

Wellspring Community Filing No.1

DOUGLAS COUNTY, COLORADO

PREPARED FOR

OWNER/DEVELOPER:
Wellspring Community
826 Park Street, Suite 200
Castle Rock, CO 80109

APPLICANT:
Matrix Design Group, Inc.
2435 Research Parkway, Suite 300.
Colorado Springs, CO 80920

Phase I Drainage Study

October 2026

PREPARED BY:

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Castle Rock Water
175 Kellogg Court
Castle Rock, CO 80109
720-733-6000

Phase I Drainage Report Checklist

The Phase I Drainage Report must be in conformance with the latest Town of Castle Rock Storm Drainage Design and Technical Criteria Manual available on the Town's website.

The Phase I Drainage Report must be signed and sealed by a Professional Engineer licensed in the State of Colorado. The purpose of the Phase I Drainage Report is to describe, at a conceptual level, the feasibility and design characteristics of stormwater management facilities within the proposed development.

The preparer should contact and work with the Town Stormwater Engineering Staff regarding any design, master planning and existing system questions (720-733-6000). The following outline sets forth the **required minimum** content to be provided in the Phase I Drainage Report that shall be submitted with the Planned Development Plan or Straight Zoning documents. A copy of this checklist must be submitted with the Phase I Drainage Report.

Please see Chapter 4 of the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual for additional details and information. Please check off the following items to assure your report is complete. Appropriate notations shall be provided with the checklist. For example, if a specific item is not addressed or not applicable, an explanation needs to be provided.

Included	N/A	
X		**I. COVER SHEET**
X		A. Name of Project, including legal name of development
X		B. Address
X		C. Owner
X		D. Developer
X		E. Engineer
X		F. Submittal date and revision dates as applicable
X		**II. GENERAL LOCATION AND DESCRIPTION**
X		A. Site Location
X		B. Description of Property and Land Use
X		**III. DRAINAGE BASIN AND SUB-BASINS**
X		A. Major Drainage Basins
X		B. Minor Drainage Basins
X		**IV. EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES**
X		A. Existing Stormwater Conveyance Facilities
X		B. Existing Stormwater Storage Facilities
X		**V. PROPOSED STORMWAER CONVEYANCE OR STORAGE FACILITIES**
X		A. Proposed Stormwater Conveyance Facilities
X		B. Proposed Stormwater Storage Facilities

Phase I Drainage Report Checklist

Included	N/A	
X		**VI. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES**
X		A. Non-structural Best Management Practices
X		B. Structural Best Management Practices
X		**VII. FLOODPLAIN MODIFICATIONS**
	N/A	A. Major Drainageway—Undesignated Floodplain
X		B. Major Drainageway—Designated Floodplain
X		**VIII. POTENTIAL PERMITTING REQUIREMENTS**
X		**IX. REFERENCES**
X		**X. APPENDICES**
X		**OVERALL DRAINAGE PLAN (IN POCKET)**
	N/A	**DETAILED DRAINAGE PLANS (IN POCKET)**

Notes/Comments:

ENGINEER'S STATEMENT:

The enclosed drainage report, and exhibits, were prepared by me, or under my direct supervision, and are correct to the best of my knowledge and belief. Said drainage report has been prepared in accordance with applicable Town of Castle Rock criteria and is in conformance with the master plan of drainage for the effected area. I accept responsibility for any liability causes by negligent acts, errors or omissions on my part in preparing this report.



Virgil A. Sanchez, P.E.
Colorado Registered Professional Engineer No. 37160
For and On behalf of M&S Civil Consultants

OWNER/ DEVELOPER'S STATEMENT:

As Owner/Developer of land(s) identified within this report; I agree to proceed, implement and comply with all recommendations and requirements outlined herein.

Owner Name and Signature

TOWN OF CASTLE ROCK APPROVALS:

ENGINEERING DIVISION _____ DATE _____

PUBLIC WORKS DIRECTOR _____ DATE _____

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WELLSPRING COMMUNITY FILING NO.1
DOUGLAS COUNTY, COLORADO
PHASE I DRAINAGE STUDY

GENERAL LOCATION AND DESCRIPTION

Site Location

Wellspring Community Filing No.1 is located in portions of in the southwest 1/4 of Section 3, of Township 8 South, Range 67 West of the Sixth Principal Meridian, Douglas County, Colorado (Figure 1). The site is bounded to the north by Wolfensberger Road, to the south and west by Castle Highlands Filing No. 2 (Tract D & F) and the Omni Channel. The site is bound to the east by a Tract C of Highlands Filing No 2. Immediately adjacent to Tract C is the Epiphany Evangelical Lutheran Church of Castle Rock. This proposed development is requesting a rezone and annexation into the Town of Castle Rock.

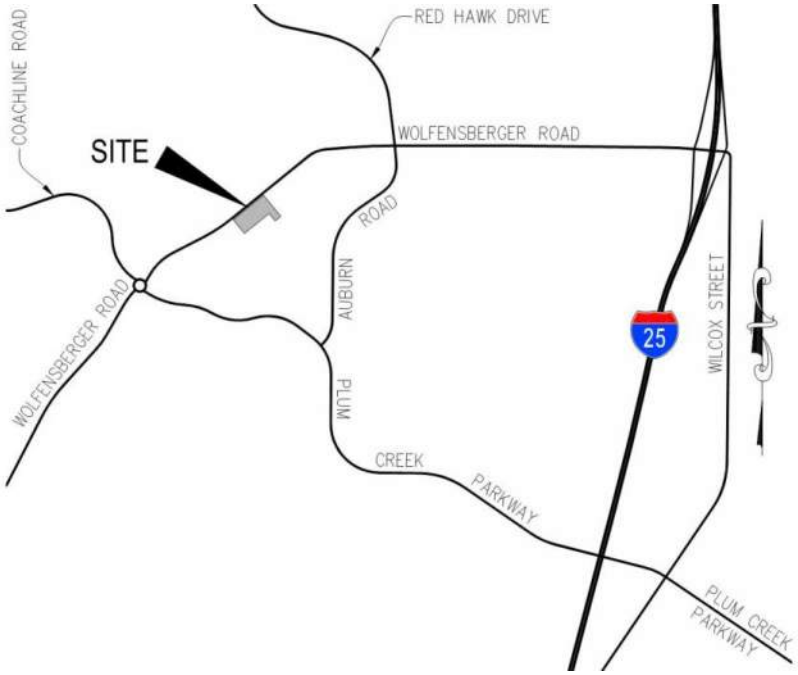


Figure 1. - Vicinity Map

Description of Property

Wellspring Community Filing No.1 consists of 2.702 acres, which are currently zoned as "A1 (DC)" in Douglas County. In existing conditions, the property consists of the three rectangular fenced pieces of ground that occupy two parcels. The remains of two concrete residential foundations, a circular dirt driveway, and portions of fencing are present. Two water wells, an electric transformer and a few power poles also occupy the property. Vegetation consists of native

grasses with a few scattered trees. The site is bisected by a ridge line just the north of the southern boundary. The northern portion of the site slopes to the northeasterly direction at moderate slopes ranging from 2% to 10%. The remainder of the lot slopes to the southeast toward the embankment edges of the Omni Channel also at moderate slopes ranging from 2% to 10%.

A large online sub-regional detention pond and a portion of the aforementioned Omni Channel were constructed with Castle Highlands Filing No.2 and are located offsite immediately south of the subject site. The offsite pond and channel are book-ended by an existing grouted boulder rundown and a pond outlet structure/spillway, which somewhat align with the west and east property lines.

Per the Natural Resources Conservation Service Web Soil Survey, the property contains Bresser-Truckton sandy loams, 5-25 percent slopes (Bte) and Loamy alluvial land (Lo), soils. They possess a Hydrologic Soil Group Type of "B" and "C" respectively. Type "B" soils are described to having moderately low runoff potential when thoroughly wet and have a moderate rate of water transmission. Type "C" soils are described to having a slow infiltration rate when thoroughly wet and a very slow rate of water transmission. A copy of the onsite soils is provided in the appendix.

There are no irrigation canals or geological features on the site

The proposed site will be rezoned to "R-2". The development will include all necessary infrastructures, inclusive to wet and dry utilities, parking drive isles, and storm drainage and drainage control facilities. An extended detention facility (EDB-1) will be located within a proposed Tract. At this time, a site plan has not been generated; therefore, additional engineering measurements will need to be taken at the time of final design. This Drainage Report is meant to accompany the rezoning application for this property. The proposed storm sewer system, full-spectrum detention basin, and associated public improvements are preliminary in nature at the time of this submittal.

DRAINAGE BASINS AND SUB-BASINS

Major Drainage Basins

Wellspring Community Filing No.1 is located within the Omni drainage basin. Plum Creek is located approximately one mile downstream of this site. According to the FEMA Flood Insurance Rate Map 08035C0169G, effective on March 16, 2016, the site lays within a Shaded Zone X flood area. Shaded Zone X (other flood areas) - Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depth of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. The USDA NRCS Soil Conservation Service classifies the on-site soils as Hydrologic Group B and C.

Minor Drainage Basins

The site is bisected by a ridge line just to the north of the southern boundary. Approximately 3/4 of the site (northern portion) slopes to the northeasterly direction at moderate slopes ranging from 2% to 10% where it outfalls to an existing roadway ditch that runs along the south side of Wolfensberger Road. The remaining 1/4 of the lot slopes to the southeast. This area is routed to the existing Omni channel. The channel continues easterly in direction for approximately thirteen hundred feet where it ties into a tributary of East Plum Creek.

Pre-Project:

Basin A is approximately 1.87 acres and includes portion of the existing site and the south half of Wolfensberger Road. The runoff from this basin typically drains as sheet flow toward the northeast corner of the property (Design Point 1). The collected runoff continues east along the south side of Wolfensberger Road.

Basin B is approximately 0.80 acres in size. The runoff from the basin sheet flows to the embankment of the Omni Channel along the southern property line.

Basin C is approximately 0.56 acres in size. The runoff from this basin sheet flows to the southeastern corner of the site. The collected runoff is conveyed within a shallow offsite swale (Tract G Castle Highlands Filing 2) to hardened spillway improvements that are located within the Omni Channel.

Post-Project:

Basin A is approximately 0.83 acres and includes portions of eastern half of existing Wolfensberger Right-of-Way, a portion of the proposed northwest entrance, and proposed landscaping. This basin is tributary to a proposed private CDOT Type C Inlet located at Design Point 1 (DP1). Runoff reduction may be achieved within this basin as development drainage can be discharged to the pervious swale that resides up-gradient from the sump inlet. Flows from the inlet are conveyed under the proposed drive to the existing drainage swale along the south side of Wolfensberger Road.

Basin B is approximately 0.72 acres and includes portions of the proposed single-family residential development and associated landscaping. This basin is tributary to a proposed private 6' Denver No. 16 Combination sump inlet (at DP2) that will discharge to EDB-1 by a proposed private storm drain.

Basin C is approximately 1.17 acres and includes portions of the proposed west access/entrance, landscaping as well as portions of the proposed single-family residential development. This

basin is tributary to a proposed private 9' Denver No. 16 Combination sump inlet (at DP3) that will discharge directly to EDB-1 by a proposed private storm drain.

Basin D is approximately 0.18 acres and encompasses the proposed full spectrum detention pond. The total runoff collected by the private storm sewer system and the runoff in Basin D combine at EDB-1/Design Point 4.

Basin E is approximately 0.13 acres and includes a portion of the pervious embankment located adjacent to the EDB. Runoff from the basin will be discharged to the existing embankment slope as sheet flow. When combined with the discharge from the EDB the total runoff directed to the Omni channel is less than in the historic condition. (Existing Condition DP4 Q5 = 0.57 cfs, Q100 = 4.55 cfs, Proposed Condition DP5 + DP6 Q5 = 0.18 cfs, Q100 = 3.39 cfs)

Basin F is approximately 0.18 acres and includes a portion of the eastern half of existing Wolfensberger Right-of-Way and a portion of the proposed northeast entrance roadway. Runoff from the basin will be discharged to the existing roadside ditch. Runoff directed to this location is comparable to the historic condition. (Existing Condition DP1 Q5 = 0.98 cfs, Q100 = 5.91 cfs, Proposed Condition DP7 Q5 = 1.10 cfs, Q100 = 4.13 cfs)

The uncaptured runoff at DP7 is routed from predominantly off-site Right-of-Way dedicated to the City of Castle Rock. This area is anticipated to be used in a future development to widen the existing Wolfensberger Rd, and the peak flow and total runoff volume discharged to the northeast of the site is reduced as a result of this development. Additionally, multiple existing land characteristics present challenges with routing the runoff from Basin A and Basin F to the proposed FSD pond including the elevation of the existing Wolfensberger Rd at the tie-in location, the locally regulated 100-year floodplain adjacent to the proposed FSD pond (which also affects the design of the proposed FSD pond), and the proximity to the adjacent property (which creates grading constraints on the proposed entrance road).

Drainage Design Criteria

Regulations

This report was prepared to meet the regulatory requirements of the Town of Castle Rock, Colorado as this project is being annexed. This report was prepared following guidelines and regulations of the Town of Castle Rock, Colorado Storm Drainage Design and Technical Criteria and the "Urban Storm Drainage Criteria Manuals Volumes 1-3", (USDCM, Updated March 2024).

Drainage Studies, Outfall Systems Plans and Site Constraints

The following paragraphs discuss previous drainage studies, outfall system plans and known site constraints that were discovered prior to the writing of this report.

The construction of the adjacent Omni channel and Pond A sub-regional detention pond were addressed in an approved Phase III drainage report by JR Engineering titled "Castle Highlands Preliminary Drainage Study" (September 1, 1994) and in subsequent construction plans titled "Public Improvement Construction Plans Castle Highlands Filing No. 2," (Revised July 12, 2000.)

Per the report; *"The net release rate from "Pond A" is 59.9 cfs for the 10-year event and 499.1 for the 100-year event which is below historic rates. The release structure is a three-stage structure consisting of a water quality riser, 10-year orifice and a 100-year weir with one-foot of freeboard. The required water quality volume is 48,000 cubic feet (CF) and the pond provides 51,700 CF of water quality storage. The water quality riser was designed to drain this volume over a 40 hour time period. The 10-year required storage volume is 104,100 CF and the pond provides 108,900 CF of storage. The outlet structure utilizes a 36" RCP. The pipe opening does not require an orifice plate since the calculated orifice diameter was 36". The 100-year required volume is 442,950 CF per the CUHP runs performed with the preliminary drainage study. The pond provides 447,600 CF of storage at an elevation of 6292.4. The 100-year release is accommodated by the 36" RCP conveying 110 cfs and 389.1 cfs flowing through the weir at a depth of 1.7'. The top of weir elevation is 6290.7 and the top of berm elevation is 6294.0, which provides 1.6' of freeboard. A drop structure has been designed on the back side of this weir to reduce channel velocity to acceptable levels before resuming the natural stream configuration."*

Omni, Industrial, and Westfield Watershed Master Plan Conceptual Preliminary Design (OIWWMPCPD), by CH2MHill studied the existing Omni Channel and online pond located immediately to the south of the Wellspring Community site. Based upon the plan and profile exhibits provided, with the report; the subject site bounds a portion of reach 3-4, Reach 3-4 extends from Station 70+25 to Station 55+35, and the west property line lies at about ~ Station 61+00, while the east boundary coincides approximately with Station 56+10.

The flow rates for the channel listed on the plan and profile page for the reach are as follows, Q10=268 cfs, Q50 = 667.48 cfs, and Q100 = 755.59 cfs.

"Station 73+00 is just downstream of Plum Creek Parkway/Coachline Road and Station 45+00 is just upstream of East Wolfensberger Road. From Station 73+00 to approximate (sic) Station 60+00 there is a concrete lined low flow channel with three grouted riprap drops that lead to a detention pond with a water quality outfall structure. The side slopes of the concrete lined low flow channel are grass lined with an approximate slope of 4:1 (H:V). The detention pond is designed to detain and treat on-site 100-year flows for water quality and bypass the historic 100-year flows through an overflow weir outfall. The designed 100-year release rate from the pond is approximately 500 cfs. The pond is lined with short native grasses and sand bar willow and the wetland species Juncus balticus are seen in patches throughout the detention pond. Just

upstream of the grouted riprap drop at the inlet of the pond is a section of the channel that is lined with willow trees and other wetland species. Downstream of the detention pond spillway the channel is severely eroded with near vertical banks and little channel vegetation. Further downstream are areas of heavy sediment deposition most likely caused by erosion in this reach."

Commentary Sheet 4 of the report recommends the repair of an existing grouted riprap rundown at Station 60+50 (?) and estimates the cost of repair at $50,000, the assumed cost breakdown has been assigned to Castle Rock Utilities.

Within the plan view of the plan and profile sheet (sheet 4) it lists expanding the water quality detention facility by 10 acre-feet (Priority 2). This item does not show up on the executive statement summary or within the cost estimate. It could be an alternative solution to raising the downstream bed (below the site) but it is unclear.

M&S obtained Right of Way plans for the widening of Wolfensberger Road by Jacobs. Based upon the information provided, the roadway appears to possess curb and gutter and will likely reduce the quantity of runoff that reaches the site. Additional coordination with Jacobs/Town of Castle Rock is anticipated prior to development of a Phase II drainage report.

Based upon the current drainage plan for the site, runoff generated within the proposed site can be detained and treated for water quality by a proposed full spectrum detention facility. The site grading was constrained by existing grades of surrounding improvements adjacent to the site.

Hydrologic Criteria

The Rational Method analysis, utilizing the Intensity-Duration-Frequency curves established for the Town of Castle Rock was used to determine the on-site runoff generated for the 5-year (minor), and 100-year (major) storm events. Runoff coefficients were based on the type of proposed development outlined in the MHFD manual. Runoff coefficients used in the analysis were weighted according to the existing and proposed land uses in each basin or sub-basin and the time of concentration values have been calculated for each of the basins or sub-basins per the Town of Castle Rock criteria. Hydrologic calculations can be found in Appendix B.

Hydraulic Criteria

Open channel flow calculations utilized Manning's equation. Storm sewer capacities, hydraulic grades and energy grades were also calculated using Manning's equation. Pond release rates were calculated the UDFCD Detention Basin Design Workbook spreadsheet (MHDF-Detention Version 4.06).

EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES

Existing Stormwater Conveyance Facilities

A portion of the existing site drained to an offsite roadside ditch located adjacent to Wolfensberger Drive. No formal stormwater improvements exist onsite.

Existing Stormwater Storage Facilities

No stormwater storage facilities currently exist onsite. An existing water quality/detention pond is located to the south of the property which resides within the Omni Channel. The channel and the pond were constructed as a portion of the Castle Highlands Filing No. 2 development.

PROPOSED STORMWATER CONVEYANCE OR STORAGE FACILITIES

Proposed Stormwater Conveyance Facilities

General Concept:

The project shall be designed to convey runoff from the proposed site in accordance with the Town of Castle Rock, Colorado Storm Drainage Design and Technical Criteria manual. Areas from the property that historically discharged to public right of way have been reduced thereby reducing the stormwater runoff to public infrastructure. One extended detention basin is proposed to reduce peak flows to pre-project conditions and to satisfy water quality treatment. Inlets have been preliminarily sized to collect runoff from the major storm event. The storm sewer systems have been preliminarily designed using Manning's equation for the major storm event, to evaluate the general hydraulic capacity. The proposed storm systems drain to detention basin (EDB-1) where the flow is detained and released at allowable rates to the existing Omni channel located south of the subject site. The construction of EDB-1 will encroach into the Shaded Zone X floodplain.

