PHASE II DRAINAGE STUDY

FOR

CHATEAU VALLEY SUBDIVISION
TOWN OF CASTLE ROCK
DOUGLAS COUNTY, COLORADO
Case No. SDP21-0060

June 1, 2022
Revised: January 7, 2026

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"This report for the Phase II Drainage design of Chateau Valley Subdivision, was prepared by me or under my direct supervision in accordance with the provisions of the Town of Castle Rock Storm Drainage and Environmental Criteria Manual. I understand that the Town of Castle Rock and its designated town authority do not and will not assume liability for drainage facilities designed by others."

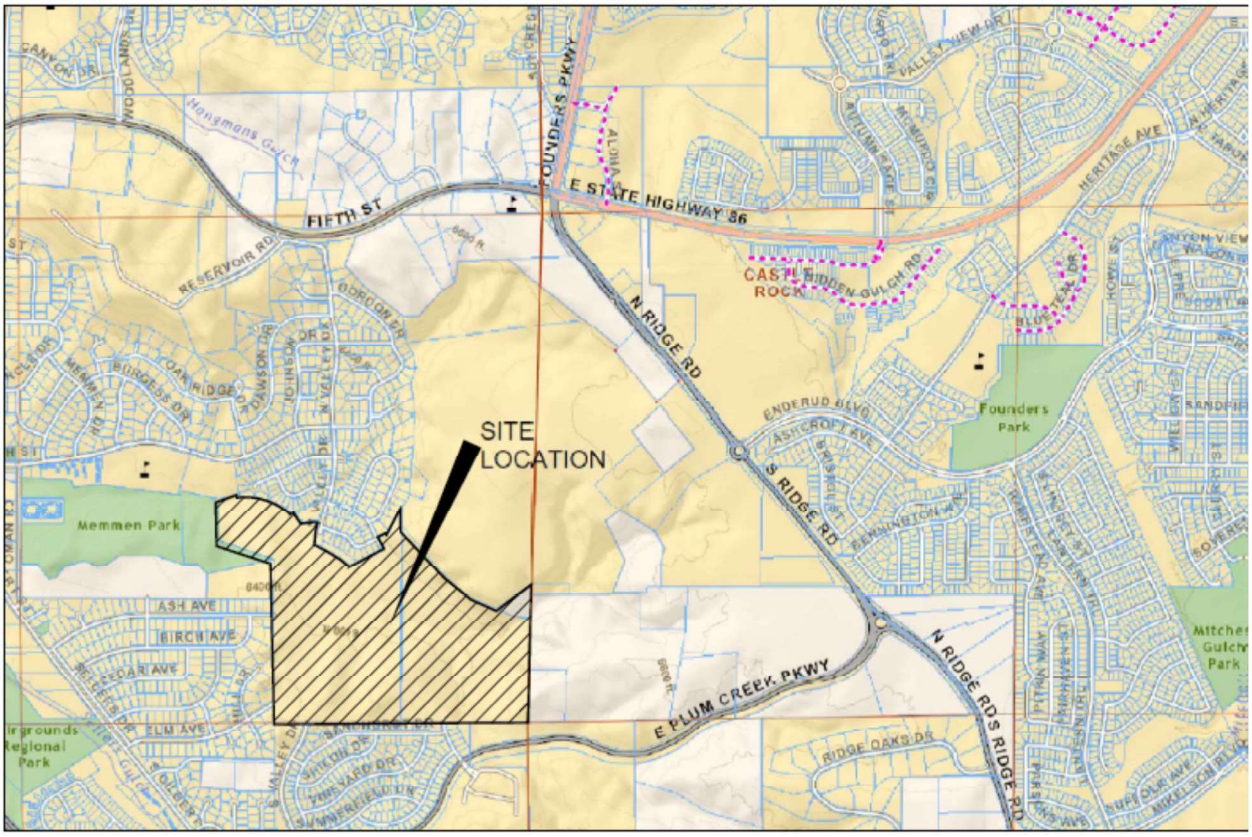


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VICINITY MAP

1"=2000'

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II. GENERAL LOCATION AND DESCRIPTION

A. Site Location

2. Township

Chateau Valley is located within part of the South ½ of Section 12, Township 8 South, Range 66 West of the Sixth Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado.

3. Existing and Proposed Streets

Chateau Valley is an infill subdivision having existing public streets dead-end at the North, South and West boundaries of the subdivision. Valley Drive is a collector street proposed to be connected through Chateau Valley Subdivision. Residential streets proposed to be extended into Chateau Valley Subdivision are Ash Avenue and Santana Drive. A network of residential streets are proposed to provide home sites and adequate traffic circulation to both residential Collector streets.

4. Surrounding Streets and Properties

The proposed site is bound to the north by Michaels 2nd Addition to Castle Rock Amended, South Ridge Townhouse Subdivision Filing No 5B and South Ridge Townhouse Subdivision Filing No. 3, to the South by Baldwin Park Estates Filing No. 2, to the East by Founders Vista Subdivision Filing No. 1 and to the West by Glover Subdivision.

B. Description of Property

1. Area of Property

Chateau Valley Subdivision is a proposed Single Family Subdivision consisting of approximately 113 acres.

2. Ground Cover

The project site is presently undeveloped Pasture land with exposed outcroppings of rock and boulders along the east property line. A tributary to Sellers Gulch runs from East to West through the center of the property. Native grasses and shrubs cover most of the site with clusters of ponderosa pine trees located along the western perimeter.

3. NRCS

The Natural Resources Conservation Service (NRCS) web soils survey map identify soils for this site as 27 percent Blakeland sandy loam and Stapleton Bresser, having Hydrologic Soil Group A, and 39 percent Bresser Truckton sandy loams and soils, having Hydrologic Soil Group B, and Stoney Rough land, having Hydrologic Soil Group D.

4. Major and Minor drainageways

The entire project site is tributary to Sellers Gulch to Plum Creek. A tributary to Sellers Gulch runs from East to West through the center of the property.

5. Floodplains

The project site is tributary to Plum Creek Southwest of the project site. According to the FEMA panel number 08035C0302G, Effective date 03/16/2016, the westerly portion of the minor tributary to Sellers Gulch project site is located within a special flood hazard area identified as a regulatory floodway. The upper portion of the minor tributary to Sellers Gulch located east of Valley Drive, is an area identified as having 0.2% annual chance flood hazard. The remainder of the property outside the minor tributary is within an unshaded Zone X, which is defined as an area having minimal flood hazard, and is not located within any 100 year floodplain. The Minor Tributary is a Town regulated drainageway, which will require a floodplain development permit.

6. Existing Canals and Ditches

No ditches or canals exist on the project site.

7. Significant Geological Features

The Northeastern edge of the site is a steep cliff, having some vertical cliffs and slopes ranging from 20 to 35 percent grade, with exposed rock out croppings. A geological hazards review of the site for any hazards that require mitigation for lots located at the base of the slope shall be requested at time of grading permit.

8. Proposed Land Uses

Chateau Valley Subdivision is a proposed single family subdivision consisting of approximately 415 lots with 257 single family detached and 158 attached duplex homes. The site layout was designed to provide a centralized urban development with approximately 45 percent open space buffers around the perimeter of the property.

III. DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basins

1. Basin Characteristics and Flow Patterns

Historic Basins H-1 through H-10 are located along the tributary to Sellers Gulch having moderate slopes ranging from 1 - 10 percent with steeper slopes along the edge of the existing tributary, (see historic drainage map in appendix).

Runoff continues overland to Sellars Gulch located approximately 750 feet southwest of the project site.

Historic Basin H-1, H-4 and H-8, having a combined area of 23.4 acres, located along the base of a cliff on the north side of the Tributaries Nos. 2 and 3 to Sellers Gulch. Offsite sub-basins ON-1 through ON-4 having a combined area of 17.7 acres, are tributary to Basin H-1, H-4 and H-8. Runoff is conveyed overland, sheet flowing in a southwesterly direction toward the existing Tributary 2 to Sellers Gulch. Steep Slopes ranging from 25-35 percent down the cliff to slopes ranging from 1-10 percent near the northeast property line. Runoff continues conveyance overland in a southwesterly direction to the Sellars Gulch tributary.

Historic Basin H-2 and H-3 consists of 12.9 and 10.8 acres, respectively. The basins straddle Tributary No. 2 to Sellars Gulch from the South. Tributary No. 3 located in Basin H-1 converge with the Tributary No. 2, straddled by basins H-2 and H-3, at design point 6.

Historic runoff from Basins H-4 through H-8, having a combined area of 39.0 acres straddling Tributary No. 2, are located at the Northern portion of the site east of Valley Drive at design point 12. Offsite Basin SR-2 is tributary to Tributary 2 at design point 12. This portion of Tributary 2 within sub-basin SR-2, and the remaining downstream portion of Tributary 2 adjacent to Chateau Valley, has been improved with channel stabilization per "Unnamed Tributary to Sellers Gulch – Letter of Map Revision", dated February 1994.

2. Land Use

The property is currently vacant agricultural land use.

The proposed land use is for an urban development of single family attached and detached homes. Basin A contains 20.1 acres having approximately 18.0 acres of single family detached home lots and 2.1 acres of open space. Basin B contains 32.0 acres having approximately 22.0 acres of single family detached home lots, 10.0 acres of single family attached homes. Basin C contains 31.4 acres having approximately 19.8 acres of single family detached home lots and 11.6 acres of open space. A public street network will provide access through the site with access to Valley Drive.

Basin D consists of 26.6 acres containing open space and two tributaries to Sellers Gulch, T-2 and T-3. The tributaries are proposed to be improved with channel stabilization. Open space will provide land buffer between different land use and aesthetic enjoyment.

Basin E contains 7.8 acres having approximately 6.8 acres of single family detached home lots and 1.0 acres of open space

Basin J consists of 1.40 acres containing open space. The open space will provide land buffer between existing subdivisions and aesthetic enjoyment.

3. FHAD Studies and Master Planning Studies

Two Major Drainage studies have been prepared for Sellars Gulch which impact Chateaus Valley. The Sellars Gulch Major Drainageway Master Plan, prepared by PBS&J in December 2008, and Sellars Gulch Major Drainageway Master Plan Amendment, prepared by CH2M Hill, amended February 2012.

Concurrently with this drainage report for Chateau Valley Subdivision, a Preliminary Floodplain Modification Study for Chateau Valley by Phelps Engineering Services, Inc. is prepared to address channel stabilization and roadway crossings.

4. Developed Flow Impacts on existing tributaries

The existing drainageway has a thalweg slope of approximately 2.6%. The channel is proposed to be stabilized using grade control structures to reduce the thalweg slope and dissipate energy. Three channel crossings are anticipated for roadways. The crossings will be designed to convey the 100 year flow without overtopping the roadways.

A minimum of 2-feet of freeboard shall be provided between the 100-year base flood elevation and the lowest finished floor elevation of all structures (this includes basements). For facilities which are not structures (typically not requiring a building permit) such as roadways, utility cabinets, parks and trails improvements, etc., a minimum of 2-feet of freeboard is also required.

5. Developed Flow Impacts of offsite flow patterns

Chateau Valley will have Four basins A, B C and E proposed for single family development. Each basin will provide full spectrum detention and water quality. The attenuated runoff for Basins A, B and C will be conveyed to Tributary 2 to Sellars Gulch via storm sewer pipe. Attenuated runoff for Basins E will be conveyed to Elm Street via storm sewer pipe. Rip Rap will be provide at each pipe daylight to mitigate potential for erosion from occurring.

All improvements will be constructed in accordance with TCR and UDFCD criteria having no impact on downstream on adjacent properties.

B. Minor Drainage Basins

1. Characteristics and Developed flow patterns

Four onsite detention ponds for Basins A, B C and E are proposed to attenuate developed runoff for the Full Spectrum storm events, respectively. Basin A is located on the eastern third of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a sump inlet located at design point 8 and 9. During the 100 year storm event, runoff not intercepted by inlets upstream will be intercepted by an inlet in a sump condition at design point 8 and 9. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A located on the Northwest corner of the site Basin A in Sub-basin A-8. The attenuated runoff from detention pond A will be conveyed via storm sewer west to Tributary 2 to Sellars Gulch.

Basin B is located on the Central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to detention pond B located on the North end of Basin B in Sub-basin B-15 at design point 35 on the drainage map. The attenuated runoff from detention pond B will be conveyed via storm

sewer to Tributary 2 to Sellars Gulch.

Basin C is located on the Northwestern third of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to detention pond C located on the Northwestern corner of the site in Sub-basin C-13. The attenuated runoff from detention pond C will be conveyed south via storm sewer west to Tributary 2 to Sellars Gulch.

Basin D is located through the northern and central portions of the site containing open space and two tributaries to Sellers Gulch, T-2 and T-3. The tributaries are proposed to be improved with channel stabilization. Two roadway crossings are proposed over Tributary 2 and one roadway crossing is proposed over Tributary 3. Box culverts with wingwalls are proposed at Santana Drive crossing Tributary 2 and at Santana Drive crossing Tributary 3 located at the Southeast portion of the site. A Con-span bridge is proposed at Valley Drive crossing Tributary 2 located at the North central portion of the site. All three crossing are designed to convey the 100 year flow without overtopping the roadways.

Basin E is located on the Southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to detention Pond E located on the Southeastern portion of the site in Sub-basin E-7. The attenuated runoff from detention Pond E will be conveyed South via storm sewer to Elm Street.

2. Land Use

The property is currently vacant agricultural land use. The proposed land use is for urban development of single family attached and detached homes.

3. Impacts to irrigation facilities

No irrigation facilities exist onsite nor will be impacted as a result of this development.

4. Impacts of offsite flow patterns and paths.

No offsite paths or flow patterns will be impacted as a result of this development.

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

The drainage facilities for Chateau Valley were designed in accordance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual and the Urban Drainage Criteria Manual (USDCM, 2018). Note" The final construction plans for Chateau Valley will be subject to the revised Town of Castle Rock Storm Drainage Design and Technical Criteria Manual going into effect in February 2025.

B. Drainage Studies, Master Plans, Site Constraints

1. Previous Drainage Studies

No previous drainage studies for this site have been prepared.

2. Adjacent Development Impact.

Valley Drive will be connected from the north end of Baldwin Park to the South end of south end of South Ridge Town House Subdivision through Chateau Valley. A Con-span bridge is proposed at Valley Drive crossing Tributary 2 located at the North central portion of the site. The Bridge will span the existing Tributary 2 at Valley Drive which will not affect the existing floodplain of Tributary 2 during the first phase of channel improvements. The second phase of channel improvements will include slope reduction and channel stabilization improvements. The floodplain modification report accompanying this report prepared by Phelps Engineering Services, Inc., states that the channel improvements and crossings will not impede or have any impact on adjoining properties. The two other roadway crossings are internal to Chateau Valley, and will have no impact on adjacent properties.

3. Town Master Plans

Two Major Drainage studies have been prepared for Sellars Gulch which impact Chateau Valley. The Sellars Gulch Major Drainageway Master Plan, prepared by PBS&J in December 2008, and Sellars Gulch Major Drainageway Master Plan, prepared by CH2M Hill, amended February 2012.

4. Stormwater Management Facility Constraints

No Site constraints were encountered as part of this drainage report.

C. Hydrology

1. Runoff Calculation Method

Since the Basin study area is less than 90 acres, an analysis and determination of the amounts of flows at various predetermined design points have been made using the "Rational Method". The runoff analysis is based on the proposed land use and topographic features of the project area. The average land slopes are used for computing runoff. The drainage facilities are designed such that increased flows and velocities will not cause erosion damage.

2. Design Storm recurrence intervals

The initial and the major design storm runoff drainage has been analyzed in this report. The initial design storm drainage system, based on a 5-year storm return frequency is evaluated to provide protection against regularly recurring damage, reduce asphalt wear,

provide an orderly drainage system and offer convenience to the customers, general public and employees. The major design storm drainage system, based on a 100-year storm frequency, is defined as "not to cause major property damage or loss of life from major storm runoff."

3. Design Rainfall

Figure 6-1 “Rainfall Intensity-Duration Curve Town of Castle Rock” was utilized for computations using the rational formula.

4. Detention Storage calculation method

Four onsite detention/water quality ponds “A”, “B”, “C” and “E” will be constructed to provide water quality, and detention for the Full Spectrum storm event. The MHFD Detention Spreadsheet program Version 4.02 is used to determine required detention and Water Quality Capture Volume.

5. Detention Storage release rate calculation method

The Natural Resources Conservation Service (NRCS) web soils survey map identify soils for Basin A as predominately Stoney Rough Land, being Hydrologic Soil Group D. The Natural Resources Conservation Service (NRCS) web soils survey map identify soils for Basins B, C, D and E as predominately percent Bresser Truckton sandy loams, having Hydrologic Soil Group A. The MHFD Detention Spreadsheet program Version 4.02 was used to calibrate the peak discharge out of each respective basin to match pre-development peak discharge rates for each watershed.

D. Hydraulics

1. Methods used to determine conveyance facility capacities
Mannings Equation for pipe capacity was utilized for storm sewer design.

2. Hydraulic grade line calculation method and discussion of loss coefficients
Civil 3-D pipe design was utilized for hydraulic grade line calculations.

3. Methods used to calculate water surface profiles

The existing drainageway has a thalweg slope of approximately 2.6% and is characterized by a natural floodplain with a channel showing signs of incision and instability from upstream development. The project will stabilize the drainageway using grade control structures to dissipate energy and reduce thalweg slope as measured along the centerline of the delineated 100-year flood hazard area. The low-flow channel will be stabilized at varying slope less than 0.53%. The proposed drainageway improvements will reduce velocities and shear stress as well as flooding potential along the banks. Refer to Floodplain Modification Study for Chateau Valley by Phelps Engineering Services, Inc. for open channel profiles proposed as part of this project.

4. Detention Pond Routing
No pond routing was determined as part of this project.

E. Storage and Water Quality Enhancement
1. Detention Facilities

This Preliminary Drainage Plan depicts 4 onsite detention ponds for Basins A, B, C and E to attenuate developed runoff for the Full Spectrum storm events. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to detention ponds A, B, C and E respectively.

Detention ponds A, B and C are located along Tributary 2 to Sellars Gulch. Access will be available to each pond through the open space areas contained in Sub-basins A-8, B-13 and C-15, respectively, to allow maintenance and repair as required. The attenuated runoff from Ponds A, B, and C will be conveyed via storm sewer to Tributary 2 to Sellars Gulch.

2. 4-step process, WQCV, Stream stabilization and source control

1. Reducing Runoff Volume

Diversion swales are proposed along Tributary 2 to Sellars gulch to intercept runoff from rear draining lots continue conveyance via swale and concrete trough to the respective basin detention ponds.

Soft trail material will be used for the pedestrian and maintenance paths in open space and along the existing tributaries to maintain near zero percent impervious.

2. Providing Water Quality and Flood Control

The Urban Drainage Criteria Manual is used to determine water quality volume and design of water quality release structures. All ponds will have 4:1 side slopes with flat bottom configuration to optimize settlement and infiltration. The urban EURV and WQCV provided in detention ponds A, B, C and E will drain within a 72-hour time frame to allow optimum time for pollutants and sediments to settle within the respective ponds before continuing conveyance downstream.

3. Stream Stabilization Techniques
Storm sewer from detention ponds A, B and C are proposed to daylight at the base of proposed Tributary 2 to Sellars Gulch. Rip Rap will be constructed to reduce flow velocity and disperse concentrated flow exiting the pipe before continuing conveyance downstream.

A Major Drainageway Master Plan (MDP) was developed for Sellars Gulch by PBS&J in 2009 which includes the unnamed Tributary 2 (SG T-2) through the site. It was amended in 2012 by CH2M HILL. The MDP delineated a Special Flood Hazard zone for SG T-2

which was adopted by FEMA. The MDP also outlined stabilization measures for the drainageway including the reduction of thalweg slope using grade control structures and the use of vegetative measures to stabilize slopes.

4. Undertaking source control

Open space amenities located along the tributaries and next to Detention ponds A, B, C and E include public and private open space. Trash receptacles will be provided as required to Tot Lots and path entrances, and properly disposed of. Detention Ponds A and C will collect much of the surface runoff and provide water quality treatment from much of the open space amenities. Basin D, containing the tributaries is proposed to remain as a natural aesthetic environment with soft trails for pedestrian use. Minimal illicit discharge is anticipated in Basin D to require containment measures.

All private open space, including detention facilities, shall be maintained by the Chateau Valley Home Owners Association or Metropolitan District. The HOA/Metropolitan district shall keep landscape areas and open space clean and in good functioning order.

Existing Stormwater Conveyance Facilities
No Existing Stormwater Conveyance Facilities or water quality facilities exist onsite or near the project site.

V. STORMWATER MANAGEMENT FACILITY DESIGN

A. Proposed Stormwater Conveyance Facilities

1. Proposed drainage facility concept

Developed runoff from Sub-basins A, B, C and E will be conveyed via storm sewer and roadways to detention ponds within the respective basins. Storm sewer inlets are proposed at locations where the amount of developed runoff within roadways approach street capacity as required by the Town of Castle Rock criteria. During the 100 year storm event, the remainder of the developed runoff is intercepted by the storm sewer inlets in a sump condition at the end of the basins.

This Phase II Drainage Plan depicts 4 onsite detention ponds for Basins A, B, C and E to attenuate developed runoff for the Full Spectrum storm events. Detention Ponds A, B and C will convey its attenuated runoff to Tributary 2 to Sellars Gulch. Detention Pond E will convey its attenuated runoff to Elm Street.

2. Proposed Drainage paths and patterns

Sub-Basin A-1 and A-4 contains 2.2 acres and 2.1 acres located at the northeast portion of the site. Runoff from offsite sub-basins ON-1, ON-2, and ON-3 are tributary to sub-basins A-1 and A-4..The sub-basin has steep slopes ranging from 25-35 percent down toward sub-basin A-2 and A-5. Runoff from sub-basin A-1, A-4 and offsite basins will sheet flow to a drainage diversion swale located at the base of the slope and continue conveyance to type C inlets designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer pipe to Detention Pond A.

Sub-Basins A-2 and A-3 contain 6.2 acres and 2.1 acres, respectively, located on the eastern portion of the site. Runoff from sub-basins A-2 and A-3 are conveyed via roadway to type 16 inlets located at design points 6 and 7. During the 100 year storm event, runoff not intercepted by the inlet at design points 6 and 7 will continue conveyance via roadway to design points 8 and 9.

Sub-Basins A-5 and A-6 contain 1.8 acres and 0.8 acres, respectively, located on the eastern portion of the site. Runoff from sub-basins A-5 and A-6 are conveyed via roadway to type 16 inlets located in sump conditions at design points 8 and 9. The inlets are designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer pipe to Detention pond A.

Sub-Basin A-7 contains 2.7 acres located at the east portion of the site. Runoff from sub-basin A-7 will sheet flow to a drainage diversion swale located at the rear of the lots and continue conveyance to a type C inlet designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer pipe to Detention Pond A.

Sub-Basin A-8 contains 2.2 acres located in the eastern portion of the site containing Detention pond A.

Sub-Basin B-1 and B-2 contain 3.8 and 3.3 acres, respectively, located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet located at design point 26. During the 100 year storm event, runoff not intercepted by the inlet at design point 26 will continue conveyance via roadway to design points 32.

Sub-Basin B-3 contains 2.6 acres located at the center portion of the site. Runoff from sub-basin B=3 will sheet flow overland to storm sewer inlet located at design point 21. During the 100 year storm event, runoff not intercepted by the inlet at design point 21 will continue conveyance via roadway to design points 24.

Sub-Basin B-4 and B-5 contain 2.2 and 1.5 acres, respectively, located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to storm sewer inlet located at design point 22. Runoff got

the minor and major storm events will be continue conveyance via roadway tom design points 24.

Sub-Basin B-6 contains 2.0 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet located at design point 25. During the 100 year storm event, runoff not intercepted by the inlet at design point 25 will continue conveyance via roadway to design points 33.

Sub-Basin B-7 contains 0.1 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will combine with carry over runoff from sub-basins B-3 through B-5, and continue conveyance overland via public roadways to a storm sewer inlet located at design point 28. During the 100 year storm event, runoff not intercepted by the inlet at design point 28 will continue conveyance via roadway to design points 32.

Sub-Basin B-8 contains 2.8 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to storm sewer inlet located at design point 28. Runoff got the minor and major storm events will be continue conveyance via roadway tom design points 32.

Sub-Basin B-9 contains 0.8 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to storm sewer inlet located at design point 29. Runoff got the minor and major storm events will be continue conveyance via roadway tom design points 31.

Sub-Basin B-10 contains 2.0 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet located at design point 30. During the 100 year storm event, runoff not intercepted by the inlet at design point 30 will continue conveyance via roadway to design points 31.

Sub-Basin B-11 contains 4.7 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 31. The inlet is designed to intercept runoff for the 100 year storm event, and continue conveyance to Detention pond B.

Sub-Basin B-12 contains 0.5 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 32. The inlet is designed to intercept runoff for the 100 year storm event, and continue conveyance to Detention pond B.

Sub-Basin B-13 contains 0.8 acres located in the south central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 33. The inlet is designed to intercept runoff for the 100 year storm event, and continue conveyance to Detention pond B.

Sub-Basin B-14 contains 2.9 acres located at the North central portion of the site. Runoff from sub-basin B-14 will sheet flow to a drainage diversion swale located at the rear of the lots and continue conveyance to a type C inlet located at design point 34, tributary to detention pond B.

Sub-Basin B-15 contains Detention Pond B and is planned for a future recreation center. Sub-basin B-15 contains 2.0 acres located in the north central portion of the site. Developed runoff for the major and minor storm events will sheet flow overland to Detention pond B.

Sub-Basin C-1 contains 1.5 acres located in the south-central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an inlet proposed at design point 40. During the 100 year storm event, runoff not intercepted by the inlet at design point 40 will continue conveyance via roadway to design points 42.

Sub-Basin C-2 contain 1.8 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an inlet proposed at design point 42. During the 100 year storm event, runoff not intercepted by the inlet at design point 40 will continue conveyance via roadway to design points 44.

