Run-on and Run-off Control System Plan

For Compliance with the Coal Combustion Residuals Rule
(40 CFR 257.81)

Valmont Station - Ash Disposal Facility
Public Service Company of Colorado
Denver, Colorado
October 17, 2016

Revised October 15, 2021

PREPARED FOR

VALMONT STATION

1800 North 63rd Street
Boulder, Colorado 80301

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Table of Abbreviations and Acronyms

Abbreviation	Definition
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cfs	cubic feet per second
CN	Curve Number
EPA	Environmental Protection Agency
HSG	Hydrologic Soil Group
NOAA	National Oceanic and Atmospheric Administration
RCRA	Resource Conservation and Recovery Act
SCS	Soil Conservation Service
TR-20	Technical Release 20
TR-55	Technical Release 55

1.0 Introduction

On April 17, 2015 the U.S. Environmental Protection Agency (EPA) published regulations under Subtitle D of the Resource Conservation and Recovery Act (RCRA) meant to control the safe disposal of coal combustion residuals (CCR) generated by coal-fired electric utilities. The rule defines a set of requirements for the disposal and handling of CCR within CCR units (defined as either landfills or surface impoundments). The requirements include preparation of a Run-on and Run-off Control System Plan for all existing and new CCR landfills.

This Run-on and Run-off Control System Plan (RORO) was prepared for the CCR landfill unit at the Valmont Station, operated by Public Service Company of Colorado (PSCo), an Xcel Energy Company. It was prepared in accordance with the requirements of 40 Code of Federal Regulations (CFR) 257.81. The regulation required an initial Run-on and Run-off Control System Plan be prepared no later than October 17, 2016 and a revision frequency of 5 years.

The initial RORO was reviewed, and limited revisions were made to reflect current site conditions. PSCo expects to make additional changes to the RORO within the next 1-2 years to reflect an anticipated project to remove ash from the landfill for encapsulated beneficial use.

1.1 Facility Description

The Valmont Station CCR landfill unit is located approximately 0.5 mile north of the power plant on the north side of Leggett Reservoir. The Valmont Station is approximately 4 miles east of downtown Boulder, Colorado.

A location map is included as **Figure 1**.

The CCR landfill unit is the highest topographic point in the immediate area. It is located along a natural slope north of the Leggett Reservoir. To the west it is bordered by 63rd Street, to the north and off of Valmont Station property is a former mine tailings pond, and to the east is the Valmont Reservoir. The CCR landfill parcel is approximately 60 acres, of which approximately 53 acres contain landfilled CCR. The landfilled areas consist of disposal cells designated as Area A-1, A-2, and A-3; Area B-1; Area C-1; Area D-1; Area E-1; and Area Q-1 and Q-2.

According to PSCo, Areas A-1, A-2, A-3, B-1, and C-1 as well as the sideslopes of Q-1 (below elevation 5290') and Q-2 were closed prior to publication of 40 CFR 257. Areas Q-1 and Q-2 (top portions are closed and covered but will require final closure in the future in accordance with 40 CFR 257. Areas D-1 and Area E-1 currently have intermediate cover placed within the footprint and have the potential to receive additional CCR waste in the future, eventually Areas D-1 and E-1will be closed in accordance with 40 CFR 257. The existing conditions of these areas are described further in **Section 2.1.1** of this report.

1.2 Regulatory Requirements

40 CFR 257.81 requires that an owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill design, construct, operate, and maintain:

1) a run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm;
2) a run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm; and

3) a run-off control system designed to handle run-off so that it does not cause a discharge of pollutants to waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under Section 402 of the Clean Water Act.

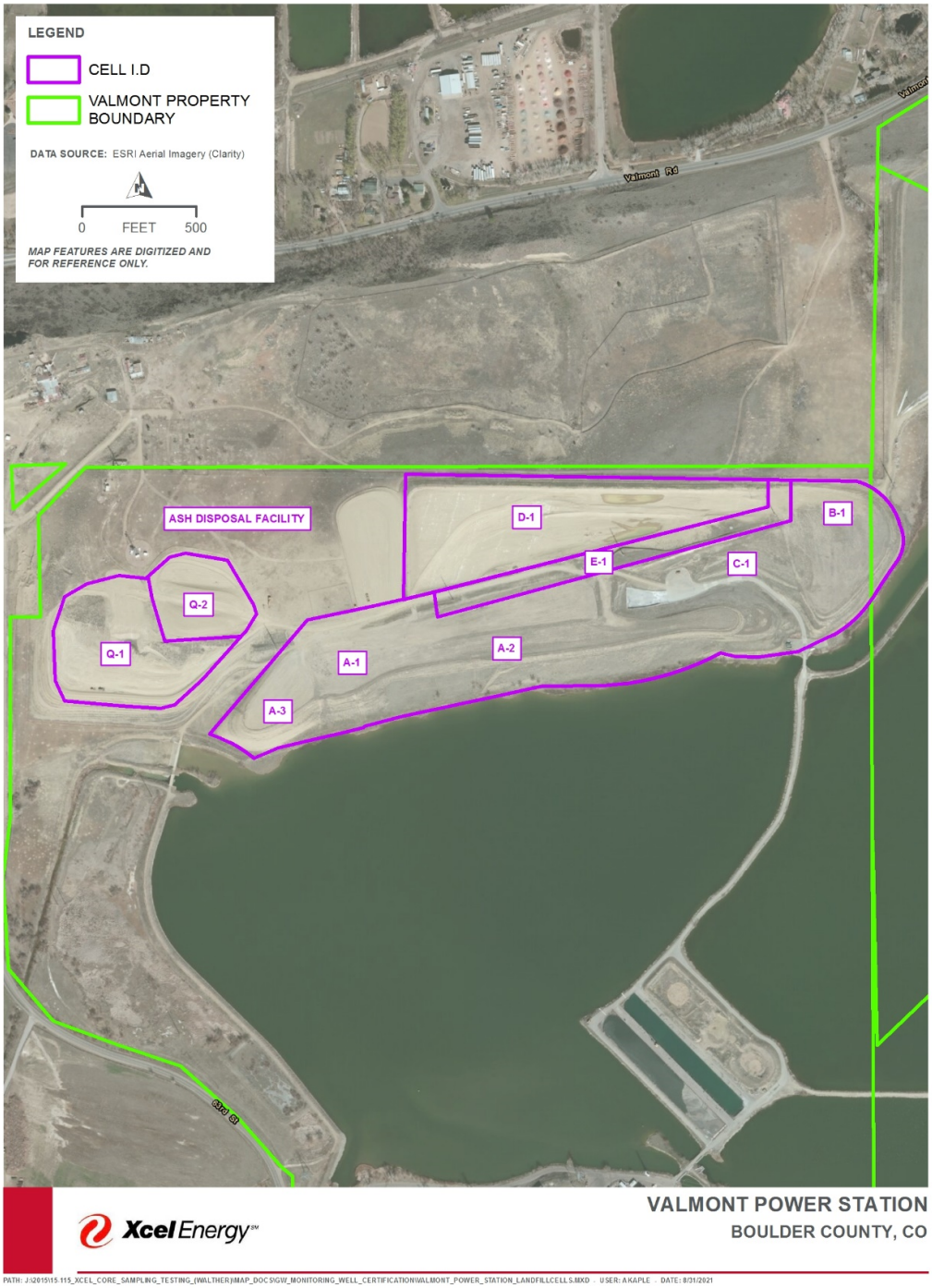


Figure 1. Valmont Power Station Location Map

2.0 Run-on / Run-off Controls for CCR Landfill

A hydrologic and hydraulic analysis was completed for the active portion of the CCR landfill unit in accordance with 40 CFR 257.81. Per §257.53, the active portion means "*that part of the CCR unit that has received or is receiving CCR or non-CCR waste and that has not completed closure in accordance with §257.102"*. Thus, the top portions of Areas Q-1 and Q-2 along with Areas D-1 and E-1 are considered active at the time of this report.

According to PSCo, prior to publication of 40 CFR 257.81 Areas A, B, C, and the Q-1 and Q-2 sideslopes were completed and closed. These areas were closed with final cover material and are fully vegetated and are not considered active portions of the CCR landfill unit. Therefore, these areas, including all permanent run-off control systems in these areas, were not included in the original evaluation. However, the portions of these areas that may be re-opened for clean-closure via ash removal will be considered active *if* the final cover is removed to begin this process.

The evaluation included preparation of a surface water run-off model using HydroCAD® 10.10-6a to determine whether existing run-on and run-off control systems meet the required criteria for controlling run-on and run-off from the 25-year, 24-hour storm event. The evaluation was completed using the best available information at the time and was based on an original survey completed in October 2017 and updated in November 2018 and June 2021.

2.1 Description of CCR Landfill and Drainage Area

Based on the survey data, Area D-1 and Area E-1 comprise 9.65 and 4.21 acres of the CCR landfill unit, respectively. The drainage area extends beyond the active landfill operations as a result of a soil stockpile located west of the active area that drains run-off into the active portion. The total drainage area is approximately 16.58 acres and consists of approximately 1.07 acres of a soil stockpile area and 15.51 acres of fallow, bare soils.