Street Capacity and Inlets:

CDOT Type C and Denver No. 16 Combination inlets along the proposed streets and parking areas have been preliminarily designed utilizing the UDFCD Street and Inlet Hydraulics spreadsheet (UD-Inlet Version 6.00) Type C inlets have been designed utilizing the weir equation and assuming 50% clogging to account for the grate and debris build up. The inlet calculations include the interception rates for both the minor and major storm events. Output from the UD-Inlet spreadsheet is included in Appendix B.

Storm Sewer System:

The proposed storm drain system shall be designed in accordance with Chapter 9 of the Town of Castle Rock, Colorado Storm Drainage Design and Technical Criteria manual. The storm sewer systems have been preliminarily designed using Manning's equation for the major storm event, to evaluate the general hydraulic capacity. Upon development of the Phase III drainage report, Hydraflow Storm Sewers Extension for Autodesk Civil 3D shall be utilized in calculating the Hydraulic Grade line analysis.

Riprap:

Riprap at pipe outlets have been preliminarily designed per USDCM Volume 2, Chapter 9, Section 3. The detention basin emergency spillways have been preliminarily designed using the Steep Slope Riprap Design Figure 5.5 and UDFCD Volume 2, Chapter 12, Section 5. Calculations for the proposed riprap pads and emergency spillways are included in the Appendix.

Proposed Stormwater Storage Facilities

The project proposes one (1) detention basin, EDB-1. The detention basin has been designed using 4:1 side slopes and requires retaining walls to 1) provide a facility and 2) ensure minimum parking stall count is accommodated. A micropool is provided at the bottom. Per Town of Castle Rock, Colorado Storm Drainage Design and Technical Criteria manual, one (1) foot of freeboard is provided. The emergency spillway for the proposed detention basins has been designed to convey the post-project un-detained 100-year runoff while maintaining the minimum freeboard.

The Town of Castle Rock requires that the 100-year volume provided for full spectrum detention facilities are equal to the 100-year detention volume calculated using the UDFCD simplified equation plus 0.5 times the Water Quality Capture Volume, making the total required detention volume 0.240 acre-feet. EDB-1 provides 0.448 acre-feet of storage at the invert of the emergency spillway. The post-project flow rates for the 100-year storm event will be detained back to the predevelopment peak flow rates.

The tributary area for EDB-1 is 2.07 acres. Detention basins were designed utilizing the UDFCD Detention Basin Design Workbook spreadsheet (MHDF-Detention Version 4.06) for all return periods to mitigate for the additional impervious area in the proposed condition. Please refer to Appendix B for supporting detention calculations. The detention basin was designed to provide detention for all of its respective tributary areas, with exception of peripheral Basins A, E and F, which total is 1.14 acres in size and is predominantly comprised of off-site area. The total runoff leaving the subject post development is less than 90% of predevelopment rates. The design maximum allowable release rate for these detention basins will match the overall pre-project development flow rate for the 100-year storm, as stipulated by Town of Castle Rock, Colorado Storm Drainage Design and Technical Criteria manual.

The following table presents a summary of the drainage conditions for the proposed FSD pond EDB-1 all values provided are from the MHFD worksheet. Elevation Top of Micropool = 6291.00.

FSD EDB-1 (MHFD-Det.Ver.4.06)	WQCV	EURV	5 Year	100 Year
Maximum Volume Stored (acre-ft) (prov'd)	0.042	0.130	0.152	0.217
Maximum WS Elevation (ft)	6292.00	6293.31	6293.56	6294.23
Peak Inflow (cfs)	N/A	N/A	2.9	6.6
Pre-development Peak (cfs)	N/A	N/A	0.7	3.0
Peak Outflow (cfs)	0.0	0.1	0.1	2.9

A proposed emergency overflow structure should be sized for EDB-1 to convey the un-detained Q_{100} safely through the proposed outfall pipes without flooding or impacting the adjacent roads or pads. The pipe outlet into the extended detention basin should be designed per Chapter 8 and Chapter 9 of the UDFCD's Urban Storm Drainage Criteria Manual (USDCM). The Emergency overflow spillway riprap has been preliminarily designed per Chapter 12 of the USDCM. Maintenance of these planned detention basins will be facilitated via the future maintenance district.

It should be noted as currently designed the micro-pool elevation (6291.0) falls below the 100 year elevation reported within the channel (92.4). As such the outfall hydraulic constraints for the onsite pond are anticipated to be set based upon 5-10 year event within the channel.

WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) for the project are implemented using a four-step process as defined in Chapter 14 of the Town of Castle Rock Drainage Criteria Manual as follows:

Step 1: Reduce runoff volume to the maximum extent practicable.
Step 2: Provide WQCV and flood control detention via full-spectrum detention.
Step 3: Utilize stream channel stabilization techniques.
Step 4: Undertake source control.

Non-Structural Best Management Practices (BMPs) focus on preserving open space, protecting natural systems and incorporating existing landscape into the site plan to manage stormwater at its source. Non-structural BMPs are to be incorporated into the site plan by the inclusion parkways fronting the roadway that surrounds the property.

The development minimizes impervious areas where applicable and incorporates preventative maintenance measures during construction to minimize storm water contamination. Structural BMPs are incorporated to improve water quality and runoff leaving the site. Structural BMPs include ditches and EDB with low flow channels, micropools, forebays and outlet control systems to control sediment in the stormwater and attenuate the peak flows. A single (1) EDB is proposed as part of the project.

FLOODPLAIN MODIFICATIONS

Major Drainageway – Designated Floodplain

Per the Town of Castle Rock Drainage Criteria Manual, a Floodplain Modification Study is required when development or other activities are proposed that require modification of, or construction in, the existing floodplain, the FEMA Special Flood Hazard Area, or when proposals involve use of property within the floodplain limits.

Based upon the included FEMA FIRM maps, a portion of the site lies within Shaded Zone X (other flood areas) which includes areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depth of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. The Town of Castle Rock recognizes this area as a locally regulated 100-year floodplain.

Based upon the proposed drainage plan, stormwater improvements and grading associated with the construction of the proposed full spectrum detention pond and the associated outlet works would occur within the adjacent, locally regulated 100-year floodplain. This project will require a Floodplain Development Permit and a potential Floodplain Modification Study with the Town of Castle Rock. FEMA approval will not be required. Refer to The Omni, Industrial, and Westfield Watershed Masterplan Conceptual Preliminary Design Report for more information on the locally regulate floodplain.

ALTERNATIVE DRAINAGE PLAN

An alternative drainage plan to discuss with the Town of Castle Rock is the acceptance of discharge from the site to the existing Castle Highlands Filing No. 2 'Pond A' located within the adjacent Omni Channel.

In this concept, the runoff collect onsite would be conveyed un-detained (or partially detained) onsite via storm sewer to 'Pond A' located within the Omni Channel.

Based upon the OIWWMPCPD, the adjacent channel releases ~500 cfs at or near the point of planned discharge from the subject site. Runoff produced onsite and directed to the Omni

Channel has been estimated at ~15.1 cfs (Direct Addition of Design Point 5 & Basin G) in the proposed condition and ~4.2 cfs in the existing condition. The differential flow would result in a maximum 2.0% increase in peak flows estimated to leave the pond (510.9/500), without accounting for the effects of detention or consideration for the offset in the local and offsite hydrographs.

Based upon the JR study, the required *water quality volume is 48,000 cubic feet (CF) and the pond provides 51,700 CF of water quality storage.* This 3,170 CF of excess WQ volume meets or exceeds the required 0.067 acre-feet or 2918.52 CF (un-routed) required by the MHFD spreadsheet.

Additional engineering will be required to bring the existing 'Pond A' infrastructure into compliance with the current standards for Full-Spectrum Detention.

POTENTIAL PERMITTING REQUIREMENTS

A Grading, Erosion and Sediment Control (GESC) Permit · Colorado Department of Public Health & Environment – General Permit for Stormwater Discharges Associated with Construction Activity (NPDES) will be required prior to construction. Additionally, this project will require a Floodplain Development Permit and a potential Floodplain Modification Study with the Town of Castle Rock. FEMA approval will not be required.

CONCLUSIONS

The storm water conveyance system for Wellspring Community Filing No.1 includes a curb and gutter, storm sewer network, and full spectrum detention facility. Water quality and detention will be provided located on the southeast corner of the site. Preliminary design calculations for the storm sewer, detention ponds and channel improvements are provided in Appendix B.

Preliminary design calculations show the level of protection provided for the minor and major storm events. Considerations for the future improvements to Wolfensberger Road have been evaluated and determined that this proposed project does not encumber those planned improvements. The annexation and development of the subject site will not negatively affect water quality or downstream properties or facilities.

This Phase I Drainage Report meets criteria set forth by the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual, February 2025 and the Urban Storm Drainage Criteria Manual (USDCM) – Urban Drainage and Flood Control District (UDFCD), Revised March 2024.

Drainage Concept:

Wellspring Community Filing No.1 development can provide full conveyance of stormwater flow from the project site during the minor and major storm events. All stormwater flow from the project site can be treated for water quality and full-spectrum detention can be provided. The improvements associated with this project are not anticipated to have a negative impact on water quality or to any downstream facilities or property.

REFERENCES

1. Town of Castle Rock Drainage Design and Technical Criteria Manual, February 2025.

2. Urban Storm Drainage Criteria Manuals Volume 1-3, Urban Drainage and Flood Control District, Rev. March 2024.

3. USDA NRCS Soil Conservation Service, Web Soil Survey.

4. Wolfensberger Widening Project, 30% Street Improvement Plans – stamped "Preliminary Not for Construction" – Jacobs, No date provided.

5. Omni, Industrial, and Westfield Watershed Masterplan, Conceptual Preliminary Design Report, Omni Tributary, CH2MHill, Plot Date 11/8/2010

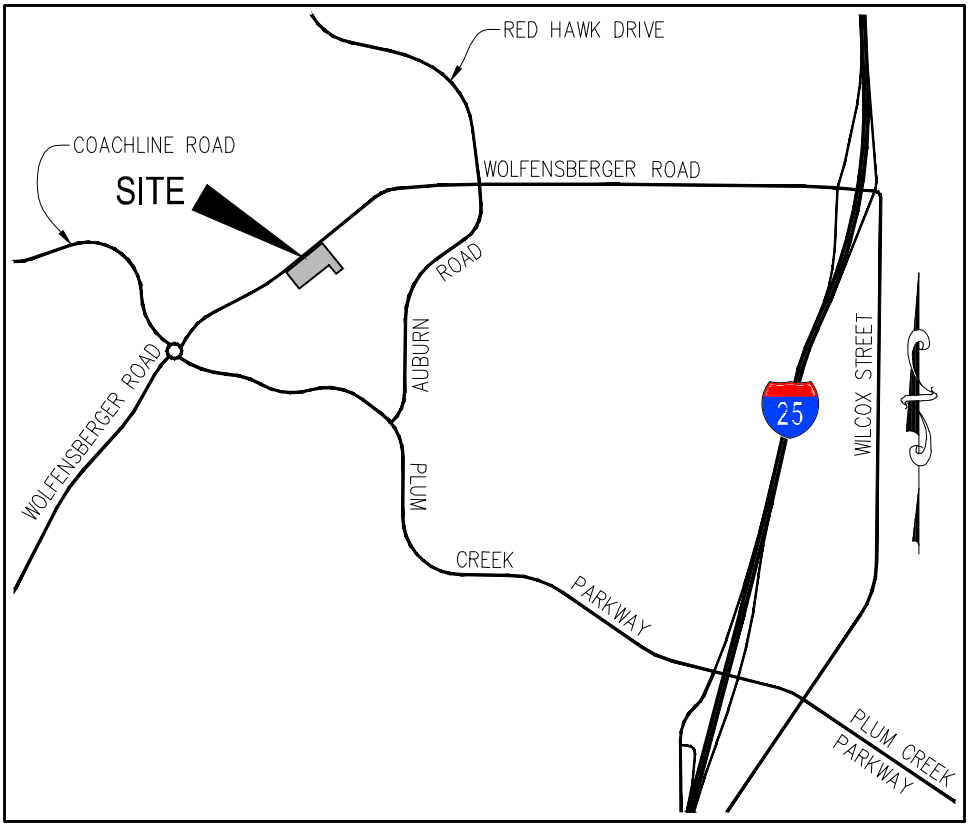
6. Conceptual Preliminary Design Report, Omni Tributary,
   Plan and Profile Sta 73+00 to Sta 45+00, CH2MHill, Plot Date 11/8/2010

7. Castle Highlands Filing No. 2 Phase III Drainage Study, JR Engineering,
   Plot date August 23, 1999

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APPENDIX

VICINITY MAP



VICINITY MAP

N.T.S.

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

SOILS MAP



HYDROLOGIC TYPE B SOILS

HYDROLOGIC TYPE C SOILS

WATERSHED BOUNDARY

SITE BOUNDARY

1" = 100'

0 50 100 200

Scale in Feet

Summary by Map Unit — Castle Rock Area, Colorado (CO622)

Summary by Map Unit — Castle Rock Area, Colorado (CO622)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	1.1	33.9%
Lo	Loamy alluvial land	C	2.1	66.1%

WELLSPRING FILING NO. 1 SOILS MAP

CIVIL CONSULTANTS, INC.

212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

O:\43146A-Wolfensberger\Landhuis-Castle Rock\Dwg\Eng Exhibits\43146-Soils Map.dwg 10/3/2023 12:56 PM

FIRM PANELS



PIN
- Approximate location based on user input and does not represent an authoritative property location

MAP PANELS
- Selected FloodMap Boundary
- Digital Data Available
- No Digital Data Available
- Unmapped

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D
- Otherwise Protected Area
- Coastal Barrier Resource System Area

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth
- Regulatory Floodway Zone AE, AO, AH, VE, AR

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 Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

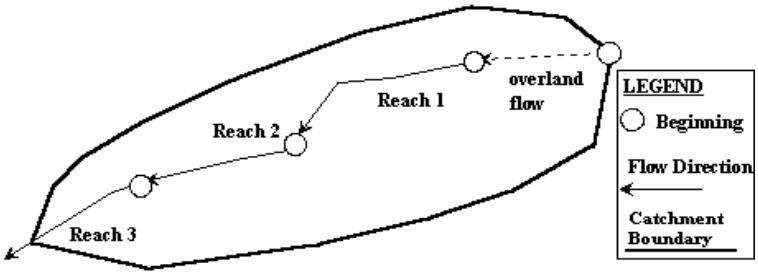
GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

HYDROLOGIC CALCULATIONS

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
A	5.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
Ab	100.00	6318.00	6311.00	0.070
Total Overland Length (ft)	100.00		Length-Weighted Slope (ft/ft)	0.070

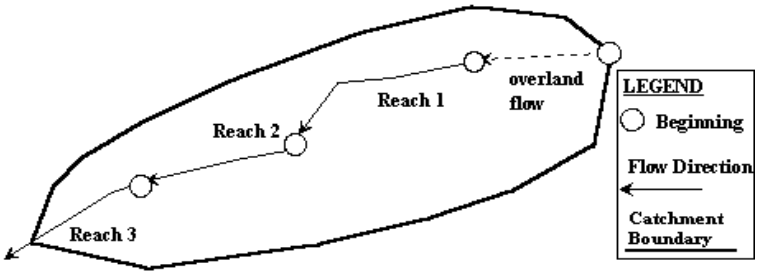
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
Ac	417.50	6311.00	6293.00	0.043
Ab	76.40	6293.00	6292.00	0.013
Total Channelized Length (ft)	493.90		Length-Weighted Slope (ft/ft)	0.038

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
B	5.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
Bb	70.00	6318.00	6312.00	0.086
Total Overland Length (ft)	70.00		Length-Weighted Slope (ft/ft)	0.086

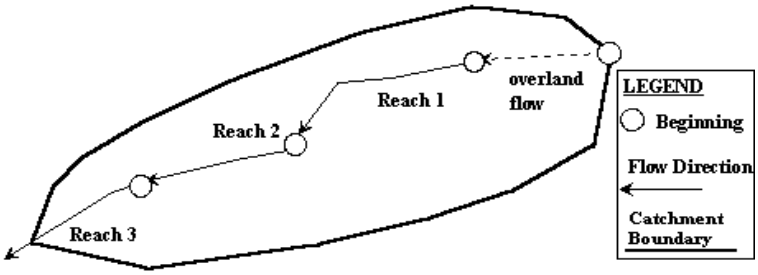
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
Bc	296.10	6312.00	6299.00	0.044
Total Channelized Length (ft)	296.10		Length-Weighted Slope (ft/ft)	0.044

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
C	5.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
Cc	100.00	6308.00	6305.00	0.030
Total Overland Length (ft)	100.00		Length-Weighted Slope (ft/ft)	0.030

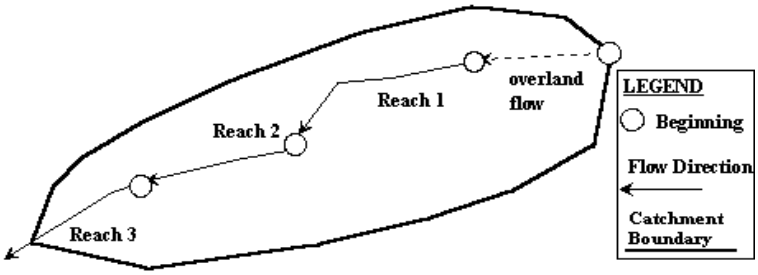
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
Cc	338.00	6305.00	6289.00	0.047
Total Channelized Length (ft)	338.00		Length-Weighted Slope (ft/ft)	0.047

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
A	5.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
Ab	100.00	0.070	0.16	8.93
Weighted Totals	100.00	0.070	Total t_i (min)	8.93

CHANNELIZED FLOW

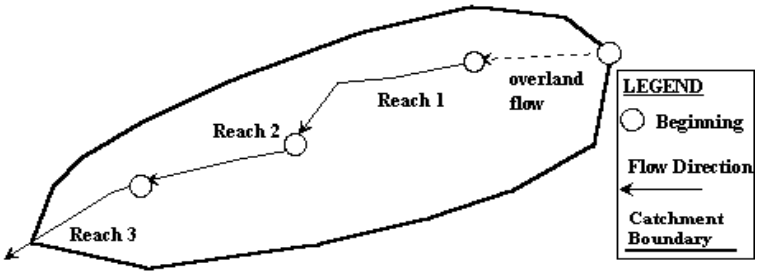
Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
Ac	493.90	0.038	7	6.03
Weighted Totals	493.90	0.038	Total t_t (min)	6.03

Computed t_c (min)	14.96
Regional t_c (min)	29.50
Selected t_c (min)	14.96

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
B	5.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
Bb	70.00	0.086	0.14	7.13
Weighted Totals	70.00	0.086	Total t_i (min)	7.13

CHANNELIZED FLOW

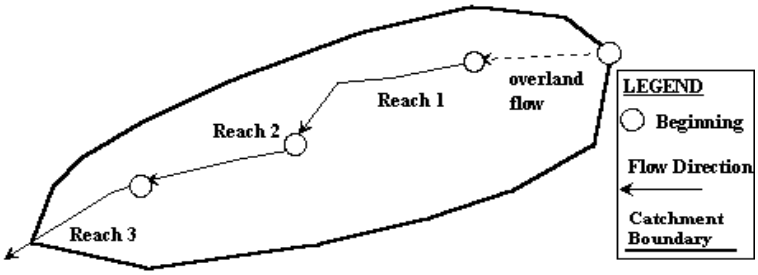
Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
Bc	296.10	0.044	7	3.36
Weighted Totals	296.10	0.044	Total t_t (min)	3.36

Computed t_c (min)	10.49
Regional t_c (min)	27.58
Selected t_c (min)	10.49

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
C	5.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
Cc	100.00	0.030	0.08	12.82
Weighted Totals	100.00	0.030	Total t_i (min)	12.82

CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
Cc	338.00	0.047	7	3.71
Weighted Totals	338.00	0.047	Total t_t (min)	3.71

Computed t_c (min)	16.53
Regional t_c (min)	27.83
Selected t_c (min)	16.53

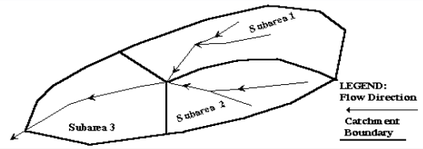
Determination of Runoff Coefficients for Rational Method

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock

MHFD-Rational, Version 3.01 (August 2026)

Cells of this color are for required user-input
Cells of this color are for optional override values

When hovering over these red triangles, a pop-up box will display useful information.