Sub-Basin C-3 contain 0.5 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an inlet proposed at design point 41. During the 100 year storm event, runoff not intercepted by the inlet at design point 41 will continue conveyance via roadway to design points 43.

Sub-Basin C-4 contain 1.1 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an inlet proposed at design point 44. During the 100 year storm event, runoff not intercepted by the inlet at design point 44 will continue conveyance via roadway to design points 46.

Sub-Basin C-5 contain 1.4 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet at design point 43. During the 100 year storm event, runoff not intercepted by the inlet at design point 43 will continue conveyance via roadway to design points 46.

Sub-Basin C-6 contain 0.5 acres located in the southwestern portion of the site. Developed

runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet on grade located at design point 44.1. The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to Detention pond C.

Sub-Basin C-7.1 contains 1.6 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an inlet proposed at design point 44.2. During the 100 year storm event, runoff not intercepted by the inlet at design point 44.2 will continue conveyance via roadway to design points 44.3.

Sub-Basin C-7.2 contains 1.6 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an inlet on grade proposed at design point 44.3. The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to Detention pond C.

Sub-Basin C-8 contain 1.3 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will sheet flow overland to a proposed diversion swale tributary to a type C inlet located at design point 47. The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to Detention pond C.

Sub-Basin C-9 contain 4.1 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 48. The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to Detention pond C.

Sub-Basin C-10 contain 0.3 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will sheet flow overland to a proposed diversion swale tributary to a type C inlet located at design point 49 The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to Detention pond C.

Sub-Basin C-11 and C-12 contain 2.8 acres and 1.0 acres, respectively, located in the northwest portion of the site. Developed runoff from sub-basins C-11 and C-12 will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 50. The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to Detention pond C.

Sub-Basin C-13 contains 5.3 acres located in the northwest corner of the site containing Detention pond C. Developed runoff for the major and minor storm events will sheet flow overland to Detention pond C.

Sub-Basin OC-1 is an offsite basin containing 4.6 acres located north of Chateau Valley in South Ridge Townhouse Subdivision Filing No. 5B. Developed runoff for the major and minor storm events is presently conveyed within public streets to the Dead End Valley Drive, and continues directly into the existing Tributary No. 2 overland. Upon construction of Valley Drive to Chateau Valley Subdivision, Developed runoff from Sub-basin OC-1 will continue within Valley Drive to a storm sewer inlet in a sump condition located at design point 45. The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to the tributary to Sellars Gulch.

Sub-Basin OC-2 is an offsite basin containing 0.5 acres located north of Chateau Valley in South Ridge Townhouse Subdivision Filing No. 5B. Developed runoff for the major and minor storm events is presently conveyed within Valley Drive to the Dead End and continues directly into the existing Tributary No. 2 overland. Upon construction of Valley Drive to Chateau Valley Subdivision, Developed runoff from Sub-basin OC-2 will continue within Valley Drive to a storm sewer inlet in a sump condition located at design point 46. The inlet is designed to intercept runoff for the 100 year storm event and will combine with the intercepted runoff from Sub-basin OC-1 and continue conveyance via storm sewer to the tributary to Sellars Gulch.

Sub-Basin D-1 consists of 6.8 acres located on the eastern portion of the site. Sub-basin D-1 will remain undisturbed open space. Runoff for the major and minor storm event will sheet flow overland to existing Tributary 3. Runoff in Tributary 3 will be conveyed across Santana Drive via 8'x10' box culvert. Tributary 3 converges with Tributary 2 immediately downstream from the box culvert.

Sub-Basin ON-5 is an offsite basin consisting of 3.0 acres located east of the site tributary to Sub-basin D-2. Sub-basin ON-5 is undeveloped open space. Runoff for the major and minor storm event will sheet flow overland to design point 12.

Sub-Basin D-2 contains 3.7 acres located in the eastern portion of the site. Developed runoff for the major and minor storm events will combine with runoff from Sub-basin ON-5 and sheet flow overland to a proposed diversion swale tributary to a type C inlet located at design point 13. The inlet is designed to intercept runoff for the 100 year storm event and continue conveyance via storm sewer to Tributary 2 in Sub-basin D-3.

Sub-Basin D-3 consists of 2.8 acres located on the eastern portion of the site. Sub-basin D-3 will remain undisturbed open space. Runoff for the major and minor storm event will sheet flow overland to existing Tributary 2. Runoff in Tributary will be conveyed across Santana Drive via 8'x10' box culvert.

Sub-Basin D-4 consists of 10.1 acres being a portion of Tributary 2 located on the central portion of the site. Sub-basin D-4 will remain as an undisturbed open space channel until the channel stabilization is constructed in phase 2. Runoff for the major and minor storm

event will sheet flow overland to existing Tributary 2. Runoff in Tributary 2 is tributary to Sellars Gulch. Runoff in Tributary 2 will be conveyed across Valley Drive via Con-span bridge.

Sub-Basin D-5 consists of 3.2 acres being a portion of Tributary 2 located on the northwestern portion of the site. Sub-basin D-5 will remain as an undisturbed open space channel until the channel stabilization is constructed in phase 2. Runoff for the major and minor storm event will sheet flow overland into existing Tributary 2. Runoff conveyed within Tributary 2 is tributary to Sellars Gulch.

Sub-Basin E-3 contains 0.1 acres located in the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet at design point 62. The inlet is designed to intercept most or all of the runoff for the 100 year storm event before continuing South offsite via Valley Drive. The runoff intercepted by the inlet at design point 62 will continue conveyance via storm sewer to detention pond E.

Sub-Basin E-2 contains 1.8 acres located at the Southern portion of the site. Runoff from sub-basin E-2 will sheet flow to a drainage diversion swale located at the rear of the lots and continue conveyance to a type C inlet located at design point 61, tributary to detention pond E.

Sub-Basin E-1 contains 1.4 acres located in the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet at design point 60. The inlet is designed to intercept most or all of the runoff for the 100 year storm event before continuing South offsite via Valley Drive to an inlet at design point 62. The runoff intercepted by the inlet at design point 62 will continue conveyance via storm sewer to detention pond E.

Sub-Basin E-4 contains 0.1 acres located in the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet at design point 63. The inlet is designed to intercept most or all of the runoff for the 100 year storm event before continuing South offsite via Valley Drive. The runoff intercepted by the inlet at design point 63 will continue conveyance via storm sewer to detention pond E.

Sub-Basin E-5 contains 1.3 acres located in the southwestern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet at design point 64. The inlet is designed to intercept most or all of the runoff for the 100 year storm event before continuing West offsite via Elm Street. The runoff intercepted by the inlet at design point 64 will continue conveyance via storm sewer to detention pond E.

Sub-Basin E-6 contains 2.3 acres located in the southwestern portion of the site. Developed

runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet at design point 65. The inlet is designed to intercept most or all of the runoff for the 100 year storm event before continuing West offsite via Elm Street. The runoff intercepted by the inlet at design point 65 will continue conveyance via storm sewer to detention pond E.

Sub-Basin E-7 contains 0.8 acres located in the Southwest corner of the site containing Detention pond E. Developed runoff for the major and minor storm events will sheet flow overland to Detention pond E.

3. Storm Sewer Design

For minor storm events, storm sewer inlets are proposed to intercept runoff at locations to maintain flow depths in the street below back of sidewalk elevations. The 5 year storm event was analyzed for minor storm depths and storm sewer design. During major storm events, runoff will be conveyed via public roadways and storm sewer to a sump inlet located at design point proposed at the low end of each basin. During the 100 year storm event, runoff not intercepted by inlets upstream during the minor storm events will be intercepted by the inlet in a sump condition.

4. Storm Sewer Outfall

Storm sewer outfalls are proposed within Basins A, B, C and E to the respective detention ponds. Basin A and C contain one respective storm sewer outfall, and Basin C contains three storm sewer outfalls.

*A storm sewer outfall from Detention pond A is proposed to convey attenuated from Pond A to Tributary 2 to Sellers Gulch.

*A storm sewer outfall if proposed from Detention Pond B to convey attenuated runoff from Pond B to Tributary 2 to Sellers Gulch.

*A storm sewer outfall from Detention Pond C is proposed to convey attenuated runoff from Pond C Tributary 2 to Sellers Gulch.

*A storm sewer outfall from Detention Pond E is proposed to convey attenuated runoff from Pond E to Elm Street.

5. Conveyance to nearest drainageway

Tributary 2 to Sellars Gulch runs through Chateau Valley. Three Detention ponds are proposed as part of this development with storm sewer proposed to daylight directly into the Tributary 2 to Sellars Gulch from each detention pond.

6. Open Channels

Concurrently with this drainage report for Chateau Valley Subdivision, a Floodplain Modification Study for Chateau Valley by Phelps Engineering Services, Inc. is prepared to address channel stabilization and roadway crossings.

The existing drainageway has a thalweg slope of approximately 2.6%. The channel is proposed to be stabilized using grade control structures to reduce the thalweg slope and dissipate energy. Three channel crossings are anticipated for roadways. The crossings will be designed to convey the 100 year flow without overtopping the roadways.

7. Allowable Street Capacities
The Town of Castle Rock allowable street capacities charts are utilized to verify streets have capacity for developed flows.

8. Maintenance
The Chateau Valley Homeowners Association or Metropolitan District will be responsible for maintenance of each detention pond and storm sewer appurtenances. The Town of Castle Rock will be responsible for maintenance of storm sewer within public streets, Tributary 2 and Tributary 3 to Sellars Gulch.

9. Offsite Facilities
No offsite facilities are proposed as part of this project.

10. Lot Drainage characteristics
Overlot grading templates , A, B, G and WO, identify the drainage patterns for each lot within the subdivision. The T lot grading template identifies a combination of the four grading templates. Plot plats for each individual lots will be required as part of the building permit for detail grading and to provide positive drainage along each common lot line.

B. Stormwater Storage Facilities
1. Detention Pond Designs
Four onsite detention/water quality ponds “A”, “B”, “C” and “E” will be constructed to provide water quality, and detention for the Full Spectrum storm event.

2. Pond Outfall Locations
Outlet structures are proposed to be constructed at the base of each pond partially within the pond embankment. Pond outfalls are proposed to convey the attenuated runoff to receiving infrastructure and drainage ways downstream.

3. Pond Runoff Conveyance
*A storm sewer outfall from Detention pond A is proposed to convey attenuated from Pond A to Tributary 2 to Sellers Gulch.
*A storm sewer outfall if proposed from Detention Pond B to convey attenuated runoff from Pond B to Tributary 2 to Sellers Gulch.
*A storm sewer outfall from Detention Pond C is proposed to convey attenuated runoff from Pond C Tributary 2 to Sellers Gulch.
*A storm sewer outfall from Detention Pond E is proposed to convey attenuated runoff from Pond E Tributary 2 to Elm Street.

4. Compliance with Water Right exemption
Each detention pond outlet structures were design to attenuate developed runoff for the 100 year and EURV storm events. Release rates for the 100 year storm event to match the historic runoff

rate for the 100 year storm event.

5. Maintenance
The Chateau Valley Homeowners will be responsible for maintenance of each detention pond and storm sewer appurtenances. In the event that the detention pond is not properly maintained, the Town of Castle Rock will have the right to make any repairs as necessary to keep the pond in good functioning order. The Town of Castle Rock will be responsible for maintenance of storm sewer within public streets.

C. Water Quality Enhancement Control Measures

1. Structural and Non-structural BMPs
Structural Practices: The outlet structures for Ponds A, B, C and E shall have orifice plates to slow runoff and allow pollutants and sediment to settle. Forebays will be constructed in each pond to allow larger products to settle before reaching the respective pond outlet structure.
A grass lined drainage swale is proposed upstream of Pond C in Sub-basin C-13 to provide benefit of pollutant removal.

Non-structural Practices: Upon establishment of surface vegetation, temporary structural erosion control measures shall then be removed, (except for sedimentation ponds), whereby non-structural methodology shall be practiced. The grading improvements generally direct runoff to central points of site release within in each basin thereby permitting point source methods of pollution abatement management practices. Trash shall pick-up, snow removal, and landscape maintenance shall be monitored and enforced by the Homeowners association. The Chateau Valley Homeowners will be responsible for snow removal and common area landscape maintenance. Pet waste bags and garbage cans will be placed at the entrance to common open space areas. The Town of Castle Rock may enforce ordinances as required and offer public education for clean water efforts.

2. Conveyance pathway to nearest drainageway
Four onsite detention ponds for Basins A, B. C and E will attenuate developed runoff for the Full Spectrum storm events. Ponds A. B and C will have access through the proposed open space amenity and public roadways. Pond E will have access from Elm Street.

3. Maintenance
The Chateau Valley Homeowners District will be responsible for maintenance of each detention pond and storm sewer appurtenances. In the event that a detention pond is not properly maintained, the Town of Castle Rock will have the right to make any repairs as necessary to keep the pond in good functioning order. The Town of Castle Rock will be responsible for maintenance of storm sewer within public streets.

E. Geotechnical Investigation and Sub-surface Collection System Design
1. Geotechnical Investigation Results

Geotechnical investigations have not been completed for this project site, but will be required with the Phase III drainage report. The Phase III Drainage report shall include discussion from the Geotechnical report which analyze and provide further discussion on the sub-surface collection system design including but not limited to the following:

A Geotechnical Investigation Report for Chateau Valley will be required to determine subsurface conditions that may affect the function of stormwater management facilities, and other infrastructure and perform an analyses to quantify potential impacts and to develop designs, which mitigate any potential impacts from groundwater. Geotechnical investigations, groundwater data and recommendations regarding subsurface collection systems shall be discussed in the design.

The report shall include descriptions of the subsurface conditions encountered in exploratory borings, and discussions of site development and construction as influenced by geotechnical considerations. The report shall analyze that proposed Grades have been designed to avoid creating shallow groundwater conditions and that adequate separation has been provided between the basement elevation and groundwater. Groundwater levels may fluctuate seasonally, and rise in response to development, precipitation, landscape irrigation and changes in land-use. With long-term development and subsequent irrigation, groundwater may develop and rise and subsoils may become wetted by irrigation. The water could lead to expansive soil related problems and frequent pumping of foundation drains.

2. Sub-surface collection

Surfacing groundwater issues have been found to increase significantly with multi-lot drainage configurations and when significant open space is allowed to drain through residential lots resulting in reduced design life of pavement and sidewalks. Diversion swales are proposed upstream of lots receiving runoff from areas having more than one and one-half time the area of the downstream lot. Perforated pipe interceptors are proposed along the proposed street sidewalks of the downstream lots where lot to lot drainage exists and upstream open space runoff is diverted around lots.

The Phase II drainage report shall identify other concerns and/or recommendations contained in the Geotechnical Investigation Report for Chateau Valley relating to groundwater or sub-surface flows collection. The Soils engineer may recommend the use of Foundation and Sump Pumps but shall address excessive flow, icing and algae nuisances which can result. Other factors, including increased irrigation, introduction of non-native soils during grading operations, varying levels of compaction adjacent to structures, etc. that lead to excessive sub-surface flows being discharged to the surface shall be discussed.

F. Operation and Maintenance
N/A
1. Responsible Party
2. Maintenance Requirements
3. Inspections

G. Additional Permitting Requirements
1. Section 404 of the Clean Water Act
A storm water discharge permit will be acquired from the Colorado Department of Health prior to any construction activity.

2. The Endangered Species Act
No endangered species have been noted to exist on this site.

3. Other
N/A
H. General
1. Tables, figures, charts, drawings
As contained in the appendix of this report.

VI Conclusions
a. Compliance with Standards
The drainage facilities for Chateau Valley were designed in accordance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual and the Urban Drainage Criteria Manual (USDCM, 2018).

1. Town of Castle Rock
2. Master Plans
N/A
3. Cherry Creek Reservoir CR No. 72
N/A
4. Chatfield Reservoir CR No. 73
N/A
B. Variances
1. A variance is requested for providing water quality for Tributary 2 to Sellars Gulch. Channel stabilization at the three roadway channel crossings proposed as part of this project. The total disturbed area for the channel crossings is slightly less than 0.25 acres with no impervious area proposed. Grading is proposed from the rear of proposed lots to the edge of the outer banks of the existing channel in order to match existing grade along top outer banks of the channel.

2. A variance is requested for providing water quality to construct a sanitary sewer main across Tributary 2 to Sellars Gulch. Activities for installation or maintenance of the sanitary sewer will not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity. This exclusion includes, but is not limited to, activities to install, replace, or maintain utilities under roadways or other paved areas that return the surface to the same condition.

3. A variance is requested for providing water quality for sub-basin J-2 located at the southwest portion of the site for the proposed roadway connection of Elm Street into the project. Sub-basin J-2 consists of 0.7 acres, having **0.09** acres of impervious roadway and sidewalk. The existing

grade for Elm Street is 8.0 percent from North to South and the connection point is approximately 15 feet lower in elevation than the onsite surrounding area. Detention Pond E is proposed near the roadway connection, but it is not feasible to intercept 100 percent of the developed runoff upstream of the existing roadway.

4. A variance is requested for providing water quality for sub-basin J-1 and J-3 containing 0.6 acres and 0.2 acres respectively. Grading is proposed in both sub-basins in order to match existing grade along the subdivision perimeter. No human-made structures such as buildings or pavement are proposed such that the sub-basins will remain undeveloped after grading is complete.

5. A variance is requested for providing water quality for the proposed maintenance road along Tributary 2 to Sellars Gulch. The maintenance road will contain gravel surface and will also serve as a pedestrian trail. No human-made structures such as buildings or pavement are proposed on the maintenance road.

6. A variance is requested for providing water quality for a portion of sub-basins OC-1 and OC-2 located offsite at the Valley Drive Bridge Crossing near the Northcentral portion of the site. Sub-basin OC-1 and Oc-2 consists of 4.6 and 0.5 acres, respectively. Developed runoff from both sib-basins are currently conveyed to Tributary 2 to Sellars Gulch undetained and untreated. The new bridge and roadway construction will add 0.2 acres of additional un-impervious area to Sub-basins OC-1 and OC-2. The Low Point and inlets are proposed north of the bridge and it is not feasible to intercept and convey the offsite runoff to any of the Chateau Valley detention facilities. The area of impervious roadway and sidewalk is **0.25** acres.

1. Provisions
N/A
2. Justification
N/A

C. Drainage Concept
1. Discuss overall effectiveness
This final drainage report presents design to intercept developed runoff allowing streets to function within acceptable parameters. Detention and water quality is provided to mitigate potential damage from occurring downstream.

Floodplain References
1. The Sellars Gulch Major Drainageway Master Plan, prepared by PBS&J in December 2008,
2. Sellars Gulch Major Drainageway Master Plan, prepared by CH2M Hill, amended February 2012.
3. Modification Study for Chateau Valley by Phelps Engineering Services, Inc.

Report References
A. Hydraulic Computations
1. Runoff Coefficients and times of concentration were determined using the UD Rational spread

sheet version 2.0
2. Land Use assumptions for offsite areas.
Land uses for adjoining properties were determined from Douglas County aerial maps and the Douglas County Assessor information contained on their website.
3. CUHP information N/A
4. SWMM information N/A
5. The rational method for determining flows was used.
6. Rainfall information was obtained from the UD Rational spread sheet version 2.0
7. CUHP information N/A
8. The UD Detention spreadsheet was utilized for design of the detention pond volume which calculated pond hydrographs.
9. A connectivity diagram was not prepared for this report. The Drainage Plan depicts each drainage basin with design points and detention ponds proposed as part of this project.

B. Hydraulic Computations
1. Culvert capacities N/A
2. Storm Sewer capacities and hydraulic grade line computations are summarized in the appendix of this report. Civil 3-D storm Sewers release 2020 was utilized for hydraulic grade line computations.
3. Street capacities were using the proposed slope shown in the roadway plan and profiles and the Town of Castle Rock Street Capacity Chart.
4. The UD-Inlet spreadsheet Version 4.05 was utilized for determination of Inlet capacities and interception calculations.
5. Open channel N/A. Swale capacities were analyzed using the Civil 3-D Hydro-flow software.
6. Low flow and trickle pans are proposed within each of the four proposed detention ponds to mitigate potential from erosion from occurring in the respective pond bases.

7. USD Volumes 1 and 2 were used for Stabilization and grade control design.
8. No open channel water surface profiles were analyzed as part of this report.
9. The UD Detention spreadsheet was utilized for design of the detention pond volume and outlet structure.

C. Water Quality
Water quality is provided in each of the four proposed detention ponds.

D. Referenced Information
N/A

2. Offsite Runoff conveyance

Six offsite sub-basins are identified on the Preliminary Drainage Plan, Sub-basins ON-1, ON-2, ON-3, ON-4, OS-1 and OS-2. Runoff from sub-basin ON-1, ON-2 and ON-3 will sheet flow to Sub-basin A-1 and A-4. Runoff from sub-basins A-1, A-4 and offsite sub-basins will be intercepted by a drainage diversion swale located at the base of the slope in Sub-basin A-1 and A-4 and continue conveyance via drainage diversion swale to type C

inlets. Conveyance will continue via storm sewer pipe to Detention pond A.

Runoff from Sub-basins ON-4 is tributary to Tributary 2 to Sellars Gulch

Runoff from sub-basin OS-1and OS-2 will sheet flow to Sub-basin C-14. Runoff from sub-basins C-14 and offsite sub-basins will be intercepted by a drainage diversion swale located at the base of the slope in Sub-basin C-14 and continue conveyance via drainage diversion swale to Detention pond C.

3. Drainage Criteria

General: Except where specified elsewhere in this report, the procedures, criteria and standards as set forth in the "Urban Storm Drainage Criteria Manual," (USD), and the "The Town of Castle Rock Storm Drainage Design and Technical Criteria Manual " are utilized to determine the adequacy of this storm Drainage Plan. Technical data used by Town of Castle Rock, as it applies to this analysis.

Hydrologic Criteria: Since the Basin study area is less than 90 acres, an analysis and determination of the amounts of flows at various predetermined design points have been made using the "Rational Method". The runoff analysis is based on the proposed land use and topographic features of the project area. The average land slopes are used for computing runoff. The drainage facilities are designed such that increased flows and velocities will not cause erosion damage.

Table 6-1
1-HOUR POINT RAINFALL VALUES FOR
THE TOWN OF CASTLE ROCK (INCHES)

2-YR	5-YR	10-YR	50-YR	100-YR
1.06	1.43	1.66	2.26	2.60

The one-hour rainfall depths are the basis of the Towns intensity-duration rainfall curves used for the Runoff flow rate calculations herein.

Design Storm Frequencies: The initial and the major design storm runoff drainage has been analyzed in this report. The initial design storm drainage system, based on a 5-year storm return frequency is evaluated to provide protection against regularly recurring damage, reduce asphalt paving maintenance costs, provide an orderly drainage system and offer convenience to the customers, general public and employees. The major design storm drainage system, based on a 100-year storm frequency, is defined as "not to cause major property damage or loss of life from major storm runoff."

Time of Concentration: The time of concentration (when maximum discharge of the drainage area is reached) is the time required for runoff from the most remote point of the drainage area to arrive at the design point. The "most remote point" is that point from

which the time of flow to the design point is the greatest and not necessarily the greatest linear distance.

Detention : Four onsite detention/water quality ponds “A”, “B” “C” and “E” will be constructed to provide water quality, and detention for the Full Spectrum storm event. The UD Detention Spreadsheet program Version 4.02 is used to determine required detention volume. A release rate for the 100 year storm event is 1.00 cfs per acre or the Historic rate.

4. Anticipated Conveyance Problems
None

5. Ownership and Maintenance

The Four detention ponds proposed in Basins A, B, C and E will be owned and maintained by the Chateau Valley Homeowners Association. Tributary 2 and Tributary 3 to Sellars Gulch will be owned and maintained by the Town of Castle Rock.

B. Proposed Stormwater Storage Facilities

1. Detention

The Preliminary Drainage Plan depicts Four onsite detention ponds “A”, “B” “C”. and “E” will attenuate developed runoff for the Full Spectrum storm events. The UD Detention Spreadsheet program Version 4.02 is used to determine required detention and WQCV volume. The release rate for the 100 year storm event for the detention ponds is will be determined with the Phase III Drainage report for Chateau Valley in accordance with the Mile High Flood District detention spreadsheet. The Urban Drainage Criteria Manual is used to determine water quality volume and design of water quality release structures.

2. Outlet Structure Design

Dual Chamber Outlet structures are proposed to attenuate developed runoff for the Full Spectrum storm events. The outer wall entrance will orifices to attenuate developed runoff for the EURV storm event and water quality. Runoff in excess of the 100-year storm event will spill through the top of the second chamber into the second chamber before being released downstream. In the event that the outlet structure plugs, or does not function as intended, an overflow weir will be constructed in the detention pond embankment to continue conveyance downstream along its respective historic course.

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3. Anticipated Storage Problems and Maintenance

It will be the responsibility of the Chateau Valley Homeowners Association to visually inspect the condition of the drainage facilities after any major storm event which may have sufficient force to result in sediment deposits or erosion to landscape drainage ways. If erosion or damage occurs frequently, the HOA/Metropolitan district may attempt to

stabilize the soil with additional riprap, or consult with an engineer to rectify the problem.

VI. WATER QUALITY ENHANCEMENT

1. Reducing Runoff Volume

Runoff from Sub-basin C-15 will be conveyed via grass lined swale to Detention pond C to reduce velocity, increase time of concentration, and reduce flows tributary to proposed detention pond B.

Detention ponds and surrounding open space are planned for public and private open space. Natural vegetation and topography will be utilized with moderate grading and compaction improvements to allow higher infiltration while providing a natural environment for public enjoyment.

Soft trail material will be used for the pedestrian paths around the open space are to maintain near zero percent impervious.

2. Providing Water Quality and Flood Control

The Urban Drainage Criteria Manual is used to determine water quality volume and design of water quality release structures. All ponds will have 4:1 side slopes with flat bottom configuration to optimize settlement and infiltration. The urban EURV and WQCV provided in detention ponds A, B, C and E will drain within a 72-hour time frame to allow optimum time for pollutants and sediments to settle within the respective ponds before continuing conveyance downstream.