In addition, the upper portions of Q-1 and Q-2 represent areas that have accepted CCR material after April 17, 2015. These areas are no longer accepting CCR material, and have been graded, covered, and seeded, but are not yet considered closed in accordance with 40 CFR 257. Area Q-1 and Q-2 comprise 10.29 and 2.87 acres of the CCR landfill until respectively. The upper portion of Q-1 is approximately 6.91 acres. The drainage area for Q-1 includes part of the top portion of Area Q-2 and surrounding area to the northwest which drain run-off into this area. Thus, the drainage area, consisting of fallow, bare soils, for Q-1 is 4.43 acres and Q-2 is 1.90 acres.

The active landfill areas and delineated drainage subcatchments are shown on **Figure 2**.

2.2 Description of Existing Run-on / Run-off Controls

2.2.1 Run-on Controls

The landfill cells, D-1 and E-1 are located at, and incised into, the topographic high point of the landfill area which prevents any run-on from entering the areas from the north, east, and south. To the west of the landfill is a soil stockpile area which provides a source of cover soil for the site. Surface water run-off from a portion of this stockpile drains towards the covered landfill area. Since Areas D-1 and E-1 do not have any exposed or ongoing CCR placement, there is no need for run-on controls.

The upper portions of areas Q-1 (above 5290 feet) and Q-2 are the final grades for the top of the Q-1 and Q-2 cells. The topography is such that any stormwater will run-off and away from these areas. Due to the elevations of these areas being above the surrounding grade, there is no run-on to Q-1 and Q-2 and no need for run-on controls.

2.2.2 Run-off Control

Areas D-1 and E-1 are graded to direct surface water run-off to the east where it ultimately is collected in the Leggett Reservoir.

The Q-1 area drains radially south towards the closed sideslopes where it is captured by a sideslope swale that directs stormwater east to a riprap downchute located on the southeast corner of the Q-1 plateau area. The downchute discharges water to the Leggett Reservoir. The Q-2 area drains radially north off the landfill and sheet flows towards a low-lying area where it collects and infiltrates.

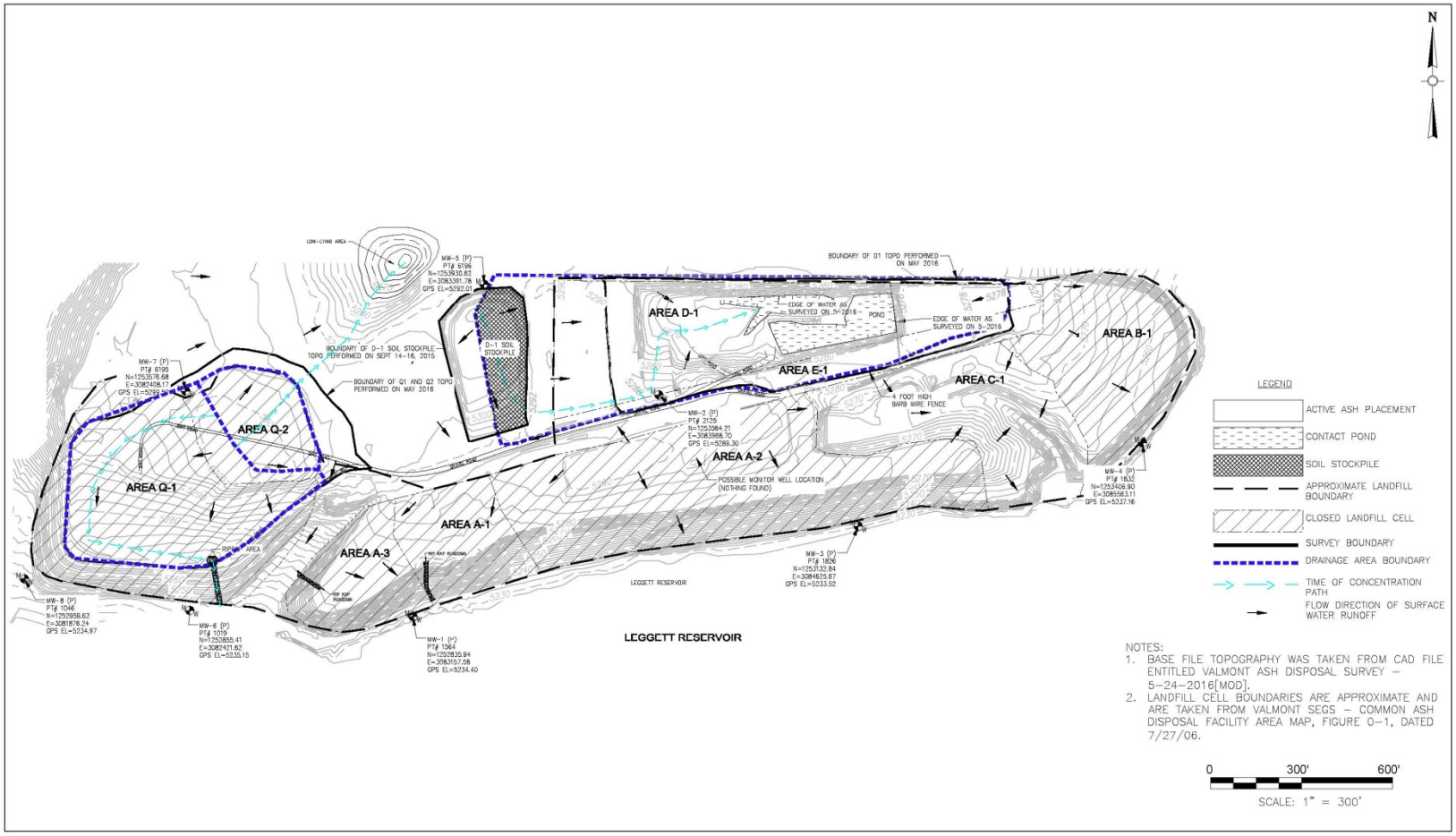


Figure 2. Stormwater Drainage Map (Areas D-1, E-1, Q-1 and Q-2)

2.3 Surface Water Run-off Model

A surface water run-off model was prepared using HydroCAD® which utilizes procedures outlined in the Soil Conservation Service (SCS) Technical Release 55 (TR-55) for computing curve numbers and times of concentration and SCS TR-20 for calculating and generating run-off hydrographs. The models are included as **Appendix A**. A detailed discussion of the information inputted into the model is provided below.

2.3.1 Rainfall Data

Rainfall data was taken from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server. Rainfall data inputted into the model included the 2-year and 25-year, 24-hour storm events. The precipitation amounts are summarized below and the information from the NOAA Precipitation Frequency Data Server is included as **Appendix B**.

Table 1. Rainfall Data	
24 Hour Rainfall Event	**Precipitation (inches)**
2-year	1.92
25-year	3.85

2.3.2 Weighted Curve Number

The weighted curve number (CN) is determined according to a hydrologic soil group (HSG) and ground cover for a delineated drainage basin. To compute the weighted CN, the Soil Conservation District Web Soil Survey map was consulted to identify the hydrologic soil groups for the native soils. According to the web soil map, the native soils consist of Valmont cobbly clay loam, 1 to 5 % slopes (VcC). This soil type is in HSG C. A soil report for the native soils is included in **Appendix C**.

The soil stockpile was assumed from native soils surrounding the landfill area and was modeled to be bare soil of HSG C. Cells D-1 and E-1 of the landfill were delineated into one drainage basin which drains to the Leggett Reservoir (refer to **Figure 2**). The ground cover for the ash disposal area was inputted into the model as bare soil. Area Q-1 and Q-2 were identified as soil type HSG C and modeled as bare soils.

Given that all soils can be assumed to be of the same cover type, the curve number for all drainage areas was determined to be 91, as broken down in **Table 2**.

Table 2. Summary of Area Breakdown			
Cover Type	**HSG**	**Area (acres)**	**Curve Number**
Intermediate Cover (Bare, Fallow)	C	15.51	91
Soil Stockpile (Bare, Fallow)	C	1.07	91
Area D-1 & E-1 Weighted CN			**91**
Areas Q-1 CN	**C**	**4.43**	**91**
Area Q-2 CN	**C**	**1.90**	**91**

2.3.3 Time of Concentration

The time of concentration is defined as the time required for run-off to travel from the most hydrologically distant point of a sub-catchment to the point of collection. It is determined by summing the travel time for consecutive flow segments along the sub-catchment's hydraulic path. The path for the time of concentration used to compute surface water run-off from the existing conditions is shown in **Figure 2.**

2.3.4 Basins

Exfiltration rates were calculated based on the conductivity of the underlying native soils taken from the Soil Conservation District Web Soil Report (**Appendix C**). According to the report, the native soils have a moderately low to moderately high capacity to transmit water (saturated hydraulic conductivity) at an estimated rate of 0.06 to 0.20 inch/hour. For the model, the medial rate of 0.13 inch/hour was assumed.