Provide subcatchment names on the Rational Calcs worksheet to open up the table below.

Subcatchment Name	# of Subareas	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness				Runoff Coefficient, C							(Optional) Override Runoff Coefficient, C							Comments
				Imperviousness Source	Imperviousness Category	Calculated Imperviousness	(Optional) Override Imperviousness	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	
A	**5**	**1.87**	**B,C/D**			**17.6%**	**17.6%**	**0.13**	**0.16**	**0.23**	**0.39**	**0.46**	**0.53**	**0.62**	**0.13**	**0.16**	**0.23**	**0.39**	**0.46**	**0.53**	**0.62**	
		0.18	B	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.82	0.85	0.86	0.87	0.88								
		0.10	B	Surface Type	Gravel - No Traffic	40%		0.29	0.32	0.38	0.50	0.55	0.61	0.68								
		0.11	C/D	Surface Type	Gravel - No Traffic	40%		0.30	0.36	0.43	0.54	0.59	0.65	0.71								
		0.65	B	Surface Type	Historic Flow Analysis	5%		0.03	0.03	0.10	0.28	0.36	0.45	0.55								
		0.83	C/D	Surface Type	Historic Flow Analysis	5%		0.03	0.08	0.17	0.35	0.42	0.50	0.60								
B	**4**	**0.80**	**B,C/D**			**13.4%**	**13.4%**	**0.10**	**0.14**	**0.22**	**0.39**	**0.45**	**0.53**	**0.62**	**0.10**	**0.14**	**0.22**	**0.39**	**0.45**	**0.53**	**0.62**	
		0.04	C/D	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.83	0.85	0.86	0.87	0.89								
		0.09	C/D	Surface Type	Gravel - No Traffic	40%		0.30	0.36	0.43	0.54	0.59	0.65	0.71								
		0.09	B	Surface Type	Historic Flow Analysis	5%		0.03	0.03	0.10	0.28	0.36	0.45	0.55								
		0.58	C/D	Surface Type	Historic Flow Analysis	5%		0.03	0.08	0.17	0.35	0.42	0.50	0.60								
C	**4**	**0.56**	**B,C/D**			**6.9%**	**6.9%**	**0.04**	**0.08**	**0.17**	**0.35**	**0.42**	**0.50**	**0.60**	**0.04**	**0.08**	**0.17**	**0.35**	**0.42**	**0.50**	**0.60**	
		0.004	C/D	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.83	0.85	0.86	0.87	0.89								
		0.02	C/D	Surface Type	Gravel - No Traffic	40%		0.30	0.36	0.43	0.54	0.59	0.65	0.71								
		0.08	B	Surface Type	Historic Flow Analysis	5%		0.03	0.03	0.10	0.28	0.36	0.45	0.55								
		0.46	C/D	Surface Type	Historic Flow Analysis	5%		0.03	0.08	0.17	0.35	0.42	0.50	0.60								

Calculation of Peak Runoff using Rational Method

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock

MHFD-Rational, Version 3.01 (August 2026)

Cells of this color are for required user-input
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When hovering over these red triangles, a pop-up box will display useful information.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed $t_c = t_i + t_t$

Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_{c\ minimum}$ = 5 (urban)
$t_{c\ minimum}$ = 10 (non-urban)

Selected $t_c = \max(t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c))$

Provide input for area, soil type, and imperviousness on the Runoff Coeffs worksheet.

Calculation of Peak Runoff using Rational Method

Select MHFD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	WQE	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =		1.06	1.43	1.66		2.26	2.60	

Rainfall Intensity Equation Coefficients =	a	b	c
	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group(s)	Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration				Rainfall Intensity, I (in/hr)								Peak Flow, Q (cfs)							
				WQE & 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)	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)	**(Optional)** Override t_c (min)	WQE	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	WQE	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A	1.87	B,C/D	17.6%	0.13	0.16	0.23	0.39	0.46	0.53	0.62	100.00			0.070	8.92	493.90			0.038	7	1.36	6.03	14.95	26.69	14.95			2.41	3.25	3.77		5.14	5.91			0.59	0.98	1.65		4.38	5.91	
B	0.80	B,C/D	13.4%	0.10	0.14	0.22	0.39	0.45	0.53	0.62	70.00			0.086	7.13	296.10			0.044	7	1.47	3.36	10.49	25.88	10.49			2.81	3.80	4.41		6.00	6.90			0.22	0.42	0.79		2.17	2.94	
C	0.56	B,C/D	6.9%	0.04	0.08	0.17	0.35	0.42	0.50	0.60	100.00			0.030	12.75	338.00			0.047	7	1.52	3.71	16.47	27.44	16.47			2.30	3.10	3.60		4.91	5.64			0.06	0.15	0.35		1.16	1.61	

Combined Peak Runoff Calculations for Inlets and Storm Drains

Combined Peak Runoff Calculations for Inlets and Storm Drains

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock

MHFD-Rational, Version 3.01 (August 2026)

5-yr **Design Storm Return Period** (Note: this worksheet can only evaluate one design storm at a time)

When hovering over these red triangles, a pop-up box will display useful information.

Use 1 column (C, D, E) per row

Obtain Inlet Capacity from MHFD-Inlet (Optional)

Design Point	# of Upstream Runoff Sources	Local Subcatchment Name	Upstream Surface Design Point	Upstream Pipe Design Point	Local Subcatchment Runoff: Area (ac)	C	t_c (min)	Local Q (cfs)	Surface Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Surface Runoff (cfs)	Inlet Capacity / Bypass Flow: (Optional) Inlet Name	Inlet Capacity (cfs)	Bypass Flow (cfs)	Total Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Total Runoff (cfs)	Pipe Downstream of Design Point: Pipe Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Manning's n	Min. Pipe Diameter (in)	Pipe Diameter (in)	Min. Box Dimension L=W (in)	Box Height (in)	Box Width (in)	Full Flow Capacity (cfs)	Full Flow Velocity (ft/sec)	Pipe t_t (min)	Surface Bypass Flow Downstream of Design Point: Bypass Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Conveyance Factor K	Velocity (ft/sec)	Surface t_t (min)	Comments
1	1								0.30	14.95	3.25	0.98			0.98	0.30	14.95	3.25	0.98	0.00														0.98	0.30								
		A			1.87	0.16	14.95	0.98	0.30	14.95	3.25	0.98				0.30	14.95	3.25	0.98																									
2	1								0.11	10.49	3.80	0.42			0.42	0.11	10.49	3.80	0.42	0.00															0.42	0.11								
		B			0.80	0.14	10.49	0.42	0.11	10.49	3.80	0.42				0.11	10.49	3.80	0.42																									
3	1								0.05	16.47	3.10	0.15			0.15	0.05	16.47	3.10	0.15	0.00															0.15	0.05								
		C			0.56	0.08	16.47	0.15	0.05	16.47	3.10	0.15				0.05	16.47	3.10	0.15																									

Combined Peak Runoff Calculations for Inlets and Storm Drains

Combined Peak Runoff Calculations for Inlets and Storm Drains

Designer: CGR
Company: M&S Civil Consultants
Date: 10/14/2026
Project: WellSpring Community
Location: Castle Rock

MHFD-Rational, Version 3.01 (August 2026)

100-yr **Design Storm Return Period** (Note: this worksheet can only evaluate one design storm at a time)

When hovering over these red triangles, a pop-up box will display useful information.

Use 1 column (C, D, E) per row

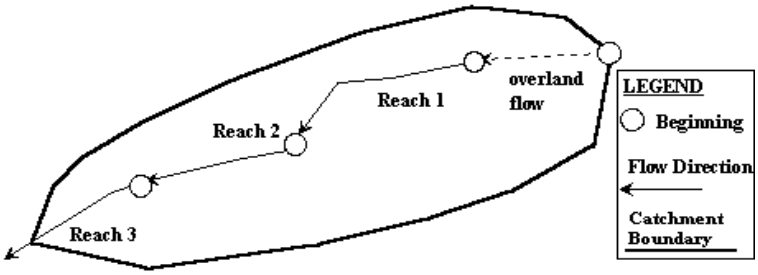
Obtain Inlet Capacity from MHFD-Inlet (Optional)

Design Point	# of Upstream Runoff Sources	Local Subcatchment Name	Upstream Surface Design Point	Upstream Pipe Design Point	Local Subcatchment Runoff: Area (ac)	C	t_c (min)	Local Q (cfs)	Surface Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Surface Runoff (cfs)	Inlet Capacity / Bypass Flow: (Optional) Inlet Name	Inlet Capacity (cfs)	Bypass Flow (cfs)	Total Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Total Runoff (cfs)	Pipe Downstream of Design Point: Pipe Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Manning's n	Min. Pipe Diameter (in)	Pipe Diameter (in)	Min. Box Dimension L=W (in)	Box Height (in)	Box Width (in)	Full Flow Capacity (cfs)	Full Flow Velocity (ft/sec)	Pipe t_t (min)	Surface Bypass Flow Downstream of Design Point: Bypass Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Conveyance Factor K	Velocity (ft/sec)	Surface t_t (min)	Comments
1	1								1.00	14.95	5.91	5.91			5.91	1.00	14.95	5.91	5.91	0.00															5.91	1.00								
		A			1.87	0.53	14.95	5.91	1.00	14.95	5.91	5.91				1.00	14.95	5.91	5.91																									
2	1								0.43	10.49	6.90	2.94			2.94	0.43	10.49	6.90	2.94	0.00															2.94	0.43								
		B			0.80	0.53	10.49	2.94	0.43	10.49	6.90	2.94				0.43	10.49	6.90	2.94																									
3	1								0.28	16.47	5.64	1.61			1.61	0.28	16.47	5.64	1.61	0.00															1.61	0.28								
		C			0.56	0.50	16.47	1.61	0.28	16.47	5.64	1.61				0.28	16.47	5.64	1.61																									

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
A	24.5%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
A	100.00	6317.00	6310.00	0.070
Total Overland Length (ft)	100.00		Length-Weighted Slope (ft/ft)	0.070

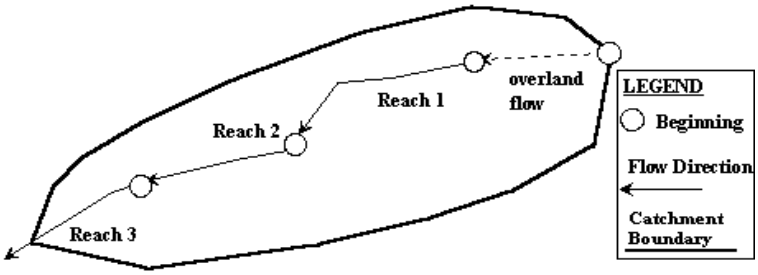
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
A	377.00	6310.00	6293.50	0.044
Total Channelized Length (ft)	377.00		Length-Weighted Slope (ft/ft)	0.044

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
B	65.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
B	100.00	6312.50	6308.20	0.043
Total Overland Length (ft)	100.00		Length-Weighted Slope (ft/ft)	0.043

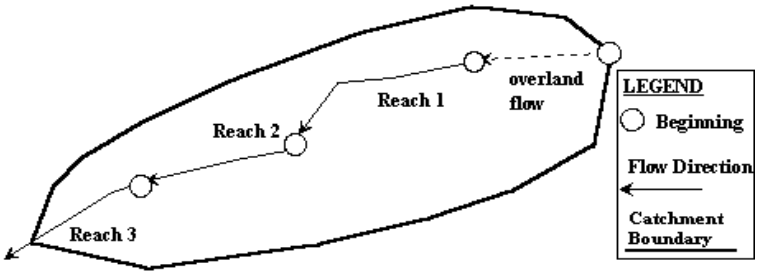
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
B	347.00	6308.20	6296.50	0.034
Total Channelized Length (ft)	347.00		Length-Weighted Slope (ft/ft)	0.034

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
C	66.8%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
C	25.00	6316.40	6314.85	0.062
Total Overland Length (ft)	25.00		Length-Weighted Slope (ft/ft)	0.062

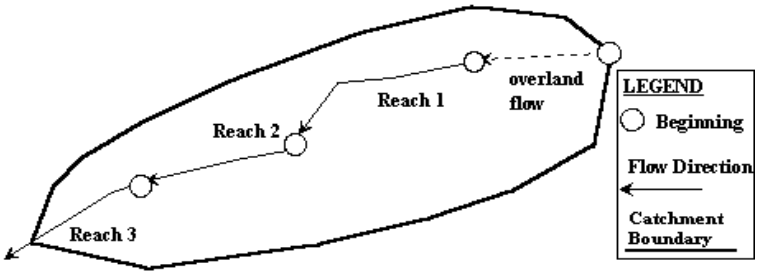
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
C	765.00	6314.85	6296.50	0.024
Total Channelized Length (ft)	765.00		Length-Weighted Slope (ft/ft)	0.024

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
D	25.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
D	24.00	6297.00	6291.00	0.250
Total Overland Length (ft)	24.00		Length-Weighted Slope (ft/ft)	0.250

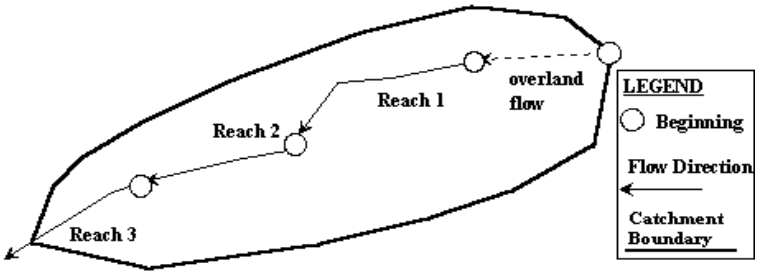
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
D	53.00	6291.00	6290.74	0.005
Total Channelized Length (ft)	53.00		Length-Weighted Slope (ft/ft)	0.005

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
E	20.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
E	17.00	6297.50	6294.00	0.206
Total Overland Length (ft)	17.00		Length-Weighted Slope (ft/ft)	0.206

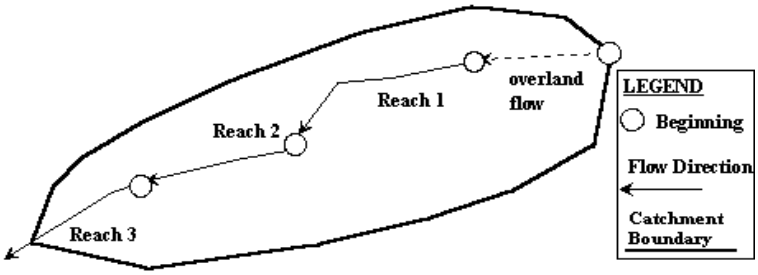
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
E	20.00	6294.00	6287.00	0.350
Total Channelized Length (ft)	20.00		Length-Weighted Slope (ft/ft)	0.350

Length-Weighted Slope Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
F	20.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)
F	40.00	6296.90	6296.70	0.005
Total Overland Length (ft)	40.00		Length-Weighted Slope (ft/ft)	0.005

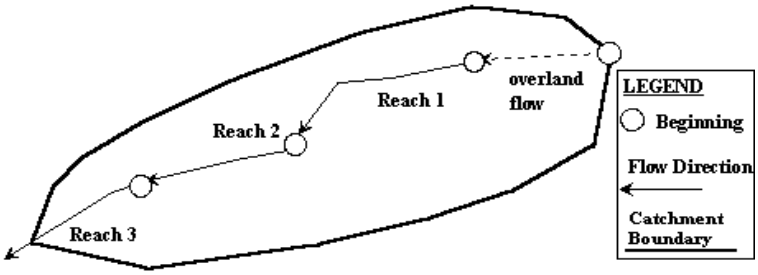
CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)
F	180.00	6296.70	6292.50	0.023
Total Channelized Length (ft)	180.00		Length-Weighted Slope (ft/ft)	0.023

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
A	24.5%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
A	100.00	0.070	0.20	8.55
Weighted Totals	100.00	0.070	Total t_i (min)	8.55

CHANNELIZED FLOW

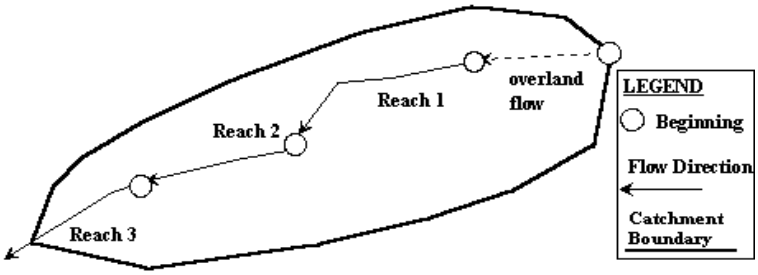
Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
A	377.00	0.044	20	1.50
Weighted Totals	377.00	0.044	Total t_t (min)	1.50

Computed t_c (min)	10.05
Regional t_c (min)	24.24
Selected t_c (min)	10.05

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
B	65.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
B	100.00	0.043	0.56	6.02
Weighted Totals	100.00	0.043	Total t_i (min)	6.02

CHANNELIZED FLOW

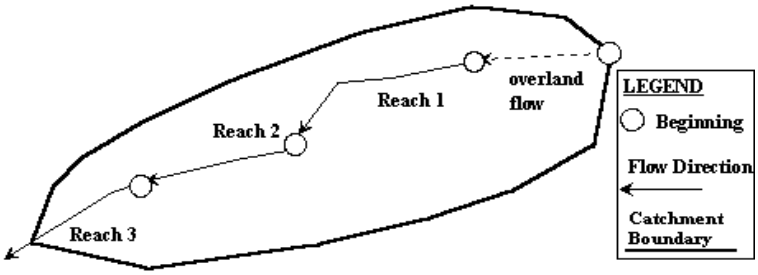
Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
B	347.00	0.034	20	1.57
Weighted Totals	347.00	0.034	Total t_t (min)	1.57

Computed t_c (min)	7.59
Regional t_c (min)	16.68
Selected t_c (min)	7.59

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
C	66.8%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
C	25.00	0.062	0.58	2.57
Weighted Totals	25.00	0.062	Total t_i (min)	2.57

CHANNELIZED FLOW

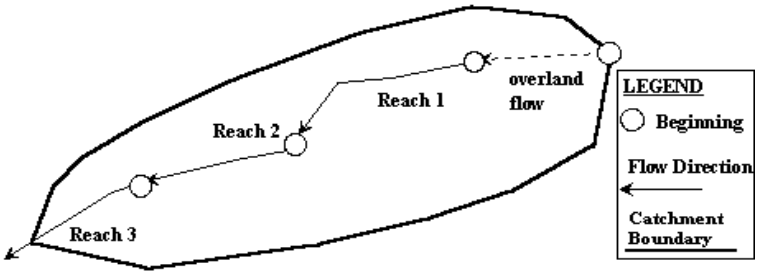
Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
C	765.00	0.024	20	4.12
Weighted Totals	765.00	0.024	Total t_t (min)	4.12

