

PHASE II DRAINAGE STUDY
FOR
FOUNDERS VISTA SUBDIVISION
TOWN OF CASTLE ROCK
DOUGLAS COUNTY, COLORADO
Case No. SDP20-0026

JUNE 30, 2024

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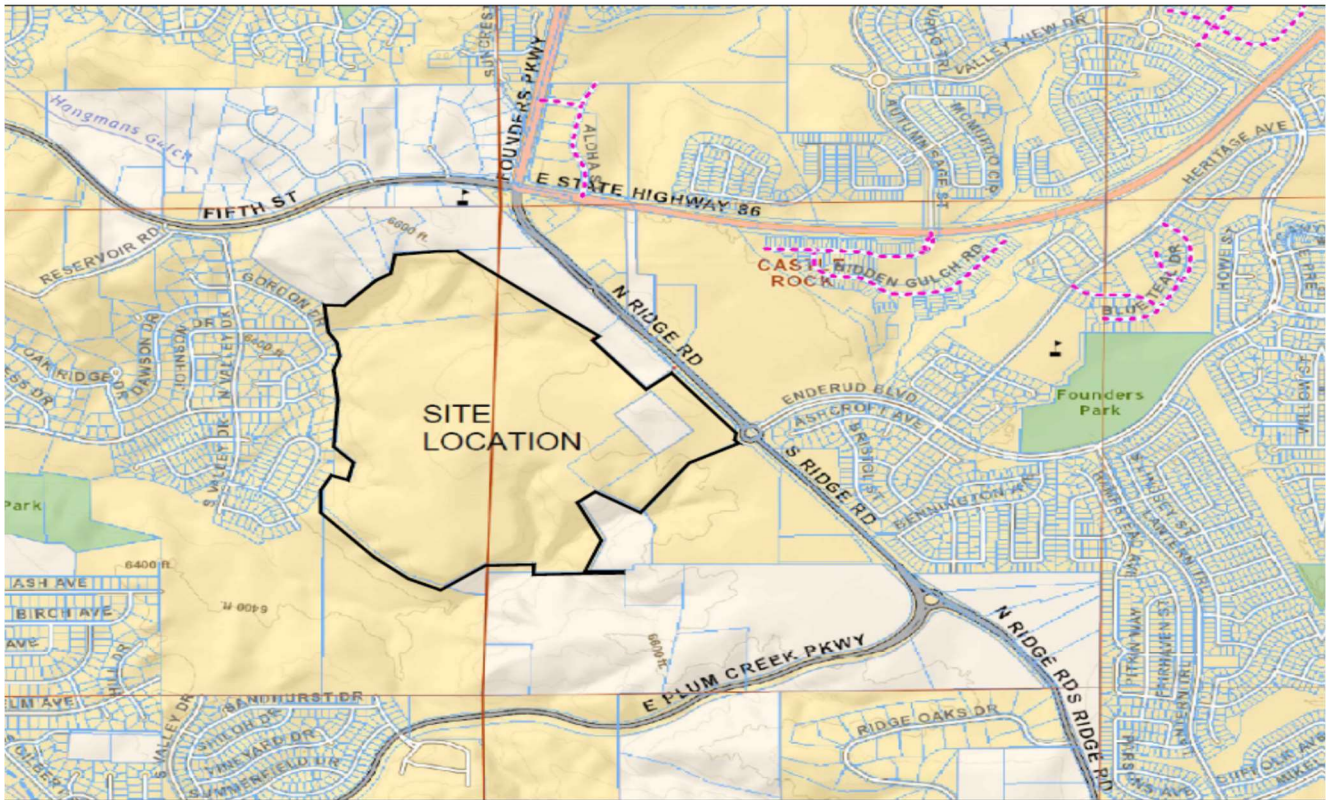
Job No. Founders

“I affirm that this report and plan for the Phase II Drainage design of Founders Vista Subdivision, was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others.”

Russell B. Hall, PE & PLS
Colorado Registration No. 26715

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VICINITY MAP



II. GENERAL LOCATION AND DESCRIPTION

A. Site Location

2. Township

Founders Vista is located within part of the West ½ of Section 7, Township 8 South, Range 66 West of the Sixth Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado.

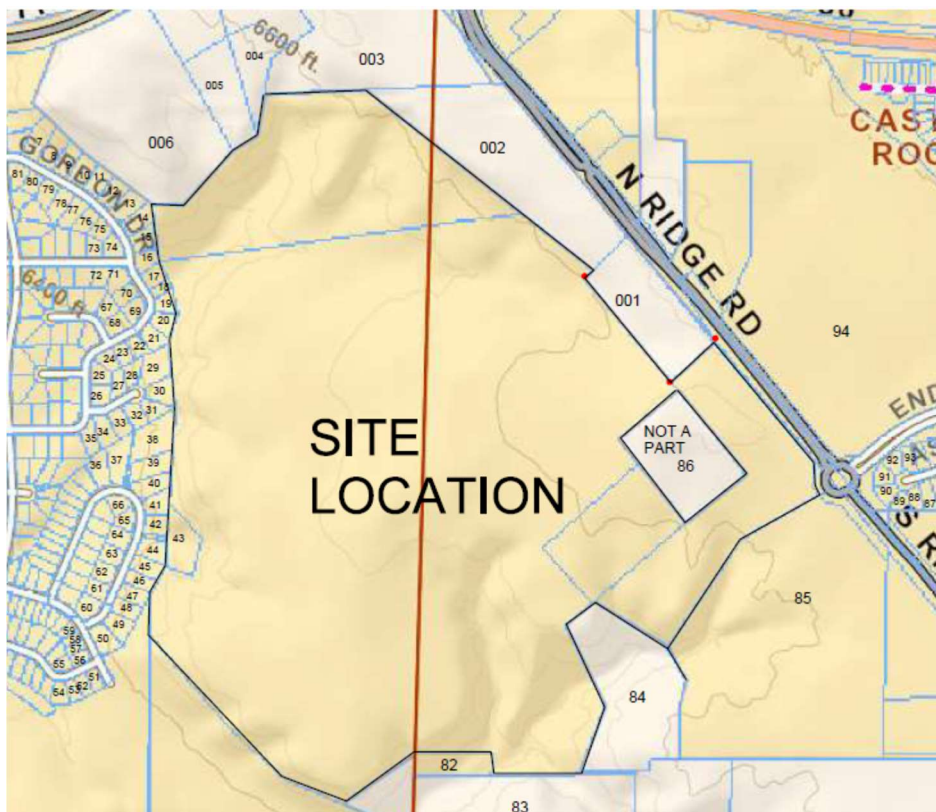
3. Existing and Proposed Streets

The proposed site is bound to the northeast by Ridge Road. Two residential collector streets are proposed to provide access to the property. A network of residential streets are proposed to provide home sites and adequate traffic circulation to both residential Collector streets.

4. Surrounding Streets and Properties

(See Parcel Map – Below)

The proposed site is bound to the northeast by Ridge Road and 5-acre parcels containing single family detached homesites (See 001-002), to the Southeast by undeveloped agricultural land (See 84-86), to the Southwest and West by single family detached homes within subdivisions “Memmen's 3rd Add To Castle Rock” and “Michael's 2nd Addition To Castle Rock” and to the Northwest by unincorporated Douglas County homesites (See 003-005) and the St. Francis of Assisi Church (See 006).



B. Description of Property

1. Area of Property

Founders Vista Subdivision is a proposed Single Family Subdivision consisting of approximately 180.5 acres.

2. Ground Cover

The project site is presently mostly undeveloped Pasture land with exposed outcroppings of rock and boulders. Native grasses and shrubs cover most of the site with clusters of ponderosa pine trees located along the western perimeter. Ridge Road is presently paved with water main and dry utilities.

3. NRCS

The Natural Resources Conservation Service (NRCS) web soils survey map identify soils for this site as predominately Fondis Clay Loam and Fondis-Kutch association. According to the NRCS, Hydrologic soil group C are recommended for purposes of this report

4. Major and Minor drainageways

The entire project site is tributary to Plum Creek. No Major drainageways exist onsite. Minor tributaries to Sellars Gulch are located along the western edge and Eastern edge of the project site. The Town GIS map showing watersheds indicate a portion of the project identified in State Parcel No. 2507-072-00-028 to be tributary to Cherry Creek, but is actually tributary to Plum Creek.

5. Floodplains

The project site is tributary to Plum Creek Southwest of the project site. According to the FEMA panel number 08035C0302G, Effective date 03/16/2016, the project site is located within Zone X, which is defined as an area having minimal flood hazard, and is not located within any 100 year floodplain.

6. Existing Canals and Ditches

No ditches or canals exist on the project site.

7. Significant Geological Features

The Southwestern edge of the site is a steep cliff, having slopes ranging from 20 to 35 percent grade, with exposed rock out cropping.

8. Proposed Land Uses

Founders Vista Subdivision is a proposed single family subdivision consisting of approximately 521 lots for 297 single family detached and 224 attached duplex homes. The site layout was designed to provide a centralized urban development with approximately 50 percent open space buffers along the South and Southwestern edge of the property. A public street network will provide access through the site with two points of access onto Ridge Road.

III. DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basins

1. Basin Characteristics and Flow Patterns

Historic Basins H-1 through H-6 have a plateau with moderate slopes ranging from 1 - 10 percent sloping towards the southwest, (see historic drainage map in appendix). Minor tributaries have formed due to wind and runoff erosion to convey surface runoff from the plateau to the south and southwest property line. Slopes significantly steepen at the southwestern edge of the plateau with slopes ranging from 20-40 percent down to the base of the plateau. The steep downward slope is approximately 250 feet long dropping approximately 100 feet in elevation. Runoff continues overland to Sellars Gulch located approximately 750 feet southwest of the project site.

Historic Basin H-1 consists of 57.8 acres located at the Norwest portion of the site. Offsite sub-basins O-1 and O-2 consisting of 22.6 acres and 7.4 acres respectively, are tributary to Basin H-1. Runoff is conveyed overland, sheet flowing in a westerly direction toward an existing ravine at the northwest portion of the site. Steep Slopes ranging from 25-35 percent in the ravine reduce significantly to slopes ranging from 1-10 percent near the northwest property line and runoff continues conveyance overland in a southwesterly direction to Sellars Gulch.

Historic Basin H-2 consists of 60.1 acres located on the western portion of the site. Runoff is conveyed overland, sheet flowing at slopes ranging from 1-10 percent in a westerly direction toward the west property line. Slopes steepen significantly , ranging from 25 to 40 percent, approximately 100 feet east of the west property line. Runoff conveyance is continued overland down the steeper slope within numerous gullies and minor tributaries exist. The steep slope reduces approximately 100 feet west of the west property line, and continues west to Sellars Gulch

Basins H-3 through H-6 are located at the southern portion of the site. Offsite Basin O-3 is tributary to Basin H-3 approximately 600 feet east of Design Point 3, (See Historic Drainage Map). A steep ravine, having slopes from 20 – 40 percent, starts at the southern edge of Basin H-6, runs westerly through offsite basin O-3 to the south portion of Basin H-3. Runoff from each Basin H-3 through H-6 sheet flows overland to the existing ravine.

2. Land Use

The property is currently vacant agricultural land use.

The proposed land use is for and urban development of single family attached and detached homes. Basin A contains 62.1 acres having approximately 30 acres of single family detached home lots, 16 acres of duplex lots, and 16 acres of open space. Basin B contains 39.0 acres having approximately 30.5 acres of single family detached home lots, and 10 acres of open space. Basin C contains 41.4 acres having approximately 15 acres of single family detached home lots and 24 acres of open space. A public street network will provide access through the site with two points of access onto Ridge Road.

Offsite basins O-1 and O-2 depicted on the Historic Drainage Map contain approximate 5-acre single family detached home sites. Offsite basin O-3 is presently undeveloped agricultural land use.

3. FHAD Studies and Master Planning Studies

No FHAD or Master Planning studies are known to have been prepared for this site.

4. Developed Flow Impacts on existing tributaries

Sub-basin A-9.2 contains 15.4 acres located at the northwest portion of the site. Sub-basin A-9.2 is planned to remain open space which contains a ravine. Developed runoff for the major and minor storm events will be conveyed overland within the ravine to Detention pond A located at design point 12. The flow rate within the ravine will be less than historic upstream from Detention Pond A, which will reduce potential for erosion from occurring down the steep incline ranging from 20-35 percent grade.

Sub-basin C-4 contains 4.9 acres located at the south portion of the site. Sub-basin C-4 is planned to remain open space which contains a ravine. Developed runoff for the major and minor storm events will be conveyed overland within the ravine to a tributary to Sellers Gulch at design point 26.

Attenuated runoff from Detention Pond B and Pond C combine in storm sewer downstream from Pond C and continue conveyance via storm sewer to a minor tributary of the Sellars Gulch tributary at design point 27. The MHFD Detention Spreadsheet program Version 4.06 was used to calculate pre-development peak discharges tributary to Detention Pond B and C to determine allowable release rates. The combined attenuated flow from Pond B and Pond C will be conveyed via storm sewer pipe to a tributary to Sellers Gulch at design point 26. No significant impact to the Sellers Gulch Tributary is anticipated as a result of this project.

Sub-basin C-5 contains 13.0 acres located at the southeast portion of the site. Sub-basin C-5 is planned to remain mostly open space which contains a ravine. 0.4 acres of B-Lots, Garden Level and Walkout type lots proposed along the northeast edge of Sub-basin C-5.1 will sheet flow down the cliff embankment. The amount of runoff from the perimeter lots will be less than historic flow rate and will have less erosion potential than historic to the rocky incline. Developed runoff for the major and minor storm events will be conveyed overland within the ravine to a minor tributary to Sellers Gulch at design point 26. Runoff from Basin 5 and upstream offsite sub basins O-3 combine in the Sellars Gulch tributary at design point 26.

5. Developed Flow Impacts of offsite flow patterns

Detention Pond A-1 is located on the top plateau at Design Point 11.3. Detention Pond A-1 will attenuate developed runoff from Basins A-1 to A-9.1, O-2, O-4, and O-5 comprising of

57.3 acres. Detention Pond A-1 is designed to attenuate developed runoff for the full spectrum storm event and continue conveyance via storm sewer pipe to Storm sewer outfall Downstream from Detention Pond A-2 located at the base of the plateau at design point 12.1.

Detention Pond A-2 is designed to attenuate developed runoff for the full spectrum storm event for Basin A-9.2, OA-1 and OA-2 comprising of 32.5 acres. The storm sewer conveying the attenuated runoff from Detention Pond A-1 will combine with the storm sewer outfall from Detention Pond A-2, and continue conveyance to an existing Flume and storm sewer outfall located in Tract A and Gordan Drive of Memmens 3rd Addition to Castle Rock Subdivision.

According to the approved drainage study for Gordan Drive Improvements Project, the Gordan Drive Storm sewer outfall will intake 136.5 cfs from Founders Vista Subdivision, (Basin A), and Off-site basins, (O-1, O-2, O-4 and O-5). The combined release rate from Detention Ponds A-1 and A-2 will be 136.5 cfs in accordance with the Gordan Drive Improvements Project.

In the event the storm sewer outfall from Detention Pond A-1 is plugged, or the drainage facilities do not function as intended, an overflow structure is proposed to direct developed runoff overland to Detention Pond A-2.

In the event the storm sewer outfall from Detention Pond A-2 is plugged, or the drainage facilities do not function as intended, an overflow structure is proposed to convey developed runoff overland to the existing Flume and storm sewer outfall located in Tract A and Gordan Drive of Memmens 3rd Addition to Castle Rock Subdivision. The MHFD Detention Spreadsheet program Version 4.06 was used calculate post-development peak discharge tributary to Detention Ponds A-1 and A-2. The combined peak flow tributary to Detention pond A-1 and A-2 to be $156.4 \text{ cfs} + 62.4 \text{ cfs} = 218.8 \text{ cfs}$ total.

In the event overflows from both Detention Ponds A-1 and A-2 are activated to convey the Peak post-development flow of 218.8 cfs to Gordan Drive, the Flume and existing Gordan Drive outfall will intercept 136.5 cfs, and the remaining 82.3 cfs of developed runoff not intercepted by the Flume and outfall at Gordan Drive will continue conveyance overland within Gordan Drive. According to Figure 7-1 “Town of Castle Rock Street Capacity Chart”, Gordan Drive will have sufficient capacity to convey the runoff not intercepted by the Flume and Gordan Drive outfall. The outfall at Gordan Drive and Gordan Drive have sufficient capacity to convey the 100 year storm event from Pond A in the event the overflow structure is active.

In order to demonstrate sufficient capacity in downstream conveyance such that no downstream structures are in the path of the overflow from both detention ponds A-1 and A-2, the UD-Inlet model contained in the Phase III drainage Study for Gordan Drive was reconstructed to determine the maximum flow capacity for Gordan Drive. The UD-Inlet summary contained in the approved drainage report only calculated street capacity from curb face to curb face. The UD-inlet data from the Gordan Drive drainage report was input with additional data to widen the flow width for Gordan Drive to be allowed 10 feet beyond the ROW line and having a depth of 12-inches above the existing curb flowline. 10 feet behind the ROW was selected because the front of existing Homes along Gordan Drive are set back 20 feet from the street Right-of-Way

and are typically set a minimum of 2' above the existing flowline of Gordan Drive. A field survey was conducted to obtain existing flowline elevations and spot elevations on existing lots to confirm that a minimum of 12-inches above flowline plus 1-foot free board exists on Gordan Drive to confirm that no homes or structures exist within the 100-year storm event plus overflow from detention pond A-1 and A-2 flow path along Gordan Drive. (See drainage plan sheet D-3 – Gordan Drive Overflow Path Exhibit). The results from the updated UD-Inlet calculation for street capacity yielded a street capacity range of 220.2 cfs to 271 cfs. Using the lowest capacity of 220.2 cfs, Gordan Drive has adequate capacity to convey the 82.3 cfs which would spill into Gordan Drive at the existing Flume downstream of Detention pond A-2 in the event both overflow structures in Detention Ponds A-1 and A-2 are activated. (See Appendix B – Gordan Drive UD Inlet).

Detention Pond B is designed to attenuate developed runoff for the full spectrum storm event for Basin B. Historically, runoff from basin B is conveyed overland to an existing tributary to Sellers Gulch located between single family lots and Outlot A of Michaels 2nd Addition to Castle Rock and continues overland to S. Larkspur Drive. A feasible conveyance method in accordance with the Town's drainage criteria does not exist to convey the attenuated runoff from Pond B, down the steep terrain, to the existing tributary below in Michaels 2nd Addition. Therefore, the attenuated runoff from Detention Pond B is proposed to be conveyed South via storm sewer pipe to the proposed storm sewer outfall from Detention Pond C which daylights at the tributary to Sellers Gulch at design point 28. The MHFD Detention Spreadsheet program Version 4.06 was used calculate the pre-development peak discharge tributary to Detention Pond B for determination of the allowable release rate from Detention Pond B. The attenuated will be released at the historic rate and will have no significant impact to the existing drainage facilities downstream. In the event the storm sewer is plugged in Pond B or the drainage facilities do not function as intended, an over flow structure is proposed to convey developed runoff overland to the existing tributary to Sellers Gulch located in Michaels 2nd Addition to Castle Rock Subdivision. The MHFD Detention Spreadsheet program Version 4.06 was used calculate post-development peak discharge tributary to Detention Pond B at 130.5 cfs. The existing tributary to Sellers Gulch has sufficient capacity to convey the 100 year storm event, 130.5 cfs, from Pond B when the overflow structure is active.

Detention Pond C is designed to attenuate developed runoff for the full spectrum storm event for Basin C. The attenuated runoff from Detention Pond C will be conveyed via storm sewer pipe to the existing tributary to Sellers Gulch located at design point 28. The attenuated will be released at historic rate, combining with the attenuated runoff from Basin B. The MHFD Detention Spreadsheet program Version 4.06 was used calculate pre-development peak discharge tributary to Detention Pond C, (Basins C-1, C-2 and C-3) was used to determine the allowable release rate for Detention Pond C..

The attenuated runoff from Detention Pond B will be conveyed via storm sewer pipe to the outfall from Detention Pond C. The combined attenuated runoff from Detention Ponds B and C will be conveyed to the existing tributary to Sellars Gulch.

In the event the storm sewer is plugged or the drainage facilities do not function as intended, an

overflow structure is proposed to convey developed runoff overland from Detention Pond C to the existing tributary to Sellers Gulch. The MHFD Detention Spreadsheet program Version 4.06 was used to calculate post-development peak discharge tributary to Detention Pond C at 75.2 cfs. The tributary to Sellers Gulch has sufficient capacity to convey the 100 year storm event, 75.2 cfs, from Pond C in the event the overflow structure is active.

B. Minor Drainage Basins

1. Characteristics and Developed flow patterns

Four onsite detention ponds for Basins A, B and C are proposed to attenuate developed runoff for the Full Spectrum storm events. Developed runoff for the major and minor storm events will be conveyed via public roadways. On Grade Storm Sewer inlets within streets are proposed at location where developed runoff approaches street capacity for the minor storm event. Storm sewer inlets within streets in a sump condition are designed to intercept all remaining carry-over flow not intercepted by upstream inlets during the minor and major storm events. In the event the sump inlet is plugged or does not function as intended, developed runoff will overtop the curb and sidewalk and be conveyed via armored overflow swales within proposed open space tracts to roadways and drainage facilities downstream. The Phase III drainage report will demonstrate overflow path routing as well as maximum ponding depth for each inlet proposed in a sump condition. Any locations where the flow depth exceeds the allowable spread onto private lots and measures to reduce depths during the 100 year storm event shall be noted in the Phase III Drainage Report.

Basins A-1 through A-9.1, O-2, O-4, and O-5 consists of 57.3 acres located on the northern half of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a sump inlet located at design point 11.2. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located at the Northwest corner of the site in Sub-basin A-9.1 on the top plateau at design point 11.3. . The attenuated runoff from detention pond A-1 will be conveyed via storm sewer Northwest to the storm sewer outfall downstream of Detention Pond A-2.

Basins A-9.2, O1-A and O1-B consists of 32.5 acres are located on the northern half of the site at the base of the plateau. Surface runoff will be conveyed overland via existing swales and gullies through the ravine to Detention Pond A-2 at design point 12.

0.8 acres of Basin A-9.2 consists of B-Lots, Garden Level and Walkout type lots proposed along the western edge of the plateau from which developed runoff will sheet flow down the cliff embankment. The amount of runoff from the perimeter lots will be less than historic flow rate and will have less erosion potential than historic to the rocky incline. The remainder of Basin 9.2 will remain undeveloped from which surface runoff will be conveyed overland along its historic course to Detention Pond A-2, and combine with surface runoff from offsite basins OA-1 and OA-2 at design point 12.

The total of Basin A, sub-basin O-1, and O-2, O-4 and O-5 comprise of a total of 89.8 acres tributary to design point 12.2 on the drainage map. Historic Basin H-1, O-1 and O-2 comprise of 87.8 acres tributary to design point 1 on the historic drainage map. The tributary area of the proposed basin was designed to be the approximate same size basin as historic. Detention ponds A-1 and A-2 will attenuate the developed runoff to equal the downstream outfall capacity being less than historic. No significant impact of this development are anticipated to the downstream drainage facilities.

Basin B consists of 39.0 acres located on the Central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to detention pond B located on the West edge of the top plateau in Sub-basin B-8 at design point 21 on the drainage map. The attenuated runoff from detention pond B will be conveyed via storm sewer South to the proposed storm sewer outfall Southwest of Proposed Detention Pond C.

Basin D-1, consisting of 36.4 acres, is a proposed open space buffers located along the west portion of the site. Drainage patterns within this open space area will remain mostly undisturbed. Runoff from Basin D-1 will sheet flow down the cliff embankment. The amount of runoff from Basin D-1 will be less than historic flow rate and will have less erosion potential than historic to the rocky incline.

Basin C-1 through C-3 consists of 23.5 acres located on the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to detention pond C located on the Southwest edge of the top plateau in Sub-basin C-3.2. The attenuated runoff from detention pond C will be conveyed south via storm sewer west, combining with attenuated runoff from Basin B via storm sewer to an existing minor tributary Sellars Gulch located offsite at the base of the plateau below at design point 28.

B-Lots, Garden Level and Walkout type lots proposed along the eastern edge of the plateau in Sub-basin C-3.1 and C-1.6 will be intercepted by a diversion swale. Runoff will continue to respective Type C Inlets and continued via storm sewer to Detention Pond C.