2.3.5 Low-Lying Area

The low-lying area to the north of Q-2 that receives the run-off from this area was modeled as a stormwater basin with exfiltration. This area was modeled as an 18-ft-deep basin with a surface area of approximately 1.75 acres and with a bottom elevation of 5252' and top elevation of 5270'. The storage capacity of the low-lying area was estimated to be 3.63 acre-ft.

2.4 Evaluation of Existing Run-on / Run-off Controls

To comply with 40 CFR 257.81, the stormwater management system must be of sufficient size to collect and control run-off resulting from the 25 year, 24-hour storm event.

The model estimated a peak run-off volume of 74.99 cubic feet per second (cfs) during the 25-year, 24-hour storm event for the Area D-1 and E-1 run-off. This runoff is captured by a grass swale(s) that directs stormwater east to a riprap downchute located in Area B-1. The swale size and riprap size were evaluated for the 25-year, 24-hour storm event.

The Q-1 run-off was modeled to have a maximum runoff volume of 30.50 cfs. This runoff is captured by a grass sideslope swale that directs stormwater east to a riprap downchute located on the southeast corner of the Q-1 plateau area that directs the runoff to the reservoir. The swale size and riprap size were evaluated for the 25-year, 24-hour storm event. The riprap downchute has sufficient capacity and the 12" riprap installed will be adequate to withstand the volume and velocity. The velocity of runoff in the grass sideslope swale was calculated to be 8.32 feet per second (fps). Typically, velocities greater than 5.0 fps require riprap to avoid excessive erosion however no erosion has been present during stormwater inspections. See calculations in **Appendix A**.

The Q-2 area drains radially north off the landfill and sheet flows towards a low-lying area where it collects and infiltrates. Areas Q-2 was modeled to have a maximum runoff flow of 7.66 cfs. There are no run-off controls for the Q-2 area as stormwater simply sheet-flows off the landfill to a low-lying area. Exfiltration was modeled as the primary outflow with a maximum discharge of 0.05 cfs. During the 25-year, 24-hour storm event the maximum basin height reached 5,255.22 feet or .39 ac-ft of storage required which leaves over 14 feet of freeboard and 89% of storage available.

2.5 Improvements to Existing Run-on / Run-off Controls

Based on the available information and the model results, the existing run-on and run-off controls in place for the active portion (Areas D-1 and E-1) of the Valmont CCR landfill unit meet the requirements of 40 CFR Part 257.81 and no improvements are needed.

The existing run-on and run-off controls in place for the active portion of Areas Q-1 and Q-2 meet the requirements of 40 CFR Part 257.81. However, continued inspection of the grass sideslope swale on Area Q-1 occur to identify future erosion.

Professional Engineer Certification

Valmont Station CCR Unit 2021 Run-on and Run-off Controls for CCR Landfills Compliance with the Federal Coal Combustion Residuals Rule

The undersigned Registered Professional Engineer is familiar with the requirements of Part 257 of Title 40 of the Code of Federal Regulations (40 CFR Part 257) and has visited and examined the facility or has supervised examination of the facility by appropriately qualified personnel. The undersigned Registered Professional Engineer attests that this Run-on and Run-off Controls System Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR Part 257.

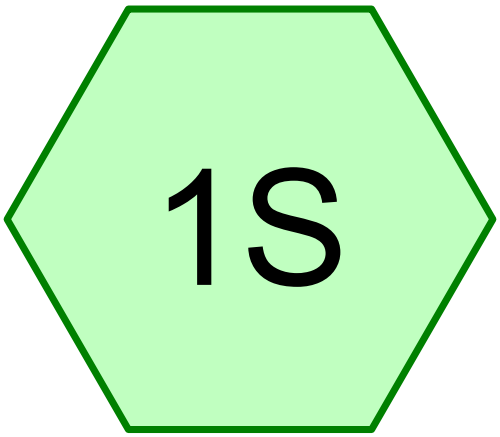
This Plan is valid only to the extent that the facility owner or operator maintains existing run-on and run-off controls described in this Plan to prevent flow onto the active portion and prevent surface discharges of CCR in solution or suspension.

SIGNATURE:

Brent Learch, PE Colorado PE 0056841

DATE: October 15, 2021

Appendix A - HydroCAD® Model Results



D-1/E-1 to Riprap Downchute

Subcat Reach Pond Link

Routing Diagram for Cells D+E_Final
Prepared by HDR, Inc, Printed 10/5/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
16.580	91	Fallow, bare soil, HSG C (1S)
16.580	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
16.580	HSG C	1S
0.000	HSG D	
0.000	Other	
16.580		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	16.580	0.000	0.000	16.580	Fallow, bare soil	1S
0.000	**0.000**	**16.580**	**0.000**	**0.000**	**16.580**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: D-1/E-1 to Riprap Runoff Area=16.580 ac 0.00% Impervious Runoff Depth>2.69"
Flow Length=2,616' Tc=7.6 min CN=91 Runoff=74.99 cfs 3.720 af

Total Runoff Area = 16.580 ac Runoff Volume = 3.720 af Average Runoff Depth = 2.69"
100.00% Pervious = 16.580 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: D-1/E-1 to Riprap Downchute

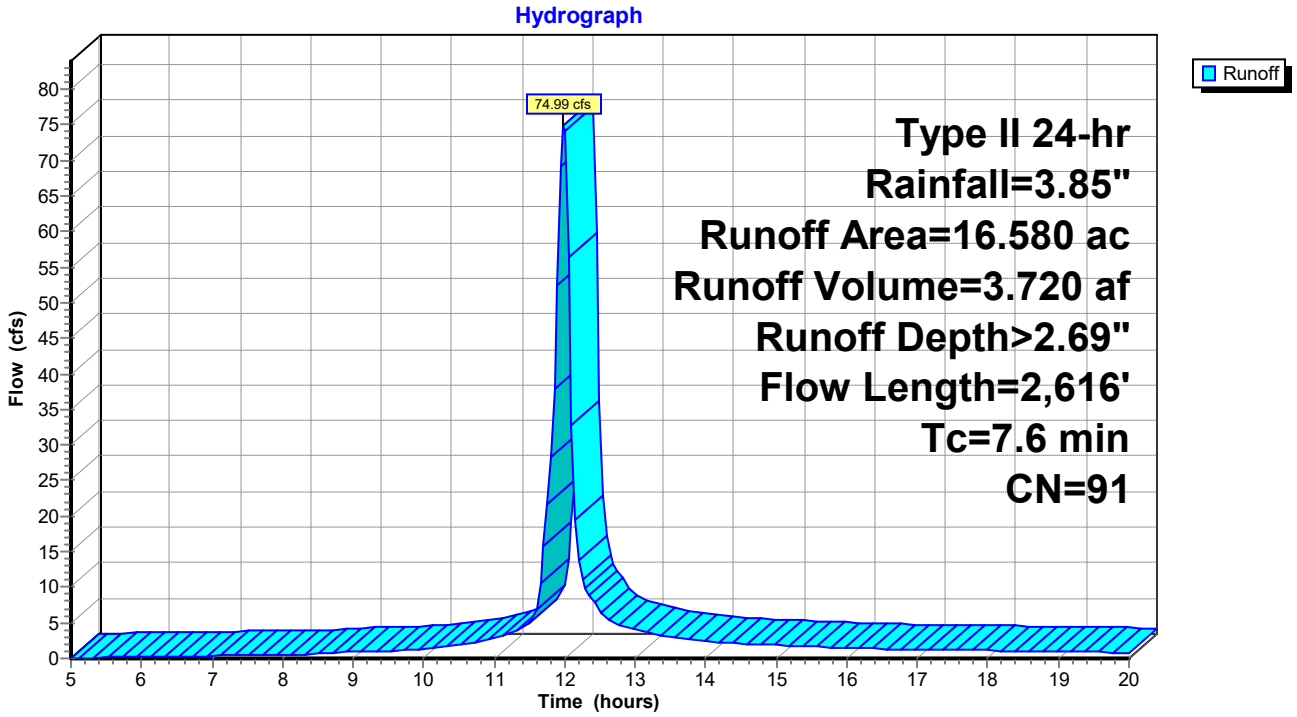
Runoff = 74.99 cfs @ 11.99 hrs, Volume= 3.720 af, Depth> 2.69"
Routed to nonexistent node 1R

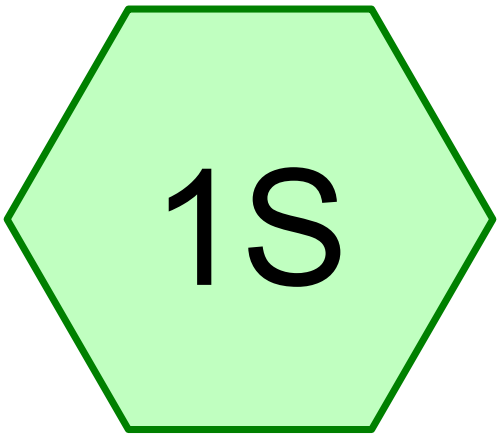
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.85"