Computed t_c (min)	6.69
Regional t_c (min)	19.13
Selected t_c (min)	6.69

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
D	25.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
D	24.00	0.250	0.24	2.63
Weighted Totals	24.00	0.250	Total t_i (min)	2.63

CHANNELIZED FLOW

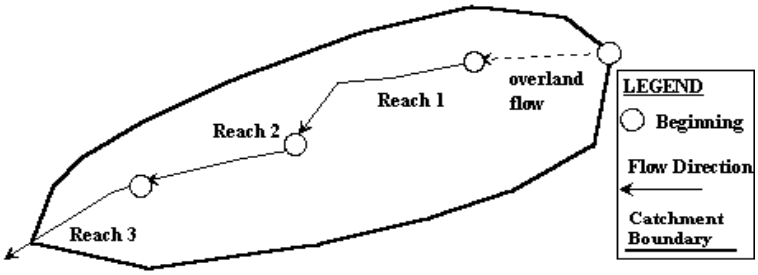
Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
D	53.00	0.005	20	0.62
Weighted Totals	53.00	0.005	Total t_t (min)	0.62

Computed t_c (min)	3.25
Regional t_c (min)	22.75
Selected t_c (min)	5.00

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
E	20.0%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
E	17.00	0.206	0.17	2.55
Weighted Totals	17.00	0.206	Total t_i (min)	2.55

CHANNELIZED FLOW

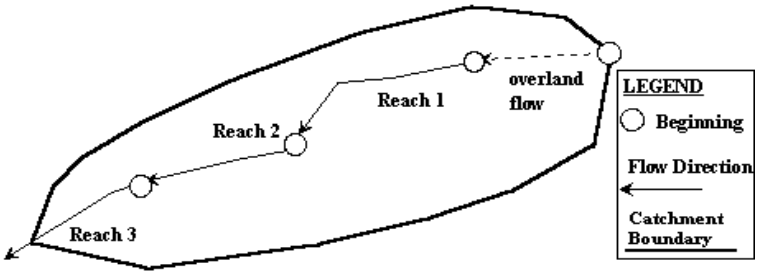
Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
E	20.00	0.350	20	0.03
Weighted Totals	20.00	0.350	Total t_t (min)	0.03

Computed t_c (min)	2.58
Regional t_c (min)	22.65
Selected t_c (min)	10.00

Reach-Weighted Time of Concentration Calculations

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock



Subcatchment Name	Imperviousness
F	78.3%

OVERLAND FLOW

Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
F	40.00	0.005	0.67	6.17
Weighted Totals	40.00	0.005	Total t_i (min)	6.17

CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
F	180.00	0.023	20	0.99
Weighted Totals	180.00	0.023	Total t_t (min)	0.99

Computed t_c (min)	7.16
Regional t_c (min)	13.68
Selected t_c (min)	7.16

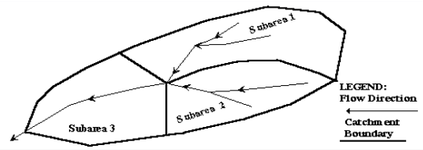
Determination of Runoff Coefficients for Rational Method

MHFD-Rational, Version 3.01 (August 2026)

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock

Cells of this color are for required user-input
Cells of this color are for optional override values

When hovering over these red triangles, a pop-up box will display useful information.



Provide subcatchment names on the Rational Calcs worksheet to open up the table below.

Subcatchment Name	# of Subareas	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness				Runoff Coefficient, C							(Optional) Override Runoff Coefficient, C							Comments
				Imperviousness Source	Imperviousness Category	Calculated Imperviousness	(Optional) Override Imperviousness	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	WQE & 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	
A	**2**	**0.83**	**B**			**24.5%**	**24.5%**	**0.19**	**0.20**	**0.25**	**0.40**	**0.46**	**0.54**	**0.63**	**0.19**	**0.20**	**0.25**	**0.40**	**0.46**	**0.54**	**0.63**	
		0.18	B	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.82	0.85	0.86	0.87	0.88								
		0.65	B	Land Use	Open Space, Undisturbed Native Grasses	5%		0.03	0.03	0.10	0.28	0.36	0.45	0.55								
B	**2**	**0.72**	**B,C/D**			**65.0%**	**65.0%**	**0.51**	**0.56**	**0.61**	**0.68**	**0.71**	**0.75**	**0.79**	**0.51**	**0.56**	**0.61**	**0.68**	**0.71**	**0.75**	**0.79**	
		0.06	B	Land Use	Single-Family - High Density	65%		0.50	0.54	0.58	0.66	0.69	0.73	0.77								
		0.66	C/D	Land Use	Single-Family - High Density	65%		0.51	0.56	0.61	0.68	0.71	0.75	0.79								
C	**6**	**1.17**	**B,C/D**			**66.8%**	**66.8%**	**0.53**	**0.58**	**0.62**	**0.69**	**0.72**	**0.76**	**0.80**	**0.53**	**0.58**	**0.62**	**0.69**	**0.72**	**0.76**	**0.80**	
		0.01	B	Land Use	Single-Family - High Density	65%		0.50	0.54	0.58	0.66	0.69	0.73	0.77								
		0.99	C/D	Land Use	Single-Family - High Density	65%		0.51	0.56	0.61	0.68	0.71	0.75	0.79								
		0.03	B	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.82	0.85	0.86	0.87	0.88								
		0.10	C/D	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.83	0.85	0.86	0.87	0.89								
		0.02	B	Surface Type	Disturbed Soil	20%		0.13	0.15	0.22	0.37	0.44	0.52	0.61								
		0.02	C/D	Surface Type	Disturbed Soil	20%		0.14	0.20	0.28	0.43	0.49	0.57	0.65								
D	**1**	**0.18**	**C/D**			**25.0%**	**25.0%**	**0.18**	**0.24**	**0.32**	**0.46**	**0.52**	**0.59**	**0.67**	**0.18**	**0.24**	**0.32**	**0.46**	**0.52**	**0.59**	**0.67**	
		0.18	C/D	Surface Type	Extended Detention Basins	25%		0.18	0.24	0.32	0.46	0.52	0.59	0.67								
E	**2**	**0.13**	**B,C/D**			**20.0%**	**20.0%**	**0.13**	**0.17**	**0.24**	**0.40**	**0.46**	**0.54**	**0.63**	**0.13**	**0.17**	**0.24**	**0.40**	**0.46**	**0.54**	**0.63**	
		0.08	B	Surface Type	Disturbed Soil	20%		0.13	0.15	0.22	0.37	0.44	0.52	0.61								
		0.05	C/D	Surface Type	Disturbed Soil	20%		0.14	0.20	0.28	0.43	0.49	0.57	0.65								
F	**4**	**0.18**	**B,C/D**			**78.3%**	**78.3%**	**0.64**	**0.67**	**0.70**	**0.75**	**0.77**	**0.80**	**0.83**	**0.64**	**0.67**	**0.70**	**0.75**	**0.77**	**0.80**	**0.83**	
		0.07	B	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.82	0.85	0.86	0.87	0.88								
		0.07	C/D	Surface Type	Concrete Driveways and Walks	95%		0.79	0.81	0.83	0.85	0.86	0.87	0.89								
		0.02	B	Surface Type	Disturbed Soil	20%		0.13	0.15	0.22	0.37	0.44	0.52	0.61								
		0.02	C/D	Surface Type	Disturbed Soil	20%		0.14	0.20	0.28	0.43	0.49	0.57	0.65								

Calculation of Peak Runoff using Rational Method

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock

MHFD-Rational, Version 3.01 (August 2026)

Cells of this color are for required user-input
Cells of this color are for optional override values

When hovering over these red triangles, a pop-up box will display useful information.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed $t_c = t_i + t_t$

Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_{c\ minimum}$ = 5 (urban)
$t_{c\ minimum}$ = 10 (non-urban)

Selected $t_c = \max(t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c))$

Provide input for area, soil type, and imperviousness on the Runoff Coeffs worksheet.

Select MHFD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	WQE	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =		1.06	1.43	1.66		2.26	2.60	

Rainfall Intensity Equation Coefficients =	a	b	c
	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group(s)	Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration				Rainfall Intensity, I (in/hr)								Peak Flow, Q (cfs)							
				WQE & 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)	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)	**(Optional)** Override t_c (min)	WQE	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	WQE	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A	0.83	B	24.5%	0.19	0.20	0.25	0.40	0.46	0.54	0.63	100.00			0.070	8.54	337.00			0.044	20	4.20	1.34	9.87	23.99	9.87	10.05		2.86	3.86	4.48		6.10	7.02			0.45	0.65	0.95		2.35	3.15	
B	0.72	B/C/D	65.0%	0.51	0.56	0.61	0.68	0.71	0.75	0.79	100.00			0.043	6.00	347.00			0.034	20	3.69	1.57	7.57	16.68	7.57	7.59		3.17	4.28	4.97		6.76	7.78			1.17	1.73	2.17		3.47	4.19	
C	1.17	B/C/D	66.8%	0.53	0.58	0.62	0.69	0.72	0.76	0.80	25.00			0.062	2.58	765.00			0.024	20	3.10	4.12	6.69	19.13	6.69	6.69		3.31	4.46	5.18		7.05	8.11			2.06	3.02	3.76		5.95	7.17	
D	0.18	C/D	25.0%	0.18	0.24	0.32	0.46	0.52	0.59	0.67	24.00			0.250	2.63	53.00			0.005	20	1.41	0.62	3.26	22.75	5.00	5.00		3.60	4.85	5.63		7.67	8.82			0.11	0.21	0.32		0.71	0.93	
E	0.13	B/C/D	20.0%	0.13	0.17	0.24	0.40	0.46	0.54	0.63	17.00			0.206	2.56	20.00			0.350	20	11.83	0.03	2.59	22.65	10.00	10.00		2.87	3.87	4.49		6.11	7.03			0.05	0.08	0.14		0.37	0.49	
F	0.18	B/C/D	78.3%	0.64	0.67	0.70	0.75	0.77	0.80	0.83	40.00			0.005	6.19	180.00			0.023	20	3.03	0.99	7.18	13.67	7.18	7.16		3.23	4.36	5.07		6.90	7.93			0.37	0.53	0.64		0.96	1.14	

Combined Peak Runoff Calculations for Inlets and Storm Drains

Combined Peak Runoff Calculations for Inlets and Storm Drains

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock

MHFD-Rational, Version 3.01 (August 2026)

5-yr **Design Storm Return Period** (Note: this worksheet can only evaluate one design storm at a time)

When hovering over these red triangles, a pop-up box will display useful information.

Use 1 column (C, D, E) per row

Obtain Inlet Capacity from MHFD-Inlet (Optional)

Design Point	# of Upstream Runoff Sources	Local Subcatchment Name	Upstream Surface Design Point	Upstream Pipe Design Point	Local Subcatchment Runoff: Area (ac)	C	t_c (min)	Local Q (cfs)	Surface Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Surface Runoff (cfs)	Inlet Capacity / Bypass Flow: (Optional) Inlet Name	Inlet Capacity (cfs)	Bypass Flow (cfs)	Total Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Total Runoff (cfs)	Pipe Flow Downstream of Design Point: Pipe Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Manning's n	Min. Pipe Diameter (in)	Pipe Diameter (in)	Min. Box Dimension L=W (in)	Box Height (in)	Box Width (in)	Full Flow Capacity (cfs)	Full Flow Velocity (ft/sec)	Pipe t_t (min)	Surface Bypass Flow Downstream of Design Point: Bypass Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Conveyance Factor K	Velocity (ft/sec)	Surface t_t (min)	Comments
DP1	1								0.17	10.05	3.86	0.65	DP1	2.11	0.00	0.17	10.05	3.86	0.65	0.65	0.17	40.00			0.005	0.013	7.20	18.00	6.57			7.45	4.21	0.16											
		A			0.83	0.20	10.05	0.65	0.17	10.05	3.86	0.65				0.17	10.05	3.86	0.65																									
DP2	1								0.40	7.59	4.28	1.73	DP2	5.53	0.00	0.40	7.59	4.28	1.73	1.73	0.40	50.00			0.010	0.013	9.16	18.00	8.35			10.53	5.96	0.14											
		B			0.72	0.56	7.59	1.73	0.40	7.59	4.28	1.73				0.40	7.59	4.28	1.73																									
DP3	2								0.68	6.69	4.46	3.02	DP3	8.75	0.00	1.08	7.73	4.25	4.60	4.60	1.08	50.00			0.010	0.013	13.21	24.00	12.05			22.68	7.22	0.12											
		C			1.17	0.58	6.69	3.02	0.68	6.69	4.46	3.02				0.68	6.69	4.46	4.58																									
				DP2												0.40	7.73	4.25	4.60																									
DP4	2								0.04	5.00	4.85	0.21			0.21	1.12	7.85	4.23	4.76	4.55	1.08														0.21	0.04									
		D			0.18	0.24	5.00	0.21	0.04	5.00	4.85	0.21				0.04	5.00	4.85	3.55																									
				DP3												1.08	7.85	4.23	4.76																									
DP5	1								0.02	10.00	3.87	0.08			0.08	0.02	10.00	3.87	0.08	0.00															0.08	0.02									
		E			0.13	0.17	10.00	0.08	0.02	10.00	3.87	0.08				0.02	10.00	3.87	0.08																									
DP6	1											0.00			0.00				0.00	0.00																									
				DP4												1.08																													
DP7	2								0.12	7.16	4.36	0.53			0.53	0.29	10.21	3.84	1.10	0.58	0.15														0.53	0.12									
		F			0.18	0.67	7.16	0.53	0.12	7.16	4.36	0.53				0.12	7.16	4.36	1.04																									
				DP1												0.17	10.21	3.84	1.10																									

Combined Peak Runoff Calculations for Inlets and Storm Drains

Combined Peak Runoff Calculations for Inlets and Storm Drains

Designer: CGR
Company: M&S Civil Consultants
Date: 10/16/2026
Project: WellSpring Community
Location: Castle Rock

MHFD-Rational, Version 3.01 (August 2026)

100-yr **Design Storm Return Period** (Note: this worksheet can only evaluate one design storm at a time)

When hovering over these red triangles, a pop-up box will display useful information.

Use 1 column (C, D, E) per row

Obtain Inlet Capacity from MHFD-Inlet (Optional)

Design Point	# of Upstream Runoff Sources	Local Subcatchment Name	Upstream Surface Design Point	Upstream Pipe Design Point	Local Subcatchment Runoff: Area (ac)	C	t_c (min)	Local Q (cfs)	Surface Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Surface Runoff (cfs)	Inlet Capacity / Bypass Flow: (Optional) Inlet Name	Inlet Capacity (cfs)	Bypass Flow (cfs)	Total Runoff to Design Point: Σ(C*A) (acre)	t_c (min)	Intensity (in/hr)	Total Runoff (cfs)	Pipe Flow Downstream of Design Point: Pipe Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Manning's n	Min. Pipe Diameter (in)	Pipe Diameter (in)	Min. Box Dimension L=W (in)	Box Height (in)	Box Width (in)	Full Flow Capacity (cfs)	Full Flow Velocity (ft/sec)	Pipe t_t (min)	Surface Bypass Flow Downstream of Design Point: Bypass Flow (cfs)	Σ(C*A) (acre)	Length (ft)	U/S Elevation (ft)	D/S Elevation (ft)	Slope (ft/ft)	Conveyance Factor K	Velocity (ft/sec)	Surface t_t (min)	Comments
DP1	1								0.45	10.05	7.02	3.15	DP1	5.12	0.00	0.45	10.05	7.02	3.15	3.15	0.45	40.00			0.005	0.013	13.05	18.00	11.90			7.45	4.21	0.16											
		A			0.83	0.54	10.05	3.15	0.45	10.05	7.02	3.15				0.45	10.05	7.02	3.15																									
DP2	1								0.54	7.59	7.78	4.19	DP2	5.53	0.00	0.54	7.59	7.78	4.19	4.19	0.54	50.00			0.010	0.013	12.76	18.00	11.63			10.53	5.96	0.14											
		B			0.72	0.75	7.59	4.19	0.54	7.59	7.78	4.19				0.54	7.59	7.78	4.19																									
DP3	2								0.88	6.69	8.11	7.17	DP3	8.75	0.00	1.42	7.73	7.73	11.01	11.01	1.42	50.00			0.010	0.013	18.32	24.00	16.71			22.68	7.22	0.12											
		C			1.17	0.76	6.69	7.17	0.88	6.69	8.11	7.17				0.88	6.69	8.11	10.95																									
				DP2												0.54	7.73	7.73	11.91																									
DP4	2								0.11	5.00	8.82	0.93			0.93	1.53	7.85	7.69	11.76	10.83	1.41													0.93	0.11										
		D			0.18	0.59	5.00	0.93	0.11	5.00	8.82	0.93				0.11	5.00	8.82	3.92																									
				DP3												1.42	7.85	7.69	11.76																									
DP5	1								0.07	10.00	7.03	0.49			0.49	0.07	10.00	7.03	0.49	0.00														0.49	0.07										
		E			0.13	0.54	10.00	0.49	0.07	10.00	7.03	0.49				0.07	10.00	7.03	0.49																									
DP6	1											0.00			0.00				0.00	0.00																									
				DP4												1.41																													
DP7	2								0.14	7.16	7.93	1.14			1.14	0.59	10.21	6.98	4.13	2.99	0.43													1.14	0.14										
		F			0.18	0.80	7.16	1.14	0.14	7.16	7.93	1.14				0.14	7.16	7.93	3.63																									
				DP1												0.45	10.21	6.98	4.13																									

HYDRAULIC CALCULATIONS / POND CALCULATIONS

Project: Wellspring Community

Date: 10/26/2026

Area Treated by FSD - Impervious Average of Basins B, C, & D

- Basin B: 0.72 Ac @ 65% Imp.
- Basin C: 1.17 Ac @ 66.8% Imp.
- Basin D: 0.18 Ac @ 25% Imp.
- Total Area = 2.07 Ac
- % Imp = $\frac{(0.72 \times 0.65) + (1.17 \times 0.668) + (0.18 \times 0.25)}{2.07}$

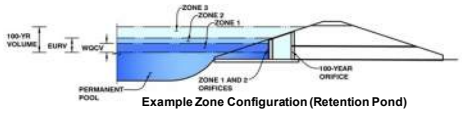
  = 62.5%

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: WELLSPRING COMMUNITY

Basin ID: FULL SPECTRUM DETENTION



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	2.07	acres
Watershed Length =	513	ft
Watershed Length to Centroid =	245	ft
Watershed Slope =	0.039	ft/ft
Watershed Imperviousness =	62.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	32.0%	percent
Percentage Hydrologic Soil Groups C/D =	68.0%	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.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.042	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.130	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	0.108	acre-feet	1.06 inches
5-yr Runoff Volume (P1 = 1.43 in.) =	0.164	acre-feet	1.43 inches
10-yr Runoff Volume (P1 = 1.66 in.) =	0.201	acre-feet	1.66 inches
25-yr Runoff Volume (P1 = 1.69 in.) =	0.212	acre-feet	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	0.307	acre-feet	2.26 inches
100-yr Runoff Volume (P1 = 2.6 in.) =	0.370	acre-feet	2.60 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.464	acre-feet	inches
Approximate 2-yr Detention Volume =	0.098	acre-feet	
Approximate 5-yr Detention Volume =	0.147	acre-feet	
Approximate 10-yr Detention Volume =	0.174	acre-feet	
Approximate 25-yr Detention Volume =	0.166	acre-feet	
Approximate 50-yr Detention Volume =	0.204	acre-feet	
Approximate 100-yr Detention Volume =	0.230	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.042	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.088	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.100	acre-feet
Total Detention Basin Volume =	0.230	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