3. Stream Stabilization Techniques

Storm sewer from detention ponds A, B and C are proposed to daylight at the base of proposed Tributary 2 to Sellars Gulch. Rip Rap will be constructed to reduce flow velocity and disperse concentrated flow exiting the pipe before continuing conveyance downstream. Storm sewer from Detention Pond E will daylight upstream of Elm Street and will continue conveyance via sidewalk chase to Elm Street.

4. Undertaking source control

Potential pollutant material brought onsite would be fuel for earth moving and trenching equipment, as well as daily vehicle refueling. The detention pond shall be utilized to contain fuel spillage. The Fire Protection District is equipped for spill cleanup. Any contaminated materials shall be properly disposed of.

Other potential pollutant material includes concrete wash water. This shall be done in areas designed by the developer's construction manager and protected from runoff and, after hydration, buried in designated construction zones.

Building materials are expensive and shall be protected by storage outside of runoff

areas. This shall be performed by the materials owner to protect the inherent value and no additional measures will be taken.

Waste building materials shall be collected by a reputable waste management company and transported to a legal waste disposal facility. Site inspections shall be performed by the owner/representative weekly to assure onsite collection. No dedicated concrete or asphalt batch plants are proposed on the site

VII. FLOODPLAIN MODIFICATIONS

Concurrently with this drainage report for Chateau Valley Subdivision, a Preliminary Floodplain Modification Study for Chateau Valley by Phelps Engineering Services, Inc. is prepared to address channel stabilization and roadway crossings.

1. Proposed Floodplain Modifications: Two roadway crossings are proposed across Tributary No. 2 and One roadway crossing is proposed across Tributary No. 3.
2. Source Of Floodplain Information:
   A. According to the FEMA panel number 08035C0302G, Effective date 03/16/2016, the westerly portion of the minor tributary to Sellers Gulch project site is located within a special flood hazard area identified as a regulatory floodway.
   B. Floodplain Modification Study for Chateau Valley, Prepared by Phelps Engineering. Currently waiting for Jurisdictional Determination of Public Waterways for the existing Tributary 2 and 3 upstream by the Army Core of Engineers.
   A. A Major Drainageway Master Plan (MDP) was developed for Sellars Gulch by PBS&J in 2009 which includes the unnamed Tributary 2 (SG T-2) through the site. It was amended in 2012 by CH2M HILL.
3. Details of Floodplain Modification: Improvements are proposed in two major phases. These will be separate and stand-alone phases within the context of FEMA regulations and permitting.
   A. The first phase will be implemented by the developer and will consist of construction of the three roadway crossings including necessary stabilization adjacent to the crossings, temporary measures required to construct the crossings, final construction of the crossing mitigation measures, and documentation of future construction issues related to the full channel stabilization integrated into the crossings improvements.
   B. The second phase will be implemented by the Developer for the cost, final approval, construction and acceptance of the channel improvements. This phase has been outlined and conceptually designed and modeled in the Preliminary Floodplain Modification Study for Chateau Valley by Phelps Engineering Services, Inc. The second phase full stream stabilization measures will consist of permitting and construction of grouted sloping boulder drop structures along Tributary No. 2.
4. CLOMR and LOMR discussion: No CLOMR and LOMR will be required for the three roadway crossings along Tributary No. 2 and No. 3 at the initial Phase 1 of construction. A Con-span bridge will be constructed to span across the existing FEMA mapped floodplain at the Valley Drive crossing, and will not have any effect on the existing 100-year channel water surface. The two upstream roadway-channel crossings are not located within any FEMA mapped 100 year floodplain, and the TOCR has jurisdiction for floodplain management upstream.

   Channel stabilization for Tributary 2 is proposed in Phase 2 of the Tributary 2 improvements. A CLOMR and LOMR will be required for the channel stabilization improvements proposed in Tributary No. 2 and No. 3. A Nationwide permit for impacts will be required for the second phase

of the improvements described above.

TOCR Floodplain Development Regulations: The TOCR Floodplain Development Regulations shall be utilized and complied with for the proposed channel improvements associated with Chateau Valley Subdivision. A minimum of 2-feet of freeboard shall be provided between the 100-year base flood elevation and the lowest finished floor elevation of all structures (this includes basements). For facilities which are not structures (typically not requiring a building permit) such as roadways, utility cabinets, parks and trails improvements, etc., a minimum of 2-feet of freeboard is also required.

VIII. MASTER PLAN RECOMMENDATIONS

The existing drainageway has a thalweg slope of approximately 2.6%. The channel is proposed to be stabilized using grade control structures to reduce the thalweg slope and dissipate energy. Three channel crossings are anticipated for roadways. The crossings will be designed to convey the 100 year flow without overtopping the roadways.

IX. POTENTIAL PERMITTING REQUIREMENTS

Ecological Resource Consultants, Inc. (ERC) has completed several environmental studies in support of the Chateau Valley Subdivision project located in Castle Rock, Douglas County, Colorado. Studies completed include an Aquatic Resource Delineation and Screening for Federal-State Listed Threatened and Endangered Species and General Wildlife. As part of final project authorization, documentation will be required from the US Army Corps of Engineers Denver Regulatory Office ensuring compliance with Clean Water Act Section 404 and from the US Fish and Wildlife Service under the Endangered Species Act. Compliance documentation will be obtained and provided for the project.

X. REFERENCES

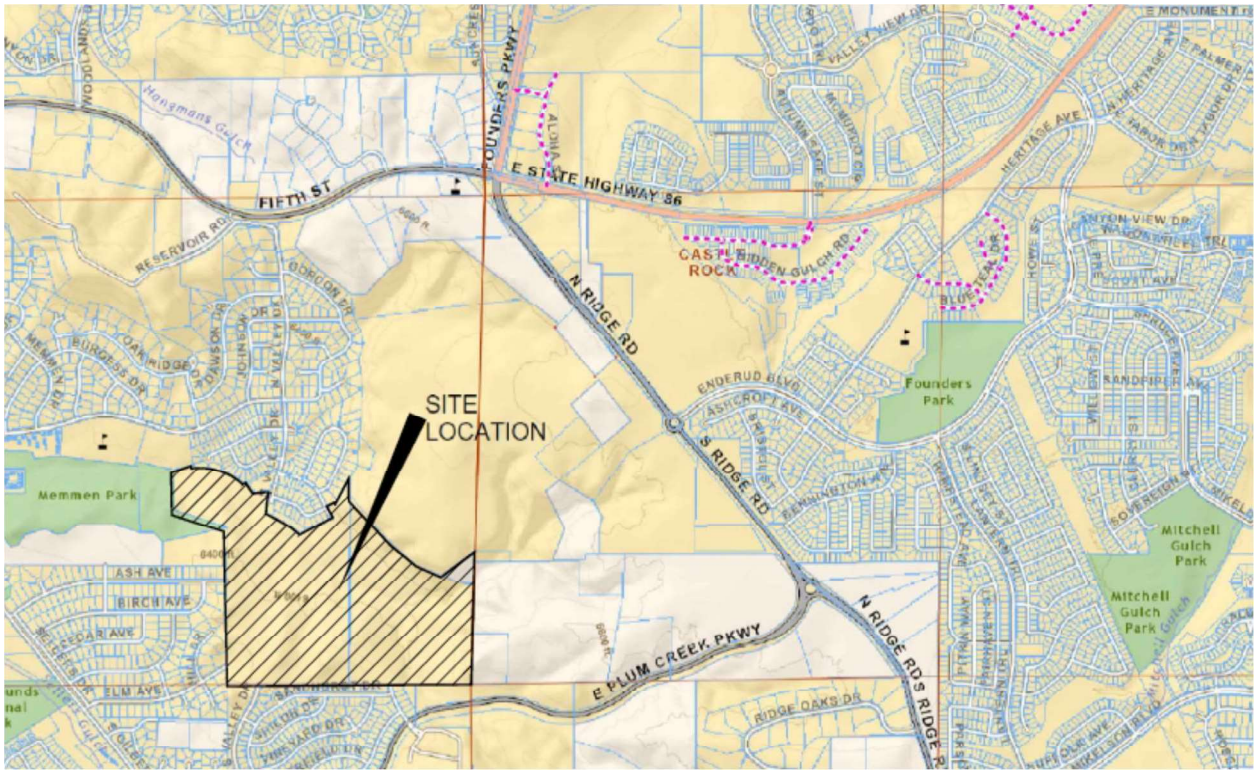
The drainage facilities for Chateau Valley were designed in accordance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual and the Urban Drainage Criteria Manual (USDCM, 2018).

1. "Urban Storm Drainage Criteria Manual", prepared by Wright McLaughline Engineers for Urban Drainage and Flood Control District, March 1969.

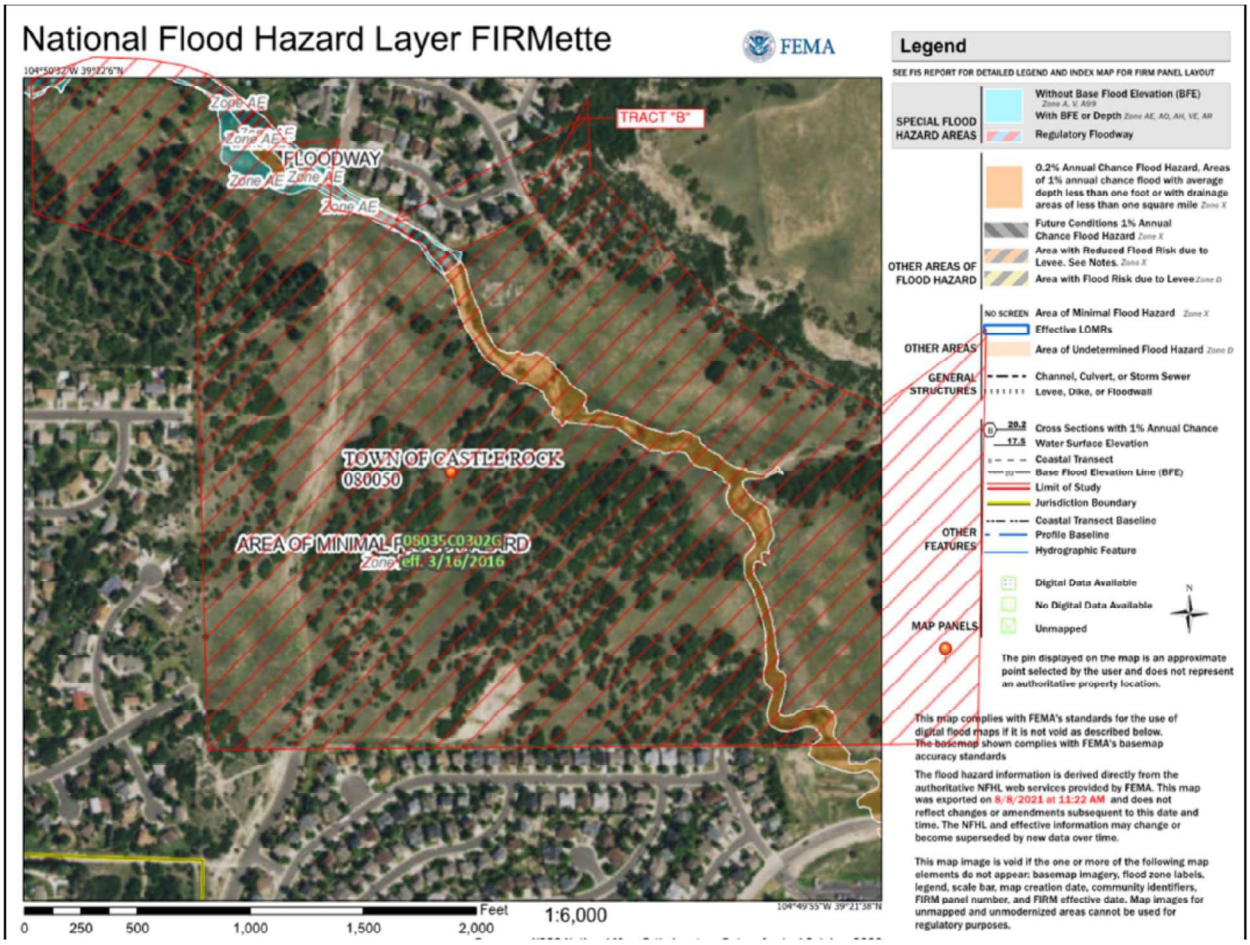
2. "Town of Castle Rock Storm Drainage Design and Technical Criteria Manual", prepared by Castle Rock Water Department, Revised June 2019.

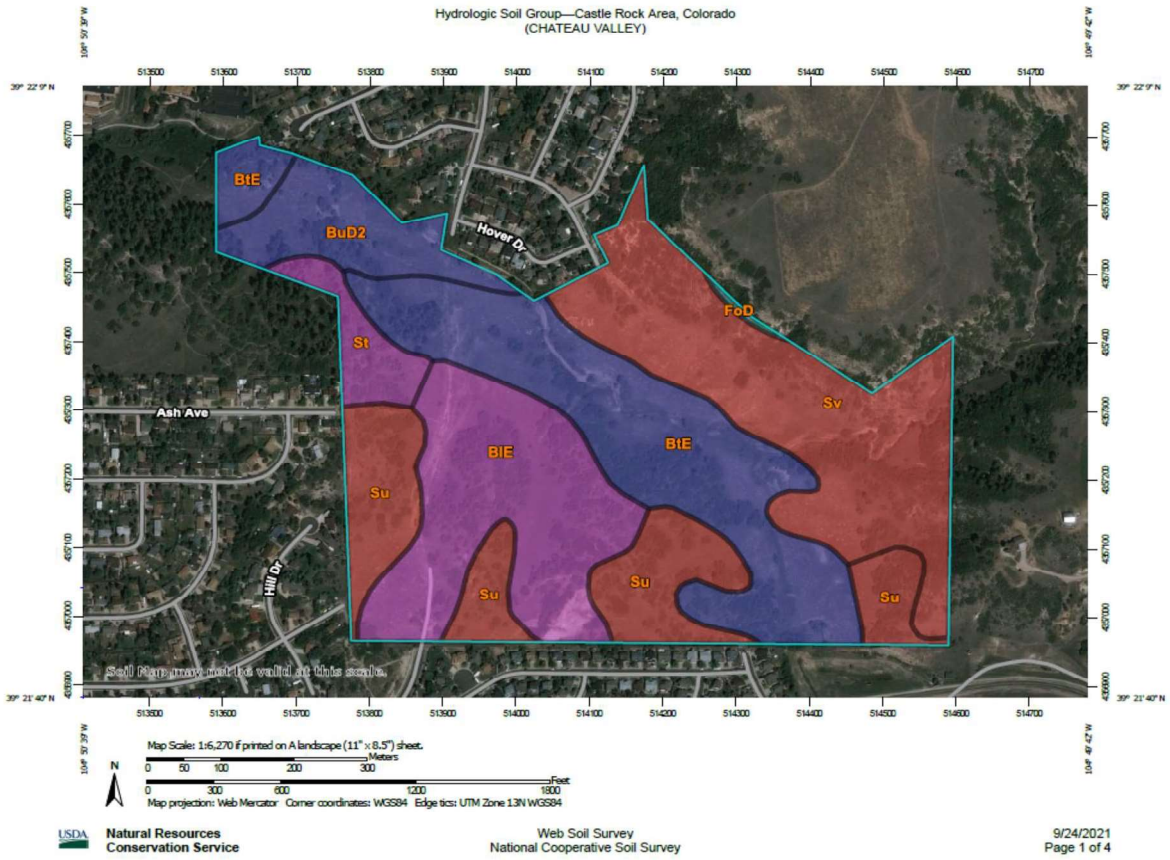
XI APPENDICES

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VICINITY MAP


National Flood Hazard Layer FIRMette
FEMA
Zone AE
FLOODWAY
TRACT "B"
TOWN OF CASTLE ROCK
080050
AREA OF MINIMAL FLOOD HAZARD
Zone X
eff. 3/16/2016
0 250 500 1,000 1,500 2,000 Feet
1:6,000
Legend
SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
SPECIAL FLOOD HAZARD AREAS
Without Base Flood Elevation (BFE)
With BFE or Depth
Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD
0.2% Annual Chance Flood Hazard. Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile
Future Conditions 1% Annual Chance Flood Hazard
Area with Reduced Flood Risk due to Levee. See Notes.
Area with Flood Risk due to Levee
OTHER AREAS
Area of Minimal Flood Hazard
Effective LOMRs
Area of Undetermined Flood Hazard
GENERAL STRUCTURES
Channel, Culvert, or Storm Sewer
Levee, Dike, or Floodwall
Cross Sections with 1% Annual Chance
Water Surface Elevation
Coastal Transect
Base Flood Elevation Line (BFE)
Limit of Study
Jurisdiction Boundary
OTHER FEATURES
Coastal Transect Baseline
Profile Baseline
Hydrographic Feature
MAP PANELS
Digital Data Available
No Digital Data Available
Unmapped
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/8/2021 at 11:22 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

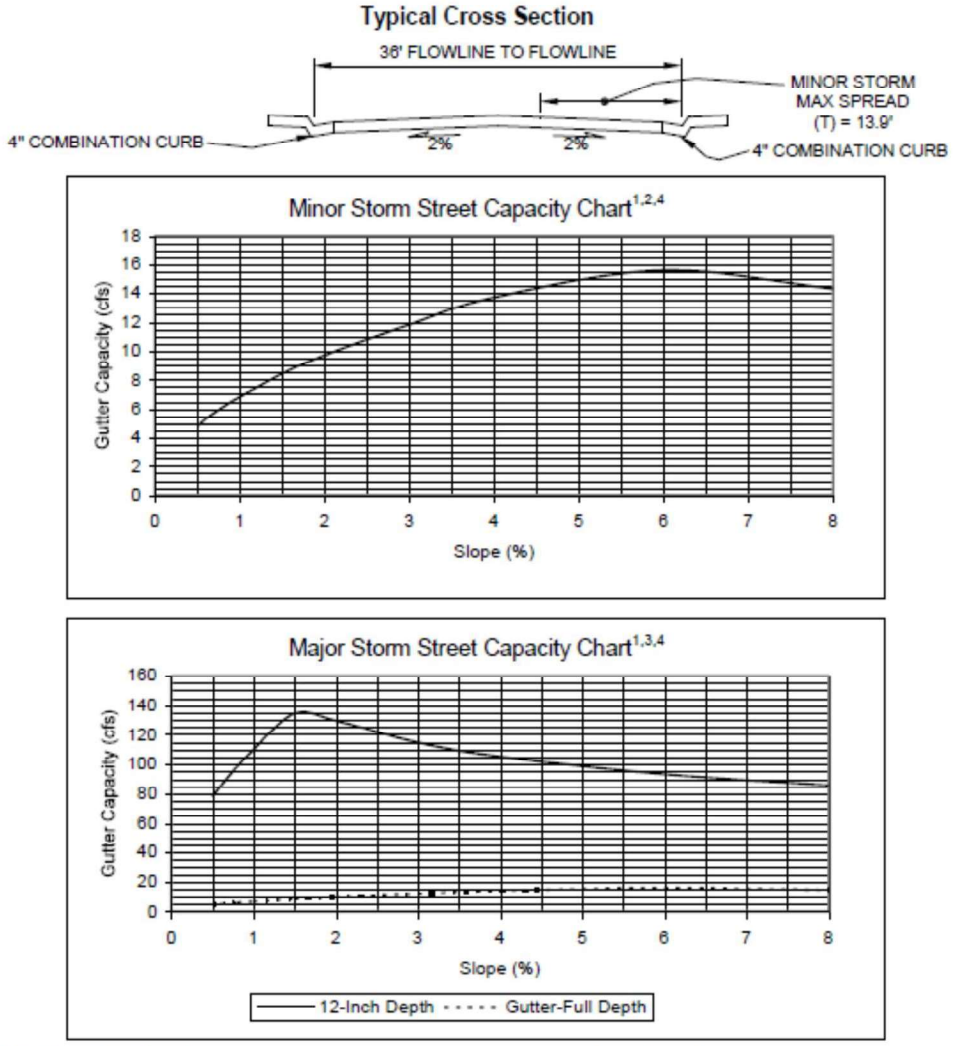


Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BlE	Blakeland sandy loam, 1 to 15 percent slopes	A	22.5	19.7%
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	30.4	26.6%
BuD2	Bresser and Truckton soils, 3 to 12 percent slopes, eroded	B	8.7	7.6%
FoD	Fondis clay loam, 3 to 9 percent slopes	C	0.3	0.3%
St	Stapleton-Bresser association	A	4.1	3.6%
Su	Stony rough land	D	19.0	16.6%
Sv	Stony steep land	D	29.3	25.6%
Totals for Area of Interest			**114.4**	**100.0%**

FIGURE 7-1, TOWN OF CASTLE ROCK STREET CAPACITY CHART

LOCAL TYPE I AND TYPE II (SINGLE FAMILY)



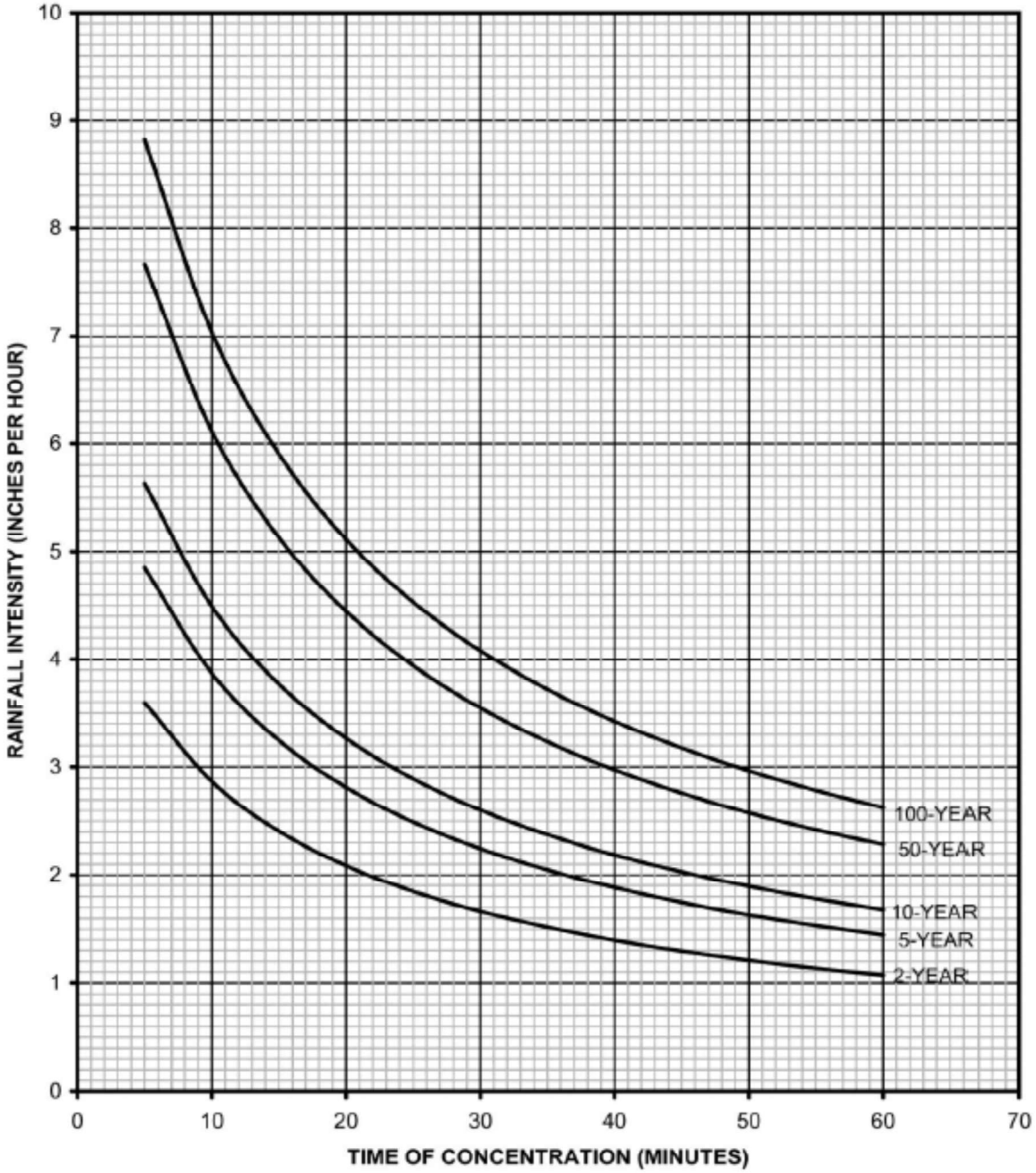
[1] The Town of Castle Rock standard street section parameters must apply to use these charts. For non-standard sections, the street capacity shall be calculated using the UDFCD spreadsheets (see Section 7.5). The capacity shown is based on ½ the street section.

[2] The maximum spread width is limited by the curb height based on no curb overtopping allowable during a minor storm.

[3] Calculations for the 12-inch depth curve assume a vertical wall behind the top of curb. For the gutter-full depth case, the Minor Storm Capacity Chart may be used.

[4] The capacity shown assumes gutter-full depth of 4.9" to the back of the attached sidewalk. If a 4" curb without an attached sidewalk is used, the street capacity shall be calculated using the UDFCD spreadsheets.