Basin C comprises 41.4 acres and Basin B comprises of 39.0 acres for a total of 80.4 acres tributary to design point 28 on the drainage map. Historic Basins H-3, H-4, H-5 and H-6 comprise of 62.6 acres tributary to design points 3 and 4 on the historic drainage map. The tributary area of the proposed basin B-C outfall was designed to approximately match the historic basin's H-3 through H-6's tributary area to the existing Sellars Gulch tributary. The proposed basin B-C outfall daylights approximately 730 feet downstream (Southwest) of design point 4 on the historic drainage map. No significant impact of runoff from this development is anticipated to the downstream drainage facilities.

2. Land Use

The proposed land use is for and urban development of single family attached and detached homes. Basin A contains 62.1 acres having approximately 30 acres of single family detached home lots, 16 acres of duplex lots, and 16 acres of open space. Basin B contains 39.0 acres having approximately 30.5 acres of single family detached home lots, and 10 acres of open space. Basin C contains 41.4 acres having approximately 15 acres of single family detached home lots and 24 acres of open space. A public street network will provide access through the site with two points of access onto Ridge Road

3. Impacts to irrigation facilities

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

4. Impacts of offsite flow patterns and paths.

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

IV. DRAINAGE DESIGN CRITERIA

A. Regulations

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

B. Drainage Studies, Master Plans, Site Constraints

1. Previous Drainage Studies

No previous drainage studies or master plans for this site have been prepared.

2. Adjacent Development Impact.

The Final Drainage Report for Memmens 3rd Addition to Castle Rock identifies receiving historic runoff from Historic Basin H-1, and adjoining offsite basins.

The Final Drainage Report for Memmens 2nd Addition to Castle Rock and Michaels 2nd Addition to Castle Rock identifies receiving historic runoff from Historic Basin H-1, and adjoining offsite basins.

3. Town Master Plans

No Master plans were reviewed as part of this drainage report.

4. Stormwater Management Facility Constraints

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

C. Hydrology

1. Runoff Calculation Method

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

2. Design Storm recurrence intervals

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

3. Design Rainfall

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

4. Detention Storage calculation method

Four onsite detention/water quality ponds "A-1", "A-2", "B" and "C" will be constructed to provide water quality, and detention for the Full Spectrum storm event. The MHFD Detention Spreadsheet program Version 4.06 is used to determine required detention and Water Quality Capture Volume.

5. Detention Storage release rate calculation method

BASIN A

The MHFD Detention Spreadsheet program Version 4.06 was used calculate pre-development peak discharge of 89.3 cfs tributary to Detention Pond A-1 AND 62.0 cfs tributary to Detention Pond A-2 = for a total 151.3 cfs tributary to the existing Outfall in Gordan Drive.

According to the approved drainage study for Gordan Drive Improvements Project, the Gordan Drive Storm sewer will intake 136.5 cfs from Basin A and O. The total combined release rate from Detention Ponds A-1 and A-2 is limited to 136.5 cfs. The release rates for Detention Pond A-1 and A-2 are proportionately calculated below having a total release rate of 136.5 cfs.

The release rate per acre for Detention Ponds A-1 and A-2 are calculated to be:

$$136.5 \text{ cfs} / 89.8 \text{ Ac.} = 1.52 \text{ cfs/ac.}$$

Proportionately, the release rate for Detention Pond A-1 will be:

$$57.3 \text{ Ac.} \times 1.52 \text{ cfs/ac.} = 87.10 \text{ cfs.}$$

Proportionately, the release rate for Detention Pond A-2 will be:

$$32.5 \text{ Ac.} \times 1.52 \text{ cfs/ac.} = 49.40 \text{ cfs.}$$

BASIN B AND C

Basin B consists of 39.0 acres, and Basins C-1 to C-3 tributary to Detention Pond C is 23.5 acres. The MHFD Detention Spreadsheet program Version 4.06 was used calculate pre-development peak discharge of 71.4 cfs tributary to Detention Pond B and 38.6 cfs tributary to Detention Pond C.

The release rate per acre for Detention Ponds B and C are calculated to be 71.4 scf and 38.6 cfs respectively.

The attenuated flow from Detention Pond B will be conveyed via storm sewer pipe to the outfall from Detention Pond C. The combined flow from Detention Pond B and C will not exceed pre-development peak discharge for the 100 year storm event to mitigate impact on downstream facilities.

D. Hydraulics

1. Methods used to determine conveyance facility capacities

Mannings Equation for pipe capacity was utilized for storm sewer design.

2. Hydraulic grade line calculation method and discussion of loss coefficients

Civil 3-D pipe design was utilized for hydraulic grade line calculations.

3. Methods used to calculate water surface profiles

No open channels are proposed as part of this project.

4. Detention Pond Routing

No pond routing was determined as part of this project.

Attenuated runoff from Detention Pond A-1 will be conveyed via storm sewer pipe to the proposed storm sewer outfall downstream of Detention Pond A-2, and continue conveyance via storm sewer to the existing Gordan Street outfall.

The attenuated flow from Detention Pond B will be conveyed via storm sewer pipe to the proposed storm sewer outfall from Detention Pond C, and continue conveyance via storm sewer to the existing tributary to Sellars Gulch.

E. Storage and Water Quality Enhancement

1. Detention Facilities

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

detention ponds A-1, B and C respectively. Developed runoff for the major and minor storm events will be conveyed overland via minor tributaries within the ravine in Basin A-9.2 to detention ponds A-2.

Basins A-1 through A-9.1, O-2, O-4, and O-5 consists of 57.3 acres located on the northern half of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a sump inlet located at design point 11.2. The intercepted runoff will continue conveyance via storm sewer pipe to Detention Pond A-1 located at the Northwest corner of the site in Sub-basin A-9.1 on the top plateau at design point 11.3. The attenuated runoff from detention pond A-1 will be conveyed via storm sewer along a proposed 15-foot maintenance road to the proposed storm sewer outfall downstream of Detention Pond A-2 .

Detention pond A-2 is located at the base of the ravine in sub basin A-9.2. A 15-foot maintenance access will be available to the detention pond through Memmen's 2nd Addition to Castle Rock to allow maintenance and repair as required. The 15 foot Maintenance Road from Memmens 2nd Addition will connect to proposed 15-foot maintenance road from Detention Pond A-1 and Birrcastle Way.

Detention ponds B and C are located near the western edge of the plateau. Access will be available to both ponds from public roadways through the open space areas contained in Sub-basins B-3 and C-3 to allow maintenance and repair as required. The attenuated runoff from each detention pond will be conveyed via storm sewer west to the base of the plateau.

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

1. Reducing Runoff Volume

Runoff from Sub-basin C-3.2 which abuts the open space located in Basin D will be conveyed via grass lined swale to Detention pond C to reduce velocity, increase time of concentration, and reduce flows tributary to proposed detention pond C.

Basin D and the Detention ponds and surrounding open space within sub-basins B-8 and C-3 are planned to be Park land use open to the public. Natural vegetation and topography will be utilized with moderate grading and compaction improvements to allow higher infiltration while providing a natural environment for public enjoyment.

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

2. Providing Water Quality and Flood Control

The Urban Drainage Criteria Manual is used to determine water quality volume and design of water quality release structures. Both ponds will have 4:1 side slopes with flat bottom configuration to optimize settlement and infiltration. The urban EURV and

WQCV provided in detention ponds A and B will drain within a 72-hour time frame to allow optimum time for pollutants and sediments to settle within the respective ponds before continuing conveyance downstream.

3. Stream Stabilization Techniques

Energy dissipator may be necessary to be constructed prior to exiting the property downstream to reduce runoff velocity and disperse flows. Storm sewer from detention ponds B and C are proposed to daylight at the base of the steeper slopes. Rip Rap lined Stilling Basins will be constructed to reduce flow velocity and disperse concentrated flow exiting the pipe before continuing conveyance downstream.

4. Undertaking source control

Open space amenities located on the top plateau next to Detention ponds B and C include private open space, Public Park, and Tot Lot. Trash receptacles will be provided next to the Tot Lot at the park entrance, and properly disposed of. Detention Ponds A and C will collect much of the surface runoff and provide water quality treatment from much of the open space amenities. Basin D, containing the park land use area, is proposed to remain as a natural aesthetic environment with soft trails for pedestrian use. Minimal illicit discharge is anticipated in Basin D to require containment measures.

All private open space, including detention facilities, shall be maintained by the Founders Vista Metropolitan District. The Metropolitan district shall keep landscape areas and open space clean and in good functioning order.

Existing Stormwater Conveyance Facilities

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

V. STORMWATER MANAGEMENT FACILITY DESIGN

A. Proposed Stormwater Conveyance Facilities

1. Proposed drainage facility concept

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

This Phase II Drainage Plan depicts 4 onsite detention ponds for Basins A, B and C to attenuate developed runoff for the Full Spectrum storm events.

Detention Pond A-1 located at the Northwest corner of the site in Sub-basin A-9.1 on the top plateau at design point 11.3. The attenuated runoff from detention pond A-1 will be conveyed via storm sewer along a proposed 15-foot maintenance road to the proposed storm sewer outfall downstream of Detention Pond A-2 .

Detention pond A-2 is located at the base of the ravine in sub basin A-9.2. The attenuated runoff from detention pond A-2 will be conveyed via storm sewer to the existing outfall at Gordan Street at Design Point 12.1. Access will be available to detention pond through Memmen's 2nd Addition to Castle Rock to allow maintenance and repair as required.

Detention ponds B and C are located near the western edge of the plateau. Access will be available to both ponds through the open space areas contained in Sub-basins B-3 and C-3 to allow maintenance and repair as required. The attenuated runoff from each detention pond will be conveyed via storm sewer west to the Sellars Gulch tributary at design point 28.

2. Proposed Drainage paths and patterns

Sub-Basin A-1 contains 3.9 acres located at the northwest portion of the site. The sub-basin has steep slopes ranging from 25-35 percent down toward sub-basin A-3. Runoff from sub-basin A-1 will sheet flow to a diversion swale located at the base of the slope and continue conveyance to a Type C Inlet tributary to the Basin A storm outfall tributary to Detention pond A-2.

Sub-Basin A-2 contains 10.8 acres located south of Sub basin A-3 in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to on grade storm sewer inlets located at design point 7.1 through 7.6. The inlets proposed at Design points 7.1 and 7.2 are intended to intercept minor and nuisance flow to prevent flow spreading. Upstream of Design points 7.1 and 7.2, the roadway is designed at a constant 5 percent grade, and spreading is not anticipated. During the 100 year storm event, runoff not intercepted by the inlets at design points 7.1 through 7.6 will be intercepted by an inlet in a sump condition at design point 10.5. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 11.3. The attenuated runoff from detention pond A-1 will be conveyed via storm sewer west to the storm sewer outfall downstream of Detention Pond A-2, and continue via storm sewer to the Gordan Street existing outfall located in Memmen's 3rd Addition to Castle Rock Subdivision.

Sub-Basin A-3 contains 5.4 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an

on grade storm sewer inlet located at design point 5. During the 100 year storm event, runoff not intercepted by the inlet at design point 5 will be intercepted by an inlet in a sump condition at design point 10.5. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 13.3. The attenuated runoff from detention pond A-1 will be conveyed via storm sewer west to the storm sewer outfall downstream of Detention Pond A-2, and continue via storm sewer to the Gordan Street existing outfall located in Memmen's 3rd Addition to Castle Rock Subdivision.

Sub-Basin A-4 contains 7.9 acres in the central portion of the site. Developed runoff from Sub-basins A-4.1, O-4 and O-5 for the major and minor storm events will be conveyed via diversion swale to a type C inlet located at design point 4. The Type C inlet is designed to intercept the 100 year storm event and continue conveyance via storm sewer to Pond A-1. Developed runoff from Sub-basins A-4.2, and 4.3 for the major and minor storm events will be conveyed via public roadways to an on grade storm sewer inlet located at design point 6.1 and 6.2. During the 100 year storm event, runoff not intercepted by the inlet at design point 6.1 and 6.2 will be intercepted by an inlet in a sump condition at design point 10.5. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 11.3. The attenuated runoff from detention pond A-1 will be conveyed via storm sewer west to the storm sewer outfall downstream of Detention Pond A-2, and continue via storm sewer to the Gordan Street existing outfall located in Memmen's 3rd Addition to Castle Rock Subdivision.

Sub-Basin A-5 contains 4.7 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 8. The Inlet is designed to intercept developed runoff for the 100 year storm event and continue conveyance to Detention Pond A-1 via storm sewer pipe.

Sub-Basin A-7.1 contains 0.9 acres located in the central portion of the site. Developed runoff from Sub-basin A-7.1 for the major and minor storm events will be conveyed via diversion swale to a type C inlet located at design point 10.2. The Type C inlet is designed to intercept the 100 year storm event and continue conveyance via storm sewer to Pond A-1.

Sub-Basin A-7.2 contains 0.5 acres located in the central portion of the site. Developed runoff from Sub-basin A-7.2 for the major and minor storm events will be conveyed via diversion swale to a type C inlet located at design point 10.3. The Type C inlet is designed to intercept the 100 year storm event and continue conveyance via storm sewer to Pond A-1.

Sub-Basin A-7.3 contains 4.0 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a

storm sewer inlet on grade located at design point 10.4. Runoff not intercepted by the inlet at design point 10.4 will be intercepted by an inlet in a sump condition at design point 10.5. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 11.3.

Sub-Basin A-7.5 contains 2.0 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 10.5. Runoff from Sub basin A-7.5 and carry over flow from upstream sub-basins A-1 through A-7.3 will be intercepted for 100 year storm event by the sump inlet at design point 10.5. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 11.3.

Sub-Basin A-7.4 contains 0.4 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet on grade located at design point 10.1. Runoff not intercepted by the inlet at design point 10.1 will be intercepted by an inlet in a sump condition at design point 11.2. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 11.3.

Sub-Basin A-8.1 contains 4.6 acres located in the northern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet on grade located at design point 11.1. Runoff not intercepted by the inlet at design point 11.1 will be intercepted by an inlet in a sump condition at design point 11.2. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 11.3.

Sub-Basin A-8.2 contains 0.2 acres located in the northern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at design point 11.2. Runoff from Sub basin A-8.2 and carry over flow from upstream sub-basins A-7.4 and A-8.1 will be intercepted for 100 year storm event by the sump inlet at design point 11.2. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond A-1 located on the Northwest corner of the site in Sub-basin A-9.1 at design point 11.3.

The attenuated runoff from detention pond A-1 will be conveyed via storm sewer west to the storm sewer outfall downstream of Detention Pond A-2, and continue via storm sewer to the Gordan Street existing outfall located in Memmen's 3rd Addition to Castle Rock Subdivision.

Offsite Basins O1-A and O1-B consists of 12.0 acres and 5.1 acres respectively located

North of the site, and are tributary to Basin 9.2. Surface runoff from the offsite basins will combine with runoff from Basin A-9.2 and be conveyed overland via existing swales and gullies through the ravine to Detention Pond A-2 at design point 12.

Basin A-9.2 consists of 15.4 acres located on the Northern portion of the site. Surface runoff will be conveyed overland via existing swales and gullies through the ravine to Detention Pond A-2 at design point 12. 0.8 acres of Basin A-9.2 consists of B-Lots, Garden Level and Walkout type lots proposed along the western edge of the plateau from which developed runoff will sheet flow down the cliff embankment. The amount of runoff from the perimeter lots will be less than historic flow rate and will have less erosion potential than historic to the rocky incline. The remainder of Basin 9.2 will remain undeveloped from which surface runoff will be conveyed overland along its historic course to Detention Pond A-2, and combine with surface runoff from offsite basins OA-1 and OA-2 at design point 12.

Detention Pond and A-2 is designed to attenuate developed runoff for the full spectrum storm event for Basin A-9.2, OA-1 and OA-2 comprising of 32.5 acres. The total tributary area to Detention Pond A-2 is 89.8 acres. The storm sewer conveying the attenuated runoff from Detention Pond A-1 will combine with attenuated runoff from from Detention Pond A-2, and continue conveyance to an existing Flume and storm sewer outfall located in Tract A and Gordan Drive of Memmens 3rd Addition to Castle Rock Subdivision.

Basins B-1.1 and B-1.2, containing 1.8 acres and 0.9 acres respectively, are planned for a future Clubhouse amenity. A Final drainage report will be required with a Site Development Plan for the Clubhouse and appurtenances. Until a Site Development Plan is approved for the Clubhouse, Sub-Basin B-1.1 and B-1.2 will remain undeveloped, and surface runoff from both basins will sheet flow to a Type C inlet located at design point 13.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention Pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-basin B-2 consists of 1.0 acres, being the south half of the west end of the Endurud Boulevard, being a collector street with the existing round-a-bout on Ridge Road. Developed runoff for the major and minor storm events will be conveyed via public roadway to a storm sewer inlet in a sump condition at the end of the cul de sac located design point 20.2. Conveyance will continue from design point 20 to detention pond B via storm sewer.

Sub-Basin B-3.1 contains 1.4 acres located on the east central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in an on grade storm sewer inlet located at design point 16.1. During the 100 year storm event, runoff not intercepted by the inlet at design point 16.1 will be intercepted by an inlet in a sump condition at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-3.2 contains 5.9 acres located on the east central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an on grade storm sewer inlet located at design point 16.2. During the 100 year storm event, runoff not intercepted by the inlet at design point 16.2 will be intercepted by an inlet in a sump condition at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-3.3 contains 5.7 acres located on the east central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an on grade storm sewer inlet located at design point 16.4. During the 100 year storm event, runoff not intercepted by the inlet at design point 16.4 will be intercepted by an inlet in a sump condition at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-3.4 contains 0.6 acres located on the east central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an on grade storm sewer inlet located at design point 16.5. During the 100 year storm event, runoff not intercepted by the inlet at design point 16.5 will be intercepted by an inlet in a sump condition at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-3.5 contains 0.4 acres located on the south side of sub basin B-3.2. The on grade inlet proposed at Design point 16.6 is intended to intercept minor and nuisance flow to prevent flow spreading on the collector street.

Sub-Basin B-4 contains 3.5 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an on grade storm sewer inlet located at design point 17. During the 100 year storm event, runoff not intercepted by the inlet at design point 17 will be intercepted by an inlet in a sump condition at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-5 contains 4.5 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an on grade storm sewer inlet located at design point 18. During the 100 year storm event, runoff not intercepted by the inlet at design point 18 will be intercepted by an inlet in a sump condition at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-6 contains 2.9 acres located in the east central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to an on grade storm sewer inlet located at design point 19. During the 100 year storm event, runoff not intercepted by the inlet at design point 19 will be intercepted by an inlet in a sump condition at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-7.1 contains 1.6 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at the end of the eye-brow at design point 20.1. Runoff from Sub basin B-7.1, and upstream sub-basins B-2 through B-7 will be intercepted for 100 year storm event by the sump inlet at design point 20.1. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-7.2 contains 0.6 acres located in the central portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways to a storm sewer inlet in a sump condition located at the end of the eye brow at design point 20.2. Runoff from Sub basin B-7.2, and upstream sub-basins B-2 through B-7.1 will be intercepted for 100 year storm event by the sump inlet at design point 20. The intercepted runoff will continue conveyance via storm sewer pipe to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21.

Sub-Basin B-8 contains 8.2 acres located in the west-central portion of the site, being mostly open space which contains detention pond B. Developed runoff for the major and minor storm events will be conveyed overland directly to Detention pond B located on the west edge of the top plateau in Sub-basin B-8 at design point 21. The attenuated runoff from detention pond B will be conveyed via storm sewer South to the proposed storm sewer outfall downstream of Proposed Detention Pond C.

Sub-basin C-1.1 consists of 4.2 acres located at the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a storm sewer inlet on grade at design point 22.1. During the 100 year storm event, runoff not intercepted by the inlet at design point 22.1 will be intercepted by an inlet in a sump condition at design point 22.6. The intercepted runoff will be conveyed via storm sewer and tie into the proposed storm sewer in Sub-basin C-2.

Sub-basin C-1.2 consists of 0.5 acres located at the southeastern portion of the site. Developed runoff for the major and minor storm events will sheet flow to a proposed diversion swale. The drainage swale will continue conveyance to a type C inlet located at design point 22.2. The type C inlet will intercept developed runoff for both the major and minor storm events. The intercepted runoff will continue conveyance via storm sewer pipe to Detention Pond C.

Sub-basin C-1.3 consists of 1.2 acres located at the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a storm sewer inlet on grade at design point 22.3. During the 100 year storm event, runoff not intercepted by the inlet at design point 22.3 will be intercepted by an inlet in a sump condition at design point 22.7. The intercepted runoff will be conveyed via storm sewer and tie into the proposed storm sewer in Sub-basin C-2.

Sub-basin C-1.4 consists of 2.4 acres located at the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a storm sewer inlet on grade at design point 22.4. During the 100 year storm event, runoff not intercepted by the inlet at design point 22.4 will be intercepted by an inlet in a sump condition at design point 22.6. The intercepted runoff will be conveyed via storm sewer and tie into the proposed storm sewer in Sub-basin C-2.

Sub-basin C-1.5 consists of 0.9 acres located at the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a storm sewer inlet on grade at design point 22.5. During the 100 year storm event, runoff not intercepted by the inlet at design point 22.5 will be intercepted by an inlet in a sump condition at design point 22.7. The intercepted runoff will be conveyed via storm sewer and tie into the proposed storm sewer in Sub-basin C-2.

Sub-basin C-1.6 consists of 1.6 acres located at the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a storm sewer inlet in a sump condition at the eye brow cul de sac at design point 22.6. Runoff from Sub basin C-1.6 will be intercepted for 100 year storm event by the sump inlet at design point 22.6. The intercepted runoff will combine with runoff from sub-basins C-1.1 and C-1.2, C-1.3 and C-1.4 and continue conveyance via storm sewer and tie into the proposed storm sewer in Sub-basin C-2.

Sub-basin C-1.7 consists of 0.9 acres located at the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a storm sewer inlet in a sump condition at the eye brow cul de sac at design point 22.7. Runoff from Sub basin C-1.7 will be intercepted for 100 year storm event by the sump inlet at design point 22.7. The intercepted runoff will combine with runoff from sub-basins C-1.1 through C-1.6 and continue conveyance via storm sewer and tie into the proposed storm sewer in Sub-basin C-2.

Sub-basin C-1.8 consists of 1.0 acres located on the Southern portion of the site. Developed runoff for the major and minor storm events will sheet flow to a proposed diversion swale. The drainage swale will continue conveyance to a type C inlet located at design point 22.8. The type C inlet will intercept developed runoff for both the major and minor storm events. The intercepted runoff will continue conveyance via storm sewer pipe to Detention Pond C.

Sub-basin C-2.1 and Sub-basin C-2.2 consists of 2.7 acres and 3.5 acres respectively, located at the southern portion of the site. Developed runoff for the major and minor storm events will be conveyed via public roadways and storm sewer to a storm sewer inlets in a sump condition at the end of the cul de sac at design point 23.2. Runoff from Sub basin C-2.1 and C-2.2 will be intercepted for 100 year storm event by the sump inlet at design point 23. The intercepted runoff will be conveyed via storm sewer pipe to Detention pond C located on the south edge of the top plateau in Sub-basin C-3 at design point 24.2.

Sub-basin C-3.1 consists of 0.6 acres located at the southeastern portion of the site. Developed runoff for the major and minor storm events will sheet flow to a proposed diversion swale. The drainage swale will continue conveyance to a type C inlet located at design point 24.1. The type C inlet will intercept developed runoff for both the major and minor storm events. The intercepted runoff will continue conveyance via storm sewer pipe to Detention Pond C.

Sub-basin C-3.2 consists of 4.0 acres located at the southwestern portion of the site. Sub-basin C-3.2 contains the open space and Detention Pond C. Developed runoff for the major and minor storm events will sheet flow overland to design point 24.2 in Detention pond C.

Developed runoff for the minor and major storm event from upstream sub basins C-1, C-2 and C-3 are tributary to the Detention pond C and will be detained for the full spectrum storm event. The attenuated runoff from detention pond C will be conveyed via storm sewer south to the Pond B-C storm sewer outfall. The attenuated runoff from detention pond B will be combine with the attenuated runoff from Detention Pond C and continue conveyance via storm sewer to the existing tributary to Sellers Gulch at design point 28. A 15-foot access will be constructed along the storm sewer to the existing tributary to Sellers Gulch at design point 28.

Sub-basin C-4 contains 4.9 acres located at the south portion of the site. Sub-basin C-4 is planned to remain as open space which contains a ravine. Runoff for the major and minor storm events will be conveyed overland within the ravine to the Sellars Gulch tributary at design point 28.