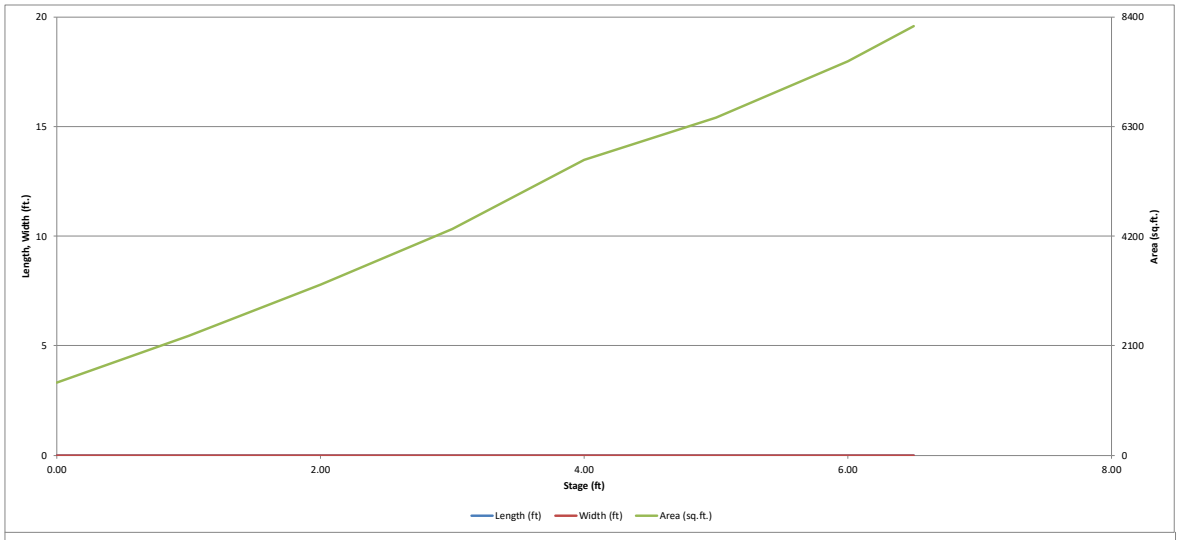
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

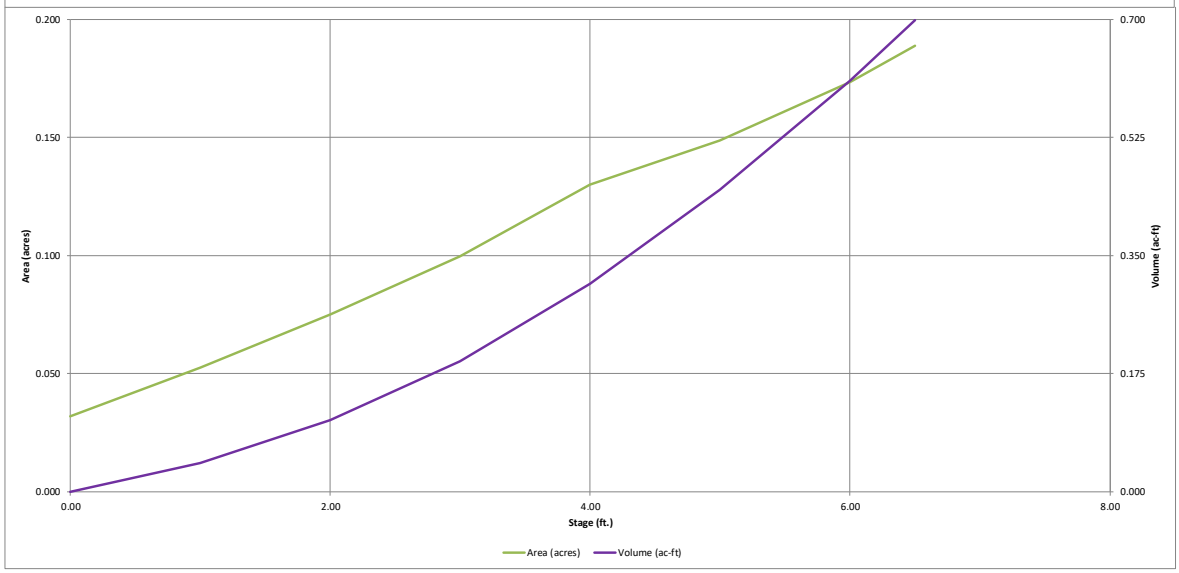
Depth Increment = 0.50 ft

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)
6291 **Top of Micropool**	--	0.00	--	--	--	1,395	0.032		
	--	1.00	--	--	--	2,285	0.052	1,840	0.042
	--	2.00	--	--	--	3,270	0.075	4,617	0.106
	--	3.00	--	--	--	4,342	0.100	8,423	0.193
	--	4.00	--	--	--	5,667	0.130	13,428	0.308
	--	5.00	--	--	--	6,475	0.149	19,499	0.448
	--	6.00	--	--	--	7,548	0.173	26,510	0.609
	--	6.50	--	--	--	8,227	0.189	30,454	0.699

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



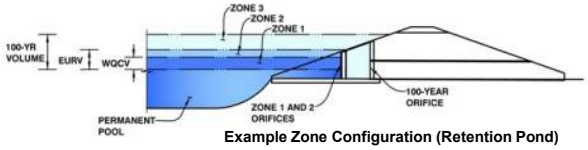


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **WELLSPRING COMMUNITY**

Basin ID: **FULL SPECTRUM DETENTION**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.00	0.042	Orifice Plate
Zone 2 (EURV)	2.31	0.088	Orifice Plate
Zone 3 (100-year)	3.35	0.100	Weir&Pipe (Restrict)
Total (all zones)		0.230	

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 =	4.167E-03	ft²
Depth at top of Zone using Orifice Plate =	2.28	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	16.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.60	sq. inches (diameter = 7/8 inch)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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	0.76	1.52					
Orifice Area (sq. inches)	0.60	0.60	0.60					

	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 =	2.75	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.75	N/A	feet
Overflow Weir Front Edge Length =	2.00	N/A	feet	Overflow Weir Slope Length =	2.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.32	N/A	
Horiz. Length of Weir Sides =	2.00	N/A	feet	Overflow Grate Open Area w/o Debris =	2.78	N/A	ft²
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	1.39	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 =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.33	N/A	ft²
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.22	N/A	feet
Restrictor Plate Height Above Pipe Invert =	4.40		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.03	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.28	feet
Spillway Crest Length =	15.00	feet	Stage at Top of Freeboard =	6.28	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.18	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.66	acre-ft

Calculated Parameters for Spillway

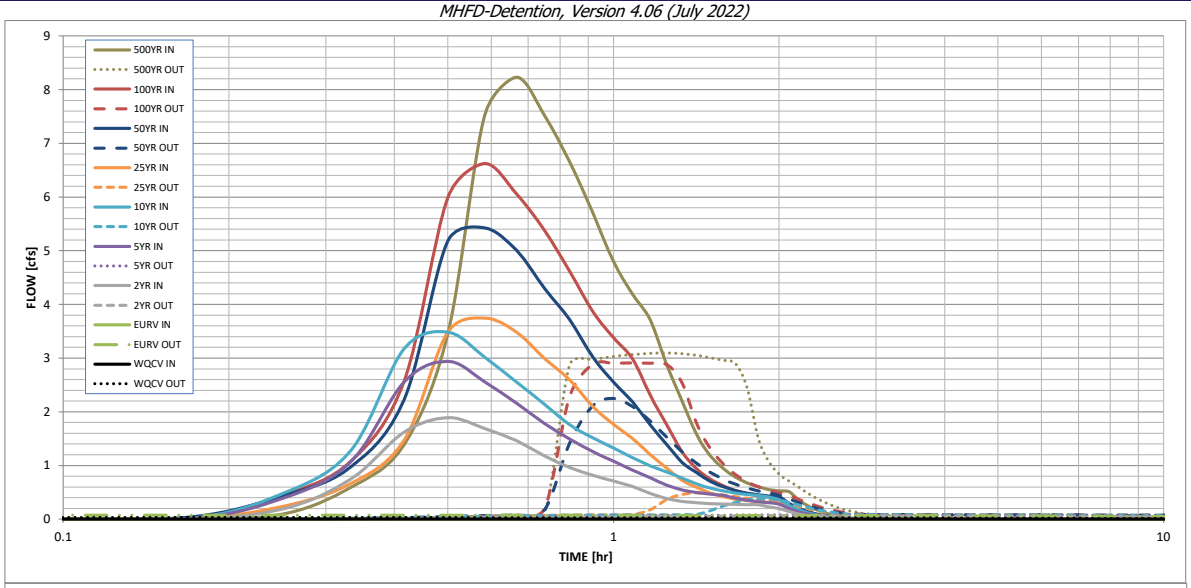
Routed Hydrograph Results

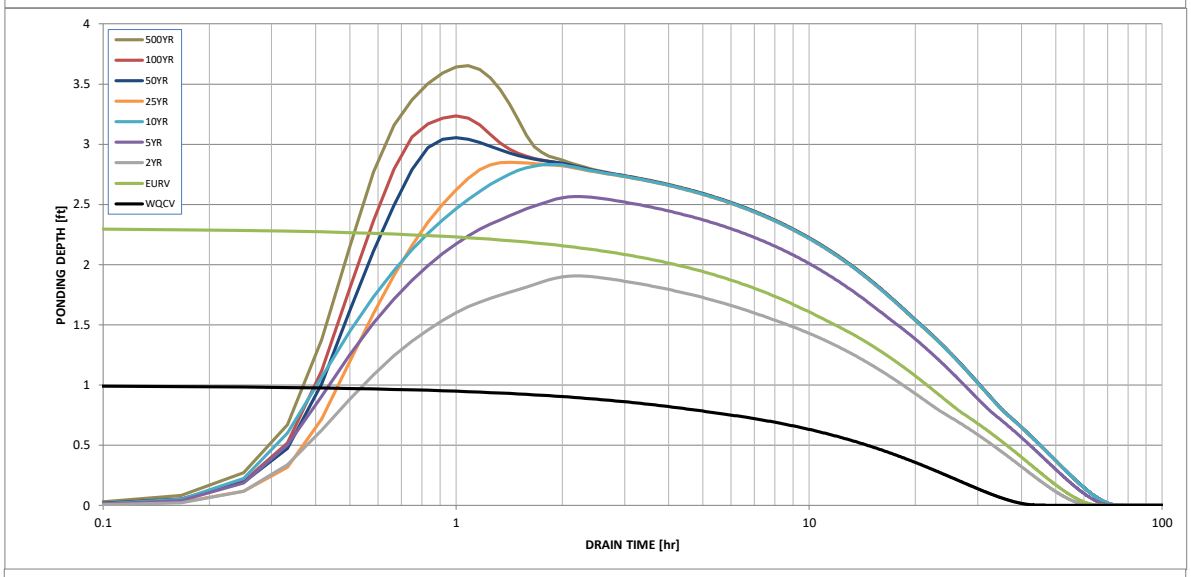
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

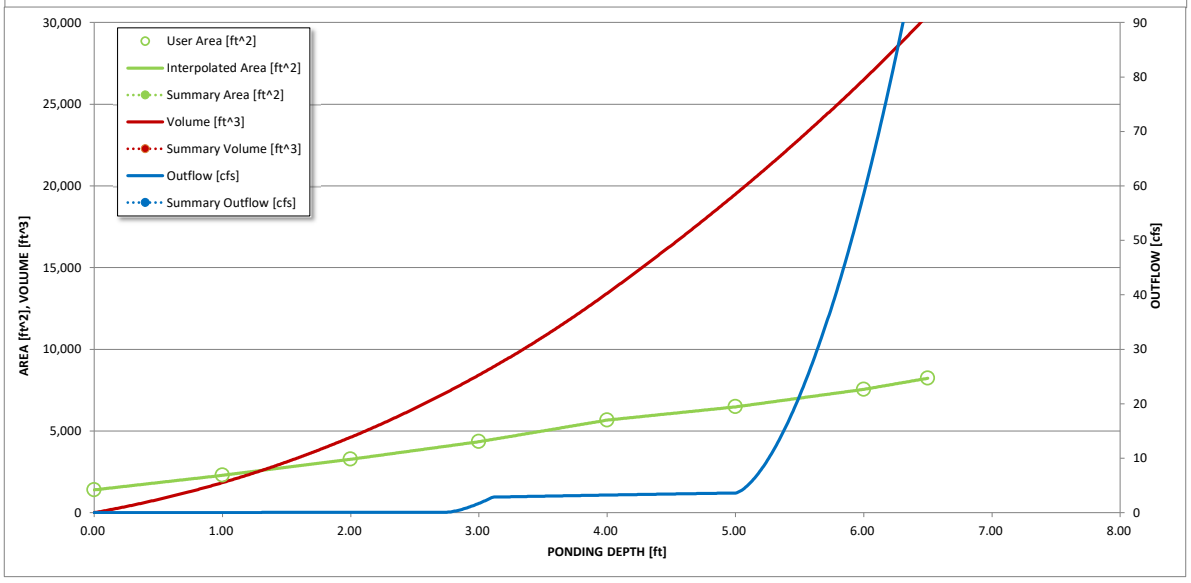
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.69	2.26	2.60	3.14
CUHP Runoff Volume (acre-ft) =	0.042	0.130	0.108	0.164	0.201	0.212	0.307	0.370	0.464
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.108	0.164	0.201	0.212	0.307	0.370	0.464
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.7	1.0	1.3	2.4	3.0	4.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.07	0.34	0.50	0.65	1.14	1.46	1.94
Peak Inflow Q (cfs) =	N/A	N/A	1.9	2.9	3.5	3.7	5.4	6.6	8.2
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.4	0.5	2.2	2.9	3.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.4	0.4	1.0	1.0	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	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	N/A	0.1	0.1	0.8	1.0	1.1
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) =	37	53	51	57	58	58	54	52	49
Time to Drain 99% of Inflow Volume (hours) =	**40**	59	56	64	66	65	63	62	61
Maximum Ponding Depth (ft) =	1.00	2.31	1.91	2.56	2.83	2.85	3.05	3.23	3.65
Area at Maximum Ponding Depth (acres) =	0.05	0.08	0.07	0.09	0.10	0.10	0.10	0.11	0.12
Maximum Volume Stored (acre-ft) =	0.042	0.130	0.099	0.152	0.177	0.178	0.198	0.217	0.265

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.09
	0:15:00	0.00	0.00	0.19	0.38	0.47	0.24	0.43	0.44	0.59
	0:20:00	0.00	0.00	0.75	1.07	1.28	0.66	0.97	1.08	1.39
	0:25:00	0.00	0.00	1.62	2.56	3.18	1.48	2.23	2.58	3.45
	0:30:00	0.00	0.00	1.89	2.94	3.49	3.49	5.18	5.99	7.51
	0:35:00	0.00	0.00	1.69	2.56	3.02	3.74	5.43	6.62	8.23
	0:40:00	0.00	0.00	1.46	2.16	2.55	3.49	5.01	6.06	7.51
	0:45:00	0.00	0.00	1.17	1.78	2.14	2.99	4.29	5.37	6.65
	0:50:00	0.00	0.00	0.96	1.49	1.76	2.59	3.71	4.61	5.71
	0:55:00	0.00	0.00	0.82	1.26	1.52	2.10	3.02	3.87	4.80
	1:00:00	0.00	0.00	0.71	1.08	1.33	1.77	2.55	3.38	4.19
	1:05:00	0.00	0.00	0.61	0.92	1.15	1.51	2.19	2.99	3.71
	1:10:00	0.00	0.00	0.48	0.77	0.99	1.20	1.75	2.31	2.87
	1:15:00	0.00	0.00	0.38	0.63	0.88	0.95	1.39	1.76	2.20
	1:20:00	0.00	0.00	0.33	0.54	0.77	0.72	1.06	1.25	1.57
	1:25:00	0.00	0.00	0.31	0.50	0.66	0.59	0.86	0.94	1.18
	1:30:00	0.00	0.00	0.29	0.46	0.58	0.49	0.71	0.75	0.94
	1:35:00	0.00	0.00	0.28	0.44	0.52	0.42	0.60	0.62	0.78
	1:40:00	0.00	0.00	0.28	0.39	0.49	0.37	0.53	0.53	0.67
	1:45:00	0.00	0.00	0.27	0.35	0.46	0.35	0.49	0.48	0.60
	1:50:00	0.00	0.00	0.27	0.33	0.44	0.33	0.45	0.44	0.55
	1:55:00	0.00	0.00	0.23	0.31	0.41	0.31	0.43	0.41	0.52
	2:00:00	0.00	0.00	0.20	0.28	0.37	0.31	0.42	0.41	0.51
	2:05:00	0.00	0.00	0.14	0.20	0.26	0.22	0.30	0.29	0.36
	2:10:00	0.00	0.00	0.10	0.14	0.18	0.15	0.21	0.20	0.26
	2:15:00	0.00	0.00	0.07	0.10	0.12	0.11	0.14	0.14	0.18
	2:20:00	0.00	0.00	0.05	0.06	0.08	0.07	0.10	0.10	0.12
	2:25:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.08
	2:30:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.04	0.05
	2:35:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	2:40:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

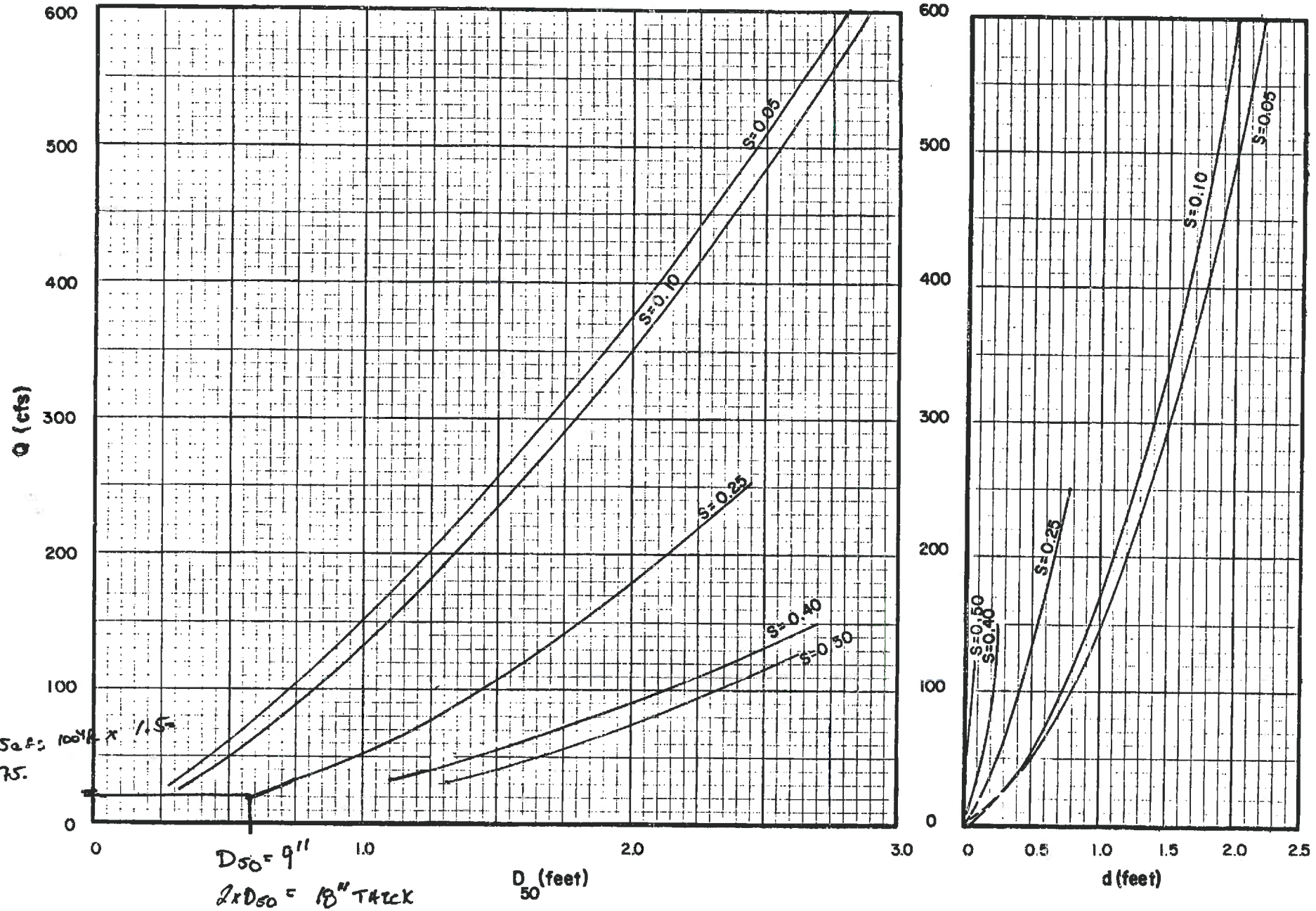


Figure 5.5. Steep slope riprap design, trapezoidal channel, 2:1 sideslopes, (10) ft base width.
1.5 x 10 = 15 ft.