FIGURE 6-1
RAINFALL INTENSITY-DURATION CURVE
TOWN OF CASTLE ROCK



Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)
ON-1	3.80	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	30.00			0.100	4.85
ON-2	6.20	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	150.00			0.010	23.19
ON-3	4.80	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	100.00			0.010	18.93
ON-4	2.90	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	30.00			0.100	4.85
A-1	2.20	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	20.00			0.330	2.67
A-2	6.20	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	102.50			0.030	7.33
A=3	2.10	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	10.00			0.020	2.62
A-4	2.10	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	105.00			0.030	13.50
A-5	1.80	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	102.50			0.030	13.34
A-6	0.80	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
A-7	2.70	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	40.00			0.030	4.58
A-8	2.20	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	25.00			0.040	5.99
B-1	3.80	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	50.00			0.030	5.12
B-2	3.30	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	45.00			0.030	5.49
B-3	2.60	A	5.0	0.02	0.02	0.02	0.03	0.07	0.15	0.29	45.00			0.030	9.11
B-4	1.70	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	45.00			0.030	5.49
B-5	1.50	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	45.00			0.030	5.49
B-6	2.00	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	10.00			0.020	2.96
B-7	0.10	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	45.00			0.030	5.49
B-8	2.80	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	45.00			0.030	5.49
B-9	0.80	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	115.00			0.030	8.78
B-10	2.00	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	45.00			0.030	5.49
B-11	4.70	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	25.00			0.020	4.68
B-12	0.50	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	45.00			0.030	5.49
B-13	0.80	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	60.00			0.030	6.34
B-14, B-15	4.90	A	60.0	0.43	0.45	0.47	0.50	0.54	0.58	0.64	60.00			0.030	6.34

Tc BASIN A and B

Subcatchment Name	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)
ON-1	120.00	6645.00	6640.00	0.042	15	3.06	0.65	5.50	26.72	10.00
ON-2	300.00	6654.00	6618.00	0.120	15	5.20	0.96	24.15	27.22	24.15
ON-3	300.00			0.120	15	5.20	0.96	19.90	27.22	19.90
ON-4	1890.00	6650.00	6560.00	0.048	15	3.27	9.62	14.47	41.22	14.47
A-1	1890.00	6650.00	6560.00	0.048	20	4.36	7.22	9.89	41.22	10.00
A-2	1900.00	6434.00	6383.00	0.027	20	3.28	9.66	16.99	26.91	16.99
A=3	1900.00	6434.00	6383.00	0.027	20	3.28	9.66	12.28	26.91	12.28
A-4	1650.00	6613.50	6548.30	0.040	20	3.98	6.92	20.42	40.57	20.42
A-5	350.00	6383.00	6380.00	0.009	20	1.85	3.15	16.49	32.45	16.49
A-6	380.00	6383.00	6380.00	0.008	20	1.78	3.56	8.42	19.90	8.42
A-7	1900.00	6410.00	6373.00	0.019	20	2.79	11.35	15.92	28.84	15.92
A-8	400.00	6364.00	6351.00	0.033	15	2.70	2.47	8.46	29.64	10.00
B-1	700.00	6441.00	6418.00	0.033	20	3.63	3.22	8.34	19.50	8.34
B-2	1150.00	6425.00	6393.00	0.028	20	3.34	5.75	11.23	22.40	11.23
B-3	730.00	6443.00	6410.00	0.045	15	3.19	3.81	12.93	31.05	12.93
B-4	650.00	6428.00	6410.00	0.028	20	3.33	3.26	8.74	19.54	8.74
B-5	500.00	6425.00	6410.00	0.030	20	3.46	2.41	7.90	18.57	7.90
B-6	200.00	6405.00	6394.00	0.055	20	4.69	0.71	3.67	16.62	5.00
B-7	1150.00	6420.00	6394.00	0.023	20	3.01	6.37	11.86	23.13	11.86
B-8	1150.00	6433.00	6393.00	0.035	20	3.73	5.14	10.63	21.71	10.63
B-9	630.00	6419.00	6394.00	0.040	20	3.98	2.64	11.41	18.83	11.41
B-10	630.00	6419.00	6394.00	0.040	20	3.98	2.64	8.13	18.83	8.13
B-11	1050.00	6418.00	6380.00	0.036	20	3.80	4.60	9.28	21.09	9.28
B-12	1050.00	6418.00	6380.00	0.036	20	3.80	4.60	10.09	21.09	10.09
B-13	675.00	6393.00	6371.00	0.033	20	3.61	3.12	9.45	19.38	9.45
B-14	2080.00	6425.00	6352.00	0.035	20	3.75	9.25	15.59	26.43	15.59

Tc BASIN ON, A and B

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)
C-1	1.50	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	102.50			0.030	7.33
C-2	1.80	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	110.00			0.030	7.59
C-3	0.50	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
C-4	1.70	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
C-5	1.40	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.030	5.61
C-6	0.50	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	10.00			0.020	2.62
C=7	3.20	B	60.0	0.46	0.49	0.54	0.63	0.66	0.71	0.76	100.00			0.030	7.64
C-8	1.30	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
C-9	4.10	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	20.00			0.020	3.70
C-10	0.30	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	170.00			0.330	4.28
C-11	2.80	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	102.50			0.030	7.33
C-12	1.00	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
C=13	5.30	B	60.0	0.46	0.49	0.54	0.63	0.66	0.71	0.76	115.00	6346.00	6330.00	0.139	4.94
J-1	0.60	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	50.00			0.030	9.67
J-2	0.70	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	5.00			0.330	1.39
OS-1	2.50	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	25.00			0.200	3.52
OS-2	3.50	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	25.00			0.200	3.52
OS-3	2.10	B	50.0	0.37	0.40	0.46	0.56	0.61	0.66	0.72	50.00			0.030	6.19

Tc BASIN C, J AND OS

Subcatchment Name	Channelized (Travel) Flow Time							Time of Concentration		
	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)
C-1	1450.00	6444.00	6410.00	0.023	20	3.06	7.89	15.22	24.87	15.22
C-2	550.00	6410.00	6379.00	0.056	20	4.75	1.93	9.52	18.02	9.52
C-3	790.00	6420.50	6410.00	0.013	20	2.31	5.71	10.57	22.36	10.57
C-4	1150.00	6420.50	6378.00	0.037	20	3.84	4.99	9.84	21.53	9.84
C-5	560.00	6410.00	6379.50	0.054	20	4.67	2.00	7.61	18.10	7.61
C-6	550.00	6376.00	6345.00	0.056	20	4.75	1.93	4.55	18.02	5.00
C=7	635.00	6376.00	6345.00	0.049	20	4.42	2.39	10.04	18.55	10.04
C-8	450.00	6381.00	6356.00	0.056	20	4.71	1.59	6.45	17.63	6.45
C-9	1500.00	6420.00	6357.00	0.042	20	4.10	6.10	9.80	22.81	9.80
C-10	800.00	6395.00	6353.00	0.053	20	4.58	2.91	7.19	19.14	7.19
C-11	600.00			0.010	20	2.00	5.00	12.33	21.55	12.33
C-12	600.00			0.010	20	2.00	5.00	9.85	21.55	9.85
C=13	800.00	6330.00	6304.00	0.033	20	3.61	3.70	8.64	20.05	8.64
					15					
					15					
J-1	275.00			0.050	15	3.35	1.37	11.03	27.87	11.03
J-2	25.00			0.330	15	8.62	0.05	1.43	25.74	10.00
OS-1	380.00	6410.00	6360.00	0.132	15	5.44	1.16	4.69	27.54	10.00
OS-2	510.00	6410.00	6345.00	0.127	15	5.36	1.59	5.11	28.23	10.00
OS-3	750.00	6382.00	6334.00	0.064	20	5.06	2.47	8.66	20.59	8.66

Tc BASIN C, J AND OS

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)
E-1	1.40	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	50.00			0.030	5.12
E-2	1.80	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	55.00			0.040	4.88
E-3	0.10	D	90.0	0.74	0.77	0.79	0.82	0.84	0.85	0.87	10.00			0.020	1.51
E-4	0.10	D	90.0	0.74	0.77	0.79	0.82	0.84	0.85	0.87	10.00			0.020	1.51
E-5	1.30	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	83.00			0.330	2.99
E-6	2.30	D	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	100.00			0.030	7.24
E-7	0.80	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	20.00			0.050	4.98

Subcatchment Name	Channelized (Travel) Flow Time							Time of Concentration		
	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)
E-1	900.00	6441.00	6414.00	0.030	20	3.46	4.33	9.45	20.78	9.45
E-2	900.00	6437.00	6409.00	0.031	20	3.53	4.25	9.13	20.69	9.13
E-3	86.00			0.040	20	4.00	0.36	1.86	11.03	5.00
E-4	160.00			0.040	20	4.00	0.67	2.17	11.32	5.00
E-5	600.00	6414.00	6387.00	0.045	20	4.24	2.36	5.35	18.51	5.35
E-6	500.00	6413.00	6387.00	0.052	20	4.56	1.83	9.06	17.90	9.06
E-7	240.00	6412.00	6382.00	0.125	15	5.30	0.75	5.73	26.88	10.00

Tc BASIN E

CHATEAU VALLEY							CASTLEROCK					5 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN A						FLOW IN STREET				PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
1	ON-1	3.8	0.04	0.152	10.0	3.85	**0.6**										
2	A-4	2.1	0.04	0.084	20.4	2.75	**0.2**										TYPE C INLET A-1
2	ON-1,A-4	5.9		0.236	20.4	2.75	**0.6**										
3	ON-2	6.2	0.04	0.248	24.1	2.55	**0.6**										
4	ON-3	4.8	0.04	0.192	19.9	2.8	**0.5**										
5	A-1	2.2	0.04	0.088	10.0	3.85	**0.3**										
5	ON-2,3, A-1	13.2		0.528	24.1	2.55	**1.3**										TYPE C INLET A-2
6	A-2	6.2	0.52	3.224	17.0	3.1	**10.0**										INLET A-3 TYPE S
6	A-1,A-2, ON2,ON3	19.4		3.752	24.1	2.55	**9.6**										
7	A-3	2.1	0.52	1.092	12.6	3.55	**3.9**										INLET A-4 TYPE S
8	A-5	1.8	0.52	0.936	16.5	3.1	**2.9**										
8	A-2, A-5	8.0	0.52	4.16	17.0	3.1	**12.9**										INLET A-5 TYPE S
8	A-1,2,4,5, ON-1,2,3	27.1	0.52	8.1	24.1	2.55	**20.8**										
9	A-6	0.8	0.52	0.416	8.4	4.15	**1.7**										

Q-5 SUMMARY

CHATEAU VALLEY							CASTLEROCK					5 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN A & B						FLOW IN STREET				PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
9	A-3, A-6	2.9		1.508	12.3	3.55	**5.4**										INLET A-6 TYPE S
9	A-1 THRU A-6, ON-1,2,3	30.0		9.7	24.1	2.55											
10	A-7	2.7	0.52	1.404	15.9	3.15	**4.4**										INLET A-7 TYPE C
11	A-8	2.2	0.52	1.144	10.0	3.85	**4.4**										POND A
11	A. ON-1,2,3	34.9		12.2	24.1	2.55	**31.1**										
20	B-1	3.8	0.52	1.976	10.8	3.75	**7.4**										
21	B-3	2.6	0.52	1.352	12.8	3.5	**4.7**										INLET B-1
22	B-4	2.2	0.52	1.144	8.4	4.15	**4.7**										INLET B-2
22	B-3, B-4	4.8		2.5	7.5	4.3	**10.7**										INLET B-2
24	B-5	1.5	0.52	0.78	5.0	4.85	**3.8**						200	5.5	4.7	0.7	INLET B-3

CHATEAU VALLEY							CASTLEROCK					5 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN B						FLOW IN STREET				PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
24	B-3 TO B-5	6.3		3.3	13.5	3.4	**11.1**										INLET B-3
25	B-6	2.0	0.52	1.04	11.5	3.65	**3.8**										INLET B-4
26	B-2	3.3	0.52	1.716	10.9	3.8	**6.4**										INLET B-5
26	B-1 TO B-6	15.4		8.0	13.5	3.4	**27.2**						225	2.7	3.3	1.1	
27	B-7	0.1	0.52	0.052	5	4.85	**0.3**										INLET B-6
27	B-1 TO B-7	15.5		8.1	13.5	3.4	**27.4**										
28	B-8	2.8	0.52	1.456	10.8	3.8	**5.5**										INLET B-7
28	B-1 TO B-8	18.3		9.52	14.6	3.3	**30.9**										
29	B-9	0.8	0.52	0.416	5.0	4.85	**2.0**										INLET B-8
30	B-10	2.0	0.52	1.04	9.0	4.0	**4.2**										INLET B-9
30	B-9, B-10	2.8		1.5	9.0	4.0	**5.8**										
31	B-11	4.7	0.52	2.44	15.4	3.2	**7.8**						210	5	4.4	0.8	INLET B-10
31	B-9 TO B-11	7.5		3.9	15.4	3.2	**12.5**										
32	B-12	0.5	0.52	0.26	5.0	4.85	**1.3**										INLET B-11
32	B-1 TO B-12	26.3		13.7	15.4	3.2	**43.8**										
33	B-13	0.8	0.52	0.42	5.0	4.85	**2.0**										INLET B-12
33	B-1 TO B-13	27.1		14.1	15.4	3.2	**45.1**										
34	B-14	2.9	0.52	1.51	9.0	4.0	**6.0**										INLET TYPE C
35	B-15	2.0	0.52	1.04	5.0	4.85	**5.0**										
35	B	32.0		16.6	15.4	3.2	**53.2**										DET. POND B

Q-5 SUMMARY

CHATEAU VALLEY							CASTLEROCK					5 YEAR STORM					
FILING 1							DATE 10/15/25					JOB CHATEAU					
	BASIN C						FLOW IN STREET				PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
40	C-1	1.5	0.52	0.78	15.6	3.20	**2.5**	0.16	0.5		0.63	2.0	550	5.6	4.75	1.9	INLET C-1 Qint=2.0 cfs
41	C-3	0.5	0.52	0.26	10.8	3.75	**1.0**	0.02	0.1		0.24	0.9	560	5.4	4.7	2.0	INLET C-2 Qint=0.9 cfs
	C-1, C-3										0.87						
42	C-2	1.8	0.52	0.94	10.0	3.9	**3.6**	1.09	3.3		1.10	3.3					INLET C-3 Qint=3.3 cfs
42	C-1, C-2	3.3	0.52	1.72	17.5	3.0	**5.1**	-0.01	0.0		1.97	5.9	550	5.6	4.75	1.9	
43	C-5	1.4	0.52	0.73	7.9	4.2	**3.1**	0.75	2.6		0.75	2.6					INLET C-4 Qint=2.6 cfs
43	C-3, C-5	1.9		0.99	12.8	3.45	**3.4**	-0.01	0.0		2.72	9.4	635	4.9	4.4	2.4	
44	C-4	1.7	0.52	0.88	10.1	3.9	**3.4**	0.88	3.0		0.87	3.0					INLET C-5 Qint=3.0 cfs
44	C-3, C-4, C-5	3.6		1.87	12.8	3.45	**6.5**	0.01	0.0		3.59	12.4					
44.1	C-6	0.5	0.52	0.26	5.0	4.9	**1.3**	0.26	0.7		0.26	0.7					INLET C-5.1 Qint=0.7 cfs
44.1	C-1, C-2, C-6	3.8		1.98	20.0	2.80	**5.5**	0.00			0.26	0.7					
45	OC-1	4.6	0.52	2.39	10.0	3.9	**9.3**	2.39	9.3		2.39	9.3					INLET C-6 Qint=9.3 cfs
46	OC-2	0.5	0.52	0.26	10.0	3.9	**1.0**	0.26	1.0		0.26	8.4					INLET C-7 Qint=1.0 cfs
46	OC-1, OC-2	5.1		2.65	10.0	3.9	**10.3**	0.00			2.65	10.3					
47	C-8	1.3	0.52	0.68	6.7	4.5	**3.0**				0.68	3.0					INLET C-8 Qint=3.0 cfs
48	C-9	4.1	0.52	2.13	10.0	3.85	**8.2**				2.13	8.2					INLET C-9 Qint=8.2 cfs
48	C-8, C-9	5.4		2.81	10.0	3.85	**10.8**				2.81	10.8					
48.1	JXN MH - C-1 TO C-5, C-8, C-9				12.8	3.45		`			6.40	22.1					PIPE FLOW
44.2	C-7.1	1.6	0.52	0.83	10.0	3.85	**3.2**	0.83			0.83	3.2					INLETC-5.2 TYPE R Qint=3.2 cfs
44.3	C-7.2	1.6	0.52	0.83	10.0	3.85	**3.2**	0.83			0.83	3.2					INLETC-5.3 TYPE R Qint=3.2 cfs
44.3	C-1 TO C-9	16.0		8.32	20.0	5.1	**42.4**				8.32	42.4					
49	C-10	0.3	0.52	0.16	7.2	4.4	**0.7**										
49	OS-1	2.5	0.52	1.3	10.0	3.85	**5.0**	1.46	5.6								INLET C-10 TYPE C Qint=5.6 cfs
49	C-10, OS-1	2.8		1.46	10.0	3.85	**5.6**	0.00	0.0		1.46	5.6					
50	C-11	2.8	0.52	1.46	12.7	3.45	**5.0**				1.46	5.0					INLET C-11 Qint=5.0 cfs
50	C-10, C-11 OS-1	5.6		2.91	12.7	3.45	**10.0**				2.91	10.0					
51	C-12	1.0	0.52	0.52	10.1	3.8	**2.0**				0.52	2.0					INLET C-12 TYPE C Qint=1.8 cfs
51	C-1 TO C-9, C-12	17.0		8.84	20.0	2.80	**24.8**				8.84	24.8					
52	C-1 TO C-12, OS-1	22.6		11.75	20.0	2.80	**32.9**				11.75	32.9					
52	OS-2	3.5	0.52	1.82	6.8	4.5	**8.2**										OVERLAND FLOW
52	C-13	5.3	0.52	2.76	8.6	4.1	**11.3**										OVERLAND FLOW
52	C-1 TO C-13 OS-1,OS-2	31.4		16.33	20.0	2.80	**45.7**	4.58	12.8		11.75	32.9					

Q-5 SUMMARY

CHATEAU VALLEY							CASTLEROCK					5 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN E&J							FLOW IN STREET			PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
60	E-1	1.4	0.52	0.73	10.0	3.85	**2.8**										INLET E-1
60	E-1	1.4	0.52	0.73	10.0	3.85	**2.8**										INLET E-2
61	E-2	1.8	0.52	0.94	10.0	3.85	**3.6**										INLET E-3 TYPE C
61	E-1,E-2	3.2		1.7	10.0	3.85	**6.4**										
62	E-3	0.1	0.52	0.05	10.0	3.85	**0.2**										INLET E-4
62	E-1,E-2,E-3	3.3		1.7	10.0	3.85	**6.6**										TRIB POND E
63	E-4	0.1	0.52	0.05	10.0	3.85	**0.2**										INLET E-5
64	E-5	1.3	0.52	0.68	10.0	3.85	**2.6**										INLET E-6
65	E-6	2.3	0.52	1.20	10.0	3.85	**4.6**										INLET E-6
65	E-5,E-6	3.6		1.9	10.0	3.85	**7.2**										TRIB POND E
66	E-7	0.8	0.52	0.42	10.0	3.85	**1.6**										
66	E	7.7		4.0	10.0	3.85	**15.4**										
67	J-1	0.6	0.52	0.31	10.0	3.85	**1.2**										
68	J-2	0.7	0.52	0.36	10.0	3.85	**1.4**										
69	J-3	0.1	0.52	0.05	10.0	3.85	**0.2**										

Q-5 SUMMARY

CHATEAU VALLEY							CASTLEROCK					100 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN A							FLOW IN STREET			PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
1	ON-1	3.8	0.48	1.82	10.0	7.00	**12.8**										
2	A-4	2.1	0.48	1.01	20.4	5.00	**5.0**										TYPE C INLET A-1
2	ON-1,A-4	5.9		2.83	20.4	5.00	**14.2**										
3	ON-2	6.2	0.49	3.04	24.1	4.6	**14.0**										
4	ON-3	4.8	0.48	2.3	19.9	5.1	**11.8**										
5	A-1	2.2	0.49	1.07	10.0	7.0	**7.5**										
5	ON-2,3, A-1	13.2	0.49	6.41	24.1	4.6	**29.5**										TYPE C INLET A-2
6	A-2	6.2	0.73	4.53	17.0	5.5	**24.9**										INLET A-3 TYPE S
6	A-1,A-2, ON2,ON3	19.4		10.9	24.1	4.6	**50.3**										
7	A-3	2.1	0.73	1.53	12.6	6.4	**9.8**										INLET A-4 TYPE S
8	A-5	1.8	0.73	1.31	16.5	5.6	**7.4**										
8	A-2, A-5	8.0		5.84	17.0	5.5	**32.1**										INLET A-5 TYPE S
8	A-1,2,4,5, ON-1,2,3	27.1		19.6	24.1	4.6	**90.2**										
9	A-6	0.8	0.73	0.58	8.4	7.6	**4.4**										

Q-100 SUMMARY

CHATEAU VALLEY							CASTLEROCK					100 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN A							FLOW IN STREET			PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
9	A-3, A-6	2.9		2.12	12.6	6.3	**13.3**										INLET A-6 TYPE S
9	A-1 THRU A-6, ON-1,2,3	30.0		21.7	24.1	4.6											
10	A-7	2.7	0.73	1.97	15.9	5.7	**11.2**										INLET A-7 TYPE C
11	A-8	2.2	0.73	1.61	10.0	7.0	**11.2**										POND A
11	A. ON-1,2,3	34.9		25.3	24.1	4.60	**116.4**										
20	B-1	3.8	0.73	2.77	10.8	6.90	**19.1**										
21	B-3	2.6	0.73	1.9	10.0	7.0	**13.3**										INLET B-1
22	B-4	2.2	0.73	1.61	8.4	7.5	**12.0**										INLET B-2
22	B-3, B-4	4.8		3.5	7.5	7.9	**27.7**										INLET B-2

CHATEAU VALLEY							CASTLEROCK					100 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN B, C & D							FLOW IN STREET			PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
24	B-5	1.5	0.73	1.1	5.0	8.8	**9.6**										INLET B-3
24	B-3 TO B-5	6.3		4.6	11.4	6.65	**30.6**										INLET B-3
25	B-6	2.0	0.73	1.46	11.5	6.65	**9.7**										INLET B-4
26	B-2	3.3	0.73	2.41	10.9	6.75	**16.3**										
26	B-1 TO B-6	15.4		11.2	13.5	6.2	**69.7**										INLET B-5
27	B-7	0.1	0.73	0.07	5.0	8.8	**0.6**										INLET B-6
27	B-1 TO B-7	15.5		11.3	13.5	6.2	**70.2**										
28	B-8	2.8	0.73	2.04	10.8	6.85	**14.0**										INLET B-7
28	B-1 TO B-8	18.3		13.4	13.5	6.2											
29	B-9	0.8	0.73	0.58	5	8.8	**5.1**										INLET B-8
30	B-10	2.0	0.73	1.46	9.0	7.4	**10.8**										INLET B-9
30	B-9, B-10	2.8		2.0	9.0	7.4	**15.1**										
31	B-11	4.7	0.73	3.43	15.4	5.9	**20.1**										INLET B-10
31	B-9 TO B-11	7.5		5.5	15.4	5.9	**32.3**										
32	B-12	0.5	0.73	0.37	5.0	8.8	**3.2**										INLET B-11
32	B-1 TO B-12	26.3		19.2	15.4	5.9	**113.3**										
33	B-13	0.8	0.73	0.58	5.0	8.8	**5.1**										INLET B-12
33	B-1 TO B-12	27.1		19.8	15.4	5.9	**116.7**										
34	B-14	2.9	0.73	2.12	9.0	7.3	**15.5**										INLET TYPE C
35	B-15	2.0	0.73	1.46	5.0	8.8	**12.8**										
35	B	32.0		23.4	15.4	5.85	**136.7**										

Q-100 SUMMARY

CHATEAU VALLEY							CASTLEROCK					100 YEAR STORM					
FILING 1							DATE 10/1/24					JOB CHATEAU					
	BASIN C						FLOW IN STREET				PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
40	C-1	1.5	0.73	1.1	12.7	5.80	**6.4**	0.47	2.8		0.62	3.6	550	0.7	1.7	5.4	INLET C-1 Qint=3.6 cfs
41	C-3	0.5	0.73	0.37	10.2	6.9	**2.5**	0.13	0.9		0.23	1.6	560	0.7	1.7	5.4	INLET C-2 Qint=1.6 cfs
	C-1, C-3										0.85						
42	C-2	1.8	0.73	1.31	9.5	6.4	**8.4**	1.79	9.7		1.24	6.7					INLETC-3 10' TYP R Qint=6.7 cfs
42	C-1, C-2	3.3	0.73	2.41	18.1	5.4	**13.0**	0.55	3.0		2.09	11.3	550	5.6	4.75	1.9	
43	C-5	1.4	0.73	1.02	5.1	8.8	**9.0**	1.16	6.4		1.05	5.8					INLET C-4 TYPE R Qint=5.8 cfs
43	C-3, C-5	1.9		1.39	17.6	5.5	**7.6**	0.10	0.6		3.15	17.3	635	4.9	4.4	2.4	Tt 43-44.2
44	C-4	1.7	0.73	1.24	10.1	7.0	**8.7**	1.34	7.4		1.35	7.4					INLETC-5 10' TYP R Qint=7.4 cfs
44	C-3, C-4, C-5	3.6		2.63	17.6	5.5	**14.5**	0.00	0.0		4.49	24.7					C-1 TO C-5 IN PIPE
44.1	C-6	0.5	0.73	0.37	5.0	8.8	**3.2**	0.91	4.7								INLETC-5.1 TYPE R Qint=4.7 cfs
44.1	C-1, C-2, C-6	3.8		2.77	20.0	5.1	**14.1**	0.00	0.0		0.91	4.7					
45	OC-1	4.6	0.73	3.36	10.0	7.0	**23.5**	3.36	23.5		3.36	23.5					INLET C-6 Qint=23.5 cfs
46	OC-2	0.5	0.73	0.37	10.0	7.0	**2.6**	0.37	2.6		0.37	2.6					INLET C-7 Qint=2.6 cfs
46	OC1, OC-2	5.1	0.73	3.72	10.0	7.0	**26.1**	3.72	26.1		3.73	26.1					TRIB TO CHANNEL
47	C-8	1.3	0.73	0.95	6.7	7.1	**6.7**				0.95	6.7					INLET C-8 TYPE C Qint=6.7 cfs
48	C-9	4.1	0.73	2.99	10.0	7.0	**21.0**				2.99	21.0					INLET C-9 Qint=21.0 cfs
48	C-8, C-9	5.4		3.94	10.0	7.0	**27.6**				3.94	27.6					
48.1	JXN MH - C-1 TO C-5, C-8, C-9				12.8	6.4					8.44	54.0					PIPE FLOW @ J2
44.2	C-7.1	1.6	0.73	1.17	10.0	7.0	**8.2**	1.17	8.2								INLETC-5.2 TYPE R Qint=8.2 cfs
44.3	C-7.2	1.6	0.73	1.17	10.0	7.0	**8.2**	1.17	8.2								INLETC-5.3 TYPE R Qint=8.2 cfs
44.3	C-1 TO C-9	16.0		11.68	20.0	5.1	**59.6**				11.68	59.6					
49	C-10	0.3	0.73	0.22	7.2	8.0	**1.8**										
49	OS-1	2.5	0.73	1.83	10.0	7.0	**12.8**										
49	C-10, OS-1	2.8		2.04	10.0	7.0	**14.3**				2.04	14.3					INLET C-10 TYPE C Qint=14.3 cfs
50	C-11	2.8	0.73	2.04	12.7	6.4	**13.1**				2.04	13.1					INLET C-11 Qint=13.1 cfs
50	C-10, C-11 OS-1	5.6		4.09	12.7	6.4	**26.2**				4.09	26.2					
51	C-12	1.0	0.73	0.73	10.1	7.0	**5.1**				0.73	5.1					INLET C-12 TYPE C Qint=5.1 cfs
51	C-1 TO C-9, C-12	17.0		12.4	20.0	5.1	**63.3**				12.41	63.3					
52	C-1 TO C-12, OS-1	22.6		16.5	20.0	5.1	**84.1**				16.50	84.1					
52	OS-2	3.5	0.73	2.56	6.8	5.1	**13.0**										OVERLAND FLOW
52	C-13	5.3	0.73	3.87	8.6	7.5	**29.0**										OVERLAND FLOW
52	C-1 TO C-13 OS-1,OS-2	31.4		22.92	20.0	5.1	**116.9**										POND C

Q-100 SUMMARY

CHATEAU VALLEY							CASTLEROCK					100 YEAR STORM					
FILING 1							DATE 3/1/23					JOB CHATEAU					
	BASIN C , D							FLOW IN STREET			PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
60	E-1	1.4	0.73	1.02	10.0	3.85	**3.9**										INLET D-1
60	E-1	1.4	0.73	1.02	10.0	3.85	**3.9**										INLET D-2
61	E-2	1.8	0.73	1.31	10.0	3.85	**5.1**										INLET D-3 TYPE C
61	E-1,E-2	3.2		2.3	10.0	3.85	**9.0**										
62	E-3	0.1	0.73	0.07	10.0	3.85	**0.3**										INLET D-4
62	E-1,E-2,E-3	3.3		2.4	10.0	3.85	**9.3**										TRIB POND D
63	E-4	0.1	0.73	0.07	10.0	3.85	**0.3**										INLET D-5
64	E-5	1.3	0.73	0.95	10.0	3.85	**3.7**										INLET D-6
65	E-6	2.3	0.73	1.68	10.0	3.85	**6.5**										INLET D-6
65	E-5,E-6	3.6		2.6	10.0	3.85	**10.1**										TRIB POND D
66	E-7	0.8	0.73	0.58	10.0	3.85	**2.2**										
66	E	7.7		5.6	10.0	3.85	**21.6**										
67	J-1	0.6	0.73	0.44	10.0	3.85	**1.7**										
68	J-2	0.7	0.73	0.51	10.0	3.85	**2.0**										
69	J-3	0.1	0.73	0.07	10.0	3.85	**0.3**										

Q-100 SUMMARY

BASIN A, B & C VOLUME VS ELEVATION

HIGHLINE ENGINEERING AND SURVEYING CO.