Sub-basin C-5 contains 13.0 acres located at the southeast portion of the site. Sub-basin C-5 is planned to remain mostly open space which contains a ravine. Sub-basin C-5.1 contains 0.4 acres of B-Lots, Garden Level and Walkout type lots. Runoff from Subbasin C-5.1 will sheet flow down the cliff embankment. The amount of runoff from the perimeter lots will be less than historic flow rate and will have less erosion potential than historic to the rocky incline. The release rate from detention pond C will be reduced to account for the undetained runoff from Sub-basin C-5.1. Because no water quality treatment is provided, a variance is requested for Sub-basin C-5.1. Developed runoff for the major and minor storm events for Sub-basins C-5.2 and C-5.3 will be conveyed

overland within the ravine to a minor tributary to Sellars Gulch at design point 28.

3. Storm Sewer Design

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

4. Storm Sewer Outfall

Four storm sewer outfalls are proposed within Basins A, B, and C to the respective detention ponds. Basin A-1 and C contain one respective storm sewer outfall, and Basin B contains two storm sewer outfalls. Developed runoff from Basin A-2 will be conveyed overland to Detention Pond A-2.

Storm Sewer Outfalls are proposed to convey attenuated runoff along the following courses:

- *A storm sewer outfall from Detention pond A-1 is proposed to convey attenuated runoff from Pond A-1 to the outfall proposed downstream of Detention Pond A-2. The Storm sewer outfall from Detention Pond A-2 is tributary to the existing 36-inch storm sewer in Gordan Drive.

- *A storm sewer outfall is proposed from Detention Pond B to convey attenuated runoff from Pond B to the storm sewer proposed downstream of Detention Pond C.

- *A storm sewer outfall from Detention Pond C is proposed to convey attenuated runoff from Pond C and attenuated runoff from Detention Pond B to the minor tributary to Sellars Gulch.

5. Conveyance to nearest drainageway

The existing 36 inch outfall in Gordan Drive is tributary to Sellars Gulch. The storm sewer from Basins B and C daylight directly into the Sellars Gulch tributary.

6. Open Channels

No open channels are proposed as part of this development.

Drainage diversion swales are proposed in Sub-Basins A-1 and A-4.1 to intercept runoff from upstream offsite basins before reaching proposed platted lots and street right-of-way. The swales shall have 2 percent cross slopes, sloping toward a concrete trough having capacity to convey the historic 100 year developed flow from the offsite basins.

Drainage diversion swales are proposed in Sub-basins C-1.2, C-1.8 and C-3.1 to intercept and convey developed runoff to their respective basin detention ponds before leaving the project site.

Drainage diversion swales are proposed in Sub-Basins A-7.1, A-7.2 and B-1.2 to intercept and convey developed runoff to their respective basin detention ponds to mitigate potential damage to downstream lots.

7. Allowable Street Capacities

The Town of Castle Rock allowable street capacities chart are utilized to verify streets have capacity for developed flows.

8. Maintenance

The Founders Village Metropolitan District will be responsible for maintenance of each detention pond and storm sewer appurtenances. The Town of Castle Rock will be responsible for maintenance of storm sewer within public streets.

9. Offsite Facilities

No offsite facilities are proposed as part of this project.

10. Lot Drainage characteristics

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

B. Stormwater Storage Facilities

1. Detention Pond Designs

Four onsite detention/water quality ponds “A-1”, “A-2”, “B” and “C” will be constructed to provide water quality, and detention for the Full Spectrum storm event.

2. Pond Outfall Locations

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

3. Pond Runoff Conveyance

*A storm sewer outfall from Detention Pond A-1 is proposed to convey attenuated from Pond A-1 to the proposed storm sewer outfall downstream of Detention Pond A-2, and continue to the existing 36-inch storm sewer in Gordan Drive.

*A storm sewer outfall from Detention Pond A-2 is proposed to convey attenuated from Pond A-2 to the existing 36-inch storm sewer in Gordan Drive.

*A storm sewer outfall if proposed from Detention Pond B to convey attenuated runoff from Pond B to the storm sewer proposed downstream of Detention Pond C.

*A storm sewer outfall from Detention Pond C is proposed to convey attenuated runoff from Pond C to the Sellars Gulch tributary.

4. Compliance with Water Right exemption

Each detention pond outlet structures were design to attenuate developed runoff for the 100 year and EURV storm events.

The combined release rate from Detention Ponds A-1 and A-2 will be 136.5 cfs in accordance with the Gordan Drive Improvements Project.

The release rate per acre for Detention Ponds A-1 and A-2 are calculated to be:

136.5 cfs / 89.8 Ac. = 1.52 cfs/ac.

The MHFD Detention Spreadsheet program Version 4.06 was used calculate pre-development peak discharge of 38.6 cfs tributary to Detention Pond C.

The release rate per acre for Detention Ponds B and C are calculated to be:

38.6 cfs / 62.5 Ac. = 0.62 cfs/ac.

5. Maintenance

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

C. Water Quality Enhancement Control Measures

1. Structural and Non-structural BMPs

Structural Practices: The outlet structures for Ponds A-1, A-2, B, and C shall have orifice plates to slow runoff and allow pollutants and sediment to settle. Forebays will be constructed in each pond to allow larger products to settle before reaching the respective pond outlet structure.

A grass lined drainage swale is proposed upstream of Pond C in Sub-basin C-3 to provide benefit of pollutant removal.

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

2. Conveyance pathway to nearest drainageway

Three onsite detention ponds for Basins A-1, A-2, B and C to attenuate developed runoff for the Full Spectrum storm events. Detention pond A is located at the base of the ravine in sub basin A-4. Access will be available to detention pond through Memmen's 2nd Addition to Castle Rock to allow maintenance and repair as required. Ponds B and C will have access through the proposed open space amenity.

3. Maintenance

The Founders Village Metropolitan District will be responsible for maintenance of each detention pond and storm sewer appurtenances. In the event that the detention pond is not properly maintained, the Town of Castle Rock will have the right to make any repairs as necessary to keep the pond in good functioning order. The Town of Castle Rock will be

responsible for maintenance of storm sewer within public streets.

E. Geotechnical Investigation and Sub-surface Collection System Design

1. Geotechnical Investigation Results

Geotechnical investigations have not been completed for the project site.

2. Sub-surface collection

Perforated pipe interceptors are proposed along the proposed street sidewalks of the downstream lots where lot to lot drainage exists and upstream open space runoff is diverted around lots.

F. Operation and Maintenance

N/A

1. Responsible Party

2. Maintenance Requirements

3. Inspections

G. Additional Permitting Requirements

1. Section 404 of the Clean Water Act

A storm water discharge permit will be acquired from the Colorado Department of Health prior to any construction activity.

2. The Endangered Species Act

No endangered species have been noted to exist on this site.

3. Other

N/A

H. General

1. Tables, figures, charts, drawings

As contained in the appendix of this report.

VI Conclusions

a. Compliance with Standards

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

1. Town of Castle Rock

2. Master Plans

N/A

3. Cherry Creek Reservoir CR No. 72

N/A

4. Chatfield Reservoir CR No. 73

N/A

B. Variances

One variance is requested to allow developed runoff from Sub-basins C-5.1 (0.4 acres) and D-1.1 (0.6 acres), which total 1.0 acres, to be conveyed offsite downstream without providing water quality treatment or capture volume.

1. Provisions

N/A

2. Justification

N/A

C. Drainage Concept

1. Discuss overall effectiveness

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

VII. References

VIII

A. Hydraulic Computations

1. Runoff Coefficients and times of concentration were determined using the UD Rational spread sheet version 2.0

2. Land Use assumptions for offsite areas.

Land uses for adjoining properties were determined from Douglas County aerial maps and the Douglas County Assessor information contained on their website.

3. CUHP information N/A

4. SWMM information N/A

5. The rational method for determining flows was used.

6. Rainfall information was obtained from the UD Rational spread sheet version 2.0

7. CUHP information N/A

8. The UD Detention spreadsheet was utilized for design of the detention pond volume which calculated pond hydrographs.

9. A connectivity diagram was not prepared for this report. The Drainage Plan depicts each drainage basin with design points and detention ponds proposed as part of this project. Additional hydraulic calculations will be provided in the Phase III Drainage Report.

B. Hydraulic Computations

1. Culvert capacities N/A

2. Storm Sewer capacities and hydraulic grade line computations are summarized in the appendix of this report. Civil 3-D storm Sewers release 2020 was utilized for hydraulic grade line computations.

3. Street capacities were using the proposed slope shown in the roadway plan and profiles and the Town of Castle Rock Street Capacity Chart.

4. The UD-Inlet spreadsheet Version 4.05 was utilized for determination of Inlet capacities and interception calculations.

5. Open channel N/A. Swale capacities were analyzed using the Civil 3-D Hydro-flow software.

6. Low flow and trickle pans are proposed within each of the three proposed detention ponds to

mitigate potential from erosion from occurring in the respective pond bases.

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

C. Water Quality

Water quality is provided in each of the three proposed detention ponds

D. Referenced Information

N/A

2. Offsite Runoff conveyance

Five offsite sub-basins are identified on the Preliminary Drainage Plan, Sub-basins O-1, O-2, O-3, O-4 and O-5. Runoff from sub-basin O-2 will sheet flow to Sub-basin A-1. Runoff from sub-basins A-1 and O-2 will be intercepted by a drainage swale located at the base of the slope in Sub-basin A-1 and continue conveyance via drainage swale to the ravine in Sub-basin 9 and to Detention Pond A. Runoff from Sub-basins O-4 and O-5 will sheet flow to a drainage swale located in Sub-basin A-4.1. Runoff from Sub-basins A-4.1, O-4 and O-5 will be conveyed via drainage swale to a type C inlet in Sub-basin A-4.1, and continue conveyance via storm sewer to Pond A.

Runoff from offsite Sub-basins O-1A and O-1B will be conveyed along their historic course through Basin A-9 to Detention Pond A.

Runoff from offsite Sub-basin O-3 will be conveyed along its historic course through Basin C-5.3 to the existing Sellars Gulch tributary.

3. Drainage Criteria

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

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

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

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

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

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

Time of Concentration: The time of concentration (when maximum discharge of the drainage area is reached) is the time required for runoff from the most remote point of the drainage area to arrive at the design point. The "most remote point" is that point from which the time of flow to the design point is the greatest and not necessarily the greatest linear distance.

Detention : Four onsite detention/water quality ponds "A-1", "A-2", "B" and "C" will be constructed to provide water quality, and detention for the Full Spectrum storm event. The UD Detention Spreadsheet program Version 4.06 is used to determine required detention volume.

Developed runoff from Type B, Walk Out and Garden lots proposed along the downstream perimeter of Sub-basins C-5.1 will sheet flow down the cliff embankment undetained. The amount of runoff from the perimeter lots will be less than historic flow rate and will have less erosion potential than historic to the rocky incline. Release rates for detention ponds B and C may be reduced to compensate for the undetained flow. Due to the nature of the steep terrain, having slopes ranging from 25 to 35 percent, it is not feasible to construct water quality ponds to meet requirements for water quality.

4. Anticipated Conveyance Problems

None

5. Ownership and Maintenance

The Four detention ponds proposed in Basins A-1, A-2, B and C will be owned and maintained by the Founders Village Metropolitan District or HOA. Historic Basin D, proposed Detention ponds B and C, and surrounding open space are planned to be Park land use open to the public and Town as required for access.

B. Proposed Stormwater Storage Facilities

1. Detention

The Preliminary Drainage Plan depicts four onsite detention ponds "A-1", "A-2", "B" and "C" which will attenuate developed runoff for the Full Spectrum storm events. The UD Detention Spreadsheet program Version 4.06 is used to determine required detention and WQCV volume. The Urban Drainage Criteria

Manual is used to determine water quality volume and design of water quality release structures.

2. Outlet Structure Design

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

3. Anticipated Storage Problems and Maintenance

It will be the responsibility of the Founders Village Metropolitan District to visually inspect the condition of the drainage facilities after any major storm event which may have sufficient force to result in sediment deposits or erosion to landscape drainage ways. If erosion or damage occurs frequently, the metropolitan district may attempt to stabilize the soil with additional riprap, or consult with an engineer to rectify the problem.

VI. WATER QUALITY ENHANCEMENT

1. Reducing Runoff Volume

Basin D and the Detention ponds and surrounding open space within sub-basins B-3 and C-3 are planned to be Park land use open to the public. Natural vegetation and topography will be utilized with moderate grading and compaction improvements to allow higher infiltration while providing a natural environment for public enjoyment.

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

2. Providing Water Quality and Flood Control

The Urban Drainage Criteria Manual is used to determine water quality volume and design of water quality release structures. Both ponds will have 4:1 side slopes with flat bottom configuration to optimize settlement and infiltration. The urban EURV and WQCV provided in detention ponds A, B and C will drain within a 40-hour time frame to allow optimum time for pollutants and sediments to settle within the respective ponds before continuing conveyance downstream.

3. Stream Stabilization Techniques

Energy dissipator may be necessary to be constructed prior to exiting the property downstream to reduce runoff velocity and disperse flows. Storm sewer from detention ponds B and C are proposed to daylight at the base of the steeper slopes. Rip Rap lined Stilling Basins will be constructed to reduce flow velocity and disperse concentrated flow exiting the pipe before continuing conveyance downstream.

4. Undertaking source control

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

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

Building materials are expensive and shall be protected by storage outside of runoff areas. This shall be performed by the materials owner to protect the inherent value and no additional measures will be taken.

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

Variance from Criteria :

A variance from providing WQCV is requested for 0.4 acres of Sub-basin C-5.1. Surface runoff from the rear half of B-Lots, Garden Level and Walkout type lots proposed along the edge of sub-basin C-5.1 will sheet flow down their respective cliff embankment undetained and untreated for water quality. It is not feasible to provide a pond with maintenance access for water quality in this region due to the steep terrain. The release rate for Detention Pond B and C will be reduced to compensate for the developed runoff for the 1.0 acre area allowed to sheet flow down the respective ravines. The amount of runoff from the perimeter lots will be less than historic flow rate and will have less erosion potential than historic to the rocky incline.

VII. FLOODPLAIN MODIFICATIONS

N/A

VIII. MASTER PLAN RECOMMENDATIONS

N/A

IX. POTENTIAL PERMITTING REQUIREMENTS

N/A

X. REFERENCES

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

1. “Urban Storm Drainage Criteria Manual”, prepared by Wright McLaughline Engineers for Urban Drainage and Flood Control District, March 1969.
2. “Town of Castle Rock Storm Drainage Design and Technical Criteria Manual”, prepared by Utilities Department, Revised June 2019.
3. “Gordan Drive Improvements Project”, Prepared by Bohannon Huston, Inc., February 22, 2019

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National Flood Hazard Layer FIRMette



Legend

SEE THIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE)
- With BFE or Depth Zone A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, AV, AW, AX, AY, AZ, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, BN, BO, BP, BQ, BR, BS, BT, BU, BV, BW, BX, BY, BZ, CA, CB, CC, CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CO, CP, CQ, CR, CS, CT, CU, CV, CW, CX, CY, CZ, DA, DB, DC, DD, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, DO, DP, DQ, DR, DS, DT, DU, DV, DW, DX, DY, DZ, EA, EB, EC, ED, EE, EF, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, EW, EX, EY, EZ, FA, FB, FC, FD, FE, FF, FG, FH, FI, FJ, FK, FL, FM, FN, FO, FP, FQ, FR, FS, FT, FU, FV, FW, FX, FY, FZ, GA, GB, GC, GD, GE, GF, GG, GH, GI, GJ, GK, GL, GM, GN, GO, GP, GQ, GR, GS, GT, GU, GV, GW, GX, GY, GZ, HA, HB, HC, HD, HE, HF, HG, HH, HI, HJ, HK, HL, HM, HN, HO, HP, HQ, HR, HS, HT, HU, HV, HW, HX, HY, HZ, IA, IB, IC, ID, IE, IF, IG, IH, II, IJ, IK, IL, IM, IN, IO, IP, IQ, IR, IS, IT, IU, IV, IW, IX, IY, IZ, JA, JB, JC, JD, JE, JF, JG, JH, JI, JJ, JK, JL, JM, JN, JO, JP, JQ, JR, JS, JT, JU, JV, JW, JX, JY, JZ, KA, KB, KC, KD, KE, KF, KG, KH, KI, KJ, KK, KL, KM, KN, KO, KP, KQ, KR, KS, KT, KU, KV, KW, KX, KY, KZ, LA, LB, LC, LD, LE, LF, LG, LH, LI, LJ, LK, LL, LM, LN, LO, LP, LQ, LR, LS, LT, LU, LV, LW, LX, LY, LZ, MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MM, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN, NO, NP, NQ, NR, NS, NT, NU, NV, NW, NX, NY, NZ, OA, OB, OC, OD, OE, OF, OG, OH, OI, OJ, OK, OL, OM, ON, OO, OP, OQ, OR, OS, OT, OU, OV, OW, OX, OY, OZ, PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU, PV, PW, PX, PY, PZ, QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU, QV, QW, QX, QY, QZ, RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU, RV, RW, RX, RY, RZ, SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR, SS, ST, SU, SV, SW, SX, SY, SZ, TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO, TP, TQ, TR, TS, TT, TU, TV, TW, TX, TY, TZ, UA, UB, UC, UD, UE, UF, UG, UH, UI, UJ, UK, UL, UM, UN, UO, UP, UQ, UR, US, UT, UY, UW, UX, UY, UZ, VA, VB, VC, VD, VE, VF, VG, VH, VI, VJ, VK, VL, VM, VN, VO, VP, VQ, VR, VS, VT, VU, VV, VW, VX, VY, VZ, WA, WB, WC, WD, WE, WF, WG, WH, WI, WJ, WK, WL, WM, WN, WO, WP, WQ, WR, WS, WT, WU, WV, WW, WX, WY, WZ, XA, XB, XC, XD, XE, XF, XG, XH, XI, XJ, XK, XL, XM, XN, XO, XP, XQ, XR, XS, XT, XU, XV, XW, XX, XY, XZ, YA, YB, YC, YD, YE, YF, YG, YH, YI, YJ, YK, YL, YM, YN, YO, YP, YQ, YR, YS, YT, YU, YV, YW, YX, YY, YZ, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN, ZO, ZP, ZQ, ZR, ZS, ZT, ZU, ZV, ZW, ZX, ZY, ZZ

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 dike ridge 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 Levees, See Notes, Zone X
- Area with Flood Risk due to Levees Zone D

OTHER AREAS

- Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

GENERAL STRUCTURES

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

OTHER FEATURES

- Cross Sections with 1% Annual Chance
- Water Surface Elevation
- Coastal Tract
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Tract Boundary
- Profile Baseline
- Hydrographic Feature

MAP PANELS

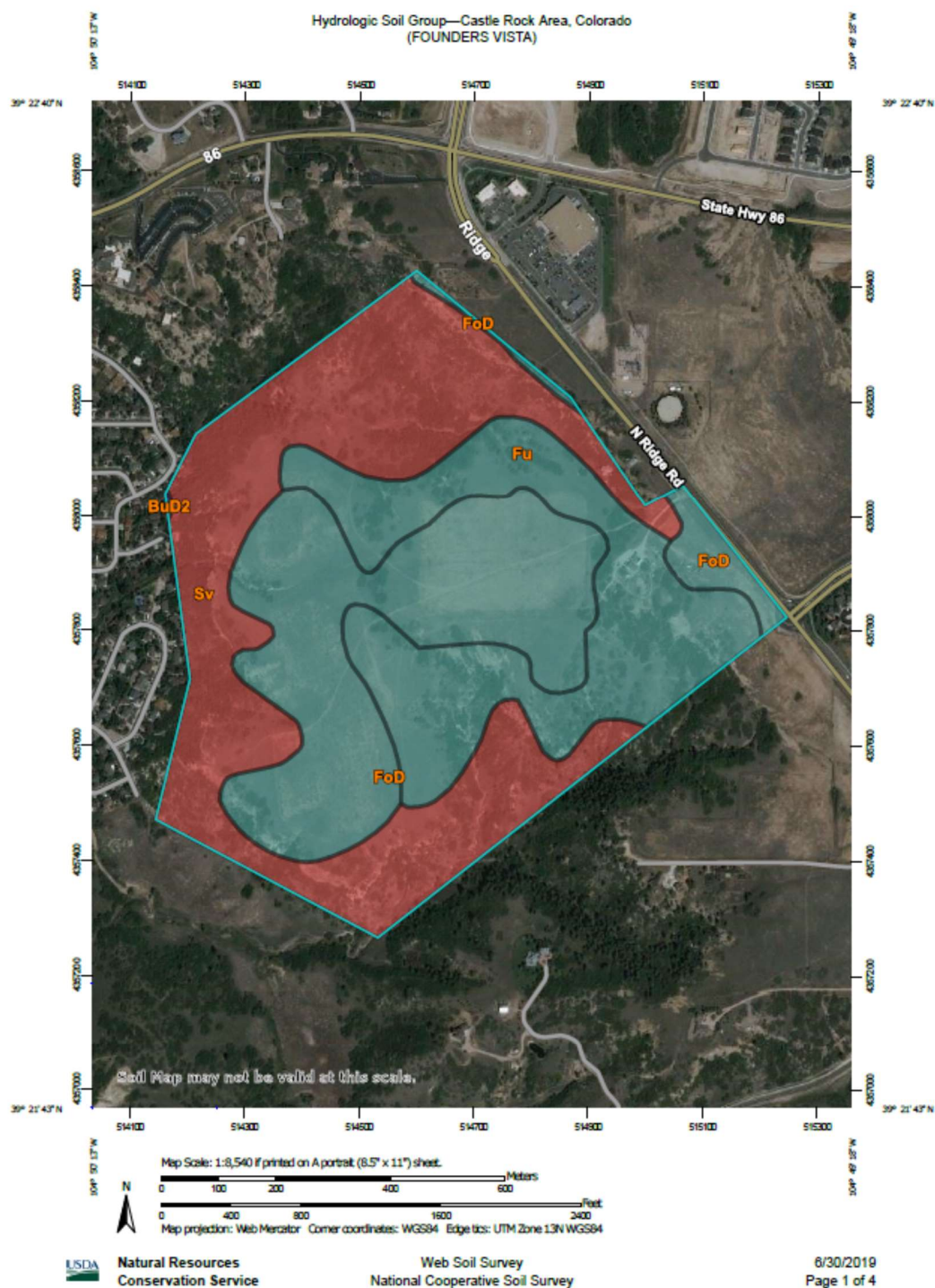
- Digital Data Available
- No Digital Data Available
- Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps. If it is not valid as described below, the basemap shown complies with FEMA's basemap accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was updated on 6/30/2019 at 7:50:14 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is valid if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifier, FIRM panel number, and FIRM effective date. Map images for unmapped and unmapped areas cannot be used for regulatory purposes.