MHFD-Inlet, Version 6.00 (August 2025)

INLET MANAGEMENT

Project: WELLSPRING COMMUNITY
Minor: 5-year
Major: 100-year

Worksheet Protected

INLET NAME	DP1	DP2	DP3
Inlet Application (Street or Area)	AREA	STREET	STREET
Hydraulic Condition	Swale	In Sump	In Sump
Inlet Type	CDOT Type C	Denver No. 16 Combination	Denver No. 16 Combination
Number of Inlet Units	1	2	3

USER-DEFINED INPUT

User-Defined Peak Flows

Minor Peak Flow, Q (cfs)	0.65	1.73	3.02
Major Peak Flow, Q (cfs)	3.15	4.19	7.17

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Bypass Flow Description (Optional):			
Minor Bypass Flow Received, Q_b (cfs)	0.00	0.00	0.00
Major Bypass Flow Received, Q_b (cfs)	0.00	0.00	0.00

CALCULATED OUTPUT

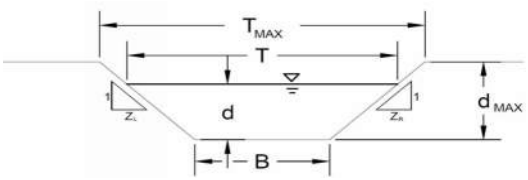
Minor Total Design Peak Flow, Q (cfs)	0.65	1.73	3.02
Major Total Design Peak Flow, Q (cfs)	3.15	4.19	7.17
Minor Inlet Interception Capacity, Q_a (cfs)	2.11	5.53	8.75
Major Inlet Interception Capacity, Q_a (cfs)	5.12	5.53	8.75
Minor Flow Bypassed Downstream, Qb (cfs)	0.00	N/A	N/A
Major Flow Bypassed Downstream, Qb (cfs)	0.00	N/A	N/A
Minor Flow Capture Percentage, C%	100%	100%	100%
Major Flow Capture Percentage, C%	100%	100%	100%

MHFD-Inlet, Version 6.00 (August 2025)

AREA INLET IN A SWALE

WELLSPRING COMMUNITY

DP1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n for grass-lined channels.

An override Manning's n can be entered for other channel materials.

Analysis of Trapezoidal Channel (Grass-Lined uses SCS Method)

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.025	
Channel Invert Slope	S_O =	0.0440	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Sloe	Z2 =	4.00	ft/ft

Check one of the following soil types:

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

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

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**2.40**	**4.20**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.30**	**0.48**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**1.2**	**4.4**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**0.30**	**0.48**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**0.7**	**3.2**	**cfs**
Water Depth	d =	**0.24**	**0.42**	**ft**

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

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

MHFD-Inlet, Version 6.00 (August 2025)

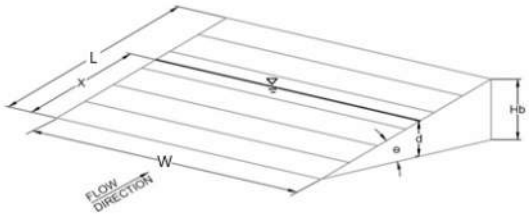
AREA INLET IN A SWALE

WELLSPRING COMMUNITY

DP1

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



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

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.24	0.42	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.1**	**5.1**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

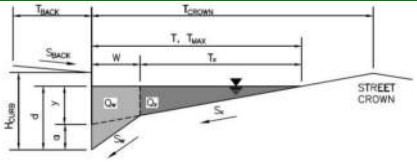
MHFD-Inlet, Version 6.00 (August 2025)

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

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

Project: **WELLSPRING COMMUNITY**

Inlet ID: **DP2**



Gutter Geometry:

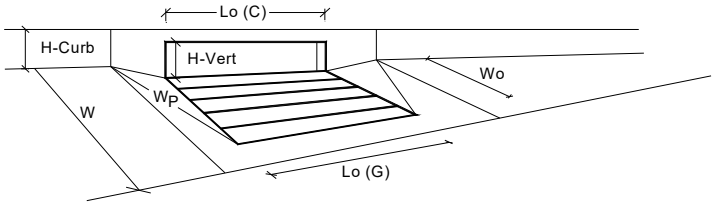
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.028	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.4	5.4	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.47	0.47	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.28	0.28	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.63	0.63	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.63	0.63	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.5**	**5.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.7	4.2	cfs

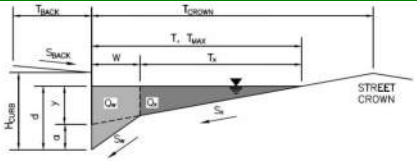
MHFD-Inlet, Version 6.00 (August 2025)

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

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

Project: **WELLSPRING COMMUNITY**

Inlet ID: **DP3**



Gutter Geometry:

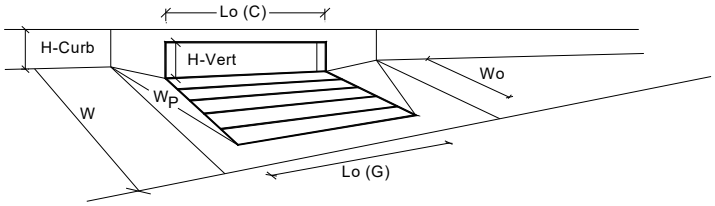
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.041	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.52	0.52	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.57	0.57	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.57	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.7**	**8.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.0	7.2	cfs

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 1

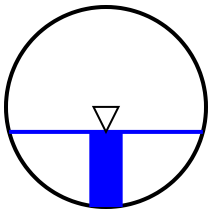
Q100 = 3.15 cfs

Inputs

Pipe diameter, d_0	1.5	ft
Manning roughness, n	0.013	
Friction slope, S_f?	.01	rise/run
Relative flow depth, y/d_0	37.5478	%

Results

Flow depth, y	0.5632	ft
Flow area, A	0.6063	ft^2
Pipe area, A_0	1.7671	ft^2
Relative area, A/A_0	0.3431	fraction
Wetted perimeter, P_w	1.9787	ft
Hydraulic radius, R_h	0.3064	ft
Top width, T	1.4527	ft
Velocity, v	5.1953	ft/sec
Velocity head, h_v ?	0.4194	ft H2O
Velocity check	✓ OK	
Froude number, Fr	1.42	
Average shear stress, τ	0.1913	psf
Flow, Q ?	3.1500	cfs
Full flow, Q_0	10.5038	cfs
Ratio to full flow, Q/Q_0	0.2999	fraction



Notes

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to estimate the headwater depth, or see my 2-minute tutorial for standard culvert headwater calculations using HY-8, the free culvert program from the U.S. Federal Highway Administration.

Designing a sanitary sewer?
See the minimum sewer slope tables for 4 to 96 inch (100 to 2400 mm) pipe, given in m/m, mm/m and percent, and the peaking factors for very low flows study. Both are reference documents in English only.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 2

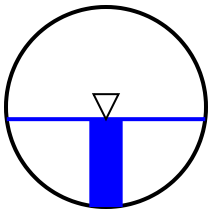
Q100 = 4.19 cfs

Inputs

Pipe diameter, d_0	1.5	ft
Manning roughness, n	0.013	
Friction slope, S_f?	.01	rise/run
Relative flow depth, y/d_0	43.9166	%

Results

Flow depth, y	0.6587	ft
Flow area, A	0.7470	ft^2
Pipe area, A_0	1.7671	ft^2
Relative area, A/A_0	0.4227	fraction
Wetted perimeter, P_w	2.1732	ft
Hydraulic radius, R_h	0.3437	ft
Top width, T	1.4889	ft
Velocity, v	5.6089	ft/sec
Velocity head, h_v ?	0.4889	ft H2O
Velocity check	✓ OK	
Froude number, Fr	1.40	
Average shear stress, τ	0.2146	psf
Flow, Q ?	4.1900	cfs
Full flow, Q_0	10.5038	cfs
Ratio to full flow, Q/Q_0	0.3989	fraction



Notes

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to estimate the headwater depth, or see my 2-minute tutorial for standard culvert headwater calculations using HY-8, the free culvert program from the U.S. Federal Highway Administration.

Designing a sanitary sewer?
See the minimum sewer slope tables for 4 to 96 inch (100 to 2400 mm) pipe, given in m/m, mm/m and percent, and the peaking factors for very low flows study. Both are reference documents in English only.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 3

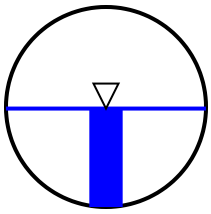
Q100 = 11.01 cfs

Inputs

Pipe diameter, d_0	2	ft
Manning roughness, n	0.013	
Friction slope, S_f?	.01	rise/run
Relative flow depth, y/d_0	49.2156	%

Results

Flow depth, y	0.9843	ft
Flow area, A	1.5394	ft^2
Pipe area, A_0	3.1416	ft^2
Relative area, A/A_0	0.4900	fraction
Wetted perimeter, P_w	3.1102	ft
Hydraulic radius, R_h	0.4950	ft
Top width, T	1.9998	ft
Velocity, v	7.1520	ft/sec
Velocity head, h_v ?	0.7949	ft H2O
Velocity check	✓ OK	
Froude number, Fr	1.44	
Average shear stress, τ	0.3090	psf
Flow, Q ?	11.0100	cfs
Full flow, Q_0	22.6212	cfs
Ratio to full flow, Q/Q_0	0.4867	fraction



Notes

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to estimate the headwater depth, or see my 2-minute tutorial for standard culvert headwater calculations using HY-8, the free culvert program from the U.S. Federal Highway Administration.

Designing a sanitary sewer?
See the minimum sewer slope tables for 4 to 96 inch (100 to 2400 mm) pipe, given in m/m, mm/m and percent, and the peaking factors for very low flows study. Both are reference documents in English only.

Manning Formula Uniform Pipe Flow at Given Slope and Depth

Pipe Run 4

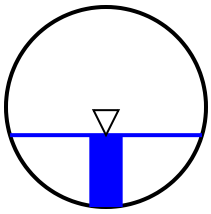
Q100 = 2.9 cfs

Inputs

Pipe diameter, d_0	1.5	ft
Manning roughness, n	0.013	
Friction slope, S_f?	.01	rise/run
Relative flow depth, y/d_0	35.9205	%

Results

Flow depth, y	0.5388	ft
Flow area, A	0.5710	ft^2
Pipe area, A_0	1.7671	ft^2
Relative area, A/A_0	0.3231	fraction
Wetted perimeter, P_w	1.9280	ft
Hydraulic radius, R_h	0.2962	ft
Top width, T	1.4393	ft
Velocity, v	5.0786	ft/sec
Velocity head, h_v ?	0.4008	ft H2O
Velocity check	✓ OK	
Froude number, Fr	1.42	
Average shear stress, τ	0.1849	psf
Flow, Q ?	2.9000	cfs
Full flow, Q_0	10.5038	cfs
Ratio to full flow, Q/Q_0	0.2761	fraction



Notes

This is the flow and depth inside an *infinitely long* pipe.
Getting the flow into the pipe may require significantly higher headwater depth. Add at least 1.5 times the velocity head to estimate the headwater depth, or see my 2-minute tutorial for standard culvert headwater calculations using HY-8, the free culvert program from the U.S. Federal Highway Administration.

Designing a sanitary sewer?
See the minimum sewer slope tables for 4 to 96 inch (100 to 2400 mm) pipe, given in m/m, mm/m and percent, and the peaking factors for very low flows study. Both are reference documents in English only.

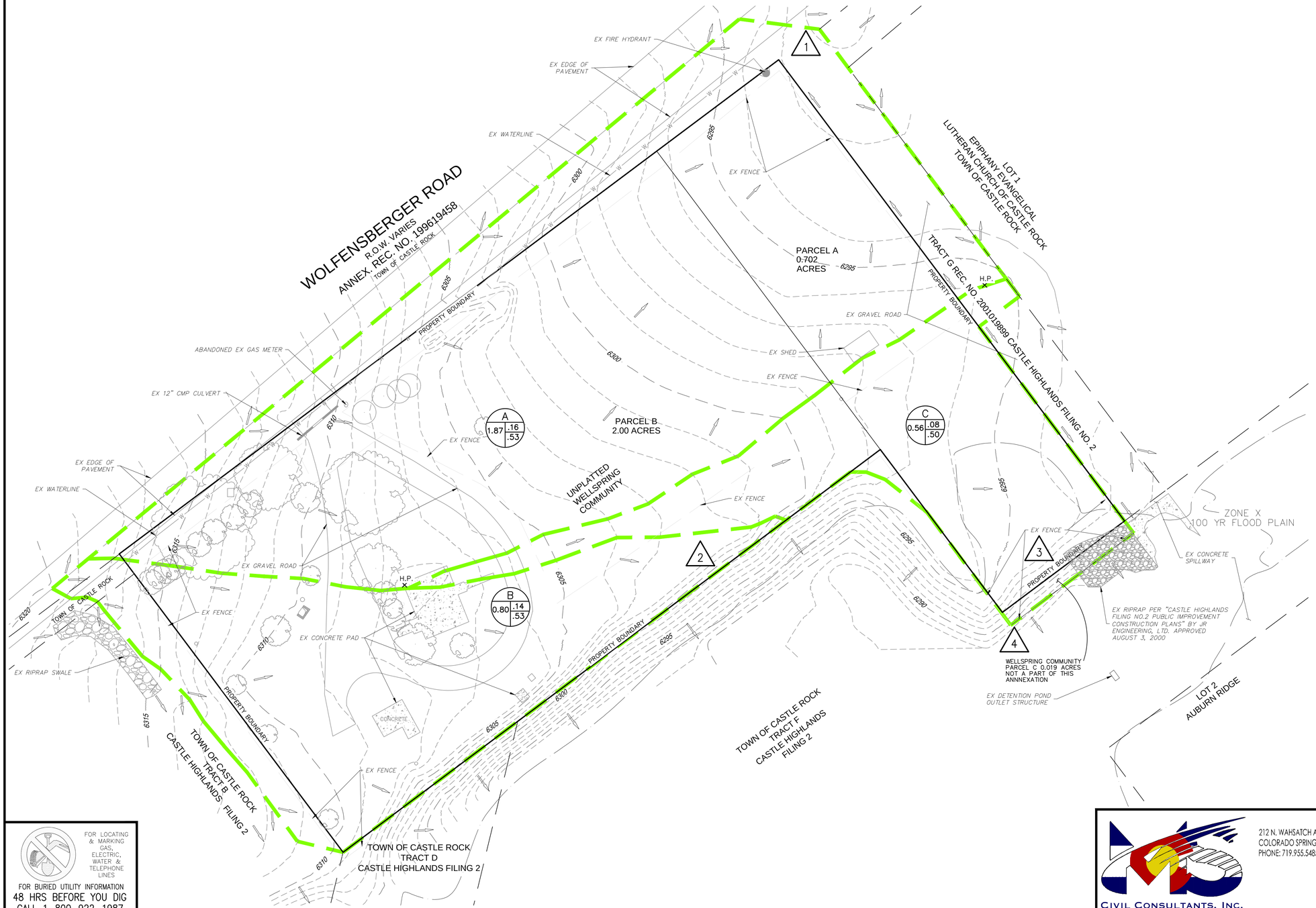
DRAINAGE MAPS

WELLSPRING COMMUNITY

CITY OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO

EXISTING DRAINAGE MAP

OCTOBER 2026



BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
A	1.87	0.98	5.91
B	0.80	0.42	2.94
C	0.56	0.15	1.61

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN(S)/ DESIGN PT(S)	PRIVATE STRUCTURE
1	0.98	5.91	A	EX WOLFSENGER ROAD SWALE
2	0.42	2.94	B	SOUTHEAST EDGE OF PROPERTY
3	0.15	1.61	C	NORTHEAST EDGE OF PROPERTY
4	0.57	4.55	DP2, DP3	CUMULATIVE FLOW EXITING SITE

LEGEND

BASIN DESIGNATION (A; 1.0 ACRES; .75; .83; C5; C100)

SURFACE DESIGN POINT

BASIN BOUNDARY

EXIST MAJ CONT (7070)

EXIST MIN CONT (7072)

EXIST MAJ CONT (7070)

EXIST MIN CONT (7072)

EXISTING FLOW DIRECTION ARROW

PROPOSED FLOW DIRECTION ARROW

H.P. HIGH POINT

L.P. LOW POINT

PROPOSED STORM SEWER PIPE

EXISTING STORM SEWER PIPE

SITE BOUNDARY

1" = 30'

0 15 30 60

Scale in Feet

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

WELLSPRING COMMUNITY

EXISTING DRAINAGE PLAN

PROJECT NO. 43-146	SCALE: HORIZONTAL: 1"=30' VERTICAL: NA	DATE: 10-13-2026	
DESIGNED BY: CGR		SHEET 1 OF 1	EDM
DRAWN BY: CGR			
CHECKED BY: VAS			