Area (ac)	CN	Description
15.510	91	Fallow, bare soil, HSG C
1.070	91	Fallow, bare soil, HSG C
16.580	91	Weighted Average
16.580		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	100	0.1300	0.67		**Sheet Flow, Sheet Flow** Fallow n= 0.050 P2= 1.92"
3.5	278	0.0180	1.34		**Shallow Concentrated Flow, Soil Stockpile** Nearly Bare & Untilled Kv= 10.0 fps
1.5	2,174	0.0770	24.56	589.45	**Channel Flow, Swale** Area= 24.0 sf Perim= 16.0' r= 1.50' n= 0.022 Earth, clean & straight
0.1	64	0.2700	11.99	239.84	**Channel Flow, RipRap** Area= 20.0 sf Perim= 15.0' r= 1.33' n= 0.078 Riprap, 12-inch
7.6	2,616	Total			

Subcatchment 1S: D-1/E-1 to Riprap Downchute





Q-1 to Riprap Downchute

Subcat Reach Pond Link

Routing Diagram for Cell Q-1_Final
Prepared by HDR, Inc, Printed 10/5/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
8.630	91	Fallow, bare soil, HSG C (1S)
8.630	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
8.630	HSG C	1S
0.000	HSG D	
0.000	Other	
8.630		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	8.630	0.000	0.000	8.630	Fallow, bare soil	1S
0.000	**0.000**	**8.630**	**0.000**	**0.000**	**8.630**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Q-1 to Riprap Downchute Runoff Area=8.630 ac 0.00% Impervious Runoff Depth>2.69"
Flow Length=1,483' Tc=15.4 min CN=91 Runoff=30.50 cfs 1.932 af

Total Runoff Area = 8.630 ac Runoff Volume = 1.932 af Average Runoff Depth = 2.69"
100.00% Pervious = 8.630 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Q-1 to Riprap Downchute

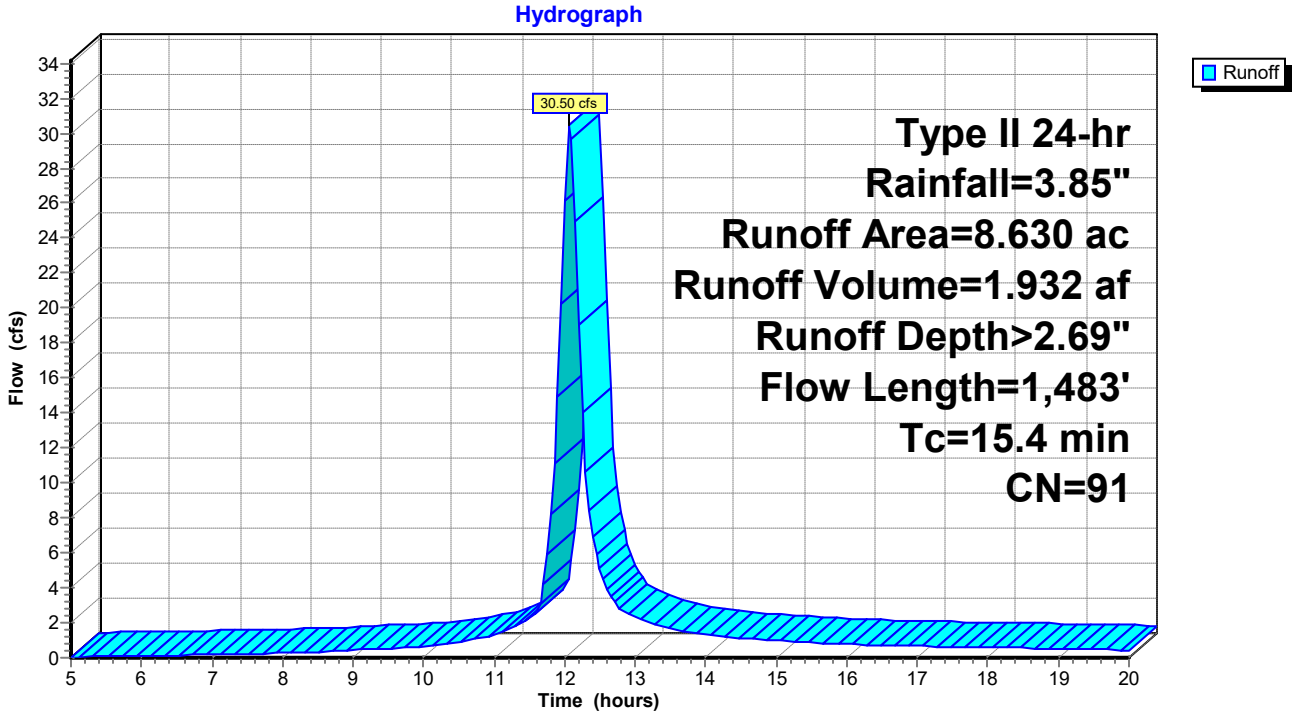
Runoff = 30.50 cfs @ 12.07 hrs, Volume= 1.932 af, Depth> 2.69"
Routed to nonexistent node 1R

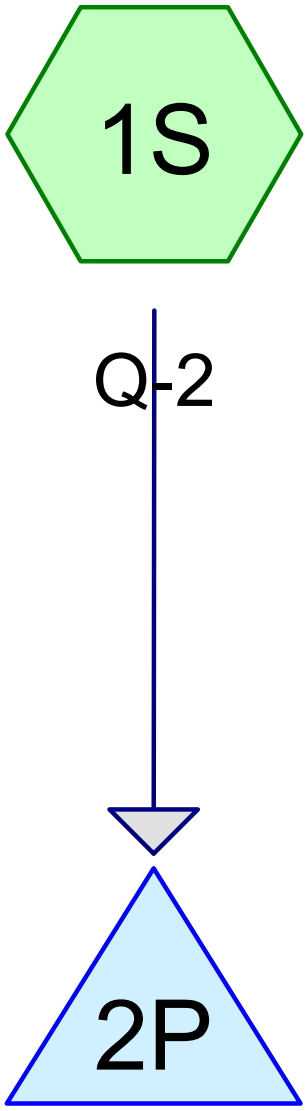
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.85"

Area (ac)	CN	Description
8.630	91	Fallow, bare soil, HSG C
8.630		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	100	0.0080	0.22		**Sheet Flow, Sheet Flow** Fallow n= 0.050 P2= 1.92"
6.6	535	0.0180	1.34		**Shallow Concentrated Flow, Shallow Concentrated Flow** Nearly Bare & Untilled Kv= 10.0 fps
0.9	683	0.0280	13.12	131.15	**Channel Flow, Swale** Area= 10.0 sf Perim= 8.0' r= 1.25' n= 0.022 Earth, clean & straight
0.3	165	0.2200	10.83	216.50	**Channel Flow, RipRap** Area= 20.0 sf Perim= 15.0' r= 1.33' n= 0.078 Riprap, 12-inch
15.4	1,483	Total			

Subcatchment 1S: Q-1 to Riprap Downchute





Low-Lying Area

Subcat Reach Pond Link

Routing Diagram for Cell Q-2_Final
Prepared by HDR, Inc, Printed 9/30/2021

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.900	91	Fallow, bare soil, HSG C (1S)
1.900	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.900	HSG C	1S
0.000	HSG D	
0.000	Other	
1.900		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.900	0.000	0.000	1.900	Fallow, bare soil	1S
0.000	**0.000**	**1.900**	**0.000**	**0.000**	**1.900**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Q-2 Runoff Area=1.900 ac 0.00% Impervious Runoff Depth>2.69"
Flow Length=864' Tc=11.0 min CN=91 Runoff=7.66 cfs 0.426 af

Pond 2P: Low-Lying Area Peak Elev=5,255.22' Storage=0.390 af Inflow=7.66 cfs 0.426 af
Outflow=0.05 cfs 0.035 af

Total Runoff Area = 1.900 ac Runoff Volume = 0.426 af Average Runoff Depth = 2.69"
100.00% Pervious = 1.900 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Q-2