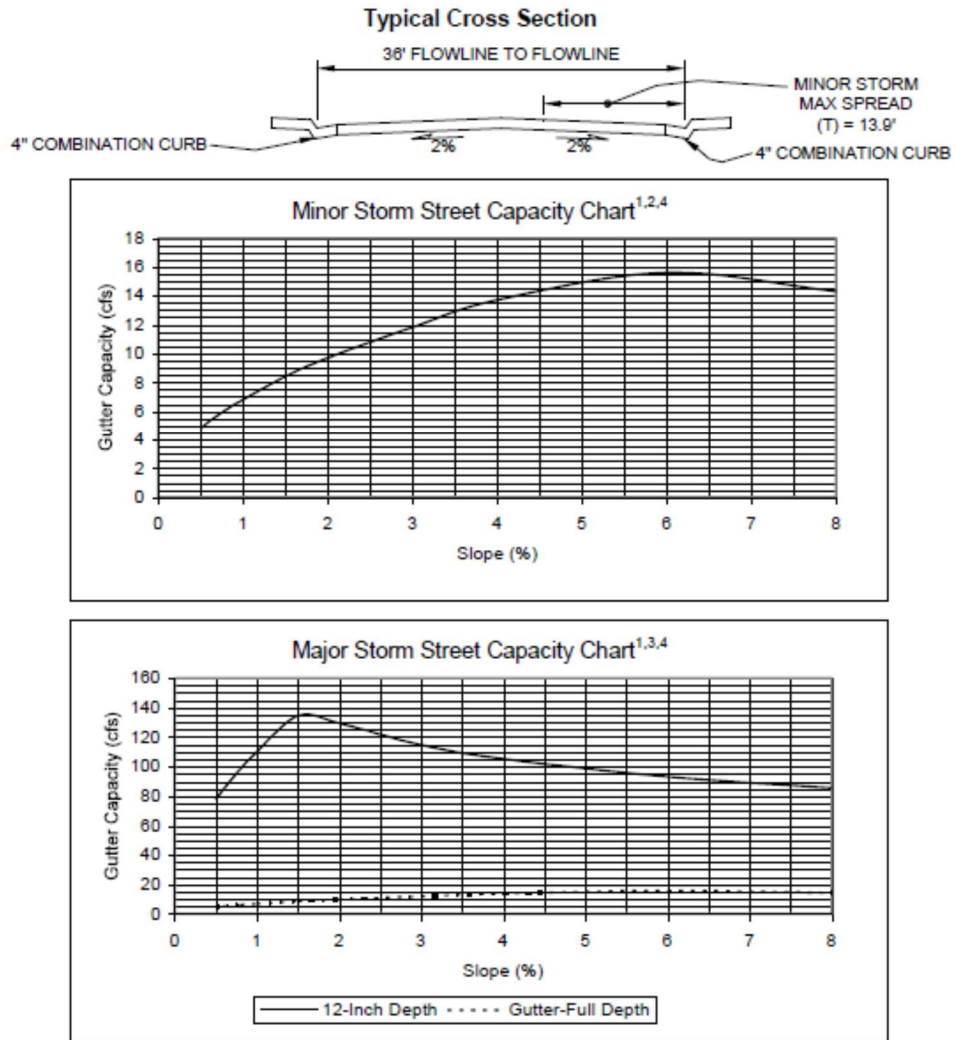


Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BuD2	Bresser and Truckton soils, 3 to 12 percent slopes, eroded	B	0.1	0.0%
FoD	Fondis clay loam, 3 to 9 percent slopes	C	60.4	32.1%
Fu	Fondis-Kutch association	C	50.4	26.8%
Sv	Stony steep land	D	77.0	41.0%
Totals for Area of Interest			187.9	100.0%

Chapter 7. Street Drainage

FIGURE 7-1, TOWN OF CASTLE ROCK STREET CAPACITY CHART
LOCAL TYPE I AND TYPE II (SINGLE FAMILY)



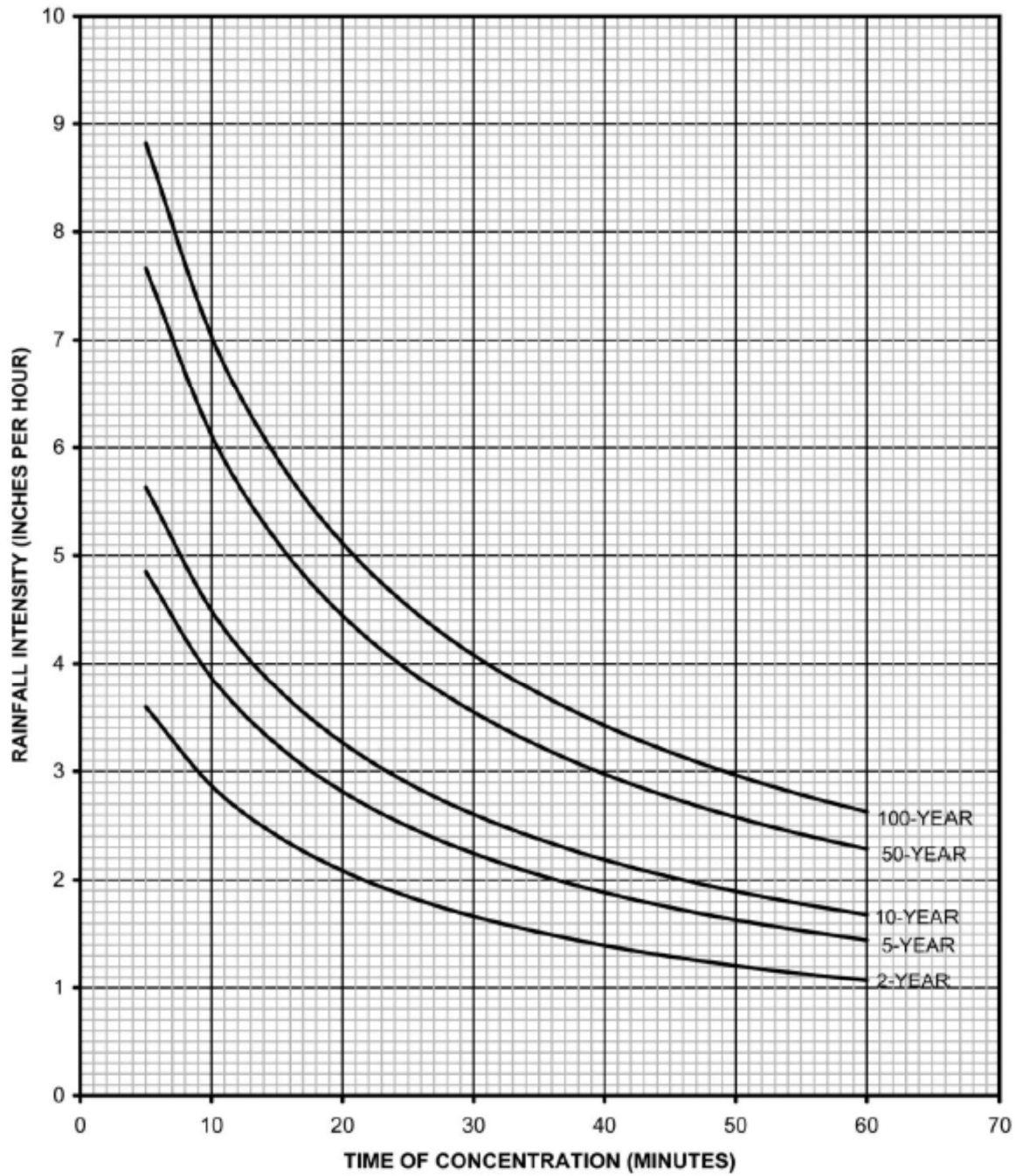
¹ The Town of Castle Rock standard street section parameters must apply to use these charts. For non-standard sections, the street capacity shall be calculated using the UDFCD spreadsheets (see Section 7.5). The capacity shown is based on ½ the street section.

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

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

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

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



Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L _i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S _i (ft/ft)	Overland Flow Time t _i (min)
A-1	3.90	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	10.00			0.020	4.76
O-5	4.30	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	20.00			0.050	4.98
O-4	1.90	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	20.00			0.050	4.98
A-2.5	1.70	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	90.00			0.030	6.87
A-2.3	3.70	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	15.00			0.030	2.80
A-2.1	1.30	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	15.00			0.200	1.50
A-2.2	3.00	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	65.00			0.050	4.93
A-2.4	1.10	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	100.00			0.030	7.24
A-3	5.40	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.020	5.55
A-4.1	1.40	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	20.00			0.050	4.98
A-4.2	2.50	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	102.50			0.030	7.33
A-5	4.70	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	25.00			0.030	3.62
O-2	4.40	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	75.00			5.900	2.00
A-7.2, 7.3	4.50	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
A-7.4	0.40	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	15.00			0.030	2.80
A-8.1	4.60	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	105.00			0.020	8.48
A-8.2	0.20	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	105.00			0.030	7.42
A-9.1	1.40	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	55.00			0.030	5.37
A-4.3	4.00	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	102.50			0.030	7.33
A-7.5	2.00	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
A-7.1	0.90	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.030	5.61
A-1 TO A-9.1, O-2, O-4 & O-5	57.30														
O-1A	12.00	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	65.00			0.120	6.72
O-1B	5.10	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	90.00			0.100	8.40
A-9.2	15.40	C	5.0	0.03	0.08	0.17	0.35	0.42	0.50	0.60	15.00			0.030	4.98

Tc BASIN A

Subcatchment Name	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)
A-1	1020.00	6610.00	6579.00	0.030	15	2.62	6.50	11.26	36.17	11.26
O-5	300.00	6654.00	6618.00	0.120	20	6.93	0.72	5.70	27.22	10.00
O-4	300.00			0.120	15	5.20	0.96	5.94	27.22	10.00
A-2.5	650.00	6573.00	6547.00	0.040	20	4.00	2.71	9.57	18.91	9.57
A-2.3	1500.00	6649.00	6573.00	0.051	20	4.50	5.55	8.36	22.18	8.36
A-2.1	1500.00	6649.00	6573.00	0.051	20	4.50	5.55	7.05	22.18	7.05
A-2.2	675.00	6578.00	6556.00	0.033	20	3.61	3.12	8.05	19.38	8.05
A-2.4	613.00	6573.00	6547.00	0.042	20	4.12	2.48	9.72	18.65	9.72
A-3	1730.00	6621.00	6557.00	0.037	20	3.85	7.50	13.05	24.42	13.05
A-4.1	670.00	6637.00	6599.00	0.057	15	3.57	3.13	8.10	30.71	10.00
A-4.2	770.00	6620.00	6595.00	0.032	20	3.60	3.56	10.89	19.89	10.89
A-5	1380.00	6600.00	6538.00	0.045	20	4.24	5.43	9.04	22.04	9.04
O-2	140.00	6645.00	6640.00	0.036	15	2.83	0.82	2.82	26.99	10.00
A-7.2, 7.3	1400.00	6592.00	6535.00	0.041	20	4.04	5.78	10.64	22.45	10.64
A-7.4	240.00	6546.00	6535.00	0.046	20	4.28	0.93	3.74	16.87	5.00
A-8.1	1800.00	6599.40	6535.00	0.036	20	3.78	7.93	16.41	24.92	16.41
A-8.2	760.00	6554.00	6525.00	0.038	20	3.91	3.24	10.66	19.53	10.66
A-9.1	440.00	6530.00	6517.00	0.030	20	3.44	2.13	7.50	18.25	7.50
A-4.3	1115.00	6596.00	6554.00	0.038	20	3.88	4.79	12.11	21.30	12.11
A-7.5	330.00	6536.00	6525.00	0.033	20	3.65	1.51	6.36	17.53	6.36
A-7.1	540.00	6586.00	6570.00	0.030	20	3.44	2.61	8.22	18.80	8.22
A-1 TO A-9.1, O-2, O-4 & O-5	530.00			22.200	15	70.68	0.12			
O-1A	1290.00	6636.00	6494.00	0.110	15	4.98	4.32	11.04	32.64	11.04
O-1B	463.00	6644.00	6574.00	0.151	15	5.83	1.32	9.72	27.80	10.00
A-9.2	1000.00	6556.00	6428.00	0.128	15	5.37	3.11	8.09	29.95	10.00

Tc Basin A

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L _i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S _i (ft/ft)	Overland Flow Time t _i (min)
B-1.1	1.80	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	25.00			0.030	3.62
B-1.2	0.90	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	100.00			0.030	7.24
B-2	1.00	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	15.00			0.020	3.20
B-3.1	1.40	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	40.00			0.030	4.58
B-3.2	5.90	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	20.00			0.020	3.70
B-3.4	0.60	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	15.00			0.020	3.20
B-3.3	5.70	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	175.00			0.030	9.57
B-3.5	0.40	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	15.00			0.020	3.20
B-4	3.50	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.020	6.41
B-3, B-4	17.50	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	85.00			0.020	7.63
B-5	4.50	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.020	6.41
B-3, B-4, B-5	22.00	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	85.00			0.020	7.63
B-6	2.90	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.020	6.41
B-3 TO B-6	24.90	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	85.00			0.020	7.63
B-7.1	1.60	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.020	6.41
B-7.2	0.60	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.020	6.41
B-8	8.20	C	6.7	0.04	0.09	0.18	0.36	0.43	0.51	0.61	60.00			0.020	11.24
C-1.1	4.20	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	120.00			0.030	7.93
C-1.3	1.20	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
C-1.2	0.50	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.050	4.74
C-1.4	2.40	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	160.00			0.050	7.73
C-2.1	2.70	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	100.00			0.030	7.24
C-2.2	3.50	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	100.00			0.030	7.24
C-3.1	0.60	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	55.00			0.050	4.53
C-3.2	4.00	C	13.0	0.08	0.14	0.23	0.39	0.46	0.54	0.63	60.00			0.030	9.33
C-4	4.90	D	17.0	0.11	0.17	0.26	0.41	0.48	0.55	0.64	60.00			0.030	9.02
C-1 TO C-3	23.50	C	38.9	0.29	0.35	0.42	0.54	0.59	0.64	0.71	45.00				
C-1.5	0.90	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	60.00			0.030	5.61
C-1.6	1.60	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	25.00			0.030	3.62
C-1.7	0.90	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	55.00			0.050	4.53
C-1.8	1.00	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	43.00			0.030	4.75
C-5.1	0.40	C	60.0	0.47	0.52	0.57	0.66	0.69	0.73	0.78	45.00			0.030	4.85
C-5.2	2.30	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	30.00			0.033	6.99
C-5.3	10.30	C	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	90.00			0.050	10.56
O-3	30.80	D	2.0	0.01	0.05	0.15	0.33	0.40	0.49	0.59	45.00			0.030	8.84
C, O-3	72.20	C	14.0	0.09	0.15	0.23	0.40	0.46	0.54	0.63	45.00			0.030	8.01

Tc BASIN B, C & D

Subcatchment Name	Channelized Flow Length L _t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S _t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V _t (ft/sec)	Channelized Flow Time t _t (min)	Computed t _c (min)	Regional t _c (min)	Selected t _c (min)
								5.29	17.72	5.29
B-1.1	400.00			0.040	20	4.00	1.67	9.01	17.84	9.01
B-1.2	425.00			0.040	20	4.00	1.77	9.94	21.61	9.94
B-2	1200.00	6600.00	6553.00	0.039	15	2.97	6.74	6.40	17.90	6.40
B-3.1	500.00	6638.00	6612.00	0.052	20	4.56	1.83	6.75	19.30	6.75
B-3.2	825.00	6649.00	6607.00	0.051	20	4.51	3.05	9.52	23.06	9.52
B-3.4	1250.00	6644.00	6610.00	0.027	20	3.30	6.32	16.15	21.47	16.15
B-3.3	1100.00	6640.00	6602.00	0.035	15	2.79	6.58	8.14	21.47	8.14
B-3.5	1100.00	6640.00	6602.00	0.035	20	3.72	4.93	8.70	18.43	8.70
B-4	550.00	6613.00	6591.00	0.040	20	4.00	2.29	17.78	27.46	17.78
B-3, B-4	1950.00	6641.00	6591.00	0.026	20	3.20	10.15	9.29	19.11	9.29
B-5	650.00	6601.00	6578.00	0.035	20	3.76	2.88	18.46	28.25	18.46
B-3, B-4, B-5	2200.00	6641.00	6578.00	0.029	20	3.38	10.83	9.59	19.46	9.59
B-6	715.00	6590.00	6565.00	0.035	20	3.74	3.19	19.22	29.12	19.22
B-3 TO B-6	2450.00	6641.00	6565.00	0.031	20	3.52	11.59	8.99	18.76	8.99
B-7.1	535.00	6574.00	6558.00	0.030	20	3.46	2.58	8.99	18.76	8.99
B-7.2	535.00	6574.00	6558.00	0.030	20	3.46	2.58	13.05	28.49	13.05
B-8	520.00	6545.00	6515.00	0.058	20	4.80	1.80	12.04	20.53	12.04
C-1.1	1000.00	6604.00	6563.00	0.041	20	4.05	4.12	10.02	21.74	10.02
C-1.3	1200.00	6608.00	6563.00	0.038	20	3.87	5.16	7.44	18.91	7.44
C-1.2	325.00			0.010	20	2.00	2.71	9.40	17.71	9.40
C-1.4	450.00	6589.50	6566.70	0.051	20	4.50	1.67	10.03	19.01	10.03
C-2.1	650.00	6557.50	6533.00	0.038	20	3.88	2.79	11.21	20.37	11.21
C-2.2	1000.00	6563.00	6519.00	0.044	20	4.20	3.97	6.35	17.36	6.35
C-3.1	400.00	6539.00	6515.00	0.060	15	3.67	1.81	12.41	29.48	12.41
C-3.2	880.00	6555.00	6505.00	0.057	20	4.77	3.08	11.12	25.88	11.12
C-4	710.00	6540.00	6440.00	0.141	15	5.63	2.10		29.65	
C-1 TO C-3	2360.00	6606.00	6440.00	0.070	20	5.30	7.42	7.27	17.71	7.27
C-1.5	450.00	6589.50	6566.70	0.051	20	4.50	1.67	5.57	18.04	5.57
C-1.6	425.00	6568.00	6554.00	0.033	20	3.63	1.95	5.92	17.00	5.92
C-1.7	250.00	6552.00	6542.00	0.040	15	3.00	1.39	5.90	17.13	5.90
C-1.8	300.00	6556.00	6542.00	0.047	20	4.32	1.16	5.06	16.04	5.06
C-5.1	55.00			0.050	20	4.47	0.20	7.84	27.04	10.00
C-5.2	300.00	6591.00	6545.00	0.153	15	5.87	0.85	13.47	30.36	13.47
C-5.3	1000.00	6579.00	6433.00	0.146	15	5.73	2.91	15.34	39.67	15.34
O-3	2300.00	6640.00	6440.00	0.087	20	5.90	6.50	15.43	37.15	15.43
C, O-3	2360.00	6606.00	6440.00	0.070	20	5.30	7.42			

Tc BASIN B, C & D

FOUNDERS VISTA FILING 1						CASTLEROCK DATE 2/15/25				5 YEAR STORM JOB FOUNDERS							
BASIN A						FLOW IN STREET				PIPE FLOW		TRAVEL TIME					
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
1A	O-1A	12	0.04	0.48	11.0	3.70	1.8										
1B	O-1B	5.1	0.04	0.2	10.0	3.85	0.8	0.20									
2A	O-2	4.4	0.04	0.18	10.0	3.9	0.7	0.18	0.7								SWL
2B	A-1	3.9	0.04	0.16	11.3	3.7	0.6	0.13	0.3								SWL
2B	A-1, O-2	8.3		0.33	16.5	3.1	1.0				0.3	1.0					TYPE C INLET A-8.3
3A	O-4	1.9	0.04	0.08	10.0	3.85	0.3	0.08	0.3								
3B	O-5	4.3	0.04	0.17	10.0	3.85	0.7	0.17	0.7				300	12	6.9	0.7	
4	A-4.1	1.4	0.04	0.06	10.0	3.85	0.2	0.06	0.2								
4	A-4.1, O-4, O-5	7.6		0.3	11.0	3.7	1.1				0.304	1.2					TYPE C INLET A-4.1
5	A-3	5.4	0.52	2.81	13.1	3.4	9.5	1.22	4.1		1.59	5.4					INLET A-3 Q5int=5.4
6.1	A-4.2	2.5	0.52	1.3	10.9	3.7	4.8	0.40	1.4		0.90	3.3					INLET A-4.2 Q5int=3.3 CFS
6.1	O-4, O-5, A-4.1, A-4.2	10.1		1.6	11.7	3.65	5.9	0.40	1.4		1.21	4.4					
6.2	A-4.3	4.0	0.52	2.08	12.1	3.6	7.5	3.70	11.3		1.90	5.8					INLET A-4.3 Q5int=5.8 CFS
6.2	O-4, O-5, A-3, A-4	19.5		6.5	16.9	3.05	19.8	1.79	5.5		4.70	14.3					
7.1	A-2.3	3.7	0.52	1.92	8.2	4.1	7.9	0.97	4.0		0.95	3.9	650	0.05	4.5	2.4	INLET A-2.4 Q5int=3.9 CFS
7.2	A-2.1	1.3	0.52	0.68	7.1	4.4	3.0	0.22	1.0		0.45	2.0					INLET A-2.1 Q5int=2.0 CFS
7.3	A-2.2	3.0	0.52	1.56	8.1	4.2	6.6	1.78	7.5		0.90	3.8					INLET A-2.2 Q5int=3.8
								0.88	4.2		2.31	9.7					
7.4	A-2.1, A-2.2	4.3		2.2	8.1	4.2	9.4	0.88	3.7		0.57	2.4					INLET A-2.3 Q5int=2.4
								0.31	1.3		2.88	12.1					
7.5	A-2.4	1.1	0.52	0.57	8.1	4.2	2.4				0.50	2.1					INLET A-2.3A Q5INT=2.1 CFS
		5.4		2.8				0.07	0.3		3.38	14.2					
7.6	A-2.5	1.7	0.52	2.50	8.4	4.15	10.4	5.26	16.1		2.10	6.4					INLET A-2.5 Q5INT=6.4 CFS
7.6	A-2.3,A-2.5, A-3 A-4,O-4, O-5	24.9		10.9	18.2	3.05	33.3	3.16	9.65		10.18	31.0	250	0.046	4.3	1.0	Tt 7.4-10.5
8	A-5	4.7	0.52	2.44	9.0	4	9.8	0.00	0.0		2.44	9.8					INLET A-5 Q5int=9.8 CFS
10.5	A-2.3,A-2.5, A-3 TO A-5, O-4, O-5	29.6		13.4	19.2	2.95	39.4	3.16	9.34		12.62	37.2					INLET A-6 Q5int=2.4 CFS

Q-5 SUMMARY

DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
10.1	A-7.4	0.4	0.52	0.21	6.4	4.6	1.0	3.37	15.5		0.98	4.5					INLET A-7.4 Q5int=4.5 CFS
10.5	A-2.3,A-2.5, A-3 TO A-6, A-7.4,O-4,O-5	30.0		13.6	22.9	2.6	35.3	2.39	6.2		13.60	35.4					
10.2	A-7.1	0.9	0.52	0.47	10.8	3.75	1.8				0.47	1.8					C-INLET A-7.1 Q5int=1.8 CFS
10.2	A-7.1, A-1, O-2	9.2									0.80	3.0					
10.3	A-7.2	0.5	0.52	0.26	5.0	4.85	1.3				0.26	1.3					C-INLET A-7.2 Q5int=1.3 CFS
10.4	A-7.3	4.0	0.52	2.08	10.8	3.75	7.8	1.07	4.0		1.01	3.8					INLET A-7.3 Q5int=3.8 CFS
10.4	A-7.1, A-7.2, A-7.3,A-1, O-2	13.7						0.05	0.2		2.07	7.8					
11.1	A-8.1	4.6	0.52	2.39	16.4	3.2	7.7	1.17	3.8		1.22	3.9	440	3	3.4	2.1	INLET A-8.1 Q5int=3.9 CFS
	A-7.1, A-7.2, A-7.3,A-8.1, A-1, O-2										3.29	10.5					
10.5	A-7.5	2.0	0.52	1.04	6.4	4.6	4.8	3.49	16		3.49	16.0					INLET A-7.5 Q5int=9.2 CFS
10.5	A-2.3,A-2.5, A-3 TO A-7, O-4, O-5	37.4		17.2	22.9	2.6	44.6	0.00	0		20.38	53.0					
11.2	A-8.2	0.2	0.52	0.1	10.7	3.75	0.4	1.65	4.3		1.65	4.3					INLET A-8.2 Q5int=7.3 CFS
11.2	A-1 TO A-8, O-2,O-4,O-5	55.9		22.8	22.9	2.6	59.2	0.00	0		22.03	57.3					
11.3	A-9.1	1.4	0.04	0.06	7.5	4.3	0.2				0.06	0.2					DETENTION POND A-1
11.3	A-1 TO A-9.1, O-2,O-4,O-5	57.3		22.8	22.9	2.6	59.4				22.09	57.4	1160	2.5	13	1.5	Tt 11.3 to 12.1
12	A-9.2	15.4	0.04	0.62	10	3.85	2.4										
12	O1-A	12.0	0.04	0.48	11	3.7	1.8										
12	O1-B	5.1	0.04	0.2	10	3.85	0.8										
12	A-9.2,O-1	32.5		1.3	14.1	3.3	4.3										DET. POND A-2
12.1	A-O-1,O-2 O-4,O-5,	89.8		24.1	22.9	2.6	62.7										DET. POND A-2
BASIN B, C & D								FLOW IN STREET			PIPE FLOW		TRAVEL TIME				
13	B-1.1	1.8	0.52	0.94	5.3	4.70	4.4		0.0		0.936	4.40					INLET B-1.1-SUMP Q5INT=4.6
13	B-1.2	0.9	0.52	0.47	9.0	4.05	1.9		0.0		0.468	1.90					INLET B-1.2-TYPE C Q5INT=2.1
15	B-2	1.0	0.52	0.52	9.9	3.9	2.0	0.99	2.0								Trib to Inlet B-7.2 INLET B-3A - Q5INT=2.2
16.1	B-3.1	1.4	0.52	0.73	6.4	4.5	3.3	0.24	1.1		0.49	2.20					INLET B-3B Q5INT=6.0 CFS
16.2	B-3.2	5.9	0.52	3.07	6.8	4.5	13.7	1.72	0.0		1.35	6.00					INLET B-3C Q5INT=4.4 CFS
16.3	B-3.1, B-3.2	7.3		3.8	6.8	4.5	16.9	1.96	8.7		0.99	4.40					