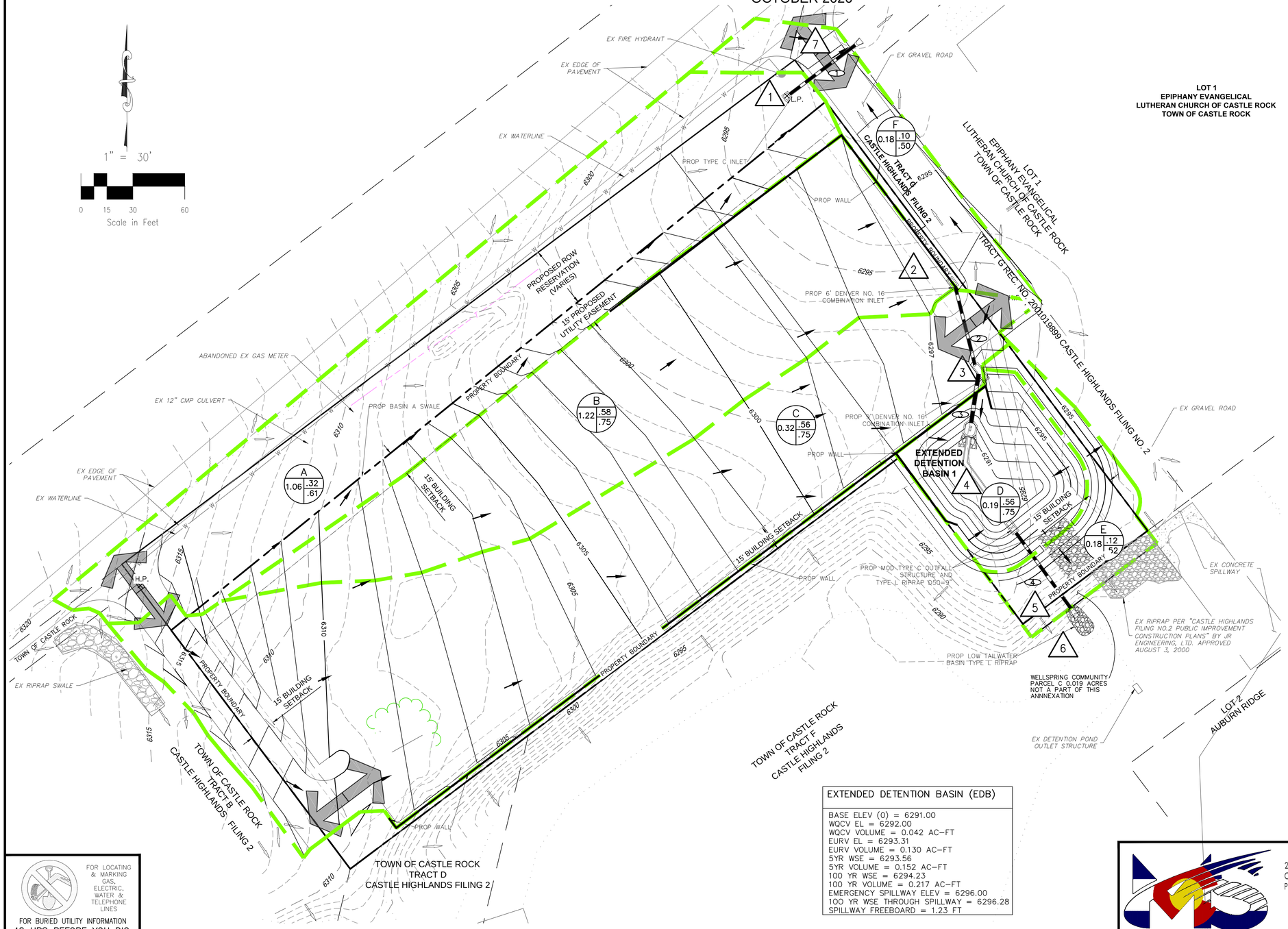
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WELLSPRING COMMUNITY

CITY OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO

PROPOSED DRAINAGE MAP

OCTOBER 2026



LEGEND

BASIN DESIGNATION (A; 1.0 ACRES; .75 / .83; C5 / C100)

SURFACE DESIGN POINT

PIPE RUN REFERENCE LABEL

BASIN BOUNDARY

EXIST MAJ CONT

EXIST MIN CONT

EXIST MAJ CONT

EXIST MIN CONT

EXISTING FLOW DIRECTION ARROW

PROPOSED FLOW DIRECTION ARROW

HIGH POINT

LOW POINT

PROPOSED STORM SEWER PIPE

EXISTING STORM SEWER PIPE

SITE BOUNDARY

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
A	0.83	0.65	3.15
B	0.72	1.73	4.19
C	1.17	3.02	7.17
D	0.18	0.21	0.93
E	0.13	0.08	0.49
F	0.18	0.53	1.14

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN(S)/ DESIGN PT(S)	PRIVATE STRUCTURE
1	0.65	3.15	A	PROP CDOT TYPE C INLET
2	1.73	4.19	B	PROP 6' DENVER NO.16 COMBINATION SUMP INLET
3	3.02	7.17	C	PROP 9' DENVER NO.16 COMBINATION SUMP INLET
4	4.55	11.76	D, PR3	FSD POND
5	0.08	0.49	E	SHEET FLOW EXITING SOUTH AND EAST OF SITE
6	0.1	2.9	PR4	OUTLET FROM FSD POND
7	1.10	4.13	F, PR1	CUMMALATIVE FLOW EXITING NORTH AND EAST OF SITE

STORM SEWER SUMMARY			
PIPE RUN	Q_5	Q_{100}	PIPE SIZE
1	0.65	3.15	18" RCP (PVT)
2	1.73	4.19	18" RCP (PVT)
3	4.60	11.01	24" RCP (PVT)
4	0.1	2.9	18" RCP (PVT)

EXTENDED DETENTION BASIN (EDB)
BASE ELEV (0) = 6291.00
WQCV EL = 6292.00
WQCV VOLUME = 0.042 AC-FT
EURV EL = 6293.31
EURV VOLUME = 0.130 AC-FT
5YR WSE = 6293.56
5YR VOLUME = 0.152 AC-FT
100 YR WSE = 6294.23
100 YR VOLUME = 0.217 AC-FT
EMERGENCY SPILLWAY ELEV = 6296.00
100 YR WSE THROUGH SPILLWAY = 6296.28
SPILLWAY FREEBOARD = 1.23 FT

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

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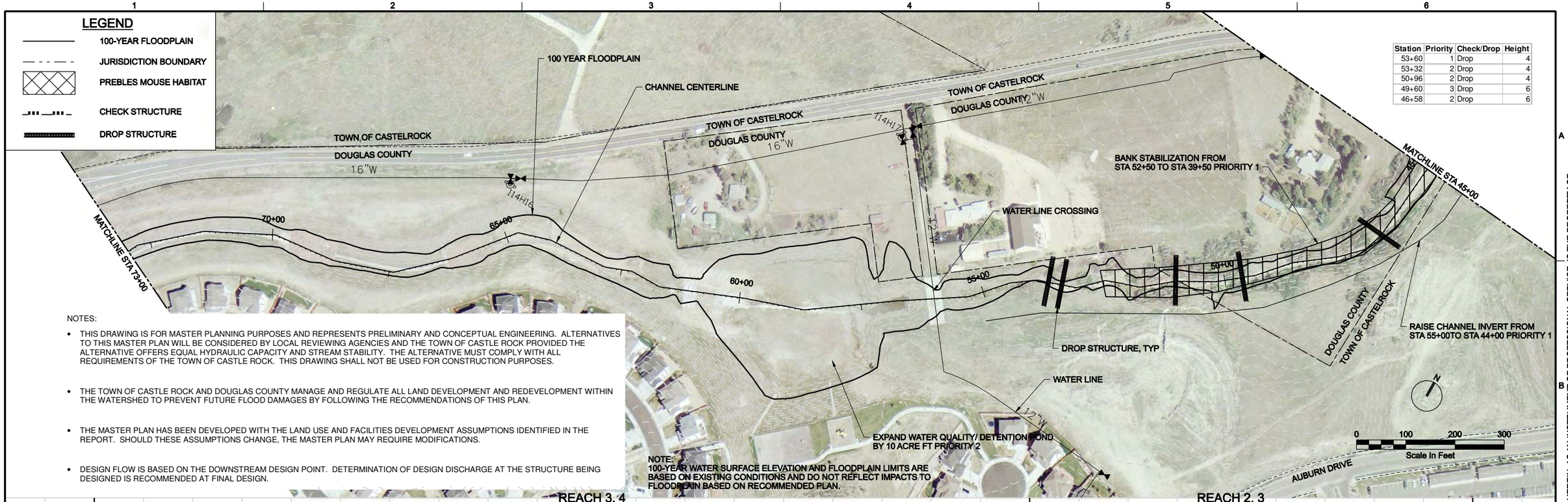
WELLSPRING COMMUNITY

PROPOSED DRAINAGE PLAN

PROJECT NO. 43-146	SCALE: HORIZONTAL: 1"=30' VERTICAL: NA	DATE: 10-16-2026	
DESIGNED BY: CGR		SHEET 1 OF 1	PDM
DRAWN BY: CGR			
CHECKED BY: VAS			

File: O:\43146A-Wolfensberger\Landhus-Castle Rock\Drainage\Drainage Map\261016 43-146 Proposed Drainage Map.dwg Plotstamp: 10/22/2026 10:56 AM

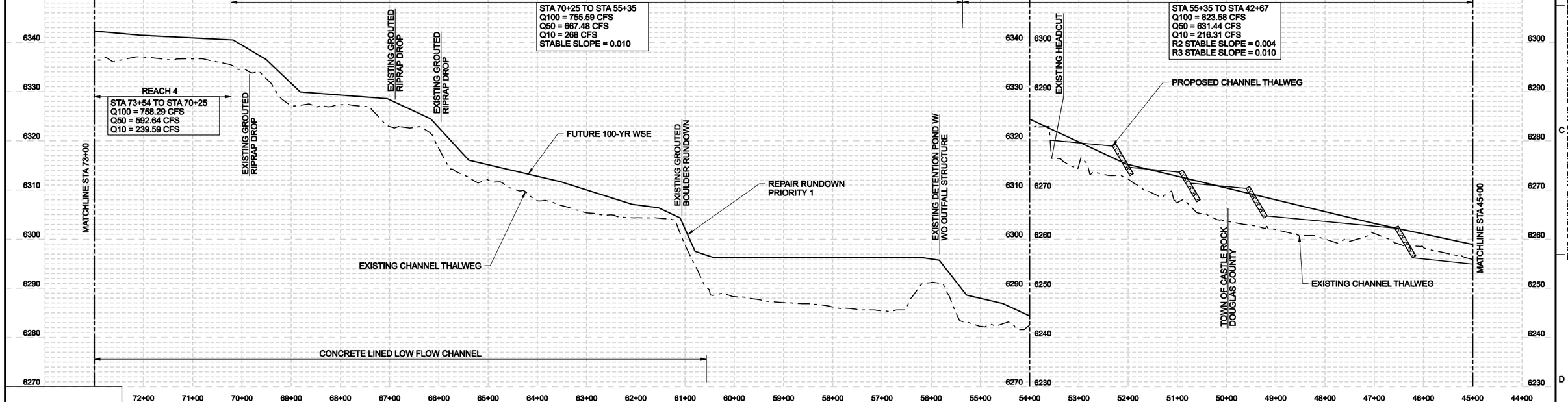
BACKGROUND INFORMATION



Station	Priority	Check/Drop	Height
53+60	1	Drop	4
53+32	2	Drop	4
50+96	2	Drop	4
49+60	3	Drop	6
46+58	2	Drop	6

NOTES:

- THIS DRAWING IS FOR MASTER PLANNING PURPOSES AND REPRESENTS PRELIMINARY AND CONCEPTUAL ENGINEERING. ALTERNATIVES TO THIS MASTER PLAN WILL BE CONSIDERED BY LOCAL REVIEWING AGENCIES AND THE TOWN OF CASTLE ROCK PROVIDED THE ALTERNATIVE OFFERS EQUAL HYDRAULIC CAPACITY AND STREAM STABILITY. THE ALTERNATIVE MUST COMPLY WITH ALL REQUIREMENTS OF THE TOWN OF CASTLE ROCK. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.
- THE TOWN OF CASTLE ROCK AND DOUGLAS COUNTY MANAGE AND REGULATE ALL LAND DEVELOPMENT AND REDEVELOPMENT WITHIN THE WATERSHED TO PREVENT FUTURE FLOOD DAMAGES BY FOLLOWING THE RECOMMENDATIONS OF THIS PLAN.
- THE MASTER PLAN HAS BEEN DEVELOPED WITH THE LAND USE AND FACILITIES DEVELOPMENT ASSUMPTIONS IDENTIFIED IN THE REPORT. SHOULD THESE ASSUMPTIONS CHANGE, THE MASTER PLAN MAY REQUIRE MODIFICATIONS.
- DESIGN FLOW IS BASED ON THE DOWNSTREAM DESIGN POINT. DETERMINATION OF DESIGN DISCHARGE AT THE STRUCTURE BEING DESIGNED IS RECOMMENDED AT FINAL DESIGN.



NOTE:
TOPOGRAPHY FROM TOWN OF CASTLE ROCK (2006), NAVD 88 VERTICAL DATUM,
NAD 83 STATE PLANE COLORADO CONTROL HORIZONTAL DATUM
AERIAL MAPPING FROM TOWN OF CASTLE ROCK (2006)

PRELIMINARY

NOT FOR CONSTRUCTION

DSGN	A TURNER						VERIFY SCALE
DR	C SCHNEE						BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
CHK	C HOOPER	NO	DATE	DESCRIPTION	APVR	N	IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.
APVD	M GLIDDEN	NO.	DATE	REVISION	BY	APVD	

CH2MHILL

Town of Castle Rock COLORADO

OMNI TRIBUTARY
PLAN AND PROFILE
STA 73+00 TO STA 45+00

SHEET	4
DWG	PP-4
DATE	JULY 2010
PROJ	381198

FILENAME: MP_Omni_PP04.dgn PLOT DATE: 11/8/2010 PLOT TIME: 3:49:06 PM

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Commentary Sheet 4

Omni Tributary - Reach 3, 4

Station 73+00 to Station 45+00

Existing Conditions: Station 73+00 is just downstream of Plum Creek Parkway/Coachline Road and Station 45+00 is just upstream of East Wolfensberger Road. From Station 73+00 to approximte Station 60+00 there is a concrete lined low flow channel with three grouted riprap drops that lead to a detention pond with a water quality outfall structure. The side slopes of the concrete lined low flow channel are grass lined with an approximate slope of 4:1 (H:V). The detention pond is designed to detain and treat on-site 100-year flows for water quality and bypass the historic 100-year flows through an overflow weir outfall. The designed 100-year release rate from the pond is approximately 500 cfs. The pond is lined with short native grasses and sand bar willow and the wetland species Juncus balticus are seen in patches throughout the detention pond. Just upstream of the grouted riprap drop at the inlet of the pond is a section of the channel that is lined with willow trees and other wetland species. Downstream of the detention pond spillway the channel is severely eroded with near vertical banks and little channel vegetation. Further downstream are areas of heavy sediment deposition most likely caused by erosion in this reach.

Preliminary Design Cost Estimate

Item	Priority	Unit	Quantity	Unit cost	Total Cost	Assumed Cost Breakdown: Castle Rock Utilities	Douglas County	Other
4' Drop Structure at Station 53+60	1	Each	1	$75,000	$75,000	x		
Bank Stabilization from Station 52+50 to Station 45+00	1	CY	367	$100	$36,700	x		
Repair Grouted Riprap Rundown at Station 60+50	1	Each	1	$50,000	$50,000	x		
Raise Channel Invert from Station 55+00 to Station 44+00	1	CY	3260	$8	$26,080	x		
4' Drop Structure at Station 52+32	2	Each	1	$75,000	$75,000			x
4' Drop Structure at Station 50+96	2	Each	1	$75,000	$75,000			x
6' Drop Structure at Station 46+58	2	Each	1	$75,000	$75,000			x
6' Drop Structure at Station 49+60	3	Each	1	$75,000	$75,000	x		

Proposed Priority 1 Improvements: Priority 1 improvements for this sheet are a 4 foot drop structure at Station 53+60 to stabilize an existing head cut, bank stabilization from Station 52+50 to Station 45+00, raising the channel invert from Station 55+00 to Station 44+00, and repairing an existing grouted riprap rundown. Bank stabilization is required because the channel is incised and threatening private property. The grouted riprap rundown is the entrance to the existing detention/water quality pond.

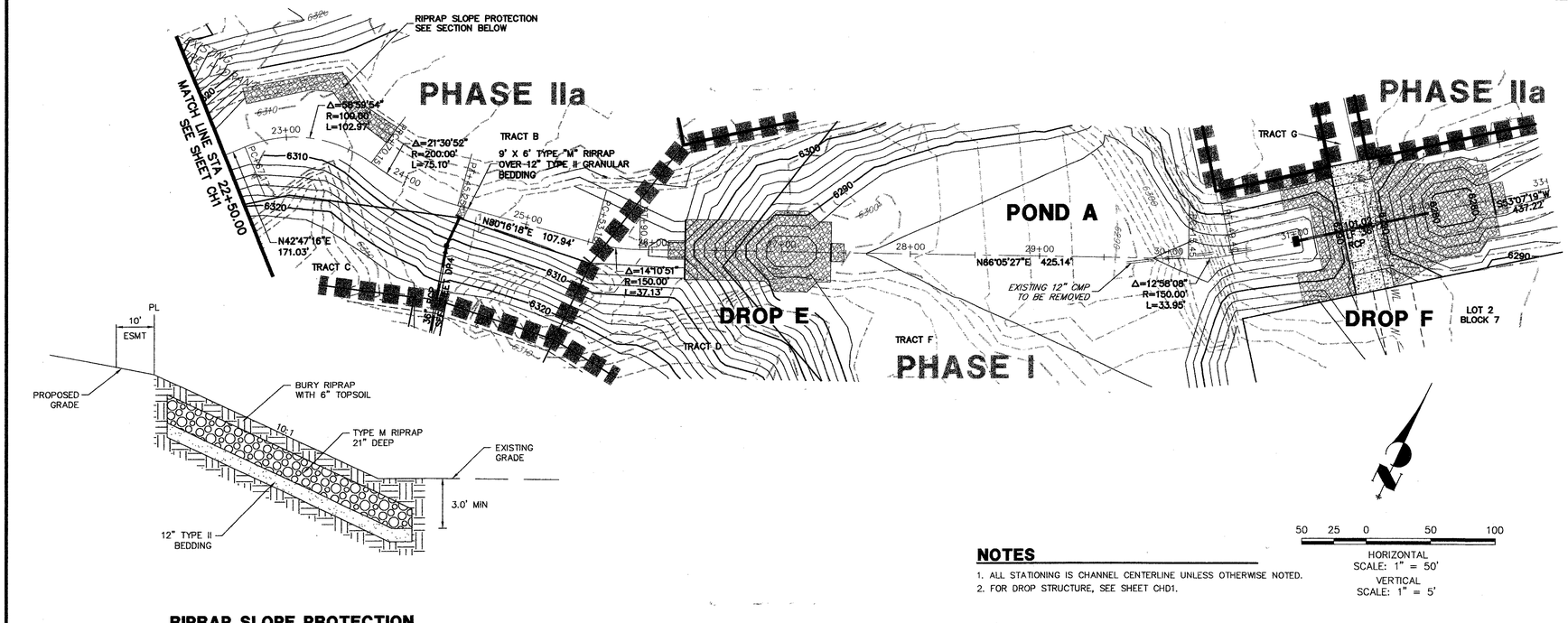
Drainageway Costs (Priority 1)	$187,780	$187,780	$0	$0
Contingency and Unscoped Items (30% of Drainageway Costs)	$56,300	$56,334	$0	$0
Construction Access (5% of Drainageway Costs)	$9,400	$9,389	$0	$0
Subtotal (Priority 1)	**$253,500**	**$253,503**	**$0**	**$0**
Mobilization and Permitting Requirements (15% of Subtotal)	$38,000	$38,025	$0	$0
Construction Total (Priority 1)	**$291,500**	**$291,528**	**$0**	**$0**
Administration and Engineering (20% of Construction Total)	$58,300	$58,306	$0	$0
Total (Priority 1)	**$349,800**	**$349,834**	**$0**	**$0**

Proposed Priority 2 Improvements: Priority 2 improvements for this sheet are 3 drop structures located designed to stabilize the channel grade. Priority 2 structures are recommended to be drop structures where channel improvements are also recommended.