POND VOLUME VS ELEVATION

PROJECT NAME: CHATEAU VALLEY
PROJECT NUMBER: CHATEAU
DATE: 10/1/24

DETENTION VOLUME VS ELEVATION
DETENTION POND A

V =(h/3)*(a+b)+[(a*b)^(1/2)]

ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME	
6350	0	0	0	
6351	18601	6200	6200	
6355	35750	106851	113051	
6356	40086	37897	150949	
				100 YEAR WSEL=54.80

$V_{100\ REQUIRED}$=2.478 AC-FT = 107,942 CF
1.0' FREEBOARD

DETENTION VOLUME VS ELEVATION
DETENTION POND B

V =(h/3)*(a+b)+[(a*b)^(1/2)]

ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME	
6352	0	0	0	
6353	15845	5282	5282	
6355	21760	37449	42731	
6360	35477	141703	184433	
				100 YEAR WSEL=6359.14

$V_{100\ REQUIRED}$=3.675 AC-FT=160,083 CF
1.0' FREEBOARD

DETENTION VOLUME VS ELEVATION
DETENTION POND C

V =(h/3)*(a+b)+[(a*b)^(1/2)]

ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME	
6304	0	0	0	
6305	9155	3052	3052	
6310	22705	77129	80181	
6312	29065	51639	131820	
6313	34465	31727	163547	
				100 YEAR WSEL=6312.42

$V_{100\ REQUIRED}$=3.336 AC-FT =145,316 CF
1.0' FREEBOARD

DETENTION VOLUME VS ELEVATION
DETENTION POND E

V =(h/3)*(a+b)+[(a*b)^(1/2)]

ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME	
6382	0	0	0	
6383	4000	1333	1333	
6384	12293	7768	9102	
6385	14380	13323	22425	
6386	16582	15468	37893	
				100 YEAR WSEL=6385.96

$V_{100\ REQUIRED}$=0.856 AC-FT=37,287 CF
1.0' FREEBOARD

CHATEAU VALLEY SUB				
% IMPERVIOUS				
BASIN	AREA (AC)	% IMP	AxIMP	WEIGHTED
				% IMPERVIOUS
A-1	2.20	2.00	0.04	
A-2	6.20	60.00	3.72	
A-3	2.10	60.00	1.26	
A-4	2.10	2.00	0.04	
A-5	1.80	60.00	1.08	
A-6	0.80	60.00	0.48	
A-7	2.70	60.00	1.62	
A-8	2.20	60.00	1.32	
ON-1	3.80	2.00	0.08	
ON-2	6.20	2.00	0.12	
ON-3	4.80	2.00	0.10	
TOTAL A	34.90		9.86	28.26

PERCENT IMPERVIOUS SUMMARY

BASIN	AREA (AC)	% IMP	AxIMP	WEIGHTED
				% IMPERVIOUS
B-1	3.80	60.00	2.28	
B-2	3.30	60.00	1.98	
B-3	2.60	60.00	1.56	
B-4	2.20	60.00	1.32	
B-5	1.50	60.00	0.90	
B-6	2.00	60.00	1.20	
B-7	0.10	60.00	0.06	
B-8	2.80	60.00	1.68	
B-9	0.80	60.00	0.48	
B-10	2.00	60.00	1.20	
B-11	4.70	60.00	2.82	
B-12	0.50	60.00	0.30	
B-13	0.80	60.00	0.48	
B-14	2.90	60.00	1.74	
B-15	2.00	2.00	0.04	
TOTAL B	32.00		18.04	56.38

PERCENT IMPERVIOUS SUMMARY

BASIN	AREA (AC)	% IMP	AxIMP	
C-1	1.50	60.00	0.90	
C-2	1.80	60.00	1.08	
C-3	0.50	60.00	0.30	
C-4	1.70	60.00	1.02	
C-5	1.40	60.00	0.84	
C-6	0.50	60.00	0.30	
C-7	3.20	60.00	1.92	
C-8	1.30	60.00	0.78	
C-9	4.10	60.00	2.46	
C-10	0.30	2.00	0.01	
C-11	2.80	60.00	1.68	
C-12	1.00	60.00	0.60	
C-13	5.30	2.00	0.11	
OS-1	2.50	2.00	0.05	
OS-2	3.50	2.00	0.07	
OC-1	4.60	60.00	2.76	
OC-2	0.50	60.00	0.30	
TOTAL C	36.50		15.17	
				41.57
BASIN	AREA (AC)	% IMP	AxIMP	
E-1	1.40	60.00	0.84	
E-2	1.80	60.00	1.08	
E-3	0.10	60.00	0.06	
E-4	0.10	60.00	0.06	
E-5	1.30	60.00	0.78	
E-6	2.30	60.00	1.38	
E-7	0.80	2.00	0.02	
TOTAL E	7.80		4.22	
				54.05

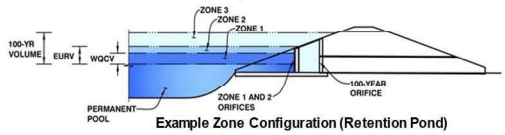
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Clear Workbook

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS A



Example Zone Configuration (Retention Pond)

Watershed Information

Extended Detention Basin (EDB)	**EDB**	
Watershed Area =	34.90	acres
Watershed Length =	2,000	ft
Watershed Length to Centroid =	1,600	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	28.30%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1 hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Run CUHP

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.425	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.893	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	0.936	acre-feet	1.06	inches
5-yr Runoff Volume (P1 = 1.43 in.) =	1.835	acre-feet	1.43	inches
10-yr Runoff Volume (P1 = 1.66 in.) =	2.469	acre-feet	1.66	inches
25-yr Runoff Volume (P1 = 1.73 in.) =	2.625	acre-feet	1.73	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	4.377	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.6 in.) =	5.550	acre-feet	2.60	inches
500-yr Runoff Volume (P1 = 3.07 in.) =	6.969	acre-feet	3.07	inches
Approximate 2-yr Detention Volume =	0.681	acre-feet		
Approximate 5-yr Detention Volume =	1.236	acre-feet		
Approximate 10-yr Detention Volume =	1.432	acre-feet		
Approximate 25-yr Detention Volume =	1.476	acre-feet		
Approximate 50-yr Detention Volume =	1.793	acre-feet		
Approximate 100-yr Detention Volume =	2.273	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV)	0.425	acre-feet
Zone 2 Volume (EURV - Zone 1)	0.468	acre-feet
Z Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2)	1.592	acre-feet
Total Detention Basin Volume =	2.485	acre-feet
Initial Surcharge Volume (ISV) =	56	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	5.75	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	3	
Initial Surcharge Area (A_{ISV}) =	168	ft^2
Surcharge Volume Length (L_{ISV}) =	13.0	ft
Surcharge Volume Width (W_{ISV}) =	13.0	ft
Depth of Basin Floor (H_{FLOOR}) =	1.11	ft
Length of Basin Floor (L_{FLOOR}) =	239.4	ft
Width of Basin Floor (W_{FLOOR}) =	87.0	ft
Area of Basin Floor (A_{FLOOR}) =	20,821	ft^2
Volume of Basin Floor (V_{FLOOR}) =	8,459	ft^3
Depth of Main Basin (H_{MAIN}) =	3.81	ft
Length of Main Basin (L_{MAIN}) =	269.9	ft
Width of Main Basin (W_{MAIN}) =	117.4	ft
Area of Main Basin (A_{MAIN}) =	31,699	ft^2
Volume of Main Basin (V_{MAIN}) =	99,327	ft^3
Calculated Total Basin Volume (V_{total}) =	**2.478**	acre-feet

Depth Increment = 0.10 ft

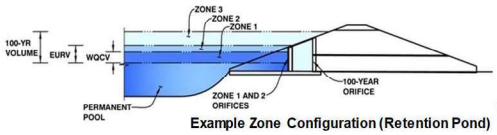
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		13.0	13.0	168		0.004		
ISV	0.33		13.0	13.0	168		0.004	56	0.001
	0.40		13.0	13.0	168		0.004	67	0.002
	0.50		13.0	13.0	168		0.004	84	0.002
	0.60		13.0	13.0	168		0.004	101	0.002
	0.70		13.0	13.0	168		0.004	118	0.003
	0.80		13.0	13.0	168		0.004	135	0.003
	0.90		27.2	17.6	481		0.011	162	0.004
	1.00		47.6	24.3	1,158		0.027	241	0.006
	1.10		68.0	31.0	2,107		0.048	402	0.009
	1.20		88.4	37.6	3,329		0.076	672	0.015
	1.30		108.8	44.3	4,822		0.111	1,077	0.025
	1.40		129.2	51.0	6,588		0.151	1,645	0.038
	1.50		149.6	57.6	8,625		0.198	2,404	0.055
	1.60		170.0	64.3	10,935		0.251	3,379	0.078
	1.70		190.4	71.0	13,516		0.310	4,600	0.106
	1.80		210.8	77.6	16,370		0.376	6,092	0.140
	1.90		231.2	84.3	19,495		0.448	7,883	0.181
Floor	1.94		239.4	87.0	20,821		0.478	8,689	0.199
	2.00		239.9	87.4	20,978		0.482	9,943	0.228
	2.10		240.7	88.2	21,241		0.488	12,054	0.277
	2.20		241.5	89.0	21,505		0.494	14,191	0.326
	2.30		242.3	89.8	21,770		0.500	16,355	0.375
Zone 1 (WQCV)	2.40		243.1	90.6	22,036		0.506	18,545	0.426
	2.50		243.9	91.4	22,304		0.512	20,762	0.477
	2.60		244.7	92.2	22,573		0.518	23,006	0.528
	2.70		245.5	93.0	22,843		0.524	25,277	0.580
	2.80		246.3	93.8	23,114		0.531	27,574	0.633
	2.90		247.1	94.6	23,387		0.537	29,900	0.686
	3.00		247.9	95.4	23,661		0.543	32,252	0.740
	3.10		248.7	96.2	23,936		0.550	34,632	0.795
	3.20		249.5	97.0	24,213		0.556	37,039	0.850
Zone 2 (EURV)	3.28		250.1	97.7	24,435		0.561	38,985	0.895
	3.30		250.3	97.8	24,491		0.562	39,474	0.906
	3.40		251.1	98.6	24,770		0.569	41,937	0.963
	3.50		251.9	99.4	25,050		0.575	44,428	1.020
	3.60		252.7	100.2	25,332		0.582	46,948	1.078
	3.70		253.5	101.0	25,615		0.588	49,495	1.136
	3.80		254.3	101.8	25,899		0.595	52,071	1.195
	3.90		255.1	102.6	26,185		0.601	54,675	1.255
	4.00		255.9	103.4	26,472		0.608	57,308	1.316
	4.10		256.7	104.2	26,760		0.614	59,969	1.377
	4.20		257.5	105.0	27,049		0.621	62,660	1.438
	4.30		258.3	105.8	27,340		0.628	65,379	1.501
	4.40		259.1	106.6	27,632		0.634	68,128	1.564
	4.50		259.9	107.4	27,925		0.641	70,906	1.628
	4.60		260.7	108.2	28,220		0.648	73,713	1.692
	4.70		261.5	109.0	28,515		0.655	76,550	1.757
	4.80		262.3	109.8	28,812		0.661	79,416	1.823
	4.90		263.1	110.6	29,111		0.668	82,312	1.890
	5.00		263.9	111.4	29,410		0.675	85,238	1.957
	5.10		264.7	112.2	29,711		0.682	88,194	2.025
	5.20		265.5	113.0	30,014		0.689	91,180	2.093
	5.30		266.3	113.8	30,317		0.696	94,197	2.162
	5.40		267.1	114.6	30,622		0.703	97,244	2.232
	5.50		267.9	115.4	30,928		0.710	100,321	2.303
	5.60		268.7	116.2	31,235		0.717	103,429	2.374
	5.70		269.5	117.0	31,544		0.724	106,568	2.446
Z3 (100+1/2WQCV)	5.76		270.0	117.5	31,730		0.728	108,467	2.490

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS A



Example Zone Configuration (Retention Pond)

Clear Input Parameters (Including Tables)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	
Zone 1 (WQCV)	2.40	0.425	Orifice Plate	Orifice Plate
Zone 2 (EURV)	3.28	0.468	Orifice Plate	Orifice Plate
(100+1/2WQCV)	5.76	1.592	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)		2.485		

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.181E-02	ft²
Depth at top of Zone using Orifice Plate =	3.28	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.70	sq. inches (diameter = 1-7/16 inches)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

Size Plate to match WQCV Drain Time

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.09	2.19					
Orifice Area (sq. inches)	1.70	1.70	1.70					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.28	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.78	N/A	feet
Overflow Weir Front Edge Length =	14.00	N/A	feet	Overflow Weir Slope Length =	10.31	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	23.88	N/A	
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	100.44	N/A	ft²
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	50.22	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.21	N/A	ft²
Outlet Pipe Diameter =	33.00	N/A	inches	Outlet Orifice Centroid =	1.03	N/A	feet
Restrictor Plate Height Above Pipe Invert =	22.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Size Outlet Plate to match 90% of Predevelopment 100-year Peak Runoff Rate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.75	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.69 feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	7.44 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.85 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.81 acre-ft

Size Emergency Spillway to pass Developed 100-yr Peak Runoff Rate

Calculated Parameters for Spillway

Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
CUHP Runoff Volume (acre-ft) =	0.425	0.893	0.936	1.835	2.469	2.825	4.377	5.550	6.969
Inflow Hydrograph Volume (acre ft) =	N/A	N/A	0.936	1.835	2.469	2.825	4.377	5.550	6.969
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.8	10.3	14.5	19.9	32.7	42.8	54.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.30	0.42	0.57	0.94	1.23	1.56
Peak Inflow Q (cfs) =	N/A	N/A	9.2	18.1	23.0	28.8	44.0	55.6	69.4
Peak Outflow Q (cfs) =	0.2	0.2	0.2	6.4	11.5	15.3	29.4	41.6	44.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.8	0.8	0.9	1.0	0.8
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.1	0.1	0.3	0.4	0.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	63	65	65	64	62	58	54	51
Time to Drain 99% of Inflow Volume (hours) =	**40**	65	68	70	69	69	67	66	64
Maximum Ponding Depth (ft) =	2.40	3.28	3.25	3.87	4.13	4.29	4.77	5.09	5.74
Area at Maximum Ponding Depth (acres) =	0.51	0.56	0.56	0.60	0.62	0.63	0.66	0.68	0.73
Maximum Volume Stored (acre-ft) =	0.426	0.895	0.878	1.237	1.389	1.495	1.797	2.018	2.468

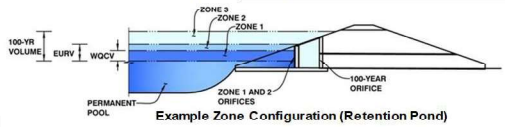
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Clear Workbook

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS B



Example Zone Configuration (Retention Pond)

Watershed Information

Extended Detention Basin (EDB)	EDB	
Watershed Area =	32.00	acres
Watershed Length =	1,600	ft
Watershed Length to Centroid =	800	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	56.40%	percent
Percentage Hydrologic Soil Group A =	60.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	40.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Run CUHP

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.599	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.981	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	1.434	acre-feet	1.06	inches
5-yr Runoff Volume (P1 = 1.43 in.) =	2.064	acre-feet	1.43	inches
10-yr Runoff Volume (P1 = 1.66 in.) =	2.558	acre-feet	1.66	inches
25-yr Runoff Volume (P1 = 1.73 in.) =	2.867	acre-feet	1.73	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	4.171	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.6 in.) =	5.187	acre-feet	2.60	inches
500-yr Runoff Volume (P1 = 3.07 in.) =	6.428	acre-feet	3.07	inches
Approximate 2-yr Detention Volume =	1.289	acre-feet		
Approximate 5-yr Detention Volume =	1.894	acre-feet		
Approximate 10-yr Detention Volume =	2.225	acre-feet		
Approximate 25-yr Detention Volume =	2.340	acre-feet		
Approximate 50-yr Detention Volume =	2.931	acre-feet		
Approximate 100-yr Detention Volume =	3.353	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV)	0.599	acre-feet
Zone 2 Volume (EURV - Zone 1)	1.382	acre-feet
Z Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2)	1.671	acre-feet
Total Detention Basin Volume =	3.652	acre-feet
Initial Surcharge Volume (ISV) =	78	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	8.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	1.5	

Ratio not typical.

Initial Surcharge Area (A_{ISV}) =	237	ft^2
Surcharge Volume Length (L_{ISV}) =	15.4	ft
Surcharge Volume Width (W_{ISV}) =	15.4	ft
Depth of Basin Floor (H_{FLOOR}) =	0.68	ft
Length of Basin Floor (L_{FLOOR}) =	154.1	ft
Width of Basin Floor (W_{FLOOR}) =	106.1	ft
Area of Basin Floor (A_{FLOOR}) =	16,348	ft^2
Volume of Basin Floor (V_{FLOOR}) =	4,206	ft^3
Depth of Main Basin (H_{MAIN}) =	6.49	ft
Length of Main Basin (L_{MAIN}) =	206.0	ft
Width of Main Basin (W_{MAIN}) =	158.0	ft
Area of Main Basin (A_{MAIN}) =	32,552	ft^2
Volume of Main Basin (V_{MAIN}) =	155,691	ft^3
Calculated Total Basin Volume (V_{total}) =	**3.675**	acre-feet

Depth Increment = 0.20 ft

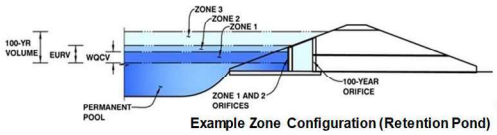
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		15.4	15.4	237		0.005		
ISV	0.33		15.4	15.4	237		0.005	78	0.002
	0.40		15.4	15.4	237		0.005	95	0.002
	0.60		15.4	15.4	237		0.005	142	0.003
	0.80		15.4	15.4	237		0.005	190	0.004
	1.00		50.1	38.1	1,907		0.044	357	0.008
	1.20		90.9	64.7	5,003		0.115	1,100	0.025
	1.40		131.7	91.4	12,036		0.276	2,855	0.066
Floor	1.51		154.1	106.1	16,348		0.375	4,410	0.101
	1.60		154.8	106.8	16,535		0.380	5,890	0.135
	1.80		156.4	108.4	16,957		0.389	9,239	0.212
	2.00		158.0	110.0	17,383		0.399	12,673	0.291
	2.20		159.6	111.6	17,814		0.409	16,193	0.372
	2.40		161.2	113.2	18,251		0.419	19,799	0.455
	2.60		162.8	114.8	18,692		0.429	23,493	0.539
Zone 1 (WQCV)	2.74		164.0	115.9	19,005		0.436	26,132	0.600
	2.80		164.4	116.4	19,139		0.439	27,276	0.626
	3.00		166.0	118.0	19,591		0.450	31,149	0.715
	3.20		167.6	119.6	20,048		0.460	35,113	0.806
	3.40		169.2	121.2	20,510		0.471	39,169	0.899
	3.60		170.8	122.8	20,977		0.482	43,318	0.994
	3.80		172.4	124.4	21,450		0.492	47,560	1.092
	4.00		174.0	126.0	21,927		0.503	51,898	1.191
	4.20		175.6	127.6	22,410		0.514	56,332	1.293
	4.40		177.2	129.2	22,898		0.526	60,862	1.397
	4.60		178.8	130.8	23,391		0.537	65,491	1.503
	4.80		180.4	132.4	23,889		0.548	70,219	1.612
	5.00		182.0	134.0	24,392		0.560	75,047	1.723
	5.20		183.6	135.6	24,900		0.572	79,976	1.836
	5.40		185.2	137.2	25,413		0.583	85,007	1.951
Zone 2 (EURV)	5.46		185.7	137.7	25,568		0.587	86,536	1.987
	5.60		186.8	138.8	25,932		0.595	90,141	2.069
	5.80		188.4	140.4	26,455		0.607	95,380	2.190
	6.00		190.0	142.0	26,984		0.619	100,724	2.312
	6.20		191.6	143.6	27,518		0.632	106,174	2.437
	6.40		193.2	145.2	28,057		0.644	111,731	2.565
	6.60		194.8	146.8	28,601		0.657	117,397	2.695
	6.80		196.4	148.4	29,150		0.669	123,172	2.828
	7.00		198.0	150.0	29,704		0.682	129,057	2.963
	7.20		199.6	151.6	30,264		0.695	135,054	3.100
	7.40		201.2	153.2	30,828		0.708	141,163	3.241
	7.60		202.8	154.8	31,398		0.721	147,385	3.384
	7.80		204.4	156.4	31,972		0.734	153,722	3.529
Z3 (100+1/2WQCV)	7.97		205.8	157.7	32,465		0.745	159,199	3.655
	8.00		206.0	158.0	32,552		0.747	160,175	3.677
	8.20		207.6	159.6	33,137		0.761	166,744	3.828
	8.40		209.2	161.2	33,727		0.774	173,430	3.981
	8.60		210.8	162.8	34,323		0.788	180,235	4.138
	8.80		212.4	164.4	34,923		0.802	187,159	4.297
	9.00		214.0	166.0	35,529		0.816	194,204	4.458
	9.20		215.6	167.6	36,139		0.830	201,371	4.623
	9.40		217.2	169.2	36,755		0.844	208,660	4.790
	9.60		218.8	170.8	37,376		0.858	216,073	4.960
	9.80		220.4	172.4	38,002		0.872	223,611	5.133
	10.00		222.0	174.0	38,633		0.887	231,274	5.309
	10.20		223.6	175.6	39,269		0.901	239,065	5.488
	10.40		225.2	177.2	39,910		0.916	246,982	5.670
	10.60		226.8	178.8	40,557		0.931	255,029	5.855

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	Clear Input Parameters (Including Tables)
Zone 1 (WQCV)	2.74	0.599	Orifice Plate	Orifice Plate
Zone 2 (EURV)	5.46	1.382	Orifice Plate	Orifice Plate
(100+1/2WQCV)	7.97	1.671	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)		3.652		

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.46	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

Size Plate to match WQCV Drain Time

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.82	3.64					
Orifice Area (sq. inches)	3.22	3.22	8.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.46	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.96	N/A	feet
Overflow Weir Front Edge Length =	9.00	N/A	feet	Overflow Weir Slope Length =	10.31	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	21.23	N/A	
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	64.57	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	32.28	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.04	N/A	ft^2
Outlet Pipe Diameter =	27.00	N/A	inches	Outlet Orifice Centroid =	0.90	N/A	feet
Restrictor Plate Height Above Pipe Invert =	19.30		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.01	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Size Outlet Plate to match 90% of Predevelopment 100-year Peak Runoff Rate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.94 feet
Spillway Crest Length =	33.00	feet	Stage at Top of Freeboard =	9.94 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.88 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	5.26 acre-ft

Size Emergency Spillway to pass Developed 100-yr Peak Runoff Rate

Calculated Parameters for Spillway

Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
CUHP Runoff Volume (acre-ft) =	0.599	1.981	1.434	2.064	2.558	2.867	4.171	5.187	6.428
Inflow Hydrograph Volume (acre ft) =	N/A	N/A	1.434	2.064	2.558	2.867	4.171	5.187	6.428
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	1.7	6.6	13.1	29.0	41.0	55.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.05	0.21	0.41	0.91	1.28	1.74
Peak Inflow Q (cfs) =	N/A	N/A	25.7	37.2	46.6	53.4	78.9	99.1	122.7
Peak Outflow Q (cfs) =	0.3	0.8	0.6	0.8	3.9	5.9	21.8	38.1	49.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.6	0.5	0.8	0.9	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.1	0.3	0.6	0.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	69	62	71	72	71	68	65	62
Time to Drain 99% of Inflow Volume (hours) =	**40**	73	65	75	77	77	76	75	73
Maximum Ponding Depth (ft) =	2.74	5.46	4.31	5.39	5.94	6.11	6.93	7.46	8.21
Area at Maximum Ponding Depth (acres) =	0.44	0.59	0.52	0.58	0.62	0.63	0.68	0.71	0.76
Maximum Volume Stored (acre-ft) =	0.600	1.987	1.350	1.946	2.275	2.381	2.908	3.283	3.828

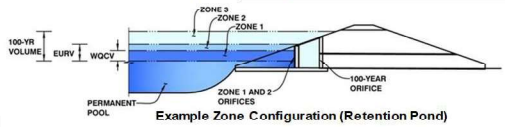
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Clear Workbook

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS C



Example Zone Configuration (Retention Pond)

Watershed Information

Extended Detention Basin (EDB)	EDB	
Watershed Area =	36.50	acres
Watershed Length =	2,500	ft
Watershed Length to Centroid =	1,400	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	41.60%	percent
Percentage Hydrologic Soil Group A =	10.0%	percent
Percentage Hydrologic Soil Group B =	70.0%	percent
Percentage Hydrologic Soil Groups C/D =	20.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Run CUHP

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.560	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.569	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	1.242	acre-feet	1.06 inches
5-yr Runoff Volume (P1 = 1.43 in.) =	2.096	acre-feet	1.43 inches
10-yr Runoff Volume (P1 = 1.66 in.) =	2.666	acre-feet	1.66 inches
25-yr Runoff Volume (P1 = 1.73 in.) =	3.115	acre-feet	1.73 inches
50-yr Runoff Volume (P1 = 2.26 in.) =	4.687	acre-feet	2.26 inches
100-yr Runoff Volume (P1 = 2.6 in.) =	5.888	acre-feet	2.60 inches
500-yr Runoff Volume (P1 = 3.07 in.) =	7.362	acre-feet	3.07 inches
Approximate 2-yr Detention Volume =	1.053	acre-feet	
Approximate 5-yr Detention Volume =	1.599	acre-feet	
Approximate 10-yr Detention Volume =	2.075	acre-feet	
Approximate 25-yr Detention Volume =	2.118	acre-feet	
Approximate 50-yr Detention Volume =	2.593	acre-feet	
Approximate 100-yr Detention Volume =	3.056	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV)	0.560	acre-feet
Zone 2 Volume (EURV - Zone 1)	1.009	acre-feet
Z Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2)	1.767	acre-feet
Total Detention Basin Volume =	3.336	acre-feet
Initial Surcharge Volume (ISV) =	73	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	8.25	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	1.4	Ratio not typical.