Q-5 SUMMARY

FOUNDERS VISTA							CASTLEROCK						5 YEAR STORM				
FILING 1							DATE 7/05/24						JOB FOUNDERS				
BASIN B,C&D							FLOW IN STREET				PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
16.4	B-3.3	5.7	0.52	2.96	16.2	3.1	9.2	1.48	4.6		1.48	4.6					INLET B-3D Q5INT=4.6 CFS
								3.44	10.7		2.47	7.7					
16.5	B-3.4	0.6	0.52	0.31	8.1	4.1	1.3	3.75	11.6		2.12	4.1					INLET B-3F Q5INT=4.1
16.5	B-3.1, B-3.2, B-3.3, B-3.4	13.6		7.1	16.2	3.1	21.9	1.63	5.1		4.59	14.2					
16.6	B-3.5	0.4	0.52	0.21	8.1	4.1	0.9				0.15	0.6					INLET B-3G Q5INT=0.6 CFS
								1.63			4.74	14.7					CARRY TRIB TO DP 15
17	B-4	3.5	0.52	1.82	8.7	4.1	7.5	3.45	10.7		1.23	3.8					INLET B-4 Q5INT=3.8
17	B-3, B-4	17.5		8.9	17.4	3.1	27.6	2.23	6.9		5.96	18.5	330	4.9	4.5	1.2	
18	B-5	4.5	0.52	2.34	9.3	4.0	9.4	4.57	13.2		1.55	4.5					INLET B-5 Q5int=4.5CFS
18	B-3, B-4, B-5	22.0	0.52	11.2	18.6	2.90	32.6	3.01	8.7		7.52	21.8	330	4.9	4.5	1.2	
19	B-6	2.9	0.52	1.51	9.6	4.0	6.0	4.52	12.9		2.11	6.0					INLET B-6 Q5int=6.0CFS
19	B-3 TO B-6	24.9	0.52	12.9	19.8	2.85	36.9	2.42	6.9		9.62	27.4	210	2.7	3.1	1.1	
20.1	B-7.1	1.6	0.52	0.83	9.0	4.05	3.4	3.25	8.9		2.09	6.2					INLET B-7.1 Q5INT=6.2
20.1	B-3 TO B-7.1	26.5	0.52	13.8	20.9	2.75	37.9	0.00	0.0		10.78	29.7					
20.2	B-7.2	0.6	0.52	0.31	9.0	4.05	1.3	0.31	1.3		0.31	1.3					INLET B-7.2 Q5INT=4.1
20.2	B-2 TO B-7	28.1		14.6	20.9	2.75	40.2		0.0		11.09	30.5					
21	B-8	8.2	0.09	0.74	13.0	3.45	2.5										
21	B	39.0		1.99	21.6	2.7	5.4										POND B
22.1	C-1.1	4.2	0.52	2.18	12.0	3.6	7.9	1.02	3.66		1.17	4.2	250	3.2	3.5	1.2	INLET C-1.1
22.2	C-1.2	0.5	0.52	0.26	7.4	4.35	1.1				0.26	1.1					INLET C-1.2 TYPE C
22.3	C-1.3	1.2	0.52	0.62	7.4	4.35	2.7	0.33	1.41		0.30	1.3					INLET C-1.3
22.4	C-1.4	2.4	0.52	1.25	9.4	4.00	5.0	0.72	2.89		0.53	2.1					INLET C-1.4
22.5	C-1.5	0.9	0.52	0.47	5.6	4.70	2.2	0.79	2.54		0.41	1.3					INLET C-1.5
22.5	C-1.2, C-1.3, C-1.5	2.6		1.4	13.2	3.20	4.3	0.39	1.43		1.49	4.8					
22.6	C-1.6	1.6	0.52	0.83	5.9	4.70	3.9	2.57	9.5		2.57	8.9					INLET C-1.6 SUMP
22.6	C-1.1, C-1.4, C-1.6	8.2		4.3	12.0	3.60	15.4	0.00			5.23	18.8					
22.7	C-1.7	0.9	0.52	0.47	5.9	4.70	2.2	0.85	2.7		0.85	2.7					INLET C-1.7 SUMP
22.7	C-1.1 THRU C-1.7	11.7		6.1	13.2	3.20	19.5				6.08	19.5					
22.8	C-1.8	1.0	0.52	0.52	5.9	4.70	2.4				0.52	2.4					INLET C-1.8 SUMP
22.8	C-1.1 THRU C-1.8	12.7		6.6	13.2	3.20	21.1				6.60	21.1					INLET C-1.8 TYPE C
23.1	C-2.1	2.7	0.52	1.4	10	3.85	5.4	0.23	2.3		0.81	3.1					INLET C-2.1 Q5INT=3.1CFS
23.0	C-2.2	3.5	0.52	1.82	11.2	3.70	6.7	2.05	7.59		7.40	25.5					INLET C-2.2 Q5INT=7.6CFS
23.0	C-1, C-2	18.9	0.52	8.4	12.9	3.45	29.1				9.45	32.6					
24.1	C-3.1	0.6	0.52	0.31	8.3	4.10	1.3				0.31	1.3					INLET C-3.1 TYPE C
24.2	C-3.2	4	0.14	0.56	12.4	3.50	2.0										
24.2	C-3	4.6	0.14	0.87	12.4	3.50	3.1										
24.2	C-1 TO C-3	23.5		9.3	12.9	3.45	32.1										DET-POND C
25	C-5.1	0.4	0.52	0.21	10.0	3.85	0.8										
25	C-5.2	2.3	0.04	0.09	12.4	3.50	0.3										
26	C-5.3	10.3	0.04	0.41	12.4	3.50	1.4										
26	C-4	4.9	0.17	0.83	11.1	3.70	3.1										
26	C-5, C-4	17.9		1.5	12.4	3.50	5.4										
27	D-1	36.4	0.04	1.46	32.0	1.60	2.3										
28	C	41.4		10.8	13.7	3.35	36.3										
28	O-3	30.8	0.04	1.23	15.4	3.20	3.9										
28	C, O-3	72.2		12.1	15.4	3.20	38.6										TRIB #3 TO SELLERS

Q-5 SUMMARY

FOUNDERS VISTA FILING 1						CASTLEROCK DATE 02/15/25						100 YEAR STORM JOB FOUNDERS		1 HR-RAINFALL DATA (INCHES) 5YR=1.43" 100YR=2.60"			
BASIN A						FLOW IN STREET					PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
1A	O-1A	12	0.48	5.76	11.0	6.8	39.2						140	3.6	2.8	0.8	
1B	O-1B	5.1	0.48	2.45	10.0	7.0	17.1										
2A	O-2	4.4	0.49	2.16	10.0	7.0	15.1	2.16	15.1				1020	3	2.6	6.5	Tt 2A-2B
2B	A-1	3.9	0.48	1.87	11.3	6.8	12.7	1.87	12.7				1300	2.8	3.4	6.4	Tt 2B-10.5
2B	A-1, O-2	8.3		4.03	16.5	5.65	22.8				4.028	22.8					TYPE C INLET A-8.3
3B	O-5	4.3	0.49	2.11	10.0	7.0	14.7	2.11	14.7								
3A	O-4	1.9	0.49	0.93	10.0	7.0	6.5	0.93	6.5				300	12	5.2	1.0	
4	A-4.1	1.4	0.49	0.69	10.0	7.0	4.8				0.69	4.8	250	2.4	2.4	1.7	TYPE C INLET A-4.1
4	A-4.1, O-4, O-5	7.6		3.72	11.0	6.8	25.7	0.00			3.72	25.32					Q100-INT=25.7 INLET A-3
5	A-3	5.4	0.73	3.94	13.1	6.3	22.9	2.58	16.2		1.37	8.60					Q100-INT=8.6
6.1	A-4.2	2.5	0.73	1.83	10.9	6.8	11.5	0.94	6.41		0.88	6.00					INLET A-4.2 Q100-int=6.0
6.1	O-4, O-5, A-4.1,A-4.2	10.1		9.49	11.7	6.4	59.8	0.94	6.0		4.61	29.48	1115	3.2	3.6	5.2	
6.2	A-4.3	4.0	0.73	2.92	12.1	6.5	18.4	6.44	36.1		1.66	9.30					INLET A-4.3 Q100-int=9.3
6.2	O-4, O-5, A-3, A-4	19.5	0.64	14.2	16.9	5.6	82.6	4.78	26.8		7.63	42.74	350	3.5	3.7	1.6	Tt 6.2-10.5
7.1	A-2.3	3.7	0.73	2.7	8.2	7.6	20.3	1.87	14.2		0.829	6.30	650	0.05	4.5	2.4	INLET A-2.4 Q100-INT=6.3
7.2	A-2.1	1.3	0.73	0.95	7.1	8.0	7.6	0.47	3.8		0.475	3.80					INLET A-2.1 Q100-INT=3.8
								2.66	20.4		1.304	9.91					
7.3	A-2.2	3.0	0.73	2.19	8.1	7.65	16.8	2.66	20.4		0.77	5.90					INLET A-2.2 Q100-INT=5.9
											2.08	15.77					
7.4	A=2.1, A-2.2	4.3		3.1	8.1	7.65	24.0	1.89	14.5		0.67	5.10					INLET A-2.3 Q100-INT=5.1
								1.23	9.4		2.74	20.84					
7.5	A-2.4	1.1	0.73	0.8	8.1	7.65	6.1	0.27	2.04		0.54	4.1					INLET A-2.3A Q100-INT=4.1
								1.49	11.4		3.28	25.08					
7.6	A-2.5	1.7	0.73	1.24	8.4	7.5	9.3	7.9	45.8		1.57	9.10					INLET A-2.5 Q100-INT=9.1
7.6	A-2.3,A-2.5, A-3,A-4 O-4,O-5	24.9		13.4	18.2	5.8	77.9	6.32	36.7		12.48	72.38	250	0.046	4.3	1.0	Tt 7.5-10.5
8	A-5	4.7	0.73	3.43	9.0	7.3	25.0	0.00	0.0		3.43	25.00					INLET A-5 Q100-Int=25.0
10.5	A-2.3,A-2.5 A-3 TO A-5, A-7.6, O-4, O-5	29.6		16.9	19.2	5.15	86.8	6.32	32.6		15.91	81.94					

Q-100 SUMMARY

FOUNDERS VISTA				CASTLEROCK				100 YEAR STORM				1 HR-RAINFALL DATA (INCHES)			
FILING 1				DATE 04/1/22				JOB FOUNDER				5YR=1.43" 100YR=2.60"			
BASIN A				FLOW IN STREET				PIPE FLOW				TRAVEL TIME			

10.1	A-7.4	0.4	0.73	0.29	6.4	8.2	2.4	6.61	34.1		1.54	7.40					INLET A-7.4 Q100-int=7.4
10.5	A-2.3,A-2.5, A-3 TO A-5, A- 7.4, O-4, O-5	30.0		17.2	22.9	4.8	82.3	5.07	24.4		17.45	83.77					
10.2	A-7.1	0.9	0.73	0.66	10.8	6.85	4.5				0.66	4.5	800	2.9	3.4	3.9	TYPE C INLET A-7.1 Qint=4.5 cfs
10.2	A-7.1, A-1, O-2										4.69	32.1					
10.3	A-7.2	0.5	0.73	0.37	5.0	8.8	3.2				0.37	5.8					TYPE C INLET A-7.2 Qint=5.8 cfs
	A-7.1, A-1, O-2										5.05	34.6					
10.4	A-7.3	4.0	0.73	2.92	10.8	6.85	20.0	2.06	14.1		0.86	5.9					INLET A-7.3 Q100 -int=5.9
11.1	A-8.1	4.6	0.73	3.36	16.4	5.85	19.6	2.33	13.6		1.03	6	440	3	3.4	2.1	INLET A-8.1 Q100 -int=6.0
											6.57	38.446					
10.5	A-7.5	2.0	0.73	1.46	6.4	8.2	12.0	7.13	34.2		6.46	31.0					INLET A-7.5 Q100 -int=31.0
10.5	A-2.3,A-2.5, A-3 TO A-7, O-4, O-5	37.4		22.2	22.9	4.8	106.5	0.67	3.2		30.48	146.31					

FOUNDERS VISTA							CASTLEROCK				100 YEAR STORM						
FILING 1							DATE 09/15/24				JOB FOUNDERS						
BASIN A						FLOW IN STREET					PIPE FLOW		TRAVEL TIME				
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
11.2	A-8.2	0.2	0.73	0.15	10.7	6.85	19.5	3.15	15.1		4.31	20.7					INLET A-8.2 Q100 -int=20.7
11.2	A-1 TO A-8, O-2,O-4,O-5	55.9		33.7	22.9	4.8	161.6				34.79	167.0					
11.3	A-9.1	1.4	0.49	0.69	7.5	8.25	5.7				0.69	5.7					DETENTION POND A-1
11.3	A-1 TO A-9.1, O-2,O-4,O-5	57.3		34.4	22.9	4.8	164.9				35.48	170.3					
12	A-9.2	15.4	0.49	7.55	10	6.25	47.2						1000	12.8	5.4	3.1	
12	O1-A	12.0	0.49	5.88	11	5.8	34.1										
12	O1-B	5.1	0.49	2.5	10	6.25	15.6										
12.0	A-9.2,O-1	32.5	0.49	15.9	14.1	6.1	96.3										DETENTION POND A-2
12.1	A,O-1,O-2 O-4,O-5	89.8	0.62	55.7	22.9	4.8	267.2										GORDAN DRIVE OUTFALL

Q-100 SUMMARY

FOUNDERS VISTA							CASTLEROCK					100 YEAR STORM					
FILING 1							DATE 06/15/24					JOB FOUNDERS					
BASIN B & C							FLOW IN STREET			PIPE FLOW		TRAVEL TIME					
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS
13	B-1.1	1.8	0.73	1.31	5.3	8.70	11.4		0.0		1.314	11.4					INLET B-1 Q100-INT=12.1
13	B-1.2	0.9	0.73	0.66	9.0	7.35	4.8		0.0		0.657	4.8					TYPE C INLET B-1.2
15	B-2	1.0	0.73	0.73	9.9	7.05	5.1	1.39	5.1								Trib to Inlet B-7.2
16.1	B-3.1	1.4	0.73	1.02	6.4	8.2	8.4	0.53	4.4		0.49	4.0					INLET B-3A Q100-INT=4.0
16.2	B-3.2	5.9	0.73	4.31	6.8	8.1	34.9	3.18	25.8		1.12	9.1					INLET B-3B Q100-INT=9.1
16.3	B-3.1, B-3.2	7.3	0.73	5.33	6.8	8.1	43.2	2.66	21.6		2.67	21.6					INLET B-3C Q100-INT=8.5
16.4	B-3.3	5.7	0.73	4.16	16.2	5.7	23.7	2.37	13.5		1.79	10.2	325	4.9	4.5	1.2	INLET B-3D Q100-INT=10.2
16.5	B-3.4	0.6	0.73	0.44	8.1	7.7	3.4	5.47	31.2		4.46						
16.5	B-3.1, B-3.2, B-3.3, B-3.4	13.6		9.9	16.2	5.7	56.6	2.58	14.7		7.35	41.9					INLET B-3F Q100-INT=16.5
16.6	B-3.5	0.4	0.73	0.29	8.1	7.7	2.2	0.10	0.7		0.19	1.5					Q100-INT=1.5 cfs
17	B-4	3.5	0.73	2.56	8.7	7.4	18.9	5.13	28.2		0.973	7.2					INLET B-4 Q100-INT=7.2
17	B-3, B-4	17.5	0.73	12.8	17.4	5.5	70.3	4.26	23.4		8.52	46.853	330	4.9	4.5	1.2	
18	B-5	4.5	0.73	3.29	9.3	7.2	23.7	7.54	40.0		1.139	8.2					INLET B-5 Q100-INT=8.2 CFS
18	B-3, B-4, B-5	22	0.73	16.1	18.6	5.3	85.1	6.40	33.9		9.66	51.185	330	4.9	4.5	1.2	
19	B-6	2.9	0.73	2.12	9.6	7.1	15.0	8.52	45.2		1.92	13.6					Q100-INT=13.6
19	B-3 TO B-6	24.9	0.73	18.2	18.6	5.3	96.3	6.60	35.0		11.57	61.337	210	2.7	3.1	1.1	
20.1	B-7.1	1.6	0.73	1.17	9.0	7.35	8.6	7.77	38.9		4.15	30.5					INLET B-7.1 Q100-INT=30.5
20.1	B-3 TO B-7.1	26.5	0.73	19.3	20.9	5.0	96.7	3.62	18.1		15.72	78.613					
20.2	B-7.2	0.6	0.73	0.44	9.0	7.35	3.2	4.79	24.0		4.96	24.8					INLET B-7.2 Q100-INT=24.8
20.2	B-2 TO B-7	28.1		20.5	20.9	5.0	102.6	-0.17	-0.8		20.68	103.41					
21	B-8	8.2	0.51	4.18	13.0	6.3	26.3	8.97			6.79						
21	B-2 TO B-8	36.3		24.7	21.6	4.9	121.0	1.22	5.98		6.79	33.271					TRIB TO POND B
								0.00	0		8.01	121.01					
21	B	39.0		26.7	21.6	4.9	130.7										POND B OVERFLOW

Q-100 SUMMARY

FOUNDERS VISTA FILING 1							CASTLEROCK DATE 04/1/22				100 YEAR STORM JOB FOUNDERS							
BASIN C & D							FLOW IN STREET				PIPE FLOW		TRAVEL TIME					
DESIGN POINT	BASIN	AREA (AC)	C	AxC	Tc	I (in/hr)	Q (cfs)	SUM AxC	Q (cfs)	CAP	SUM AxC	Q (cfs)	LENGTH (ft)	SLOPE (%)	VEL. (fps)	Tt	REMARKS	
22.1	C-1.1	4.2	0.73	3.07	12	6.5	19.9	2.07	13.4		1.00	6.5	250	3.2	3.5	1.2	INLET C-1.1 Q100-INT=6.5	
22.2	C-1.2	0.5	0.73	0.37	7.4	7.9	2.9	0.00	0		0.37	2.9					INLET C-1.2 TYPE C	
22.3	C-1.3	1.2	0.73	0.88	7.4	7.9	6.9	0.42	3.32		0.46	3.6					INLET C-1.3 Q- INT=3.6	
											0.82	6.5						
22.4	C-1.4	2.4	0.73	1.75	9.4	7.2	12.6	1.06	7.61		0.69	5.0					INLET C-1.4 Q-100=5.0	
22.5	C-1.5	0.9	0.73	0.66	5.6	8.6	5.7	1.08	6.72		0.26	2.2					INLET C-1.5 Q-INT=2.2	
22.5	C-1.2, C-1.3, C-1.5	2.6		1.9	13.2	6.25	11.9	0.82	5.12		1.08	6.74						
22.6	C-1.6	1.6	0.73	1.17	5.6	8.6	10.0	4.29	26.8		4.29	26.80					INLET C-1.6 Q-INT=26.8	
22.6	C-1.1, C-1.4, C-1.6	8.2		6.0	12.0	6.25	37.4	0.00	0		7.06	44.13						
22.7	C-1.7	0.9	0.73	0.66	5.9	8.5	5.6	1.48	9.23		1.48	9.20					INLET C-1.7 Q- INT=9.2	
22.7	C-1.1 THRU C-1.7	11.7		8.5	13.2	6.25	53.4	0.00			8.54	53.38						
22.8	C-1.8	1.0	0.73	0.73	5.9	8.5	6.2	0.73	6.2		8.54	53.38					TYPE C INLET C-1.8	
22.8	C-1.1 THRU C-1.8	12.7		9.3	13.2	6.25	57.9	0.00	0		9.27	57.94						
23.1	C-2.1	2.7	0.73	1.97	10	7.0	13.8	1.23	8.6		0.74	5.20					INLET C-2.1 Q100-INT=5.2	
23.2	C-2.2	3.5	0.73	2.56	11.2	6.7	17.1	3.78	25.3		10.01	62.59					INLET C-2.2 SUMP Q100-INT=25.3	
23.2	C-1, C-2	18.9		13.8	12.9	6.25	86.2				13.80	86.23						
24.1	C-3.1	0.6	0.73	0.44	6.6	8.4	3.7	0.00			0.44	3.70					INLET C-3.1 Q100-INT=3.7	
											14.24	88.98						
24.2	C-3.2	4.0	0.54	2.16	12.4	6.3	13.6											
24.2	C-1, C-2, C-3	23.5		16.4	12.4	6.3	103.3										TRIB TO POND C	
25.0	C-5.1	0.4	0.73	0.29	10.0	7	2.0											
25.0	C-5.2	2.3	0.49	1.13	12.4	6.4	7.2											
26.0	C-5.3	10.3	0.49	5.05	12.4	6.4	32.3											
26.0	C-4	4.9	0.55	2.7	11.1	6.8	18.3											
26.0	C-4, C-5	17.9		9.2	12.4	6.4	58.6											
27.0	D-1	36.4	0.49	17.8	32.0	3.95	70.5											
28.0	C	41.4		25.6	13.7	6.2	158.4											
28.0	O-3	30.8	0.49	15.1	15.4	5.8	87.5											
28.0	C-O-3	72.2		40.6	15.4	5.8	235.8											

Q-100 SUMMARY

FOUNDERS SUB					
% IMPERVIOUS TRIB TO POND A-1					
BASIN	AREA (AC)	% IMP	AxIMP	WEIGHTED % IMPERVIOUS	
A-1	3.90	2.00	0.08		
A-2	10.80	60.00	6.48		
A-3	5.40	60.00	3.24		
A-4	7.90	60.00	4.74		
A-5	4.70	60.00	2.82		
A-7	7.80	60.00	4.68		
A-8	4.80	60.00	2.88		
A-9.1	1.40	5.20	0.07		
O-2	4.40	2.00	0.09		
O-4	1.90	2.00	0.04		
O-5	4.30	2.00	0.09		
TOTAL	57.30		25.08	43.8	
FOUNDERS SUB					
% IMPERVIOUS TRIB TO POND A					
BASIN	AREA (AC)	% IMP	AxIMP	WEIGHTED % IMPERVIOUS	
A-9.2	15.40	5.00	0.77		
O-1A	12.00	2.00	0.24		
O-1B	5.10	2.00	0.10		
TOTAL	32.50		1.11	3.4	

BASIN A - % IMPERVIOUS CALCULATION

FOUNDERS SUB				
% IMPERVIOUS TRIB TO POND B AND C				
BASIN	AREA (AC)	% IMP	AxIMP	WEIGHTED % IMPERVIOUS
B-1	2.70	60.00	1.62	
B-2	1.00	90.00	0.90	
B-3.1 TO B-3.3	13.00	60.00	7.80	
B-3.4, B-3.5	1.00	60.00	0.60	
B-4	3.50	60.00	2.10	
B-5	4.50	60.00	2.70	
B-6	2.90	60.00	1.74	
B-7	2.20	60.00	1.32	
B-8	8.20	6.70	0.55	
TOTAL	39.00		19.33	49.56
BASIN	AREA (AC)	% IMP	AxIMP	
C-1	12.70	60.00	7.62	
C-2	6.20	60.00	3.72	
C-3.1	0.60	60.00	0.36	
C-3.2	4.00	13.00	0.52	
SUB-TOTAL	23.50		12.22	52.00
C-4	4.90	17.00	0.83	
C-5.1	0.40	60.00	0.24	
C-5.2	2.30	2.00	0.05	
C-5.3	10.30	2.00	0.21	
TOTAL	64.90		25.77	39.70

BASIN B & C - % IMPERVIOUS CALCULATION

HIGHLINE ENGINEERING AND SURVEYING CO.