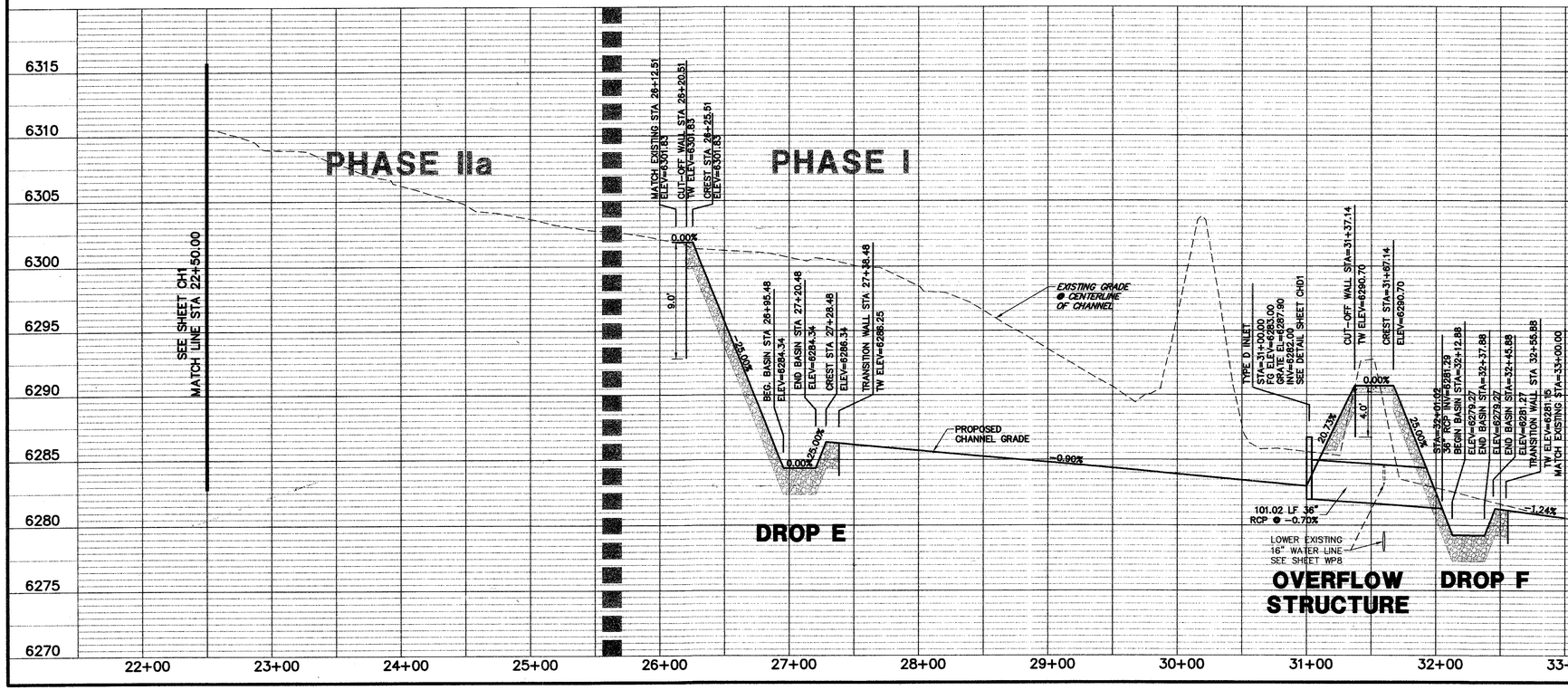
Drainageway Costs (Priority 2)	$225,000	$0	$0	$225,000
Contingency and Unscoped Items (30% of Drainageway Costs)	$67,500	$0	$0	$67,500
Construction Access (5% of Drainageway Costs)	$11,300	$0	$0	$11,250
Subtotal (Priority 2)	**$303,800**	**$0**	**$0**	**$303,750**
Mobilization and Permitting Requirements (15% of Subtotal)	$45,600	$0	$0	$45,563
Construction Total (Priority 2)	**$349,400**	**$0**	**$0**	**$349,313**
Administration and Engineering (20% of Construction Total)	$69,900	$0	$0	$69,863
Total (Priority 2)	**$419,300**	**$0**	**$0**	**$419,175**

Proposed Priority 3 Improvements: The Priority 3 improvement for this sheet is one drop structure located at Station 76+60. This drop structure should be constructed if the Priority 1 and Priority 2 drop/check structures do not stabilize the channel.

Drainageway Costs (Priority 3)	$75,000	$75,000	$0	$0
Contingency and Unscoped Items (30% of Drainageway Costs)	$22,500	$22,500	$0	$0
Construction Access (5% of Drainageway Costs)	$3,800	$3,750	$0	$0
Subtotal (Priority 3)	**$101,300**	**$101,250**	**$0**	**$0**
Mobilization and Permitting Requirements (15% of Subtotal)	$15,200	$15,188	$0	$0
Construction Total (Priority 3)	**$116,500**	**$116,438**	**$0**	**$0**
Administration and Engineering (20% of Construction Total)	$23,300	$23,288	$0	$0
Total (Priority 3)	**$139,800**	**$139,725**	**$0**	**$0**
Total Cost of Improvements	***$908,900***	***$489,559***	***$0***	***$419,175***

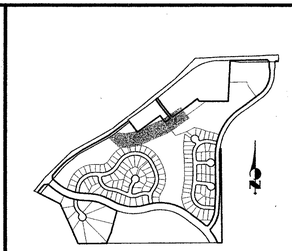


RIPRAP SLOPE PROTECTION



LEGEND

- 5700 — PROPOSED CONTOUR
- 5700 — EXISTING CONTOUR
- PROPOSED STORM SEWER
- DROP STRUCTURE



KEY MAP

1"=1000'

BENCHMARK

DOUGLAS COUNTY BENCHMARK 3.011025. BENCHMARK IS WITNESSED BY A BROWN CARSONITE POST AND IS LOCATED APPROXIMATELY 230 FEET FROM THE WEST END OF ATCHISON COURT ALONG A DIRT ACCESS ROAD. EL=6351.35

ENGINEER'S STATEMENT

I HEREBY AFFIRM THAT THESE CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY AND THAT I AM FULLY RESPONSIBLE FOR ALL DESIGN.

JAMES R. FITZMORRIS, P.E.
COLORADO NO. 28211
FOR AND ON BEHALF OF JR ENGINEERING

7/24/00

NOTES

1. ALL STATIONING IS CHANNEL CENTERLINE UNLESS OTHERWISE NOTED.
2. FOR DROP STRUCTURE, SEE SHEET CHD1.

50 25 0 50 100

HORIZONTAL
SCALE: 1" = 50'
VERTICAL
SCALE: 1" = 5'

TOWN OF CASTLE ROCK APPROVALS
THESE PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF PUBLIC WORKS DIRECTOR APPROVAL

RECOMMEND APPROVAL BY:
ENGINEERING DIVISION — DATE 7/25/00

APPROVED BY:
PUBLIC WORKS DIRECTOR — DATE 8/3/00

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING, LTD. APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

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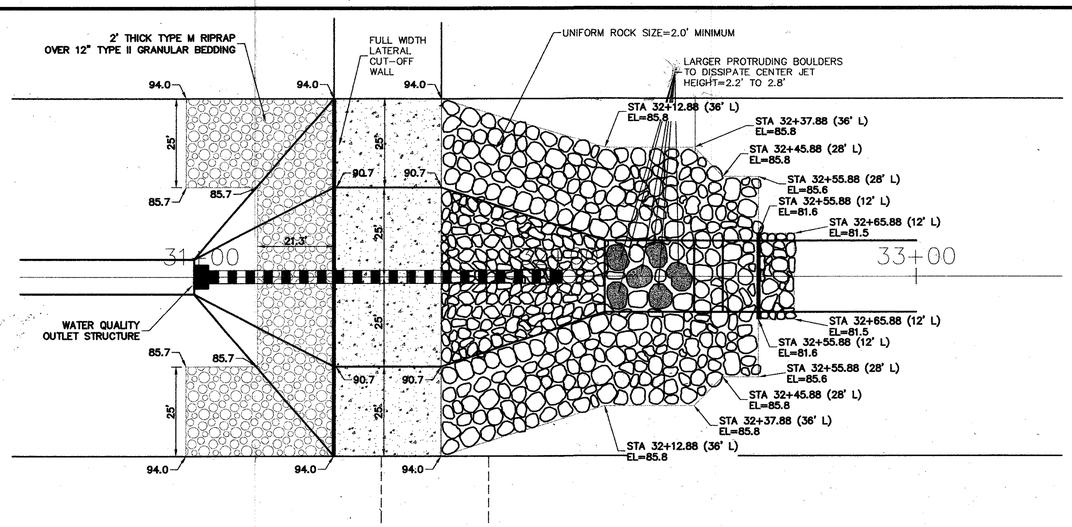
No.	REVISION	BY	DATE
1	PER TOWN OF CASTLE ROCK COMMENTS	AHK	11/08/99
2	PER TOWN COMMENTS	WRL	12/10/99
3	REVISED PHASING	JEL	7/12/00

SCALE 1"=50' | DATE 7/22/99 | DES. BY RDC | CHK. BY JRF | DWN. BY WBH

CASTLE HIGHLANDS FILING NO. 2
DRAINAGE CHANNEL PLAN & PROFILE
CASTLE ROCK EQUITITES, L.L.C.

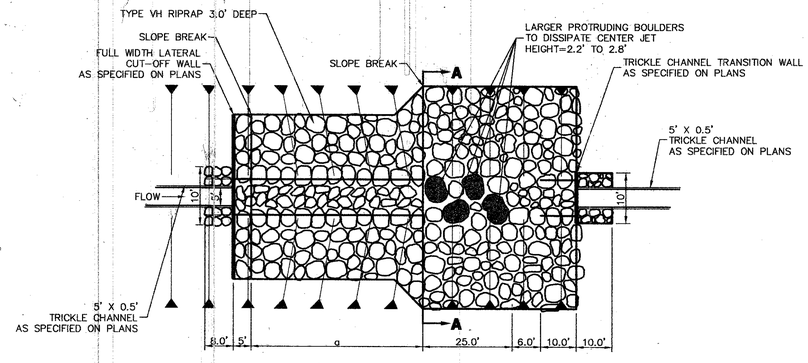
SHEET CH2 OF 2
JOB NO. 2316.05

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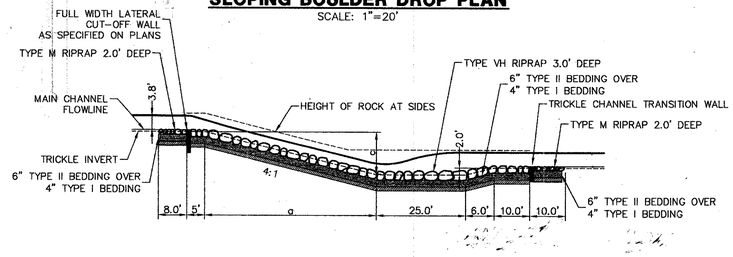


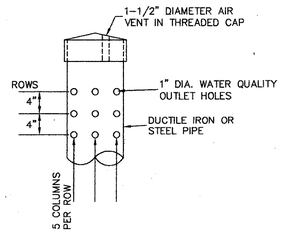
DETENTION POND A OVERFLOW STRUCTURE DETAIL
SCALE: 1"=20'

DROP STRUCTURE TABLE	DROP A	DROP B	DROP C	DROP D	DROP E	DROP F
a	47.40'	48.00'	48.00'	51.66	69.97	45.74'
b	10.00'	10.00'	10.00'	10.00'	10.00'	8.00'
c	11.84'	12.00'	12.00'	12.91'	17.49'	11.43'



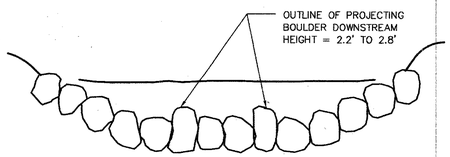
SLOPING BOULDER DROP PLAN
SCALE: 1"=20'



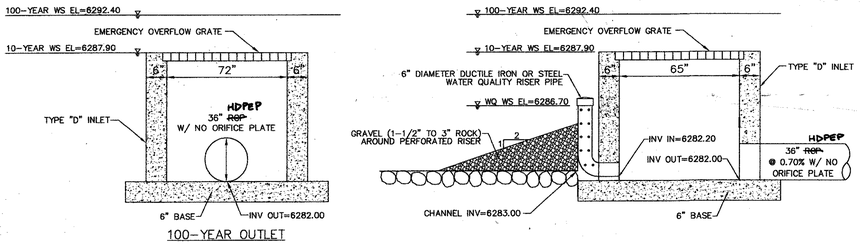


WATER QUALITY RISER PIPE

SLOPING BOULDER DROP PROFILE
SCALE: 1"=20'



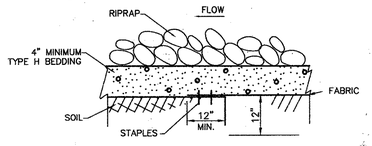
SECTION A-A
SCALE: N.T.S.



100-YEAR OUTLET

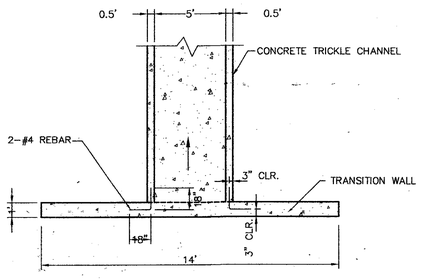
WATER QUALITY OUTLET STRUCTURE
N.T.S.

NOTES:
1. ALWAYS PLACE FABRIC STARTING DOWNSTREAM AND WORK UPSTREAM
2. ALL FILTER FABRIC TO BE INSTALLED SHALL COMPLY WITH URBAN DRAINAGE.
3. FILTER FABRIC LAP SHALL INCLUDE A 12" VERTICAL CUTOFF WHEREIN THE UPSTREAM END OF THE DOWNSTREAM PIECE IS FOLDED VERTICALLY 12" INTO THE GROUND AND THE UPSTREAM PIECE IS LAID OVER THE TOP WITH A 12" LAP.

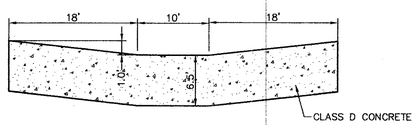


PROFILE SECTION

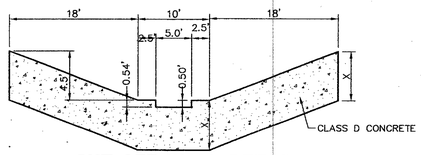
TYPICAL LAP DETAIL AND FILTER FABRIC PLACEMENT
SCALE: 1"=5'



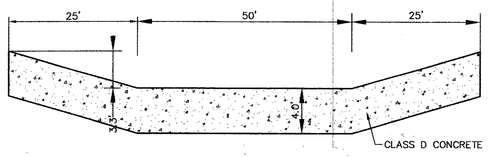
TRICKLE CHANNEL & TRANSITION WALL REBAR PLACEMENT TYPICAL
SCALE: 1"=5'



CUT-OFF WALL DETAIL DROP A
SCALE: N.T.S.

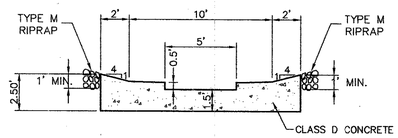


CUT-OFF WALL DETAIL DROPS B,C,D AND E
SCALE: N.T.S.

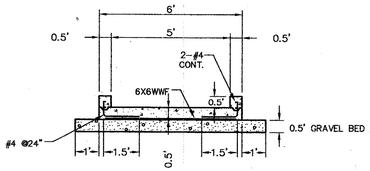


CUT-OFF WALL DETAIL DROP F
SCALE: N.T.S.

CUT-OFF WALL TABLE	DROP B	DROP C	DROP D	DROP E
X	6.0'	6.0'	6.5'	9.0



TYPICAL TRICKLE CHANNEL TRANSITION WALL
SCALE: 1"=5'



CONCRETE TRICKLE CHANNEL
SCALE: 1"=3'

ENGINEER'S STATEMENT

THESE DETAILS SHOWN WERE REVIEWED ONLY AS TO THEIR APPLICATION ON THIS PROJECT

JAMES P. FITZMORRIS, P.E.
COLORADO NO. 28211
FOR AND ON BEHALF OF JR ENGINEERING, LTD.

7/24/00

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SCALE AS SHOWN | DES. BY | CHK. BY | DWN. BY
DATE 7/24/99 | RDC | JPF | WBH

CASTLE HIGHLANDS FILING NO. 2

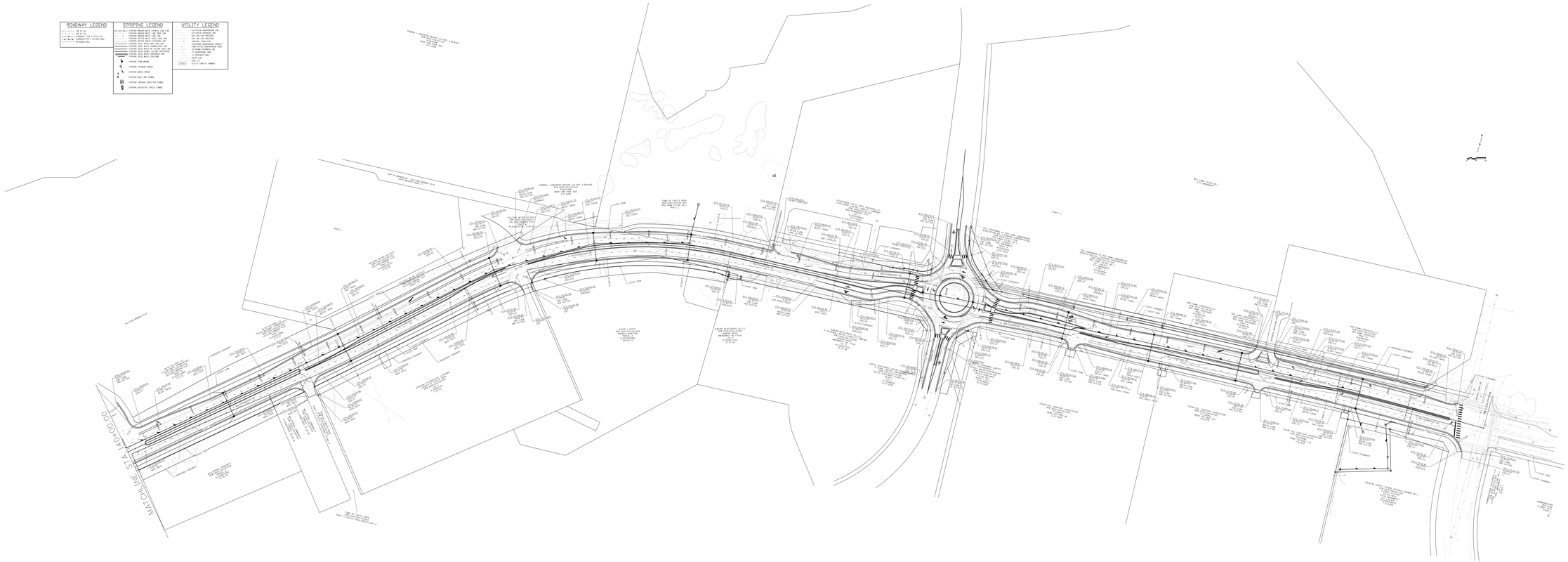
DRAINAGE CHANNEL DETAILS

CASTLE ROCK EQUITIES, L.L.C.
PREPARED FOR

SHEET CHD1 OF 1

JOB NO. 2316.05

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5/24/2023 mdelkey 8:02:07 AM j:\projects\cad-sw\pw\berkley.com\projects-sw-pw-02\Documents\WX\170100 - Rollerblade\Wpw_Projects\4 Delivery\WIP-Roadway\Drawings\35-Plan Drawings\WW - 20psm -Roadway 2 Plans.dgn