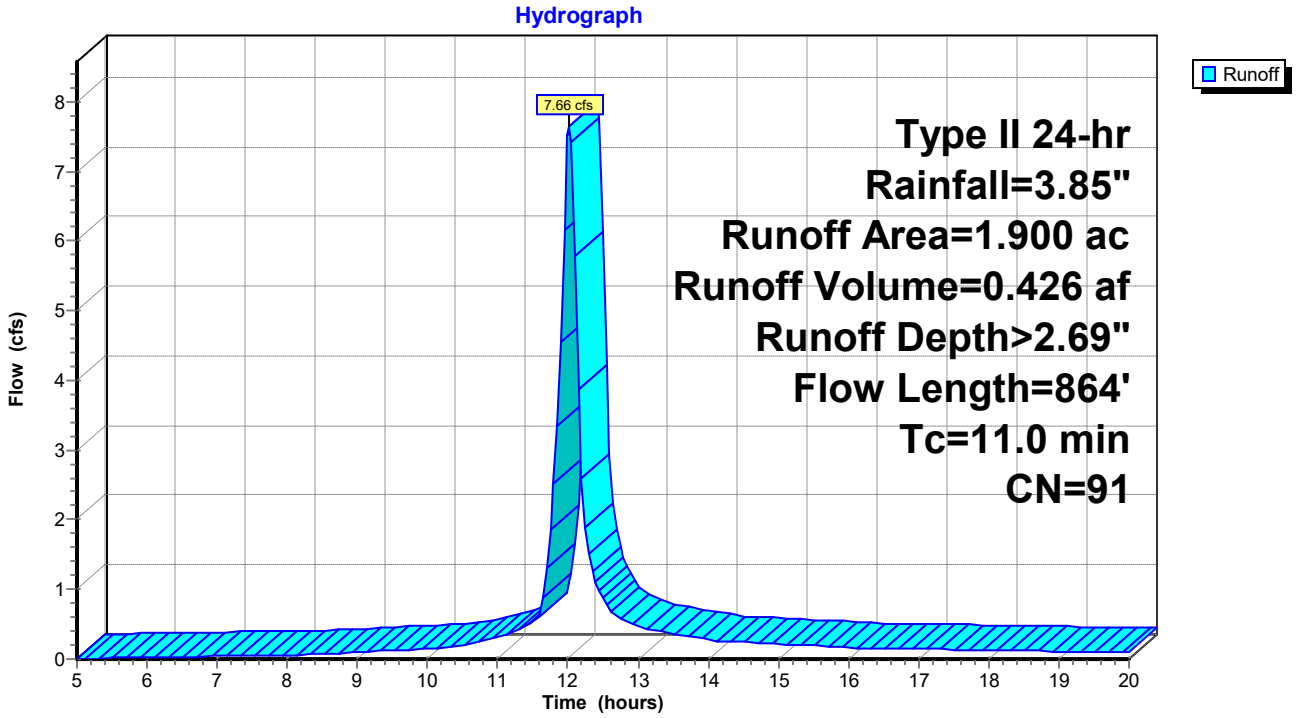
Runoff = 7.66 cfs @ 12.02 hrs, Volume= 0.426 af, Depth> 2.69"
Routed to Pond 2P : Low-Lying Area

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=3.85"

Area (ac)	CN	Description
1.900	91	Fallow, bare soil, HSG C
1.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	100	0.0163	0.29		**Sheet Flow, Sheet Flow** Fallow n= 0.050 P2= 1.92"
5.3	764	0.0583	2.41		**Shallow Concentrated Flow, Shallow Concentrated Flow** Nearly Bare & Untilled Kv= 10.0 fps
11.0	864	Total			

Subcatchment 1S: Q-2



Summary for Pond 2P: Low-Lying Area

Inflow Area = 1.900 ac, 0.00% Impervious, Inflow Depth > 2.69"
Inflow = 7.66 cfs @ 12.02 hrs, Volume= 0.426 af
Outflow = 0.05 cfs @ 20.00 hrs, Volume= 0.035 af, Atten= 99%, Lag= 478.7 min
Primary = 0.05 cfs @ 20.00 hrs, Volume= 0.035 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 5,255.22' @ 20.00 hrs Surf.Area= 0.396 ac Storage= 0.390 af

Plug-Flow detention time= 401.1 min calculated for 0.035 af (8% of inflow)
Center-of-Mass det. time= 181.6 min (943.3 - 761.7)

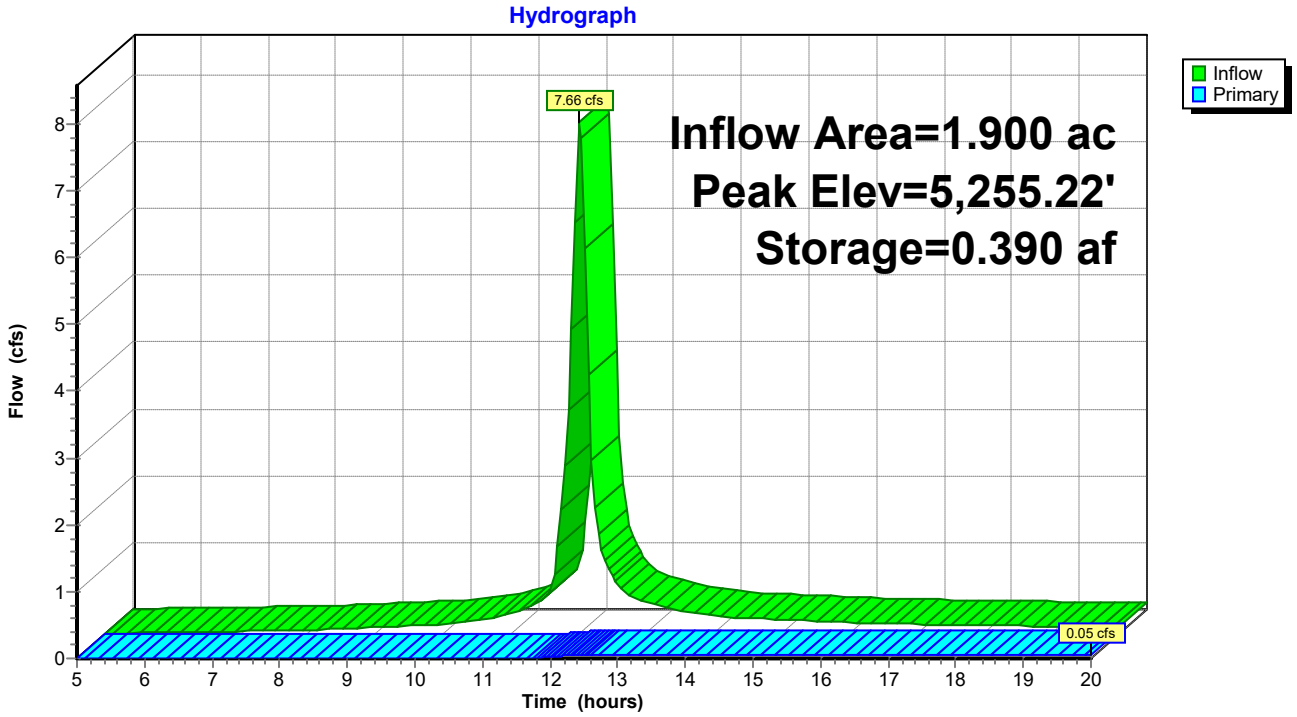
Volume	Invert	Avail.Storage	Storage Description
#1	5,252.00'	3.634 af	**Custom Stage Data (Prismatic)** Listed below

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
5,252.00	0.024	0.000	0.000
5,253.00	0.034	0.029	0.029
5,254.00	0.065	0.050	0.079
5,255.00	0.369	0.217	0.296
5,256.00	0.491	0.430	0.725
5,257.00	0.772	0.631	1.357
5,258.00	0.594	0.683	2.040
5,259.00	0.129	0.361	2.401
5,260.00	0.121	0.125	2.526
5,261.00	0.000	0.061	2.587
5,262.00	0.138	0.069	2.656
5,263.00	0.137	0.138	2.793
5,264.00	0.140	0.139	2.932
5,265.00	0.133	0.137	3.068
5,266.00	0.358	0.245	3.314
5,267.00	0.000	0.179	3.493
5,268.00	0.094	0.047	3.540
5,269.00	0.030	0.062	3.602
5,270.00	0.033	0.031	3.634