Initial Surcharge Area (A_{ISV}) =	222	ft^2
Surcharge Volume Length (L_{ISV}) =	14.9	ft
Surcharge Volume Width (W_{ISV}) =	14.9	ft
Depth of Basin Floor (H_{FLOOR}) =	0.59	ft
Length of Basin Floor (L_{FLOOR}) =	135.2	ft
Width of Basin Floor (W_{FLOOR}) =	99.2	ft
Area of Basin Floor (A_{FLOOR}) =	13,413	ft^2
Volume of Basin Floor (V_{FLOOR}) =	3,021	ft^3
Depth of Main Basin (H_{MAIN}) =	6.83	ft
Length of Main Basin (L_{MAIN}) =	189.9	ft
Width of Main Basin (W_{MAIN}) =	153.8	ft
Area of Main Basin (A_{MAIN}) =	29,208	ft^2
Volume of Main Basin (V_{MAIN}) =	142,097	ft^3
Calculated Total Basin Volume (V_{total}) =	**3.336**	acre-feet

Depth Increment = 0.30 ft

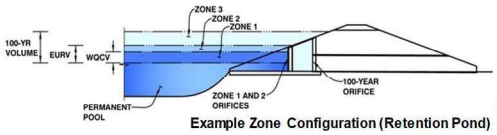
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		14.9	14.9	222		0.005		
ISV	0.33		14.9	14.9	222		0.005	73	0.002
	0.60		14.9	14.9	222		0.005	133	0.003
	0.90		29.2	24.9	726		0.017	216	0.005
	1.20		90.4	67.7	6,122		0.141	1,112	0.026
Floor	1.42		135.2	99.2	13,413		0.308	3,209	0.074
	1.50		135.9	99.0	13,564		0.311	4,200	0.096
	1.80		138.3	102.2	14,135		0.325	8,442	0.194
	2.10		140.7	104.6	14,718		0.338	12,770	0.293
	2.40		143.1	107.0	15,313		0.352	17,275	0.397
	2.70		145.5	109.4	15,919		0.365	21,959	0.504
Zone 1 (WQCV)	2.86		146.8	110.7	16,247		0.373	24,532	0.563
	3.00		147.9	111.8	16,536		0.380	26,827	0.616
	3.30		150.3	114.2	17,165		0.394	31,882	0.732
	3.60		152.7	116.6	17,806		0.409	37,127	0.852
	3.90		155.1	119.0	18,458		0.424	42,567	0.977
	4.20		157.5	121.4	19,122		0.439	48,203	1.107
	4.50		159.9	123.8	19,797		0.454	54,041	1.241
	4.80		162.3	126.2	20,483		0.470	60,082	1.379
	5.10		164.7	128.6	21,182		0.486	66,332	1.523
Zone 2 (EURV)	5.20		165.5	129.4	21,417		0.492	68,462	1.572
	5.40		167.1	131.0	21,891		0.503	72,793	1.671
	5.70		169.5	133.4	22,612		0.519	79,468	1.824
	6.00		171.9	135.8	23,345		0.536	86,361	1.983
	6.30		174.3	138.2	24,089		0.553	93,476	2.146
	6.60		176.7	140.6	24,845		0.570	100,816	2.314
	6.90		179.1	143.0	25,612		0.588	108,384	2.488
	7.20		181.5	145.4	26,391		0.606	116,185	2.667
	7.50		183.9	147.8	27,182		0.624	124,220	2.852
	7.80		186.3	150.2	27,983		0.642	132,495	3.042
	8.10		188.7	152.6	28,797		0.661	141,012	3.237
Z3 (100+1/2WQCV)	8.25		189.9	153.8	29,208		0.671	145,362	3.337
	8.40		191.1	155.0	29,622		0.680	149,774	3.438
	8.70		193.5	157.4	30,458		0.699	158,786	3.645
	9.00		195.9	159.8	31,306		0.719	168,050	3.858
	9.30		198.3	162.2	32,166		0.738	177,571	4.076
	9.60		200.7	164.6	33,037		0.758	187,351	4.301
	9.90		203.1	167.0	33,919		0.779	197,394	4.532
	10.20		205.5	169.4	34,813		0.799	207,703	4.768
	10.50		207.9	171.8	35,719		0.820	218,283	5.011
	10.80		210.3	174.2	36,636		0.841	229,135	5.260
	11.10		212.7	176.6	37,564		0.862	240,265	5.516
	11.40		215.1	179.0	38,504		0.884	251,675	5.778
	11.70		217.5	181.4	39,456		0.906	263,369	6.046
	12.00		219.9	183.8	40,419		0.928	275,350	6.321
	12.30		222.3	186.2	41,394		0.950	287,621	6.603
	12.60		224.7	188.6	42,380		0.973	300,187	6.891
	12.90		227.1	191.0	43,378		0.996	313,050	7.187
	13.20		229.5	193.4	44,387		1.019	326,215	7.489
	13.50		231.9	195.8	45,407		1.042	339,684	7.798
	13.80		234.3	198.2	46,440		1.066	353,460	8.114
	14.10		236.7	200.6	47,483		1.090	367,549	8.438
	14.40		239.1	203.0	48,539		1.114	381,952	8.768
	14.70		241.5	205.4	49,606		1.139	396,673	9.106
	15.00		243.9	207.8	50,684		1.164	411,716	9.452
	15.30		246.3	210.2	51,774		1.189	427,084	9.805
	15.60		248.7	212.6	52,875		1.214	442,781	10.165
	15.90		251.1	215.0	53,988		1.239	458,811	10.533

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS C



Example Zone Configuration (Retention Pond)

Clear Input Parameters (Including Tables)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	
Zone 1 (WQCV)	2.86	0.560	Orifice Plate	Orifice Plate
Zone 2 (EURV)	5.20	1.009	Orifice Plate	Orifice Plate
(100+1/2WQCV)	8.25	1.767	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)		3.336		

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.000E-02	ft²
Depth at top of Zone using Orifice Plate =	5.20	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.88	sq. inches (diameter = 1-7/8 inches)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

Size Plate to match WQCV Drain Time

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.73	3.47					
Orifice Area (sq. inches)	2.88	2.88	2.88					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.20	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.70	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	10.31	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.08	N/A	
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	21.52	N/A	ft²
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	10.76	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.04	N/A	ft²
Outlet Pipe Diameter =	27.00	N/A	inches	Outlet Orifice Centroid =	0.90	N/A	feet
Restrictor Plate Height Above Pipe Invert =	19.30		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.01	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Size Outlet Plate to match 90% of Predevelopment 100-year Peak Runoff Rate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.80 feet
Spillway Crest Length =	33.00	feet	Stage at Top of Freeboard =	9.80 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.77 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.45 acre-ft

Size Emergency Spillway to pass Developed 100-yr Peak Runoff Rate

Calculated Parameters for Spillway

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
CUHP Runoff Volume (acre-ft) =	0.560	1.569	1.242	2.096	2.666	3.115	4.687	5.888	7.362
Inflow Hydrograph Volume (acre ft) =	N/A	N/A	1.242	2.096	2.666	3.115	4.687	5.888	7.362
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.5	7.0	11.2	17.6	31.2	41.9	54.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.19	0.31	0.48	0.85	1.15	1.48
Peak Inflow Q (cfs) =	N/A	N/A	14.7	26.4	33.0	41.0	61.7	76.4	94.5
Peak Outflow Q (cfs) =	0.3	0.5	0.4	2.5	6.8	11.1	27.8	39.4	63.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.6	0.9	0.9	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.3	0.5	1.3	1.8	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	61	71	70	69	64	61	57
Time to Drain 99% of Inflow Volume (hours) =	**40**	70	64	76	76	75	74	73	71
Maximum Ponding Depth (ft) =	2.86	5.20	4.33	5.80	6.28	6.59	7.37	7.94	8.37
Area at Maximum Ponding Depth (acres) =	0.37	0.49	0.45	0.52	0.55	0.57	0.62	0.65	0.68
Maximum Volume Stored (acre-ft) =	0.563	1.572	1.160	1.871	2.129	2.309	2.765	3.126	3.411

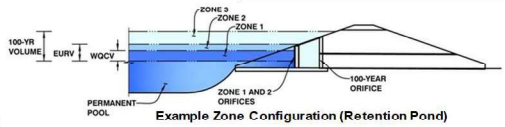
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Clear Workbook

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS E



Example Zone Configuration (Retention Pond)

Watershed Information

Extended Detention Basin (EDB)	EDB	
Watershed Area =	7.80	acres
Watershed Length =	760	ft
Watershed Length to Centroid =	325	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	54.10%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	50.0%	percent
Percentage Hydrologic Soil Groups C/D =	50.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Run CUHP

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.142	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.428	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	0.347	acre-feet	1.06	inches
5-yr Runoff Volume (P1 = 1.43 in.) =	0.548	acre-feet	1.43	inches
10-yr Runoff Volume (P1 = 1.66 in.) =	0.684	acre-feet	1.66	inches
25-yr Runoff Volume (P1 = 1.73 in.) =	0.756	acre-feet	1.73	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	1.086	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.6 in.) =	1.326	acre-feet	2.60	inches
500-yr Runoff Volume (P1 = 3.07 in.) =	1.632	acre-feet	3.07	inches
Approximate 2-yr Detention Volume =	0.312	acre-feet		
Approximate 5-yr Detention Volume =	0.473	acre-feet		
Approximate 10-yr Detention Volume =	0.574	acre-feet		
Approximate 25-yr Detention Volume =	0.567	acre-feet		
Approximate 50-yr Detention Volume =	0.684	acre-feet		
Approximate 100-yr Detention Volume =	0.783	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV)	0.142	acre-feet
Zone 2 Volume (EURV - Zone 1)	0.286	acre-feet
Z Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2)	0.426	acre-feet
Total Detention Basin Volume =	0.854	acre-feet
Initial Surcharge Volume (ISV) =	18	ft^3
Initial Surcharge Depth (ISD) =	0.33	ft
Total Available Detention Depth (H_{total}) =	4.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	1.3	

Ratio not typical.

Initial Surcharge Area (A_{ISV}) =	56	ft^2
Surcharge Volume Length (L_{ISV}) =	7.5	ft
Surcharge Volume Width (W_{ISV}) =	7.5	ft
Depth of Basin Floor (H_{FLOOR}) =	0.55	ft
Length of Basin Floor (L_{FLOOR}) =	119.7	ft
Width of Basin Floor (W_{FLOOR}) =	92.1	ft
Area of Basin Floor (A_{FLOOR}) =	11,023	ft^2
Volume of Basin Floor (V_{FLOOR}) =	2,175	ft^3
Depth of Main Basin (H_{MAIN}) =	2.62	ft
Length of Main Basin (L_{MAIN}) =	140.6	ft
Width of Main Basin (W_{MAIN}) =	113.1	ft
Area of Main Basin (A_{MAIN}) =	15,902	ft^2
Volume of Main Basin (V_{MAIN}) =	35,078	ft^3
Calculated Total Basin Volume (V_{total}) =	**0.856**	acre-feet

Depth Increment = 0.30 ft

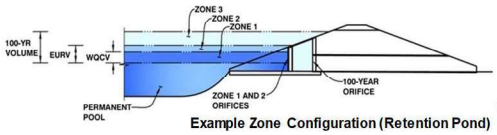
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		7.5	7.5	56		0.001		
ISV	0.33		7.5	7.5	56		0.001	18	0.000
	0.60		7.5	7.5	56		0.001	34	0.001
	0.90		21.8	18.3	397		0.009	61	0.001
	1.20		83.0	64.4	5,344		0.123	781	0.018
Floor	1.38		119.7	92.1	11,023		0.253	2,223	0.051
	1.50		120.6	93.1	11,220		0.258	3,550	0.082
Zone 1 (WQCV)	1.73		122.5	94.9	11,624		0.267	6,186	0.142
	1.80		123.0	95.5	11,746		0.270	7,004	0.161
	2.10		125.4	97.9	12,277		0.282	10,607	0.244
	2.40		127.8	100.3	12,818		0.294	14,371	0.330
	2.70		130.2	102.7	13,371		0.307	18,299	0.420
Zone 2 (EURV)	2.73		130.5	102.9	13,427		0.308	18,701	0.429
	3.00		132.6	105.1	13,936		0.320	22,395	0.514
	3.30		135.0	107.5	14,512		0.333	26,662	0.612
	3.60		137.4	109.9	15,100		0.347	31,104	0.714
	3.90		139.8	112.3	15,700		0.360	35,723	0.820
Z3 (100+1/2WQCV)	4.00		140.6	113.1	15,902		0.365	37,304	0.856
	4.20		142.2	114.7	16,310		0.374	40,525	0.930
	4.50		144.6	117.1	16,933		0.389	45,511	1.045
	4.80		147.0	119.5	17,567		0.403	50,685	1.164
	5.10		149.4	121.9	18,212		0.418	56,052	1.287
	5.40		151.8	124.3	18,869		0.433	61,614	1.414
	5.70		154.2	126.7	19,537		0.449	67,374	1.547
	6.00		156.6	129.1	20,217		0.464	73,337	1.684
	6.30		159.0	131.5	20,909		0.480	79,506	1.825
	6.60		161.4	133.9	21,612		0.496	85,884	1.972
	6.90		163.8	136.3	22,326		0.513	92,474	2.123
	7.20		166.2	138.7	23,052		0.529	99,281	2.279
	7.50		168.6	141.1	23,790		0.546	106,307	2.440
	7.80		171.0	143.5	24,539		0.563	113,556	2.607
	8.10		173.4	145.9	25,299		0.581	121,031	2.778
	8.40		175.8	148.3	26,072		0.599	128,736	2.955
	8.70		178.2	150.7	26,855		0.617	136,675	3.138
	9.00		180.6	153.1	27,650		0.635	144,851	3.325
	9.30		183.0	155.5	28,457		0.653	153,266	3.519
	9.60		185.4	157.9	29,275		0.672	161,926	3.717
	9.90		187.8	160.3	30,105		0.691	170,833	3.922
	10.20		190.2	162.7	30,946		0.710	179,990	4.132
	10.50		192.6	165.1	31,799		0.730	189,402	4.348
	10.80		195.0	167.5	32,663		0.750	199,071	4.570
	11.10		197.4	169.9	33,539		0.770	209.001	4.798
	11.40		199.8	172.3	34,426		0.790	219,195	5.032
	11.70		202.2	174.7	35,325		0.811	229,657	5.272
	12.00		204.6	177.1	36,235		0.832	240,391	5.519
	12.30		207.0	179.5	37,157		0.853	251,400	5.771
	12.60		209.4	181.9	38,091		0.874	262,687	6.030
	12.90		211.8	184.3	39,035		0.896	274,255	6.296
	13.20		214.2	186.7	39,992		0.918	286,109	6.568
	13.50		216.6	189.1	40,960		0.940	298,251	6.847
	13.80		219.0	191.5	41,939		0.963	310,686	7.132
	14.10		221.4	193.9	42,930		0.986	323,416	7.425
	14.40		223.8	196.3	43,933		1.009	336,445	7.724
	14.70		226.2	198.7	44,947		1.032	349,777	8.030
	15.00		228.6	201.1	45,972		1.055	363,415	8.343
	15.30		231.0	203.5	47,009		1.079	377,362	8.663
	15.60		233.4	205.9	48,058		1.103	391,621	8.990
	15.90		235.8	208.3	49,118		1.128	406,198	9.325

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: CHATEAU VALLEY SUBDIVISION

Basin ID: BASINS E



Example Zone Configuration (Retention Pond)

Clear Input Parameters (Including Tables)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	
Zone 1 (WQCV)	1.73	0.142	Orifice Plate	Orifice Plate
Zone 2 (EURV)	2.73	0.286	Orifice Plate	Orifice Plate
(100+1/2WQCV)	4.00	0.426	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)		0.854		

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	2.73	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

Size Plate to match WQCV Drain Time

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.70	1.40	2.10				
Orifice Area (sq. inches)	0.57	0.57	0.57	8.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.73	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.23	N/A	feet
Overflow Weir Front Edge Length =	15.00	N/A	feet	Overflow Weir Slope Length =	10.31	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	71.01	N/A	
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	107.61	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	53.81	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.52	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.65	N/A	feet
Restrictor Plate Height Above Pipe Invert =	14.40		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.21	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Size Outlet Plate to match 90% of Predevelopment 100-year Peak Runoff Rate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.40 feet
Spillway Crest Length =	33.00	feet	Stage at Top of Freeboard =	5.40 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.43 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.41 acre-ft

Size Emergency Spillway to pass Developed 100-yr Peak Runoff Rate

Calculated Parameters for Spillway

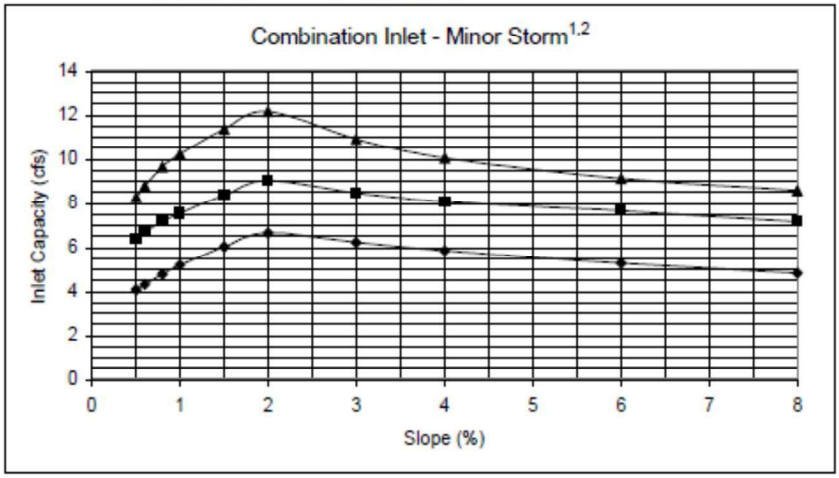
Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

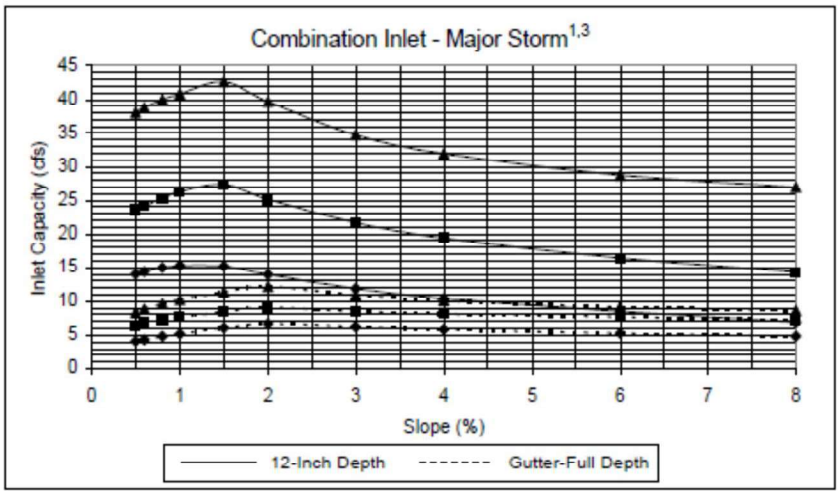
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
CUHP Runoff Volume (acre-ft) =	0.142	0.428	0.347	0.548	0.684	0.756	1.086	1.326	1.632
Inflow Hydrograph Volume (acre ft) =	N/A	N/A	0.347	0.548	0.684	0.756	1.086	1.326	1.632
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.5	3.1	4.6	6.4	10.8	13.9	17.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.07	0.40	0.59	0.83	1.38	1.78	2.28
Peak Inflow Q (cfs) =	N/A	N/A	6.9	11.3	13.6	15.2	21.8	26.9	32.8
Peak Outflow Q (cfs) =	0.1	0.3	0.2	1.0	2.2	3.7	8.8	13.0	13.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.5	0.6	0.8	0.9	0.8
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.0	0.0	0.1	0.1	0.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	65	69	68	67	64	62	59
Time to Drain 99% of Inflow Volume (hours) =	**40**	71	68	73	73	73	72	71	70
Maximum Ponding Depth (ft) =	1.73	2.73	2.37	2.86	3.00	3.12	3.42	3.61	4.00
Area at Maximum Ponding Depth (acres) =	0.27	0.31	0.29	0.31	0.32	0.32	0.34	0.35	0.36
Maximum Volume Stored (acre-ft) =	0.142	0.429	0.321	0.470	0.511	0.550	0.649	0.718	0.853

FIGURE 8-2, INLET CAPACITY CHART COMBINATION (TYPE 16) INLET

LOCAL TYPE I AND TYPE II (MULTI-FAMILY)

Street Section Data: Street Width Flowline to Flowline = 44'
Type of Curb and Gutter = 6" vertical
Minor Storm Maximum Spread = 18.7'

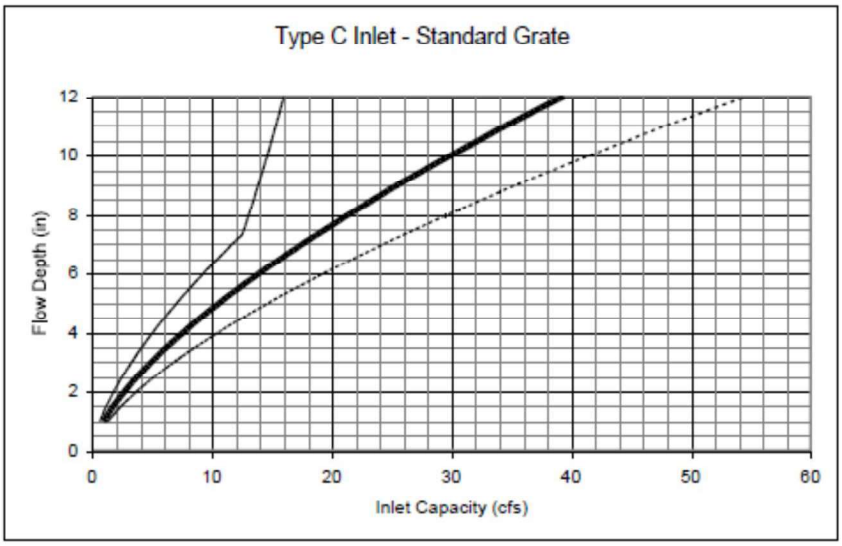


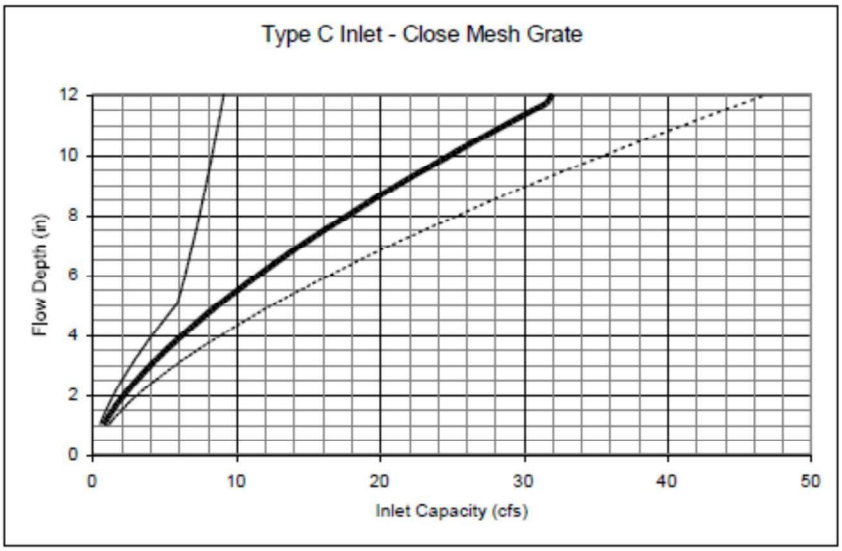


◆ Single ■ Double ▲ Triple

[1]The Town of Castle Rock standard street section parameters must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets (see Section 8.4).
[2] The maximum spread width is limited by the curb height based on no curb overtopping allowable during a minor storm.
[3]Calculations for the 12-inch depth curve assume a vertical wall behind the top of curb. For the gutter-full depth case, the Minor Storm Capacity Chart may be used.

