EXISTING FACILITIES

- ✓ A. Contours at two foot intervals, based on USGS datum. Contours to extend at least 50 feet past property line.
- N/A B. Location and elevation of USGS benchmarks or benchmarks referenced to USGS.
- N/A C. Property lines.
- N/A D. Drainage easements.
- N/A E. Street names.
- N/A F. Major and minor channels and floodplains.
- ✓ G. A historic drainage plan including historic basin boundaries and flow paths.

II. PROPOSED FACILITIES

- ✓ A. Contours at two-foot intervals, based on USGS datum.
- N/A B. Property lines.
- N/A C. Drainage easements.
- N/A D. Street names and grades.
- N/A E. Right of way and easement.
- N/A F. Finished floor elevations for protection from major storm run-off.
- N/A G. Detention pond information:
  1. N/A Location of each detention pond with site at 1"=50' scale or larger with 2-foot contour intervals.
  2. N/A Inlet and outlet structure, and trickle channel design details.
  3. N/A Details of emergency spillway and channel.
  4. N/A Landscape information, including side slopes, vegetation and planting requirements.
  5. N/A Details of water quality outlet structure.
- N/A H. Channel Information:
  1. N/A Profiles with existing and proposed grades.
  2. N/A Cross sections on 100-foot stations showing existing and proposed topography and required rights of way.
  3. ✓ Locations and size of all existing and proposed structures.
  4. N/A Locations and profiles of adjacent utilities.
  5. N/A Typical channel section and lining details.
- N/A I. Storm sewer information:
  1. N/A Alignment and location of manholes, inlets, and outlet structures.
  2. N/A Profile of invert and pipe crown.
  3. N/A Invert elevations at manholes and inlets.
  4. N/A Lengths and grades between manholes and inlets.
  5. N/A Locations and elevations of utilities adjacent to and crossing storm sewer.
  6. N/A Easement and other O&M access geometry.
  7. N/A Outlet details, such as end sections, headwall and wingwalls, erosion control, and vegetation.
- N/A J. Street cross sections with design 100-year flood depth.
- N/A K. Other drainage related structures and facilities, including underdrains and sump pump discharge lines.
- N/A L. Other permanent BMP measures to control pollutant discharges to the County's MS4 system.

III. HYDRAULIC AND HYDROLOGIC INFORMATION

✓ A. Routing and accumulative runoff peaks at upstream and downstream ends of the site and at various critical points onsite for initial and major storms. Inflow and outflow from each subbasin shall be shown for both initial and major storms.

N/A B. Street cross sections showing 100-year flood levels.

N/A C. Major and minor channels and floodplains.

N/A D. Detention pond data:

N/A 1. Release rates for 10- and 100-year storm events.

N/A 2. Required and provided volumes for 10- and 100-year storm events.

N/A 3. Design depths for 10- and 100-year storm events.

N/A 4. Water quality capture volume and pool elevation.

E. Channel data:

N/A 1. Water surface profiles.

N/A 2. Representative 100-year flow velocity and Froude number.

F. Storm sewer data:

N/A 1. Profile of water surface for design flow rate.

N/A 2. Peak flows for design flow, 2-year and 100-year storm events.

IV. STANDARD NOTES

✓ A. No building, structure, or fill will be placed in the detention areas and no changes or alterations affecting the hydraulic characteristics of the detention areas will be made without the approval of the County.

✓ B. Maintenance and operation of the detention and water quality areas is the responsibility of property owner. If owner fails in this responsibility, the County has the right to enter the property, maintain the detention areas, and be reimbursed for costs incurred.

✓ C. Detention pond volumes, all drainage appurtenances, and basin boundaries shall be verified. As-built drawings shall be prepared by a registered professional engineer prior to issuance of certificate of occupancy for any structure within the development.

D. Permission to reproduce these plans is hereby given to Mesa County for County purposes associated with plan review, approval, permitting, inspection and construction of work.

✓ **V. PROFESSIONAL ENGINEER'S SEAL AND SIGNATURE**

VI. OTHER

N/A A. Horizontal and vertical control information and ties to existing and proposed features.

ACKNOWLEDGEMENTS

Drainage Plan checklist was prepared by: Alex Lheritier