POND VOLUME VS ELEVATION

PROJECT NAME: FOUNDERS VISTA

PROJECT NUMBER: FOUNDER

DATE: 09/15/24

DETENTION VOLUME VS ELEVATION

DETENTION POND A-2

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

ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME
26	0	0	0
30	6430	8573	8573
32	3767	10079	18652
35	7645	16778	35431

V₁₀₀ REQUIRED=35,284 CF
1.0' FREEBOARD

DETENTION VOLUME VS ELEVATION

DETENTION POND B

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

ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME
0	0	0	0
18	0	0	0
20	35604	23736	23736
25	52194	218177	241913

V₁₀₀ REQUIRED=171,016 CF
1.0' FREEBOARD

BASIN A-2 & B VOLUME VS ELEVATION

DETENTION VOLUME VS ELEVATION**DETENTION POND C**

$V = (h/3) * (a+b) + [(a*b)^{(1/2)}]$			
ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME
9	2220	0	0
10	17051	8474	8474
15	26129	107146	115620
16	28866	27486	143106
V ₁₀₀ REQUIRED = 107,1580 CF			
1.0' FREEBOARD			

PROJECT NAME: FOUNDERS VISTA

PROJECT NUMBER: FOUNDER

DATE: 09/15/24

DETENTION VOLUME VS ELEVATION**DETENTION POND A-1**

$V = (h/3) * (a+b) + [(a*b)^{(1/2)}]$			
ELEV (FT)	AREA (SF):	VOLUME (CF):	TOTAL VOLUME
32	0	0	0
34	14255	9503	9503
35	20180	17132	26635
40	38104	143356	169991
42	46827	84781	254773
V ₁₀₀ REQUIRED = 232,044 CF			
1.0' FREEBOARD			

BASIN C & A-1 VOLUME VS ELEVATION

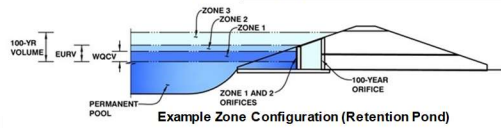
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-DETENTION, Version 4.06 (July 2022)

Clear Workbook

Project: FOUNDERS VISTA SUBDIVISION

Basin ID: BASINA-1



Example Zone Configuration (Retention Pond)

Watershed Information

Extended Detention Basin (EDB) **EDB**

Watershed Area = 57.30 acres

Watershed Length = 2,325 ft

Watershed Length to Centroid = 1,450 ft

Watershed Slope = 0.050 ft/ft

Watershed Imperviousness = 43.80% percent

Percentage Hydrologic Soil Group A = 0.0% percent

Percentage Hydrologic Soil Group B = 0.0% percent

Percentage Hydrologic Soil Groups C/D = 100.0% percent

Target WQCV Drain Time = 40.0 hours

Location for 1-hr Rainfall Depths = User Input

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

Run CUHP

Optional User Overrides

Water Quality Capture Volume (WQCV) = 0.906 acre-feet

Excess Urban Runoff Volume (EURV) = 2.349 acre-feet

2-yr Runoff Volume (P1 = 1.06 in.) = 2.306 acre-feet

5-yr Runoff Volume (P1 = 1.43 in.) = 3.872 acre-feet

10-yr Runoff Volume (P1 = 1.66 in.) = 4.938 acre-feet

25-yr Runoff Volume (P1 = 1.73 in.) = 5.469 acre-feet

50-yr Runoff Volume (P1 = 2.26 in.) = 8.063 acre-feet

100-yr Runoff Volume (P1 = 2.6 in.) = 9.949 acre-feet

500-yr Runoff Volume (P1 = 3.07 in.) = 12.310 acre-feet

Approximate 2-yr Detention Volume = 1.834 acre-feet

Approximate 5-yr Detention Volume = 3.007 acre-feet

Approximate 10-yr Detention Volume = 3.416 acre-feet

Approximate 25-yr Detention Volume = 3.401 acre-feet

Approximate 50-yr Detention Volume = 4.103 acre-feet

Approximate 100-yr Detention Volume = 4.891 acre-feet

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) = 0.906 acre-feet

Zone 2 Volume (EURV - Zone 1) = 1.443 acre-feet

Zone 3 (100yr = 1/2 WQCV - Zones 1 & 2) = 2.995 acre-feet

Total Detention Basin Volume = 5.344 acre-feet

Initial Surge Volume (ISV) = 118 ft³

Initial Surge Depth (ISD) = 0.33 ft

Total Available Detention Depth (H_{total}) = 9.50 ft

Depth of Trickle Channel (H_{TC}) = 0.50 ft

Slope of Trickle Channel (S_{TC}) = 0.005 ft/ft

Slopes of Main Basin Sides (S_{main}) = 4 H:V

Basin Length-to-Width Ratio (R_{LW}) = 2.7

Initial Surge Area (A_{ISV}) = 359 ft²

Surge Volume Length (L_{ISV}) = 18.9 ft

Surge Volume Width (W_{ISV}) = 18.9 ft

Depth of Basin Floor (H_{FLOOR}) = 0.94 ft

Length of Basin Floor (L_{FLOOR}) = 210.7 ft

Width of Basin Floor (W_{FLOOR}) = 88.6 ft

Area of Basin Floor (A_{FLOOR}) = 18,663 ft²

Volume of Basin Floor (V_{FLOOR}) = 6,771 ft³

Depth of Main Basin (H_{MAIN}) = 7.73 ft

Length of Main Basin (L_{MAIN}) = 272.5 ft

Width of Main Basin (W_{MAIN}) = 150.4 ft

Area of Main Basin (A_{MAIN}) = 40,995 ft²

Volume of Main Basin (V_{MAIN}) = 224,990 ft³

Calculated Total Basin Volume (V_{total}) = 5,327 acre-feet

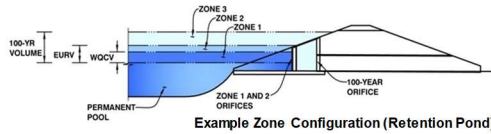
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		18.9	18.9	359		0.008		
ISV	0.33		18.9	18.9	359		0.008	118	0.003
	0.40		18.9	18.9	359		0.008	144	0.003
	0.60		18.9	18.9	359		0.008	215	0.005
	0.80		18.9	18.9	359		0.008	287	0.007
	1.00		53.6	31.5	1,691		0.039	460	0.011
	1.20		94.4	46.4	4,377		0.100	1,046	0.024
	1.40		135.2	61.2	8,271		0.190	2,291	0.053
	1.60		176.0	76.0	13,375		0.307	4,436	0.102
Floor	1.77		210.7	88.6	18,663		0.428	7,146	0.164
	1.80		210.9	88.8	18,735		0.430	7,707	0.177
	2.00		212.5	90.4	19,217		0.441	11,503	0.264
	2.20		214.1	92.0	19,704		0.452	15,395	0.353
	2.40		215.7	93.6	20,197		0.464	19,385	0.445
	2.60		217.3	95.2	20,694		0.475	23,474	0.539
	2.80		218.9	96.8	21,197		0.487	27,663	0.635
	3.00		220.5	98.4	21,705		0.498	31,953	0.734
	3.20		222.1	100.0	22,218		0.510	36,345	0.834
Zone 1 (WQCV)	3.34		223.3	101.1	22,580		0.518	39,481	0.906
	3.40		223.7	101.6	22,736		0.522	40,840	0.938
	3.60		225.3	103.2	23,259		0.534	45,440	1.043
	3.80		226.9	104.8	23,787		0.546	50,144	1.151
	4.00		228.5	106.4	24,321		0.558	54,955	1.262
	4.20		230.1	108.0	24,859		0.571	59,873	1.374
	4.40		231.7	109.6	25,403		0.583	64,899	1.490
	4.60		233.3	111.2	25,951		0.596	70,034	1.608
	4.80		234.9	112.8	26,505		0.608	75,280	1.728
	5.00		236.5	114.4	27,064		0.621	80,637	1.851
	5.20		238.1	116.0	27,628		0.634	86,106	1.977
	5.40		239.7	117.6	28,198		0.647	91,688	2.105
	5.60		241.3	119.2	28,772		0.661	97,385	2.236
Zone 2 (EURV)	5.78		242.8	120.7	29,293		0.672	102,611	2.356
	5.80		242.9	120.8	29,351		0.674	103,197	2.369
	6.00		244.5	122.4	29,936		0.687	109,126	2.505
	6.20		246.1	124.0	30,526		0.701	115,172	2.644
	6.40		247.7	125.6	31,120		0.714	121,337	2.786
	6.60		249.3	127.2	31,720		0.728	127,621	2.930
	6.80		250.9	128.8	32,325		0.742	134,025	3.077
	7.00		252.5	130.4	32,936		0.756	140,551	3.227
	7.20		254.1	132.0	33,551		0.770	147,200	3.379
	7.40		255.7	133.6	34,171		0.784	153,972	3.535
	7.60		257.3	135.2	34,797		0.799	160,868	3.693
	7.80		258.9	136.8	35,427		0.813	167,891	3.854
	8.00		260.5	138.4	36,063		0.828	175,040	4.018
	8.20		262.1	140.0	36,704		0.843	182,316	4.185
	8.40		263.7	141.6	37,350		0.857	189,722	4.355
	8.60		265.3	143.2	38,001		0.872	197,257	4.528
	8.80		266.9	144.8	38,658		0.887	204,923	4.704
	9.00		268.5	146.4	39,319		0.903	212,720	4.883
	9.20		270.1	148.0	39,985		0.918	220,651	5.065
	9.40		271.7	149.6	40,657		0.933	228,715	5.251
Z3 (100+1/2WQCV)	9.51		272.6	150.5	41,029		0.942	233,207	5.354
	9.60		273.3	151.2	41,334		0.949	236,914	5.439
	9.80		274.9	152.8	42,016		0.965	245,249	5.630
	10.00		276.5	154.4	42,703		0.980	253,720	5.825
	10.20		278.1	156.0	43,395		0.996	262,330	6.022
	10.40		279.7	157.6	44,092		1.012	271,078	6.223
	10.60		281.3	159.2	44,794		1.028	279,967	6.427

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **FOUNDERS VISTA SUBDIVISION**

Basin ID: **BASIN A-1**



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	
Zone 1 (WQCV)	3.34	0.906	Orifice Plate	Orifice Plate
Zone 2 (EURV)	5.78	1.443	Orifice Plate	Orifice Plate
Zone 3 (100+1/2WQCV)	9.51	2.995	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)	5.344			

Clear Input Parameters (Including Tables)

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = 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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (use rectangular openings)

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = 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	1.93	3.85	4.00				
Orifice Area (sq. inches)	4.20	4.20	4.20	4.20				

	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)								

Size Plate to match WQCV Drain Time

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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)

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type =
Debris Clogging % = %

Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

Calculated Parameters for Overflow Weir

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = feet
Spillway End Slopes = H:V
Freeboard above Max Water Surface = feet

Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = 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).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
One-Hour Rainfall Depth (in) =	0.906	2.349	2.306	3.872	4.938	5.469	8.063	9.949	12.310
CUHP Runoff Volume (acre-ft) =	N/A	N/A	2.306	3.872	4.938	5.469	8.063	9.949	12.310
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	6.1	22.3	31.2	41.8	68.7	89.3	113.5
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.11	0.39	0.54	0.73	1.20	1.56	1.98
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	34.9	61.7	76.1	86.6	127.8	156.4	192.5
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.9	10.7	21.2	29.9	#NUM!	80.6	127.3
Peak Inflow Q (cfs) =	0.4	1.0	0.9	10.7	21.2	29.9	#NUM!	80.6	127.3
Peak Outflow Q (cfs) =	N/A	N/A	N/A	0.5	0.7	0.7	#NUM!	0.9	1.1
Ratio Peak Outflow to Predevelopment Q =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	#NUM!	Outlet Plate 1	Spillway
Structure Controlling Flow =	N/A	N/A	N/A	0.2	0.4	0.5	#NUM!	1.4	1.4
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	#NUM!	N/A	N/A
Max Velocity through Gate 2 (fps) =	39	61	61	63	61	60	#NUM!	53	50
Time to Drain 97% of Inflow Volume (hours) =	40	65	65	69	68	68	#NUM!	65	63
Maximum Ponding Depth (ft) =	3.34	5.78	5.48	6.78	7.28	7.59	#NUM!	9.13	9.62
Area at Maximum Ponding Depth (acres) =	0.52	0.67	0.65	0.74	0.78	0.80	#NUM!	0.91	0.95
Maximum Volume Stored (acre-ft) =	0.906	2.356	2.157	3.055	3.433	3.677	#NUM!	5.001	5.458

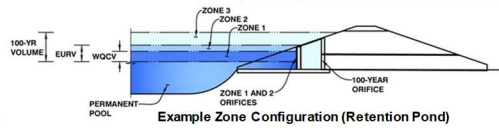
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Clear Workbook

Project: **FOUNDERS VISTA SUBDIVISION**

Basin ID: **BASIN A-2**



Example Zone Configuration (Retention Pond)

Watershed Information

Extended Detention Basin (EDB) **EDB**

Watershed Area = 32.50 acres

Watershed Length = 1,450 ft

Watershed Length to Centroid = 1,265 ft

Watershed Slope = 0.150 ft/ft **Steep Slope > 0.06 ft/ft**

Watershed Imperviousness = 3.40% percent

Percentage Hydrologic Soil Group A = 0.0% percent

Percentage Hydrologic Soil Group B = 0.0% percent

Percentage Hydrologic Soil Groups C/D = 100.0% percent

Target WQCV Drain Time = 40.0 hours

Location for 1-hr Rainfall Depths = User Input

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

Run CUHP

Optional User Overrides

Water Quality Capture Volume (WQCV) = 0.068 acre-feet

Excess Urban Runoff Volume (EURV) = 0.084 acre-feet

2-yr Runoff Volume (P1 = 1.06 in.) = 0.262 acre-feet

5-yr Runoff Volume (P1 = 1.43 in.) = 0.965 acre-feet

10-yr Runoff Volume (P1 = 1.66 in.) = 1.506 acre-feet

25-yr Runoff Volume (P1 = 1.73 in.) = 1.901 acre-feet

50-yr Runoff Volume (P1 = 2.26 in.) = 3.277 acre-feet

100-yr Runoff Volume (P1 = 2.6 in.) = 4.403 acre-feet

500-yr Runoff Volume (P1 = 3.07 in.) = 5.689 acre-feet

Approximate 2-yr Detention Volume = 0.057 acre-feet

Approximate 5-yr Detention Volume = 0.260 acre-feet

Approximate 10-yr Detention Volume = 0.409 acre-feet

Approximate 25-yr Detention Volume = 0.427 acre-feet

Approximate 50-yr Detention Volume = 0.490 acre-feet

Approximate 100-yr Detention Volume = 0.770 acre-feet

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) = 0.068 acre-feet

Zone 2 Volume (EURV - Zone 1) = 0.016 acre-feet

Zone 3 (100yr = 1/2 WQCV - Zones 1 & 2) = 0.720 acre-feet

Total Detention Basin Volume = 0.804 acre-feet

Initial Surge Volume (ISV) = 4 ft³

Initial Surge Depth (ISD) = 0.33 ft

Total Available Detention Depth (H_{total}) = 9.00 ft

Depth of Trickle Channel (H_{TC}) = 0.50 ft

Slope of Trickle Channel (S_{TC}) = 0.005 ft/ft

Slopes of Main Basin Sides (S_{main}) = 4 H:V

Basin Length-to-Width Ratio (R_{LW}) = 2.7

Initial Surge Area (A_{ISV}) = 12 ft²

Surge Volume Length (L_{ISV}) = 3.5 ft

Surge Volume Width (W_{ISV}) = 3.5 ft

Depth of Basin Floor (H_{FLOOR}) = 0.22 ft

Length of Basin Floor (L_{FLOOR}) = 48.4 ft

Width of Basin Floor (W_{FLOOR}) = 19.8 ft

Area of Basin Floor (A_{FLOOR}) = 956 ft²

Volume of Basin Floor (V_{FLOOR}) = 79 ft³

Depth of Main Basin (H_{MAIN}) = 7.95 ft

Length of Main Basin (L_{MAIN}) = 112.0 ft

Width of Main Basin (W_{MAIN}) = 83.4 ft

Area of Main Basin (A_{MAIN}) = 9,335 ft²

Volume of Main Basin (V_{MAIN}) = 35,191 ft³

Calculated Total Basin Volume (V_{total}) = **0.810** acre-feet

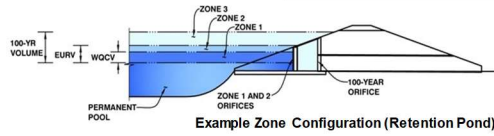
Depth Increment = 0.10 ft									
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		3.5	3.5	12		0.000		
ISV	0.33		3.5	3.5	12		0.000	4	0.000
	0.40		3.5	3.5	12		0.000	5	0.000
	0.50		3.5	3.5	12		0.000	6	0.000
	0.60		3.5	3.5	12		0.000	7	0.000
	0.70		3.5	3.5	12		0.000	8	0.000
Floor	0.80		3.5	3.5	12		0.000	10	0.000
	0.90		17.8	8.7	154		0.004	15	0.000
	1.00		38.2	16.1	613		0.014	51	0.001
	1.05		48.4	19.8	956		0.022	90	0.002
	1.10		48.8	20.2	984		0.023	138	0.003
	1.20		49.6	21.0	1,040		0.024	239	0.005
	1.30		50.4	21.8	1,097		0.025	346	0.008
	1.40		51.2	22.6	1,155		0.027	459	0.011
	1.50		52.0	23.4	1,215		0.028	577	0.013
	1.60		52.8	24.2	1,276		0.029	702	0.016
	1.70		53.6	25.0	1,338		0.031	833	0.019
	1.80		54.4	25.8	1,401		0.032	969	0.022
	1.90		55.2	26.6	1,466		0.034	1,113	0.026
	2.00		56.0	27.4	1,532		0.035	1,263	0.029
	2.10		56.8	28.2	1,599		0.037	1,419	0.033
Zone 1 (WQCV)	2.20		57.6	29.0	1,668		0.038	1,583	0.036
	2.30		58.4	29.8	1,738		0.040	1,753	0.040
	2.40		59.2	30.6	1,809		0.042	1,930	0.044
	2.50		60.0	31.4	1,881		0.043	2,115	0.049
	2.60		60.8	32.2	1,955		0.045	2,307	0.053
	2.70		61.6	33.0	2,030		0.047	2,506	0.058
	2.80		62.4	33.8	2,106		0.048	2,713	0.062
	2.90		63.2	34.6	2,184		0.050	2,927	0.067
	3.00		64.0	35.4	2,263		0.052	3,150	0.072
	3.10		64.8	36.2	2,343		0.054	3,380	0.078
	3.20		65.6	37.0	2,424		0.056	3,618	0.083
	3.30		66.4	37.8	2,507		0.058	3,865	0.089
	3.40		67.2	38.6	2,591		0.059	4,120	0.095
	3.50		68.0	39.4	2,676		0.061	4,383	0.101
	3.60		68.8	40.2	2,763		0.063	4,655	0.107
Zone 2 (EURV)	3.70		69.6	41.0	2,850		0.065	4,936	0.113
	3.80		70.4	41.8	2,940		0.067	5,225	0.120
	3.90		71.2	42.6	3,030		0.070	5,523	0.127
	4.00		72.0	43.4	3,122		0.072	5,831	0.134
	4.10		72.8	44.2	3,214		0.074	6,148	0.141
	4.20		73.6	45.0	3,309		0.076	6,474	0.149
	4.30		74.4	45.8	3,404		0.078	6,810	0.156
	4.40		75.2	46.6	3,501		0.080	7,155	0.164
	4.50		76.0	47.4	3,599		0.083	7,510	0.172
	4.60		76.8	48.2	3,698		0.085	7,875	0.181
	4.70		77.6	49.0	3,799		0.087	8,249	0.189
	4.80		78.4	49.8	3,901		0.090	8,634	0.198
	4.90		79.2	50.6	4,004		0.092	9,030	0.207
	5.00		80.0	51.4	4,108		0.094	9,435	0.217
	5.10		80.8	52.2	4,214		0.097	9,851	0.226
	5.20		81.6	53.0	4,321		0.099	10,278	0.236
	5.30		82.4	53.8	4,429		0.102	10,716	0.246
	5.40		83.2	54.6	4,539		0.104	11,164	0.256
	5.50		84.0	55.4	4,650		0.107	11,623	0.267
	5.60		84.8	56.2	4,762		0.109	12,094	0.278

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **FOUNDERS VISTA SUBDIVISION**

Basin ID: **BASIN A-2**



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	
Zone 1 (WQCV)	2.92	0.068	Orifice Plate	Orifice Plate
Zone 2 (EURV)	3.23	0.016	Orifice Plate	Orifice Plate
Zone 3 (100+1/2WQCV)	8.94	0.720	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)		0.804		

Clear Input Parameters (Including Tables)

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = 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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 9/16 inch)

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = 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	1.00	2.00	3.00				
Orifice Area (sq. inches)	0.24	0.24	0.24	0.24				

	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)								

Size Plate to match WQCV Drain Time

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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)

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type =
Debris Clogging % = %

Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area = ft²
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

Calculated Parameters for Overflow Weir

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = feet
Spillway End Slopes = H:V
Freeboard above Max Water Surface = feet

Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = 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).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
One-Hour Rainfall Depth (in) =	0.068	0.084	0.262	0.965	1.506	1.901	3.277	4.403	5.689
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.262	0.965	1.506	1.901	3.277	4.403	5.689
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.3	16.1	22.4	29.5	48.5	62.0	78.8
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.50	0.69	0.91	1.49	1.91	2.43
Peak Inflow Q (cfs) =	N/A	N/A	4.7	16.5	22.8	29.9	48.9	62.4	79.2
Peak Outflow Q (cfs) =	0.0	0.0	1.9	14.1	20.9	28.7	41.8	47.3	76.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.9	1.0	0.9	0.8	1.0
Structure Controlling Flow =	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	0.04	0.3	0.5	0.7	1.0	1.1	1.1
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	44	55	40	32	27	13	4	2
Time to Drain 99% of Inflow Volume (hours) =	41	46	60	54	50	47	38	33	27
Maximum Ponding Depth (ft) =	2.92	3.22	4.45	5.36	5.67	5.95	7.11	8.89	9.30
Area at Maximum Ponding Depth (acres) =	0.05	0.06	0.08	0.10	0.11	0.12	0.15	0.21	0.22
Maximum Volume Stored (acre-ft) =	0.068	0.084	0.167	0.251	0.284	0.318	0.474	0.795	0.882

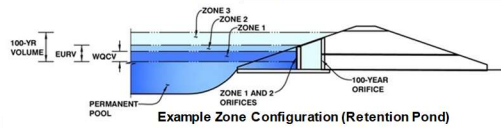
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-DETENTION, Version 4.06 (July 2022)

Clear Workbook

Project: FOUNDERS VISTA

Basin ID: BASIN B



Example Zone Configuration (Retention Pond)

Watershed Information

Extended Detention Basin (EDB) **EDB**

Watershed Area = 39.00 acres

Watershed Length = 2,320 ft

Watershed Length to Centroid = 550 ft

Watershed Slope = 0.040 ft/ft

Watershed Imperviousness = 49.60% percent

Percentage Hydrologic Soil Group A = 0.0% percent

Percentage Hydrologic Soil Group B = 0.0% percent

Percentage Hydrologic Soil Groups C/D = 100.0% percent

Target WQCV Drain Time = 40.0 hours

Location for 1-hr Rainfall Depths = User Input

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

Run CUHP

Optional User Overrides

Water Quality Capture Volume (WQCV) = 0.667 acre-feet

Excess Urban Runoff Volume (EURV) = 1.029 acre-feet

2-yr Runoff Volume (P1 = 1.06 in.) = 1.724 acre-feet

5-yr Runoff Volume (P1 = 1.43 in.) = 2.791 acre-feet

10-yr Runoff Volume (P1 = 1.66 in.) = 3.509 acre-feet

25-yr Runoff Volume (P1 = 1.73 in.) = 3.849 acre-feet

50-yr Runoff Volume (P1 = 2.26 in.) = 5.586 acre-feet

100-yr Runoff Volume (P1 = 2.6 in.) = 6.831 acre-feet

500-yr Runoff Volume (P1 = 3.07 in.) = 8.408 acre-feet

Approximate 2-yr Detention Volume = 1.437 acre-feet

Approximate 5-yr Detention Volume = 2.296 acre-feet

Approximate 10-yr Detention Volume = 2.604 acre-feet

Approximate 25-yr Detention Volume = 2.571 acre-feet

Approximate 50-yr Detention Volume = 3.093 acre-feet

Approximate 100-yr Detention Volume = 3.619 acre-feet

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) = 0.667 acre-feet

Zone 2 Volume (EURV - Zone 1) = 1.162 acre-feet

Zone 3 (100-yr - 1/2 WQCV - Zones 1 & 2) = 2.124 acre-feet

Total Detention Basin Volume = 3.953 acre-feet

Initial Surge Volume (ISV) = 87 ft³

Initial Surge Depth (ISD) = 0.33 ft

Total Available Detention Depth (H_{total}) = 7.00 ft

Depth of Trickle Channel (H_{TC}) = 0.50 ft

Slope of Trickle Channel (S_{TC}) = 0.006 ft/ft

Slopes of Main Basin Sides (S_{main}) = 4 H:V

Basin Length-to-Width Ratio (R_{L/W}) = 1.5 Ratio not typical.