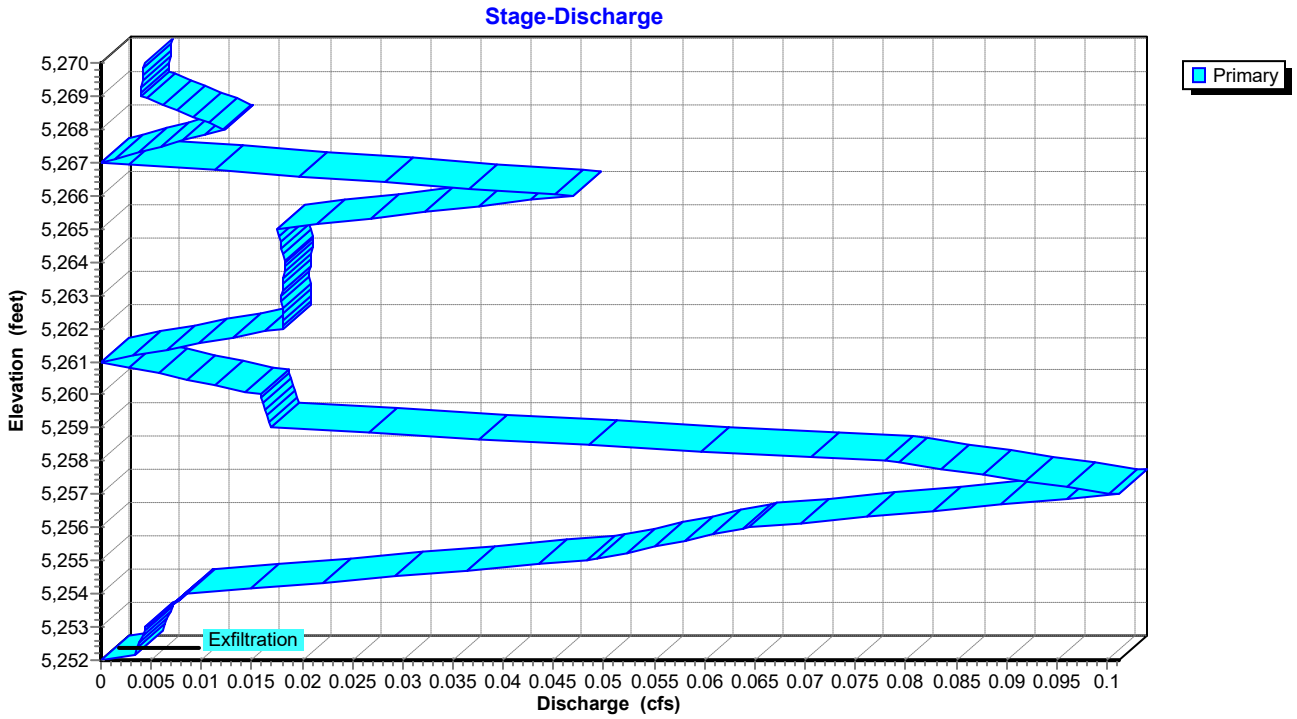
Device	Routing	Invert	Outlet Devices
#1	Primary	5,252.00'	**0.130 in/hr Exfiltration over Surface area**

Primary OutFlow Max=0.05 cfs @ 20.00 hrs HW=5,255.22' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.05 cfs)