FIGURE 8-9, INLET CAPACITY CHART SUMP CONDITIONS
AREA (TYPE C) INLET



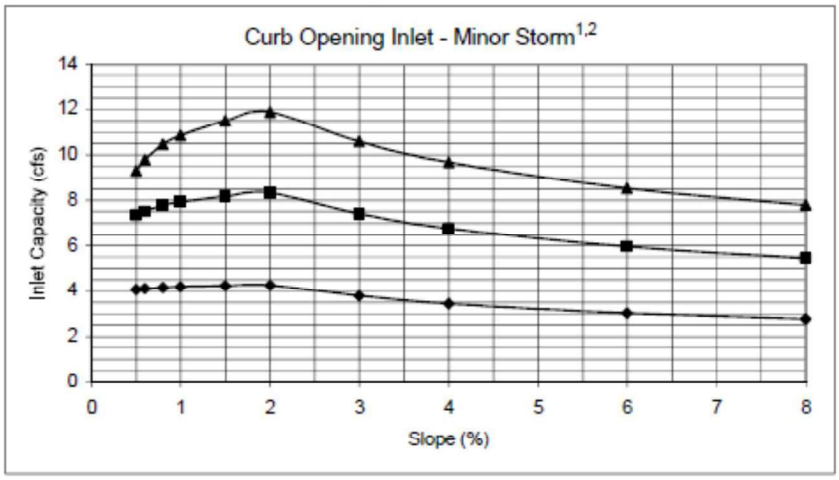


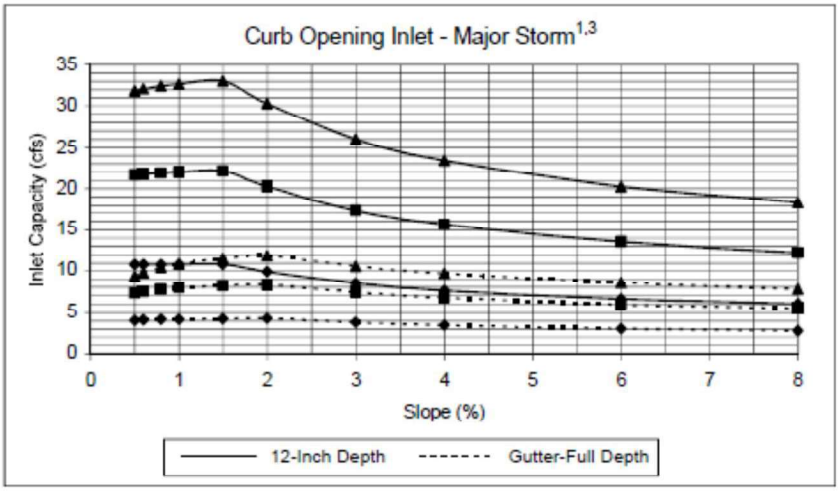


Notes:
1. The Town of Castle Rock standard inlet parameters must apply to use these charts.

FIGURE 8-4, INLET CAPACITY CHART CURB OPENING (TYPE R) INLET
MINOR COLLECTOR

Street Section Data: Street Width Flowline to Flowline = 48'
Type of Curb and Gutter = 6" vertical
Minor Storm Maximum Spread = 18.7'

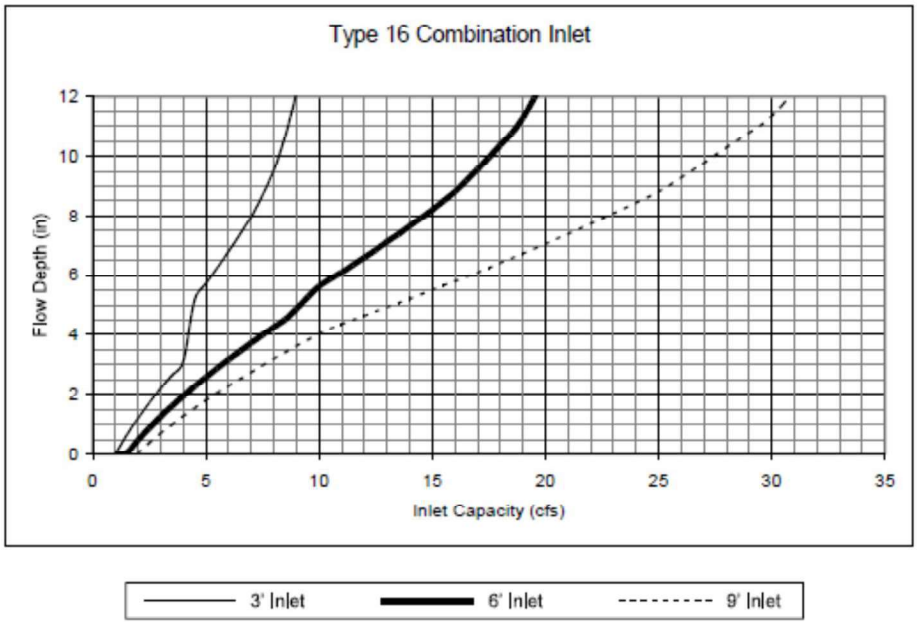




◆ Single ■ Double ▲ Triple

[1]The Town of Castle Rock standard street section parameters must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets (see Section 8.4).
[2] The maximum spread width is limited by the curb height based on no curb overtopping allowable during a minor storm.
[3]Calculations for the 12-inch depth curve assume a vertical wall behind the top of curb. For the gutter-full depth case, the Minor Storm Capacity Chart may be used.

FIGURE 8-11, INLET CAPACITY CHART SUMP CONDITIONS
COMBINATION (TYPE 16) INLET



Notes:
1. The Town of Castle Rock standard inlet parameters must apply to use this chart.

TOWN OF CASTLE ROCK COLORADO

Summary of Water Quality Conformance to MS4 Permit

The purpose of this worksheet is to document conformance with the Town of Castle Rock's MS4 permit with regard to permanent water quality on land disturbance projects.

Project Name CHATEAU VALLEY SUBDIVISION

Project Owner 113M LLC

Project Location SOUTH 1/2 SEC. 12, T. 8 S. R. 66 WEST OF THE 6TH P.M.

ToCR Project Number SDP21 0060

Total Site Area 113 **acres**

Total Size of Common Plan of Development 113 **acres**

Check all that apply:

☒ **Project within Plum Creek Basin**

☐ **Project within Cherry Creek Basin**

Estimated construction completion date _____

---

1. The water quality control measure(s) for applicable development sites shall meet one of the following base design standards as per the SDDTCM Section 14.4. Please select all design standards that were applied to meet conformance with the MS4 on this site.

☒ WQCV standard

☐ Pollutant removal standard

☐ Runoff reduction standard

☐ Applicable site draining to regional WQVC control measure (accepts drainage prior to discharging to WOTS)

☐ Applicable site draining to regional WQVC control facility (with receiving pervious area control measure upstream of WOTS)

☐ Constrained redevelopment sites standard

- Imperviousness of existing site _____/_____(Imp. Ac/Site Ac) =____%
- Variance required TCV No. _____

☐ Existing control measure with WQCV per previous criteria standards

- Reference Construction Permit No. _____

☐ Cherry Creek Basin only, choose one: ☐ Tier 1 ☐ Tier 2 ☐ Tier 3

☐ No control measures provided (See Permanent WQ Worksheet for applicability)

Summary of Water Quality Conformance to MS4 Permit

2. Was an exclusion to water quality applied as per SDDTCM Section 13.1.5? ☐Yes ☐No

   i. If yes, please select all that apply, provide total excluded impervious area(s) and submit variance, as applicable: TCV No. _____

   - ☐ Pavement management site
     Excluded impervious area: _____ acres
   - ☒ Excluded roadway redevelopment
     Excluded impervious area: 0.34 acres
   - ☐ Excluded existing roadway areas
     Excluded impervious area: _____ acres
   - ☐ Above ground and below ground utilities
   - ☐ Large lot single family home
   - ☐ Non-residential and non-commercial infiltration
     Excluded impervious area: _____ acres
   - ☒ Land disturbance for land to remain undeveloped
     Excluded impervious area: 0.0 acres
   - ☒ Stream Stabilization Sites
     Excluded impervious area: 0.0 acres
   - ☒ Trails
     Excluded impervious area: 0.91 acres
   - ☐ Oil and Gas Exploration

3. For Development and Redevelopment sites, following any exclusions claimed above, was any portion of the site excluded up to 20% of the site and not to exceed one acre? ☐Yes ☒No

   If yes, complete the following:

   Excluded area: _____ acres
   Total Site area: _____ acres, _____ % site excluded

4. For Constrained sites, was any portion of the site excluded up to 50% of the site and not to exceed 50% of the impervious area? ☐Yes ☒No

   If yes, complete the following:

   Excluded area: _____ acres
   Excluded impervious area: _____ acres
   Total Site area: _____ acres, _____ % site excluded
   Total Impervious area: _____ acres, _____ % impervious excluded

Permanent Water Quality Determination Worksheet (Taken from 2019 SDDTCM Sections 13.1.4 and 13.1.5)

Project: Chateau Valley Subdivision **Project #:** SDP21 0060 **Applicant:** Highline C.M.

Section	Question	Response	Instructions
1	**Non-applicable Sites**		
1.1	Will the project result in a temporary disturbance of greater than one acre?	○ No ◉ Yes	Proceed to section 1.2. Proceed to section 2.
1.2	Is the project part of a larger common plan of development or sale where multiple separate and distinct construction activities may be taking place at different times on different schedules, but remain related and are within 1/4 mile of each other? (A common plan of development will generally be documented on a site development plan, master plan, or equivalent, for the property/project)	○ No ○ Yes	Proceed to section 1.3. Proceed to section 2.
1.3	Is the project within the Cherry Creek Watershed?	○ Yes ○ No	Permanent water quality control measures may be required. Refer to Water Qualtiy Control Regulation 72.7 for details and allowable exclusions. Permanent water quality control measures are not required.
2	**Applicable Site Types and Exclusions by Variance**		
2.1	Does the project have more than 35% impervious area on the existing site?	○ No ◉ Yes	Project is an applicable Development Site. Proceed to section 3. Proceed to 2.2.
2.2	Does the project have greater than 75% impervious area on the existing site?	◉ No ○ Yes	Project is an applicable Redevelopment Site. Proceed to section 3. Project is an applicable Constrainted Redevelopment Site. Proceed to 2.3.
2.3	Will 100% of the runoff from the existing and proposed site be captured and treated using one or more of the allowable design standards for permanent water quality?	○ Yes ○ No	No further action required. Proceed to 2.4.
2.4	Do any other water quality exclusions apply to the site?	○ No ○ Yes	Portions of the project are excluded. Proceed with design in accordance with Constrained Redevelopment standards and apply for **variance** for Constrained Redevelopment Sites. Proceed to section 3. Following approval of other exclusions, design remaining site in accordance with Constrained Redevelopment standards and apply for **variance** for Constrained Redevelopment Sites.

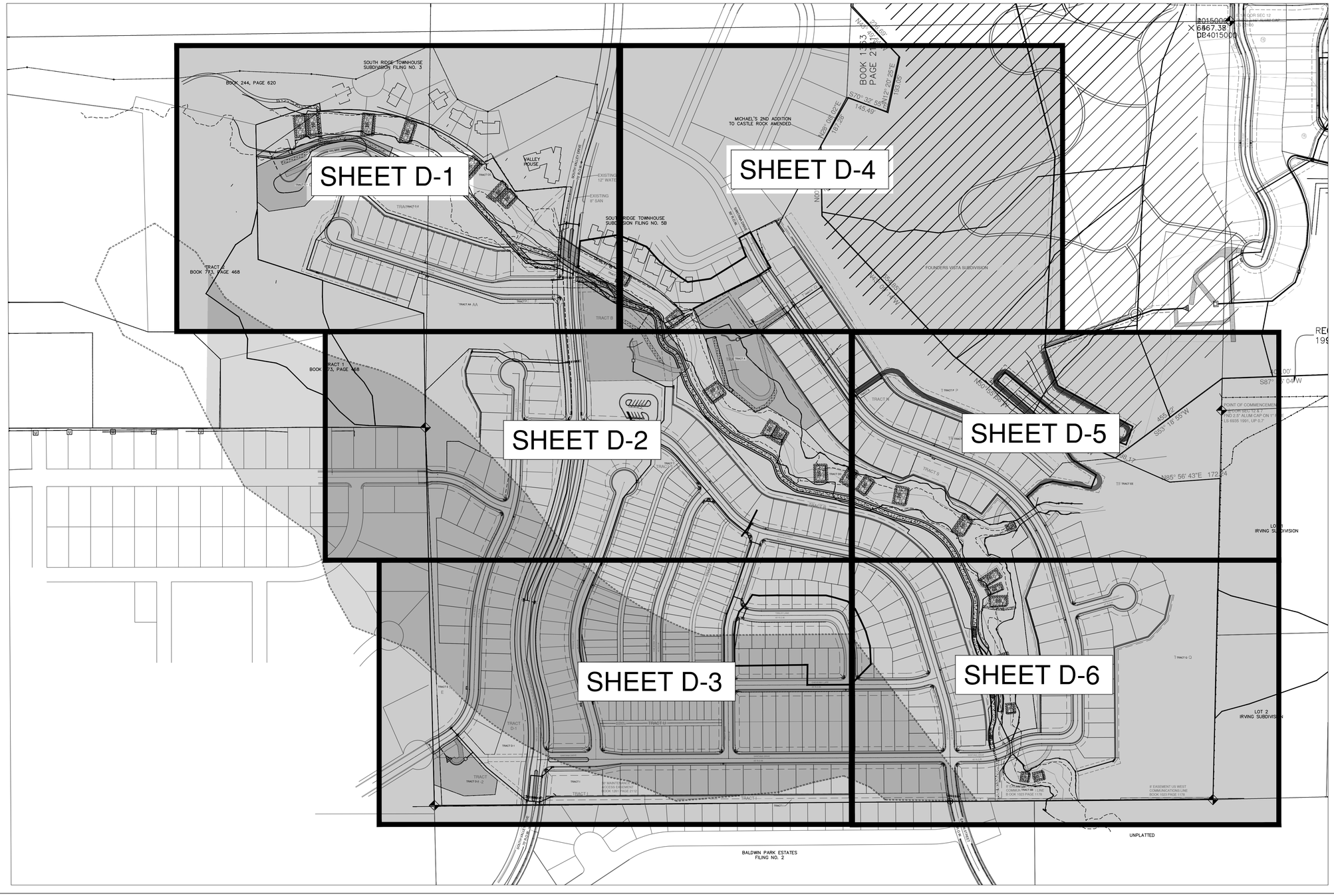
Section	Question	Response	Instructions
3	**Applicable Sites with Other Exclusions by Variance**		
3.1	**Category 1: Roadways, bridges and trails only**		
3.1.1	Is the project a bike or pedestrian trail?	◯ Yes	Proceed to next line.
		◯ No	Proceed to 3.1.2.
	Is the trail for a roadway?	◯ Yes	Proceed to 3.1.2.
		◯ No	Project is excluded. Submit **variance** for Trails Excluded from Permanent Water Quality Requirements.
3.1.2	Is the project primarily used for parking or access to parking?	◯ Yes	This exclusion does not apply. Permanent water quality is required.
		◯ No	Proceed to 3.1.3.
3.1.3	Does the project add impervious area?	◯ No	Project is excluded. Submit **variance** for Pavement Management Sites Excluded from Permanent Water Quality Requirements.
		◯ Yes	Proceed to 3.1.4.
3.1.4	Does the project add more than 8.25 feet of paved width at any location to the existing roadway?	◯ No	Project is excluded. Submit **variance** for Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements.
		◯ Yes	Proceed to next line.
	Does the project add more than one acre of paved area per mile to an existing roadway?	◯ No	Project is excluded. Submit **variance** for Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements.
		◯ Yes	Proceed to next line.
	Does the project increase the width by two times or more, on average, of the original roadway area?	◯ No	Existing areas of site are excluded only. Submit **variance** for Existing Roadway Surfaces Only Excluded from Permanent Water Quality Requirements.
		◯ Yes	This exclusion does not apply. Permanent water quality is required.
3.2	**Category 2: Non-residential and non-commercial projects only**		
3.2.1	Is the project associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities, including activities necessary to prepare a site for drilling and the movement and placement of drilling equipment?	◯ Yes	Project is excluded. Submit **variance** for Oil and Gas Exploration Sites Excluded from Permanent Water Quality Requirements.
		◯ No	Proceed to 3.2.2.
3.2.2	Is the project for stream stabilization?	◯ Yes	Project is excluded. Submit **variance** for Stream Stabilization Sites Excluded from Permanent Water Quality Requirements.
		◯ No	Proceed to 3.2.3.
3.2.3	Is the project for installation or maintenance of aboveground or underground utilities or infrastructure that does not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity including activities to install, replace or maintain utilities under roadways or other paved areas that return the surface to the same condition?	◯ Yes	Project is excluded. Submit **variance** for Aboveground and Underground Utilities Excluded from Permanent Water Quality Requirements.
		◯ No	Proceed to 3.2.4.
3.2.4	Is the project on undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the project?	◯ Yes	Project is excluded. Submit **variance** for Sites with Land Disturbances to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements.
		◯ No	Proceed to 3.2.5.
3.2.5	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	◯ No	Project is excluded. Submit **study** along with **variance** for Non-residential and Non-commercial Infiltration Conditions Excluded from Permanent Water Quality Requirements.
		◯ Yes	This exclusion does not apply. Permanent water quality is required.

Section	Question	Response	Instructions
3.3	**Category 3: Residential, Agricultural and Commercial projects**		
3.3.1	Is the project a single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling unit?	○ Yes	Proceed to next line.
		◉ No	Proceed to 3.3.2.
	Is the project site greater than 10% impervious?	○ No	Project is excluded. Submit **variance** for Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements.
		○ Yes	Proceed to next line.
	Is the project site greater than 20% impervious?	○ Yes	This exclusion does not apply. Permanent water quality is required.
		○ No	Proceed to next line.
	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	○ No	Project is excluded. Submit **study** along with **variance** for Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements.
		○ Yes	This exclusion does not apply. Permanent water quality is required.
3.3.2	Will 100% of the runoff from the residential or commercial site be captured?	○ Yes	This exclusion does not apply. Permanent water quality is required.
		◉ No	Proceed to next line.
	Is all or a portion of the site undeveloped or will it remain undeveloped after construction?	◉ Yes	This portion of the project is excluded. Submit **variance** for Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements. Proceed to next line.
		○ No	Proceed to next line.
	Is the remaining untreated impervious area greater than 20% of the site?	○ Yes	This exclusion does not apply. Permanent water quality is required.
		◉ No	Proceed to next line.
	Is the remaining untreated impervious area greater than one acre?	◉ Yes	This exclusion does not apply. Permanent water quality is required.
		○ No	Proceed to next line.
	Is it practicable to capture runoff from portions of the site that will not drain to a control measure?	◉ No	Document justification demonstrating that it is not practicable to capture runoff from this portion of the site in the **drainage report**. No further action is needed.
		○ Yes	This exclusion does not apply. Permanent water quality is required.

CHATEAU VALLEY

PHASE II DRAINAGE PLAN

A PARCEL OF LAND LOCATED IN THE SOUTH HALF OF SECTION 12,
TOWNSHIP 08 SOUTH, RANGE 67 WEST OF THE
6th PRINCIPAL MERIDIAN, TOWN OF CASTLEROCK, COUNTY OF DOUGLAS, STATE OF COLORADO.
TOWN OF CASTLE ROCK PROJECT NO. SDP21-0060



HIGHLINE ENGINEERING & SURVEYING COMPANY, INC.
ENGINEERING CONSULTANTS
PO BOX 1295
PARKER, COLORADO 80134
(303)889-0044 Tel. No.
(303)380-3320 Fax. No.

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RUSSELL B. HALL
26715
01/7/26
P.E. & P.L.S.

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DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
RBH	DLC	JRH	RBH

CHATEAU VALLEY

PHASE II
DRAINAGE PLAN

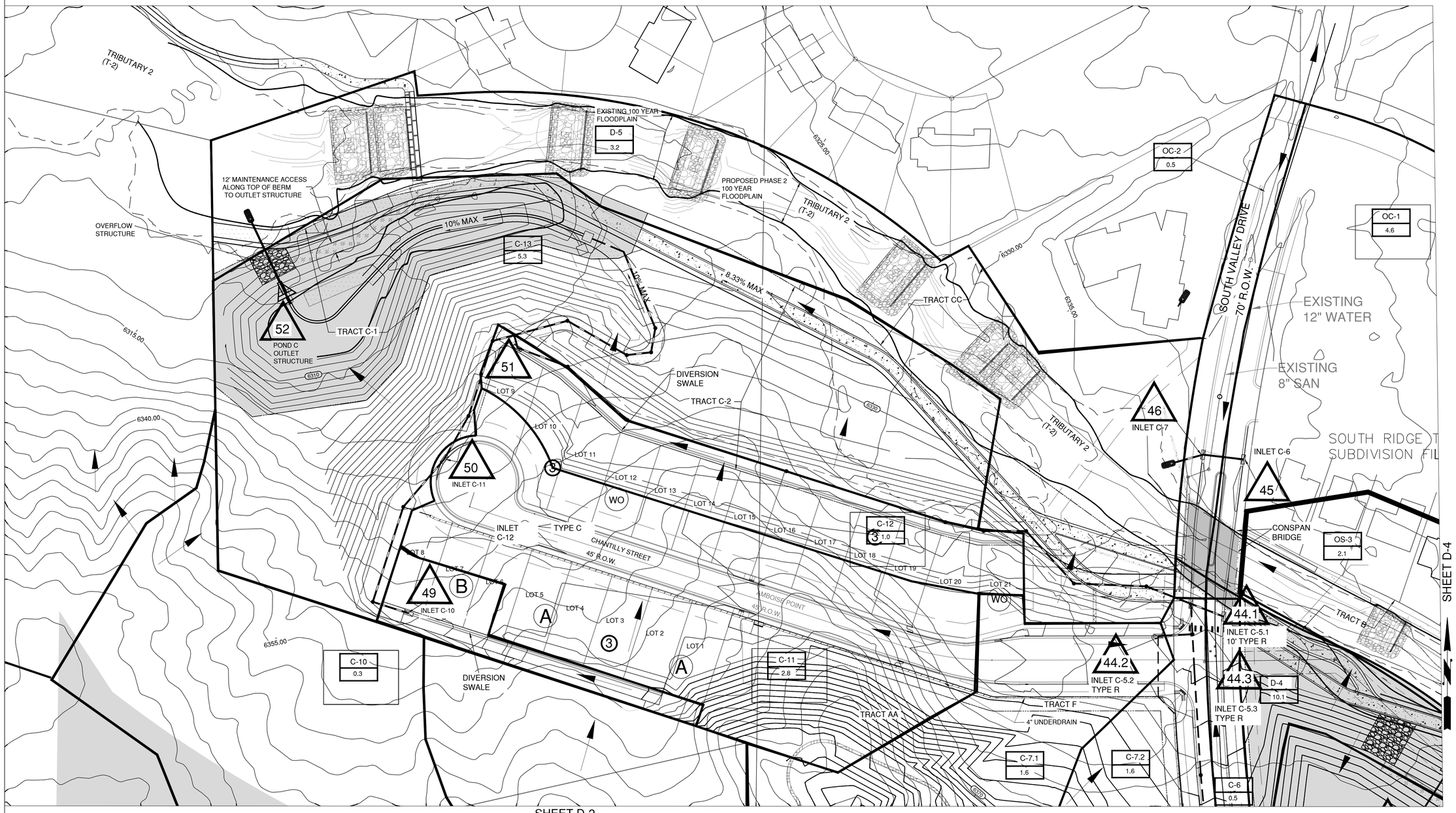
DATE: JAN 7, 2026
DWG NO: CHATEAU
SCALE
HORIZONTAL NTS VERTICAL

KEY MAP

CHATEAU VALLEY

PHASE II DRAINAGE PLAN

A PARCEL OF LAND LOCATED IN THE SOUTH HALF OF SECTION 12,
TOWNSHIP 08 SOUTH, RANGE 67 WEST OF THE
6th PRINCIPAL MERIDIAN, TOWN OF CASTLEROCK, COUNTY OF DOUGLAS, STATE OF COLORADO.
TOWN OF CASTLE ROCK PROJECT NO. SDP21-0060



NOTE:
12' CONCRETE PEDESTRIAN WALKS SHALL HAVE A MAXIMUM LONGITUDINAL SLOPE OF 8.33%.
15' MAINTENANCE ROADS SHALL HAVE A MAXIMUM LONGITUDINAL SLOPE OF 10.0%.

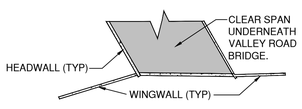
TRAIL LEGEND

- 8' SOFT PEDESTRIAN TRAIL
- 10' CONCRETE PEDESTRIAN WALK
- 15' MAINTENANCE GRAVEL ROAD
- MINOR RIDGELINE

LEGEND

- TRACT BOUNDARY
- PROPOSED CONTOURS (6725)
- PROPOSED CONTOURS (PHASE 2 CHANNEL) (6725)
- EXISTING 5' CONTOURS (6725)
- BASIN DESIGNATION: H-1 / 5.0 — AREA (ACRES)
- DESIGN POINT: 1
- ONSITE BASIN BOUNDARY
- OFF-SITE BASIN BOUNDARY
- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED PHASE 1 100-YEAR FLOODPLAIN
- PROPOSED PHASE 2 100-YEAR FLOODPLAIN
- UNDERDRAIN
- PROPOSED STORM SEWER

TYPICAL PHASE 2 GROUTED BOULDER DROP STRUCTURE



VALLEY ROAD BRIDGE LEGEND

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BRIAN H. BLUE
26715
01/7/26
P.E. & P.L.S.

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DRAWN BY: DLC
CHECKED BY: JRH
APPROVED BY: RBH

CHATEAU VALLEY
PHASE II DRAINAGE PLAN

DATE: JAN 7, 2026
DWG NO: CHATEAU
SCALE
HORIZONTAL 1"=100'
VERTICAL NONE

D-1

CHATEAU VALLEY

PHASE II DRAINAGE PLAN

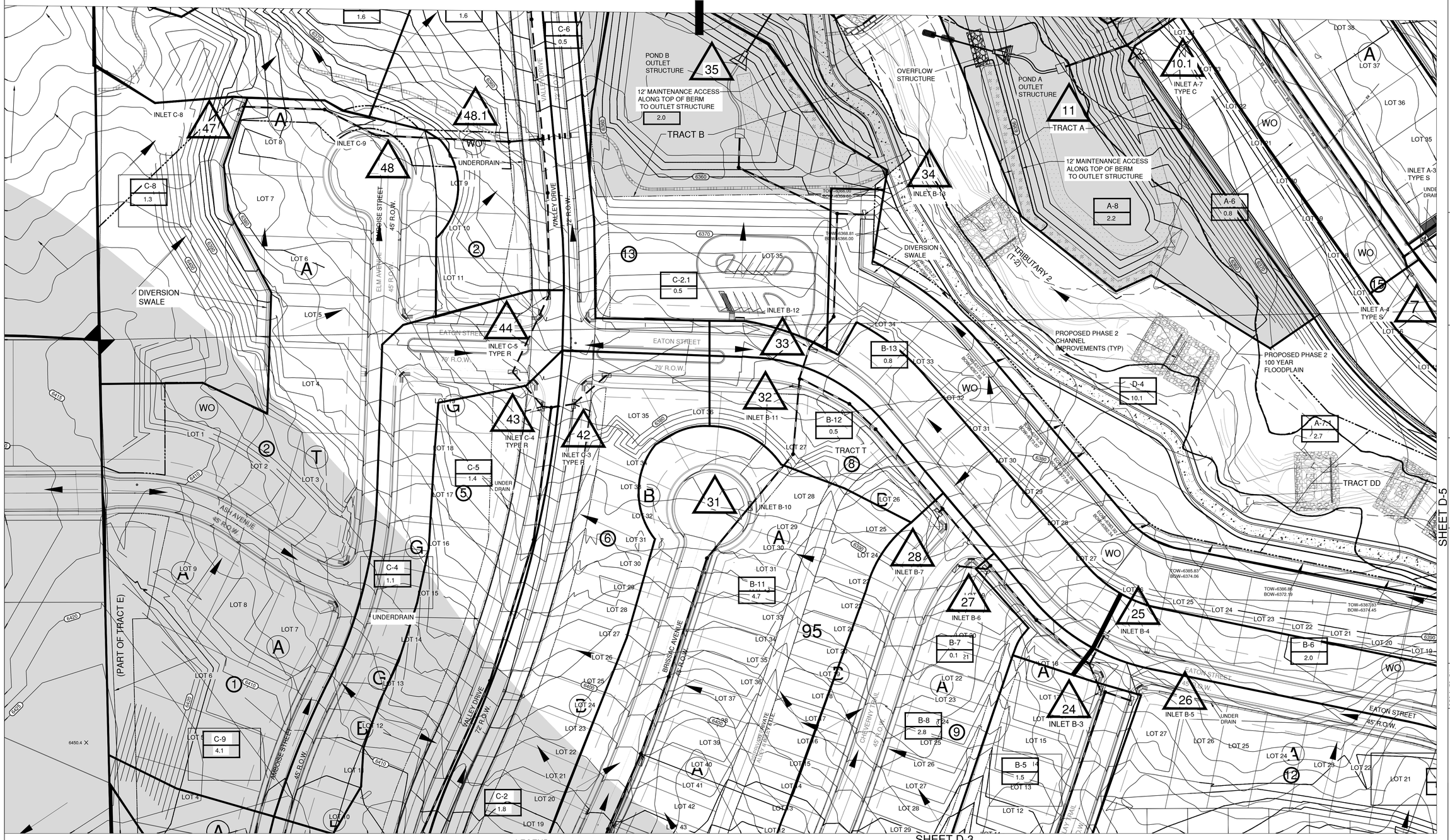
A PARCEL OF LAND LOCATED IN THE SOUTH HALF OF SECTION 12,
TOWNSHIP 08 SOUTH, RANGE 67 WEST OF THE
6th PRINCIPAL MERIDIAN, TOWN OF CASTLEROCK, COUNTY OF DOUGLAS, STATE OF COLORADO.
TOWN OF CASTLE ROCK PROJECT NO. SDP21-0060

SHEET D-1

SHEET D-4

SHEET D-5

SHEET D-3



TRAIL LEGEND

- 8' SOFT PEDESTRIAN TRAIL
- 10' CONCRETE PEDESTRIAN WALK
- 15' MAINTENANCE GRAVEL ROAD
- TRACT BOUNDARY
- MINOR RIDGELINE

LEGEND

- PROPOSED CONTOURS (6725)
- PROPOSED CONTOURS (PHASE 2 CHANNEL) (6725)
- EXISTING 5' CONTOURS (6725)
- BASIN DESIGNATION: H-1 / 5.0 (AREA (ACRES))
- DESIGN POINT (1)
- ONSITE BASIN BOUNDARY
- OFF-SITE BASIN BOUNDARY
- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED PHASE 1 100-YEAR FLOODPLAIN
- PROPOSED PHASE 2 100-YEAR FLOODPLAIN
- UNDERDRAIN
- PROPOSED STORM SEWER

TYPICAL PHASE 2 GROUTED BOULDER DROP STRUCTURE

50 0 50 100 150 Feet
SCALE: 1" = 50'

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CHATEAU VALLEY

PHASE II DRAINAGE PLAN

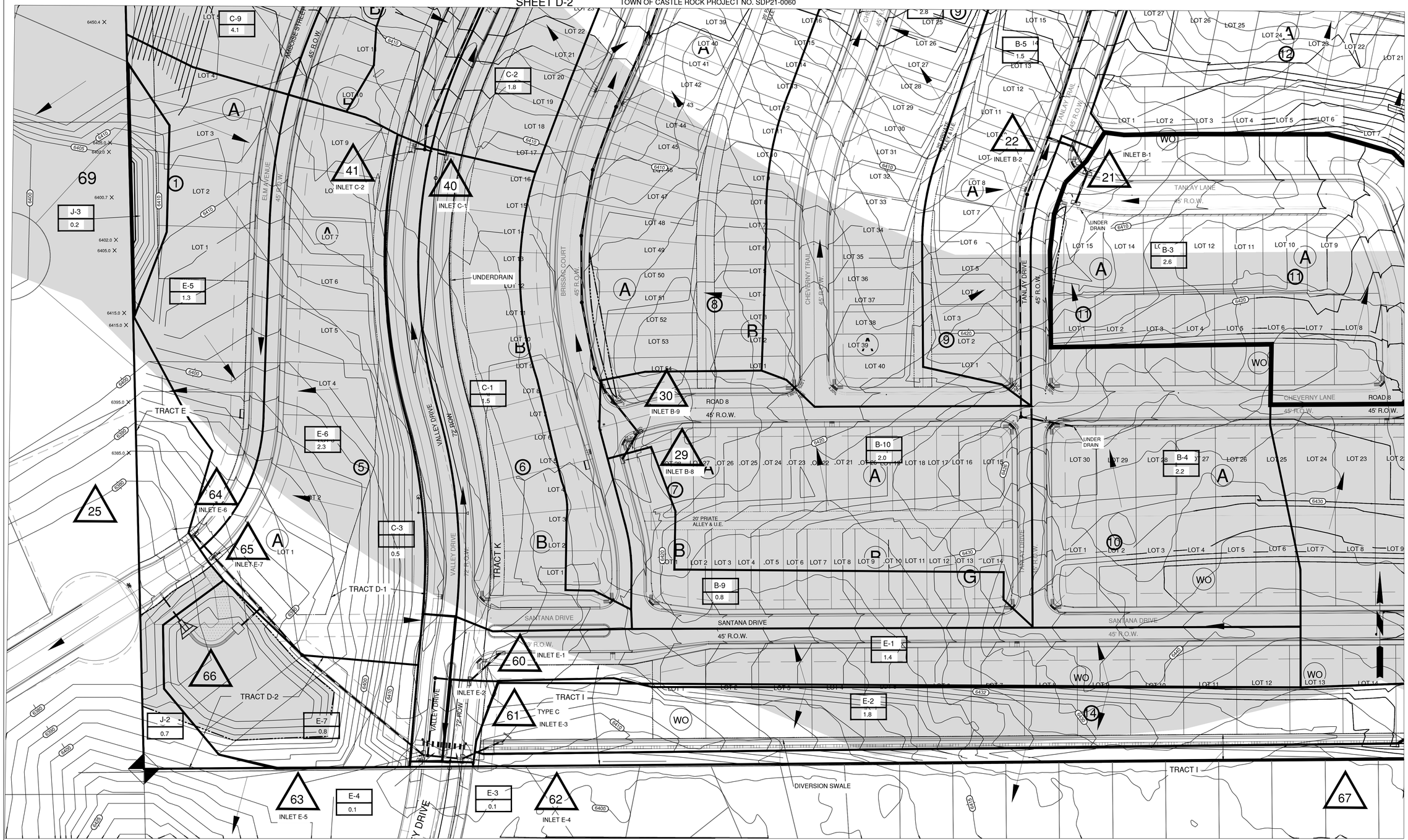
DATE: JAN 7, 2026
DWG NO: CHATEAU
SCALE
HORIZONTAL 1"=50' VERTICAL NONE

D-2

CHATEAU VALLEY
PHASE II DRAINAGE PLAN

A PARCEL OF LAND LOCATED IN THE SOUTH HALF OF SECTION 12,
TOWNSHIP 08 SOUTH, RANGE 67 WEST OF THE
6th PRINCIPAL MERIDIAN, TOWN OF CASTLEROCK, COUNTY OF DOUGLAS, STATE OF COLORADO.
TOWN OF CASTLE ROCK PROJECT NO. SDP21-0060

SHEET D-2



TRAIL LEGEND

- 8' SOFT PEDESTRIAN TRAIL
- 10' CONCRETE PEDESTRIAN WALK
- 15' MAINTENANCE GRAVEL ROAD
- TRACT BOUNDARY
- MINOR RIDGELINE

LEGEND

- PROPOSED CONTOURS (6725)
- PROPOSED CONTOURS (PHASE 2 CHANNEL) (6720)
- EXISTING 5' CONTOURS (6725)
- BASIN DESIGNATION (H-1 / 5.0)
- AREA (ACRES)
- DESIGN POINT (1)
- ONSITE BASIN BOUNDARY
- OFF-SITE BASIN BOUNDARY
- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED PHASE 1 100-YEAR FLOODPLAIN
- PROPOSED PHASE 2 100-YEAR FLOODPLAIN
- UNDERDRAIN
- PROPOSED STORM SEWER

TYPICAL PHASE 2 GROUTED BOULDER DROP STRUCTURE

50 0 50 100 150 Feet
SCALE: 1" = 50'

SHEET D-6

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CHATEAU VALLEY

PHASE II DRAINAGE PLAN

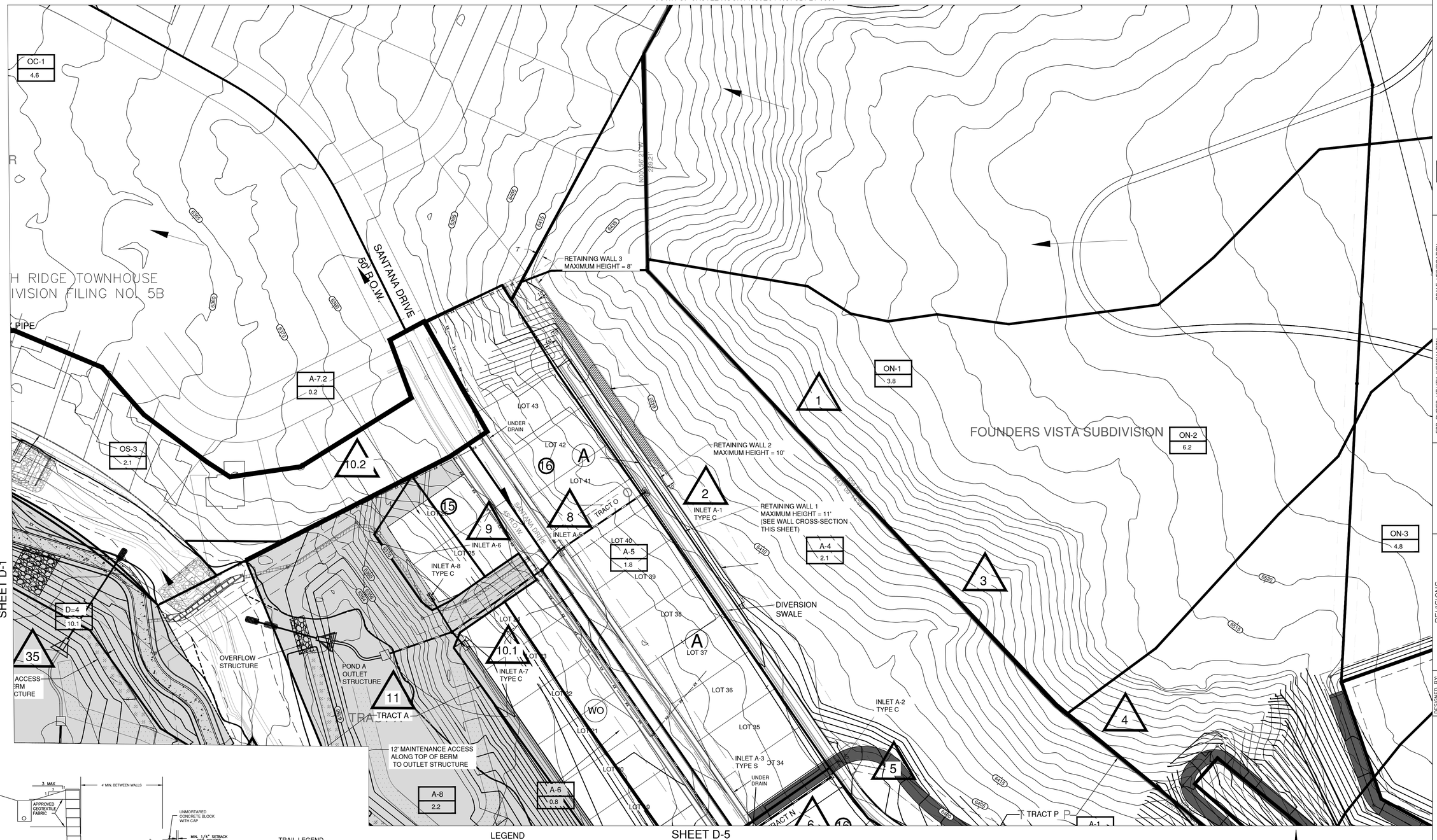
DATE: JAN 7, 2026
DWG NO: CHATEAU
SCALE
HORIZONTAL 1"=50' VERTICAL NONE

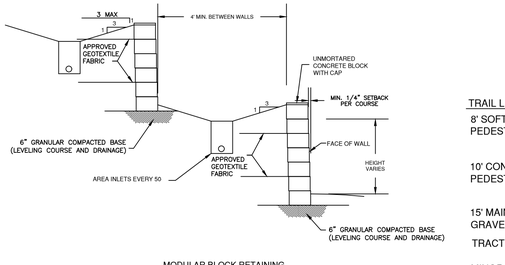
D-3

CHATEAU VALLEY

PHASE II DRAINAGE PLAN

A PARCEL OF LAND LOCATED IN THE SOUTH HALF OF SECTION 12,
TOWNSHIP 08 SOUTH, RANGE 67 WEST OF THE
6th PRINCIPAL MERIDIAN, TOWN OF CASTLEROCK, COUNTY OF DOUGLAS, STATE OF COLORADO.
TOWN OF CASTLE ROCK PROJECT NO. SDP21-0060





MODULAR BLOCK RETAINING
WALL CROSS SECTION
NOT TO SCALE

TRAIL LEGEND

- 8' SOFT PEDESTRIAN TRAIL
- 10' CONCRETE PEDESTRIAN WALK
- 15' MAINTENANCE GRAVEL ROAD
- TRACT BOUNDARY
- MINOR RIDGELINE

LEGEND

- PROPOSED CONTOURS (6770')
- PROPOSED CONTOURS (PHASE 2 CHANNEL) (6770')
- EXISTING 5' CONTOURS (6770')
- H-1 / 5.0 — BASIN DESIGNATION / AREA (ACRES)
- 1 — DESIGN POINT
- ONSITE BASIN BOUNDARY
- OFF-SITE BASIN BOUNDARY
- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED PHASE 1 100-YEAR FLOODPLAIN
- PROPOSED PHASE 2 100-YEAR FLOODPLAIN
- UNDERDRAIN
- PROPOSED STORM SEWER



TYPICAL PHASE 2
GROUTED BOULDER
DROP STRUCTURE

50 0 50 100 150 Feet
SCALE: 1" = 50'

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JASON R. HALL
26715
01/7/26
P.E. & P.L.S.

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APPROVED BY: RBH

CHATEAU VALLEY

PHASE II
DRAINAGE PLAN

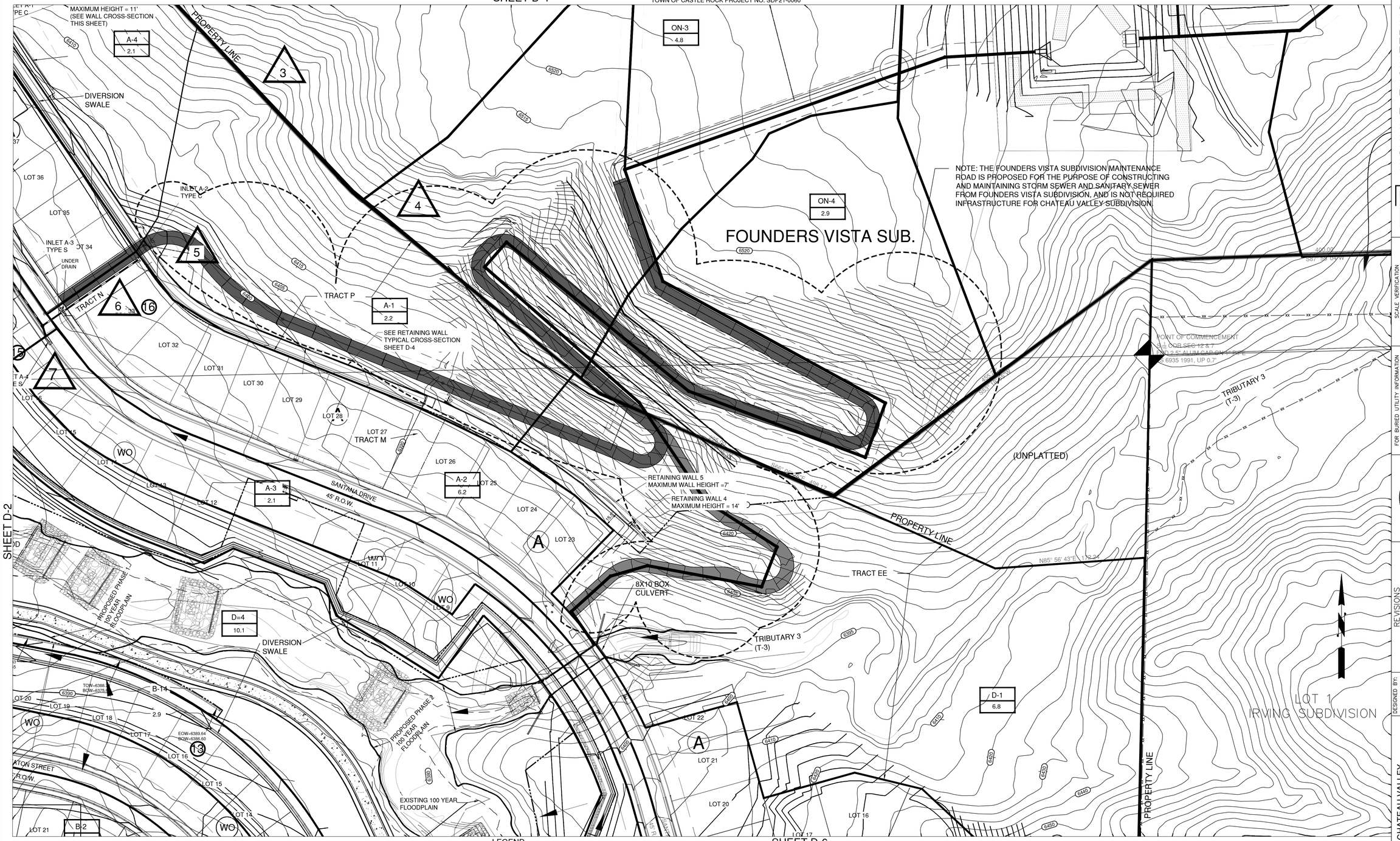
DATE: JAN 7, 2026
DWG NO: CHATEAU
SCALE
HORIZONTAL 1"=50'
VERTICAL NONE

D-4

CHATEAU VALLEY
PHASE II DRAINAGE PLAN

A PARCEL OF LAND LOCATED IN THE SOUTH HALF OF SECTION 12,
TOWNSHIP 08 SOUTH, RANGE 67 WEST OF THE
6th PRINCIPAL MERIDIAN, TOWN OF CASTLEROCK, COUNTY OF DOUGLAS, STATE OF COLORADO.
TOWN OF CASTLE ROCK PROJECT NO. SDP21-0060

SHEET D-4



TRAIL LEGEND

- 8' SOFT PEDESTRIAN TRAIL
- 10' CONCRETE PEDESTRIAN WALK
- 15' MAINTENANCE GRAVEL ROAD
- TRACT BOUNDARY
- MINOR RIDGELINE

LEGEND

- PROPOSED CONTOURS (6720)
- PROPOSED CONTOURS (PHASE 2 CHANNEL) (6720)
- EXISTING 5' CONTOURS (6720)
- BASIN DESIGNATION: H-1 / 5.0 (AREA (ACRES))
- 1 DESIGN POINT
- ONSITE BASIN BOUNDARY
- OFF-SITE BASIN BOUNDARY
- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED PHASE 1 100-YEAR FLOODPLAIN
- PROPOSED PHASE 2 100-YEAR FLOODPLAIN
- UNDERDRAIN
- PROPOSED STORM SEWER

TYPICAL PHASE 2 GROUTED BOULDER DROP STRUCTURE

50 0 50 100 150 Feet
SCALE: 1" = 50'

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26715
01/7/26
P.E. & P.L.S.

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DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
RBH	DLC	JRH	RBH

CHATEAU VALLEY

PHASE II
DRAINAGE PLAN

DATE: JAN 7, 2026
DWG NO: CHATEAU
SCALE
HORIZONTAL 1"=50' VERTICAL NONE

D-5

CHATEAU VALLEY

PHASE II DRAINAGE PLAN

A PARCEL OF LAND LOCATED IN THE SOUTH HALF OF SECTION 12,
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6th PRINCIPAL MERIDIAN, TOWN OF CASTLEROCK, COUNTY OF DOUGLAS, STATE OF COLORADO.
TOWN OF CASTLE ROCK PROJECT NO. SDP21-0060

SHEET D-5

SHEET D-3



TRAIL LEGEND

- 8' SOFT PEDESTRIAN TRAIL
- 10' CONCRETE PEDESTRIAN WALK
- 15' MAINTENANCE GRAVEL ROAD
- TRACT BOUNDARY
- MINOR RIDGELINE

LEGEND

- PROPOSED CONTOURS (6720)
- PROPOSED CONTOURS (PHASE 2 CHANNEL) (6720)
- EXISTING 5' CONTOURS (6720)
- BASIN DESIGNATION: H-1 / 5.0 (AREA (ACRES))
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- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED PHASE 1 100-YEAR FLOODPLAIN
- PROPOSED PHASE 2 100-YEAR FLOODPLAIN
- UNDERDRAIN
- PROPOSED STORM SEWER

TYPICAL PHASE 2 GROUTED BOULDER DROP STRUCTURE

50 0 50 100 150 Feet
SCALE: 1" = 50'

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26715
01/7/26
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DRAWN BY: DLC
CHECKED BY: JRH
APPROVED BY: RBH

CHATEAU VALLEY
PHASE II DRAINAGE PLAN

DATE: JAN 7, 2026
DWG NO: CHATEAU
SCALE
HORIZONTAL 1"=50'
VERTICAL NONE

D-6