Initial Surge Area (A_{ISV}) = 264 ft²

Surge Volume Length (L_{ISV}) = 16.2 ft

Surge Volume Width (W_{ISV}) = 16.2 ft

Depth of Basin Floor (H_{FLOOR}) = 1.01 ft

Length of Basin Floor (L_{FLOOR}) = 188.6 ft

Width of Basin Floor (W_{FLOOR}) = 128.5 ft

Area of Basin Floor (A_{FLOOR}) = 24,233 ft²

Volume of Basin Floor (V_{FLOOR}) = 9,099 ft³

Depth of Main Basin (H_{MAIN}) = 5.16 ft

Length of Main Basin (L_{MAIN}) = 229.9 ft

Width of Main Basin (W_{MAIN}) = 169.8 ft

Area of Main Basin (A_{MAIN}) = 39,026 ft²

Volume of Main Basin (V_{MAIN}) = 161,700 ft³

Calculated Total Basin Volume (V_{total}) = 3,926 acre-feet

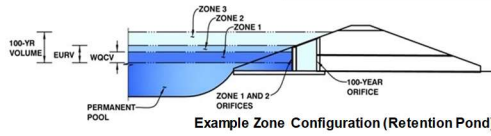
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		16.2	16.2	264		0.006		
ISV	0.33		16.2	16.2	264		0.006	87	0.002
	0.60		16.2	16.2	264		0.006	158	0.004
	1.20		79.4	57.4	4,554		0.105	950	0.022
	1.80		181.8	124.0	22,548		0.518	8,398	0.193
Floor	1.84		188.6	128.5	24,233		0.556	9,334	0.214
	2.40		193.1	133.0	25,673		0.589	23,306	0.535
Zone 1 (WQCV)	2.63		194.9	134.8	26,277		0.603	29,280	0.672
	3.00		197.9	137.8	27,261		0.626	39,184	0.900
	3.60		202.7	142.6	28,896		0.663	56,028	1.286
	4.20		207.5	147.4	30,576		0.702	73,868	1.696
Zone 2 (EURV)	4.39		209.0	148.9	31,118		0.714	79,728	1.830
	4.80		212.3	152.2	32,302		0.742	92,729	2.129
	5.40		217.1	157.0	34,075		0.782	112,640	2.586
	6.00		221.9	161.8	35,893		0.824	133,628	3.068
	6.60		226.7	166.6	37,758		0.867	155,721	3.575
Zone 3 (100+1/2WQCV)	7.03		230.1	170.0	39,122		0.898	172,249	3.954
	7.20		231.5	171.4	39,668		0.911	178,946	4.108
	7.80		236.3	176.2	41,625		0.956	203,332	4.668
	8.40		241.1	181.0	43,628		1.002	228,905	5.255
	9.00		245.9	185.8	45,677		1.049	255,695	5.870
	9.60		250.7	190.6	47,772		1.097	283,727	6.513
	10.20		255.5	195.4	49,913		1.146	313,030	7.186
	10.80		260.3	200.2	52,100		1.196	343,632	7.889
	11.40		265.1	205.0	54,333		1.247	375,559	8.622
	12.00		269.9	209.8	56,613		1.300	408,841	9.386
	12.60		274.7	214.6	58,938		1.353	443,504	10.181
	13.20		279.5	219.4	61,309		1.407	479,575	11.010
	13.80		284.3	224.2	63,727		1.463	517,084	11.871
	14.40		289.1	229.0	66,191		1.520	556,057	12.765
	15.00		293.9	233.8	68,700		1.577	596,522	13.694
	15.60		298.7	238.6	71,256		1.636	638,506	14.658
	16.20		303.5	243.4	73,858		1.696	682,038	15.657
	16.80		308.3	248.2	76,506		1.756	727,145	16.693
	17.40		313.1	253.0	79,200		1.818	773,855	17.765
	18.00		317.9	257.8	81,940		1.881	822,194	18.875
	18.60		322.7	262.6	84,726		1.945	872,192	20.023
	19.20		327.5	267.4	87,558		2.010	923,875	21.209
	19.80		332.3	272.2	90,437		2.076	977,271	22.435
	20.40		337.1	277.0	93,361		2.143	1,032,408	23.701
	21.00		341.9	281.8	96,332		2.211	1,089,314	25.007
	21.60		346.7	286.6	99,348		2.281	1,148,015	26.355
	22.20		351.5	291.4	102,411		2.351	1,208,541	27.744
	22.80		356.3	296.2	105,520		2.422	1,270,918	29.176
	23.40		361.1	301.0	108,674		2.495	1,335,174	30.651
	24.00		365.9	305.8	111,875		2.568	1,401,336	32.170
	24.60		370.7	310.6	115,122		2.643	1,469,433	33.734
	25.20		375.5	315.4	118,415		2.718	1,539,492	35.342
	25.80		380.3	320.2	121,755		2.795	1,611,541	36.996
	26.40		385.1	325.0	125,140		2.873	1,685,607	38.696
	27.00		389.9	329.8	128,571		2.952	1,761,718	40.443
	27.60		394.7	334.6	132,048		3.031	1,839,902	42.238
	28.20		399.5	339.4	135,572		3.112	1,920,185	44.081
	28.80		404.3	344.2	139,141		3.194	2,002,597	45.973
	29.40		409.1	349.0	142,757		3.277	2,087,164	47.915
	30.00		413.9	353.8	146,419		3.361	2,173,915	49.906

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **FOUNDERS VISTA**

Basin ID: **BASIN B**



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	
Zone 1 (WQCV)	2.63	0.667	Orifice Plate	Orifice Plate
Zone 2 (EURV)	4.39	1.162	Orifice Plate	Orifice Plate
Zone 3 (100+1/2WQCV)	7.03	2.124	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)		3.953		

Clear Input Parameters (Including Tables)

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = 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 = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 1-13/16 inches)

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = 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	1.20	2.40	2.50				
Orifice Area (sq. inches)	2.66	2.66	2.66	2.66				

	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)								

Size Plate to match WQCV Drain Time

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

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)

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Grate Slope = H:V
Horiz. Length of Weir Sides = feet
Overflow Grate Type =
Debris Clogging % = %

Height of Grate Upper Edge, H_u = feet
Overflow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area =
Overflow Grate Open Area w/o Debris = ft²
Overflow Grate Open Area w/ Debris = ft²

Calculated Parameters for Overflow Weir

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

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = inches
Restrictor Plate Height Above Pipe Invert = inches

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = feet
Spillway End Slopes = H:V
Freeboard above Max Water Surface = feet

Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres
Basin Volume at Top of Freeboard = acre-ft

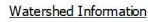
Calculated Parameters for Spillway

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).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
CUHP Runoff Volume (acre-ft) =	0.667	1.829	1.724	2.791	3.509	3.849	5.586	6.831	8.408
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.724	2.791	3.509	3.849	5.586	6.831	8.408
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	5.0	18.5	25.8	33.9	55.9	71.4	90.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.47	0.66	0.87	1.43	1.83	2.33
Peak Inflow Q (cfs) =	N/A	N/A	32.7	54.6	65.8	73.5	106.0	130.5	159.1
Peak Outflow Q (cfs) =	0.3	0.6	0.6	7.1	14.4	22.3	46.8	67.0	95.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.7	0.8	0.9	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	0.1	0.1	0.2	0.4	0.5	0.5
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	65	64	67	66	65	62	59	57
Time to Drain 99% of Inflow Volume (hours) =	40	69	67	72	72	71	70	69	68
Maximum Ponding Depth (ft) =	2.63	4.39	4.12	4.92	5.23	5.50	6.12	6.53	6.93
Area at Maximum Ponding Depth (acres) =	0.60	0.71	0.70	0.75	0.77	0.79	0.83	0.86	0.89
Maximum Volume Stored (acre-ft) =	0.672	1.830	1.633	2.211	2.454	2.664	3.167	3.506	3.865

MHFD-Detention, Version 4.06 (July 2022)

[Clear Workbook](#)Basin ID: BASIN C

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 Override

Zone 1 Volume (WQCV)	0.415	acre-feet
Zone 2 Volume (EURV - Zone 1)	0.745	acre-feet
Zone 3 Volume (100yr - 1/2 WQCV - Zones 1 & 2)	1.301	acre-feet
Total Detention Basin Volume =	2.461	acre-feet
Initial Surge Volume (ISV)	54	ft ³
Initial Surge Depth (ISD)	0.33	ft
Total Available Detention Depth (H_{TAD})	7.00	ft
Depth of Trickle Channel (H_{TC})	0.50	ft
Slope of Trickle Channel (S_{TC})	0.005	ft/ft
Slopes of Main Basin Sides (S_{main})	4	Ht:V
Basin Length-to-Width Ratio ($R_{L/W}$)	1.5	

Ratio not typical.

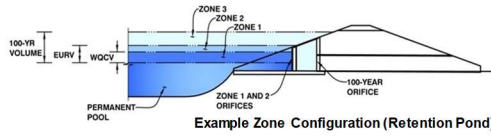
Depth Increment =	0.20	ft							
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (ac)	Volume (ft ³)	Volume (ac-ft)
Top of Micropool	0.00		12.8	12.8	164		0.004		
ISV	0.33		12.8	12.8	164		0.004	54	0.001
	0.40		12.8	12.8	164		0.004	66	0.002
	0.60		12.8	12.8	164		0.004	99	0.002
	0.80		12.8	12.8	164		0.004	131	0.003
Floor	1.00		47.5	35.5	1,685		0.039	271	0.006
	1.20		88.3	62.1	5,487		0.126	952	0.022
	1.40		129.1	88.8	11,466		0.263	2,611	0.060
	1.44		137.3	94.1	12,922		0.297	3,099	0.071
	1.60		138.5	95.4	13,220		0.303	5,190	0.119
	1.80		140.1	97.0	13,597		0.312	7,872	0.181
Zone 1 (WQCV)	2.00		141.7	98.6	13,979		0.321	10,629	0.244
	2.20		143.3	100.2	14,366		0.330	13,464	0.309
	2.40		144.9	101.8	14,759		0.339	16,376	0.376
	2.52		145.9	102.8	14,996		0.344	18,161	0.417
Zone 2 (EURV)	2.60		146.5	103.4	15,156		0.348	19,368	0.445
	2.80		148.1	105.0	15,558		0.357	22,439	0.515
	3.00		149.7	106.6	15,966		0.367	25,591	0.587
	3.20		151.3	108.2	16,379		0.376	28,826	0.662
	3.40		152.9	109.8	16,797		0.386	32,143	0.738
	3.60		154.5	111.4	17,220		0.395	35,545	0.816
	3.80		156.1	113.0	17,648		0.405	39,031	0.896
	4.00		157.7	114.6	18,081		0.415	42,604	0.978
	4.20		159.3	116.2	18,519		0.425	46,264	1.062
	4.40		160.9	117.8	18,963		0.435	50,012	1.148
4.43		161.2	118.1	19,030		0.437	50,582	1.161	
Zone 2 (EURV)	4.60		162.5	119.4	19,411		0.446	53,850	1.236
	4.80		164.1	121.0	19,865		0.456	57,777	1.326
	5.00		165.7	122.6	20,324		0.467	61,796	1.419
	5.20		167.3	124.2	20,788		0.477	65,907	1.513
	5.40		168.9	125.8	21,257		0.488	70,111	1.610
	5.60		170.5	127.4	21,731		0.499	74,410	1.708
	5.80		172.1	129.0	22,210		0.510	78,804	1.809
	6.00		173.7	130.6	22,695		0.521	83,295	1.912
	6.20		175.3	132.2	23,184		0.532	87,882	2.018
	6.40		176.9	133.8	23,679		0.544	92,569	2.125
Zone 2 (EURV)	6.60		178.5	135.4	24,179		0.555	97,354	2.235
	6.80		180.1	137.0	24,684		0.567	102,241	2.347
	7.00		181.7	138.6	25,194		0.578	107,228	2.462
	7.20		183.3	140.2	25,709		0.590	112,318	2.578
	7.40		184.9	141.8	26,229		0.602	117,512	2.698
	7.60		186.5	143.4	26,755		0.614	122,810	2.819
	7.80		188.1	145.0	27,285		0.626	128,214	2.943
	8.00		189.7	146.6	27,821		0.639	133,725	3.070
	8.20		191.3	148.2	28,361		0.651	139,343	3.199
	8.40		192.9	149.8	28,907		0.664	145,070	3.330
Zone 2 (EURV)	8.60		194.5	151.4	29,458		0.676	150,906	3.464
	8.80		196.1	153.0	30,014		0.689	156,853	3.601
	9.00		197.7	154.6	30,576		0.702	162,912	3.740
	9.20		199.3	156.2	31,142		0.715	169,084	3.882
	9.40		200.9	157.8	31,713		0.728	175,369	4.026
	9.60		202.5	159.4	32,290		0.741	181,770	4.173
	9.80		204.1	161.0	32,872		0.755	188,286	4.322
	10.00		205.7	162.6	33,458		0.768	194,919	4.475
	10.20		207.3	164.2	34,050		0.782	201,669	4.630
	10.40		208.9	165.8	34,647		0.795	208,539	4.787
Zone 2 (EURV)	10.60		210.5	167.4	35,250		0.809	215,529	4.948
	10.80		212.1	169.0	35,857		0.823	222,639	5.111

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: FOUNDERS VISTA

Basin ID: BASIN C



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type	
Zone 1 (WQCV)	2.52	0.415	Orifice Plate	Orifice Plate
Zone 2 (EURV)	4.43	0.745	Orifice Plate	Orifice Plate
Zone 3 (100+1/2WQCV)	7.00	1.301	Weir&Pipe (Restrict)	Weir and Pipe (w/ Restrictor Plate)
Total (all zones)	2.461			

Clear Input Parameters (Including Tables)

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 Diameter = N/A inches

Underdrain Orifice Area = N/A ft²
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)
Depth at top of Zone using Orifice Plate = 4.43 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = 2.07 sq. inches (diameter = 1-5/8 inches)

WQ Orifice Area per Row = 1.438E-02 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
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	1.48	2.95	2.25				
Orifice Area (sq. inches)	2.07	2.07	2.07	2.07				

	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)								

Size Plate to match WQCV Drain Time

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = N/A inches

Vertical Orifice Area = N/A ft²
Vertical Orifice Centroid = N/A feet

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)

Overflow Weir Front Edge Height, H_o = 4.43 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 5.00 feet
Overflow Weir Grate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 10.00 feet
Overflow Grate Type = Type C Grate
Debris Clogging % = 50%

Height of Grate Upper Edge, H_u = 6.93 feet
Overflow Weir Slope Length = 10.31 feet
Grate Open Area / 100-yr Orifice Area = 11.36
Overflow Grate Open Area w/o Debris = 35.87 ft²
Overflow Grate Open Area w/ Debris = 17.94 ft²

Calculated Parameters for Overflow Weir

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

Depth to Invert of Outlet Pipe = 0.00 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 27.00 inches
Restrictor Plate Height Above Pipe Invert = 20.00 inches

Outlet Orifice Area = 3.16 ft²
Outlet Orifice Centroid = 0.92 feet
Half-Central Angle of Restrictor Plate on Pipe = 2.07 radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 6.80 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 25.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Spillway Design Flow Depth = 0.92 feet
Stage at Top of Freeboard = 8.72 feet
Basin Area at Top of Freeboard = 0.68 acres
Basin Volume at Top of Freeboard = 3.54 acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

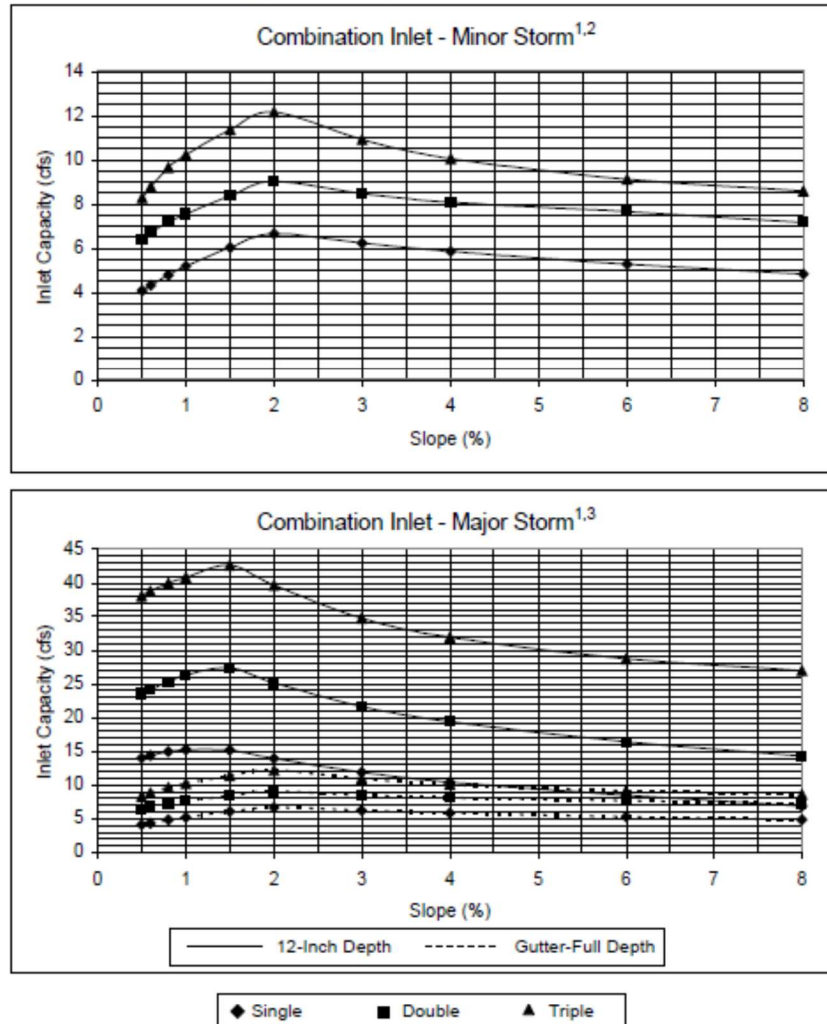
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.06	1.43	1.66	1.73	2.26	2.60	3.07
One-Hour Rainfall Depth (in) =	0.415	1.160	1.087	1.738	2.174	2.376	3.426	4.176	5.129
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.087	1.738	2.174	2.376	3.426	4.176	5.129
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.7	9.9	13.9	18.3	30.2	38.6	49.2
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.12	0.42	0.59	0.78	1.29	1.64	2.09
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	19.3	31.8	38.3	42.8	61.4	75.2	91.6
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.4	3.5	7.3	10.9	24.5	36.5	50.7
Peak Inflow Q (cfs) =	N/A	N/A	0.4	0.4	0.5	0.6	0.8	0.9	1.0
Peak Outflow Q (cfs) =	N/A	N/A	0.4	0.4	0.5	0.6	0.8	0.9	1.0
Ratio Peak Outflow to Predevelopment Q =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Structure Controlling Flow =	N/A	N/A	N/A	0.1	0.2	0.3	0.7	1.0	1.0
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	62	61	65	63	62	58	56	53
Time to Drain 99% of Inflow Volume (hours) =	40	66	65	70	70	69	68	67	65
Maximum Ponding Depth (ft) =	2.52	4.43	4.11	5.06	5.41	5.66	6.30	6.70	7.10
Area at Maximum Ponding Depth (acres) =	0.34	0.44	0.42	0.47	0.49	0.50	0.54	0.56	0.58
Maximum Volume Stored (acre-ft) =	0.417	1.161	1.020	1.442	1.610	1.733	2.066	2.285	2.520

Chapter 8. Inlets

FIGURE 8-2, INLET CAPACITY CHART COMBINATION (TYPE 16) INLET
LOCAL TYPE I AND TYPE II (MULTI-FAMILY)

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



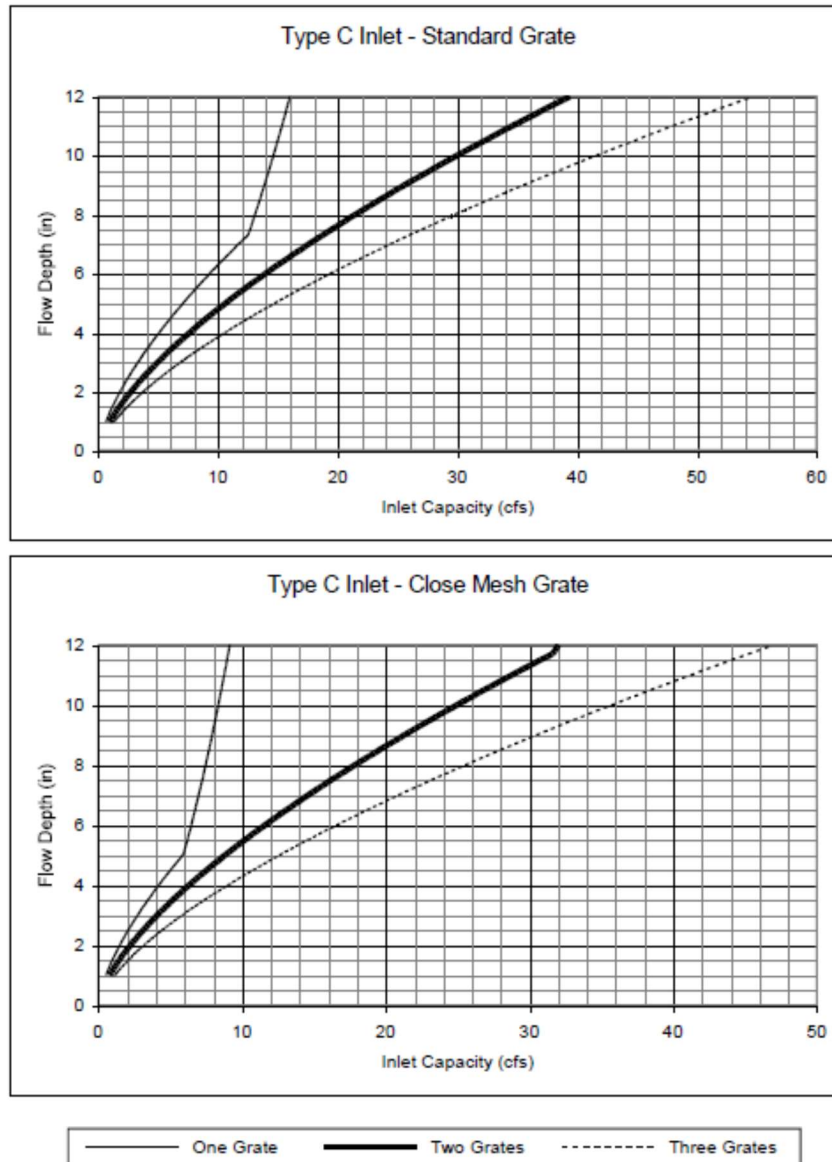
¹The Town of Castle Rock standard street section parameters must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets (see Section 8.4).