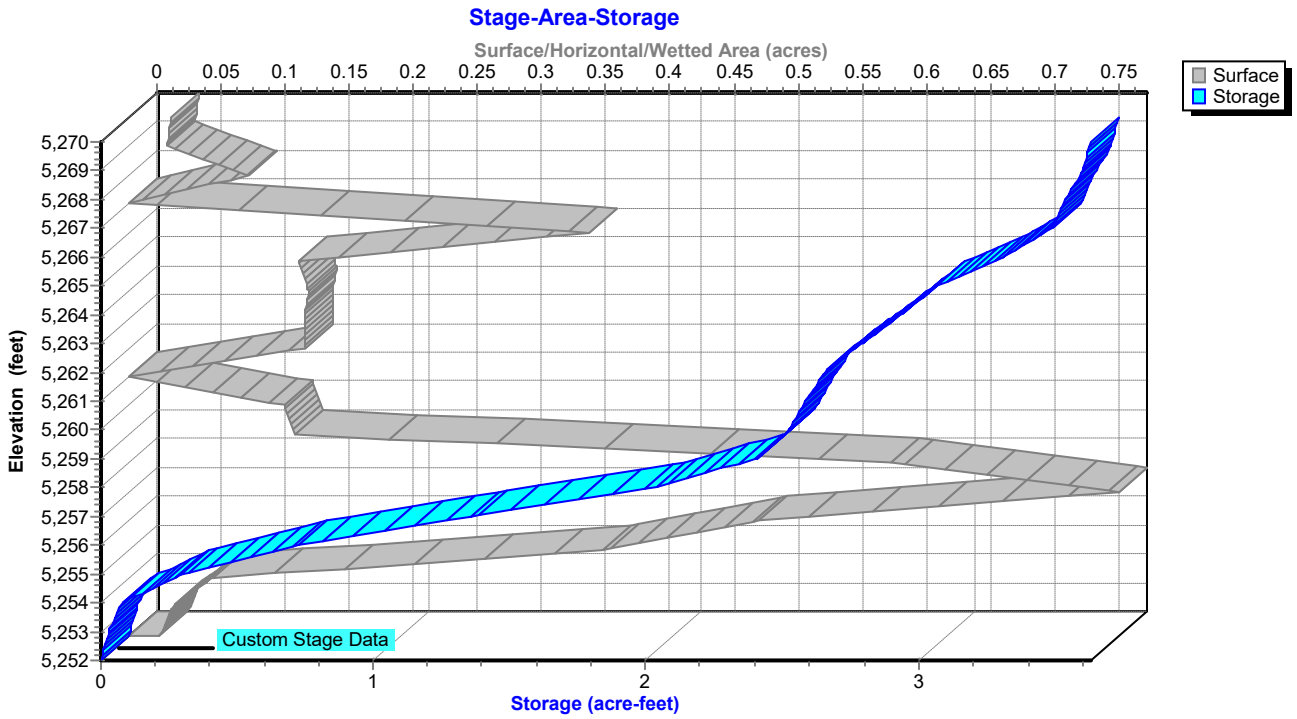
Pond 2P: Low-Lying Area



Pond 2P: Low-Lying Area



Pond 2P: Low-Lying Area



Appendix B - NOAA Rainfall Data

NOAA Atlas 14, Volume 8, Version 2
Location name: Boulder, Colorado, USA*
Latitude: 40.0266°, Longitude: -105.2024°
Elevation: 5229.03 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.211** (0.172-0.261)	**0.259** (0.210-0.320)	**0.351** (0.284-0.435)	**0.441** (0.354-0.549)	**0.585** (0.460-0.776)	**0.712** (0.540-0.949)	**0.853** (0.620-1.16)	**1.01** (0.697-1.41)	**1.24** (0.816-1.77)	**1.43** (0.906-2.04)
10-min	**0.309** (0.251-0.382)	**0.379** (0.308-0.468)	**0.514** (0.416-0.637)	**0.645** (0.519-0.803)	**0.857** (0.674-1.14)	**1.04** (0.791-1.39)	**1.25** (0.907-1.70)	**1.48** (1.02-2.06)	**1.82** (1.20-2.59)	**2.10** (1.33-2.98)
15-min	**0.377** (0.307-0.466)	**0.462** (0.375-0.571)	**0.626** (0.507-0.776)	**0.787** (0.633-0.980)	**1.05** (0.821-1.39)	**1.27** (0.964-1.69)	**1.52** (1.11-2.07)	**1.81** (1.25-2.51)	**2.22** (1.46-3.15)	**2.56** (1.62-3.64)
30-min	**0.520** (0.423-0.643)	**0.635** (0.516-0.785)	**0.859** (0.695-1.06)	**1.08** (0.866-1.34)	**1.43** (1.13-1.90)	**1.74** (1.32-2.32)	**2.09** (1.52-2.84)	**2.47** (1.71-3.44)	**3.04** (2.00-4.32)	**3.50** (2.22-4.99)
60-min	**0.644** (0.524-0.796)	**0.786** (0.639-0.972)	**1.06** (0.858-1.31)	**1.33** (1.07-1.65)	**1.76** (1.38-2.33)	**2.13** (1.62-2.84)	**2.55** (1.85-3.47)	**3.01** (2.08-4.19)	**3.69** (2.43-5.26)	**4.26** (2.69-6.06)
2-hr	**0.768** (0.630-0.939)	**0.937** (0.767-1.15)	**1.26** (1.03-1.55)	**1.58** (1.28-1.94)	**2.08** (1.65-2.73)	**2.52** (1.93-3.32)	**3.01** (2.21-4.05)	**3.56** (2.48-4.90)	**4.35** (2.89-6.13)	**5.01** (3.21-7.07)
3-hr	**0.843** (0.695-1.02)	**1.03** (0.845-1.25)	**1.38** (1.13-1.68)	**1.71** (1.40-2.10)	**2.25** (1.79-2.93)	**2.72** (2.09-3.55)	**3.23** (2.38-4.32)	**3.80** (2.67-5.20)	**4.64** (3.10-6.49)	**5.33** (3.43-7.47)
6-hr	**1.03** (0.855-1.24)	**1.24** (1.03-1.50)	**1.64** (1.36-1.98)	**2.02** (1.66-2.45)	**2.62** (2.10-3.36)	**3.14** (2.43-4.05)	**3.71** (2.76-4.89)	**4.33** (3.07-5.86)	**5.24** (3.54-7.25)	**5.99** (3.90-8.31)
12-hr	**1.30** (1.09-1.55)	**1.56** (1.31-1.86)	**2.03** (1.70-2.43)	**2.48** (2.05-2.97)	**3.16** (2.55-4.00)	**3.75** (2.93-4.77)	**4.38** (3.29-5.71)	**5.07** (3.63-6.78)	**6.07** (4.15-8.31)	**6.89** (4.54-9.47)
24-hr	**1.57** (1.33-1.85)	**1.92** (1.62-2.26)	**2.52** (2.12-2.97)	**3.05** (2.55-3.62)	**3.85** (3.12-4.78)	**4.51** (3.55-5.65)	**5.21** (3.94-6.68)	**5.96** (4.30-7.84)	**7.02** (4.84-9.47)	**7.86** (5.25-10.7)
2-day	**1.79** (1.53-2.09)	**2.24** (1.91-2.61)	**2.99** (2.53-3.49)	**3.63** (3.06-4.26)	**4.54** (3.69-5.53)	**5.26** (4.16-6.49)	**6.01** (4.57-7.58)	**6.78** (4.93-8.78)	**7.84** (5.45-10.4)	**8.66** (5.85-11.7)
3-day	**1.95** (1.68-2.26)	**2.40** (2.06-2.79)	**3.17** (2.70-3.68)	**3.82** (3.24-4.46)	**4.75** (3.88-5.75)	**5.49** (4.37-6.73)	**6.25** (4.79-7.84)	**7.05** (5.15-9.07)	**8.13** (5.70-10.7)	**8.98** (6.11-12.0)
4-day	**2.09** (1.80-2.41)	**2.53** (2.18-2.92)	**3.28** (2.81-3.80)	**3.93** (3.34-4.57)	**4.86** (3.99-5.86)	**5.60** (4.48-6.84)	**6.37** (4.91-7.96)	**7.18** (5.28-9.21)	**8.29** (5.84-10.9)	**9.15** (6.26-12.2)
7-day	**2.43** (2.11-2.78)	**2.87** (2.48-3.28)	**3.61** (3.11-4.14)	**4.25** (3.64-4.89)	**5.17** (4.29-6.18)	**5.92** (4.77-7.16)	**6.69** (5.19-8.28)	**7.50** (5.56-9.53)	**8.61** (6.12-11.2)	**9.48** (6.55-12.5)
10-day	**2.73** (2.38-3.10)	**3.17** (2.76-3.61)	**3.93** (3.40-4.47)	**4.57** (3.94-5.24)	**5.50** (4.58-6.53)	**6.24** (5.06-7.50)	**7.01** (5.48-8.63)	**7.82** (5.83-9.87)	**8.92** (6.38-11.6)	**9.78** (6.79-12.9)
20-day	**3.56** (3.13-4.00)	**4.07** (3.57-4.57)	**4.91** (4.29-5.53)	**5.62** (4.88-6.36)	**6.61** (5.54-7.71)	**7.38** (6.04-8.74)	**8.16** (6.44-9.90)	**8.97** (6.76-11.2)	**10.0** (7.27-12.9)	**10.9** (7.65-14.1)
30-day	**4.23** (3.73-4.72)	**4.82** (4.25-5.39)	**5.79** (5.09-6.49)	**6.59** (5.76-7.41)	**7.68** (6.46-8.88)	**8.52** (7.00-9.99)	**9.35** (7.41-11.2)	**10.2** (7.72-12.6)	**11.3** (8.21-14.3)	**12.1** (8.57-15.6)
45-day	**5.05** (4.48-5.60)	**5.79** (5.13-6.42)	**6.96** (6.15-7.75)	**7.91** (6.95-8.84)	**9.18** (7.75-10.5)	**10.1** (8.36-11.8)	**11.1** (8.80-13.2)	**12.0** (9.12-14.6)	**13.1** (9.60-16.5)	**14.0** (9.97-17.9)
60-day	**5.73** (5.11-6.32)	**6.61** (5.88-7.30)	**8.00** (7.09-8.86)	**9.11** (8.03-10.1)	**10.6** (8.94-12.0)	**11.6** (9.63-13.4)	**12.7** (10.1-15.0)	**13.6** (10.4-16.6)	**14.9** (10.9-18.6)	**15.8** (11.3-20.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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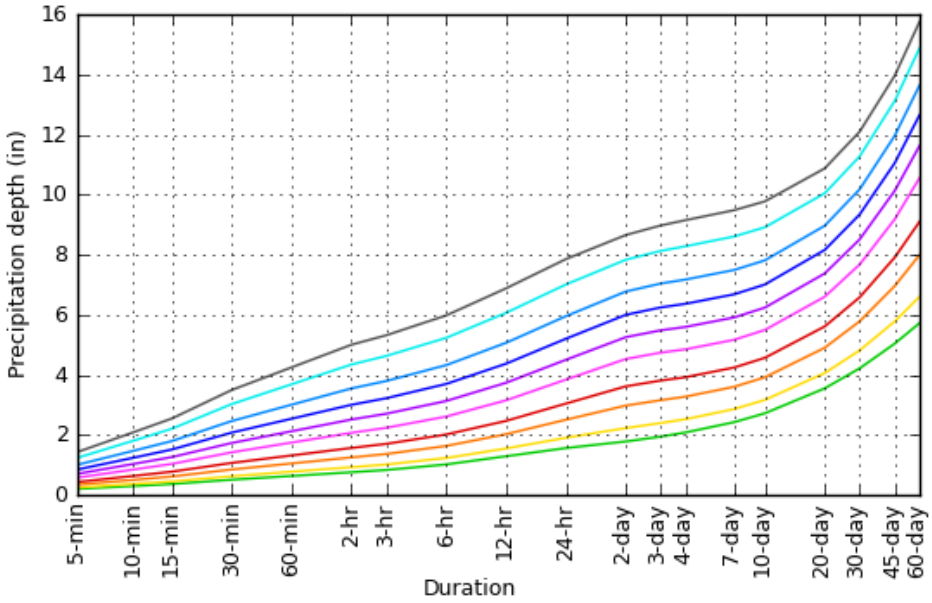
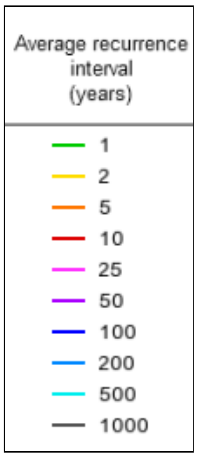
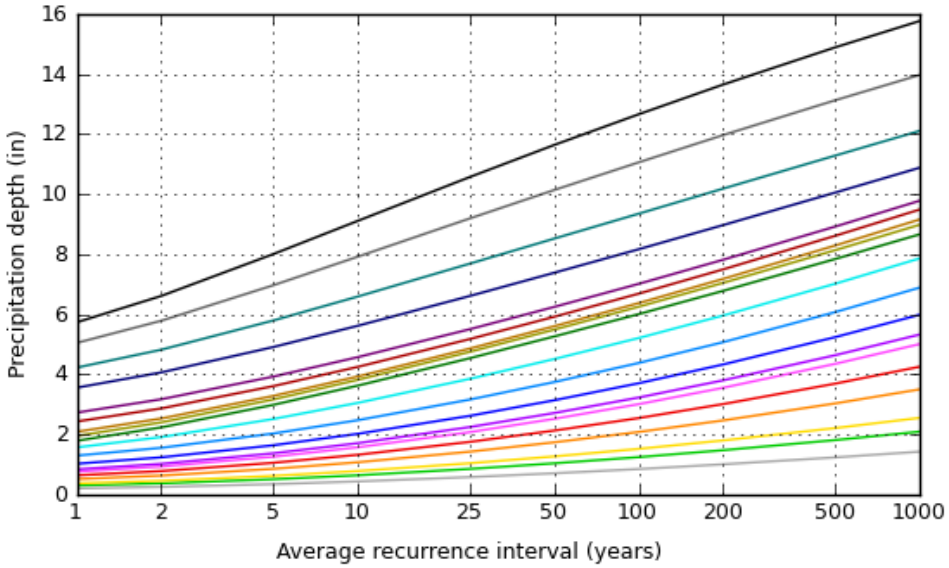
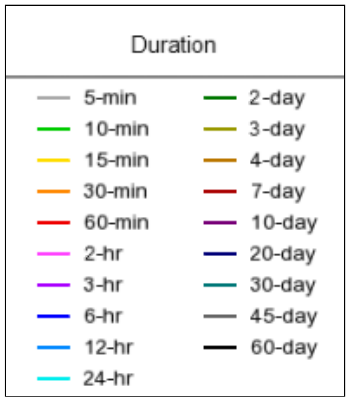
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.0266°, Longitude: -105.2024°









NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Tue Sep 14 17:53:14 2021

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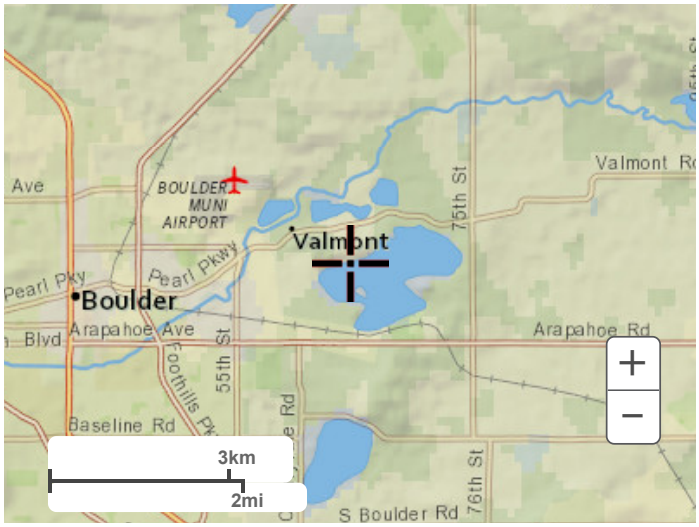
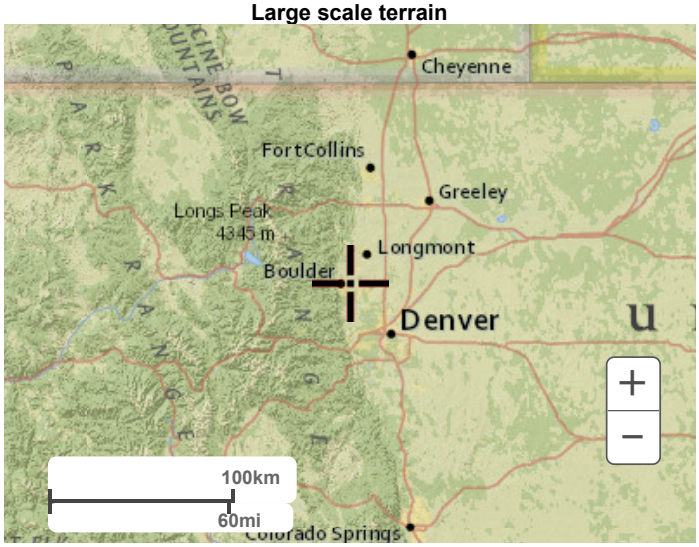
Maps & aerials

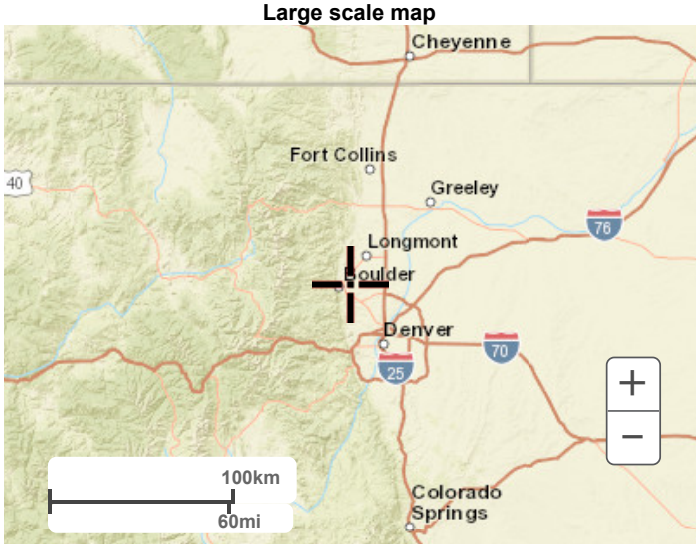
Small scale terrain



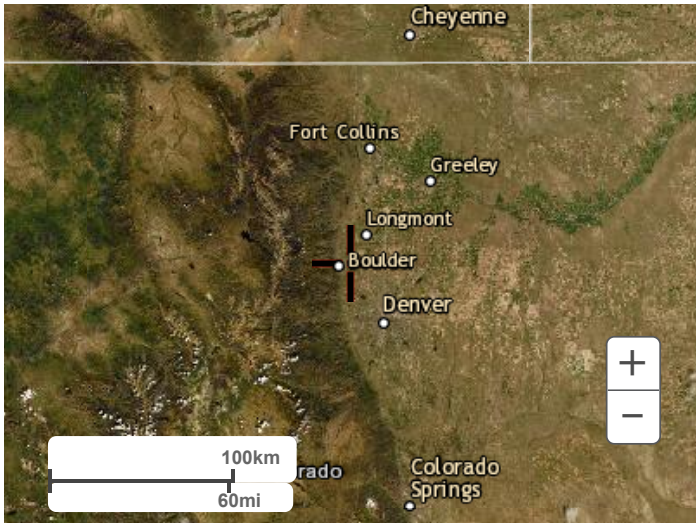
Large scale terrain



Large scale map



Large scale aerial



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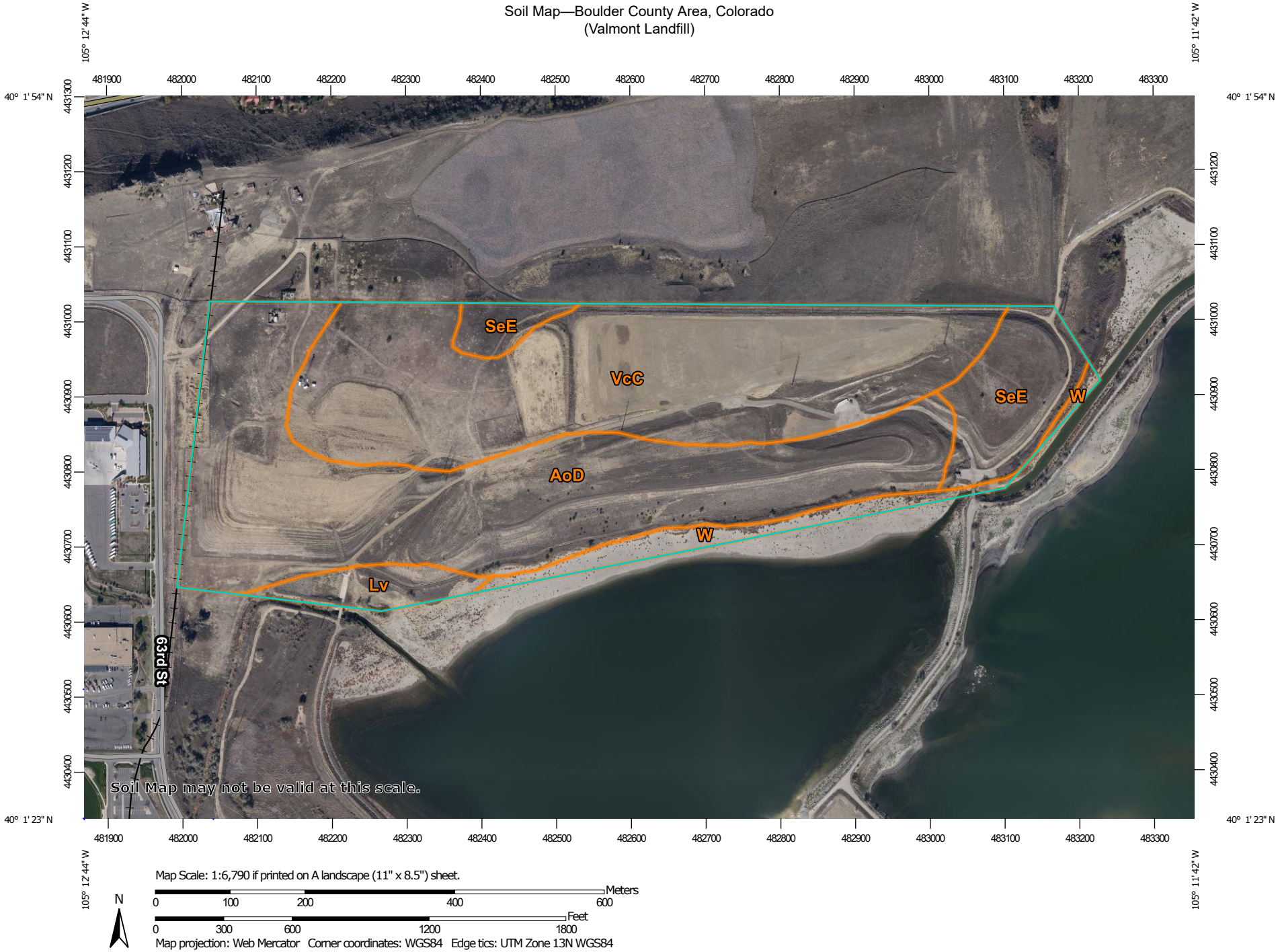
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix C - Soil Conservation District Soil Report

Soil Map—Boulder County Area, Colorado
(Valmont Landfill)



Map Scale: 1:6,790 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 17, Jun 5, 2020

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

Date(s) aerial images were photographed: Oct 1, 2018—Oct 31, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AoD	Ascalon-Otero complex, 5 to 9 percent slopes	41.8	43.1%
Lv	Loveland soils	3.2	3.2%
SeE	Samsil-Shingle complex, 5 to 25 percent slopes	9.3	9.6%
VcC	Valmont cobbly clay loam, 1 to 5 percent slopes	38.8	39.9%
W	Water	4.1	4.2%
Totals for Area of Interest		**97.2**	**100.0%**