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

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

Chapter 8. Inlets

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



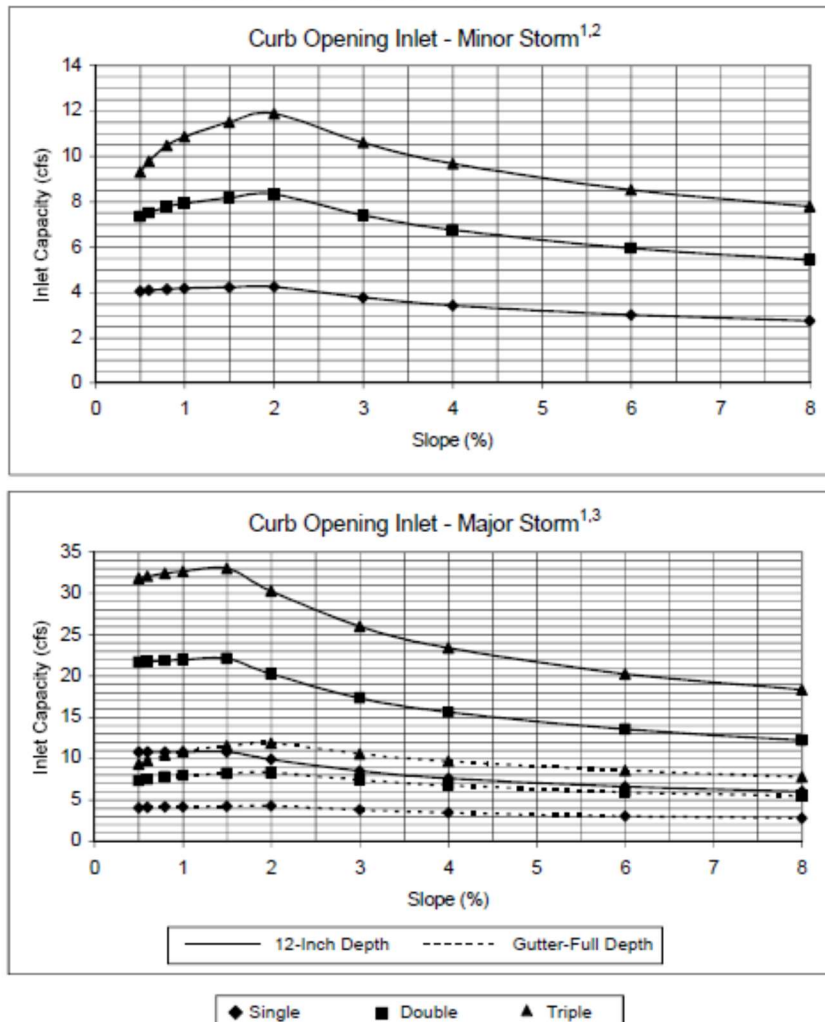
Notes:

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

Chapter 8. Inlets

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

Street Section Data: Street Width Flowline to Flowline = 48'
Type of Curb and Gutter = 6" vertical
Minor Storm Maximum Spread = 18,7'



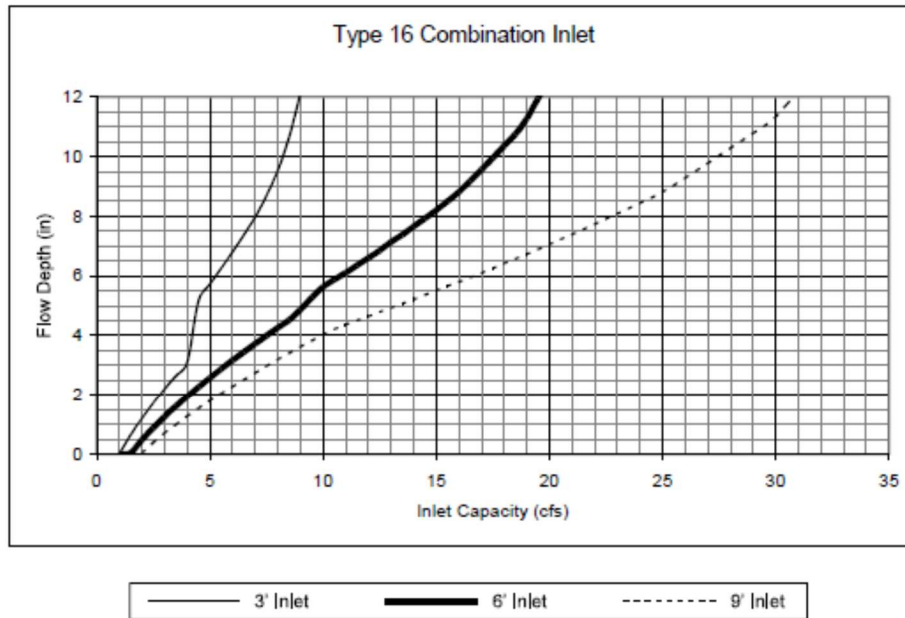
¹The Town of Castle Rock standard street section parameters must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets (see Section 8.4).

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

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

Chapter 8. Inlets

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



Notes:

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



Summary of Water Quality Conformance to MS4 Permit

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

Project Name Founders Vista Subdivision

Project Owner 176M LLC

Project Location 667 North Ridge Road

ToCR Project Number SDP20-026

Total Site Area 180.5 acres

Total Size of Common Plan of Development 180.5 acres

Check all that apply:

☒ **Project within Plum Creek Basin**

☐ **Project within Cherry Creek Basin**

Estimated construction completion date 06-01-26

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

- ☒ WQCV standard
- ☐ Pollutant removal standard
- ☐ Runoff reduction standard
- ☐ Applicable site draining to regional WQVC control measure (accepts drainage prior to discharging to WOTS)
- ☐ Applicable site draining to regional WQVC control facility (with receiving pervious area control measure upstream of WOTS)
- ☐ Constrained redevelopment sites standard
 - Imperviousness of existing site _____ / _____ (Imp. Ac/Site Ac) = ____ %
 - Variance required TCV No. _____
- ☐ Existing control measure with WQCV per previous criteria standards
 - Reference Construction Permit No. _____
- ☐ Cherry Creek Basin only, choose one: ☐ Tier 1 ☐ Tier 2 ☐ Tier 3
- ☐ No control measures provided (See Permanent WQ Worksheet for applicability)

Summary of Water Quality Conformance to MS4 Permit

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

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

- ☐ Pavement management site
Excluded impervious area: _____ acres
- ☐ Excluded roadway redevelopment
Excluded impervious area: _____ acres
- ☐ Excluded existing roadway areas
Excluded impervious area: _____ acres
- ☒ Above ground and below ground utilities
- ☐ Large lot single family home
- ☐ Non-residential and non-commercial infiltration
Excluded impervious area: _____ acres
- ☒ Land disturbance for land to remain undeveloped
Excluded impervious area: 0 _____ acres
- ☐ Stream Stabilization Sites
Excluded impervious area: _____ acres
- ☐ Trails
Excluded impervious area: _____ acres
- ☐ Oil and Gas Exploration

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

If yes, complete the following:

Excluded area: 1.0 _____ acres
Total Site area: 180.5 _____ acres, 0.5 % site excluded

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

If yes, complete the following:

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

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

Project: Founders Vista Subdivision

Project #: SDP20 26

Applicant: Macor LLC

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

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

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

APPENDIX B

GORDAN DRIVE UD-INLET WORKSHEET VERSION 4.05

Reference: Phase III Drainage Report for Gordan Drive Improvements Project, Prepared by Bohannon Huston, Inc., February 22, 2019.

INLET MANAGEMENT

Worksheet Protected

	Rename	Rename	Rename	Rename	Rename	Rename
	Delete	Delete	Delete	Delete	Delete	Delete
INLET NAME	INLET 1	INLET 2	INLET 3	INLET 4	INLET 5	INLET 6
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade	On Grade	In Sump
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination

ERODED INPUT

Show Input Details

User-Defined Design Flows

Minor Q_{down} (cfs)	2.5	2.5	4.1	3.3	0.4	0.5	3.4
Major Q_{down} (cfs)	9.6	9.6	106.1	13.8	0.9	12.7	95.0

Bypass (Cant-Over) Flow from Upstream

Reverse Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	INLET 1	INLET 2	INLET 3	INLET 4	User Defined
Minor Bypass Flow Received Q_b (cfs)	0.0	0.0	0.9	0.9	2.0	1.5	0.4
Major Bypass Flow Received Q_b (cfs)	0.0	0.0	6.3	6.3	106.6	14.2	119.6

Watershed Characteristics

Subcatchment Area (acres)							
Percent Impervious							
NRCS Soil Type							

Watershed Profile

Overland Slope (ft/ft)							
Overland Length (ft)							
Channel Slope (ft/ft)							
Channel Length (ft)							

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)							
One-Hour Precipitation, P_1 (inches)							

Major Storm Rainfall Input

--	--	--	--	--	--	--	--

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.5	2.5	4.1	2.4	2.0	3.8
Major Total Design Peak Flow, Q (cfs)	9.6	9.6	20.1	105.5	26.9	114.6
Minor Flow Bypassed Downstream, Q_b (cfs)	0.9	0.9	1.5	0.6	0.5	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	6.3	6.3	14.2	100.3	20.6	N/A

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, V_t	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, V_t	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, T_t	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, T_t	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_s	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, V_t	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, V_t	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, T_t	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, T_t	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

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

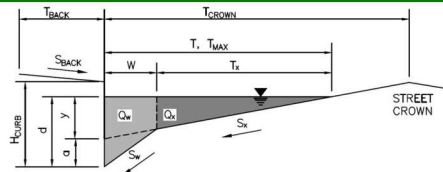
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

FOUNDERS VISTA SUBDIVISION

Inlet ID:

INLET 1



Show Details

Clear Worksheet

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $T_{BACK} = 17.0$ ft $S_{BACK} = 0.020$ ft/ft $n_{BACK} = 0.016$ $H_{CURB} = 4.00$ inches $T_{CROWN} = 18.0$ ft $W = 2.00$ ft $S_x = 0.020$ ft/ft $S_w = 0.083$ ft/ft $S_o = 0.047$ ft/ft $n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

Minor Storm Major Storm

 $T_{MAX} = 18.0$ 18.0 ft $d_{MAX} = 6.0$ 12.0 inches☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

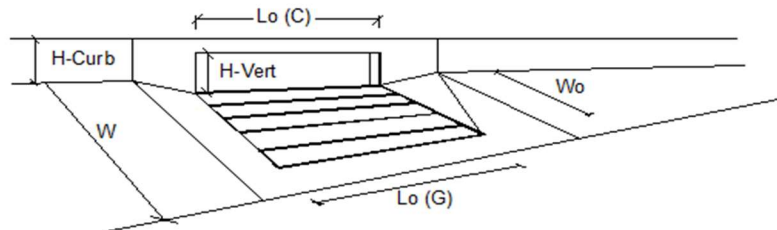
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

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

Minor Storm Major Storm

 $Q_{allow} = 20.8$ 152.1 cfs

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

INLET ON A CONTINUOUS GRADE

Show Details

Reset Defaults

Clear Worksheet

Design Information (Input)

Denver No. 16 Combination

Type of Inlet

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

MINOR MAJOR

Type = Denver No. 16 Combination

 $a_{LOCAL} = 2.0$ 2.0 inches

No = 2 2

 $L_o = 3.00$ 3.00 ft $W_o = 1.73$ 1.73 ft $C_{r-G} = 0.50$ 0.50 $C_{r-C} = 0.10$ 0.10Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

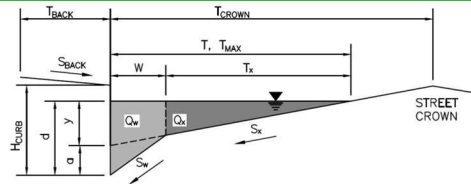
Capture Percentage = $Q_u/Q_o =$

MINOR MAJOR

 $Q = 1.6$ 3.3 cfs $Q_b = 0.9$ 6.3 cfs $C\% = 64$ 34 %

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

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

FOUNDERS VISTA SUBDIVISION**INLET 2**

Show Details

Clear Worksheet

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 17.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_X = 0.020$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_D = 0.047$ ft/ft
 $n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

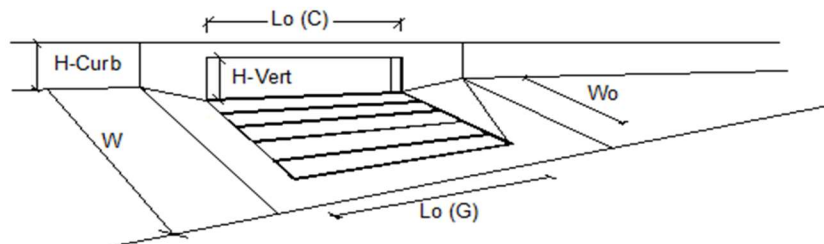
	Minor Storm	Major Storm	
$T_{MAX} = 18.0$	18.0	18.0	ft
$Q_{MAX} = 4.0$	4.0	12.0	inches
☐		☒	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM Allowable Capacity is based on Depth Criterion****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'**

	Minor Storm	Major Storm	
$Q_{allow} = 9.0$	9.0	152.1	cfs

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Show Details

Reset Defaults

Clear Worksheet

Design Information (Input)Type of Inlet Denver No. 16 Combination

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
$a_{LOCAL} = 2.0$	2.0	2.0	inches
No = 2	2	2	
$L_o = 3.00$	3.00	3.00	ft
$W_o = 1.73$	1.73	1.73	ft
$C_rG = 0.50$	0.50	0.50	
$C_rC = 0.10$	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage = $Q_a/Q_o =$

	MINOR	MAJOR	
$Q = 1.6$	1.6	3.3	cfs
$Q_b = 0.9$	0.9	6.3	cfs
$C\% = 64$	64	34	%

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

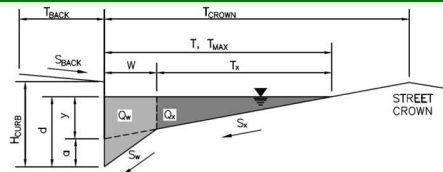
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

FOUNDERS VISTA SUBDIVISION

Inlet ID:

INLET 3



Show Details

Clear Worksheet

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 17.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.047$ ft/ft
 $n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} = 18.0$	18.0	18.0	ft
$d_{MAX} = 6.0$	6.0	12.0	inches
☐	☐	☒	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

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'

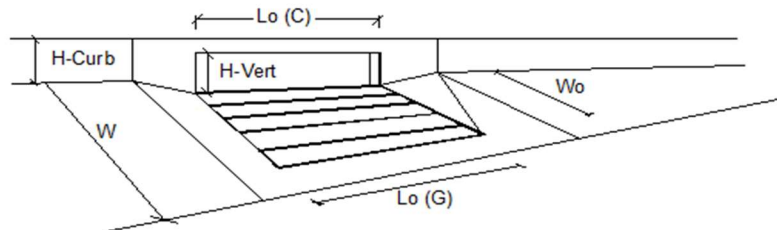
	Minor Storm	Major Storm	
$Q_{allow} = 20.8$	20.8	152.1	cfs

Warning 02

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Show Details

Reset Defaults

Clear Worksheet

Design Information (Input)

Denver No. 16 Combination

Type of Inlet

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
$a_{LOCAL} = 2.0$	2.0	2.0	inches
No = 3	3	3	
$L_o = 3.00$	3.00	3.00	ft
$W_o = 1.73$	1.73	1.73	ft
$C_rG = 0.50$	0.50	0.50	
$C_rC = 0.10$	0.10	0.10	

Street Hydraulics: OK - $Q < Q_{allow}$ Allowable Street Capacity

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage = $Q_i/Q_o =$

	MINOR	MAJOR	
$Q = 3.0$	3.0	6.8	cfs
$Q_o = 2.0$	2.0	105.6	cfs
$C\% = 60$	60	6	%

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

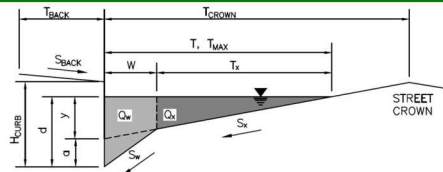
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

FOUNDERS VISTA SUBDIVISION

Inlet ID:

INLET 4



Show Details

Clear Worksheet

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 17.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

$H_{CURB} = 4.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.050$ ft/ft
 $n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} = 18.0$	18.0	18.0	ft
$d_{MAX} = 6.0$	6.0	12.0	inches
☐	☒		check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

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'

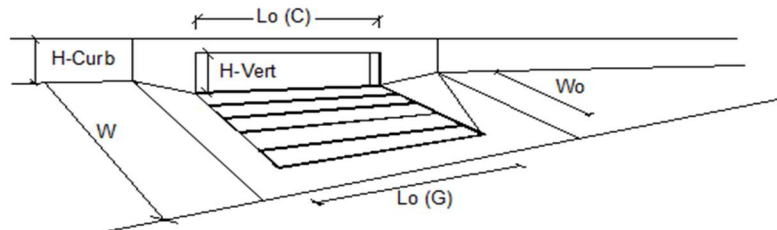
	Minor Storm	Major Storm	
$Q_{allow} = 20.4$	20.4	149.3	cfs

Warning 02

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Show Details

Reset Defaults

Clear Worksheet

Design Information (Input)

Denver No. 16 Combination

Type of Inlet

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
$a_{LOCAL} = 2.0$	2.0	2.0	inches
No = 3	3	3	
$L_o = 3.00$	3.00	3.00	ft
$W_o = 1.73$	1.73	1.73	ft
$C_rG = 0.50$	0.50	0.50	
$C_rC = 0.10$	0.10	0.10	

Street Hydraulics: OK - $Q < Q_{allow}$ Street Capacity

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage = $Q_i/Q_o =$

	MINOR	MAJOR	
$Q = 2.6$	2.6	5.9	cfs
$Q_o = 1.5$	1.5	14.2	cfs
$C\% = 63$	63	30	%

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

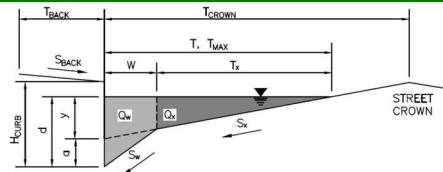
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

FOUNDERS VISTA SUBDIVISION

Inlet ID:

INLET 5



Show Details

Clear Worksheet

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	17.0	ft
S_{BACK}	0.020	ft/ft
n_{BACK}	0.013	

H_{CURB}	4.00	inches
T_{CROWN}	18.0	ft
W	2.00	ft
S_x	0.020	ft/ft
S_w	0.083	ft/ft
S_o	0.047	ft/ft
n_{STREET}	0.013	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
T_{MAX}	13.9	18.0	ft
d_{MAX}	6.0	12.0	inches
☐		☒	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

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'

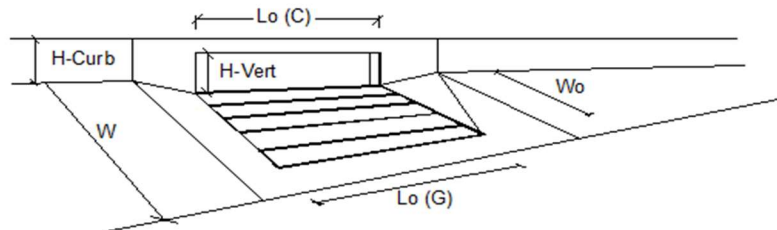
	Minor Storm	Major Storm	
Q_{allow}	18.1	162.8	cfs

Warning 02

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Show Details

Reset Defaults

Clear Worksheet

Design Information (Input)

Denver No. 16 Combination

Type of Inlet

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	Denver No. 16 Combination		
a_{LOCAL}	2.0	2.0	inches
No	3	3	
L_o	3.00	3.00	ft
W_o	1.73	1.73	ft
C_rG	0.50	0.50	
C_rC	0.10	0.10	

Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

Capture Percentage = Q_u/Q_o =

	MINOR	MAJOR	
Q	1.8	6.3	cfs
Q_b	0.6	100.3	cfs
$C\%$	75	6	%

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

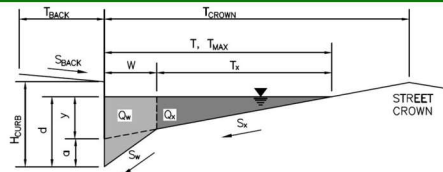
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

FOUNDERS VISTA SUBDIVISION

Inlet ID:

INLET 6



Show Details

Clear Worksheet

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $T_{BACK} = 17.0$ ft $S_{BACK} = 0.020$ ft/ft $n_{BACK} = 0.013$ $H_{CURB} = 4.00$ inches $T_{CROWN} = 18.0$ ft $W = 2.00$ ft $S_x = 0.020$ ft/ft $S_w = 0.083$ ft/ft $S_o = 0.050$ ft/ft $n_{STREET} = 0.013$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

Minor Storm Major Storm

 $T_{MAX} = 13.9$ 18.0 ft $d_{MAX} = 6.0$ 12.0 inches☐ ☒ check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

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'

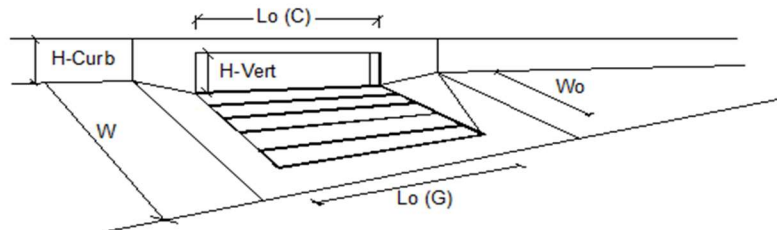
Minor Storm Major Storm

 $Q_{allow} = 18.7$ 159.8 cfs

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Show Details

Reset Defaults

Clear Worksheet

Design Information (Input)

Denver No. 16 Combination

Type of Inlet

Local Depression (additional to continuous gutter depression 'a')

Total Number of Units in the Inlet (Grate or Curb Opening)

Length of a Single Unit Inlet (Grate or Curb Opening)

Width of a Unit Grate (cannot be greater than W, Gutter Width)

Clogging Factor for a Single Unit Grate (typical min. value = 0.5)

Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

MINOR MAJOR

Type = Denver No. 16 Combination

 $a_{LOCAL} = 2.0$ 2.0 inches

No = 3 3

 $L_o = 3.00$ 3.00 ft $W_o = 1.73$ 1.73 ft $C_{rG} = 0.50$ 0.50 $C_{rC} = 0.10$ 0.10Street Hydraulics: OK - $Q < Q_{allow}$ Allowable Street Capacity

Total Inlet Interception Capacity

Total Inlet Carry-Over Flow (flow bypassing inlet)

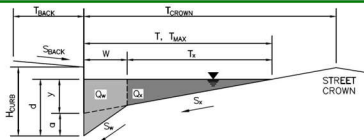
Capture Percentage = Q_i/Q_o

MINOR MAJOR

 $Q = 1.5$ 6.2 cfs $Q_o = 0.5$ 20.6 cfs $C\% = 77$ 23 %

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

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

Project:
Inlet ID:FOUNDERS VISTA SUBDIVISION
INLET 7

Show Details

Clear Worksheet

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK} = 17.0 ft
 S_{BACK} = 0.020 ft/ft
 n_{BACK} = 0.016

H_{CURB} = 4.00 inches
 T_{CROWN} = 18.0 ft
 W = 2.00 ft
 S_x = 0.020 ft/ft
 S_w = 0.083 ft/ft
 S₀ = 0.000 ft/ft
 n_{STREET} = 0.016

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T _{MAX}	18.0	18.0	ft
d _{MAX}	6.0	16.0	inches

MINOR STORM Allowable Capacity is based on Depth Criterion

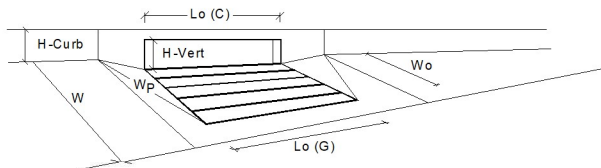
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q _{allow}	SUMP	SUMP	cfs

Warning 02

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

INLET IN A SUMP OR SAG LOCATION



Show Details

Reset Defaults

Clear Worksheet

Design Information (Input)

Type of Inlet: Denver No. 16 Combination

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

	MINOR	MAJOR	
Type	Denver No. 16 Combination		
a _{local}	2.00	2.00	inches
No	1	1	
Ponding Depth	5.8	5.8	inches
	MINOR	MAJOR	Override Depths
L _g (G)	3.00	3.00	feet
W _g	1.73	1.73	feet
A _{ratio}	0.31	0.31	
C _r (G)	0.50	0.50	
C _w (G)	3.60	3.60	
C _o (G)	0.60	0.60	
	MINOR	MAJOR	
L _o (C)	3.00	3.00	feet
H _{vert}	6.50	6.50	inches
H _{throat}	5.25	5.25	inches
Theta	0.00	0.00	degrees
W _p	2.00	2.00	feet
C _r (C)	0.10	0.10	
C _w (C)	3.70	3.70	
C _o (C)	0.66	0.66	
	MINOR	MAJOR	
d _{Grate}	0.509	0.509	ft
d _{Curb}	0.32	0.32	ft
RF _{Combination}	0.91	0.91	
RF _{Curb}	1.00	1.00	
RF _{Grate}	0.91	0.91	
	MINOR	MAJOR	
Q _s	3.6	3.6	cfs
Q _{PEAK REQUIRED}	3.8	114.6	cfs

Total Inlet Interception Capacity (assumes clogged condition)

WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms